



REGIONAL WATER QUALITY CONTROL BOARD,
CENTRAL VALLEY REGION

Amendment
To the
Water Quality Control Plan for the
Tulare Lake Basin

To
Remove the Municipal and Domestic Supply (MUN) and
Agricultural Supply (AGR) Beneficial Uses within a Designated
Horizontal and Vertical Portion of the Tulare Lake Bed

Draft Staff Report

December 2016



CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY



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DISCLAIMER

This publication is a report by staff of the California Regional Water Quality Control Board, Central Valley Region. This report contains the evaluation of alternatives and technical support for the adoption of an amendment to the Water Quality Control Plan for the Tulare Lake Basin (Resolution No. R5-201x-xxxx). Mention of specific products does not represent endorsement of those products by the Regional Board.

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Final Draft Staff Report

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REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

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ACKNOWLEDGEMENTS:

Disclosure: This project was initiated by the Central Valley Salinity Alternatives for Long Term Sustainability (CV-SALTS) initiative with focused support by the Tulare Lake Drainage District and Tulare Lake Basin Water Storage District (stakeholders). CV-SALTS and the districts provided the technical data and evaluation to support development of the staff report. Funding for this project has also been provided in part through an Agreement between the State Water Resources Control Board and the CV-SALTS initiative. This Agreement provided resources for development of this Staff Report including the CEQA and economic analyses by Larry Walker and Associates.

EXECUTIVE SUMMARY

The purpose of this Staff Report is to provide the rationale and supporting documentation for a proposed amendment to the Water Quality Control Plan for the Tulare Lake Basin (Basin Plan) to de-designate the Municipal and Domestic Supply (MUN) and the Agricultural Supply (AGR) beneficial uses from groundwater within horizontally and vertically delineated areas underlying a portion of the historical Tulare Lake Bed.

The proposed amendment is part of a larger effort by the stakeholder led Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) initiative to develop a comprehensive Salt and Nitrate Management Plan (SNMP) for the Central Valley. As part of its work on the SNMP, CV-SALTS is reviewing the Basin Plan's beneficial use designations to determine whether these beneficial use designations are appropriate and, if so, whether the Basin Plan's implementation programs provide an appropriate level of protection for the waterbodies that support these beneficial uses. Where appropriate, CV-SALTS is proposing that the California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board or Board) modify the Basin Plan's MUN and/or AGR beneficial use designations and programs of implementation to encourage reuse and recycling, give regulated entities more flexibility in managing limited water supplies, and identify potential salt management areas that would help salt to be moved out of sensitive areas.

The Central Valley Water Board has incorporated State Water Resources Control Board Resolution No. 88-63, the Sources of Drinking Water Policy, into the Basin Plans, and has designated all surface and ground water bodies in the Central Valley region as supporting the MUN beneficial use unless a particular water body is specifically identified as not supporting the MUN beneficial use in the Basin Plans. The *Sources of Drinking Water Policy* identifies exceptions to the MUN beneficial use that can apply to certain water bodies, including an exception that applies to water bodies where the total dissolved solids (TDS) exceeds 3,000 milligrams per liter (mg/L) or 5,000 microsiemens per centimeter ($\mu\text{S}/\text{cm}$) as electrical conductivity (EC), provided that the waterbody is not expected to supply a public water system. [Hereinafter in this Staff Report, EC values will be cited instead of TDS values to avoid confusion.] The *Sources of Drinking Water Policy* also provides an exception for water bodies that do not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day. However, these exceptions are not self-implementing – the Central Valley Water Board is required to protect the MUN beneficial use even in water bodies that meet the exception criteria in the *Sources of Drinking Water Policy* unless and until a Basin Plan amendment is adopted that specifically de-designates the MUN use in such water bodies.

With regard to the AGR beneficial use, the Basin Plan states that unless otherwise designated by the Central Valley Water Board, “all ground waters in the region are considered suitable or potentially suitable, at a minimum, for agricultural supply (AGR)...” Agricultural supply includes the use of groundwater for irrigation, livestock watering, and support of vegetation for range grazing. When protecting the AGR beneficial use, the narrative Chemical Constituents water quality objective generally sets the minimum regulatory requirements that the discharge must

meet. The Chemical Constituents groundwater water quality objective states, “[g]round waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.” The Central Valley Water Board has utilized salinity guidelines identified in Ayers and Westcot (Ayers and Westcot, 1985) to interpret this narrative objective, and has previously considered irrigation water supply at 700 $\mu\text{S}/\text{cm}$ to be protective of all crops at all times. The CV-SALTS initiative conducted a review of literature related to salinity impacts on both irrigation and stock watering, and found that the literature concurred with the Ayers and Westcot finding that only the most salt tolerant crops may be sustainably irrigated with water exceeding 3,000 $\mu\text{S}/\text{cm}$ (CV-SALTS, 2013). As part of the literature review, CV-SALTS also identified a range of acceptable salt levels for livestock watering of 5,000 $\mu\text{S}/\text{cm}$ or less.

The Board identified the need to evaluate the appropriateness of designated beneficial uses as a priority in the Board’s 2014 Triennial Review (Central Valley Water Board, 2014). Concurrently, the CV-SALTS initiative identified that there was a need to define the salinity-related requirements for the protection of both the MUN and AGR beneficial uses. To support both needs, the Central Valley Salinity Coalition (CVSC), a discharger group financially supporting and managing the CV-SALTS initiative, the Tulare Lake Drainage District and Tulare Lake Basin Water Storage District (CVSC members) jointly provided resources for the development of technical information and environmental and economic analyses in support of this MUN and AGR beneficial use evaluation project for a portion of the historical Tulare Lake Bed.

The technical and regulatory information developed in support of this beneficial use evaluation is compiled in the *Technical and Regulatory Evaluation of MUN and AGR Beneficial Uses in the Tulare Lake Bed Area* (Beneficial Use Evaluation Report) prepared by Kenneth D. Schmidt and Associates, CDM Smith, and Summers Engineering (CV-SALTS, 2015). Stakeholders participating in the effort provided updates on the project to the CV-SALTS Executive Committee during public meetings. The Executive Committee is comprised of representatives from state, federal, and local agencies, the discharger community, environmental organizations, disadvantaged communities and Environmental Justice groups.

As part of the investigation for the Beneficial Use Evaluation, representatives of Tulare Lake Drainage District (TLDD) and Tulare Lake Basin Water Storage District (TLBWSD) initiated meetings with stakeholders within and surrounding the project area. Stakeholder meetings generally were focused on the solicitation of input from the surrounding disadvantaged communities and municipalities, farmers/ranchers, and landowners in the project area with regard to the proposal to de-designate MUN and AGR beneficial uses in a portion of the historical Tulare Lake Bed. This stakeholder effort has resulted in local support for the proposed project. On 14 April 2015, Board staff held an initial California Environmental Quality Act scoping meeting in Corcoran to provide information on the proposed project and solicit additional information from the public to inform development of the Staff Report.

The Project Study Area is located in the southern part of the Central Valley of California in the Tulare Lake Basin, within the historic Tulare Lake Bed. The Tulare Lake Basin essentially functions as a closed basin. Because the Tulare Lake Basin is currently a closed basin, there is no natural outfall, which has allowed salt to accumulate. The diversion of water into the hydrologic basin from other watersheds to support 3 million acres of agriculture (Sholes, 2006),

including three of the five most agriculturally productive counties in the United States (United States Department of Agriculture, 2012 Census of Agriculture, 2012), has exacerbated the accumulation of salts. The majority of the western and southern Tulare Lake Basin and most of the historical Tulare Lake Bed is underlain by clay layers ranging from the A-Clay near the surface to the F-Clay below the Corcoran Clay (also known as the E-Clay). The Corcoran Clay varies in depth from the surface, is up to 200 feet thick and serves as a confining layer, splitting the aquifer into a distinct shallow, perched groundwater zone and a lower, confined zone. The shallow perched groundwater in the proposed de-designation area and in the surrounding area contains highly elevated salinity concentrations. Four urban areas (Stratford, Kettleman City, Alpaugh, and Corcoran) exist along the fringes of the study area, just outside of the proposed de-designation horizontal boundary. Communities and agricultural operations within the project area utilize either imported surface water or groundwater from aquifers situated beneath the proposed vertical de-designation boundaries for their water supplies.

The Beneficial Use Evaluation Report (CV-SALTS, 2015) used historical information for the Project Study Area related to groundwater conditions, subsurface geologic conditions, groundwater quality, and well construction data to establish a preliminary horizontal de-designation boundary for MUN and AGR beneficial uses as an initial step in the process. This information indicates that natural groundwater gradients in the project area are from the surrounding area toward the central area of the historical Tulare Lake Bed. As a second step in the evaluation process, the Project Study Area was divided into five subareas for more detailed examination: Central Subarea, North Subarea, West Subarea, South Subarea, and East Subarea (see **Figure ES 1**). All subareas except the Central Subarea, which is located in the middle of the historical Tulare Lake Bed, extended outside of the preliminary horizontal de-designation boundary. Each subarea was evaluated in greater detail with respect to soil conditions, groundwater conditions, water quality, regional subsurface geology, surface features, active water supply wells and their uses, and nearby cities and communities. District staff also utilized records from well construction, historical well location information, in person communication, google earth, and field verification to verify:

- status and location of irrigation, domestic, and stock wells;
- water source for livestock;
- water quality data; and,
- well construction information.

This information for each of the four outer subareas – referred to as fringe areas – was used to adjust the preliminary horizontal de-designation boundary to define the proposed horizontal de-designation boundary for MUN and AGR beneficial uses. Additionally, the focused analyses conducted within each of the subareas allowed for delineation of vertical de-designation depths. Vertical de-designation depths within in the de-designation area vary according to the depth of the confining clay layers that separate the shallow, unconfined groundwater zone from the lower confined zone.

The proposed horizontal de-designation boundary was adjusted to exclude nearby towns and domestic well users. The communities pump their groundwater from locations upgradient from the proposed de-designation area. The technical authors of the Beneficial Use Evaluation Report conducted a zone of capture analysis to confirm that the pumping of municipal wells

outside of the proposed de-designation boundary would not influence the flow of shallow groundwater toward municipal wells and would not result in the extraction of groundwater from within the de-designation area.

A second zone of capture analysis performed for a representative, shallow, (50-100 foot deep), private domestic well located just outside of the proposed de-designation boundary found that a well located greater than 87.5 feet from the de-designation boundary would not draw groundwater from within the de-designation boundary, nor influence the flow of shallow groundwater toward the domestic well (KDSA, 2016b). To be conservative, a buffer of 100 feet from the de-designation boundary was included for the domestic wells. District staff utilized google earth and field reconnaissance to ground truth the locations of any potentially active wells within or close by to the de-designation area horizontal boundary. Based on the ground truth work, three active domestic wells are located within the horizontal extent of the proposed de-designation area but below the proposed vertical de-designation boundary. Two of these three active domestic wells (located southwest of Stratford as shown in **Figure ES 1**) are completed below the Corcoran Clay, while one draws water from a depth of 500-520 feet, below the proposed vertical de-designation boundary (below the A-Clay). A number of active irrigation supply wells have been identified within the proposed horizontal de-designation boundary (see **Figure ES 1**); however, all of these wells are completed below the Corcoran Clay and thus, below the proposed vertical de-designation boundary in which they are located.

Based on the groundwater well reconnaissance work performed as part of the Beneficial Use Evaluation Report, it was determined that the three-dimensional space described by the horizontal and vertical de-designation boundaries shown in **Figure ES 1** contains groundwater that exceeds an EC of 5,000 $\mu\text{S}/\text{cm}$, and in many portions falls within the range 10,000 to 40,000 $\mu\text{S}/\text{cm}$. Where wells exhibited EC levels less than 5,000 $\mu\text{S}/\text{cm}$, proposed de-designation boundaries were adjusted to not include these wells or the zones from which they extract groundwater. EC levels in the proposed de-designation area meet the water quality conditions of Exception 1a of the *Sources of Drinking Water Policy*, and the groundwater is not reasonably expected to supply a public water system. EC levels of 5,000 $\mu\text{S}/\text{cm}$ or greater also exceed guidelines from the Canadian Council of Ministers for the Environment that recommend a maximum EC limit of 5,000 $\mu\text{S}/\text{cm}$ for all classes of livestock (Canada, 2012). These Canadian guidelines were included in the CV-SALTS literature review that evaluated salinity impacts on stock watering (CV-SALTS, 2013).

Public outreach within and outside of the project area has been an ongoing process throughout the development of the Beneficial Use Evaluation Report since 2011. Outreach to landowners and local agencies have been led by the district staff. As part of the investigation for the Beneficial Use Evaluation, representatives of TLDD and TLBWS also initiated meetings with stakeholders within and surrounding the project area. Stakeholder meetings generally were focused on the solicitation of input from the surrounding disadvantaged communities and municipalities, farmers/ranchers, and landowners in the project area with regard to the proposal to de-designate MUN and AGR beneficial uses in a portion of the historical Tulare Lake Bed. A list of meetings is provided in Appendix A of this Staff Report.

Alternatives to the proposed horizontal and vertical de-designation boundaries shown in **Figure ES 1** were identified by stakeholders for both the MUN and AGR beneficial uses in the project area.

Stakeholders identified the following four project alternatives pertaining to the MUN beneficial use designation for a portion of the historical Tulare Lake Bed:

1. No Action.
2. De-designate MUN Beneficial Use within the Historical Footprint of the Tulare Lake Bed at an Elevation of 200 Feet above Mean Sea Level with No Vertical De-designation Boundary.
3. De-designate MUN Beneficial Use in a Portion of the Historical Tulare Lake Bed Based on Application of the *Sources of Drinking Water Policy* (SWRCB Resolution No. 88-63) Exception 1a.
4. Development of MUN Site-Specific Salinity Objectives within the Proposed MUN De-designation Boundary.

Stakeholders also identified the following six project alternatives pertaining to the AGR beneficial use designation for a portion of the historical Tulare Lake Bed:

1. No Action
2. Development of AGR Site-Specific Salinity Objectives within the Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering.
3. De-designate AGR Beneficial Use within Separate Horizontal and Vertical Boundaries for Irrigation Supply and Livestock Watering.
4. Development of Classes of AGR Uses and Water Quality Objectives that Better Represent Irrigation and Livestock Watering Limitations at Different Groundwater Salinity Concentrations within the Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering.
5. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 5,000 $\mu\text{S}/\text{cm}$.
6. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 7,500 $\mu\text{S}/\text{cm}$.

This Staff Report contains an analysis of the above described MUN and AGR project alternatives using the nine criteria listed below:

1. Maintain consistency with federal and state water quality laws and policies as applicable
2. Meet exception(s) of *Sources of Drinking Water Policy*
3. Protect existing and future potential beneficial uses
4. Maintain agricultural production in the project area
5. Support the proactive control and management of salt for application or disposal in the western portion of the Basin, toward the drainage trough of the valley
6. Technically feasible, economically viable, and reasonable action
7. Scientifically supported by existing data

8. Support socioeconomic well-being of the project area
9. Ease of implementation

Based upon use of the above criteria to score and rank the various alternatives, this Staff Report proposes that the preferred alternative for MUN beneficial use de-designation is the application of the *Sources of Drinking Water Policy* Exception 1a (MUN Alternative 3), where water quality exceeds 5000 $\mu\text{S}/\text{cm EC}$. The recommended alternative for AGR beneficial use de-designation is to de-designate the AGR use within the proposed de-designation area based on a 5,000 $\mu\text{S}/\text{cm EC}$ threshold value taken from the Canadian Council of Ministers for the Environment which established a maximum recommended limit of 5,000 $\mu\text{S}/\text{cm EC}$ for all classes of livestock (Canada, 2012) (AGR Alternative 5). The 5,000 $\mu\text{S}/\text{cm EC}$ threshold value for AGR de-designation exceeds the threshold value for irrigation of most salt tolerant crops (3,000 $\mu\text{S}/\text{cm}$), as established by the findings of Ayers and Westcot (Ayers and Westcot, 1985).

Finally, this Staff Report evaluates the proposed Basin Plan Amendment's consistency with existing federal and state laws, regulations and policies, contains an environmental analysis that complies with the applicable requirements of the California Environmental Quality Act and includes antidegradation and economic analyses that evaluate potential impacts of this project. The Board's Basin Planning Program is considered a certified regulatory program, which means that the Board is exempt from the requirement to prepare an environmental impact report for basin planning activities under the California Environmental Quality Act. (Pub. Res. Code, § 21080.5; Cal. Code Regs., tit. 14, § 15251(g).) The Board's environmental review of the proposed Basin Plan Amendments, as contained in this Staff Report, along with the entire Staff Report and the project's administrative record is considered to be the "substitute environmental documentation" or "SED" for the project. The resultant finding was no significant impacts for the proposed basin plan amendment or its implementation. Additionally, the preferred alternative has received local support from the surrounding communities, residents, and land owners, as documented in Appendices A and B of this Staff report.

Specific proposed Basin Plan Amendment language is contained in the following section.

PROPOSED AMENDMENT LANGUAGE

Proposed Basin Plan Language

The proposed changes to the Basin Plan are as follows. Text additions to the existing Basin Plan language are underlined and *italicized*. Text deletions to the existing Basin Plan are in ~~strikethrough~~.

Modify the Basin Plan in Chapter 2 Existing and Potential Beneficial Uses, column two, paragraph four (page II-2), as follows:

Figure II-2 and Table II-2 present the AGR, IND, PRO, REC-1, REC-2, and WILD beneficial uses of ground water that existed as of 1993. Due to the “Sources of Drinking Water Policy,” all ground waters are designated MUN (the use may be existing or potential) unless specifically exempted by the Regional Water Board and approved for exemption by the State Water Board. Ground water areas exempted from MUN or other beneficial uses are ~~footnoted~~ presented in Table II-2~~3~~.

Modify the Basin Plan in Chapter 2, Table II-2 (page II-6) as follows:
Add the following footnote to bottom of page II-5:

1 – See Table II-3 for listed groundwater beneficial use exceptions

Modify the Basin Plan in Chapter 2, Tulare Lake Basin Groundwater Beneficial Use Exceptions, Table II-2 (page II-7), to delete text as follows:

Table II-2
TULARE LAKE BASIN
GROUND WATER BENEFICIAL USES (continued)
Beneficial Use Exceptions

- ~~a. Ground water contained in the lower Transition Zone and Santa Margarita formation within 3,000 feet of the Kern Oil and Refining Company proposed injection wells in Section 25, T30S, R28E, MDB&M, is not suitable, or potentially suitable, for municipal or domestic supply (MUN). Ground water contained in the basal Etcheگوین formation, Chanac formation, and Santa Margarita formation within, and extending to one quarter mile outside the administrative boundary of the Fruitvale Oil Field, as defined by the State of California, Department of Conservation, Division of Oil and Gas in *Application for Primacy in the Regulation of Class II Injection Wells Under Section 1425 of the Safe Drinking Water Act*, dated April 1981, is not suitable, or potentially suitable, for municipal or domestic supply (MUN). However, the upper ground water zone (ground water to a depth of 3,000 feet) retains the MUN beneficial use.~~
- ~~b. Ground water and spring water within 1/2 mile radius of the McKittrick Waste Treatment (formerly Liquid Waste Management) site in Section 29, T30S, R22E, MDB&M, are not suitable, or potentially suitable, for municipal or domestic supply (MUN).~~
- ~~c. Ground water in the San Joaquin, Etcheگوین, and Jacalitos Formations within one half mile of existing surface impoundments P 1, P 2, P 3, P 4, P 4 1/2, P 5, P 6, P 7, P 8, P 9, P 10, P 11, P 12/12A, P 13, P 14, P 15, P 16,~~

~~P 17, P 18, P 19, and P 20, and proposed surface impoundments P 21, P 24, P 25, P 27, P 28, and P 29 at the Kettleman Hills Facility (Sections 33 and 34, T22S, R18E, and Section 3, T23S, R18E, MDB&M) of Chemical Waste Management is not a municipal or domestic supply (MUN).~~

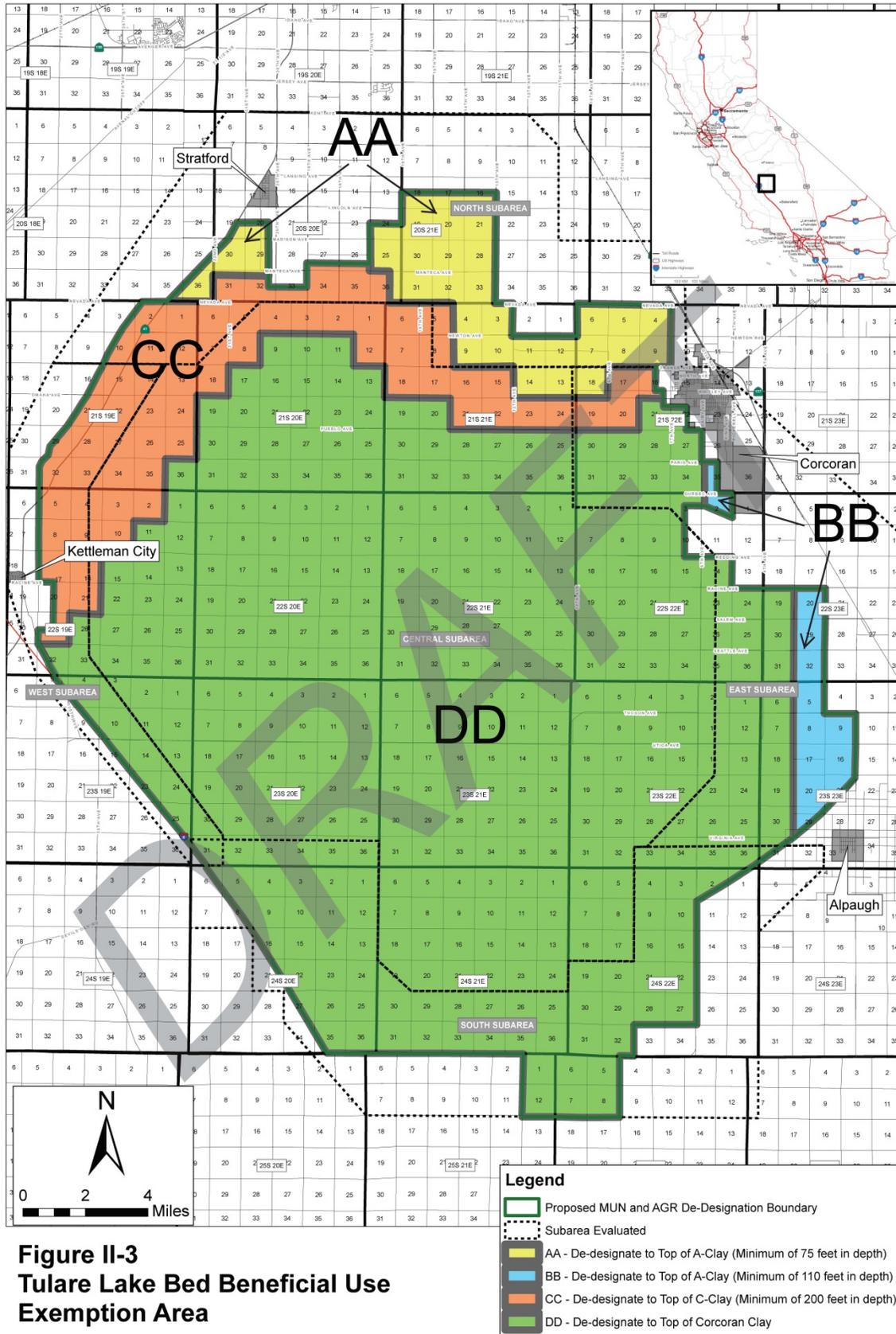
Modify the Basin Plan in Chapter 2, to insert new Table II-3 (page II-7) as follows:

TABLE II-3
TULARE LAKE BASIN
GROUND-WATER BENEFICIAL USE EXCEPTIONS

Exception Area	<u>Area Description</u>	<u>DAU#</u>
<u>1</u>	<p>Ground water contained in the lower Transition Zone and Santa Margarita formation within 3,000 feet of the Kern Oil and Refining Company proposed injection wells in Section 25, T30S, R28E, MDB&M, is not suitable, or potentially suitable, for municipal or domestic supply (MUN).</p> <p>Ground water contained in the basal Etchegoin formation, Chanac formation, and Santa Margarita formation within, and extending to one-quarter mile outside the administrative boundary of the Fruitvale Oil Field, as defined by the State of California, Department of Conservation, Division of Oil and Gas in Application for Primacy in the Regulation of Class II Injection Wells Under Section 1425 of the Safe Drinking Water Act, dated April 1981, is not suitable, or potentially suitable, for municipal or domestic supply (MUN). However, the upper ground water zone (ground water to a depth of 3,000 feet) retains the MUN beneficial use.</p>	<u>254</u>
<u>2</u>	Ground water and spring water within 1/2 mile radius of the McKittrick Waste Treatment (formerly Liquid Waste Management) site in Section 29, T30S, R22E, MDB&M, are not suitable, or potentially suitable, for municipal or domestic supply (MUN).	<u>259</u>
3	Ground water in the San Joaquin, Etchegoin, and Jacalitos Formations within one-half mile of existing surface impoundments P-1, P-2, P-3, P-4, P-4 1/2, P-5, P-6, P-7, P-8, P-9, P-10, P-11, P-12/12A, P-13, P-14, P-15, P-16, P-17, P-18, P-19, and P-20, and proposed surface impoundments P-21, P-24, P-25, P-27, P-28, and P-29 at the Kettleman Hills Facility (Sections 33 and 34, T22S, R18E, and Section 3, T23S, R18E, MDB&M) of Chemical Waste Management is not a municipal or domestic supply (MUN).	<u>N/A</u>
<u>4</u>	<p><u>Groundwater in the Tulare Lake Bed within the horizontal and vertical boundaries as described below, and as shown in Figure II-3, are not suitable for municipal, and domestic or agricultural irrigation and stock watering supply (MUN and AGR):</u></p> <p><u>For the most accurate location for the de-designation boundary refer to figure ES-1 and the detailed boundary narrative description in Appendix ES-A of the staff report. However, the overall de-designation horizontal boundary general begins to the Northwest, just south of Stratford, to the North following Laurel</u></p>	<u>238,</u> <u>241,</u> <u>243,</u> <u>244,</u> <u>246,</u> <u>255</u> <u>and</u> <u>259</u>

	<p><u>Avenue, south at 13th Avenue, east at Nevada Avenue, south at between 8th and 7th Avenues along the western boundary of the town of Corcoran, to the west just south of Quebec Avenue, south approximately 6 ½ Avenue, east on Redding Avenue, south on 5th Avenue, east on Racine Avenue, South at approximately 2nd Avenue, begin angling just south of Utica Avenue past the westside boundary of Alpaugh moving west toward 6th Avenue south toward the county line, along county line moving to the west toward approximately 17th Avenue, then north toward Virginia Avenue, west to Interstate 5 moving north towards the east boundary of Kettleman City, continuing north just west of the Highway 41 to the southern boundary of Stratford.</u></p> <p><u>Depth discrete boundaries, AA through DD, are shown in Figure II-3 and described below:</u></p> <ul style="list-style-type: none"> • <u>Horizontal boundary AA to a vertical boundary to the top and extending to the bottom of the A-Clay (minimum of 75 feet in depth)</u> • <u>Horizontal boundary BB to a vertical boundary to the top and extending to the bottom of the A-Clay (Minimum of 110 feet in depth)</u> • <u>Horizontal boundary CC to a vertical boundary to the top and extending to the bottom of the C-Clay (minimum of 200 feet in depth)</u> • <u>Horizontal boundary DD to a vertical boundary to the top and extending to the bottom of the E-Clay (Corcoran clay)</u> 	
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Add the following figure to the Basin Plan as Figure II-3, Tulare Lake Bed Beneficial Use Exemption Area, to new page II-7.02.



**Figure II-3
Tulare Lake Bed Beneficial Use
Exemption Area**

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Modify the Basin Plan in Chapter III WATER QUALITY OBJECTIVES, WATER QUALITY OBJECTIVES FOR GROUND WATERS, column one, sentence one (page III-7) as follows:

The following water quality objectives apply to all ground waters in the Tulare Lake Basin, except for those areas with specific beneficial use exceptions as listed in Table II-3.

Modify the Basin Plan in Chapter III WATER QUALITY OBJECTIVES, WATER QUALITY OBJECTIVES FOR GROUND WATERS, Salinity, column one, paragraph one (page III-8) as follows:

All ground waters shall be maintained as close to natural concentrations of dissolved matter as is reasonable considering careful use and management of water resources, except for those areas with specific beneficial use exceptions as listed in Table II-3.

