Draft
Environmental Impact Report

SCH# 2021060079

Volume 4

Appendices I through K

ROSAMOND SOUTH SOLAR PROJECT
by Golden Fields Solar IV, LLC *(PP19151)*

Specific Plan Amendment No. 40, Map No. 231
Specific Plan Amendment No. 33, Map No. 232
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Kern County
Planning and Natural Resources Department
Bakersfield, California

July 2022

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Kern County
Planning and Natural Resources Department
Bakersfield, California

Technical Assistance by:
Kimley-Horn

July 2022

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Appendices – Volume 4

<u>NOTE TO REVIEWER OF ELECTRONIC FILES</u>:

To assist you in reviewing this electronic document, "bookmarks" and/or "links" have been provided for easier navigation between sections. When available, bookmarks are located in the panel to the left. Links are highlighted in BLUE in the Table of Contents. Clicking on either the bookmarks or links will take you to the selected item. This document may consist of multiple linked PDF files. If saving this document to your computer, you must save all corresponding files to a directory on your hard drive to maintain the manner in which these PDF documents are linked.

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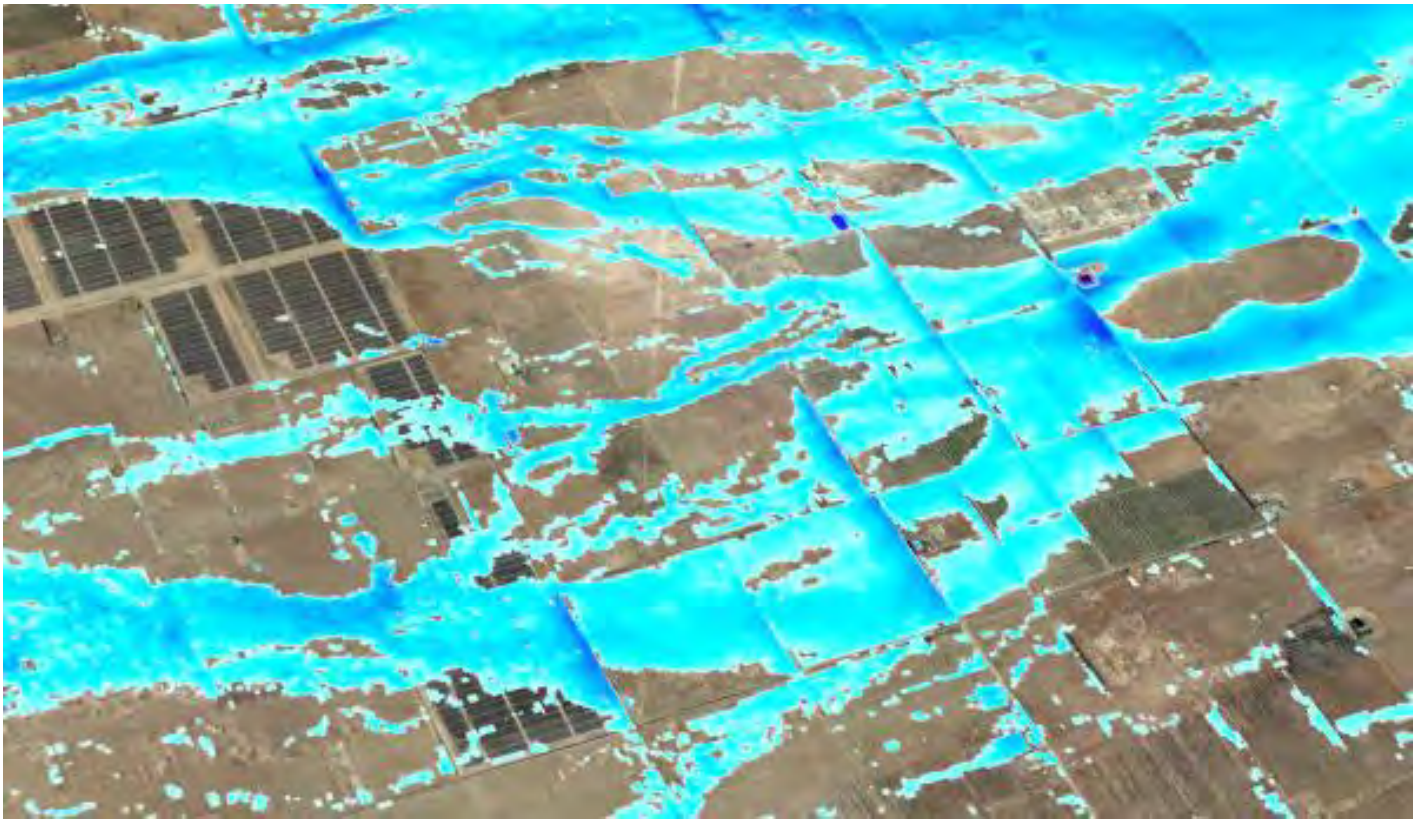
Appendix I
Prelim Hydrology Study



PRELIMINARY HYDROLOGY STUDY

Rosamond South Solar

Kern County, California

JULY 2020 *(UPDATED AUGUST 2021)*

PREPARED FOR:

Clearway

PREPARED BY:

Westwood

Preliminary Hydrology Study

Rosamond South Solar

Kern County, California

Prepared For:

Clearway Energy
100 California Street, Suite 400
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Project Number: R0027097.00
Date: July 27, 2020 *(Updated August 6, 2021)*

Westwood

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Executive Summary

The purpose of the study is to analyze and review the existing hydrology of the Rosamond South Solar project ("the project") and any impacts that the hydrology may play in the design of the proposed solar array. This report was prepared to be used by the project team in the design and layout of the project and intended for submittal to Kern County.

The project site is proposed on approximately 1,113.5 acres and is located approximately 6 miles west of the city of Rosamond in Kern County, California (Exhibit 1). The site is located on relatively flat land that generally slopes to the east. The modeled watershed area encompasses approximately 130 square miles and generally slopes southeast and east.

FEMA has completed a study to determine flood hazards for the selected location; the entire project area contains FEMA Zone A areas. No preliminary or pending FEMA data was located that will affect the project area.

The hydrologic modeling in this report was created using FLO-2D modeling software. FLO-2D was used to review the overall watershed drainage to and through the project to determine if any overland runoff causes flooding, high velocity, or scour impacts to the site. This FLO-2D model was calibrated to the Kern County Hydrology Manual (CivilD) and used to model the site hydrology.

The analysis shows low to moderate water depths and low velocities (Exhibits 6 through 14A and Exhibits 18 through 26A) across the majority of the site. Higher flood depths exist within multiple parcels, notably the southeastern parcels. Minimal velocities and scour are expected on site due to the flat terrain. Based on experience with similar projects, the majority of the site is suitable for the planned development by avoiding or designing to areas of high flood depths. Runoff mitigation will be met following Kern County requirements for basin design with similar landcover in pre and post conditions. Only minor grading is anticipated and a proposed FLO2D model will be run once the site design is finalized to determine any high water level impacts. No potential for decreased aquifer discharge is anticipated. Mud or debris flow was not a part of this study, scour has been calculated and will be accounted for in the civil design. The drainage density of the project will not be affected since landcover and drainage patterns are being maintained.

Data Sources

TABLE 1: DATA SOURCES

Task	Format	Source	Use
Elevation	1-Meter Digital Elevation Model (DEM)	USGS	FLO-2D Model Elevations
Elevation	Flown Topographic Data	QK	FLO-2D Model Elevations
Crop Data	Shapefile	USDA 2013 Crop Data Layer	Landcover
Soils	Shapefile	USGS SSURGO Dataset	Curve Numbers
Precipitation	PDF File	NOAA Atlas 14	Design Storms
HUC-12 Drainage Boundary	Shapefile	USGS	Define Model Extents
Site Boundary	Rosamond South I.kmz	Clearway Energy	Define Model Extents
2014 Aerial Photography	ArcGIS Map Service	USDA FSA	Reference
FEMA Flood Zones	PDF; Shapefile	FEMA	Reference
Culvert Locating and Sizing	Aerial Imagery	Google Earth	Culvert Modeling

Existing Conditions

The project area is located approximately 6 miles west of the city of Rosamond in Kern County, California. The project site is approximately 1,113.5 acres and is located on relatively flat terrain that generally slopes to the east.

Watershed Hydrology

The modeled watershed area encompasses approximately 130 square miles that generally slopes to the southeast and east. The modeled watershed area includes Burham Canyon, Tylerhorse Canyon, Cottonwood Creek, 180902061702, and part of Bean Canyon HUC-12 watersheds. The Los Angeles Aqueduct flows northeast to southwest through the modeled watershed, but flows perpendicular to other stormwater runoff within the watershed and does not impact the hydrology of the site.

Onsite Conditions

The project is located on flat terrain at the base of steep mountain slopes, with the project area situated on slopes of up to 2%. The entire site drains from west to east towards the wash south of the city of Rosamond. The landcover on the project area is primarily Chaparral, Narrowleaf (Exhibit 4) and has soils that generally belonging to Hydrologic Soil Groups A and B (Exhibit 3). The main potential hydrologic issues on site are flooding and erosive velocities.

FEMA Flood Zones

FEMA has completed a study to determine flood hazards for the selected location; the project area is covered by panels 06029C3975E and 06029C4000E (Appendix C). The entire project area is located within a FEMA Zone A area (Exhibit 2). A FEMA Zone A flood hazard is a 100-year flood hazard with no base flood elevation determined. No preliminary or pending FEMA changes are proposed within the project area.

Post-Construction Stormwater Management

California State and Kern County requirements have been reviewed and are summarized below.

State of California Requirements

The project will be subject to the State of California's stormwater discharge permit and the California Pre-Post Water Balance Calculator (Appendix G).

Kern County Hydrology (CivilD)

CivilD modeling software was used to calculate flow rates and confirm that the FLO-2D model was providing results consistent with the Kern County methods (Appendix E). A point (Exhibit 15) was selected to calibrate the results of the FLO-2D model. This location works reasonably well as a calibration point because it is similar to watersheds that contribute to the project site and is relatively concentrated. Inputs to CivilD were calculated following guidance in the KCHM and modeling inputs/outputs can be found in Appendix D. The peak flow rate for the calibration watershed using CivilD was 1,610.07 cfs. Table 2 below shows the inputs into the CivilD model.

Table 2: CivilD Calibration Watershed Inputs

Description	Equation	Unit	Value
Watershed Area	Calculated in GIS	Square Mi.	3.02
Watershed Area	Conversion	Acres	1,932
100-year Aerial Reduction	Figure E-4	Unitless	1.00
Watershed Area with Reduction	Aerial Reduction*Area	Acres	1,932
Equation	Lag=24n(l*lca/sqrt(s))^0.38	Hours	0.84
Basin Factor	KCHM Page 156 (n)	Unitless	0.05
Longest Watercourse	Calculated in GIS (l)	Miles	4.92
Length to Centroid	Calculated in GIS (lca)	Miles	2.12
Upstream Elevation	From 1-m onsite DTM	Feet	7,860.00
Elevation at Concentration	From 1-m onsite DTM	Feet	4,304.00
Difference in Elevation	Upstream – Downstream (H)	Feet	3,556.00
Slope along Watercourse	Slope (s)	FT/Mi.	722.76
Average CN for watershed (Appendix B)	CN=	Unitless	78

FLO-2D Modeling

FLO-2D is a physical process model that routes rainfall runoff and flood hydrographs over flow surfaces or in channels using the dynamic wave approximation to the momentum equation. FLO-2D offers advantages over 1-D models and unit hydrograph methods by allowing for breakout flows and visualization of flows across a potential site. The primary inputs are a DTM (elevation data), curve numbers and precipitation. Major culverts impacting the site were modeled based on aerial imagery provided by Google Earth.

Because of the complex and distributary nature of flow paths and through the project site and the size of the modeled watershed, to the site a FLO-2D model with 50' grid cells was utilized to determine flow depths and velocities throughout the site.

Elevation Data

The elevation data input into the FLO-2D model was a blend of client provided topographic data and 1-Meter DEM data from the USGS Data Gateway (Exhibit 5 for public elevation data only and Exhibit 17 for public and client elevation data), which was incorporated into the DTM using the export to xyz function in Global Mapper. These XYZ files are read directly into FLO-2D.

Watershed Soils and Land Cover

USDA-NRCS SSURGO soil data provides soil types within the project boundary and full coverage of the contributing watershed. Soils are primarily classified as Hydrologic Soil Groups A and B in the project boundary (Exhibit 3). Land cover was obtained from the USDA 2013 Crop Data Layer. Exhibit 4 displays the land cover classes for the entire watershed. The majority of land in this area is assumed to be covered by barren land, chaparral, narrowleaf, woodland (4) areas. Smaller portions of the area are urban or close seeded agriculture. With the majority of the land being undeveloped, the soil conditions assumed in the model were poor soils in order to take the most conservative approach. This raises the curve number of the model because the soil conditions do not have as much plant growth on them. Curve numbers were applied to each grid cell in the FLO-2D model based on intersecting the grid with the fallow soil and landcover data (Exhibits 5 and 17). The majority of the project area has a curve number between 70 and 90. Areas with a higher curve number will have more runoff and areas with a lower curve number will have less runoff. This is based on the type of soils, "A" soils have the highest infiltration rates and "D" soils have the lowest infiltration rates, along with the landcover of the area, dense vegetation will have less runoff and fallow farm fields and impervious areas will have more runoff.

Precipitation

Precipitation data for both the project site and mountainous contributing watershed was downloaded from the NOAA Atlas 14 (Appendix A). These rainfall depths were averaged and used for the FLO-2D analysis for the 100-year, 50-year, 25-year, and 10-year, 24-hour storms. The rainfall depths of 3.98, 4.91, 5.62, and 6.33 inches respectively were distributed based on a nested Atlas 14 distribution pattern and input into FLO-2D. Using a variety of storm events allows for the results to be bracketed and the worst areas of flooding and erosion to be identified.

Calibration

The FLO-2D model was calibrated to CivilD by comparing peak flow rates and volumes for a small watershed within the FLO-2D model to peak flow rates and volumes for the same watershed as modeled in CivilD. The model results from FLO-2D matched closely (<5% for peak flow and <5% for volume) to the Kern County results providing assurances that the FLO-2D software was performing adequately (Table 3).

Table 3: Comparison of modeling methods at calibration point

	CivilD (Kern County)	FLO-2D
Peak Flow (cfs)	1,610.07	1,690.13
Volume (ac-ft)	639.46	608.61

On-Site Retention Requirements

The proposed solar project development will require retention to mitigate the runoff from the new impervious surfaces, primarily piles. Due to the spacing of the piles and parcels, it is not feasible to direct runoff from all array locations to a common basin. Therefore the proposed basin will not retain runoff from the entire site, but will be located in a common discharge point for as many piles as possible and will include the required capacity to offset the increased runoff from all of the piles. Runoff generated from the piles and access roads will be allowed to disperse and infiltrate across the site in existing flow patterns.

The site layout and facilities have not yet been finalized but future basins will be placed throughout the project to meet the retention volume required when design is finalized. Table 4 below summarizes the proposed impervious areas and retention volumes provided as of 07/20/2020 based on Kern County retention requirements (Appendix F). The added piles to the site were assumed to be 1% impervious cover of the site, however the onsite requirements and imperviousness will be updated during final design to ensure that it meets all the storage requirements. The State of California Water Balance Calculation Sheet was utilized to determine that a storage credit is not required for the site (Appendix G). However, Kern County regulations required storage and so a value of 3.99 ac-ft of retention must be provided by the site as shown in the calculations below.

Table 4: Proposed Impervious Areas and Kern County Retention Calculations

Site	10-yr, 5-day Rainfall Depth (in)	Impervious Cover (%)*	Drainage Area (ac)**	Retention Volume Required (ac-ft)	Retention Volume Provided (ac-ft)
Solar Project Development	4.30	1.00	1,113.5	3.99	TBD during Final Design
Total			1,113.5	3.99	TBD

*The impervious cover calculations are the added impervious piles at the panel locations.

**The drainage area is the area that is within the total temporary disturbance of the project.

The design volume for the retention basins is calculated Engineering Bulletin 11-02 of the Kern County Development Standards (KCDS). The runoff volume form the ISDD five-day storm is calculated as:

Retention Basin Volume (ac-ft) = $[(D_{10yr\text{-}5day})/12](a\ i)(Area)$ = 3.99 ac-ft

Where,

D_{10} =10-yr, 5-day depth of rainfall (in) = 4.30 inches

a i=average percentage of impervious area = 1%

Area= Drainage area of total development = 1,113.5 acres

Preliminary basin locations and storage values can be found in Exhibit 16 and the table below.

Table 5. Preliminary Basin Storage Values

Basin	Contributing Drainage Area (ac)	Required Storage (ac-ft)
1	83.12	0.30
2	158.44	0.57
3	20.08	0.07
4	20.07	0.07
5	59.89	0.21
6	4.56	0.02
7	32.27	0.12
8	71.37	0.26
9	36.56	0.13
10	19.39	0.07
11	23.36	0.08
12	16.31	0.06
13	19.89	0.07
14	4.97	0.02
15	11.64	0.04
16	14.26	0.05
17	76.73	0.27
18	71.49	0.26
19	369.11	1.32

Flood Analysis Results

Existing Conditions Flood Analysis

The analysis shows low to moderate water depths and low velocities (Exhibits 6 through 14A and 18-26A) across the majority of the site. During a 100-year storm, the flood depths across the majority of the project area are less than 0.5 feet with velocities less than 1 foot/second. Multiple parcels, notably the southeastern parcels, contain higher flood depths sometimes exceeding 2 feet, with much of the parcels containing flood depths of greater than 0.5 feet. Exhibits 6-14A show flood depth, velocity, and scour results for public elevation data only, while Exhibits 18-26A show flood depth, velocity, and scour results for the blend of public and client data for which this report was updated. Due to inconsistencies between the elevation data provided by QK and publicly available 1-meter DEM, blending was performed to improve continuity, however slight artificial ponding may occur due to these inconsistencies as seen in Exhibits 18A, 21A, 23A, and 25A. The original data received from this surveyor was incorrectly processed, subsequently reprocessed and provided to Westwood for use in this hydrology study. The quality of this data should be verified with QK. See Exhibits 6 through 14A for areas within the project with higher flood depths and velocities. Minimal scour is expected on site (Exhibits 8 and 20). The scour depths calculated for this project consist of local scour only and are based on unarmored soils and pile bases in order to provide the most conservative local scour results.

Recommendations

Based on experience on similar projects, the site is suitable for the planned development and hydrologic concerns can be addressed by either avoiding areas of high flood depths or through detailed engineering design.

Next Steps

1. Final engineering design should account for the flood depths, velocities, and scour presented in Exhibits 6-8 and Exhibits 18-20.

2. Facilities recommended to be elevated 1' above the 100-year, 24-hour peak flood elevations.

3. Stormwater management should be revisited to ensure the final design meets the local and state requirements.

Included Output Files

1. Shapefile of 100-year Rain Event Flow Depth
   2021-05-12_RosamondSouth_PrelimFlowDepthatCell_100yr.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Max Flow Depth (Feet)

2. KMZ of 100-year Rain Event Flow Depth
   2021-05-12_RosamondSouth_PrelimFlowDepth_100yr.kmz
   Overlay in Google Earth for graphical representation.

3. Shapefile of 100-year Rain Event Velocity
   2021-05-12_RosamondSouth_PrelimVelocityatCell_100yr.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Velocity (FPS)

4. KMZ of 100-year Rain Event Velocity
   2021-05-12_RosamondSouth_PrelimVelocity_100yr.kmz
   Overlay in Google Earth for graphical representation.

5. Shapefile of 50-year Rain Event Flow Depth
   2021-05-12_RosamondSouth_PrelimFlowDepthatCell_50yr.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Max Flow Depth (Feet)

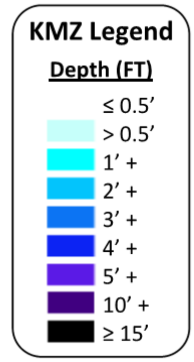
6. KMZ of 50-year Rain Event Flow Depth
   2021-05-12_RosamondSouth_PrelimFlowDepth_50yr.kmz
   Overlay in Google Earth for graphical representation.

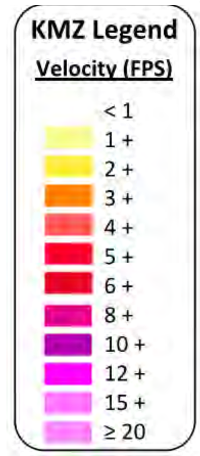
7. Shapefile of 50-year Rain Event Velocity
   2021-05-12_RosamondSouth_PrelimVelocityatCell_50yr.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Velocity (FPS)

8. KMZ of 50-year Rain Event Velocity
   2021-05-12_RosamondSouth_PrelimVelocity_50yr.kmz
   Overlay in Google Earth for graphical representation.

9. Shapefile of 25-year Rain Event Flow Depth
   2021-05-12_RosamondSouth_PrelimFlowDepthatCell_25yr.shp
   Attribute "ID" = Grid Cell Number
   Attribute "VAR" = Max Flow Depth (Feet)

10. KMZ of 25-year Rain Event Flow Depth
    2021-05-12_RosamondSouth_PrelimFlowDepth_25yr.kmz
    Overlay in Google Earth for graphical representation.





11. Shapefile of 25-year Rain Event Velocity
    2021-05-12_RosamondSouth_PrelimVelocityatCell_25yr.shp
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    Attribute "VAR" = Velocity (FPS)

12. KMZ of 25-year Rain Event Velocity
    2021-05-12_RosamondSouth_PrelimVelocity_25yr.kmz
    Overlay in Google Earth for graphical representation.

13. Shapefile of 10-year Rain Event Flow Depth
    2021-05-12_RosamondSouth_PrelimFlowDepthatCell_10yr.shp
    Attribute "ID" = Grid Cell Number
    Attribute "VAR" = Max Flow Depth (Feet)

14. KMZ of 10-year Rain Event Flow Depth
    2021-05-12_RosamondSouth_PrelimFlowDepth_10yr.kmz
    Overlay in Google Earth for graphical representation.

15. Shapefile of 10-year Rain Event Velocity
    2021-05-12_RosamondSouth_PrelimVelocityatCell_10yr.shp
    Attribute "ID" = Grid Cell Number
    Attribute "VAR" = Velocity (FPS)

16. KMZ of 10-year Rain Event Velocity
    2021-05-12_RosamondSouth_PrelimVelocity_10yr.kmz
    Overlay in Google Earth for graphical representation.

References Cited

National Engineering Handbook, Part 630 Hydrology. Chapter 9 Hydrologic Soil-Cover Complexes. USDA. NRCS. 210-VI-NEH, July 2004

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Exhibits

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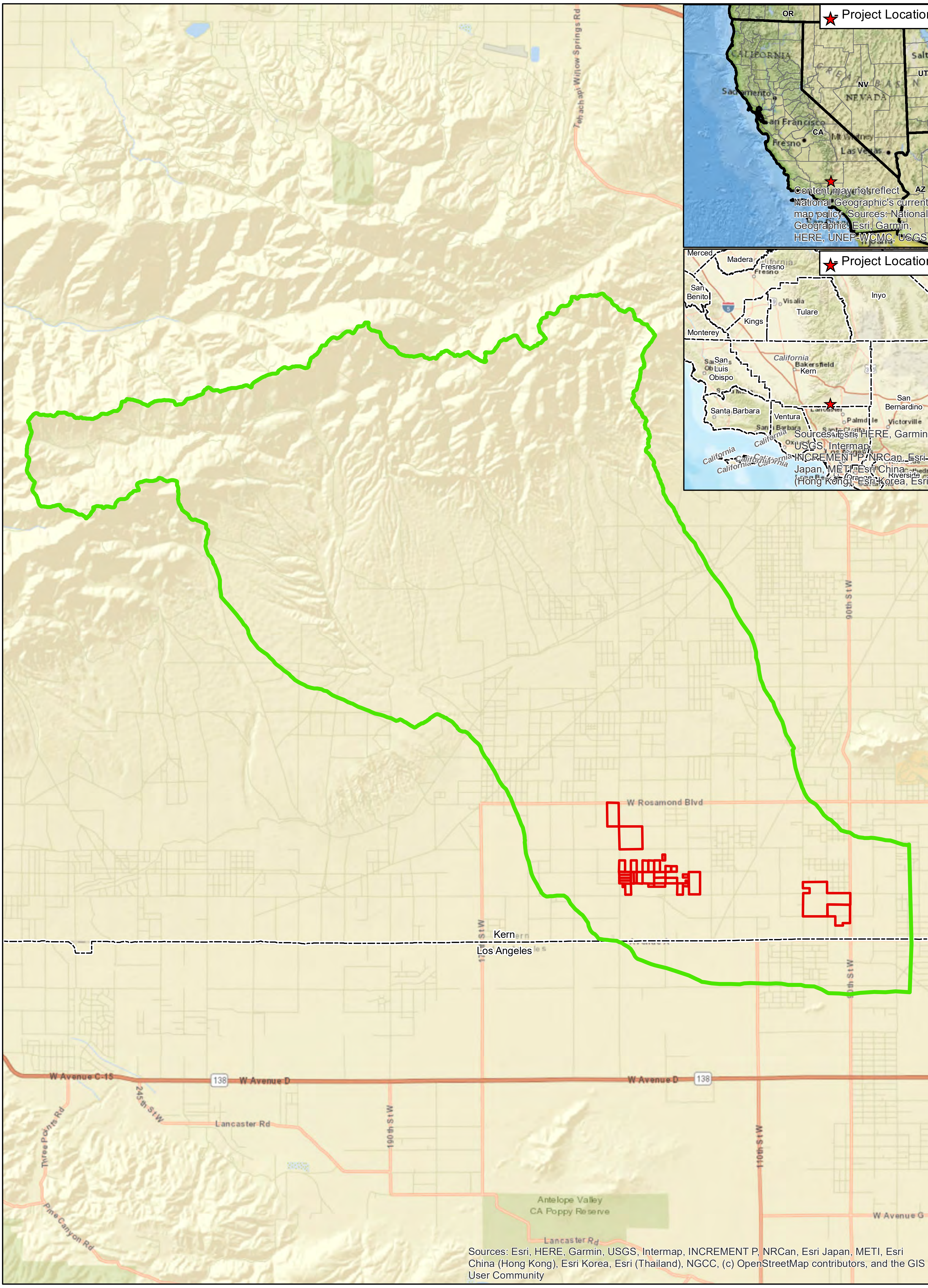

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary

Rosamond South Solar Project

Kern County, California

Exhibit 1: Location Map

July 20, 2020

N

0 2 Miles

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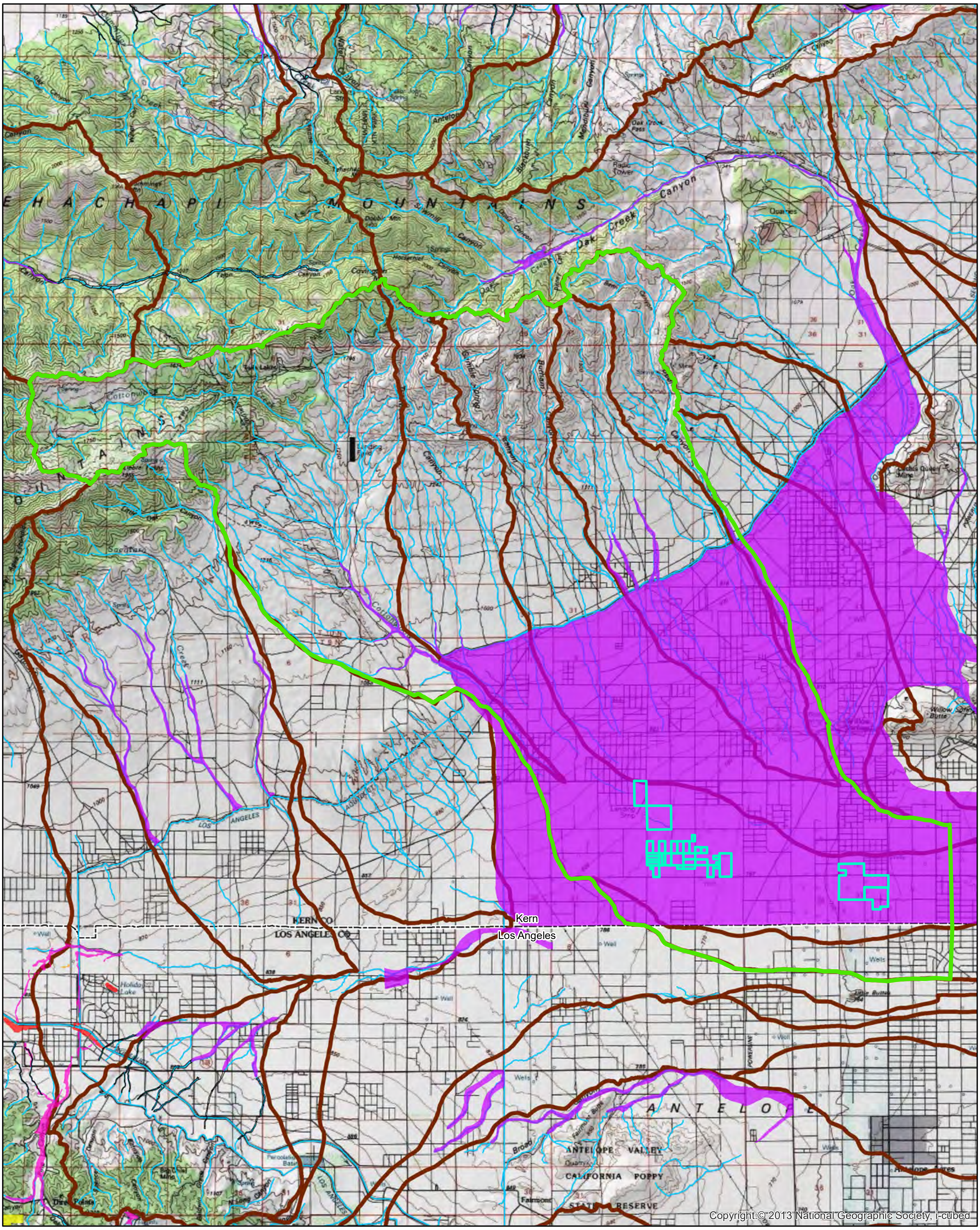

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Rosamond South Solar Project

Kern County, California

Exhibit 2: Base Map

July 20, 2020

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline
- CA DWR Flood Awareness Layer*
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

N

0 2 Miles

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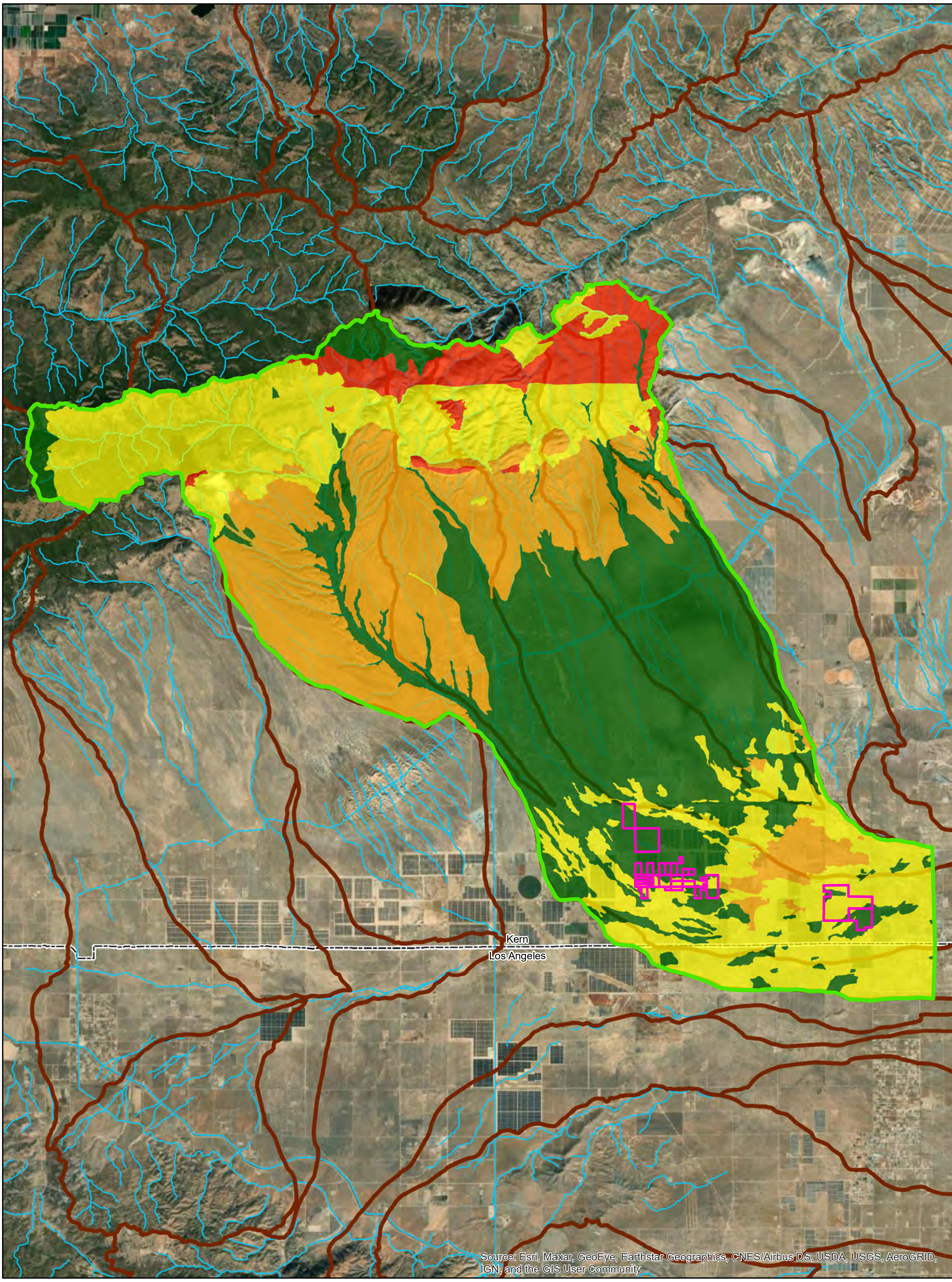

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline

Hydrologic Soils Group

- A
- B
- C
- D

Rosamond South Solar Project

Kern County, California

Exhibit 3: Soils Map

July 20, 2020

N

0 2 Miles

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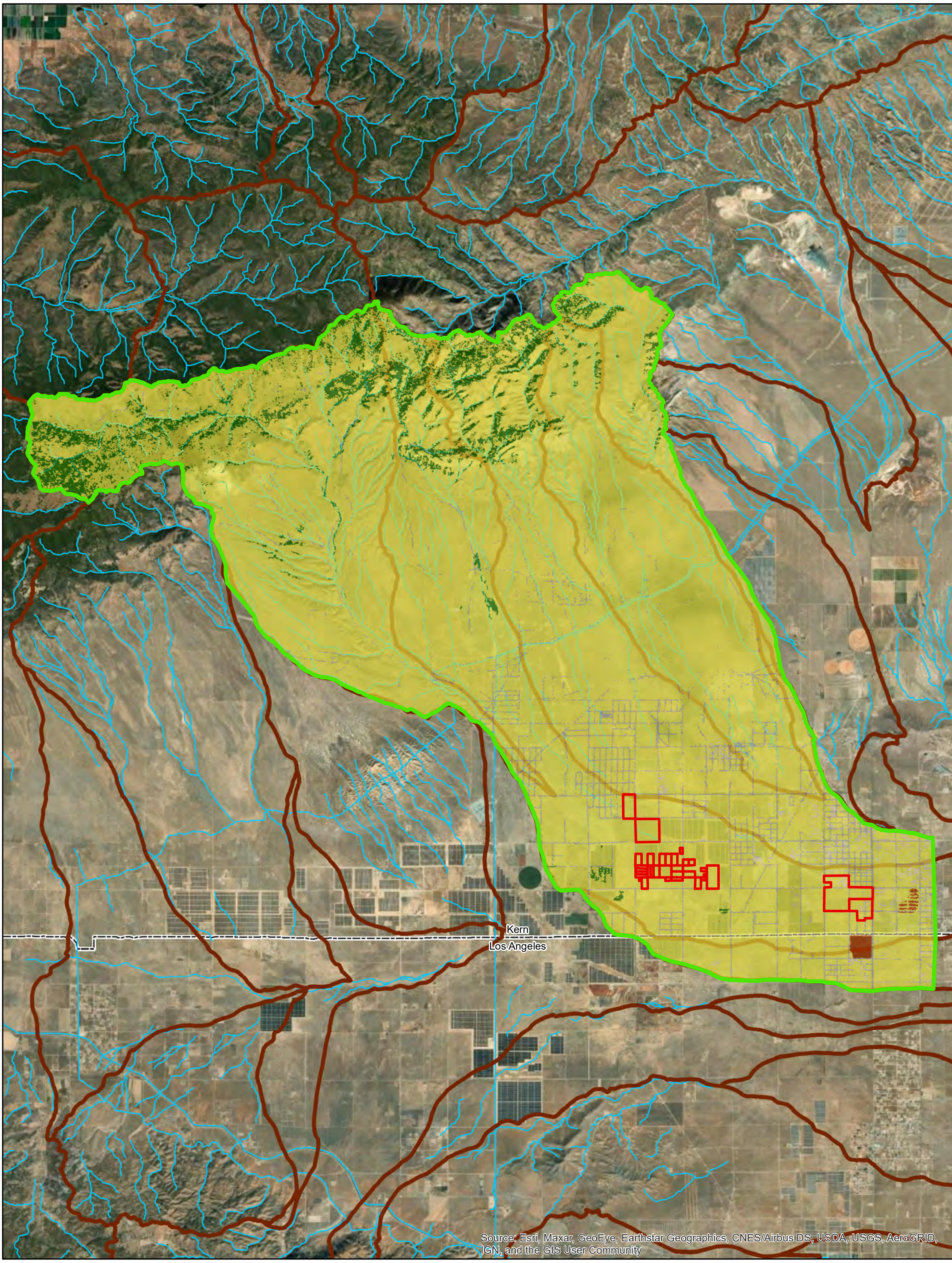

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline

Landcover

- Barren
- Chaparral, Narrowleaf
- Close Seeded
- Urban
- Woodland (4)

Rosamond South Solar Project

Kern County, California

Exhibit 4: Landcover Map

July 20, 2020

N

0 2 Miles

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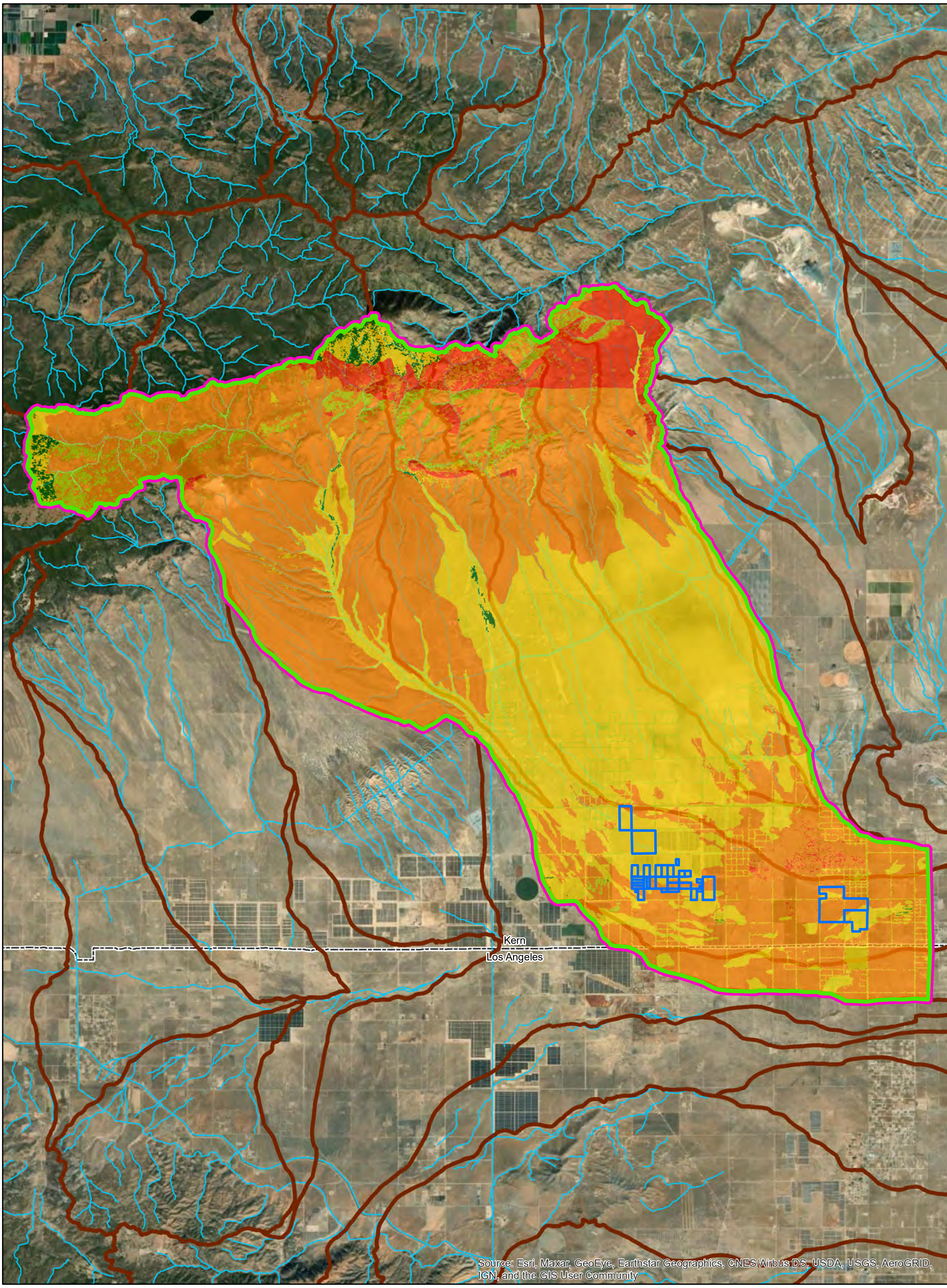

Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Rosamond South Solar Project

Kern County, California

Exhibit 5: Curve Number and Topographic Source Map

July 20, 2020

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline
- 1M USGS Extents

Curve Number

40-49, 50-59, 60-69, 70-79, 80-89, 90-99

N

0 2 Miles

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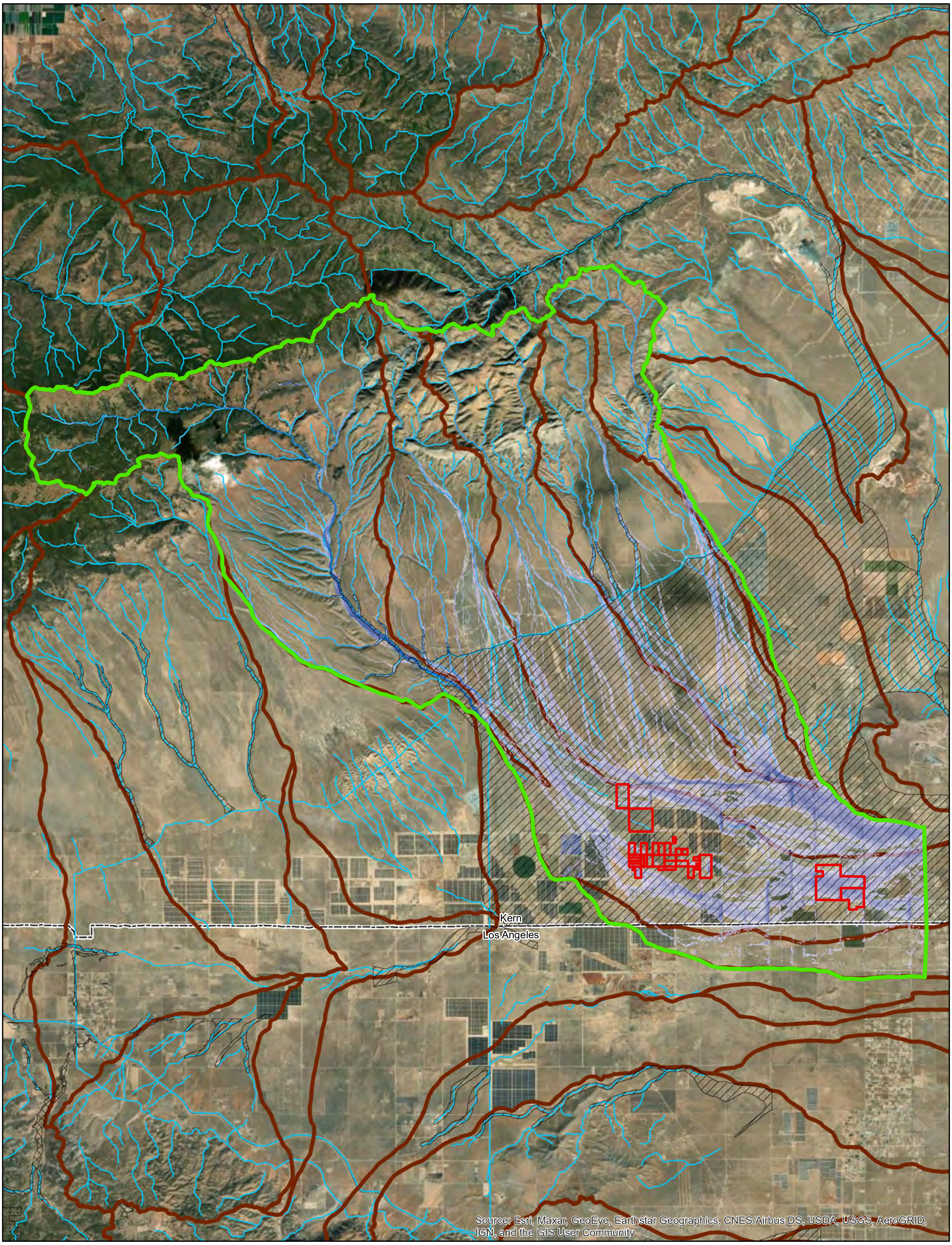


Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00, 1.01 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01 - 6.00, 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 6: 100-year Max Water Depth Map

July 20, 2020

N

0 2 Miles

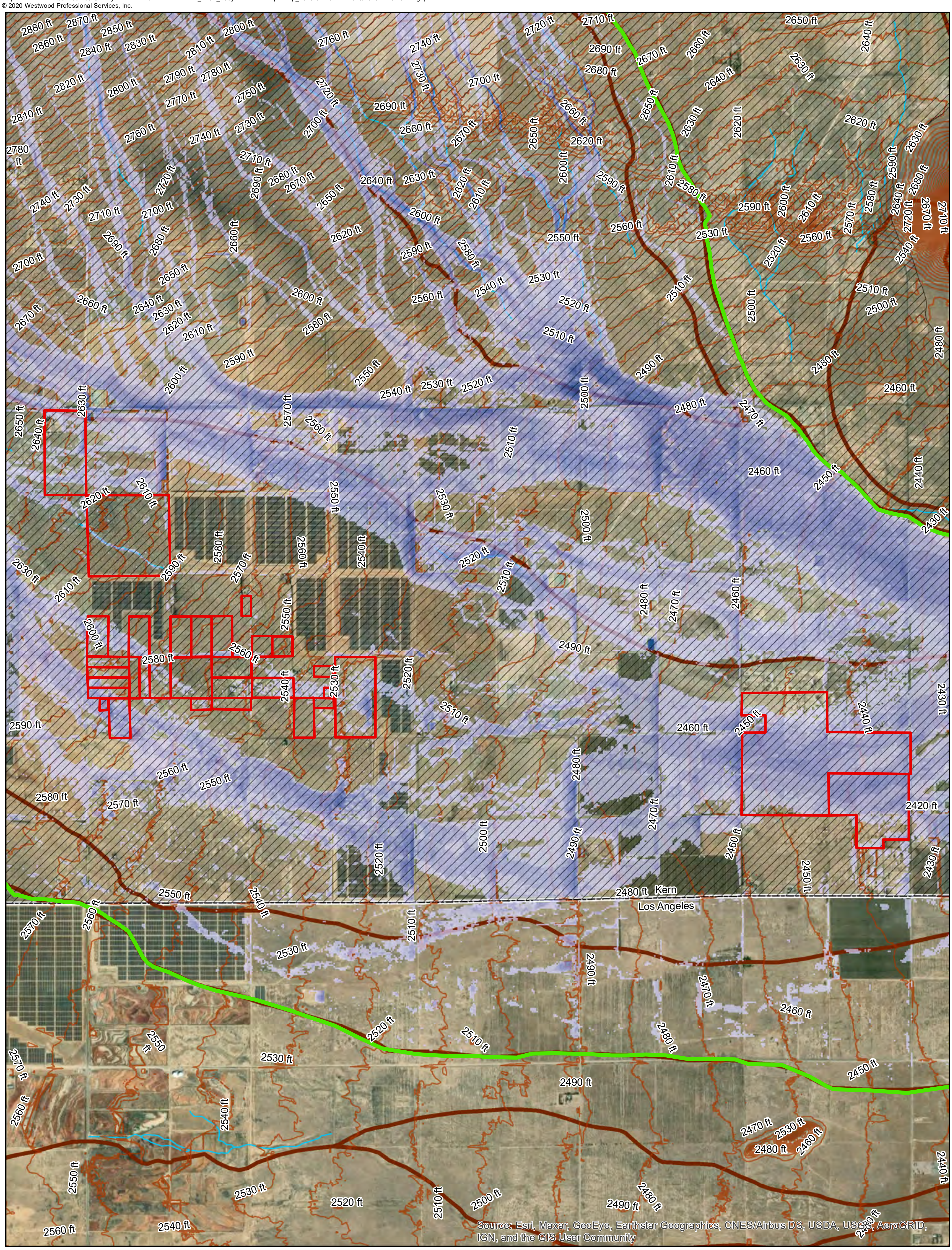
Westwood

Toll Free (888) 937-5150 westwoodps.com

Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex6A_100yrMaxWaterDepthMap_2020-07-20.mxd 7/20/2020 4:13:18 PM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Flow Depth (ft)

0.50 - 1.00, 1.01 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01 - 6.00, 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 6A: 100-year Max Water Depth Project Area Map

July 20, 2020

N

Feet

0 3,000

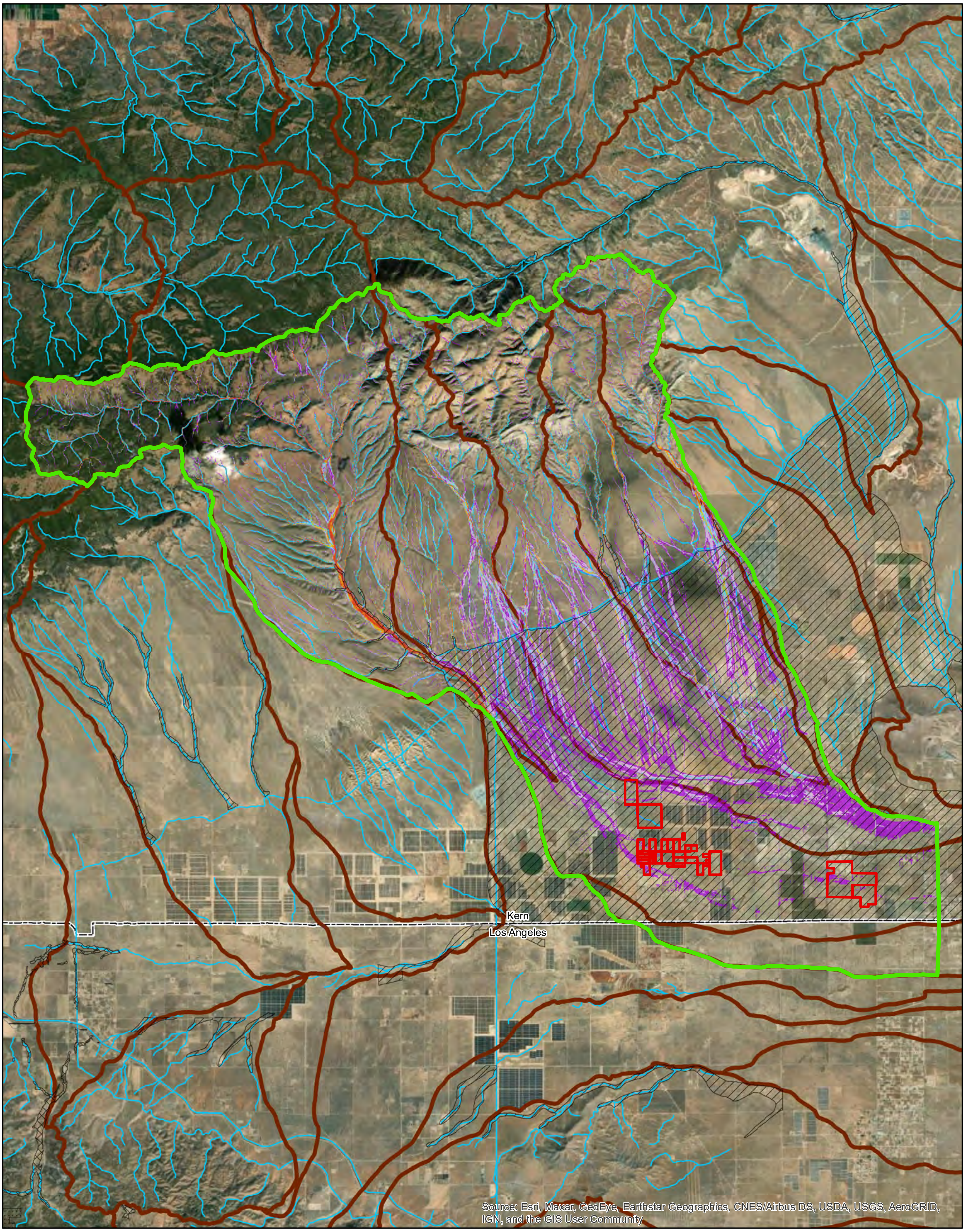
Westwood

Toll Free (888) 937-5150 westwoodps.com

Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex7_100yrPeakVelocityMap_2020-07-20.mxd 7/20/2020 3:50:05 PM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 7: 100-year Peak Velocity Map

July 20, 2020

N

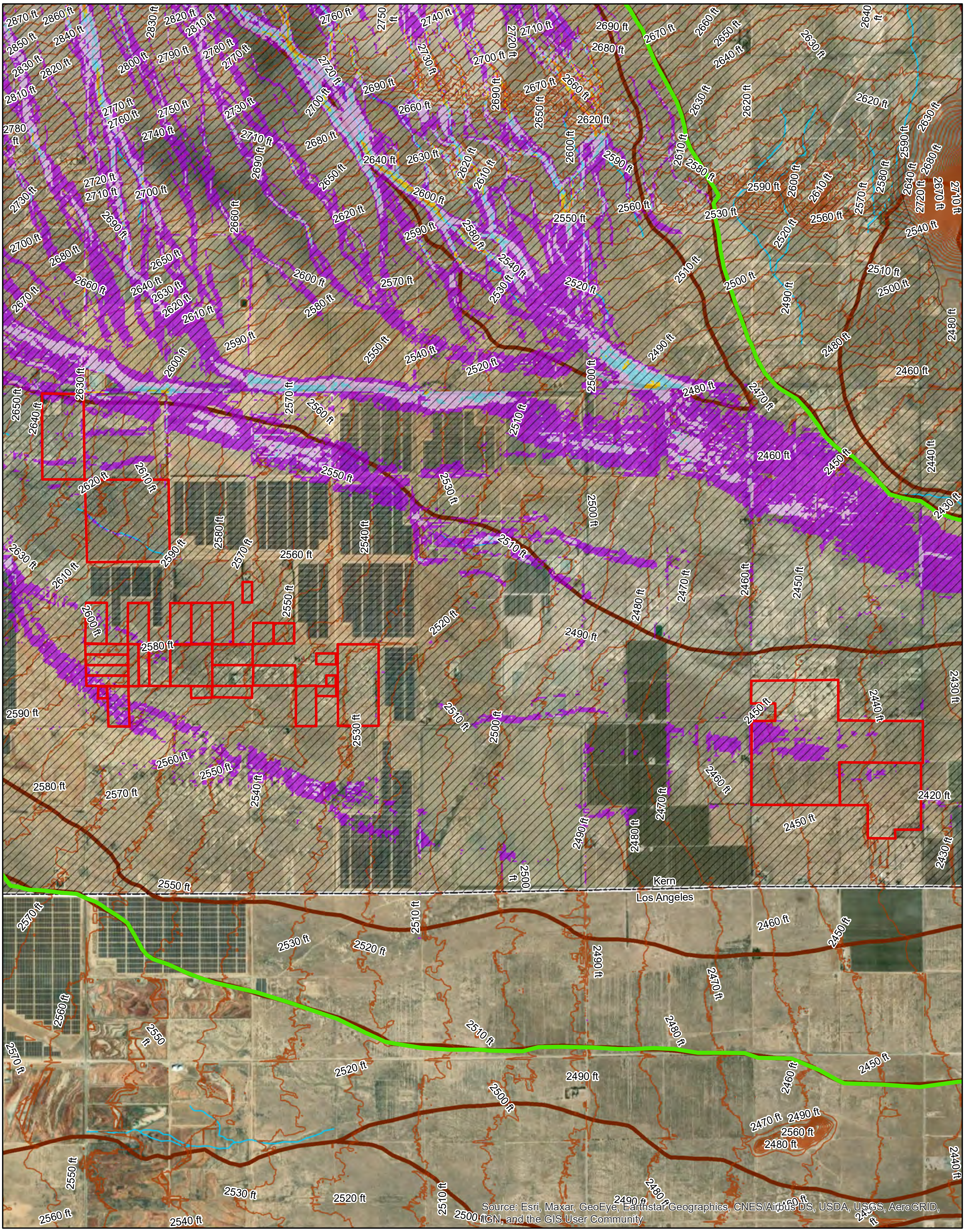
0 2 Miles

Westwood

Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex7A_100yrPeakVelocityMap_2020-07-20.mxd 7/20/2020 4:17:15 PM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Rosamond South Solar Project

Kern County, California

Exhibit 7A: 100-year Peak Velocity Project Area Map

July 20, 2020

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

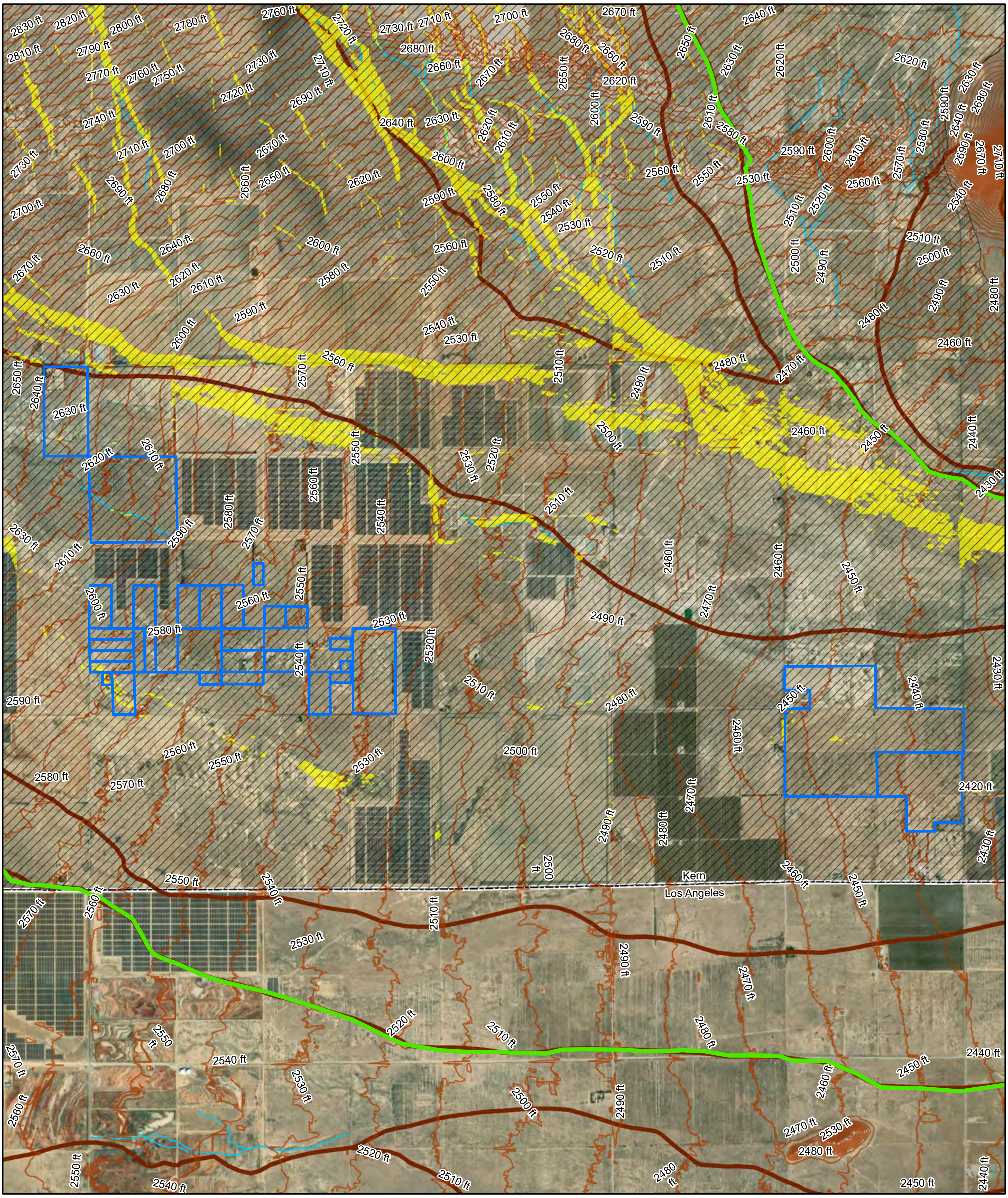
N

0 3,000 Feet

Westwood
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex8_100YearScourMap_2020-07-20.mxd 7/20/2020 4:21:01 PM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline
- CA DWR Flood Awareness Layer*
- FEMA Zone A
- 10-ft Contours

Scour

- 1.00-1.50
- 1.51-2.0
- 2.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 8: 100-year Scour Project Area Map

July 20, 2020

N

Feet
0 3,000

Westwood
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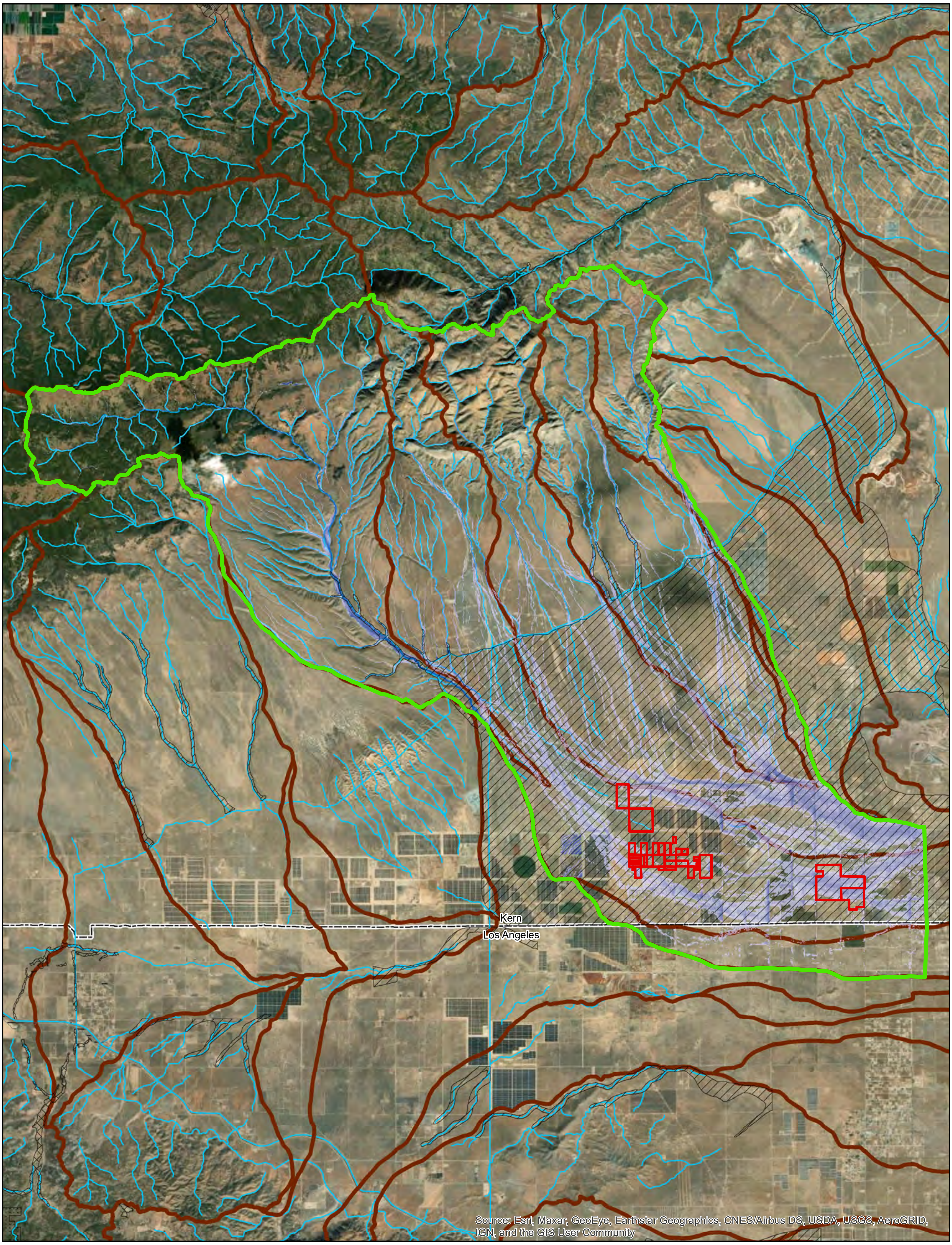
Westwood Professional Services, Inc.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex9_50yrMaxWaterDepthMap_2020-07-22.mxd 7/22/2020 9:12:23 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 9: 50-year Max Water Depth Map

July 22, 2020

N

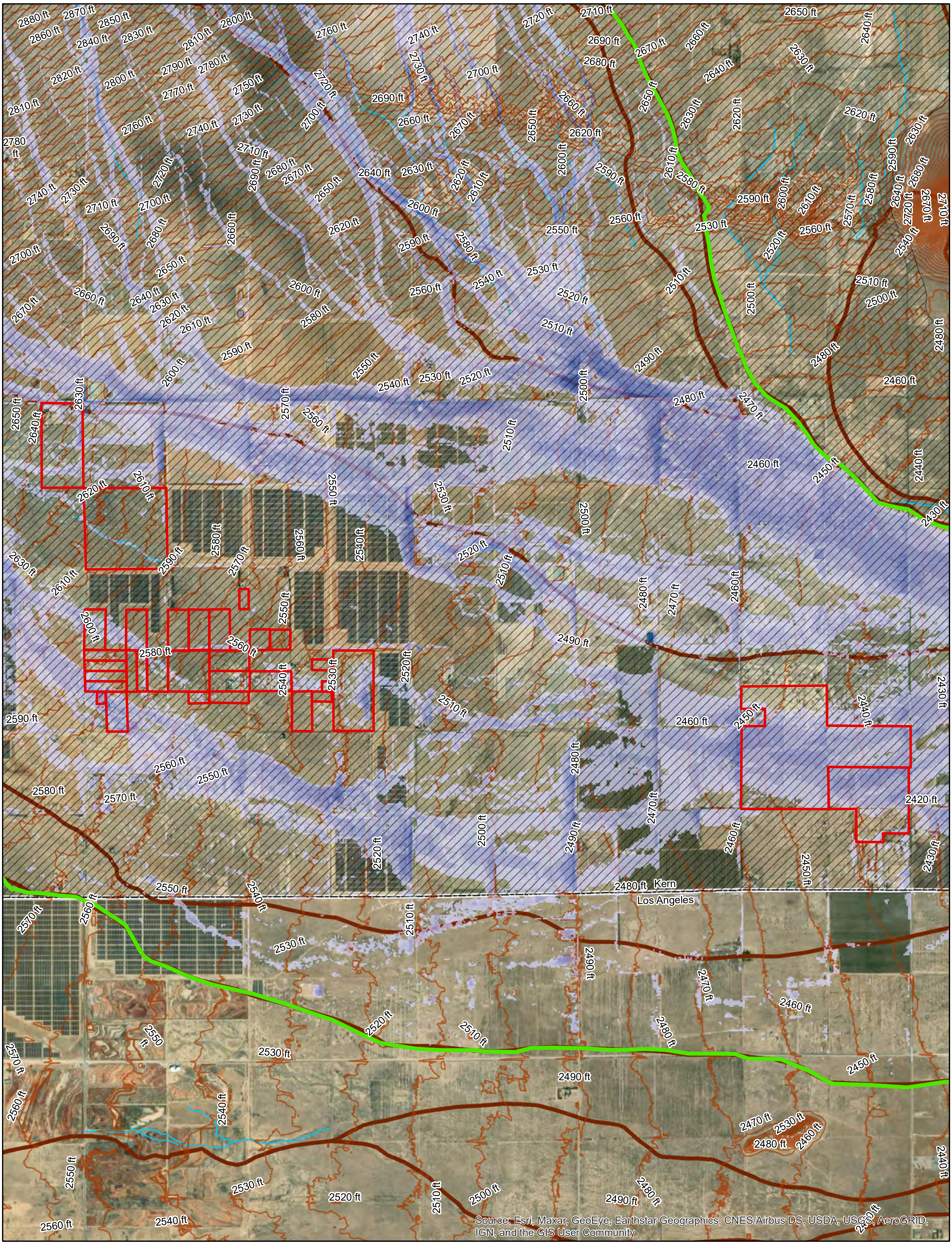
0 2 Miles

Westwood

Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex9A_50yrMaxWaterDepthMap_2020-07-22.mxd 7/22/2020 9:12:26 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Flow Depth (ft)

0.50 - 1.00; 1.01 - 1.50; 1.51 - 2.00; 2.01 - 2.50; 2.51 - 3.00; 3.01 - 4.00; 4.01 - 6.00; 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 9A: 50-year Max Water Depth Project Area Map

July 22, 2020

N

Feet
0 3,000

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Westwood
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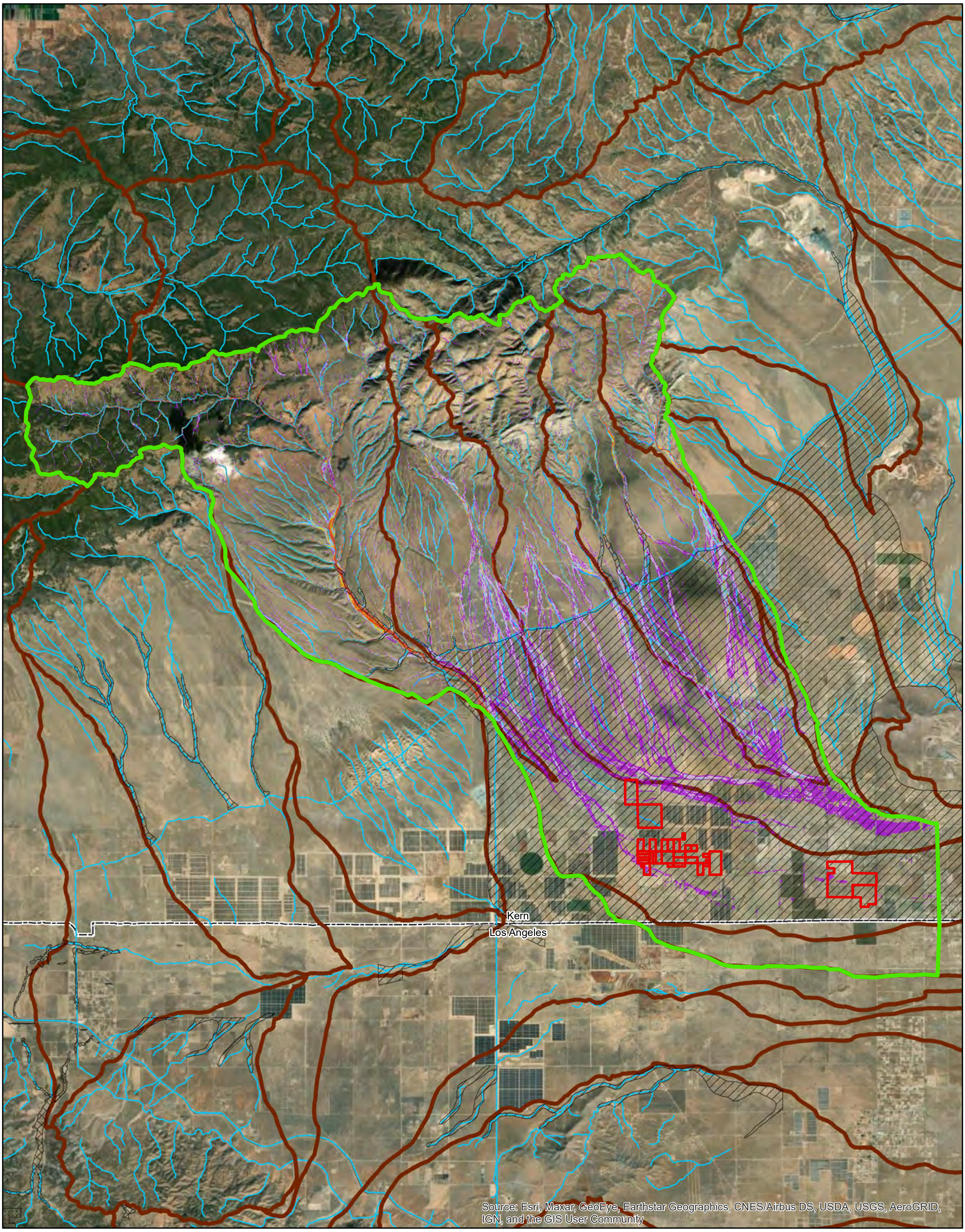
Westwood Professional Services, Inc.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex10_50yrPeakVelocityMap_2020-07-22.mxd 7/22/2020 9:38:50 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 10: 50-year Peak Velocity Map

July 22, 2020

N

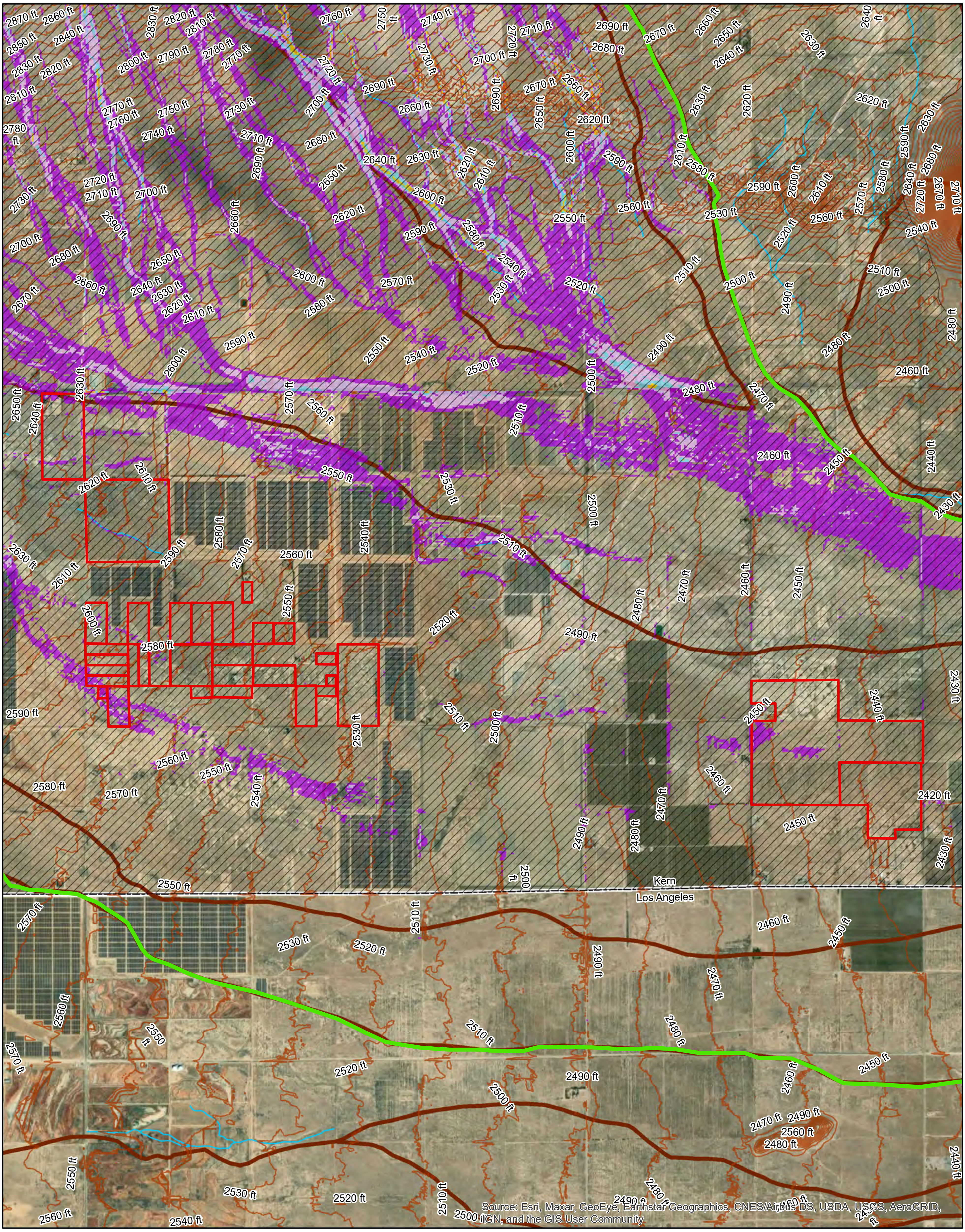
0 2 Miles

Westwood

Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex10A_50yrPeakVelocityMap_2020-07-22.mxd 7/22/2020 9:11:16 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Rosamond South Solar Project

Kern County, California

Exhibit 10A: 50-year Peak Velocity Project Area Map

July 22, 2020

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

1.00 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01+

N

Feet
0 3,000

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Westwood
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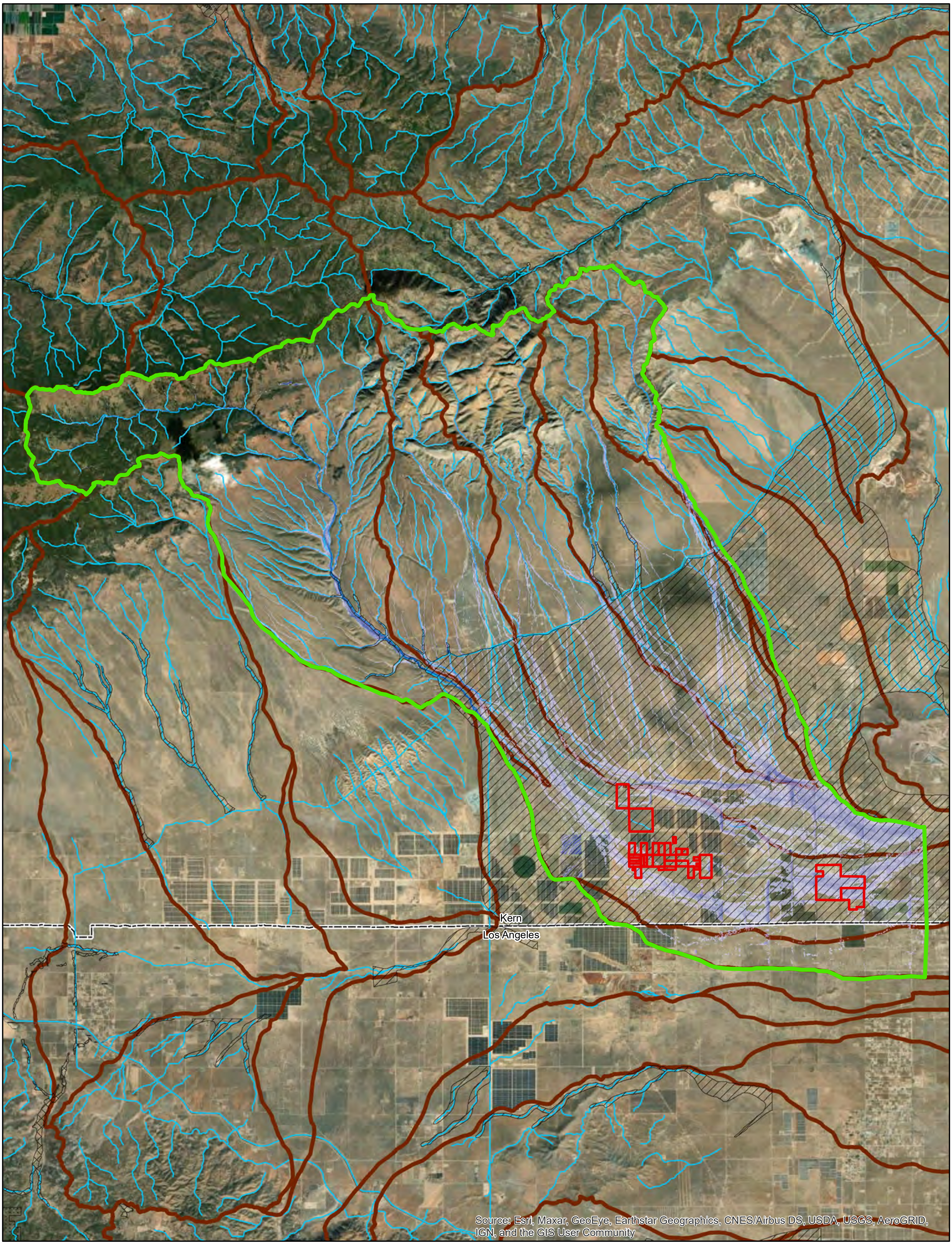
Westwood Professional Services, Inc.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex11_25yrMaxWaterDepthMap_2020-07-22.mxd 7/22/2020 9:31:15 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00, 1.01 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01 - 6.00, 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 11: 25-year Max Water Depth Map

July 22, 2020

N

Miles
0 2

Westwood
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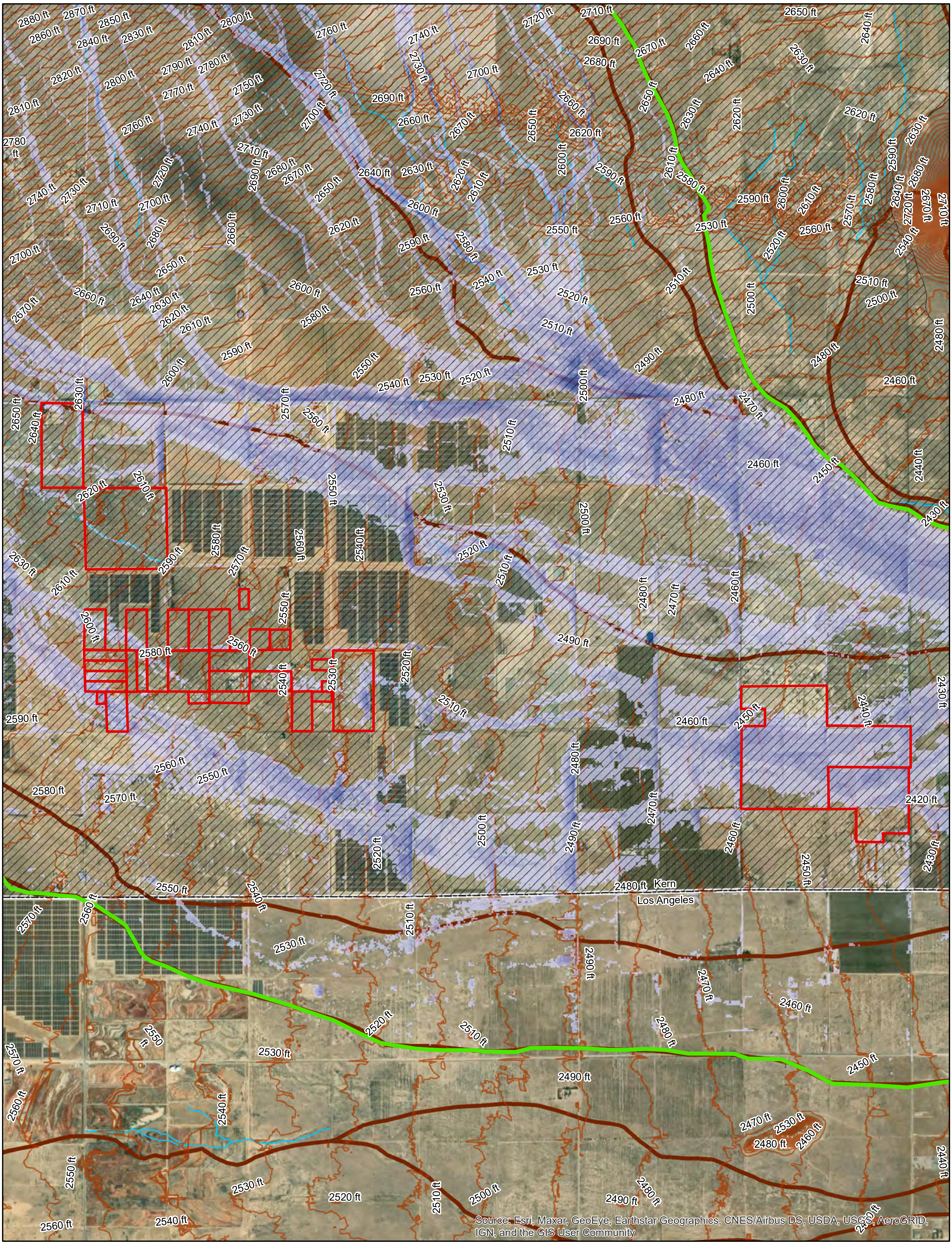
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex11A_25yrMaxWaterDepthMap_2020-07-22.mxd 7/22/2020 9:31:17 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Flow Depth (ft)

0.50 - 1.00, 1.01 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01 - 6.00, 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 11A: 25-year Max Water Depth Project Area Map

July 22, 2020

N

Feet

0 3,000

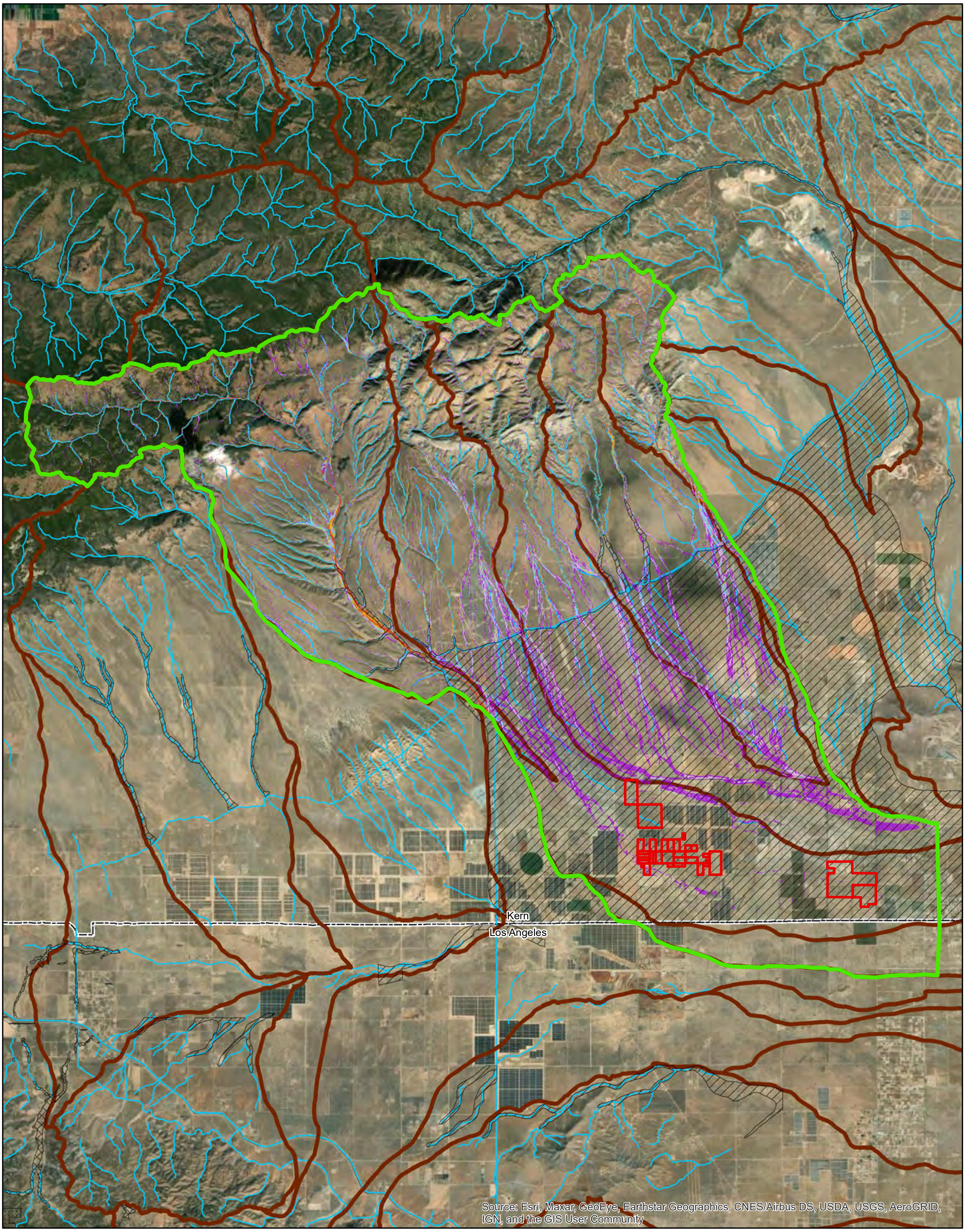
Westwood

Toll Free (888) 937-5150 westwoodps.com

Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex12_25yrPeakVelocityMap_2020-07-22.mxd 7/22/2020 9:57:26 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 12: 25-year Peak Velocity Map

July 22, 2020

N

0 2 Miles

Westwood

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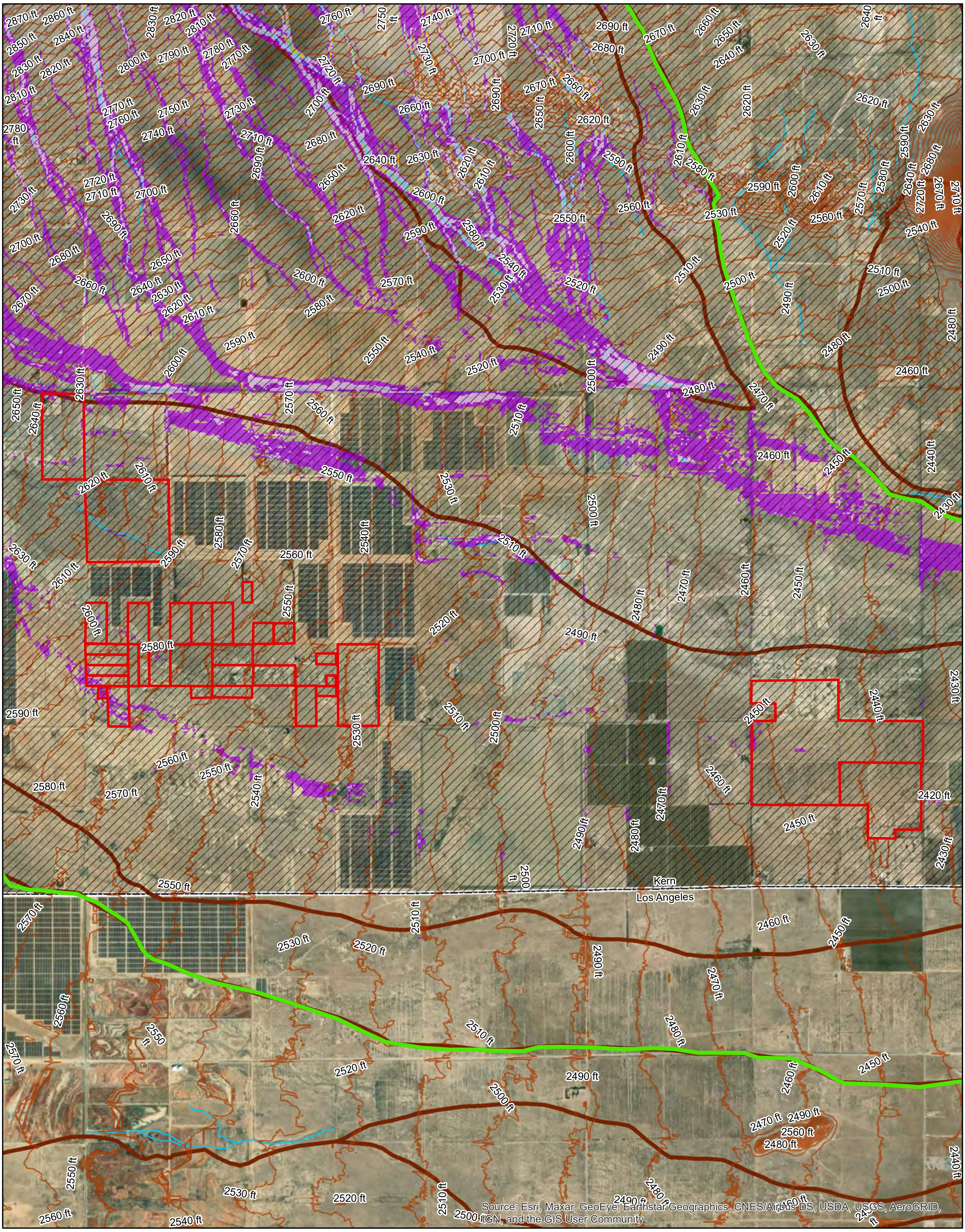
Westwood Professional Services, Inc.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex12A_25yrPeakVelocityMap_2020-07-22.mxd 7/22/2020 9:57:29 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 12A: 25-year Peak Velocity Project Area Map

July 22, 2020

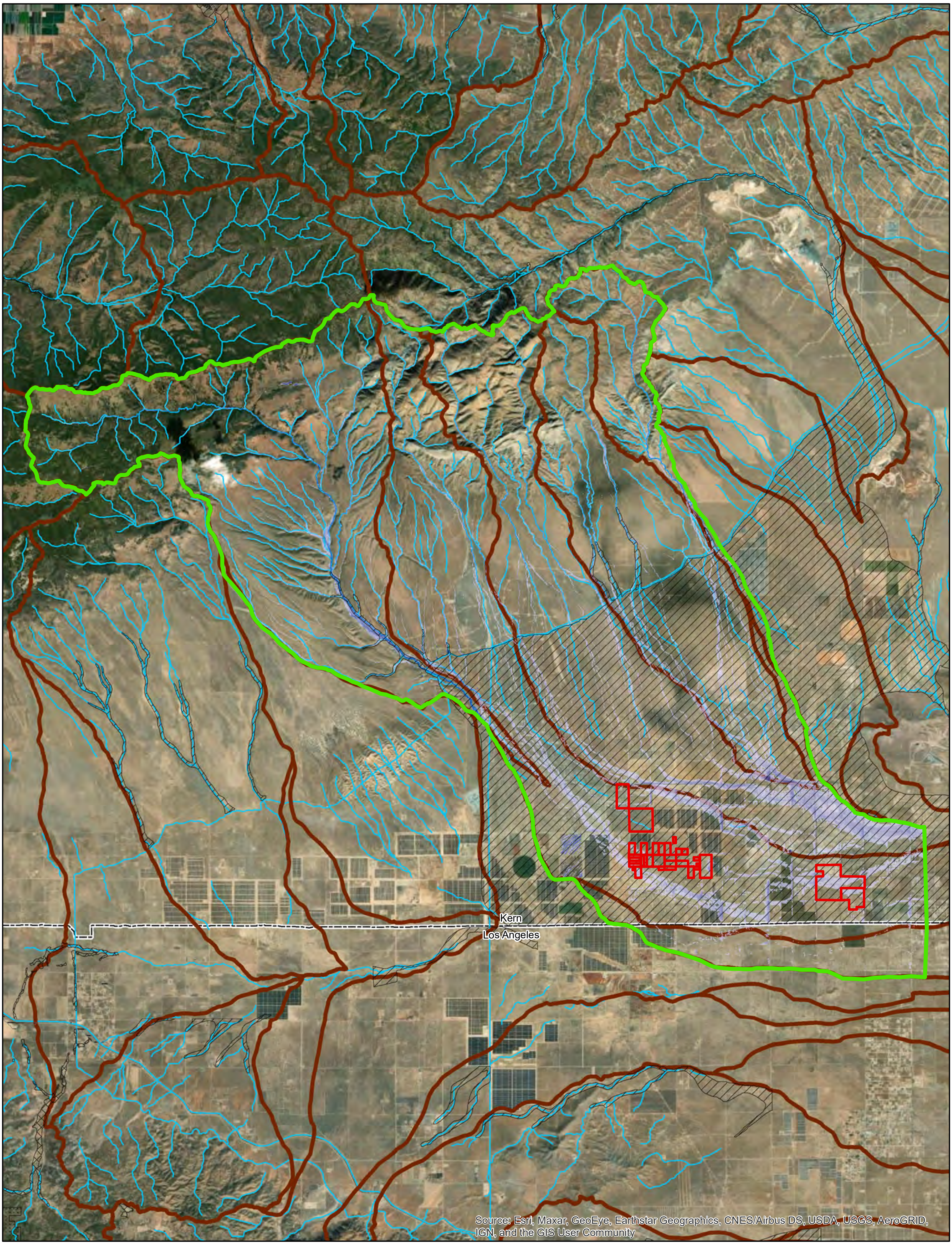
N

Feet
0 3,000

Westwood
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex13_10yrMaxWaterDepthMap_2020-07-22.mxd 7/22/2020 9:48:35 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01 - 6.00
6.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 13: 10-year Max Water Depth Map