Modify the Basin Plan in Chapter III WATER QUALITY OBJECTIVES, WATER QUALITY OBJECTIVES FOR GROUND WATERS, Salinity, column one, paragraph three (page III-8) as follows:

The maximum average annual increase in salinity measured as electrical conductivity shall not exceed the values specified in Table III-4 for each hydrographic unit shown in Figure III-1, except for those areas with specific beneficial use exceptions as listed in Table II-3.

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LIST OF ACRONYMS

3D	Three-Dimensional
AGR	Agricultural Supply
Basin Plan	Water Quality Control Plan for the Tulare Lake Basin
bgs	Below Ground Surface
BUER	Beneficial Use Evaluation Report (aka CV-SALTS, 2015)
CCME	Canadian Council of Ministers for the Environment
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability
DAU	Detailed Analysis Unit
DWR	California Department of Water Resources
EC	Electrical Conductivity
gpd	Gallons per Day
GHG	Greenhouse Gas
GW	Groundwater
HDPE	High-density Polyethylene
IND	Industrial Service Supply
ILRP	Irrigated Lands Regulatory Program
LSCE	Luhdorff & Scalmanini Consulting Engineers
MCLs	Maximum Contaminant Levels
MSL	Mean Sea Level
M/S	Monitoring and Surveillance
MUN	Municipal and Domestic Supply
NMFS	National Marine Fisheries Service
PRO	Industrial Process Supply
REC-1	Water Contact Recreation
REC-2	Non-contact Water Recreation
SED	Substitute Environmental Documentation
SJVAPCD	San Joaquin Valley Air Pollution Control District
SNMP	Salt and Nutrient Management Plan
SSO	Site-Specific Objective
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TLBWSD	Tulare Lake Basin Water Storage District
TLDD	Tulare Lake Drainage District
TLGB	Tulare Lake Groundwater Basin
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USFW	United States Fish and Wildlife Service
WDR	Waste Discharge Requirement
WQO	Water Quality Objective
WILD	Wildlife Habitat

FIGURE CROSS REFERENCE

This Basin Plan Amendment Staff Report uses several figures originally included in the *Technical and Regulatory Evaluation of MUN and AGR Beneficial Uses in the Tulare Lake Bed Area* (Beneficial Use Evaluation Report) prepared by Kenneth D. Schmidt and Associates , CDM Smith, and Summers Engineering (CV-SALTS, 2015). Below is a cross reference table that denotes the numbers of figures in this Staff Report and their corresponding numbers in the Beneficial Use Evaluation Report, where applicable.

Basin Plan Amendment Staff Report Figures	Beneficial Use Evaluation Report Figures
Figure ES 1	Exclusive to Basin Plan Amendment Staff Report – Compiles information from Figures 4-28, 4-29, 4-30, 4-31, 4-32, 5-1, plus additional well reconnaissance information.
Figure 1	Exclusive to Basin Plan Amendment Staff Report
Figure 2	As above
Figure 3	Figure 3-3
Figure 4	Figure 3-1 with enhancements
Figure 5	Exclusive to Basin Plan Amendment Staff Report
Figure 6	Exclusive to Basin Plan Amendment Staff Report – Compiles information from Figures 4-28, 4-29, 4-30, 4-31, 4-32, plus additional well reconnaissance information.
Figure 7	Figure 3-6
Figure 8	Figure 1-2
Figure 9	Exclusive to Basin Plan Amendment Staff Report – Compiles information from Figures 4-28, 4-29, 4-30, 4-31, 4-32, 5-1, plus additional well reconnaissance information.
Figure 10	Exclusive to Basin Plan Amendment Staff Report
Figure 11	Figure 1-3
Figure 12	Exclusive to Basin Plan Amendment Staff Report
Figure 13	Exclusive to Basin Plan Amendment Staff Report

1 INTRODUCTION AND EXISTING CONDITIONS

The purpose of this Staff Report is to provide the rationale and supporting documentation for a proposed amendment to the Water Quality Control Plan for the Tulare Lake Basin (Basin Plan) to de-designate the Municipal and Domestic Supply (MUN) and the Agricultural Supply (AGR) beneficial uses from groundwater within horizontally and vertically delineated areas underlying a portion of the historical Tulare Lake Bed.

The proposed amendment is part of a larger effort by the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) stakeholder led initiative to develop a comprehensive Salt and Nitrate Management Plan (SNMP) for the Central Valley. As part of its work on the SNMP, CV-SALTS is reviewing the Basin Plan's beneficial use designations to determine whether these beneficial use designations were appropriately made and, if so, whether the Basin Plan's implementation programs provide an appropriate level of protection for the waterbodies that support these beneficial uses. Where appropriate, CV-SALTS is proposing that the California Regional Water Quality Control Board, Central Valley Region (Central Valley Water Board) modify the Basin Plan's MUN and/or AGR beneficial use designations and programs of implementation to encourage reuse and recycling, to give regulated entities more flexibility in managing limited water supplies, and to identify potential salt management areas that would help salt to be moved out of sensitive areas.

The Central Valley Water Board has incorporated State Water Board Resolution No. 88-63, the *Sources of Drinking Water Policy*, into the Basin Plans, and has designated all surface and ground water bodies in the Central Valley region as supporting the MUN beneficial use unless a particular water body is specifically designated as not supporting the MUN beneficial use in the Basin Plans. The *Sources of Drinking Water Policy* identifies exceptions to the MUN beneficial use that can apply to certain water bodies, including an exception that applies to water bodies where the total dissolved solids (TDS) exceeds 3,000 milligrams per liter (mg/L) (5,000 microsiemens per centimeter ($\mu\text{S}/\text{cm}$) as electrical conductivity (EC)), provided that the waterbody is not expected to supply a public water system. [Hereinafter in this Staff Report, EC values will be cited instead of TDS values to avoid confusion.] The *Sources of Drinking Water Policy* also provides an exception for water bodies that do not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gallons per day (gpd). However, these exceptions are not self-implementing – the Central Valley Water Board is required to protect the MUN beneficial use even in water bodies that meet the exception criteria in the *Sources of Drinking Water Policy* unless and until a Basin Plan amendment is adopted that specifically de-designates the MUN use in such water bodies.

With regard to the AGR beneficial use, the Basin Plan states that unless otherwise designated by the Central Valley Water Board, “all ground waters in the region are considered suitable or potentially suitable, at a minimum, for agricultural supply (AGR)...” Agricultural supply includes the use of groundwater for irrigation, livestock watering, and support of vegetation for range grazing. When protecting the AGR beneficial use, the narrative Chemical Constituents water quality objective generally sets the minimum regulatory requirements that the discharge must meet. The Chemical Constituents groundwater water quality objective states, “[g]round waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses.”

The Central Valley Water Board has utilized salinity guidelines identified in Ayers and Westcot (Ayers and Westcot, 1985) to interpret the Basin Plan's narrative objective, and has previously considered irrigation water supply at 700 $\mu\text{S}/\text{cm}$ to be protective of all crops at all times. CV-SALTS conducted a review of literature related to salinity impacts on both irrigation and stock watering, and found that the

irrigation literature concurred with the Ayers and Westcot finding that only the most salt tolerant crops may be sustainably irrigated with water exceeding 3,000 µS/cm (CV-SALTS, 2012a). As part of the stock watering literature review, CV-SALTS also identified a range of acceptable salt levels for livestock watering (CV-SALTS, 2013).

The Board identified the need to evaluate the appropriateness of designated beneficial uses as a priority in the Board's 2014 Triennial Review (Central Valley Water Board, 2014). Concurrently, the CV-SALTS initiative identified that there was a need to define the salinity-related requirements for the protection of both the MUN and AGR beneficial uses. To support both needs, the Central Valley Salinity Coalition, a discharger group financially supporting and managing the CV-SALTS initiative, and the Tulare Lake Drainage District jointly provided resources for the development of technical information and environmental and economic analyses in support of this MUN and AGR beneficial use evaluation project for a portion of the historical Tulare Lake Bed. The technical and regulatory information developed in support of this beneficial use evaluation is compiled in the *Technical and Regulatory Evaluation of MUN and AGR Beneficial Uses in the Tulare Lake Bed Area* (Beneficial Use Evaluation Report) prepared by Kenneth D. Schmidt and Associates, CDM Smith, and Summers Engineering (CV-SALTS, 2015). Stakeholders participating in the effort provided updates on the project to the CV-SALTS Executive Committee during public meetings. The Executive Committee is comprised of representatives from state, federal, and local agencies, the discharger community, environmental organizations, disadvantaged communities and Environmental Justice groups.

This Staff Report describes the proposed Basin Plan Amendment and provides the rationale behind each part of the amendment addressing application and de-designation of MUN and AGR beneficial uses. The report also presents the alternatives considered, the public processes utilized, and the results of California Environmental Quality Act (CEQA), antidegradation, and economic evaluations of the preferred alternatives. If adopted, this amendment will utilize (1) Exception 1a in the Sources of Drinking Water Policy to de-designate the MUN beneficial use and (2) salinity thresholds identified by Ayers and Westcot (1985) and the CV-SALTS literature review (CV-SALTS, 2013) to de-designate the AGR beneficial use in a portion of the historical Tulare Lake Bed. In addition, the amendment identifies potential, future project-by-project monitoring to ensure that groundwater outside of the MUN and AGR de-designation area meets all relevant water quality objectives.

1.1 BACKGROUND AND NEED FOR PROPOSED BASIN PLAN AMENDMENT

1.1.1 Current Application of the MUN Beneficial Use

When the Central Valley Water Board incorporated the *Sources of Drinking Water Policy* into the Basin Plan, the Board made a blanket designation that all groundwaters support the MUN beneficial use by default. The Board may only exempt waterbodies from MUN beneficial use designations by amending the Basin Plans. (see *California Ass'n of Sanitation Agencies v. State Water Resources Control Bd.* (2012) 208 Cal.App.4th 1438, 1463, as modified on denial of reh'g (Sept. 27, 2012).)

The Basin Plan further states that waters designated as supporting the MUN beneficial use must not exceed Maximum Contaminant Levels (MCLs) of Title 22 of the California Code of Regulations for chemical constituents, pesticides, and radionuclides (Basin Plan, Chapter III Water Quality Objectives). While Resolution No. 88-63 does contain exceptions for the MUN designation, to utilize the exception, the Basin Plan requires "... [A] formal Basin Plan amendment which includes a public hearing. The exception becomes effective upon approval by the State Water Board and Office of Administrative Law", as noted in the Plans and Policies chapter (Basin Plan, Chapter V, page V-2) under the discussion of State Water Board Resolution 88-63.

In considering Basin Plan amendments that will have the effect of dedesignating the MUN beneficial use, the Regional Water Board utilizes the following criteria from the *Sources of Drinking Water Policy*:

1. The EC must exceed 5,000 $\mu\text{S}/\text{cm}$ and the aquifer cannot be reasonably expected to supply a public water systems, or
2. There is contamination, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices, or
3. The water source cannot provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gpd, or
4. The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR, Section 261.3.

1.1.2 Current Application of the AGR Beneficial Use

The Basin Plan requires consistency with the *Sources of Drinking Water Policy* in making exceptions to beneficial use designations other than the MUN beneficial use. Therefore, in making any exceptions to the beneficial use designation of agricultural supply (AGR), the Regional Water Board must consider the following criteria:

1. There is pollution, either by natural processes or by human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for agricultural use using either Best Management Practices or best economically achievable treatment practices, or
2. The water source does not provide sufficient water to supply a single well capable of producing an average, sustained yield of 200 gpd, or
3. The aquifer is regulated as a geothermal energy producing source or has been exempted administratively pursuant to 40 CFR, Section 146.4 for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy, provided that these fluids do not constitute a hazardous waste under 40 CFR Section 261.3.

De-designation of the AGR beneficial use for groundwater would similarly require the development of a Basin Plan Amendment and public hearing followed by approval of the amendment by the State Water Board and Office of Administrative Law.

1.1.3 History of Evaluating Beneficial Uses in Groundwater

Beneficial uses in groundwater within the Tulare Lake Basin have been evaluated in the past, with the most recent comprehensive Basin-wide evaluation occurring in 1993. The Tulare Lake Basin is divided into hydrologic units and satellite basins. Hydrologic units are further subdivided into detailed analysis units (DAUs). DAUs and satellite basins are the geospatial areas for which groundwater beneficial uses have been designated. The following beneficial uses have been identified to occur throughout the Basin: Municipal and Domestic Supply (MUN), Agricultural Supply (AGR), Industrial Service Supply (IND), Industrial Process Supply (PRO), Water Contact Recreation (REC-1), and Wildlife Habitat (WILD). Due to the *Sources of Drinking Water Policy*, all ground waters are designated MUN (the use may be existing or potential) unless specifically exempted by the Central Valley Water Board and approved by the State Water Board. Portions of two DAUs (254 and 259) within the Kern County Basin have received

beneficial use exceptions because the Board found groundwater in these areas not to be suitable, or potentially suitable, for municipal and domestic use (MUN). Additionally, ground waters in the San Joaquin, Etchegoin, and Jacalitos Formations within one-half mile of existing and proposed surface impoundments and the Chemical Waste Management Kettleman Hills Facility have been exempted from use as municipal or domestic supply (MUN) (Basin Plan, Table II-2).

Appropriate protection of the AGR beneficial use was evaluated for the White Wolf Basin that resulted in the adoption of site-specific water quality objectives for discharges overlying groundwater of varying quality that is used for irrigation. Irrigation water quality was divided into three classes. These site-specific water quality objectives are based on crop sensitivity and natural background conditions identified for several sub-basins (see **Table 1**).

Table 1: Site-Specific Water Quality Objectives in the White Wolf Subarea for the Protection of the AGR Beneficial Use.

Constituent	Class I	Class II	Class III
TDS (mg/L)	<700	700 – 2,000	>2,000
EC (µS/cm)	<1,000	1,000 – 3,000	>3,000
Chlorides (mg/L)	<175	175 - 350	>350
Sodium (percent base constituents)	<60	60 - 75	>75
Boron (mg/L)	<0.5	0.5 - 2	>2

Taken from Basin Plan, Chapter IV, page IV-11.

In order for groundwater to support existing or potential AGR beneficial uses, it is generally considered that it must not possess electrical conductivities greater than 3,000 µS/cm for irrigation and 7,500 µS/cm for livestock watering. The 3,000 µS/cm EC threshold for irrigation is based on a literature review prepared for CV-SALTS, which is developing a SNMP for the Central Valley, including the Tulare Lake Basin (CV-SALTS, 2013). The literature review concurred with the Ayers and Westcot finding that only the most salt tolerant crops may be sustainably irrigated with water exceeding 3,000 µS/cm (Ayers and Westcot, 1985). The 7,500 µS/cm EC threshold for livestock watering is based on the same CV-SALTS literature review (CV-SALTS, 2013). The literature review for livestock watering (CV-SALTS, 2013) also includes guidance from the Canadian Council of Ministers for the Environment (CCME) guidelines that recommend a maximum EC limit of 5,000 µS/cm for all classes of livestock (Canada, 2012).

1.1.4 Joint Initiative with CV-SALTS for the Development of a Region-wide Framework

The CV-SALTS initiative is a stakeholder process developing a Salt and Nitrate Management Plan (SNMP) for the Central Valley. This effort includes evaluating the appropriate designation and level of protection for water bodies currently designated with the MUN and/or AGR beneficial uses, in order to ensure protection of sensitive uses, while increasing flexibility to manage limited water supplies, encourage reuse and recycling, and identify potential salt management areas (those with limited or no AGR or MUN use due to naturally elevated salinity concentrations) to allow salt to be moved out of sensitive areas. In particular, CV-SALTS members were encouraged to provide submissions for “archetype” studies to identify waters that clearly meet the exemption criteria set forth in the *Sources of Drinking Water Policy*.

As members of CV-SALTS, the Tulare Lake Drainage District (TLDD) and the Tulare Lake Basin Water Storage District (TLBWSD) jointly provided a study proposal for the de-designation of the MUN use from a portion of the historic Tulare Lake Bed in March 2011. TLDD and TLBWSD will hereinafter be collectively referred to as the Districts. In fall 2013, an evaluation of the appropriateness of the existing

AGR beneficial use designation in a portion of the historical Tulare Lake Bed was added to the MUN beneficial use evaluation effort with the approval of the CV-SALTS Executive Committee.

The Central Valley Water Board recognized the need for evaluating appropriate MUN and other beneficial uses in portions of the Tulare Lake Bed in its 2014 Tulare Lake Basin Triennial Review (Central Valley Water Board, 2014). The approved triennial review work plan allocated nominal staff resources to initiate the evaluation. Staff worked in conjunction with the CV-SALTS initiative on this evaluation in order to combine and leverage resources. Central Valley Water Board staff met with TLDD representatives in April 2011 to explore the proposal to evaluate MUN and identified preliminary data requirements. At a subsequent meeting in September 2011, additional discussions were held among Central Valley Water Board staff, the Districts and others regarding the potential study area for the MUN de-designation. The outcome of this meeting was a November 2011 Central Valley Water Board staff letter to the TLDD that recommended the next steps for this project. A Final Workplan was submitted to CV-SALTS in June 2012 and subsequently approved (CV-SALTS, 2012b). An addendum to the work plan was approved in 2013 in order to account for the parallel evaluation of AGR.

1.1.5 Stakeholder/Public Participation Process

A stakeholder group, including representatives from the Central Valley Water Board, CV-SALTS, the Districts, the surrounding disadvantaged communities and municipalities, the County of Kings, agricultural interests and knowledgeable consultants in the area, met on several occasions between spring 2011 and spring 2016 to contribute to the development of this proposed Basin Plan Amendment and the proposed project alternatives evaluated herein (see **Appendix A**). Stakeholder meetings generally were focused on the solicitation of input from the surrounding disadvantaged communities and municipalities, farmers/ranchers, and landowners in the project area with regard to the proposal to de-designate MUN and AGR beneficial uses in a portion of the historical Tulare Lake Bed. This stakeholder effort has resulted in local support for the proposed project, as evidenced by letters of support from the cities of Stratford, Kettleman City, Alpaugh, and Corcoran for de-designation of the MUN beneficial use in a portion of the Tulare Lake Bed (see **Appendix B**).

Central Valley Water Board staff conducted a CEQA scoping meeting in the City of Corcoran on 14 April 2015, to discuss and solicit comments from the public regarding both the appropriate application of the MUN and AGR beneficial uses and level of protection in ground waters. Stakeholders and potentially interested parties were notified of the scoping meeting through announcements sent on 18 March 2015 to Central Valley Water Board electronic email and postal lists. Tribal notifications of the scoping meeting were sent by regular U.S. mail on 20 March 2015. Central Valley Water Board staff kept stakeholders updated on the project via an email subscription list of approximately 140 subscribers and a publically available website¹ containing meeting notes and other project-related documents. Notices of availability of documents for review and public meetings are also sent via postal mail to a postal list created for this project.

1.2 PROJECT STUDY AREA

1.2.1 Background

The Project Study Area is located in the southern part of the Central Valley of California in the Tulare Lake Basin. The Tulare Lake Basin essentially functions as a closed basin. (see **Figure 1**). Because the Tulare Lake Basin is currently a closed basin, there is no natural outfall, which has allowed salt to accumulate through evaporation and evapotranspiration of both surface waters and shallow

¹ http://www.waterboards.ca.gov/centralvalley/water_issues/salinity/tulare_lakebed_mun_evaluation/index.shtml

groundwater. The diversion of water into the hydrologic basin from other watersheds to support 3 million acres of agriculture (Sholes 2006), including three of the five most agriculturally productive counties in the United States (2012²), has exacerbated the accumulation of salts. The majority of the western and southern Tulare Lake Basin and most of the historical Tulare Lake Bed is underlain by clay layers ranging from the A-Clay near the surface to the F-Clay below the Corcoran Clay (also known as the E-Clay). The Corcoran Clay varies in depth from the surface, up to 200 feet thick and serves as a confining layer, splitting the aquifer into a distinct shallow, perched groundwater zone and a lower, confined zone. The shallow perched groundwater in the proposed de-designation area and in the surrounding area contains highly elevated salinity concentrations. Communities and agricultural operations in the project area utilize either imported water or groundwater from the lower, confined aquifer for their water supplies.

Prior to the construction of dams and reservoirs that regulate the flows of the Basin's major tributaries, flows from the four major tributaries (Kings, Kaweah, Tule, and Kern rivers) traveled from the east side of the San Joaquin Valley, to the Tulare Lake Bed. The boundaries of the historical Tulare Lake changed from year to year based on precipitation and tributary inflows. The maximum reported area of Tulare Lake was about 800 square miles (in 1862 and again in 1868). Since the construction of dams and reservoirs and the development of irrigated agriculture in both the Tulare Lake Bed and the Tulare Lake Basin, the historical Lake Bed has contracted from a maximum of 400,000 acres to less than 200,000 acres, which although drained, is still subject to periodic flooding.

The topography of the Tulare Lake Bed is a gradually sloping trough from the former lake outer boundary toward the lowest region in the Tulare Lake Bed. The lowest region of the Tulare Lake Bed is approximately 175 feet above mean sea level (MSL) (see **Figure 3**). The generally flat terrain has an average slope of about one-foot per every mile from the lowest area towards the boundary. Flows from the four major tributaries flood the farmland within the Tulare Lake Bed approximately one out of every seven years. This periodic flooding of the area has kept residential dwellings, permanent plantings (e.g., orchards), and municipal water supply wells from being located in the interior portion of the Tulare Lake Bed (CV-SALTS, 2015). While alkaline heavy clay soils, extremes in climate, and a continuing flood hazard have prevented the planting of orchards and vineyards or the cultivation of most fresh vegetable crops, the Basin does support the production of cotton, wheat, safflower, alfalfa hay, processing tomatoes, and other field crops (TLBWSD, 2012). Since the formation of the TLDD, more than 40,000 acres of agricultural land have been restored and preserved due to drainage of shallow groundwater, with an additional 50,000 acres targeted for drainage in the future.

The area proposed for MUN and AGR beneficial use de-designation comprises a portion of the historical Tulare Lake Bed and is located in portions of four hydrologic units. Within these four hydrologic units, the Basin Plan identifies seven Detailed Analysis Units (DAUs), as shown in **Figure 2**. **Table 2** lists the hydrologic units, DAUs, and beneficial uses assigned to each DAU in the Project Study Area. All DAUs in the project area are designated for MUN, AGR, and Industrial Service Supply (IND) beneficial uses. DAU 238 and 243 are also designated for Industrial Process Supply (PRO), and DAU 243 and 255 are designated for Wildlife Habitat (WILD). The proposed Basin Plan Amendment is not seeking to change the IND, PRO, or WILD beneficial uses currently designated in the project area. There are currently no existing IND or PRO uses of groundwater in the proposed de-designation area. The Board recognizes that any utilization of groundwater for IND or PRO purposes would be significantly limited by the quality of the groundwater. Should the groundwater be utilized for IND or PRO purposes at any point in the future within the proposed de-designation area, the Central Valley Water Board would regulate discharges to provide reasonable protection of those uses

² http://agcomm.co.tulare.ca.us/default/assets/File/2012CensusCA_1.pdf

Table 2: Hydrologic Units, Detailed Analysis Units, and Designated Beneficial Uses of the Project Study Area.

Hydrologic Unit	Detailed Analysis Unit	Basin Plan Beneficial Uses				
		MUN	AGR	IND	PRO	WILD
Tulare Lake Basin	238	■	■	■	■	
	241	■	■	■		
	246	■	■	■		
Tule Basin	243	■	■	■	■	■
Westside Basin	244	■	■	■		
Kern County Basin	255	■	■	■		■
	259	■	■	■		

Taken from Table II-2: Tulare Lake Basin Ground Water Beneficial Uses.



Figure 1: Tulare Lake Basin Showing Project Study Area.

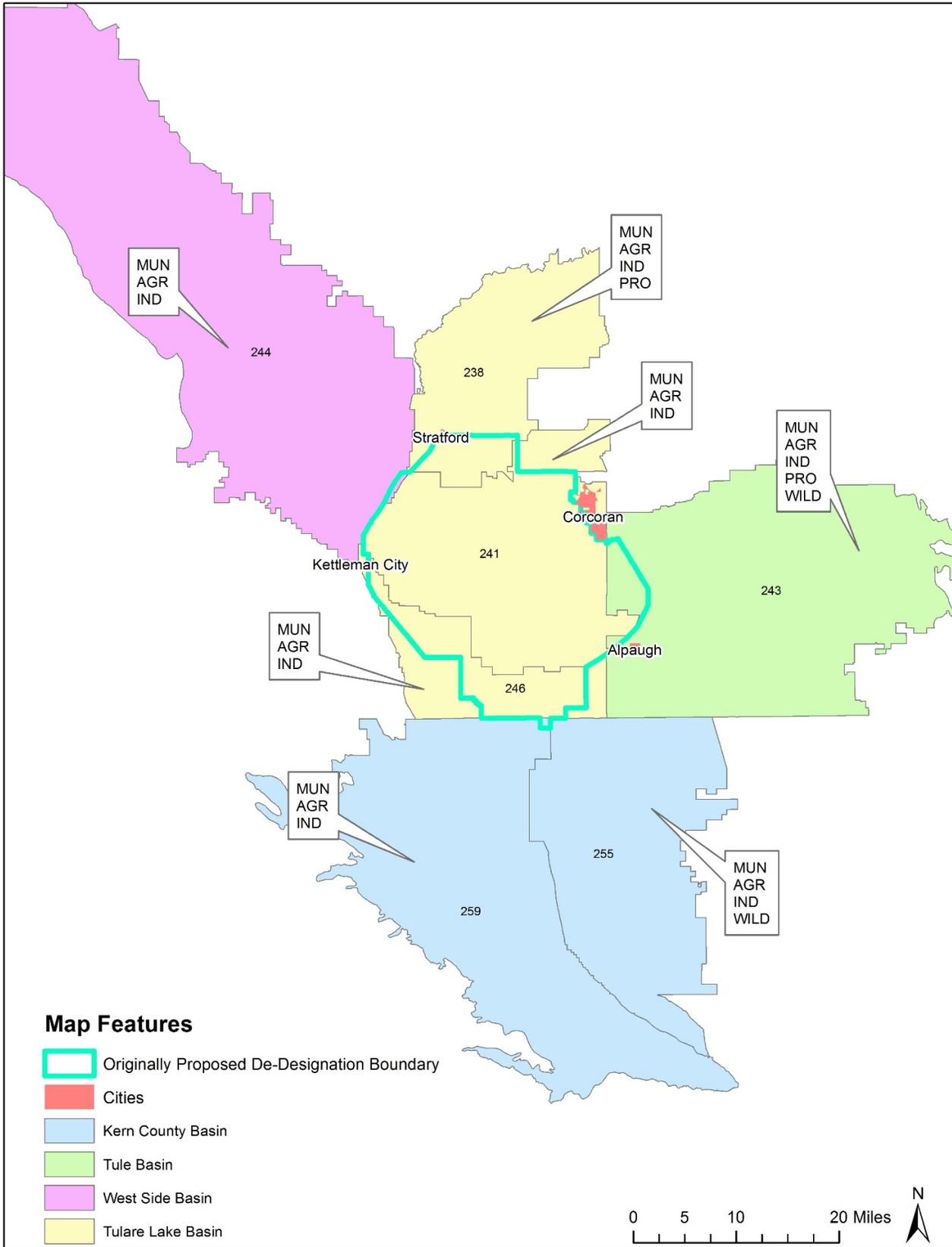


Figure 2: Detailed Analysis Units and Designated Beneficial Uses of the Project Study Area.

1.2.2 Preliminary Project Area Delineation

The Project Study Area is a portion of the center of the Tulare Lake Bed. Historical information on groundwater conditions, subsurface geologic conditions, groundwater quality, and well construction data, as well as identification of active wells and their uses were used to establish a preliminary, horizontal boundary that served as the preliminary Project Study Area for potential MUN/AGR de-designation (CV-SALTS, 2015). Surface features, such as major roads, and the boundaries of the local agricultural water purveyor (Tulare Lake Basin Water Storage District [TLBWSD]) and the entity managing drainage and salt load (Tulare Lake Drainage District [TLDD]) were included to make the preliminary horizontal boundaries more easily identifiable (see **Figure 4**). Because TLBWSD and TLDD manage inflows and drainage, respectively, within a portion of the Tulare Lake Bed, the Preliminary Project Study Area closely approximates the service areas of these two agencies. The Project Study Area was divided into a Central Subarea and four fringe subareas: North, West, South, and East. The four fringe subareas extend outside of the preliminary project boundary to allow for more in-depth evaluation and facilitated the analysis of where the MUN and AGR beneficial uses could be de-designated and where they should remain (see **Figure 5**). **Figure 6** adds to the previous two figures by including representations of all water supply wells identified within the Central Subarea and four fringe subareas.

A thorough ground level well reconnaissance effort in the Central Subarea and four fringe subareas was performed to determine which of the water supply wells shown in **Figure 6** were active and which were abandoned or destroyed. This information was used to determine if the originally proposed de-designation boundary was appropriate (i.e., not acting to remove an existing beneficial use of the groundwater), or if the de-designation boundary needed to be adjusted within the four fringe subareas to account for existing wells pumping groundwater on either side of the originally proposed de-designation boundary. The process employed to determine the status and use of wells identified via the well reconnaissance effort is described in **Appendix C**. General descriptions of the Central and fringe subareas included in the Beneficial Use Evaluation Report are provided below, along with well information developed through the aforementioned reconnaissance effort (CV-SALTS, 2015).

- The Central Subarea is distant from municipal and domestic supply wells, has extensive clay deposits, and very high salinity shallow groundwater. The boundaries of each of the four fringe subarea were generally delineated to extend 1 – 4 miles in both directions from the originally proposed de-designation boundary. The well reconnaissance effort in this subarea identified 75 wells in total. The vast majority of these wells are irrigation supply wells, along with two stock wells and one domestic well. The only active wells identified were irrigation supply wells that draw groundwater from below the Corcoran Clay.
- The North Subarea is located between Kent Avenue and Orange Avenue. This subarea generally covers the north part of the Lake Bed and adjoining areas, including the Town of Stratford. The Westlake Farms North Evaporation basins are located just north of this subarea. The south branch of the Kings River and several branches of the Kaweah River pass through this subarea. The well reconnaissance effort in this subarea identified 136 wells in total: three municipal wells (belonging to the Stratford Public Utilities District), numerous irrigation supply and domestic wells, five stock wells, two small water system wells, and one dairy well. With one exception, all wells that actively pump groundwater (three municipal, three domestic, and nine irrigation supply wells) in the subarea are completed below the Corcoran Clay. The one exception is a domestic well that resides 560 feet outside of the proposed MUN de-designation boundary and taps strata below the first confining layer (A-Clay) in the western portion of the North Subarea.

- The West Subarea generally extends to the west to near Kettleman City, and extends from Orange Avenue on the north to the Garces Highway on the south. The Westlake Farms South Evaporation Basins are in this subarea. No large streams pass through this subarea. The well reconnaissance effort in this subarea identified 26 wells in total. The only active wells identified by the reconnaissance effort in this subarea were three municipal wells belonging to the Kettleman City Community Services District. These wells tap strata above the Corcoran Clay, but a zone of capture analysis (see Section 3.4) found that the pumping of these municipal wells wouldn't influence the direction of groundwater flow in the area proposed for MUN de-designation, nor draw groundwater from within or beneath the area proposed for de-designation (KDSA, 2016a; see **Appendix D**).
- The South Subarea extends from 22nd Avenue on the west to Road 32 on the east, and is primarily south of Virginia Avenue. The TLDD Hacienda and South Evaporation Basins are in this subarea. No urban areas are located in the subarea. The Kern River overflow channel passes through the south part of this subarea. The well reconnaissance effort in this subarea identified 40 wells in total, but all were found to be either abandoned or destroyed.
- The East Subarea extends from Orange Avenue on the north to one mile south of Virginia Avenue on the south. This subarea includes the City of Corcoran and Alpaugh, and the Tule River passes through the central part of the subarea. The well reconnaissance effort in this subarea identified 141 wells in total. The vast majority of these wells are irrigation supply wells, along with 11 domestic well, one dairy well, and one municipal well belonging to the Alpaugh Community Services District. The only active wells identified were 20 irrigation supply wells and the Alpaugh municipal well, all of which draw groundwater from beneath the Corcoran Clay.

The Project Study Area is bounded to the north by Laurel Avenue, on the west by Highway 41 and Interstate 5, and on the east by Highway 43. Where no roads existed, canals and ground surface contour lines were also used to delineate the boundary. As mentioned above, the proposed MUN and AGR beneficial use de-designation boundaries possess both horizontal and vertical dimensions. Development of the originally proposed de-designation boundary (see **Figure 4**) did not include a vertical delineation because all data, regardless of vertical depth, were included in the technical analysis that was used to identify the precise horizontal and vertical beneficial use de-designation boundaries. Based on information evaluated within the fringe areas, including identification of wells providing water for existing MUN and/or AGR beneficial uses, the preliminary horizontal boundary of the Project Study Area was re-adjusted and then further adjusted based on well construction information. The proposed MUN and AGR beneficial use de-designation boundaries fall within the preliminary Project Study Area. The development of the proposed MUN and AGR beneficial use de-designation boundaries is described in more detail in Section 3, MUN and AGR Evaluation in a Portion of the Historical Tulare Lake Bed.

Due to the concern that abandoned wells in the Project Study Area could provide a potential conduit for the downward migration of higher saline groundwater from the upper aquifer to the lower aquifer beneath the Corcoran Clay, an evaluation of ambient EC levels measured in three irrigation wells that tap strata below the Corcoran Clay southwest and east of the City of Corcoran was performed. The EC data measured in these three irrigation wells indicate that neither the groundwater wells nor their gravel packs are acting as conduits for the downward migration of the poor quality, shallow groundwater that exists in the upper aquifer. Furthermore, these data support the assertion that the intervening clay layers between the upper and lower aquifers are acting as confining layers that prevent the downward migration of poor quality water. Additional information regarding this evaluation is provided in Section 3.5, Proposed Horizontal and Vertical AGR De-Designation Boundaries.

1.2.3 Soil Conditions

The technical analysis performed in support of the proposed project revealed that the Tulare Lake area is largely underlain by relatively impermeable basin soils, the predominant soil being Tulare Clay, a deep and very finely textured soil. Alluvial deposits derived from Coast Range marine sedimentary deposits are found in the western part of the Basin. These deposits have finer textures and higher clay content as compared to the sediments found in the eastern part of the Basin. Lacustrine and marsh deposits exist beneath the Tulare Lake Bed. These deposits are composed primarily of silts and clays (CV-SALTS, 2015)

The clay deposits have been designated from the youngest to the oldest by the letters A through F (see **Figure 6**). The most prominent of these clay units is the E-Clay or Corcoran Clay Member of the Tulare Formation (Corcoran Clay) which extends throughout the majority of the western and southern Tulare Lake Basin (absent along the eastern boundary and in the Bakersfield area). The Corcoran Clay generally separates unconfined groundwater conditions above the clay to confined conditions below the clay. The Corcoran Clay is an impermeable hydrologic barrier that ranges from 400 to 600 feet below the surface. The Corcoran Clay layer ranges in thickness from 50 to more than 200 feet. As a result of the clay strata that continue below the Corcoran Clay, any economically feasible attempt to directly recharge the aquifer below the Corcoran Clay is impractical within the Tulare Lake Bed. The clay layers above and below the Corcoran Clay layer extend several thousand feet from the surface down to an unknown depth (CV-SALTS, 2015).

1.2.4 Groundwater Conditions

Groundwater conditions in the Tulare Lake area are documented in reports produced by the United States Geological Survey (USGS), California Department of Water Resources (DWR) and others, and demonstrated from records of actual and attempted development of groundwater resources. First groundwater typically is encountered a few feet below the soil surface. Historically, a large amount of resources have been expended through the use of tile drain systems to keep naturally occurring poor quality first encountered groundwater from reaching the root zone of plants where it acts to lower crop yields. The TLDD was formed in 1966 to manage and dispose of subsurface tile drainage waters produced by the agricultural activities of its members (CV-SALTS, 2015).

The Beneficial Use Evaluation Report found that with the exception of a small number of deep wells screened below the Corcoran Clay, there are no wells in the Lake Bed proper (CV-SALTS, 2015). The USGS and others have documented salinities, expressed as EC, of between 5,000 – 10,000 $\mu\text{S}/\text{cm}$ in much of the Tulare Lake Bed. USGS and DWR describe the Tulare Lake Groundwater Basin (TLGB) as consisting essentially of a shallow saline aquifer and a deep aquifer separated by the Corcoran Clay hydrologic barrier (CV-SALTS, 2015). The soils underlying the Corcoran Clay are primarily low water-bearing, fine-textured clay materials, with interspersed silty sand lenses. The relatively impermeable heavy clay soils prevent any attempt to directly recharge either the shallow or lower aquifers. In order to find any useable groundwater, a well would need to be drilled below one of the clay formations (e.g., A-Clay, C-Clay, or Corcoran Clay) found in the Tulare Lake Bed (CV-SALTS, 2015). As noted in **Figure 6**, active irrigation wells in the project area are completed below the Corcoran Clay. Two of the three active domestic wells in the North Subarea are completed below the Corcoran Clay, while one taps strata below the first confining clay layer (A-Clay) present beneath the well. The vertical component of the proposed de-designation area is discussed in Section 3.

1.2.5 Water Quality

The unconfined aquifer in the interior portion of the Tulare Lake Bed contains high concentrations of salts. Historical data from farm operators indicate that the EC is in the range of 5,000 to greater than

35,000 $\mu\text{S}/\text{cm}$, which meets the exception from MUN use in the Sources of Drinking Water Policy and exceeds thresholds noted for agricultural supply and stock watering (CV-SALTS, 2013). Thus, there is limited to no shallow water suitable for these uses. Extending outward from the Project Study Area, the first encountered groundwater improves in quality. The Project Study Area encompasses the area where the EC is documented to be 5,000 $\mu\text{S}/\text{cm}$ or greater (CV-SALTS, 2015).

1.2.6 Water Use

The ground level well reconnaissance work performed in the Central Subarea and the four fringe subareas allowed for the identification of water supply wells where groundwater is currently pumped for irrigation or drinking water in the Tulare Lake Bed. **Figure 6** notes all water supply wells identified in the five subareas and shows those wells that are active, abandoned, or destroyed. The collection of wells shown in **Figure 6** was the result of an initial and a follow up search for all wells in the Project Study Area. The follow up effort was prompted by Central Valley Water Board staff who identified 14 additional wells that were potentially unidentified in the initial search effort. TLBWSD staff evaluated the 14 identified wells and found 12 of them to exist in the Project Study Area. The results of this follow up well reconnaissance effort are described in **Appendix E**. The identification of active wells used for municipal, domestic, and irrigation supply was used to delineate a proposed horizontal de-designation boundary (green line in **Figure 6**) that was adjusted from the originally proposed de-designation boundary for the purpose of protecting existing or potential MUN or AGR beneficial uses in areas where groundwater quality supports these uses. The vertical component of the proposed de-designation area (see Section 3) was developed after the establishment of the horizontal boundary by comparing the screen interval and well seal depth of active wells to the depth of clay layers that are known to separate shallow unconfined groundwater from deeper confined groundwater. Adding a vertical component to the proposed horizontal de-designation boundary supports the appropriate delineation of the proposed de-designation area and allows existing or potential uses of groundwater from specific depths to continue to be protected for such uses (see **Figure 8**). The proposed de-designation area does not include areas outside (upgradient) or below the project area where existing or potential MUN or AGR beneficial uses exist.

1.2.7 Regional Subsurface Geology

As previously stated, the soils in the historic Tulare Lake Bed are primarily impermeable clays. Soils along the rim of the historic Lake Bed are primarily fine grained, silty alluvium which was deposited along the shoreline. Older Continental alluvium deposits have noticeably finer texture than the younger Sierra Nevada deposits. The Project Study Area boundary surrounds the relatively impermeable heavy clay soils that are several thousand feet deep with the Corcoran Clay separating the confined from the unconfined aquifers. The clay layers rise and thin out near the fringe of the Project Study Area (CV-SALTS, 2015).

1.2.8 Surface Features

There are no natural water bodies in the Project Study Area; all of the canals in the Lake Bed are man-made. The Tulare Lake Basin is a closed basin and there are no outlets to any natural water bodies. Because the area is also prone to periodic flooding, there are no residential areas, permanent plantings or municipal supply wells located in the interior portion of the Tulare Lake Bed (CV-SALTS, 2015). Primary land use is agricultural production. Field crops cultivated in the Project Study area, as well as livestock raised there, are maintained using surface water supplies from outside the Tulare Lake Bed and groundwater pumped from wells screened below the proposed vertical de-designation depths within the de-designation area (CV-SALTS, 2015).

TLDD operates three evaporation basins for the purpose of disposal of agricultural drainage water. The TLDD service area encompasses 218,054 assessed acres, with approximately 185 landowners. There are 183,729 undrained acres, and 34,325 acres equipped with underground drainage collection and conveyance facilities. The design and operation of the agricultural drainage collection facilities up to the point of discharge into the TLDD system are the responsibility of individual landowners. Agricultural drainage is conveyed to TLDD's evaporation basins for disposal. The evaporation basins, which have a combined surface area of 3,165 acres, include the North Evaporation Basin, which initiated operation in 1975, encompassing a total wetted surface area of 264 acres; the South Evaporation Basin, which initiated operation in 1979, and has a total wetted surface area of 1,793 acres; and the Hacienda Evaporation Basin, which initiated operation in 1978, with a total wetted surface area of 1,108 acres.

1.2.9 Cities and Communities

There are no towns or communities within the Project Study Area (see **Figure 4**). Local towns all lie in the fringe subareas just outside of the proposed MUN and AGR beneficial use de-designation boundaries. These communities pump their groundwater from locations upgradient from the Lake Bed and Project Study Area (KDSA, 2016a; see **Appendix D**). Areas where groundwater is currently used as a potable water supply were not included in the Project Study Area (see **Figure 6**). The community of Stratford is north of the Project Study Area, Kettleman City is to the west, the City of Corcoran is on the northeast corner of the Project Study Area, and the Community of Alpaugh is to the southeast (see **Figure 6**). The growth of these communities is away from the proposed Project Study Area, primarily due to the risk of periodic flooding. The groundwater gradient along the fringe of the Project Study Area flows away from the domestic well fields and towards the center of the Project Study Area (CV-SALTS, 2015; KDSA, 2016a (see **Appendix D**)). A discussion of the sources of municipal water for each community and the direction of shallow groundwater flow away from each community's municipal wells and toward the center of the Lake Bed is provided in Section 3.4.

1.3 REGULATORY AUTHORITY AND MANDATES FOR BASIN PLAN AMENDMENTS

In enacting the Porter-Cologne Water Quality Act (Wat. Code, § 13000 et seq.), the Legislature found and declared that activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.

The State Water Board and the nine Regional Water Quality Control Boards (Regional Water Boards) are the state agencies with primary responsibility for coordination and control of water quality (Wat. Code, § 13000). Each Regional Water Board is required to adopt a water quality control plan, or Basin Plan, which provides the basis for regulatory actions to protect water quality (Wat. Code, § 13240 et seq.). Basin Plans designate beneficial uses of water, water quality objectives to protect those uses, and a program of implementation to achieve the objectives (Wat. Code, § 13050, subd.(j) ; also § 13241 and 13242). Basin Plans, once adopted, must be periodically reviewed and may be revised (Wat. Code, § 13240). Under the federal Clean Water Act (33 USC section 1251 et seq.), the states are required to adopt water quality standards for surface waters. (33 USC § 1313(c)) Water quality standards, as defined in Clean Water Act section 303(c), consist of the designated beneficial uses (e.g., swimming, fishing, municipal drinking water supply, etc.,) of a water body and water quality criteria necessary to protect those uses. A difference between the state and federal programs is that California's Basin Plans establish beneficial uses and water quality objectives to protect those uses for ground waters in addition to surface waters; beneficial uses and water quality objectives for groundwater are found in the Basin Plans.

Regional Water Boards adopt and amend Basin Plans through a structured process involving scientific peer review, public participation, and environmental review. Regional Water Boards must comply with the California Environmental Quality Act (CEQA) (Pub. Res. Code. § 21000 et seq.) when amending their Basin Plans. The Secretary of Natural Resources has certified the basin planning process as exempt from the CEQA requirement to prepare an environmental impact report or other appropriate environmental document. (Pub. Res. Code, § 21080.5; Cal. Code Regs., tit. 14, § 15251, subd. (g).) Instead, State Water Board regulations on its exempt regulatory programs require the Regional Water Boards to prepare a written report and an accompanying CEQA Environmental Checklist and Determination with respect to Significant Environmental Impacts (CEQA Checklist) (Cal. Code Regs., tit. 23, § 3775 et seq.).

Appendix P of this Staff Report provides justification that the proposed Basin Plan Amendment does not have any elements premised upon, or derived from, empirical data or other scientific findings, conclusions, or assumptions and that establish a regulatory level, standard, or other requirement for the protection of public health or the environment that have not already undergone peer review. Therefore, peer review of the scientific portions of this Basin Plan amendment is not required pursuant to Health and Safety Code section 57004(d).

Basin Plan amendments are not effective until they are approved by the State Water Board and the regulatory provisions are approved by the State Office of Administrative Law. The United States Environmental Protection Agency (USEPA) also must review and approve amendments that add or modify water quality standards for surface waters of the United States.

2 LAWS, PLANS AND POLICIES RELEVANT TO BASIN PLANNING

The project alternatives presented in Section 4, Project Alternatives, encompass potential changes to the Basin Plan in the areas of Beneficial Uses, Water Quality Objectives, and Implementation. Therefore, state laws, plans or policies pertaining to these three areas of the Basin Plan are described below. The preferred alternative is evaluated for consistency with relevant laws, plans and policies in Section 6, Consistency with Laws, Plans and Policies.

2.1 REGULATIONS THAT APPLY TO BENEFICIAL USES

2.1.1 Federal Regulations and Guidance

Federal regulations require the protection of designated uses in all (surface) waters of the United States as specified by the Clean Water Act. Federal regulations establish special protections for the uses specified in Clean Water Act section 101(a)(2) uses. Clean Water Act section 101(a)(2) states that it is a national goal that wherever attainable, water quality should be sufficient “for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water.” These uses are also referred to as “fishable/swimmable” uses. However, Clean Water Act section 101(a)(2) only pertains to surface waters, and, since the current project is only concerned with potential impacts to groundwater, these federal regulations do not apply.

2.1.2 State Regulations and Guidance

The Water Code includes designation of beneficial uses in both Basin Plans and statewide plans. (Wat. Code, §13050, subd. (j).) The Water Code defines beneficial uses of water as including, but not limited to: “domestic, municipal, agricultural, and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.” (Wat. Code, §13050, subd. (f).)

The Basin Plan lists beneficial uses for surface water (Table II-1) and groundwater (Table II-2). Groundwater beneficial uses are the uses germane to the Proposed Amendment to the Basin Plan.

The groundwater beneficial uses of the Tulare Lake Basin as listed in Table II-2 include: municipal and domestic supply (MUN), agricultural supply (AGR), industrial service supply (IND), industrial process supply (PRO), water contact recreation (REC-1), non-contact water recreation (REC-2), and wildlife habitat (WILD). Groundwater areas exempted from MUN are footnoted in Table II-2. Unless otherwise designated by the Regional Water Board, all ground waters in the Region are considered suitable or potentially suitable, at a minimum, for agricultural supply (AGR), industrial supply (IND), and industrial process supply (PRO) (Basin Plan pg. II-2).

2.1.3 State Water Board Resolution 88-63, the Sources of Drinking Water Policy

The *Sources of Drinking Water Policy*, establishes state policy that all waters are considered suitable or potentially suitable to support the MUN beneficial use, with certain exceptions.

When the Central Valley Water Board incorporated the *Sources of Drinking Water Policy* into the Basin Plan, the Board made a blanket designation that all groundwaters support the MUN beneficial use by default. The Board may only exempt waterbodies from MUN beneficial use designations by amending the Basin Plans. However, the *Sources of Drinking Water Policy* also identifies exception criteria that the Board may use to de-designate the MUN beneficial use from waterbodies that were subject to the blanket MUN designation. The *Sources of Drinking Water Policy* identifies exceptions that may be used to dedesignate the MUN beneficial use from surface and ground waters: 1) with EC exceeding

5,000 $\mu\text{S}/\text{cm}$; 2) with contamination that cannot reasonably be treated for domestic use; 3) where there is insufficient water supply for a single well to provide an average, sustained yield of 200 gpd; or 4) the aquifer is regulated as a geothermal energy producing source or has been exempted administratively for the purpose of underground injection of fluids associated with the production of hydrocarbon or geothermal energy. However, the *Sources of Drinking Water Policy* only addresses the designation of water as a drinking water source; it does not establish objectives for constituents that are protective of the designated MUN use.

2.2 REGULATIONS THAT APPLY TO WATER QUALITY OBJECTIVES

2.2.1 Federal Regulations and Guidance

Federal regulations require States to adopt narrative or numeric water quality criteria to protect designated beneficial uses of surface waters within federal jurisdiction (40 CFR §131.11(a)(1).)

2.2.2 State Statute, Regulations and Guidance

Water Code section 13050, subdivision (h) defines water quality objectives as "...the limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area."

Pursuant to Water Code section 13241, when establishing water quality objectives, the Regional Water Board is required to consider:

- (a) Past, present, and probable future beneficial uses of water;
- (b) Environmental characteristics of the hydrographic unit under consideration, including the quality of water available thereto;
- (c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area;
- (d) Economic considerations;
- (e) The need for developing housing within the region;
- (f) The need to develop and use recycled water; and
- (g) The Program of Implementation (Wat. Code, §13242).

2.3 REGULATIONS TO ESTABLISH AN IMPLEMENTATION PROGRAM

2.3.1 Federal Regulations and Guidance

Section 402 of the Clean Water Act requires a permitting system for surface waters which USEPA addressed by promulgating 40 Code of Federal Regulations, part 122, which are the regulations pertaining to the NPDES program. The State's regulations pertaining to NPDES permits must be consistent with the federal regulations. The Project Study Area and proposed de-designation boundaries do not currently receive discharges subject to the NPDES program and thus, these federal regulations are not germane to the proposed project.

2.3.2 State Statute, Regulations and Guidance

Water Code section 13050

Pursuant to Water Code section 13050, subdivision (j)(3), a Basin Plan Amendment must include an implementation program to achieve water quality objectives. Water Code section 13242 prescribes the program of implementation for achieving water quality objectives, which include the following:

- A description of the nature of actions which are necessary to achieve the water quality objectives, including recommendations for appropriate action by an entity, public or private;
- A time schedule for the actions to be taken; and
- A description of a monitoring and surveillance program to determine compliance with water quality objectives.

State Water Board Resolution 88-63, the Sources of Drinking Water Policy

Monitoring is required as part of using the Exception 2b in the Sources of Drinking Water Policy: *The water is in systems designed or modified for the primary purpose of conveying or holding agricultural drainage waters, provided that the discharge from such systems is monitored to assure compliance with all relevant water quality objectives as required by the Regional Boards.* Since the proposed project does not seek to de-designate MUN beneficial uses in the proposed MUN de-designation boundary based on Exception 2b, the project is exempt from the monitoring required when seeking MUN de-designation.

Water Code section 106.3

In compliance with Water Code section 106.3, it is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes.

3 MUN AND AGR EVALUATION IN A PORTION OF THE HISTORICAL TULARE LAKE BED

3.1 CHARACTERISTICS OF THE HISTORICAL TULARE LAKE BED

As discussed in Section 1.2, Project Study Area, the area proposed for MUN and AGR beneficial use de-designation comprises a portion of the historical Tulare Lake Bed and is located in the Tulare Lake Basin, Tule Basin, Westside Basin, and Kern County Basin Hydrologic Units. The Basin Plan identifies seven DAUs that comprise the proposed MUN and AGR beneficial use de-designation area: DAU 238, 241, 246, 243, 244, 255, and 259 (see **Table 2** and **Figure 2**). All DAUs in the project area are designated for MUN, AGR, and Industrial Service Supply (IND) beneficial uses. DAU 238 and 243 are also designated for Industrial Process Supply (PRO), and DAU 243 and 255 are designated for Wildlife Habitat (WILD).

The topography of the Tulare Lake Bed is a gradually sloping trough from the former lake outer boundary toward the lowest region in the Tulare Lake Bed, which exists at approximately 175 feet above mean sea level (MSL) (see **Figure 3**). The generally flat terrain has an average slope of about one-foot per every mile from the lowest area towards the boundary. Flows from the Kings, Kaweah, Tule, and Kern rivers on the east side of the San Joaquin Valley flood the farmland within the Tulare Lake Bed approximately one out of every seven years. This periodic flooding of the area has kept residential dwellings, permanent plantings (e.g. orchards), and municipal water supply wells (see **Figure 6**) from being located in the interior portion of the Tulare Lake Bed (CV-SALTS, 2015).

The Lake Bed is predominately underlain by relatively impermeable basin soils, the most common being Tulare Clay, a deep and very finely textured soil. The Tulare Lake Bed clay extends hundreds of feet deep and its layers have been designated from youngest to oldest by the letters A through F, as shown in cross section in **Figure 7**. The most prominent of these clay units is the E-Clay or Corcoran Clay Member of the Tulare Formation (Corcoran Clay) which extends throughout the majority of western and southern Tulare Lake Basin. The Corcoran Clay generally separates unconfined groundwater conditions above the clay to confined conditions below the clay. The Corcoran Clay is an impermeable hydrologic barrier that ranges from 400 to 600 feet below the surface. The Corcoran Clay layer ranges in thickness from 50 to more than 200 feet. The clay layers above and below the Corcoran Clay layer extend several thousand feet from the surface down to an unknown depth. As a result of its geology, the Lake Bed features poor quality groundwater in a shallow saline aquifer above the Corcoran Clay, and better quality groundwater in a deep aquifer located below the clay units. The poor quality of the shallow groundwater above the A-Clay, C-Clay, and Corcoran Clay makes it unusable. Field crops cultivated in the Lake Bed area, as well as livestock raised there, are maintained using either surface water supplies from outside the Tulare Lake Bed, groundwater drawn from wells outside of the proposed MUN and AGR de-designation boundaries, or irrigation wells from within the proposed horizontal de-designation boundary that are either completed below the Corcoran Clay or at depths below the proposed vertical de-designation boundary in which they are located (e.g., below A-Clay or C-Clay layers) (CV-SALTS, 2015).

3.1.1 Past, Present and Future MUN and AGR Uses

As part of the Beneficial Use Evaluation Report conducted in support of this proposed Basin Plan Amendment, extensive reconnaissance was conducted regarding the ability of current groundwater quality in the historical Tulare Lake Bed to support MUN and AGR beneficial uses. Reports evaluating groundwater conditions, subsurface geologic conditions, and shallow and deep groundwater quality, along with well construction data and conversations with landowners were used to identify where groundwater is pumped from the Lake Bed, the depth at which the groundwater is withdrawn, and the

use of the groundwater. While the groundwater in DAUs 238, 241, 246, 243, 244, 255, and 259 is currently designated to support MUN and AGR beneficial uses (as well as other uses; see Section 3.1 and **Table 2**), no evidence was found that residents and farmers in the Lake Bed are using any groundwater from above the proposed vertical de-designation zones (above the A-Clay or C-Clay layers, and in most cases, above the E-Clay or Corcoran Clay) to support these uses due to the saline nature of the unconfined groundwater (CV-SALTS, 2015). Well locations and depths, and the uses of groundwater pumped from the historical Lake Bed were tracked and later used to revise the preliminary horizontal de-designation boundary, as well as develop a vertical de-designation boundary, so as not to include portions of the groundwater that provide a groundwater source for wells that are currently identified as supporting either MUN or AGR beneficial uses in the three dimensional (3D) space proposed for de-designation.

Four urban areas (Stratford, Kettleman City, Alpaugh, and Corcoran) exist near the margins of the four fringe subareas and just outside of the Project Study Area evaluated for MUN and AGR beneficial uses, as shown in **Figure 5**. Each of these municipalities submitted letters to the Central Valley Water Board stating that the shallow groundwater of the historical Tulare Lake Bed is nonviable as a water supply source for municipal and domestic water supply wells now and into the future. These letters are included as an attachment to the Beneficial Use Evaluation Report, and included in **Appendix B** of this document. Furthermore, existing wells used by these cities for municipal and domestic supply (as well as any future wells developed for these purposes) are located up gradient and outside of the proposed horizontal and vertical de-designation boundaries identified as part of the Beneficial Use Evaluation Report. A zone of capture analysis (see Section 3.4) was conducted to document that local municipal wells are upgradient of the proposed de-designation area and determine if municipal wells outside of the proposed MUN de-designation boundary could influence the existing flow of shallow groundwater toward the center of the Lake Bed or extract groundwater from within or beneath the proposed de-designation area (KDSA, 2016a; see **Appendix D**).