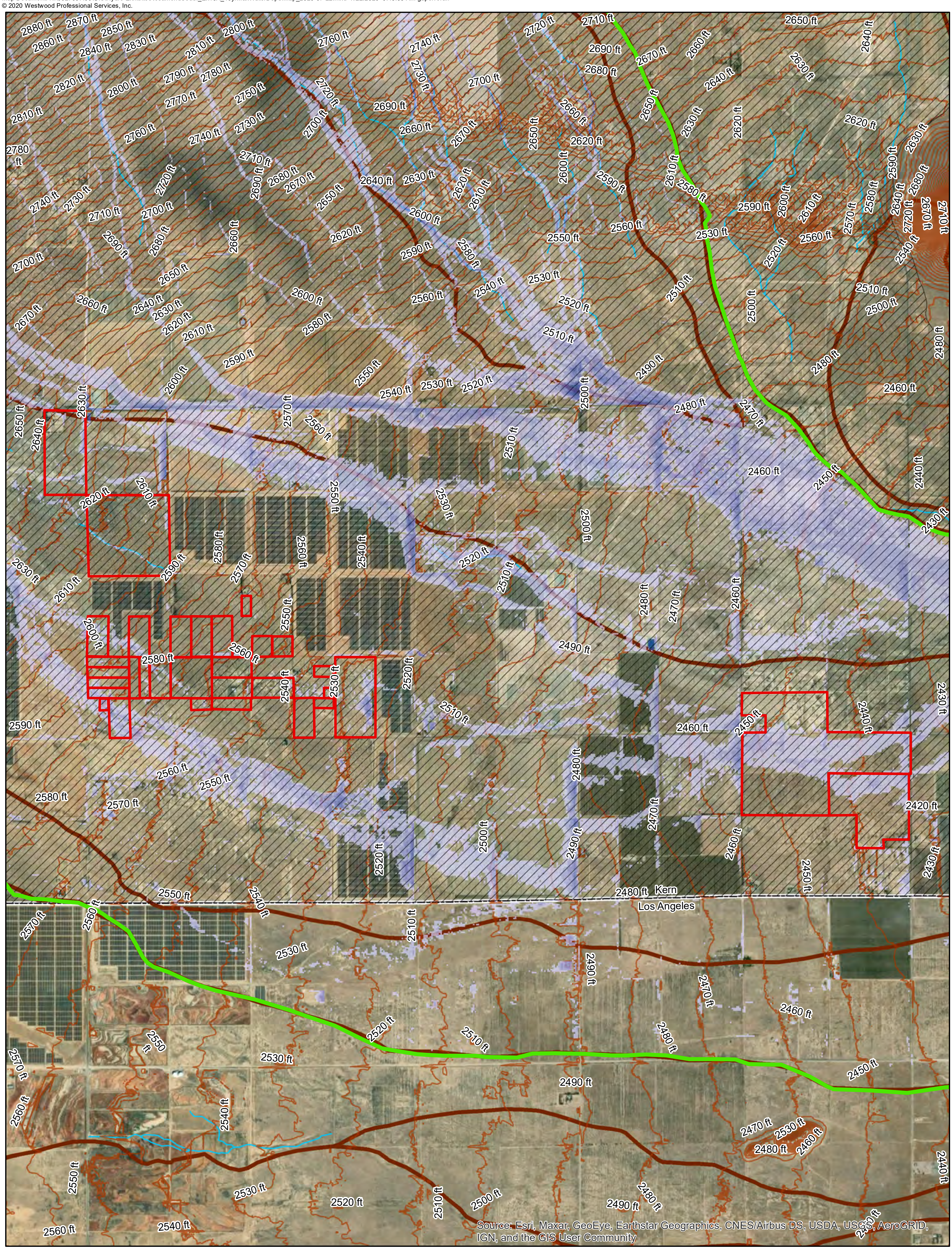
July 22, 2020

N

0 2 Miles

Westwood
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex13A_10yrMaxWaterDepthMap_2020-07-22.mxd 7/22/2020 9:48:38 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 13A: 10-year Max Water Depth Project Area Map

July 22, 2020

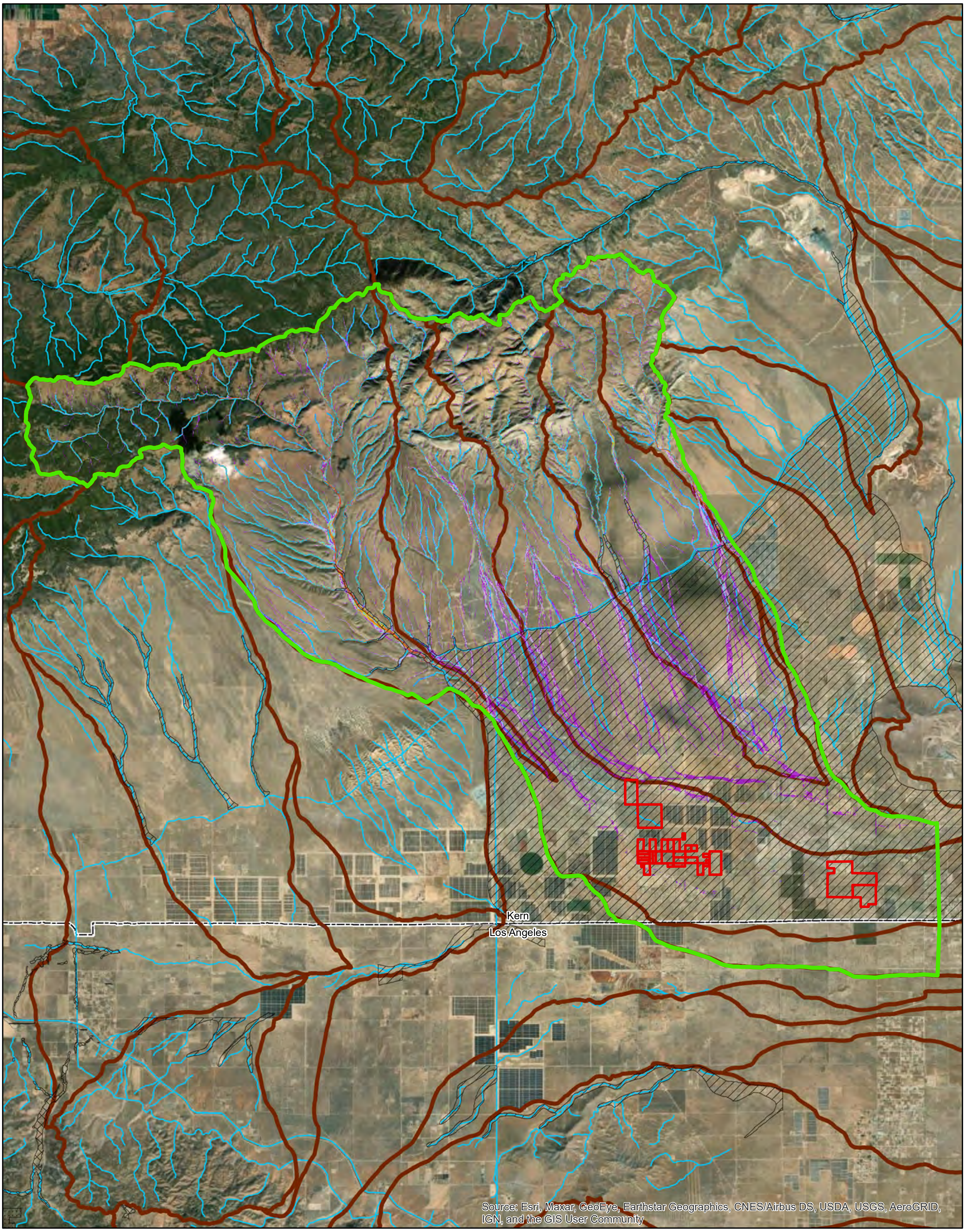
N

Feet
0 3,000

Westwood
Toll Free (888) 937-5150 westwoodps.com
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex14_10yrPeakVelocityMap_2020-07-22.mxd 7/22/2020 10:09:56 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 14: 10-year Peak Velocity Map

July 22, 2020

N

0 2 Miles

Westwood

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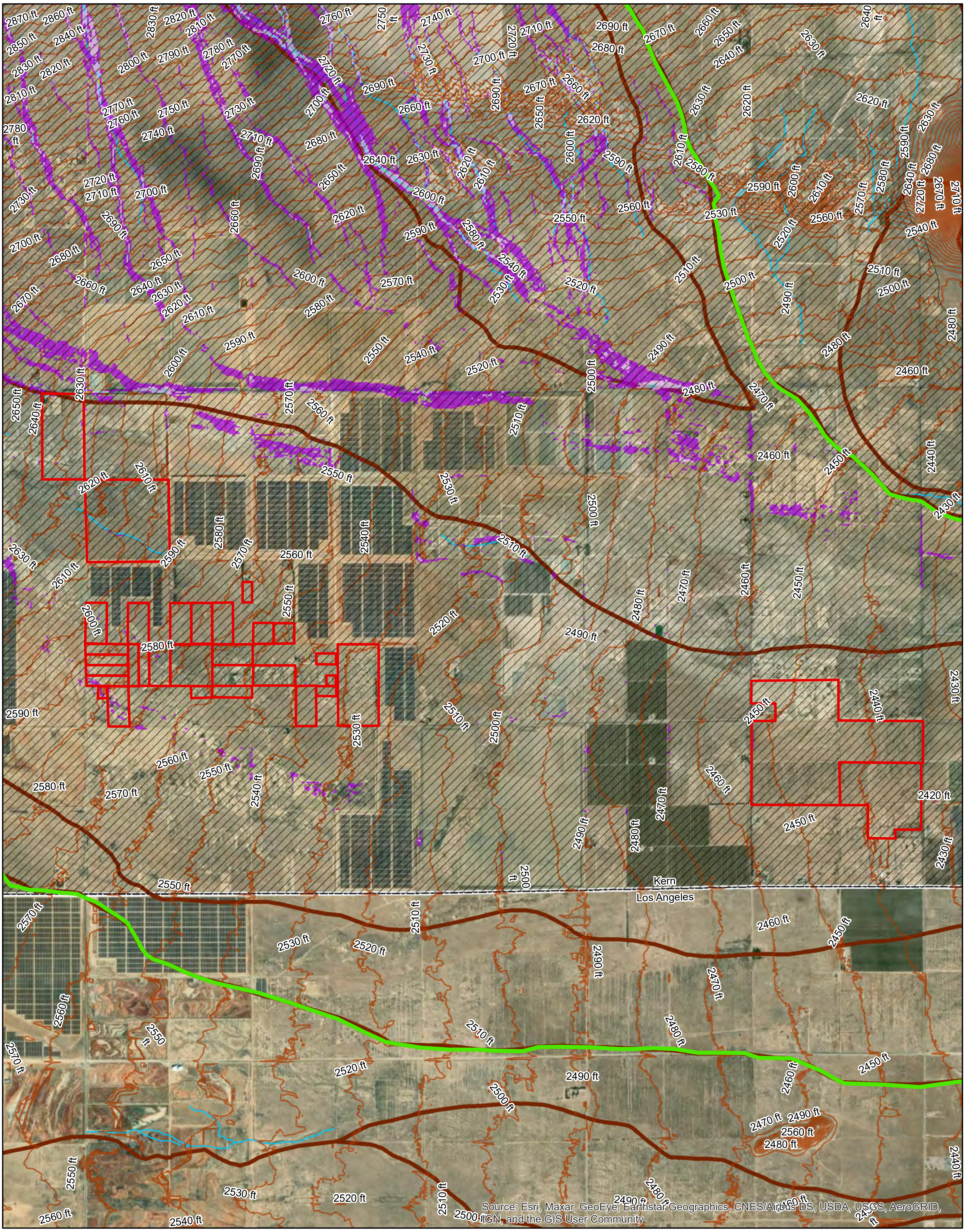
Westwood Professional Services, Inc.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex14A_10yrPeakVelocityMap_2020-07-22.mxd 7/22/2020 10:10:46 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

1.00 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 14A: 10-year Peak Velocity Project Area Map

July 22, 2020

N

0 — 3,000 Feet

Westwood

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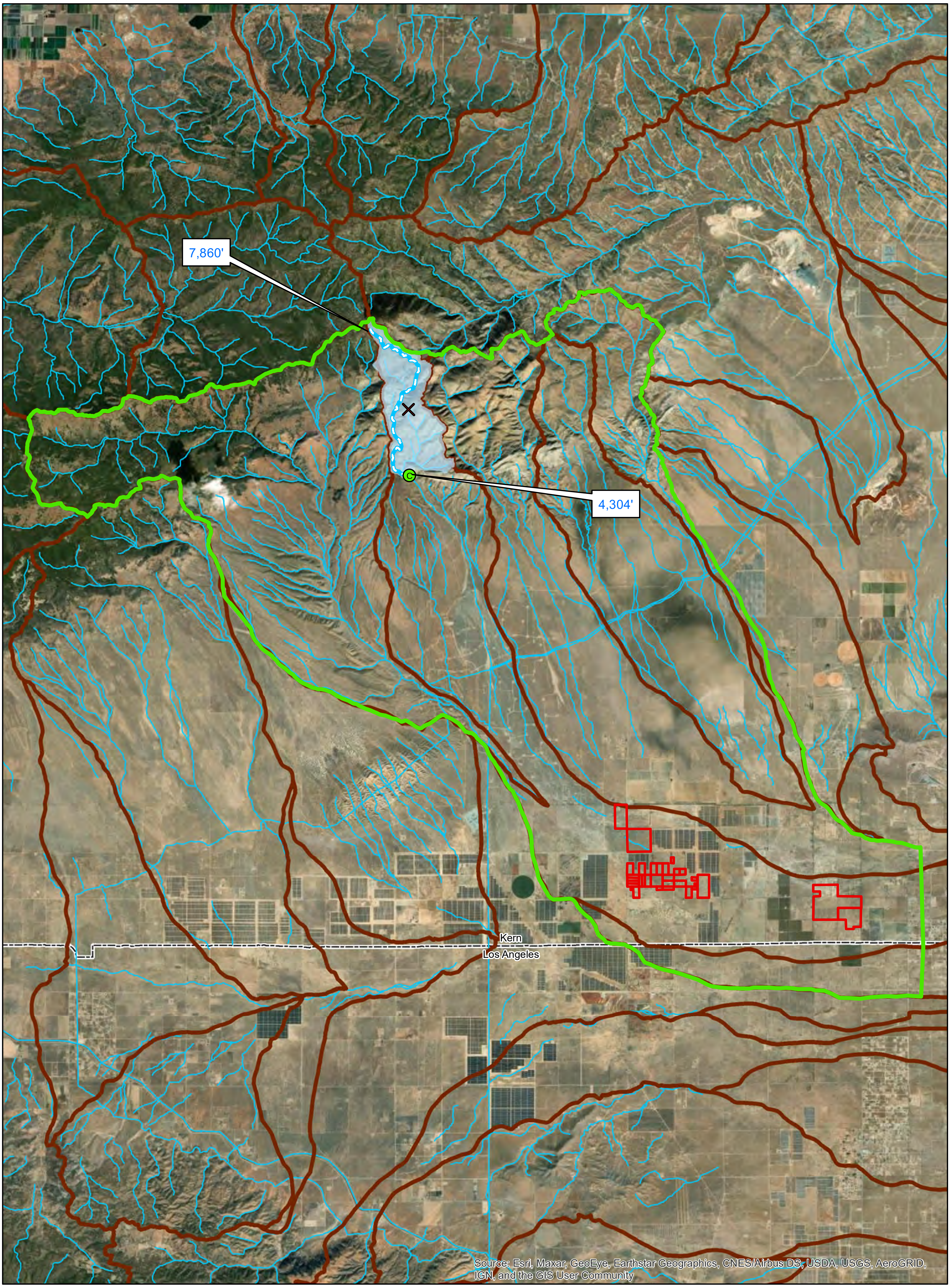
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex15_KernCountyMap_2020-07-20.mxd 7/21/2020 9:22:23 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline
- Calibration Centroid
- Calibration Point
- Longest Watercourse
- Kern County Hydrology Calibration Watershed

Rosamond South Solar Project

Kern County, California

Exhibit 15: Kern County Hydrology Map

July 21, 2020

N

0 2 Miles

Westwood

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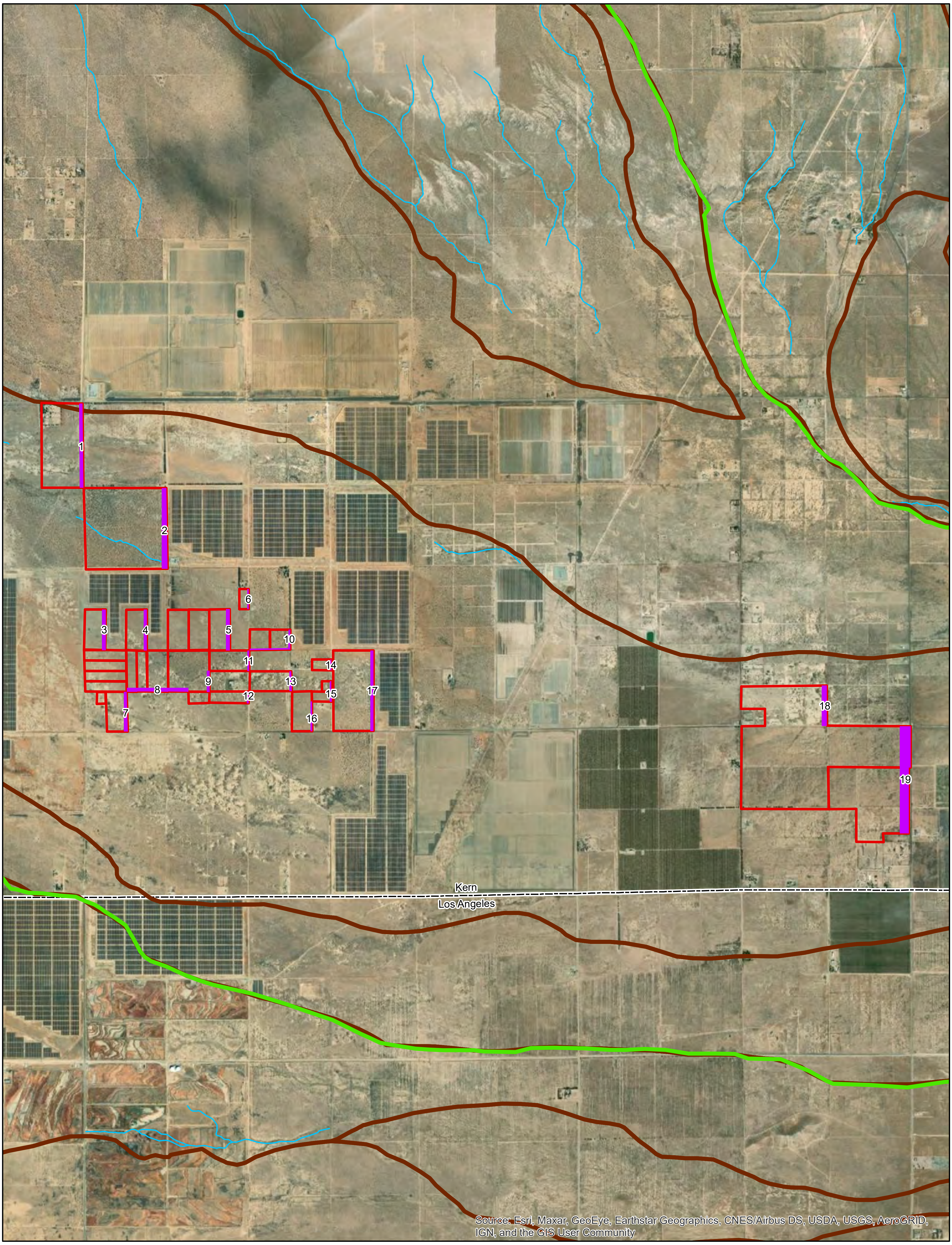
Westwood Professional Services, Inc.

Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex16_BasinMap_2020-07-20.mxd 7/21/2020 9:27:58 AM gapolverari



Data Sources: Westwood (2020); Esri WMS Basemap Imagery (Accessed 2020); USGS (2020); FEMA (2020); USDA (2020)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline
- Preliminary Basin

Rosamond South Solar Project

Kern County, California

Exhibit 16: Preliminary Basin Map

July 21, 2020

N

0 3,000 Feet

Westwood

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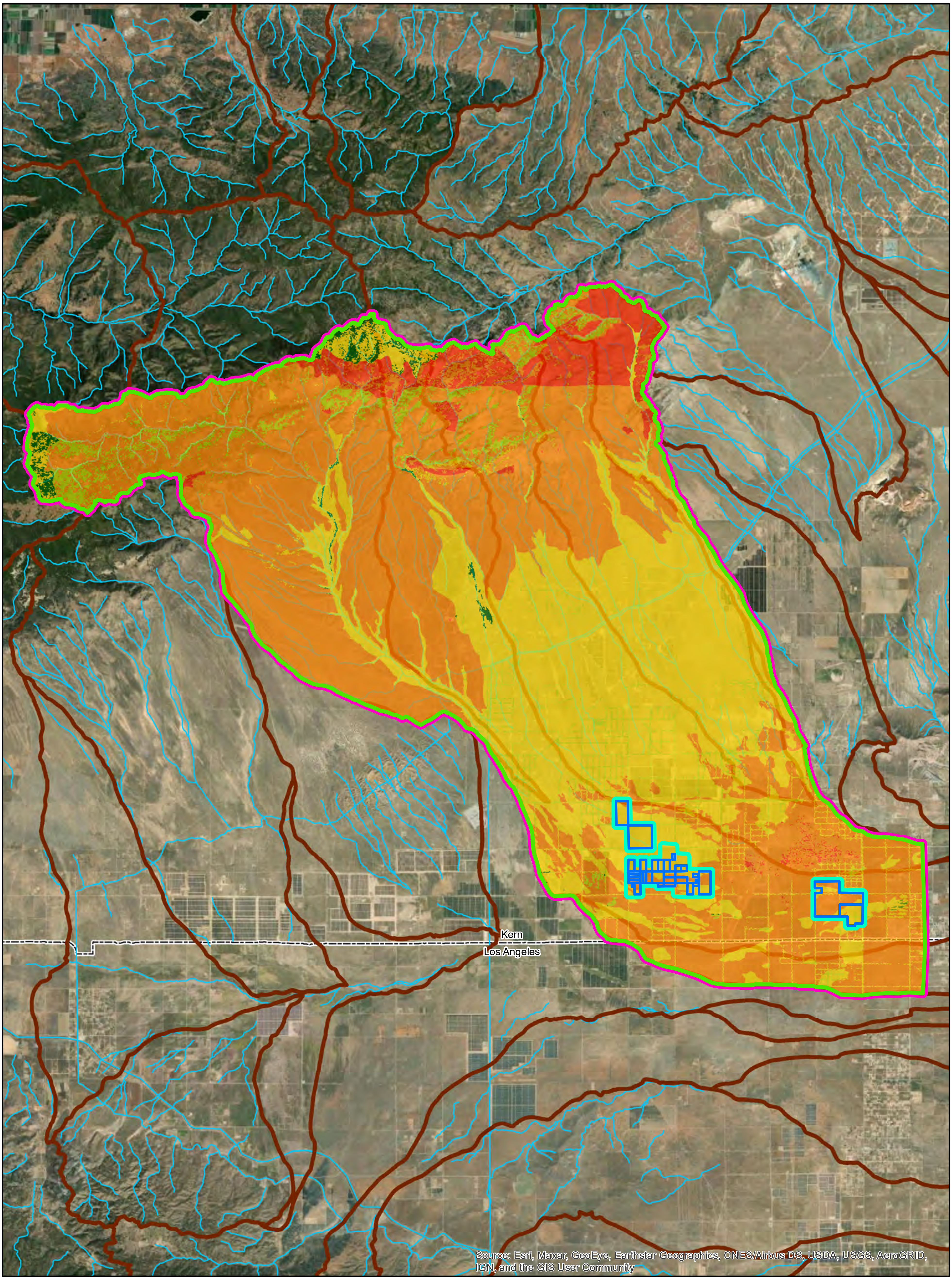
Map Document: N:\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex17_CurveNumberMap_2021-05-12.mxd 5/13/2021 11:09:42 AM GAPolverari



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline
- 1M USGS Extents
- Client Topo Extents

Curve Number

40-49 | 50-59 | 60-69 | 70-79 | 80-89 | 90-99

Rosamond South Solar Project

Kern County, California

Exhibit 17: Curve Number and Topographic Source Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

Westwood

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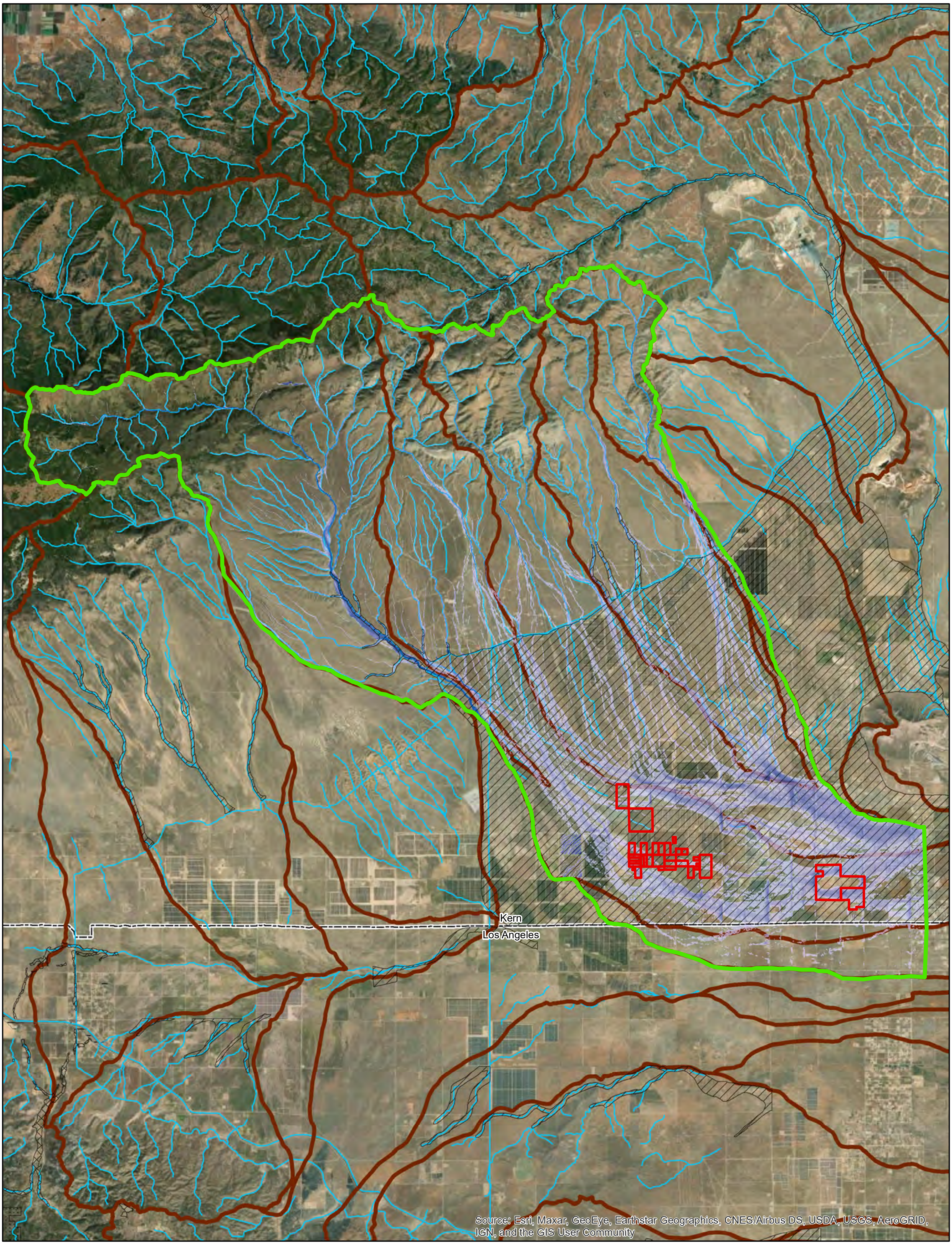

Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00, 1.01 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01 - 6.00, 6.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 18: 100-year Max Water Depth Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

Westwood
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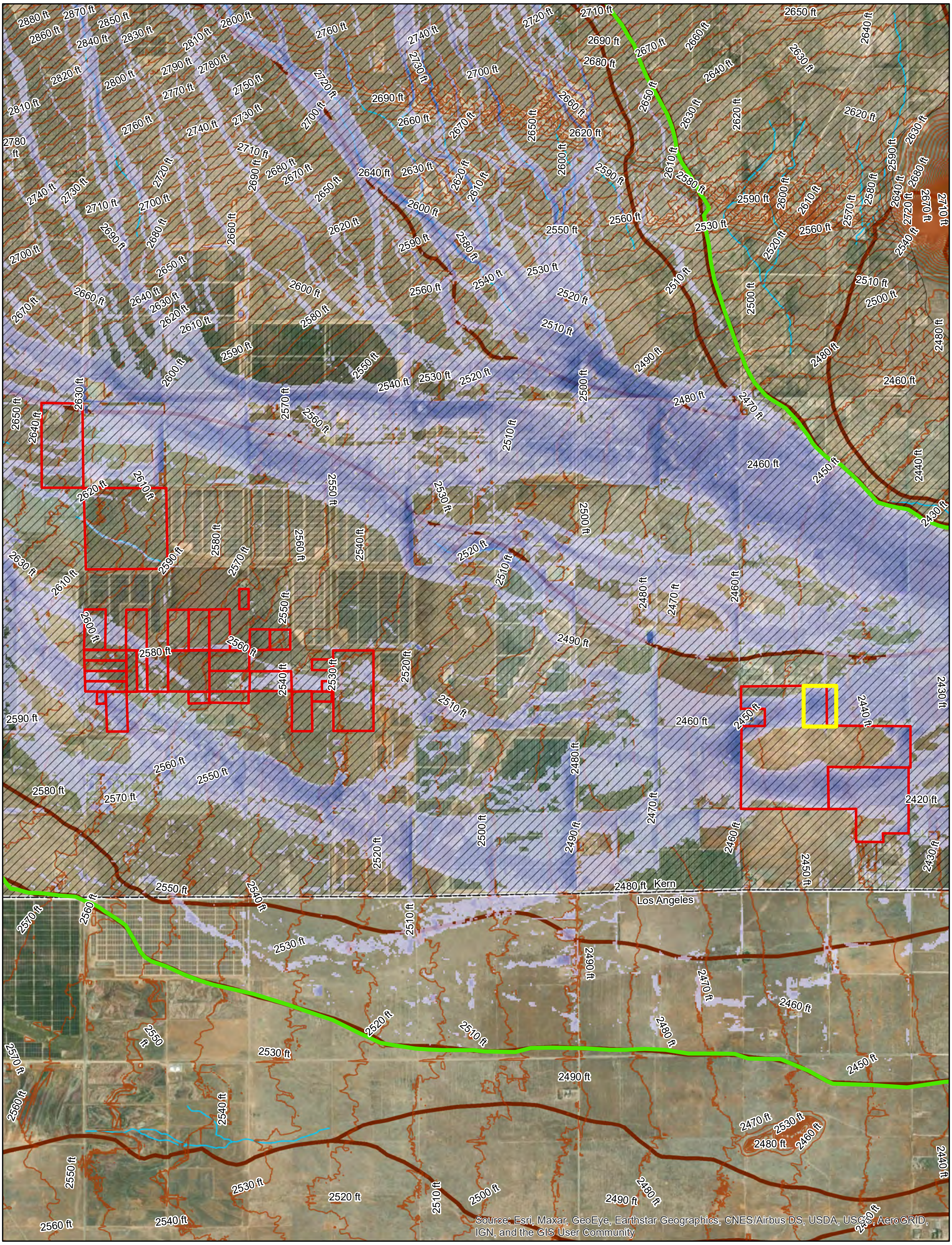
Westwood Professional Services, Inc.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex18A_100yrMaxWaterDepthMap_2021-05-12.mxd 5/13/2021 12:46:15 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours
- **Area of Inconsistent Elevation Data

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

**Elevation data inconsistencies exist in this area and blending was performed to improve continuity, however some artificial ponding may be occuring in the results due to these inconsistencies.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 18A: 100-year Max Water Depth Project Area Map - Public and Client Elevation Data

May 13, 2021

N

Feet
0 3,000

Westwood
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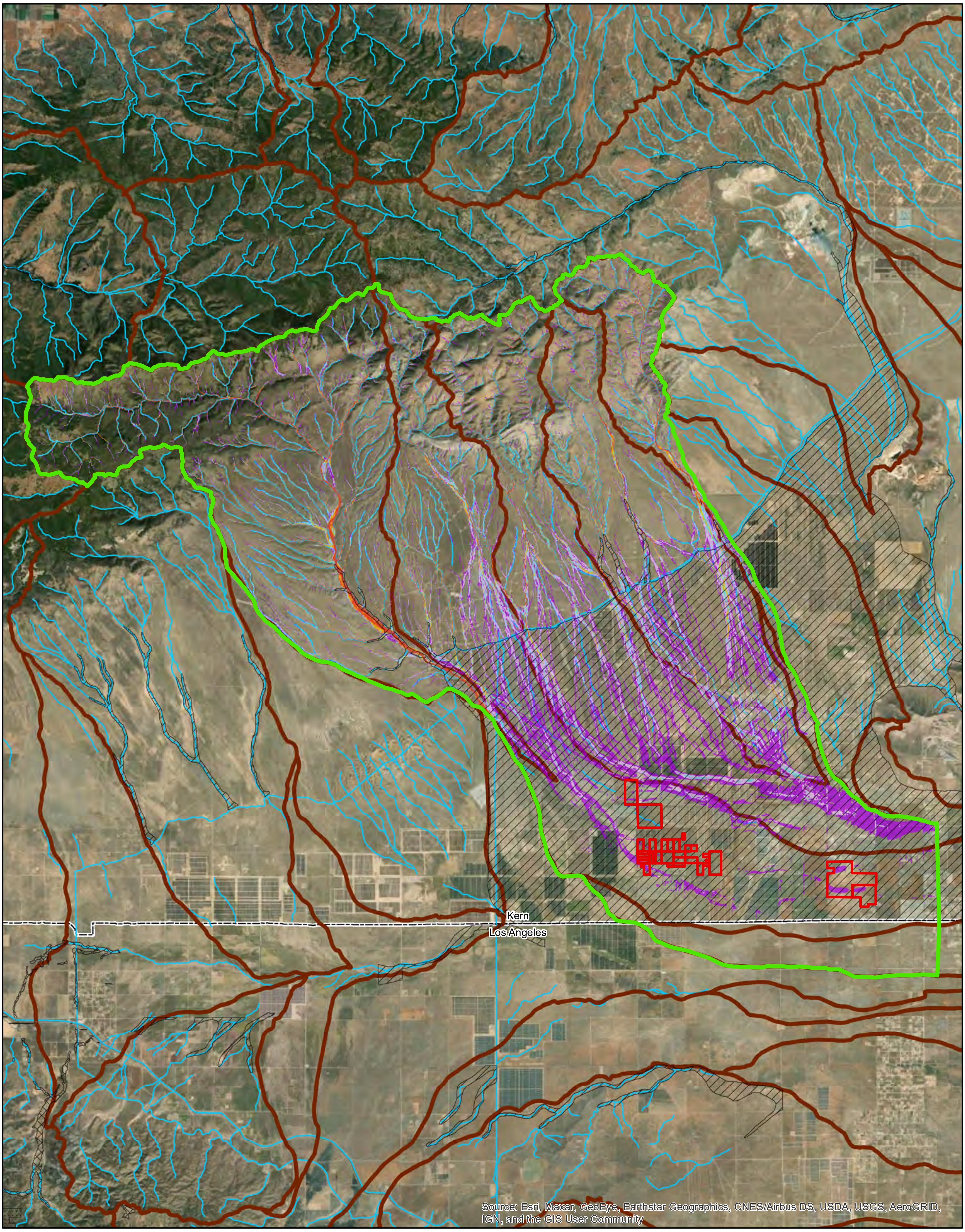
Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex19_100yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 12:58:27 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 19: 100-year Peak Velocity Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

Westwood

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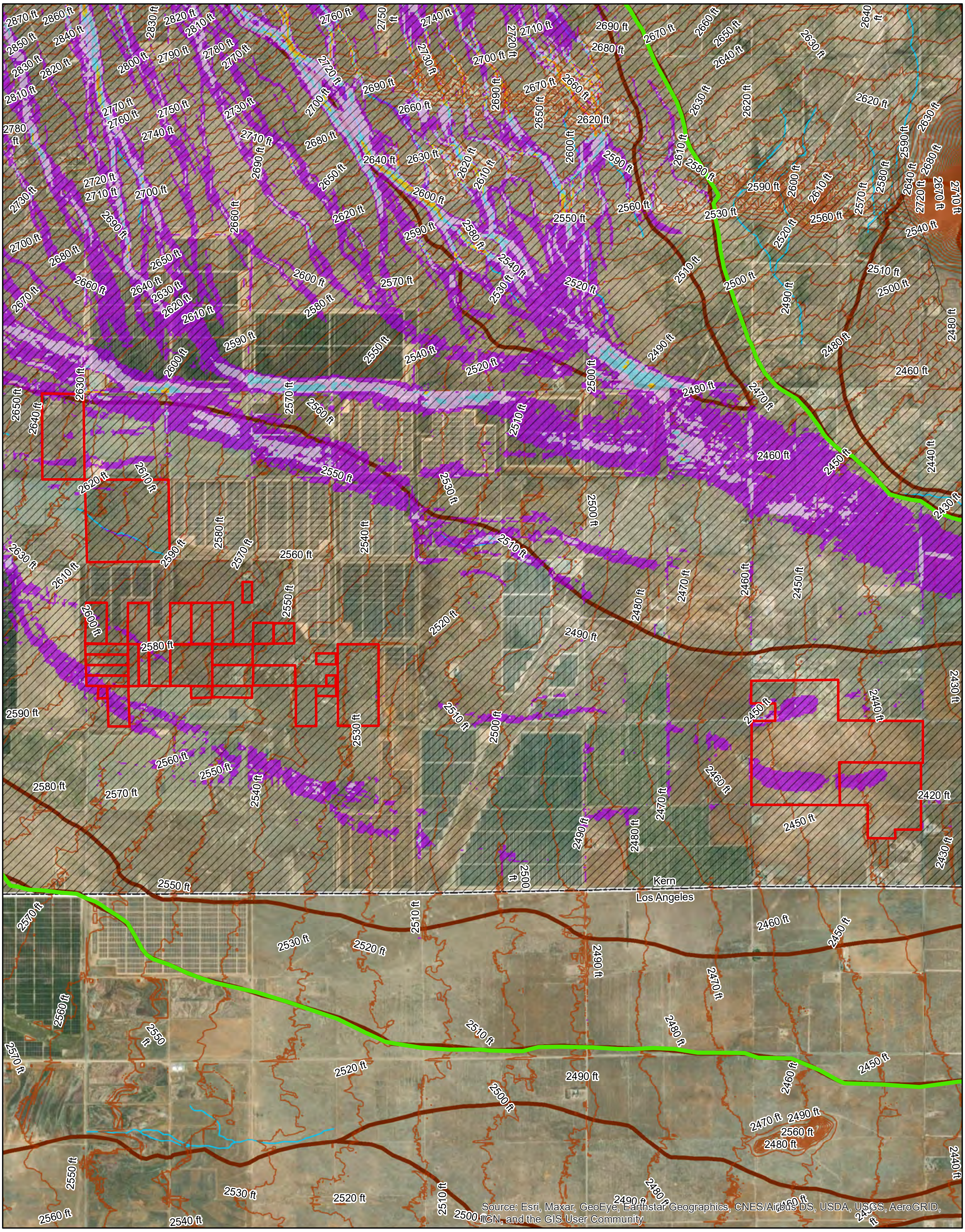
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex19A_100yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 1:15:04 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Rosamond South Solar Project

Kern County, California

Exhibit 19A: 100-year Peak Velocity Project Area Map - Public and Client Elevation Data

May 13, 2021

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

- 1.00 - 1.50
- 1.51 - 2.00
- 2.01 - 2.50
- 2.51 - 3.00
- 3.01 - 4.00
- 4.01+

N

Feet

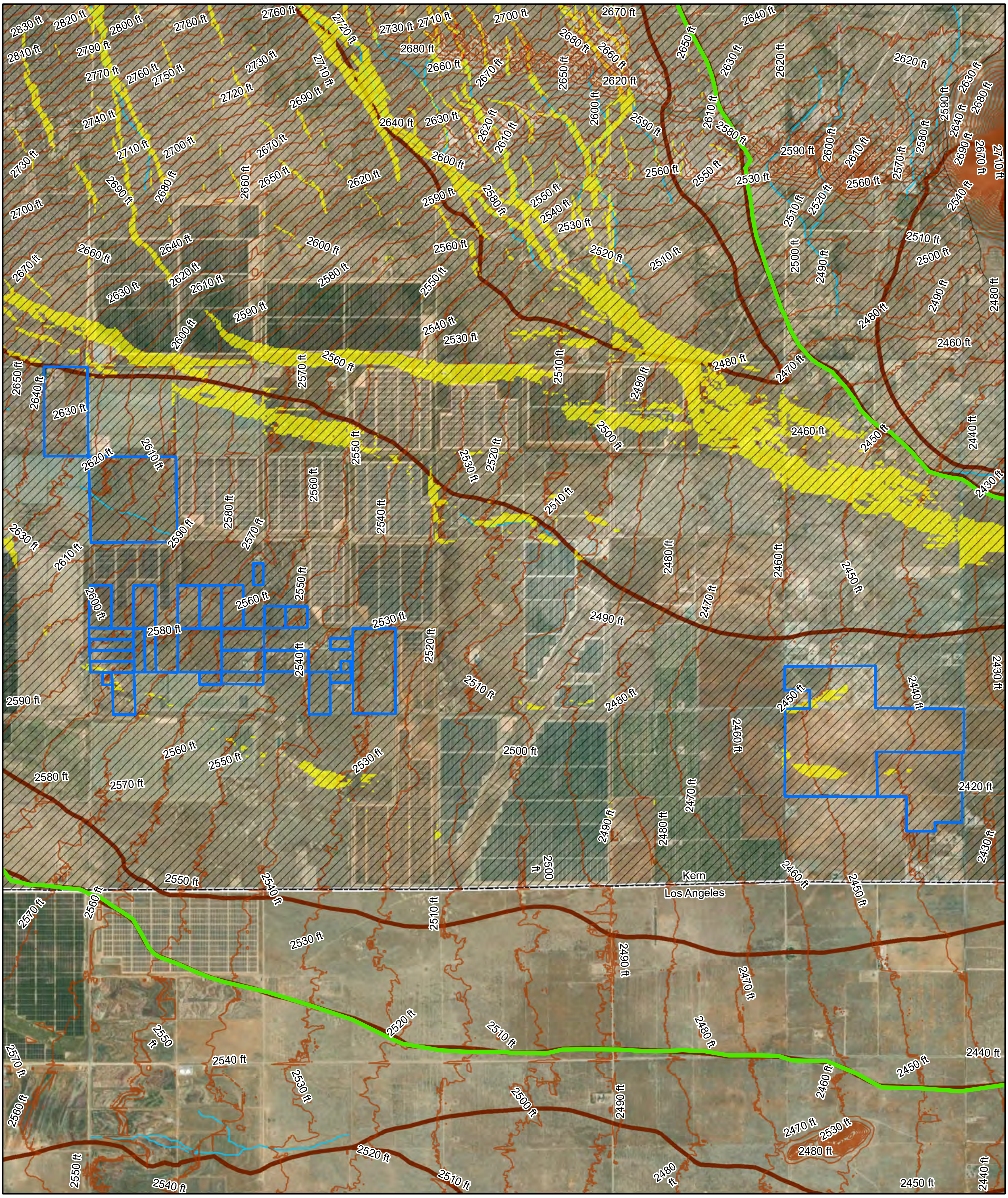
0 3,000

Westwood

Toll Free (888) 937-5150 westwoodps.com

Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- HUC 12 Boundary
- NHD Flowline
- CA DWR Flood Awareness Layer*
- FEMA Zone A
- 10-ft Contours

Scour

- 1.00-1.50
- 1.51-2.0
- 2.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 20: 100-year Scour Project Area Map - Public and Client Elevation Data

May 13, 2021

N

0 3,000 Feet

Westwood

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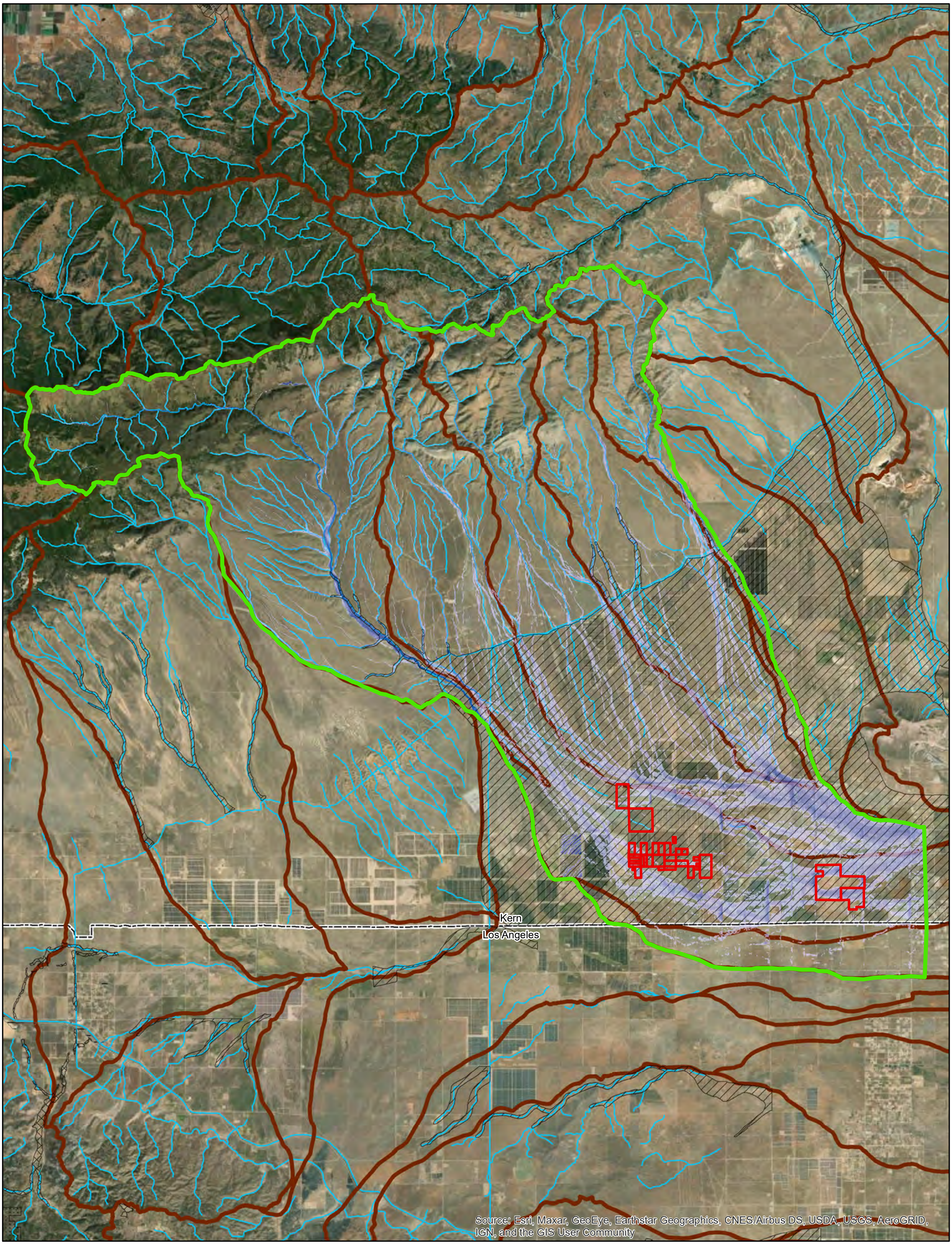
Westwood Professional Services, Inc.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex21_50yrMaxWaterDepthMap_2021-05-12.mxd 5/13/2021 1:12:06 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01 - 6.00
6.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 21: 50-year Max Water Depth Map - Public and Client Elevation Data

May 13, 2021

N

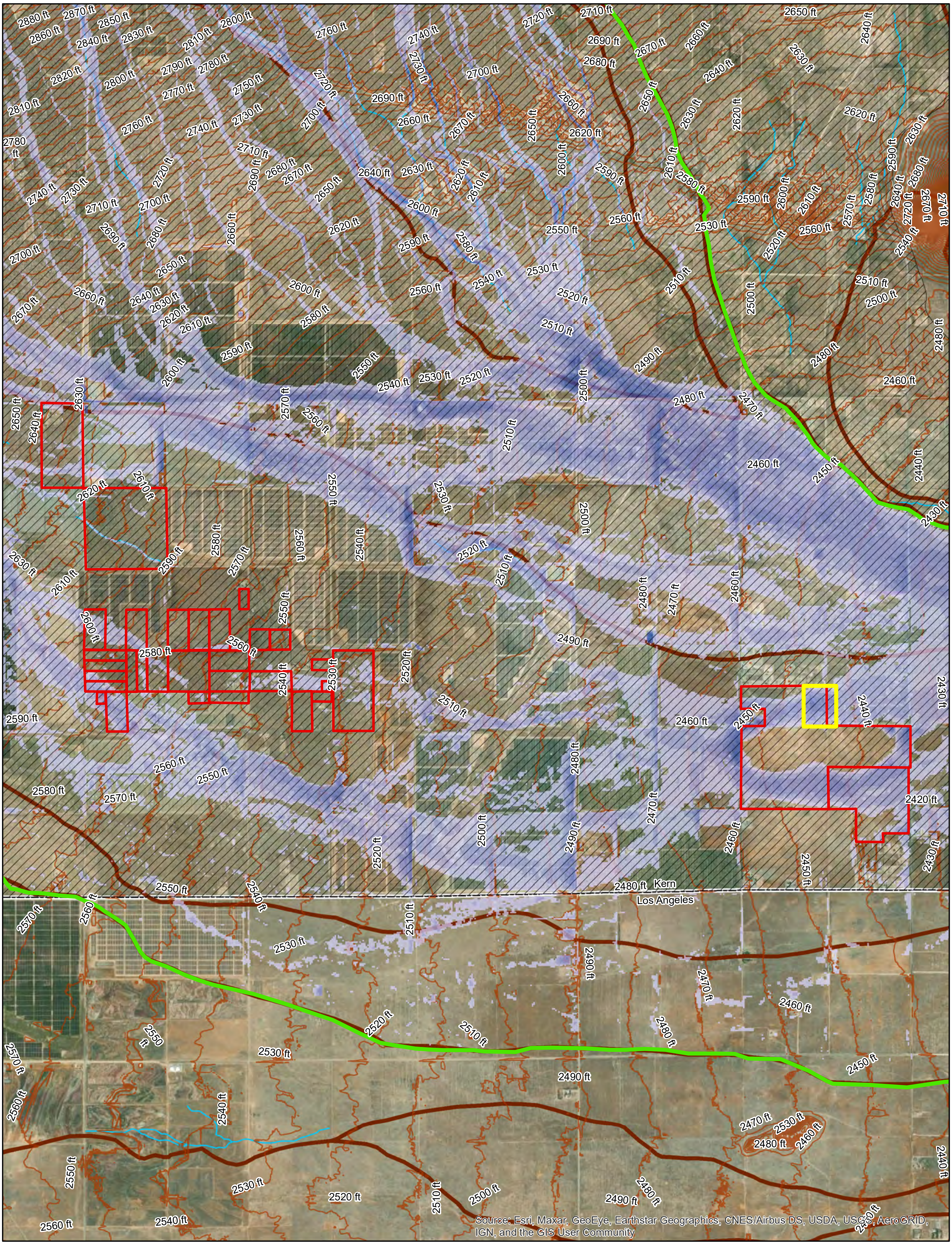
0 2 Miles

Westwood

Toll Free (888) 937-5150 westwoodps.com

Westwood Professional Services, Inc.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex21A_50yrMaxWaterDepthMap_2021-05-12.mxd 5/13/2021 1:31:25 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours
- **Area of Inconsistent Elevation Data

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

**Elevation data inconsistencies exist in this area and blending was performed to improve continuity, however some artificial ponding may be occuring in the results due to these inconsistencies.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 21A: 50-year Max Water Depth Project Area Map - Public and Client Elevation Data

May 13, 2021

N

Feet
0 3,000

Westwood
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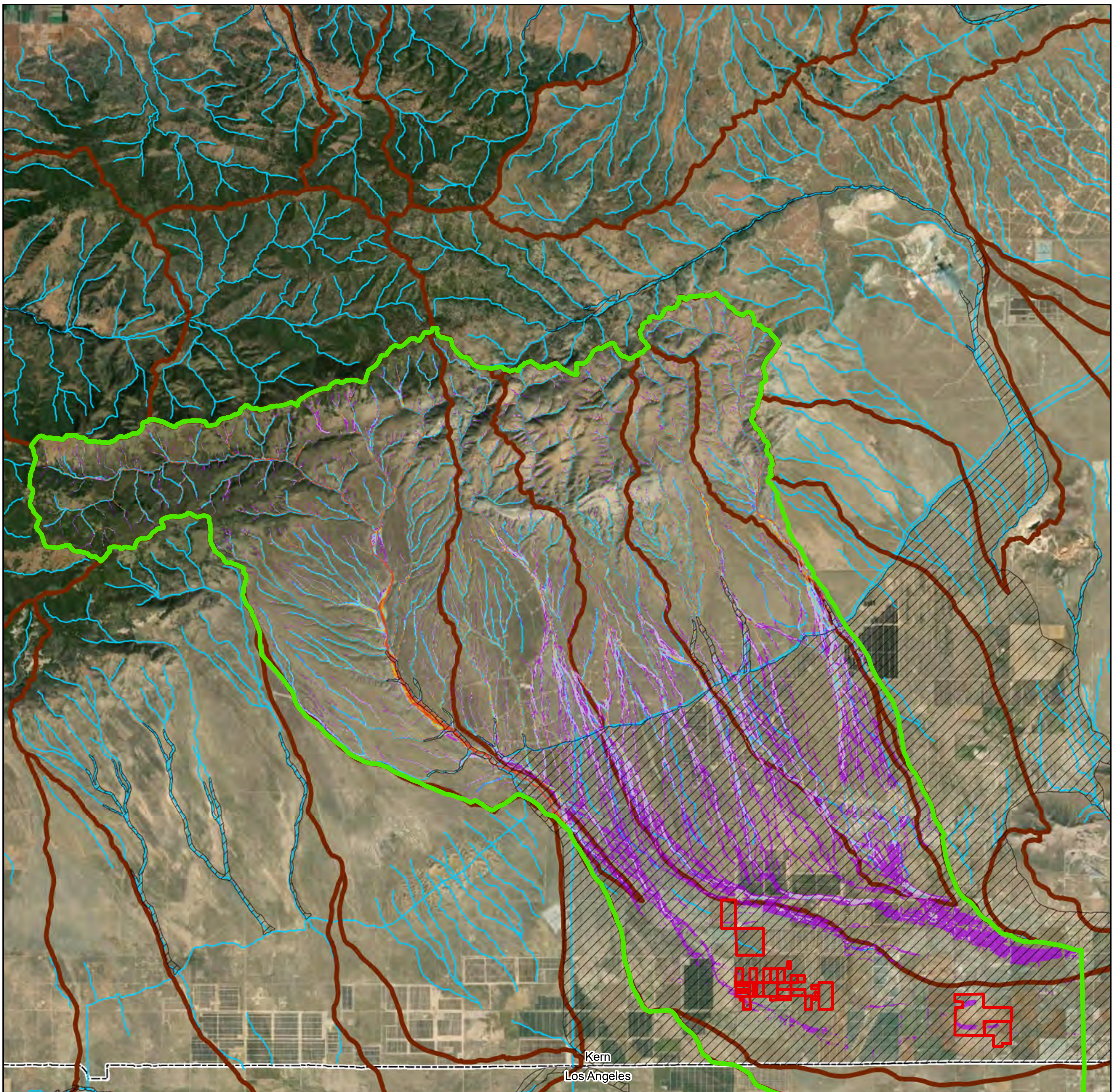
Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex22_50yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 1:33:06 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 22: 50-year Peak Velocity Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

Westwood

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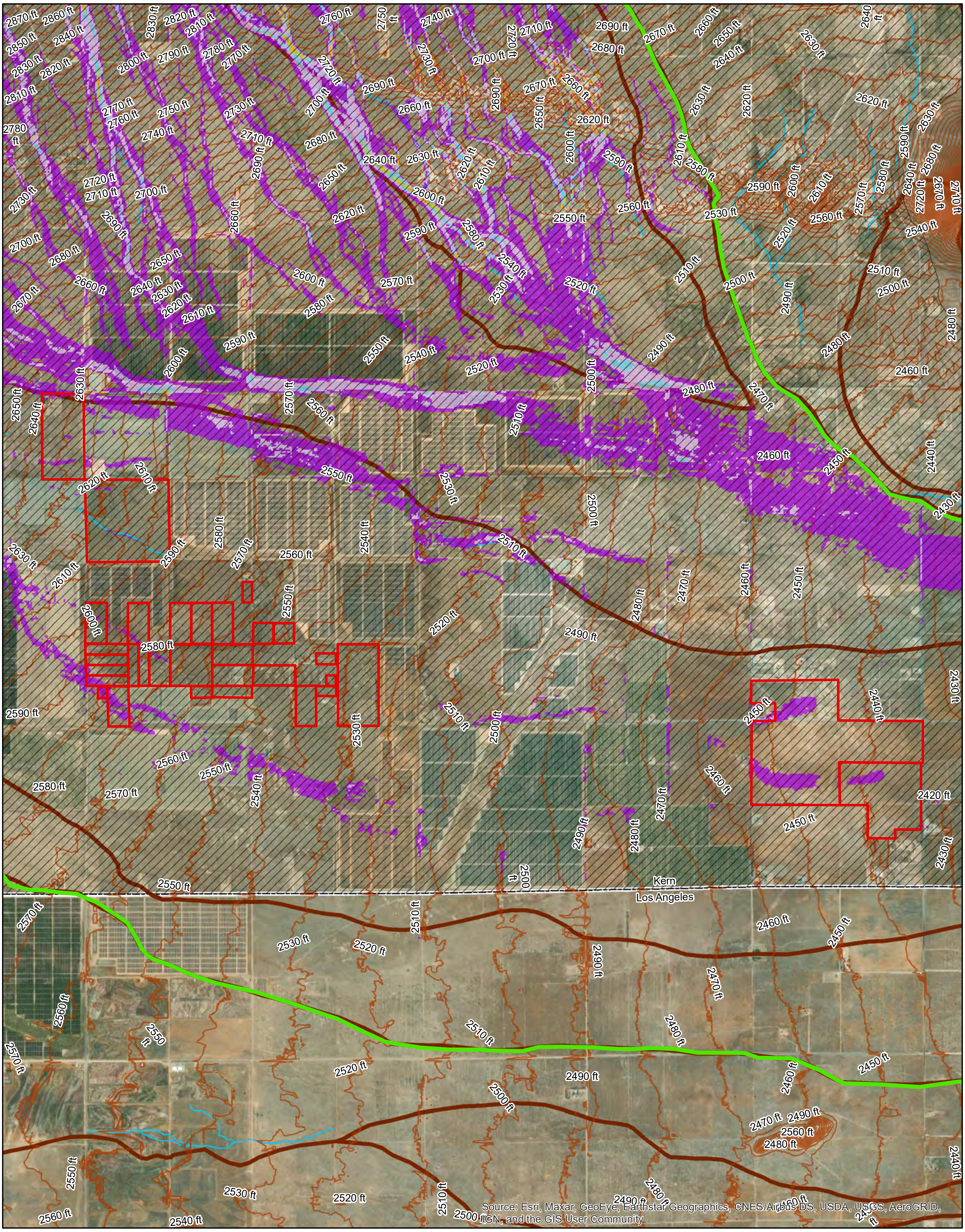
*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex22A_50yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 1:34:56 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 22A: 50-year Peak Velocity Project Area Map - Public and Client Elevation Data

May 13, 2021

N

0 3,000 Feet

Westwood

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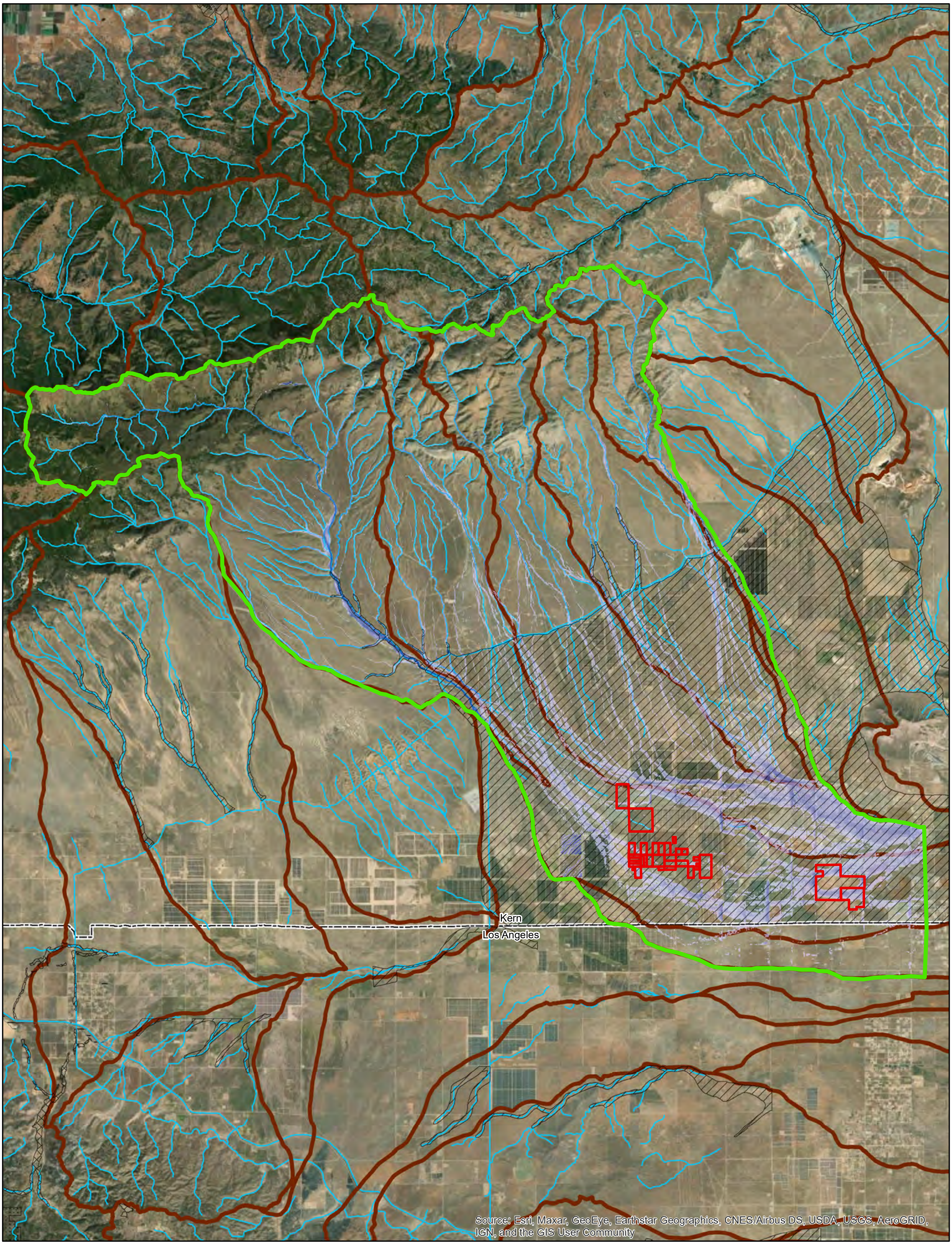
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex23_25yrMaxWaterDepthMap_2021-05-12.mxd 5/13/2021 1:36:10 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00, 1.01 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01 - 6.00, 6.01+

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 23: 25-year Max Water Depth Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

Westwood
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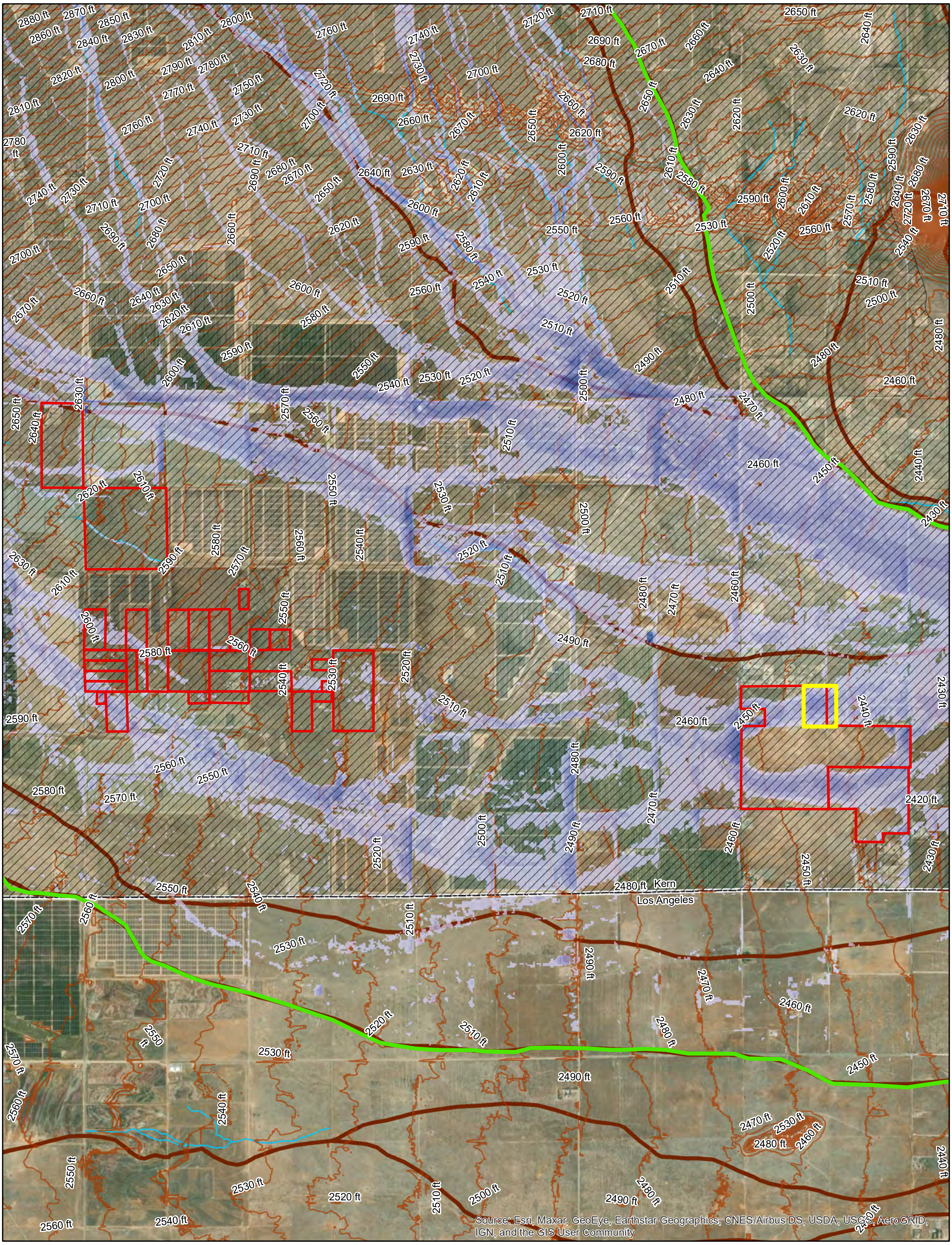
Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex23A_25yrMaxWaterDepthMap_2021-05-12.mxd 5/13/2021 1:53:15 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours
- **Area of Inconsistent Elevation Data

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 23A: 25-year Max Water Depth Project Area Map - Public and Client Elevation Data

May 13, 2021

N

Feet
0 3,000

**Elevation data inconsistencies exist in this area and blending was performed to improve continuity, however some artificial ponding may be occuring in the results due to these inconsistencies.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Westwood
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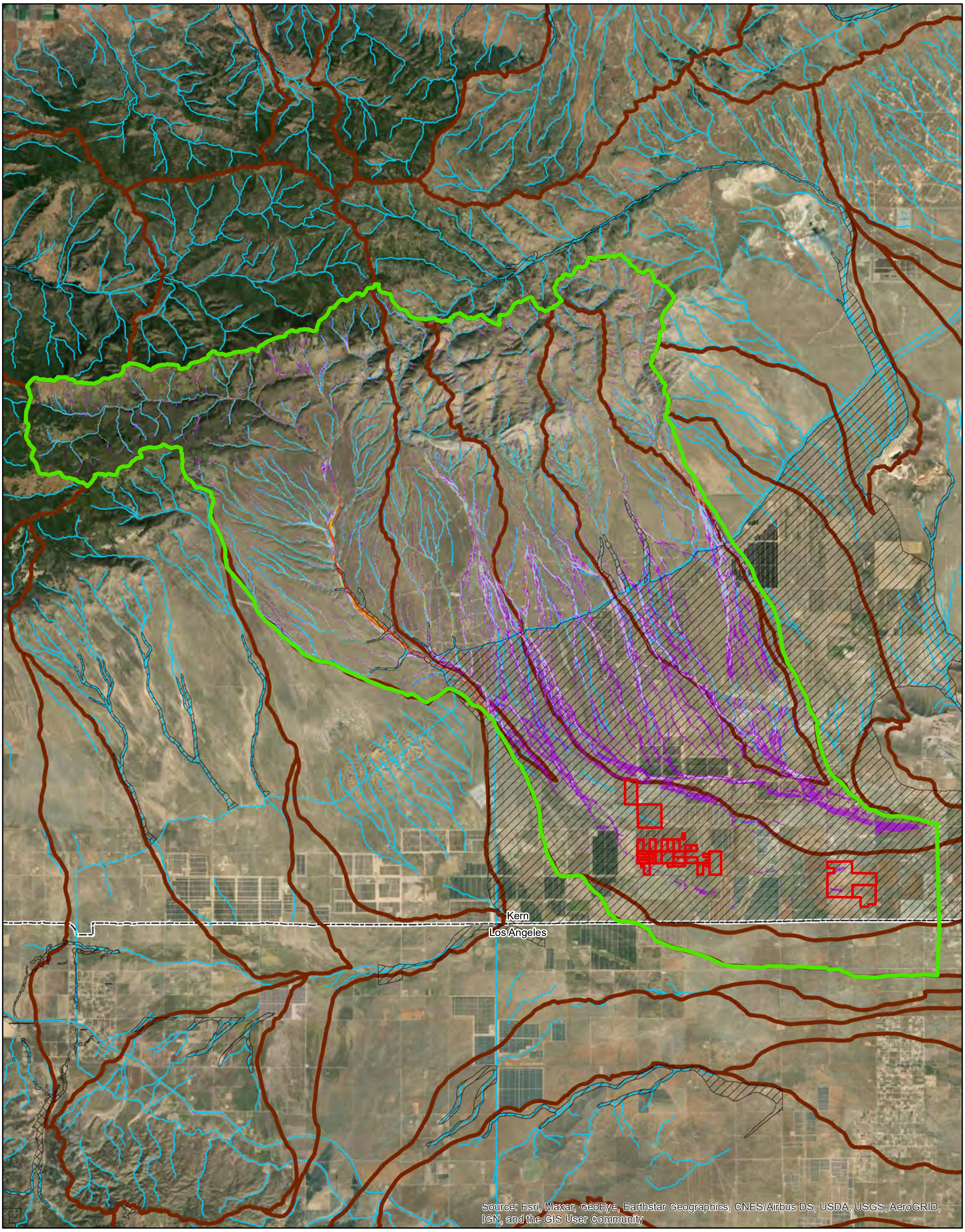
Westwood Professional Services, Inc.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex24_25yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 1:55:09 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 24: 25-year Peak Velocity Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Westwood
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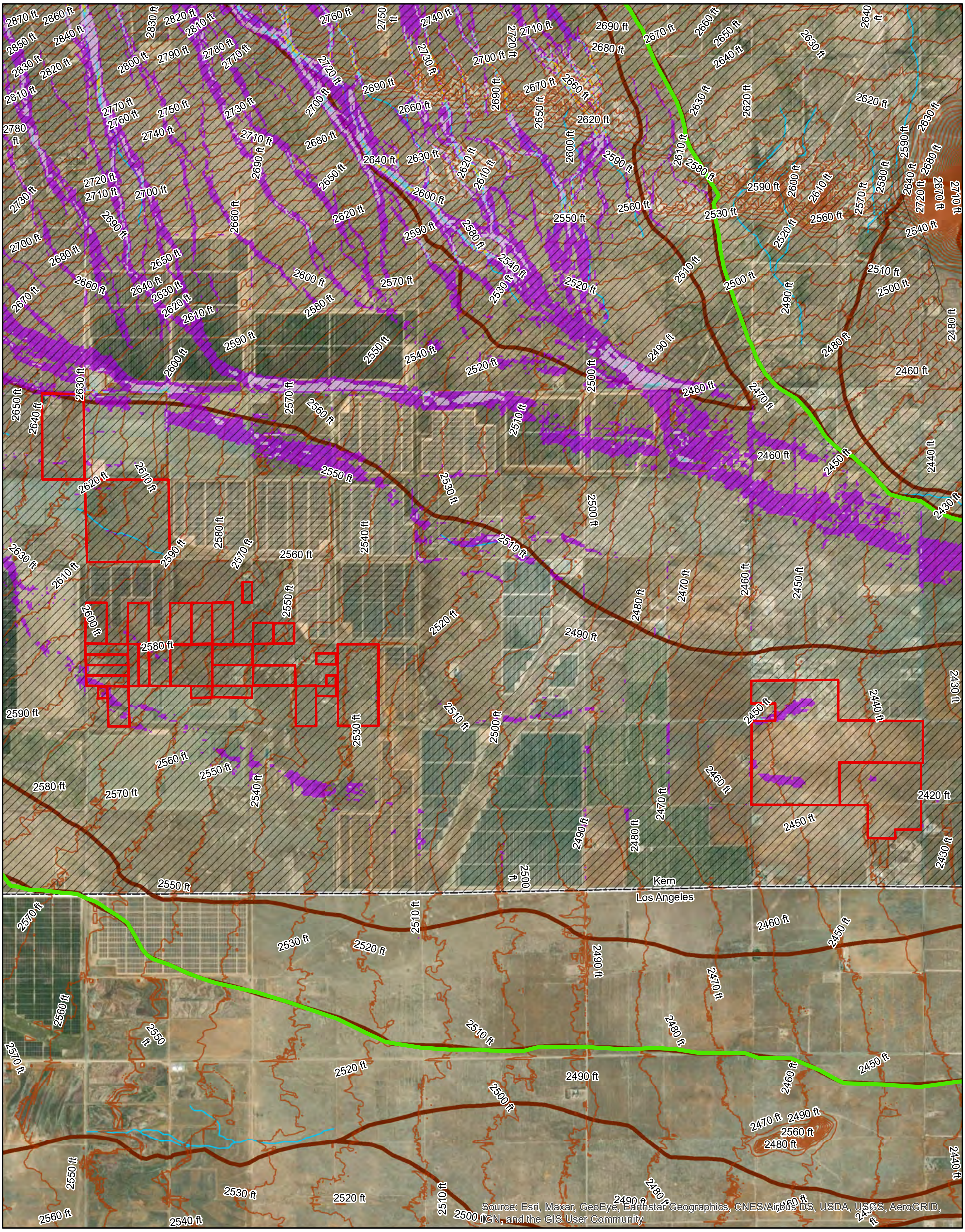
Westwood Professional Services, Inc.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex24A_25yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 1:56:39 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 24A: 25-year Peak Velocity Project Area Map - Public and Client Elevation Data

May 13, 2021

N

0 3,000 Feet

Westwood

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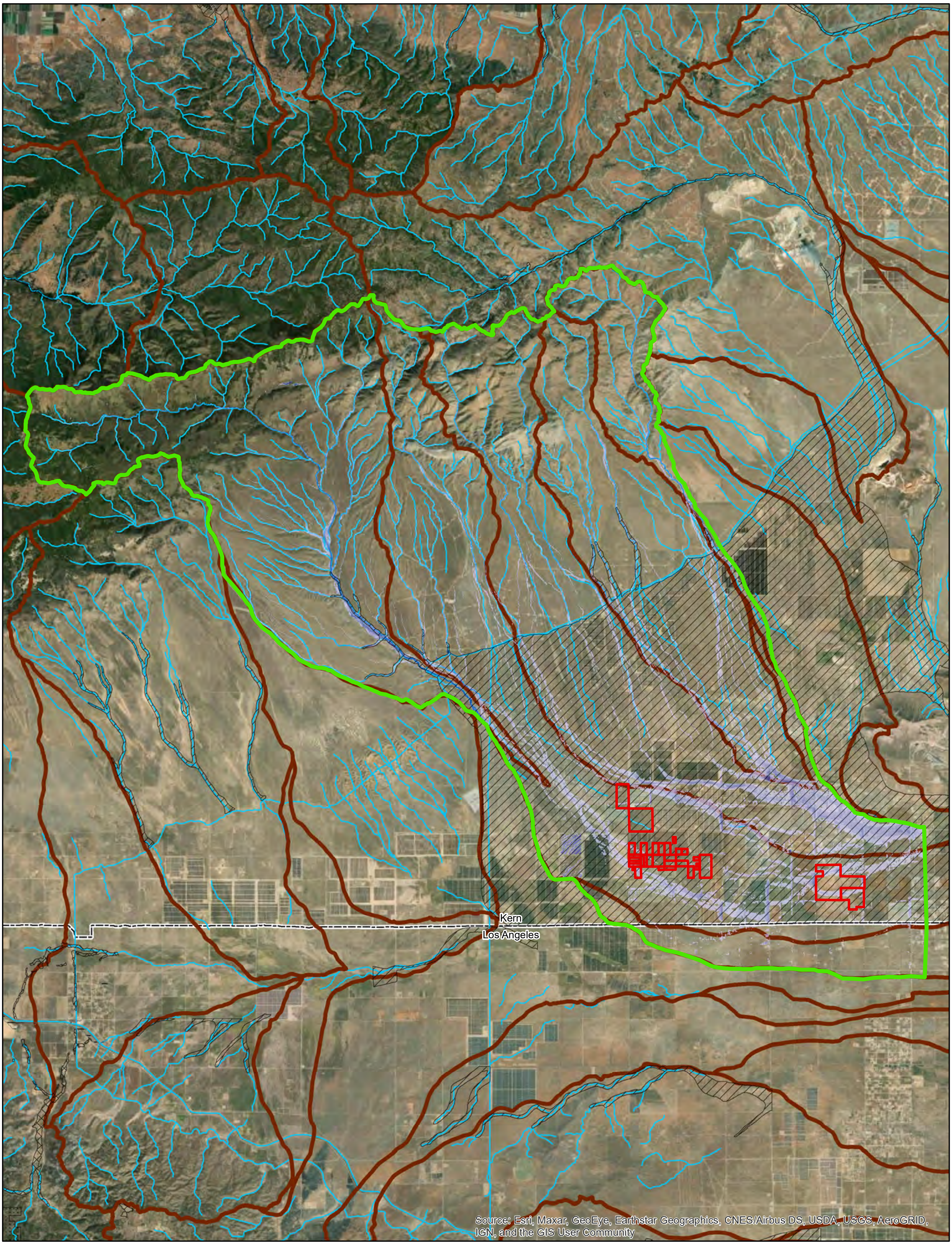
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Flow Depth (ft)

0.50 - 1.00, 1.01 - 1.50, 1.51 - 2.00, 2.01 - 2.50, 2.51 - 3.00, 3.01 - 4.00, 4.01 - 6.00, 6.01+

Rosamond South Solar Project

Kern County, California

Exhibit 25: 10-year Max Water Depth Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

Westwood

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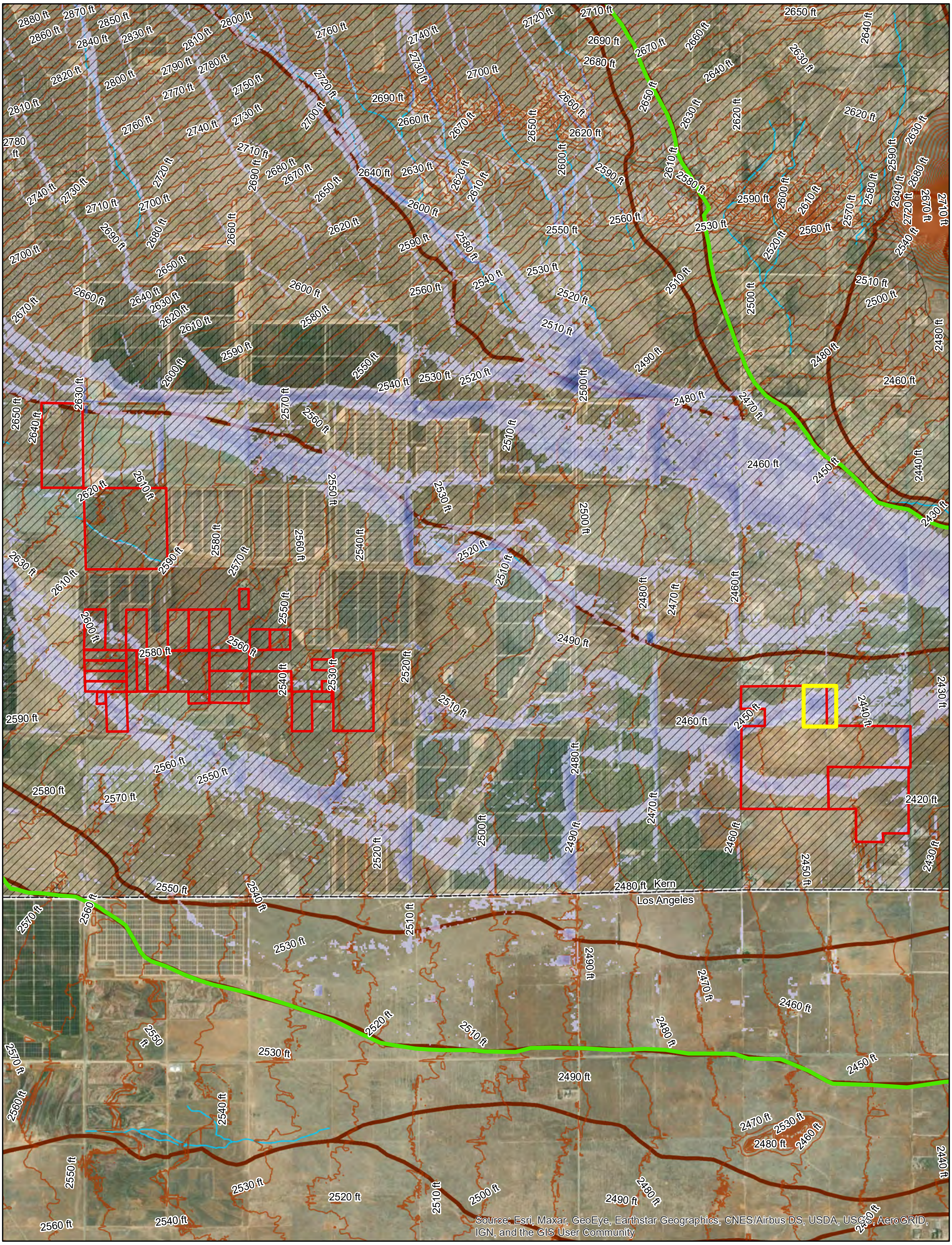
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours
- **Area of Inconsistent Elevation Data

Peak Flow Depth (ft)

0.50 - 1.00 | 1.01 - 1.50 | 1.51 - 2.00 | 2.01 - 2.50 | 2.51 - 3.00 | 3.01 - 4.00 | 4.01 - 6.00 | 6.01+

**Elevation data inconsistencies exist in this area and blending was performed to improve continuity, however some artificial ponding may be occuring in the results due to these inconsistencies.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Rosamond South Solar Project

Kern County, California

Exhibit 25A: 10-year Max Water Depth Project Area Map - Public and Client Elevation Data

May 13, 2021

N

Feet
0 3,000

Westwood
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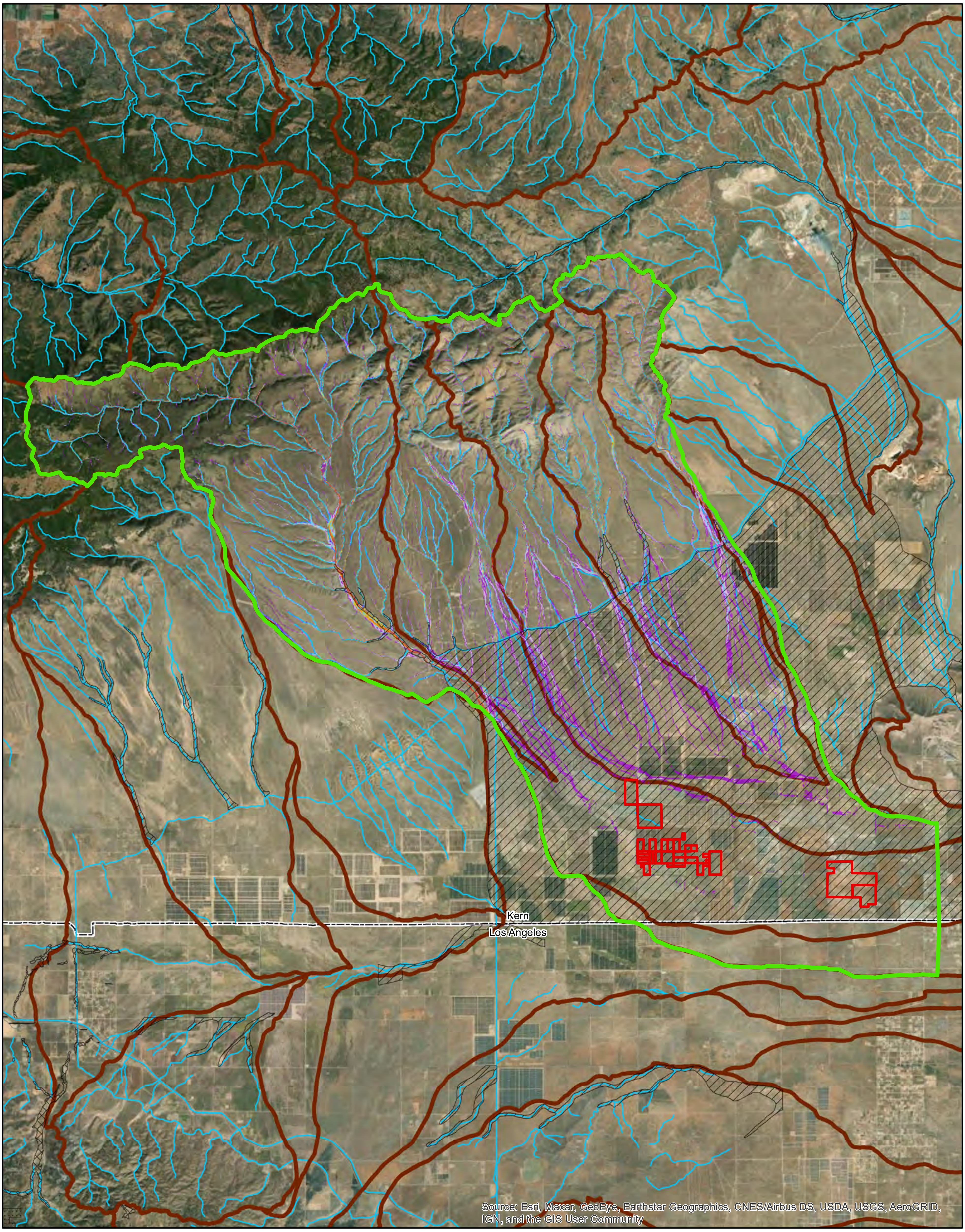
Westwood Professional Services, Inc.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex26_10yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 2:14:43 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- FEMA Zone AE
- FEMA Zone AH
- FEMA Zone AO
- FEMA Zone D

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 26: 10-year Peak Velocity Map - Public and Client Elevation Data

May 13, 2021

N

0 2 Miles

Westwood

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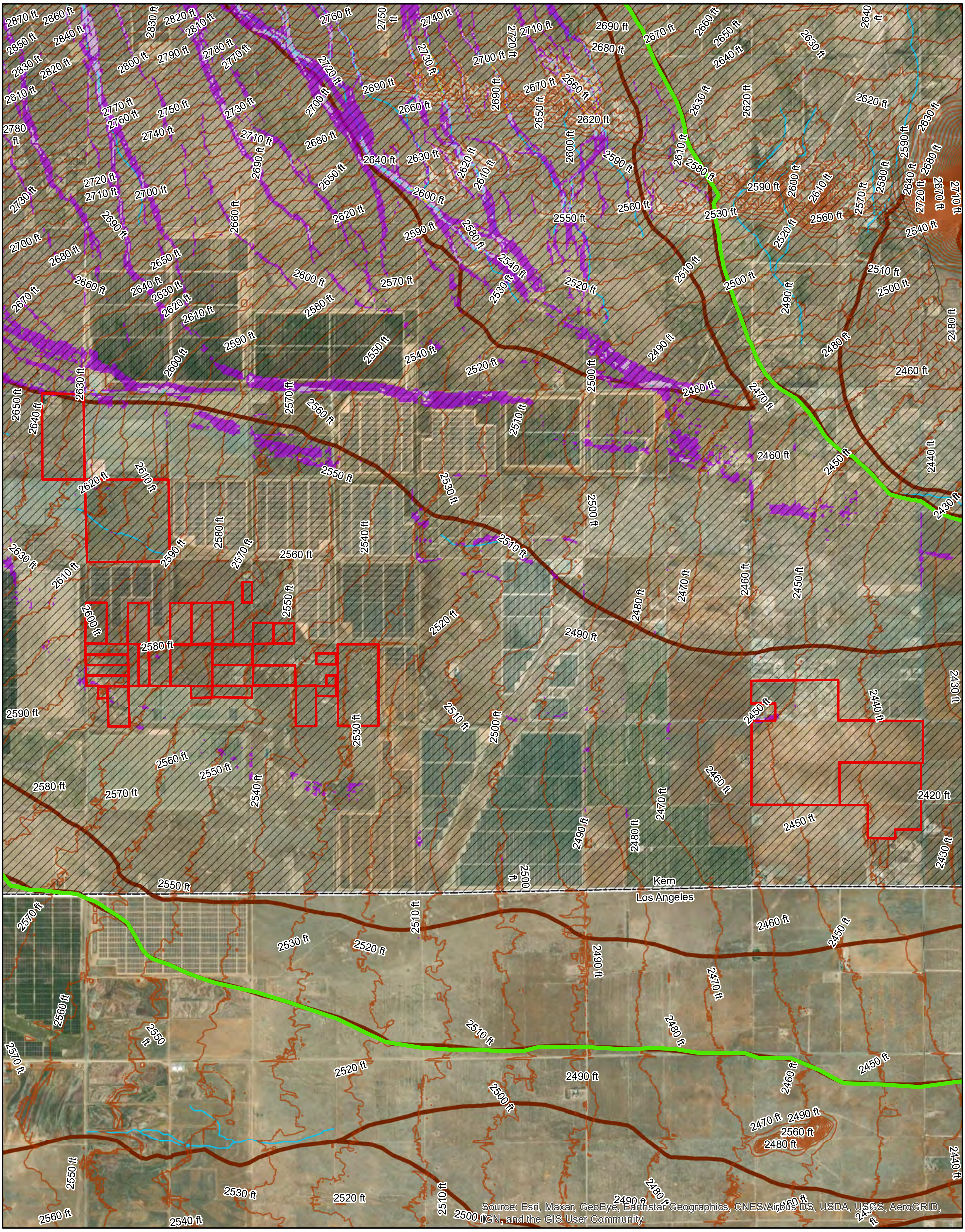
Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Map Document: \\westwoodps.local\Global Projects\0027097.00\GIS\Hydro Exhibits\RosamondSouth_Ex26A_10yrPeakVelocityMap_2021-05-12.mxd 5/13/2021 2:16:25 PM ALBialik



Data Sources: Westwood (2021); Esri WMS Basemap Imagery (Accessed 2021); USGS (2021); FEMA (2021); USDA (2021)

Legend

- Project Boundary
- FLO-2D Model Boundary
- County Boundary
- CA DWR Flood Awareness Layer*
- HUC 12 Boundary
- NHD Flowline
- FEMA Zone A
- 10-ft Contours

Peak Velocity (fps)

1.00 - 1.50
1.51 - 2.00
2.01 - 2.50
2.51 - 3.00
3.01 - 4.00
4.01+

Rosamond South Solar Project

Kern County, California

Exhibit 26A: 10-year Peak Velocity Project Area Map - Public and Client Elevation Data

May 13, 2021

N

0 3,000 Feet

Westwood

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Westwood Professional Services, Inc.

*No CA DWR Flood Awareness areas fall within the FLO-2D Model Boundary or Project Area.