With regard to irrigation supply wells, proposed horizontal and vertical de-designation boundaries exclude the portion of the aquifer utilized by active irrigation wells that exist in the study area. Conversations held with area landowners in December 2013 and March 2015 revealed that any existing livestock watering needs within the portion of the Tulare Lake Bed proposed for de-designation of the AGR livestock watering beneficial use were being met by either transporting water into the area or using supplies delivered by a local surface water ditch (CV-SALTS, 2015). Refer to **Appendices C** and **F** for documentation of conversations with stock operators in the Project Study Area. The proposed horizontal and vertical boundaries of the proposed de-designation area are described in Section 3.3 (MUN) and Section 3.5 (AGR) of this report.

3.1.2 Summary of Groundwater Basin Characteristics

As noted above, a detailed technical analysis was performed as part of the Beneficial Use Evaluation Report for each of the five subareas that comprise the Project Study Area. The technical analysis was performed to evaluate where potential MUN and AGR beneficial use de-designation in groundwater is appropriate based on the subsurface geologic conditions and the existing groundwater quality in the Project Study Area. The technical review included evaluations of subsurface geologic conditions, known water supply wells and their use, groundwater quality characteristics, water supply well pumpage, and downward head gradients in each of the five subareas. The findings from these technical evaluations completed for each of the subareas provides the basis for the proposed horizontal and vertical MUN and AGR de-designation boundaries in a portion of the historical Tulare Lake Bed (see Section 3.3 and Section 3.5).

Subsurface geologic conditions were evaluated with regard to both hydrology and stratigraphy. The A-Clay, the B-Clay, and the C-Clay layers are of particular interest in this de-designation evaluation. The average depths of these clays in the Tulare Lake Bed area, where they can be identified, are, in general, about 60, 130, and 230 feet, respectively. High salinity groundwater is common above the uppermost of these clays and sometimes as deep as below the B-Clay. Lower salinity groundwater is usually present beneath the C-Clay, and in some areas also below the A-Clay, both of which exist above the Corcoran Clay. The shallowest public supply wells in or near the lake bed are for the City of Corcoran, and some of these tap sands above the C-Clay. However, most of the production from these wells is from below the C-Clay. Kettleman City, located just west of the proposed de-designation area, also taps strata above the Corcoran Clay. Other public supply wells (e.g., Stratford and Alpaugh) tap sand layers below the Corcoran Clay. In the lake bed proper, clay is predominant to several thousand feet in depth, and these tongues are usually not distinguishable from the other clay that is present (see **Figure 7**).

Figure 7 shows a cross section that extends from the northwest to the southeast through the Tulare Lake Bed, from northwest of Stratford extending to the Kings/Kern County line just southwest of Alpaugh (CV-SALTS, 2015).

New cross sections were prepared for some subareas to augment previously prepared cross sections. Because the most important confining beds relative to the high salinity shallow groundwater are above a depth of about 250 feet, most of the sections were prepared to only show strata above this depth in order to determine if there were pockets of water suitable for MUN/AGR above the Corcoran Clay and if those areas were confined by any of the other clay lenses. However, some deeper cross sections that were prepared prior to this evaluation were used near urban areas, where deeper groundwater is tapped. Deeper cross sections were also prepared in the Central Subarea. A recent technical memorandum prepared by Luhdorff & Scalmanini Consulting Engineers (LSCE) was used to provide additional information on subsurface geologic conditions above the Corcoran Clay, particularly in the northeast part of the Lake Bed (LSCE 2014). The LSCE analysis confirmed the general findings of the Beneficial Use Evaluation Report and provided information on the occurrence and distribution of sand units above the E-Clay as a basis for defining the limits of potential water supply sources.

Shallow groundwater exists at depths of less than 20 feet in most of the Lake Bed. Available data indicate that the direction of shallow groundwater flow in most of the lake bed area generally follows the topography, flowing from the exterior part of the subareas toward the center of the lake bed (see **Figure 3**). The direction of groundwater flow near the fringes of the Lake Bed is also toward the interior of the Lake Bed. An examination of water-level data for the shallow groundwater in the Project Study Area showed that significant vertical water-level differences exist in the absence of pumping and thus, indicate the extremely low hydraulic conductivities of the clay layers, in particular, the A and B-clays. The low vertical conductivities of these clay layers suggests that there is very little, if any, downward flow of groundwater (CV-SALTS, 2015). A zone of capture analysis was conducted in order to calculate the maximum width or radius that a pumping well could impact to determine if municipal wells in the four urban areas just outside of the proposed MUN de-designation boundary could influence the existing flow of shallow groundwater toward the center of the Lake Bed or extract groundwater from within or beneath the proposed de-designation area. The analysis (see Section 3.4) found that pumping groundwater from municipal wells in Stratford, Alpaugh, Kettleman City, and Corcoran would not influence the flow of shallow groundwater, and in the cases of Kettleman City and Corcoran where wells tap strata above the Corcoran Clay, these wells would not extract water from within or beneath adjacent strata proposed for de-designation (KDSA, 2016a; see **Appendix D**).

Detailed analyses of all of the technical evaluations used to characterize the geology and hydrology of the Tulare Lake Bed that are summarized above are included in Section 4 of the Beneficial Use Evaluation Report (CV-SALTS, 2015).

3.2 EVALUATION OF GROUNDWATER QUALITY IN THE TULARE LAKE BED STUDY AREA

The Beneficial Use Evaluation Report compiled data from a variety of sources to determine existing groundwater quality in the five subareas: USGS reports, shallow groundwater monitoring data measured near Westlake Farms and TLDD evaporation basins, DWR San Joaquin District maps, data from landowner backhoe excavations in the study area, recent dairy monitoring reports, and E-logs from wells within the study area. The shallow groundwater data evaluated was generally categorized as “shallowest groundwater” or “first encountered groundwater” and “deeper shallow groundwater”. The former data were generated from measurements taken at a depth of 50 feet or less, while the latter were taken from depths typically ranging from depths of 50 to 200 feet (CV-SALTS, 2015). The available data were evaluated for each of the subareas and is discussed below with detailed water quality information documented in Attachments H and I of the Beneficial Use Evaluation Report (CV-SALTS, 2015).

3.2.1 North Subarea

The shallowest groundwater data evaluated in the North Subarea were obtained from Westlake Farms North Evaporation Basins monitoring, USGS reports, backhoe excavations, and dairy monitoring programs. The majority of the shallowest groundwater samples evaluated were collected at depths less than 30 feet, where EC levels ranged from greater than 10,000 $\mu\text{S}/\text{cm}$ in the west part of the subarea to greater than 5,000 $\mu\text{S}/\text{cm}$ in most of the rest of the subarea. EC levels less than 5,000 $\mu\text{S}/\text{cm}$ were observed in monitoring wells near or inside of the North Evaporation Basins, but were determined not to be characteristic of groundwater quality in the subarea. Rather these wells were determined to be influenced by the water stored in the basins (CV-SALTS, 2015).

3.2.2 West Subarea

Electrical conductivities were available for 14 wells in the West Subarea, all of which were approximately 20 feet deep. Some of these wells are near the Westlake Farms South Evaporation Basins. Electrical conductivities of water from all of these wells exceeded 10,000 $\mu\text{S}/\text{cm}$. Values ranged from 12,600 to 59,200 $\mu\text{S}/\text{cm}$, and were generally lowest in the central part of the subarea, east of Kettleman City. EC levels measured in backhoe excavations from east of 22nd avenue all exceeded 10,000 $\mu\text{S}/\text{cm}$. These values were similar to those for shallow groundwater in USGS monitoring wells to the west and within about three miles of the excavations.

3.2.3 South Subarea

Electrical conductivities were available for multiple wells in the South Subarea, including monitoring wells for the TLDD Hacienda and South Evaporation Basins, two USGS clustered monitoring wells, and landowner backhoe excavations. Most EC levels measured in the shallowest groundwater (approximately 10 – 50 feet in depth) in this subarea exceeded 10,000 $\mu\text{S}/\text{cm}$. Similar to conductivities observed adjacent to evaporation ponds in the North Subarea, lower salinities (i.e., 1,750 $\mu\text{S}/\text{cm}$) were measured in a well west of the TLDD South Evaporation Basins. However, the subject well (T25S/R21E-1N1) is perforated from 10 to 20 feet in depth and is adjacent to a local irrigation ditch. Electrical conductivities in this well were determined not to be characteristic of groundwater quality in the subarea, but rather influenced by the water stored in the irrigation ditch (CV-SALTS, 2015). EC levels of the groundwater at this site measured between 52 and 62 feet in depth had an electrical conductivity of 12,000 $\mu\text{S}/\text{cm}$, which is considered representative of the shallowest groundwater in the vicinity. Backhoe excavations at four locations north of the Hacienda Evaporation Basins exhibited EC levels ranging from 1,600 to 3,400 $\mu\text{S}/\text{cm}$, while one shallow well near the basins possessed an EC of less than

10,000 $\mu\text{S}/\text{cm}$. The groundwater quality measured in these four backhoe excavations north of the Hacienda Evaporation Basins were considered to be influenced by the water stored in the basins and not characteristic of groundwater quality in the subarea. Apart from these four examples where EC levels in the shallowest groundwater were less than 5,000 $\mu\text{S}/\text{cm}$, all other conductivities measured in the subarea exceeded 5,000 $\mu\text{S}/\text{cm}$, with some EC values exceeding 40,000 $\mu\text{S}/\text{cm}$ (CV-SALTS, 2015).

An evaluation of deeper groundwater quality was made by utilizing five monitoring wells at or near the TLDD Hacienda Evaporation Basins that range in depth from approximately 80 to 100 feet. The salinities measured in these wells ranged from 4,600 to 25,000 $\mu\text{S}/\text{cm}$, with lower EC values measured at greater depths. Another set of five monitoring wells at or near the TLDD South Evaporation Basins having depths of approximately 100 feet exhibited salinities ranging from 2,900 to 47,000 $\mu\text{S}/\text{cm}$. Three other wells in the South Subarea with perforations in the deeper groundwater (90 to 100 feet in depth) had EC levels exceeding 40,000 $\mu\text{S}/\text{cm}$. A well in the Trico Gas Field that is perforated from 90 to 100 feet in depth exhibited an EC value of 8,900 $\mu\text{S}/\text{cm}$. Two USGS monitoring wells perforated at greater depths (between 175 and 200 feet) had salinities of 4,540 $\mu\text{S}/\text{cm}$ and 2,380 $\mu\text{S}/\text{cm}$, respectively. This relatively lower salinity deeper groundwater (between 175 and 200 feet) is separated from the overlying high salinity groundwater by significant clay layers (CV-SALTS, 2015).

3.2.4 East Subarea

The quality of the shallowest groundwater in the East Subarea was derived from samples collected above a depth of approximately 20 feet. Salinities in the shallowest groundwater in this subarea varied substantially based on location. Electrical conductivities of the shallowest groundwater exceeded 50,000 $\mu\text{S}/\text{cm}$ in the area south of Avenue 96 and southwest of a line extending from near Quebec Avenue and 9th Avenue to the southeast, to near Avenue 96 and Road 40. EC levels were less than 5,000 $\mu\text{S}/\text{cm}$ in an area primarily south of Avenue 144 and east of 6½ Avenue. The south boundary of this area was near Avenue 120 between 5th Avenue and Road 32. In the area south of Avenue 136, the transition from lower salinity (less than 5,000 $\mu\text{S}/\text{cm}$) to higher salinity (more than 10,000 $\mu\text{S}/\text{cm}$) shallowest groundwater occurred in a relatively short distance (less than a mile) (CV-SALTS, 2015).

Little information on the salinity of groundwater between a depth of about 30 feet and 250 feet (above the C-Clay) exists for this subarea. However, sampling of water for a test well in Alpaugh adjacent to the proposed subarea boundary indicated an electrical conductivity of 1,330 $\mu\text{S}/\text{cm}$ at a depth near 250 feet, indicating that groundwater below the C-Clay in this area has lower electrical conductivity than that of the shallowest groundwater (indicated to range from about 30,000 to 57,000 $\mu\text{S}/\text{cm}$) in the vicinity (CV-SALTS, 2015).

3.2.5 Central Subarea

The shallowest groundwater data evaluated in the Central Subarea came from samples collected at depths above approximately 20 feet. Additionally, most samples were collected from excavations and USGS monitoring wells. EC levels were predominantly above 5,000 $\mu\text{S}/\text{cm}$, with the exception of three wells that possessed noticeably low conductivities, ranging from 1,340 $\mu\text{S}/\text{cm}$ to 2,210 $\mu\text{S}/\text{cm}$. These three shallow monitoring wells are located near irrigation ditches and samples were collected during the summer irrigation season when low EC water is being delivered through these conveyances. Hence, the salinities measured in these wells were determined not to be characteristic of groundwater quality in the subarea and were determined to be artificially influenced by imported irrigation supplies (CV-SALTS, 2015).

Additional detailed information regarding the groundwater quality in the Project Study Area is included in Section 4 of the Beneficial Use Evaluation Report (CV-SALTS, 2015).

3.2.6 Electric Log Data, Supply Well Pumpage, and Downward Head Gradients

The groundwater quality data compiled for the Project Study Area were supplemented with geophysical measurements (specifically, electric resistivity) taken along boreholes in the project area. Interpretation of electric log (E-log) data provide information about groundwater salinity and the location and thickness of sand bodies and clay layers. For example, sand has a higher resistivity than clay, and increasing salinity results in decreasing resistivity of a geologic formation. The variable salinities observed for groundwater at variable depths in the project area are due to the subsurface geologic formations that either allow or prevent downward flow of water. Areas that currently possess high salinity shallow groundwater and low salinity deeper groundwater are expected to continue to show these salinity differentials in the future as the presence of low hydraulic conductivity clay layers prevent downward flow of high salinity shallow groundwater (CV-SALTS, 2015).

The Beneficial Use Evaluation Report also considered the degree to which wells in the Lake Bed area have the potential to act as conduits for the downward flow of groundwater from upper levels to lower levels. It was determined that old (pre-1970s) well construction methods (direct rotary method) utilized substantial amounts of bentonite or other clays to make up the drilling fluid and new (reverse rotary method) well construction methods in the area have substantial amounts of clay introduced to the drilling fluid from native deposits or added to prevent borehole collapse. When the gravel packs are placed in the Lake Bed area they contain substantial amount of this interstitial clay-rich drilling fluid. Subsequently, the gravel packs opposite the coarse-grained strata were developed and should have been relatively permeable. However, opposite sections of blank casing and/or clay layers, the gravel packs could not be developed, due to a lack of water production from such zones. The overall effect of this is that the vertical permeability of the gravel packs would be expected to be low opposite sections of blank casing and clay layers. Numerous clay layers are normally present and are often predominant in the lake bed area. This would normally preclude the gravel packs from functioning as significant conduits for the downward flow of poor quality shallow groundwater (CV-SALTS, 2015). Despite the downward head gradient for many decades, the electrical conductivities in the groundwater below one or more of the clay tongues (A-Clay, B-Clay, and C-Clay) has remained low. This is attributed to the lower vertical hydraulic conductivity of these clay layers and the interbedded deposits. There is no indication that high salinity shallow groundwater has moved to greater depths, even after about 60 years of such deep well pumping (CV-SALTS, 2015).

A brief discussion of groundwater quality measured in three irrigations wells southwest and east of the City of Corcoran that tap strata beneath the Corcoran Clay is included in Section 3.5. EC levels measured in two of these wells over a number of years show a downward trend in EC, while the third well exhibits recent measurements in line with measurements taken decades earlier. These results suggest that these wells and others in the vicinity are not acting as conduits for the migration of poor quality groundwater in the upper aquifer to the lower aquifer beneath the Corcoran Clay.

3.3 PROPOSED HORIZONTAL AND VERTICAL MUN DE-DESIGNATION BOUNDARIES

All of the technical analyses (hydrologic evaluation, evaluation of stratigraphy above the Corcoran Clay (E-Clay layer), identification of water supply wells and their use, groundwater characteristics, groundwater quality, and supply well pumpage and downward head gradients) performed as part of the Beneficial Use Evaluation Report were used to refine the preliminary horizontal de-designation boundary (same as originally proposed de-designation boundary; see **Figure 6**) and determine the proposed vertical depths to which de-designation is warranted. This determination was made based on existing groundwater quality, the depths of active wells identified in the Project Study Area that currently provide groundwater for beneficial uses and the existing use provided, and the clay layers that limit the movement of groundwater between the shallow saline aquifer and the deep aquifer. Based on the

evaluations performed for each of the five subareas, the preliminary horizontal de-designation boundary (see **Figure 6**) was expanded in the South Subarea (i.e., extended to cover a larger surface area than the original boundary) and diminished in other subareas (i.e., contracted to cover a smaller surface area than the original boundary) in consideration of the presence of domestic wells identified during the ground level well reconnaissance effort. The process employed to determine the status and use of wells identified via the well reconnaissance effort is described in **Appendix C**. The green line in **Figure 6** shows the proposed horizontal boundary for de-designation of the MUN beneficial use. The differences between the red (preliminary horizontal de-designation boundary) and green (proposed horizontal de-designation boundary) lines shown in **Figure 6** illustrate how well reconnaissance information was used to adjust the horizontal boundary of the proposed MUN de-designation area so as not to include domestic wells that may be used as a drinking water source, or contain water quality characteristics that do not support the *Sources of Drinking Water Policy* exception criteria. EC levels within the proposed de-designation area are provided by subarea in **Table 3**.

Table 3: Electrical Conductivity in Proposed De-designation Area by Subarea.

Subarea	Electrical Conductivity ($\mu\text{S/cm}$) in Proposed De-designation Area			
	Minimum	Maximum	Median	Average
North	7,100	22,000	9,930	12,419
West	12,600	59,200	40,000	34,356
South	6,250	57,000	25,000	26,289
East	10,500	44,000	19,250	22,667
Central	5,800	12,400	10,400	9,436

Information on vertical trends in EC was available at a number of sites where multiple completion monitoring wells were installed and sampled. Monitoring well data in each of the five subareas, along with a stratigraphic evaluation of the Lake Bed (LSCE, 2014), were used to determine vertical depths where EC levels are equal to or greater than 5,000 $\mu\text{S/cm}$ and thus, meet Exception 1a of the *Sources of Drinking Water Policy*. As shown by the green area in **Figure 8** – illustrative of where the MUN beneficial use can be delisted to the top of the Corcoran Clay (or E-Clay layer) – most of the area proposed for de-designation of the MUN beneficial use is recommended for de-designation to the top of the Corcoran Clay (approximately 400 to 600 feet below land surface). This is also an area where no known active wells support the MUN beneficial use. Other than the northern and eastern fringe areas where numerous water well logs were available, much of the contour map for the Corcoran Clay boundary was constructed using oil and gas well logs obtained from the California Division of Oil, Gas and Geothermal Resources website. Both resistivity and gamma ray (when available) curves were used to determine the Corcoran Clay depth. The Corcoran Clay acts as a hydrologic barrier between the shallow saline aquifer above this clay layer and the deep aquifer below (CV-SALTS, 2015).

The hydrologic and stratigraphic evaluations performed in the North and East Subareas showed that the highest salinity groundwater occurs at shallower depths above the Corcoran Clay layer in some portions of these subareas and related to the clay layers in those areas. **Figure 8** includes a yellow-colored area in the North Subarea and a blue-colored area in the East Subarea that are recommended for de-designation of the MUN beneficial use at the top of the A-Clay layer at minimum depths of 75 (yellow area) and 110 feet (blue area), respectively. The A-Clay is typically present somewhere in the interval between about 60 and 100 feet in depth in the Tulare Lake Bed area. In portions of these subareas, the A-Clay layer acts as a hydrologic barrier between the shallow saline aquifer above the A-Clay layer and the deep aquifer below. The North and West Subareas also include portions that are recommended for de-designation of the MUN beneficial use to a minimum depth of 200 feet (orange-colored area (C-Clay

layer) in **Figure 8**). Again, in portions of these subareas, clay deposits beginning at a depth of 200 feet create a hydrologic barrier between the shallow saline aquifer above the C-Clay layer and the deep aquifer below it (CV-SALTS, 2015).

All municipal wells are outside of the proposed horizontal de-designation boundary and most are screened at depths below the proposed vertical boundary of the de-designation area to which they are adjacent. An exception is two public supply wells that provide water to the City of Corcoran that draw water from below the A-Clay layer at depths of 116 and 120 feet, respectively. However, these wells are not pumped significantly (KDSA, 2016a; see **Appendix D**). The City of Corcoran municipal well that is pumped most heavily is Well 4-B and its zone of capture was analyzed to determine if heavy pumping would influence the direction of groundwater flow in the adjacent, proposed de-designation area, or result in the pumping of groundwater from beneath the proposed de-designation area. The results of that analysis are provided in the following section. Three public supply wells in Kettleman City are completed above the Corcoran Clay (less than 800 feet in depth in this area), but below the C-Clay layer (minimum of 200 feet in depth) proposed as the vertical extent of de-designation in the western most portion of the West Subarea to which these wells are adjacent. Of the three Kettleman City municipal wells shown in **Figure 9**³, the middle well, known as the “School Well”, is used only for landscape irrigation, not for potable use, as it shows arsenic contamination (*Id.*). Finally, municipal wells in the towns of Stratford and Alpaugh tap strata below the Corcoran Clay layers adjacent to the North Subarea (Stratford) and East Subarea (Alpaugh), respectively. Active municipal water wells are located from 0.6 miles (Kettleman City) to 3.8 miles (City of Corcoran) outside of the proposed horizontal MUN de-designation boundary shown in **Figure 9** (all other active municipal wells are located at distances greater than 0.6 miles and less than 3.8 miles outside of the proposed horizontal MUN de-designation boundary).

Only three active domestic wells are within the proposed MUN horizontal de-designation boundary (southwest of Stratford). Two of these domestic wells (T21S/R19E-11 and T21S/R19E-01) are completed below the Corcoran Clay and one domestic well (T20S/R20E-29) draws water from a depth of 500-520 feet (below the A-Clay layer). All three wells are completed well below the proposed vertical de-designation boundary in which they are located. T21S/R19E-11 and T21S/R19E-01 are located in an area with a proposed vertical de-designation boundary of a minimum of 200 feet, and T20S/R20E-29 is situated in an area with a proposed vertical de-designation boundary of a minimum of 75 feet (CV-SALTS, 2015). The locations of these active domestic wells are shown in **Figure 9**, as are the locations of all active irrigation wells and other abandoned or destroyed wells that once supported a variety of uses. The extensive groundwater well reconnaissance effort conducted to determine the ability of current groundwater quality in the project area to support MUN and AGR beneficial uses, along with the identification of active wells and their uses, resulted in the development of significant well characterization data in all five subareas.

As a means to provide a three dimensional (3D) depiction of the vertical de-designation component of the proposed de-designation area, a 3D cutaway graphic (see **Figure 10**) was developed to show the discrete, vertical, de-designation depths underlying the A-Clay and C-Clay layers, as well as the variable depths (600 – 800 feet in depth) of the Corcoran Clay layer (green area). The one dimensional, left hand image in **Figure 10** shows the same horizontal de-designation area presented in **Figures 8 – 9** and **11 – 12**, but adds to it contour lines that represent the variable vertical depths to de-listing underlying the three clay layers (A-Clay, C-Clay, and Corcoran Clay) depicted in the figure.

³ Note that Figure 9 and Figure ES 1 are the same figure.

3.4 ZONE OF CAPTURE ANALYSES

3.4.1 Municipal Wells

An analysis was conducted to determine if pumping from the municipal water wells located outside of the proposed horizontal MUN de-designation boundary would influence the direction of groundwater flow in the proposed de-designation area toward the municipal wells, or result in the pumping of groundwater from within or beneath the proposed vertical boundaries of the de-designation area. This zone of capture⁴ analysis focused on municipal wells providing public water supply to residents of Stratford, Alpaugh, Kettleman City, and Corcoran. Municipal wells in the project area are shown in **Figure 9**. The primary public supply well in Stratford is located more than one-half mile from the proposed MUN de-designation boundary, perforated from 660 to 1,170 feet below ground surface (ft. bgs), and taps strata below the Corcoran Clay. The two other municipal wells in Stratford are used as ‘standby’ wells and aren’t pumped significantly. These two wells are located more than 2,640 feet outside of the proposed MUN de-designation boundary. The direction of shallow groundwater flow is indicated to be south, based primarily on monitoring at the Westlake Farms North Evaporation Basins. The proposed vertical de-designation depth in the project area just south of these wells is a minimum of 75 feet (see **Figure 9**). Pumpage from the primary Stratford supply well and two standby wells would not influence the direction of groundwater flow above the Corcoran Clay because the intervening clay layers below the base of the de-designated strata (minimum of 75 feet) and above the top of the perforations and opposite the annular seal would not allow these wells to draw groundwater from beneath the area proposed for MUN de-designation (KDSA, 2016a; see **Appendix D**).

The primary supply well in Alpaugh is located more than a mile from the proposed MUN de-designation boundary, perforated from 1,025 to 1,210 ft. bgs, and taps strata below the Corcoran Clay. The well is adjacent to the southeast portion of the East Subarea (see **Figure 9**) with a proposed vertical de-designation depth of a minimum of 110 feet and is sealed off opposite all strata above a depth of 900 feet. The direction of shallow groundwater flow near Alpaugh is indicated to be to the west, based on topography. The well’s annular seal would preclude any influence in the direction of groundwater flow in shallow strata due to pumping of the well because of the extensive clay layers between the minimum 110 feet (top of A-Clay layer) proposed de-designation depth and the 900 feet depth of the well (KDSA, 2016a; see **Appendix D**).

Two Angiola Water District irrigation wells (G-30 and W-18), which could be converted to provide Alpaugh with a municipal water supply in the future, are perforated from 260 – 500 ft. bgs and tap strata above the Corcoran Clay. These wells have annular seals extending from the surface to at least 220 feet in depth. These irrigation wells are located approximately 1-mile east of the proposed MUN de-designation boundary. As discussed above, the proposed vertical de-designation depth in the project area nearest to these wells is a minimum of 110 feet (top of A-Clay layer). The direction of shallow groundwater flow in the area (between Avenues 104 and 112 and Roads 32 and 40) is indicated to be to the west, based on topography. Each of these wells is sealed opposite three clay layers between 115 feet and 220 feet in depth. These clay layers would preclude the pumping of the wells, if they were ever converted from irrigation use to municipal use, from affecting the direction of groundwater flow in strata above a depth of 110 feet. Additionally, these wells would not draw groundwater from beneath the area proposed for MUN de-designation (KDSA, 2016a; see **Appendix D**).

⁴ Zone of capture = area that contributes groundwater to a well or discharge point. All free water contained within the “capture zone” will ultimately be captured by the supply well. This does not necessarily mean that the area experiences drawdown.

As mentioned in the prior section, Kettleman City has three municipal wells, but only two of them are pumped for potable supply. The middle Kettleman City well shown in **Figure 9**, known as the School Well is only used for irrigation supply as it contains arsenic concentrations that prevent it from being used for drinking water (KDSA, 2016a; see **Appendix D**). The two active wells range in depth from about 500 to 700 feet and tap strata above the Corcoran Clay, which exists at a depth of approximately 800 feet in the Kettleman City area. The direction of shallow groundwater flow is indicated to be to the northeast, based primarily on the topography and the direction of flow at the Westlake Farms South Evaporation Basins. The nearest well is just over 0.6 miles from the proposed horizontal MUN de-designation boundary, while the farthest well is approximately 1-mile from the boundary. A zone of capture analysis was conducted to evaluate the extent that the Kettleman City pumpage could reverse the direction of groundwater flow in strata above the Corcoran Clay. The maximum width of the capture zone for the well nearest the de-designation boundary was calculated as 130 feet (0.025 miles) using an equation from Fetter (1994) and based on a water-level slope of 60 feet per mile. This finding indicates that even if the water-level slope was greater, the cone of depression would only extend less than 200 feet northeast of the well. Both wells are located upgradient of the proposed MUN de-designation boundary and their pumping was determined to have no impact on the direction of groundwater flow near the de-designation boundary, nor draw groundwater from within or beneath the area proposed for MUN de-designation (*Id.*). Both wells will be used as backup water supply sources once a new surface water treatment plant next to the California Aqueduct is constructed and begins providing potable water to the City. The surface water treatment plant could begin operation as soon as 2020 (Roger Reynolds, personal communication with Summers Engineering Vice President/Senior Engineer, phone call, July 14, 2016; see **Appendix D**).

The City of Corcoran has nine municipal supply wells that are located more than two miles from the proposed horizontal MUN de-designation boundary. The most distant City well is located 3.8 miles from the proposed de-designation boundary. The well shown in **Figure 9** that is nearest the proposed de-designation boundary is not pumped significantly. However, the next closest well (Well 4B) that is located near the intersection of 4th and Waukena (Highway 137) Avenues is heavily pumped. This well is perforated from 235 to 485 ft. bgs and accounts for most of the upper aquifer City pumpage closest to the de-designation area, which is located approximately 2.5 miles to the southwest. Water-level maps for the period 1997 – 2003 were used to determine that shallow groundwater flow is in the southwesterly direction toward the center of the Lake Bed. Because the proposed MUN de-designation area southwest of Corcoran extends to the top of the Corcoran Clay, a zone of capture evaluation was conducted for City Well 4B. The maximum width of the capture zone calculated for City Well 4B was 1,934 feet (0.37 miles) using an equation from Fetter (1994). The depression cone from pumping this well could extend about 1,900 feet southwest of the well, but would still be approximately two miles from the proposed MUN de-designation boundary. Thus pumping of the City of Corcoran municipal wells would not influence the direction of groundwater flow in the area proposed for MUN de-designation, nor would these wells draw groundwater from within or beneath the area proposed for de-designation (KDSA, 2016a see **Appendix D**).

3.4.2 Representative Domestic Well

A second zone of capture analysis was performed for a representative, shallow, private domestic well located just outside of the proposed MUN de-designation boundary to determine if pumping from such a well located just outside of the proposed horizontal de-designation boundary would influence the direction of groundwater flow in the proposed de-designation area toward the domestic well, or result in the pumping of groundwater from within the MUN de-designation area. It was assumed that the pumping rate for such a residential well would be 20 gallons per minute. It was also assumed that the well would have a lateral hydraulic conductivity of 100 feet per day. A relatively flat water level slope of about six

feet per mile was used. Similar to the analyses conducted for municipal drinking water wells, the maximum width of the capture zone was calculated for the representative domestic well using an equation from Fetter (1994). The depression cone from pumping a shallow, private domestic well could extend from 87.5 feet. To this end, a domestic well greater than 100 feet away from the de-designation boundary would not draw groundwater from the area proposed for MUN de-designation, nor effect the gradient-driven flow of groundwater toward the center of the lake bed (KDSA, 2016b; see **Appendix G**). This information was used to confirm that the proposed horizontal MUN de-designation boundary is sufficiently distant from potentially active domestic wells located outside of the proposed de-designation boundary so as not to impact existing or potential MUN beneficial uses in the four fringe subareas.

3.5 PROPOSED HORIZONTAL AND VERTICAL AGR DE-DESIGNATION BOUNDARIES

The groundwater quality data (see Section 3.2 above) developed for the Beneficial Use Evaluation Report were also used to establish separate proposed horizontal de-designation boundaries for de-designation of the AGR beneficial uses which include irrigation supply and AGR livestock watering. Again, the proposed horizontal boundaries for AGR de-designation represent both expansions and contractions of the originally proposed horizontal de-designation boundary (see **Figure 6**). The proposed horizontal de-designation boundary for the AGR irrigation supply was based on an EC threshold of 3,000 $\mu\text{S}/\text{cm}$ and is shown in **Figure 11**. The proposed de-designation boundary for AGR irrigation supply is identical to the proposed de-designation boundary for the MUN beneficial use (see **Figure 8**). The groundwater EC levels within the proposed MUN de-designation boundary exceed 5,000 $\mu\text{S}/\text{cm}$ and therefore, also exceed the EC threshold of 3,000 $\mu\text{S}/\text{cm}$ used to protect groundwater used for irrigation supply. The MUN (**Figure 8**) and AGR irrigation supply (**Figure 11**) de-designation boundaries cover a total area of approximately 315,730 acres (approximately 493 square miles).

The proposed horizontal de-designation boundary for the livestock watering portion of the AGR beneficial use was based on an EC threshold of 7,500 $\mu\text{S}/\text{cm}$ and is shown in **Figure 12**. This figure was generated based on groundwater EC data in the five subareas that exceed 7,500 $\mu\text{S}/\text{cm}$. The four vertical boundaries (top of A-Clay layer at minimum depths of 75 and 110 feet, respectively; top of C-Clay layer at minimum depth of 200 feet; and top of Corcoran Clay layer) proposed for de-designation of the AGR beneficial uses (irrigation supply and livestock watering) are the same as the four vertical boundaries proposed for de-designation of the MUN beneficial use (see Section 3.3). This is because the vertical depths to the tops of the three clay layers (A-Clay, C-Clay, and Corcoran Clay) are the same within the area proposed for de-designation, even though the horizontal footprints of the irrigation supply and livestock watering de-designation boundaries differ slightly due to groundwater EC levels measured in the eastern portion of the Central Subarea and the northwestern portion of the East Subarea. The difference in the horizontal de-designation boundary surface areas shown in **Figure 11** (AGR irrigation supply portion) and **Figure 12** (AGR livestock watering portion) is approximately 4,680 acres, with the surface area of the de-designation boundary shown in **Figure 12** being less than 1.5% smaller than that of **Figure 11**.

Numerous active irrigation supply wells have been identified within the proposed AGR horizontal de-designation boundaries; however, all are completed below the Corcoran Clay and thus, below the proposed vertical de-designation boundary in which they are located. The locations of these active irrigation wells and their associated vertical de-designation boundaries are shown in **Figure 9**. Two active irrigation wells are located outside of the proposed de-designation boundary immediately east of the East Subarea. The well located in T22S/R23E-21 has a bentonite plug from 550 to 560 ft. bgs and is screened from 620 to 900 ft. bgs. The well located in T22S/R23E-28 has a bentonite plug from 540 to 550 ft. bgs and is screened from 620 to 940 ft. bgs. Both of these active irrigation wells pump from depths below the Corcoran Clay and well below the minimum 110 feet vertical de-designation depth

proposed for the eastern most portion of the East Subarea (see the blue portion of East Subarea in **Figure 9**).

An evaluation of EC levels in three irrigation wells southwest and east of the City of Corcoran that tap strata below the Corcoran Clay was conducted to determine if ambient EC levels have changed over time; ostensibly, increasing due to the downward migration of higher saline groundwater from the upper aquifer to the lower aquifer beneath the Corcoran Clay. The active irrigation well located in T21S/R22E-35 (see **Figure 9**) shows a minor downward trend in EC levels when comparing data collected from January 2003 through March 2016. This well has a cement seal to a depth of 50 feet and is perforated below the Corcoran Clay. Over the period of measurement, EC ranged from 198 to 300 $\mu\text{S}/\text{cm}$, with an average of 254.7 $\mu\text{S}/\text{cm}$. The active irrigation well located in T22S/R22E-3 (see **Figure 9**) shows a more pronounced downward trend in EC levels when comparing data collected from May 2008 through June 2016. This well has a cement seal to a depth of 500 feet and is perforated below the Corcoran Clay. Over its period of measurement, the EC of the well ranged from 230 to 500 $\mu\text{S}/\text{cm}$, with an average of 341.3 $\mu\text{S}/\text{cm}$. Finally, an inactive irrigation well located in T21S/R20E-3 (see **Figure 9**) shows an upward trend in EC when comparing a group of measurements taken in 1966 (EC range from approximately 650 to 780 $\mu\text{mhos}/\text{cm}$) to a group of measurements taken in 2015 (EC range from approximately 700 to 770 $\mu\text{mhos}/\text{cm}$). The seal depth of this well is unknown. Although the trend line indicates that EC in this well is slightly increasing over time, yet within the allowable rate of degradation specified in the Basin Plan, the recent maximum EC readings have not exceeded the maximum EC measurement taken in 1966. The EC data measured in these three irrigation wells indicate that neither the groundwater wells nor their gravel packs are acting as conduits for the downward migration of the poor quality, shallow groundwater that exists in the upper aquifer. Furthermore, these data support the assertion that the intervening clay layers between the upper and lower aquifers are acting as confining layers that prevent the downward migration of poor quality water (TLBWSD, 2016a). Additional information regarding these irrigation wells is included in **Appendix H**.

Where irrigation wells were identified in one of the four fringe subareas just outside of the proposed horizontal de-designation boundary for AGR beneficial uses (irrigation supply and livestock watering), a ground level reconnaissance effort was undertaken to confirm that these wells (status active, abandoned, or destroyed) are completed below the Corcoran Clay and do not draw groundwater from within the proposed de-designation zones (CV-SALTS, 2015; TLBWSD, 2016b (see **Appendix E**)).

3.6 STAKEHOLDER OUTREACH

From September 2013 through January 2014, TLDD and TLBWSD staff met with representatives from the four local urban areas (Stratford, Kettleman City, Alpaugh, and Corcoran) that exist near the margins of the four fringe subareas and just outside of the Project Study Area. TLDD and TLBWSD staff also met with representatives from the County of Kings, Kings County Water Commission, as well as local farmers, ranchers, and landowners to discuss the proposal to de-designate the MUN groundwater beneficial use from a portion of the historical Tulare Lake Bed (see **Appendix A**). These meetings were held to describe the steps involved in the Basin Plan Amendment process that could result in a de-designation of the MUN groundwater beneficial use within the project area and to solicit input from stakeholders regarding concerns and issues over such a MUN de-designation. Each of the four municipalities, along with farmers, ranchers, and landowners, submitted letters to the Central Valley Water Board stating that the shallow groundwater of the historical Tulare Lake Bed is nonviable as a water supply source for municipal and domestic water supply wells now and into the future. These letters are included as an attachment to the Beneficial Use Evaluation Report, and included in **Appendix B** of this document.

In a separate outreach effort, TLDD and TLBWS staff met with representatives from agricultural operations in the project area in December 2013 and March 2015 to discuss the proposal to de-designate the AGR groundwater beneficial use from a portion of the historical Tulare Lake Bed. These meetings were held to describe the steps involved in the Basin Plan Amendment process that could result in a de-designation of the AGR groundwater beneficial use within the project area and to solicit input from these agricultural representatives regarding concerns and issues over the proposed action. These meetings offered the opportunity to ask local farmers/ranchers if they currently use local groundwater for stock watering. Of the six entities contacted, half of them do not carry out stock operations on their lands, and those who are stock operators provide water to their livestock that is imported from outside the Project Study Area (water is delivered via either earthen ditches, water trucks, or pipelines; see the stock watering outreach contact and water source table provided in **Appendix B**). All of the individuals contacted indicated that they would not even consider using the shallow groundwater due to the elevated EC levels.

4 PROJECT ALTERNATIVES

The technical and regulatory analysis provided in the Beneficial Use Evaluation Report (CV-SALTS, 2015) considered information relevant to the proposed de-designation of MUN and AGR beneficial uses in groundwater in a portion of the historical Tulare Lake Bed. The information evaluated included geologic subsurface conditions, the location of existing water supply wells, groundwater movement, and groundwater quality. The findings of the evaluation provided a basis for recommending individual horizontal and vertical boundaries for de-designation of the MUN beneficial use, the AGR irrigation supply beneficial use, and the AGR livestock watering beneficial use.

Stakeholders identified the following four project alternatives pertaining to the MUN beneficial use designation for a portion of the historical Tulare Lake Bed:

1. No Action
2. De-designate MUN Beneficial Use within the Historical Footprint of the Tulare Lake Bed at an Elevation of 200 Feet above Mean Sea Level with No Vertical De-designation Boundary (see **Figure 13**)
3. De-designate MUN Beneficial Use in a Portion of the Historical Tulare Lake Bed Based on Application of the *Sources of Drinking Water Policy* (SWRCB Resolution No. 88-63) Exception 1a (see **Figure 8**)
4. Development of MUN Site-Specific Salinity Objectives within the Proposed MUN De-designation Boundary (see **Figure 8**).

General components of each of the MUN regulatory project alternatives are shown in **Table 4**. Detailed descriptions of each alternative are provided in Section 4.1.

Stakeholders also identified the following six project alternatives pertaining to the AGR beneficial use designation for a portion of the historical Tulare Lake Bed:

1. No Action
2. Development of AGR Site-Specific Salinity Objectives within the Proposed AGR De-designation Boundaries for Irrigation Supply (see **Figure 11**) and Livestock Watering (see **Figure 12**).
3. De-designate AGR Beneficial Use within Separate Horizontal and Vertical Boundaries for Irrigation Supply (see **Figure 11**) and Livestock Watering (see **Figure 12**)
4. Development of Classes of AGR Uses and Water Quality Objectives that Better Represent Irrigation and Livestock Watering Limitations at Different Groundwater Salinity Concentrations within the Proposed AGR De-designation Boundaries for Irrigation Supply (see **Figure 11**) and Livestock Watering (see **Figure 12**).
5. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 5,000 $\mu\text{S}/\text{cm}$ (see **Figure 8**)
6. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 7,500 $\mu\text{S}/\text{cm}$ (**Figure 12**)

General components of each of the AGR regulatory project alternatives are shown in **Table 5**. Detailed descriptions of each alternative are provided in Section 4.1.

Table 4: Project Alternatives Pertaining to MUN Use Designation in Groundwater in the Tulare Lake Bed.

Project Alternatives	Beneficial Use Designation Components	Water Quality Objective Components	Implementation Components	Monitoring/ Surveillance (M/S) Components
1. No Action	No Change in MUN Beneficial Use Designation	No New Water Quality Objectives (WQOs)	No New Implementation Program	No New Monitoring and Surveillance Program
2. De-designate MUN Beneficial Use within the Historical Footprint of the Tulare Lake Bed at an Elevation of 200 Feet above Mean Sea Level with No Vertical De-designation Boundary	Use technical and regulatory analyses in Beneficial Use Evaluation Report to support de-designation of MUN beneficial use	MUN WQOs will no longer apply to groundwater within specific area of the historical Tulare Lake Bed defined by the contour line representing 200 feet above MSL.	Existing Regulatory Programs to Implement	Selected New Monitoring to Fill Data Gaps
3. De-designate MUN Beneficial Use in a Portion of the Historical Tulare Lake Bed Based on Application of the Sources of Drinking Water Policy Exception 1a	Use the <i>Sources of Drinking Water Policy</i> Exception 1a and supporting evidence to de-designate the MUN beneficial use	MUN WQOs will no longer apply to groundwater within specific area of the historical Tulare Lake Bed having groundwater EC levels greater than 5,000 $\mu\text{S}/\text{cm}$ as defined by proposed de-designation boundaries identified in Beneficial Use Evaluation Report	Existing Regulatory Programs to Implement	Selected New Monitoring to Fill Data Gaps
4. Development of MUN Site-Specific Salinity Objectives within the Proposed MUN De-designation Boundary	Re-designate Beneficial Use as Limited-MUN	Develop Individual Site-Specific Objectives (SSOs) that maintain existing ambient concentrations	Existing Regulatory Programs to Implement	Adjust Existing Regulatory Programs to Account for New Objectives

Table 5: Project Alternatives Pertaining to AGR Use Designation in Groundwater in the Tulare Lake Bed.

Project Alternatives	Beneficial Use Designation Components	Water Quality Objective Components	Implementation Components	Monitoring/ Surveillance (M/S) Components
1. No Action	No Change in AGR Beneficial Use Designation	No New Water Quality Objectives (WQOs)	No New Implementation Program	No New Monitoring and Surveillance Program
2. Development of AGR Site-Specific Salinity Objectives within the Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering	No Change in AGR Beneficial Use Designation	Develop Individual Site-Specific Objectives (SSOs) that maintain existing ambient concentrations	Existing Regulatory Programs to Implement	Adjust Existing Regulatory Programs to Account for New Objectives
3. De-designate AGR Beneficial Use within Separate Horizontal and Vertical Boundaries for Irrigation Supply (EC groundwater quality threshold of 3,000 $\mu\text{S}/\text{cm}$) and Livestock Watering (EC groundwater quality threshold of 7,500 $\mu\text{S}/\text{cm}$)	Use technical and regulatory analyses in Beneficial Use Evaluation Report to support de-designation of AGR beneficial use	AGR WQOs will no longer apply to groundwater within specific area of the historical Tulare Lake Bed defined by proposed de-designation boundaries identified in Beneficial Use Evaluation Report	Existing Regulatory Programs to Implement	Selected New Monitoring to Fill Data Gaps
4. Development of Classes of AGR Uses and WQOs that Better Represent Irrigation and Livestock Watering Limitations at Different Groundwater Salinity Concentrations within Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering	No Change in AGR Beneficial Use Designation	Utilize Existing Classes (Mineral Quality of Irrigation Water) included in Basin Plan or AGR EC Classes Considered by CV-SALTS	Existing Regulatory Programs to Implement	Adjust Existing Regulatory Programs to Account for New Objectives
5. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 5,000 $\mu\text{S}/\text{cm}$	Use technical and regulatory analyses in Beneficial Use Evaluation Report to support de-designation of AGR beneficial use	AGR WQOs will no longer apply to groundwater within specific area of the historical Tulare Lake Bed defined by proposed de-designation boundaries identified in Beneficial Use Evaluation Report	Existing Regulatory Programs to Implement	Selected New Monitoring to Fill Data Gaps

Project Alternatives	Beneficial Use Designation Components	Water Quality Objective Components	Implementation Components	Monitoring/ Surveillance (M/S) Components
6. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 7,500 µS/cm	Use technical and regulatory analyses in Beneficial Use Evaluation Report to support de-designation of AGR beneficial use	AGR WQOs will no longer apply to groundwater within specific area of the historical Tulare Lake Bed defined by proposed de-designation boundaries identified in Beneficial Use Evaluation Report	Existing Regulatory Programs to Implement	Selected New Monitoring to Fill Data Gaps

4.1 MUN BENEFICIAL USE ALTERNATIVES

The various project alternatives pertaining to the designation of the MUN beneficial use in groundwater in a portion of the historical Tulare Lake Bed are described below.

4.1.1 No Action Alternative

MUN Alternative 1 would not amend the Basin Plan; rather it would continue to maintain the current MUN beneficial use designation for the Tulare Lake Basin (i.e., designation of MUN in DAUs 238, 241, and 246). Accordingly, there would be no change in water quality objectives associated with meeting the MUN water quality objectives and the current MUN-related water quality objectives from the Title 22 primary and secondary MCL tables, as well as CTR human health criteria for the protection of human health from consumption of water and organisms where these objectives are currently being met. Otherwise, for those areas that currently do not meet MUN and MUN-related water quality objectives due to naturally occurring background concentrations, controllable factors, such as agriculture, would not be allowed to further degrade existing water quality under the No Action Alternative. In addition, no new implementation provisions or monitoring and surveillance programs would be initiated.

4.1.2 De-designate MUN within the Historical Footprint of the Tulare Lake Bed at an Elevation of 200 Feet above Mean Sea Level with No Vertical De-Designation Boundary Alternative

MUN Alternative 2 would amend the Basin Plan to state that the MUN beneficial use does not apply to the area of the historical Tulare Lake Bed that is delineated by the contour line at 200 feet above mean sea level (MSL). The area circumscribed by the contour would define the horizontal extent of the MUN de-designation boundary. This alternative does not feature a vertical de-designation boundary and hence, all groundwater underlying the horizontal boundary would not be considered to support the MUN beneficial use. MUN water quality objectives would no longer apply to groundwater underlying the horizontal boundary delineated by the contour line at 200 feet above MSL. This alternative is only partially supported by the technical and regulatory analyses conducted for the Beneficial Use Evaluation Report (CV-SALTS, 2015) and the stratigraphy evaluation performed by LSCE (2014). No changes will be made to other designated beneficial uses. Two monitoring and surveillance elements were identified for this project alternative: Element A – Lateral Monitoring of Shallowest Groundwater, and Element B – Vertical Monitoring of Deeper Shallow Groundwater. A discussion of these elements is provided in Section 5, Program of Implementation.

4.1.3 De-designate MUN in a Portion of the Historical Tulare Lake Bed Based on Application of the Sources of Drinking Water Policy Exception 1a Alternative

MUN Alternative 3 would amend the Basin Plan, based on Exception 1a of the *Sources of Drinking Water Policy*, to state that the MUN beneficial use does not apply to a portion of the historical Tulare Lake Bed within the horizontal boundary to the variable vertical depths represented in **Figure 8**.

The *Sources of Drinking Water Policy* contains an exception (1a) for surface and ground waters where “the total dissolved solids (TDS) exceed 3,000 mg/L (5,000 µS/cm, electrical conductivity) and is not reasonably expected by Regional Boards to supply a public water system.” The portion of the historical Tulare Lake Bed identified in **Figure 8** features groundwater EC levels greater than 5,000 µS/cm and is thus eligible for MUN de-designation under this exception. MUN de-designation means that the MUN-related water quality objectives would no longer apply within the horizontal boundary to at least the minimum variable vertical depths represented in **Figure 8**. The minimum variable depths shown in **Figure 8** represent the depths at which specific clay layers are first encountered within the boundary area proposed for MUN de-designation. Because the clay layers in this area are of variable thickness, the de-designation of the MUN beneficial use would extend to the bottom of the clay layer along the outside surface of the de-designation boundary. No changes will be made to other designated beneficial uses. Two monitoring and surveillance elements were identified for this project alternative: Element A – Lateral Monitoring of Shallowest Groundwater, and Element B – Vertical Monitoring of Deeper Shallow Groundwater. A discussion of these elements is provided in Section 5, Program of Implementation.

4.1.3.1 Evidence to support MUN de-designation via the Sources of Drinking Water Policy

As summarized in Section 3.1.1, Past, Present and Future MUN and AGR Use, the four urban areas (Stratford, Kettleman City, Alpaugh, and Corcoran) that exist just outside of the Project Study Area have not relied upon the groundwater within the proposed MUN de-designation boundary to support the MUN beneficial use in the past, are not currently relying on this area to support the use, and do not expect the area to support the use in the foreseeable future (see letters from the municipalities of Stratford, Kettleman City, Alpaugh, and Corcoran included in **Appendix B**). In addition, the groundwater quality evaluation performed as part of the Beneficial Use Evaluation Report found that EC levels exceed 5,000 µS/cm within the proposed MUN de-designation boundary to the variable depths identified in **Figure 8** and thus, meet the *Sources of Drinking Water Policy* Exception 1a. As such, the groundwater in this area would not reasonably be expected to supply a public water system.

Additionally, the proposed MUN de-designation boundary (**Figure 8**) was developed to preclude areas where active municipal and domestic wells pump groundwater and includes a buffer area between active wells and the proposed de-designation boundary based on a zone of capture analysis (see Section 3.4) that evaluated the potential for municipal wells operated by the City of Corcoran and Kettleman City to extract groundwater from within or beneath the proposed de-designation area (KDSA, 2016a; see **Appendix D**). The study found that pumping of these municipal wells wouldn't influence the direction of groundwater flow in the area proposed for MUN de-designation, nor would these wells draw groundwater from within or beneath the area proposed for de-designation (*Id.*). Additionally, a second zone of capture analysis (see Section 3.4) performed for a representative, shallow, private domestic well located just outside of the proposed de-designation boundary found that a well located greater than 87.5 feet from the de-designation boundary would not draw groundwater from within the de-designation boundary, nor influence the flow of shallow groundwater toward the domestic well (KDSA, 2016b; see **Appendix G**). To be conservative, a domestic well greater than 100 feet away from the de-designation boundary would not draw groundwater from the area proposed for MUN de-designation, nor effect the gradient-driven flow of groundwater toward the center of the lake bed.

All active municipal and domestic supply wells identified in the five subareas through the thorough ground level well reconnaissance effort carried out as part of this project either exist at distances sufficiently far away from the proposed MUN de-designation boundary so as to have no potential to draw water from within the proposed de-designation area, or in the case of three domestic wells identified in the western portion of the North Subarea (see **Figure 9**), pump water from either below the Corcoran Clay or below the proposed vertical de-designation boundary (below the A-Clay) over which the subject well is located (CV-SALTS, 2015; TLBWSD, 2016b (see **Appendix E**)).

Groundwater only needs to meet one of the exceptions in the *Sources of Drinking Water Policy* to be eligible to have the MUN beneficial use removed. However, information presented in Section 3, MUN and AGR Evaluation in a Portion of the Historical Tulare Lake Bed, provides supporting evidence that the shallow groundwater in the Tulare Lake Bed meets other *Sources of Drinking Water Policy* exceptions. For example, exception 1b is for waters where there “is contamination, either by natural processes or by human activity (unrelated to the specific pollution incident), that cannot reasonably be treated for domestic use using either Best Management Practices or best economically achievable treatment practices”. As discussed in Section 3.1.1, the four above-mentioned municipalities submitted letters to the Central Valley Water Board stating that the shallow groundwater of the historical Tulare Lake Bed is nonviable for their use as a water supply source for municipal and domestic water supply wells now and into the future (CV-SALTS, 2015).

4.1.4 Development of MUN Site-Specific Salinity Objectives within the Proposed MUN De-designation Boundary Alternative

MUN Alternative 4 would involve changes to the Basin Plan pertaining to the beneficial use and water quality objectives for groundwater in the Tulare Lake Bed. This alternative would involve a change in the beneficial use designation of groundwater in the Tulare Lake Bed from MUN to a new Limited-MUN use. The development of site-specific objectives (SSOs) for constituents of concern for the groundwater would be developed based on existing ambient groundwater concentrations. Where groundwater currently does not meet MUN and MUN-related water quality objectives due to naturally occurring background concentrations, controllable factors, such as agriculture, would not be allowed to further degrade existing water quality under this alternative. Groundwater designated as having a Limited-MUN beneficial use would need to be treated or blended prior to use as municipal and domestic supply. Existing regulatory programs would be responsible for implementing the monitoring and surveillance program needed to assure that waste discharges do not further degrade existing ambient groundwater concentrations in a site-specific area, including the maximum average annual increase in EC allowed by the Basin Plan.

4.2 EVALUATION OF MUN BENEFICIAL USE ALTERNATIVES

The above-described MUN Basin Plan Amendment alternatives were evaluated based on their ability to meet the following nine selection criteria (additional information describing a criterion is included where it was thought to be helpful):

1. Maintain consistency with federal and state water quality laws and policies as applicable (e.g., *Sources of Drinking Water Policy*, Antidegradation Policy, etc.)
2. Meet exception(s) of *Sources of Drinking Water Policy*
3. Protect existing and future potential beneficial uses
4. Maintain agricultural production in the project area
(i.e., *Alternative has the potential to allow agricultural production in the project area to be in compliance with water quality requirements*).

5. Support the proactive control and management of salt for application or disposal in the western portion of the Basin, toward the drainage trough of the valley
(i.e., Alternative has the potential in the future to allow the de-designated area to accept salts from outside of the project area on a case-by-case basis, subject to appropriate environmental review).
6. Technically feasible, economically viable, and reasonable action
7. Scientifically supported by existing data
8. Support socioeconomic well-being of the project area
9. Ease of implementation

Each MUN project alternative was evaluated with regard to how well it satisfies each criterion. A scale of “low”, “medium”, and “high” was used to rank how well an alternative meets a criterion. The low, medium, and high rankings are characterized as follows:

Low	Alternative largely does not satisfy criterion
Medium	Alternative satisfies criterion, in part
High	Alternative largely satisfies criterion

A ranking of each proposed MUN project alternative with respect to the nine evaluation criteria is provided in **Table 6**. A description of the assumptions and rationale used when ranking each MUN project alternative is provided in **Appendix I**.

4.3 RECOMMENDED ALTERNATIVE FOR MUN BENEFICIAL USE DESIGNATION

Central Valley Water Board staff recommends MUN Alternative 3, which is to de-designate the MUN beneficial use from the portion of the historical Tulare Lake Bed represented in **Figure 8** by applying the Sources of Drink Water Policy Exception 1a. MUN Alternative 3 best satisfies the selection criteria (see **Table 6**) since the action would:

1. Be consistent with both federal and state water quality laws and policies. Section 4.1.3.1 demonstrates that the area proposed for MUN de-designation meets Exception 1a of the *Sources of Drinking Water Policy*.
2. Be the appropriate protection for the groundwater in the area proposed for MUN de-designation. Section 4.1.3.1 demonstrates that the proposed de-designation area has no past, current, or planned future use for municipal or domestic supply due to high background salinity of the groundwater and therefore, need not be protected for the MUN use.
3. Ensure that existing and future potential beneficial uses of groundwater resources outside (upgradient and beneath) the proposed MUN de-designation boundary have been accounted for.
4. Be the most beneficial and cost effective measure because it does not require extensive scientific review and development of SSOs or additional costly measures to avoid groundwater quality degradation and/or meet MUN-related water quality objectives in an area with no potential to sustainably supply a municipal or domestic water supply.
5. Finds it appropriate that agriculture or other regulated entities in the project area not be required to implement new treatment processes or other control measures to avoid groundwater quality

degradation and/or meet MUN-related discharge limitations in Waste Discharge Requirements (WDRs) when no such use currently exists or is anticipated to exist for groundwater in the area proposed for MUN de-designation.