Appendix A

Atlas 14 Precipitation Data

NOAA Atlas 14, Volume 6, Version 2
Location name: Tehachapi, California, USA*
Latitude: 34.9686°, Longitude: -118.5846°
Elevation: 5446.3 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.125** (0.104-0.153)	**0.163** (0.135-0.200)	**0.216** (0.178-0.265)	**0.263** (0.215-0.325)	**0.332** (0.262-0.425)	**0.390** (0.301-0.510)	**0.455** (0.343-0.610)	**0.529** (0.388-0.730)	**0.645** (0.453-0.928)	**0.751** (0.510-1.12)
10-min	**0.180** (0.149-0.220)	**0.234** (0.193-0.287)	**0.310** (0.255-0.380)	**0.377** (0.307-0.466)	**0.475** (0.375-0.609)	**0.559** (0.432-0.731)	**0.652** (0.491-0.874)	**0.759** (0.556-1.05)	**0.924** (0.649-1.33)	**1.08** (0.730-1.60)
15-min	**0.217** (0.180-0.266)	**0.283** (0.234-0.346)	**0.375** (0.308-0.460)	**0.456** (0.372-0.564)	**0.575** (0.454-0.736)	**0.676** (0.522-0.884)	**0.789** (0.594-1.06)	**0.917** (0.672-1.26)	**1.12** (0.785-1.61)	**1.30** (0.883-1.94)
30-min	**0.306** (0.253-0.374)	**0.398** (0.328-0.487)	**0.527** (0.433-0.647)	**0.641** (0.523-0.793)	**0.808** (0.638-1.03)	**0.951** (0.735-1.24)	**1.11** (0.836-1.49)	**1.29** (0.945-1.78)	**1.57** (1.10-2.26)	**1.83** (1.24-2.73)
60-min	**0.452** (0.374-0.553)	**0.589** (0.486-0.721)	**0.780** (0.642-0.957)	**0.948** (0.774-1.17)	**1.20** (0.944-1.53)	**1.41** (1.09-1.84)	**1.64** (1.24-2.20)	**1.91** (1.40-2.63)	**2.33** (1.63-3.35)	**2.71** (1.84-4.04)
2-hr	**0.690** (0.570-0.843)	**0.894** (0.737-1.09)	**1.17** (0.964-1.44)	**1.41** (1.15-1.74)	**1.75** (1.38-2.24)	**2.03** (1.57-2.65)	**2.33** (1.75-3.12)	**2.66** (1.95-3.67)	**3.15** (2.22-4.54)	**3.58** (2.43-5.34)
3-hr	**0.882** (0.729-1.08)	**1.14** (0.941-1.40)	**1.49** (1.23-1.83)	**1.78** (1.46-2.21)	**2.20** (1.74-2.82)	**2.53** (1.96-3.31)	**2.89** (2.18-3.87)	**3.27** (2.40-4.51)	**3.84** (2.70-5.52)	**4.32** (2.93-6.44)
6-hr	**1.32** (1.09-1.62)	**1.72** (1.42-2.10)	**2.24** (1.84-2.75)	**2.67** (2.18-3.31)	**3.27** (2.58-4.19)	**3.74** (2.89-4.89)	**4.24** (3.19-5.68)	**4.76** (3.49-6.56)	**5.50** (3.86-7.91)	**6.11** (4.14-9.09)
12-hr	**1.82** (1.51-2.23)	**2.40** (1.98-2.94)	**3.16** (2.60-3.88)	**3.78** (3.09-4.68)	**4.62** (3.65-5.92)	**5.27** (4.07-6.89)	**5.93** (4.47-7.95)	**6.62** (4.85-9.13)	**7.58** (5.32-10.9)	**8.34** (5.65-12.4)
24-hr	**2.41** (2.14-2.77)	**3.25** (2.88-3.74)	**4.34** (3.84-5.01)	**5.22** (4.58-6.08)	**6.41** (5.43-7.72)	**7.32** (6.07-9.00)	**8.24** (6.67-10.4)	**9.19** (7.23-11.9)	**10.5** (7.90-14.2)	**11.5** (8.37-16.1)
2-day	**3.02** (2.68-3.48)	**4.12** (3.66-4.74)	**5.56** (4.91-6.41)	**6.73** (5.90-7.83)	**8.35** (7.08-10.0)	**9.60** (7.97-11.8)	**10.9** (8.81-13.7)	**12.2** (9.62-15.9)	**14.1** (10.6-19.1)	**15.6** (11.3-21.8)
3-day	**3.36** (2.99-3.86)	**4.61** (4.09-5.31)	**6.25** (5.52-7.21)	**7.61** (6.67-8.85)	**9.50** (8.06-11.4)	**11.0** (9.12-13.5)	**12.5** (10.1-15.8)	**14.2** (11.1-18.4)	**16.4** (12.4-22.2)	**18.2** (13.3-25.6)
4-day	**3.68** (3.27-4.23)	**5.06** (4.48-5.82)	**6.87** (6.07-7.92)	**8.38** (7.35-9.75)	**10.5** (8.90-12.6)	**12.2** (10.1-15.0)	**13.9** (11.3-17.5)	**15.8** (12.4-20.4)	**18.3** (13.8-24.8)	**20.4** (14.9-28.6)
7-day	**4.24** (3.76-4.87)	**5.80** (5.14-6.68)	**7.85** (6.94-9.06)	**9.56** (8.39-11.1)	**12.0** (10.1-14.4)	**13.8** (11.5-17.0)	**15.8** (12.8-20.0)	**18.0** (14.1-23.3)	**20.9** (15.8-28.3)	**23.4** (17.0-32.7)
10-day	**4.57** (4.06-5.25)	**6.24** (5.53-7.18)	**8.42** (7.45-9.72)	**10.2** (8.98-11.9)	**12.8** (10.8-15.4)	**14.8** (12.3-18.2)	**16.9** (13.7-21.3)	**19.2** (15.1-24.9)	**22.3** (16.8-30.2)	**24.9** (18.2-35.0)
20-day	**5.39** (4.78-6.19)	**7.36** (6.53-8.47)	**9.96** (8.81-11.5)	**12.1** (10.6-14.1)	**15.1** (12.8-18.2)	**17.5** (14.5-21.5)	**20.0** (16.2-25.2)	**22.7** (17.8-29.4)	**26.5** (20.0-35.9)	**29.7** (21.6-41.6)
30-day	**6.36** (5.65-7.31)	**8.71** (7.72-10.0)	**11.8** (10.4-13.6)	**14.4** (12.6-16.7)	**17.9** (15.2-21.5)	**20.7** (17.2-25.5)	**23.7** (19.2-29.9)	**27.0** (21.2-35.0)	**31.6** (23.8-42.8)	**35.5** (25.8-49.8)
45-day	**7.52** (6.68-8.65)	**10.3** (9.10-11.8)	**13.9** (12.3-16.0)	**16.9** (14.8-19.6)	**21.0** (17.8-25.3)	**24.3** (20.2-29.9)	**27.9** (22.6-35.1)	**31.7** (25.0-41.1)	**37.3** (28.1-50.5)	**41.9** (30.5-58.8)
60-day	**8.55** (7.59-9.83)	**11.6** (10.3-13.3)	**15.6** (13.8-18.0)	**18.9** (16.5-22.0)	**23.5** (19.9-28.3)	**27.2** (22.6-33.4)	**31.1** (25.2-39.2)	**35.4** (27.9-46.0)	**41.7** (31.4-56.4)	**47.0** (34.2-65.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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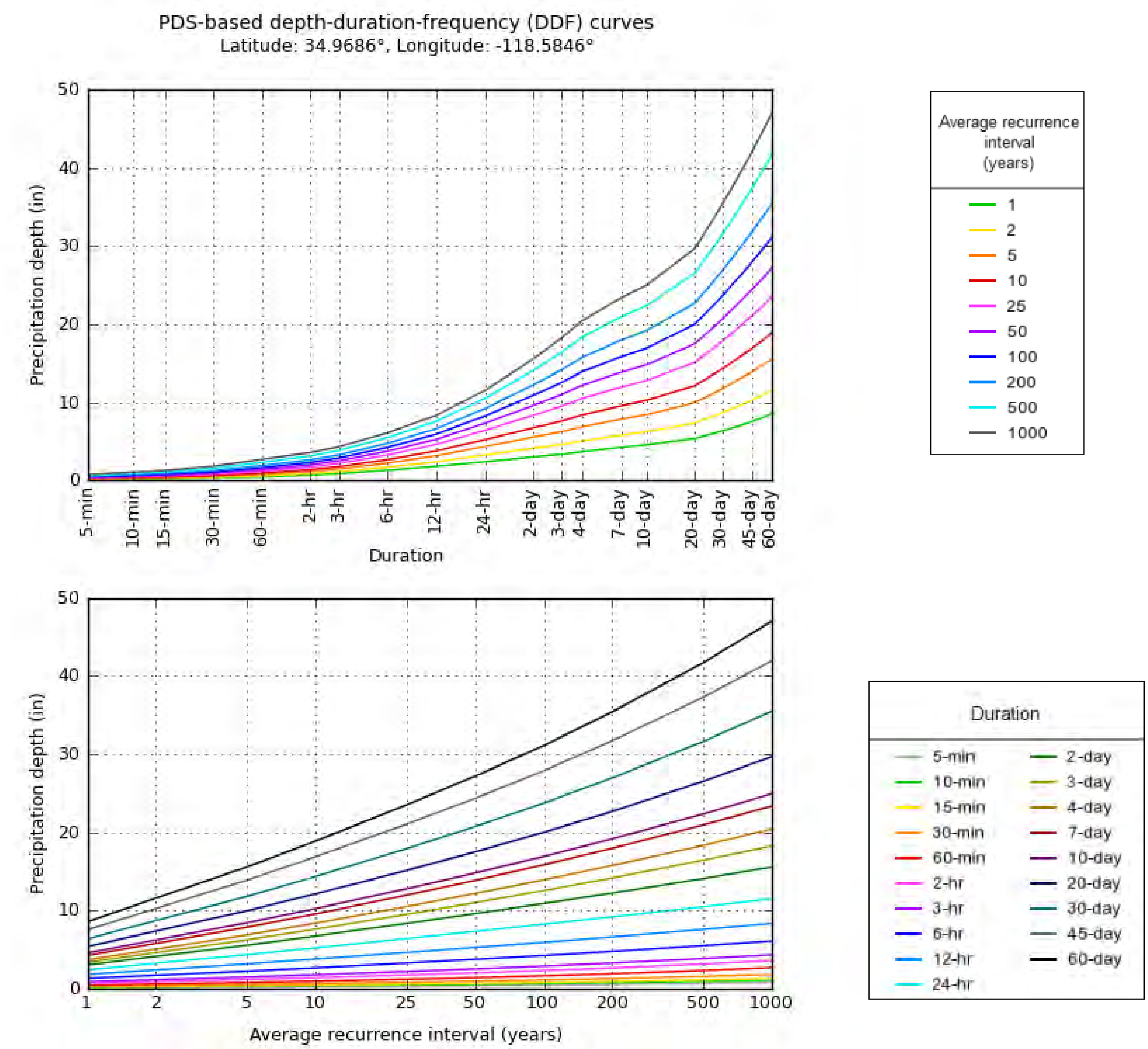
PF graphical



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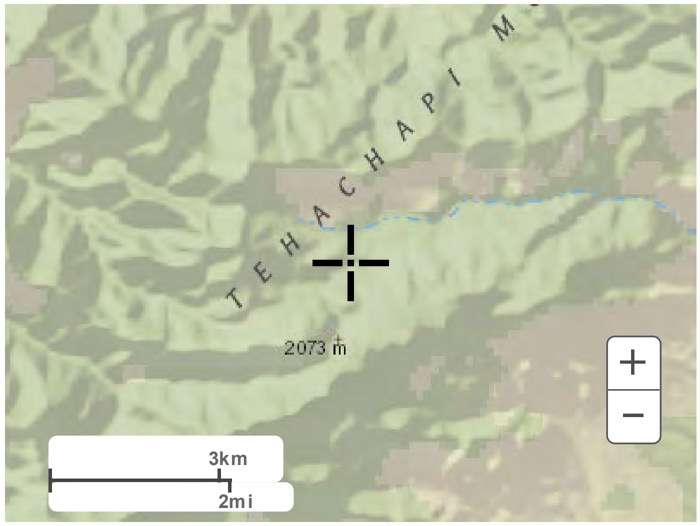
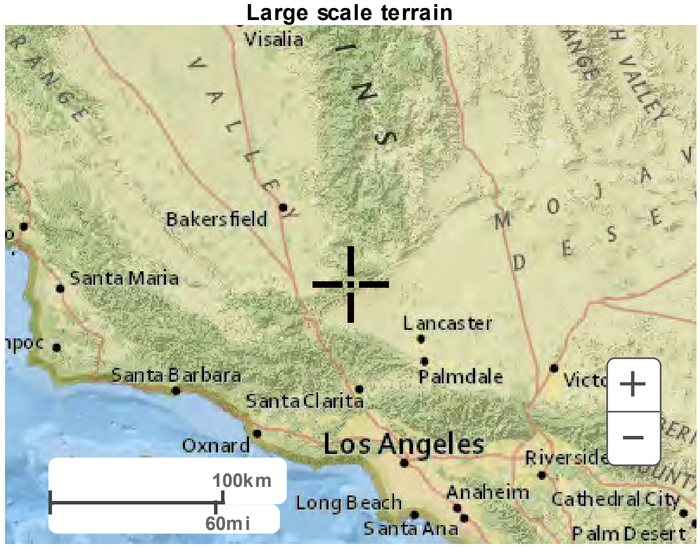
Maps & aerials

Small scale terrain

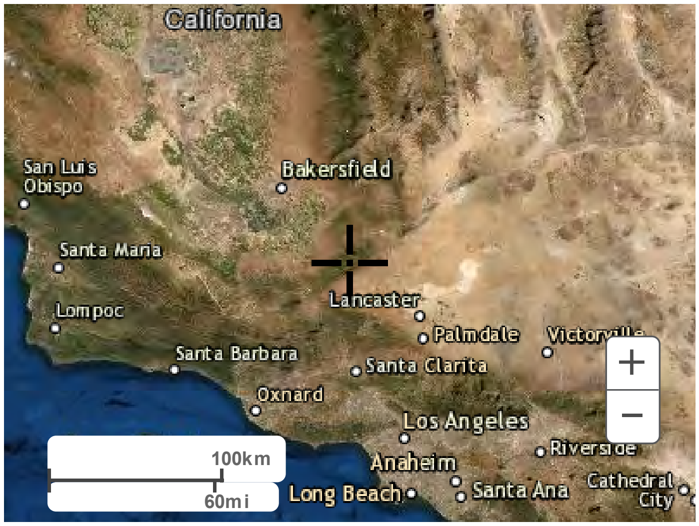


Large scale terrain



Large scale map

Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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NOAA Atlas 14, Volume 6, Version 2
Location name: Rosamond, California, USA*
Latitude: 34.8415°, Longitude: -118.3431°
Elevation: 2523.64 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.075 (0.062-0.092)	0.099 (0.082-0.122)	0.133 (0.109-0.163)	0.161 (0.132-0.199)	0.202 (0.159-0.258)	0.235 (0.181-0.307)	0.269 (0.203-0.361)	0.306 (0.225-0.422)	0.359 (0.252-0.516)	0.401 (0.272-0.597)
10-min	0.108 (0.089-0.132)	0.142 (0.118-0.174)	0.190 (0.157-0.234)	0.231 (0.189-0.286)	0.289 (0.228-0.370)	0.336 (0.260-0.439)	0.386 (0.291-0.517)	0.439 (0.322-0.605)	0.514 (0.361-0.739)	0.575 (0.390-0.856)
15-min	0.130 (0.108-0.159)	0.172 (0.142-0.211)	0.230 (0.190-0.282)	0.279 (0.228-0.345)	0.350 (0.276-0.448)	0.407 (0.314-0.531)	0.467 (0.352-0.626)	0.531 (0.389-0.732)	0.622 (0.437-0.894)	0.695 (0.472-1.03)
30-min	0.180 (0.149-0.220)	0.238 (0.196-0.291)	0.318 (0.262-0.390)	0.385 (0.315-0.477)	0.483 (0.381-0.618)	0.561 (0.434-0.733)	0.644 (0.486-0.863)	0.733 (0.537-1.01)	0.858 (0.603-1.23)	0.960 (0.651-1.43)
60-min	0.254 (0.210-0.311)	0.336 (0.277-0.411)	0.449 (0.369-0.551)	0.544 (0.444-0.673)	0.682 (0.538-0.872)	0.792 (0.612-1.04)	0.910 (0.686-1.22)	1.03 (0.759-1.43)	1.21 (0.852-1.74)	1.36 (0.920-2.02)
2-hr	0.379 (0.313-0.463)	0.499 (0.412-0.610)	0.661 (0.544-0.811)	0.797 (0.651-0.986)	0.988 (0.780-1.26)	1.14 (0.881-1.49)	1.30 (0.979-1.74)	1.46 (1.07-2.02)	1.69 (1.19-2.43)	1.87 (1.27-2.78)
3-hr	0.476 (0.393-0.582)	0.626 (0.517-0.766)	0.828 (0.681-1.02)	0.996 (0.813-1.23)	1.23 (0.972-1.58)	1.42 (1.10-1.85)	1.61 (1.21-2.15)	1.81 (1.33-2.49)	2.08 (1.46-2.99)	2.29 (1.56-3.41)
6-hr	0.671 (0.555-0.820)	0.889 (0.734-1.09)	1.18 (0.969-1.45)	1.42 (1.16-1.75)	1.74 (1.38-2.23)	2.00 (1.54-2.61)	2.26 (1.70-3.03)	2.53 (1.85-3.48)	2.89 (2.03-4.16)	3.17 (2.15-4.72)
12-hr	0.874 (0.722-1.07)	1.20 (0.989-1.47)	1.62 (1.34-1.99)	1.97 (1.60-2.43)	2.43 (1.92-3.11)	2.78 (2.15-3.64)	3.14 (2.37-4.20)	3.50 (2.56-4.82)	3.98 (2.80-5.72)	4.34 (2.95-6.46)
24-hr	1.14 (1.01-1.31)	1.62 (1.44-1.87)	2.25 (1.98-2.59)	2.74 (2.40-3.19)	3.41 (2.89-4.10)	3.91 (3.25-4.81)	4.42 (3.57-5.57)	4.93 (3.88-6.39)	5.60 (4.23-7.58)	6.11 (4.45-8.56)
2-day	1.40 (1.24-1.61)	2.00 (1.77-2.30)	2.78 (2.46-3.21)	3.42 (3.00-3.98)	4.27 (3.62-5.14)	4.92 (4.08-6.05)	5.57 (4.51-7.02)	6.24 (4.91-8.09)	7.12 (5.37-9.63)	7.80 (5.68-10.9)
3-day	1.55 (1.37-1.78)	2.21 (1.96-2.55)	3.10 (2.74-3.58)	3.82 (3.35-4.44)	4.79 (4.06-5.76)	5.53 (4.59-6.80)	6.28 (5.08-7.91)	7.04 (5.54-9.14)	8.08 (6.09-10.9)	8.87 (6.47-12.4)
4-day	1.65 (1.46-1.90)	2.37 (2.10-2.73)	3.33 (2.94-3.84)	4.10 (3.60-4.78)	5.16 (4.37-6.21)	5.96 (4.95-7.34)	6.79 (5.49-8.55)	7.63 (6.00-9.89)	8.77 (6.61-11.9)	9.64 (7.02-13.5)
7-day	1.84 (1.64-2.12)	2.64 (2.34-3.04)	3.72 (3.29-4.29)	4.60 (4.03-5.36)	5.80 (4.92-6.99)	6.73 (5.58-8.27)	7.66 (6.20-9.66)	8.62 (6.78-11.2)	9.91 (7.48-13.4)	10.9 (7.94-15.3)
10-day	1.93 (1.71-2.22)	2.77 (2.46-3.19)	3.91 (3.46-4.52)	4.85 (4.25-5.65)	6.14 (5.20-7.39)	7.13 (5.92-8.77)	8.14 (6.59-10.3)	9.17 (7.22-11.9)	10.6 (7.98-14.3)	11.6 (8.48-16.3)
20-day	2.26 (2.01-2.60)	3.28 (2.91-3.78)	4.68 (4.14-5.41)	5.85 (5.13-6.81)	7.49 (6.35-9.02)	8.77 (7.28-10.8)	10.1 (8.17-12.7)	11.5 (9.01-14.8)	13.3 (10.0-18.0)	14.7 (10.7-20.6)
30-day	2.60 (2.30-2.99)	3.77 (3.35-4.35)	5.41 (4.78-6.25)	6.80 (5.96-7.91)	8.76 (7.42-10.5)	10.3 (8.55-12.7)	11.9 (9.62-15.0)	13.5 (10.7-17.6)	15.8 (11.9-21.4)	17.5 (12.8-24.5)
45-day	3.06 (2.71-3.51)	4.44 (3.93-5.11)	6.37 (5.63-7.35)	8.02 (7.03-9.34)	10.4 (8.81-12.5)	12.3 (10.2-15.1)	14.2 (11.5-18.0)	16.3 (12.8-21.1)	19.1 (14.4-25.8)	21.2 (15.5-29.8)
60-day	3.45 (3.06-3.96)	4.97 (4.41-5.73)	7.14 (6.31-8.24)	9.00 (7.89-10.5)	11.7 (9.89-14.1)	13.8 (11.5-17.0)	16.1 (13.0-20.3)	18.4 (14.5-23.9)	21.6 (16.3-29.3)	24.1 (17.6-33.8)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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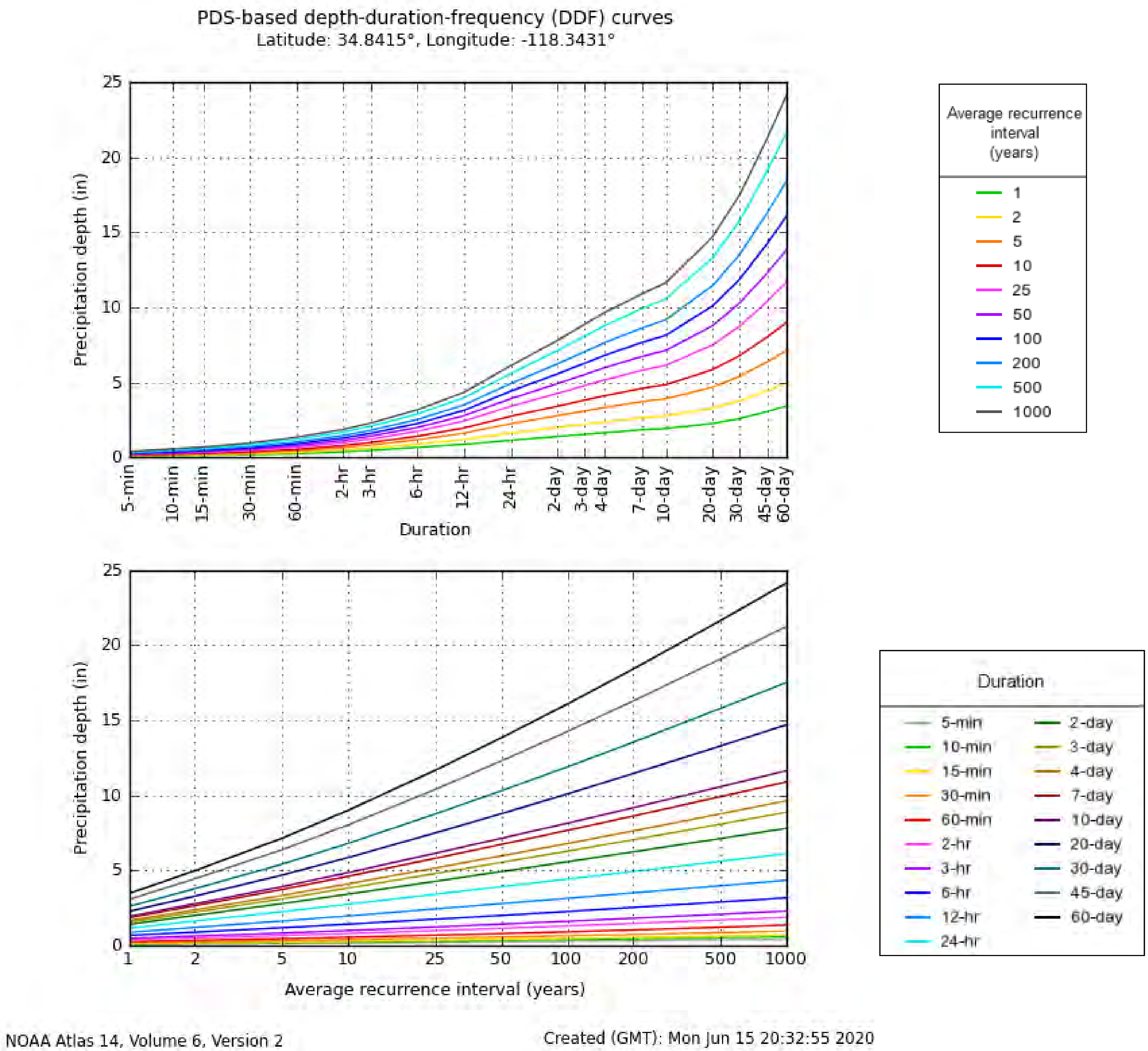
PF graphical



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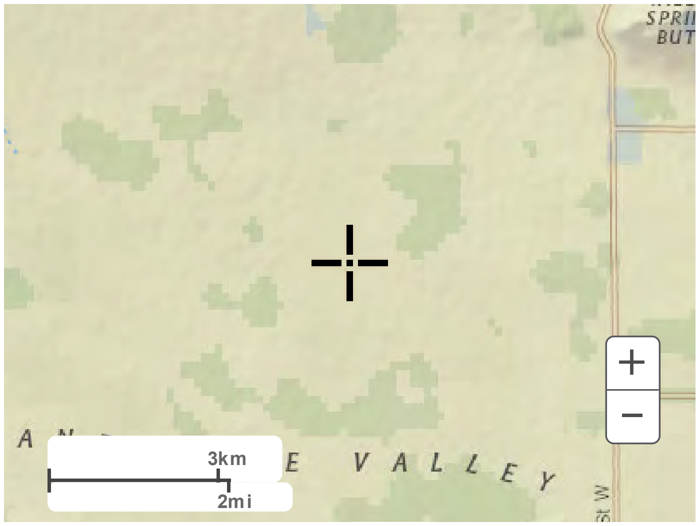
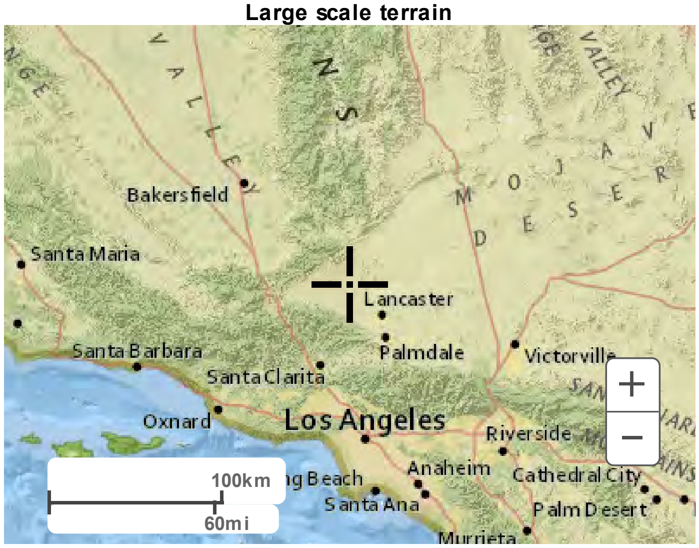
Maps & aerials

Small scale terrain



Large scale terrain



Large scale map

Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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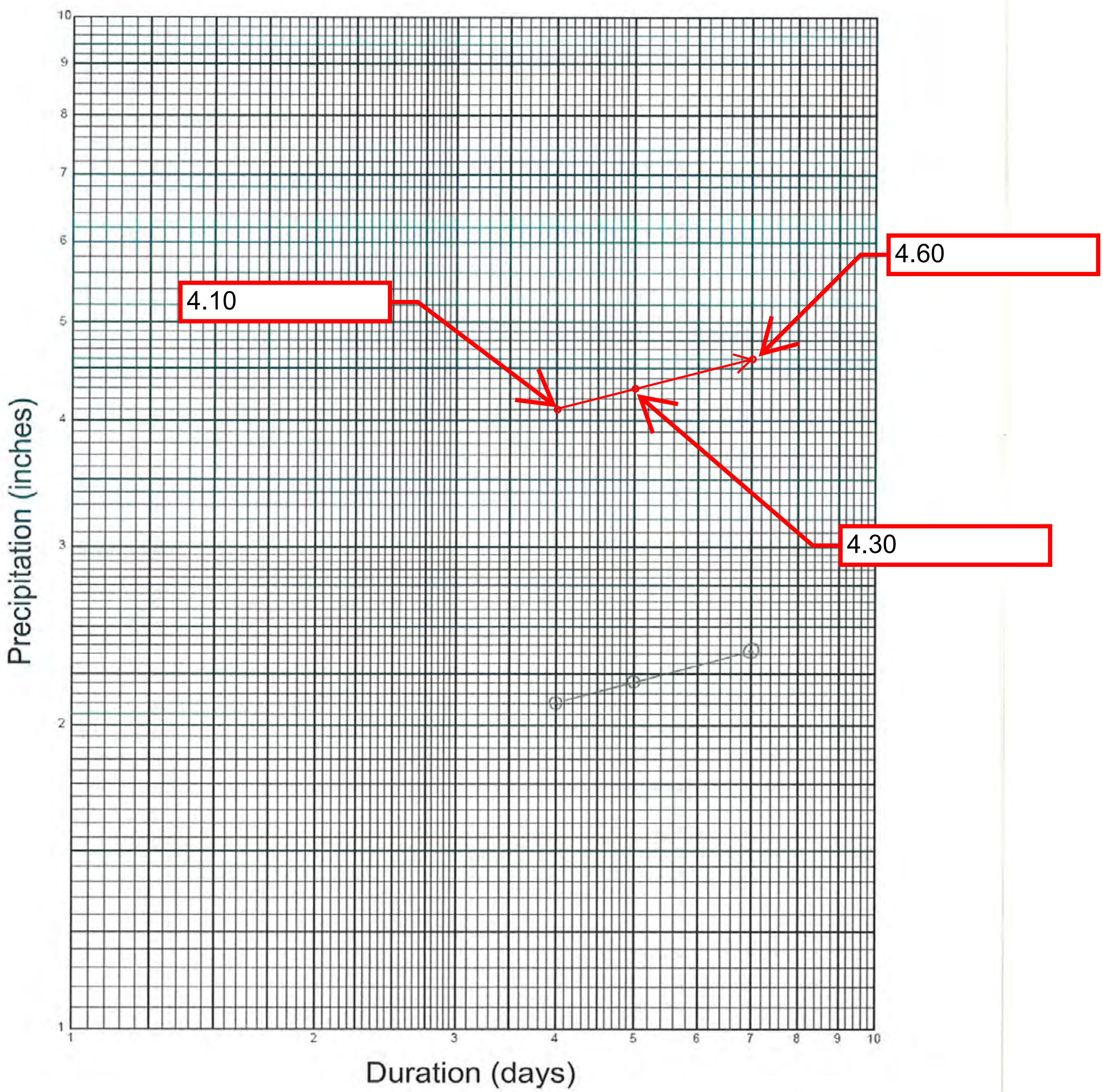
6) Select 10yr 4day rainfall depth – **2.10** and 10yr 7 day rainfall depth – **2.36**
7) Plot points on log–log graph paper.



8) Read the solution for the 10 yr 5 day depth of rainfall– **2.20 inches**

Appendix B

Kern County Curve Number Table

Residential Landscaping (Lawn, Shrubs, etc.) - The pervious portions of commercial establishments, single and multiple family dwellings, trailer parks and schools where the predominant land cover is lawn, shrubbery and trees.

Row Crops - Lettuce, tomatoes, beets, tulips or any field crop planted in rows far enough apart that most of the soil surface is exposed to rainfall impact throughout the growing season. At plowing, planting and harvest times it is equivalent to fallow.

Small Grain - Wheat, oats, barley, flax, etc. planted in rows close enough that the soil surface is not exposed except during planting and shortly thereafter.

Legumes - Alfalfa, sweetclover, timothy, etc. and combinations are either planted in close rows or broadcast.

Fallow - Fallow land is land plowed but not yet seeded or tilled.

Woodland - grass - Areas with an open cover of broadleaf or coniferous trees usually live oak and pines, with the intervening ground space occupied by annual grasses or weeds. The trees may occur singly or in small clumps. Canopy density, the amount of ground surface shaded at high noon, is from 20 to 50 percent.

Woodland - Areas on which coniferous or broadleaf trees predominate. The canopy density is at least 50 percent. Open areas may have a cover of annual or perennial grasses or of brush. Herbaceous plant cover under the trees is usually sparse because of leaf or needle litter accumulation.

Chaparral - Land on which the principal vegetation consists of evergreen shrubs with broad, hard, stiff leaves such as manzonita, ceanothus and scrub oak. The brush cover is usually dense or moderately dense. Diffusely branched evergreen shrubs with fine needle-like leaves, such as chamise and redchank, with dense high growth are also included in this soil cover.

Annual Grass - Land on which the principal vegetation consists of annual grasses and weeds such as annual bromes, wild barley, soft chess, ryegrass and filaree.

Irrigated Pasture - Irrigated land planted to perennial grasses and legumes for production of forage and which is cultivated only to establish or renew the stand of plants. Dry land pasture is considered as annual grass.

Meadow - Land areas with seasonally high water table, locally called cienegas. Principal vegetation consists of sod-forming grasses interspersed with other plants.

Orchard (Deciduous) - Land planted to such deciduous trees as apples, apricots, pears, walnuts, and almonds.

Orchard (Evergreen) - Land planted to evergreen trees which include citrus and avocados and coniferous plantings.

Turf - Golf courses, parks and similar lands where the predominant cover is irrigated mowed close-grown turf grass. Parks in which trees are dense may be classified as woodland.

SCS
COVER TYPE
DESCRIPTIONS

FIGURE C-1

(CN Here)

Curve(1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		77	86	91	94
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and Redskank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadows or Cienagas (Areas with seasonally high water table, principal vegatation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs-buckwheat,sage,etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (4) (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawns, shrubs, etc.)	Good	39	61	74	80
Turf (Irrigated and mowed grass)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80

Curve[1] Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS -					
Fallow (Bare Soil)		77	86	91	94
Close Seeded (alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avacodos, etc.)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Pasture (Grassland or range, continuos forage for grazing)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Row Crops (Straight row, non-contoured)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Straight row, non-contoured)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. Average runoff condition, Ia = 0.2(S)

2. Poor: Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair: Moderate cover with 50 percent to 75 percent of the ground surface protected. In wooded areas the woods are grazed but not burned, and some forest litter covers the soil.

   Good: Heavy or dense cover with more than 75 percent of the ground surface protected. In wooded areas the woods are protected from grazing, litter and brush adequately cover soil.

3. See Figure C-1 for definition of cover types.

Appendix C

FEMA FIRM Panels

NOTES TO USERS

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Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was derived from USDA - Farm Service Agency - Aerial Photography Field Office dated 2005 and from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1992 or later.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

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Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a *Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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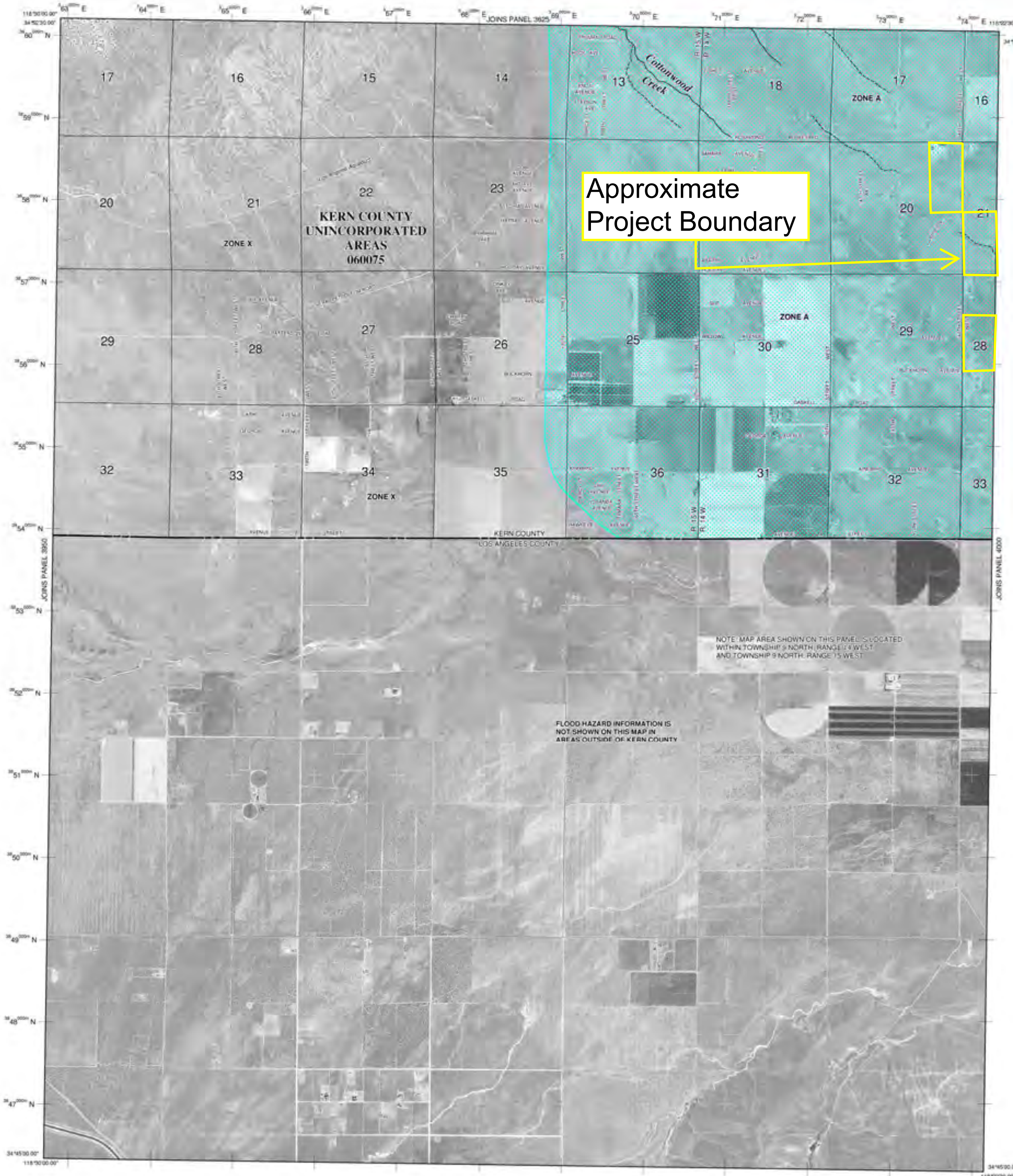

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

~~ 513 ~~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

A —— A	Cross section line
23 - - - - 23	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000m N	1000-meter Universal Transverse Mercator grid ticks, zone 11
6000000 M	5000-foot grid ticks: California State Plane coordinate system, V zone (FIPSZONE 0405), Lambert Conformal Conic
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

N

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

600 0 600 1200 METERS

NFIP

PANEL 3975E

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

KERN COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 3975 OF 4125
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KERN COUNTY	060075	3975	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06029C3975E

EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

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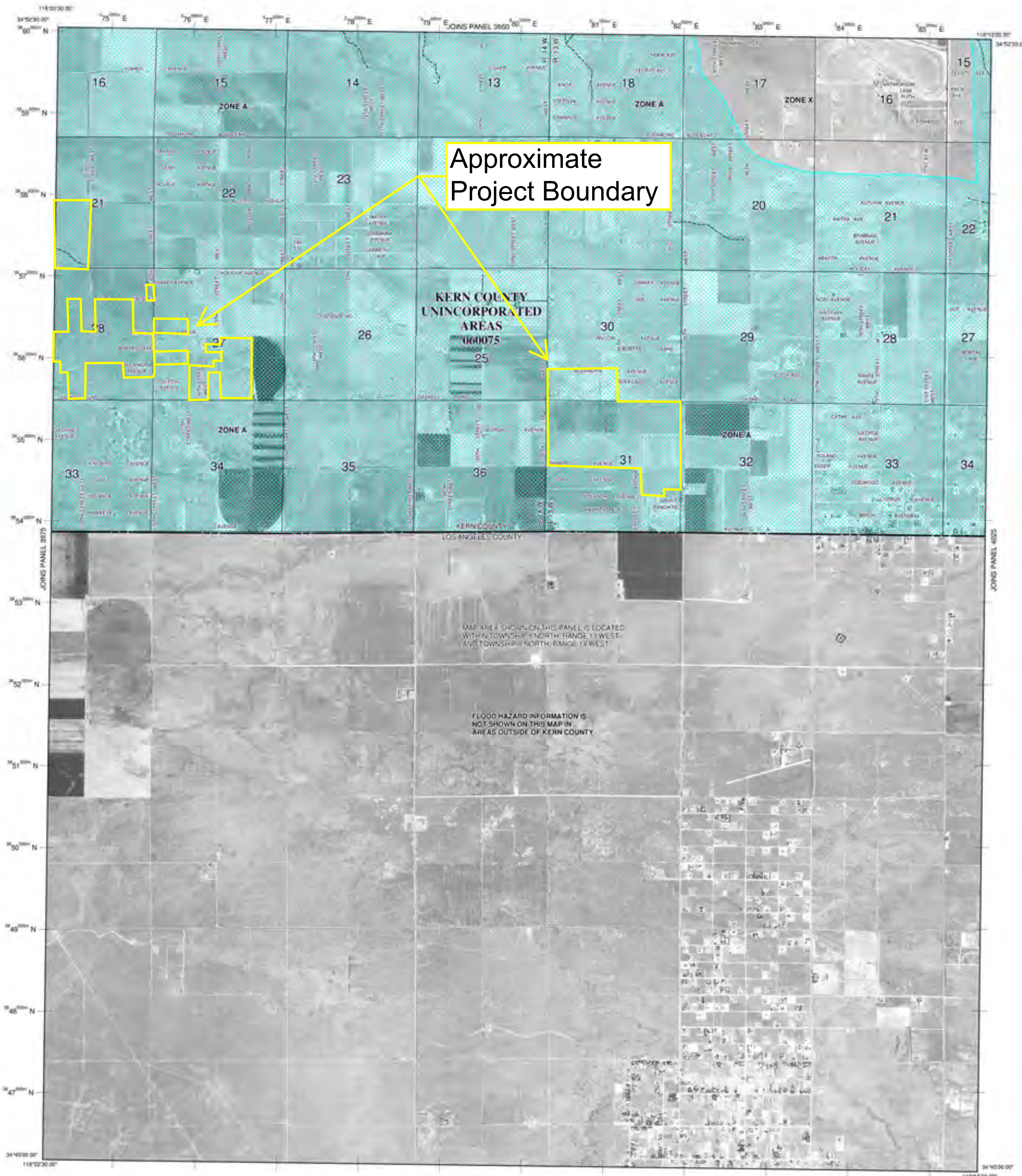

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(EL 987) Base Flood Elevation value where uniform within zone; elevation in feet*

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N

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600 0 600 1200 METERS

NFIP

PANEL 4000E

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP
KERN COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 4000 OF 4125
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KERN COUNTY	060075	4000	E

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MAP NUMBER
06029C4000E

EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

Appendix D

CivilD Printouts (Kern County Hydrology Manual)

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 06/29/20

++

Kern County Synthetic Unit Hydrograph Hydrology Method
Manual date - 1992

Program License Serial Number 6271

Rosamond South Solar

Storm Event Year = 100

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

RAINFALL DATA INPUT:
Slope of Intensity-Duration Curve Slope = 0.600

Zone Designation: Desert Region Latitude = 34.84

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 2		
1932.00	6	1.30
Rainfall data for year 2		
1932.00	24	2.44
Rainfall data for year 100		
1932.00	6	3.25
Rainfall data for year 100		
1932.00	24	6.33

++
DESERT REGION area of study
Log-Log Rainfall Intensity Slope = 0.60

******** Area-averaged max loss rate, Fm ********

SCS curve   Area   Area   Fp   Ap   Fm

```
Number          (Ac.)    Fraction   (In/Hr)  (dec.)   (In/Hr)
 78.0       1932.00      1.000     0.416    1.000    0.416

Area-averaged adjusted loss rate Fm (In/Hr) =  0.416

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN        S     Pervious
 (Ac.)      Fract         (AMC2)             Yield Fr
  1932.00   1.000         78.0         2.82     0.612

Area-averaged catchment yield fraction, Y =  0.612
Area-averaged low loss fraction, Yb =  0.388
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watercourse length =   25978.00(Ft.)
Length from concentration point to centroid =   11209.00(Ft.)
Elevation difference along watercourse =    3556.00(Ft.)
Mannings friction factor along watercourse =  0.050
Watershed area =    1932.00(Ac.)
Catchment Lag time =   0.838 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time =  9.9463
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.416(In/Hr)
Average low loss rate fraction (Yb) = 0.388 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.606(In)
Computed peak 30-minute rainfall =  1.242(In)
Specified peak 1-hour rainfall =  1.639(In)
Computed peak 3-hour rainfall =  2.494(In)
Specified peak 6-hour rainfall =  3.250(In)
Specified peak 24-hour rainfall =  6.330(In)


Note: User specified rainfall values used.
Computed peak 5-minute rainfall =  0.360(In)
Computed peak 30-minute rainfall =  0.880(In)
Specified peak 1-hour rainfall =  1.280(In)
Computed peak 3-hour rainfall =  2.250(In)
Specified peak 6-hour rainfall =  3.250(In)
Specified peak 24-hour rainfall =  6.330(In)


Rainfall depth area reduction factors:
Using a total area of    1932.00(Ac.) (Ref: fig. E-4)

5-minute factor = 0.914     Adjusted rainfall =  0.329(In)
30-minute factor = 0.914    Adjusted rainfall =  0.804(In)
1-hour factor = 0.914       Adjusted rainfall =  1.170(In)
3-hour factor = 0.987       Adjusted rainfall =  2.221(In)
6-hour factor = 0.994       Adjusted rainfall =  3.229(In)
24-hour factor = 0.996      Adjusted rainfall =  6.305(In)
---------------------------------------------------------------------

                        U n i t   H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval         'S' Graph         Unit Hydrograph
Number           Mean values           ((CFS))
---------------------------------------------------------------------
                (K =     23365.12 (CFS))

  1               0.553                 129.109
  2               1.670                 261.193
```

3	3.251	369.235
4	5.486	522.160
5	8.738	759.944
6	13.280	1061.168
7	20.741	1743.432
8	30.597	2302.854
9	41.407	2525.594
10	46.327	1149.579
11	52.216	1375.992
12	56.919	1098.997
13	60.914	933.320
14	64.332	798.577
15	67.054	636.176
16	69.528	578.010
17	71.784	527.187
18	73.797	470.279
19	75.625	427.088
20	77.224	373.479
21	78.700	344.953
22	80.105	328.209
23	81.438	311.615
24	82.638	280.221
25	83.736	256.543
26	84.694	223.875
27	85.598	211.231
28	86.442	197.230
29	87.238	185.917
30	88.014	181.369
31	88.691	158.183
32	89.354	154.931
33	90.002	151.364
34	90.567	132.015
35	91.119	129.109
36	91.672	129.109
37	92.188	120.479
38	92.651	108.184
39	93.113	108.091
40	93.576	108.091
41	94.013	102.064
42	94.337	75.708
43	94.647	72.624
44	94.958	72.624
45	95.269	72.624
46	95.580	72.624
47	95.889	72.273
48	96.113	52.321
49	96.288	40.771
50	96.462	40.771
51	96.637	40.771
52	96.811	40.771
53	96.986	40.771
54	97.160	40.771
55	97.335	40.771
56	97.509	40.771
57	97.684	40.771
58	97.858	40.771
59	98.015	36.635
60	98.118	24.099
61	98.218	23.240
62	98.317	23.240
63	98.416	23.240
64	98.516	23.240
65	98.615	23.240

66	98.715	23.240
67	98.814	23.240
68	98.914	23.240
69	99.013	23.240
70	99.113	23.240
71	99.212	23.240
72	99.312	23.240
73	99.411	23.240
74	99.511	23.240
75	99.610	23.240
76	99.709	23.240
77	99.809	23.240
78	100.000	44.645

Rainfall values calculated at 5 minute intervals:

Peak Rainfall Unit Number	Intensity	Depth	Adjusted	Unit Rainfall (In)
1	4.32	0.36	0.33	0.329
2	3.05	0.51	0.46	0.136
3	2.49	0.62	0.57	0.104
4	2.16	0.72	0.66	0.088
5	1.93	0.80	0.73	0.077
6	1.76	0.88	0.80	0.070
7	1.64	0.96	0.87	0.070
8	1.54	1.03	0.94	0.065
9	1.46	1.10	1.00	0.062
10	1.39	1.16	1.06	0.059
11	1.33	1.22	1.12	0.056
12	1.28	1.28	1.17	0.054
13	1.23	1.33	1.23	0.056
14	1.19	1.39	1.28	0.054
15	1.15	1.44	1.33	0.053
16	1.11	1.48	1.38	0.051
17	1.08	1.53	1.43	0.050
18	1.05	1.58	1.48	0.049
19	1.02	1.62	1.53	0.048
20	1.00	1.66	1.58	0.046
21	0.97	1.71	1.62	0.046
22	0.95	1.75	1.67	0.045
23	0.93	1.79	1.71	0.044
24	0.91	1.83	1.75	0.043
25	0.90	1.87	1.80	0.042
26	0.88	1.90	1.84	0.042
27	0.86	1.94	1.88	0.041
28	0.85	1.98	1.92	0.040
29	0.83	2.01	1.96	0.040
30	0.82	2.05	2.00	0.039
31	0.81	2.08	2.04	0.039
32	0.79	2.12	2.07	0.038
33	0.78	2.15	2.11	0.038
34	0.77	2.18	2.15	0.037
35	0.76	2.22	2.18	0.037
36	0.75	2.25	2.22	0.036
37	0.74	2.28	2.25	0.033
38	0.73	2.32	2.29	0.033
39	0.72	2.35	2.32	0.032
40	0.71	2.38	2.35	0.032
41	0.71	2.41	2.38	0.032
42	0.70	2.44	2.41	0.031
43	0.69	2.47	2.44	0.031
44	0.68	2.50	2.48	0.031
45	0.68	2.53	2.51	0.030
46	0.67	2.56	2.54	0.030

47	0.66	2.59	2.56	0.030
48	0.66	2.62	2.59	0.029
49	0.65	2.65	2.62	0.029
50	0.64	2.68	2.65	0.029
51	0.64	2.71	2.68	0.029
52	0.63	2.73	2.71	0.028
53	0.63	2.76	2.74	0.028
54	0.62	2.79	2.76	0.028
55	0.61	2.82	2.79	0.028
56	0.61	2.84	2.82	0.027
57	0.60	2.87	2.85	0.027
58	0.60	2.90	2.87	0.027
59	0.59	2.92	2.90	0.027
60	0.59	2.95	2.93	0.026
61	0.59	2.98	2.95	0.026
62	0.58	3.00	2.98	0.026
63	0.58	3.03	3.00	0.026
64	0.57	3.05	3.03	0.026
65	0.57	3.08	3.06	0.025
66	0.56	3.10	3.08	0.025
67	0.56	3.13	3.11	0.025
68	0.56	3.15	3.13	0.025
69	0.55	3.18	3.16	0.025
70	0.55	3.20	3.18	0.025
71	0.55	3.23	3.20	0.024
72	0.54	3.25	3.23	0.024
73	0.54	3.26	3.25	0.022
74	0.53	3.28	3.27	0.021
75	0.53	3.30	3.29	0.021
76	0.52	3.32	3.31	0.021
77	0.52	3.35	3.34	0.021
78	0.52	3.37	3.36	0.021
79	0.51	3.39	3.38	0.021
80	0.51	3.41	3.40	0.021
81	0.51	3.43	3.42	0.020
82	0.50	3.45	3.44	0.020
83	0.50	3.47	3.46	0.020
84	0.50	3.49	3.48	0.020
85	0.50	3.51	3.50	0.020
86	0.49	3.53	3.52	0.020
87	0.49	3.55	3.54	0.020
88	0.49	3.57	3.56	0.020
89	0.48	3.59	3.58	0.019
90	0.48	3.61	3.60	0.019
91	0.48	3.63	3.62	0.019
92	0.48	3.64	3.63	0.019
93	0.47	3.66	3.65	0.019
94	0.47	3.68	3.67	0.019
95	0.47	3.70	3.69	0.019
96	0.46	3.72	3.71	0.019
97	0.46	3.74	3.73	0.019
98	0.46	3.76	3.75	0.019
99	0.46	3.78	3.77	0.018
100	0.46	3.79	3.78	0.018
101	0.45	3.81	3.80	0.018
102	0.45	3.83	3.82	0.018
103	0.45	3.85	3.84	0.018
104	0.45	3.87	3.86	0.018
105	0.44	3.88	3.87	0.018
106	0.44	3.90	3.89	0.018
107	0.44	3.92	3.91	0.018
108	0.44	3.94	3.93	0.018
109	0.44	3.95	3.94	0.018

110	0.43	3.97	3.96	0.017
111	0.43	3.99	3.98	0.017
112	0.43	4.01	4.00	0.017
113	0.43	4.02	4.01	0.017
114	0.43	4.04	4.03	0.017
115	0.42	4.06	4.05	0.017
116	0.42	4.07	4.06	0.017
117	0.42	4.09	4.08	0.017
118	0.42	4.11	4.10	0.017
119	0.42	4.12	4.12	0.017
120	0.41	4.14	4.13	0.017
121	0.41	4.16	4.15	0.017
122	0.41	4.17	4.17	0.017
123	0.41	4.19	4.18	0.016
124	0.41	4.21	4.20	0.016
125	0.41	4.22	4.21	0.016
126	0.40	4.24	4.23	0.016
127	0.40	4.26	4.25	0.016
128	0.40	4.27	4.26	0.016
129	0.40	4.29	4.28	0.016
130	0.40	4.30	4.29	0.016
131	0.40	4.32	4.31	0.016
132	0.39	4.34	4.33	0.016
133	0.39	4.35	4.34	0.016
134	0.39	4.37	4.36	0.016
135	0.39	4.38	4.37	0.016
136	0.39	4.40	4.39	0.016
137	0.39	4.41	4.40	0.016
138	0.39	4.43	4.42	0.015
139	0.38	4.44	4.44	0.015
140	0.38	4.46	4.45	0.015
141	0.38	4.47	4.47	0.015
142	0.38	4.49	4.48	0.015
143	0.38	4.51	4.50	0.015
144	0.38	4.52	4.51	0.015
145	0.38	4.54	4.53	0.015
146	0.37	4.55	4.54	0.015
147	0.37	4.57	4.56	0.015
148	0.37	4.58	4.57	0.015
149	0.37	4.60	4.59	0.015
150	0.37	4.61	4.60	0.015
151	0.37	4.62	4.62	0.015
152	0.37	4.64	4.63	0.015
153	0.37	4.65	4.65	0.015
154	0.36	4.67	4.66	0.015
155	0.36	4.68	4.68	0.015
156	0.36	4.70	4.69	0.015
157	0.36	4.71	4.70	0.014
158	0.36	4.73	4.72	0.014
159	0.36	4.74	4.73	0.014
160	0.36	4.76	4.75	0.014
161	0.36	4.77	4.76	0.014
162	0.35	4.78	4.78	0.014
163	0.35	4.80	4.79	0.014
164	0.35	4.81	4.80	0.014
165	0.35	4.83	4.82	0.014
166	0.35	4.84	4.83	0.014
167	0.35	4.85	4.85	0.014
168	0.35	4.87	4.86	0.014
169	0.35	4.88	4.87	0.014
170	0.35	4.90	4.89	0.014
171	0.34	4.91	4.90	0.014
172	0.34	4.92	4.92	0.014

173	0.34	4.94	4.93	0.014
174	0.34	4.95	4.94	0.014
175	0.34	4.96	4.96	0.014
176	0.34	4.98	4.97	0.014
177	0.34	4.99	4.98	0.014
178	0.34	5.01	5.00	0.014
179	0.34	5.02	5.01	0.014
180	0.34	5.03	5.03	0.013
181	0.33	5.05	5.04	0.013
182	0.33	5.06	5.05	0.013
183	0.33	5.07	5.07	0.013
184	0.33	5.09	5.08	0.013
185	0.33	5.10	5.09	0.013
186	0.33	5.11	5.11	0.013
187	0.33	5.13	5.12	0.013
188	0.33	5.14	5.13	0.013
189	0.33	5.15	5.15	0.013
190	0.33	5.17	5.16	0.013
191	0.33	5.18	5.17	0.013
192	0.32	5.19	5.18	0.013
193	0.32	5.20	5.20	0.013
194	0.32	5.22	5.21	0.013
195	0.32	5.23	5.22	0.013
196	0.32	5.24	5.24	0.013
197	0.32	5.26	5.25	0.013
198	0.32	5.27	5.26	0.013
199	0.32	5.28	5.27	0.013
200	0.32	5.29	5.29	0.013
201	0.32	5.31	5.30	0.013
202	0.32	5.32	5.31	0.013
203	0.32	5.33	5.33	0.013
204	0.31	5.34	5.34	0.013
205	0.31	5.36	5.35	0.013
206	0.31	5.37	5.36	0.013
207	0.31	5.38	5.38	0.013
208	0.31	5.39	5.39	0.013
209	0.31	5.41	5.40	0.012
210	0.31	5.42	5.41	0.012
211	0.31	5.43	5.43	0.012
212	0.31	5.44	5.44	0.012
213	0.31	5.46	5.45	0.012
214	0.31	5.47	5.46	0.012
215	0.31	5.48	5.48	0.012
216	0.31	5.49	5.49	0.012
217	0.30	5.51	5.50	0.012
218	0.30	5.52	5.51	0.012
219	0.30	5.53	5.52	0.012
220	0.30	5.54	5.54	0.012
221	0.30	5.55	5.55	0.012
222	0.30	5.57	5.56	0.012
223	0.30	5.58	5.57	0.012
224	0.30	5.59	5.59	0.012
225	0.30	5.60	5.60	0.012
226	0.30	5.61	5.61	0.012
227	0.30	5.63	5.62	0.012
228	0.30	5.64	5.63	0.012
229	0.30	5.65	5.64	0.012
230	0.30	5.66	5.66	0.012
231	0.29	5.67	5.67	0.012
232	0.29	5.69	5.68	0.012
233	0.29	5.70	5.69	0.012
234	0.29	5.71	5.70	0.012
235	0.29	5.72	5.72	0.012

236	0.29	5.73	5.73	0.012
237	0.29	5.74	5.74	0.012
238	0.29	5.76	5.75	0.012
239	0.29	5.77	5.76	0.012
240	0.29	5.78	5.77	0.012
241	0.29	5.79	5.79	0.012
242	0.29	5.80	5.80	0.012
243	0.29	5.81	5.81	0.012
244	0.29	5.83	5.82	0.012
245	0.29	5.84	5.83	0.012
246	0.29	5.85	5.84	0.011
247	0.28	5.86	5.85	0.011
248	0.28	5.87	5.87	0.011
249	0.28	5.88	5.88	0.011
250	0.28	5.89	5.89	0.011
251	0.28	5.91	5.90	0.011
252	0.28	5.92	5.91	0.011
253	0.28	5.93	5.92	0.011
254	0.28	5.94	5.93	0.011
255	0.28	5.95	5.95	0.011
256	0.28	5.96	5.96	0.011
257	0.28	5.97	5.97	0.011
258	0.28	5.98	5.98	0.011
259	0.28	5.99	5.99	0.011
260	0.28	6.01	6.00	0.011
261	0.28	6.02	6.01	0.011
262	0.28	6.03	6.02	0.011
263	0.28	6.04	6.03	0.011
264	0.28	6.05	6.05	0.011
265	0.27	6.06	6.06	0.011
266	0.27	6.07	6.07	0.011
267	0.27	6.08	6.08	0.011
268	0.27	6.09	6.09	0.011
269	0.27	6.11	6.10	0.011
270	0.27	6.12	6.11	0.011
271	0.27	6.13	6.12	0.011
272	0.27	6.14	6.13	0.011
273	0.27	6.15	6.14	0.011
274	0.27	6.16	6.16	0.011
275	0.27	6.17	6.17	0.011
276	0.27	6.18	6.18	0.011
277	0.27	6.19	6.19	0.011
278	0.27	6.20	6.20	0.011
279	0.27	6.21	6.21	0.011
280	0.27	6.22	6.22	0.011
281	0.27	6.23	6.23	0.011
282	0.27	6.25	6.24	0.011
283	0.27	6.26	6.25	0.011
284	0.26	6.27	6.26	0.011
285	0.26	6.28	6.27	0.011
286	0.26	6.29	6.28	0.011
287	0.26	6.30	6.29	0.011
288	0.26	6.31	6.31	0.011

Time = 24.00 Hours   Total unit rainfall = 6.31(In)

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0106	0.0041	0.0065
2	0.0106	0.0041	0.0065
3	0.0106	0.0041	0.0065
4	0.0107	0.0041	0.0065

5	0.0107	0.0042	0.0065
6	0.0107	0.0042	0.0066
7	0.0108	0.0042	0.0066
8	0.0108	0.0042	0.0066
9	0.0108	0.0042	0.0066
10	0.0108	0.0042	0.0066
11	0.0109	0.0042	0.0067
12	0.0109	0.0042	0.0067
13	0.0109	0.0042	0.0067
14	0.0110	0.0043	0.0067
15	0.0110	0.0043	0.0067
16	0.0110	0.0043	0.0067
17	0.0111	0.0043	0.0068
18	0.0111	0.0043	0.0068
19	0.0111	0.0043	0.0068
20	0.0112	0.0043	0.0068
21	0.0112	0.0043	0.0069
22	0.0112	0.0044	0.0069
23	0.0113	0.0044	0.0069
24	0.0113	0.0044	0.0069
25	0.0113	0.0044	0.0069
26	0.0114	0.0044	0.0069
27	0.0114	0.0044	0.0070
28	0.0114	0.0044	0.0070
29	0.0115	0.0045	0.0070
30	0.0115	0.0045	0.0070
31	0.0116	0.0045	0.0071
32	0.0116	0.0045	0.0071
33	0.0116	0.0045	0.0071
34	0.0117	0.0045	0.0071
35	0.0117	0.0045	0.0072
36	0.0117	0.0046	0.0072
37	0.0118	0.0046	0.0072
38	0.0118	0.0046	0.0072
39	0.0119	0.0046	0.0073
40	0.0119	0.0046	0.0073
41	0.0119	0.0046	0.0073
42	0.0120	0.0046	0.0073
43	0.0120	0.0047	0.0074
44	0.0121	0.0047	0.0074
45	0.0121	0.0047	0.0074
46	0.0121	0.0047	0.0074
47	0.0122	0.0047	0.0075
48	0.0122	0.0047	0.0075
49	0.0123	0.0048	0.0075
50	0.0123	0.0048	0.0075
51	0.0124	0.0048	0.0076
52	0.0124	0.0048	0.0076
53	0.0125	0.0048	0.0076
54	0.0125	0.0049	0.0076
55	0.0126	0.0049	0.0077
56	0.0126	0.0049	0.0077
57	0.0126	0.0049	0.0077
58	0.0127	0.0049	0.0078
59	0.0127	0.0049	0.0078
60	0.0128	0.0050	0.0078
61	0.0128	0.0050	0.0079
62	0.0129	0.0050	0.0079
63	0.0129	0.0050	0.0079
64	0.0130	0.0050	0.0079
65	0.0131	0.0051	0.0080
66	0.0131	0.0051	0.0080
67	0.0132	0.0051	0.0080

68	0.0132	0.0051	0.0081
69	0.0133	0.0052	0.0081
70	0.0133	0.0052	0.0081
71	0.0134	0.0052	0.0082
72	0.0134	0.0052	0.0082
73	0.0135	0.0052	0.0083
74	0.0135	0.0053	0.0083
75	0.0136	0.0053	0.0083
76	0.0137	0.0053	0.0084
77	0.0137	0.0053	0.0084
78	0.0138	0.0054	0.0084
79	0.0139	0.0054	0.0085
80	0.0139	0.0054	0.0085
81	0.0140	0.0054	0.0086
82	0.0140	0.0054	0.0086
83	0.0141	0.0055	0.0086
84	0.0142	0.0055	0.0087
85	0.0143	0.0055	0.0087
86	0.0143	0.0056	0.0087
87	0.0144	0.0056	0.0088
88	0.0144	0.0056	0.0088
89	0.0145	0.0056	0.0089
90	0.0146	0.0057	0.0089
91	0.0147	0.0057	0.0090
92	0.0147	0.0057	0.0090
93	0.0148	0.0058	0.0091
94	0.0149	0.0058	0.0091
95	0.0150	0.0058	0.0092
96	0.0150	0.0058	0.0092
97	0.0152	0.0059	0.0093
98	0.0152	0.0059	0.0093
99	0.0153	0.0059	0.0094
100	0.0154	0.0060	0.0094
101	0.0155	0.0060	0.0095
102	0.0156	0.0060	0.0095
103	0.0157	0.0061	0.0096
104	0.0157	0.0061	0.0096
105	0.0159	0.0062	0.0097
106	0.0159	0.0062	0.0097
107	0.0160	0.0062	0.0098
108	0.0161	0.0063	0.0099
109	0.0162	0.0063	0.0099
110	0.0163	0.0063	0.0100
111	0.0164	0.0064	0.0101
112	0.0165	0.0064	0.0101
113	0.0167	0.0065	0.0102
114	0.0167	0.0065	0.0102
115	0.0169	0.0066	0.0103
116	0.0170	0.0066	0.0104
117	0.0171	0.0066	0.0105
118	0.0172	0.0067	0.0105
119	0.0173	0.0067	0.0106
120	0.0174	0.0068	0.0107
121	0.0176	0.0068	0.0108
122	0.0177	0.0069	0.0108
123	0.0179	0.0069	0.0109
124	0.0179	0.0070	0.0110
125	0.0181	0.0070	0.0111
126	0.0182	0.0071	0.0111
127	0.0184	0.0071	0.0113
128	0.0185	0.0072	0.0113
129	0.0187	0.0073	0.0114
130	0.0188	0.0073	0.0115

131	0.0190	0.0074	0.0116
132	0.0191	0.0074	0.0117
133	0.0193	0.0075	0.0118
134	0.0195	0.0076	0.0119
135	0.0197	0.0076	0.0120
136	0.0198	0.0077	0.0121
137	0.0201	0.0078	0.0123
138	0.0202	0.0078	0.0123
139	0.0204	0.0079	0.0125
140	0.0206	0.0080	0.0126
141	0.0208	0.0081	0.0127
142	0.0210	0.0081	0.0128
143	0.0213	0.0083	0.0130
144	0.0214	0.0083	0.0131
145	0.0243	0.0094	0.0149
146	0.0245	0.0095	0.0150
147	0.0248	0.0096	0.0152
148	0.0249	0.0097	0.0153
149	0.0253	0.0098	0.0155
150	0.0255	0.0099	0.0156
151	0.0258	0.0100	0.0158
152	0.0260	0.0101	0.0159
153	0.0264	0.0103	0.0162
154	0.0266	0.0103	0.0163
155	0.0271	0.0105	0.0166
156	0.0273	0.0106	0.0167
157	0.0278	0.0108	0.0170
158	0.0280	0.0109	0.0171
159	0.0285	0.0111	0.0174
160	0.0288	0.0112	0.0176
161	0.0293	0.0114	0.0179
162	0.0296	0.0115	0.0181
163	0.0302	0.0117	0.0185
164	0.0305	0.0119	0.0187
165	0.0312	0.0121	0.0191
166	0.0316	0.0123	0.0193
167	0.0323	0.0125	0.0198
168	0.0327	0.0127	0.0200
169	0.0362	0.0141	0.0222
170	0.0367	0.0142	0.0224
171	0.0376	0.0146	0.0230
172	0.0381	0.0148	0.0233
173	0.0391	0.0152	0.0239
174	0.0397	0.0154	0.0243
175	0.0409	0.0159	0.0250
176	0.0416	0.0161	0.0254
177	0.0430	0.0167	0.0263
178	0.0438	0.0170	0.0268
179	0.0455	0.0177	0.0278
180	0.0465	0.0181	0.0284
181	0.0486	0.0189	0.0297
182	0.0498	0.0194	0.0305
183	0.0526	0.0204	0.0322
184	0.0542	0.0210	0.0331
185	0.0537	0.0209	0.0329
186	0.0560	0.0218	0.0343
187	0.0618	0.0240	0.0378
188	0.0654	0.0254	0.0400
189	0.0699	0.0271	0.0428
190	0.0773	0.0300	0.0473
191	0.1042	0.0347*	0.0695
192	0.1359	0.0347*	0.1012
193	0.3290	0.0347*	0.2943

194	0.0878	0.0341	0.0537
195	0.0699	0.0271	0.0427
196	0.0587	0.0228	0.0359
197	0.0559	0.0217	0.0342
198	0.0511	0.0199	0.0313
199	0.0475	0.0185	0.0291
200	0.0446	0.0173	0.0273
201	0.0423	0.0164	0.0259
202	0.0403	0.0156	0.0246
203	0.0386	0.0150	0.0236
204	0.0371	0.0144	0.0227
205	0.0331	0.0129	0.0202
206	0.0319	0.0124	0.0195
207	0.0309	0.0120	0.0189
208	0.0299	0.0116	0.0183
209	0.0290	0.0113	0.0178
210	0.0283	0.0110	0.0173
211	0.0275	0.0107	0.0168
212	0.0269	0.0104	0.0164
213	0.0262	0.0102	0.0160
214	0.0257	0.0100	0.0157
215	0.0251	0.0098	0.0154
216	0.0246	0.0096	0.0151
217	0.0216	0.0084	0.0132
218	0.0211	0.0082	0.0129
219	0.0207	0.0080	0.0127
220	0.0203	0.0079	0.0124
221	0.0199	0.0077	0.0122
222	0.0196	0.0076	0.0120
223	0.0192	0.0075	0.0118
224	0.0189	0.0073	0.0116
225	0.0186	0.0072	0.0114
226	0.0183	0.0071	0.0112
227	0.0180	0.0070	0.0110
228	0.0178	0.0069	0.0109
229	0.0175	0.0068	0.0107
230	0.0173	0.0067	0.0106
231	0.0170	0.0066	0.0104
232	0.0168	0.0065	0.0103
233	0.0166	0.0064	0.0101
234	0.0164	0.0064	0.0100
235	0.0162	0.0063	0.0099
236	0.0160	0.0062	0.0098
237	0.0158	0.0061	0.0097
238	0.0156	0.0061	0.0095
239	0.0154	0.0060	0.0094
240	0.0153	0.0059	0.0093
241	0.0151	0.0059	0.0092
242	0.0149	0.0058	0.0091
243	0.0148	0.0057	0.0090
244	0.0146	0.0057	0.0090
245	0.0145	0.0056	0.0089
246	0.0143	0.0056	0.0088
247	0.0142	0.0055	0.0087
248	0.0141	0.0055	0.0086
249	0.0139	0.0054	0.0085
250	0.0138	0.0054	0.0085
251	0.0137	0.0053	0.0084
252	0.0136	0.0053	0.0083
253	0.0135	0.0052	0.0082
254	0.0133	0.0052	0.0082
255	0.0132	0.0051	0.0081
256	0.0131	0.0051	0.0080

257	0.0130	0.0051	0.0080
258	0.0129	0.0050	0.0079
259	0.0128	0.0050	0.0078
260	0.0127	0.0049	0.0078
261	0.0126	0.0049	0.0077
262	0.0125	0.0049	0.0077
263	0.0124	0.0048	0.0076
264	0.0123	0.0048	0.0075
265	0.0123	0.0048	0.0075
266	0.0122	0.0047	0.0074
267	0.0121	0.0047	0.0074
268	0.0120	0.0047	0.0073
269	0.0119	0.0046	0.0073
270	0.0118	0.0046	0.0072
271	0.0118	0.0046	0.0072
272	0.0117	0.0045	0.0071
273	0.0116	0.0045	0.0071
274	0.0115	0.0045	0.0071
275	0.0115	0.0044	0.0070
276	0.0114	0.0044	0.0070
277	0.0113	0.0044	0.0069
278	0.0112	0.0044	0.0069
279	0.0112	0.0043	0.0068
280	0.0111	0.0043	0.0068
281	0.0110	0.0043	0.0068
282	0.0110	0.0043	0.0067
283	0.0109	0.0042	0.0067
284	0.0109	0.0042	0.0066
285	0.0108	0.0042	0.0066
286	0.0107	0.0042	0.0066
287	0.0107	0.0041	0.0065
288	0.0106	0.0041	0.0065
	6.3054	2.3316	3.9738

Total soil rain loss = 2.33(In)
Total effective rainfall = 3.97(In)
Peak flow rate in flood hydrograph = 1610.07(CFS)

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	425.0	850.0	1275.0	1700.0
0+ 5	0.0058	0.84	Q	|	|	|	|
0+10	0.0232	2.53	Q	|	|	|	|
0+15	0.0571	4.92	Q	|	|	|	|
0+20	0.1143	8.31	Q	|	|	|	|
0+25	0.2056	13.25	Q	|	|	|	|
0+30	0.3444	20.15	Q	|	|	|	|
0+35	0.5612	31.48	Q	|	|	|	|
0+40	0.8812	46.47	VQ	|	|	|	|
0+45	1.3146	62.93	VQ	|	|	|	|
0+50	1.8004	70.53	VQ	|	|	|	|
0+55	2.3488	79.63	VQ	|	|	|	|
1+ 0	2.9476	86.95	V Q	|	|	|	|
1+ 5	3.5897	93.23	V Q	|	|	|	|
1+10	4.2692	98.65	V Q	|	|	|	|

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1+15        4.9788   103.05  V Q       |         |         |         |
1+20        5.7162   107.07  V Q       |         |         |         |
1+25        6.4792   110.78  V Q       |         |         |         |
1+30        7.2653   114.13  V Q       |         |         |         |
1+35        8.0726   117.22  V Q       |         |         |         |
1+40        8.8988   119.97  V Q       |         |         |         |
1+45        9.7428   122.55  V Q       |         |         |         |
1+50       10.6038   125.02  V Q       |         |         |         |
1+55       11.4812   127.40  V Q       |         |         |         |
2+ 0       12.3736   129.57  V  Q      |         |         |         |
2+ 5       13.2800   131.62  V  Q      |         |         |         |
2+10       14.1990   133.44  V  Q      |         |         |         |
2+15       15.1302   135.21  V  Q      |         |         |         |
2+20       16.0729   136.87  |V Q      |         |         |         |
2+25       17.0267   138.49  |V Q      |         |         |         |
2+30       17.9913   140.07  |V Q      |         |         |         |
2+35       18.9660   141.52  |V Q      |         |         |         |
2+40       19.9504   142.94  |V Q      |         |         |         |
2+45       20.9446   144.36  |V Q      |         |         |         |
2+50       21.9477   145.64  |V Q      |         |         |         |
2+55       22.9596   146.93  |V Q      |         |         |         |
3+ 0       23.9803   148.21  |V Q      |         |         |         |
3+ 5       25.0097   149.46  |V Q      |         |         |         |
3+10       26.0469   150.61  |V Q      |         |         |         |
3+15       27.0923   151.79  |V Q      |         |         |         |
3+20       28.1458   152.96  |V Q      |         |         |         |
3+25       29.2071   154.11  |V Q      |         |         |         |
3+30       30.2752   155.08  |V Q      |         |         |         |
3+35       31.3499   156.05  |V Q      |         |         |         |
3+40       32.4313   157.02  | VQ      |         |         |         |
3+45       33.5195   158.00  | VQ      |         |         |         |
3+50       34.6143   158.98  | VQ      |         |         |         |
3+55       35.7161   159.97  | VQ      |         |         |         |
4+ 0       36.8237   160.83  | VQ      |         |         |         |
4+ 5       37.9369   161.63  | VQ      |         |         |         |
4+10       39.0555   162.42  | VQ      |         |         |         |
4+15       40.1797   163.24  | VQ      |         |         |         |
4+20       41.3095   164.05  | VQ      |         |         |         |
4+25       42.4450   164.87  | VQ      |         |         |         |
4+30       43.5862   165.69  | VQ      |         |         |         |
4+35       44.7331   166.53  | VQ      |         |         |         |
4+40       45.8857   167.36  | VQ      |         |         |         |
4+45       47.0443   168.22  | VQ      |         |         |         |
4+50       48.2086   169.06  |  Q      |         |         |         |
4+55       49.3787   169.90  |  Q      |         |         |         |
5+ 0       50.5540   170.65  |  VQ     |         |         |         |
5+ 5       51.7346   171.42  |  VQ     |         |         |         |
5+10       52.9204   172.18  |  VQ     |         |         |         |
5+15       54.1116   172.96  |  VQ     |         |         |         |
5+20       55.3081   173.73  |  VQ     |         |         |         |
5+25       56.5101   174.53  |  VQ     |         |         |         |
5+30       57.7175   175.31  |  VQ     |         |         |         |
5+35       58.9305   176.13  |  VQ     |         |         |         |
5+40       60.1490   176.93  |  VQ     |         |         |         |
5+45       61.3732   177.75  |  VQ     |         |         |         |
5+50       62.6030   178.57  |  VQ     |         |         |         |
5+55       63.8387   179.41  |  VQ     |         |         |         |
6+ 0       65.0800   180.25  |   Q     |         |         |         |
6+ 5       66.3273   181.11  |   Q     |         |         |         |
6+10       67.5804   181.95  |   Q     |         |         |         |
6+15       68.8396   182.83  |   Q     |         |         |         |
6+20       70.1048   183.70  |   Q     |         |         |         |
6+25       71.3761   184.59  |   Q     |         |         |         |
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 6+30      72.6544    185.62  |   Q     |         |         |         |
 6+35      73.9380    186.38  |   Q     |         |         |         |
 6+40      75.2268    187.13  |   Q     |         |         |         |
 6+45      76.5210    187.92  |   Q     |         |         |         |
 6+50      77.8205    188.69  |   Q     |         |         |         |
 6+55      79.1255    189.49  |   Q     |         |         |         |
 7+ 0      80.4360    190.28  |   QV    |         |         |         |
 7+ 5      81.7521    191.10  |   QV    |         |         |         |
 7+10      83.0738    191.91  |   QV    |         |         |         |
 7+15      84.4013    192.76  |   QV    |         |         |         |
 7+20      85.7345    193.59  |   QV    |         |         |         |
 7+25      87.0737    194.45  |   QV    |         |         |         |
 7+30      88.4188    195.30  |   QV    |         |         |         |
 7+35      89.7700    196.19  |   QV    |         |         |         |
 7+40      91.1272    197.07  |   QV    |         |         |         |
 7+45      92.4907    197.98  |   QV    |         |         |         |
 7+50      93.8605    198.88  |   QV    |         |         |         |
 7+55      95.2366    199.82  |   QV    |         |         |         |
 8+ 0      96.6192    200.74  |   Q V   |         |         |         |
 8+ 5      98.0084    201.71  |   Q V   |         |         |         |
 8+10      99.4041    202.66  |   Q V   |         |         |         |
 8+15     100.8067    203.65  |   Q V   |         |         |         |
 8+20     102.2160    204.63  |   Q V   |         |         |         |
 8+25     103.6323    205.65  |   Q V   |         |         |         |
 8+30     105.0556    206.66  |   Q V   |         |         |         |
 8+35     106.4861    207.71  |   Q V   |         |         |         |
 8+40     107.9238    208.75  |   Q V   |         |         |         |
 8+45     109.3689    209.83  |   Q V   |         |         |         |
 8+50     110.8214    210.90  |   Q V   |         |         |         |
 8+55     112.2816    212.02  |   Q  V  |         |         |         |
 9+ 0     113.7493    213.12  |    Q V  |         |         |         |
 9+ 5     115.2251    214.28  |    Q V  |         |         |         |
 9+10     116.7086    215.41  |    Q V  |         |         |         |
 9+15     118.2004    216.60  |    Q V  |         |         |         |
 9+20     119.7002    217.78  |    Q V  |         |         |         |
 9+25     121.2086    219.01  |    Q V  |         |         |         |
 9+30     122.7253    220.22  |    Q V  |         |         |         |
 9+35     124.2507    221.50  |    Q V  |         |         |         |
 9+40     125.7848    222.75  |    Q V  |         |         |         |
 9+45     127.3280    224.07  |    Q V  |         |         |         |
 9+50     128.8801    225.37  |    Q  V |         |         |         |
 9+55     130.4416    226.73  |    Q  V |         |         |         |
10+ 0     132.0123    228.07  |    Q  V |         |         |         |
10+ 5     133.5928    229.49  |    Q  V |         |         |         |
10+10     135.1829    230.88  |    Q  V |         |         |         |
10+15     136.7831    232.35  |    Q  V |         |         |         |
10+20     138.3933    233.80  |    Q  V |         |         |         |
10+25     140.0139    235.32  |    Q  V |         |         |         |
10+30     141.6449    236.82  |    Q  V |         |         |         |
10+35     143.2868    238.40  |    Q  V |         |         |         |
10+40     144.9395    239.97  |    Q   V|         |         |         |
10+45     146.6035    241.61  |    Q   V|         |         |         |
10+50     148.2787    243.24  |    Q   V|         |         |         |
10+55     149.9657    244.95  |    Q   V|         |         |         |
11+ 0     151.6644    246.65  |    Q   V|         |         |         |
11+ 5     153.3754    248.44  |    Q   V|         |         |         |
11+10     155.0986    250.21  |    Q   V|         |         |         |
11+15     156.8346    252.07  |    Q   V|         |         |         |
11+20     158.5834    253.92  |    Q   V|         |         |         |
11+25     160.3456    255.87  |     Q   V         |         |         |
11+30     162.1211    257.80  |     Q   V         |         |         |
11+35     163.9107    259.84  |     Q   V         |         |         |
11+40     165.7142    261.87  |     Q   V         |         |         |
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11+45     167.5324    264.01  |     Q   V         |         |         |
11+50     169.3653    266.13  |     Q   V         |         |         |
11+55     171.2137    268.38  |     Q   V         |         |         |
12+ 0     173.0774    270.61  |     Q   V         |         |         |
12+ 5     174.9588    273.18  |     Q   V         |         |         |
12+10     176.8592    275.94  |     Q   |V        |         |         |
12+15     178.7807    279.01  |     Q   |V        |         |         |
12+20     180.7250    282.30  |     Q   |V        |         |         |
12+25     182.6955    286.12  |     Q   |V        |         |         |
12+30     184.6955    290.40  |     Q   |V        |         |         |
12+35     186.7335    295.92  |     Q   |V        |         |         |
12+40     188.8154    302.29  |      Q  |V        |         |         |
12+45     190.9449    309.20  |      Q  |V        |         |         |
12+50     193.1069    313.93  |      Q  | V       |         |         |
12+55     195.3053    319.20  |      Q  | V       |         |         |
13+ 0     197.5370    324.04  |      Q  | V       |         |         |
13+ 5     199.8016    328.82  |      Q  | V       |         |         |
13+10     202.0977    333.39  |      Q  | V       |         |         |
13+15     204.4249    337.92  |      Q  | V       |         |         |
13+20     206.7828    342.37  |       Q | V       |         |         |
13+25     209.1725    346.98  |       Q |  V      |         |         |
13+30     211.5934    351.51  |       Q |  V      |         |         |
13+35     214.0468    356.24  |       Q |  V      |         |         |
13+40     216.5324    360.90  |       Q |  V      |         |         |
13+45     219.0518    365.82  |       Q |  V      |         |         |
13+50     221.6051    370.74  |       Q |  V      |         |         |
13+55     224.1944    375.97  |       Q |   V     |         |         |
14+ 0     226.8196    381.18  |       Q |   V     |         |         |
14+ 5     229.4846    386.95  |        Q|   V     |         |         |
14+10     232.1908    392.94  |        Q|   V     |         |         |
14+15     234.9422    399.51  |        Q|   V     |         |         |
14+20     237.7410    406.38  |        Q|   V     |         |         |
14+25     240.5930    414.11  |        Q|    V    |         |         |
14+30     243.5023    422.43  |        Q|    V    |         |         |
14+35     246.4803    432.40  |         Q    V    |         |         |
14+40     249.5340    443.40  |         Q    V    |         |         |
14+45     252.6704    455.40  |         Q    V    |         |         |
14+50     255.8748    465.28  |         Q     V   |         |         |
14+55     259.1549    476.28  |         |Q    V   |         |         |
15+ 0     262.5094    487.08  |         |Q    V   |         |         |
15+ 5     265.9428    498.52  |         |Q    V   |         |         |
15+10     269.4557    510.08  |         | Q   V   |         |         |
15+15     273.0544    522.53  |         | Q    V  |         |         |
15+20     276.7419    535.42  |         | Q    V  |         |         |
15+25     280.5256    549.40  |         | Q    V  |         |         |
15+30     284.4079    563.71  |         |  Q   V  |         |         |
15+35     288.4008    579.76  |         |  Q    V |         |         |
15+40     292.5101    596.67  |         |   Q   V |         |         |
15+45     296.7500    615.64  |         |   Q   V |         |         |
15+50     301.1293    635.87  |         |   Q   V |         |         |
15+55     305.6795    660.69  |         |    Q   V|         |         |
16+ 0     310.4513    692.87  |         |     Q  V|         |         |
16+ 5     315.6839    759.77  |         |      Q V|         |         |
16+10     321.4208    833.00  |         |        QV         |         |
16+15     327.6614    906.14  |         |         VQ        |         |
16+20     334.5108    994.52  |         |         V  Q      |         |
16+25     342.1842   1114.18  |         |         |V    Q   |         |
16+30     350.8742   1261.79  |         |         |V       Q|         |
16+35     361.0628   1479.38  |         |         | V       |   Q     |
16+40     372.1514   1610.07  |         |         |  V      |      Q  |
16+45     383.1470   1596.56  |         |         |  V      |      Q  |
16+50     391.7546   1249.82  |         |         |   V    Q|         |
16+55     400.3916   1254.10  |         |         |    V   Q|         |
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17+ 0     408.3090   1149.61   |         |         |    V Q  |         |
17+ 5     415.6970   1072.73   |         |         |    QV   |         |
17+10     422.5950   1001.60   |         |         |  Q  V   |         |
17+15     429.0100    931.45   |         |         |Q    V   |         |
17+20     435.1250    887.90   |         |         Q      V  |         |
17+25     440.9650    847.98   |         |        Q|      V  |         |
17+30     446.5312    808.21   |         |        Q|      V  |         |
17+35     451.8466    771.79   |         |       Q |       V |         |
17+40     456.9067    734.74   |         |      Q  |       V |         |
17+45     461.7628    705.10   |         |     Q   |       V |         |
17+50     466.4562    681.47   |         |     Q   |        V|         |
17+55     470.9874    657.93   |         |    Q    |        V|         |
18+ 0     475.3412    632.17   |         |   Q     |        V|         |
18+ 5     479.5347    608.90   |         |   Q     |        V|         |
18+10     483.5654    585.25   |         |  Q      |         V         |
18+15     487.4724    567.30   |         |  Q      |         V         |
18+20     491.2595    549.88   |         | Q       |         V         |
18+25     494.9336    533.48   |         | Q       |         V         |
18+30     498.5039    518.40   |         | Q       |         |V        |
18+35     501.9421    499.23   |         |Q        |         |V        |
18+40     505.2762    484.12   |         |Q        |         |V        |
18+45     508.5044    468.73   |         |Q        |         |V        |
18+50     511.6245    453.04   |         Q         |         | V       |
18+55     514.6632    441.22   |         Q         |         | V       |
19+ 0     517.6278    430.46   |         Q         |         | V       |
19+ 5     520.5088    418.31   |        Q|         |         | V       |
19+10     523.3070    406.30   |        Q|         |         | V       |
19+15     526.0453    397.60   |        Q|         |         | V       |
19+20     528.7223    388.70   |        Q|         |         |  V      |
19+25     531.3264    378.12   |       Q |         |         |  V      |
19+30     533.8337    364.06   |       Q |         |         |  V      |
19+35     536.2858    356.05   |       Q |         |         |  V      |
19+40     538.6916    349.32   |       Q |         |         |  V      |
19+45     541.0531    342.89   |       Q |         |         |  V      |
19+50     543.3689    336.25   |      Q  |         |         |  V      |
19+55     545.6341    328.91   |      Q  |         |         |   V     |
20+ 0     547.8220    317.67   |      Q  |         |         |   V     |
20+ 5     549.9516    309.22   |      Q  |         |         |   V     |
20+10     552.0450    303.97   |      Q  |         |         |   V     |
20+15     554.1051    299.13   |      Q  |         |         |   V     |
20+20     556.1337    294.55   |     Q   |         |         |   V     |
20+25     558.1321    290.16   |     Q   |         |         |   V     |
20+30     560.1016    285.98   |     Q   |         |         |    V    |
20+35     562.0429    281.87   |     Q   |         |         |    V    |
20+40     563.9565    277.86   |     Q   |         |         |    V    |
20+45     565.8423    273.82   |     Q   |         |         |    V    |
20+50     567.6984    269.50   |     Q   |         |         |    V    |
20+55     569.5170    264.06   |     Q   |         |         |    V    |
21+ 0     571.2890    257.30   |     Q   |         |         |    V    |
21+ 5     573.0351    253.53   |    Q    |         |         |    V    |
21+10     574.7585    250.24   |    Q    |         |         |    V    |
21+15     576.4603    247.09   |    Q    |         |         |     V   |
21+20     578.1411    244.06   |    Q    |         |         |     V   |
21+25     579.8017    241.12   |    Q    |         |         |     V   |
21+30     581.4431    238.32   |    Q    |         |         |     V   |
21+35     583.0655    235.58   |    Q    |         |         |     V   |
21+40     584.6696    232.92   |    Q    |         |         |     V   |
21+45     586.2555    230.27   |    Q    |         |         |     V   |
21+50     587.8234    227.65   |    Q    |         |         |     V   |
21+55     589.3739    225.14   |    Q    |         |         |     V   |
22+ 0     590.9079    222.75   |    Q    |         |         |     V   |
22+ 5     592.4253    220.32   |    Q    |         |         |      V  |
22+10     593.9261    217.91   |    Q    |         |         |      V  |
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22+15	595.4104	215.52	Q			V	
22+20	596.8804	213.45	Q			V	
22+25	598.3343	211.10	Q			V	
22+30	599.7910	211.52	Q			V	
22+35	601.1561	198.21	Q			V	
22+40	602.5021	195.44	Q			V	
22+45	603.8316	193.04	Q			V	
22+50	605.1467	190.96	Q			V	
22+55	606.4478	188.92	Q			V	
23+ 0	607.7358	187.01	Q			V	
23+ 5	609.0113	185.20	Q			V	
23+10	610.2748	183.46	Q			V	
23+15	611.5268	181.79	Q			V	
23+20	612.7677	180.18	Q			V	
23+25	613.9979	178.62	Q			V	
23+30	615.2174	177.07	Q			V	
23+35	616.4270	175.64	Q			V	
23+40	617.6271	174.25	Q			V	
23+45	618.8178	172.89	Q			V	
23+50	619.9994	171.57	Q			V	
23+55	621.1722	170.29	Q			V	
24+ 0	622.3364	169.03	Q			V	
24+ 5	623.4863	166.98	Q			V	
24+10	624.6165	164.10	Q			V	
24+15	625.7222	160.55	Q			V	
24+20	626.7970	156.06	Q			V	
24+25	627.8306	150.08	Q			V	
24+30	628.8097	142.16	Q			V	
24+35	629.7048	129.97	Q			V	
24+40	630.4915	114.24	Q			V	
24+45	631.1607	97.17	Q			V	
24+50	631.7743	89.09	Q			V	
24+55	632.3225	79.60	Q			V	
25+ 0	632.8181	71.96	Q			V	
25+ 5	633.2688	65.44	Q			V	
25+10	633.6809	59.84	Q			V	
25+15	634.0619	55.32	Q			V	
25+20	634.4146	51.21	Q			V	
25+25	634.7414	47.45	Q			V	
25+30	635.0450	44.09	Q			V	
25+35	635.3275	41.03	Q			V	
25+40	635.5915	38.33	Q			V	
25+45	635.8384	35.84	Q			V	
25+50	636.0689	33.48	Q			V	
25+55	636.2840	31.24	Q			V	
26+ 0	636.4852	29.21	Q			V	
26+ 5	636.6736	27.36	Q			V	
26+10	636.8508	25.72	Q			V	
26+15	637.0174	24.19	Q			V	
26+20	637.1740	22.75	Q			V	
26+25	637.3214	21.39	Q			V	
26+30	637.4597	20.08	Q			V	
26+35	637.5900	18.92	Q			V	
26+40	637.7126	17.80	Q			V	
26+45	637.8276	16.70	Q			V	
26+50	637.9360	15.74	Q			V	
26+55	638.0379	14.80	Q			V	
27+ 0	638.1334	13.87	Q			V	
27+ 5	638.2229	13.00	Q			V	
27+10	638.3070	12.21	Q			V	
27+15	638.3858	11.44	Q			V	
27+20	638.4592	10.66	Q			V	
27+25	638.5276	9.93	Q			V	

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   27+30     638.5922      9.38  Q          |          |          |        V|
   27+35     638.6532      8.85  Q          |          |          |        V|
   27+40     638.7105      8.32  Q          |          |          |        V|
   27+45     638.7642      7.80  Q          |          |          |        V|
   27+50     638.8144      7.28  Q          |          |          |        V|
   27+55     638.8610      6.77  Q          |          |          |        V|
   28+ 0     638.9050      6.39  Q          |          |          |        V|
   28+ 5     638.9469      6.08  Q          |          |          |        V|
   28+10     638.9867      5.78  Q          |          |          |        V|
   28+15     639.0245      5.48  Q          |          |          |        V|
   28+20     639.0602      5.19  Q          |          |          |        V|
   28+25     639.0939      4.89  Q          |          |          |        V|
   28+30     639.1256      4.60  Q          |          |          |        V|
   28+35     639.1552      4.30  Q          |          |          |        V|
   28+40     639.1829      4.02  Q          |          |          |        V|
   28+45     639.2085      3.73  Q          |          |          |        V|
   28+50     639.2322      3.44  Q          |          |          |        V|
   28+55     639.2542      3.18  Q          |          |          |        V|
   29+ 0     639.2749      3.01  Q          |          |          |        V|
   29+ 5     639.2945      2.84  Q          |          |          |        V|
   29+10     639.3129      2.67  Q          |          |          |        V|
   29+15     639.3301      2.51  Q          |          |          |        V|
   29+20     639.3463      2.34  Q          |          |          |        V|
   29+25     639.3613      2.18  Q          |          |          |        V|
   29+30     639.3752      2.02  Q          |          |          |        V|
   29+35     639.3880      1.86  Q          |          |          |        V|
   29+40     639.3996      1.69  Q          |          |          |        V|
   29+45     639.4102      1.53  Q          |          |          |        V|
   29+50     639.4197      1.38  Q          |          |          |        V|
   29+55     639.4281      1.22  Q          |          |          |        V|
   30+ 0     639.4354      1.06  Q          |          |          |        V|
   30+ 5     639.4416      0.91  Q          |          |          |        V|
   30+10     639.4468      0.75  Q          |          |          |        V|
   30+15     639.4509      0.60  Q          |          |          |        V|
   30+20     639.4539      0.44  Q          |          |          |        V|
   30+25     639.4559      0.29  Q          |          |          |         V
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Appendix E

Kern County Hydrology Manual Excerpts

Residential Landscaping (Lawn, Shrubs, etc.) - The pervious portions of commercial establishments, single and multiple family dwellings, trailer parks and schools where the predominant land cover is lawn, shrubbery and trees.

Row Crops - Lettuce, tomatoes, beets, tulips or any field crop planted in rows far enough apart that most of the soil surface is exposed to rainfall impact throughout the growing season. At plowing, planting and harvest times it is equivalent to fallow.

Small Grain - Wheat, oats, barley, flax, etc. planted in rows close enough that the soil surface is not exposed except during planting and shortly thereafter.

Legumes - Alfalfa, sweetclover, timothy, etc. and combinations are either planted in close rows or broadcast.

Fallow - Fallow land is land plowed but not yet seeded or tilled.

Woodland - grass - Areas with an open cover of broadleaf or coniferous trees usually live oak and pines, with the intervening ground space occupied by annual grasses or weeds. The trees may occur singly or in small clumps. Canopy density, the amount of ground surface shaded at high noon, is from 20 to 50 percent.

Woodland - Areas on which coniferous or broadleaf trees predominate. The canopy density is at least 50 percent. Open areas may have a cover of annual or perennial grasses or of brush. Herbaceous plant cover under the trees is usually sparse because of leaf or needle litter accumulation.

Chaparral - Land on which the principal vegetation consists of evergreen shrubs with broad, hard, stiff leaves such as manzonita, ceanothus and scrub oak. The brush cover is usually dense or moderately dense. Diffusely branched evergreen shrubs with fine needle-like leaves, such as chamise and redchank, with dense high growth are also included in this soil cover.

Annual Grass - Land on which the principal vegetation consists of annual grasses and weeds such as annual bromes, wild barley, soft chess, ryegrass and filaree.

Irrigated Pasture - Irrigated land planted to perennial grasses and legumes for production of forage and which is cultivated only to establish or renew the stand of plants. Dry land pasture is considered as annual grass.

Meadow - Land areas with seasonally high water table, locally called cienegas. Principal vegetation consists of sod-forming grasses interspersed with other plants.

Orchard (Deciduous) - Land planted to such deciduous trees as apples, apricots, pears, walnuts, and almonds.

Orchard (Evergreen) - Land planted to evergreen trees which include citrus and avocados and coniferous plantings.

Turf - Golf courses, parks and similar lands where the predominant cover is irrigated mowed close-grown turf grass. Parks in which trees are dense may be classified as woodland.

Curve[1] Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	Soil Group B	Soil Group C	Soil Group D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		77	86	91	94
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and Redskank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadows or Cienagas (Areas with seasonally high water table, principal vegatation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs-buckwheat,sage,etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (4) (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawns, shrubs, etc.)	Good	39	61	74	80
Turf (Irrigated and mowed grass)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80

Curve[1] Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS -					
Fallow (Bare Soil)		77	86	91	94
Close Seeded (alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avacodos, etc.)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Pasture (Grassland or range, continuos forage for grazing)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Row Crops (Straight row, non-contoured)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Straight row, non-contoured)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. Average runoff condition, Ia = 0.2(S)
2. Poor: Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair: Moderate cover with 50 percent to 75 percent of the ground surface protected. In wooded areas the woods are grazed but not burned, and some forest litter covers the soil.

   Good: Heavy or dense cover with more than 75 percent of the ground surface protected. In wooded areas the woods are protected from grazing, litter and brush adequately cover soil.
3. See Figure C-1 for definition of cover types.

ACTUAL IMPERVIOUS COVER

Land Use	Range-Percent	Recommended Value For Average Conditions-Percent (1)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (2)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2-3 DU/acre 1/2 acre	20 - 40	30
R1 3-5 DU/acre 1/4 acre	30 - 50	R1 40
R2 5-8 DU/acre	35 - 55	50
R3 8-10 DU/acre	50 - 70	R2-R3 60
MH More than 10 DU/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Parks	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1) Recommended values are based on average conditions which may not apply to a particular study. The percentage impervious may vary greatly even on comparable study sized lots due to differences in in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

2) For typical equestrian subdivisions increase impervious area 5% over the values recommended in the table above.