Implementation of MUN Alternative 1 (No Action) would not satisfy the selection criteria because it would not be consistent with the intent of the *Sources of Drinking Water Policy* Exception 1a. Implementation of MUN Alternative 1 would also result in costly treatment or other control measures for agriculture and other regulated entities beyond those currently required to avoid groundwater quality degradation and/or meet MUN water quality objectives. The economic impacts of additional treatment and control of agricultural drainage and the fallowing of land are considered in Section 7.2, Economic Analysis.

Implementation of MUN Alternative 2 (De-designate MUN beneficial use within the historical footprint of the Tulare Lake Bed at an elevation of 200 feet above MSL with no vertical de-designation boundary) would not satisfy the selection criteria because it would de-designate the MUN beneficial use in the unconfined, deep aquifer below the confining clay layers that separate the upper and lower aquifers. The technical findings of the Beneficial Use Evaluation Report showed that groundwater quality beneath the impermeable clay layers in some portions of the Project Study Area features EC levels less than 5,000 $\mu\text{S}/\text{cm}$. Use of the groundwater in the lower aquifer would not be protected under MUN Alternative 2 because it does not feature the vertical boundaries identified in MUN Alternative 3. The absence of a vertical limit to de-designation could deny certain geographic areas a beneficial use that is currently supported by existing water quality at some vertical depth. Because this alternative is viewed as unnecessarily limiting beneficial use protection in the project area, it is eliminated from further consideration and no specific environmental, antidegradation, or economic analyses are conducted for it.

Implementation of MUN Alternative 4 (Development of MUN site-specific objectives within the proposed MUN de-designation boundary) would not satisfy the selection criteria because it also would not be consistent with the intent of the *Sources of Drinking Water Policy* Exception 1a in that groundwater EC levels exceed 5,000 $\mu\text{S}/\text{cm}$ in the proposed MUN de-designation boundary. Unlike MUN Alternative 3, SSOs do not address the primary question of what the appropriate MUN beneficial use protection is for the historical Tulare Lake Bed. Since the MUN use is not existing in the area, SSOs would only be possible to support a "limited MUN" use, whereby waters would need to be treated or blended prior to use. A rational basis for a Limited-MUN SSO would be existing ambient water quality. This alternative would then be similar to MUN Alternative 1 (No Action), which allows only limited degradation of groundwater quality. However, as described in Section 4.1.3.1, because the degree of MUN use of the groundwater contained in the proposed de-designation area is no MUN use, developing SSOs for another degree of use is not a reasonable alternative. As such, SSOs for the protection of the MUN beneficial use are eliminated from further consideration and specific environmental, antidegradation, or economic analyses are conducted on this alternative.

Recommendations for the Monitoring and Surveillance component of MUN Alternative 3 are discussed further in Section 5, Program of Implementation.

Table 6: Evaluation of Project Alternatives Pertaining to MUN Use Designation in Groundwater in a Portion of the Historical Tulare Lake Bed.

MUN Project Alternatives	1. Maintain consistency with federal and state WQ laws and policies.	2. Meet exception(s) to Sources of Drinking Water Policy.	3. Protect existing and future potential beneficial uses.	4. Maintain agricultural production in the project area.	5. Support proactive control/management of salt for application and disposal.	6. Technically feasible, economically viable, and reasonable action.	7. Scientifically supported by existing data.	8. Support socioeconomic well-being of the project area.	9. Ease of implementation.
1. No Action	High	Low	High	Low	Low	Low	Low	Low	Low
2. De-designate MUN Beneficial Use within the Historical Footprint of the Tulare Lake Bed at an Elevation of 200 feet above Mean Sea Level (MSL)	Low	Low ¹	Low ¹	High	Med	Med ¹	Low ¹	Med	Low
3. De-designate MUN Beneficial Use in a Portion of the Historical Tulare Lake Bed Based on Exception 1a of the <i>Sources of Drinking Water Policy</i>	High	High	High	High	Med	High	High	High	High
4. Development of MUN Site-Specific Salinity Objectives within the Proposed MUN De-designation Boundary	High	Low	High	Low	Low	Low	Low	Low	Low

1. Absence of vertical limit to de-designation boundary could deny certain geographic areas a beneficial use that is currently supported by existing water quality at some vertical depth.

4.4 AGR BENEFICIAL USE ALTERNATIVES

The various project alternatives pertaining to the designation of the AGR beneficial use in groundwater in a portion of the historical Tulare Lake Bed are described below.

4.4.1 No Action Alternative

AGR Alternative 1 would not amend the Basin Plan; rather it would continue to maintain the current AGR beneficial use designation for the Tulare Lake Basin (DAUs 238, 241, and 246). Accordingly, there would be no change in the recommended upper ranges of water quality objectives associated with irrigation supply (EC groundwater threshold of 3,000 $\mu\text{S}/\text{cm}$) and livestock watering (EC groundwater threshold of 5,000 – 7,500 $\mu\text{S}/\text{cm}$). Otherwise, for areas that currently do not meet AGR-related water quality objectives due to naturally occurring background concentrations, controllable factors, such as agriculture, would not be allowed to further degrade existing water quality under the No Action Alternative. The estimated economic impacts of the No Action Alternative are discussed in Section 7.2. In addition, no new implementation provisions or monitoring and surveillance programs would be initiated.

4.4.2 Development of AGR Site-Specific Salinity Objectives within the Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering Alternative

AGR Alternative 2 would involve changes to the Basin Plan pertaining to water quality objectives for groundwater in the Tulare Lake Bed. The development of SSOs for constituents of concern for the groundwater would be developed based on existing ambient groundwater concentrations. Where groundwater quality (measured as EC) currently does not support the irrigation supply beneficial use (i.e., EC exceeds 3,000 $\mu\text{S}/\text{cm}$) or the livestock watering beneficial use (i.e., EC exceeds 7,500 $\mu\text{S}/\text{cm}$) due to naturally occurring background concentrations, controllable factors, such as agriculture, would not be allowed to further degrade existing water quality under this alternative. Existing regulatory programs would be responsible for implementing the monitoring and surveillance program needed to assure that waste discharges do not further degrade existing ambient groundwater concentrations in a site-specific area.

4.4.3 De-designate AGR Beneficial Use within Separate Horizontal and Vertical Boundaries for Irrigation Supply and Livestock Watering Alternative

AGR Alternative 3 would amend the Basin Plan to state that the AGR beneficial use does not apply to a portion of the historical Tulare Lake Bed within the horizontal boundary to the variable vertical depths represented in **Figure 11** (pertaining to irrigation supply) and **Figure 12** (pertaining to livestock watering). The minimum variable depths shown in these figures represent the depths at which specific clay layers are first encountered within the boundary areas proposed for AGR de-designation. Because the clay layers in these areas are of variable thickness, the de-designation of the AGR beneficial use would extend to the bottom of the clay layer along the outside surface of the de-designation boundary areas. No changes will be made to other designated beneficial uses. Two monitoring and surveillance elements were identified for this project alternative: Element A – Lateral Monitoring of Shallowest Groundwater, and Element B – Vertical Monitoring of Deeper Shallow Groundwater. A discussion of these elements is provided in Section 5, Program of Implementation.

4.4.3.1 Evidence to support AGR de-designation via the findings of the Beneficial Use Evaluation Report

The proposed AGR de-designation boundaries for irrigation supply (see **Figure 11**) and livestock watering (see **Figure 12**) were developed to preclude areas where active irrigation wells and stock wells are located, and include buffer areas between active irrigation and stock wells and the proposed de-

designation boundaries based on a thorough ground level reconnaissance of all irrigation supply wells within the five subareas. Ground level well reconnaissance in these areas found that all active irrigation supply wells within the proposed AGR de-designation boundaries and those wells just outside of the proposed boundaries (well status active, abandoned, or destroyed) are completed below the Corcoran Clay and do not draw water from within the area proposed for de-designation of the AGR beneficial use (CV-SALTS, 2015; TLBWSD, 2016b (see **Appendix E**)).

There are active irrigation wells in the North Subarea, East Subarea, and northeast portion of the Central Subarea, but records indicate that these wells are completed below the vertical de-designation boundary identified in **Figure 11** (CV-SALTS, 2015). Additionally, groundwater EC levels within the AGR de-designation boundary for irrigation supply exceed 5,000 $\mu\text{S}/\text{cm}$, which is significantly higher than the upper EC limit of 3,000 $\mu\text{S}/\text{cm}$ established for water used as irrigation supply (CV-SALTS, 2015). The horizontally and vertically delineated area identified in **Figure 12** for de-designation of the AGR livestock watering beneficial use relies upon a maximum EC groundwater quality threshold of 7,500 $\mu\text{S}/\text{cm}$ included in the CV-SALTS literature review prepared by Kennedy/Jenks Consultants and Texas A&M Agrilife Research (CV-SALTS, 2013). The 7,500 $\mu\text{S}/\text{cm}$ EC threshold is an aggregate level (i.e., synthesized from reviews of three studies on stock watering: NAS and NAE 1973; Ayers and Westcot 1985; NRC 2005) identified as a maximum limit that can be used with reasonable safety for dairy and beef cattle, sheep, swine, and horses (CV-SALTS, 2013). However, an EC threshold of 7,500 $\mu\text{S}/\text{cm}$ is not acceptable for pregnant or lactating animals and is not acceptable for poultry (CV-SALTS, 2013). Reconnaissance of landowners in the Project Study Area revealed that half of them do not carry out stock operations on their lands, and those who are stock operators provide water to their livestock that is imported from outside the Project Study Area (water is delivered via either earthen ditches, water trucks, or pipelines; see the stock watering outreach contact and water source table provided in **Appendix F**).

4.4.4 Development of Classes of AGR Uses and Water Quality Objectives that Better Represent Irrigation and Livestock Watering Limitations at Different Groundwater Salinity Concentrations within the Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering Alternative

AGR Alternative 4 would amend the Basin Plan to limit the discharge of certain constituents to groundwater to specific levels within defined areas of the Tulare Lake Bed. These specific levels would be associated with AGR classes or sub-categories of use. Limits to pollutant concentrations in specific areas would be based on the existing groundwater quality in those areas. This alternative also would amend the Basin Plan with respect to the level of AGR beneficial use protection associated with a particular AGR class. The Central Valley Water Board could use existing classes of irrigation water included in the Basin Plan, or use the AGR Classes proposed by CV-SALTS to control discharges to groundwater (see **Table 7**). Because existing groundwater quality within the AGR de-designation boundaries exceeds EC levels in some of the classes shown in **Table 7**, potential classes that could be assigned to the AGR irrigation supply de-designation boundary (see **Figure 11**) include existing Basin Plan Class III and CV-SALTS Proposed AGR Class 3. Similarly, the two potential classes that could be assigned to the AGR livestock watering de-designation boundary (see **Figure 12**) include existing Basin Plan Class III and CV-SALTS Proposed AGR Class 4. Existing regulatory programs would be responsible for implementing the monitoring and surveillance program needed to assure that waste discharges do not degrade existing ambient groundwater in a defined area to the degree that ambient concentrations exceed the water quality class to which the area is assigned.

4.4.5 De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 5,000 µS/cm Alternative

AGR Alternative 5 would amend the Basin Plan to state that the AGR beneficial use does not apply to a portion of the historical Tulare Lake Bed within the horizontal boundary to the variable vertical depths represented in **Figure 11**, pertaining to both irrigation supply and livestock watering. The minimum variable depths shown in **Figure 12** represent the depths at which specific clay layers are first encountered within the boundary area proposed for AGR de-designation. Because the clay layers in this area are of variable thickness, the de-designation of the AGR beneficial use would extend to the bottom of the clay layer along the outside surface of the de-designation boundary. The selection of AGR Alternative 5 would result in a single de-designation boundary for both the MUN and AGR beneficial uses in groundwater in a portion of the historical Tulare Lake Bed because the MUN de-designation boundary (see **Figure 8**) and AGR irrigation supply de-designation boundary (see **Figure 11**) are identical. In addition, the selection of AGR Alternative 5 would have the effect of de-designating the AGR beneficial use for livestock watering for a surface area of approximately 4,680 acres (see **Figure 12**) where the EC of the underlying groundwater is greater than 5,000 µS/cm and less than 7,500 µS/cm. No changes will be made to other designated beneficial uses. Two monitoring and surveillance elements were identified for this project alternative: Element A – Lateral Monitoring of Shallowest Groundwater, and Element B – Vertical Monitoring of Deeper Shallow Groundwater. A discussion of these elements is provided in Section 5, Program of Implementation.

Table 7: Possible Criteria for Mineral Quality of Irrigation Water in the Tulare Lake Bed.

Constituent	Existing Basin Plan Classes ¹			CV-SALTS Proposed AGR Classes ²			
	Class I	Class II	Class III	AGR Class 1	AGR Class 2	AGR Class 3	AGR Class 4
EC (µS/cm)	<1,000	1,000 – 3,000	>3,000	<1,000	1,000 – <3,000	3,000 – <7,500	>7,500
TDS (mg/L)	<700	700 – 2,000	>2,000	---	---	---	---
Chlorides (mg/L)	<175	175 - 350	>350	---	---	---	---
Sodium (% base constituents)	<60	60 - 75	>75	---	---	---	---
Boron (mg/L)	<0.5	0.5 - 2	>2	---	---	---	---

1. Taken from Tulare Lake Basin Plan pg. IV-11: criteria for mineral quality of irrigation water in the White Wolf Subarea.

2. CV-SALTS Draft AGR Policy: Salinity Management to Provide Reasonable Protection of AGR Beneficial Uses in Groundwater (AGR Policy), September 12, 2016.

4.4.5.1 Evidence to support AGR de-designation via the findings of the Beneficial Use Evaluation Report and a 5,000 µS/cm EC groundwater salinity threshold for livestock watering

The proposed AGR de-designation boundary for irrigation supply (**Figure 9**) was developed to preclude areas where active irrigation wells are located, and includes a buffer area between active irrigation wells and the proposed de-designation boundary based on a thorough ground level reconnaissance of all irrigation supply wells within the five subareas. Ground level well reconnaissance in these areas found that all active irrigation supply wells within the proposed AGR de-designation boundary and those wells just outside of the proposed boundary (well status active, abandoned, or destroyed) are completed below the Corcoran Clay and do not draw water from within the area proposed for de-designation of the AGR

beneficial use (CV-SALTS, 2015; TLBWSD, 2016b (see **Appendix E**)). There are active irrigation wells in the North Subarea, East Subarea, and northeast portion of the Central Subarea, but records indicate that these wells are completed below the vertical de-designation boundary identified in **Figure 11** (CV-SALTS, 2015). Additionally, groundwater EC levels within the AGR de-designation boundary for irrigation supply exceed 5,000 $\mu\text{S}/\text{cm}$ (CV-SALTS, 2015), which means they significantly exceed the upper EC limit of 3,000 $\mu\text{S}/\text{cm}$ recommended for water used as irrigation supply.

The EC groundwater salinity threshold of 5,000 $\mu\text{S}/\text{cm}$ proposed for de-designation of the AGR livestock watering beneficial use is based on findings included in the May 2013 stock watering literature review prepared for CV-SALTS by Kennedy/Jenks Consultants and Texas A&M Agrilife Research (CV-SALTS, 2013). The 5,000 $\mu\text{S}/\text{cm}$ EC threshold is taken from the Canadian Council of Ministers of the Environment (CCME) which established a maximum recommended limit of 5,000 $\mu\text{S}/\text{cm}$ EC for all classes of livestock (Canada 2012).

The following additional information was used to support the selection of an EC groundwater salinity threshold of 5,000 $\mu\text{S}/\text{cm}$ for de-designation of the AGR livestock watering beneficial use in the project area:

- Stock operators in the project area currently do not use, and do not anticipate using in the future local groundwater pumped from within or near the project area for watering livestock due to the elevated salinity of the groundwater;
- Stock operators in the project area water their livestock using water that is delivered via either earthen ditches, water trucks, or pipelines (see **Appendix F**);
- Sufficient surface water resources are available to satisfy the requirements of livestock watering in the project area;
- Livestock watering in the project area is limited to times of the year when local vegetation supports livestock grazing. Because livestock grazing and watering does not occur throughout the year in the project area, it is more cost effective for stock operators to import surface water to meet temporal stock watering demands than it would be to drill a well in the deep aquifer that underlies the proposed de-designation area as a means to provide water of sufficient quality to meet livestock watering demands.

4.4.6 De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 7,500 $\mu\text{S}/\text{cm}$ Alternative

AGR Alternative 6 would amend the Basin Plan to state that the AGR beneficial use does not apply to a portion of the historical Tulare Lake Bed within the horizontal boundary to the variable vertical depths represented in **Figure 12**, pertaining to both irrigation supply and livestock watering. The minimum variable depths shown in **Figure 12** represent the depths at which specific clay layers are first encountered within the boundary area proposed for AGR de-designation. Because the clay layers in this area are of variable thickness, the de-designation of the AGR beneficial use would extend to the bottom of the clay layer along the outside surface of the de-designation boundary. The selection of AGR Alternative 6 would have the effect of not de-designating the AGR beneficial use for irrigation supply for a surface area of approximately 4,680 acres (see **Figure 12**) where the underlying groundwater is greater than 5,000 $\mu\text{S}/\text{cm}$ and thus, far exceeds the 3,000 $\mu\text{S}/\text{cm}$ EC groundwater salinity threshold for irrigated agriculture. No changes will be made to other designated beneficial uses. Two monitoring and surveillance elements were identified for this project alternative: Element A – Lateral Monitoring of

Shallowest Groundwater, and Element B – Vertical Monitoring of Deeper Shallow Groundwater. A discussion of these elements is provided in Section 5, Program of Implementation.

4.4.6.1 Evidence to support AGR de-designation via the findings of the Beneficial Use Evaluation Report and a 7,500 $\mu\text{S}/\text{cm}$ EC groundwater salinity threshold for livestock watering

The proposed AGR de-designation boundary for livestock watering (see **Figure 12**) was developed to preclude areas where active stock wells are located, and includes a buffer area between active stock wells and the proposed de-designation boundary based on a thorough ground level reconnaissance of all irrigation supply wells within the five subareas. Ground level well reconnaissance in these areas found that all active irrigation supply wells within the proposed AGR de-designation boundaries and those wells just outside of the proposed boundaries (well status active, abandoned, or destroyed) are completed below the Corcoran Clay and do not draw water from within the area proposed for de-designation of the AGR beneficial use (CV-SALTS, 2015; TLBWS, 2016b (see **Appendix E**)). With regard to irrigation supply wells within this de-designation boundary for livestock watering, there are active irrigation supply wells in the North Subarea, East Subarea, and northeast portion of the Central Subarea, but records indicate that these wells are completed below the vertical de-designation boundary identified in **Figure 12** (CV-SALTS, 2015). Additionally, groundwater EC levels within the AGR de-designation boundary for livestock watering exceed 7,500 $\mu\text{S}/\text{cm}$ (CV-SALTS, 2015).

The EC groundwater salinity threshold of 7,500 $\mu\text{S}/\text{cm}$ included in AGR Alternative 6 is based on findings included in the May 2013 stock watering literature review prepared for CV-SALTS by Kennedy/Jenks Consultants and Texas A&M Agrilife Research (CV-SALTS, 2013). The 7,500 $\mu\text{S}/\text{cm}$ EC threshold is an aggregate level (i.e., synthesized from reviews of three studies on stock watering: NAS and NAE, 1973; Ayers and Westcott, 1985; NRC, 2005) identified as a maximum limit that can be used with reasonable safety for dairy and beef cattle, sheep, swine, and horses (CV-SALTS, 2013). However, an EC threshold of 7,500 $\mu\text{S}/\text{cm}$ is not acceptable for pregnant or lactating animals and is not acceptable for poultry (CV-SALTS, 2013). Reconnaissance of landowners in the Project Study Area revealed that half of them do not carry out stock operations on their lands, and those who are stock operators provide water to their livestock that is imported from outside the Project Study Area (water is delivered via either earthen ditches, water trucks, or pipelines; see the stock watering outreach contact and water source table provided in **Appendix F**).

4.5 EVALUATION OF AGR BENEFICIAL USE ALTERNATIVES

Similar to the process used to evaluate MUN alternatives, the above-described AGR Basin Plan Amendment alternatives were evaluated based on their ability to meet 8 of the 9 selection criteria described in Section 4.2. Selection criterion 2, “Meet exception(s) to *Sources of Drinking Water Policy*”, is not applicable to the AGR beneficial use. Each AGR project alternative was evaluated with regard to how well it satisfies each criterion. Again, a scale of “low”, “medium”, and “high” was used to rank how well an alternative meets a criterion. Definitions of these rankings are provided in Section 4.2. A ranking of each proposed AGR project alternative with respect to the evaluation criteria is provided in **Table 8**. A description of the assumptions and rationale used when ranking each AGR project alternative is provided in **Appendix J**.

4.6 RECOMMENDED ALTERNATIVE FOR AGR USE DESIGNATION

Central Valley Water Board staff recommends AGR Alternative 5, which is to de-designate the AGR beneficial use from the portion of the historical Tulare Lake Bed represented in **Figure 8** based on an EC groundwater quality threshold of 5,000 $\mu\text{S}/\text{cm}$ that is supported by the findings of the Beneficial Use Evaluation Report and the literature review prepared for CV-SALTS by Kennedy/Jenks Consultants and

Texas A&M Agrilife Research (CV-SALTS, 2013). AGR Alternative 5 best satisfies the selection criteria (see **Table 8**) since the action would:

1. Be consistent with both federal and state water quality laws and policies.
2. Be the appropriate protection for the groundwater in the area proposed for AGR de-designation. Section 4.4.5.1 demonstrates that the proposed de-designation area has no past, current, or potential future use for agricultural supply (irrigation supply and livestock watering) due to high background salinity of the groundwater.
3. Ensure that all existing and future potential groundwater beneficial uses are protected.
4. Be the most beneficial and cost effective measure because it does not require extensive scientific review and development of SSOs, classes of AGR uses, or additional costly measures to avoid groundwater quality degradation and/or meet EC levels generally considered to support AGR beneficial uses: 3,000 $\mu\text{S}/\text{cm}$ for irrigation and 7,500 $\mu\text{S}/\text{cm}$ for livestock watering.
5. Finds it appropriate that agriculture in the project area not be required to implement new treatment processes or other control measures to avoid groundwater quality degradation and/or meet AGR-related discharge limitations in WDRs when no such use currently exists or is anticipated to exist for groundwater in the area proposed for AGR de-designation.

Implementation of AGR Alternative 1 (No Action) would not satisfy the selection criteria because it would act to reduce agricultural production in the project area, would not lead to the improvement of salinity management outside of the project area, has the potential to cause socioeconomic impacts in the project area, and is not supported by existing scientific data. Implementation of AGR Alternative 1 would result in costly treatment or other control measures for agriculture and other regulated entities beyond those currently required to avoid groundwater quality degradation and/or meet AGR water quality objectives. The economic impacts of additional treatment and control of agricultural drainage and the fallowing of land are considered in Section 7.2, Economic Analysis.

Implementation of AGR Alternative 2 (Development of site-specific objectives within the proposed de-designation boundaries for irrigation supply and livestock watering) would not satisfy the selection criteria because it would also act to reduce agricultural production in the project area, would not lead to the improvement of salinity management outside of the project area, and has the potential to cause socioeconomic impacts in the project area. Unlike AGR Alternatives 3, 5, and 6, SSOs do not address the primary question of what the appropriate AGR beneficial use protection is for the historical Tulare Lake Bed. Since the AGR use is not existing in the area, SSOs would only be possible to support a "limited AGR" use, whereby waters would need to be treated or blended prior to use. A rational basis for a Limited-AGR SSO would be existing ambient water quality. This alternative would then be similar to AGR Alternative 1 (No Action), which allows limited degradation of groundwater quality. However, as described in Sections 4.4.3.1, 4.4.5.1, and 4.4.6.1, because the degree of AGR use of the groundwater contained in the proposed de-designation area is no AGR use, developing SSOs for another degree of use is not a reasonable alternative. As such, SSOs for the protection of AGR beneficial uses are eliminated from further consideration and no environmental, antidegradation, or economic analyses are conducted on this alternative. However, as noted in the assumptions and rationale used when ranking the AGR project alternatives (see **Appendix J**), implementation of SSOs for the protection of AGR beneficial uses would require agriculture to implement additional treatment and control of its discharge to reduce its impact on groundwater or would lead to reduced agricultural production in the area through land fallowing. Implementation of these measures would produce unwarranted adverse socioeconomic impacts in the project area.

Implementation of AGR Alternative 3 (De-designate AGR beneficial use with separate horizontal and vertical boundaries for irrigation supply and livestock watering) is ranked similarly to AGR Alternative 5 except for those selection criteria associated with maintaining agricultural production (Criterion 4) and socioeconomic well-being (Criteria 6 and 8) in the project area, and ease of implementation (Criterion 9; see **Table 8**). Because the proposed AGR livestock watering de-designation boundary included as part of this alternative has a smaller horizontal surface area as compared to the AGR irrigation supply de-designation boundary, it would result in approximately 4,680 fewer acres in the project area that would not be de-designated for the AGR livestock watering beneficial use (see **Figure 12**). These 4,680 acres are located in the East Subarea and are situated on higher ground that would be able to support the construction and operation of new drainage facilities because these areas are less susceptible to flooding. If this acreage is not de-designated for all AGR beneficial uses, then agriculture would need to implement additional treatment and control of its discharge to reduce its impact on groundwater on these 4,680 acres or would need to reduce agricultural production on this land (i.e., fallow acreage). To this end, this alternative is considered to be less economically viable and less easy to implement as compared to the alternative that would implement the proposed AGR de-designation boundary using a single EC groundwater quality threshold of 5,000 $\mu\text{S}/\text{cm}$ to de-designate all AGR beneficial uses (i.e., AGR Alternative 5).

Implementation of AGR Alternative 4 (Development of classes of AGR uses and water quality objectives) would not satisfy the selection criteria because it would also act to reduce agricultural production in the project area, would not lead to the improvement of salinity management outside of the project area, and has the potential to cause socioeconomic impacts in the project area. Unlike AGR Alternatives 3, 5, and 6, and similar to Alternative 2, classes of AGR uses do not address the primary question of what the appropriate AGR beneficial use protection is for the historical Tulare Lake Bed. A rational basis for classes of AGR uses in the project area would be existing ambient water quality. This alternative would then be similar to AGR Alternative 1 (No Action), which allows limited degradation of groundwater quality. However, as described in Sections 4.4.3.1, 4.4.5.1, and 4.4.6.1, because the degree of AGR use of the groundwater contained in the proposed de-designation area is no AGR use, developing classes of AGR uses for another degree of use is not a reasonable alternative. As such, classes of AGR uses for the protection of AGR beneficial uses are eliminated from further consideration and no environmental, antidegradation, or economic analyses are conducted on this alternative. However, as noted in the assumptions and rationale used when ranking the AGR project alternatives (see **Appendix J**), implementation of classes of AGR uses for the protection of AGR beneficial uses would require agriculture to implement additional treatment and control of its discharge to reduce its impact on groundwater or would lead to reduced agricultural production in the area through land fallowing. Implementation of these measures would produce socioeconomic impacts in the project area.

Implementation of AGR Alternative 6 (De-designation AGR irrigation supply and livestock watering beneficial uses within combined horizontal and vertical boundaries based on an EC groundwater quality threshold of 7,500 $\mu\text{S}/\text{cm}$) is ranked similarly to AGR Alternative 5 except for those selection criteria associated with maintaining agricultural production (Criterion 4) and socioeconomic well-being (Criteria 6 and 8) in the project area (see **Table 8**). Because the proposed AGR livestock watering de-designation boundary included as part of this alternative has a smaller horizontal surface area as compared to the AGR irrigation supply de-designation boundary, it would result in approximately 4,680 fewer acres in the project area that are de-designated for all AGR beneficial uses. These 4,680 acres are located in the East Subarea and are situated on higher ground that would be able to support the construction and operation of new drainage facilities because these areas are less susceptible to flooding. If this acreage is not de-designated for all AGR beneficial uses, then agriculture would need to implement additional

treatment and control of its discharge to reduce its impact on groundwater or would need to reduce agricultural production on this land (i.e., fallow acreage). To this end, this alternative is considered to be less economically viable as compared to the alternative that would implement the proposed AGR de-designation boundary using a single EC groundwater quality threshold of 5,000 $\mu\text{S}/\text{cm}$ to de-designate all AGR beneficial uses (i.e., AGR Alternative 5).

Recommendations for the Monitoring and Surveillance component of AGR Alternative 5 are discussed further in Section 5, Program of Implementation.

Table 8: Evaluation of Project Alternatives Pertaining to AGR Use Designation in Groundwater in a Portion of the Historical Tulare Lake Bed.

AGR Project Alternatives	Evaluation Criteria for Project Alternatives								
	1. Maintain consistency with federal and state WQ laws and policies.	2. Meet exception(s) to Sources of Drinking Water Policy.	3. Protect existing and future potential beneficial uses.	4. Maintain agricultural production in the project area.	5. Support proactive control/management of salt for application or disposal.	6. Technically feasible, economically viable, and reasonable solution.	7. Scientifically supported by existing data.	8. Support socioeconomic well-being of the project area.	9. Ease of implementation.
1. No Action	High	N/A	High	Low	Low	Low	Low	Low	Low
2. Development of AGR Site-Specific Salinity Objectives within the Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering	High	N/A	High	Low	Low	Low	Low	Low	Low
3. De-designate AGR Beneficial Use within Separate Horizontal and Vertical Boundaries for Irrigation Supply (EC GW quality threshold 3,000 µS/cm) and Livestock Watering (EC GW quality threshold of 7,500 µS/cm)	High	N/A	High	Med	Med	Med	High	Med	Med
4. Development of Classes of AGR Uses and WQOs that Better Represent Irrigation and Livestock Watering Limitations at Different Groundwater Salinity Concentrations within the Proposed AGR De-designation Boundaries for Irrigation Supply and Livestock Watering	High	N/A	High	Low	Low	Low	Low	Low	Low
5. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 5,000 µS/cm	High	N/A	High	High	Med	High	High	High	High

AGR Project Alternatives	Evaluation Criteria for Project Alternatives								
	1. Maintain consistency with federal and state WQ laws and policies.	2. Meet exception(s) to Sources of Drinking Water Policy.	3. Protect existing and future potential beneficial uses.	4. Maintain agricultural production in the project area.	5. Support proactive control/management of salt for application or disposal.	6. Technically feasible, economically viable, and reasonable solution.	7. Scientifically supported by existing data.	8. Support socioeconomic well-being of the project area.	9. Ease of implementation.
6. De-designate AGR Irrigation Supply and Livestock Watering Beneficial Uses within Combined Horizontal and Vertical Boundaries Based on an EC Groundwater Quality Threshold of 7,500 μ S/cm	High	N/A	High	Med	Med	Med	High	Med	High

5 PROGRAM OF IMPLEMENTATION

5.1 PROGRAM OF IMPLEMENTATION FOR PREFERRED ALTERNATIVES

Implementation provisions ordinarily describe the actions the Regional Water Board will take to implement a change in water quality standards (a combination of beneficial use and the water quality objectives to protect that use), after those standards are integrated into the Basin Plan. However, in this proposed Basin Plan Amendment, under preferred MUN Alternative 3, the Central Valley Water Board proposes to de-designate the MUN beneficial use from groundwater within horizontally and vertically delineated areas under a portion of the historical Tulare Lake Bed that meet Exception 1a of the *Sources of Drinking Water Policy*. The de-designation would in turn remove the applicability of all water quality objectives in place to protect MUN (e.g., the MCLs specified in Title 22) from the groundwater within the de-designation boundary (see **Figure 8**), thereby not requiring any additional implementation actions by dischargers whose zone of influence lies within the identified area, to meet MCLs.

Additionally, under preferred AGR Alternative 5, the Central Valley Water Board proposes to de-designate the AGR beneficial use from groundwater within horizontally and vertically delineated areas under a portion of the historical Tulare Lake Bed that do not support AGR beneficial uses due to the elevated salinities of existing ambient groundwater. This de-designation would in turn remove the applicability of all narrative water quality objectives in place to protect AGR and the numeric values used to interpret those narrative objectives from the groundwater within the de-designation boundary. Ambient EC levels of the groundwater within the proposed MUN and AGR de-designation boundary exceed 5,000 $\mu\text{S}/\text{cm}$ (see **Figure 11**). The de-designation would not require additional implementation actions by land dischargers whose zone of influence lies within the delineated area.

The de-designation boundary associated with the two preferred alternatives is a three-dimensional (3D) space formed by impermeable clay layers that produce a hydrologic barrier to the downward flow of groundwater. The Beneficial Use Evaluation Report determined average minimum depths to the tops of clay layers (see **Figures 8** and **11**). The thickness of these layers is variable. The point of compliance at which groundwater is required to meet relevant WQOs is at the bottom of the clay layer along the outside surface of the de-designation boundary. An entity wishing to determine exactly where beneficial uses are protected at any given horizontal location would need to drill a borehole to determine at which depth a particular clay layer ends.

5.2 MONITORING AND SURVEILLANCE FOR PREFERRED ALTERNATIVES

Although no new monitoring or surveillance is being proposed as part of the current Basin Plan Amendment, this section describes two elements that would pertain to new projects and changes to existing discharge drainage patterns which may be proposed within the proposed de-designation area to determine whether these discharges to the de-designation area may cause or contribute to beneficial uses not being met outside of the de-designation boundary. The recommendations are included with the recognition that the de-designation may lead to focused movement of saline water into the proposed de-designation area consistent with the Basin Plan directive to move drainage to the west of the Basin. The first monitoring element (A) addresses new projects and changes to existing discharge drainage patterns that may be

proposed along the periphery of the de-designation boundary. The second monitoring element (B) addresses all other new projects proposed within the interior of the de-designation area. For proposed new projects, the Central Valley Water Board will have discretion to require monitoring if available information indicates that such monitoring is necessary and appropriate to protect beneficial uses. No new monitoring or surveillance is proposed to address existing activities within the de-designation area, given the results of the extensive review of the impacts of those historical and ongoing activities presented in the Beneficial Use Evaluation Report.

5.2.1 Element A – Monitoring of Shallow Groundwater along Periphery of De-Designation Area

For proposed new projects within and immediately adjacent to the de-designation boundary, the Central Valley Water Board may, at its discretion, based on site-specific evaluation, require monitoring to address concerns for impacts to beneficial uses outside of the de-designation area. Available information indicates that (1) existing shallow monitoring wells and (2) routinely dug backhoe excavations would be sufficient to assess impacts to shallow groundwater associated with a new project along the periphery of the de-designation area to assure that “shallowest groundwater” or “first encountered groundwater” outside the MUN and AGR beneficial use de-designation boundary in the lateral, upgradient direction meets relevant water quality objectives. This shallowest groundwater exists at depths of 50 feet or less (see Section 3.2).

The continued discharge of agricultural drainage within the proposed de-designation boundary is not anticipated to impact groundwater adjacent to and outside of the de-designation boundary. This is based on the findings of the Beneficial Use Evaluation Report which showed historical and current agricultural operations occurring in the project area have not resulted in lateral impacts to groundwater since the gradient is toward the center of the historical Tulare Lake Bed, at the interior of the de-designation area (CV-SALTS, 2015). The findings of the Beneficial Use Evaluation Report were confirmed by a zone of capture analysis performed for municipal drinking water supply wells (KDSA, 2016a; see **Appendix D**). The analysis (see Section 3.4) evaluated the potential for municipal wells operated by the City of Corcoran and Kettleman City to extract groundwater from within or beneath the proposed de-designation area. The study found that pumping of these municipal wells wouldn’t influence the direction of groundwater flow in the area proposed for MUN de-designation, nor would these wells draw groundwater from within or beneath the area proposed for de-designation (*Id.*). A second zone of capture analysis (see Section 3.4) performed for a representative, shallow, private domestic well located just outside of the proposed de-designation boundary found that a well located greater than 87.5 feet from the de-designation boundary would not draw groundwater from within the de-designation boundary, nor influence the flow of shallow groundwater toward the domestic well (KDSA, 2016b; see **Appendix G**). To be conservative, a domestic well greater than 100 feet away from the de-designation boundary would not draw groundwater from the area proposed for MUN de-designation, nor affect the gradient-driven flow of groundwater toward the center of the lake bed.

Monitoring Element A would only apply to a new discharge and changes to existing discharge drainage patterns to the area along the periphery of the de-designation area that might trigger project-specific groundwater monitoring in the adjacent groundwater outside of the de-designation area. Such monitoring may or may not be deemed to be required. Under this

element, the cost of additional monitoring and reporting would be borne by the entity responsible for the discharge. Groundwater monitoring under Element A would require a minimum of two wells: one upgradient and one downgradient. The cost to install one 6” diameter monitoring well to a depth of 100 feet is estimated to cost \$13,300 (see **Appendix L**). The installation of two wells would cost \$26,600. The completion of a well at a shallower depth (less than 100 feet) can be expected to result in some cost savings as compared to the estimate provided above. Sampling (\$512) and analysis (\$22) of EC and nitrate at a single well are estimated to cost \$534 (see **Appendix L**). Analysis costs for two wells would total \$44; no additional sampling costs are anticipated for the sampling of two nearby wells on the same day. Sampling and analysis costs for two wells are estimated at \$556 per monitoring event.

5.2.2 Element B – Vertical Monitoring of Deep Groundwater

For proposed new projects within the interior of the de-designation area, new vertical monitoring below the confining clay layers would not be expected. At its discretion, in special circumstances, the Board may require monitoring to address exceptional concerns. Such monitoring and surveillance would include project-specific monitoring and reporting requirements beyond current monitoring efforts to document compliance with relevant water quality objectives in the deeper groundwater below the MUN and AGR beneficial use de-designation boundary.

The continued discharge of agricultural drainage within the proposed de-designation boundary is not anticipated to appreciably impact groundwater below confining clay layers based on the findings of the Beneficial Use Evaluation Report which showed that agricultural operations occurring in the project area for decades have not resulted in the movement of higher saline groundwater above the clay layers to the lower saline groundwater below the clay layers (CV-SALTS, 2015). Additionally, an evaluation of EC levels in three irrigation wells southwest and east of the City of Corcoran that tap strata below the Corcoran Clay was conducted to determine if ambient EC levels have changed over time; ostensibly, increasing due to the downward migration of higher saline groundwater from the upper aquifer to the lower aquifer beneath the Corcoran Clay (see Section 3.5). The EC data measured in these three irrigation wells indicate that neither the groundwater wells nor their gravel packs are acting as conduits for the downward migration of the poor quality, shallow groundwater that exists in the upper aquifer. Furthermore, these data support the assertion that the intervening clay layers between the upper and lower aquifers are acting as confining layers that prevent the downward migration of poor quality water (TLBWSD, 2016a; see **Appendix H**).

Monitoring Element B would only apply to a new discharge to the area that might, under special circumstances, trigger project-specific groundwater monitoring directly beneath the new discharge location below confining layers. Under this element, the cost of additional monitoring and reporting would be borne by the entity responsible for the new discharge. Groundwater monitoring under Element B could be accomplished using clustered monitoring wells with a shallow well tapping strata above the Corcoran Clay at a depth of 100 feet and a deep well tapping strata below the Corcoran Clay at a depth of 800 feet. The installation of two clustered monitoring wells is estimated to cost \$123,505 (see **Appendix M**). Using the same sampling and analysis costs presented for Element A, sampling and analysis costs for the two clustered wells are estimated at \$556 per monitoring event (see **Appendix L**).

5.2.3 Recommendation for Monitoring and Surveillance

The Central Valley Water Board may, under project-specific circumstances, require lateral (Element A) or vertical (Element B) groundwater monitoring of new projects implemented in the de-designation area to provide protection of designated beneficial uses. Otherwise, no additional monitoring and surveillance is recommended in relation to the proposed de-designation of MUN and AGR beneficial uses in groundwater in a portion of the historical Tulare Lake Bed.

6 CONSISTENCY WITH LAWS, PLANS AND POLICIES

State and federal laws, plans and policies were reviewed for this Basin Plan Amendment.

6.1 ANTIDEGRADATION ANALYSIS

The State Water Resources Control Board has adopted State Water Board Resolution 68-16, the Statement of Policy with Respect to Maintaining High Quality of Waters in California (*State Antidegradation Policy*) as part of its approach to regulating water quality. The Central Valley Water Board must ensure that its actions do not violate the *State Antidegradation Policy*. The *State Antidegradation Policy* applies to discharges to all high quality waters of the state, which includes both groundwater and surface water. (Wat. Code, § 13050, subd. (e).)

6.1.1 State Antidegradation Policy

Antidegradation provisions of the *State Antidegradation Policy* state, in part:

“(1) Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

(2) Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.”

6.1.2 Antidegradation Analysis of the Proposed Amendments

Discharges from irrigated agriculture have occurred for over a century in the Tulare Lake Basin and are currently regulated under WDRs through the Irrigated Lands Regulatory Program (ILRP). De-designation of the MUN and AGR beneficial uses in groundwater within the proposed de-designation boundary, where existing groundwater quality does not support these uses and said uses cannot be feasibly attained through treatment and control, is not expected to result in any significant increase in the discharge of pollutants to the groundwater in the project area. The preferred MUN (see Section 4.1.3) and AGR (see Section 4.4.5) project alternatives would allow for continued agricultural discharges to groundwater within the de-designation boundary without a requirement for agriculture to implement costly treatment and control of its drainage in order to meet relevant MUN- and AGR-related WQOs. The existing practice of TLBDWSD members reusing tailwater until its salinity prohibits further reuse would continue. Once tailwater is discharged from a member’s drainage facilities to the TLDD system, it is conveyed to one of three evaporation basins operated by TLDD and regulated under a Board-issued WDR (Order R5-93-136). A new evaporation pond, the Mid Evaporation Basin, is scheduled to begin operation in late 2016 and will be regulated under its own WDR (Order R5-2015-0134). Future quantities and qualities of agricultural drainage discharged within the de-

designation boundary are not anticipated to significantly change existing ambient groundwater quality within or outside of the proposed MUN and AGR de-designation boundaries.

Any substantial change in discharge quantity or quality under the ILRP would trigger further environmental evaluation. Section 7.1 further evaluates the potential environmental impacts of the four MUN project alternatives and six AGR project alternatives. Section 7.2 details the economic factors involved with MUN and AGR de-designation as it pertains to the maximum benefit to the people of the State.

6.2 CONSISTENCY WITH FEDERAL AND STATE LAWS

Federal agencies have adopted regulations implementing federal laws to which Central Valley Water Board actions must conform. The following federal laws were evaluated for this proposed Basin Plan Amendment:

- Clean Water Act
- Federal & State Endangered Species Acts (50 CFR *et seq.*, Fish and G. Code §2050-2116 *et seq.*)

These laws and their relevance to the proposed Basin Plan Amendment are described in the following sections in addition to state law.

6.2.1 Clean Water Act

Requirements for Avoiding Wetlands Loss

Under Clean Water Act section 404 and the Rivers and Harbors Act of 1899 Section 10, alteration of waterways, including wetlands that affect navigable waters requires a permit from the Federal government and assurance that impacts will be avoided or mitigated. The U.S. Army Corps of Engineers operates the 404 permit program with a goal of achieving “no net loss” of wetlands. For projects proposing unavoidable impacts on wetlands, compensatory mitigation in the form of replacing the lost aquatic functions is generally required. Under authority of Clean Water Act section 401, the State also reviews projects affecting water bodies. The State may require compensatory mitigation for wetlands impacts not under the jurisdiction of the Federal government, e.g., for wetlands not contiguous with navigable waters.

The proposed Basin Plan Amendment will not adversely affect or have net loss to current wetlands. Therefore, these laws and regulations pertaining to wetland loss are not applicable to the proposed Basin Plan Amendment.

6.2.2 Federal and State Endangered Species Act

The Federal Endangered Species Act of 1973 (50 CFR *et seq.*) was established to identify, protect and recover imperiled species and the ecosystems upon which they depend. It is administered by the Interior Department’s U.S. Fish and Wildlife Service (USFWS) and the Department of Commerce’s National Oceanic and Atmospheric Administration’s National Marine Fisheries Service (NMFS). The USFWS has primary responsibility for terrestrial and freshwater organisms, while the NMFS has primary responsibility for marine species such as salmon and whales. In addition, the State of California enacted the California Endangered Species Act (Fish

& G. Code, sections 2050-2116 et seq.), which is administered by the California Department of Fish and Wildlife and similarly maintains State lists of rare, threatened and endangered species.

The proposed Basin Plan Amendment is not expected to affect fish and wildlife as it only de-designates the MUN and AGR beneficial uses in groundwater. Therefore, the Endangered Species Act is not applicable to the proposed Basin Plan Amendment.

6.3 CONSISTENCY WITH CALIFORNIA WATER CODE SECTION 106.3

In compliance with Water Code section 106.3, it is the policy of the State of California that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes. Water Code section 106.3 states that:

- a. It is hereby declared to be the established policy of the state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes
- b. All relevant state agencies, including the department, the state board, and the State Department of Public Health, shall consider this state policy when revising, adopting, or establishing policies, regulations, and grant criteria when those policies, regulations, and criteria are pertinent to the uses of water described in this section.
- c. This section does not expand any obligation of the state to provide water or to require the expenditure of additional resources to develop water infrastructure beyond those obligations that may exist pursuant to subdivision (b).
- d. This section shall not apply to water supplies for new development.
- e. The implementation of this section shall not infringe on the rights or responsibilities of any public water system.

As discussed in Section 3.3 (Proposed Horizontal and Vertical MUN De-designation Boundaries), the portion of the historical Tulare Lake Bed proposed for de-designation of the MUN beneficial use (see **Figure 8**) in this Basin Plan Amendment features a shallow saline aquifer with groundwater EC levels exceeding 5,000 $\mu\text{S}/\text{cm}$. This condition meets Exception 1a of the *Sources of Drinking Water Policy* which supports a conclusion that the groundwater is not suitable or potentially suitable to support the MUN beneficial use. Additionally, as discussed in Section 3.1.1 (Past, Present and Future MUN and AGR Uses), the four neighboring communities (Stratford, Kettleman City, Alpaugh, and Corcoran) that surround the proposed MUN de-designation boundary have submitted letters to the Central Valley Water Board stating that the shallow groundwater of the historical Tulare Lake Bed is nonviable as a water supply source for municipal and domestic water supply wells now and into the future (CV-SALTS, 2015; see **Appendix B**). This proposed amendment is consistent with Water Code section 106.3.

6.4 ASSEMBLY BILL 32 – CALIFORNIA GLOBAL WARMING SOLUTIONS ACT

Assembly Bill (AB) 32 is a California State Law that fights global warming by establishing a comprehensive program to reduce greenhouse gas (GHG) emissions from all sources throughout the state. The Water Boards are committed to the adoption and implementation of

effective actions to mitigate GHG emissions and adaptation of our policies and programs to the environmental conditions resulting from climate change.

The proposed Basin Plan Amendment is not expected to affect climate change because its adoption is not anticipated to produce a measureable change in existing GHG emissions in the project area. The proposed project may include the use of GHG-generating equipment or machinery for monitoring well installation. However, equipment used in monitoring well installation is comparable to equipment used in existing agricultural operations that are authorized pursuant to the agriculture land use designation in the project area. Any release of GHG-related pollutants as a result of project implementation would be insignificant, infrequent, and consistent with the existing agriculture land use designation in the project area. Therefore, the proposed Basin Plan Amendment is consistent with the California Global Warming Solutions Act.

6.5 CONSISTENCY WITH STATE WATER BOARD POLICIES

The State Water Board is authorized to adopt state policy for water quality control. (Wat. Code §13140) State Water Board water quality control plans supersede any regional water quality control plans for the same waters to the extent of any conflict. (Wat. Code §13170) The following are the State Water Board policies relevant to the proposed Basin Plan Amendment:

- State Policy for Water Quality Control
- Statement of Policy with Respect to Maintaining High Quality of Water in California (Antidegradation Implementation Policy) (Resolution No. 68-16)
- State Water Board Resolution No. 77-1, Policy and Action Plan for Water Reclamation in California
- *Sources of Drinking Water Policy* (Resolution No. 88-63)
- Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304 (Resolution No. 92-49)
- Nonpoint Source Management Plan & the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (Resolution No. 99-114 and 2004-0030)
- Water Quality Enforcement Policy and Policy on Supplemental Environmental Projects
- Policy for Water Quality Control for Recycled Water (Resolution No. 2009-0011)

6.5.1 State Policy for Water Quality Control

Adopted in 1972, this policy declares the State Water Board's intent to protect water quality through the implementation of water resources management programs and serves as the general basis for subsequent water quality control policies.

The proposed Basin Plan Amendment does not change how the state will implement water resources management programs or water quality control policies.

6.5.2 Resolution No. 68-16: Statement of Policy with Respect to Maintaining High Quality of Water in California (Antidegradation Implementation Policy)

This policy is discussed above in Section 6.1.

6.5.3 State Water Board Resolution No. 77-1, Policy and Action Plan for Water Reclamation in California

This policy was adopted on 6 January 1977. Because reclamation provides an alternative source of water suitable for irrigation, reuse is encouraged by the State Water Board. The policy also encourage water conservation and calls for other agencies to assist in implementation.

The proposed Basin Plan Amendment will not restrict reclamation or reuse of water.

6.5.4 Resolution No. 88-63: Sources of Drinking Water Policy

This policy states that all waters of the state, surface and ground waters, are to be considered suitable or potentially suitable for municipal and domestic supply unless one such exception is met. One such exception is Exception 1a, which states that surface and ground waters with TDS exceeding 3,000 mg/L (equivalent to 5,000 $\mu\text{S}/\text{cm EC}$) are not considered suitable or potentially suitable to support the MUN beneficial use.

This policy is examined in detail in Section 2.1.3. The findings in this Staff Report demonstrate that the proposed de-designation volume, as defined by horizontal and vertical boundaries, meets Exception 1a in the *Sources of Drinking Water Policy* because EC levels of the groundwater contained within the designated volume exceed 5,000 $\mu\text{S}/\text{cm}$.

6.5.5 Resolution No. 92-49: Policies and Procedures for Investigations and Cleanup and Abatement of Discharges under Water Code Section 13304

This policy contains procedures for the Central Valley Water Board to follow for oversight of cleanup projects to ensure cleanup and abatement activities protect the high quality of surface and groundwater. The proposed Basin Plan Amendment does not include any change to the procedures pertaining to cleanup and abatement activities; therefore, this policy is not applicable to the proposed Basin Plan Amendment.

6.5.6 Resolution No. 99-114 & Resolution No. 2004-0030: Nonpoint Source Management Plan & the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program

In December 1999, the State Water Board adopted the Plan for California's Nonpoint Source (NPS) Pollution Control Program (NPS Program Plan) and in May 2004, the State Water Board adopted the Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy). The NPS Policy explains how State and Regional Water Boards will use their administrative permitting authority under the Porter-Cologne Act to implement and enforce the NPS Program Plan. The NPS Policy requires all nonpoint source discharges to be regulated under waste discharge requirements, waivers of waste discharge requirements, a Basin Plan prohibition, or some combination of these administrative tools. The NPS Policy also describes the key elements that must be included in a nonpoint source implementation program.

While the proposed Basin Plan Amendment will change the applicability of water quality criteria related to the MUN and AGR beneficial uses in groundwater in the project area, the Proposed Amendment does not change how the management, implementation or enforcement activities of nonpoint source pollution control programs.

6.5.7 Resolution No. 2002-0040: Water Quality Enforcement Policy (Enforcement Policy) and Policy on Supplemental Environmental Projects (SEP Policy)

The State Water Board adopted this policy to ensure enforcement actions are consistent, predictable, and fair. The policy describes tools that the State and Regional Water Boards may use to determine the following: type of enforcement order applicable, compliance with enforcement orders by applying methods consistently, and type of enforcement actions appropriate for each type of violation. The State and Regional Water Boards have authority to take a variety of enforcement actions under the Porter-Cologne Water Quality Control Act. These include the issuance of orders assessing administrative civil liability, time schedule orders, cease and desist orders, and cleanup and abatement orders.

The State Water Board adopted the SEP Policy as an adjunct to the Water Boards' enforcement program and allows for the inclusion of a supplemental environmental project in administrative civil liability actions as long as certain criteria are met to ensure that such a project has environmental value, furthers the goals of the State Water Board and Regional Water Boards, and are subject to appropriate input and oversight by the Water Boards. Both the Enforcement Policy and the SEP Policy, including future revisions, are incorporated into this Basin Plan and shall be implemented according to the policies' provisions.

The proposed Basin Plan Amendment does not change how the water quality enforcement actions are taken or how the SEP Policy is implemented.

6.5.8 Resolution No. 2009-0011: Policy for Water Quality Control for Recycled Water (Recycled Water Policy)

This Policy is intended to establish consistent and predictable requirements in order to increase the use of recycled water in California. The Policy establishes mandates for the use of recycled water; requires the development by stakeholders and the adoption by Regional Water Quality Control Boards of regional salt/nutrient management plans; establishes requirements for regulating incidental runoff from landscape irrigation with recycled water; establishes criteria and procedures for recycled water landscape irrigation projects eligible for streamlined permitting; establishes procedures for permitting groundwater recharge projects; establishes procedures for implementing the *State Antidegradation Policy* for recycled water projects; requires the establishment of a scientific advisory panel to advise the State Water Board on regulation of constituents of emerging concern; and establishes actions and incentives to promote the use of recycled water.

The proposed Basin Plan Amendment will not restrict the development or use of recycled water.

7 ENVIRONMENTAL AND ECONOMIC ANALYSIS

7.1 ENVIRONMENTAL REVIEW

7.1.1 Background

The Central Valley Water Board, when acting as a Lead Agency under CEQA, is responsible for evaluating all the potential environmental impacts that may occur due to changes made to the Basin Plan. The Secretary of Resources has determined that the Central Valley Water Board's basin planning process qualifies as a certified regulatory program pursuant to Public Resources Code section §21080.5 and California Code of Regulations, title 14, section §15251, subdivision (g). This determination means that the Central Valley Water Board is exempt from the requirement to prepare an environmental impact report. Instead, this Staff Report and the Environmental Checklist provided in **Appendix K** satisfy the requirements of State Water Board's Regulations for Implementation of CEQA, Exempt Regulatory Programs, which are found at California Code of Regulations, title 23, sections 3775 et seq.

This section and the Environmental Checklist provided in **Appendix K** evaluate the Proposed Amendment to the Basin Plan discussed in this Staff Report, which is the de-designation of the MUN and AGR beneficial uses in the groundwater within horizontally and vertically delineated areas under a portion of the historical Tulare Lake Bed as identified in **Figure 8** and **Figure 11**. The Proposed Amendment would also establish a Program of Implementation, which includes a Monitoring and Surveillance element, to ensure that groundwater outside of the de-designation area will be in compliance with relevant water quality objectives.

7.1.2 Setting/Baseline

The baseline against which the proposed Basin Plan amendment is assessed includes the following characteristics:

- Existing groundwater characteristics, hydrology, and uses of groundwater
- Existing discharges to the ground waters under consideration (including discharges from irrigated agriculture and storm water) and groundwater quality
- Existing agricultural operations
- Existing regulatory programs and policies

The Beneficial Use Evaluation Report characterized the various components of groundwater and groundwater uses listed above in each of the five subareas included in the proposed de-designation area (CV-SALTS, 2015). Current groundwater quality in the project area was determined through review of USGS reports, shallow groundwater monitoring data measured near Westlake Farms and TLDD evaporation basins, DWR San Joaquin District maps, data from landowner backhoe excavations in the study area, recent dairy monitoring reports, and E-logs from wells within the study area. The current and anticipated future uses of local groundwater supplies in the project area were determined through outreach to municipalities and landowners within and just outside of the proposed de-designation area.