KERN COUNTY
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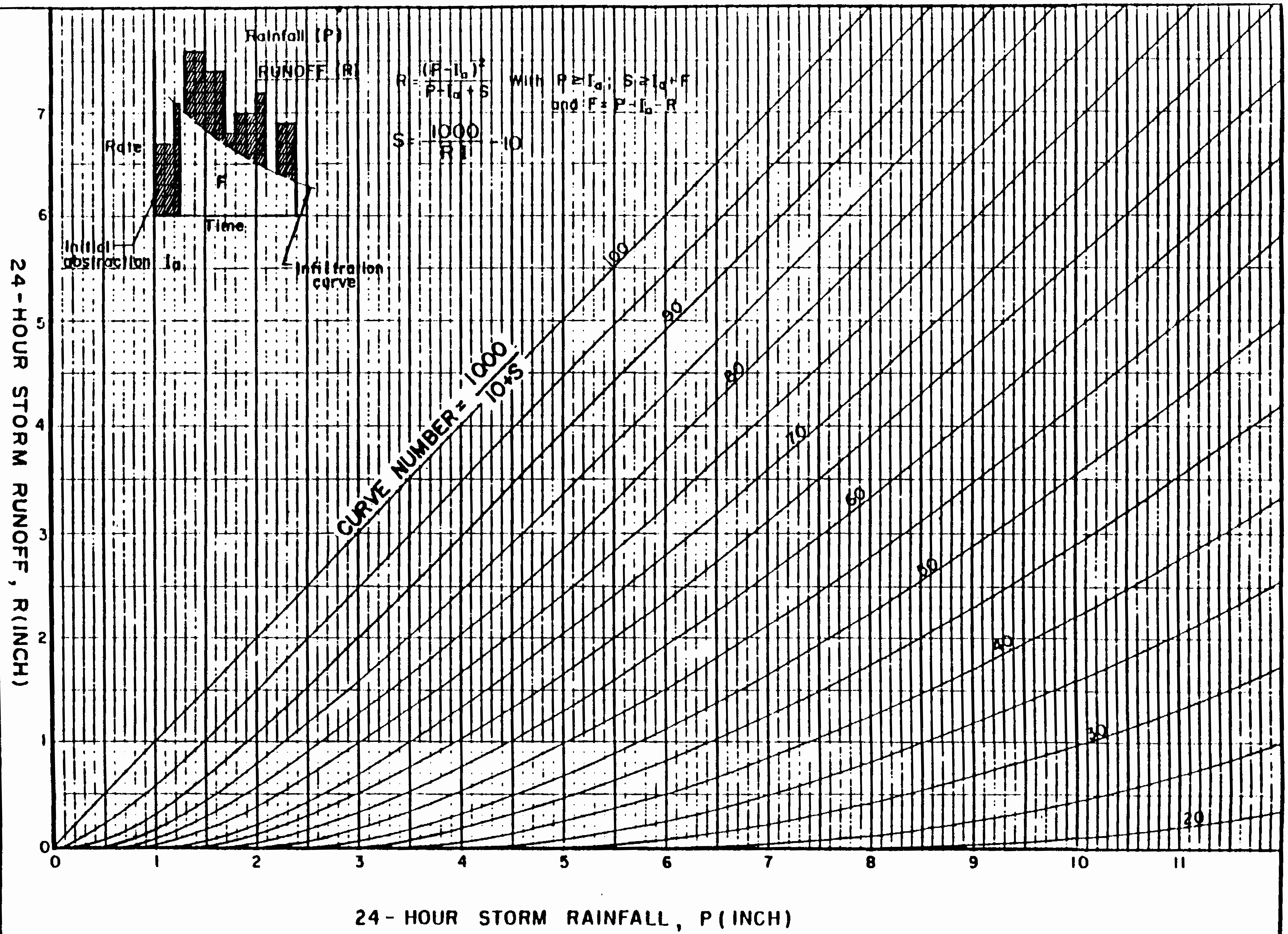
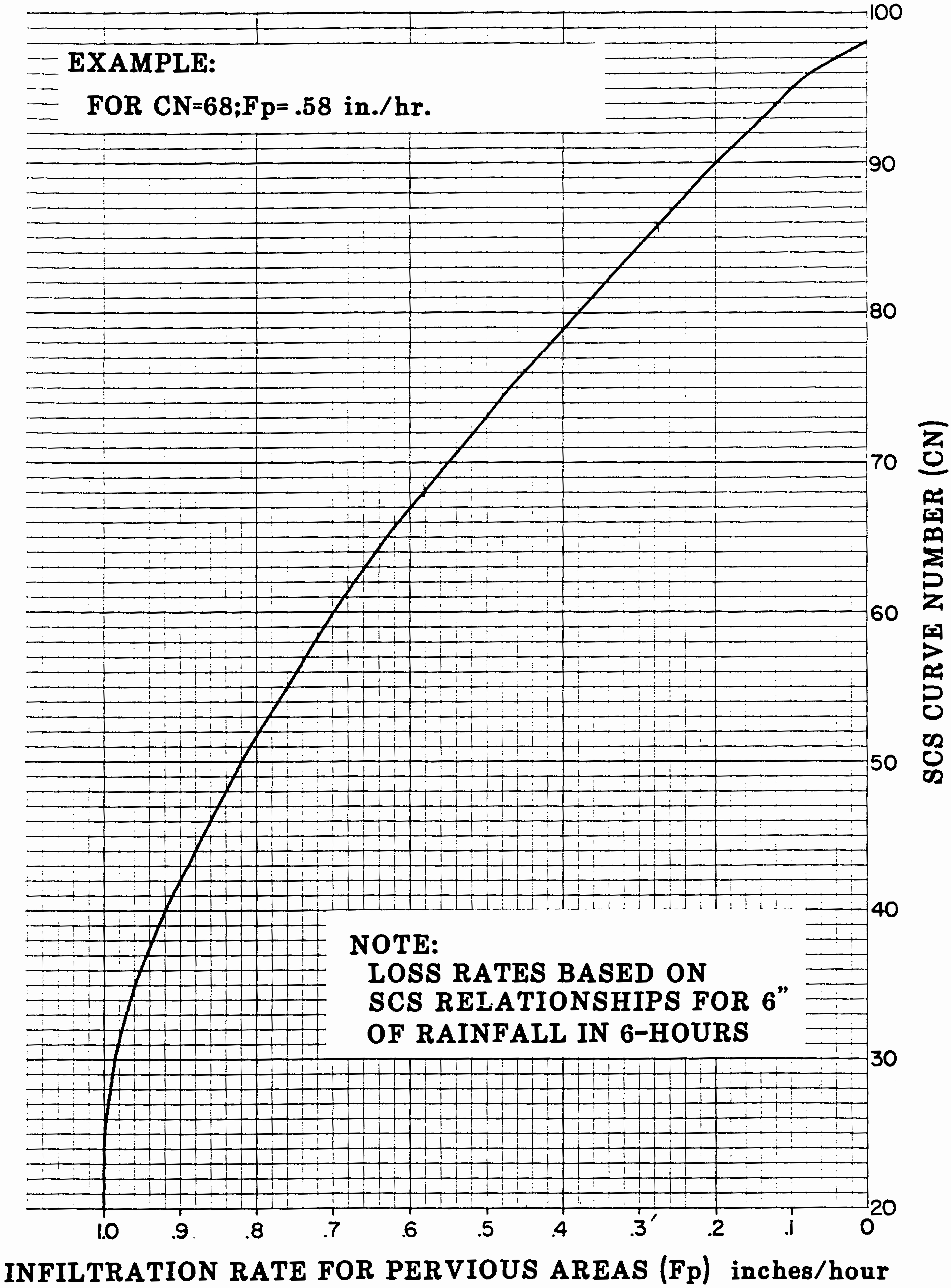
ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS

KERN COUNTY
HYDROLOGY MANUAL



SCS 24-HOUR STORM
RAINFALL-RUNOFF
RELATIONSHIPS

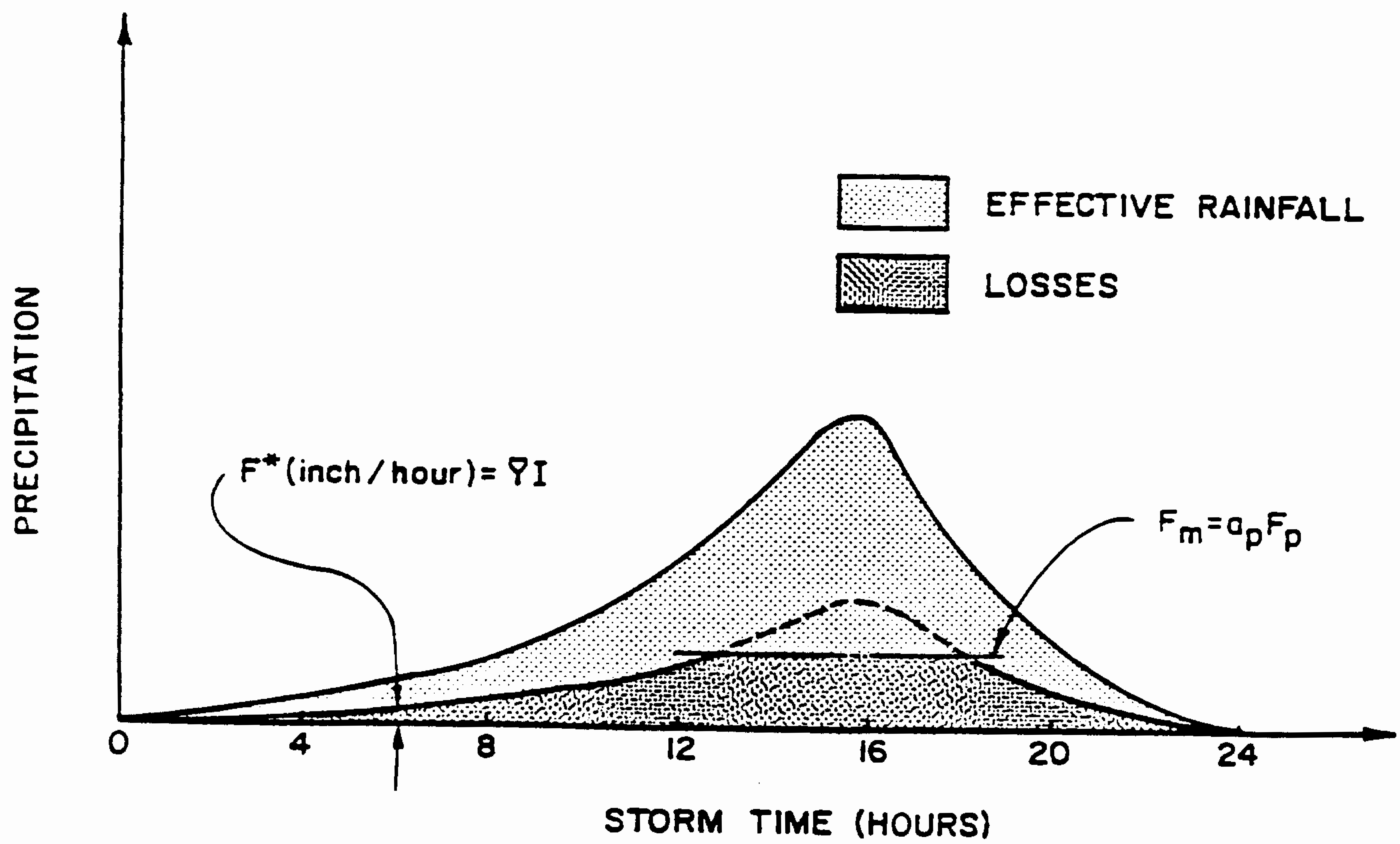
FIGURE C-4



KERN COUNTY
Hydrology Manual

INFILTRATION RATE FOR PERVIOUS AREAS VERSUS SCS CURVE NUMBERS

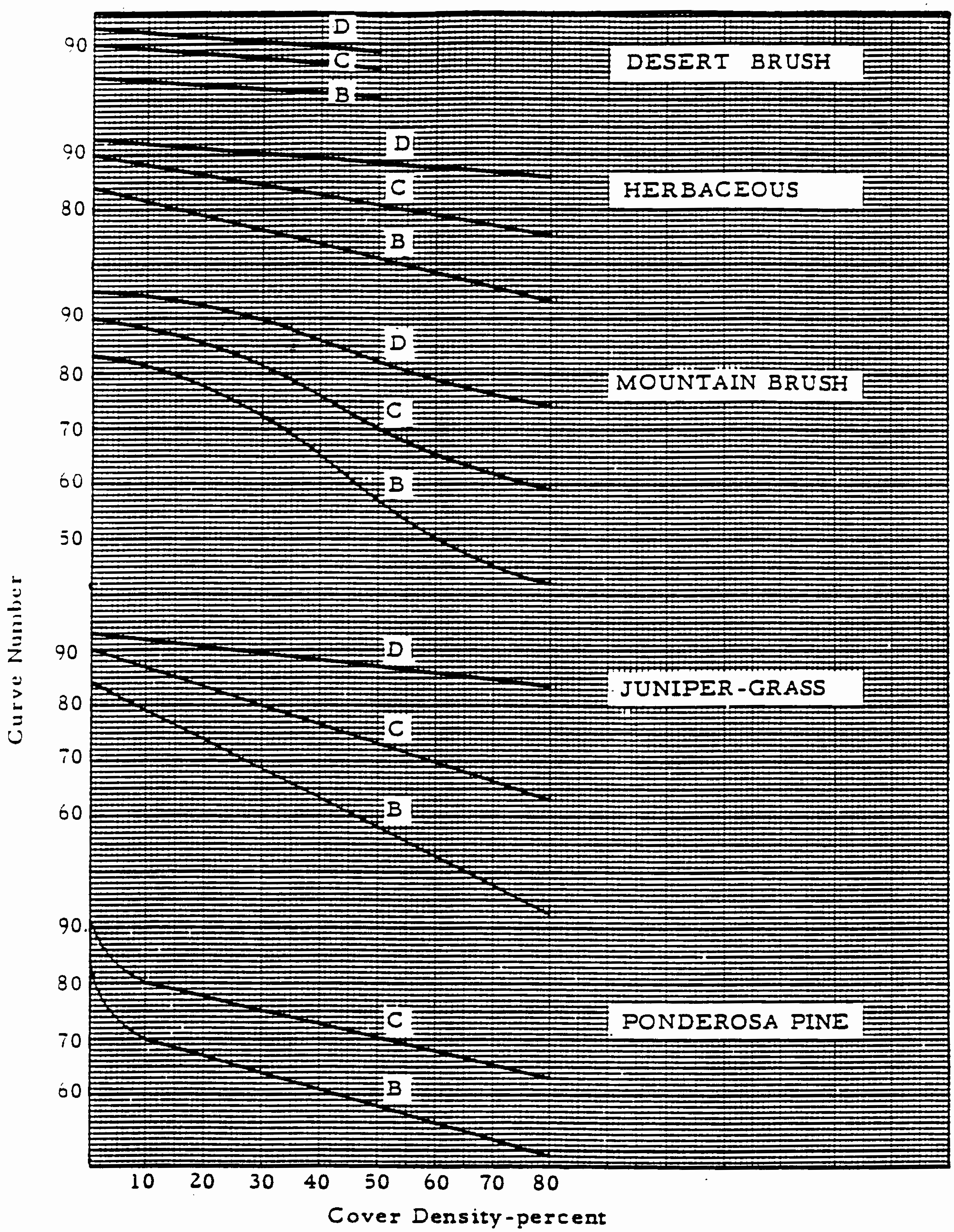
FIGURE C-5



KERN COUNTY
HYDROLOGY MANUAL

DESIGN STORM
LOSS FUNCTION

FIGURE C-6



KERN COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOIL
COVER COMPLEXES AND
ASSOCIATED CURVE NUMBERS

FIGURE C-7

Section C

Equations

List of Equations

Equation No.	Equation
C.1	$Ia = 0.2S$
C.2	$S = \frac{1000}{CN} - 10$
C.3	$Y_j = \frac{(P_{24} - Ia)^2}{(P_{24} - Ia + S)P_{24}}$
C.4	$Y = \frac{Y_1 A_1 + ... + Y_m A_m}{A_1 + A_2 + ... + A_m}$
C.5	$\overline{Y} = 1 - Y$
C.6	$F^* = \overline{Y} \cdot I$
C.7	$Fm = a_p F_p$

Variables

Ia	Initial Abstraction (inches)
S	Estimate soil capacity
CN	Area Curve Number
Y_j	Yield fraction for 24-hour storm runoff
Y	Yield
$\overline{Y}$	Catchment low loss fraction

Appendix F

Kern County Development Standards: Standards for Drainage

DIVISION FOUR

STANDARDS FOR DRAINAGE

CHAPTER I. GENERAL

Sec. 401-1 General Purpose

401-1.01 It is the general purpose of these standards that waters generated by storms, springs, or other sources be mitigated so as to provide reasonable levels of protection for life and property, and the maintenance of necessary access to property or passage of the traveling public on the public highways.

401-1.02 To meet this general purpose, it is necessary that these standards reasonably protect life from the direct effects of flood waters, the indirect health effects associated with stagnating water, and the attractive nuisance provided by standing waters. It is necessary to reasonably protect property from the damaging effects of flood waters. Property access for the ingress and egress of emergency vehicles, or the general public should be reasonably provided. The passage of public vehicles on the public highways should also be reasonably ensured.

401-1.03 In general, the mitigation measures for the protection of life and property, and the maintenance of emergency vehicle access are based upon the Capital Storm Design Discharge (CSDD). The issues related to property access (by the public) and passage on public highways, and local drainage facility design are based upon the Intermediate Storm Design Discharge (ISDD).

401-1.04 The design standards in this section are to be deemed to be minimal, and shall not limit the design engineer from using higher standards based upon the engineer's assessment of the protection needs of the development. Alternatives are permissible which are determined by the Director to be of equal or higher quality.

401-1.05 The Director may allow such exceptions as he may find to be reasonably required by the specific circumstances, to be in the public interest and in conformity with the general objectives of these standards.

401-1.06 Special circumstances may exist that require additional mitigation above and beyond these standards as determined by the Director.

Sec. 401-2 Maintenance

401-2.01 All facilities intended for public maintenance shall be designed and constructed subject to the approval of the Director and the maintenance entity, or these standards, whichever is more conservative.

401-2.02 All drainage facilities intended for private maintenance shall provide a maintenance plan, subject to the approval of the Director. All such facility maintenance plans shall include, but not be limited to: (a) schedule of cleaning (or clearing), (b) mosquito and vector abatement measures (if applicable), (c) pump maintenance schedule (if applicable), (d) notarized statement by the owner(s) acknowledging his/her/their responsibility and intent to maintain the proposed facility in accordance with the approved maintenance schedule.

401-2.03 Subdivisions with privately maintained streets shall have the drainage facilities maintained by a homeowners association or other entity which has the ability to assess fees for maintenance.

CHAPTER II. DEFINITIONS

Sec. 402-1 Definitions:

402-1.01 **AGENCY**: refers to the Department of the County of Kern with jurisdiction.

402.1.02 **ALLUVIAL FAN**: is a landform originating at an apex and characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flow paths.

402-1.03 **APEX**: means a point on an alluvial fan or similar landform below which the flow path of the major stream that formed the fan becomes unpredictable and alluvial fan flooding can occur.

402-1.04 **CAPITAL STORM DESIGN DISCHARGE (CSDD)**: is that flow determined based upon a precipitation event having a one percent probability of being equaled or exceeded in any given year, commonly referred to as the 100 year storm.

402-1.05 **CLOSED CONDUIT**: is any system of underground drainage facilities, other than culverts.

402-1.06 **COMPREHENSIVE DRAINAGE PLAN**: refers to a storm water runoff mitigation plan for multi-phase developments. Such a plan need not be adopted by the County, but will be kept on file by the Director.

402-1.07 **CONSTRUCTED CHANNEL**: refers to the physical modification of natural channels or the construction of channels.

402-1.08 **CONTROL FACILITY**: are those hydraulic structures which mitigate the effects of surface runoff resulting from development, flow pattern modification, or flood flows.

402-1.09 **CULVERT**: is a hydraulically short conduit which conveys storm runoff flows through a roadway embankment or past some other type of flow obstruction.

402-1.10 **DESIGN PONDING DEPTH**: is the depth to which the design volume will pond in a storm water basin.

402-1.11 **DETENTION BASIN**: is a storm water facility designed to affect flood hydrograph peak attenuation.

402-1.12 **EMBANKMENT AREA**: is an area of compacted fill material.

402-1.13 **ENCROACHMENT:** refers to any change in land use that materially alters the lands flow conveyance potential.

402-1.14 **FLOOD CONTROL PLAN**: is a plan for the mitigation of flood flows originating from off-site watersheds, or resulting from on-site development.

402-1.15 **FLOOD FLOW**: shall be considered to be the CSDD for reference in these standards.

402-1.16 **FLOW PATTERN**: refers to any physical tracing resultant from the historic or existing runoff of water.

402-1.17 **INTERMEDIATE STORM DESIGN DISCHARGE (ISDD)**: is that flow determined based upon a precipitation event having a ten percent probability of being equaled or exceeded in any given year, commonly referred to as the ten-year storm.

402-1.18 **LEVEE**: is an embankment whose primary purpose is to furnish drainage or flood protection from storm water runoff and which is, therefore, subject to water loading for periods of only a few days or weeks a year.

402-1.19 **MASTER DRAINAGE PLAN**: refers to a comprehensive drainage plan or flood control plan adopted by the County which includes adopted funding mechanisms.

402-1.20 **NATURAL CHANNEL**: is a flow pattern characterized by incised flow channelization with well defined banks and including the overbank flow areas.

402-1.21 **NUISANCE FLOW**: shall be considered as those waters originating from within, or adjacent to, the development not resulting from storm runoff.

402-1.22 **ONE PERCENT RISK FLOW**: is the flow on an alluvial fan based upon the joint probability of the flow distribution at the fan apex and the probability of occurring at the development site.

402-1.23 **REASONABLE:** in the context of this section refers to the balancing of the utility of the facilities or circumstances described against the gravity of the potential for harm.

402-1.24 **RETENTION BASIN**: is a terminal storm water facility for the storage of runoff. Commonly referred to as a sump.

402-1.25 **RETARDATION BASIN**: Synonymous with Detention Basin.

402-1.26 **SLOPE EASEMENT**: shall include the horizontal dimension from the top to toe of slope plus the setback requirements specified by the Grading Ordinance.

402-1.27 **SOILS ENGINEER (GEOTECHNICAL ENGINEER):** shall mean an engineer experienced and knowledgeable in the practice of soils engineering (geotechnical engineering).

402-1.28 **SOILS ENGINEERING (GEOTECHNICAL ENGINEERING):** shall mean the application of the principles of soil mechanics in the investigation, evaluation and design of civil works involving the use of earth materials and the inspection and/or testing of the construction thereof.

402-1.29 **STRESS AREA**: refers to those locations where the erosion potential is greater than a straight, uniform channel reach, and includes junctions, transitions, and curves.

402-1-30 **WATERWAY**: refers to any natural channel, artificial channel or closed conduit, which provides a course for drainage water to flow.

Sec. 402-2 Off-Site Capital Storm Design Discharge (CSDD) Mitigation

The CSDD flow determined from the off-site watershed shall consider the total area of the off-site watershed. The watershed development condition may be considered in its existing condition at the time of the proposed development if no control facilities mitigating surface runoff exist, and as undeveloped if adequate control facilities mitigating surface runoff exist.

The design of all structures within the development shall be protected to a minimum of one (1) foot above the water surface associated with the CSDD.

The CSDD flow shall be received into the development without diversion onto adjacent property or causing more than one foot rise in pre-development water surface, and shall be discharged in a manner as similar as possible to the existing condition downstream of the development.

Sec. 402-3 Off-Site Intermediate Storm Design Discharge (ISDD) Mitigation

The ISDD flow shall be based upon the uncontrolled developed watershed proximate to the development when no defined flow pattern exists. When a flow pattern is defined, the ISDD flow determination shall include the total watershed contributing to the flow pattern.

The off-site ISDD shall be mitigated in conjunction with requirements for on-site ISDD flows.

Sec. 402-4 Hydrologic Flow Determinations

The CSDD and ISDD flows shall be calculated in accordance with the current Kern County Hydrology Manual.

CHAPTER III. DRAINAGE PLANS

Sec. 403-1 Authority

403-1.01 County Master Drainage Plans

The County administers master drainage plans (MDP) over some portions of the County. In these MDP areas, the design hydrology is governed by the assumption made and methodology used, in the development of the MDP or its most recent revision. Modifications to the MDP's assumed land uses may result in the requirement of additional permanent facilities being constructed to mitigate unanticipated runoff.

If MDP planned facilities have not been constructed at the time of site development, then temporary facilities will be required to be constructed by the Developer. Such facilities may be abandoned upon completion of the MDP facilities intended to serve the site.

403-1.02 Special Districts

Special Districts, such as Community Service Districts, may prepare comprehensive drainage and/or flood control plans for areas under their jurisdiction. Such plans are subject to the review and approval of the County.

If the Special Districts planned facilities have not been constructed at the time of site development, then temporary facilities will be required to be constructed. Such facilities may be abandoned upon completion of the planned facilities intended to serve the site.

County Service Areas are typically required to be formed for the maintenance of drainage facilities in the absence of another maintenance entity.

403-1.03 Subdivisions

These standards shall apply to the drainage/floodplain management requirements specified for subdivisions improvements in the County's Land Division Ordinance.

If the subdivisions storm runoff mitigation measures are to be constructed as part of a comprehensive drainage plan, then each phase of the development shall be designed to function independently or in conjunction with completed development phases.

403-1.04 Mobile Home/Recreational Vehicle Parks

These standards shall apply to the drainage/floodplain management review of Mobile Home/Recreational Vehicle Parks specified in the County's Zoning Ordinance.

403-1.05 Site Development

These standards shall apply to the drainage/floodplain management requirements specified for site development in the County's Building Code, Grading Code, Floodplain Management Ordinance, and all other pertinent County Ordinances.

CHAPTER IV. ALLUVIAL FAN DEVELOPMENT

Sec. 404-1 Development Policy

Development upon an alluvial fan shall mitigate the effects of the flow at the site of development, which has a one-percent risk of being equaled or exceeded in any given year. Such mitigation shall ensure that the one-percent risk flow will be received into the development site, without causing more than one foot of water surface rise resulting from encroachment at the development site, and discharge the one percent risk flow in a manner, as close as possible, to the flow pattern existing prior to development of the site.

Sec. 404-2 Flood Control Facility Requirements

The design of structural flood control measures on alluvial fans shall demonstrate that the measures will effectively eliminate alluvial fan flood hazards from the area protected by such measures. The provided analyses must include, but are not limited to, the following:

404-2.01 Engineering analyses that quantify the discharges and volumes of water, debris, and sediment movement associated with the flood that has a one percent probability of being exceeded in any year at the apex under current watershed conditions and under potential adverse conditions (e.g., deforestation of the watershed by fire). The potential for debris flow and sediment movement must be assessed using an engineering method acceptable to the Director and Federal Emergency Management Agency (FEMA). The assessment should consider the characteristics and availability of sediment in the drainage basin above the apex and on the alluvial fan.

404-2.02 Engineering analyses showing that the measures will accommodate the estimated peak discharges and volumes of water, debris, and sediment, as determined in accordance with Section 404-2.01, and will withstand the associated hydrodynamic and hydrostatic forces.

404-2.03 Engineering analyses showing that the measures have been designed to withstand the potential erosion and scour associated with estimated discharges.

404-2.04 Engineering analyses or evidence showing that the measures will provide protection from hazards associated with the possible relocation of flow paths from other parts of the fan.

404-2.05 Engineering analyses that assess the effect of the project on flood hazards, including depth and velocity of floodwaters and scour and sediment deposition, on other areas of the fan.

404-2.06 Engineering analyses demonstrating that flooding from sources other than the fan apex, including local runoff, is either insignificant or has been accounted for in the design.

CHAPTER V. STREET DRAINAGE

Sec. 405-1 Design Flow

405-1.01 The ISDD shall include the evaluation of both on-site and off-site watersheds when applicable.

405-1.02 Street Conveyance

1. For Type "A" subdivisions, the ISDD may exceed the top of a six (6) inch curb by 0.10 feet.

2. For Type "B" subdivisions, the depth of flow contained within the road right of way shall not exceed 0.60 feet for the ISDD.

3. The depth of flow for the CSDD on major and secondary highways shall be maintained as not to prohibit reasonable access.

4. For mobile home/recreational vehicle parks, the depth of flow for the ISDD shall not exceed the carrying capacity of the travel way.

5. Where the discharge exceeds the above mentioned limits, a stormdrain or other facilities shall be provided to convey the excess flows.

6. The drainage system shall be free flowing and shall not allow the retention of more than one (1) foot of water measured at the flowline after the flows have subsided.

405-1.03 Sedimentation

In areas suspected of significant sediment yield from an ISDD, the following shall apply:

1. The developer’s engineer shall quantify any sediment yield from on-site or off-site properties based upon the ISDD.

2. Sediment yield shall be independent of the runoff event and is to be mitigated separate from the design discharge.

3. Sediment shall not be deposited on the roadway.

4. Higher levels of mitigation may be required in mudslide-mudflow areas.

405-1.04 Erosion

1. Erosion protection measures based on the ISDD shall be established upstream, downstream and through the project by the developer's engineer subject to approval by the Director.

CHAPTER VI. CULVERTS, BRIDGES AND AT-GRADE-CROSSINGS

Sec. 406-1 General

406-1.01 All publicly maintained crossings of natural channels shall be bridged or culverted. The minimum length of any culvert shall be from toe-of-slope to toe-of-slope. Additional right-of-way may be required for maintenance of these facilities.

406-1.02 Roadways shall be required to bridge a floodway where encroachment of the floodway is prohibited.

406-1.03 Energy losses for bridge piers, interior walls for multiple box culverts, or other obstructions within the channel shall be predicated upon the obstruction width plus two (2) feet of debris allowance for each obstruction.

Sec. 406-2 Culverts

406-2.01 The ISDD for the total upstream watershed under existing conditions shall not exceed soffit of culvert.

406-2.02 The CSDD for the total upstream watershed under existing conditions will be allowed to overtop the roadway until 2.0 feet of specific energy is obtained, at which point additional culverts will be required to meet these minimum requirements.

406-2.03 The 2.0 feet of specific energy shall be calculated at the crown or high point of the traveled roadway.

406-2.04 The minimum size of any culvert under a publicly maintained roadway shall be 18 inches. For private roads or public access, which are privately maintained, this requirement may be waived.

406-2.05 Culverts shall be designed to have a minimum useful life of 50 years.

Sec. 406-3 <u>Bridges</u>

406-3.01 The lowest portion of the bridge span shall be one foot or 0.2 times the specific energy (whichever is greater) above the water surface elevation when the normal depth of flow for the CSDD is subcritical.

406-3.02 The lowest portion of the bridge span shall be one foot or 0.2 times the specific energy (whichever is greater) above the sequent flow depth when the normal depth of flow for the CSDD is supercritical.

406-3.03 When levee conditions exist, the lowest portion of the bridge span shall also meet the minimum freeboard requirements of the levee.

Sec. 406-4 <u>At-Grade-Crossings</u>

406-4.01 At-grade-crossings shall not be permitted on a publicly maintained roadway and shall not encroach upon a floodway.

CHAPTER VII. CLOSED CONDUIT SYSTEMS, CATCH BASINS

Sec. 407-1 <u>Design</u>

407-1.01 Closed conduit system shall be designed for the total ISDD flow less allowable street flow. (see Chapter V Street Drainage)

407-1.02 A closed conduit system intended to serve on-site lot development shall be designed for the total ISDD originating on-site.

407-1.03 Closed conduit system shall be designed to have a minimum useful life of 50 years.

407-1.04 The minimum size of a closed conduit system within the street right-of-way or intended for public maintenance shall be 18 inches.

407-1.05 The minimum size of a closed conduit system outside of the street right-of-way and intended to be privately maintained shall be eight (8) inches.

407-1.06 The minimum cover over any closed conduit system shall be 24 inches. The minimum cover required within the street right-of-way shall be 30 inches.

407-1.07 Closed conduit system shall be free flowing with no continuous standing water within the pipe.

407-1.08 The designed pipe size shall not be allowed to decrease as the system progresses downstream.

407-1.09 The minimum slope of any closed conduit system shall be .001(.10 percent) unless otherwise approved by the Director.

407-1.10 The hydrologic tie-in design criteria for the closed conduit system shall be based on equal recurrence.

407-1.11 Closed conduit system within the street right-of-way or intended for public maintenance shall be Class III reinforced concrete pipe with rubber gasket joints, or cast-in-place concrete pipe unless otherwise approved or required by the Director.

407-1.12 The developer's engineer shall plot the hydraulic grade line and the energy grade line profiles for the closed conduit system either on a set of, or on the original, street improvement plans. All calculations and related data for these profiles shall be included with the street improvement plans when submitted.

Sec. 407-2 <u>Location</u>

407-2.01 A publicly maintained closed conduit system shall be placed within the road right-of-way or easement unless otherwise approved by the Director.

407-2.02 The alignment of a publicly maintained closed conduit system shall be parallel or perpendicular with the centerline of the road unless otherwise approved by the Director.

Sec. 407-3 <u>Freeboard</u>

Within the closed conduit system, the hydraulic grade line shall be at least 0.5 feet below all inlet flowline elevations, and 0.5 feet below the top of non-pressure manholes.

Sec. 407-4 <u>Manholes</u>

407-4.01 Within the closed conduit system, manholes shall be provided at all junctions, bends, and at intervals prescribed below:

a. Manholes shall be provided at intervals no greater than 300 feet where the conduit diameter is less than or equal to 30 inches.

b. Manholes shall be provided at intervals no greater than 400 feet where the conduit diameter is larger than 30 inches, but smaller than 48 inches.

c. Manholes shall be provided at intervals no greater than 500 feet where the conduit diameter is 48 inches or larger.

407-4.02 A pressure manhole shaft and a pressure cover shall be installed in a closed conduit system whenever the energy grade line is less than 0.50 below the top of the manhole.

Sec. 407-5 Losses

In addition to normal friction losses, energy losses due to entrance and exit conditions, bends, junctions, and transitions shall be computed. The engineer shall supply all data and reference material for calculated losses subject to review and approval by the Director.

Sec. 407-6 Erosion

407-6.01 Velocities within the closed conduit system should not exceed 20 feet per second with standard wall RCP, or 10 feet per second for plastic pipe. Where velocities exceed 20 feet per second for RCP, or 10 feet per second for plastic pipe, a special pipe shall be installed as approved by the Director.

407-6.02 Erosion protection against scour velocities shall be provided at the inlet and outlet of the closed conduit system. The engineer shall supply all data and reference material supporting his/her design, subject to approval by the Director.

Sec. 407-7 Catch Basins

407-7.01 The inlet design at closed conduit systems (i.e., location, depression, capacity, structural, etc.) shall be subject to review and approval by the Director.

407-7.02 Grate type inlets to the closed conduit system within the street right-of-way shall be allowed only in conjunction with side curb openings and shall be bicycle safe.

407-7.03 The minimum width of opening for any catch basin intended to be publicly maintained shall be three (3) feet and six (6) inches (3.5').

Sec. 407-8 Rights-of-Way/Easements

407-8.01 A right-of-way sufficient to contain the closed conduit and appurtenances plus a minimum of five feet on each side, measured from the edge of the conduit or drainage structure, shall be provided but in no case shall the right-of-way be less than 15-feet in width. Whenever possible, rights-of-way for conduits shall be adjacent to property lines and outside areas where structures are planned. Under no circumstances shall closed conduits and appurtenances be constructed less than 10-feet from any planned or existing structure.

407-8.02 Easements will be required on all closed conduit systems outside of the street right-of-way, which are intended for public maintenance.

407-8.3 Land rights shall be conveyed to the County in one of the following forms, whichever is appropriate:

1. Separate parcel easement dedicated on a subdivision map.
2. Easement dedicated on a subdivision map as part of adjacent lots.
3. Fee simple or easement offered or granted by separate documents.

CHAPTER VIII. RETENTION BASIN DESIGN

Sec. 408-1 Design Volume

The design volume of storm water retention basins shall be based upon the runoff from the ISDD five-day storm event and a volume of nuisance water determined by the engineer. No runoff generated on site from the design storm or from nuisance flows will be allowed to leave the site unless downstream drainage disposal facilities exist to handle the flow. The retention of upstream off-site flows shall not be considered to reduce the size of the required on-site retention facilities or mitigate the runoff from the proposed development. An evaluation of the runoff volumes associated with the site in its existing condition shall not reduce the size of the required drainage facilities. The runoff volume from the ISDD five-day storm shall be calculated using the formula:

$$\text{Runoff Volume} = 0.12\,(D_{10})(a_i)(\text{Area})$$

D_{10} = 10 yr 24-hr. depth of rainfall (in.)
a_i = average percentage of impervious area
Area = Drainage area of total development
0.12 = 1.44 x 1/12
1.44 = 5 day mass ratio (KC Hydrology Manual, Table B-1)
1/12 = Conversion of rainfall depth in inches to feet

Sec. 408-2 Hydraulic Design

In the absence of a hydrologic volume routing analysis, the storm drain hydraulic grade line calculations shall assume that 50% of the design storm volume and 100% of the nuisance volume is in the basin when the peak flow rates occur.

Sec. 408-3 Freeboard

Freeboard shall be required for all retention basins having a design water depth exceeding 18 inches. Six (6) inches of freeboard will be required when the design ponding depth within the basin is four (4) feet or less. For basins with a design ponding depth greater than four (4) feet the amount of freeboard required shall be one (1) foot. Freeboard shall be measured from the lowest gutter inlet or top of bank, whichever is lower.

Sec. 408-4 Fencing

Retention basins shall be fenced and provided with gated access when the design ponding depth exceeds 18 inches. All retention basins, regardless of ponding depth, that are maintained by the County or an entity administered by the County shall be enclosed by a six (6) foot high masonry block wall. Exceptions may be made, subject to the Director's approval, for certain master planned facilities intended for multi-purpose use.

408-4.01 The fence shall consist of a six (6) foot high chain link fence of 9 gage fabric with redwood slats or a six (6) foot masonry block wall or approved equal. Fence post footings shall have a minimum diameter of 12 inches and a minimum depth of 30 inches. Masonry block walls shall be designed in accordance with accepted engineering practices. Retaining walls used for basin fencing requirements shall have their design approved by the Director. See Plates R-77 thru R-82.

408-4.02 Fence setbacks measured from the top of slope shall provide a reasonable maintenance way for the equipment outlined in the maintenance plan. The following minimum setbacks shall apply:

Design ponding depth	Setback
≤ 18 inches	2 feet
> 18 inches but ≤ 4 feet	5 feet
> 4 feet	10 feet
> 8 feet	10 feet (or in accordance with an approved maint-enance plan).

408-4.03 The basin access gate may be chain-link, wrought iron, or other as approved by the Director. The double gate is not to be attached directly to the masonry wall. The opening must be sufficient for the 14-foot double gate and anchor posts. If wrought iron is used, a metal mesh privacy screen is to be securely attached to the double gate by rivets or equivalent as approved by the Director. Wrought iron double gates will also require a commercial grade latch or equivalent that can be locked with a County padlock (3/8” shackle diameter). See Plates D-11 for specific sizing and material requirements.

Sec. 408-5 Access

An equipment access ramp to the bottom of the retention basin shall be provided when the design depth exceeds 18 inches or when the facility is intended for County maintenance.

408-5.01 The ramp shall be a minimum of 12 feet wide with a maximum slope of 15%. The gate to the access ramp shall be 14 feet wide.

Exception - When the design ponding depth is $\leq$ 4 feet, the maximum slope on the ramp may be increased to 20%.

408-5.02 Ramps shall not be designed to convey drainage water into the sump.

408-5.03 The ramp alignment shall be no more than 45 degrees from the center of the access gate to facilitate maintenance equipment ingress and egress. Other proposed alignments shall have their design approved by the Director.

Sec. 408-6 Curbing and Rodent Barriers

408-6.01 In conjunction with fencing, a six (6) inch wide, eighteen (18) inch deep continuous concrete curb shall be provided around the top of the sump. The top of the curb shall be 0.5 feet above the highest adjacent grade. When the sump is fronting on a street, the top of the curbing shall be a minimum of one (1) foot above the top of the street curb. Ramped access across the curb shall be provided at all gated access points to the sump.

408-6.02 Rodent barriers will be required on the sides of the sump in proximity to open space, agricultural areas or lot one (1) acre or larger. The bottom of the rodent barrier shall be a minimum of 42 inches below finish grade.

Exception - Rodent barriers may be omitted when the design water depth is 4 feet or less.

Sec. 408-7 General Construction Requirements

408-7.01 General construction requirements for retention facilities shall be in accordance with Plates D-1, D-2, and D-3.

408-7.02 Retention facilities shall have the design volume contained entirely in cut.

408-7.03 Slopes shall be designed no steeper than is safe and no steeper than two (2) horizontal to one (1) vertical. A slope stability analysis will be required when the design water depth exceeds eight (8) feet and side slopes are steeper than 3:1.

408-7.04 The minimum bottom dimension for retention basins with a design depth greater than four (4) feet shall be 20 feet. For design water depths 4 feet or less, the minimum bottom width shall be no less than that required for maintenance equipment specified in the maintenance plan.

408-7.05 The maintenance way shall be sloped away from the top of bank at a minimum 2%.

408-7.06 Drainage basins intended for County maintenance shall be located on a lot dedicated exclusively for drainage/recreational purposes.

Sec. 408-8 <u>Testing</u>

408-8.01 Retention basins shall not be permitted unless it can be demonstrated, to the satisfaction of the Director, that the basin will completely drain the design volume within seven (7) days.

408-8.02 Testing of the proposed retention basin shall be provided by a Soils Engineer and shall include, but need not be limited to, an analysis of the soils boring logs and the establishment of the drainage rates of the soils encountered. A minimum of one (1) boring shall be logged within the proposed sump location. This boring shall be advanced below the invert of the basin to a depth equivalent to at least three (3) times the design ponding depth. Testing methods used to establish soil drainage rates shall be approved by the Director.

CHAPTER IX. DETENTION BASIN DESIGN

Sec. 409-1 <u>Design Flow</u>

The design flow into the basin shall be the ISDD five-day runoff hydrograph. Hydrograph design and mass ratios shall be in accordance with the Kern County Hydrology Manual. The out flow hydrograph shall not extend beyond five days from the end of the inflow hydrograph. Infiltration effects from the detention facility shall not be included in the calculation of the outflow hydrograph.

Sec. 409-2 <u>Facility Design</u>

Sizing and placement of detention facilities shall not aggravate the potential for downstream flooding.

Requirements for fencing, curbing, setbacks, access, and freeboard shall be in accordance with retention basin design.

409-2.01 Detention basins shall be provided with a concreted low flow bypass, or approved equivalent, for the conveyance of nuisance flows to the outlet.

409-2.02 An emergency spillway will be incorporated in the design of all detention basins.

Sec. 409-3 <u>Sedimentation</u>

Sediment yield shall be determined and mitigation provided by the developer's engineer.

Sec. 409-4 <u>Duplex Pump Station (Wet Well) Design Specifications</u>

Pumps used in conjunction with detention facilities shall have their design approved by the Director. Specific design criteria shall include the use of an automated duplex pump, and an alarm system. The pump system shall be designed to pass a minimum two (2) inch sphere and for reliability and low maintenance. Pump maintenance shall be included in the facility maintenance plan.

409-4.01 Pump station shall be designed to drain the sump in 5 to 7 days with one (1) pump running. However, the minimum flow rate shall be 100 gpm.

409-4.02 Pump station shall be a duplex system which automatically alternates between pumps at the end of each cycle.

409-4.03 The pump station shall either include a lag pump design or automatic controls, which will start the second pump if the first fails to pump.

409-4.04 Pumps shall be minimum one (1) HP.

409-4.05 Pump station shall be designed to allow easy removal of pumps for maintenance, without requiring personnel to enter into a wet well or similar enclosed structure. A "cage" style pump system, where the pump is located in a cage structure at the bottom of the basin, will not be allowed.

409-4.06 Pumps and pump station inlet structure shall be screened to prohibit plugging by debris.

409-4.07 The pump station (including the electrical/control panel) shall be located next to the entrance of the basin.

409-4.08 The receiver wet well shall consist of one 60” diameter concrete precast manhole sections with single offset R-3 rubber gasket joints per ASTM C-478, latest edition or approved equal. Duplex pump system shall be equipped with two 1HP (minimum), 115V, non-clog, explosion proof, sump pumps with alarm and alarm switch, check valves, ball valves, discharge line, pump lift out assembly, and electrical junction box. Include a 30” x 42” hatch with lockable, steel hinged access with safety grate.

409-4.09 The lifting assembly shall be best suited for the pump arrangement. All cables, etc. are to be stainless steel nylon coated. All slide metal surfaces must be considered non-sparking, by URL, to prevent spark ignition in wet well.

409-4.10 The valve vault shall consist of one 42” diameter concrete precast manhole section (conforming to ASTM C-478 with single offset R-3 gasket joints) with gate valves, swing check valves, and adjustable pipe supports or equivalent. Include a 24” x 24” hatch with lockable, hinged steel access door with safety grate.

409-4.11 Sump pump wiring shall be connected to a waterproof electrical control panel in a NEMA 3 enclosure or equivalent.

409-4.12 A four inch (4”) thick Class 2 concrete pad will be required to encompass the precast top slabs, manholes and control panel.

409-4.13 All electrical conduits and connectors shall be sealed water-tight and gas-tight using bitumastic paint.

409-4.14 All pipe or conduit wall penetrations shall be sealed with a neoprene seal.

409-4.15 All exposed steel (pipe, valves, flanges, elbows, and control box exterior) shall be primed with zinc-chromate primer and painted with an epoxy enamel finish. Color to be grey unless otherwise approved.

409-4.16 A water level staff shall be placed in the sump. The staff may be either anchored to the sideslope of the sump or be attached to the outlet structure, as approved by the Director. The bottom portion of the staff shall be painted black and white, alternating at one-foot increments, to an elevation equivalent to the half full-depth of the sump. The top portion of the staff shall be painted red and white, alternating at one-foot increments, to one foot above design water surface.

409-4.17 All controls shall be mounted in a NEMA (3) metal enclosure or equivalent. The control panel and all electrical components shall bear the Underwriter's Laboratory (UL) Label. All circuit breakers shall have operators extending through the control panel door. All motor starter overload resets, selector switches, push buttons and pilot lights shall be mounted on the control panel door. The control panel shall be enclosed in a vandal resistant enclosure with provisions for locking with a County's lock 3/8" shank pad lock or approved equal.

409-4.18 The control for each pump shall include a thermal magnetic circuit breaker, rotary hand-off-automatic switch, and magnetic motor starter with ambient compensated overload relays and quicktrip heaters. The pump control circuit shall include a door interlock switch to de-energize the control circuit when the control panel door is open, a control mounted transformer with fused 115 volt secondary, and a door mounted control circuit disconnect switch.

409-4.19 Pump operation shall be controlled by three (3) bulb type liquid level sensors. An intrinsically safe pilot circuit shall be provided for each level sensor to reduce the power to the sensor to a level incapable of releasing sufficient electrical or thermal energy to ignite explosive gases.

409-4.20 A fourth level sensor, with intrinsically safe circuit, shall be furnished for indication of high water alarm condition. High water alarm shall be indicated by a panel-mounted pilot light and external audible alarm with silence button.

409-4.21 The controls shall provide for lead/lag sequencing of the pumps, an automatic alternator shall alternate the lead/lag duty on each succeeding pump cycle. An outer pump seal leakage detection system shall be included in the control enclosure. When the motor probes sense the presence of moisture in the oil seal chamber, a relay coil will illuminate a panel mounted indicating alarm lamp to indicate possible outer motor seal failure and the alarm light.

409-4.22 The pump station shall have a Hand-Off-Auto switch and an automatic low water shut-off, and have green (run) and red (alarm) indicator lights visible from the road/street.

409-4.23 Control panel shall contain hour meters for each pump.

409-4.24 Control panel shall contain a switched GFI 115 volt duplex electrical outlet.

409-4.25 Control panel shall include an emergency generator hook-up connection.

409-4.26 System Testing—Installed pumps, controls and pipes shall be tested in accordance with recommendations of the manufacturer prior to acceptance by the Kern County Engineering, Surveying & permit Services Department.

409-4.27 Prior to acceptance, two (2) complete operation and maintenance manuals, with wiring and interconnect diagrams for all equipment and controls, model and serial numbers of the sump pumps, and a set of as-built drawings on cronar shall be furnished to the County.

CHAPTER X. CONSTRUCTED CHANNEL DESIGN CRITERIA

Sec. 410-1 Design Flow

Constructed channels shall be designed to carry the CSDD plus freeboard.

Sec. 410-2 Freeboard

410-2.01 The minimum freeboard between the design water surface, and the top of bank of the channel shall be 0.50 feet or 0.20 of the specific energy, whichever is greater.

410-2.02 If the designed water surface is within the embankment area, the design and construction of the channel shall be in accordance with the levee design criteria, including freeboard requirements.

410-2.03 The minimum freeboard requirements for bridges, culverts, and utility crossings which span open channels and which are existing, planned or projected at the time of channel design shall be in accordance with the requirements specified in Sections 406-2 and 406-3.

410-2.04 Superelevation resultant from directional modification shall be considered prior to computing the required freeboard.

Sec. 410-3 Hydraulic Design

410-3.01 Channels shall be designed with proper allowance for hydraulic losses for all planned and projected future crossings or other obstructions to maintain clearance and freeboard as required.

410-3.02 The water surface and the energy grade line profile shall be computed and plotted for all constructed channels and at locations where natural channels modifications are proposed.

410-3.03 Constructed channels shall not be designed with a slope in the range of ± 20% of critical slope unless freeboard equal to the height for instability waves is added.

410-3.04 A minimum velocity of two (2) feet per second shall be maintained for lined channels to prevent sedimentation.

Sec. 410-4 Structural Design

410-4.01 The minimum bottom width of constructed channels shall be ten (10) feet. A triangular channel may be permitted when the channel side slopes are four (4) to one (1) or flatter.

410-4.02 The minimum centerline radii for curves in constructed channels shall be three (3) times the top width of the design water surface.

410-4.03 Design of slopes shall be predicated upon results of an investigation by a Soil Engineer, subject to the approval of the Director.

410-4.04 Adequate bank protection and drop structures shall be provided where the slopes in the channel are steep and high velocities are present.

410-4.05 Bank protection shall be provided based on the design engineer's recommendations, subject to the approval of the Director. Stress area protection shall extend downstream from the end of the stress area a distance equal to ten (10) times the design water depth, unless the engineer can show that the erosion potential is not excessive.

410-4.06 At drop structures or in other locations where a hydraulic jump may occur, bank protection shall be provided through the hydraulic jump for a minimum distance of six (6) times the sum of the sequent depth and the depth of freeboard. This protection shall cover the invert and extend to the height of the sequent depth plus the height of the freeboard. The protection material may be either concrete, concreted-rock slope protection, sacked concrete, air-blown mortar or other approved alternative.

410-4.07 All channel lining materials and methods shall be specified by the engineer and approved by the Director.

410-4.08 All appurtenant drainage facilities shall be constructed and areas adjacent to channels graded so that erosion will be prevented within the channel right-of-way.

410-4.09 Waterways shall enter the main channel at an angle not exceeding 25 degrees.

Sec. 410-5 Erosion

The engineer shall provide recommendations on all necessary mitigation measures for erosion including bank protection and bottom stabilization of the channel, subject to the approval of the Director.

Sec. 410-6 Fencing

410-6.01 Constructed channels with slopes steeper than four (4) to one (1) with specific energy, at any point, greater than 1.5 feet shall be fenced in its entirety.

410-6.02 A six (6) foot high nine (9) gage chain link fence fabric with tension wire shall be installed on each side of the right-of-way.

410-6.03 At all road intersections, fencing shall be installed to prevent public access to constructed channels.

410-6.04 A 14 foot wide chain link drive gate shall be provided at all points of vehicular access.

Sec. 410-7 Easements/Right-of Ways and Maintenance Ways

410-7.01 Right-of-ways for constructed channels with side slopes steeper than four (4) to one (1) shall be provided as follows:

a. The right-of-way for channels with top widths greater than 50 feet, as measured to the top of freeboard, shall include the top width of the channel, two maintenance ways (one on each side of the channel), slope easements (when applicable), and interceptor ditch area (when applicable). The maintenance ways shall be a minimum of 15 feet wide. Runoff from the maintenance ways shall be mitigated.

b. The right-of-way for channels with top widths of 50 feet or less, as measured to the top of freeboard, shall include the top width of the channel, one maintenance way on either side of the channel, slope easements (when applicable), and interceptor ditch area (when applicable). The maintenance way shall be a minimum of 15 feet wide. Runoff from the maintenance way shall be mitigated.

410-7.02 The right-of-way for constructed channels with side slopes four (4) to one (1) or flatter shall be sufficient to contain the top width of the channel (measured from top of freeboard) plus slope easements as needed. A minimum of five (5) feet on either side of the channel shall be provided for maintenance purposes.

410-7.03 Right-of-way for turn-around: Turn-around distance and radii:

At the terminus and at intervals not to exceed one channel mile, turn around areas shall be provided. The minimum inside radii for maintenance roads shall be 40 feet.

410-7.04 Tributary waterways shall be conveyed under maintenance roads in closed conduits or culverts as applicable. Where open channel tributaries cross a maintenance road, a convenient turn-around area shall be provided for maintenance vehicles. The minimum diameter of a turn-around shall be 40 feet.

410-7.05 Right-of-Way for Channels Intersecting Public Roads:
At intersections of the channel with public roads, sufficient right-of-way shall be provided to permit access from the public road to the maintenance road as approved by the Director.

In the event that the channel right-of-way does not intersect a public road, a turn-around or a 15 foot wide access right-of-way shall be provided from a public road to the channel right-of-way at intervals not to exceed one (1) channel mile.

Sec. 410-8 Sedimentation

The determination of sediment yield and proposed mitigation measures of such shall be prepared and recommended by a qualified registered civil engineer, subject to the approval of the Director.

CHAPTER XI. LEVEE DESIGN

Sec. 411-1 Design Flow

Levees shall be designed to accommodate for the CSDD plus freeboard.

Sec. 411-2 Freeboard

411-2.01 The minimum freeboard between the designed CSDD water surface and the levee's top of bank shall be three (3) feet or 0.20 times the specific energy plus one (1) foot, whichever is greater.

411-2.02 An additional one (1) foot, above this minimum of freeboard, shall be required within 100 feet of either side of structures within the levee or whenever the flow is constricted, such as at bridges. An additional 0.50 foot above the minimum is also required at the upstream end, tapering to the minimum at the downstream end of the levee.

Sec. 411-3 Hydraulic Design

See Section 410-3 Hydraulic Design for details.

Sec. 411-4 Structural Design

Levees shall be designed in accordance with the latest revision of the Corps of Engineers Design and Construction of Levees, Engineer Manual, EM1110-2-1913.

Sec. 411-5 Erosion

Mitigation measure for erosion protection shall be prepared and recommended by a registered civil engineer, subject to the approval of the Director.

Sec. 411-6 Fencing

Fencing requirements for levees shall be in accordance with the criteria contained in the constructed channel design, Section 410-6.

Sec. 411-7 <u>Easements/Right-Of-Way</u>

Access, easements and right-of-way shall be in accordance with the requirements set forth in Section 410-7. (Constructed Channels).

Sec. 411-8 <u>Sedimentation</u>

Mitigation measures shall be prepared and recommended by a qualified, registered engineer, subject to the approval of the Director.

Sec. 411-9 <u>Maintenance</u>

A maintenance plan and an entity with taxing power to maintain levees shall be established, subject to the approval of the Director. Neither the County nor County Service Area will maintain a levee.

CHAPTER XII. NATURAL CHANNELS

Sec. 412-1 <u>Delineation</u>

All natural channels shall be identified and clearly delineated on the plans with the appropriate floodplain designation.

For defined natural channels, the Floodplain and Floodway Boundaries shall be delineated, subject to the approval of the Director.

Sec. 412-2 <u>Setback</u>

The minimum setback from the top of bank of a natural channel with side slopes steeper than two (2) horizontal to one (1) vertical, shall be a two (2) to one (1) slope plus a 10 foot wide buffer strip. The setback shall be measured from the toe of the slope. Where the slopes are flatter than two (2) to one (1), the required setback shall be a minimum of 10 feet from the Floodway limit.

Sec. 412-3 <u>Tie-Ins</u>

Where natural channels merge into constructed channels, the tie-ins shall be designed in a manner to dissipate energy and protect against erosion. The design for such tie-ins shall be in accordance with acceptable engineering practices and approved by the Director.

Sec. 412-4 <u>Relocation</u>

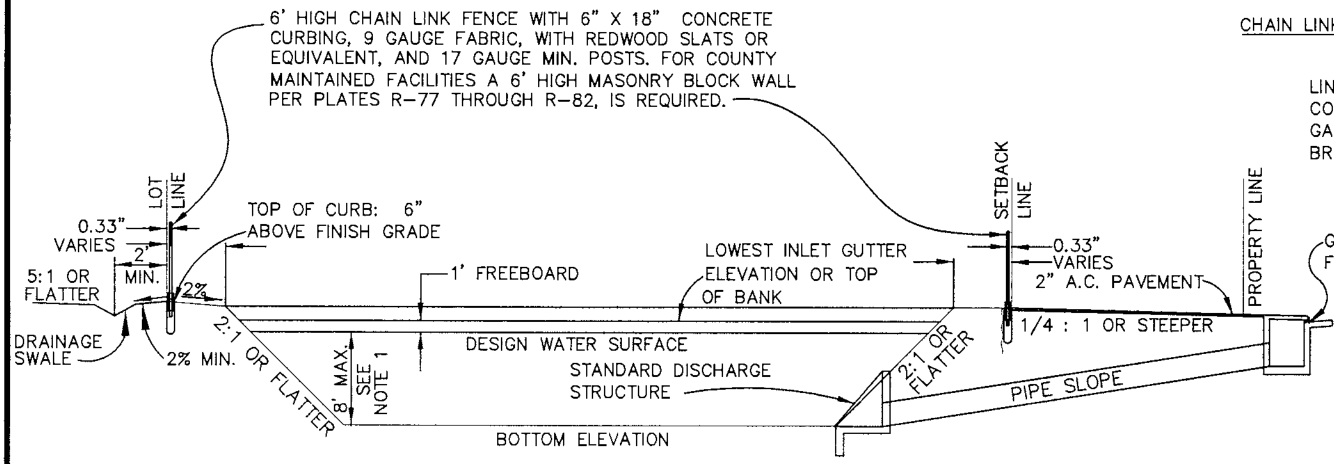
Should an existing natural channel be relocated, the channel shall be designed in accordance with the criteria specified herein for constructed channels.

Sec. 412-5 <u>Use of Natural Facilities</u>

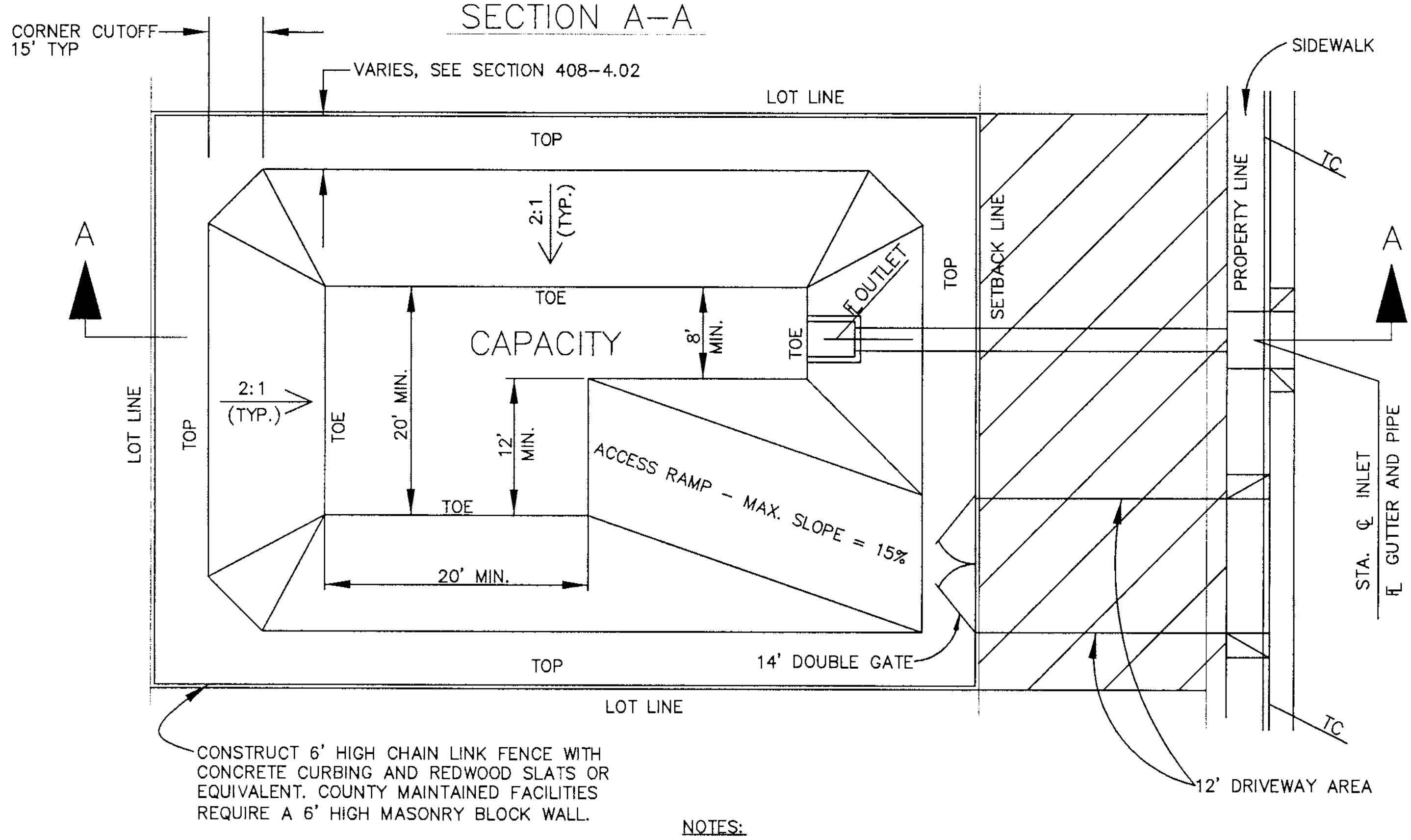
All applicable Federal and State permits and requirements shall be required for any operation that would discharge dredged or fill material in any waters of the United States (normally channels identified with blue lines on the U.S.G.S. maps).

CHAIN LINK FENCE POST:

	O.D.
LINE	2.375"
CORNER	2.875"
GATE	4.000"
BRACES	1.25"



SECTION A–A



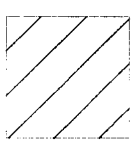
SUMP PLAN

LEGEND

TOP – TOP OF CURB

FG – FINISH GRADE

OG – ORIGINAL GROUND

 INDICATES 2" A.C. OVER NATIVE SOIL WHICH HAS BEEN TREATED WITH A PERMANENT SOIL STERILANT SUBJECT TO THE APPROVAL OF THE DIRECTOR.

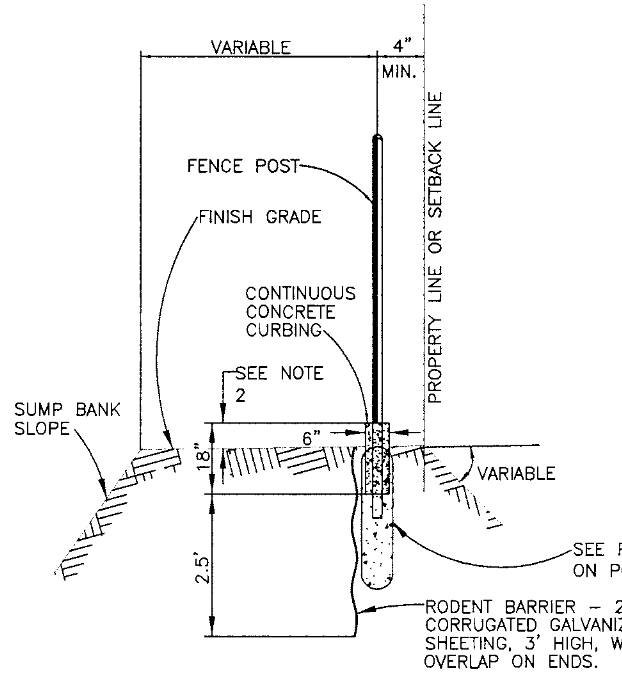
NOTES:

1. MAY EXCEED 8' IF SIDE SLOPES ARE 3:1 OR FLATTER; OR A SLOPE STABILITY ANALYSIS IS PROVIDED.
2. VARIATIONS TO THE DIMENSION MAY BE APPROVED BY THE DIRECTOR.
3. ADDITIONAL REQUIREMENTS MAY BE IMPOSED AS PART OF THE CONDITIONS ISSUED.
4. COMPACT O.G. TO 95% FOR MINIMUM OF SIX (6) INCHES UNDER 2" A.C.
5. WHEN FENCE IS SET ON FRONT R/W LINE SIDEWALK SHALL BE FULL WIDTH.
6. TACK WELD FABRIC AND HARDWARE TO POSTS.
7. TREAT BLOCK WALL WITH ANTI–GRAFFITI PRODUCT SUBJECT TO APPROVAL OF THE DIRECTOR.
8. CONSTRUCT 6" X 18" CONCRETE CURB UNDER GATE W/ TWO (2) #4 REBAR TOP AND BOTTOM.

PLOTTED: 02/25/2010

I:\Drafting\Archive\Dev_Std\Rev'd_09\Disk_2\2\D-1 Sump Details.dwg

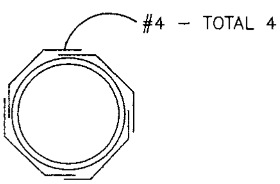
Revisions Date	Desc				
4/09	B.D.H	DATE: 8-18-1995	COUNTY OF KERN STATE OF CALIFORNIA DEVELOPMENT STANDARD	SUMP DETAILS	PLATE NO. D-1
.	.	DESIGNED BY: R.J.L.			
.	.	DRAWN BY: K.S.			
.	.	CHECKED BY: A.A.			



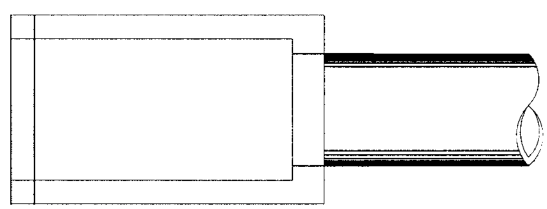
NOTES:

1. ALL CONCRETE SHALL BE CLASS 3 CONCRETE AND SHALL BE WITHIN 2.5" TO 5.5" SLUMP.
2. CONCRETE SHALL BE TOWELED SMOOTH AND BRUSH FINISHED.
3. VARIES FROM 3" TO 6" ABOVE FINISH GRADE.
4. SUBGRADE PREP. SHALL BE CONSTRUCTED TRUE TO GRADE AND CROSS SECTION WITH COMPACTION AT 90% TO DEPTH OF 6"

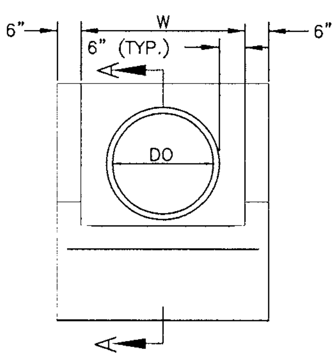
CURBING AND RODENT BARRIER DETAILS



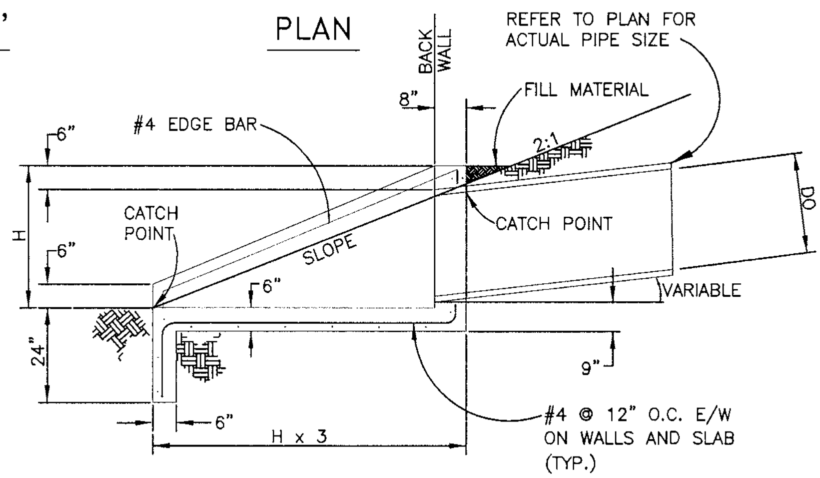
DETAIL "A"



PLAN



FRONT



SECTION A-A

DISCHARGE STRUCTURE

PLOTTED: 02/25/2010

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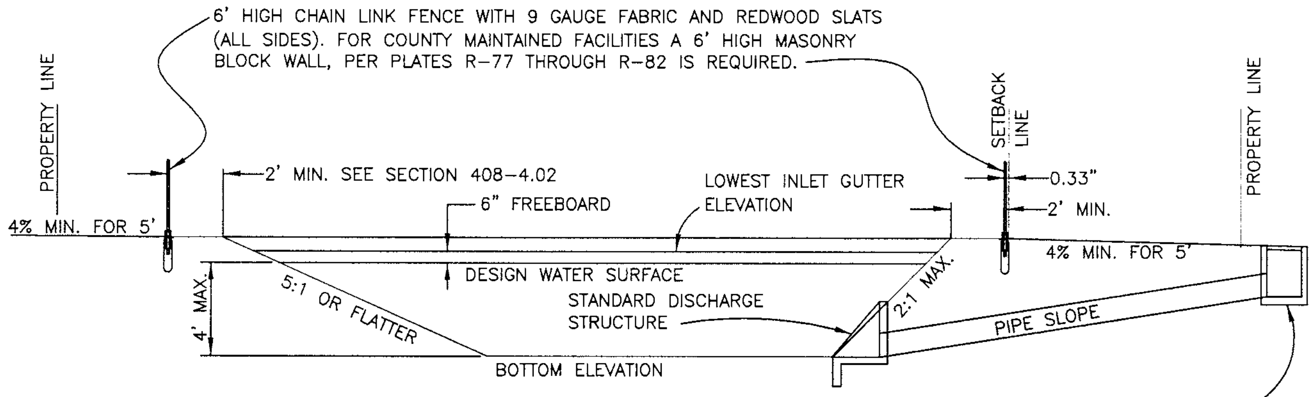
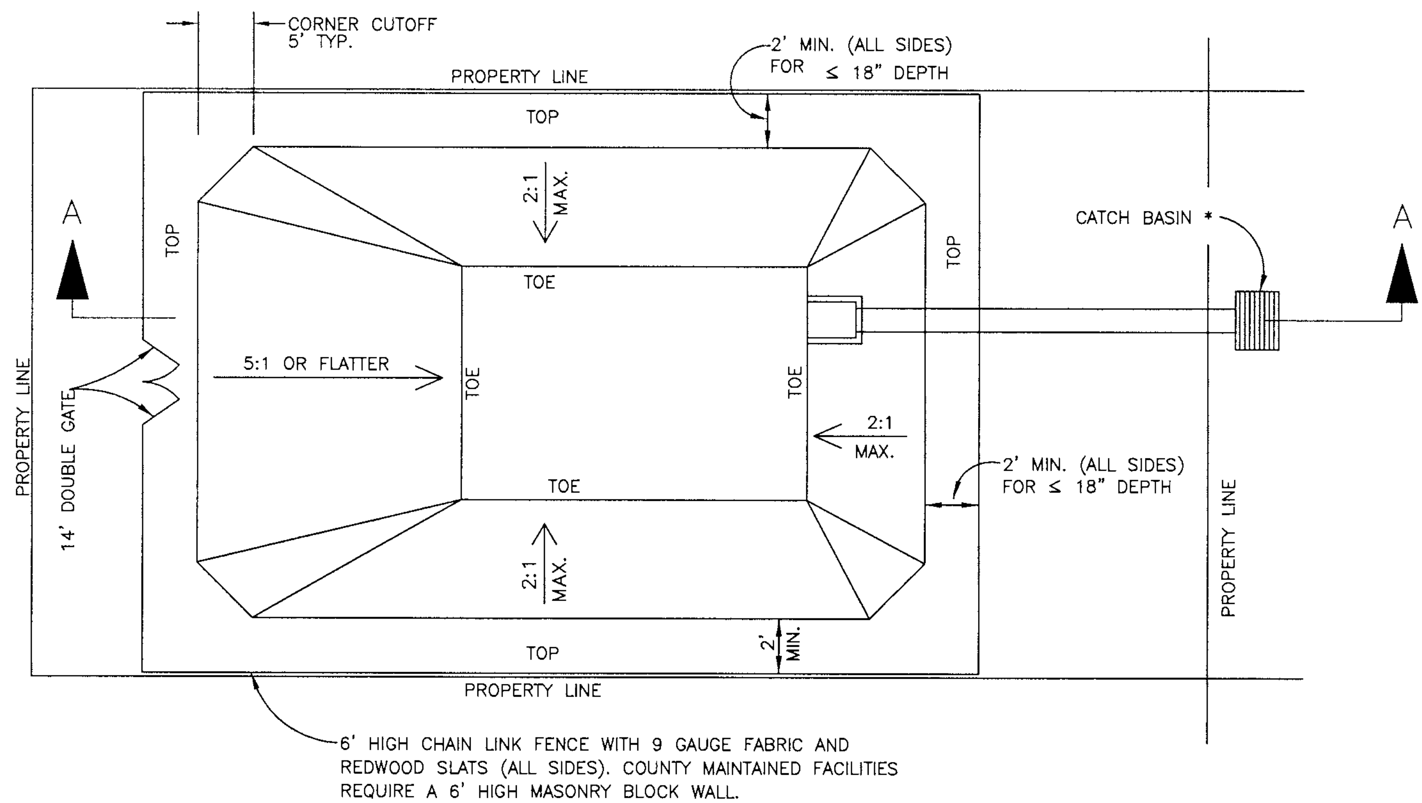
Revisions					
Date	Desc	DATE: 3-31-1995	COUNTY OF KERN STATE OF CALIFORNIA DEVELOPMENT STANDARD	CURBING, RODENT BARRIER, AND DISCHARGE STRUCTURE DETAILS	PLATE NO. D-2
4/09	B HILL	DESIGNED BY: R.J.L.			
.	.	DRAWN BY: K.S			
.	.	CHECKED BY: C.L.			
.	.				



SECTION A–A



SUMP PLAN

* NO CURB AND GUTTER SHOWN

NOTE:
SEE ADDITIONAL NOTES AND REQUIREMENTS FOR CHAIN-LINK FENCES AND MASONRY WALLS ON PLATE D-1

PLOTTED: 02/25/2010

I:\Drafting\Archive\Dev_Std\Rev'd_09\Disk_2\2\D-3 Shallow Sump.dwg

Revisions Date / Desc		
4/09	B.D.H.	DATE: 8-18-1995
.	.	DESIGNED BY: R.J.L.
.	.	DRAWN BY: K.S
.	.	CHECKED BY: C.L.
.	.	

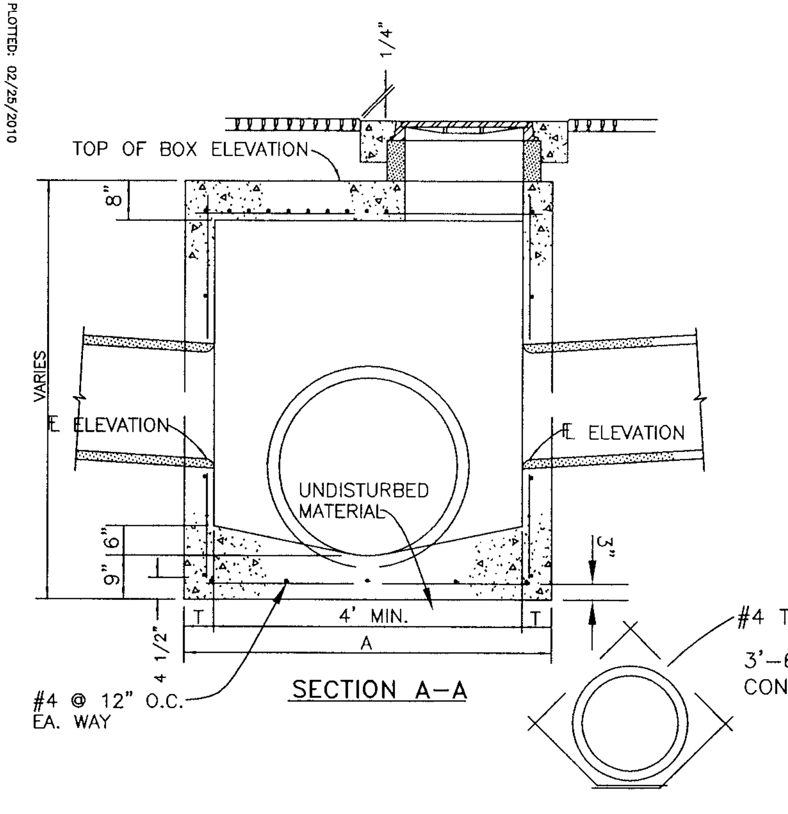
COUNTY OF KERN
STATE OF CALIFORNIA
DEVELOPMENT STANDARD

SHALLOW SUMP DETAILS

PLATE NO. D-3

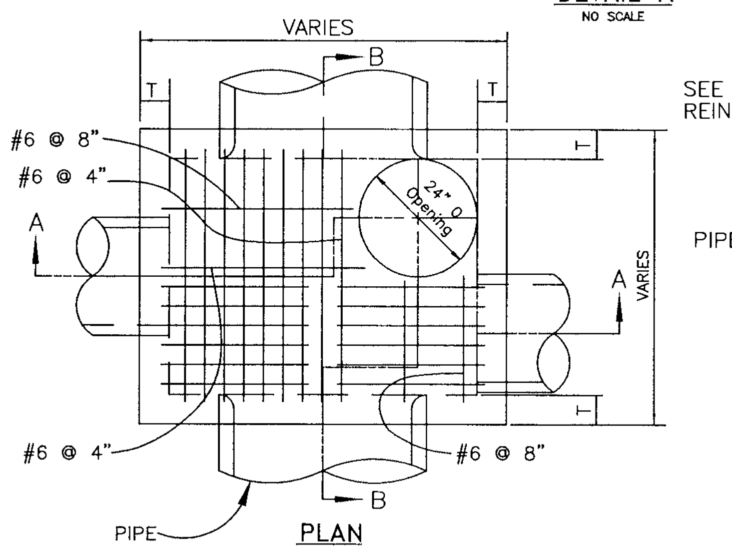
NOTES:

1. ALL CONCRETE SHALL BE MINOR CONCRETE.
2. WALL REINFORCING NOT REQUIRED WHEN H = 8' OR LESS AND THE UNSUPPORTED LENGTH OF ALL WALLS = 7' OR LESS. WALLS EXCEEDING EITHER LIMIT SHALL BE REINFORCED WITH #4 BARS AT 18" CENTERS PLACED 1 1/2" CLEAR TO INSIDE OF BOX UNLESS OTHERWISE SHOWN.
3. GALAVANIZING – SEE STANDARD SPECIFICATIONS OR SPECIAL PROVISIONS.
4. T = 6" WHEN H = 8' OR LESS AND THE UNSUPPORTED LENGTH OF ALL WALLS = 7' OR LESS. WALLS EXCEEDING EITHER LIMIT SHALL HAVE T = 8".
5. LOCATION OF FRAME AND COVER TO BE DETERMINED BY THE ENGINEER.
6. PRECAST ALTERNATIVE IS OPTIONAL. SEE SECTION 51–1.02 OF STANDARD SPECIFICATIONS.

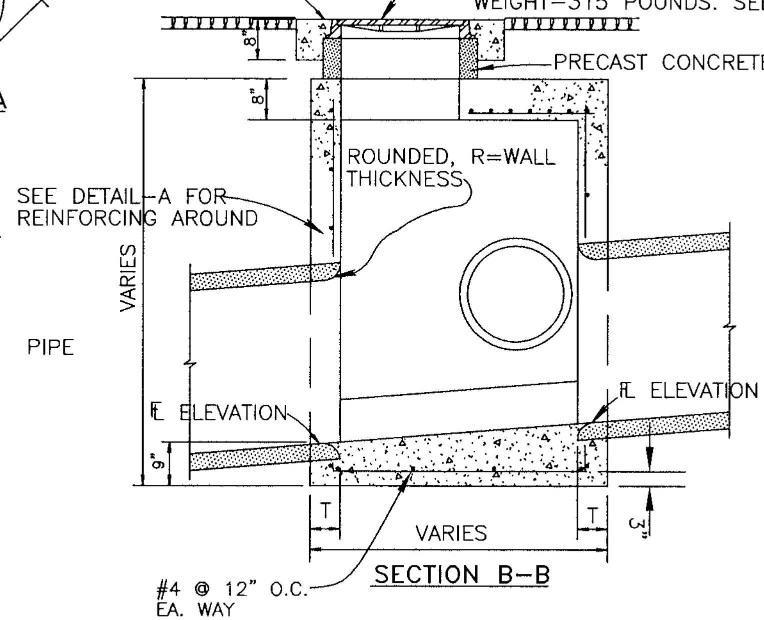


SECTION A–A

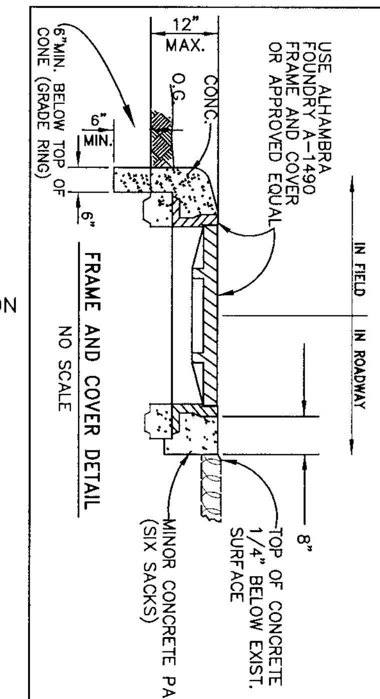
DETAIL A
NO SCALE



PLAN



SECTION B–B



FRAME AND COVER DETAIL
NO SCALE

TYPE "B" MINOR STRUCTURE

PLOTTED: 02/25/2010

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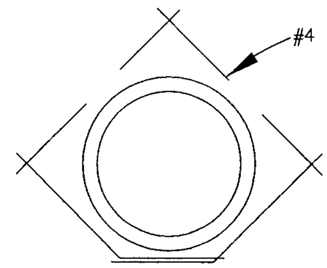
Revisions	
Date	Desc
4/10/09	REVISED

DATE: 8–18–1995
DESIGNED BY: A.A.
DRAWN BY: D.M.
CHECKED BY: G.F.

COUNTY OF KERN
STATE OF CALIFORNIA
DEVELOPMENT STANDARD

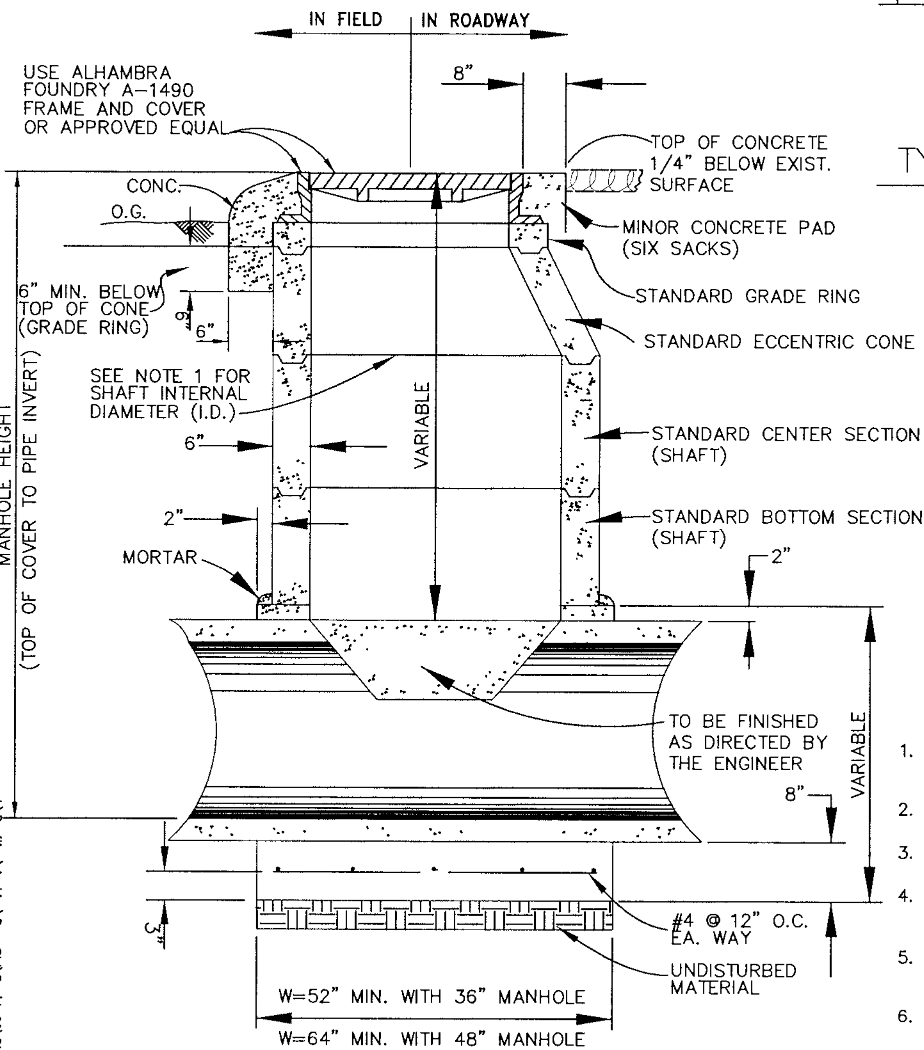
TYPE "B" MINOR STRUCTURE– JUNCTION BOX

PLATE NO. D–4



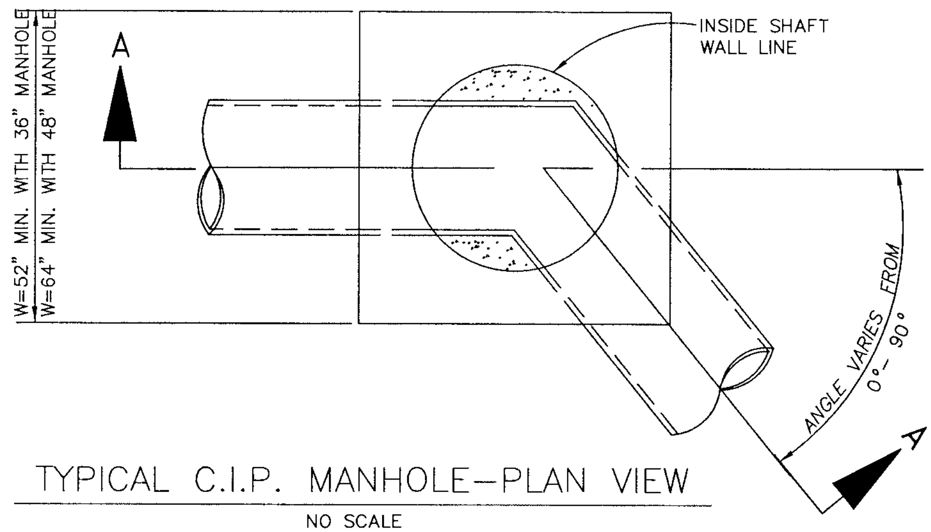
DETAIL A

NO SCALE



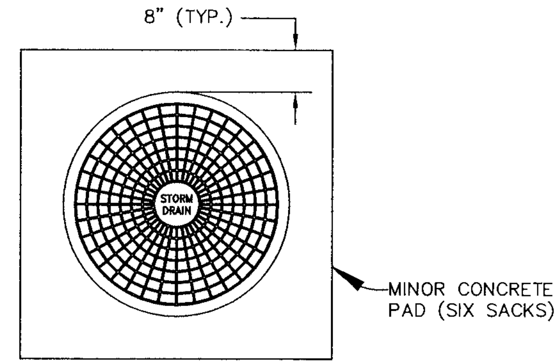
SECTION A-A

NO SCALE



TYPICAL C.I.P. MANHOLE-PLAN VIEW

NO SCALE



MANHOLE COVER AND CONCRETE PAD

NO SCALE

NOTES:

1. MANHOLE CONSTRUCTED ON CONCRETE PIPE OF 36" I.D. OR GREATER SHALL USE 48" SHAFT; CONCRETE PIPE WITH LESS THAN 36" I.D. SHALL USE 36" SHAFT.
2. USE COMBINATION OF CONE AND SHAFT AS DIRECTED BY THE ENGINEER.
3. ALL CONCRETE TO BE MINOR CONCRETE.
4. ALL REINFORCING TO BE NO.4 BARS AT 12" O.C., 1 1/2" CLEAR OF INSIDE FACE UNLESS OTHERWISE NOTED. SEE DETAIL "A" FOR REINFORCING AROUND PIPE.
5. ALL EXPOSED METAL PARTS SHALL BE GALVANIZED AFTER FABRICATION EXCEPT FRAME AND COVER.
6. LOCATION OF FRAME AND COVER TO BE DETERMINED BY THE ENGINEER.
7. ALL REINFORCEMENT FOR SURFACES IN CONTACT WITH THE GROUND SHALL BE PROTECTED WITH NOT LESS THAN 2" OF CONCRETE.
8. WORDING ON MANHOLE TO READ "STORM DRAIN".

PLOTTED: 02/25/2010

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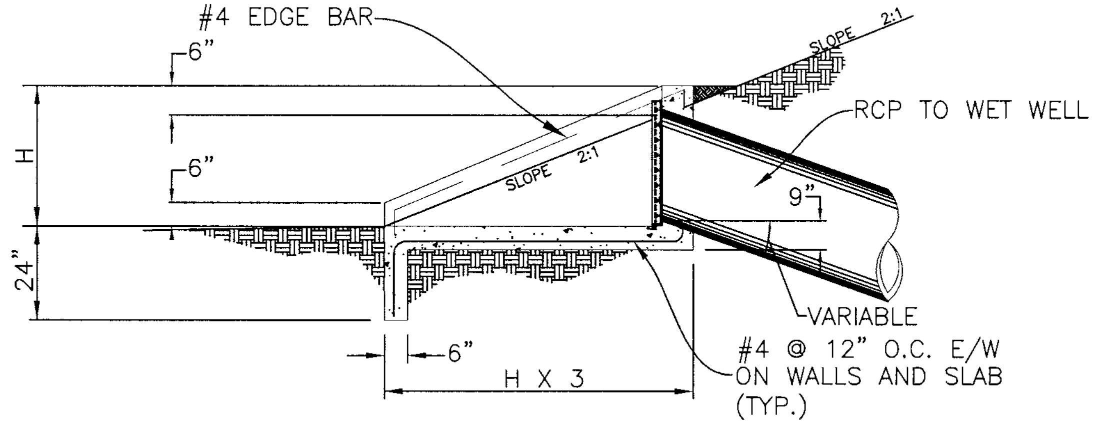
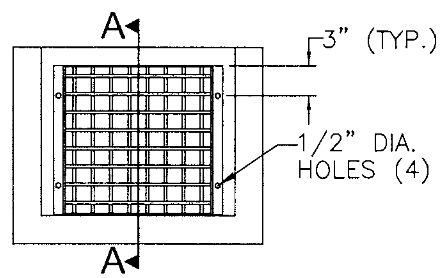
Revisions		DATE: 8-18-1995	COUNTY OF KERN STATE OF CALIFORNIA DEVELOPMENT STANDARD	TYPE "C" MINOR STRUCTURE- MANHOLE	PLATE NO. D-5
Date	Desc	DESIGNED BY: A.A.			
4/10/09	REVISED	DRAWN BY: D.M.			
.	.	CHECKED BY: G.F.			



SECTION A-A



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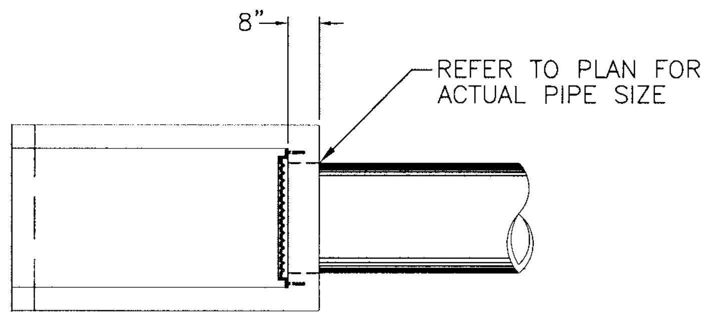

PLAN

INLET STRUCTURE

GRATE NOTES:

1. GRATE FABRICATED OR EQUIVALENT SHELF ITEM– ALL PARTS & PRODUCTS GALVANIZED
2. FRAME CONSTRUCTED W/ 1/4" x 3/4" x 2" x LENGTH (VARIES TO PIPE SIZE) ANGLE IRON
3. MIN. FOUR– 3/8"X 3" S.S. RED HEAD ANCHOR BOLTS FLAT LOCK WASHER, 2 EA PER VERTICAL ANGLE 3" FROM TOP & BOTTOM OF FRAME.
4. FOUR–1/2" DIA. HOLES IN FRAME
5. GRATE OPENING 1 3/16" x 2" O.C.
6. 1/4" DIA ROD WELDED TO FRAME ON ALL SIDES

NOTES:

1. PIPE DETAIL REFER TO PLATE D–2.

PLOTTED: 02/25/2010

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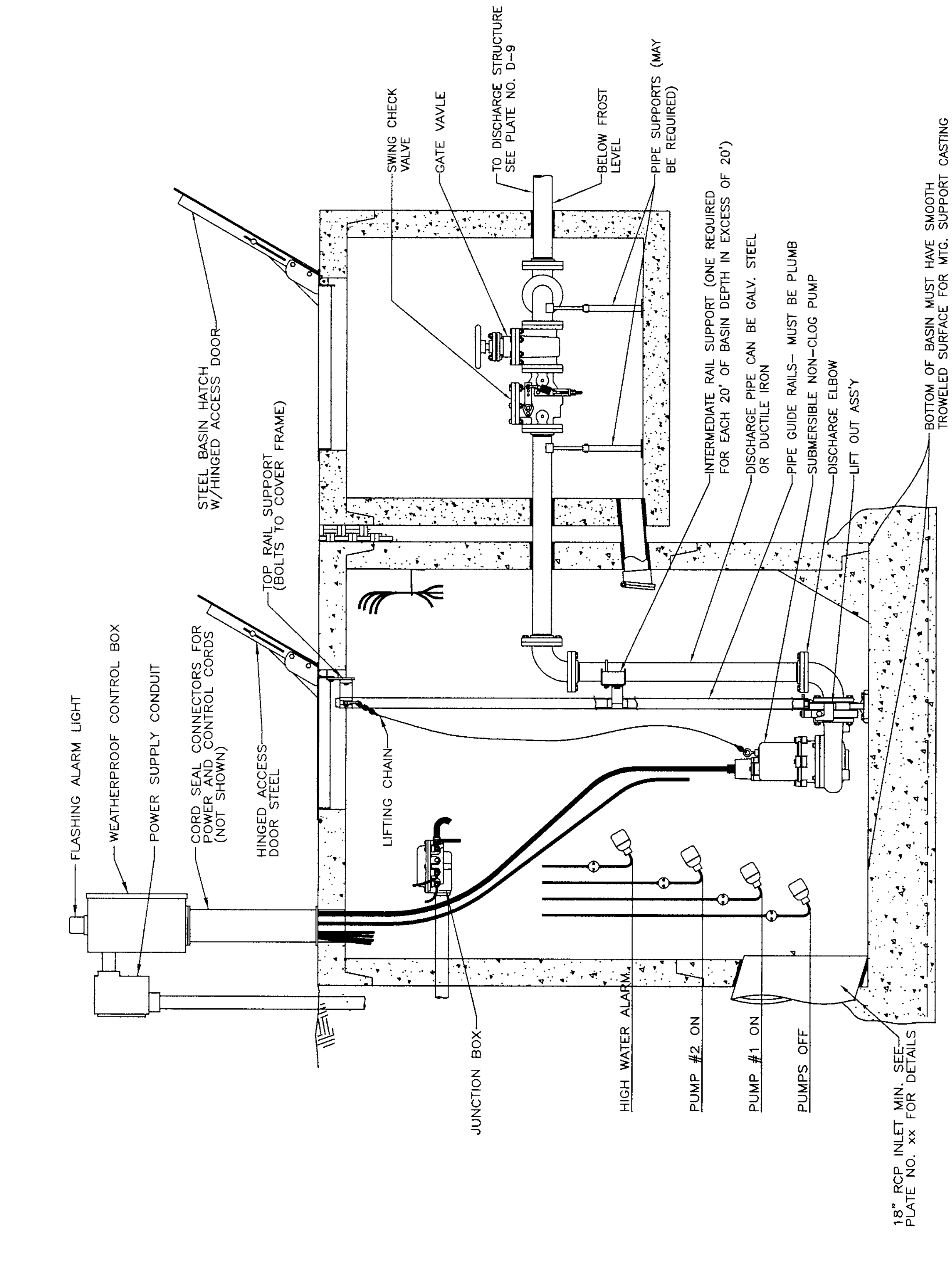
Revisions Date Desc	4–30–2009 DESIGNED BY: K.L.H. DRAWN BY: B.D.H. CHECKED BY: A.A.	COUNTY OF KERN STATE OF CALIFORNIA DEVELOPMENT STANDARD	PUMP STATION INLET STRUCTURE	PLATE NO. D–6



PLOTTED: 02/25/2010

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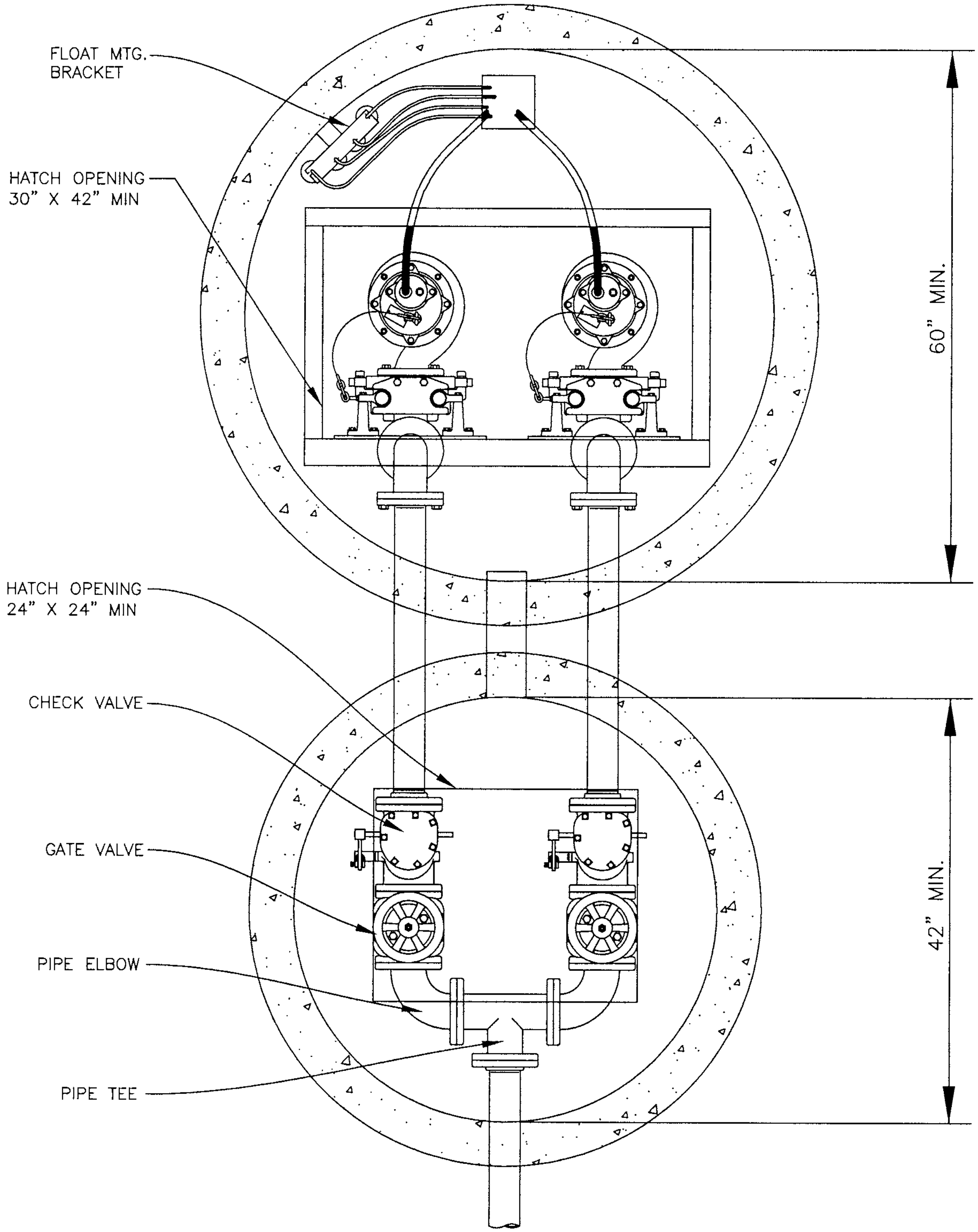
Revisions Date	Desc		COUNTY OF KERN STATE OF CALIFORNIA		PLATE NO.
.	.	4-30-2009	DEVELOPMENT STANDARD	DUPLEX PUMP STATION	D-7
.	.	DESIGNED BY: F.E.M.			
.	.	DRAWN BY: B.D.H			
.	.	CHECKED BY: K.L.H.			
.	.				

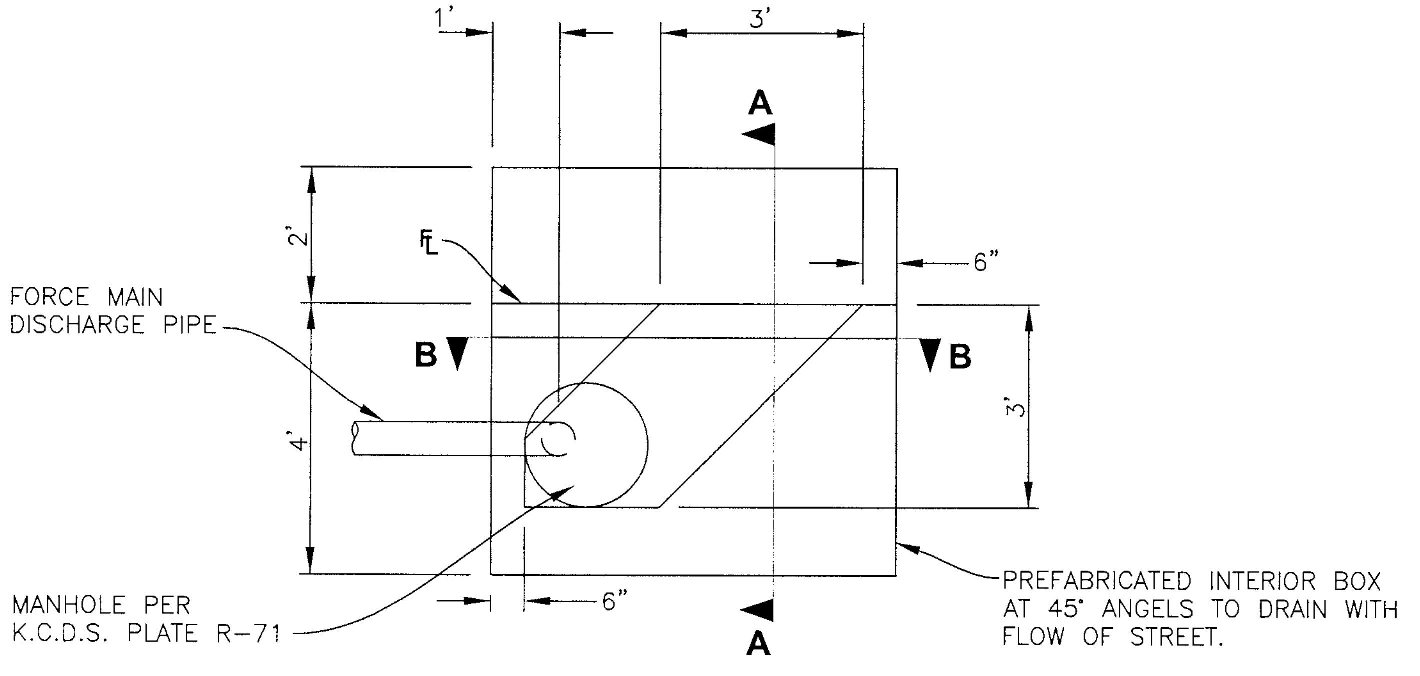


*MODIFIED FROM FEMyers.com NON-CLOG, 3" DISCHARGE, DUPLEX PUMP INSTALLATION DRAWING ESS-2228b

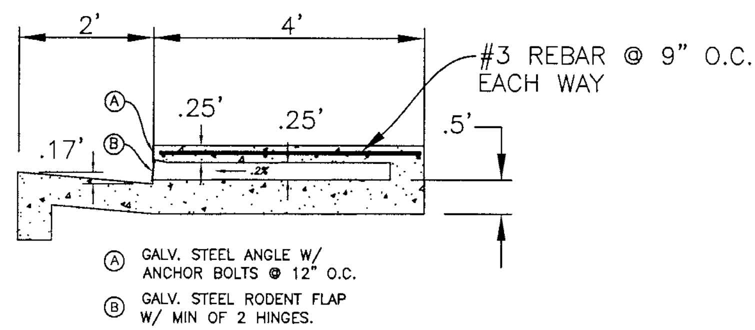
PLOTTED: 02/25/2010

I:\Drafting\Archive\Dev_Std\Rev'd_09\Disk_2\2\D-8 Duplex Pumps.dwg

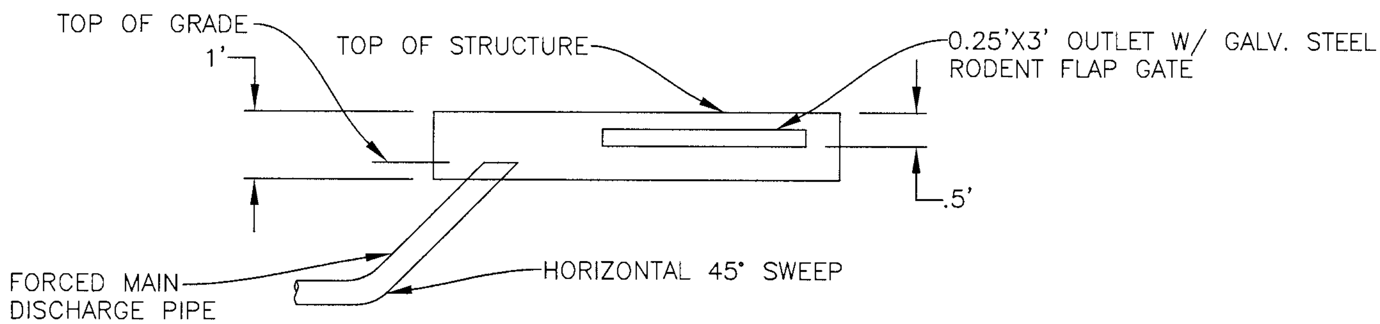
Revisions Date Desc	4-30-2009	COUNTY OF KERN STATE OF CALIFORNIA		PLATE NO.
. .	DESIGNED BY: F.E.M.	DEVELOPMENT STANDARD	PLAN VIEW DUPLEX PUMPS	D-8
. .	DRAWN BY: B.D.H.			
. .	CHECKED BY: K.L.H.			



DISCHARGE STRUCTURE



SECTION A–A



SECTION B–B

PLOTTED: 02/25/2010

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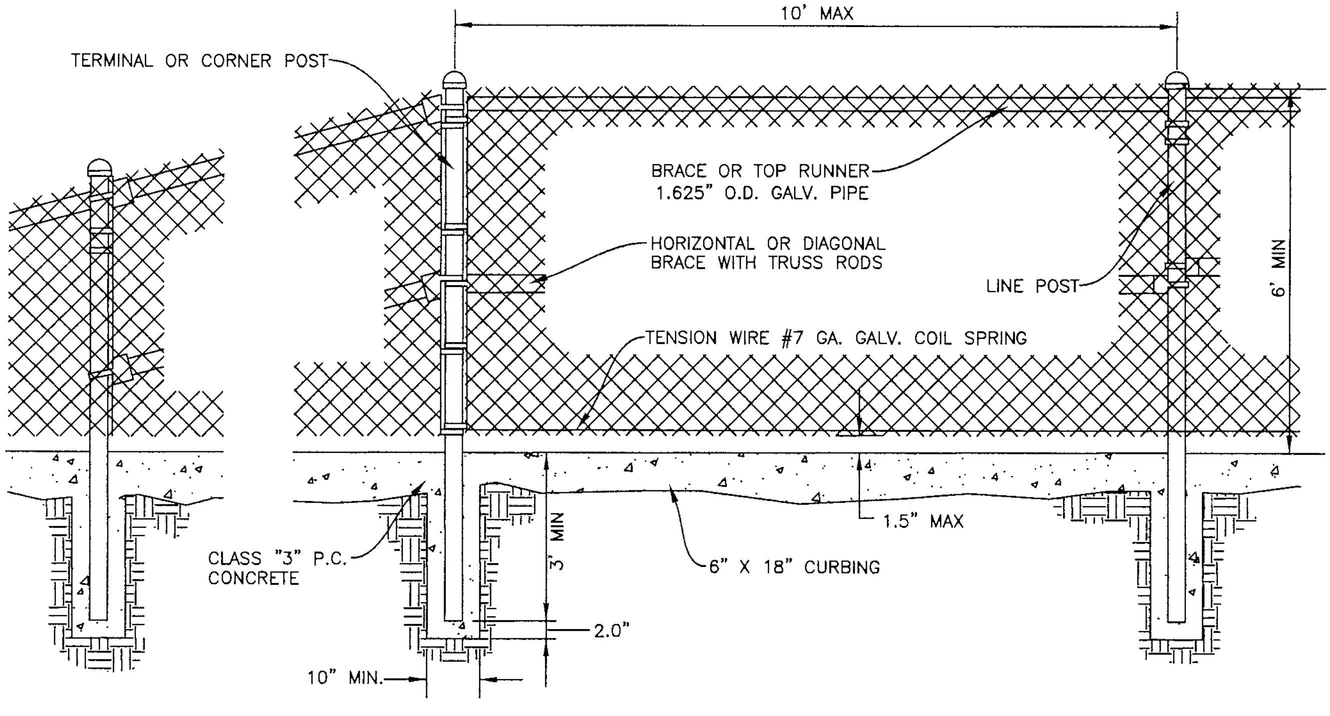
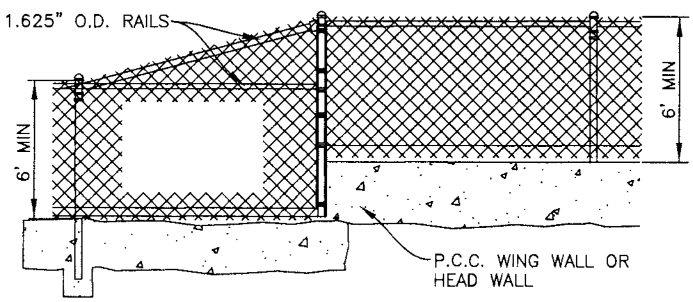
Revisions Date Desc	4-30-2009	COUNTY OF KERN STATE OF CALIFORNIA DEVELOPMENT STANDARD	PUMP STATION DISCHARGE STRUCTURE	PLATE NO. D-9
. .	DESIGNED BY: K.L.H.			
. .	DRAWN BY: B.D.H.			
. .	CHECKED BY: A.A.			
. .				



TYPICAL CHAIN LINK FENCE DETAIL



TYPICAL DETAIL AT
CULVERT ENDWALLS

FENCING SPECIFICATIONS:

1. FENCING FABRIC SHALL BE 9 GUAGE, 2" MESH, AFTER WEAVING, KNUCKLED TOP AND BOTTOM, 6' HIGH GALV.
2. CORNER POSTS SHALL BE 2–7/8" O.D. GALV. PIPE.
3. LINE POST 2–3/8" O.D. GALV. PIPE.
4. PRIVACY SLATS SHALL BE 2–3/16" X 1/4".

NOTES:

1. INSTALLATION OF FENCING AND GATES SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF "STANDARD SPECIFICATION, STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION," APPROVED CURRENT EDITION.
2. CONCRETE CURBING SHALL BE CONSTRUCTED UNDER ALL FENCES. CURBING SHALL BE 6" X 18", CLASS 3 CONCRETE.
3. CORNER POST SHALL BE INSTALLED AT ALL ANGLES IN FENCE LINE IN EXCESS OF 10".
4. END, CORNER, AND GATE POSTS SHALL BE BRACED TO THE NEAREST LINE POST WITH GALV. DIAGONAL OR HORIZONTAL BRACES USED AS COMPRESSION MEMBERS AND GALV. 0.375" STEEL TRUSS RODS WITH TURNBUCKLES OR TRUSS TIGHTENER USED AS TENSION MEMBERS.
5. FABRIC SHALL BE FASTENED TO GATE POST, TERMINAL POST, OR CORNER POST WITH 3" X 3/4" STRETCHER BAR BONDS AT 8" ON CENTER.
6. FABRIC SHALL BE FASTENED TO LINE POST, LAST RUNNER, AND BOTTOM TENSION WIRES WITH FABRIC BONDS SPACED APPROX. 14" APART.
7. FABRIC SHALL CONFORM TO ASTM A–392, CLASS 1.
8. SUBGRADE PREPARATION SHALL BE CONSTRUCTED TRUE TO GRADE AND CROSS SECTION WITH COMPACTION OF 85% TO A DEPTH OF 0.5"
9. WHEN REDWOOD SUBURBAN SCREEN, OR EQUIVALENT IS REQUIRED IT SHALL BE CONSTRUCTED SO THAT THE SLATS ARE LOCKED INTO POSITION AND CAN ONLY BE REMOVED WITH TOOLS.
10. FENCE FABRIC IS TO BE TACK WELDED TO POSTS IN THREE PLACES (TOP, CENTER, AND BOTTOM). FENCE HARDWARE IS TO BE TACK WELDED AND GROUND SMOOTH. ALL EXPOSED METAL PARTS ARE TO BE GALV. PRIOR TO INSTALLATION.

PLOTTED: 02/25/2010

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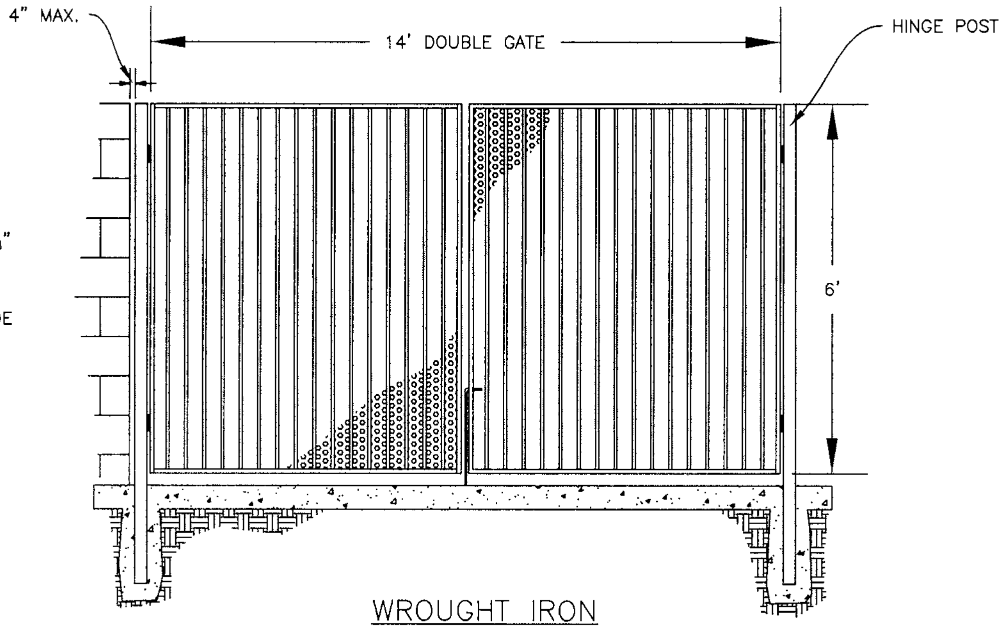
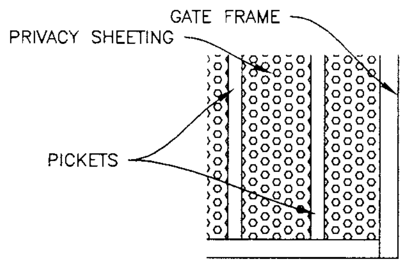
Revisions Date Desc	DATE: 6-6-2009 DESIGNED BY: K.L.H. DRAWN BY: B.D.H. CHECKED BY: A.A.	COUNTY OF KERN STATE OF CALIFORNIA DEVELOPMENT STANDARD	CHAIN LINK FENCING SPECIFICATIONS	PLATE NO. D–10

WROUGHT IRON GATE SPECS:

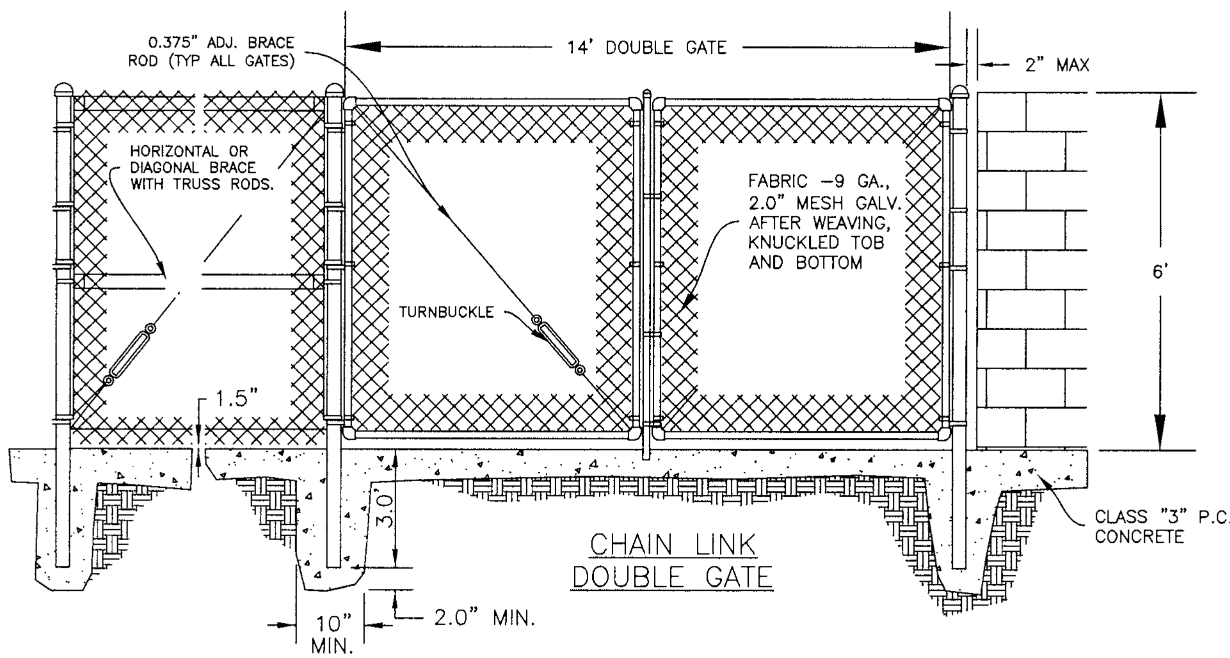
1. HINGE POST SHALL BE A MIN. OF 4x4x3/16" SQ TUBING.
2. GATE FRAME SHALL BE A MIN. 1-1/2" SQ. TUBING.
3. PICKETS SHALL BE A MIN. 3/4" SQ TUBING WITH 4" MAX CLEAR DIMENSION.
4. PRIVACY SHEETING SHALL BE PERFORATED SHEET METAL, 24 GAUGE, 1/16" DIM HOLE, 1/8" STAGGERED CENTER.
5. GATE SHALL BE A 14' DOUBLE GATE.
6. GATE LATCH SHALL HAVE COMMERCIAL GRADE LOCKING DEVICE FOR 3/8" PADLOCK SHANK OR A LICKING DEVICE THAT CAN BE KEYED TO THE STANDARD K.C.E.S.S. KEY-CORE.



WROUGHT IRON DOUBLE GATE



PRIVACY SHEETING DETAIL



CHAIN LINK DOUBLE GATE

DOUBLE DRIVE GATE

WIDTH-14'
HEIGHT-6'
FRAME-1.875" O.D. GALV. PIPE 2.72LB/FT
COMMERCIAL LOCKING DEVICE WITH DROP ROD

NOTES:

1. CURBING AS SPECIFIED BY COUNTY OF KERN DEVELOPMENT STANDARDS, PLATE D-2.
2. END, CORNER, AND GATE POSTS SHALL BE BRACED TO THE NEAREST LINE POST WITH GALV. DIAGONAL OR HORIZONTAL BRACES USED AS COMPRESSION MEMBERS AND GALV. 0.375" STEEL TRUSS RODS WITH TURNBUCKLES OR TRUSS TIGHTENERS USED AS TENSION MEMBERS.
3. WHEN REDWOOD SUBURBAN SCREEN, OR EQUIVALENT, IS REQUIRED IT SHALL BE CONSTRUCTED SO THAT THE SLATS ARE LOCKED INTO POSITION AND CAN ONLY BE REMOVED WITH TOOLS.
4. FRAMES SHALL BE MADE WITH FITTINGS OR WELDS GROUND SMOOTH, AND GALVANIZED.
5. CHAIN LINK FENCE FABRIC SHALL CONFORM TO ASTM: A-392, CLASS 1, AND BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF SECTION 80-4 OF THE "STANDARD SPECIFICATIONS, STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION", APPROVED CURRENT EDITION.

PLOTTED: 02/25/2010

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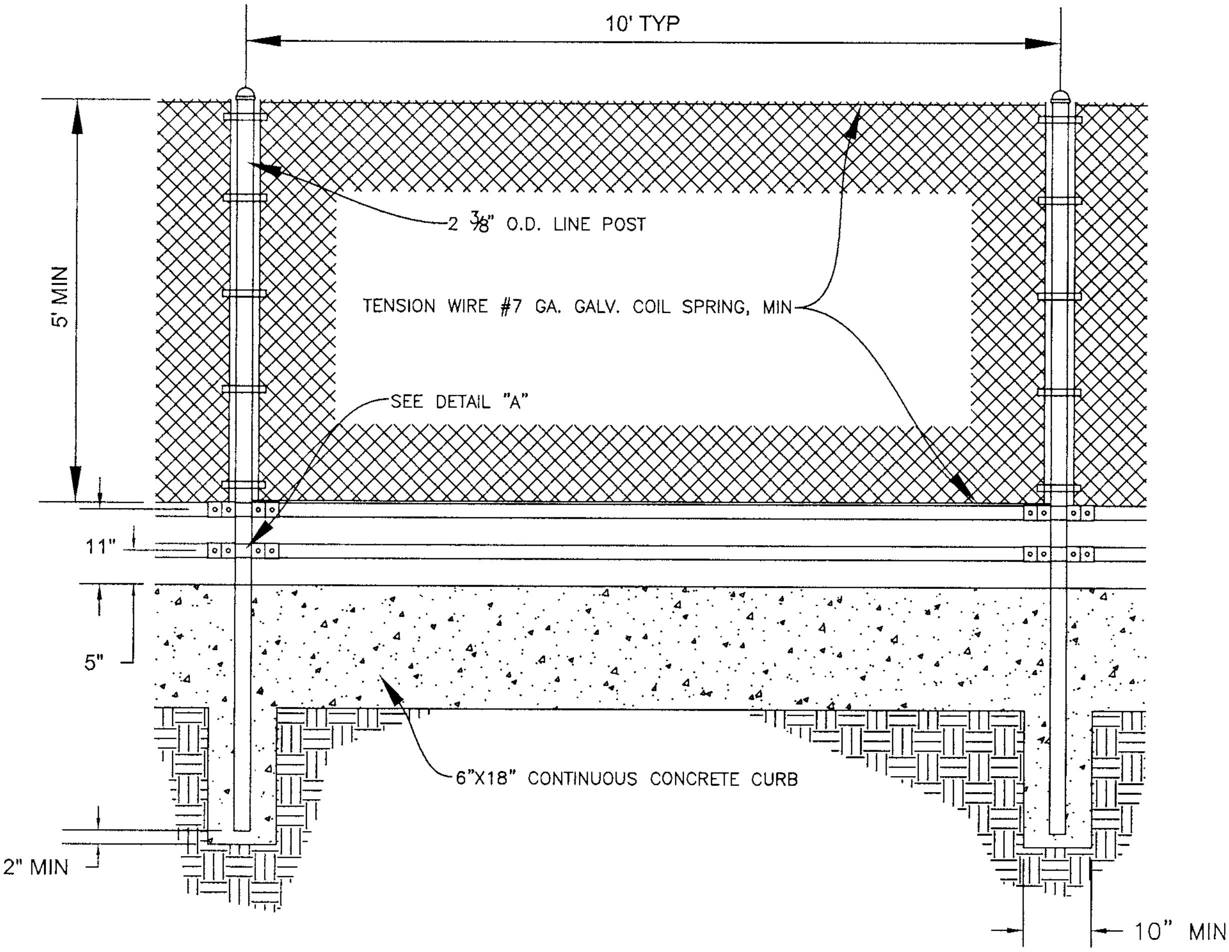
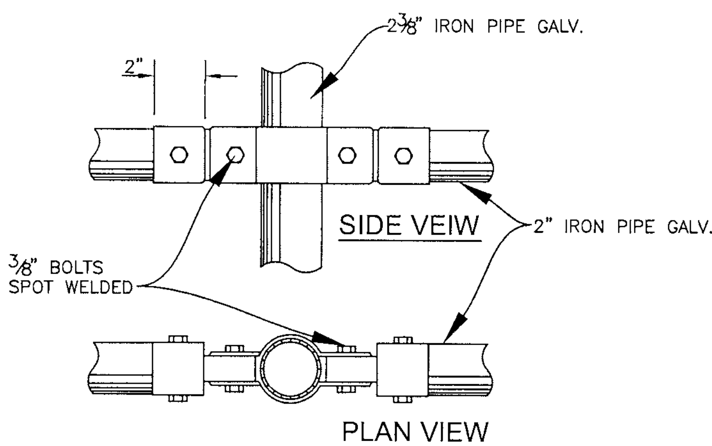
Revisions Date Desc				
. .	6-6-2009	COUNTY OF KERN	DOUBLE GATE SPECIFICATIONS	PLATE NO.
. .	DESIGNED BY: K.L.H.	STATE OF CALIFORNIA		D-11
. .	DRAWN BY: B.D.H.	DEVELOPMENT STANDARD		
. .	CHECKED BY: A.A.			
. .				



TRANSVERSE PROTECTION BAR



NOTES:
1. ALL CONCRETE SHALL BE CLASS 3.
2. SEE PLATE D-10 FOR ADDITIONAL FENCE DETAILS.
3. ALL EXPOSED METAL PARTS ARE TO BE GALV PRIOR TO INSTALLATION.
4. HARDWARE IS TO BE TACK WELDED AND GROUND SMOOTH AND GALV.
5. SEE PLATE D-2 FOR RODENT BARRIER DETAILS.

DETAIL "A"

PLOTTED: 02/26/2010

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Revisions Date Desc	6-5-2009	COUNTY OF KERN STATE OF CALIFORNIA DEVELOPMENT STANDARD	FLOOD ZONE FENCING SPECIFICATIONS	PLATE NO.
. .	DESIGNED BY: K.L.H.			D-12
. .	DRAWN BY: B.D.H.			
. .	CHECKED BY: A,J.L.			

Appendix G

Pre-Post Water Balance Calculation Sheets

Is the project located within a permitted Phase I or Phase II Municipal Separate Storm Sewer System (MS4) area?

Note: Non-traditional small MS4s that lie within a Phase I or II MS4 area but are NOT designated must comply with the Construction General Permit post construction calculator.

Will the project use an alternative method to calculate runoff volume or use different site design measures than those listed in the CGP calculator?

Will the project be subdivided into smaller sub-areas or drainage management areas?

INPUT FOR WATERSHED: Enter watershed details and click on the Compute & Save button.

I.a. Name:	Rosamond South Solar Prj
I.b. County:	Kern
I.c. Closest Location:	Mojave
I.d. Size(acres):	1113.5

Pre-Construction INPUT

I.e. Dominant Soil Type:	Group B Soils - Moderate infiltration. Silt loam or loam. Infiltration rate 0.15 to 0.3 inch/hr when wet.
I.f. Existing Dominant Non-built Land Use Type:	Natural Desert
I.g. Existing rooftop impervious area(acres):	0
I.h. Existing non-rooftop impervious area(acres):	0

Post-Construction INPUT

I.i. Proposed Dominant Non-built Land Use Type:	Natural Desert Landscape
I.j. Proposed rooftop impervious area(acres):	0
I.k. Proposed non-rooftop impervious area(acres):	55.7

Compute & Save

OUTPUT:

O.a. Existing Runoff Curve Number:	77	**O.d. Proposed Runoff Curve Number:**	78.050471
O.b. Design Storm(inches):	0.5	**O.e. Net Credit of Volume Credits(Cubic feet):**	
O.c. Pre-project Runoff Volume(Cubic Feet):	0.00	**O.f. Post-project Runoff Volume(Cubic Feet):**	0.00
O.g. Post-project Runoff Volume minus Volume Credits(Cubic Feet):			

***Pre-project Runoff Volume >= Post-project Runoff Volume. No further calculation is necessary!

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Appendix J

Water Supply Assessment

WATER SUPPLY ASSESSMENT - REVISED

KERN COUNTY

ROSAMOND SOUTH SOLAR PROJECT

MAY 2022

085963\12120610v1

WATER SUPPLY ASSESSMENT - REVISED

ROSAMOND SOUTH SOLAR PROJECT

Prepared for:

Clearway Energy Group, LLC
Rosamond South Solar Project
100 California Street, Suite 400
San Francisco, CA 94111

Consultant:

5080 California Avenue, Suite 220
Bakersfield, CA 93309
Contact: Jaymie L. Brauer
Phone: (661) 616-2600

May 2022

Project #190351

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Table of Contents

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SECTION 1 - INTRODUCTION

1.1 - Regulatory Requirement

Senate Bill 610 (Chapter 643, Statutes of 2001) amended state law, effective January 1, 2002, to improve the link between information on water supply availability and land use decisions made by cities and counties. The statute requires detailed information regarding water availability to be provided to city and county decision-makers prior to approval of specified large development projects which are subject to CEQA (the California Environmental Quality Act) approval. These include solar projects as an industrial use. The statute also requires this detailed information to be included in the administrative record that serves as the evidentiary basis for an entitlement action by the city or county on such projects. The statute-required water supply assessment (WSA) must examine the availability and sufficiency of an identified water supply under normal-year, single-dry-year, and multiple-dry-year conditions over a 20-year projection, accounting for the projected water demand of the Project in addition to other existing and planned future uses of the identified water supply.

The State Department of Water Resources "Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001" (Guidebook) and the sample format presented in the Guidebook were used as guides in preparing this water supply assessment. Pertinent excerpts from the law stipulating requirements for water supply assessments precede Sections of this report. The full text of Chapter 643, Statutes of 2001 (SB 610) is included in Appendix A.

This water supply assessment was originally submitted in January 2021. In May 2022, Kern County requested that the January 2021 WSA be amended to include the information contained in the August 2021 Antelope Valley – East Kern Water Agency 2020 Urban Water Management Plan. The January 2021 WSA used information in the 2015 Urban Water Management Plan from the Antelope Valley – East Kern Water Agency.

1.2 - Project Description and Location

The Project is a 1,292-acre solar panel facility to be developed by Rosamond South Solar, a subsidiary of Clearway Energy Group, LLC on a site consisting of four separate CUP areas that occur within three zone maps. It proposes developing a 154 MW ac solar facility with up to 200 MW of battery energy storage capacity. Electricity generated on the Project site will be transmitted to Southern California Edison's (SCE) Whirlwind Substation that runs along existing road rights-of-way.

As shown in Table 1-1, the proposed solar facility includes approximately 1,292 acres of land.

Table 1-1
Project Site Parcels

CUP AREA 1 Zone Map 233			
APN	Acres	Zone District	Zone Map
261-120-05	20.63	E(2 ½) RS FPS	233
261-120-06	20.68	E(2 ½) RS FPS	233
261-120-07	20.08	E(2 ½) RS FPS	233
261-120-09	9.60	E(2 ½) RS FPS	233
Total acres: 70.99			

CUP AREA 2 Zone Map 232			
359-020-49	160.71	A FPS	232
359-100-05	79.87	E (5)	232
Total acres: 240.58			

CUP AREA 3 Zone Map 232			
359-175-05	78.60	E (2 ½) RS FPS	232
359-331-06	5	E (2 ½) RS FPS	232
359-331-07	5	E (2 ½) RS FPS	232
359-331-12	5	E (2 ½) RS FPS	232
359-331-13	5	E (2 ½) RS FPS	232
359-331-15	5	E (2 ½) RS FPS	232
359-331-16	20.21	A FPS	232
359-331-18	20.29	A FPS	232
359-331-20	19.93	E(5) RS FPS	232
359-331-21	19.97	E(5) RS FPS	232
359-331-22	20.01	E(5) RS FPS	232
359-331-23	20.0	E(5) RS FPS	232
359-332-01	10.43	E(5) RS FPS	232

359-332-02	10.39	E(5) RS FPS	232
359-332-03	10.36	E(5) RS FPS	232
359-332-04	10.32	E(5) RS FPS	232
359-332-05	10.36	E(5) RS FPS	232
359-332-06	10.35	E(5) RS FPS	232
359-332-07	20.67	E(5) RS FPS	232
359-332-09	40.34	E(5) RS FPS	232
359-332-10	20.11	E(5) RS FPS	232
359-332-11	5.03	E (5) RS FPS	232
359-332-12	5.03	E (5) RS FPS	232
359-332-16	2.57	E (5) RS FPS	232
359-332-24	19.68	E (5) RS FPS	232
359-332-30	5.04	E (5) RS FPS	232
359-332-31	5	E(5) RS FPS	232
359-332-35	10.05	E(5) RS FPS	232
359-401-02	4.99	E (2 ½) RS FPS	232
359-401-03	2.5	E (2 ½) RS FPS	232
359-401-05	2.5	E (2 ½) RS FPS	232
359-401-12	2.5	E (2 ½) RS FPS	232
359-401-15	2.5	E (2 ½) RS FPS	232
359-401-09	2.49	E (2 ½) RS FPS	232
359-401-16	5.00	E (2 ½) RS FPS	232
359-401-19	4.64	E (2 ½) RS FPS	232
359-401-20	4.26	E(2 ½) RS FPS	232
359-401-21	5.00	E(2 ½) RS FPS	232
359-401-22	5.00	E(2 ½) RS FPS	232
359-401-23	5.01	E(2 ½) RS FPS	232
359-402-11	10.0	E(2 ½) RS FPS	232
359-402-13	5.0	E(2 ½) RS FPS	232

359-402-14	5.0	E(2 ½) RS FPS	232
359-402-15	2.50	E(2 ½) RS FPS	232
359-402-16	2.50	E(2 ½) RS FPS	232
359-402-17	2.50	E(2 ½) RS FPS	232
359-402-18	2.50	E(2 ½) RS FPS	232
359-402-19	2.50	E(2 ½) RS FPS	232
359-402-20	2.50	E(2 ½) RS FPS	232
359-402-21	2.50	E(2 ½) RS FPS	232
359-402-22	2.50	E(2 ½) RS FPS	232
359-403-08	20.01	E (2 ½) RS FPS	232
359-403-09	20.02	E (2 ½) RS FPS	232
Total acres: 541.16			

CUP AREA 4 Zone Map 231			
374-020-02	164.93	E(2 ½) RS FPS	231
374-020-15	82.08	E(2 ½) RS FPS	231
374-020-16	81.01	E(2 ½) RS FPS	231
374-450-01	37.28	E(2 ½) RS FPS	231
374-460-12	73.96	E(2 ½) RS FPS	231
Total acres: 439.26			

Corollary supportive components will include transformers, switchgears, operations and maintenance buildings, substations, and telecommunication facilities. The Project is located in southeastern Kern County bound by 90th St West (W) to the east, 170th St W to the west, Rosamond Boulevard (Blvd) to the north and Avenue A to the south. It is approximately 6.8 miles west of State Route (SR) 14. The site is located within the following sections, townships and ranges:

Table 1-2
Project Site Township, Ranges, and Sections

Township	Range	Section(s)
9	13	30,31
9	14	20, 21, 27, 28
9	15	24

Figure 1-1 shows the Project site location with respect to its geographic setting. Figure 1-2 depicts the Project site and site surroundings. Project Water Requirements and Setting

Water needed for construction will be trucked from a local water purveyor (RMR Trucking), which will obtain groundwater from wells located on land immediately adjacent to the project site. The construction process is estimated to take approximately 12 months. Construction water demands are estimated to be approximately 450 acre-feet, which is equivalent to approximately 146,633,000 gallons. Bottled drinking water will be provided for crews during construction activities.

Initial construction water usage will be in support of site preparation and grading activities. During earthwork for grading of access road foundations, equipment pads and project components, the principal use of water would be for compaction and dust control. Smaller quantities would be required for preparation of the concrete required for foundations and other minor uses. After the earthwork activities, water usage will be used for dust suppression and normal construction water requirements that are associated with construction of the small maintenance buildings, internal access roads, revegetation, and solar arrays.

The panel surfaces will be washed occasionally to increase average optical transmittance. The need for panel washing will be infrequent and will be determined based on operating conditions and the magnitude of the observed benefit from cleaning. Thus, long-term operational water demand is anticipated to be approximately 5,865,000 gallons per year or 18.0 acre-feet per year for the total Project. Water for panel washing will be trucked from the nearby water purveyor (RMR Trucking), which will obtain groundwater from wells located on land adjacent to the project site or from an offsite source within the groundwater basin (see Appendix B).

Figures 1-3 and 1-4 illustrate the location of the Project site within the South Lahontan Hydrologic Region, the Antelope Valley Groundwater Basin and the Lancaster Subbasin, and the borders of these water resource areas. Construction and operational water for the Project will be trucked in from sources pumping groundwater from these basins.

The Project location within the boundaries of the Antelope Valley Groundwater Adjudication Area is depicted on Figure 1-5.

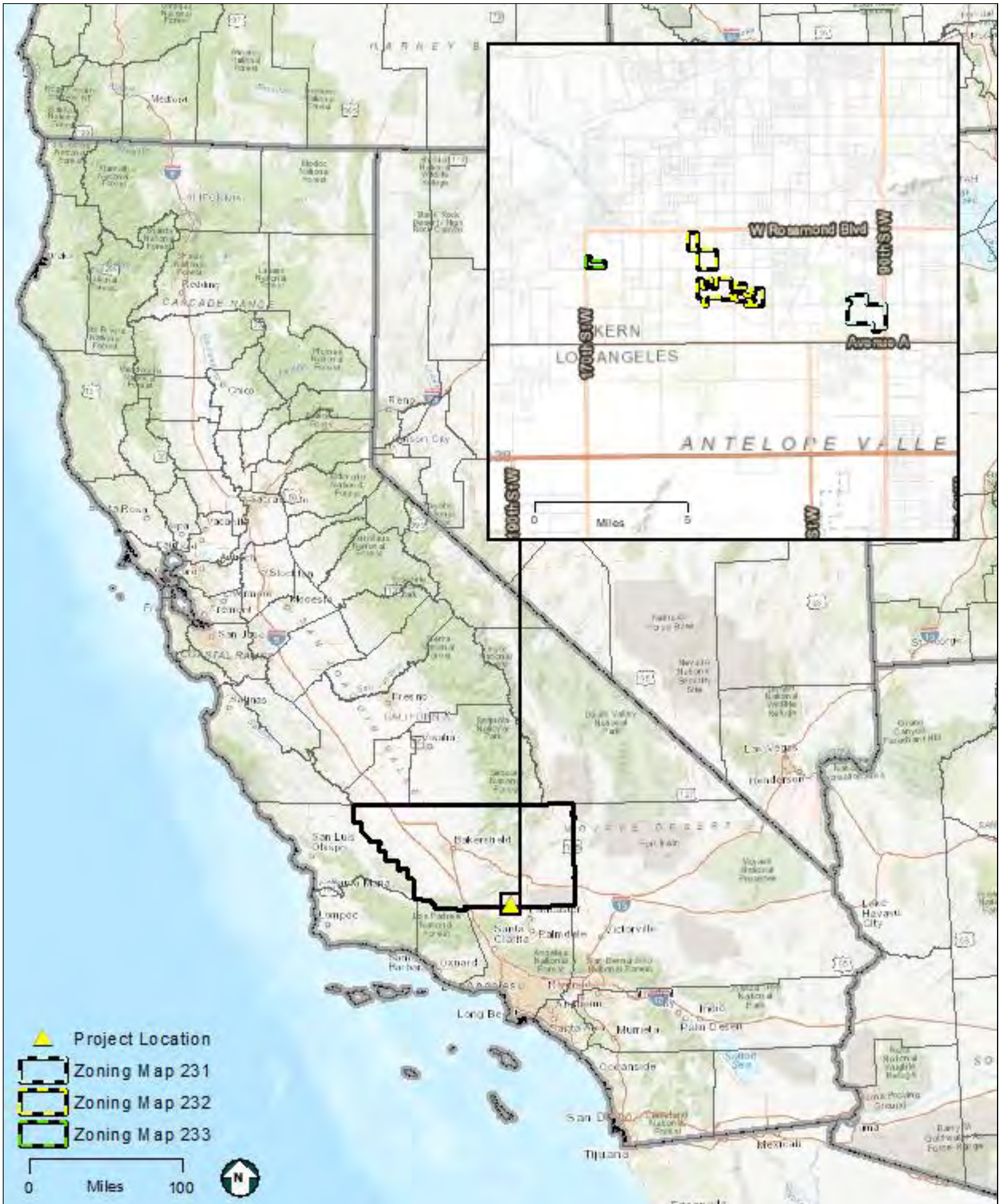

Figure 1-1
Regional Location

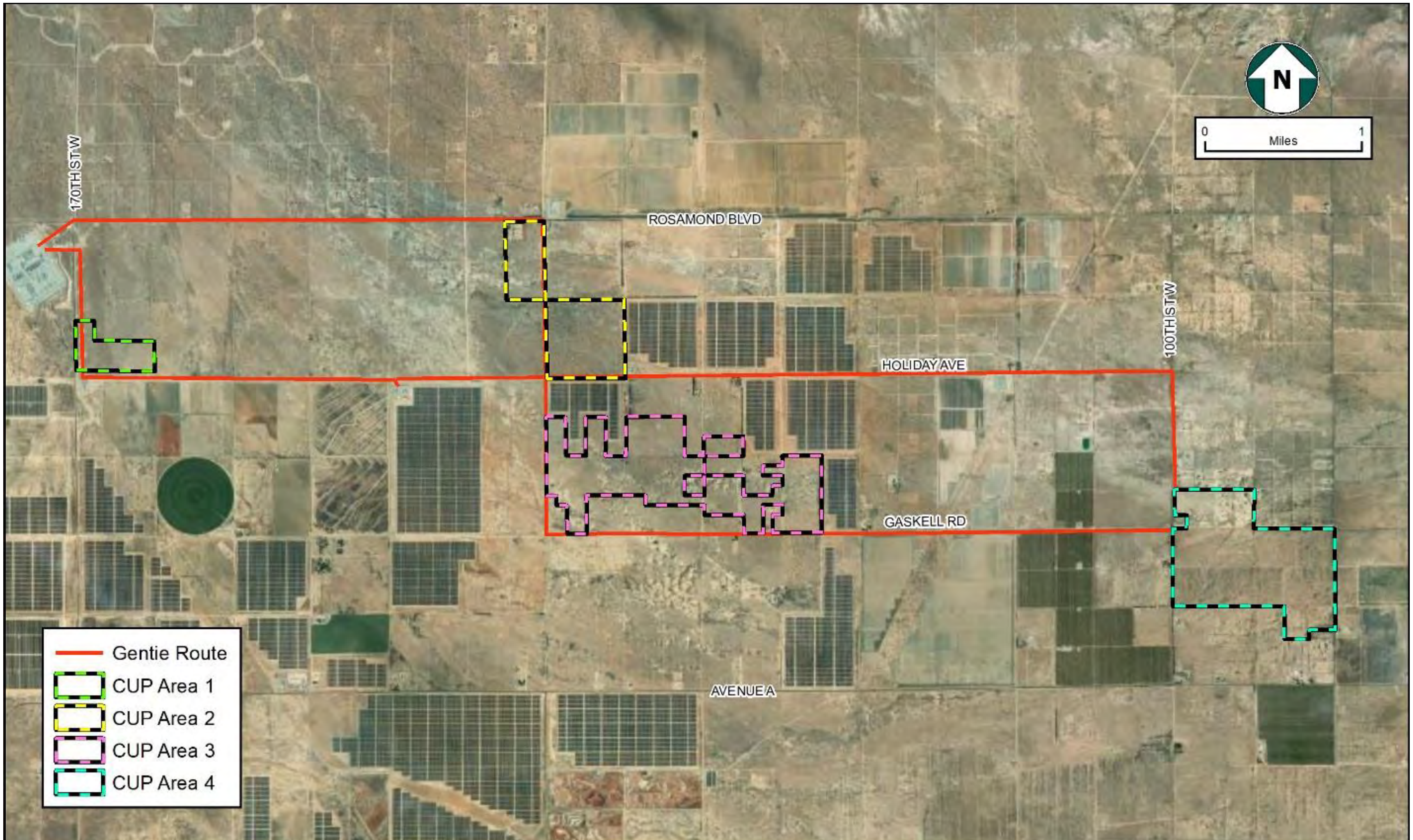

Figure 1-2
Project Site

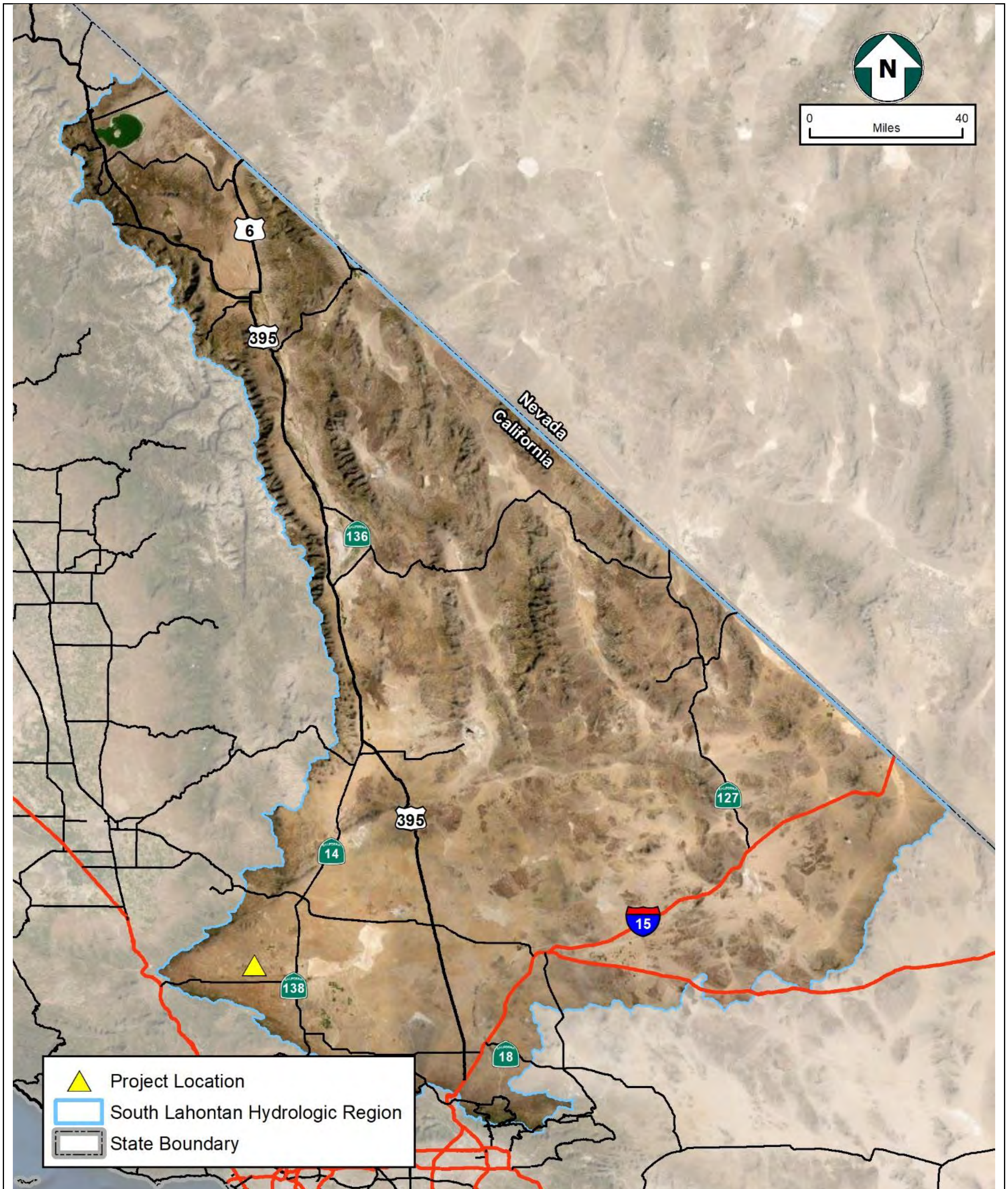

Figure 1-3
Project Location: South Lahontan Hydrologic Region

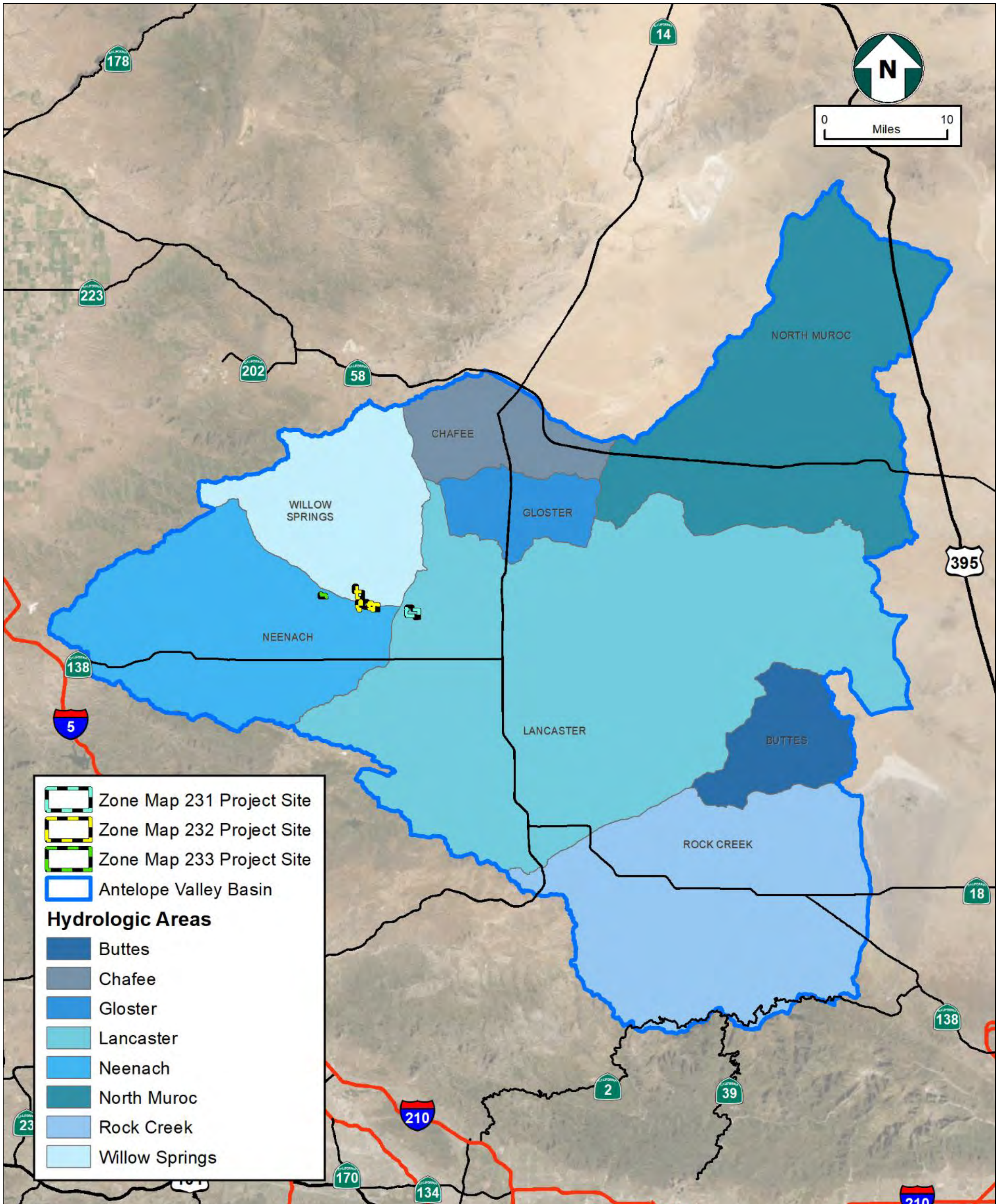

Figure 1-4
Project Location: Antelope Valley Groundwater Basin

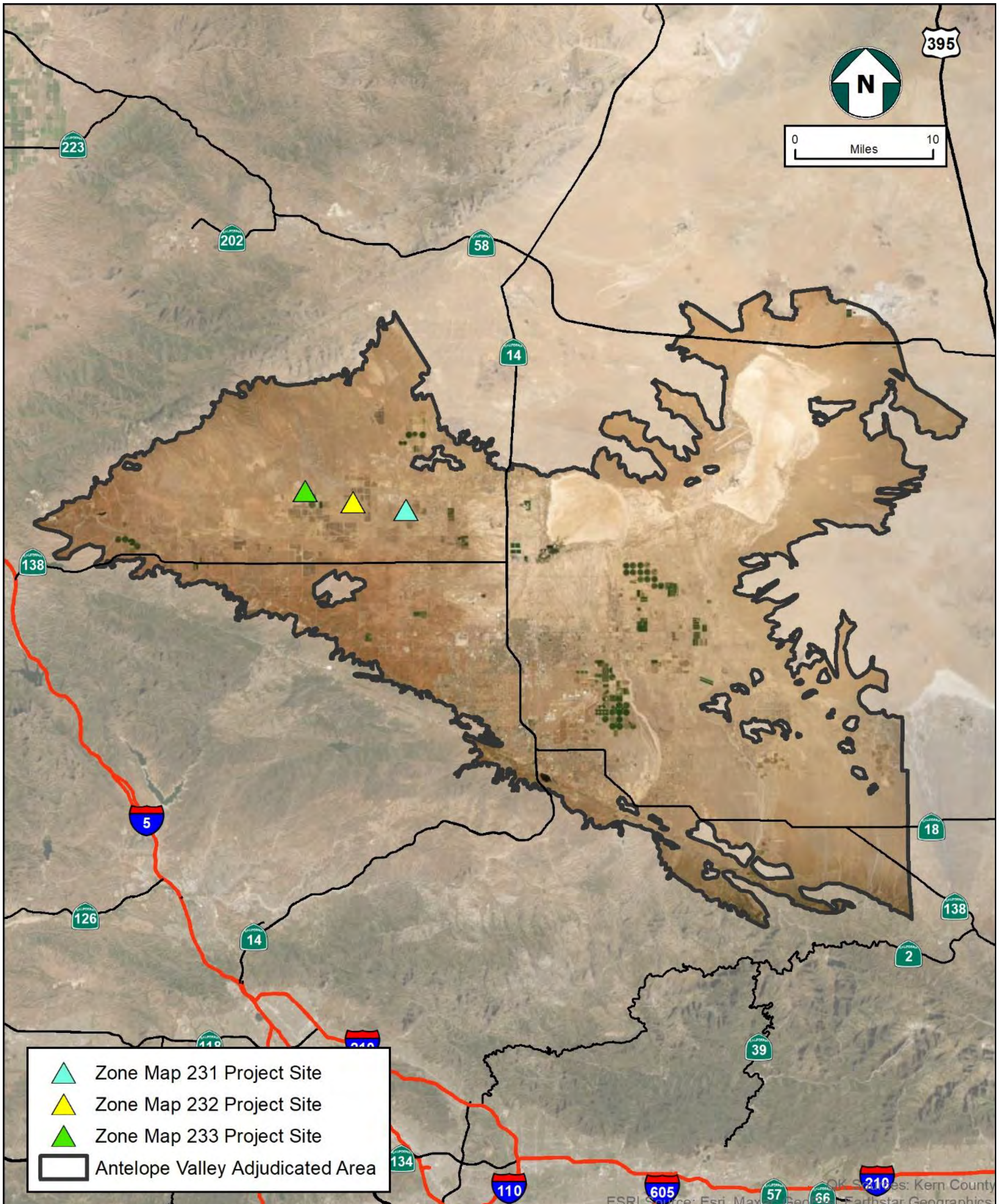

Figure 1-5
Project Location Within the Antelope Valley Adjudication Area

SECTION 2 - WATER RESOURCES/WATER SUPPLY

2.1 - Proposed Water Supply

The project will not be served by a public water system and thus the County is preparing the water assessment itself as required by Water Code section 10910(b). The purpose of the Water Supply Assessment is to determine whether "the total projected water supplies, determined to be available by Kern County for the project during normal, single dry, and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses. Water Code section 10910(c)(4).

In making the sufficiency determination, the County shall include an assessment of the following.

Water Code Section 10910

(d)(1) The assessment required by this section shall include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts.

(2) An identification of existing water supply entitlements, water rights, or water service contracts held by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall be demonstrated by providing information related to all of the following:

(A) Written contracts or other proof of entitlement to an identified water supply.

(B) Copies of a capital outlay program for financing the delivery of a water supply that has been adopted by the public water system.

(C) Federal, state, and local permits for construction of necessary infrastructure associated with delivering the water supply.

(D) Any necessary regulatory approvals that are required in order to be able to convey or deliver the water supply.

The Project site is currently not in agricultural production but is occupied by remnant native vegetation; there is no water usage on the site.

As described in Section 1, Project water supply is proposed to be from a nearby water provider (Appendix B).

The nearby well, owned by RMR Water Trucks, is located on Backus road at about 97th St W and meets the demands for the Rosamond South Solar Project with a verified rating of 432 gallons per minute from a water depth of 330 feet below ground surface (Appendix B). The water table in the Project area has remained at approximately this depth since 1980. The well, originally drilled to supply water for a nearby mine, reportedly supplied approximately 5,000,000 gallons per month for the period from 1988 to 1995. From 2001 to 2009, water was provided to other consumers at approximately the same rate. Drawdown recovery during this period was approximately 2 minutes after cessation of pumping.

There are no other known wells in the immediate Project area. The installation and water production of a similar well or wells on the Project site, if deemed necessary, appears to be physically feasible.

To be able to legally pump water from its well, RMR Trucking's pumping activities must either be exempt from the Antelope Valley Groundwater Adjudication Judgment (Appendix C) or permitted by the Watermaster pursuant to the Judgment. RMR Trucking has stated that their well is allowed to pump under the Adjudication Judgment.

2.2 - The Antelope Valley Groundwater Cases Judgment and Adjudication

Beginning with litigation in 1999, the Antelope Valley Groundwater Basin Adjudication was issued in 2015 by the Superior Court of the State of California County of Los Angeles – Central District, Judicial Council Coordination Proceeding No. 4408. As depicted on Figure 1-5, the Project site is within the adjudicated groundwater basin of approximately 1,390 square miles.

The Judgment confirmed that the Basin is in overdraft and promulgated regulations and procedures to govern groundwater usage in the Basin. It defined Classes of groundwater pumpers, two of which may include groundwater sources for this Project – a Non-Pumper Class and a Small Pumper Class. It defined a multi-party" Watermaster" to oversee continuing implementation of the Judgment (see pages 44-48 of Appendix C) and directed the appointment by the Watermaster of a Water Engineer, defining his duties (see pages 48-56 of Appendix C). The Watermaster and a Water Engineer are in place and are enforcing and implementing the Adjudication.

The Water Supply Assessment evaluates the physical availability of and adequate groundwater supply, in all "water years" for a 20-year period.

This Assessment describes the relevant Hydrologic Region, Basin, and Subbasin, describes the principal water agency (Antelope Valley – East Kern, AVEK) serving and regulating Basin water planning and surface water importation, and lists water sufficiency and planning documents regarding the Basin. Section 3 includes the latest (2020) AVEK projection of water availability (surface and ground) for the Basin for a 20-year period under the normal, single dry and multiple dry year scenarios, as required by SB 610.

2.2.1 - THE GROUNDWATER BASIN(S)

Water Code Section 10910

(f) If a water supply for a proposed project includes groundwater, the following additional information shall be included in the water assessment:

(1) A review of any information contained in the urban water management plan relevant to the identified water supply for the proposed project.

(2)(A) A description of any groundwater basin or basins from which the proposed project will be supplied.

(B) For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has the legal right to pump under the order or decree.

(C) For a basin that has not been adjudicated that is a basin designated as high- or medium-priority pursuant to Section 10722.4 , information regarding the following:

(i) Whether the department has identified the basin as being subject to critical conditions of overdraft pursuant to Section 12924 .

(ii) If a groundwater sustainability agency has adopted a groundwater sustainability plan or has an approved alternative, a copy of that alternative or plan.

(D) For a basin that has not been adjudicated that is a basin designated as low- or very low priority pursuant to Section 10722.4 , information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current bulletin of the department that characterizes the condition of the groundwater basin, and a detailed description by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), of the efforts being undertaken in the basin or basins to eliminate the long-term overdraft condition.

2.2.2 - THE SOUTH LAHONTAN HYDROLOGIC REGION

The California Department of Water Resources, (DWR) has divided the State into 10 Hydrologic Regions. The Project site is located within the South Lahontan Hydrologic Region in a Basin (the Antelope Valley Basin) ranked as “low priority” in a statewide ranking of groundwater importance (see Figure 2-1, from the DWR April 2018 Water Available for Replenishment Final Report). The Region encompasses approximately 1,500,000 acres (see Figure 1-3).

2.2.3 - The Antelope Valley Groundwater Basin

The Basin occupies approximately 1,010,000 acres within the South Lahontan Region (see Figure 1-4). It underlies an extensive alluvial valley in the western Mojave Desert. It has been subdivided by the DWR into 8 subunits based on differential ground flow patterns, recharge characteristics, and geographic location, as well as by controlling geologic structures (see Figure 1-4).

Groundwater in the Basin is used for both public water supply and irrigation. Public-supply wells in the basin are anywhere from 360 to 700 feet deep. Groundwater recharge is primarily runoff from surrounding mountains, as well as direct infiltration from irrigation, sewers, and septic systems (USGS, 2013).

Urban Water Portfolio Actions

Method	Volume of Water Increase from 2010 to 2020
Recycled Water	0.01 MAF
Desalination	0 MAF
Water Conservation	0.01 MAF

Outflow and WAFR Estimates (MAF) by Planning Area

South Lahontan HR Groundwater Basin Prioritization Summary, June 2, 2014

Basin Ranking	Basin Count per Rank	Percent of Total for Hydrologic Region	
		GW Use	Overlying Population
High	2	41%	85%
Medium	3	14%	9%
Low	7	39%	5%
Very Low	65	7%	1%
Totals	**77**	**100%**	**100%**

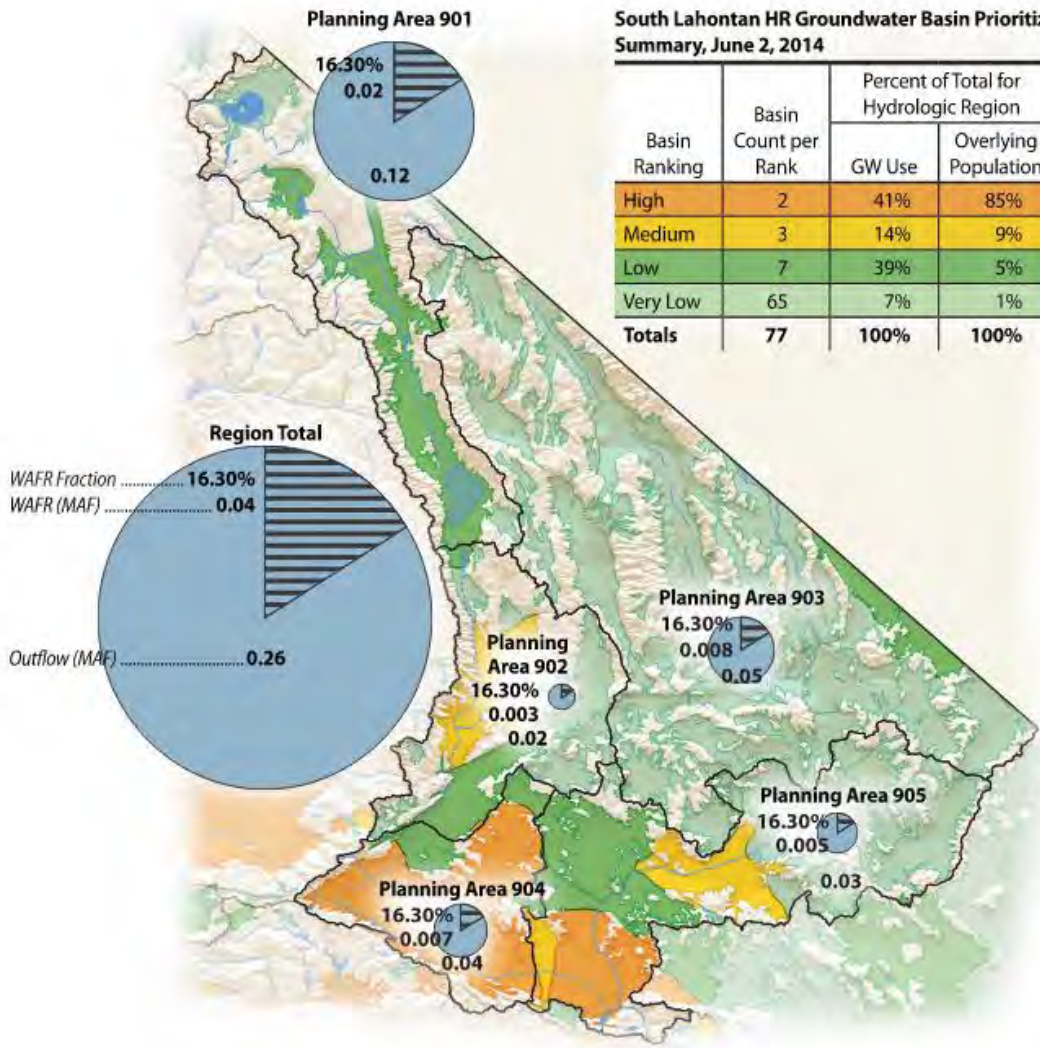

Figure 2-1
South Lahontan Groundwater Basin Prioritization

The Basin has been the subject of several water management plans and of litigation during the past several decades. Such plans, involving both groundwater and surface water supplies for the Basin are discussed in Subsection 2.5 of this Assessment.

2.2.4 - The Lancaster Subbasin

The Lancaster Subbasin of the Antelope Valley Basin and the location of the site therein is depicted on Figure 1-4.

The Lancaster subbasin is the largest in both water use and size and the most economically significant in terms of population and agriculture. Subbasin water use is for agricultural, urban and industrial applications. Groundwater flows to several pumping depressions and partially towards Rosamond and Rogers dry lakes. Due to the agricultural, urban and industrial water use, depth to water varies widely, but in general is greatest in the south and west. The subbasin area includes Lancaster, a portion of Palmdale and Willow Springs, Rosamond, and other smaller communities.

2.2.5 - The Neenach Subbasin

The Neenach Subbasin of the Antelope Valley Basin and the location of the site therein is depicted on Figure 1-4.

Neenach subbasin water use is mainly for agricultural purposes. Groundwater generally moves from west to east into the Lancaster subbasin. Water depth ranges from 150 feet to 350 feet below land surface. The subbasin area includes Neenach, Fairmont and other smaller communities.

2.2.6 - The Willow Springs Subbasin

The Willow Springs Subbasin of the Antelope Valley Basin and the location of the site therein is depicted on Figure 1-4.

Water usage in the subbasin is primarily for agricultural and urban land areas. Recharge comes from intermittent streams of the surrounding mountain areas. Recharge from the Oak Creek drainage system moves generally south-eastward toward Soledad Mountain and into the Chafee, Gloster and Willow Springs area. Within the Willow Springs Subbasin, groundwater flows southeast. Depth to water ranges from 100 to more than 300 feet. Some of this water eventually discharges across the Rosamond fault into the Lancaster Subbasin, although this flow is considered negligible (USGS 2003). The subbasin area includes Five Points, Twin Lakes, a portion of Willow Springs and other smaller communities.

There is significantly less data available regarding Willow Springs Subbasin groundwater, or surface water, resources than for the Antelope Valley Basin.

2.3 - The Antelope Valley – East Kern Water Agency

The proposed well site to provide water the project is located within the East Kern Water Agency. The proposed well site will be privately owned; however, the water pumped from the well is within the East Kern Water Agency. As such, the East Kern Water Agency has detailed information regarding groundwater conditions in the vicinity of the proposed well site.

The Antelope Valley-East Kern Water Agency (AVEK) is the third largest State Water Project (SWP) Contractor in the State and, in cooperation with the other water wholesalers and retailers in the Region, has analyzed suitable locations and methods for SWP-water storage. Based on these studies and reports, groundwater basin banking has been deemed most appropriate and efficient. AVEK encompasses 2,300 square miles in the Mojave Desert area, northeast of Los Angeles, and includes over twenty municipal users as well as Edwards Air Force Base, Palmdale Air Force (Plant 42) and U.S Borax. Because groundwater resources were severely overdrafted, AVEK contracted for a supplemental supply of municipal and industrial water (144,844 acre-feet) from the California State Water Project. Of the 144,844-acre-foot annual entitlement, the municipal and industrial, and agricultural water customers are currently only using about 75,000 acre-feet per year, thus buttressing the water-year adequacy projections which it has made in the 2020 Urban Water Management Plan which are referenced in Section 3 of this water supply assessment.

AVEK delivers State Water Project (SWP) water used by customers in lieu of or in addition to local groundwater resources. It does not have production groundwater wells but may include groundwater pumping as a water supply in the future. Delivery of SWP water is dependent upon multiple factors such as climatic variations and other uses; therefore, AVEK has established the use of supply enhancement programs such as groundwater banking in the Antelope Valley Groundwater Basin and conjunctive water use.

2.4 - The Antelope Valley – Integrated Regional Water Management Plan

The Antelope Valley Regional Water Management Group published an Integrated Regional Water Management Plan update in 2019. The 2019 Antelope Valley Integrated Regional Water Management (IRWM) Plan Update (2019 Plan Update) includes new information as required by the California Department of Water Resources' (DWR) 2016 Integrated Regional Water Management Proposition 1 Guidelines as well as updates to previous information from the 2013 Antelope Valley IRWM Plan. IRWM is a collaborative effort to manage all aspects of water resources in a region. The State recognizes that there is a need to consider a broader range of resource management issues, competing water demands, new approaches to ensuring water supply reliability, and new ways of financing. The State's IRWM program was developed beginning with Senate Bill 1672 which created the Integrated Regional Water Management Act to encourage local agencies to work cooperatively to manage local and imported water supplies to improve water quality, quantity and reliability.

The proposed well site to provide water the project is located within the IRWM area. As such, the IRWM Plan has detailed information regarding groundwater conditions in the vicinity of the proposed well site.

2.5 - The Planning Documents

The following documents were essential to the development of this report:

- Antelope Valley-East Kern Water Agency's 2020 UWMP: This report satisfies the requirements of the California Urban Water Planning Act (ACT), which states that any urban water supplier with 3,000 or more service connections, or supplying 3,000 or more acre-feet of water per year must develop an Urban Water Management Plan (Plan). The Plan is to describe and evaluate water deliveries and uses, water supply resources, efficient water uses, demand management measures and water service contingency planning. A Plan must be updated every five years.[1]
- Antelope Integrated Regional Water Management Plan – 2019 Update
- Department of Water Resources Bulletin 118
- USGS Water Resources Investigations Report 03-4016
- USGS Scientific Investigations Report 2014-5166

[1] SB610

SECTION 3 - WATER SUPPLY SUFFICIENCY

Water Code Section 10910, Section 4.5

…(c)(3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single, dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.

The sufficiency of the Project water supply is analyzed on three bases: the physical availability of the Project area aquifer, and wells drilled therein, to provide groundwater in the amounts required for Project construction and operation; the estimates (in the 2020 Antelope Valley East Kern Water Agency (AVEK), Urban Water Master Plan and the 2019 Antelope Valley Integrated Regional Water Management Plan Update) of normal water years, single dry water year and multiple dry water years, water supply and demand-related water availability with respect to projected water demand during a 20-year projection; the availability of groundwater for the Project in compliance with the implementation of the Antelope Valley Groundwater Basin Adjudication.

3.1 - Physical Availability

The information regarding the physical availability of groundwater at and near to the Project site, including the Antelope Valley Basin groundwater adjudication and the surface water impact programs of AVEK, (Section 2.1 and Appendix B) supports the conclusion that the groundwater aquifer and the well pumping history are sufficient for both Project construction and Project operation and will be sufficient to serve project needs for 20 years under the water scenarios described below. The groundwater studies referenced in Section 2.5, which served as a basis for Basin groundwater adjudication, have been addressed by the AVEK surface water importation program and by adjudication-based groundwater usage restraints to verify overall physical water resource availability considering AVEK has been able to export surface water rights during multiple-dry years (see Section 3.2). The basis for the availability of the groundwater for the project is based on the fact that the project will take land currently zoned for residential and convert it to solar. The conversion to solar will greatly reduce the water demand for the land that is currently accounted for in the Kern County General Plan and water studies mentioned in this report. On average, low density residential water usage is 1,810 gallons per day/acre. The project site will encompass 1,292 acres which would equate to a potential residential water demand of 853.6 million gallons per year. The construction water for this project is estimated at 146.6 million gallons per year or 17.2% of what the residential demand would be. The ongoing operational demand for the project is 5.9 million gallons per year or 0.69% of the potential residential water demand. The project will greatly reduce the water demand for the project parcels compared to if the parcels were developed as residential per the existing zoning.

3.2 - The 2020 AVEK Urban Water Master Plan – Water Years Adequacy Projections

The following Tables excerpted from the Master Plan illustrate the total imported State Water Project and groundwater resources available to the District, and the projected usage demand on such supplies through 2045. Since the 2020 UWMP is available, the 20-year projections are from 2025 to 2045. The following text extract (pages 7-3 through 7-5 from the Master Plan) explains how the Tables were derived.

Prior to 1972, groundwater provided more than 90 percent of the total water supply in the Antelope Valley area. Since 1972, it is estimated that between 50 to 90 percent of the area's water supplies are from groundwater. Groundwater pumping peaked in the 1950s and then declined as greater pumping lifts and increasing energy costs made the use of groundwater in the area less economical for agricultural uses. According to <u>USGS Water Resources Investigation Report 03-4016 (Simulation of Ground-Water Flow and Land Subsidence in the Antelope Valley Ground-Water Basin, California)</u>, groundwater levels declined more than 200 feet in some parts of the basin resulting in increased pumping lifts, reduced well efficiency, and land subsidence of more than 6 feet in some areas. The aquifers consist of gravel, sand, silt, and clay alluvial deposits, and clay and silty clay lacustrine deposits.

According to the Judgment, AVEK has an overlying pre-rampdown production right of 4,000 acre-feet per year and an overlying production right of 3,550 acre-feet per year at the end of the seven year production rampdown period, which begins January 1, 2016. In addition to the overlying production right, AVEK has the right to produce an amount of imported water return flows in any year equal to the applicable percentage (34% for agricultural imported water use and 39% for municipal and industrial imported water use) multiplied by the average amount of imported water used by AVEK within the Basin, and outside the Basin but within the watershed of the Basin (as approved by the Watermaster), in the preceding five year period. AVEK also has the rights to all imported water return flows from water imported through AVEK and not allocated to other parties identified in the Judgment. Carryovers of unused production rights and imported water return flows are allowed for a period of up to 10 years (or longer if a Storage Agreement is entered into with the Watermaster). The Watermaster appointed as a part of the Judgment consists of a five member board composed of one representative each from AVEK and LACWWD 40, one other Public Water Supplier representative, and two landowner representatives.

AVEK customers indicated in Table 4-2 [of the Judgment] also having overlying groundwater production rights per the Judgment have a total pre-rampdown production right of 38,000 acre-feet per year. The final overlying production right of these customers will be 19,300 acre-feet per year, indicating a reduced groundwater production right of 18,700 acre-feet after the end of the seven year rampdown period.

The Judgment does not limit or modify the operation of AVEK's preexisting banking projects or the performance of its preexisting exchange agreements. AVEK operates its groundwater *banking programs to help increase the reliability of the Antelope Valley region's water supplies. Excess water available from the State Water Project (SWP) is stored during wet periods and recovered for delivery to customers during dry and high demand periods or during a disruption in deliveries from the SWP. The maximum recharge volume for the Westside Water Bank is estimated to be approximately 36,000 AF per year. The maximum recovery volume is proposed to be about 36,000 AF per year. A ten percent loss factor is applied to groundwater recharged for the Westside Water Bank to account for evapotranspiration and other losses during recharge and conveyance as well as typical metering accuracy.*

The referenced Figures are:

Figure 7-1 Normal Year Supply and Demand Comparison

Description	2025	2030	2035	2040	2045
Supply totals	87,890	85,710	83,540	81,370	81,370
Demand totals	44,440	50,990	51,880	55,210	57,590
Difference	43,450	34,720	31,660	26,160	23,780

Figure 7-2 Single Dry Year Supply and Demand Comparison

Description	2025	2030	2035	2040	2045
Supply totals	44,440	50,990	51,880	55,210	57,590
Demand totals	44,440	50,990	51,880	55,210	57,590
Difference	0	0	0	0	0

Table 7-4 Wholesale: Multiple Dry Years Supply and Demand Comparison

Description		2025	2030	2035	2040	2045
First year	Supply totals	44,440	50,990	51,880	55,210	57,590
	Demand totals	44,440	50,990	51,880	55,210	57,590
	Difference	0	0	0	0	0
Second year	Supply totals	52,730	52,730	52,730	55,210	57,590
	Demand totals	44,440	50,990	51,880	55,210	57,590
	Difference	8,290	1,740	850	0	
Fifth year	Supply totals	44,440	50,990	51,880	55,210	57,590
	Demand totals	44,440	50,990	51,880	55,210	57,590
	Difference	0	0	0	0	0

Single dry year yield for SWP water is based on actual 2014 and 2021 (as of May 2021) allocation of 5%. Groundwater rights and non-SWP water are not impacted by short-term drought conditions, so normal year supply assumptions are applied. The remainder of demand is met with groundwater in storage. AVEK's annual banking recovery target is to produce at least enough groundwater to meet demand with 10% Table A allocations from the SWP. As shown in Figure 7-2, recovered imported water from AVEK groundwater banks enable AVEK to meet its demands in a single dry year.

For multiple dry years, SWP water availability is based on 1988 to 1992 simulated yield from the 2019 SWP DCR, which estimated the following annual Table A allocation:

- *Year 1 (1988)12.3%*
- *Year 2 (1989)32.2%*
- *Year 3 (1990)13.3%*
- *Year 4 (1991)25.6%*
- *Year 5 (1992)18.0%*

Similar to single dry year, groundwater rights and non-SWP water are not impacted by an extended drought, and recovered imported water from AVEK groundwater banks are used to meet remaining demands. Table 7-2 summarizes AVEK supply and demand totals for the multiple dry year scenario.

The water to be pumped by RMR Trucking for the Project has been included in the demand figures contained in these Tables. The responsible water agency for the Project has and must adhere to the following steps to assure that the total water supply for the service area will be adequate:

- The AVEK surface water supply assures there will be adequate groundwater supply for the Project. AVEK's surface water rights have, even during multiple dry years, permitted sale of excess surface water to other agencies.
- The adjudication requires significant rampdown of groundwater production by AVEK customers.
- Unused production rights and imported water return flows are allowed to be carried over (for dry-year/multiple-dry-year usage). AVEK conducts a groundwater banking program which permits implementation of these rights and flows.

3.3 - The Antelope Valley Groundwater Adjudication

Any use of groundwater on the Project site will need to comply with the Adjudication Judgment. RMR Trucking has stated their well and volume pumped is in compliance with the Adjudication Judgment and is permitted to export its water within the subbasin. If Project water requirements are greater than the amount of water allocated to the Project site, per the Adjudication Judgment Watermaster, the Project applicant may enter into an agreement with the Watermaster for the purchase of supplemental water, and/or trade water rights with other pumpers within the adjudication area. Similarly, use of water pumped by RMR Trucking on the adjacent site must comply with the Judgment and Watermaster regulations.

The long-standing history of water production from RMR Trucking from the proposed supply well and sale to other off-site water consumers supports the conclusion that such production is authorized and may be transferred in this case as well.

3.4 - The 2019 Antelope Valley Integrated Water Management Plan – Water Years Adequacy Projections

The following Tables excerpted from the Antelope Valley Integrated Regional Management Plan illustrate the total imported State Water Project and groundwater resources available to the Antelope Valley, and the projected usage demand on such supplies through 2040. The following text extract (pages 3-32 through 3-36 from the IRWM Plan) explains how the Tables were derived.

For an average water year, supplies are projected to exceed demands through 2025. However, demands are projected to exceed water supplies beyond 2025 as a result of increased population growth coupled with reduced groundwater Production Rights prescribed in the Judgment. The range of mismatch between supply and demand is 5,800 AFY to 19,500 AFY. Because of the uncertainty in several supply and demand estimates, including SWP deliveries and projected demand, there is still potential for a larger deficit to occur.

Table 3-17 provide a comparison of the supply and demand for the Antelope Valley Region for a single-dry water year. As shown by the comparison, future demand exceeds the existing and planned water supplies through 2040. For a single-dry water year, the range of mismatch between supply and demand is 51,300 AFY to 77,200 AFY. Though the Westside Water Bank currently has 73,750 AF of banked groundwater, this Plan assumes that a sufficient amount of wet years or water transfers will have occurred between dry year periods to keep the bank at full capacity of 120,000 AF by 2025 prior to a single-dry year. Because the duration of drought periods are unknown until the drought ends, AVEK estimates that the maximum withdrawal in any one year will only be one-third of the total banked supplies. It is also assumed that Eastside Water Bank will improve supply reliability in a single-dry year. It is possible that banked water will not be available during dry years, in which case the mismatch would be more severe (up to 122,900 AFY). These findings for a single dry year indicate the need to secure additional water supplies for the Region.

Table 3-17 Single Dry Year Supply and Demand Comparison

	2015	2020	2025	2030	2035	2040
Groundwater Storage						
Recharge + Return Flows (TSY)	126,300	118,100	110,000	110,000	110,000	110,000
Westside Water Bank (a)	0	24,600	40,000	40,000	40,000	40,000
Eastside Water Bank (b)	0	2,000	5,700	5,700	5,700	5,700
Direct Deliveries (c)	33,000	12,800	12,800	12,800	12,800	12,800
Recycle/Reuse)	300	8,700	11,900	15,100	18,300	18,300
Surface Water	500	4,000	4,500	4,500	4,500	4,500
Total Supply	**160,100**	**170,200**	**184,900**	**188,100**	**191,300**	**191,300**
Demands						
Urban Demand	71,700	137,500	153,600	167,600	181,700	184,500
Ag Demand	84,000	84,000	84,000	84,000	84,000	84,000
Total Demand	**155,700**	**221,500**	**237,600**	**251,600**	**265,700**	**268,500**
Supply and Demand Mismatch	**0**	**-51,300**	**-52,700**	**-63,500**	**-74,400**	**-77,200**

Notes: Values are rounded to the nearest 100.
(a) Assumes periodic wet years have occurred to allow quantities of SWP deliveries above AVEK demands to fill the water bank.
(b) Assumes banked groundwater supplies will be replenished and extracted the same year.
(c) 2015 deliveries represent actual deliveries in the Region; future projections assume the maximum Table A Amount available to the IRWM Region (160,452) multiplied by the SWP reliability of 8% for a single-dry year.

Table 3-18 provides a comparison of the supply and demand for the Antelope Valley Region for a multi-dry water year. Each year shown is assumed to be the average of a 4-year dry period. As shown by the comparison, future demand exceeds the existing and planned water supplies through 2040. For multi-dry water years the range of mismatch between supply and demand is 17,200 AFY to 49,700 AFY. It is assumed that the Eastside Water Bank will only provide supply reliability the first year of a 4-year drought. Though the Westside Water Bank currently has 73,750 AF of banked groundwater, this Plan assumes that a sufficient amount of wet years or water transfers will have occurred between dry year periods to keep the bank at full capacity of 120,000 AF by 2025 prior to a four-year dry period. The maximum banking capacity in the Westside Water Bank is currently 120,000 AFY; therefore it is assumed that approximately one-third of this amount would be used each year of the first three years of the 4-year dry period (40,000 AFY) and no banked groundwater supplies would be available for the fourth year of the 4-year dry period. Therefore, the Eastside and Westside water banks are assumed to provide, on average, 18,900 AFY in 2020 and 31,400 AFY thereafter in a 4-year drought. It is possible that banked water will not be available in which case the mismatch would be more severe (up to 81,100 AFY).

Table 3- 18 Multiple Dry Years Supply and Demand Comparison

	2015	2020	2025	2030	2035	2040
Groundwater Storage						
Recharge + Return Flows (TSY)	126,300	118,100	110,000	110,000	110,000	110,000
Westside Water Bank (a)	0	18,400	30,000	30,000	30,000	30,000
Eastside Water Bank (b)	0	500	1,425	1,425	1,425	1,425
Direct Deliveries (c)	33,000	54,600	54,600	54,600	54,600	54,600
Recycle/Reuse	300	8,700	11,900	15,100	18,300	18,300
Surface Water	500	4,000	4,500	4,500	4,500	4,500
Total Supply	**160,100**	**204,300**	**212,400**	**215,600**	**218,800**	**218,800**
Demands						
Urban Demand	71,700	137,500	153,600	167,600	181,700	184,500
Ag Demand	84,000	84,000	84,000	84,000	84,000	84,000
Total Demand	**155,700**	**221,500**	**237,600**	**251,600**	**265,700**	**268,500**
Supply and Demand Mismatch	**0**	**-17,200**	**-25,200**	**-36,000**	**-46,900**	**-49,700**

Notes: Values assume 4-year dry period begins in the year shown and are rounded to the nearest 100.
(a) Assumes periodic wet years have occurred to allow quantities of SWP deliveries above AVEK demands to fill the water bank. Full bank storage is evenly distributed over the first three years of the 4-year dry period, rounding to 40,000 AFY the first three years and 0 AFY the fourth year. This is an average of 30,000 AFY over the 4-year dry period.
(b) Assumes banked groundwater supplies will be available only the first year of a 4-year dry period.
(c) 2015 deliveries represent actual deliveries in the Region; future projections assume the maximum Table A Amount available to the IRWM Region (160,452) multiplied by the SWP reliability of 34% for a multi-dry year.

SECTION 4 - CONCLUSIONS

This Water Supply Assessment has provided the data and analysis needed to verify that a sufficient Project water supply is physically available (Section 3.1), and that the Project water supply is, in accord with SB 610's normal year/dry year/multiple dry year requirements, sufficient (Section 3.2).This conclusion is based upon the fact that the project will greatly reduce the future water demand for the project parcels. The project site will encompass 1,292 acres that would equate to a potential residential water demand of 853.6 million gallons per year. The construction water for this project is estimated at 146.6 million gallons per year or 17.2% of what the residential demand would be. The ongoing operational demand for the project is 5.9 million gallons per year or 0.69% of the potential residential water demand. The project will greatly reduce the water demand for the project parcels compared to if the parcels were developed as residential per the existing zoning.

It is recommended that the County of Kern conclude that the proposed water supplies for the Project be found sufficient to meet the projected Project water demand, subject to filing with the County documentation from the Antelope Valley Adjudication Watermaster that such supplies are either permitted under the Adjudication.

SECTION 5 - REFERENCES

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Antelope Valley – East Kern (AVEK) Water Agency, "2020 Urban Water Management Plan"

Antelope Valley Regional Water Management Group, "2019 Update Integrated Regional Water Management Plan"

Appendix A

Chapter 643, Statutes of 2001 (Senate Bill 610)

Chapter 643, Statutes of 2001 (Senate Bill 610)

An act to amend Section 21151.9 of the Public Resources Code, and to amend Sections 10631, 10656, 10910, 10911, 10912, and 10915 of, to repeal Section 10913 of, and to add and repeal Section 10657 of, the Water Code, relating to water. Approved by Governor October 9, 2001. Filed with Secretary of State October 9, 2001.

The people of the State of California do enact as follows:

SECTION 1. (a) The Legislature finds and declares all of the following:
(1) The length and severity of droughts in California cannot be predicted with any accuracy.

(2) There are various factors that affect the ability to ensure that adequate water supplies are available to meet all of California's water demands, now and in the future.

(3) Because of these factors, it is not possible to guarantee a permanent water supply for all water users in California in the amounts requested.

(4) Therefore, it is critical that California's water agencies carefully assess the reliability of their water supply and delivery systems.

(5) Furthermore, California's overall water delivery system has become less reliable over the last 20 years because demand for water has continued to grow while new supplies have not been developed in amounts sufficient to meet the increased demand.

(6) There are a variety of measures for developing new water supplies including water reclamation, water conservation, conjunctive use, water transfers, seawater desalination, and surface water and groundwater storage.

(7) With increasing frequency, California's water agencies are required to impose water rationing on their residential and business customers during this state's frequent and severe periods of drought.

(8) The identification and development of water supplies needed during multiple-year droughts is vital to California's business climate, as well as to the health of the agricultural industry, environment, rural communities, and residents who continue to face the possibility of severe water cutbacks during water shortage periods.

(9) A recent study indicates that the water supply and land use planning linkage, established by Part 2.10 (commencing with Section 10910) of Division 6 of the Water Code, has not been implemented in a manner that ensures the appropriate level of communication between water agencies and planning agencies, and this act is intended to remedy that deficiency in communication.

(b) It is the intent of the Legislature to strengthen the process pursuant to which local agencies determine the adequacy of existing and planned future water supplies to meet existing and planned future demands on those water supplies.

SEC. 2. Section 21151.9 of the Public Resources Code is amended to read:
21151.9. Whenever a city or county determines that a project, as defined in Section 10912 of the Water Code, is subject to this division, it shall comply with Part 2.10 (commencing with Section 10910) of Division 6 of the Water Code.

SEC. 3. Section 10631 of the Water Code is amended to read:
10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments as described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:

(1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.

(2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.

(3) A detailed description and analysis of the amount and location of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(4) A detailed description and analysis of the location, amount, and sufficiency of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(c) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:

(1) An average water year.
(2) A single dry water year.
(3) Multiple dry water years.

For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe plans to replace that source with alternative sources or water demand management measures, to the extent practicable.

(d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses:

(A) Single-family residential.
(B) Multifamily.
(C) Commercial
(D) Industrial.
(E) Institutional and governmental.
(F) Landscape.
(G) Sales to other agencies.
(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.
(I) Agricultural.

(2) The water use projections shall be in the same five-year increments as described in subdivision (a). (f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1) A description of each water demand management measure that is currently being implemented, or scheduled for implementation, including the steps necessary to implement any proposed measures, including, but not limited to, all of the following:

(A) Water survey programs for single-family residential and multifamily residential customers.
(B) Residential plumbing retrofit.
(C) System water audits, leak detection, and repair.
(D) Metering with commodity rates for all new connections and retrofit of existing connections.
(E) Large landscape conservation programs and incentives.
(F) High-efficiency washing machine rebate programs.
(G) Public information programs.
(H) School education programs.
(I) Conservation programs for commercial, industrial, and institutional accounts.
(J) Wholesale agency programs.
(K) Conservation pricing.
(L) Water conservation coordinator.
(M) Water waste prohibition.
(N) Residential ultra-low-flush toilet replacement programs.

(2) A schedule of implementation for all water demand management measures proposed or described in the plan.

(3) A description of the methods, if any, that the supplier will use to evaluate the effectiveness of water demand management measures implemented or described under the plan.

(4) An estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of such savings on the supplier's ability to further reduce demand.

(g) An evaluation of each water demand management measure listed in paragraph (1) of subdivision (f) that is not currently being implemented or scheduled for implementation. In the course of the evaluation, first consideration shall be given to water demand management measures, or combination of measures, that offer lower incremental costs than expanded or additional water supplies. This evaluation shall do all of the following:

(1) Take into account economic and non-economic factors, including environmental, social, health, customer impact, and technological factors.

(2) Include a cost-benefit analysis, identifying total benefits and total costs.

(3) Include a description of funding available to implement any planned water supply project that would provide water at a higher unit cost.

(4) Include a description of the water supplier's legal authority to implement the measure and efforts to work with other relevant agencies to ensure the implementation of the measure and to share the cost of implementation.

(h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single dry, and multiple dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

(i) Urban water suppliers that are members of the California Urban Water Conservation Council and submit annual reports to that council in accordance with the ''Memorandum of Understanding Regarding Urban Water Conservation in California,'' dated September 1991, may submit the annual reports identifying water demand management measures currently being implemented, or scheduled for implementation, to satisfy the requirements of subdivisions (f) and (g).

SEC. 3.5. Section 10631 of the Water Code is amended to read:
10631. A plan shall be adopted in accordance with this chapter and shall do all of the following:

(a) Describe the service area of the supplier, including current and projected population, climate, and other demographic factors affecting the supplier's water management planning. The projected population estimates shall be based upon data from the state, regional, or local service agency population projections within the service area of the urban water supplier and shall be in five-year increments to 20 years or as far as data is available.

(b) Identify and quantify, to the extent practicable, the existing and planned sources of water available to the supplier over the same five-year increments as described in subdivision (a). If groundwater is identified as an existing or planned source of water available to the supplier, all of the following information shall be included in the plan:

(1) A copy of any groundwater management plan adopted by the urban water supplier, including plans adopted pursuant to Part 2.75 (commencing with Section 10750), or any other specific authorization for groundwater management.

(2) A description of any groundwater basin or basins from which the urban water supplier pumps groundwater. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.

(3) A detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the urban water supplier. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(c) Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage, to the extent practicable, and provide data for each of the following:

(1) An average water year.

(2) A single dry water year.

(3) Multiple dry water years. For any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, describe plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.

(d) Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.

(e) (1) Quantify, to the extent records are available, past and current water use, over the same five-year increments described in subdivision (a), and projected water use, identifying the uses among water use sectors, including, but not necessarily limited to, all of the following uses:

(A) Single-family residential.
(B) Multifamily.
(C) Commercial.
(D) Industrial
(E) Institutional and governmental.
(F) Landscape.
(G) Sales to other agencies.
(H) Saline water intrusion barriers, groundwater recharge, or conjunctive use, or any combination thereof.
(I) Agricultural.

(2) The water use projections shall be in the same five-year increments as described in subdivision (a).

(f) Provide a description of the supplier's water demand management measures. This description shall include all of the following:

(1) A description of each water demand management measure that is currently being implemented, or scheduled for implementation, including the steps necessary to implement any proposed measures, including, but not limited to, all of the following:

(A) Water survey programs for single-family residential and multifamily residential customers.
(B) Residential plumbing retrofit.
(C) System water audits, leak detection, and repair.
(D) Metering with commodity rates for all new connections and retrofit of existing connections.
(E) Large landscape conservation programs and incentives.
(F) High-efficiency washing machine rebate programs.
(G) Public information programs.
(H) School education programs.
(I) Conservation programs for commercial, industrial, and institutional accounts.
(J) Wholesale agency programs.
(K) Conservation pricing.
(L) Water conservation coordinator.
(M) Water waste prohibition.
(N) Residential ultra-low-flush toilet replacement programs.

(2) A schedule of implementation for all water demand management measures proposed or described in the plan.

(3) A description of the methods, if any, that the supplier will use to evaluate the effectiveness of water demand management measures implemented or described under the plan.

(4) An estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the supplier's ability to further reduce demand.

(g) An evaluation of each water demand management measure listed in paragraph (1) of subdivision (f) that is not currently being implemented or scheduled for implementation. In the course of the evaluation, first consideration shall be given to water demand management measures, or combination of measures, that offer lower incremental costs than expanded or additional water supplies. This evaluation shall do all of the following:

(1) Take into account economic and noneconomic factors, including environmental, social, health, customer impact, and technological factors.

(2) Include a cost-benefit analysis, identifying total benefits and total costs.

(3) Include a description of funding available to implement any planned water supply project that would provide water at a higher unit cost.

(4) Include a description of the water supplier's legal authority to implement the measure and efforts to work with other relevant agencies to ensure the implementation of the measure and to share the cost of implementation.

(h) Include a description of all water supply projects and water supply programs that may be undertaken by the urban water supplier to meet the total projected water use as established pursuant to subdivision (a) of Section 10635. The urban water supplier shall include a detailed description of expected future projects and programs, other than the demand management programs identified pursuant to paragraph (1) of subdivision (f), that the urban water supplier may implement to increase the amount of the water supply available to the urban water supplier in average, single dry, and multiple dry water years. The description shall identify specific projects and include a description of the increase in water supply that is expected to be available from each project. The description shall include an estimate with regard to the implementation timeline for each project or program.

(i) Urban water suppliers that are members of the California Urban Water Conservation Council and submit annual reports to that council in accordance with the ''Memorandum of Understanding Regarding Urban Water Conservation in California,'' dated September 1991, may submit the annual reports identifying water demand management measures currently being implemented, or scheduled for implementation, to satisfy the requirements of subdivisions (f) and (g).
SEC. 4. Section 10656 of the Water Code is amended to read:
10656. An urban water supplier that does not prepare, adopt, and submit its urban water management plan to the department in accordance with this part, is ineligible to receive funding pursuant to Division 24 (commencing with Section 78500) or Division 26 (commencing with Section 79000), or receive drought assistance from the state until the urban water management plan is submitted pursuant to this article.

SEC. 4.3. Section 10657 is added to the Water Code, to read:
10657. (a) The department shall take into consideration whether the urban water supplier has submitted an updated urban water management plan that is consistent with Section 10631, as amended by the act that adds this section, in determining whether the urban water supplier is eligible for funds made available pursuant to any program administered by the department.

(b) This section shall remain in effect only until January 1, 2006, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2006, deletes or extends that date.

SEC. 4.5. Section 10910 of the Water Code is amended to read:
10910. (a) Any city or county that determines that a project, as defined in Section 10912, is subject to the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) under Section 21080 of the Public Resources Code shall comply with this part.

(b) The city or county, at the time that it determines whether an environmental impact report, a negative declaration, or a mitigated negative declaration is required for any project subject to the California Environmental Quality Act pursuant to Section 21080.1 of the Public Resources Code, shall identify any water system that is, or may become as a result of supplying water to the project identified pursuant to this subdivision, a public water system, as defined in Section 10912, that may supply water for the project. If the city or county is not able to identify any public water system that may supply water for the project, the city or county shall prepare the water assessment required by this part after consulting with any entity serving domestic water supplies whose service area includes the project site, the local agency formation commission, and any public water system adjacent to the project site.

(c) (1) The city or county, at the time it makes the determination required under Section 21080.1 of the Public Resources Code, shall request each public water system identified pursuant to subdivision (b) to determine whether the projected water demand associated with a proposed project was included as part of the most recently adopted urban water management plan adopted pursuant to Part 2.6 (commencing with Section 10610).

(2) If the projected water demand associated with the proposed project was accounted for in the most recently adopted urban water management plan, the public water system may incorporate the requested information from the urban water management plan in preparing the elements of the assessment required to comply with subdivisions (d), (e), (f), and (g).

(3) If the projected water demand associated with the proposed project was not accounted for in the most recently adopted urban water management plan, or the public water system has no urban water management plan, the water supply assessment for the project shall include a discussion with regard to whether the public water system's total projected water supplies available during normal, single dry, and multiple dry water years during a 20-year projection will meet the projected water demand associated with the proposed project, in addition to the public water system's existing and planned future uses, including agricultural and manufacturing uses.

(4) If the city or county is required to comply with this part pursuant to subdivision (b), the water supply assessment for the project shall include a discussion with regard to whether the total projected water supplies, determined to be available by the city or county for the project during normal, single dry, and multiple dry water years during a 20-year projection, will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses, including agricultural and manufacturing uses.

(d) (1) The assessment required by this section shall include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts.

(2) An identification of existing water supply entitlements, water rights, or water service contracts held by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall be demonstrated by providing information related to all of the following:

(A) Written contracts or other proof of entitlement to an identified water supply.

(B) Copies of a capital outlay program for financing the delivery of a water supply that has been adopted by the public water system.

(C) Federal, state, and local permits for construction of necessary infrastructure associated with delivering the water supply.

(D) Any necessary regulatory approvals that are required in order to be able to convey or deliver the water supply.

(e) If no water has been received in prior years by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), under the existing water supply entitlements, water rights, or water service contracts, the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), shall also include in its water supply assessment pursuant to subdivision (c), an identification of the other public water systems or water service contract-holders that receive a water supply or have existing water supply entitlements, water rights, or water service contracts, to the same source of water as the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has identified as a source of water supply within its water supply assessments.

(f) If a water supply for a proposed project includes groundwater, the following additional information shall be included in the water supply assessment:

(1) A review of any information contained in the urban water management plan relevant to the identified water supply for the proposed project.

(2) A description of any groundwater basin or basins from which the proposed project will be supplied. For those basins for which a court or the board has adjudicated the rights to pump groundwater, a copy of the order or decree adopted by the court or the board and a description of the amount of groundwater the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has the legal right to pump under the order or decree. For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current bulletin of the department that characterizes the condition of the groundwater basin, and a detailed description by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), of the efforts being undertaken in the basin or basins to eliminate the long-term overdraft condition.

(3) A detailed description and analysis of the amount and location of groundwater pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), for the past five years from any groundwater basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), from any basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

(5) An analysis of the sufficiency of the groundwater from the basin or basins from which the proposed project will be supplied to meet the projected water demand associated with the proposed project. A water supply assessment shall not be required to include the information required by this paragraph if the public water system determines, as part of the review required by paragraph (1), that the sufficiency of groundwater necessary to meet the initial and projected water demand associated with the project was addressed in the description and analysis required by paragraph (4) of subdivision (b) of Section 10631.

(g) (1) Subject to paragraph (2), the governing body of each public water system shall submit the assessment to the city or county not later than 90 days from the date on which the request was received. The governing body of each public water system, or the city or county if either is required to comply with this act pursuant to subdivision (b), shall approve the assessment prepared pursuant to this section at a regular or special meeting.

(2) Prior to the expiration of the 90-day period, if the public water system intends to request an extension of time to prepare and adopt the assessment, the public water system shall meet with the city or county to request an extension of time, which shall not exceed 30 days, to prepare and adopt the assessment.

(3) If the public water system fails to request an extension of time, or fails to submit the assessment notwithstanding the extension of time granted pursuant to paragraph (2), the city or county may seek a writ of mandamus to compel the governing body of the public water system to comply with the requirements of this part relating to the submission of the water supply assessment.

(h) Notwithstanding any other provision of this part, if a project has been the subject of a water supply assessment that complies with the requirements of this part, no additional water supply assessment shall be required for subsequent projects that were part of a larger project for which a water supply assessment was completed and that has complied with the requirements of this part and for which the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), has concluded that its water supplies are sufficient to meet the projected water demand associated with the proposed project, in addition to the existing and planned future uses, including, but not limited to, agricultural and industrial uses, unless one or more of the following changes occurs:

(1) Changes in the project that result in a substantial increase in water demand for the project.

(2) Changes in the circumstances or conditions substantially affecting the ability of the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), to provide a sufficient supply of water for the project.

(3) Significant new information becomes available which was not known and could not have been known at the time when the assessment was prepared.

SEC. 5. Section 10911 of the Water Code is amended to read:
10911. (a) If, as a result of its assessment, the public water system concludes that its water supplies are, or will be, insufficient, the public water system shall provide to the city or county its plans for acquiring additional water supplies, setting forth the measures that are being undertaken to acquire and develop those water supplies. If the city or county, if either is required to comply with this part pursuant to subdivision (b), concludes as a result of its assessment, that water supplies are, or will be, insufficient, the city or county shall include in its water supply assessment its plans for acquiring additional water supplies, setting forth the measures that are being undertaken to acquire and develop those water supplies. Those plans may include, but are not limited to, information concerning all of the following:

(1) The estimated total costs, and the proposed method of financing the costs, associated with acquiring the additional water supplies.

(2) All federal, state, and local permits, approvals, or entitlements that are anticipated to be required in order to acquire and develop the additional water supplies.

(3) Based on the considerations set forth in paragraphs (1) and (2), the estimated timeframes within which the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), expects to be able to acquire additional water supplies.

(b) The city or county shall include the water supply assessment provided pursuant to Section 10910, and any information provided pursuant to subdivision (a), in any environmental document prepared for the project pursuant to Division 13 (commencing with Section 21000) of the Public Resources Code.

(c) The city or county may include in any environmental document an evaluation of any information included in that environmental document provided pursuant to subdivision (b). The city or county shall determine, based on the entire record, whether projected water supplies will be sufficient to satisfy the demands of the project, in addition to existing and planned future uses. If the city or county determines that water supplies will not be sufficient, the city or county shall include that determination in its findings for the project.