The primary discharge to groundwater in the project area comes from irrigated agriculture. The area receives little precipitation, with the neighboring City of Corcoran⁵ averaging 10.1 inches per year and the Town of Alpaugh⁶ averaging 7.55 inches per year over the last 30 years, as compared to a statewide annual average rainfall of 24.71 inches for California over the same time period. The EC of subsurface drainage emanating from irrigated agriculture in the Tulare Lake Bed area as presented in the Beneficial Use Evaluation Report for two monitoring locations ranged from 7,200 – 8,900 $\mu\text{S}/\text{cm}$ (CV-SALTS, 2015). The EC of shallow groundwater in the five Subareas that comprise the proposed de-designation area range from 5,000 to 10,000 $\mu\text{S}/\text{cm}$, with some areas having EC levels ranging from greater than 10,000 $\mu\text{S}/\text{cm}$ to almost 60,000 $\mu\text{S}/\text{cm}$. By design, the proposed MUN and AGR irrigation supply de-designation boundaries contain shallow groundwater possessing EC levels greater than 5,000 $\mu\text{S}/\text{cm}$. Within the proposed MUN and AGR de-designation boundaries, there are no entities using the groundwater for MUN or AGR uses. Agriculture uses surface water imported from outside the project area or uses groundwater pumped from below the Corcoran Clay, and local urban areas withdraw their municipal supplies from the deep groundwater beneath or upgradient of the proposed horizontal and vertical de-designation boundaries.

Existing regulatory programs and policies regulate the current agricultural and storm water discharges and groundwater quality within and outside of the proposed de-designation area. These programs and policies include, but are not limited to, the Irrigated Lands Regulatory Program (ILRP), which is intended to ensure that agricultural discharges do not adversely affect beneficial uses, Phase II small municipal separate storm sewer systems (MS4s), Storm Water General Permit programs for construction and industrial activities, Water Quality Certification program for dredge and fill activities, the State Water Board *Sources of Drinking Water Policy*, and the *State Antidegradation Policy*.

7.1.3 Proposed Project Analysis

The proposed Basin Plan Amendment would remove the MUN and AGR beneficial use designation in the groundwater within a horizontally and vertically delineated volume underlying a portion of the historical Tulare Lake Bed. The MUN use is not an existing use in the shallow groundwater and cannot feasibly be attained due to the high salinity of the ambient groundwater. Similarly, the AGR use, including the use of groundwater for both irrigation supply and livestock watering, is not an existing use for the same reason noted above. A Basin Plan Amendment must be adopted to utilize Exception 1a of the *Sources of Drinking Water Policy*, as required by the Basin Plan (State Water Board Policies and Plans, page V-1), to de-designate the MUN use within the proposed project boundary. A Basin Plan Amendment must also be adopted to de-designate the AGR beneficial use in the project area, which would remove the applicability of all narrative water quality objectives in place to protect the AGR use in groundwater within the de-designation boundary. The proposed Basin Plan Amendment would not require additional implementation actions by dischargers to the groundwater within the identified de-designation area to meet MUN or AGR-related WQOs. Because the preferred MUN and AGR alternatives use the same beneficial use de-designation boundary (i.e., the boundaries shown in **Figure 8** and **Figure 11** are identical), there exists only a single three-dimensional (3D) space in which both beneficial uses would be de-designated.

⁵ <https://rainfall.weatherdb.com/I/5918/Corcoran-California>

⁶ <https://rainfall.weatherdb.com/I/702/Alpaugh-California>

Adoption of the Proposed Amendment would not have any significant effect on the existing physical environment because the amendment would not change any factors significantly affecting existing groundwater quality or hydrology within the proposed de-designation boundary or impart any changes to groundwater upgradient or beneath the proposed de-designation boundary. A zone of capture analysis (see Section 3.4) that evaluated the potential for municipal wells operated by the City of Corcoran and Kettleman City to extract groundwater from within or beneath the proposed de-designation area found that pumping of these municipal wells wouldn't influence the direction of groundwater flow in the area proposed for MUN de-designation, nor would these wells draw groundwater from within or beneath the area proposed for de-designation (KDSA, 2016a; see **Appendix D**). Additionally, a second zone of capture analysis (see Section 3.4) performed for a representative, shallow, private domestic well located just outside of the proposed de-designation boundary found that a well located greater than 87.5 feet from the de-designation boundary would not draw groundwater from within the de-designation boundary, nor effect the direction of groundwater flow within the de-designation area (KDSA, 2016b; see **Appendix G**). To be conservative, a domestic well greater than 100 feet away from the de-designation boundary would not draw groundwater from the area proposed for MUN de-designation, nor effect the gradient-driven flow of groundwater toward the center of the lake bed.

All active municipal and domestic supply wells identified through the thorough ground level well reconnaissance effort carried out as part of this project either exist at distances sufficiently far away from the proposed MUN de-designation boundary so as to have no potential to draw water from within the proposed de-designation area, or in the case of three domestic wells identified in the western portion of the North Subarea (see **Figure 9**), pump water from either below the Corcoran Clay or below the proposed vertical de-designation boundary (below the A-Clay) over which the subject well is located (CV-SALTS, 2015; TLBWS, 2016b (see **Appendix E**)). Similarly, the thorough ground level well reconnaissance in the five subareas found that all active irrigation supply wells within the proposed AGR de-designation boundaries and those wells just outside of the proposed boundaries (well status active, abandoned, or destroyed) are completed below the Corcoran Clay and do not draw water from within the area proposed for de-designation of the AGR beneficial use (*Id.*).

The proposed Basin Plan Amendment simply recognizes that MUN and AGR are not existing or attainable uses for the shallow groundwater within the proposed de-designation boundary, formally applies the exceptions identified in the *Sources of Drinking Water Policy* with regard to the MUN beneficial use, and enables the Central Valley Water Board to regulate waste discharges and irrigated agriculture within the proposed de-designation boundary and make impairment assessments based on appropriate beneficial use designations, consistent with state and federal policies. The proposed Basin Plan Amendment would not cause any potentially significant environmental impacts and, therefore, there are no mitigation measures or alternatives that could reduce or avoid significant impacts. These conclusions are reflected in the Environmental Checklist provided in **Appendix K** for the proposed Basin Plan Amendment.

7.1.4 Cumulative Impact Analysis

Cumulative impacts refer to one or more individual effects which, when taken together, are considerable or which compound or increase other environmental impacts. Cumulative impacts

are the result of the incremental impact of a project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor, but collectively significant projects taking place over a period of time. Reasonably foreseeable future projects include the Board's revision of permit requirements for regulated entities that discharge agricultural drainage to groundwater within the de-designation boundary; such revisions would not require compliance with water quality objectives or criteria developed for the protection of MUN and AGR uses in the groundwater. Although the Central Valley Water Board would still be obligated to protect MUN and AGR beneficial uses outside (upgradient and below) the de-designation boundary. Central Valley Water Board staff anticipate that the regulated entities whose permits may be revised by the Board subsequent to the adoption of the proposed Basin Plan Amendment may include agricultural and gas and oil field operations.

The Central Valley Water Board has issued ILRP General Orders to third-party coalitions (representatives of agricultural growers), including the Kings River Watershed Coalition Authority that operates in the project area, that require the coalitions to develop regional water quality management plans for areas where irrigated agriculture may be contributing to water quality problems. The ILRP General Orders require growers to conduct evaluations of their management practices to ensure they are protecting groundwater and surface water, and require coordinated monitoring at specified monitoring points that have been determined to be representative of water quality within the watershed. Because the ILRP General Orders issued to the Kings River Watershed Coalition Authority only generally specify that the management plan that it develops and implements must ensure the protection of beneficial uses in all water bodies affected by agricultural return flows, revisions to the ILRP General Orders would likely not be required solely due to the de-designation of the MUN and AGR uses in the groundwater within the de-designation boundary. However, the third-party coalition may modify its management plan to not evaluate or require compliance with the MUN and AGR beneficial uses in the groundwater in a portion of the historical Tulare Lake Bed after the Board de-designates the MUN and AGR uses in the groundwater within the de-designation boundary.

Nevertheless, the ILRP, which is a relatively new regulatory program, is requiring coalitions throughout the state to engage in a process of evaluating and addressing water quality impairments, and this program is generally resulting in increased water quality. Unless water quality conditions are expected to degrade due to either significant changes in return-flow discharge operations, or due to an expansion of irrigated acreage, water quality is generally expected to improve due to implementation of the ILRP General Orders. Because the ILRP General Orders are resulting in greater water quality improvements as the program matures, groundwater quality within and outside of the project area as affected by agricultural operations would be no worse, and will likely improve, relative to existing conditions.

Furthermore, the continued agricultural activities that discharge to the groundwater addressed by the proposed Basin Plan Amendment will all be required to comply with regulatory limits developed to protect the still-designated beneficial uses that will continue to exist in the groundwater, as well as all of the beneficial uses supported in water bodies outside of the de-designation boundary. When a potential permittee proposes a new or expanded discharge (which includes changes to existing discharge drainage patterns), they must submit a new report of waste discharge to the Central Valley Water Board, and the Board will be required to

conduct a new antidegradation analysis and ensure that the beneficial uses that may be affected by the discharge, including those areas where the MUN and AGR beneficial uses will not be de-designated, will be protected, before the Board can issue WDRs. In this manner, the Board will continue to ensure that beneficial uses outside of the de-designation boundary will continue to be protected.

Lastly, as described in Section 1.1.4, this basin planning effort is one part of a region-wide effort that the Board is undertaking to evaluate the appropriate beneficial use protection, water quality objectives, and implementation and monitoring requirements for the MUN beneficial use in various water bodies throughout the Central Valley. It is possible that other ground waters in the Central Valley may have their MUN beneficial use removed in the future if they meet one or more of the exception criteria in the *Sources of Drinking Water Policy*. Similarly, other ground waters in the Central Valley also may have their AGR beneficial use removed in the future if it is demonstrated that existing ambient EC levels do not support the use of the water for irrigated agriculture and livestock watering and no such current use of the water is found to exist. However, the current proposed project represents the largest area (approximately 493 square miles) the Central Valley Water Board has ever evaluated with respect to a potential de-designation of beneficial uses. It is likely that any future proposals to de-designate MUN and AGR beneficial uses in the Central Valley will be associated with much smaller land areas. Similar to the current project, future proposals would also seek to de-designate beneficial uses in areas where there are no existing or proposed uses of the groundwater for a particular designated beneficial use. If approved, future proposed projects would be required to implement appropriate monitoring and regulatory measures to ensure that ground waters outside of their proposed de-designation boundaries will continue to support designated beneficial uses. To this end, any cumulative impacts are expected to be similar to the effects identified for the current project.

7.1.5 No Action Alternative Analysis

Because the Proposed Project Analysis concluded that the proposed Basin Plan Amendment would not cause any potentially significant environmental impacts, no detailed analysis of alternatives to the proposed project is required. Alternatives to the Preferred MUN and AGR Alternatives (MUN Alternative 3 and AGR Alternative 5, respectively) were developed and described, as discussed in Section 4 and **Appendices I and J**. This report does include a discussion of the No Action Alternative to provide additional context for decision-making parties.

Under the No Action Alternative, there would be no change to the existing MUN and AGR beneficial use designations in the groundwater of the Tulare Lake Bed. Because existing ambient groundwater quality within the proposed de-designation boundary does not currently meet water quality objectives/criteria for protection of the MUN use, or narrative water quality objectives in place to protect the AGR use, agricultural discharges would be regulated to prevent further degradation of existing groundwater quality under the No Action Alternative. For this to occur, agricultural operations in the project area would need to implement additional treatment and control measures to reduce concentrations of drinking water constituents of concern and agricultural constituents of concern. Pollutant reductions would be required to prevent further degradation of ambient groundwater quality beyond the controlled degradation allowed by the Basin Plan and that permissible by federal and state antidegradation policies.

The management of agricultural discharges to limit further groundwater quality degradation would add costs to agricultural operations in the form of lining evaporation ponds, installing tile drain systems, or seeking an exception to groundwater quality objectives and funding an offsets project. Discharge from individual fields into TLDD drainage facilities also may become a more highly controlled action, or prohibited altogether, under this future regulatory scenario.

While the reduced discharge of drinking water constituents of concern would reduce loadings of these constituents in the shallow groundwater within the proposed de-designation area, this would have little near-term impact on ambient groundwater concentrations and would not translate to increased protection of human health because (1) ambient groundwater concentrations within the proposed de-designation area would continue to exceed water quality objectives/criteria protective of the MUN use, and (2) MUN is not a current or future anticipated use of the groundwater within the proposed de-designation area. The same concept would apply when reducing the discharge of agricultural constituents of concern; ambient groundwater concentrations of agricultural constituents of concern within the proposed de-designation boundary would continue to exceed narrative objectives for the protection of the AGR use, while the AGR use would not be an existing or future use in the shallow groundwater within the proposed de-designation area.

Two possible treatment and control options that could be used to reduce the discharge of constituents of concern related to the protection of the MUN and AGR beneficial uses are (1) advanced treatment (i.e., reverse osmosis treatment) of agricultural drainage, or (2) the lining of evaporation ponds that would need to be constructed to accommodate drainage from future acreage in the project area that could be put into agricultural production. Because the lining of evaporation ponds would produce fewer environmental impacts with respect to energy usage, greenhouse gas production, and disposal of highly concentrated brine, as compared to reverse osmosis treatment, the lining of evaporation ponds is considered further as a feasible option to reduce the discharge of pollutants from agricultural operations in the project area. It should be noted that any future evaporation pond projects would undergo project-specific CEQA evaluations. Environmental impacts that could occur during installation of pond liners may include temporary impacts to air quality, noise, water quality, biological resources, traffic, and cultural resources associated with construction activities, though these can generally be mitigated to less than significant levels. Significant long-term impacts to environmental resources would not be expected because the lining of evaporation ponds would produce a reduction in pollutant loadings to shallow groundwater in the project area. There would be increases in impervious areas, but because these areas would be small relative to the drainage area as a whole, this would not be expected to significantly reduce groundwater recharge or adversely increase storm water runoff amounts or quality.

7.2 ECONOMIC ANALYSIS

7.2.1 Introduction

There are three requirements related to economic considerations that the Central Valley Water Board must consider when adopting a Basin Plan Amendment. The first requirement is in Water Code section 13241(d) which requires that the Board consider economics when establishing water quality objectives. The second requirement is in Water Code section 13141 which requires that prior to implementation of any agricultural water quality control program, the

Board must include an estimated cost of such a program, together with an identification of potential sources of funding, in the Basin Plan. The third requirement is Public Resources Code section 21159 which requires the Board, when adopting an amendment that will require the installation of pollution control equipment or is a performance standard or treatment requirement, to include an environmental analysis of the reasonably foreseeable methods of compliance. This environmental analysis is required to take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites.

The proposed Basin Plan Amendment allows dischargers in the proposed de-designation area to continue the current discharge without implementing additional treatment. The proposed Amendment does not include the setting of new water quality objectives, does not implement an agricultural water quality control program, nor require any additional treatment as a reasonably foreseeable method of compliance. Therefore, the Central Valley Water Board is not required to consider economics when considering the proposed Basin Plan Amendment. However, since economic information regarding the prevention of discharge of salts to groundwater through the lining of evaporations ponds was available, it is provided to assist in the Central Valley Water Board's decision making process.

In addition to considering the economic effects of the proposed Basin Plan Amendment, this analysis also considers potential economic effects of MUN Alternative 1 and AGR Alternative 1, the No Action alternatives. Under the two No Action alternatives, agricultural discharges in the project area would need to comply with water quality requirements associated with the Irrigated Lands Regulatory Program (ILRP), which ultimately must ensure that agricultural discharges do not adversely affect beneficial uses in receiving waters, in this case, groundwater. Under these No Action alternatives, agricultural discharges in the project area would need to be controlled to prevent further degradation of ambient groundwater quality. This could be achieved through reducing agriculture's loading of constituents of concern to shallow groundwater through either the lining of future evaporation ponds constructed in the project area or through the fallowing of land currently in agricultural production or scheduled for future agricultural production.

7.2.2 Methodology

The economic analysis for the Proposed Amendment (MUN Alternative 3 and AGR Alternative 5) and the No Action alternatives (MUN Alternative 1 and AGR Alternative 1) includes the following consideration:

Implementation Costs – This element addresses the direct implementation costs specific to the alternative, including capital expenditures, long-term operation and maintenance (O&M) costs, including monitoring, labor costs, and Program of Implementation costs (associated with amendments to the Basin Plan).

For this analysis, the costs for the No Action alternatives (MUN Alternative 1 and AGR Alternative 1) are presented along with the Preferred Alternatives (MUN Alternative 3 and AGR Alternative 5) and quantified where possible. If inadequate information or uncertainty limited the ability to quantify costs, a qualitative evaluation was performed. Following is a summary of the information used to evaluate costs for each alternative.

- *No Action Alternatives* – Under these alternatives (MUN Alternative 1 and AGR Alternative 1), agriculture would be required to reduce concentrations of drinking water constituents of concern and agricultural constituents of concern to limit further groundwater quality degradation in the project area. As described in Section 7.2.3, agriculture could choose to reduce the concentrations of constituents of concern in its drainage by installing pond liners or by taking acreage out of agricultural production (i.e., fallowing of land). Because either the fallowing of land or the installation of pond liners would not produce groundwater impacts, no new monitoring costs would be incurred under the No Action alternatives.
- *Preferred Alternatives* – Under these alternatives (MUN Alternative 3 and AGR Alternative 5), agriculture would be allowed to continue to carry out its operations in the project area without requirements for its discharge to be protective of either the MUN or AGR uses or other beneficial uses that currently do not exist and are not anticipated to exist in the future within the proposed de-designation boundary. Therefore, there would be no new capital expenditures or O&M costs associated with the Preferred Alternatives.

7.2.3 No Action Alternatives Economic Analysis

7.2.3.1 Implementation Costs

The No Action alternatives related to either the MUN or AGR beneficial uses result in the same outcome for agricultural operations in the project area: the need to reduce agricultural discharges as a means to limit further ambient groundwater quality degradation. A reduction of agricultural discharges could be achieved through reducing agriculture’s loading of constituents of concern to shallow groundwater through either the lining of future evaporation ponds constructed in the project area or the fallowing of land currently in agricultural production or scheduled for future agricultural production.

A February 2016 cost estimate for lining TLDD’s Mid Evaporation Basin produced a cost range of \$17,423 to \$21,779 per acre for lining the evaporation basin with a high-density polyethylene (HDPE) liner. The cost estimate to line the Mid Evaporation Basin with a HDPE liner is provided in **Appendix N**.

A cost estimate of the direct cost to agriculture of fallowing an acre of land was derived from an August 2015 report produced by researchers at the University of California at Davis that developed an economic analysis of the impacts of the 2015 drought on California agriculture (Howitt et al. 2015; see **Appendix O**). The report developed estimated changes in irrigated crop acreage due to drought and estimated changes in crop revenues due to drought for the years 2015 – 2017 in four prominent agricultural regions of California: the Sacramento Basin, San Joaquin Basin, Tulare Basin, and Central Coast/Southern California Region. The average loss to agriculture in the Tulare Basin due to the fallowing of land was estimated to be \$2,121 per acre.

The draining of agricultural land in the project area generally requires one acre of evaporation basin to accept the return flows generated by 10 acres of land in agricultural production. This 10:1 ratio would result in the costs for drainage of 10 acres of irrigated land shown in **Table 9**.

While the example impacts provided in **Table 9** show that agriculture would experience a loss in income during the year in which evaporation basins were lined, such lining represents a fixed, one-time cost. Agricultural operations discharging to lined evaporation ponds in years subsequent to pond lining would only bear the cost of operations and maintenance of the ponds (an economic impact not considered in the current analysis). To this end, agriculture likely would not choose to permanently fallow acreage in areas where it proved cost-effective over time to line evaporation basins.

However, the more important point to consider is that a requirement to line evaporation basins and expend the resources to do so would provide little near-term impact on ambient groundwater concentrations and would not translate to increased protection of human health because (1) ambient groundwater concentrations within the proposed de-designation area would continue to exceed water quality objectives/criteria protective of the MUN use, and (2) MUN is not a current or future anticipated use of the groundwater within the proposed de-designation area. The same concept would apply when reducing the discharge of agricultural constituents of concern; ambient groundwater concentrations of agricultural constituents of concern within the proposed de-designation boundary would continue to exceed narrative objectives for the protection of the AGR use, while the AGR use would not be an existing or future use in the shallow groundwater within the proposed de-designation area.

Table 9: Comparison of Economic Impacts for Agricultural Production and Evaporation Pond Lining in the Project Area.

Impact Description	Cost per Acre	# of Acres	Total Cost
Avg. income generated per acre of irrigated agriculture per year ⁽¹⁾	\$2,121	10	\$21,210
Evaporation basin lining (low estimate)	\$17,423	1	\$17,423
Evaporation basin lining (high estimate)	\$21,799	1	\$21,799

1. While the cost per acre and total cost are expressed as positive values (income), the fallowing of 10 acres of irrigated land would result in an average loss of \$21,210 (negative income).

7.2.4 Preferred Alternatives Economic Analysis

7.2.4.1 Implementation Costs

As described in Section 5, Program of Implementation, under preferred MUN Alternative 3, the Central Valley Water Board proposes to de-designate the MUN beneficial use of groundwater within horizontally and vertically delineated areas under a portion of the historical Tulare Lake Bed. The de-designation would in turn remove the applicability of all water quality objectives in place to protect MUN (e.g., the MCLs specified in Title 22) from the groundwater within the de-designation boundary, thereby not requiring any additional implementation actions by dischargers within the identified area to meet MCLs.

Additionally, under preferred AGR Alternative 5, the Central Valley Water Board proposes to de-designate the AGR beneficial use from groundwater within horizontally and vertically delineated areas under a portion of the historical Tulare Lake Bed. This de-designation would in turn remove the applicability of all narrative water quality objectives in place to protect AGR (e.g., EC groundwater threshold values of 3,000 $\mu\text{S}/\text{cm}$ for the protection of irrigation supply and 5,000 –

7,500 $\mu\text{S}/\text{cm}$ for the protection of livestock watering) from the groundwater within the de-designation boundary, thereby not requiring any additional implementation actions by dischargers within the identified area to meet AGR-related WQOs.

The preferred MUN and AGR alternatives could require monitoring to assure that there are no impacts to groundwater quality upgradient or beneath the proposed de-designation boundary. However, monitoring would only apply to a new discharge to the area that could trigger project-specific groundwater monitoring directly adjacent to and beneath the new discharge location. The cost of additional monitoring and reporting would be borne by the entity responsible for the new discharge. Until such a new discharge is identified and the extent of monitoring determined, it is not possible to develop a project-specific cost for new monitoring and reporting activities. However, nonspecific well construction and sampling and analysis costs are provided in Section 5 for the monitoring of shallow groundwater along the periphery of the de-designation area and vertical monitoring of deep groundwater completed above and below the Corcoran Clay.

7.2.5 Summary

Table 10 summarizes the analysis of implementation costs for the four alternatives evaluated. The combination of MUN Alternative 3 and AGR Alternative 5 would be substantially less costly to implement relative to the No Action alternatives, MUN Alternative 1 and AGR Alternative 1.

Table 10: Estimated Economic Impacts of the No Action Alternatives and the Preferred Alternatives.

Cost Factor	No Action Alternatives: MUN Alternative 1 & AGR Alternative 1	Preferred Alternatives: MUN Alternative 3 & AGR Alternative 5
Implementation Costs	<ul style="list-style-type: none"> • Capital & O&M Costs: Fallowing of agricultural land estimated to cost \$2,121 per acre per year. Total potential number of acres to be fallowed not estimated at this time. The lining of evaporation basins (fixed, one-time cost) estimated to cost between \$17,423 and \$21,799/acre. • Monitoring Costs: No additional monitoring costs expected. 	<ul style="list-style-type: none"> • Capital & O&M Costs: No implementation costs expected. • Monitoring Costs: Additional project-specific monitoring and reporting would be required of new projects implemented in the project area. <ul style="list-style-type: none"> - Nonspecific well construction costs estimated at \$26,600 for two shallow wells along periphery of de-designation area - Nonspecific well construction costs estimated at \$123,505 for two clustered monitoring wells (one completed above and one completed below the Corcoran Clay). - Sampling and analysis costs for two wells are estimated at \$556 per monitoring event

8 REFERENCES

- Ayers, R.S. and D.W. Westcot. 1985. *Water Quality for Agriculture*. Food and Agriculture Organization of the United Nations, Irrigation and Drainage Paper 29, Rev. 1, Rome.
- California Ass'n of Sanitation Agencies v. State Water Resources Control Bd.* (2012) 208 Cal.App.4th 1438, 1463, as modified on denial of reh'g (Sept. 27, 2012)
- Canada. 2012. Canadian Environmental Quality Guidelines: Water Quality Guidelines for the Protection of Agriculture. http://www.ccme.ca/en/resources/canadian_environmental_quality_guidelines/index.html Last accessed February 3, 2016.
- Central Valley Water Board. 2011. Recommended Irrigated Lands Regulatory Program Framework Staff Report. March. Rancho Cordova, CA.
- Central Valley Water Board. 2014. Issue List and Work Plan for the 2014 Triennial Review of the Water Quality Control Plan for the Tulare Lake Basin. Resolution No. R5-2015-0020. April 16.
- Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS). 2012a. Salinity Effects on Agricultural Irrigation-Related Uses. Prepared by CDM Smith. Prepared for CV-SALTS. August 10.
- CV-SALTS. 2012b. Tulare Lake Bed MUN Evaluation Final Workplan. Prepared for San Joaquin Valley Drainage Authority. Submitted by CDM Smith. June 8.
- CV-SALTS. 2013. *Salt and Nutrients: Literature Review for Stock Drinking Water Final Report*. Prepared by Kennedy/Jenks Consultants and Texas A&M Agrilife Research. Prepared for CV-SALTS. May 20.
- CV-SALTS. 2015. *Technical and Regulatory Evaluation of MUN and AGR Beneficial Uses in the Tulare Lake Bed Area*. Prepared by Kenneth D. Schmidt & Associates (hydrology) and CDM Smith and Summers Engineering (regulatory and technical analysis). Submitted by Tulare Lake Drainage District and Tulare Lake Basin Water Storage District. December 4.
- Diamond, J. and A.K. Williamson. 1983. *A Summary of Groundwater Pumpage in the Central Valley, California, 1961-77*. USGS Water Resources Investigation Report 83-4037, 68p.
- Fetter, C.W. 1994. *Applied Hydrology, Third Edition*, Prentice-Hall Inc., Upper Saddle River, New Jersey.
- Howitt, R.E., D. MacEwan, J. Medellin-Azuara, J.R. Lund, D.A. Sumner. 2015. Economic Analysis of the 2015 Drought for California Agriculture. Prepared by Center for Watershed Sciences, University of California – Davis, Davis, CA. August 17.
- Kenneth D. Schmidt and Associates (KDSA). 2016a. Tulare Lake Bed De-Designation: Directions of Groundwater Flow near Urban Areas (Municipal Well Zone of Capture Analysis). Prepared for Tulare Lake Basin Water Storage District. July 8.
- Kenneth D. Schmidt and Associates (KDSA). 2016b. Domestic Well Zone of Capture Analysis. Prepared for Tulare Lake Basin Water Storage District. September 8.

- Luhdorff & Scalmanini Consulting Engineers (LSCE). 2014. Evaluation of Stratigraphy above the E-Clay Tulare Lake Bed Area MUN/AGR De-Designation. Prepared for Tulare Lake Basin Water Storage District and Tulare Lake Drainage District. November.
- National Academy of Science (NAS) and National Academy of Engineering (NAE). 1973. Water Quality Criteria 1972, a Report of the Committee on Water Quality Criteria. National Academy of Science and National Academy of Engineering. Washington, DC. EPA-R3-73-March 1973 (Blue Book).
- National Research Council of the National Academies (NRC). 2005. Mineral Tolerance of Animals: Second Revised Edition. Washington, DC.
- Sholes, D.A. 2006. *History, Lithology, and Groundwater Conditions in the Tulare Lake Basin*. Presentation given to Central Valley Regional Water Board Meeting. 21 September 2006.
- Tulare Lake Basin Water Storage District (TLBWSD). 2012. *Proposed MUN Delisting Boundary Description*. August 30, 2012.
- Tulare Lake Basin Water Storage District (TLBWSD). 2016a. Additional Groundwater Evaluations in a Portion of the Historical Tulare Lake Bed. Technical Memorandum #1 to Mike Trouchon (Larry Walker Associates) from Jacob Westra (TLBWSD). July 14.
- Tulare Lake Basin Water Storage District (TLBWSD). 2016b. Evaluation of 14 Potential Additional Well Locations. Technical Memorandum #2 to Mike Trouchon (Larry Walker Associates) from Jacob Westra (TLBWSD). September 14.