SEC. 6. Section 10912 of the Water Code is amended to read:
10912. For the purposes of this part, the following terms have the following meanings:

(a) ''Project'' means any of the following:

(1) A proposed residential development of more than 500 dwelling units.

(2) A proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space.

(3) A proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space.

(4) A proposed hotel or motel, or both, having more than 500 rooms.

(5) A proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area.

(6) A mixed-use project that includes one or more of the projects specified in this subdivision.

(7) A project that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project.

(b) If a public water system has fewer than 5,000 service connections, then ''project'' means any proposed residential, business, commercial, hotel or motel, or industrial development that would account for an increase of 10 percent or more in the number of the public water system's existing service connections, or a mixed-use project that would demand an amount of water equivalent to, or greater than, the amount of water required by residential development that would represent an increase of 10 percent or more in the number of the public water system's existing service connections.

(c) ''Public water system'' means a system for the provision of piped water to the public for human consumption that has 3000 or more service connections. A public water system includes all of the following:

(1) Any collection, treatment, storage, and distribution facility under control of the operator of the system which is used primarily in connection with the system.

(2) Any collection or pretreatment storage facility not under the control of the operator that is used primarily in connection with the system.

(3) Any person who treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption.

SEC. 7. Section 10913 of the Water Code is repealed.

SEC. 8. Section 10915 of the Water Code is amended to read:
10915. The County of San Diego is deemed to comply with this part if the Office of Planning and Research determines that all of the following conditions have been met:

(a) Proposition C, as approved by the voters of the County of San Diego in November 1988, requires the development of a regional growth management plan and directs the establishment of a regional planning and growth management review board.

(b) The County of San Diego and the cities in the county, by agreement, designate the San Diego Association of Governments as that review board.

(c) A regional growth management strategy that provides for a comprehensive regional strategy and a coordinated economic development and growth management program has been developed pursuant to Proposition C.

(d) The regional growth management strategy includes a water element to coordinate planning for water that is consistent with the requirements of this part.

(e) The San Diego County Water Authority, by agreement with the San Diego Association of Governments in its capacity as the review board, uses the association's most recent regional growth forecasts for planning purposes and to implement the water element of the strategy.

(f) The procedures established by the review board for the development and approval of the regional growth management strategy, including the water element and any certification process established to ensure that a project is consistent with that element, comply with the requirements of this part.

(g) The environmental documents for a project located in the County of San Diego include information that accomplishes the same purposes as a water supply assessment that is prepared pursuant to Section 10910.

SEC. 9.
Section 3.5 of this bill incorporates amendments to Section 10631 of the Water Code proposed by both this bill and AB 901. It shall only become operative if (1) both bills are enacted and become effective on or before January 1, 2002, (2) each bill amends Section 10631 of the Water Code, and (3) this bill is enacted after AB 901, in which case Section 3 of this bill shall not become operative.

SEC. 10.
No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because a local agency or school district has the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service mandated by this act, within the meaning of Section 17556 of the Government Code.

APPENDIX B

SITE-ADJACENT WATER PURVEYOR

RMR WATER TRUCKS

OFFICE: 661.510.8516
FAX: 661.294.8522
32016 N. CASTAIC RD.
CASTAIC, CA 91384

To whom it may concern:

Rosamond South Solar project, owned by Golden fields Solar IV LLC has contacted RMR Water Trucks regarding the purchase of construction and operational water for a solar project anticipated to begin construction in 2022.

The Rosamond South Solar project has an estimated water demand of approximately 146,600,000 gallons (450 acre-feet) of water during construction activities.

During operations approximately 5,865,000 gallons/year, or 18 acre-feet/year is anticipated.

RMR Water Trucks has been providing construction and operations water to green energy development projects in Kern County since 2009. The Company intends to provide water for the Rosamond South Solar Project from its water well located on Backus road at about 97th street west (APN 346-131-11). The water well has a verified rating of 432 GPM, so pumping of up to 1-acre foot per day will be no problem. Barring any unknown circumstances, we will be ready to provide water for this project in 2022.

If you have any questions, please feel free to contact me at 661 510 8516.

Thank you,

Deke Pike

President

APPENDIX C

ANTELOPE VALLEY GROUNDWATER BASIN ADJUDICATION

SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF LOS ANGELES

ANTELOPE VALLEY GROUNDWATER CASES	JUDICIAL COUNCIL COORDINATION PROCEEDING NO. 4408
This Pleading Relates to Included Action: REBECCA LEE WILLIS, on behalf of herself and all others similarly situated, Plaintiff, vs. LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 40; CITY OF LANCASTER; CITY OF PALMDALE; PALMDALE WATER DISTRICT; LITTLEROCK CREEK IRRIGATION DISTRICT; PALM RANCH IRRIGATION DISTRICT; QUARTZ HILL WATER DISTRICT; ANTELOPE VALLEY WATER CO.; ROSAMOND COMMUNITY SERVICE DISTRICT; PHELAN PINON HILL COMMUNITY SERVICE DISTRICT; and DOES 1 through 1,000; Defendants.	CASE NO. BC 364553 **~~[PROPOSED]~~ AMENDED FINAL JUDGMENT APPROVING WILLIS CLASS ACTION SETTLEMENT** Date: Time: Dept: Judge: Hon. Jack Komar Coordination Trial Judge

This matter has come before the Court on the Motion of Plaintiff Rebecca Lee Willis (Willis) for Final Approval of the Proposed Class Action Settlement between and among Rebecca Lee Willis and the Willis Class, on the one hand; and Los Angeles County Waterworks District No. 40, City of Palmdale Water District, Littlerock Creek Irrigation District, Palm Ranch Irrigation District, Quartz Hill Water District, California Water Service Company, Rosamond Community Service District, Phelan Pinon Hills Community Services District, Desert Lake Community Services District, and North Edwards Water District (collectively, the "Settling Defendants"), on the other hand.

By Order dated November 18, 2010, this Court granted Plaintiff's Motion for Preliminary Approval of the Proposed Settlement of this action and directed the sending of Notice to the Willis Class. After considering all arguments and submissions for and against final approval of the proposed settlement, and being fully advised of the premises, **IT IS HEREBY ORDERED, ADJUDGED AND DECREED AS FOLLOWS, PURSUANT TO SECTIONS 382 AND 664.6 OF THE CODE OF CIVIL PROCEDURE.**

1. For over 10 years, a number of actions have been pending in the Los Angeles County Superior Court and other California courts seeking an adjudication of the various parties' respective rights to the groundwater underlying the Antelope Valley Groundwater Basin (the "Basin").

2. A number of cases raising such issues were coordinated by a July 11, 2005 order of Judicial Council and assigned to the Honorable Jack Komar of the Superior Court for the County of Santa Clara (the "Court").

3. The Court held an initial phase of the trial on October 3006 with respect to the boundaries of the Basin and issued an Order on November 3, 2006 defining the Basin for purposes of the litigation.

4. The Willis Class Action was filed on or about January 11, 2007 to contest certain public entities' claims that those entities had obtained prescriptive rights to a portion of the Basin's groundwater. The Willis case was subsequently coordinated with the Coordinated Cases.

5. By Order dated September 11, 2007, the Court certified the Willis Class. As amended by Orders dated May 22, 2008 and September 2, 2008, the Willis Class is defined as follows:

> "All private (i.e., non-governmental) persons and entities that own real property within the Basin, as adjudicated, that are not presently pumping water on their property and have not done so at any prior time ("the Class"). The Class includes the successors-in-interest by way of purchase, gift, inheritance, or otherwise of such landowners.
>
> The Class excludes the defendants herein, any person, firm, trust, corporation, or other entity with which any defendant has a controlling interest or which is related to or affiliated with any of the defendants, and the representatives, heirs, affiliates, successors-in-interest or assigns of any such excluded party. The Class also excludes all persons to the extent their properties are connected and receive service from a municipal water system, public utility, or mutual water company. The Class shall [further] exclude Kern County Assessor's' office, unless the owners of such properties declare under penalty of perjury that they do not pump and have never pumped water on those properties."

6. Notice of the Pendency of this action was sent to the Willis Class in or about January 1, 2009 and the opt-out period (as extended) expired on August 30, 2009. Certain persons who opted out were subsequently permitted to rejoin the Class.

7. The persons listed on Exhibit 1 hereto validly excluded themselves from the Class in accordance with this Court's prior Orders (and have not re-joined the Class) and are not bound by the Settlement or this Judgment.

8. Counsel for the Willis Class engaged in settlement discussions with Defendants' counsel during mid 2009. On September 2, 2009, counsel participated in mediation session before the Honorable Ronald Robie. That mediation resulted in an agreement in principle among counsel for the Settling Parties to settle the litigation between and among their respective clients, subject to appropriate approvals.

9. By Order dated October 28, 2009, the Court stated its intent to consolidate the various Actions that were coordinated as part of JCCP No. 4408, including the Willis action. On February 19, 2010, the Court entered an Order Transferring and Consolidating [the Coordinated] Actions for All Purposes. As provided in the Consolidation Order, this Final Judgment shall not be construed to prejudice the rights of any of the Non-Settling Parties in the Consolidated Actions nor shall it prejudice the claims and defenses that the Settling Parties may assert with respect to such Non-Settling Parties.

10. By Order dated November 18, 2010, this Court granted preliminary approval to

the proposed settlement of this action and directed that Notice of the Proposed Settlement be sent to the Class.

11. Notice of the Proposed Settlement has been sent to the Willis Class by first class mail in accordance with the Court's Preliminary Approval Order. Such Notice fully and accurately informed the Class of all material terms of the proposed settlement and the opportunity to object to or comment on the Settlement. The Notice was given in an adequate and sufficient manner, constituted the best notice practicable under the circumstances, and satisfied due process.

12. The Settling Parties and each class member have irrevocably submitted to the jurisdiction of this Court for any suit, action, proceeding or dispute arising out of the Settlement Agreement.

13. It is in the best interest of the parties and the Class Members and consistent with principles of judicial economy that any dispute between any class member (including any dispute as to whether any person is a class member) and any Settling Defendant which is in any way related to the applicability or scope of the Settlement Agreement or the Final Judgment should be presented to this Court for resolution.

14. The Stipulation of Settlement submitted by the Settling Parties is hereby finally approved as fair, reasonable, and in the best interests of the Class, and the parties are directed to consummate the Settlement in accordance with its terms.

15. The Complaint in the Willis Action shall be deemed dismissed with prejudice as soon as the Final Judgment becomes effective under the terms of the Settlement Stipulation.

16. For purposes of this Final Judgment, "Released Parties" means Plaintiff Rebecca Lee Willis and the Willis Class, as well as Defendants Los Angeles County Waterworks District No. 40; The City of Palmdale; Palmdale Water District; Littlerock Creek Irrigation District; Palm Ranch Irrigation District; Quartz Hill Water District; California Water Service Company; Rosamond Community Services District; Phelan Pinon Hills Community Services District; Desert Lake Community Services District; and North Edwards Water District.

17. The Court hereby orders that the Released Parties are released and forever

discharged from the Released Claims as more specifically provided in the Stipulation of Settlement.

18. The Class members and their heirs, executors, administrators, successors, and assigns are hereby permanently barred and enjoined from instituting, commencing, prosecuting, or continuing to prosecute, either directly or indirectly, any Released Claim against any of the Released Parties in any form, other than claims to enforce the terms of the Settlement. Each Class member may hereafter discover facts other than or different from those which he or she knows or believes to be true with respect to the Released Claims. Nevertheless, each member of the Class (except those who timely opted out) waive and fully, finally and forever settle and release, upon the Settlement Agreement becoming final, any known or unknown, suspected or unsuspected, contingent or noncontingent Released Claim, whether or not concealed or hidden, without regard to the subsequent discovery or existence of such different or additional facts.

19. The Settling Defendants and their heirs, executors, administrators, successors, and assigns are hereby permanently barred and enjoined from instituting, commencing, prosecuting, or continuing to prosecute, either directly or indirectly, any Released Claim against any of the Class Members in any forum, other than claims to enforce the terms of the Settlement. Each Settling Defendant may hereafter discover facts other than or different from those which he or she knows or believes to be true with respect to the Released Claims. Nevertheless, each Settling Defendant waives and fully, finally and forever settles and releases, upon the Settlement Agreement becoming final, any known or unknown, suspected or unsuspected, contingent or noncontingent Released Claim, whether or not concealed or hidden, without regard to the subsequent discovery or existence of such different or additional facts.

20. Without affecting the finality of this Judgment, the Court hereby reserves and retains jurisdiction over this Settlement, including the administration and consummation of the Settlement, as well as any action or proceeding brought to enforce the Settlement. In addition, without affecting the finality of this Judgment, the Court retains jurisdiction over the Parties for purposes of incorporating and merging this Judgment into a physical solution or other Judgment that may ultimately be entered in the Consolidated Actions. The Settling Parties are hereby

deemed to have submitted irrevocably to the exclusive jurisdiction of this Court for any suit, action, proceeding or dispute arising out of or relating to this Judgment or the Settlement.

21. The Court after considering the pleadings on file herein, and the arguments of counsel, awards the Willis Class attorneys fees in the amount of $1,839,494, an incentive award for Ms. Rebecca Willis in the amount of $10,000, costs in the amount of $65,057.68, and supplemental attorneys fees in the amount of $160,622.50. Judgment in the amount of $2,075,174.18 is hereby entered for the Willis Class against Los Angeles County Waterworks District No. 40, City of Palmdale, Palmdale Water District, Littlerock Creek Irrigation District, Palm Ranch Irrigation District, Quartz Hill Water District, California Water Service Company, Rosamond Community Service District, Phelan Pinon Hills Community Services District, Desert Lake Community Services District, and North Edwards Water District.

Dated: 9-22-2011

Jack Komar

Judge of the Superior Court
Honorable Jack Komar

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(ADDITIONAL COUNSEL ARE LISTED ON SIGNATURE PAGES)

Superior Court of the State of California

County of Los Angeles

ANTELOPE VALLEY GROUNDWATER CASES	JUDICIAL COUNCIL COORDINATION PROCEEDING NO. 4408
This Pleading Relates to Included Action: REBECCA LEE WILLIS, on behalf of herself and all others similarly situated,	Case No. BC 364553
Plaintiff,	**WILLIS CLASS STIPULATION OF SETTLEMENT**
v.	
LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 40; CITY OF LANCASTER; CITY OF LOS ANGELES; CITY OF PALMDALE; PALMDALE WATER DISTRICT; LITTLEROCK CREEK IRRIGATION DISTRICT; PALM RANCH IRRIGATION DISTRICT; PALM RANCH IRRIGATION DISTRICT; QUARTZ HILL WATER DISTRICT; ANTELOPE VALLEY WATER CO.; ROSAMOND COMMUNITY SERVICES DISTRICT; and DOES 1 through 1,000;	
Defendants.	

This Stipulation of Settlement (the "Stipulation" or "Agreement") is entered into this 13th day of July 2010 by and between California Water Service Company, City of Palmdale, Littlerock Creek Irrigation District, Los Angeles Waterworks District No. 40 ("District 40"), Palmdale Water District, Palm Ranch Irrigation District, Phelan Pinon Hills Community Services District, Quartz Hill Water District, and Rosamond Community Services District, Desert Lake Community Services District and North Edwards Water District (collectively, "Settling Defendants"), on the one hand, and Rebecca Lee Willis and the Willis Class (as more fully defined below), which consists of certain persons who own property(ies) that overly the Antelope Valley Groundwater Basin (the "Basin") on which they do not and have not pumped groundwater, on the other hand. Settling Defendants, Rebecca Lee Willis, and the Willis Class are collectively referred to as the "Settling Parties," or individually a "Settling Party." This Stipulation and the Exhibits hereto set forth the terms of a settlement (the "Settlement") between and among the Settling Parties compromising and dismissing the claims and defenses they have asserted in the above-captioned action. The Settlement is subject to approval by the Superior Court of California for Los Angeles County; in the event such approval is denied, cannot be obtained, or is reversed on appeal, this Stipulation shall have no further force or effect, and the Settling Parties shall be returned to their respective positions in the litigation prior to execution of this Stipulation.

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I. THE SETTLING PARTIES

A. The Settling Plaintiffs are Rebecca Lee Willis and the members of the Willis Class, as defined in paragraph II, D below.

B. The Settling Defendants are as follows:

1. California Water Service Company is a California corporation which extracts groundwater from the Basin to serve customers within the Basin.

2. The City of Palmdale is a municipal corporation in the County of Los Angeles which receives water from the Basin.

3. Littlerock Creek Irrigation District is a public agency which produces groundwater from the Basin to serve customers within the Basin.

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4. Los Angeles County Waterworks District No. 40 ("District 40") is a public agency governed by the Los Angeles County Board of Supervisors. District 40 has been lawfully organized to perform various functions, including producing water from the Basin, which it provides to more than 65,000 residential and commercial customers in the Basin.

5. Palmdale Water District is an irrigation district organized and operating under Division 11 of the California Water Code, which produces groundwater from the Basin to serve customers within the Basin.

6. Palm Ranch Irrigation District is a public agency which produces groundwater from the Basin to serve customers within the Basin.

7. Rosamond Community Services District is a public agency which produces water from the Basin which it provides to customers within the Basin.

8. Quartz Hill Water District is a county water district organized and operating under Division 12 of the California Water Code. It produces water from the Basin.

9. Phelan Pinon Hills Community Services District is a public water supplier which produces water from the Basin.

10. Desert Lake Community Services District is a public agency which produces groundwater from the Basin.

11. North Edwards Water district is a public agency which produces groundwater from the Basin.

II. RECITALS

A. On or about November 29, 2004, District 40 commenced a civil action against Overlying Owners (more specifically defined in III. M) in the Basin, which is now pending in the Superior Court for Los Angeles County, seeking, inter alia, an adjudication of their respective rights to produce groundwater from the Basin. On or about July 11, 2005, that case was coordinated with several quiet title actions that had been brought by Basin landowners, which also sought a declaration of the parties' rights to produce and use the Basin's groundwater. Antelope Valley Groundwater Cases, No. 1-05-CV049053 (JCCP 4408) (hereinafter the "Coordinated Actions"). The Coordinated Actions are pending before the Honorable Jack Komar.

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B. On or about October 10, 2006, the Court held an initial phase of trial with respect to the boundaries of the Basin. The Court issued an Order on November 3, 2006, defining the Basin for purposes of this litigation.

C. On or about January 11, 2007 Plaintiff, Rebecca Lee Willis ("Willis"), filed a class action complaint in the Superior Court of the State of California for Los Angeles County (No. BC 364553) (the "Willis Action") in which she alleged that certain Public Water Suppliers had wrongfully claimed prescriptive rights to the Basin's groundwater. Willis sought, inter alia, a declaration that the Settling Defendants had not obtained prescriptive rights as to her or Willis Class Members (more specifically defined in III.X). On or about April 10, 2007, the Willis Action was coordinated as part of the Coordinated Actions.

D. By Order dated September 11, 2007 (as amended by Orders dated May 22, 2008 and September 2, 2008), the Court certified Willis as the representative of a Class of certain Overlying Owners (more specifically defined in if III.M. below) pursuant to Section 382 of the California Code of Civil Procedure and Division 7, Chapter 6 of the Rules of Court.

E. In early January 2009, Notice of the Pendency of the Willis Action was sent by first class mail to all Willis Class Members (more specifically defined in III.X below) who could be identified with reasonable effort and a summary notice was published. The deadline for putative Willis Class Members to exclude themselves (as extended) expired on August 30, 2009. The Court has made various orders allowing certain parties to rejoin the Willis Class.

F. The Settling Parties have actively discussed potential settlement for much of this year. On or about September 2, 2009, the Settling Parties engaged in mediation before the Honorable Ronald Robie during the course of which counsel for most of the parties reached an agreement in principle to settle the Willis Action, subject to the negotiation of a final settlement agreement, client approvals, and approval by the Court.

G. On or about February 19, 2010, the Court entered an Order Transferring and Consolidating Actions for All Purposes (hereinafter the "Consolidated Actions").

H. Over the course of the last three years, the Settling Plaintiffs' counsel have conducted a thorough investigation of the facts and law relating to the matters at issue in the

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Consolidated Actions and have evaluated the merits of all Settling Parties' contentions and the impact this Settlement will have on the Willis Class Members. After evaluating the foregoing, the Settling Plaintiffs and counsel are satisfied that the terms and conditions of this Stipulation are fair, reasonable, and adequate, and that the Settlement is in the best interest of the Willis Class Members.

I. The Settling Defendants contend that they have prescriptive rights to substantially more than 15% of the Basin's Native Safe Yield. The Settling Plaintiffs contend that the Settling Defendants have no such prescriptive rights as to them. This Settlement reflects a compromise between the Settling Parties and shall not (1) be construed as an admission or concession by any Settling Party of the truth of any allegation or the validity of any claim or defense asserted in any of the pleadings, (2) be construed to prejudice the rights, claims, or defenses of any persons who are not Settling Parties, or (3) be construed to prejudice the rights, claims, or defenses (whether asserted or potential) of any Settling Party vis-à-vis any non-settling party.

J. The United States owns property within the Basin as to which it claims a Federal Reserved Right to produce groundwater.

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III. DEFINITIONS

The following terms used in this Stipulation shall have the meanings set forth below:

A. "Assessments" means any monetary or other levy or charge imposed as part of a Physical Solution.

B. "Basin" means the Antelope Valley Groundwater Basin as defined in the Court's Order of November 3, 2006.

C. "Consolidated Actions" means all actions that have been or subsequently were coordinated as part of Judicial Council Coordination Proceeding No. 4408 and all actions that have been or subsequently were consolidated pursuant to the Court's Order from February 19, 2010.

D. "Correlative Rights" means the principle of California law, articulated in Katz v. Walkinshaw (1903) 141 Cal. 116 and subsequent cases, that Overlying Owners may make reasonable and beneficial use of the water in a Basin and that, if the supply of water is insufficient for all reasonable and beneficial needs, each Overlying Owner is entitled to a fair and just proportion of the water available to the Overlying Owners.

E. "Court" means the Honorable Jack Komar, sitting by designation as a Judge of the Superior Court of Los Angeles County or such other Judge as may be designated by the Judicial Conference to hear JCCP No. 4408.

F. "Effective Date" means the date on which the Court's Judgment granting final approval to the Settlement becomes final and not subject to further appeal.

G. "Federal Reserved Right" is the principle originally articulated in Winters v. United States (1908) 207 U.S. 564 and more recently in *Cappaert v. United States* (1976) 426 U.S. 128, which holds that when the Federal Government reserves land from the public domain, it impliedly reserves sufficient water to serve the purposes for which the lands were reserved, and the quantity of reserved water is limited to the amount necessary to fulfill the purposes of the reserved land. The United States contends that the Federal Reserved Right entitles the United States to a prior and paramount right to a portion of the Native Safe Yield.

H. "Federally Adjusted Native Safe Yield" for any given year means the Basin's Native Safe Yield less the actual annual production of the United States' during the prior year pursuant to its Federal Reserved Right.

I. "Final Judgment" means a final judgment to be entered by the Court in the above matter, which approves the terms and provisions of this Stipulation, and is substantially in the form attached hereto as Exhibit A.

J. "Imported Water" means water that enters the Basin and that originates outside the Basin that is not part of the Basin's Native Safe Yield, and that, absent human intervention, would not recharge or be used in the Basin. Imported Water does not include water purchased by the Watermaster with Replacement Assessments or bottled water.

K. "Native Safe Yield" means the amount of pumping, which under a given set of land use and other prevailing cultural conditions, generates Return Flows that, when combined with naturally occurring groundwater recharge to the Basin, results in no long-term depletion of

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Basin groundwater storage. Pumping of the Settling Parties' share of Native Safe Yield is not subject to any Replacement Assessment.

L. "Overlying Right" means the appurtenant right of an Overlying Owner to use groundwater from the Native Safe Yield for overlying reasonable and beneficial use.

M. "Overlying Owners" means owners of land overlying the Basin who hold an Overlying Right.

N. "Physical Solution" means a mechanism that comprehensively resolves the competing claims to the Basin's water and provides for the management of the Basin. The Settling Parties anticipate that this Settlement will later be incorporated into a Physical Solution.

O. "Preliminary Approval Order" means the Court's Order granting preliminary approval to the Settlement set forth herein, directing the manner in which notice of the Settlement shall be provided to the Willis Class, and scheduling a final Hearing for the Court to consider whether to approve the Settlement. The Settling Parties will submit a proposed Preliminary Approval Order in the form appended as Exhibit B hereto.

P. "Recycled Water" means water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and is therefore considered a valuable resource..

Q. "Replacement Assessment" means the charge imposed on any Settling Party by the Watermaster for producing more water than it is entitled to produce from the Basin under the terms of this Settlement or pursuant to such further orders as the Court may enter in the Coordinated Actions.

R. "Replacement Water" means water purchased by the Watermaster to offset production in excess of a Settling Party's share of Total Safe Yield.

S. "Return Flows" means the amount of water that is put to reasonable and beneficial agricultural, municipal or other use and thereafter returns to the Basin and is part of the Basin's Total Safe Yield.

T. "Settlement" means this Stipulation, including the Exhibits appended hereto.

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U. "Total Safe Yield" means the amount of pumping, which under a given set of land use and other prevailing cultural conditions generates Return Flows that, when combined with naturally occurring groundwater recharge to the Basin and Return Flows derived from Imported Water, results in no long-term depletion of Basin groundwater storage.

V. "Transition Period" means the period of time provided for in the Physical Solution during which the parties' right to produce water from the Native Safe Yield free from Replacement Assessment will decrease to amounts that total no more than that party's share of Native Safe Yield.

W. "Watermaster" means the person or entity appointed by the Court to monitor and manage the Basin's groundwater, subject to oversight by the Court.

X. "Willis Class" or "Willis Class Members" means the Willis Class as defined in the Court's Order of September 11, 2007, as amended by the Court's Orders of May 22, 2008, and September 2, 2008, but shall exclude all persons who timely excluded themselves from the Willis Class and have not rejoined the Willis Class. The Willis Class consists of the following:

> "All private (i.e., non-governmental) persons and entities that own real property within the Basin, as adjudicated, that are not presently pumping water on their property and have not done so at any prior time ("the Class"). The Class includes the successors-in-interest by way of purchase, gift, inheritance, or otherwise of such landowners.
>
> The Class excludes the defendants herein, any person, firm, trust, corporation, or other entity in which any defendant has a controlling interest or which is related to or affiliated with any of the defendants, and the representatives, heirs, affiliates, successors-in-interest or assigns of any such excluded party. The Class also excludes all persons to the extent their properties are connected and receive service from a municipal water system, public utility, or mutual water company. The Class shall [further] exclude all property(ies) that are listed as `improved' by the Los Angeles County or Kern County Assesor's' office, unless the owners of such properties declare under penalty of perjury that they do not pump and have never pumped water on those properties."

IV. SETTLEMENT TERMS

In consideration of the covenants and agreements set forth herein, and of the releases and dismissals described below, the Settling Parties agree to settle and compromise the claims that have been asserted or that could have been asserted between and among the Willis Class and the

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Settling Defendants, subject to Court approval, on the following terms and conditions:

A. Native Safe Yield.

Settling Defendants and the United States contend that the best estimate of the Basin's Native Safe Yield is 82,300 acre-feet per year. The Willis Class agrees not to challenge or otherwise contest the Native Safe Yield proposed by the Settling Defendants as long as it is at least 82,300 acre-feet per year. The Settling Parties understand and agree that, in the absence of stipulation by all parties in the Coordinated Actions, the Court will decide the Basin's Native Safe Yield following trial, and the Settling Parties agree to be bound by the Court's determination in that regard even if some or all of them do not participate in such a trial.

B. Total Safe Yield.

The Settling Defendants contend that the best estimate of the Basin's Total Safe Yield is 110,500 acre-feet per year. The Willis Class agrees not to challenge or otherwise contest that estimate. The Settling Parties understand and agree that, in the absence of stipulation by all parties in the Coordinated Actions, the Court will decide the Basin's Total Safe Yield following trial, and the Settling Parties agree to be bound by the Court's determination in that regard even if some or all of them do not participate in such a trial.

C. Federal Reserved Right.

The United States contends that it is entitled to a Federal Reserved Right. The Settling Parties agree that the Federal Government has a Federal Reserved Right to use a portion of the Native Safe Yield. The Settling Parties agree that the Court will decide the amount of the Federal Reserved Right and they agree to be bound by the Court's determination.

D. Allocation Of Federally Adjusted Native Safe Yield.

The Settling Parties agree to be bound by the Court's determination of the amounts of the Basin's Native Safe Yield and the United States' Federal Reserved Right. The Basin's Federally Adjusted Native Safe Yield shall be the Basin's Native Safe Yield less the prior year's production of water by the United States (not to exceed the Federal Reserved Right). The Settling Parties agree that the Settling Defendants and the Willis Class Members each have rights to produce groundwater from the Basin's Federally Adjusted Native Safe Yield.

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1. Settling Defendants' Water Rights

Settling Defendants have asserted in the Coordinated Actions that they have obtained prescriptive rights to the Basin's Native Safe Yield. This Stipulation shall neither be construed to recognize prescriptive rights nor to limit the Settling Defendants' prescriptive claims vis-a-vis the Basin or any non-settling parties, but rather as an agreement to fairly allocate the Settling Parties' respective rights to use the Basin's water. The Settling Parties agree that the Settling Defendants collectively have the right to produce up to 15% of the Basin's Federally Adjusted Native Safe Yield free of any Replacement Assessment. The Willis Class will not take any positions or enter into any agreements that are inconsistent with the exercise of the Settling Defendants' rights.

2. Willis Class Members' Pumping Rights

The Settling Parties agree that the Willis Class Members have an Overlying Right to a correlative share of 85% of the Federally Adjusted Native Safe Yield for reasonable and beneficial uses on their overlying land free of any Replacement Assessment. The Settling Defendants will not take any positions or enter into any agreements that are inconsistent with the exercise of the Willis Class Members' Overlying Right to produce and use their correlative share of 85% of the Basin's Federally Adjusted Native Safe Yield.

a. Safe Harbor.

The Willis Class Members acknowledge that the Settling Defendants may at trial prove prescriptive rights against all groundwater pumping in the Basin during a prior prescriptive period. If the Settling Defendants do prove prescriptive rights, Settling Defendants shall not exercise their prescriptive rights to diminish the Willis Class Members' Overlying Right below a correlative share of 85% of the Basin's Federally Adjusted Native Safe Yield. If the Settling Defendants fail to prove any prescriptive rights, this Agreement shall not diminish at all the rights of Willis Class Members to make reasonable and beneficial use of a correlative share of the Basin's Federally Adjusted Native Safe Yield. In no event shall this Agreement require the Willis Class Members to give to the Settling Defendants more than 15% of any rights to use the Basin's groundwater that they may obtain by way of settlement or judgment. If there is a subsequent Court decision whereby the Court determines that the Willis Class Members do not have Overlying Rights, this Agreement shall not require Settling Defendants to give the Willis Class Members any right to pump from the Native Safe Yield.

3. Correlative Rights Of Overlying Landowners

The Willis Class Members recognize that other Overlying Owners may have the right to pump correlatively with them 85% of the Federally Adjusted Native Safe Yield of the Basin for reasonable and beneficial uses on their overlying land.

4. Return Flows From Imported Water

a. The Settling Parties acknowledge and agree that they all have the right to recapture Return Flows from Imported Water that they put to reasonable and beneficial use in the Basin, consistent with California law. The Settling Parties will not be subject to any Replacement Assessment for their production of an amount equal to the Return Flows from Imported Water that they put to reasonable and beneficial use in the Basin.

b. Settling Defendants believe that the best estimates of Return Flows from Imported Water are (a) 25% of the water used for agricultural purposes and (b) 28% of the water used for municipal and industrial purposes. Settling Defendants further believe that the best estimate of total annual Return Flows from Imported Water is 28,200 acre-feet of which 25,100 acre-feet is from municipal and industrial use and 3,100 acre-feet is from agricultural use. The Willis Class agrees not to contest those estimates, and all Settling Parties agree to be bound by any findings that may later be made by the Court with respect thereto.

V. MANAGEMENT OF THE BASIN

A. General

The Settling Parties agree that the Basin has limited water resources and that they should use their best efforts to conserve and maximize reasonable and beneficial use. The Settling Parties further agree that there is a need to create a groundwater management plan to ensure that pumping from the Basin does not exceed the Basin's Total Safe Yield and that the Court should appoint a Watermaster to oversee the management of the Basin's water resources.

B. Physical Solution

The Settling Parties expect and intend that this Stipulation will become part of a Physical

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Solution entered by the Court to manage the Basin and that the Court will retain jurisdiction in the Coordinated Actions. The Settling Parties agree to be part of such a Physical Solution to the extent it is consistent with the terms of this Stipulation and to be subject to Court-administered rules and regulations consistent with California and Federal law and the terms of this Stipulation. The Settling Parties agree that the Physical Solution may require installation of a meter on any groundwater pump by a Willis Class Member before a Willis Class Member may produce groundwater. The responsibility for the cost of such meters will be determined by the Court.

C. Transition Period.

The Settling Parties agree that net groundwater production from the Basin needs to be reduced over a period of time from current levels to no more than the Basin's Total Safe Yield. This can be accomplished by reducing pumping and/or purchasing Replacement Water. The Settling Parties agree that the Transition Period should begin at the date of entry of Final Judgment in the Coordinated Actions and should last seven years. During the first two years of the Transition Period no effort will be made to curtail groundwater pumping and no Replacement Assessments will be made. By the end of the seventh year of the Transition Period, groundwater pumping from the Basin without Replacement Assessment for Replacement Water will not exceed the Native Safe Yield.

D. Replacement Water.

The Settling Parties recognize the right of any Settling Party to produce groundwater from the Basin above their share of the Native Safe Yield, subject to the Physical Solution and to any Replacement Assessment. The Settling Parties agree to provide or purchase Imported Water for all groundwater pumping that exceeds a Settling Party's share of the Federally Adjusted Native Safe Yield. The Settling Parties agree that any Settling Party who produces more than its annual share of the Federally Adjusted Native Safe Yield in any year will be responsible to provide Replacement Water or pay a Replacement Assessment to the Watermaster so that the Watermaster can purchase Imported Water to recharge the Basin.

E. Water Storage

The Settling Parties agree that water storage in the Basin offers significant benefits and

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should be encouraged. The Settling Parties further recognize that there is a limit on the Basin's available storage space and that the storage of water for uses within the Basin should have priority over storage for use outside the Basin. Subject to those general principles, the Settling Parties agree that water storage should be permitted and encouraged and agree to support appropriate provisions in the Physical Solution.

F. Recycled Water

The Settling Parties agree that it is important to encourage the treatment and use of Recycled Water. The Willis Class agrees not to challenge or otherwise contest Settling Defendants' claims to Return Flows from Recycled Water that was reclaimed by the Sanitation Districts of Los Angeles County.

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VI. PROCEDURES FOR CLASS NOTICE AND HEARING ON MOTIONS FOR PRELIMINARY AND FINAL APPROVAL OF STIPULATION

A. Preliminary Approval Motion and Settlement Notice.

Settling Plaintiffs shall file a motion for preliminary approval ("Preliminary Approval Motion") of the terms of the Settlement as soon as practicable following execution of this Stipulation by all Settling Parties. The Preliminary Approval Motion will seek entry of an Order Preliminarily Approving Class Action Settlement. The Preliminary Approval Motion shall include a proposed form of notice describing this Stipulation (the "Settlement Notice") to be disseminated to the Willis Class as well as a description of the procedures to be used in disseminating the Settlement Notice. The Settlement Notice shall be disseminated to all Willis Class Members by or under the supervision of counsel for District 40, with the expenses to be borne by District 40. The Settling Parties will attempt to agree upon the language for the Settlement Notice, but agree to be bound by the Court's determination in the event they have any disputes or disagreements in that regard. The Settling Parties agree to use their best efforts to have the Preliminary Approval Motion heard as promptly as is practical.

B. Final Approval Hearing.

The Settlement Notice will advise Willis Class Members of the date and time set for a Hearing on the Settling Plaintiffs' Motion for Final Approval of the Stipulation, including advising them of their rights to submit statements in support of or opposition to the Stipulation. The Final Approval Motion shall request that this Court find that the Stipulation and Proposed Final Judgment are fair, reasonable, and adequate to the Willis Class and shall seek entry of a Final Judgment substantially in the form attached hereto as Exhibit A.

VII. RELEASES AND DISMISSALS

A. Release By Settling Plaintiffs

1. In addition to the effect of any Final Judgment entered in accordance with this Stipulation, upon this Stipulation becoming final as set out in Section VIII, Paragraph G of this Stipulation, and in consideration for the settlement consideration set forth above, and for other valuable consideration, the Settling Plaintiffs shall completely release, acquit and forever discharge the Settling Defendants from any and all claims, demands, actions, suits, causes of action, whether class, individual, or otherwise in nature that Settling Plaintiffs, or each of them, ever had, now has, or hereafter can, shall, or may have on account of or in any way arising out of, any and all known or unknown, foreseen or unforeseen, suspected or unsuspected injuries, damages, and the consequences thereof in any way arising out of or relating in any way to the matters at issue in the Willis Action ("Released Claims"). Each Settling Plaintiff may hereafter discover facts other than or different from those which he, she, or it knows or believes to be true with respect to the claims which are the subject matter of this Stipulation, but each Settling Plaintiff hereby expressly waives and fully, finally, and forever, settles and releases, upon this Stipulation becoming final, any known or unknown, suspected or unsuspected, contingent or non-contingent claim with respect to the subject matter of the Stipulation, whether or not concealed or hidden, without regard to the subsequent discovery or existence of such different or additional facts. As provided in the Release set forth above, the Settling Plaintiffs, including any of Settling Plaintiffs' representatives, successors, agents, affiliates, employees, supervisors, officers, directors, or shareholders, agree to waive and release all rights and benefits which they might otherwise have pursuant to Section 1542 of the California Civil Code with regard to the release of such unknown, unanticipated or misunderstood claims, causes of action, liabilities, indebtedness and obligations.

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2. The Release set forth in Paragraph VII.A, above, does not include claims by any of the Settling Plaintiffs other than the claims set forth therein. In particular, the Settling Parties recognize that many persons own more than one parcel of land within the Basin. The foregoing Release only binds Willis Class Members and only with respect to those properties within the Basin on which they have not pumped water.

B. Release By Settling Defendants

In addition to the effect of any Final Judgment entered in accordance with this Stipulation, upon this Stipulation becoming final as set out in Paragraph VIII.G of this Stipulation, and in consideration of the settlement consideration set forth above, and for other valuable consideration, the Settling Defendants completely release, acquit and forever discharge Settling Plaintiffs and the Willis Class Members from any and all claims, demands, actions, suits, causes of action, whether class, individual, or otherwise in nature that Settling Defendants, or any of them, ever had, now has, or hereafter can, shall, or may have arising from or relating in any way to the matters at issue in the Willis Action ("Released Claims"). Each Settling Defendant may hereafter discover facts other than or different from those which he, she, or it knows or believes to be true with respect to the claims which are the subject matter of this Stipulation, but each Settling Defendant hereby waives any right to relief from the provisions of this Stipulation in such event, and fully, finally, and forever, settles and releases, upon this Stipulation becoming final, any known or unknown, suspected or unsuspected, contingent or non-contingent claim with respect to the subject matter of the Stipulation, whether or not concealed or hidden, and without regard to the subsequent discovery or existence of such different or additional facts.

1. As provided in the Release set forth in Paragraph VII.B, above, the Settling Defendants, including any of Settling Defendants' representatives, successors, agents, affiliates, employees, supervisors, officers, directors, or shareholders, agree to waive and release all rights and benefits which they might otherwise have pursuant to Section 1542 of the California Civil Code with regard to the release of such unknown, unanticipated or misunderstood claims, causes of action, liabilities, indebtedness and obligations.

VIII. MISCELLANEOUS PROVISIONS

A. No Concession By Any Settling Party

It is understood and agreed that this Stipulation represents the compromise of disputed positions with respect to the relevant facts and law. This Stipulation shall not be deemed a concession by any Settling Party as to any fact or the validity or invalidity of any claim or defense.

B. Best Efforts and Mutual Cooperation.

Settling Plaintiffs and Settling Defendants shall use their best efforts to effectuate this Stipulation and its purpose, and secure the prompt, complete, and final dismissal with prejudice of the Willis Action. The Settling Parties agree to take any and all reasonable steps that may be necessary in that regard, as long as those steps do not require any material deviations from the terms of this Stipulation or impose material new obligations beyond those contemplated by this Stipulation.

The Settling Parties recognize that not all parties to the Coordinated Actions have entered into this Stipulation and that a trial may be necessary as against non-settling parties. The Settling Parties agree to cooperate and coordinate their efforts in any such trial or hearing so as to obtain entry of judgment consistent with the terms of this Stipulation; this provision, however, will not require Willis Class counsel to participate in any such trial or render any efforts absent written agreement of Settling Defendants to compensate them for such efforts. Nor shall this Stipulation preclude Settling Plaintiffs from participating in any further proceedings that may affect their rights.

C. Adjustments Of Settling Parties' Estimates

In the event that the Court enters findings of fact that vary from the estimated amounts that the Settling Parties have agreed to for purposes of this Stipulation (including the length of the Transition Period described in Paragraph V.C.), the Court's findings will be determinative and will supplant the amounts set forth in this Stipulation. For example, if the Court should determine following trial that the Basin's Total Safe Yield is, in fact, 120,000 acre-feet per year (or some other amount), the Court's findings will control.

D. Fees And Costs Of Settling Plaintiff's Counsel

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The Settling Parties understand that Willis Class counsel intend to seek an award of their fees and costs from the Court. Any such awards will be determined by the Court unless agreed to by the Settling Parties. Settling Defendants will likely oppose the motion for fees and costs. If Willis Class Counsel obtain an award of fees, Settling Defendants agree to exercise their best efforts to pay any fee award within a reasonable period of time or as required pursuant to Court order. Willis Class Counsel agree that they will not seek any attorneys' fees and/or costs from Settling Defendants for any efforts Willis Class Counsel undertake after the Court's entry of Final Judgment approving the Settlement, except with respect to the following: (a) any reasonable and appropriate efforts by Willis Class Counsel to enforce the terms of this Stipulation against Settling Defendants in the event Settling Defendants fail to comply with a provision of this Stipulation; (b) any reasonable and appropriate efforts by Willis Class Counsel to defend against any new or additional claims or causes of action asserted by Settling Defendants against the Willis Class in pleadings or motions filed in the Consolidated Actions; (c) any reasonable and appropriate efforts by Willis Class Counsel that are undertaken in response to a written Court order stating that, pursuant to this provision, Class counsel may seek additional fees for specified efforts from Settling Defendants pursuant to Code of Civil Procedure section 1021.5; (d) any reasonable and appropriate efforts by Willis Class Counsel that are undertaken in response to a written request by Settling Defendants executed by counsel for all Settling Defendants that Class Counsel participate in future aspects of the Consolidated Actions (e.g., the negotiation of a Physical Solution); or (e) any reasonable and appropriate efforts that Willis Class Counsel render to defend a fee award in their favor in the event the Settling Defendants appeal such a fee award and the Court of Appeal affirms the fee award in the amount of 75 percent or more of the fees awarded by the Superior Court. Willis Class Counsel remain free to seek an award of fees from other parties to the litigation.

E. Retention Of Jurisdiction

The Superior Court of the State of California for Los Angeles County shall retain jurisdiction over the implementation, enforcement, and performance of this Stipulation, and shall have exclusive jurisdiction over any suit, action, proceeding, or dispute arising out of or relating

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to this Stipulation or the applicability of this Stipulation.

F. Choice Of Law

This Stipulation shall be governed and construed by the substantive laws of the State of California.

G. Finality

a. This Stipulation shall be effective on the Effective Date, which shall occur when the Court has entered a Final Judgment approving this Stipulation and one of the following events occurs; (i) if an appeal is taken, the date of final affirmance of the Final Judgment, or if petition for review is granted by California Supreme Court or writ of certiorari is granted by United States Supreme Court, the date of final affirmance of the Final Judgment following review pursuant to such grant; or (ii) the date of final dismissal of any appeal from Final Judgment or the final dismissal of any proceedings on petition to review the Final Judgment; or (iii) if no appeal is filed, the expiration date of the time for filing or noticing of any appeal from the Final Judgment, i.e., sixty (60) days after notice of entry of the Final Judgment.

b. In the event that the Court refuses to approve this Stipulation, or any material part hereof, or if such approval is materially modified or set aside on appeal, or if the Final Judgment is not entered in accordance with this Stipulation, appellate review is sought, and on such review, such Final Judgment is not affirmed as to all material parts, then any of the Settling Parties to the Stipulation have the option to rescind this Stipulation in its entirety. Written notice of the exercise of any such right to rescind shall be made according to the terms of this Paragraph VIII.L below within thirty (30) days of the triggering event.

H. Integrated Agreement

This Stipulation constitutes the entire, complete and integrated agreement among the Settling Parties, and supersedes all prior or contemporaneous undertakings of the Settling Parties in connection herewith. This Stipulation may not be modified or amended except in writing executed by the Settling Parties and approved by the Court. It shall be construed and interpreted to effectuate the intent of the Settling Parties which is to provide, through this Stipulation, for a complete resolution of the relevant claims between the Settling Parties on the terms provided in

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this Stipulation. Notwithstanding the foregoing, the Settling Parties intend and agree that this Stipulation will later be incorporated into a Physical Solution, as defined above, which is consistent with the terms of this Stipulation.

I. Waiver

The waiver by any Settling Party of its rights under any provision of this Stipulation or of any breach of this Stipulation shall not be deemed a waiver of any other provision or subsequent breach of this Stipulation.

J. Intended Beneficiaries

This Stipulation shall be binding upon, and inure to the benefit of, the heirs, successors and assigns of the Settling Plaintiffs and Settling Defendants. Without limiting the generality of the foregoing, this Stipulation shall bind each and every subsequent property owner who acquires property in the Basin from a Willis Class Member as well as persons who subsequently acquire such properties.

K. Interpretation and Construction

The terms of this Stipulation have been arrived at by negotiation and mutual agreement, with consideration of and participation by all Settling Parties and with the advice of counsel. Neither Settling Plaintiffs nor Settling Defendants shall be considered to be the drafter of this Stipulation or any of its provisions for the purpose of any statute, case law, or rule of interpretation or construction that would or might cause any provision to be construed against the drafter of this Stipulation (including but not limited to Civil Code Section 1654). The descriptive headings of any paragraphs or sections of this Stipulation are inserted for convenience only and do not constitute a part of this Stipulation.

L. Notices

Where this Stipulation requires either party to provide notice or any other communication or document to the other, such notice shall be in writing, and such notice, communication, or document shall be provided by personal delivery, facsimile transmission, overnight delivery, or letter sent by United States mail with delivery confirmation. Notice may be provided to the Settling Parties through their counsel of record at the following addresses:

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California Water Service Company:	Attn: President California Water Service Company 1720 North First Street San Jose, California 95112
with a copy to:	John Tootle California Water Service Company 2632 West 237th Street Torrance, California 90505
City of Palmdale:	Attn: City Manager 38300 Sierra Highway Palmdale, California 93550
with a copy to:	James Markman Richards, Watson & Gerson 355 South Grand Avenue, 40th Floor Los Angeles, California 90071
Littlerock Creek Irrigation District:	Attn: General Manager 35141 87th Street East Littlerock, California 93543
with a copy to:	Wayne Lemieux Lemieux & O'Neill 2393 Townsgate Rd., Suite 201 Westlake Village, California 91361
Los Angeles County Waterworks District No. 40:	Attn: Director 260 East Avenue K-8 Lancaster, California 93535
with a copy to:	Michael Moore Los Angeles county Counsel Office 648 Kenneth Hahn Hall of Administration 500 West Temple Street Los Angeles, California 90012
with a copy to:	Eric L. Garner

	Best Best & Krieger LLP 3750 University Avenue P.O.B 1028 Riverside, California 92502
Palmdale Water District:	Attn: General Manager 2029 E. Avenue Q Palmdale, California 93550
with a copy to:	Thomas Bunn III Lagerlof, Senecal, Gosney & Kruse, LLP 301 North Lake Avenue, 10th floor Pasadena, California 91101-4108
Palm Ranch Irrigation District:	Attn: General Manger 4871 West Avenue M. (Colombia Way) Quartz Hill, California 93536
with copy to:	Wayne Lemieux Lemieux & O'Neill 2393 Townsgate Rd., Suite 201 Westlake Village, California 91361
Quartz Hill Water District:	Attn: General Manager 42141 N. 50th Street West Quartz Hill, California 93536
with copy to:	Bradley Weeks Charlton Weeks LLP 107 West Avenue M-14, Suite A Palmdale, California 93551
Phelan Pinon Hills Community Services District:	Attn: General Manager 4037 Phelan Road, Suite C-1 Phelan, California 92371
with copy to:	Francis Logan Law Office of Susan Trager 19712 MacArthur Blvd. #120 Irvine, California 92612
Rosamond Community Services District:	Attn: General Manager

	3179 35th Street W Rosamond California 93560
with a copy to:	Eric L. Garner Best Best & Krieger LLP 3750 University Avenue P.O.Box 1028 Riverside, California 92502
Willis Class:	Rebecca Lee Willis
With a copy to:	Ralph Kalfayan Krause Kalfayan Benink & Slavens LLP 625 Broadway, Ste. 635 San Diego, CA 92101

or to such other address as any Settling Party shall, from time to time, specify in the manner provided herein.

M. No Admissions

Neither this Stipulation, nor any act performed or document executed pursuant to or in furtherance of this Stipulation is or may be deemed to be or may be used as an admission of, or evidence of, (i) the validity of any claim or defense; or (ii) the appropriateness or inappropriateness of any Willis Class Member or other representational capacity, whether contemporaneously with this Stipulation or at any time in the future.

N. Execution

This Stipulation may be executed in counterparts by Settling Plaintiffs and Settling Defendants, and a facsimile signature shall be deemed an original signature for purposes of executing this Stipulation. Each of the undersigned persons represents that he or she is fully authorized to enter into the terms and conditions of and to execute this Stipulation by the party for which he or she has signed the Stipulation.

IN WITNESS HEREOF, the undersigned being duly authorized, have executed this Stipulation on the dates shown below.

Rebecca Lee Willis Approved as to form by: Ralph Kalfayan

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By: Rebecca Lee Willis	By:
California Water Service	Approved as to form by: John Tootle
By: ______________	By: ______________
City of Palmdale	Approved as to form by: James Markman
By: ______________	By: ______________
Littlerock Creek Irrigation District	Approved as to form by: Wayne Lemieux
By: ______________	By: ______________
Los Angeles County Waterworks District No. 40	Approved as to form by: Andrea Sheridan Ordin, County Counsel
By: Gloria Molina Chair, Board of Supervisors	By: Warren R. Wellen, Principal Deputy County Counsel
	Approved as to form by: Eric L. Garner
	By: ______________
Attest: Sachi A. Hamai, Executive Officer-Clerk Of the Board of Supervisors	
By: LaChelle Smitherman DEPUTY	
Palmdale Water District	Approved as to form by: Tom Bunn
By: ______________	By: ______________

77381

By: ______________________________

By: ______________________________

California Water Service

Approved as to form by: John Tootle

By: ______________________________

By: ______________________________

City of Palmdale

Approved as to form by: James Markman

By: James T. Markman

By: James T. Markman

Littlerock Creek Irrigation District

Approved as to form by: Wayne Lemieux

By: ______________________________

By: ______________________________

Los Angeles County Waterworks District No. 40

Approved as to form by:
Andrea Sheridan Ordin, County Counsel

By: ______________________________
Chair, Board of Supervisors

By: ______________________________
Warren R. Wellen, Principal Deputy County Counsel

Approved as to form by: Eric L. Garner

By: ______________________________

Attest:
Sachi A. Hamai,
Executive Officer-Clerk Of the Board of Supervisors

By: ______________________________

Palmdale Water District

Approved as to form by: Tom Bunn

By: ______________________________

By: ______________________________

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By: ______________________

California Water Service

By: ______________________

City of Palmdale

By: ______________________

Littlerock Creek Irrigation District

By: B J Bones

Los Angeles County Waterworks District No. 40

By: ______________________
Chair, Board of Supervisors

Attest:
Sachi A. Hamai,
Executive Officer-Clerk Of the Board of Supervisors

By: ______________________

Palmdale Water District

By: ______________________

By: ______________________

Approved as to form by: John Tootle

By: ______________________

Approved as to form by: James Markman

By: ______________________

Approved as to form by: Wayne Lemieux

By: Wayne Lemieux

Approved as to form by:
Andrea Sheridan Ordin, County Counsel

By: ______________________
Warren R. Wellen, Principal Deputy County Counsel

Approved as to form by: Eric L. Garner

By: ______________________

Approved as to form by: Tom Bunn

By: ______________________

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By: Gloria Molina Chair, Board of Supervisors	By: [signature] Warren R. Wellen, Principal Deputy County Counsel
	Approved as to form by: Eric L. Garner
	By: ______________________
Attest: Sachi A. Hamai, Executive Officer-Clerk Of the Board of Supervisors	
By: LaChelle Smitherman DEPUTY	
Palmdale Water District	Approved as to form by: Tom Bunn
By: Dennis LaMoreaux	By: Thomas S. Bunn III

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Palm Ranch Irrigation District	Approved as to form by: Wayne Lemieux
By: ______________________	By: ______________________
Phelan Pinon Hills Community Services District	Approved as to form by: Francis Logan
By: ______________________	By: ______________________
Quartz Hill Water District	Approved as to form by: Brad Weeks
By: ______________________	By: ______________________
Rosamond Community Services Districts	Approved as to form by: Eric L. Garner
By: ______________________	By: ______________________
Desert Lake Community Services District	Approved as to form by: Wayne Lemieux
By: ______________________	By: ______________________
North Edwards Water District	Approved as to form by: Wayne Lemieux
By: ______________________	By: ______________________

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By: ______________________	By: ______________________
Phelan Pinon Hills Community Services District	Approved as to form by: Francis Logan
By: ______________________	By: ______________________
Quartz Hill Water District	Approved as to form by: Brad Weeks
By: ______________________	By: ______________________
Rosamond Community Services Districts	Approved as to form by: Eric L. Garner
By: ______________________	By: ______________________

Rosamond Community Services Districts

By: [signature]

Approved as to form by: Eric L. Garner

By: [signature]

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By: ____________________

Phelan Pinon Hills Community Services District

By: ____________________

Approved as to form by: Francis Logan

By: ____________________

Quartz Hill Water District

By: ____________________

Approved as to form by: Brad Weeks

By: ____________________

Rosamond Community Services Districts

By: ____________________

Approved as to form by: Eric L. Garner

By: ____________________

Desert Lake Community Services District

By: ____________________

Approved as to form by: Wayne Lemieux

By: ____________________

North Edwards Water District

By: ____________________

Approved as to form by: Wayne Lemieux

By: ____________________

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Approved as to form by: Francis Logan

By: ______________________

Quartz Hill Water District

By: ______________________

Approved as to form by: Brad Weeks

By: ______________________

Rosamond Community Services Districts

By: ______________________

Approved as to form by: Eric L. Garner

By: ______________________

Desert Lake Community Services District

By: ______________________

Approved as to form by: Wayne Lemieux

By: ______________________

North Edwards Water District

By: Dollie D. Kostopoulos

Approved as to form by: Wayne Lemieux

By: Wayne Lemieux

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APPENDIX D

2020 URBAN WATER MANAGEMENT PLAN, ANTELOPE VALLEY – EAST KERN WATER AGENCY

2019 INTEGRATED WATER MANAGEMENT PLAN – ANTELOPE VALLEY

2020 Urban Water Management Plan

Final

AUGUST 2021

ANTELOPE VALLEY-EAST KERN WATER AGENCY

ANTELOPE VALLEY-EAST KERN WATER AGENCY

2020 Urban Water Management Plan

AUGUST 2021

REGISTERED PROFESSIONAL ENGINEER
ROBERT A. MORROW
NO. 68916
Exp.
STATE OF CALIFORNIA

Prepared by Water Systems Consulting, Inc.

ACKNOWLEDGMENTS

This document was prepared in partnership between WSC and AVEK. WSC thanks the following people for their contributions:

Dwayne Chisam, General Manager

Matt Knudson, Assistant General Manager

Tom Barnes, Water Resources Manager

AVEK Board of Directors

Director Keith Dyas, Division 2, President

Director Frank S. Donato, Division 3, Vice President

Director Shelley Sorsabal, Division 1

Director George M. Lane, Division 4

Director Robert A. Parris, Division 5

Director Audrey T. Miller, Division 6

Director Gary Van Dam, Division 7

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ACRONYMS & ABBREVIATIONS

°F	Degrees Fahrenheit
AB	Assembly Bill
AF	Acre Foot
AFY	Acre Feet per Year
CIMIS	California Irrigation Management Irrigation System
DCR	DWR SWP Delivery Capacity Report
DDW	SWRCB Division of Drinking Water
DMM	Demand Management Measure
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EPA	United States Environmental Protection Agency
ETo	Reference Evapotranspiration
GPCD	Gallons per Capita per Day
GPM	Gallons per Minute
MGD	Million Gallons per Day
RWQCB	Regional Water Quality Control Board
SBX7-7	Senate Bill 7 of Special Extended Session 7
SOI	Sphere of Influence
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
UWMP	Urban Water Management Plan
UWMP Act	Urban Water Management Planning Act
WSCP	Water Shortage Contingency Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

URBAN WATER MANAGEMENT PLAN

Executive Summary

This section includes a lay description of the 2020 UWMP, which describes the fundamental determinations of the UWMP, including water supply reliability, challenges ahead, and strategies for managing reliability risks.

This section summarizes the 2020 Urban Water Management Plan (UWMP or Plan) for the Antelope Valley-East Kern Water Agency (AVEK or Agency). This UWMP was prepared in compliance with California Water Code requirements for UWMPs, following guidance from the California Department of Water Resources (DWR), and is intended to be the long-term water resources planning reference for the Agency.

AVEK is a wholesale supplier of State Water Project (SWP) water to the greater Antelope Valley region. SWP water is a secondary water source for AVEK's customers and is used in lieu of, or in addition to, pumped groundwater.

IN THIS SECTION

- Outreach and Engagement
- Population Projections
- Water Demand Projections
- Water Sources and Uses
- Water Supply Reliability

AVEK's service area encompasses nearly 2,400 square miles in northern Los Angeles and eastern Kern Counties as well as a small portion of Ventura County. AVEK has played a major role in the Valley's water system since it was granted a charter by the State Legislature in 1959 and became a SWP contractor in 1962. AVEK currently provides water to 27 retail water agencies, water companies, and agricultural customers. AVEK's mission is to deliver reliable, sustainable, and high-quality supplemental water to the region in a cost-effective and efficient manner.

Outreach and Engagement

The 2020 UWMP was prepared in a transparent manner, and AVEK actively engaged stakeholders, cities, counties, water agencies, and the public to seek and distribute information about water use, supply, and reliability to strengthen the region's ability to assess and plan for the region's water future. AVEK conducted a public hearing on June 8, 2021, and notified over 40 entities, including AVEK's customers, cities, and counties within the AVEK service area, and other water and planning agencies in the region.

Population Projections

AVEK provides service to incorporated and unincorporated areas of the greater Antelope Valley. The current and projected populations for AVEK's service area (**Table ES-1**) were based on population projections from the Southern California Association of Governments (SCAG) for Los Angeles and Ventura Counties and the Kern Council of Governments (KCOG). The combined projections result in an average annual growth rate of 1.33%, with a high growth rate initially (2020–2025) and lower rates at end of the projection (2040–2045).

Table ES-1. AVEK Service Area Current and Projected Population (DWR UWMP Table 3-1W)

	2020	2025	2030	2035	2040	2045
Los Angeles and Ventura Counties	270,615	288,578	306,542	324,505	342,229	359,953
Kern County	49,956	56,757	63,558	70,359	78,738	87,118
TOTAL	**320,571**	**345,335**	**370,100**	**394,864**	**420,967**	**447,071**

Notes:

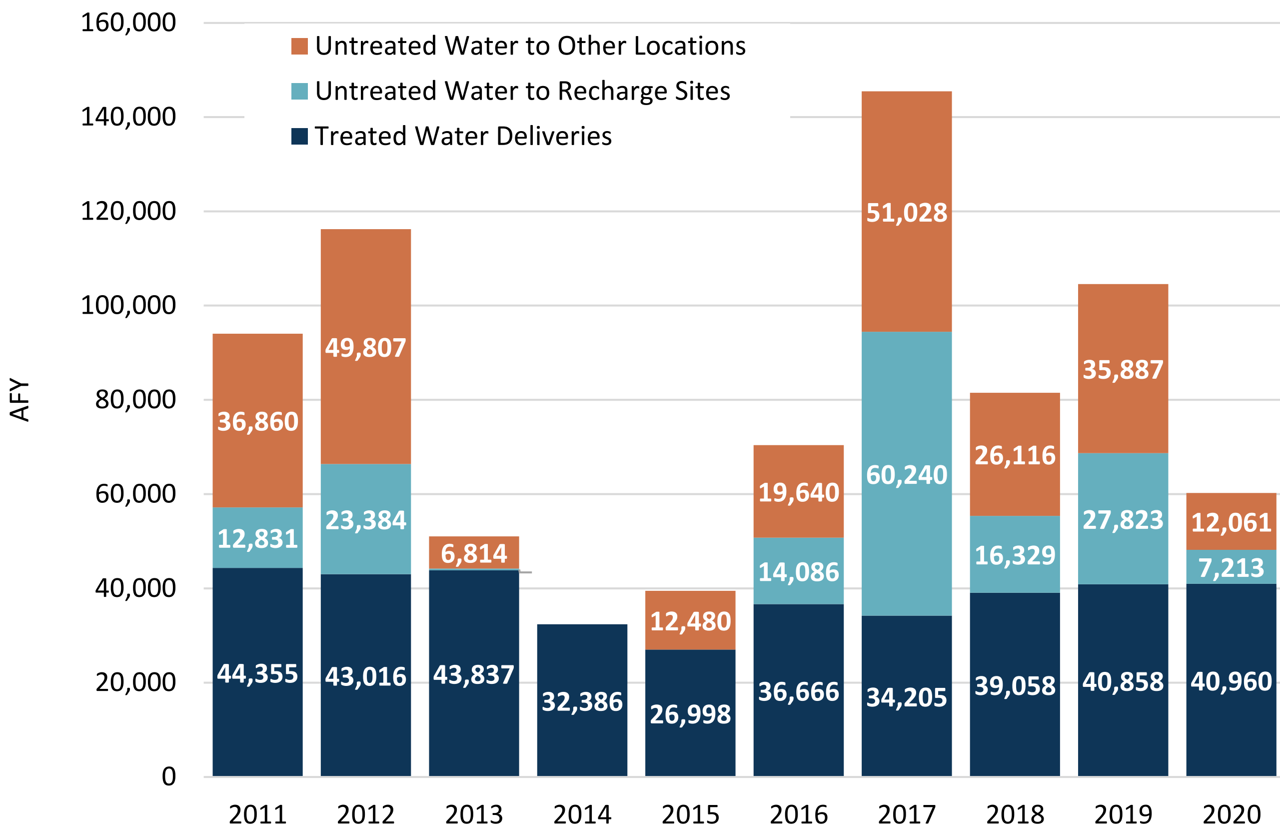
1. Data for Los Angeles and Ventura Counties from SCAG 2020 Connect SoCal Regional Transportation Plan (SCAG, 2020)
2. Data for Kern County from KCOG General Land Use Plan (KCOG, 2018).

Water Demand Projections

AVEK delivers treated water from the SWP and groundwater to 23 customers, and untreated SWP water to four customers. In addition, AVEK delivers untreated SWP water to its groundwater "banks" by recharging SWP at recharge basins and storage in the groundwater basin so that AVEK can recover the water when needed. AVEK also occasionally transfers untreated SWP water to other water agencies when AVEK has surplus water available and the other agencies are in need of water.

As shown in **Figure ES-1**, treated water deliveries to AVEK retailers were relatively consistent compared with deliveries to recharge sites and other locations. Treated water demands have increased slightly since 2017 but have not returned to the levels observed prior to 2014 following severe drought restrictions. Both recharge water deliveries and deliveries to other locations have varied significantly based on water availability, as evidenced by the high recharge volume in 2017 that coincided with high SWP allocations. Recharge deliveries are discussed further below; however, transfers are not projected in this UWMP because they are opportunistic agreements made by willing parties dependent on each party's needs and they are the lowest priority use of AVEK's supplies.

Figure ES-1. 2011–2020 AVEK Deliveries by Type



Treated Water Projections

To estimate demands on AVEK supplies, AVEK must first project total demand in the AVEK service area along with projected use of local supplies. The primary local supply is groundwater. AVEK developed a model to compare future supply and demand conditions under multiple supply and demand scenarios.

AVEK considered seven primary variables and applied the following assumptions for UWMP demand projections:

Population Growth

Applies the population projections presented earlier in this section using comprehensive data from SCAG and KCOG.

Per Capita Demand Rebound

This variable considers the extent that per capita demand, measured as gallons per capita per day (GPCD), is estimated to increase from spring 2016, which was the last year severe water use restrictions were in place by AVEK retailers. This UWMP assumes existing demands will increase from 185 GPCD in 2020 to 205 GPCD by 2030.

Passive Conservation

This variable considers water savings resulting from plumbing codes and other institutionalized water efficiency measures. This UWMP assumes 0.2% per year reduction in existing demand.

Active Conservation

This variable considers water saved as a direct result of programs and practices directly funded by a water utility. As a wholesaler, AVEK has less control over conservation programs implemented by its customers. Also, the potential demand impacts are not well understood from the "Conservation as a California Way of Life" legislative mandates from 2018, which require new urban water use efficiency standards by 2022. Therefore, to be conservative in this UWMP, AVEK assumes no active conservation savings, but AVEK intends to work with its customers to understand the potential implications of meeting new urban efficiency standards and plans to adapt its projections based on this and other available information once annual water use reporting starts in 2023.

Climate Change

This variable considers the potential change in demand from climate change. Climate models disagree on average annual precipitation projections but agree on other hydrologic metrics relevant to water resources management, including increased evapotranspiration, which would increase irrigation demands. Based on climate change projections from DWR1, by 2030, precipitation is projected to decrease by 3% and evapotranspiration is projected to increase by 4%, which roughly equates to a net irrigation demand increase of 7%. Irrigation demands may be roughly 50% of total demand, which means that increased evapotranspiration from climate change would increase demand by 3.5% — or about 3,000 acre-feet per year (AFY) over the next 25 years — compared with a more than 40% increase in demand from population growth and unit demand rebound. For this UWMP, increased evapotranspiration is not explicitly included in the demand projections because assumptions for the other variables discussed above (growth, unit demand, and conservation) have a greater impact on the demand projections, and demand impacts from climate change are within the margin of error for the projections.

Groundwater

This variable estimates the volume of pumping by AVEK customers, which would reduce the amount of AVEK water needed to meet AVEK service area demands. For this UWMP, groundwater pumping is assumed to occur at the amount of production rights described in the Stipulated Judgment (Judgment) for the 2015 Antelope Valley Groundwater Adjudication. The Judgment stipulated production rights to each party and other methods to access additional groundwater rights, such as from imported water return flows. AVEK's customers have 12,084 AFY of production rights and have received roughly 12,000 AFY of return flow rights since 2016. Imported water return flows are projected to increase as demands increase and imported water must be used to meet those demands.

Recycled Water

This variable includes with and without planned recycled water use by retailers. This UWMP assumes no recycled water will be developed that offsets projected water use through 2045.

Based on the assumptions described above, AVEK estimated total service area demand projections and net demand on AVEK projections through 2045 as shown in **Table ES-2**.

[1] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

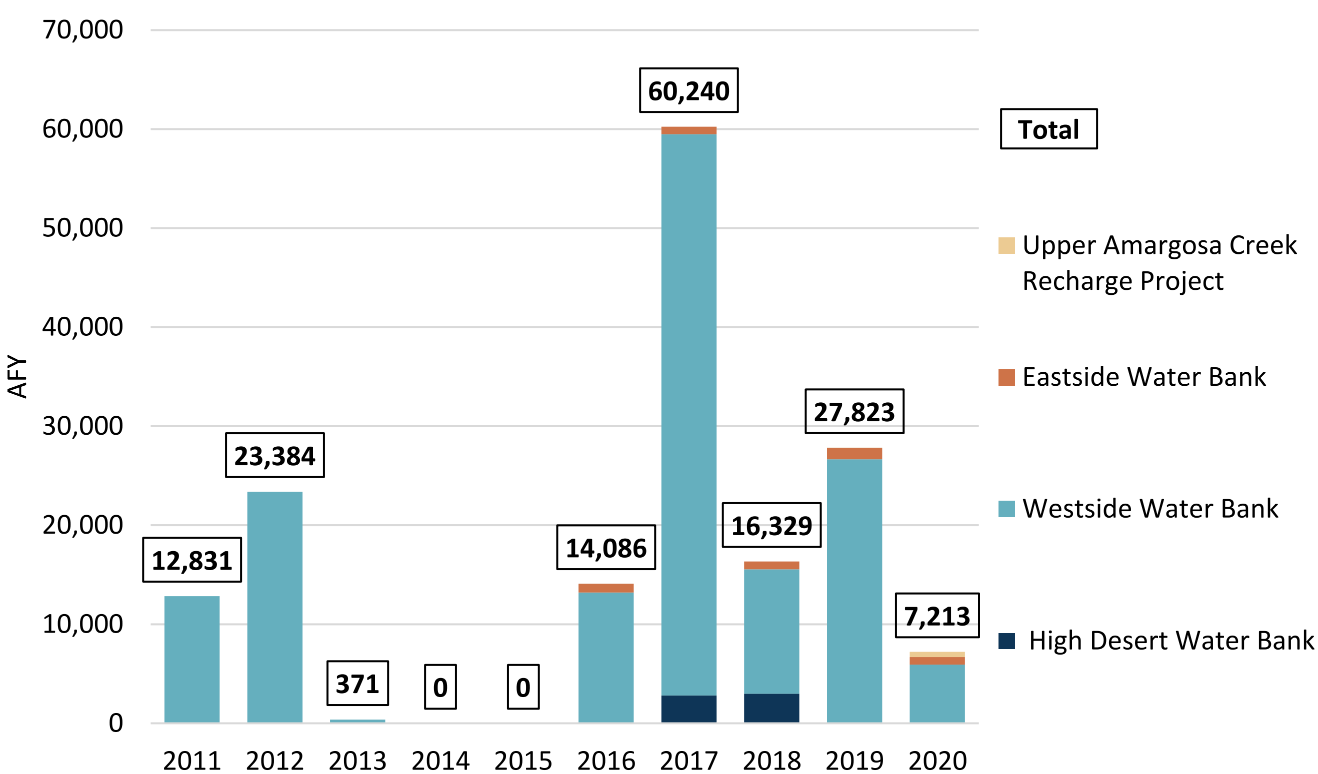
Table ES-2. 2025-2045 AVEK Demand Projections (AFY)

	2025	2030	2035	2040	2045
TOTAL AVEK SERVICE AREA DEMAND	**73,420**	**80,400**	**83,850**	**87,520**	**91,200**
NON-AVEK SUPPLIES					
Groundwater, Non-AVEK Production Rights	12,080	12,080	12,080	12,080	12,080
Groundwater, Non-AVEK Return Flows	16,900	17,330	19,890	20,230	21,530
NON-AVEK SUPPLIES TOTAL	**28,980**	**29,410**	**31,970**	**32,310**	**33,610**
NET AVEK SERVICE AREA DEMAND	**44,440**	**50,990**	**51,880**	**55,210**	**57,590**

Groundwater Recharge Projections

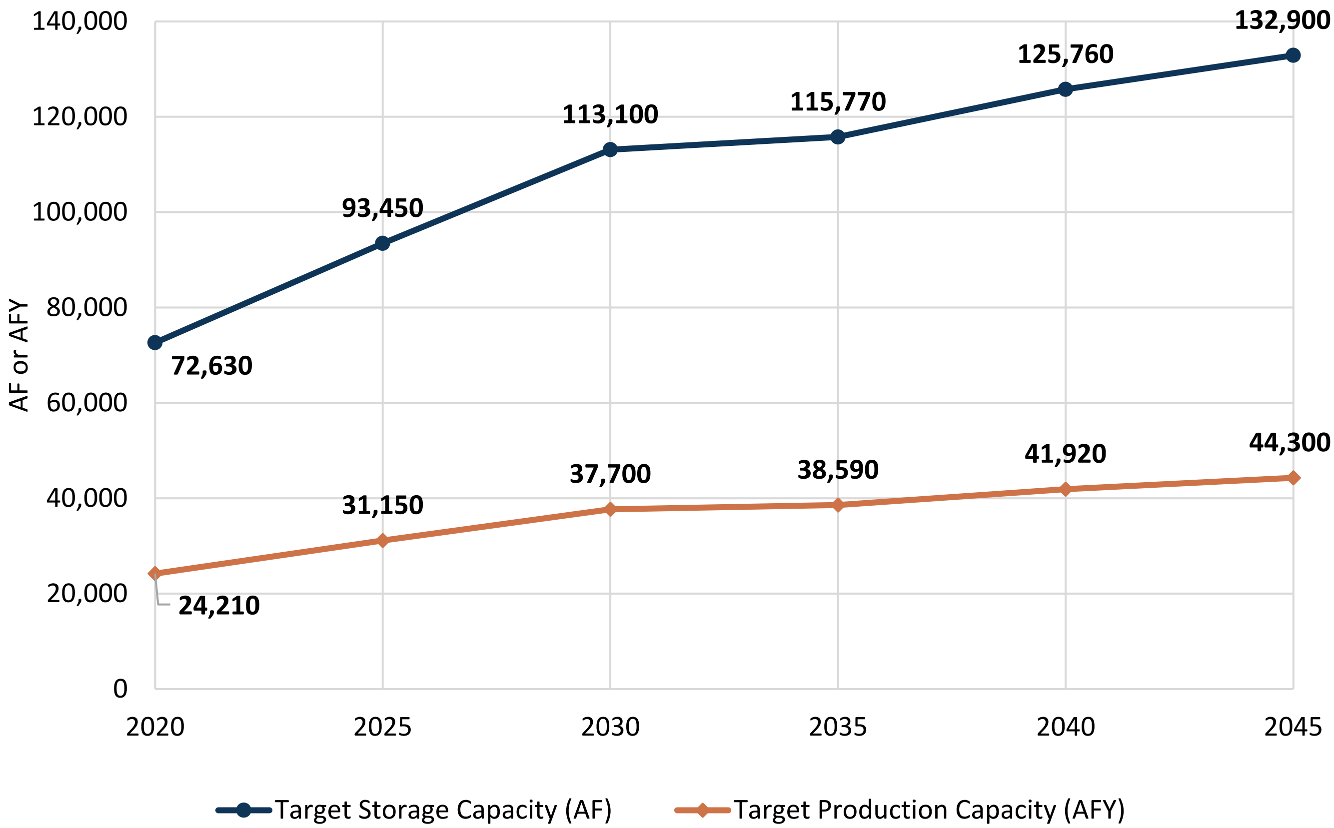
AVEK's groundwater banking programs store surplus water available from the SWP through groundwater recharge and include recovery wells to pump stored water in times of need. AVEK's groundwater banks include the Westside Water Bank, which started operations in 2010; the Eastside Water Bank, which started operations in 2016; the Upper Amargosa Creek Recharge Project, a partnership project that started operations in 2019; and, most recently, the High Desert Water Bank. Local recovery of imported water from the groundwater banks has become an important source of water for AVEK to supplement annual SWP water allocations. AVEK began recovering imported water from the groundwater banks in 2014 once groundwater production wells were in place. A summary of AVEK's historical SWP deliveries to its banking sites is provided in **Figure ES-2**.

Figure ES-2. 2011–2020 AVEK Historical Imported Water Deliveries to Groundwater Banking Sites



AVEK's goal is to have enough storage in the groundwater banks so that the agency is prepared to meet demands during three consecutive years of 10% Table A allocations from the SWP. AVEK currently has roughly 90,000 acre-feet (AF) of SWP water stored within its banks for future recovery and is implementing infrastructure projects to expand its capacity to recharge water, recover water, and distribute recovered water. Based on the demand projections presented above, the target groundwater bank storage capacity and annual production capacity are projected in **Figure ES-3**.

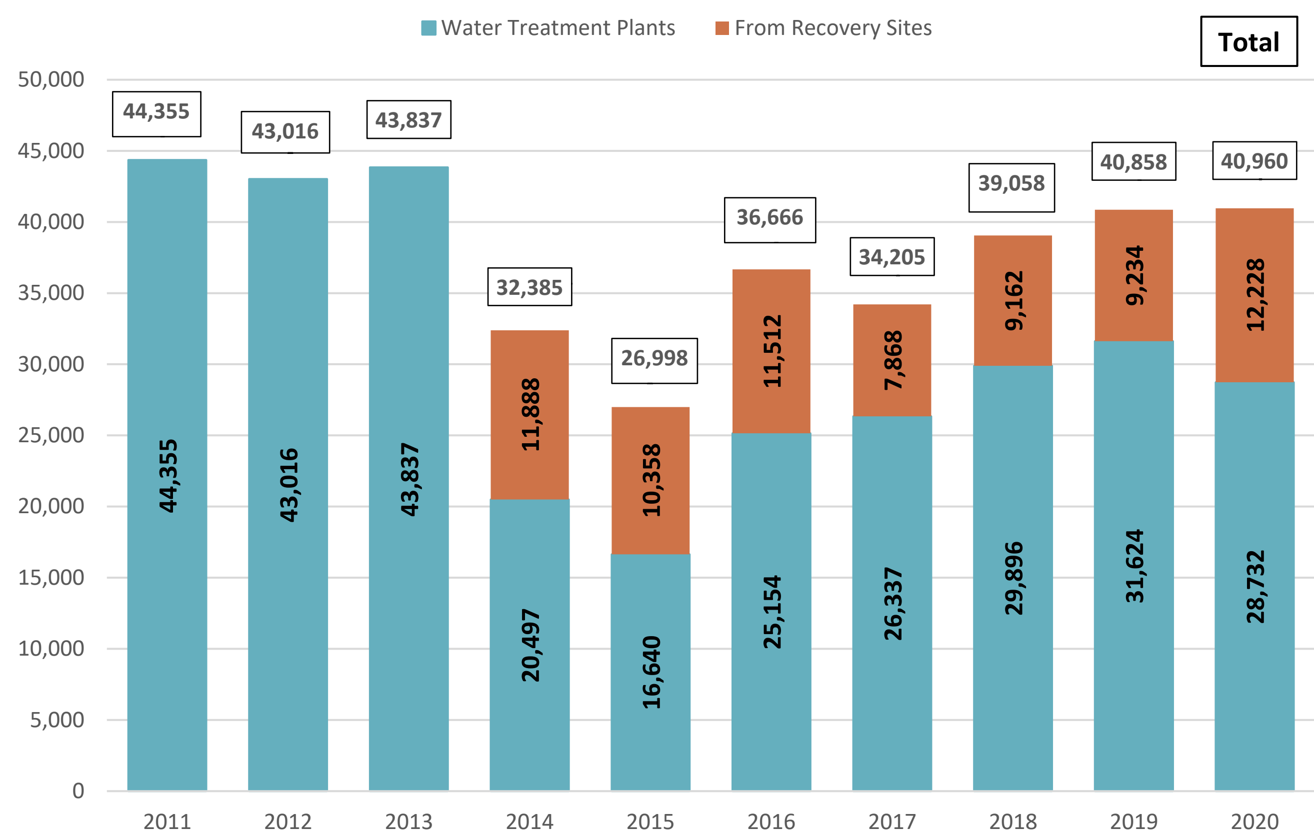
Figure ES-3. Projected AVEK Groundwater Banking Target Sizing



Water Sources and Uses

As shown in **Figure ES-4**, AVEK's potable water deliveries consist of either SWP water treated at AVEK water treatment plants, or groundwater that is either recovered from recharge in previous years or part of AVEK's adjudicated groundwater production rights. Each supply is discussed further below.

Figure ES-4. 2011–2020 AVEK Drinking Water Deliveries by Source



State Water Project

SWP water availability depends on rainfall, snowpack, runoff, reservoir storage, pumping capacity of SWP facilities, and regulatory and environmental mandates on SWP operations. DWR prepares a biennial report to assist SWP contractors and local planners in assessing the availability of supplies from the SWP. DWR's most recent update was the 2019 State Water Project Delivery Capability Report (DCR) (California Department of Water Resources, 2020). The 2019 DCR includes DWR's estimates of SWP water supply availability under both existing (2020) and future conditions (2040) for the SWP as a whole and specifically for AVEK.

To evaluate SWP supply availability under future conditions, the 2019 DCR included a model study representing hydrologic and sea level rise conditions in 2040. The future condition study used the same model assumptions as the study under existing conditions but reflected changes expected to occur from climate change, specifically, projected temperature and precipitation changes centered around 2035 (2020 to 2049) and a 45 cm sea level rise. For the long-term planning purposes of this UWMP, the long-term average allocations reported for the future conditions study from the 2019 DCR is the most appropriate estimate of future SWP water supply availability. AVEK assumes a straight-line reduction in long-term average allocation from 58% in 2020 to 52% in 2040. Allocation in 2045 is assumed to remain at 52%, as shown in **Table ES-3**.

Table ES-3. SWP Average Yield Projections

	2020	2025	2030	2035	2040	2045
Average Table A Allocation (%)	58.0%	56.5%	55.0%	53.5%	52.0%	52.0%
Average Table A Yield (AFY)	84,010	81,840	79,660	77,490	75,320	75,320

DWR's 2019 DCR indicates that the modeled single dry year SWP water supply allocation is 7% under existing conditions. However, historically, the lowest SWP allocations were 5% in 2014 and 2021 (as of May 2021). DWR's 2019 DCR indicates that the lowest consecutive five-year period occurred from 1988 to 1992, with an average allocation of 20.3% under the existing conditions. During the recent drought, Table A allocation from 2012 to 2016 averaged 37%.

Groundwater

AVEK's groundwater wells are located within the Antelope Valley Groundwater Basin (Basin). The Basin was adjudicated in 2015 after 15 years of complex proceedings among more than 4,000 parties, including public water suppliers, landowners, small pumpers and non-pumping property owners, and the federal and state governments. The Antelope Valley Area of Adjudication covers approximately 1,390 square miles, or 90% of the groundwater basin. The Judgment determined the Basin is in a state of overdraft, established respective water rights among groundwater producers based on the Basin's Native Safe Yield, and ordered a ramp-down of production to meet the Native Safe Yield by 2023. The adjudication defined a native safe yield of 82,300 AFY. To achieve sustainable groundwater elevations, groundwater production will be reduced (ramped down) over a seven-year period (2016–2022) to a final production right.

Following the adjudication, the Antelope Valley Watermaster was formed to implement the Judgment. The Watermaster is charged with administering the adjudicated water rights and managing the groundwater resources within the adjudicated portion of the Antelope Valley.

Within AVEK's service area, groundwater production rights within the AVEK service area will decrease to 15,634 AFY by 2023, including AVEK's 3,550 AFY production right. In addition, AVEK and other pumpers receive groundwater pumping rights from imported water return flows equal to the applicable percentage multiplied by the average amount of imported water used by that party within the basin in the preceding five-year period. AVEK received 822 AF of groundwater in 2019 from imported water return flows.

In recent years, AVEK has leased a portion of its groundwater productions rights to LACWD for the districts' use.

Non-SWP Water

In 2017, AVEK acquired non-SWP water supply through a long-term lease of annual supply originally belonging to the Nickel Family, a farming interest in Kern County. AVEK has acquired the rights to 1,700 acre-feet of water made available for a period of thirty-five years (with an option to extend for thirty-five more years), even in dry years. Gaining additional non-SWP supplies improves the Agency's reliability of its existing water supply, as well as provide additional supplies to meet future demand.

Summary of Projected Water Supplies

Based on the supplies described above, reasonably available volumes of AVEK water supplies are projected in **Table ES-4**. In addition, AVEK can supplement supplies by recovering banked SWP water in groundwater or accessing supplies, if available, such as carryover groundwater or SWP water types other than Table A.

Table ES-4. Projected Water Supplies

	2025	2030	2035	2040	2045
SWP Table A	81,840	79,660	77,490	75,320	75,320
Groundwater, Production Rights	3,550	3,550	3,550	3,550	3,550
Groundwater, Imported Water Return Flows	800	800	800	800	800
Non-SWP Water	1,700	1,700	1,700	1,700	1,700
TOTAL	**87,890**	**85,710**	**83,540**	**81,370**	**81,370**

Water Supply Reliability

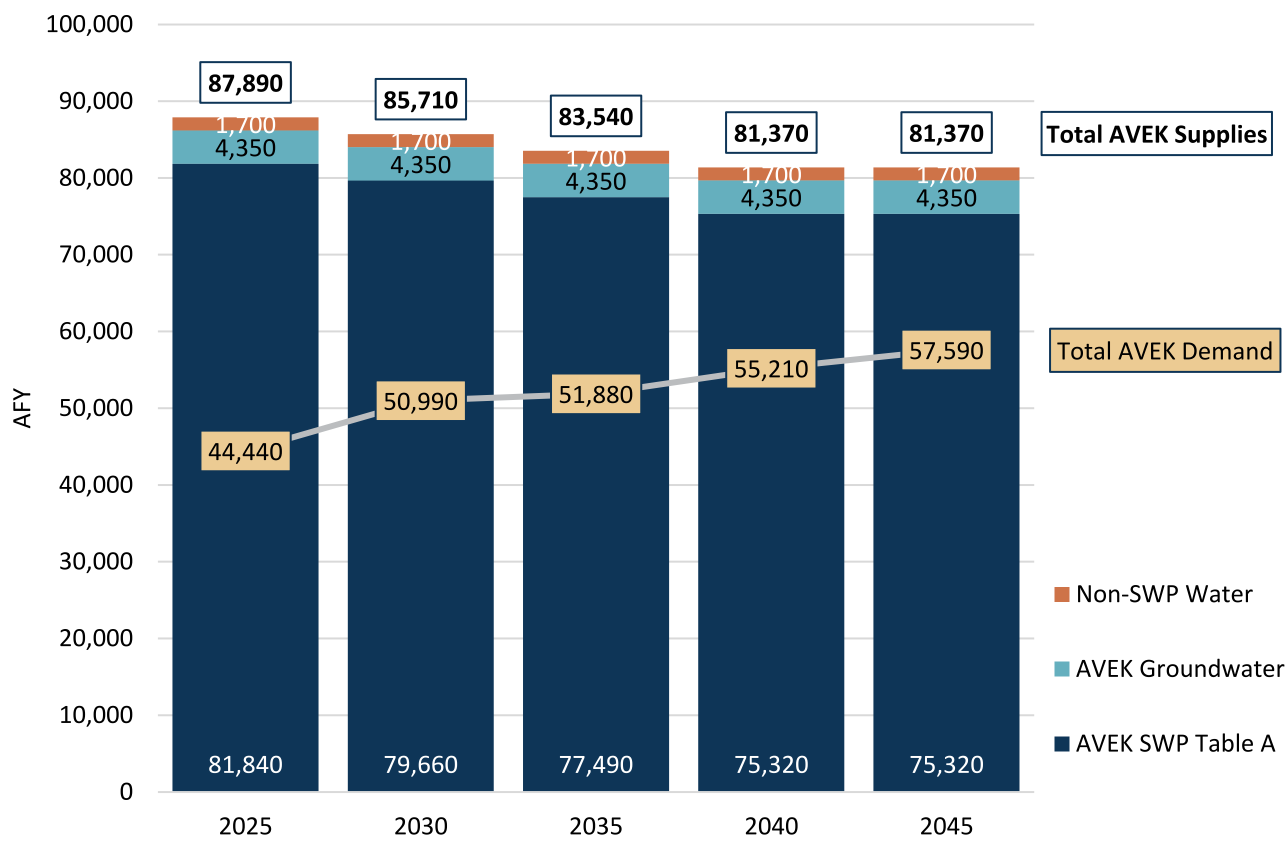
Water supply reliability reflects AVEK's ability to meet the water needs of its customers with water supplies under varying conditions. AVEK's water reliability goal is to provide a level of regional water reliability that supports customers' water needs. The foundational strategy of this goal is to develop groundwater banking programs to help increase the reliability of the greater Antelope Valley region's water supplies by storing excess SWP water during wet periods and recovering it for delivery to customers during dry and high-demand periods or during a disruption in deliveries from the SWP.

AVEK evaluated its water supply reliability for normal, single dry, and multiple dry years through 2045 and assessed the drought risk over the next five years. The analysis considered plausible hydrological and regulatory variability, climate conditions, and other factors that affect the Agency's water supply and demand.

Normal Year

Total normal year AVEK supplies are shown in **Figure ES-5** based on the supply projections discussed above. As shown in the figure, AVEK has sufficient supplies in normal years and could use available supplies to add to groundwater storage for dry periods. For example, SWP water could be recharged when available, or unused groundwater rights could be carried over for use in future years.

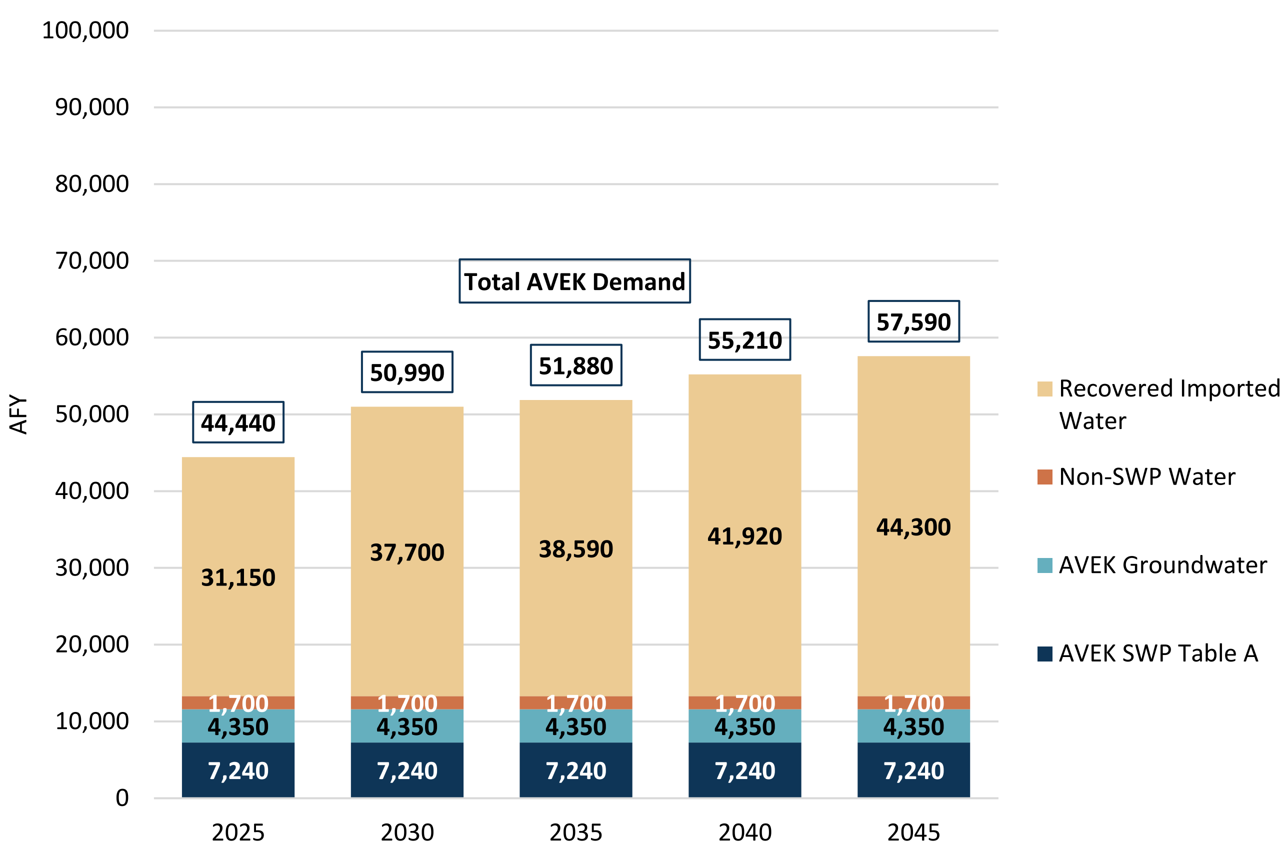
Figure ES-5. AVEK Supply and Demand Projections, Normal Year



Single Dry Year

Single dry year yield for SWP water is based on actual 2014 allocation of 5% (and 2021, as of this writing). Groundwater rights and AVEK's non-SWP water are not impacted by short-term drought conditions, so normal year supply assumptions are applied. The remainder of demand is met with groundwater in storage. As shown in **Figure ES-6**, recovered imported water from AVEK groundwater banks enable AVEK to meet its demands in a single dry year.

Figure ES-6. AVEK Supply and Demand Projections, Single Dry Year



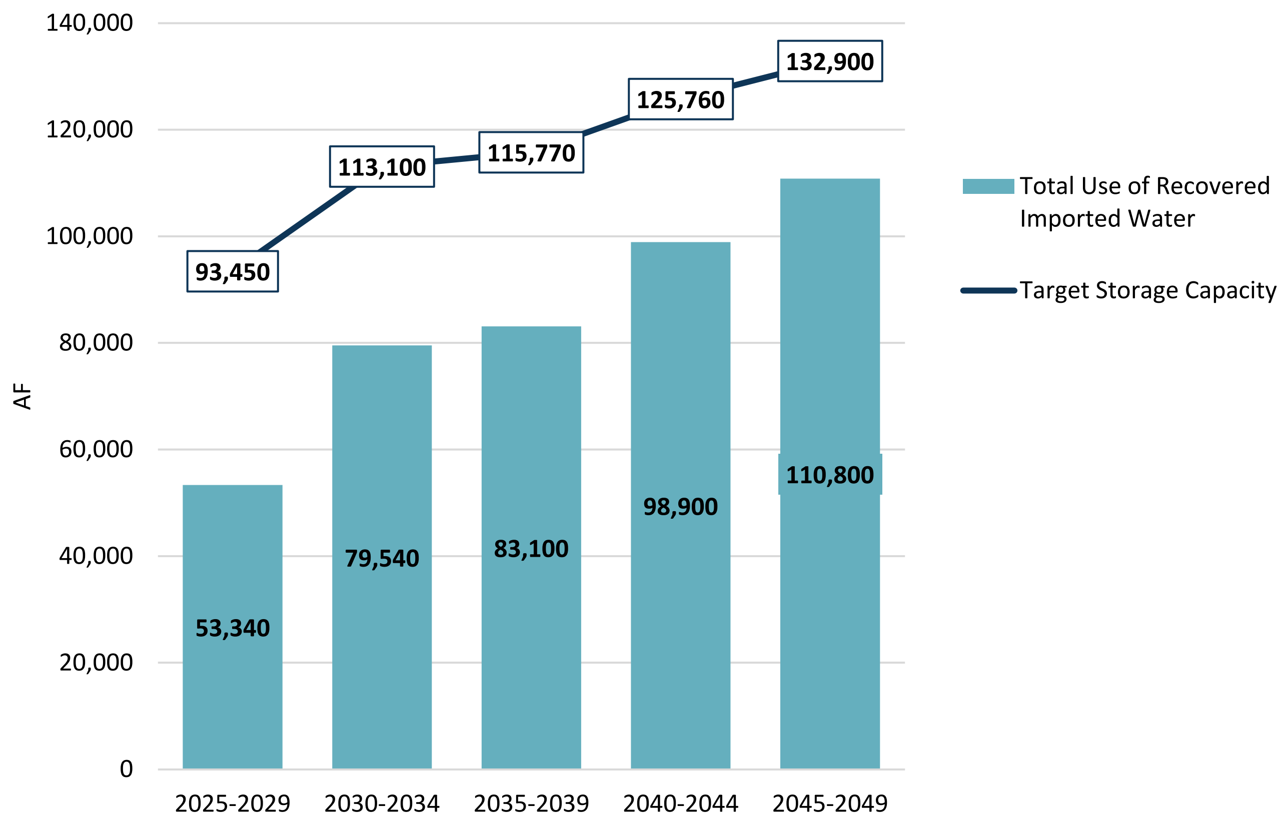
Five Consecutive Dry Years

For multiple dry years, SWP water availability is based on 1988 to 1992 simulated yield from the 2019 SWP DCR for AVEK, which estimated the following annual Table A allocation:

- **Year 1 (1988)** 12.3%
- **Year 2 (1989)** 32.2%
- **Year 3 (1990)** 13.3%
- **Year 4 (1991)** 25.6%
- **Year 5 (1992)** 18.0%

Similar to single dry year, groundwater rights and non-SWP water are not impacted by an extended drought, and recovered imported water from AVEK groundwater banks are used to meet remaining demands. **Figure ES-7** presents the total volume of imported water recovered from AVEK groundwater banks during a multiple-year drought in comparison with the target total storage volume. As shown in the figure, additional recovery of imported water from AVEK groundwater banks would be available if the five-year drought continued.

Figure ES-7. AVEK Groundwater Bank Storage Capacity vs. Use during Five Consecutive Dry Years



2021–2025 Drought Risk Assessment

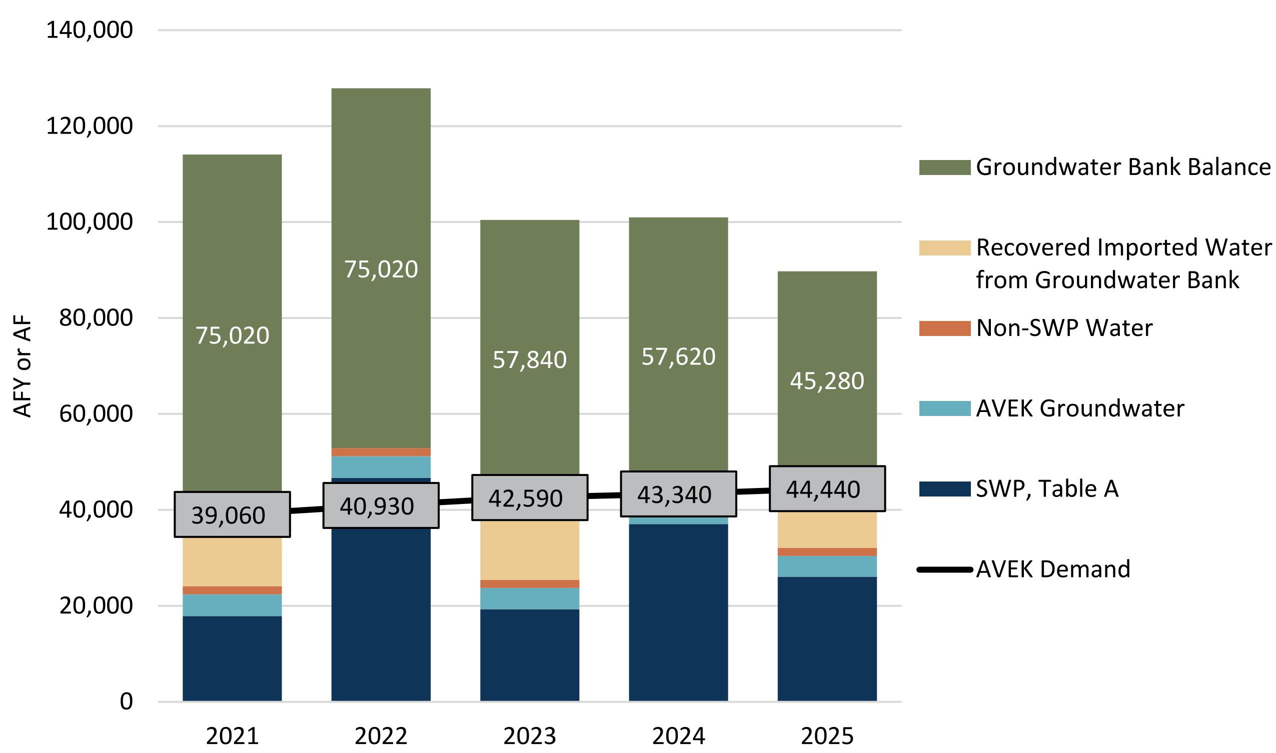
Water Code requires a Drought Risk Assessment for the upcoming five years (2021 to 2025) based on the five driest years on record. The supply assumptions are similar to the multiple dry year assumptions except that groundwater production rights are still ramping down in 2021 and 2022, so they are higher than final production rights in 2023, as shown in **Table ES-5**. AVEK currently has roughly 90,000 AF of SWP water stored within its banks for future recovery and is implementing infrastructure projects to expand its capacity to recharge water, recover water, and distribute recovered water. As shown in **Figure ES-8**, AVEK still would have over 40,000 AF of groundwater remaining in storage at the end of a five-year drought that starts in 2021.

Table ES-5. AVEK Supply Projections for 2021–2025 Drought Risk Assessment

SUPPLIES	2021	2022	2023	2024	2025
SWP, Table A	17,850	46,680	19,280	37,040	26,050
AVEK Groundwater	4,530	4,480	4,430	4,380	4,350
Non-SWP Water	1,700	1,700	1,700	1,700	1,700
Recovered Imported Water from Groundwater Bank	14,980	0	17,180	220	12,340
TOTAL AVEK SUPPLIES	**39,060**	**52,860**	**42,590**	**43,340**	**44,440**

Note: Groundwater bank supplies are used to meet balance of demand.

Figure ES-8. 2021–2025 AVEK Drought Reliability Assessment



2021 Water Shortage Contingency Plan

AVEK's 2021 Water Shortage Contingency Plan (WSCP) is a detailed plan that describes how AVEK intends to respond to foreseeable and unforeseeable water shortages. A water shortage occurs when the water supply is reduced to a level that cannot support typical demand at any given time. The WSCP is used to provide guidance by identifying response actions to allow for efficient management of any water shortage with predictability and accountability. Preparation provides the tools to maintain reliable supplies and reduce the impacts of supply interruptions due to extended drought or catastrophic supply interruptions.

The AVEK 2021 WSCP is included as **Appendix H** in the 2020 UWMP.

Demand Management Measures

Demand management is an integral part of sustainably managing water resources in California. Implementation of demand management measures that help lower demands can improve water supply reliability and help meet both state and regional water conservation goals.

AVEK has been a leader in water use efficiency for many years and actively collaborates with local and regional agencies and the communities it serves to support innovative programs that drive change. AVEK implements demand management measures as part of its ongoing operations.

Chapter 9 of the 2020 UWMP describes AVEK's efforts as a wholesale water supplier to promote conservation and reduce demands on water supplies.

1

URBAN WATER MANAGEMENT PLAN

Introduction

This chapter provides a brief overview of the Antelope Valley-East Kern Water Agency and the purpose of this 2020 Urban Water Management Plan. It also describes how the Plan is organized and how it relates to other local and regional planning efforts that AVEK is involved in.

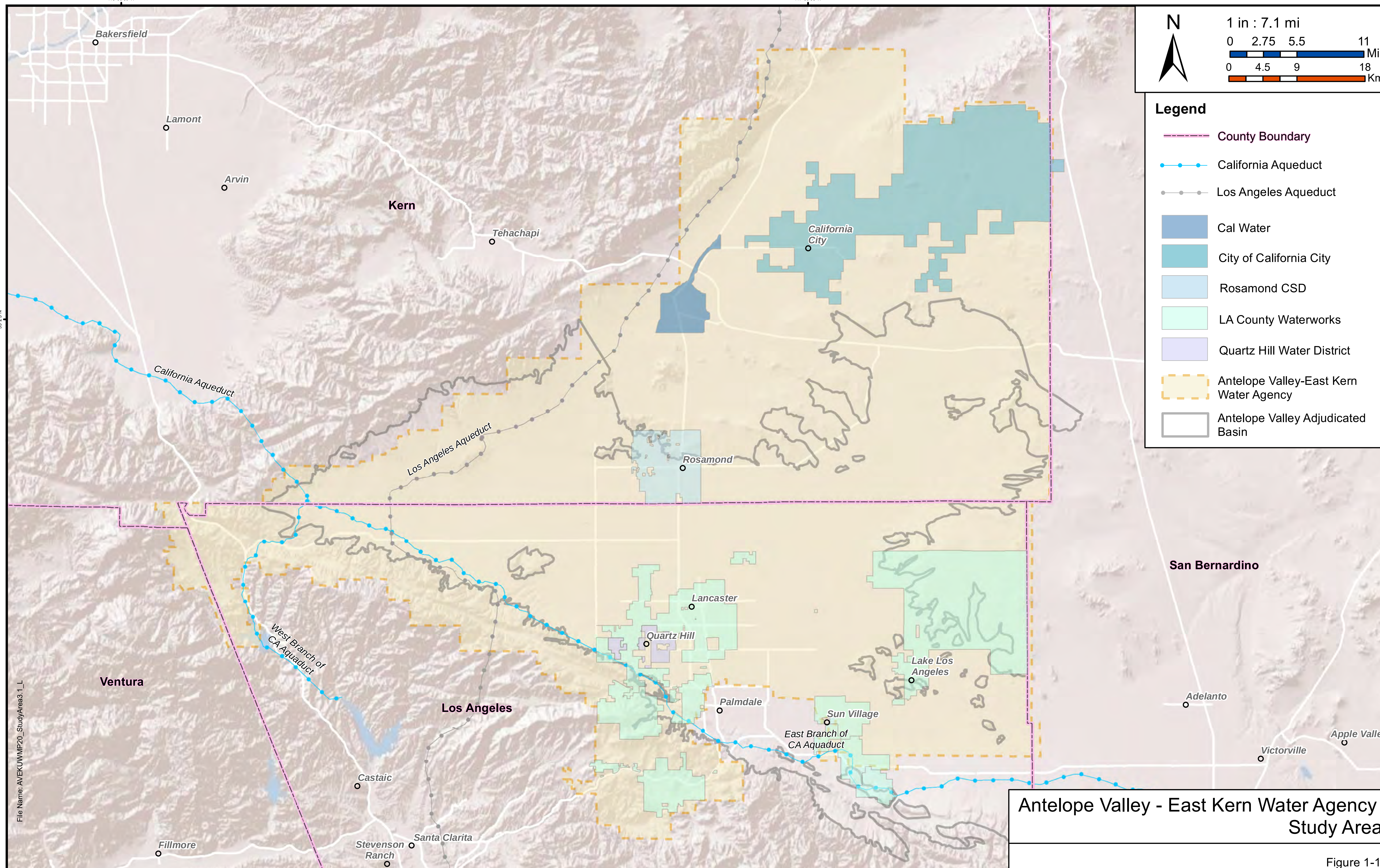
This document presents the 2020 Urban Water Management Plan (UWMP or Plan) for the Antelope Valley-East Kern Water Agency (AVEK or Agency).

AVEK is a wholesale supplier of State Water Project (SWP) water to the greater Antelope Valley region. SWP water is a secondary water source for AVEK's customers and is used in lieu of, or in addition to, pumped groundwater. The greater Antelope Valley is located in the western part of the Mojave Desert, approximately 50 miles northeast of Los Angeles, California.

IN THIS SECTION

- About Antelope Valley-East Kern Water Agency
- Purpose of the Plan
- Plan Organization
- Relationship to Other Documents and Initiatives

The region is a triangle-shaped, topographically closed basin bordered on the southwest by the San Gabriel Mountains, on the northwest by the Tehachapi Mountains, and on the east by a series of hills and buttes that generally follow the Los Angeles/San Bernardino County line. AVEK's service area encompasses nearly 2,400 square miles in northern Los Angeles and eastern Kern Counties, as well as a small portion of Ventura County. AVEK has played a major role in the Valley's water system since it was granted a charter by the State Legislature in 1959 and became an SWP contractor in 1962. AVEK currently provides water to 27 retail water agencies and water companies, as well as to agricultural customers. The five largest retailers are shown along with the AVEK service area in **Figure 1-1**.



Antelope Valley - East Kern Water Agency Study Area

Figure 1-1

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet

Date: 5/16/2021

1.1 Urban Water Management Plan Purpose and Overview

In 1983, the State of California enacted the Urban Water Management Planning Act (UWMP Act). The law required any urban water supplier providing water for municipal purposes to more than 3,000 customers, or serving more than 3,000 acre-feet per year, to adopt a UWMP every five years, demonstrating water supply reliability under normal as well as drought conditions. The Plan is required to describe and evaluate water deliveries and uses, water supply sources, demand management measures, and water shortage contingency planning.

Since the original UWMP Act was passed, it has undergone significant expansion, particularly since AVEK's previous UWMP was prepared in 2015. Prolonged droughts, groundwater overdraft, regulatory revisions, and changing climatic conditions affect the reliability of each water supplier, as well as the statewide water reliability overseen by the California Department of Water Resources (DWR) and the State Water Resources Control Board. Accordingly, the UWMP Act has grown to address changing conditions, and the current requirements are found in Sections 10610-10656 and 10608 of the California Water Code.

DWR provides guidance for urban water suppliers by preparing the UWMP Guidebook 2020 (Department of Water Resources, 2021), conducting workshops, developing tools, and providing program staff to help water suppliers prepare comprehensive and useful water management plans, implement water conservation programs, and understand the requirements in the California Water Code. Suppliers prepare their own UWMPs in accordance with the requirements and submit them to DWR. DWR then reviews the plans to make sure they have addressed the requirements identified in the California Water Code.

The purpose of this UWMP is for AVEK to evaluate long-term resource planning and establish management measures to ensure adequate water supplies are available to meet existing and future demands. The UWMP provides a framework to help water suppliers maintain efficient use of urban water supplies, continue to promote conservation programs and policies, ensure that sufficient water supplies are available for future beneficial use, and provide a mechanism for response during drought conditions or other water supply shortages.

The UWMP is a valuable planning tool used for multiple purposes, including:

- Providing a standardized methodology for water utilities to assess their water resource needs and availability.
- Serving as a resource to the community and other interested parties regarding water supply and demand, conservation, and other water-related information.
- Providing a key source of information for cities and counties when considering approval of proposed new developments and preparing regional long-range planning documents, such as city and county General Plans.
- Informing other regional water planning efforts.

California Water Code Section 10632 includes updated requirements for suppliers to prepare a Water Shortage Contingency Plan (WSCP). The WSCP documents a supplier's plans to manage and mitigate an actual water shortage condition, should one occur because of drought or other impacts on water supplies. In the 2015 UWMP cycle, the WSCP was part of the UWMP. For the 2020 update, the WSCP is required to be a stand-alone document so that it can be updated independently of the UWMP, but it must be referenced in and attached to the 2020 UWMP.

1.2 UWMP Organization

This document was prepared in compliance with the California Water Code and the 2020 Guidelines established by DWR and constitutes AVEK's 2020 UWMP. A UWMP checklist, to ensure compliance of this Plan with the UWMP Act requirements, is provided in **Appendix A**. In addition, as required by the California Water Code, standardized tables for the reporting and submittal of UWMP data have been prepared and are included in **Appendix B**. A selection of these tables is also provided in the body of this Plan, as necessary to present supporting data.

The UWMP is organized as follows:

- Chapter 1 – Introduction
- Chapter 2 – Plan Preparation
- Chapter 3 – System Description
- Chapter 4 – Water Use Characterization
- Chapter 5 – SBX7-7 Baseline and Targets
- Chapter 6 – Water Supply Characterization
- Chapter 7 – Water Supply Reliability and Drought Risk Assessment
- Chapter 8 – Water Shortage Contingency Plan Overview
- Chapter 9 – Demand Management Measures
- Chapter 10 – Plan Adoption, Submittal, and Implementation
- Appendices
    A. 2020 UWMP DWR Checklist
    B. UWMP Tables
    C. Delta Reliance
    D. Notifications and Notification List
    E. Adoption Resolutions
    F. Antelope Valley Groundwater Adjudication
    G. Antelope Valley Watermaster 2019 Annual Report
    H. Water Shortage Contingency Plan

1.3 UWMPs in Relation to Other Efforts

AVEK coordinated with multiple neighboring and stakeholder agencies to prepare this UWMP. The coordination efforts were conducted to (1) inform the agencies of AVEK's activities, (2) gather high-quality data for use in developing this UWMP, and (3) coordinate planning activities with other related regional plans and initiatives.

In addition to the 2020 UWMP, AVEK is involved in several other internal and external planning efforts, and they collaborate with a variety of stakeholders to achieve coordination and consistency between various planning documents locally and regionally.

1.4 Demonstration of Consistency with the Delta Plan for Participants in Covered Actions

Under the Sacramento-San Joaquin Delta Reform Act of 2009, state and local public agencies proposing a covered action in the Delta, prior to initiating the implementation of that action, must prepare a written certification of consistency with detailed findings as to whether the covered action is consistent with applicable Delta Plan policies and submit that certification to the Delta Stewardship Council. Anyone may appeal a certification of consistency, and if the Delta Stewardship Council grants the appeal, the covered action may not be implemented until the agency proposing the covered action submits a revised certification of consistency, and either no appeal is filed or the Delta Stewardship Council denies the subsequent appeal.

An urban water supplier that anticipates participating in or receiving water from a proposed covered action—such as a multiyear water transfer, conveyance facility, or new diversion that involves transferring water through, exporting water from, or using water in the Delta—should provide information in their 2015 and 2020 UWMPs that can then be used in the covered action process to demonstrate consistency with Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (WR P1).

Senate Bill (SB) X7-1, which was signed in 2009, reformed Sacramento-San Joaquin Delta (Delta) policy and governance, including requiring development, adoption, and implementation of a Delta Plan and establishing a statewide policy to reduce reliance on the Delta in meeting California's future water supply needs, through a statewide strategy of investing in improved regional supplies, conservation, and water use efficiency.

DWR does not review this analysis as part of the UWMP approval process; therefore, this information has been prepared as a stand-alone document and is attached as **Appendix C**. The analysis and documentation provided in the appendix include the elements described in WR P1(c)(1) that need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action.

2

URBAN WATER MANAGEMENT PLAN

Plan Preparation

This chapter provides information on the processes used for developing the UWMP, including efforts in coordination and outreach.

IN THIS SECTION

- Plan Preparation
- Coordination and Outreach

This Urban Water Management Plan (UWMP or Plan) was prepared following guidance from the California Department of Water Resources (DWR) UWMP Guidebook 2020 (Department of Water Resources, 2021) and the 2020 UWMP DWR Checklist (**Appendix A**).

The 2020 UWMP was prepared in a transparent manner, and the Antelope Valley-East Kern Water Agency (AVEK or Agency) actively engaged stakeholders, cities, counties, water agencies, and the public to both seek and distribute information about water use, supply, and reliability to strengthen the region's ability to assess and plan for the region's water future. This chapter provides details regarding AVEK's UWMP preparation and the coordination and outreach efforts conducted.

2.1 Plan Preparation

AVEK prepared this 2020 UWMP in accordance with Water Code Section 10617, which requires water suppliers with 3,000 or more service connections, or those supplying 3,000 acre-feet per year (AFY) or more to prepare a UWMP. Suppliers are required to update UWMPs at least once every five years on or before July 1 in years ending in one and six, incorporating updated and new information from the five years preceding each update. AVEK's 2020 UWMP was submitted to DWR by July 1, 2021.

2.2 Basis for Preparing a Plan

AVEK has prepared an individual UWMP as a wholesale agency and is not a member of a Regional UWMP or Regional Alliance. Throughout this report, water volume is represented in units of acre-feet or AFY, unless otherwise noted, and data is presented on a calendar year basis.

2.3 Coordination and Outreach

AVEK coordinated with multiple neighboring and stakeholder agencies to prepare the 2020 UWMP. The coordinated efforts were conducted to inform the agencies of AVEK's efforts and activities; gather high-quality data for use in developing this UWMP; and coordinate planning activities with other related regional plans and initiatives. California Water Code Section 10621(b) requires that suppliers notify cities and counties to which they serve water that the UWMP and Water Shortage Contingency Plan (WSCP) are being updated and reviewed. The Water Code specifies that this must be done at least 60 days prior to the public hearing about the updated plan. To fulfill this requirement, AVEK sent letters of notification of preparation of the 2020 UWMP, 2021 WSCP, and **Appendix J** addendum to the 2015 UWMP to the cities and counties within AVEK's service area, listed below, 60 days prior to the public hearing.

- City of California City
- City of Lancaster
- City of Palmdale
- Kern County
- Los Angeles County
- Ventura County

Copies of the 60-day notification letters are attached as Appendix D. The notifications to cities, counties, and retailers are further discussed in **Chapter 10**.

To fulfill the requirements of Water Code Section 10642 of the Urban Water Management Planning Act (UWMP Act), AVEK made the 2020 UWMP, 2021 WSCP, and Appendix J addendum to the 2015 UWMP available for public review and held a public hearing on June 8, 2021. The public review hearing was noticed on May 25, 2021; the hearing notice is attached as **Appendix D**. In addition, AVEK maintained a copy of the 2020 UWMP, 2021 WSCP, and **Appendix J** addendum to the 2015 UWMP in its office prior to the public hearing.

2.3.1 Wholesale and Retail Coordination

AVEK's service area includes 27 customers, and all were informed of AVEK's UWMP update and water supply projections from 2020 through 2045 for average, single, and five consecutive dry years.

In compliance with California Water Code 10631, AVEK notified these customers:

- Antelope Valley Country Club
- Antelope Valley Water Storage, LLC c/o WDS
- Boron Community Services District (CSD)
- California Department of Parks & Recreation (Poppy Reserve)
- California Water Service Company (Cal Water) (Antelope Valley District)
- City of California City
- Desert Lake CSD
- Desert Sage Apartments
- Edgemont Acres Mutual Water Company (MWC)
- Edwards Air Force Base
- El Dorado MWC
- Granite Construction (Shell Exploration)
- Lake Elizabeth MWC
- Landale MWC
- Los Angeles County Waterworks Districts (LACWD) No. 37 and No. 40
- Mojave Public Utility District
- Palm Ranch Irrigation District
- Quartz Hill Water District
- Rancho Vista Development
- Rio Tinto Minerals (US Borax)
- Rosamond Community Services District
- Shadow Acres MWC
- Sunnyside Farms MWC
- Tejon Ranch Co.
- Westside Park MWC
- White Fence Farms MWC
- White Fence Farms MWC #3

Copies of the 60-day notification letters are attached as **Appendix D**.

There are five retail customers within AVEK's service area that are required to prepare an UWMP, and additional coordination occurred with these agencies:

- California Water Service Co. (Antelope Valley District)
- City of California City
- LACWD No. 37 and No. 40
- Quartz Hill Water District
- Rosamond Community Services District

2.3.2 Coordination with Other Agencies and the Community

Several years ago, AVEK and 10 additional public agencies representing the broad interests of the greater Antelope Valley region formed a Regional Water Management Group. The 11 agencies signed a Memorandum of Understanding that defines roles and responsibilities to make formal decisions regarding the scope and content of the Antelope Valley Integrated Regional Water Management Plan (IRWMP). Since initial development of the IRWMP in 2007, phased efforts have been advanced to define a meaningful course of action to meet the demands for water within the greater Antelope Valley region and the shared vision within the region. AVEK remains involved in regional water management efforts and most recently participated in the 2019 update to the IRWMP (Antelope Valley Integrated Regional Water Management Group, 2019).

3

URBAN WATER MANAGEMENT PLAN

System Description

This chapter describes the AVEK service area, customers, and land uses, as well as population, demographics, and climate.

IN THIS SECTION

- AVEK Service Area
- Service Area Climate, Population and Land Uses

Antelope Valley-East Kern Water Agency (AVEK or Agency) is a wholesale supplier of State Water Project (SWP) water to the greater Antelope Valley region. The region is located in the western part of the Mojave Desert, approximately 50 miles northeast of Los Angeles. AVEK's service area encompasses nearly 2,400 square miles in northern Los Angeles and eastern Kern Counties as well as a small portion of Ventura County.

AVEK has played a major role in the Valley's water system since it was granted a charter by the State Legislature in 1959 and became a SWP contractor in 1962. AVEK's mission is to deliver reliable, sustainable, and high-quality supplemental water to the region in a cost-effective and efficient manner. AVEK's goals include groundwater basin stewardship, water reliability, and water quality promotion.

3.1 General Description

In 1962, AVEK signed a water supply contract with the California Department of Water Resources (DWR) for delivery of imported water supplies from the SWP to supplement Antelope Valley region's groundwater supplies. AVEK has the third-largest allotment of the 29 SWP contractors, with a contractual Table A amount of 144,844 acre-feet per year (AFY). Only the Metropolitan Water District of Southern California (Metropolitan) and Kern County Water Agency receive a larger allotment. Table A water is a reference to the amount of water listed in "Table A" of the contract between the SWP and the contractors and represents the maximum amount of water a contractor may request each year. Table A water is the primary delivery type of imported water AVEK receives; however, additional delivery types (e.g., Article 21 Water and Carryover Water) help to make up AVEK's full imported water supply. AVEK's imported water delivery types are further described in **Chapter 6**.

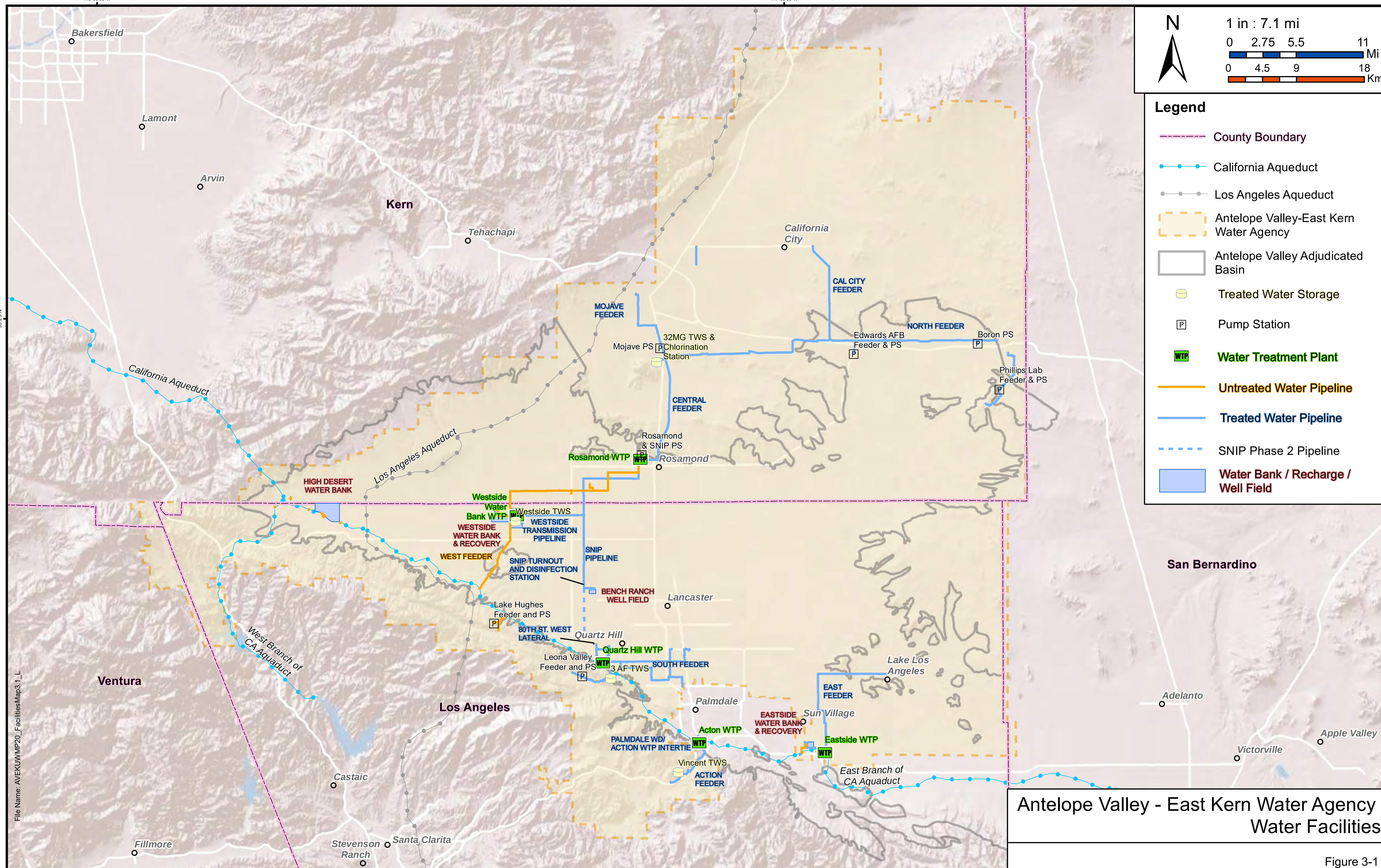
AVEK's water system is connected to the California Aqueduct at 23 different turnouts. However, only 15 of the turnouts are currently operational. AVEK's turnouts feed into six separate subsystems that are hydraulically disconnected from each other: Acton; Eastside; Rancho Vista; Rosamond; Quartz Hill; and Willow. Distribution throughout AVEK's service area is carried out through a system of approximately 184 miles of pipeline. Water travels throughout the system using booster pump stations that pump water from the lower elevations to the higher elevations. AVEK's pump stations are located at water treatment plants (WTPs) or at customer connections. There are currently 11 existing pumping stations within AVEK's system.

AVEK owns and operates four treatment plants that treat SWP water to drinking water standards from the aqueduct and deliver the treated water into the regional distribution system. The four WTPs and the year they were constructed are: Acton WTP (1991); Eastside WTP (1981); Quartz Hill WTP (1977); and Rosamond WTP (1978). AVEK's water distribution systems rely on stored water to help equalize fluctuations between supply and demand. In addition, storage is required to provide adequate water supply for emergency or unplanned outages of a major source of supply. Currently, the Agency's water system has clearwells co-located with each WTP and seven reservoirs that provide storage for the distribution system, five of which are owned and maintained by AVEK and two of which are owned by Los Angeles County Waterworks Districts (LACWD) and maintained by AVEK (Carollo, 2020).

In addition, AVEK developed groundwater banking programs to store surplus water available from the SWP during wet periods through groundwater recharge to increase water supply reliability in the greater Antelope Valley. The banking programs include recovery wells to supplement imported water during dry periods, high delivery periods, or during a disruption of SWP deliveries. Currently, AVEK's groundwater banks include the Westside Water Bank (started operations in 2010), Eastside Water Bank (started operations in 2016), Upper Amargosa Creek Recharge Project (started operations in 2019), and, most recently the High Desert Water Bank (currently in development).

AVEK has made many improvements to its water system since initially being constructed in the 1970s to allow for better distribution of water through system interconnections and expansions. The South North Intertie Pipeline and Pump Station/Turnout Project (SNIP) Phase 1 was constructed in 2011 to connect the existing Rosamond WTP and the Quartz Hill WTP by moving water through LACWD pipelines. SNIP also provides flexibility in the method of return of water banked in the Westside Water Bank (direct delivery or transfer). SNIP Phase 2 is currently in design. Other previous facility improvements include the Parallel South Feeder and the addition of 9 million gallons of storage at the Quartz Hill WTP. The Agency's major facilities are shown in **Figure 3-1**.

AVEK is currently developing a new storage program, the High Desert Water Bank, which is a partnership between AVEK and Metropolitan to increase water supply reliability by storing excess Metropolitan SWP supply in the Antelope Valley Groundwater Basin for use during periods of low SWP allocation. As the project expands and additional phases are constructed, AVEK will have dedicated capacity and the ability to recover stored imported water from the groundwater basin and pump the recovered water into the East Branch of the California Aqueduct for downstream deliveries to AVEK's existing water treatment facilities.



Antelope Valley - East Kern Water Agency Water Facilities

Figure 3-1

Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet

Date: 5/16/2021

3.2 Service Area Climate

AVEK's service area is located in the western part of the Mojave Desert within the greater Antelope Valley. The region's elevation ranges from approximately 2,300 feet to 3,500 feet above sea level. Vegetation native to the greater Antelope Valley region is typical of the high desert and includes Joshua trees, saltbush, mesquite, sagebrush, and creosote bush. The climate is characterized by hot summer days, cool summer nights, cool winter days, and cool winter nights. Typical of a semiarid region, mean daily summer temperatures range from 64 degrees Fahrenheit (°F) to 96°F, and mean daily winter temperatures range from 35°F to 60°F (Antelope Valley Integrated Regional Water Management Group, 2019). Summer temperatures can reach 112°F, while winter temperatures can drop to about 10°F. Typical annual rainfall is 4 to 6 inches. Most rainfall occurs between December and March, with little to no precipitation falling in summer months. The perimeter of the greater Antelope Valley includes low brush-covered hills transitioning into the Tehachapi Mountains to the west and the San Gabriel Mountains to the south. Surface water drainage channels and courses are only active during times of runoff due to precipitation. The water tables are well below the levels needed to sustain year-round flowing streams. The area is known for its daily winds, primarily from the west. **Table 3-1** presents the average rates of evapotranspiration (ETo), temperature, and precipitation in the service area.

Table 3-1. Precipitation, Evapotranspiration, and Temperature in AVEK Service Area

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AVG
Average Precipitation (inches)	1.0	0.9	1.1	0.3	0.2	0.0	0.1	0.2	0.2	0.2	0.4	0.8	**0.4**
Average ETo (inches)	2.3	3.1	4.9	6.5	8.2	9.2	9.8	8.9	6.5	4.6	2.9	2.0	**5.8**
Average Air Temp (°F)	43.3	46.2	51.2	57.0	64.3	73.2	78.4	78.1	71.3	59.8	49.8	42.2	**59.8**

Source: California Irrigation Management Information System (CIMIS), Station 197 Palmdale, (period of record is from April 2005 through December 2020) http://wwwcimis.water.ga.gov/cimis/data

Climate change and the potential impacts within the Agency's service area are discussed in **Section 4.2.4**, climate change considerations.

3.3 Service Area Population and Demographics

AVEK provides service to incorporated and unincorporated areas of the greater Antelope Valley. The current and projected population and demographic projections for AVEK's service area (**Table 3-2** and **Table** 3-3, respectively) were based on population projections from the Southern California Association of Governments (SCAG) for Los Angeles and Ventura Counties, and the Kern Council of Governments (KCOG). The SCAG projection data was last updated in December 2019 and is the projection modeling information that SCAG used in the 2020 Connect SoCal Regional Transportation Plan (Southern California Association of Governments, 2020). Population projections were calculated based on the SCAG 2019 regional growth forecast for the transportation analysis zones overlying AVEK service area.[1] The estimates were developed using SCAG's traffic analysis zones (TAZs), which were clipped to AVEK's service area boundary in ArcGIS. TAZs that were partially outside the service area were estimated based on the percentage of the area that lies within AVEK's service area. SCAG's 2019

[1] The analysis was performed by WSC based upon modeling information originally developed by SCAG. SCAG is not responsible for how the model is applied or for any changes to the model scripts, model parameters, or model input data. The resulting modeling data does not necessarily reflect the official views or policies of SCAG. SCAG shall not be held responsible for the modeling results or the content of the documentation.

model data has estimates for 2016 (historical estimate), 2020, 2035, and 2045. Intermediate values are linear interpolations between the given SCAG values.

SCAG prepared preliminary demographic forecast estimates for each TAZ in 2017 for the 2020 Connect SoCal Plan. Between 2017 and 2019, SCAG met with each jurisdiction to review the demographic forecasts. This review process incorporated feedback from each jurisdiction, including land use planning departments, to help align the demographic forecasts with current land use and anticipated land use changes.

The KCOG population projection data is from the KCOG General Land Use Plan (Kern County Counil of Governments, 2018) (KCOG, 2018). Similar to SCAG, the KCOG estimates were developed using KCOG's TAZs. The TAZs were clipped to AVEK's service area boundary in ArcGIS, and TAZs that were partially outside the service area were estimated based on the percentage of the area that lies within AVEK's service area. KCOG data is projected for 2020, 2035, and 2042. Similar to SCAG, linear interpolation was applied to intermediate values (2025, 2030, and 2040) and extrapolation for 2045.

The combined projections result in an average annual growth rate of 1.33% with a high growth rate initially (2020–2025) and lower rates at the end of the projection (2040–2045).

Table 3-2. Current and Projected Population (DWR UWMP Table 3-1W)

	2020	2025	2030	2035	2040	2045
Los Angeles and Ventura Counties	270,615	288,578	306,542	324,505	342,229	359,953
Kern County	49,956	56,757	63,558	70,359	78,738	87,118
TOTAL	**320,571**	**345,335**	**370,100**	**394,864**	**420,967**	**447,071**

Notes:

1. Data for Los Angeles and Ventura Counties from SCAG 2020 Connect SoCal Regional Transportation Plan (SCAG, 2020)
2. Data for Kern County from KCOG General Land Use Plan (KCOG, 2018).

Table 3-3. Current and Projected Households and Employment

	2020	2025	2030	2035	2040	2045
HOUSEHOLDS						
Los Angeles and Ventura Counties	85,305	94,696	104,088	113,479	121,487	129,495
Kern County	16,380	18,679	20,978	23,277	26,051	28,825
TOTAL	**101,685**	**113,375**	**125,066**	**136,756**	**147,538**	**158,320**
EMPLOYMENT						
Los Angeles and Ventura Counties	88,296	93,530	98,764	103,998	110,167	116,335
Kern County	17,745	20,342	22,940	25,537	28,496	31,456
TOTAL	**106,041**	**113,872**	**121,704**	**129,535**	**138,663**	**147,791**

Notes:

1. Data for Los Angeles and Ventura Counties from SCAG 2020 Connect SoCal Regional Transportation Plan (SCAG, 2020)
2. Data for Kern County from KCOG General Land Use Plan (KCOG, 2018).

4

URBAN WATER MANAGEMENT PLAN

Water Use Characterization

This chapter summarizes AVEK's past, current, and projected water demands through 2045.

Antelope Valley-East Kern Water Agency (AVEK or Agency) delivers treated water and untreated water to customers within its service area. All connections are metered and are cross-checked with California Department of Water Resources (DWR) State Water Project (SWP) delivery records. In addition, AVEK delivers untreated water for recharge of the local groundwater basin and conducts exchanges or transfers for delivery of a portion of its SWP allocation to agencies with a short-term need for additional water supplies.

IN THIS SECTION

- Past Water Use
- Current Water Use
- Projected Water Use

As an SWP contractor, AVEK provides a supplemental imported water supply from the SWP to retailers in the greater Antelope Valley region. This is a secondary water source for these suppliers and is used by these entities in lieu of, or in addition to, pumped groundwater.

Therefore, AVEK must first project total demand in the AVEK service area, along with projected utilization of local supplies, to estimate demands on AVEK supplies. The primary local supply is groundwater, but several agencies are investing in recycled water and recharge projects to diversify their water supplies.

This chapter describes recent demands in the AVEK service area and projections through 2045 for water demand in the AVEK service area, local supplies, and AVEK demands.

4.1 Past and Current Water Use

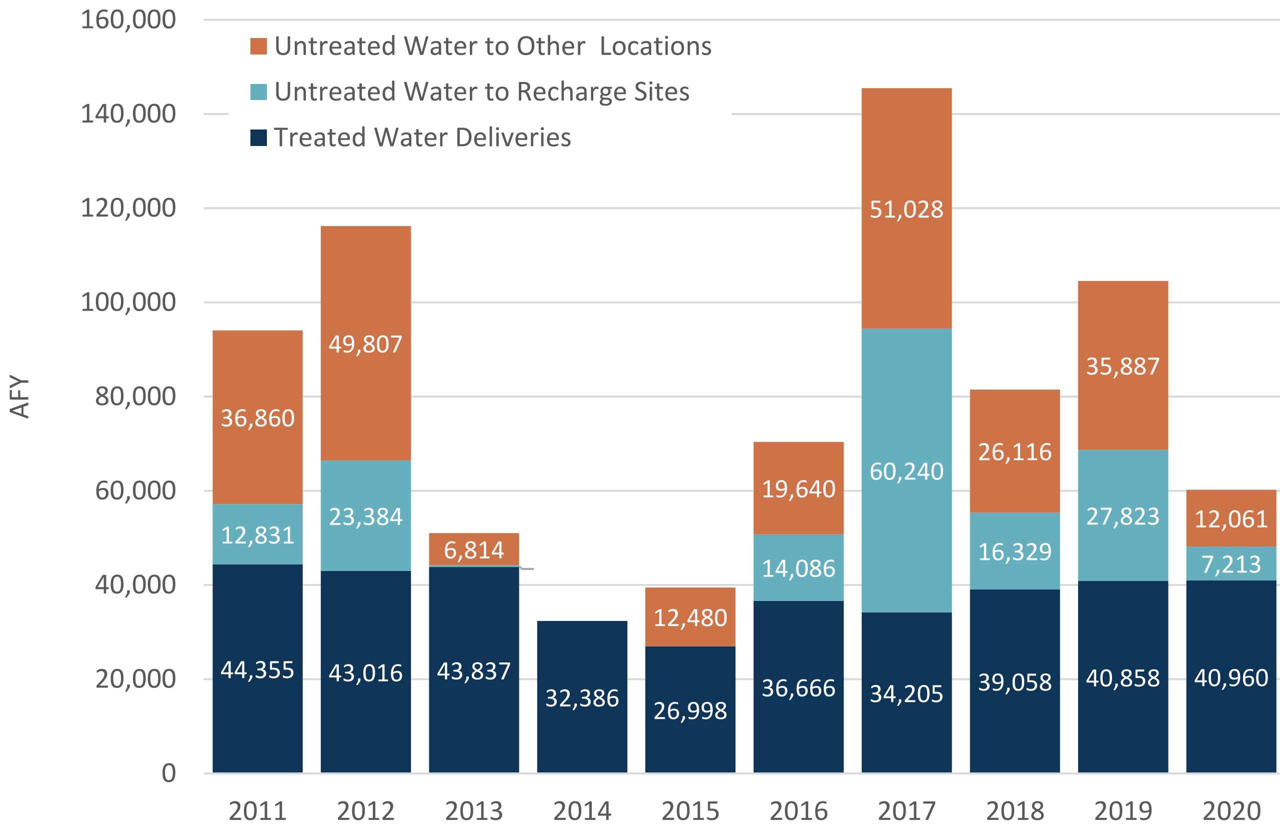
As a wholesale water supplier, AVEK reports the sale of water to other agencies; the retail water supplier is responsible for reporting the uses of their water supply by water sector. Water use sectors relevant to AVEK include sales to other agencies, groundwater recharge (groundwater banking), losses, and transfers/exchanges. Water delivery data for 2020 is summarized in **Table 4-1** and presented along with 2011–2019 deliveries in **Figure ES-1**.

Table 4-1. AVEK 2020 Actual Demands for Water (DWR UWMP Table 4-1W) (Acre-Feet per Year)

CUSTOMER OR USE	LEVEL OF TREATMENT WHEN DELIVERED	2020 VOLUME
Los Angeles County Waterworks Districts	Treated Water	32,847
Quartz Hill Water District	Treated Water	2,533
Rio Tinto Minerals / US Borax	Treated Water	1,503
Edwards Air Force Base	Treated Water	1,465
Other M&I Customers (19 Customers)	Treated Water	2,095
Untreated Water Deliveries (4 Customers)	Untreated Water	837
Transfers to Other Agencies	Untreated Water	11,286
Groundwater Recharge	Untreated Water	7,213
Losses	Treated and Untreated Water	457
	TOTAL:	**60,234**

Source: AVEK, 2020 LATIS data

Figure 4-1. 2011–2020 AVEK Deliveries by Type



As shown in **Figure 4-1**, treated water deliveries to AVEK retailers were relatively consistent compared with deliveries to recharge sites and other locations. Treated water demands have increased slightly since 2017 but have not returned to the levels observed prior to 2014, following severe drought restrictions. Recharge water deliveries have varied based on water availability, as evidenced by the high recharge volume in 2017 that coincided with high SWP allocations. Future use of untreated water for recharge is discussed further in **Section 6.1.2**. Similarly, yearly deliveries to other locations vary substantially and are primarily driven by the extent of exchanges or transfers conducted in those years. Exchanges and transfers are not explicitly projected in this UWMP because they are opportunistic agreements made by willing parties dependent on each party's needs, and they are the lowest priority use of AVEK's supplies.

The remainder of this chapter focuses on treated water demand projections.

4.2 Projected Water Use

AVEK developed a Supply and Demand Model ("the model") in Microsoft Excel to compare future supply and demand conditions under multiple supply and demand scenarios. Scenario analysis allows AVEK to compare the benefits (and costs) of different long-term water resources conditions and strategies. The model is comprised of supply and demand variables, which are combined to form scenarios with different supply and demand assumptions.

The following demand variables were considered:

Population Growth

Projects the number of new water users in the service area, based on planning agency projections and historical growth rates.

Per Capita Demand Rebound

The extent that per capita demand, measured as gallons per capita per day (GPCD), is estimated to increase from spring 2016, which was the last year severe water use restrictions were in place by AVEK retailers. This variable projects the "new normal" demand for existing customers.

Passive Conservation

Water savings resulting from plumbing codes and other institutionalized water efficiency measures.

Active Conservation

Water saved as a direct result of programs and practices directly funded by a water utility.

Climate Change

Climate models disagree on average annual precipitation projections but agree on other hydrologic metrics relevant to water resources management, including increased evapotranspiration, which would increase irrigation demands (Persad, 2020) (Partida, 2020).

Also, as a SWP contractor, AVEK provides a supplemental imported water supply to retailers in the greater Antelope Valley region, which is a secondary water source for these suppliers and is used by these entities in addition to pumped groundwater; therefore, local supply variables were also considered:

Groundwater

Includes pumping at production rights, as well as pumping below the production rights.

Recycled water

Includes with and without planned recycled water use by retailers

For the 2020 UWMP, AVEK made one assumption for each of the variables listed above. Each variable is discussed on the following page, along with the assumption used for this UWMP.

4.2.1 Population Growth

Population growth projections are based on projections from Southern California Association of Governments (SCAG) for Los Angeles and Ventura Counties and Kern County Council of Governments (KCOG) and were presented in **Section 3.3**. The combined result is an average annual growth rate of 1.33%, with a high growth rate initially (2020–2025) and lower rates at the end (2040–2045). AVEK considered both higher and lower growth rate scenarios but applies the projections from **Section 3.3** for the UWMP demand projections.

4.2.2 Per Capita Demand Rebound

Senate Bill (SB) X7-7 mandated reduction of per capita water demand by 20% by 2020. As a wholesaler, AVEK does not have a 2020 target, but every retailer that prepares a UWMP must have developed a 2020 target for their 2015 UWMP and must have been reporting water use monthly to the State since June 2014. Five of AVEK's retailers—California Water Service Co., City of California City, Los Angeles County Waterworks District (LACWD), Quartz Hill Water District (QHWD), and Rosamond Community Service District (RCSD)—must prepare UWMPs and report water use to the State; they represent roughly 90% of AVEK demand and 80% of population in the AVEK service area.

4.2.2.1 Historical Per Capita Demand

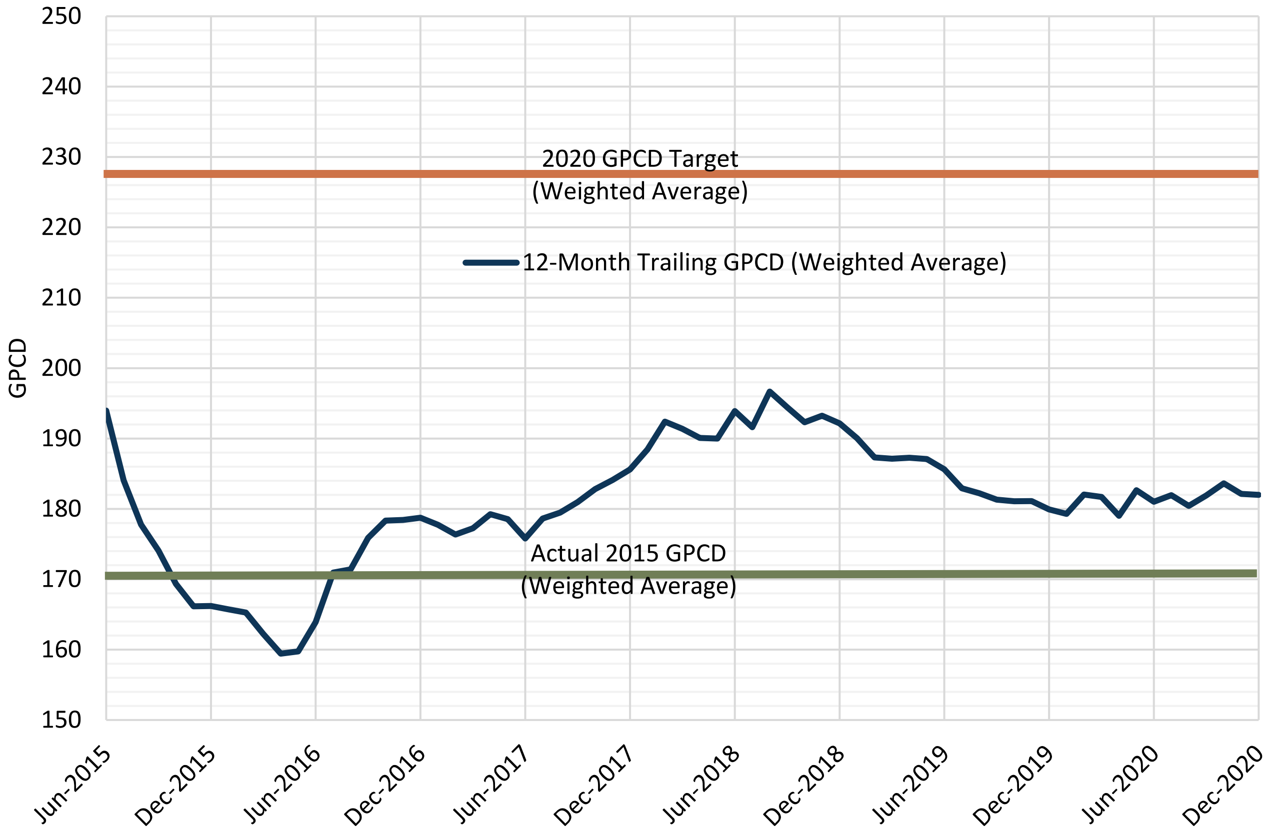
Table 4-2 estimates per capita water demand for all AVEK customers (using AVEK billing and production data), while **Figure 4-2** includes only AVEK customers that must submit a UWMP (using required monthly water use reporting to the State Water Resources Control Board [SWRCB]). As shown in the table and figure, per capita water demand in 2020 was higher than from 2015 to 2017. There was a drop in use in 2019 that may have been caused by higher than average precipitation—the area received over 7.0 inches of precipitation, while the other years from 2015 to 2020 received from 3.6 to 4.0 inches.

Table 4-2. 2016–2020 AVEK Service Area GPCD – All Customers

	2016	2017	2018	2019	2020
Treated Water Deliveries by AVEK (AF)	36,666	34,205	39,058	40,858	40,960
Groundwater Pumped by Customers (AF)	24,553	26,139	26,007	20,211	20,556
TOTAL USE (AF)	**61,219**	**60,344**	**65,065**	**61,068**	**61,516**
Population Estimate	310,407	312,911	315,415	317,951	320,571
PER CAPITA WATER DEMAND (GPCD)	**176**	**172**	**184**	**171**	**171**

Source: Treated water deliveries from AVEK billing records; Groundwater pumping from annual Watermaster reports; Population estimates from SCAG and KCOG.

Figure 4-2. 2015–2020 AVEK Retailers with UWMPs GPCD for Trailing 12 Months



Source: SWRCB Monthly Water Conservation and Production Reports[1]

Note: The figure includes only retailers that are required to submit UWMPs, which excludes roughly 10% of demand and 20% of population in the AVEK service area. Values presented are the average from each retailer weighted by their population.

4.2.2.2 Demand Rebound Estimates

AVEK considered a range of potential post-drought rebound scenarios for unit water demands, including unit demands for existing connections staying at the existing rate (roughly 185 GPCD) and unit demands increasing to the 2020 GPCD target for AVEK's retailers that submit UWMPs (roughly 230 GPCD). For the UWMP, AVEK assumed a continued post-drought unit demand rebound to 205 GPCD by 2030, which represents 90% of the weighted average 2020 GPCD target for AVEK retailers that submit an UWMP. However, AVEK intends to monitor monthly reporting by its customers to track trends in unit water demands and plans to adapt its projections based on this and other available information.

AVEK assumed 150 GPCD for new development, based on it being more efficient than existing development.

[1] https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.html

4.2.3 Passive and Active Conservation

Future demands are dependent on passive conservation, active conservation, and customer behavior. Active and passive conservation will reduce unit demand factors over time, while customer behavior could cause increased use (e.g., longer irrigation cycles) or decreased use (e.g., shorter irrigation cycles). Active conservation covers water saved as a direct result of programs and practices directly funded by a water utility, while passive conservation covers water savings resulting from plumbing codes and other institutionalized water efficiency measures. The price of water also impacts customers' water use, where increased water prices cause decreased water use.

For *existing* connections, unit demand factors will decrease slowly due to passive conservation and changes in customer water use patterns. *Future* connections are projected to be much more water efficient than existing connections due to California Plumbing Code requirements.[2] Unit demand factors for future connections will decrease due to passive conservation at a slower rate than existing connections because future connections will start with the latest plumbing code requirements.

Demand projections must account for conservation that may be required to meet the 2018 "Conservation as a California Way of Life" legislative mandates. Following the recent California drought, DWR and SWRCB established a conservation framework centered on "Making Water Conservation a California Way of Life" to help the State better prepare for droughts and climate change by establishing statewide water efficiency standards and incentivizing recycled water (California Department of Water Resources, November 2018). The resulting legislation of Senate Bill (SB) 606 and Assembly Bill (AB) 1668 (signed on May 31, 2018), along with future regulations, will have impacts on water providers over the coming years, requiring indoor, outdoor, and commercial, industrial, and institutional water use goals; water loss standards; annual water budgets; and documented preparation for long-term water shortages.

SB 606/AB 1668 requires the SWRCB to adopt urban efficiency standards for indoor use, outdoor use, water loss, variances, and incentives by June 30, 2022. Following the adoption of urban water use objectives in 2022, retailers will first have to report actual water use compared to objectives in 2024, and they must meet the objectives by 2027. Therefore, AVEK will see the potential impact on its customers' water use within the next decade.

AVEK considered several conservation scenarios, ranging from passive conservation only to high active conservation. To be conservative for the UWMP, AVEK is including passive conservation only in the demand projections, assuming a reduction of 0.2% per year (or 5% over 25 years) for existing connections. However, AVEK intends to work with its customers to understand the potential implications of meeting new urban efficiency standards, and plans to adapt its projections based on this and other available information once annual water use reporting starts in 2023.

4.2.4 Climate Change

Climate change analysis is an area of continued evolution in terms of methods, tools, forecasted datasets, and the predictions of greenhouse gas concentrations in the atmosphere. While continued warming can be expected, the extent to which climate change will impact other hydroclimatic elements such as precipitation is uncertain. Precipitation patterns are spatially and temporally more complex than warming patterns, and there is more uncertainty among these predictions, with some models showing the state becoming wetter and others showing the state becoming drier. Notably, a scenario with increased precipitation could result in more volatile precipitation patterns in which drought frequency and duration increases. Warming temperatures also increase evaporation from reservoirs and moisture loss from soils, resulting in reductions in water supply.

DWR developed a climate change resource guide to support climate change analysis for development of groundwater sustainability plans under the Sustainable Groundwater Management Act (SGMA)

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[2] http://epubs.iapmo.org/2019/CPC/index.html

(California Department of Water Resources, 2018), including a SGMA Data Viewer website.[3] The website includes precipitation and evapotranspiration change estimates for grids across the State for 2030 and 2070. The 2030 values were used for the UWMP, since they are roughly the midpoint of the planning period. By 2030, precipitation is projected to decrease by 3% and evapotranspiration is projected to increase by 4%, which roughly equates to a net irrigation demand increase of 7%.

Increased evapotranspiration would increase irrigation demands. AVEK does not have a reliable estimate for the portion of total demand attributed to irrigation because its supply is one of several used by its customers. Reviewing retailer monthly demand records submitted to the SWRCB,[4] irrigation demands appear to be roughly 50% of total demand based on the "minimum month" method (which assumes the lowest month of water use is all indoor use, and the same indoor use is assumed year-round). Based on this assumption, increased evapotranspiration from climate change would increase demand by 3.5%—or about 3,000 acre-feet per year (AFY) over the next 25 years—compared with an over 40% increase in demand from population growth and unit demand rebound. For this UWMP, increased evapotranspiration is not explicitly included in the demand projections contained herein, because assumptions for the other variables discussed above (growth, unit demand, and conservation) have a larger impact on the demand projections, and demand impacts from climate change are within the margin of error for the projections.

4.2.5 Groundwater

As detailed in **Section 6.3**, a Stipulated Judgment ("Judgment") was approved in 2015 for the Antelope Valley Groundwater Adjudication, and it governs most groundwater pumping in the AVEK service area. The Judgement stipulated production rights to each party, and other methods to access additional groundwater rights, such as from imported water return flows. AVEK's customers have 12,084 AFY of production rights and have received roughly 12,000 AFY of return flow rights since 2016.

Pumping by AVEK customers is shown in **Table 4-2**. For the UWMP local supply projections, each customer is assumed to pump their full production rights and imported water return flows each year.

4.2.6 Recycled Water

AVEK's retailers have projected an increased use of recycled water to offset potable use, but to date little progress has been made implementing recycled water projects within AVEK's service area. In its 2020 UWMP, LACWD is projecting increased recycled water use, but the use would not offset potable water. For the UWMP, AVEK assumes no recycled water will be developed that offsets projected water use through 2045.

4.2.7 Distribution System Water Losses

Wholesale Suppliers do not have to perform water loss audits and are not required to report this information in their 2020 UWMP. However, AVEK audits its system losses monthly as a part of its normal billing procedures. Pipelines are driven regularly as a part of water sample runs, during which personnel will note leaks if observed. As shown in **Table 4-1**, 2020 losses represented roughly 1% of supplies delivered within the AVEK service area. The long-term average losses are 2% to 3%, so this value is applied to demand projections. Also, losses are already included in the unit demand estimates since they are based on water production (versus customer meters), so a separate line item for losses is not included in the demand projections.

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[3] https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

[4] https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.html

4.2.8 AVEK Demand Projections

Based on the assumptions described above, AVEK estimated total service area demand projections and net demand on AVEK projections through 2045 is shown in **Table 4-3**.

Table 4-3. 2025–2045 AVEK Demand Projections (AFY)

	2025	2030	2035	2040	2045
TOTAL AVEK SERVICE AREA DEMAND	**73,420**	**80,400**	**83,850**	**87,520**	**91,200**
Non-AVEK Supplies					
Groundwater, Non-AVEK Production Rights	12,080	12,080	12,080	12,080	12,080
Groundwater, Non-AVEK Return Flows	16,900	17,330	19,890	20,230	21,530
NON-AVEK SUPPLIES TOTAL	**28,980**	**29,410**	**31,970**	**32,310**	**33,610**
NET AVEK SERVICE AREA DEMAND	**44,440**	**50,990**	**51,880**	**55,210**	**57,590**

4.2.9 Characteristic Five-Year Water Use

In **Chapter 7**, AVEK's supplies for the next five years are compared to its demands for the next five years as part of a five-year drought risk assessment. The demand projections, shown in **Table 4-4**, are supposed to be reported without drought conditions (also known as "unconstrained demand"), so they do not account for potential water shortage measures that AVEK or its customers could enact if an extended drought emerges from recent dry water years.

Table 4-4. 2021–2025 AVEK Demand Projections (AFY)

	2021	2022	2023	2024	2025
TOTAL AVEK SERVICE AREA DEMAND	**67,830**	**69,230**	**70,630**	**72,030**	**73,420**
Non-AVEK Supplies					
Groundwater, Non-AVEK Production Rights	14,060	13,070	12,080	12,080	12,080
Groundwater, Non-AVEK Return Flows	14,710	15,230	15,960	16,610	16,900
NON-AVEK SUPPLIES TOTAL	**28,770**	**28,300**	**28,040**	**28,690**	**28,980**
NET AVEK SERVICE AREA DEMAND	**39,060**	**40,930**	**42,590**	**43,340**	**44,440**

Source: Note that groundwater production rights ramp down through 2023 and then stay the same after 2023.

5

URBAN WATER MANAGEMENT PLAN

SBX7-7 Baseline, Targets and 2020 Compliance

With the adoption of the Water Conservation Act of 2009, also known as SBX7-7, California is required to reduce urban per capita water use by 20% by the year 2020. To achieve this statewide objective, each retailer was required to develop an urban water use target to help the State collectively achieve a 20% reduction.

IN THIS SECTION

- SBX7-7

As a wholesale supplier, Antelope Valley-East Kern Water Agency (AVEK) is not required to calculate baseline, targets, or compliance gallons per capita per day; therefore, this section is not required.

Measures, programs, and policies that AVEK has adopted to help the retail water suppliers within its service area to achieve their SBX7-7 water use reduction targets are discussed in **Chapter 9** (Demand Management Measures). Retail water suppliers within AVEK's service area that are required to prepare and submit an Urban Water Management Plan will include their baselines, targets, and 2020 compliance in their individual Plans.

AVEK will continue to work with its retail water suppliers to implement demand management measures (discussed in **Chapter 9**) to help them achieve their 2020 targets.

6

URBAN WATER MANAGEMENT PLAN

Water Supply Characterization

This section summarizes AVEK's water supplies and provides the basis for normal, single year, and multiple dry year supply reliability.

The Antelope Valley-East Kern Water Agency (AVEK or Agency) provides treated (drinking) water and untreated (raw) water to a variety of customers in the greater Antelope Valley, including municipal water, agricultural water, private companies, and individual agricultural customers. AVEK primarily supplies imported water from the State Water Project (SWP); however, it also supplies local groundwater and banked SWP supplies. AVEK's mission is to deliver reliable, sustainable, and high-quality supplemental water to the region in a cost-effective and efficient manner.

IN THIS SECTION

- State Water Project
- Exchanges and Transfers
- Groundwater
- Supply Characterization
- Energy Intensity

AVEK's water reliability goal is to provide a level of regional water reliability that supports customers' water needs. The foundational strategy of this goal is developing groundwater banking programs to help increase the reliability of the Antelope Valley region's water supplies by storing excess SWP water during wet periods and recovering it for delivery to customers during dry and high-demand periods or during a disruption in deliveries from the SWP.

To maximize the use of its SWP supplies, AVEK has developed a water banking program and entered into various water transfer and exchange programs with other SWP contractors. In addition to SWP supplies, AVEK also has adjudicated groundwater production rights, which are available to help meet water demands in the region. Information regarding AVEK's imported water and groundwater supplies is detailed in this chapter.

As shown in **Figure 6-1,** AVEK's potable water deliveries consist of either SWP water treated at AVEK water treatment plants, or groundwater that is recovered from SWP water previously recharged or part of AVEK's production rights. And, as shown in **Table 6-1**, AVEK also delivers raw (untreated) SWP water to customers for recharge locally or for transfer or exchange outside of the AVEK service area.

Figure 6-1. 2011–2020 AVEK Drinking Water Deliveries by Source

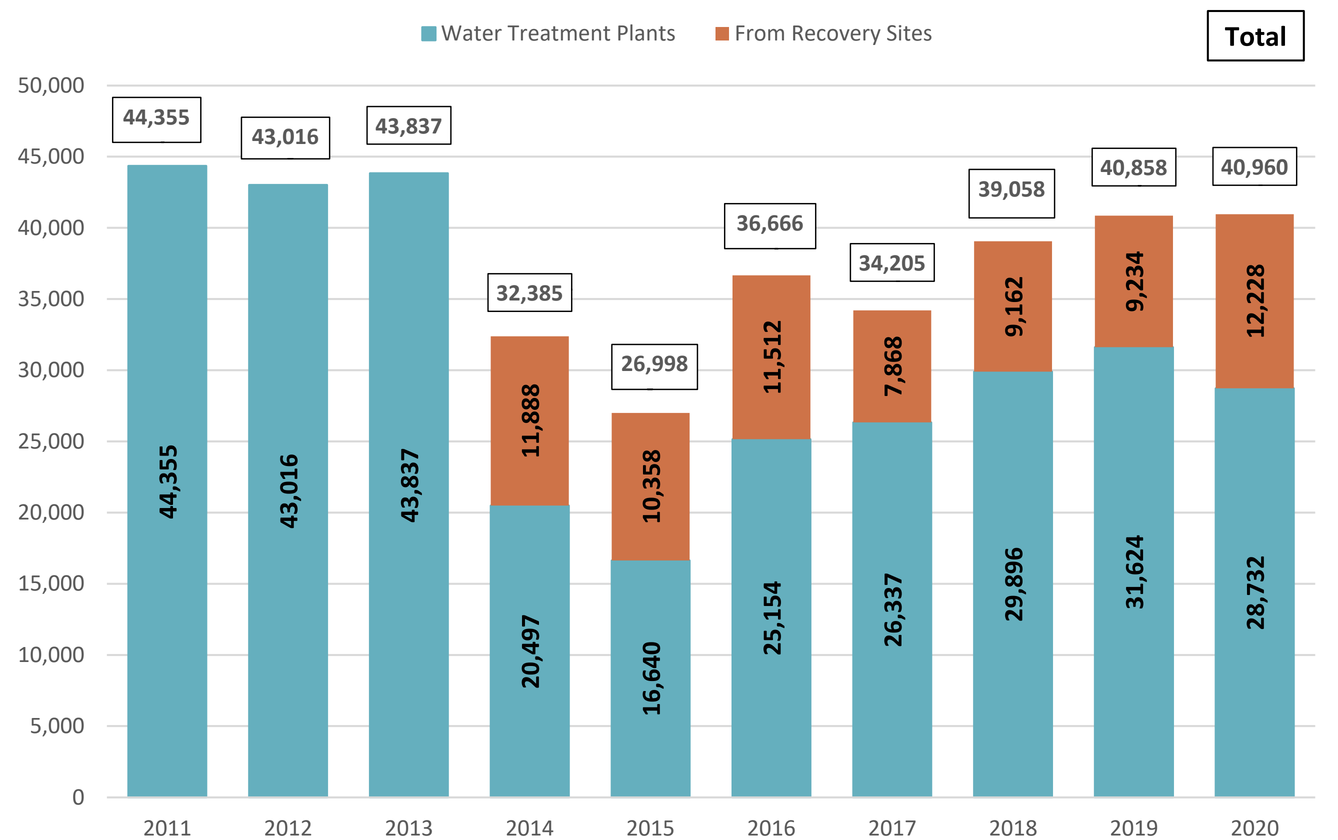


Table 6-1. AVEK 2020 Actual Water Supplies (DWR UWMP Table 6-8W)

ADDITIONAL DETAIL ON WATER SUPPLY	2020 VOLUME (AFY)
Treated Water to Retailers	28,732
Untreated Water to Retailers	775
Untreated Imported Water to Groundwater Bank	7,213
Treated Recovered Water from Groundwater Bank	12,228
Untreated Water, Transfer / Exchanges	11,286
TOTAL:	**60,234**

The following sections further describe each of AVEK's existing and potential water supplies.

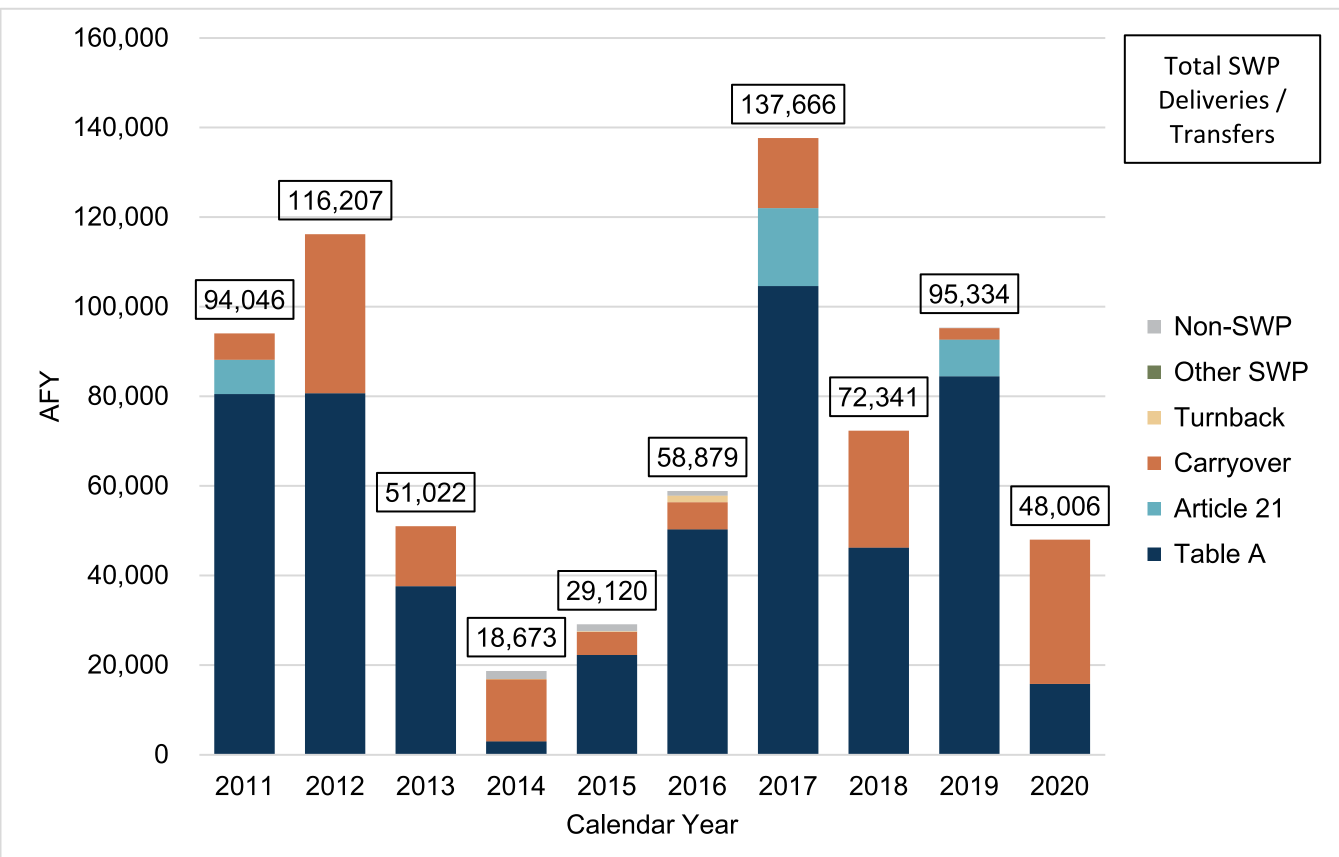
6.1 State Water Project

AVEK is a wholesale supplier of SWP water from the California Aqueduct. AVEK has the third-largest allotment of the 29 SWP contractors with a contractual Table A amount of 144,844 acre-feet per year (AFY). Table A water is a reference to the amount of water listed in "Table A" of the contract between the SWP and the contractors, representing the maximum amount of water a contractor may request each year. Table A water is the primary delivery type of imported water AVEK receives; however, additional delivery types help to make up AVEK's full imported water supply.

As listed below and shown in Figure 6-2, AVEK uses a variety of SWP water types.

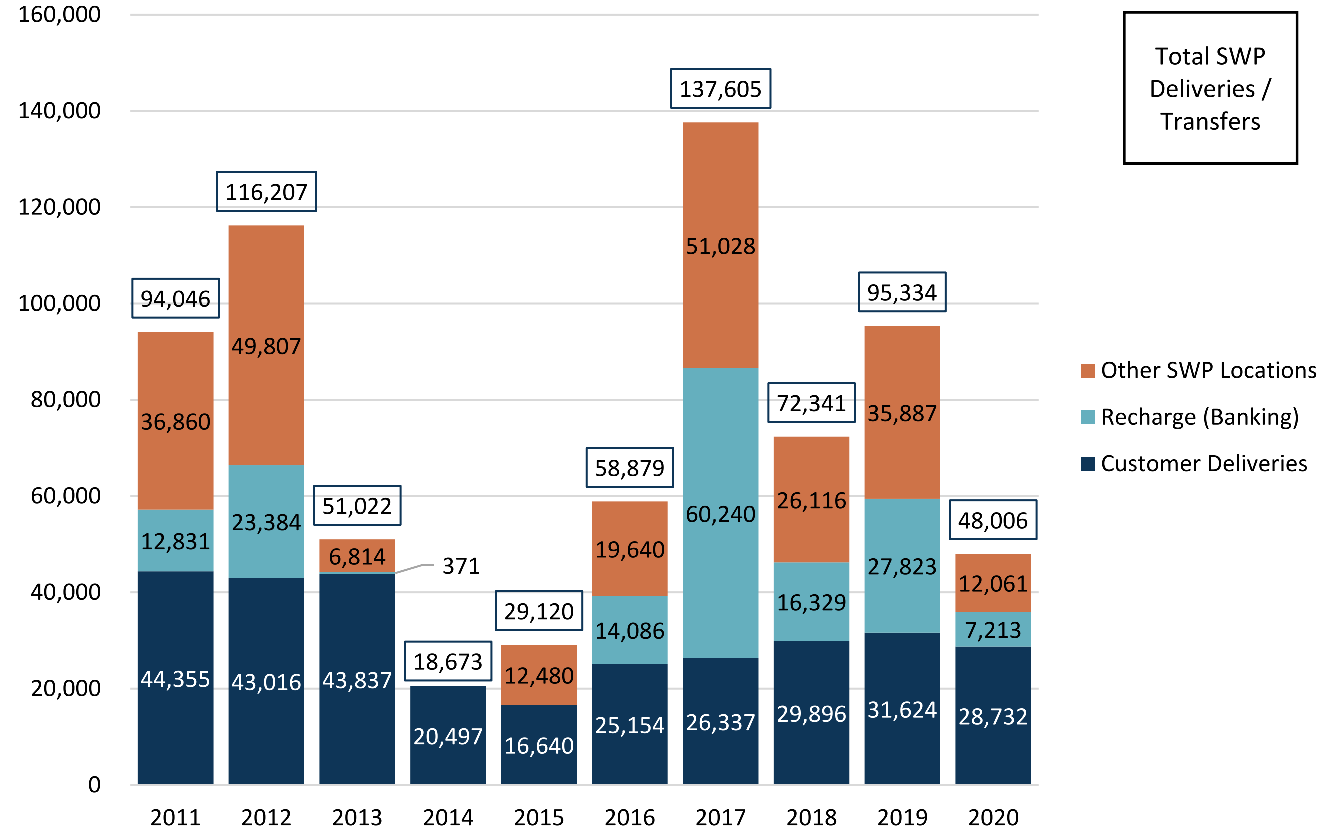
- **SWP Table A water:** Once the total amount of water to be delivered is determined for the year, all available water is allocated in proportion to each contractor's annual maximum SWP Table A amount.
- **SWP Article 21 water:** Water that SWP contractors may receive on a short-term basis in addition to their Table A water, if requested. It is predominantly available in wet years.
- **SWP carryover water:** Water that is allocated to an SWP contractor and approved for delivery to that contractor each year, but not used by the end of the year. Instead of being delivered to the contractor, the water is stored in San Luis Reservoir, when space is available, for the contractor to use in the following year. Carryover water credit is lost when the reservoir storage space is full.
- **SWP turnback pool water:** SWP contractors may offer a portion of their Table A water that has been allocated in the current year and exceeds their needs to a "turnback pool," where another contractor may purchase it.
- **Other SWP water:** Water from negotiated agreements with other SWP contractors.
- **Other non-SWP water:** Water from negotiated agreements with non-SWP contractors that is delivered through SWP.

Figure 6-2. 2011–2020 AVEK SWP Deliveries by Type of Water



As shown in **Figure 6-3**, in addition to delivering SWP water to customers, AVEK optimizes the use of available SWP water through recharge for future use or in deliveries to other SWP locations as exchanges or transfers, which are discussed in **Section 6.2**.

Figure 6-3. 2011–2020 AVEK SWP Deliveries by Location



6.1.1 SWP Water Supply Estimates

The water supply availability for delivery by the SWP depends on rainfall, snowpack, runoff, reservoir storage, pumping capacity of SWP facilities, and regulatory and environmental mandates on SWP operations. DWR prepares a biennial report to assist SWP contractors and local planners in assessing the availability of supplies from the SWP. DWR issued its most recent update, the 2019 SWP Delivery Capability Report (DCR) (California Department of Water Resources, 2020). In this update, DWR provides SWP supply estimates for SWP contractors to use in their planning efforts, including for use in their 2020 UWMPs. The 2019 DCR includes DWR's estimates of SWP water supply availability under both existing (2020) and future (2040) conditions for the SWP as a whole and specifically for AVEK.

DWR's estimates of SWP deliveries are based on a computer model that simulates monthly operations of the SWP and Central Valley Project systems. Key inputs to the model include the facilities included in the system, hydrologic inflows to the system, regulatory and operational constraints on system operations, and contractor demands for SWP water. In conducting its model studies, DWR must make assumptions regarding each of these key inputs.

In the 2019 DCR for its model study under existing conditions, DWR assumed: existing facilities; hydrologic inflows to the model based on 82 years of historical inflows (1922 through 2003); current regulatory and operational constraints, including 2018 COA Amendment, 2019 biological opinions, and 2020 Incidental Take Permit; and contractor demands at maximum Table A amounts. The long-term average allocation reported in the 2019 DCR for the existing conditions study provides appropriate estimates of the SWP water supply availability under current conditions.

To evaluate SWP supply availability under future conditions, the 2019 DCR included a model study representing hydrologic and sea level rise conditions by 2040. The future condition study used all of the same model assumptions as the study under existing conditions, but reflected changes expected to occur from climate change, specifically projected temperature and precipitation changes centered around 2035 (2020 to 2049) and a 45 centimeter sea level rise. For the long-term planning purposes of this UWMP, the long-term average allocations reported for the future conditions study from 2019 DCR is the most appropriate estimate of future SWP water supply availability.

AVEK assumes a straight-line reduction in long-term average allocation from 58% in 2020 to 52% in 2040. 2045 is assumed to remain at 52%, as shown in **Table ES-3**.

Table 6-2. SWP Average Yield Projections

	2020	2025	2030	2035	2040	2045
Average Table A Allocation (%)	58.0%	56.5%	55.0%	53.5%	52.0%	52.0%
Average Table A Yield (AFY)	84,010	81,840	79,660	77,490	75,320	75,320

DWR's 2019 DCR indicates that the modeled single dry year SWP water supply allocation is 7% under existing conditions. Historically, however, the lowest SWP allocations were 5% in 2014 and 2021 (as of May 2021). DWR's 2019 DCR indicates that the lowest consecutive five-year period occurred from 1988 to 1992, with an average allocation of 20.3% under the existing conditions. During the recent drought, Table A allocation from 2012 to 2016 averaged 37%.

AVEK's SWP projections for single dry year and multiple dry years is presented in **Table 6-3**.

Table 6-3. Table A Deliveries in Selected Drought Conditions

DROUGHT CONDITION	TABLE A ALLOCATION (%)	TABLE A ALLOCATION (AF)
SINGLE DRY YEAR		
2014	5.0%	7,242
MULTIPLE DRY YEARS (1988-1992)		
YEAR 1 (1988)	12.3%	17,854
YEAR 2 (1989)	32.2%	46,677
YEAR 3 (1990)	13.3%	19,276
YEAR 4 (1991)	25.6%	37,039
YEAR 5 (1992)	18.0%	26,048

6.1.2 Groundwater Banking

AVEK's groundwater banking programs store surplus imported water through groundwater recharge and include recovery wells to pump stored water in times of need. AVEK's groundwater banks include the Westside Water Bank (started operations in 2010), Eastside Water Bank (started operations in 2016), Upper Amargosa Creek Recharge Project (started operations in 2019), and most recently the High Desert Water Bank.

The Westside Water Bank has an estimated total storage capacity of 150,000 acre-feet (AF) and an estimated annual recharge capacity of 50,000 AFY. The Westside Water Bank includes 400 acres of groundwater recharge basins and 11 groundwater recovery wells. Up to 20 new wells may be constructed as a part of the Westside Water Bank project. Five irrigation wells existing on the property at the time of development may also be used in the program. AVEK meters the deliveries and recovery for the program and will not recover more than 90% of the amount recharged to account for evapotranspiration and other losses during recharge and conveyance as well as typical metering accuracy.

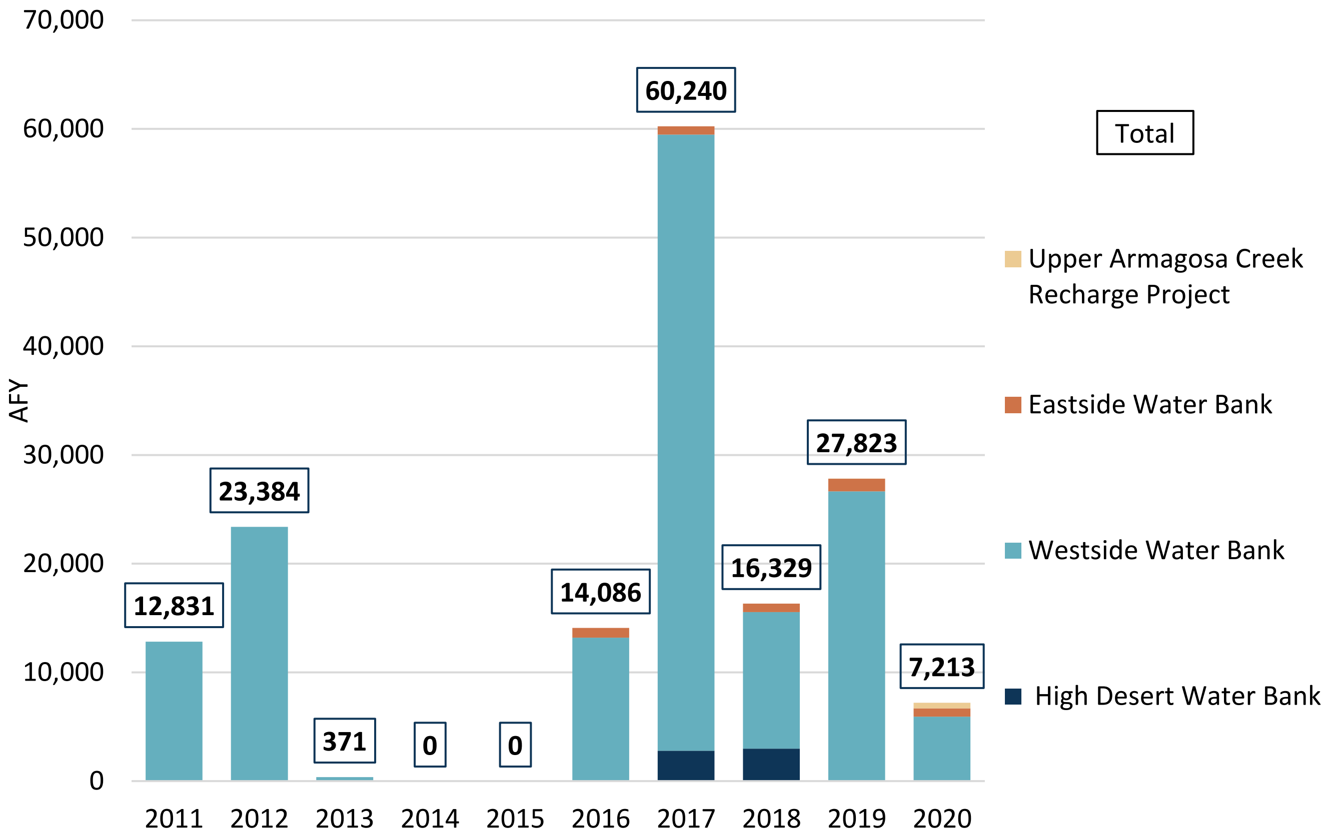
The Eastside Water Bank has an estimated total storage capacity of 6,700 AF and an estimated annual recharge capacity of 2,000 AFY. The Eastside Water Bank consists of 80 acres, with three two-acre recharge basins and three groundwater wells. The project allows for recharge of untreated water that is later recovered and blended with treated water from the Eastside Water Treatment Plant.

AVEK and partners—including Los Angeles County Waterworks Districts (LACWD), Palmdale Water District, and City of Palmdale—completed construction of the Upper Amargosa Creek Recharge Project in 2019. The project can recharge 1,600–2,350 AFY while preserving habitats for native animal species, including desert night lizards and coyotes, and providing additional flood protection. The project includes eight spreading basins, with a maximum capacity of 100 cubic feet per second during storms. The project was funded partly by Proposition 1E grant funds from DWR.

AVEK is currently developing the High Desert Water Bank in the western portion of the Antelope Valley Groundwater Basin along the East Branch of the California Aqueduct. The new groundwater storage facility is a partnership between AVEK and the Metropolitan Water District of Southern California to increase water supply reliability south of the Delta. As the project expands and additional phases are constructed, AVEK will have dedicated capacity and the ability to recover stored imported water from the groundwater basin and pump the recovered water into the East Branch of the California Aqueduct for downstream deliveries to AVEK's existing Water Treatment Facilities. The planned total storage capacity of the High Desert Water Bank will be 280,000 AF, with an estimated annual recharge capacity of 70,000 AFY. All AVEK water banks have a storage loss factor of 10%.

Local recovery of imported water from AVEK groundwater banks has become an important source of water for AVEK to supplement annual SWP water allocations. AVEK began recovering imported water from the groundwater banks in 2014, once SWP had been recharged and groundwater production wells were in place. A summary of AVEK's historical SWP deliveries to their banking sites is provided in **Figure 6-4**.

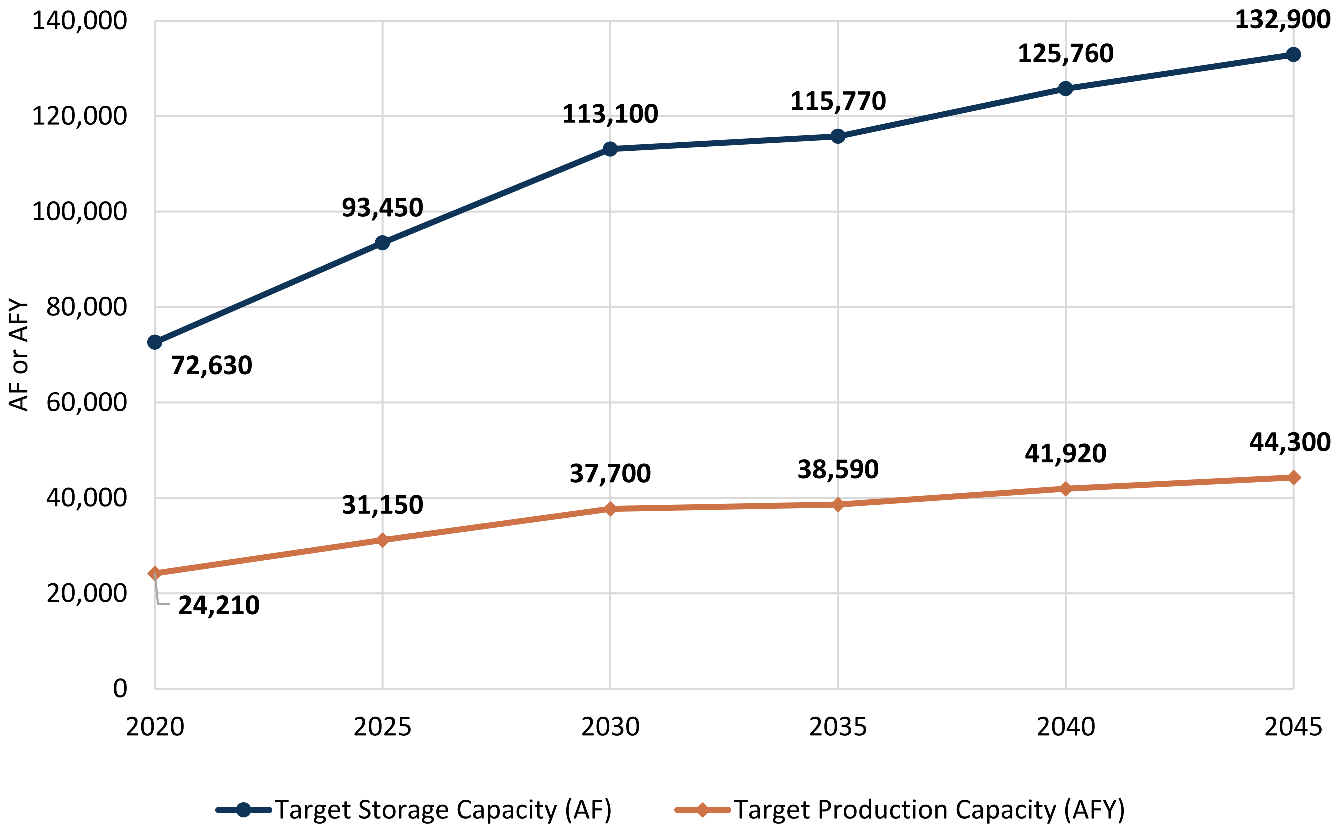
Figure 6-4. 2011–2020 AVEK Historical SWP Deliveries to Groundwater Banking Sites



AVEK's goal is to add storage in the groundwater banks so that the Agency is prepared to meet demands during three consecutive years of 10% Table A allocations from the SWP. AVEK currently has roughly 90,000 AF of SWP water stored within their banks for future recovery and is implementing infrastructure projects to expand its capacity to recharge water, recover water, and distribute recovered water.

Based on the demand projections presented in **Section 4.2**, the target groundwater bank storage capacity and annual production capacity are projected in **Figure 6-5**.

Figure 6-5. Projected AVEK Groundwater Banking Target Sizing



6.1.3 Water Quality

DWR has conducted water quality monitoring for the SWP since 1968. Initially, this program sought to monitor eutrophication (an increase in chemical nutrients) and salinity in the SWP. Over time, the water quality program expanded to include parameters of concern for drinking water, recreation, and wildlife. Water quality samples are collected at regular intervals throughout the year for chemical, physical, and biological parameters. The coverage of this program includes more than 40 locations associated with the SWP, from the Feather River drainage in the north to Lake Perris in the south.

In addition, AVEK routinely monitors for contaminants in the drinking water according to Federal and State laws. AVEK prepares an annual water quality report,[1] which provides results of the monitoring efforts. Through monitoring and testing, AVEK has found that some contaminants exist; however, all State and Federal drinking water requirements have been met. The presence of contaminants does not necessarily pose a health risk, and all drinking water, including bottled water, may be reasonably expected to contain at least small amounts of some contaminants.

The SWP water has moderate total organic carbon levels, resulting in higher disinfection byproduct (DBP) formation, and also has some taste- and odor causing compounds. AVEK's conventional surface water treatment plants use a treatment process of flocculation, sedimentation basins, ozone, followed by biologically active filters, and chlorination. The ozone effectively removes the taste and odor compounds, but DBP formation is a concern due to only moderate organics removal through the treatment process, followed by chlorination. AVEK uses the Eastside Water Bank to blend with water

[1] https://www.avek.org/water-quality-c1200b6

from the Eastside Water Treatment Plant (WTP) to control DBPs, and uses the Westside Water Bank to serve the Rosamond WTP system to minimize DBPs due to the long detention time of water in the system. Other than controlling DBP formation, there are no water quality parameters identified to be of special concern to AVEK at this time (Carollo, 2020).

6.2 Water Exchanges and Transfers

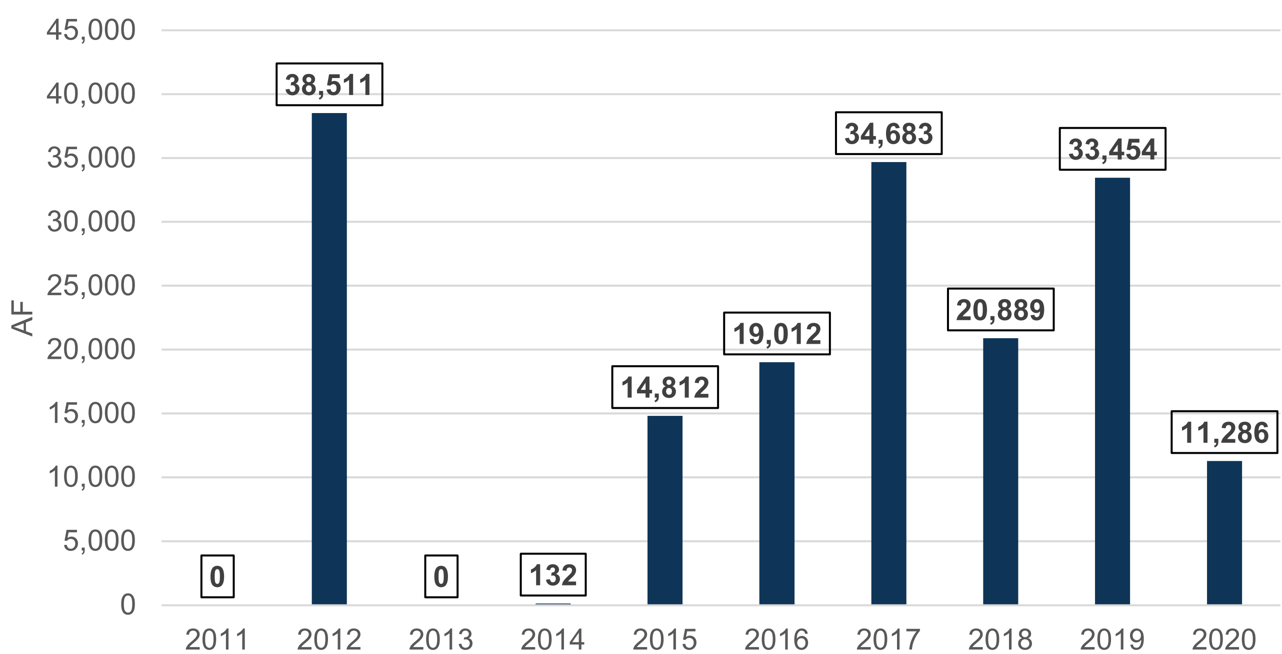
AVEK takes part in water exchanges and water transfers with other State Water Contractors, including suppliers within the greater Antelope Valley, to help meet demands within the region. A water exchange is water delivered by one water user to another, with the receiving water user providing water in return at a specified time or when conditions of the parties' agreement are met. A water transfer is a temporary or long-term change in the point in diversion, place of use, or purpose of use due to a transfer, sale, lease, or exchange of water or water rights. In the past 10 years, AVEK has executed 13 exchange agreements and eight transfer agreements totaling over 170,000 AF of water. In 2020, AVEK transferred or exchanged 11,286 AF of water to four agencies, as summarized in **Table 6-4**. **Figure 6-6** summarizes exchanges and transfer volumes from 2011 to 2020.

Table 6-4. 2020 AVEK Exchanges and Transfers

ENTITY NAME	DESCRIPTION	DWR AGREEMENT NO. (SWPAO#)	AMOUNT FROM AVEK TO OTHER AGENCIES (AF)
Kern County WA/V Lions	Table A Transfer	20-026	7,000
Littlerock Creek ID	1:1 Table A Exchange	07-031	1,380
Palmdale WD	1:1 Table A Exchange	18-032	1,500
Santa Clarita Valley WA	2:1 Table A Exchange	19-032	1,406
		TOTAL	**11,286**

Source: AVEK

Figure 6-6. 2011–2020 AVEK Annual Exchanges and Transfers Volumes



AVEK is developing a long-term exchange/storage program to further maximize the use of its SWP supplies and provide funding for purchase of additional water supplies. Other exchange programs are anticipated to be developed in the future to further secure the Agency's water supplies. Potential exchange deliveries have not been included in AVEK's projections of future water supplies.

AVEK also has an agreement with LACWD District 40 (LACWD No. 40) to transfer groundwater supplies, which is discussed in **Section 6.3**.

6.3 Groundwater

AVEK's groundwater wells are located within the Antelope Valley Groundwater Basin ("the Basin"). The Basin is a large, topographically closed alluvial basin with an estimated total storage capacity of about 68 to 70 million acre-feet. It consists of two primary aquifers: the upper unconfined aquifer ("principal aquifer"), which is the main source of groundwater for the area, and a lower aquifer that is considered to be confined. The Basin encompasses 1,580 square miles in Los Angeles, Kern, and San Bernardino counties. The groundwater basin boundaries have been defined by the California Department of Water Resources (DWR Basin Number 6-44).

Prior to 1972, groundwater provided more than 90% of the total water supply in the Antelope Valley. Since 1972, it is estimated that between 50% to 90% of the area's water supplies are from groundwater. Groundwater pumping peaked in the 1950s, and then declined as greater pumping lifts and increasing energy costs made the use of groundwater in the area less economical for agricultural uses. Groundwater levels in some areas have declined significantly since the early 1900s due to over-extraction According to the US Geological Service (USGS) (2003), groundwater levels declined more than 200 feet in some parts of the Basin, resulting in increased pumping lifts, reduced well efficiency, and land subsidence of more than six feet in some areas.

The Basin was adjudicated in 2015 after 15 years of complex proceedings among more than 4,000 parties, including public water suppliers, landowners, small pumpers and non-pumping property owners, and the Federal and State governments. The Antelope Valley Area of Adjudication covers approximately 1,390 square miles, or 90% of the groundwater basin.

The Antelope Valley Groundwater Basin Adjudication Judgment ("Judgment"), included in **Appendix F**, determined the Basin is in a state of overdraft, established respective water rights among groundwater producers based on the Basin's Native Safe Yield, and ordered a ramp-down of production to meet the Native Safe Yield by 2023. The adjudication defined a Native Safe Yield of 82,300 AFY. To achieve sustainable groundwater elevations, groundwater production will be reduced (ramped down) over a seven-year period (2016–2022) to a final Production Right. Following the adjudication, the Antelope Valley Watermaster was formed to implement the Judgment. The Watermaster is charged with administering the adjudicated water rights and managing the groundwater resources within the adjudicated portion of the Antelope Valley. **Figure 1-1** shows the adjudication boundary in relation to AVEK's service area. As shown in **Table 6-5**, the ramp-down period from 2016 to 2022 is causing substantial reductions in pumping in the Basin.

Table 6-5. Ramp-down Production Rights Within and Outside of AVEK's Service Area, AFY

	PRE-RAMP DOWN PRODUCTION RIGHTS	POST-RAMP DOWN PRODUCTION RIGHTS
AVEK	4,000.0	3,550.0
AVEK Customers	18,012.9	12,083.8
SUBTOTAL WITHIN AVEK SERVICE AREA	**22,012.9**	**15,633.8**
Non-AVEK Customers	114,007.3	66,666.2
TOTAL	**136,020.2**	**82,300.0**

Source: Judgement

There are seven potential production categories identified in the Judgment: production rights, ramp-down production, imported water return flows, carryover water, stored water, other rights to produce groundwater, and additional production. Production rights are divided into five categories: overlying production rights, non-overlying production rights, Federal Reserve water rights, small pumper class, and California production rights. Detailed information regarding each production category is available in the annual reports. The most recent available report is included in **Appendix G**.

Of most relevance to AVEK are Overlying Production Rights and Non-Overlying Production Rights within the AVEK service area, because this groundwater is the primary supply other than imported water from AVEK. AVEK has an overlying production right of 3,550 AFY.

Table 6-6. Non-Overlying Producers' Production Rights by AVEK Customers

PRODUCER	PRODUCTION RIGHT (AFY)
Boron Community Services District	50.0
California Water Services Company	343.1
Desert Lake Community Services District	73.5
LACWD No. 40	6,789.3
North Edwards Water District	49.0
Palm Ranch Irrigation District	465.7
Quartz Hill Water District	563.7
Rosamond Community Services District	404.4
West Valley County Water District	40.0
TOTAL	**8,778.8**

Note: From Judgment Table A-1 Exhibit 3. Excludes Palmdale Water District and Littlerock Creek Irrigation District. Both have their own SWP contracts.

Table 6-7. Overlying Producers' Production Rights by AVEK Customers

PRODUCER	PRODUCTION RIGHT (AFY)
60th Street Association Water System	2.2
Antelope Park Mutual Water Company	169.9
Antelope Valley Mobile Estates	8.8
Aqua-J Mutual Water Company	44.4
Averydale Mutual Water Company	254.4
Baxter Mutual Water Company	35.0
Bleich Flat Mutual Water Company	33.5
Evergreen Mutual Water Company	68.5
Land Projects Mutual Water Company	613.5
Landale Mutual Water Company	155.6
Llano del Rio Water Company	279.0
Llano Mutual Water Company	0.0
Miracle Improvement Corporation dba Golden Sands Mobile Home Park/Trailer Park	27.0
Shadow Acres Mutual Water Company	51.7
Sundale Mutual Water Company	472.2
Tierra Bonita Mutual Water Company	40.3
West Side Park Mutual Water Co.	276.9
White Fence Farms Mutual Water Co.	772.1
NON-AVEK SUBTOTAL	**3,305.0**
AVEK	3,550.0
TOTAL WITHIN AVEK SERVICE AREA	**6,855.0**

Note: From Table A-2 Exhibit 4

In addition, parties listed on Exhibit 8 of the Judgment have a right to imported water return flows equal to the applicable percentage multiplied by the average amount of imported water used by that party within the Basin in the preceding five-year period. AVEK has rights to the return flows used by parties not on Exhibit 8 of the Judgment. For example, AVEK received 822 AF of groundwater in 2019 from imported water return flows. Return flows from agricultural imported water use are set in the Judgment at 34%, and return flows from municipal and industrial imported water use are set in the Judgment at 39% of the amount of imported water used.

6.3.1 Groundwater Accounting

As shown in **Table 6-8**, AVEK has not pumped any of its production rights the last five years. The only groundwater account that AVEK has used during the last five years is recovery of stored imported water. As a result, AVEK has increased available groundwater for future years through storage of carryover water and return flows. Also, AVEK has an agreement with LACWD to transfer groundwater on a non-permanent basis from AVEK to LACWD, which helps LACWD mitigate for its wells with poor water quality.

Table 6-8. Groundwater Volume Pumped (DWR UWMP Table 6-1W)

LOCATION, TYPE	2016	2017	2018	2019	2020
Antelope Valley Basin, Production Rights	-	-	-	-	-
Antelope Valley Basin, Banked SWP Water	11,512	7,868	9,162	9,234	12,228
TOTAL:	**11,512**	**7,868**	**9,162**	**9,234**	**12,228**

6.3.2 Water Quality

Groundwater quality in the upper aquifer is generally suitable for domestic, agricultural, and industrial use. Total Dissolved Solids (TDS) concentrations are in the range of 200 to 800 milligrams per liter (mg/L). The deep aquifer typically has higher TDS concentrations. Hardness levels range from 50 to 200 mg/L. High fluoride, boron, nitrates, hexavalent chromium, and arsenic are found in some areas of the Basin. However, AVEK has not had and does not anticipate groundwater quality issues with its wells.

6.4 Non-SWP Water

On January 1, 2017, AVEK acquired an additional non-SWP water supply through a long-term lease of annual supply originally belonging to the Nickel Family, a farming interest in Kern County. AVEK has acquired the rights to 1,700 acre-feet of water made available for a period of 35 years (with an option to extend for 35 more years), even in dry years. Additional non-SWP supplies improves the Agency's reliability of its existing water supply, as well as provide additional supplies to meet future demand.

6.5 Wastewater and Recycled Water

AVEK does not provide supplemental treatment to recycled water and does not distribute recycled water. The Agency has no plans to provide recycled water as a part of its future deliveries. As a result, **DWR Table 6-3**, **Table 6-4**, and **Table 6-5** have not been completed and are not included in the UWMP.

Agencies within AVEK's service area do collect, treat, and distribute recycled water. In accordance with the 2020 UWMP Guidebook, information regarding wastewater facilities and recycled water use within AVEK's service area is provided below.

6.5.1 Recycled Water Coordination

The most recent coordination to document the collection, treatment, and distribution of recycled water in the greater Antelope Valley region occurred as part of the Antelope Valley Integrated Regional Water Management Plan (IRWMP) 2019 update.

Agencies responsible for operating, managing, and using the recycled water systems in the region are:

- Los Angeles County Sanitation Districts (LACSD) Nos. 14 & 20
- Los Angeles County Waterworks District No. 40
- Palmdale Recycled Water Authority (includes the City of Palmdale and the Palmdale Water District)
- Rosamond Community Services District (CSD)
- Edwards Air Force Base (EAFB)

6.5.2 Wastewater Collection, Treatment, and Disposal

The greater Antelope Valley region's municipal wastewater is generated from a combination of residential and commercial sources. The Cities of Lancaster and Palmdale own, operate, and maintain the wastewater collection systems in their respective service areas. In addition, the LACSD No. 14 and No. 20 serve the Antelope Valley. LACSD No. 14 serves a large portion of Lancaster, portions of Palmdale, and adjacent unincorporated areas of Los Angeles County. LACSD No. 20 provides wastewater management services for the Palmdale area as well as adjacent unincorporated Los Angeles County areas.

Recycled water in the greater Antelope Valley is available from two primary sources, the Lancaster Water Reclamation Plant (WRP) and the Palmdale WRP. The LACSD owns and operates the Lancaster WRP and Palmdale WRP, which collect wastewater from the Cities of Palmdale and Lancaster. Wastewater is treated to tertiary levels that are suitable for non-potable uses and groundwater recharge. The Lancaster WRP has a permitted capacity of 18.0 million gallons per day (MGD) and in 2019 treated 15,052 AF, which is used for irrigation, agriculture, urban reuse, wildlife habitat, maintenance, and recreational impoundments. The Palmdale WRP has a permitted capacity of 12.0 MGD and in 2019 treated 9,021 AF of wastewater for agricultural and urban reuse. The Lancaster WRP collects most of the wastewater produced within the AVEK service area.

The Rosamond CSD owns and operates the Rosamond Wastewater Treatment Plant (WWTP) located in the town of Rosamond. The Rosamond WWTP has a permitted capacity of 1.27 MGD and in 2019 treated 1,222 AF. The Rosamond WWTP currently produces secondary-treated water. In 2008, Rosamond CSD developed a plan to build a tertiary treatment plant with a potential for future expansion. However, construction to complete the upgrades is on hold indefinitely due to lack of funding and other economic considerations.

EAFB has two treatment plants that distribute recycled water to the base. The EAFB Air Force Research Laboratory Treatment Plant is a secondary wastewater treatment plant that discharges all of its effluent to evaporation ponds at the base. In 2019, approximately 34 AF was sent to the evaporation ponds. The EAFB Main Base WWTP produces tertiary treated effluent for landscape irrigation at the base golf course, and excess effluent is discharged to the evaporation ponds, which totaled approximately 387 AF in 2019.

The majority of the wastewater currently collected from within the LACWD No. 40 service area is treated and discharged outside its service area. However, recycled water from the Palmdale and Lancaster WRPs is projected to be a potential source of supply for LACWD No. 40 with completion of the Antelope Valley Backbone project. This project will provide the necessary distribution infrastructure to convey recycled water from the two WRPs to additional users in the Antelope Valley. To date, only a portion of the Antelope Valley Backbone has been constructed.

AVEK's retailers have projected increased use of recycled water to offset potable use, but to-date little progress has been made implementing recycled water projects within AVEK's service area. **Table 6-9** summarizes recycled water use projections from LACWD No. 40. For supply and demand analysis in this UWMP, no additional recycled water is assumed to be developed through 2045.

Table 6-9. Retail Recycled Water Projection Within AVEK Service Area

RETAILER	2020	2025	2030	2035	2040
LACWD No. 40	0	13,500	15,200	17,000	18,700

Source: LACWD No. 40 Draft 2020 UWMP (Brown & Caldwell, 2021).

6.6 Surface Water

AVEK does not have sources of surface water supply other than imported SWP water.

6.7 Stormwater

AVEK does not intentionally divert stormwater for beneficial use.

6.8 Desalinated Water Opportunities

AVEK has no plans for the development of desalinated water supplies within the planning horizon of this UWMP.

6.9 Future Water Projects

A description of future projects that AVEK may implement to increase water supplies is provided below.

Westside Water Bank Improvements

Construction of permanent underground piping. The project includes the replacement of temporary irrigation piping with permanent buried pipelines and appurtenances, which will improve the ability to achieve the recharge goals at the bank during wet years.

Eastside Water Bank Expansion

The expansion project will significantly increase the recharge capacity of the bank by building 85 acres of recharge basins, providing 10,400 AFY of additional capacity (for a total capacity of 11,600 AFY). The project also includes well equipping to provide an additional 300 gpm of recovery capacity.

Enterprise / High Desert Water Bank Expansion

Development of a new groundwater recharge and recovery facility, including recharge basins and pipelines, groundwater recovery wells, well collection system, and transmission and pumping facilities to deliver water from the bank to the California Aqueduct for delivery to the AVEK's banking partners. As the program expands, the Agency will also have recharge and recovery capacity in the Bank to meet increase local demands and improve water supply resiliency.

South-North Intertie Pipeline Phase 2

The South-North Intertie Pipeline Phase II Project includes the construction of a 6.5 mile 48-inch diameter potable water pipeline and equipping the existing pump station with new pumps. The new pipeline will tie into AVEK's existing South North Intertie Pipeline and connect the Westside Water Bank to the Quartz Hill Water Treatment Plant. Environmental review, feasibility study, and property acquisition are complete. Final design is nearly complete (90%). Construction of the pipeline will allow access to up to 75,000 AF of water currently stored in the Westside Water Bank and enable delivery throughout the AVEK service area.

6.10 Summary of Projected Water Supplies

AVEK's primary water supplies consist of the following sources:

SWP, Table A Allocation

Average yield based on DWR 2019 DCR and presented in **Table 6-2**.

Antelope Valley Groundwater Basin Production Rights

Based on the Judgment.

Antelope Valley Groundwater Basin Imported Water Return Flows

Estimate based on projected imported water demands for parties not on Exhibit 8 of the Judgment.

Non-SWP Water

Estimate based on reliable supply of 1,700 AFY, as described in **Section 6.4**.

The projected reasonably available volumes summarized in **Table 6-10**. In addition, AVEK can supplement supplies by recovering banked SWP water in groundwater or accessing supplies, if available, such as carryover groundwater or SWP water types other than Table A.

Table 6-10. Projected Water Supplies (DWR UWMP Table 6-9W)

	2025	2030	2035	2040	2045
SWP Table A	81,840	79,660	77,490	75,320	75,320
Groundwater, Production Rights	3,550	3,550	3,550	3,550	3,550
Groundwater, Imported Water Return Flows	800	800	800	800	800
Non-SWP Water	1,700	1,700	1,700	1,700	1,700
TOTAL	**87,890**	**85,710**	**83,540**	**81,370**	**81,370**

6.10.1 Climate Change Effects

Climate models disagree on average annual precipitation projections but agree on other hydrologic metrics relevant to water resources management, including (Persad, 2020) (Partida, 2020):

- Snowpack declines
- Increased fraction of precipitation on extreme rainfall days
- Shorter, sharper rainy season
- Increased evapotranspiration
- Higher frequency of extremely wet and extremely dry years
- Higher incidence of extremely dry year followed an extremely wet year, or vice versa

As discussed at greater length in the 2019 Antelope Valley IRWMP (Antelope Valley Integrated Regional Water Management Group, 2019), climate change is expected to increase average temperature by at least 5 degrees Fahrenheit by 2100. Despite the potential minimal impact on total annual precipitation, climate change is expected to result in a larger proportion of precipitation coming in the form of intense single-day events.

The largest impact of climate change on AVEK will likely be seen from SWP availability. The DWR 2019 DCR included a model study representing hydrologic and sea level rise conditions at 2040 to evaluate SWP supply availability under future conditions. The future condition study used the same model assumptions as the study under existing conditions but reflected changes expected to occur from climate change, specifically projected temperature and precipitation changes centered around 2035 (2020 to 2049) and a 45 centimeter sea level rise.

The long-term average allocations reported for the future conditions study from 2019 DCR is applied starting in 2040, with a straight-line decrease from existing conditions, as described in **Section 6.1.1** and presented in **Table 6-2**.

6.11 Energy Intensity

AVEK must include information that could be used to calculate the energy intensity of their water service per Water Code Section 10631.2.(a). AVEK water service energy intensity was estimated based on readily available electrical billing data and water production data. AVEK compiled electrical billing records from 2017 through 2020 and calculated the annual electrical consumption for its treatment plants and distribution system combined. The analysis focused on treated water deliveries because untreated water deliveries are typically via gravity from the California Aqueduct, and AVEK transfers and exchanges are outside of its service area. Based on this information, AVEK's average water service energy intensity was 261 kilowatt hours per AF (kWh/AF) of treated water delivered, as shown in **Table 6-11**.

Table 6-11. 2017–2020 AVEK Energy Intensity Estimates

	2017	2018	2019	2020	2017-2020 TOTAL
Electricity (kWh)	8,616,000	9,909,000	10,941,000	11,031,000	40,497,000
Treated Water Deliveries (AF)	34,205	39,058	40,858	40,960	155,082
ENERGY INTENSITY (KWH/AF)	**252**	**254**	**268**	**269**	**261**

7

URBAN WATER MANAGEMENT PLAN

Water Supply Reliability and Drought Risk Assessment

This chapter evaluates AVEK's water supply reliability under various drought and non-drought conditions and shows the benefits of AVEK's investment in groundwater banking to manage the high variability of SWP water.

This chapter describes the reliability of the Antelope Valley-East Kern Water Agency (AVEK or Agency) water supply. It presents 25-year projections for normal, single dry, and multiple dry years, and assesses the drought risk over the next five years. Water supply reliability reflects AVEK's ability to meet the water needs of its customers with water supplies under varying conditions. The analysis considers plausible hydrological and regulatory variability, climate conditions, and other factors that affect the Agency's water supply and demand.

IN THIS SECTION

AVEK's water sources and their constraints are described in detail in **Chapter 6**. The primary constraint on availability of State Water Project (SWP) supplies has been extreme drought conditions, and SWP availability depends on rainfall, snowpack, runoff, reservoir storage, pumping capacity of SWP facilities, and regulatory and environmental mandates on SWP operations. The 2019 SWP Delivery Capability Report (DCR) (California Department of Water Resources, 2020) provides SWP water supply availability under both existing (2020) and future (2040) conditions.

AVEK has invested in its groundwater banking programs to stabilize the swings in SWP water availability by storing surplus SWP water through groundwater recharge and pumping from recovery wells in times of need. The following sections analyze the performance of AVEK's supplies under different conditions.

7.1 Water Supply Reliability Assessment

This section presents AVEK's expected water supply reliability for a normal year, single dry year, and five consecutive dry years, including projections for 2025, 2030, 2035, 2040, and 2045.

AVEK's supplies for this assessment include:

SWP Table A Allocation

Yield based on the California Department of Water Resources (DWR) 2019 DCR, described in **Section 6.1.1** and summarized below.

Antelope Valley Groundwater Basin Production Rights

3,550 acre-feet per year (AFY) based on the Stipulated Judgment (Judgment) for the 2015 Antelope Valley Groundwater Adjudication.

Antelope Valley Groundwater Basin Imported Water Return Flows

800 AFY based on projected imported water demands for parties not on Exhibit 8 of the Judgment.

Non-SWP Water

1,700 AFY based on existing agreement and the supplies have high reliability, as described in **Section 6.4**.

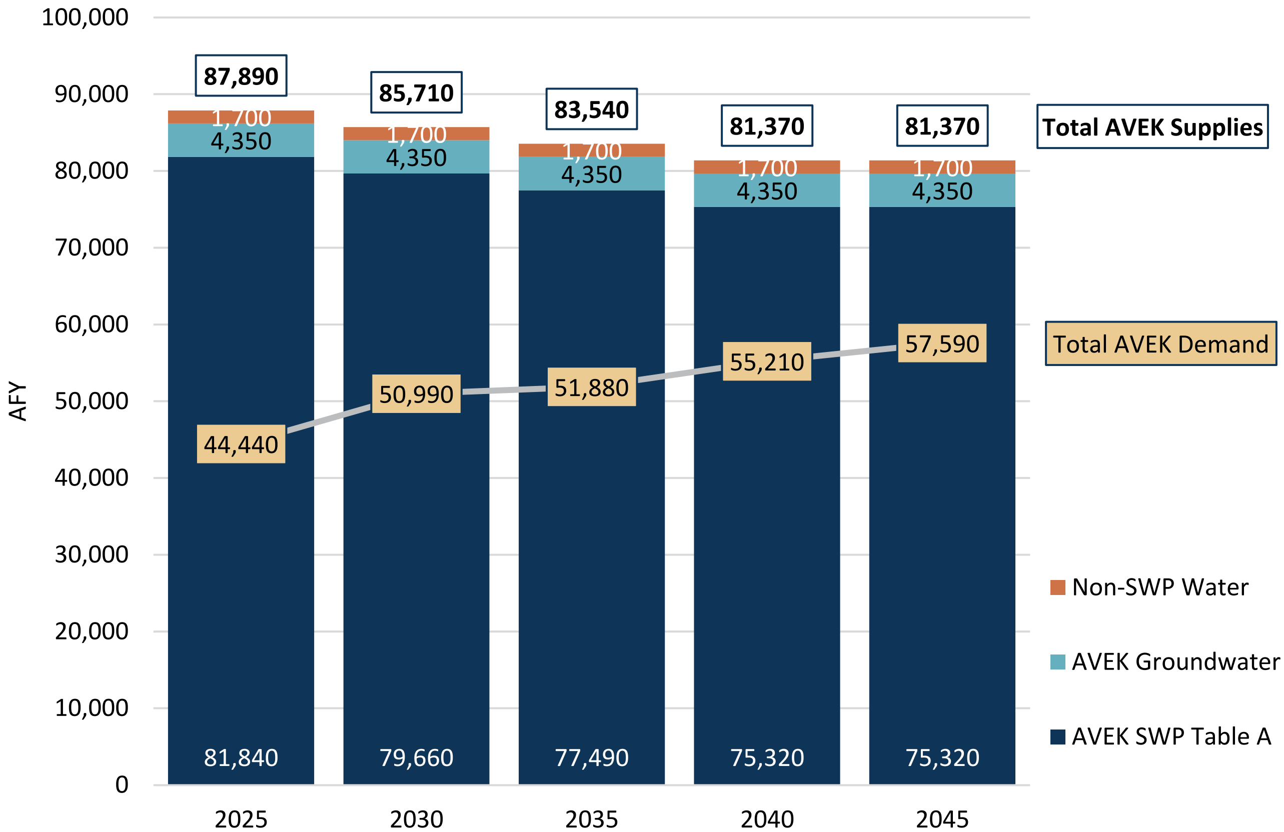
7.1.1 Water Supply Reliability – Normal Year

Average SWP Table A allocation is projected to decrease from 58% in 2020 to 52% in 2040 as shown in **Table 7-1**. Total normal year AVEK supplies are shown in **Figure 7-1** and, based on these assumptions, AVEK has sufficient supplies in normal years and could use available supplies to add groundwater storage for dry periods. For example, SWP water could be recharged when available, or unused groundwater rights can be carried over for use in future years.

Table 7-1. SWP Average Yield Projections

	2020	2025	2030	2035	2040	2045
Average Table A Allocation (%)	58.0%	56.5%	55.0%	53.5%	52.0%	52.0%
Average Table A Yield (AFY)	84,010	81,840	79,660	77,490	75,320	75,320

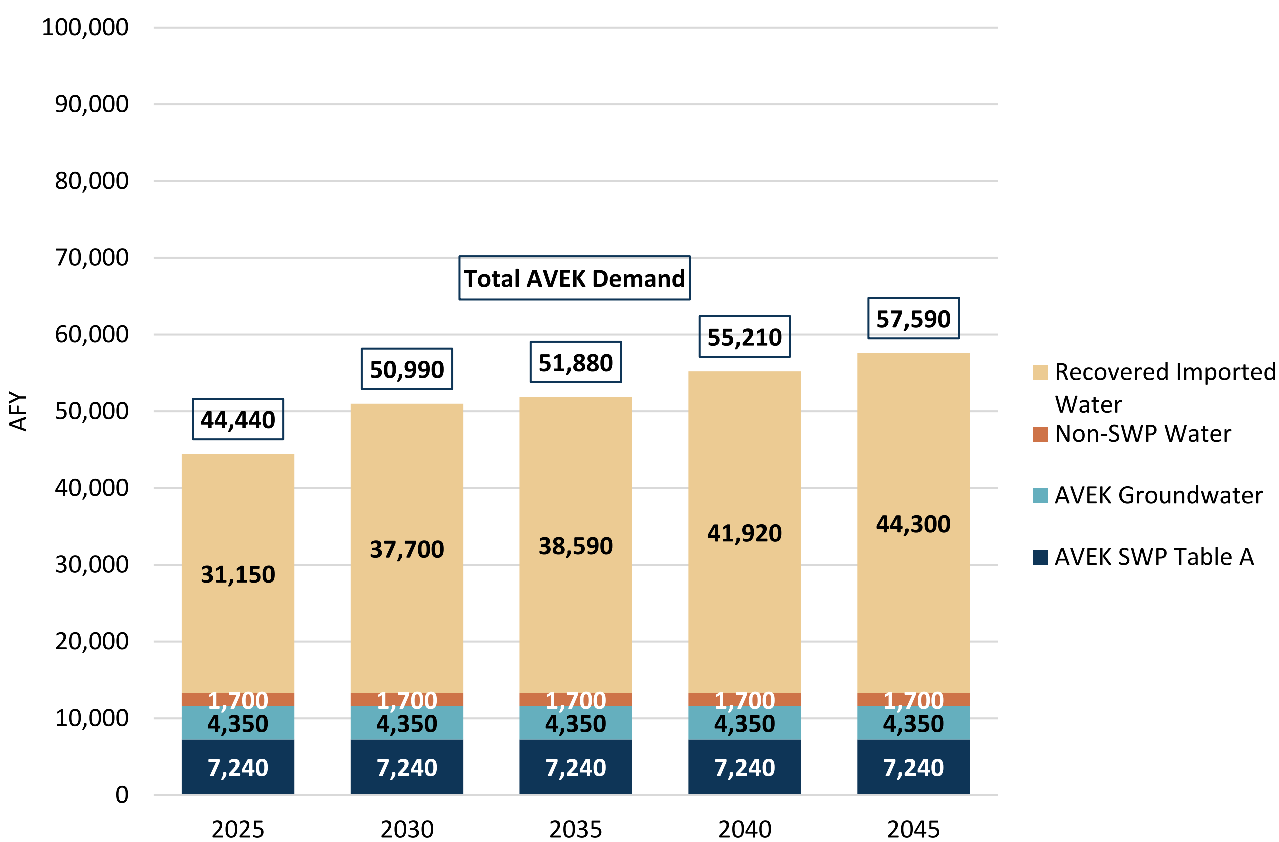
Figure 7-1. AVEK Supply and Demand Projections, Normal Year



7.1.2 Water Supply Reliability – Single Dry Year

Single dry year yield for SWP water is based on actual 2014 and 2021 (as of May 2021) allocation of 5%. Groundwater rights and non-SWP water are not impacted by short-term drought conditions, so normal year supply assumptions are applied. The remainder of demand is met with groundwater in storage. As discussed in **Section 6.1.2**, AVEK's annual banking recovery target is to produce at least enough groundwater to meet demand with 10% Table A allocations from the SWP. As shown in **Figure 7-2**, recovered imported water from AVEK groundwater banks enable AVEK to meet its demands in a single dry year.

Figure 7-2. AVEK Supply and Demand Projections, Single Dry Year



7.1.3 Water Supply Reliability – Five Consecutive Dry Years

For multiple dry years, SWP water availability is based on 1988 to 1992 simulated yield from the 2019 SWP DCR, which estimated the following annual Table A allocation:

- **Year 1 (1988)** 12.3%
- **Year 2 (1989)** 32.2%
- **Year 3 (1990)** 13.3%
- **Year 4 (1991)** 25.6%
- **Year 5 (1992)** 18.0%

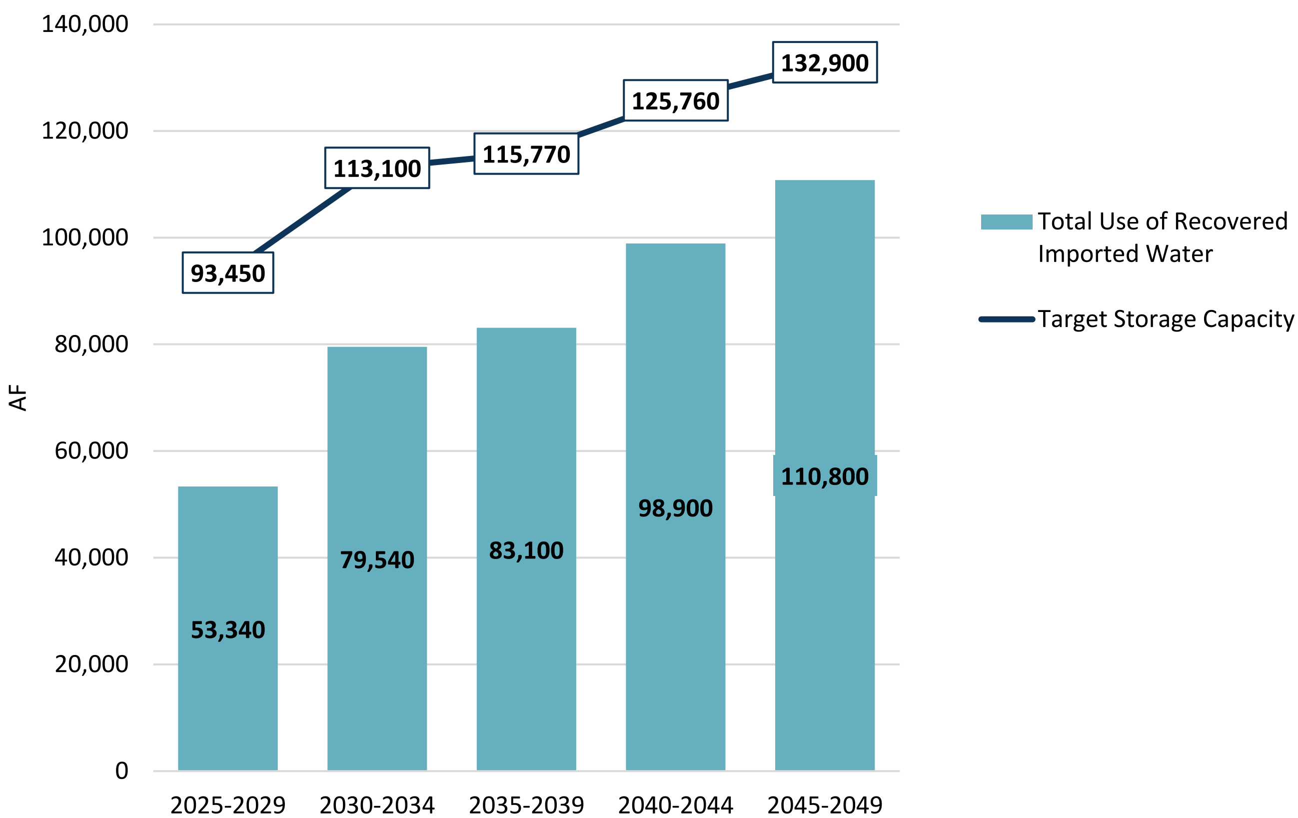
Similar to single dry year, groundwater rights and non-SWP water are not impacted by an extended drought, and recovered imported water from AVEK groundwater banks are used to meet remaining demands. **Table 7-2** summarizes AVEK supply and demand totals for the multiple dry year scenario.

Table 7-2. Multiple Dry Years Supply and Demand Comparison (DWR UWMP Table 7-4W)

		2025	2030	2035	2040	2045
First Year	Supply Totals	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	DIFFERENCE	**0**	**0**	**0**	**0**	**0**
Second Year	Supply Totals	52,730	52,730	52,730	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	DIFFERENCE	**8,290**	**1,740**	**850**	**0**	**0**
Third Year	Supply Totals	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	DIFFERENCE	**0**	**0**	**0**	**0**	**0**
Fourth Year	Supply Totals	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	DIFFERENCE	**0**	**0**	**0**	**0**	**0**
Fifth Year	Supply Totals	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	DIFFERENCE	**0**	**0**	**0**	**0**	**0**

As discussed in **Section 6.1.2**, AVEK's total banking storage target is at least enough groundwater to meet demand with 10% Table A allocations from the SWP for three consecutive years. **Figure 7-3** presents the total volume imported water recovered water from AVEK groundwater banks during a multiple year drought compared with the target total storage volume. As shown in the figure, additional recovery of imported water from AVEK groundwater banks would be available if the five-year drought continued.

Figure 7-3. AVEK Groundwater Bank Storage Capacity vs. Use During Five Consecutive Dry Years



7.2 2021–2025 Drought Risk Assessment

Water Code Section 10635(b) is a new provision of the Water Code that requires a Drought Risk Assessment (DRA) for the upcoming five years (2021 to 2025) based on the five driest years on record.

The supply assumptions are similar to the multiple dry year assumptions in the previous section:

SWP Table A Allocation

Yield based on five years with lowest yield from the DWR 2019 DCR, 1988 to 1992.

Antelope Valley Groundwater Basin Production Rights

Reducing ramp-down production rights from 3,730 AFY in 2021 to 3,550 AFY production rights in 2023.

Antelope Valley Groundwater Basin Imported Water Return Flows

800 AFY based on projected imported water demands for parties not on Exhibit 8 of the Judgment. (This value is a rough estimate because it can change over time).

Non-SWP Water

Same value (1,700 AF) in each year.

AVEK Groundwater Bank

Used to meet remaining demand and sized to meet demands in a year with SWP Table A 5% allocation.

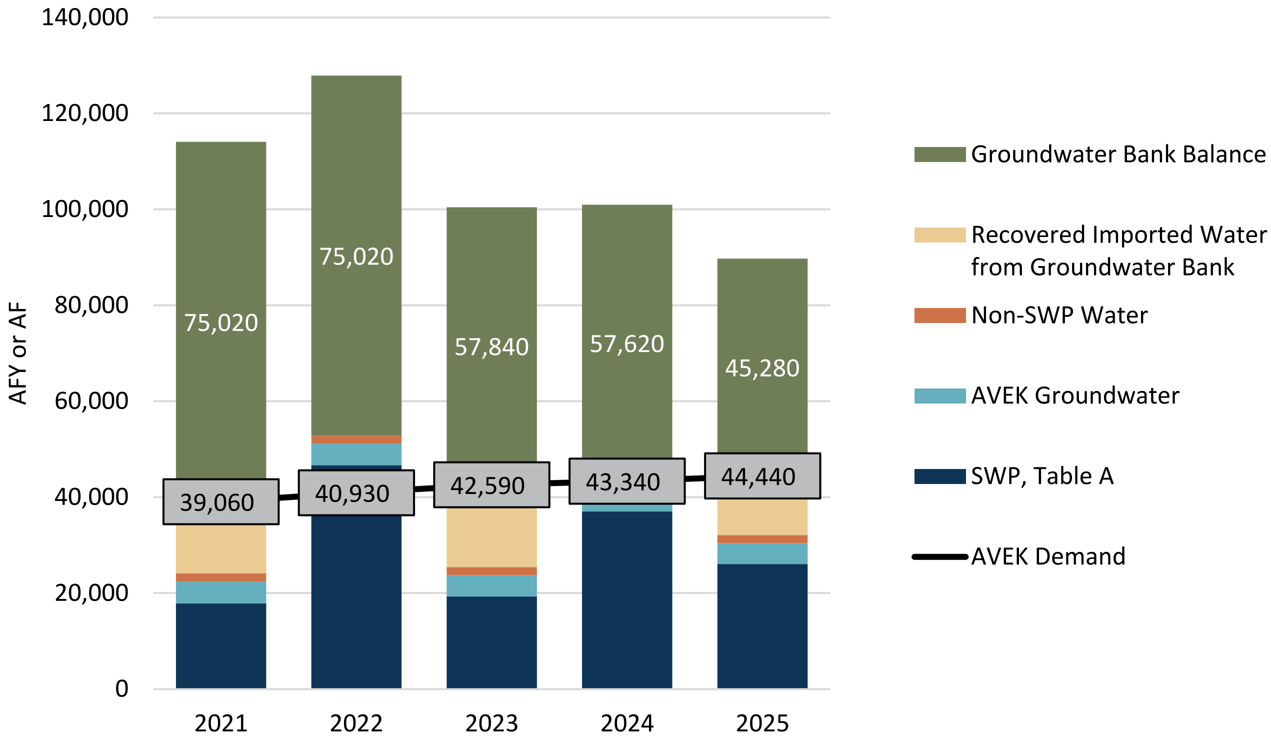
AVEK currently has roughly 90,000 AF of imported water stored within its groundwater banks for future recovery and is implementing infrastructure projects to expand its capacity to recharge water, recover water, and distribute recovered water. As shown in **Table 7-3,** AVEK still would have over 45,000 AF of groundwater remaining in storage at the end of a five-year drought that starts in 2021.

Table 7-3. AVEK Supply Projections for 2021–2025 Drought Risk Assessment

SUPPLIES	2021	2022	2023	2024	2025
SWP, Table A	17,850	46,680	19,280	37,040	26,050
AVEK Groundwater	4,530	4,480	4,430	4,380	4,350
Non-SWP Water	1,700	1,700	1,700	1,700	1,700
Recovered Imported Water from Groundwater Bank	14,980	0	17,180	220	12,340
TOTAL AVEK SUPPLIES	**39,060**	**52,860**	**42,590**	**43,340**	**44,440**

Note: Groundwater bank supplies are used to meet balance of demand.

Figure 7-4. 2021–2025 AVEK Drought Reliability Assessment



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URBAN WATER MANAGEMENT PLAN

Water Shortage Contingency Plan

This Water Shortage Contingency Plan describes how AVEK intends to respond to foreseeable and unforeseeable water shortages. This chapter provides an overview. The full plan is in Appendix H.

This Water Shortage Contingency Plan (WSCP) is a detailed plan for how the Antelope Valley-East Kern Water Agency (AVEK or Agency) intends to respond to foreseeable and unforeseeable water shortages. A water shortage occurs when the water supply is reduced to a level that cannot support typical demand at any given time. The WSCP provides guidance by identifying response actions to allow for efficient management of any water shortage with predictability and accountability. The tools in the WSCP enable AVEK to maintain reliable supplies and reduce the impact of supply interruptions due to extended drought or catastrophic supply interruptions.

The WSCP describes the following:

1. **Water supply reliability analysis:** Summarizes AVEK's water supply analysis and reliability, and identifies any key issues that may trigger a shortage condition.
2. **Annual water supply and demand assessment procedures:** Describes the key data inputs, evaluation criteria, and methodology for assessing the system's reliability for the coming year and the steps to formally declare any water shortage levels and response actions.
3. **Standard shortage stages:** Establishes water shortage levels to clearly identify and prepare for shortages.
4. **Shortage response actions:** Describes the response actions that may be implemented or considered for each stage to reduce gaps between supply and demand, and to minimize social and economic impacts to the community.
5. **Communication protocols:** Describes communication protocols under each stage to ensure customers, the public, and government agencies are informed of shortage conditions and requirements.
6. **Compliance and enforcement:** This section is not applicable to wholesalers such as AVEK.
7. **Legal authority:** Lists the legal ordinance that grants AVEK the authority to declare a water shortage and implement and enforce response actions.
8. **Financial consequences of WSCP implementation:** Describes the anticipated financial impact of implementing water shortage stages and identifies mitigation strategies to offset financial burdens.
9. **Monitoring and reporting:** This section is not applicable to wholesalers such as AVEK.
10. **WSCP refinement procedures:** Describes the factors that may trigger updates to the WSCP and outlines how to complete an update.
11. **Special water features distinctions:** This section is not applicable to wholesalers such as AVEK.
12. **Plan adoption, submittal, and availability:** Describes the process for the WSCP adoption, submittal, and availability after each revision.

The 2021 WSCP is a stand-alone document that can be modified as needed. It is included as **Appendix H**.

9

URBAN WATER MANAGEMENT PLAN

Demand Management Measures

This chapter describes AVEK's implementation of wholesale demand management measures intended to promote water use efficiency and partner with retail agencies to support sustainable management of regional water supplies.

Demand management is an integral part of sustainably managing water resources in California. Implementation of demand management measures (DMMs) that help lower demand can improve water supply reliability and help meet both state and regional water conservation goals. This chapter describes the Antelope Valley-East Kern Water Agency's (AVEK or Agency) efforts as a wholesale water supplier to promote conservation and reduce demands on water supplies.

IN THIS SECTION

- Metering
- Public Education and Outreach
- Conservation Staffing
- Asset Management

AVEK has been a leader in water use efficiency for many years. The Agency actively collaborates with local and regional agencies and the communities it serves to support innovative programs that drive change. AVEK implements DMMs as part of its ongoing operations, which are detailed in the following sections.

9.1 Demand Management Measures for Wholesale Suppliers

AVEK's system is fully metered, and unmetered connections have never been operated. AVEK charges all customers based on metered readings and established rate schedules. All current and new connections, including temporary connections, are required to be metered and billed per volume of use. Existing meters are regularly checked for leakage and accuracy.

9.2 Public Education and Outreach

A summary of public education and outreach measures implemented by AVEK are as follows:

- AVEK was the lead agency in the formation of the Antelope Valley Water Conservation Coalition (AVWCC). The AVWCC includes water districts, cities, builders, landscapers, designers, legislators, and other interested parties within the region. Water conservation in the greater Antelope Valley region is discussed during regular meetings, and the coalition provides periodic public education messaging regarding water conservation issues.
- AVEK was the lead agency and principal funding source for the development of the website AVSavesWater.com, which provided information on water conservation, water smart landscaping, resources, and rebate opportunities. The content is now hosted at avswca.org.
- AVEK sponsored water conservation grant programs in 2014 and 2015 to supporting customer conservation projects, focusing on turf buyback programs. A total of $430,000 was made available to the grant programs in fiscal years 2014 and 2015.
- AVEK was the lead agency and principal funding source for the Antelope Valley State Water Contractors Association's Water Conservation/SMART Landscaping Expos, which were held from 2014 to 2019. (The 2020 event was canceled due to COVID-19 safety restrictions.)

9.3 Water Conservation Program Coordination and Staffing

AVEK has designated a Water Conservation Program Coordinator and has established a water conservation group as part of their Board of Directors' Public Information Committee, which meets regularly. The program coordinator leads implementation of ongoing water conservation efforts described in this chapter and the Water Shortage Contingency Plan in **Appendix H**.

9.4 Asset Management

AVEK maintains its facilities according to the operations and maintenance manuals for its various facilities and equipment. In addition, AVEK conducts periodic inspections to assess the conditions of facilities and recommend needed repairs or improvements. AVEK audits system losses monthly as a part of its normal billing procedures. Pipelines are driven regularly as part of water sample runs, during which personnel will note leaks if observed. The Agency repairs leaks promptly, on average about twice per year. The Agency's average long-term system loss is about 2% to 3%, which is considered to be within the margin of error and normal.

AVEK understands the importance of maintaining its capital facilities and has included the development of a formal asset management plan under the Capital and Human Resources Stewardship Goal of its 2015 Five-Year Strategic Plan as shown below:

- **Goal 5:** Capital and Human Resources Stewardship — AVEK will be efficient and thoughtful stewards of our human and capital resource assets.
  - **Strategy 2:** Maintain capital facilities to ensure optimum facility life:
    - **Objective 1:** Develop an Asset Management Plan
    - **Objective 2:** Maintain facilities operational support

AVEK is in the process of completing a Water System Management Plan (WSMP). The WSMP will evaluate the performance and condition of AVEK's potable water system under existing conditions and future conditions. The WSMP is intended to be a strategic document that guides AVEK with prioritization and decision-making regarding future water system improvements through the planning horizon of 2040 and build-out conditions. The goal of the WSMP is to assist AVEK in the planning and development of potable water system facilities to allow the Agency to reliably and efficiently serve water to its current customers, meet future growth, and respond to emergencies. **Chapter 7** of the WSMP specifically describes the capacity evaluations of the water system under existing and future delivery needs, water system hydraulics under existing and future delivery needs, and existing system replacement.

9.5 Wholesale Supplier Assistance Programs

AVEK's Wholesale Supplier Assistance Programs are described in **Section 9.2**.

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URBAN WATER MANAGEMENT PLAN

Plan Adoption, Submittal, and Implementation

This chapter describes the steps taken to adopt, submit, and make publicly available the 2020 UWMP, 2021 WSCP, and Appendix J addendum to the 2015 UWMP.

The 2020 Urban Water Management Plan (UWMP), 2021 Water Shortage Contingency Plan (WSCP), and 2015 UWMP addendum were prepared in a transparent manner, and the Antelope Valley-East Kern Water Agency (AVEK or Agency) actively engaged stakeholders, cities, counties, water agencies, and the public to both seek and distribute information about water use, supply, and reliability to strengthen the region's ability to assess and plan for its water future.

IN THIS SECTION

- UWMP Preparation and Adoption Notification
- Public Hearing and Adoption
- Plan Submittal to the State

10.1 Notifications

Water Code Section 10621(b) requires that suppliers notify cities and counties in which they serve water that the UWMP and WSCP are being updated and reviewed at least 60 days prior to the public hearing.

To fulfill this requirement, AVEK sent letters of notification of preparation to the following cities and counties within AVEK's service area 60 days prior to the public hearing:

City of California City	**City of Palmdale**	**Los Angeles County**
City of Lancaster	**Kern County**	**Ventura County**

In addition, AVEK notified their retail customers. Copies of the 60-day notification letters are attached as **Appendix D**.

10.2 Notice of Public Hearing

AVEK made the 2020 UWMP, 2021 WSCP, and 2015 UWMP addendum available for public review on May 25, 2021, and held a public hearing on June 8, 2021. The notice to the public was made once a week for two successive weeks. The public hearing was first noticed in the Valley Press on May 26, 2021, and noticed again on June 2, 2021. The hearing notices are attached as **Appendix D**. Prior to the public hearing, AVEK maintained a copy of the 2020 UWMP, 2021 WSCP, and 2015 UWMP addendum in its office and on the Agency's website at www.avek.org.

The 2020 UWMP, 2021 WSCP, and 2015 UWMP addendum were included as separate agenda items, noticed, and reviewed in a public hearing at the regularly scheduled AVEK Board of Directors meeting on June 8, 2021. This hearing provided cities, counties, and members of the public a chance to review the report and provide comment. The public hearing took place before the adoption, allowing opportunity for the report to be modified in response to public input.

The 2020 UWMP, 2021 WSCP, and 2015 UWMP addendum were adopted by AVEK's Board of Directors on August 10, 2021. A copy of the Resolution of Adoption is included as **Appendix E**.

10.3 Submittal of the UWMP and WSCP

The 2020 UWMP, 2021 WSCP, and 2015 UWMP addendum were submitted to the California Department of Water Resources (DWR) by August 13, 2021 using the DWR Water Use Efficiency Data Portal. The documents were also sent to the California State Library and to all cities and counties within AVEK's service area within 30 days of adoption.

10.4 Public Availability

AVEK will have a copy of the 2020 UWMP, 2021 WSCP, and 2015 UWMP addendum available for public review at the AVEK office (see address below) during normal business hours.

Antelope Valley-East Kern Water Agency

6500 W. Avenue N

Palmdale, CA 93551

The documents also will be posted on the Agency's website at www.avek.org.

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URBAN WATER MANAGEMENT PLAN

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A

Appendix A: 2020 UWMP DWR Checklist

2020 Guidebook Location	Summary as Applies to UWMP	Subject	2020 UWMP Location
Chapter 1	A plan shall describe and evaluate sources of supply, reasonable and practical efficient uses, reclamation and demand management activities.	Introduction and Overview	Executive Summary
Chapter 1	Each plan shall include a simple description of the supplier's plan including water availability, future requirements, a strategy for meeting needs, and other pertinent information. Additionally, a supplier may also choose to include a simple description at the beginning of each chapter.	Summary	Executive Summary
Section 2.2	Every person that becomes an urban water supplier shall adopt an urban water management plan within one year after it has become an urban water supplier.	Plan Preparation	N/A
Section 2.6	Coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	Plan Preparation	Section 2.3
Section 2.6.2	Provide supporting documentation that the water supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan and contingency plan.	Plan Preparation	Appendix D
Section 2.6	Wholesale suppliers will include documentation that they have provided their urban water suppliers with identification and quantification of the existing and planned sources of water available from the wholesale to the urban supplier during various water year types.	System Supplies	DWR Table 2-4W
Section 3.1	Describe the water supplier service area.	System Description	Section 3.1
Section 3.3	Describe the climate of the service area of the supplier.	System Description	Section 3.2
Section 3.4	Provide population projections for 2025, 2030, 2035, 2040 and optionally 2045.	System Description	Section 3.3
Section 3.4.2	Describe other social, economic, and demographic factors affecting the supplier's water management planning.	System Description	Section 3.3
Sections 3.4 and 5.4	Indicate the current population of the service area.	System Description and Baselines and Targets	Section 3.3
Section 3.5	Describe the land uses within the service area.	System Description	Section 3.4
Section 4.2	Quantify past, current, and projected water use, identifying the uses among water use sectors.	System Water Use	Chapter 4
Section 4.2.4	Retail suppliers shall provide data to show the distribution loss standards were met.	System Water Use	Section 4.2.7
Section 4.2.6	In projected water use, include estimates of water savings from adopted codes, plans and other policies or laws.	System Water Use	Section 4.2
Section 4.2.6	Provide citations of codes, standards, ordinances, or plans used to make water use projections.	System Water Use	Section 4.2
Section 4.5	Demands under climate change considerations must be included as part of the drought risk assessment.	System Water Use	Section 4.2.4

2020 Guidebook Location	Summary as Applies to UWMP	Subject	2020 UWMP Location
Section 5.1	Wholesale suppliers shall include an assessment of present and proposed future measures, programs, and policies to help their retail water suppliers achieve targeted water use reductions.	Baselines and Targets	Chapter 5
Sections 6.1 and 6.2	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought.	System Supplies	Chapter 6
Sections 6.1	Provide a discussion of anticipated supply availability under a normal, single dry year, and a drought lasting five years, as well as more frequent and severe periods of drought, *including changes in supply due to climate change.*	System Supplies	Section 6.9.1
Section 6.1	When multiple sources of water supply are identified, describe the management of each supply in relationship to other identified supplies.	System Supplies	Chapter 6 introduction
Section 6.1.1	Describe measures taken to acquire and develop planned sources of water.	System Supplies	Section 6.8
Section 6.2.8	Identify and quantify the existing and planned sources of water available for 2020, 2025, 2030, 2035, 2040 and optionally 2045.	System Supplies	Section 6.9
Section 6.2	Indicate whether groundwater is an existing or planned source of water available to the supplier.	System Supplies	Section 6.3
Section 6.2.2	Indicate whether a groundwater sustainability plan or groundwater management plan has been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	System Supplies	Section 6.3
Section 6.2.2	Describe the groundwater basin.	System Supplies	Section 6.3
Section 6.2.2	Indicate if the basin has been adjudicated and include a copy of the court order or decree and a description of the amount of water the supplier has the legal right to pump.	System Supplies	Section 6.3
Section 6.2.2.1	For unadjudicated basins, indicate whether or not the department has identified the basin as a high or medium priority. Describe efforts by the supplier to coordinate with sustainability or groundwater agencies to achieve sustainable groundwater conditions.	System Supplies	N/A
Section 6.2.2.4	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years	System Supplies	Section 6.3
Section 6.2.2	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	System Supplies	Section 6.3
Section 6.2.7	Describe the opportunities for exchanges or transfers of water on a short-term or long- term basis.	System Supplies	Section 6.2
Section 6.2.5	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	System Supplies (Recycled Water)	N/A
Section 6.2.5	Describe the recycled water currently being used in the supplier's service area.	System Supplies (Recycled Water)	Section 6.4
Section 6.2.5	Describe and quantify the potential uses of recycled water and provide a determination of the technical and economic feasibility of those uses.	System Supplies (Recycled Water)	N/A

2020 Guidebook Location	Summary as Applies to UWMP	Subject	2020 UWMP Location
Section 6.2.5	Describe the projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	System Supplies (Recycled Water)	N/A
Section 6.2.5	Describe the actions which may be taken to encourage the use of recycled water and the projected results of these actions in terms of acre-feet of recycled water used per year.	System Supplies (Recycled Water)	N/A
Section 6.2.5	Provide a plan for optimizing the use of recycled water in the supplier's service area.	System Supplies (Recycled Water)	N/A
Section 6.2.6	Describe desalinated water project opportunities for long-term supply.	System Supplies	Section 6.7
Section 6.2.5	Describe the wastewater collection and treatment systems in the supplier's service area with quantified amount of collection and treatment and the disposal methods.	System Supplies (Recycled Water)	N/A
Section 6.2.8, Section 6.3.7	Describe the expected future water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and for a period of drought lasting 5 consecutive water years.	System Supplies	Section 6.8
Section 6.4 and Appendix O	The UWMP must include energy information, as stated in the code, that a supplier can readily obtain.	System Suppliers, Energy Intensity	Section 6.10
Section 7.2	Provide information on the quality of existing sources of water available to the supplier and the manner in which water quality affects water management strategies and supply reliability	Water Supply Reliability Assessment	Chapter 6
Section 7.2.4	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	Water Supply Reliability Assessment	Chapter 6
Section 7.3	Service Reliability Assessment: Assess the water supply reliability during normal, dry, and a drought lasting five consecutive water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years.	Water Supply Reliability Assessment	Section 7.1
Section 7.3	Provide a drought risk assessment as part of information considered in developing the demand management measures and water supply projects.	Water Supply Reliability Assessment	Section 7.2
Section 7.3	Include a description of the data, methodology, and basis for one or more supply shortage conditions that are necessary to conduct a drought risk assessment for a drought period that lasts 5 consecutive years.	Water Supply Reliability Assessment	Section 7.2
Section 7.3	Include a determination of the reliability of each source of supply under a variety of water shortage conditions.	Water Supply Reliability Assessment	Section 7.1
Section 7.3	Include a comparison of the total water supply sources available to the water supplier with the total projected water use for the drought period.	Water Supply Reliability Assessment	Section 7.1

2020 Guidebook Location	Summary as Applies to UWMP	Subject	2020 UWMP Location
Section 7.3	Include considerations of the historical drought hydrology, plausible changes on projected supplies and demands under climate change conditions, anticipated regulatory changes, and other locally applicable criteria.	Water Supply Reliability Assessment	Section 7.1
Chapter 8	Provide a water shortage contingency plan (WSCP) with specified elements below.	Water Shortage Contingency Planning	Appendix H
Chapter 8	Provide the analysis of water supply reliability (from Chapter 7 of Guidebook) in the WSCP	Water Shortage Contingency Planning	Appendix H Section 1.1
Section 8.10	Describe reevaluation and improvement procedures for monitoring and evaluation the water shortage contingency plan to ensure risk tolerance is adequate and appropriate water shortage mitigation strategies are implemented.	Water Shortage Contingency Planning	Appendix H Section 1.8
Section 8.2	Provide the written decision-making process and other methods that the supplier will use each year to determine its water reliability.	Water Shortage Contingency Planning	Appendix H Section 1.2
Section 8.2	Provide data and methodology to evaluate the supplier's water reliability for the current year and one dry year pursuant to factors in the code.	Water Shortage Contingency Planning	Appendix H Section 1.1
Section 8.3	Define six standard water shortage levels of 10, 20, 30, 40, 50 percent shortage and greater than 50 percent shortage. These levels shall be based on supply conditions, including percent reductions in supply, changes in groundwater levels, changes in surface elevation, or other conditions. The shortage levels shall also apply to a catastrophic interruption of supply.	Water Shortage Contingency Planning	Appendix H Section 1.3
Section 8.3	Suppliers with an existing water shortage contingency plan that uses different water shortage levels must cross reference their categories with the six standard categories.	Water Shortage Contingency Planning	Appendix H Section 1.3
Section 8.4	Suppliers with water shortage contingency plans that align with the defined shortage levels must specify locally appropriate supply augmentation actions.	Water Shortage Contingency Planning	Appendix H Section 1.4
Section 8.4	Specify locally appropriate demand reduction actions to adequately respond to shortages.	Water Shortage Contingency Planning	Appendix H Section 1.4
Section 8.4	Specify locally appropriate operational changes.	Water Shortage Contingency Planning	Appendix H Section 1.4
Section 8.4	Specify additional mandatory prohibitions against specific water use practices that are in addition to state-mandated prohibitions are appropriate to local conditions.	Water Shortage Contingency Planning	Appendix H Section 1.4
Section 8.4	Estimate the extent to which the gap between supplies and demand will be reduced by implementation of the action.	Water Shortage Contingency Planning	Appendix H Section 1.4
Section 8.4.6	The plan shall include a seismic risk assessment and mitigation plan.	Water Shortage Contingency Plan	Appendix H Section 1.4
Section 8.5	Suppliers must describe that they will inform customers, the public and others regarding any current or predicted water shortages.	Water Shortage Contingency Planning	Appendix H Section 1.5

2020 Guidebook Location	Summary as Applies to UWMP	Subject	2020 UWMP Location
Section 8.5 and 8.6	Suppliers must describe that they will inform customers, the public and others regarding any shortage response actions triggered or anticipated to be triggered and other relevant communications.	Water Shortage Contingency Planning	Appendix H Section 1.5
Section 8.7	Provide a statement that the supplier will declare a water shortage emergency Water Code Chapter 3.	Water Shortage Contingency Planning	Appendix H Section 1.6
Section 8.7	Provide a statement that the supplier will coordinate with any city or county within which it provides water for the possible proclamation of a local emergency.	Water Shortage Contingency Planning	Appendix H Section 1.6
Section 8.8	Describe the potential revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Appendix H Section 1.7
Section 8.8	Provide a description of mitigation actions needed to address revenue reductions and expense increases associated with activated shortage response actions.	Water Shortage Contingency Planning	Appendix H Section 1.7
Sections 8.12 and 10.4	Provide supporting documentation that Water Shortage Contingency Plan has been, or will be, provided to any city or county within which it provides water, no later than 30 days after the submission of the plan to DWR.	Plan Adoption, Submittal, and Implementation	Appendix H Section 1.9
Section 8.14	Make available the Water Shortage Contingency Plan to customers and any city or county where it provides water within 30 after adopted the plan.	Water Shortage Contingency Planning	Appendix H Section 1.9
Sections 9.1 and 9.3	Wholesale suppliers shall describe specific demand management measures listed in code, their distribution system asset management program, and supplier assistance program.	Demand Management Measures	Chapter 9
Section 10.2.1	Notify, at least 60 days prior to the public hearing, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. Reported in Table 10-1.	Plan Adoption, Submittal, and Implementation	DWR Table 10-1
Section 10.4	Each urban water supplier shall update and submit its 2020 plan to the department by July 1, 2021.	Plan Adoption, Submittal, and Implementation	Section 10.3
Sections 10.2.2, 10.3, and 10.5	Provide supporting documentation that the urban water supplier made the plan and contingency plan available for public inspection, published notice of the public hearing, and held a public hearing about the plan and contingency plan.	Plan Adoption, Submittal, and Implementation	Section 10.2
Section 10.2.2	The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water.	Plan Adoption, Submittal, and Implementation	Section 10.1
Section 10.3.2	Provide supporting documentation that the plan and contingency plan has been adopted as prepared or modified.	Plan Adoption, Submittal, and Implementation	Appendix D
Section 10.4	Provide supporting documentation that the urban water supplier has submitted this UWMP to the California State Library.	Plan Adoption, Submittal, and Implementation	Section 10.3

2020 Guidebook Location	Summary as Applies to UWMP	Subject	2020 UWMP Location
Section 10.4	Provide supporting documentation that the urban water supplier has submitted this UWMP to any city or county within which the supplier provides water no later than 30 days after adoption.	Plan Adoption, Submittal, and Implementation	Section 10.3
Sections 10.4.1 and 10.4.2	The plan, or amendments to the plan, submitted to the department shall be submitted electronically.	Plan Adoption, Submittal, and Implementation	N/A
Section 10.5	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Section 10.3
Section 10.5	Provide supporting documentation that, not later than 30 days after filing a copy of its water shortage contingency plan with the department, the supplier has or will make the plan available for public review during normal business hours.	Plan Adoption, Submittal, and Implementation	Section 10.3
Section 10.6	If supplier is regulated by the Public Utilities Commission, include its plan and contingency plan as part of its general rate case filings.	Plan Adoption, Submittal, and Implementation	N/A
Section 10.7.2	If revised, submit a copy of the water shortage contingency plan to DWR within 30 days of adoption.	Plan Adoption, Submittal, and Implementation	N/A

B

Appendix B: 2020 UWMP DWR Tables

2-2 | Public Water Systems

Type of Plan	Member of RUWMP	Member of Regional Alliance	Name of RUWMP or Regional Alliance
Individual UWMP	No	No	NA

2-3 | Agency Identification

Type of Supplier	Year Type	First Day of Year		Unit Type
		DD	MM	
Wholesaler	Calendar Years			Acre Feet (AF)

Conversion to Gallons: *325851*
Conversion to Gallons per Day: *892.7425*

2-4W | Water Supplier Information Exchange

Supplier has informed more than 10 other water suppliers of water supplies available in accordance with Water Code Section 10631. Completion of the table below is optional.

If not completed, include a list of the water suppliers that were informed.

Location of List: Section 2.3.1

3-1W | Current & Projected Population

Population Served	2020	2025	2030	2035	2040	2045
Los Angeles and Ventura Counties	270,615	288,578	306,542	324,505	342,229	359,953
Kern County	49,956	56,757	63,558	70,359	78,738	87,118
Total	**320,571**	**345,335**	**370,100**	**394,864**	**420,967**	**447,071**

Notes:
1. Data for Los Angeles and Ventura Counties from SCAG 2020 Connect SoCal Regional Transportation Plan (SCAG, 2020)
2. Data for Kern County from KCOG General Land Use Plan (KCOG, 2018a).

4-1W | Actual Demands for Water

Use Type	Additional Description	Level of Treatment When Delivered	2020 Volume
Sales/Transfers/Exchanges to Other Agencies	Los Angeles County Waterworks District	Drinking Water	32,847
Sales/Transfers/Exchanges to Other Agencies	Quartz Hill Water District	Drinking Water	2,533
Sales/Transfers/Exchanges to Other Agencies	Rio Tinto Minerals / US Borax	Drinking Water	1,503
Sales/Transfers/Exchanges to Other Agencies	Edwards Air Force Base	Drinking Water	1,465
Sales/Transfers/Exchanges to Other Agencies	Other M&I Customers (19 Customers)	Drinking Water	2,095
Sales/Transfers/Exchanges to Other Agencies	Raw Water Deliveries (4 Customers)	Raw Water	837
Sales/Transfers/Exchanges to Other Agencies	Transfers to Other Agencies	Raw Water	11,286
Groundwater Recharge	Groundwater Recharge	Raw Water	7,213
Losses	Losses	Drinking Water	457
		Total:	**60,234**

Source: AVEK, 2020 LATIS data

4-2W | Projected Demands for Water

Use Type	Additional Description	Projected Water Use				
		2025	2030	2035	2040	2045
Sales/Transfers/Exchanges to Other Agencies		44,440	50,990	51,880	55,210	57,590
	Total:	**44,440**	**50,990**	**51,880**	**55,210**	**57,590**

4-3W | Total Water Use

	2020	2025	2030	2035	2040	2045
Potable and Raw Water From Table 4-1W and 4-2W	60,234	44,440	50,990	51,880	55,210	57,590
Recycled Water Demand* From Table 6-4W	-	-	-	-	-	-
Total Water Demand:	**60,234**	**44,440**	**50,990**	**51,880**	**55,210**	**57,590**

6-1W | Groundwater Volume Pumped

Select One						
Groundwater Type	**Location or Basin Name**	**2016**	**2017**	**2018**	**2019**	**2020**
Alluvial Basin	AV Basin, Production Rights	-	-	-	-	-
Alluvial Basin	AV Basin, Banking	11,512	7,868	9,162	9,234	12,228
	Total:	**11,512**	**7,868**	**9,162**	**9,234**	**12,228**

6-3W | Wastewater Treatment & Discharge Within Service Area in 2020

Wholesale Supplier neither distributes nor provides supplemental treatment to recycled water. The supplier will not complete the table.											
Wastewater Treatment Plant Name	Discharge Location Name or Identifier	Discharge Location Description	Wastewater Discharge ID Number	Method of Disposal	Plant Treats Wastewater Generated Outside the Service Area	Treatment Level	2020 Volumes				
							Wastewater Treated	Discharged Treated Wastewater	Recycled Within Service Area	Recycled Outside of Service Area	Instream Flow Permit Requirement
						Total:	-	-	-	-	-

6-4W | Current & Projected Retailers Provided Recycled Water within Service Area

Recycled water is not used and is not planned for use within the service area of the supplier. The supplier will not complete the table.

6-5W | 2015 Recycled Water Use Projection Compared to 2020 Actual

Recycled water was not used or distributed by the supplier in 2015, nor projected for use or distribution in 2020. The supplier will not complete the table.

6-7W | Expected Future Water Supply Projects or Programs

Some or all of the supplier's future water supply projects or programs are not compatible with this table and are described in a narrative format.						
		Page Location for Narrative in UWMP:	Section 6.8			
Name of Future Projects or Programs	**Joint Project with Other Suppliers**	**Agency Name**	**Description**	**Planned Implementation Year**	**Planned for Use in Year Type**	**Expected Increase in Water Supply to Supplier**
Note: Refer to 2020 UWMP Section 6.8						

6-8W | Actual Water Supplies

Water Supply	Additional Detail on Water Supply	2020		
		Actual Volume	Water Quality	Total Right or Safe Yield
Purchased or Imported Water	To Retailers - Treated Water	28,732	Drinking Water	
Purchased or Imported Water	To Retailers - Untreated Water	775	Other Non-Potable Water	
Purchased or Imported Water	To GW Bank - Untreated Water	7,213	Other Non-Potable Water	
Groundwater (not desalinated)	From GW Bank - Treated Water	12,228	Drinking Water	
Purchased or Imported Water	Transfer / Exchanges - Untreated Water	11,286	Other Non-Potable Water	
	Total:	**60,234**		**-**

6-8DS | Source Water Desalination

Neither groundwater nor surface water are reduced in salinity prior to distribution. The supplier will not complete the table.

6-9W | Projected Water Supplies

Water Supply	Additional Detail on Water Supply	Projected Water Supply									
		2025		2030		2035		2040		2045	
		Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield	Reasonably Available Volume	Total Right or Safe Yield
Purchased or Imported Water	SWP Table A	81,840		79,660		77,490		75,320		75,320	
Groundwater (not desalinated)	Production Rights	3,550		3,550		3,550		3,550		3,550	
Groundwater (not desalinated)	Imported Water Return Flows	800		800		800		800		800	
Purchased or Imported Water	Non-SWP Water	1,700		1,700		1,700		1,700		1,700	
	Total:	**87,890**	**-**	**85,710**	**-**	**83,540**	**-**	**81,370**	**-**	**81,370**	**-**

7-1W | Basis of Water Year Data (Reliability Assessment)

Quantification of available supplies is not compatible with this table and is provided elsewhere in the UWMP.
Page Location for Narrative in UWMP: Page 7-2

7-2W | Normal Year Supply and Demand Comparison

	2025	2030	2035	2040	2045
Supply Totals From Table 6-9W	87,890	85,710	83,540	81,370	81,370
Demand Totals From Table 4-3W	44,440	50,990	51,880	55,210	57,590
Difference:	**43,450**	**34,720**	**31,660**	**26,160**	**23,780**

7-3W | Single Dry Year Supply & Demand Comparison

	2025	2030	2035	2040	2045
Supply Totals	44,440	50,990	51,880	55,210	57,590
Demand Totals	44,440	50,990	51,880	55,210	57,590
Difference:	**0**	**0**	**0**	**0**	**0**
Note: Supply equals demand because AVEK would extract groundwater stored in local groundwater banks to meet supply shortfalls.					

7-4W | Multiple Dry Years Supply & Demand Comparison

		2025	2030	2035	2040	2045
First Year	**Supply Totals**	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	Difference:	**0**	**0**	**0**	**0**	**0**
Second Year	**Supply Totals**	52,730	52,730	52,730	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	Difference:	**8,290**	**1,740**	**850**	**0**	**0**
Third Year	**Supply Totals**	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	Difference:	**0**	**0**	**0**	**0**	**0**
Fourth Year	**Supply Totals**	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	Difference:	**0**	**0**	**0**	**0**	**0**
Fifth Year	**Supply Totals**	44,440	50,990	51,880	55,210	57,590
	Demand Totals	44,440	50,990	51,880	55,210	57,590
	Difference:	**0**	**0**	**0**	**0**	**0**
Sixth Year	**Supply Totals**					
	Demand Totals					
	Difference:	**0**	**0**	**0**	**0**	**0**
Note: Supply equals demand because AVEK would extract groundwater stored in local groundwater banks to meet supply shortfalls.						

7-5 | Five-Year Drought Risk Assessment Tables to Address Water Code Section 10635(b)

2021	**Gross Water Use**	39,060
	Total Supplies	24,080
	Surplus/Shortfall without WSCP Action	**-14,980**
	Planned WSCP Actions (Use Reduction and Supply Augmentation)	
	WSCP (Supply Augmentation Benefit)	14,980
	WSCP (Use Reduction Savings Benefit)	
	Revised Surplus/Shortfall	**0**
	Resulting Percent Use Reduction from WSCP Action	**0%**
2022	**Gross Water Use**	40,930
	Total Supplies	52,860
	Surplus/Shortfall without WSCP Action	**11,930**
	Planned WSCP Actions (Use Reduction and Supply Augmentation)	
	WSCP (Supply Augmentation Benefit)	
	WSCP (Use Reduction Savings Benefit)	
	Revised Surplus/Shortfall	**11,930**
	Resulting Percent Use Reduction from WSCP Action	**0%**
2023	**Gross Water Use**	42,590
	Total Supplies	25,410
	Surplus/Shortfall without WSCP Action	**-17,180**
	Planned WSCP Actions (Use Reduction and Supply Augmentation)	
	WSCP (Supply Augmentation Benefit)	17,180
	WSCP (Use Reduction Savings Benefit)	
	Revised Surplus/Shortfall	**0**
	Resulting Percent Use Reduction from WSCP Action	**0%**
2024	**Gross Water Use**	43,340
	Total Supplies	43,120
	Surplus/Shortfall without WSCP Action	**-220**
	Planned WSCP Actions (Use Reduction and Supply Augmentation)	
	WSCP (Supply Augmentation Benefit)	220
	WSCP (Use Reduction Savings Benefit)	
	Revised Surplus/Shortfall	**0**
	Resulting Percent Use Reduction from WSCP Action	**0%**
2025	**Gross Water Use**	44,440
	Total Supplies	32,100
	Surplus/Shortfall without WSCP Action	**-12,340**
	Planned WSCP Actions (Use Reduction and Supply Augmentation)	
	WSCP (Supply Augmentation Benefit)	12,340
	WSCP (Use Reduction Savings Benefit)	
	Revised Surplus/Shortfall	**0**
	Resulting Percent Use Reduction from WSCP Action	**0%**

WSCP (Supply Augmentation Benefit) is AVEK pumping from its local groundwater banks

8-1 | Water Shortage Contingency Plan Levels

Shortage Level	**Percent Shortage Range**[1] (Numerical Value as a Percent)	**Shortage Response Actions**
1	Up to 50%	Reduction in SWP Allocation below Current Demand
2	>50%	Catastrophic water supply shortage

[1] One stage in the Water Shortage Contingency Plan must address a water shortage of 50%.

8-2 | Demand Reduction Actions

Shortage Level	Demand Reduction Actions	How much is this going to reduce the shortage gap?	Additional Explanation or Reference	Penalty, Charge, or Other Enforcement
All	Expand Public Information Campaign	up to 50%		

8-3 | Supply Augmentation & Other Actions

Shortage Level	Supply Augmentation Methods and Other Actions by Water Supplier	How much is this going to reduce the shortage gap?	Additional Explanation or Reference

10-1W | Notification to Cities & Counties

Supplier has not notified more than 10 cities or counties in accordance with Water Code Sections 10621 (b) and 10642. Completion of the table is required.

City	60 Day Notice	Notice of Public Hearing	Other
City of California City	Yes	Yes	
City of Lancaster	Yes	Yes	
City of Palmdale	Yes	Yes	
County	**60 Day Notice**	**Notice of Public Hearing**	**Other**
Kern County	Yes	Yes	
Los Angeles County	Yes	Yes	
Ventura County	Yes	Yes	
Other	**60 Day Notice**	**Notice of Public Hearing**	**Other**

Note: See Appendix D for notices.

C

Appendix C: Delta Reliance

Technical Memorandum

Date: 8/24/2021

To: Matt Knudson
Antelope Valley – East Kern Water Agency (AVEK)

CC: Tom Barnes (AVEK)

Prepared by: Rob Morrow, P.E.

Project: 2020 UWMP

SUBJECT: **QUANTIFYING REGIONAL SELF-RELIANCE AND REDUCED RELIANCE ON WATER SUPPLIES FROM THE DELTA WATERSHED**

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1 Background

Under the Sacramento-San Joaquin Delta Reform Act of 2009, state and local public agencies proposing a covered action in the Delta, prior to initiating the implementation of that action, must prepare a written certification of consistency with detailed findings as to whether the covered action is consistent with applicable Delta Plan policies and submit that certification to the Delta Stewardship Council. Anyone may appeal a certification of consistency, and if the Delta Stewardship Council grants the appeal, the covered action may not be implemented until the agency proposing the covered action submits a revised certification of consistency, and either no appeal is filed, or the Delta Stewardship Council denies the subsequent appeal.

An urban water supplier that anticipates participating in or receiving water from a proposed covered action such as a multi-year water transfer, conveyance facility, or new diversion that involves transferring water through, exporting water from, or using water in the Delta should provide information in their 2015 and 2020 Urban Water Management Plans (UWMPs) that can then be used in the covered action process to demonstrate consistency with Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (WR P1).

WR P1 details what is needed for a covered action to demonstrate consistency with reduced reliance on the Delta and improved regional self-reliance. WR P1 subsection (a) states that:

> *(a) Water shall not be exported from, transferred through, or used in the Delta if all of the following apply:*
>
> > *(1) One or more water suppliers that would receive water as a result of the export, transfer, or use have failed to adequately contribute to reduced reliance on the Delta and improved regional self-reliance consistent with all of the requirements listed in paragraph (1) of subsection (c);*
> >
> > *(2) That failure has significantly caused the need for the export, transfer, or use; and*
> >
> > *(3) The export, transfer, or use would have a significant adverse environmental impact in the Delta.*

WR P1 subsection (c)(1) further defines what adequately contributing to reduced reliance on the Delta means in terms of (a)(1) above.

(c)(1) Water suppliers that have done all the following are contributing to reduced reliance on the Delta and improved regional self-reliance and are therefore consistent with this policy:

(A) Completed a current Urban or Agricultural Water Management Plan (Plan) which has been reviewed by the California Department of Water Resources for compliance with the applicable requirements of Water Code Division 6, Parts 2.55, 2.6, and 2.8;

(B) Identified, evaluated, and commenced implementation, consistent with the implementation schedule set forth in the Plan, of all programs and projects included in the Plan that are locally cost effective and technically feasible which reduce reliance on the Delta; and

(C) Included in the Plan, commencing in 2015, the expected outcome for measurable reduction in Delta reliance and improvement in regional self-reliance. The expected outcome for measurable reduction in Delta reliance and improvement in regional self- reliance shall be reported in the Plan as the reduction in the amount of water used, or in the percentage of water used, from the Delta watershed. For the purposes of reporting, water efficiency is considered a new source of water supply, consistent with Water Code section 1011(a).

The analysis and documentation provided below include all the elements described in WR P1(c)(1) that need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action.

2 Methodology

As stated in WR P1(c)(1)(C), the policy requires that, commencing in 2015, UWMPs include expected outcomes for improved regional self-reliance and measurable reduction in Delta reliance. WR P1 further states that those outcomes shall be reported in the UWMP as the reduction in the amount of water used, or in the percentage of water used, from the Delta. The expected outcomes for AVEK regional self-reliance and reduced Delta reliance were developed using the approach and guidance described in Appendix C of DWR's Urban Water Management Plan Guidebook 2020 issued in March 2020 (Guidebook Appendix C).

The methodology used to determine AVEK's improved regional self-reliance and reduced Delta reliance is consistent with the approach detailed in DWR's UWMP Guidebook Appendix C, including the use of narrative justifications for the accounting of supplies and the documentation of specific data sources. Some of the key assumptions include:

- All data were obtained from the current 2020 UWMP or previously adopted UWMPs and represent average or normal water year conditions.
- All analyses were conducted at the service area level, and all data reflect the total contributions of AVEK and its customers as well as their customers.

To calculate the expected outcomes for improved regional self-reliance and reduced Delta reliance, a baseline is needed to compare against. This analysis uses a normal water year representation of 2010 as the baseline, which is consistent with the approach described in the Guidebook Appendix C. Data for the 2010 baseline were taken from AVEK's 2005 UWMP as the UWMPs generally do not provide normal water year data for the year that they are adopted (i.e., 2005 UWMP forecasts begin in 2010, 2010 UWMP forecasts begin in 2015, and so on).

Consistent with the 2010 baseline data approach, the expected outcomes for improved regional self-reliance and reduced Delta reliance for 2015 and 2020 were taken from AVEK's 2010 and 2015 UWMPs, respectively. Expected outcomes for 2025-2045 are from the current 2020 UWMP. Documentation of the specific data sources and assumptions are included in the discussions below.

3 Demonstration of Regional Self-Reliance

Service Area Demands without Water Use Efficiency

In alignment with the Guidebook Appendix C, this analysis uses normal water year demands, rather than normal water year supplies to calculate expected outcomes in terms of the percentage of water used. Using normal water year demands serves as a proxy for the amount of supplies that would be used in a normal water year, which helps alleviate issues associated with how supply capability is presented to fulfill requirements of the UWMP Act versus how supplies might be accounted for to demonstrate consistency with WR P1.

Because WR P1 considers water use efficiency savings a source of water supply, water suppliers such as AVEK that do not explicitly quantify water use efficiency savings in their UWMPs can calculate their embedded water use efficiency savings based on changes in forecasted per capita water use since the baseline.

Agencies that explicitly calculate and report water use efficiency savings in their UWMP will need to make an adjustment to properly reflect normal water year demands in the calculation of reduced reliance. As explained in the Guidebook Appendix C, water use efficiency savings must be added back to the normal year demands to represent demands without water use efficiency savings accounted for; otherwise the effect of water use efficiency savings on regional self-reliance would be overestimated. Table 1 shows the results of this adjustment for AVEK. Supporting narratives and documentation for all the data shown in Table 1 are provided below.

<u>Service Area Demands with Water Use Efficiency</u>

The service area demands shown in Table 1 represent the total water demands for AVEK's service area. The demand data shown in Table 1 were collected from the following sources:

- Baseline (2010): AVEK 2005 UWMP, Table 7 and Table 8
- 2015: AVEK 2010 UWMP, Table 4 and Table 5
- 2020: AVEK 2015 UWMP, Table 4-2
- 2025-2045: AVEK 2020 UWMP, Table ES-2

<u>Service Area Population</u>

The population data shown in Table 1 were collected from the following sources:

- Baseline (2010): AVEK 2010 UWMP, Table 2
- 2015: AVEK 2015 UWMP, Table 3-1
- 2020-2045: AVEK 2020 UWMP, Table ES-1

<u>Estimated Water Use Efficiency Since Baseline</u>

Calculated using "Potable Service Area Demands with Water Use Efficiency" divided by "Service Area Population" and then calculating Estimated Water Use Efficiency Since Baseline by comparing with 2010 Per Capita Water Use.

Service Area Water Demands without Water Use Efficiency

Add "Service Area Demands with Water Use Efficiency" to "Estimated Water Use Efficiency Since Baseline."

Supplies Contributing to Regional Self-Reliance

For a covered action to demonstrate consistency with the Delta Plan, WR P1 subsection (c)(1)(C) states that water suppliers must report the expected outcomes for measurable improvement in regional self-reliance. Table 2 shows expected outcomes for supplies contributing to regional self-reliance both in amount and as a percentage. The numbers shown in Table 2 represent efforts to improve regional self-reliance for AVEK's entire service area and include the total contributions of AVEK and its customers. Supporting narratives and documentation for all of the data shown in Table 2 are provided below.

Water Use Efficiency

The water use efficiency information shown in Table 2 is taken directly from Table 1.

Local and Regional Water Supply and Storage Programs

The local and regional water supply and storage programs data shown in Table 2 represent groundwater pumping estimates by AVEK and entities within AVEK's service area. The estimates were complicated because the Antelope Valley Groundwater Basin Judgment (Judgment) did not go into effect until 2016 and roughly half of annual pumping rights are associated with imported water return flows, which is dependent on total demands in the AVEK service area. Now that the Judgment is in place, the following categories were totaled to estimate annual pumping rights

- Exhibit 3 – Non-Overlying Producers Production Rights
    - Production Rights
    - Rights from Return Flows
- Exhibit 4 – Overlying Producers Production Rights
    - Production Rights
    - Rights from Return Flows

Based on this information, groundwater pumping data was estimated from the following sources:

- Baseline (2010): Prior to the Judgement, there were not estimates of groundwater pumping within AVEK service area so the 2010 pumping value was assumed to be equivalent to the 2015 estimate
- 2015: Groundwater accounting for the Judgement started in 2016 so the 2016 production rights values for 2016 from the 2016 Annual Report from the Antelope Valley Watermaster were used for 2015 values
- 2020: 2020 groundwater sources from the Annual Report from the Antelope Valley Watermaster
- 2025-2045: Judgement production rights plus estimated return flows based on projected AVEK demands presented in the 2020 UWMP

Other Programs and Projects that Contribute to Regional Self-Reliance

Other Programs and Projects that Contribute to Regional Self-Reliance includes non-SWP water supply acquired by AVEK in 2017 through a long-term lease of annual supply originally belonging to the Nickel Family, a farming interest in Kern County. AVEK acquired the rights to 1,700 acre-feet of water made available for a period of 35 years (with an option to extend for 35 more years), even in dry years.

Conclusions

The results shown in Table 2 demonstrate that AVEK's service area is measurably improving its regional self-reliance. In the near-term (2025), the expected outcome for normal water year regional self-reliance is expected to increase by 57,500 AFY from the 2010 baseline; this represents an increase of about 39 percent of 2025 normal water year retail demands. In the long-term (2045), the expected outcome for normal water year regional self-reliance is expected to increase by more than 83,100 AFY from the 2010 baseline, this represents an increase of about 38 percent of 2045 normal water year retail demands (Table 2). The results show that as a region, AVEK and its customers are measurably reducing reliance on the Delta and improving regional self-reliance, both as an amount of water used and as a percentage of water used.

4 Demonstration of Reduced Reliance on the Delta

AVEK's service area reduces reliance on the Delta through investments in non-Delta water supplies, local water supplies, and regional and local demand management measures. For reduced reliance on supplies from the Delta Watershed, the data used in this analysis represent the total regional efforts of AVEK and its customers, and were developed in conjunction with AVEK customers as part of the UWMP coordination process (as described in Chapter 2 of AVEK's 2020 UWMP). In accordance with UMWP requirements, several of AVEK's customers also report demands and supplies for their service areas in their respective UWMPs. The data reported by those agencies are not additive to the regional totals shown in AVEK's UWMP, rather their reporting represents subtotals of the regional total and should be considered as such for the purposes of determining reduced reliance on the Delta.

Calculation of Reliance on Water Supplies from the Delta Watershed

The calculation of reliance on water supplies from the Delta watershed, shown in Table 3, is based on the following assumptions. AVEK water supplies from the Delta watershed include "CVP/SWP Contract Supplies."

CVP/SWP Contract Supplies

The supply data shown in Table 3 is for AVEK's SWP Table A allocation and were collected from the following sources:

- Baseline (2010): AVEK 2005 UWMP, Table 10
- 2015: AVEK 2010 UWMP, Table 6
- 2020: AVEK 2015 UWMP, Table 6-9
- 2025-2045: AVEK 2020 UWMP, Table ES-3

Total Water Supplies from the Delta Watershed

Total Water Supplies from the Delta Watershed is equivalent to CVP/SWP Contract Supplies.

Change in Supplies from the Delta Watershed

Calculates changes in Total Water Supplies from the 2010 baseline value with future values.

Percent Change in Supplies from the Delta Watershed

Divides "Water Supplies from the Delta Watershed" by "Service Area Demands without Water Use Efficiency" and calculates changes from the 2010 baseline.

Conclusions

The following provides a summary of the near-term (2025) and long-term (2045) expected outcomes for AVEK's Delta reliance on supplies from the Delta watershed:

- Near-term (2025) – Normal water year reliance on supplies from the Delta watershed decreased by 18,600 AF from the 2010 baseline, this represents a decrease of 28 percent of 2025 normal water year demands without water use efficiency (Table 3).
- Long-term (2045) – Normal water year reliance on supplies from the Delta watershed decreased by 25,100 AF from the 2010 baseline, this represents a decrease of 46 percent of 2025 normal water year demands without water use efficiency (Table 3).

The results show that as a region, AVEK and its customers (including AVEK) as well as their customers are measurably reducing reliance on the Delta and improving regional self-reliance, both as an amount of water used and as a percentage of water used.

5 UWMP Implementation

In addition to the analysis and documentation described above, WR P1 subsection (c)(1)(B) requires that all programs and projects included in the UWMP that are locally cost-effective and technically feasible, which reduce reliance on the Delta, are identified, evaluated, and implemented consistent with the implementation schedule. WR P1 (c)(1)(B) states that:

> *(B) Identified, evaluated, and commenced implementation, consistent with the implementation schedule set forth in the Plan, of all programs and projects included in the Plan that are locally cost effective and technically feasible which reduce reliance on the Delta[.]*

In accordance with Water Code Section 10631(f), water suppliers must already include in their UWMP a detailed description of expected future projects and programs that they may implement to increase the amount of water supply available to them in normal and single-dry water years and for a period of drought lasting five consecutive years. The UWMP description must also identify specific projects, include a description of the increase in water supply that is expected to be available from each project, and include an estimate regarding the implementation timeline for each project or program.

Chapter 6 of AVEK's 2020 UWMP summarizes the implementation plan and continued progress in developing a diversified water portfolio to meet the region's water needs.

6 2015 UWMP Appendix J

The information contained in this appendix is also intended to be a new Appendix J attached to AVEK's 2015 UWMP consistent with WR P1 subsection (c)(1)(C) (Cal. Code Regs. tit. 23, § 5003). AVEK provided notice of the availability of the draft 2020 UWMP, 2021 WSCP, and a new Appendix J to the 2015 UWMP and the public hearing to consider adoption of the documents in accordance with CWC Sections 10621(b) and 10642, and Government Code Section 6066, and Chapter 17.5 (starting with Section 7290) of Division 7 of Title 1 of the Government Code. The public review drafts of the 2020 UWMP, Appendix J to the 2015 UWMP, and the 2021 WSCP were posted on AVEK's website, avek.org, on April 6, 2021, more than 60 days in advance of the public hearing on June 8, 2021. The notice of availability of the documents was sent to AVEK's customers, as well as cities and counties in AVEK's service area. Copies of the notification letter sent to the customers and cities and counties in AVEK's service area are included in the 2020 UWMP Appendix D. Thus, this Appendix C to AVEK's 2020 UWMP, which was adopted with AVEK's 2020 UWMP, will also be recognized and treated as Appendix J to AVEK's 2015 UWMP.

AVEK held the public hearing for the draft 2020 UWMP, draft Appendix J to the 2015 UWMP, and draft 2021 WSCP on June 8, 2021, at a regular Board of Directors meeting, held online due to COVID-19 concerns. On August 24, 2021, AVEK's Board of Directors determined that the 2020 UWMP and the 2021 WSCP accurately represent the water resources plan for AVEK's service area. In addition, AVEK's Board of Directors determined that Appendix J to both the 2015 UWMP and the 2020 UWMP includes all of the elements described in Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs. tit. 23, § 5003), which need to be included in a water supplier's UWMP to support a certification of consistency for a future covered action. As stated in Resolution No. R-21-08, the AVEK Board of Directors adopted the 2020 UWMP, Appendix J to the 2015 UWMP, and the 2021 WSCP and authorized their submittal to the State of California. Copies of the resolutions are included in the 2020 UWMP Appendix E.

Table 1. Calculation of Service Area Water Demands without Water Use Efficiency (UWMP Table C-1 and Table C-2)

Table C-1: Optional Calculation of Water Use Efficiency -To be completed if Water Supplier does not specifically estimate Water Use Efficiency as a supply

Service Area Water Use Efficiency Demands (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Service Area Water Demands with Water Use Efficiency Accounted For	111,031	91,075	83,680	73,420	80,400	83,850	87,520	91,200
Non-Potable Water Demands								
Potable Service Area Demands with Water Use Efficiency Accounted For	111,031	91,075	83,680	73,420	80,400	83,850	87,520	91,200

Total Service Area Population	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Service Area Population	291,063	359,500	320,571	345,335	370,100	394,864	420,967	447,071

Water Use Efficiency Since Baseline (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Per Capita Water Use (GPCD)	341	226	233	190	194	190	186	182
Change in Per Capita Water Use from Baseline (GPCD)		(114)	(108)	(151)	(147)	(151)	(155)	(158)
Estimated Water Use Efficiency Since Baseline		46,062	38,607	58,314	60,781	66,778	73,065	79,343

Table C-2: Calculation of Service Area Water Demands Without Water Use Efficiency

Total Service Area Water Demands (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Service Area Water Demands with Water Use Efficiency Accounted For	111,031	91,075	83,680	73,420	80,400	83,850	87,520	91,200
Reported Water Use Efficiency or Estimated Water Use Efficiency Since Baseline		46,062	38,607	58,314	60,781	66,778	73,065	79,343
Service Area Water Demands without Water Use Efficiency Accounted For	111,031	137,137	122,287	131,734	141,181	150,628	160,585	170,543

Table 2. Calculation of Supplies Contributing to Regional Self-Reliance (UWMP Table C-3)

Water Supplies Contributing to Regional Self-Reliance (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Water Use Efficiency		46,062	38,607	58,314	60,781	66,778	73,065	79,343
Water Recycling								
Stormwater Capture and Use								
Advanced Water Technologies								
Conjunctive Use Projects								
Local and Regional Water Supply and Storage Projects	35,870	35,870	33,280	33,330	33,760	36,320	36,660	37,960
Other Programs and Projects the Contribute to Regional Self-Reliance			1,700	1,700	1,700	1,700	1,700	1,700
Water Supplies Contributing to Regional Self-Reliance	35,870	81,932	73,587	93,344	96,241	104,798	111,425	119,003

Service Area Water Demands without Water Use Efficiency (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Service Area Water Demands without Water Use Efficiency Accounted For	111,031	137,137	122,287	131,734	141,181	150,628	160,585	170,543

Change in Regional Self Reliance (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Water Supplies Contributing to Regional Self-Reliance	35,870	81,932	73,587	93,344	96,241	104,798	111,425	119,003
Change in Water Supplies Contributing to Regional Self-Reliance		46,062	37,717	57,474	60,371	68,928	75,555	83,133

Percent Change in Regional Self Reliance (As Percent of Demand w/out WUE)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Percent of Water Supplies Contributing to Regional Self-Reliance	32.3%	59.7%	60.2%	70.9%	68.2%	69.6%	69.4%	69.8%
Change in Percent of Water Supplies Contributing to Regional Self-Reliance		27.4%	27.9%	38.6%	35.9%	37.3%	37.1%	37.5%

Table 3. Reliance on Water Supplies from the Delta Watershed (UWMP Table C-4)

Water Supplies from the Delta Watershed (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
CVP/SWP Contract Supplies	100,394	87,688	85,460	81,840	79,660	77,490	75,320	75,320
Delta/Delta Tributary Diversions								
Transfers and Exchanges								
Other Water Supplies from the Delta Watershed								
Total Water Supplies from the Delta Watershed	100,394	87,688	85,460	81,840	79,660	77,490	75,320	75,320

Service Area Water Demands without Water Use Efficiency (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Service Area Water Demands without Water Use Efficiency Accounted For	111,031	137,137	122,287	131,734	141,181	150,628	160,585	170,543

Change in Supplies from the Delta Watershed (Acre-Feet)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Water Supplies from the Delta Watershed	100,394	87,688	85,460	81,840	79,660	77,490	75,320	75,320
Change in Water Supplies from the Delta Watershed		(12,706)	(14,934)	(18,554)	(20,734)	(22,904)	(25,074)	(25,074)

Percent Change in Supplies from the Delta Watershed (As a Percent of Demand w/out WUE)	Baseline (2010)	2015	2020	2025	2030	2035	2040	2045 (Optional)
Percent of Water Supplies from the Delta Watershed	90.4%	63.9%	69.9%	62.1%	56.4%	51.4%	46.9%	44.2%
Change in Percent of Water Supplies from the Delta Watershed		-26.5%	-20.5%	-28.3%	-34.0%	-39.0%	-43.5%	-46.3%

D

Appendix D: Notifications and Notification List

April 6, 2021

NOTICE OF PUBLIC HEARING ON THE ANTELOPE VALLEY-EAST KERN WATER AGENCY DRAFT 2020 URBAN WATER MANAGEMENT PLAN, DRAFT 2021 WATER SHORTAGE CONTINGENCY PLAN, AND DRAFT APPENDIX J TO THE 2015 UWMP

Dear Recipient,

The Antelope Valley-East Kern Water Agency (AVEK) is in the process of preparing its 2020 Urban Water Management Plan (UWMP) and 2021 Water Shortage Contingency Plan (WSCP) as required by the Urban Water Management Planning Act (Act). In addition, AVEK is preparing an Appendix to both the 2015 UWMP and 2020 UWMP to demonstrate consistency with the Delta Plan Policy WR P1, Reduced Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit.23, §5003). The 2015 UWMP is being amended only to report reduced reliance on the Delta and this action is separate from adoption of the 2020 UWMP and adoption of the 2021 WSCP.

AVEK is required to notify its retailers as well as cities, and counties within its service areas that it is preparing its 2020 UWMP, 2021 WSCP, and Appendix J of the 2015 UWMP at least 60 days prior to holding a public hearing. The public hearing is scheduled as part of a regularly scheduled AVEK Board meeting on **June 8, 2021 at 5:30 p.m.**

This serves as your official public hearing notice and intent to adopt the 2020 UWMP, 2021 WSCP and Appendix J of the 2015 UWMP before the July 1, 2021 deadline. A draft of each document will be available for review by May 25, 2021. AVEK will distribute a public draft review notification on or before May 25, 2021 with information on how to access the draft documents. Until that time, if you have any questions or comments regarding the documents or this process, please contact me at (661) 943-3201 or mknudson@avek.org.

Very truly yours,

Matthew Knudson,
Assistant General Manager

From: Tom Barnes <tbarnes@avek.org>
Date: May 25, 2021 at 6:52:00 PM PDT
Subject: AVEK Water Agency 2020 UWMP-Notice of Public Hearing/Public Draft Documents

May 25, 2021

RE: NOTICE OF PUBLIC HEARING AND RELEASE OF PUBLIC DRAFT OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY DRAFT 2020 URBAN WATER MANAGEMENT PLAN, DRAFT 2021 WATER SHORTAGE CONTINGENCY PLAN, AND DRAFT APPENDIX J TO THE 2015 UWMP

Dear Recipient,

The Antelope Valley-East Kern Water Agency (AVEK) is releasing its Public Draft 2020 Urban Water Management Plan (UWMP) and 2021 Water Shortage Contingency Plan (WSCP) as required by the Urban Water Management Planning Act (Act). In addition, AVEK has prepared an Appendix to both the 2015 UWMP and 2020 UWMP to demonstrate consistency with the Delta Plan Policy WR P1, Reduced Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit.23, §5003). The 2015 UWMP is being amended only to report reduced reliance on the Delta and this action is separate from adoption of the 2020 UWMP and adoption of the 2021 WSCP.

AVEK is notifying its retailers as well as cities, and counties within its service areas that it is releasing its 2020 UWMP, 2021 WSCP, and Appendix J of the 2015 UWMP for public review and comment prior to holding a public hearing. The public hearing is scheduled as part of a regularly scheduled AVEK Board meeting on June 8, 2021 at 5:30 p.m. online via teleconference.

A copy of the Public Draft 2020 UWMP and mentioned documents will also be made available for public review on the Agency website at: www.avek.org<http://www.avek.org>.

This notice serves as your official public hearing notice and intent to adopt the 2020 UWMP, 2021 WSCP and Appendix J of the 2015 UWMP before the July 1, 2021 deadline. If you have any questions or comments regarding the documents or this process, please contact Matt Knudson/Tom Barnes at 661-943-3201 or info@avek.org<mailto:info@avek.org>.

Sincerely,

Dwayne Chisam
General Manager

Tom Barnes | Resources Manager
Antelope Valley-East Kern Water Agency
6450 West Avenue N, Palmdale, CA 93551
Main: 661-943-3201 | fax: 661-943-3204
Direct: 661-234-8437 | mobile: 661-810-9440
Email: tbarnes@avek.org<mailto:tbarnes@avek.org> | website: www.avek.org<http://www.avek.org/>

AVEK 2020 UWMP, 2021 WSCP, and 2015 UWMP Appendix J
PUBLIC HEARING NOTIFICATION (April 5, 2021)
PUBLIC DRAFT NOTIFICATION (May 25, 2021)
RECIPIENT LIST

Water Retailer Notification Letter:

- Antelope Valley Country Club
- Boron Community Services District
- California Water Service Company Antelope Valley District
- City of California City
- Desert Lake Community Services District
- Desert Sage Apartments c/o Rex Nishimura
- Edgemont Acres Mutual Water Co.
- Edwards Air Force Base
- El Dorado Mutual Water Co.
- Lake Elizabeth Mutual Water Co.
- Landale Mutual Water Co.
- Los Angeles County Waterworks Districts - Alhambra
- Los Angeles County Waterworks Districts - Lancaster
- Mojave Public Utility District
- Palm Ranch Irrigation District
- Quartz Hill Water District
- Rosamond Community Services District
- Shadow Acres Mutual Water Co.
- Sunnyside Farms Mutual Water Co.
- West Side Park Mutual Water Co.
- White Fence Farms Mutual Water Co.
- White Fence Farms Mutual Water Co. #3

Customer Notification Letter:

- Antelope Valley Water Storage, LLC c/o WDS
- CA Dept of Parks & Recreation (Poppy Reserve)
- Rancho Vista Golf Club
- Tejon Ranch Company
- US. Borax (Rio Tinto Minerals)

Public Notification Letter:

- Antelope Valley Watermaster
- Building Industry Association
- Littlerock Creek Irrigation District
- Mojave Water Agency
- North Edwards Water District
- Palmdale Water District

Cities/Counties Notification Letter:

- City of Lancaster Planning Division
- City of Lancaster City Manager
- City of Palmdale Planning Division
- City of Palmdale Public Works
- Kern County Planning Department
- Los Angeles County Department of Regional Planning Division
- Supervisor Kathryn Barger Antelope Valley Field Office
- Ventura County Resource Management Agency Planning Division

Valley Press Ad

NOTICE OF PUBLIC HEARING
ANTELOPE VALLEY-EAST KERN WATER AGENCY

NOTICE is hereby given that a Public Hearing will be held by the Antelope Valley-East Kern Water Agency (AVEK) on Tuesday, June 8, 2021 at 5:30 PM, as part of a regularly scheduled AVEK Board meeting online via teleconference.

The Board of Directors of AVEK will receive public comment regarding the Agency's adoption of its 2020 Urban Water Management Plan (2020 UWMP) and 2021 Water Shortage Contingency Plan (WSCP), which have been prepared in compliance with the Urban Water Management Planning Act. In addition, Appendix J of the AVEK 2015 UWMP, Reduced Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit.23, §5003), will be amendment. A Draft copy of the 2020 UWMP and related documents are available for public review on the Agency website at: www.avek.org.
Publish: May 26 and June 2, 2021

E

Appendix E: Adoption Resolution

RESOLUTION NO. R-21-08

A RESOLUTION OF THE BOARD OF DIRECTORS OF ANTELOPE VALLEY-EAST KERN WATER AGENCY ("AVEK") ADOPTING, DIRECTING THE FILING OF, AND IMPLEMENTING THE ANTELOPE VALLEY-EAST KERN WATER AGENCY 2020 URBAN WATER MANAGEMENT PLAN, 2021 WATER SHORTAGE CONTINGENCY PLAN, AND APPENDIX J AS AN ADDENDUM TO THE 2015 URBAN WATER MANAGEMENT PLAN

WHEREAS, the Antelope Valley-East Kern Water Agency was formed in 1959 by an act of the State Legislature. AVEK's powers, duties, authorities and other matters are set forth in its enabling act, which is codified at California Water Code, Uncodified Acts, Act 9095 (the "AVEK Enabling Act"); and

WHEREAS, AVEK's jurisdictional boundaries cover portions of three counties, Los Angeles, Ventura County and Kern County, and is more particularly described in Section 3 and Figure 3-1 of the 2020 Urban Water Management Plan ("AVEK's Jurisdictional Boundaries"); and

WHEREAS, AVEK was formed for the purpose of providing water received from the State Water Project ("SWP") as a supplemental source of water to retail water purveyors and other water interests within AVEK's Jurisdictional Boundaries on a wholesale basis; and

WHEREAS, in order to effectuate the above-referenced purpose, AVEK, among other things, entered into a contract with the Department of Water Resources ("DWR"), which operates the SWP, in order for AVEK to receive water from the SWP ("SWP Water"); and

WHEREAS, AVEK has entered into contracts with various retail purveyors and other water interests in AVEK's Jurisdictional Boundaries that govern AVEK's delivery of SWP Water to those purveyors and other water interests (the "AVEK's Water Supply Contracts"); and

WHEREAS, AVEK has developed and does operate water banking facilities within AVEK's Jurisdictional Boundaries, and has right to produce waters from these facilities for the purpose of providing groundwater as a supplemental source of water to retail water purveyors and other water interests within AVEK's Jurisdictional Boundaries on a wholesale basis; and

WHEREAS, the California Legislature enacted Assembly Bill 797 during the 1983-1984 Regular Session of the California Legislature (Water Code Section 10610 et. seq.) known as the Urban Water Management Plan Act (the Act).

WHEREAS, the Act mandates that every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually prepare, and every five (5) years thereafter update, its Urban Water Management Plan (UWMP), the primary objective of which is to plan for the conservation and efficient use of water; and

WHEREAS, the California Water Code Section 10632 requires that every urban water supplier shall prepare and adopt a Water Shortage Contingency Plan (WSCP); and

WHEREAS, the WSCP is consistent with the California Water Code Sections 350 through 359 and Section 10632 and guidance provided by the California Department of Water Resources 2020 UWMP Guidebook; and

WHEREAS, Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs., tit. 23, § 5003, subdivision (c)(1)) need to be included in a water supplier's urban water management plan to support a certification of consistency for one or more future water supply covered actions in the Sacramento-San Joaquin Delta; and

WHEREAS, the 2020 UWMP, 2021 WSCP, and Appendix J as an Addendum to the 2015 UWMP (together known as the Plans) must be adopted by July 1, 2021 and filed with the California Department of Water Resources and entities specified in the UWMP Act within thirty days of adoption; and

WHEREAS, AVEK has circulated drafts of its proposed Plans for public review and comment; and

WHEREAS, AVEK's Board of Directors ("AVEK Board") held a duly noticed public hearing on its proposed Plans on June 8, 2021; and

WHEREAS, the AVEK Board received no written or verbal comment from the public or others concerning its proposed Plans; and

WHEREAS, AVEK retained technical and legal consultants to provide expert assistance concerning its Plans; and

NOW, THEREFORE, BE IT RESOLVED by the Board of the Directors of the Antelope Valley-East Kern Water Agency as follows:

1. The 2020 Urban Water Management Plan, the 2021 Water Shortage Contingency Plan, and Appendix J as an Addendum to the 2015 UWMP are hereby approved and adopted.

2. The General Manager is authorized and directed to file the Plans with the entities specified in the UWMP Act by the dates specified therein.

PASSED AND ADOPTED at the Regular Meeting of the Antelope Valley-East Kern Water Agency Board of Directors held on August 24, 2021.

Keith Dyas

Keith Dyas, President of the Board of Directors of Antelope Valley-East Kern Water Agency

ATTEST:

Board Secretary-Treasurer,
Antelope Valley-East Kern Water Agency

STAFF REPORT	
To: Board of Directors	Date: August 20, 2021
From: Dwayne Chisam, General Manager	Prepared By: Matthew Knudson, Assistant GM M.K.
Subject: Consideration and possible action on Resolution No. R-21-08 – Approving and adopting the 2020 Urban Water Management Plan, 2021 Water Shortage Contingency Plan, and Appendix J as an Addendum to the 2015 Urban Water Management Plan	
Meeting Date: August 24, 2021 Agenda Items: 7 (b-1)	Attachment(s): ☒ YES ☐ NO

Recommendations:

Staff recommends that the Board:

1. Approve Resolution No. R-21-08 adopting, directing the filing of, and implementing the Antelope Valley-East Kern Water Agency 2020 Urban Water Management Plan (UWMP), the 2021 Water Shortage Contingency Plan (WSCP), and Appendix J as an Addendum to the 2015 Urban Water Management Plan.

Background:

The California Legislature enacted Assembly Bill 797 during the 1983-1984 Regular Session of the California Legislature (Water Code Section 10610 et. seq.) known as the Urban Water Management Plan Act that mandates every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually prepare, and every five (5) years thereafter update, its UWMP, the primary objective of which is to plan for the conservation and efficient use of water.

Also, the California Water Code Section 10632 requires that every urban water supplier shall prepare and adopt a WSCP.

Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs., tit. 23, § 5003, subdivision (c)(1)) need to be included in a water supplier's urban water management plan to support a certification of consistency for one or more future water supply covered actions in the Sacramento-San Joaquin Delta.

Agency staff and consultants have prepared the 2020 UWMP, 2021 WSCP, and Appendix J as an Addendum to the 2015 UWMP. Water Code 10642 requires that prior to adoption, an urban water supplier shall make the plan available for public inspection and shall hold at least one public hearing. The subject documents were posted on the Agency's website on Tuesday, May 25, 2021, for public review and comment. Staff and the Agency's consultant (Water Systems Consulting, Inc.) also presented an overview or the documents at the June 8, 2021 Board Meeting / Public Hearing.

No public comments have been received to date.

Strategic Plan Element:

The 2020 UWMP and related documents will assist AVEK in meeting the following Strategic Plan Goals and Objectives:

- Goal 2 – Water Reliability
- Goal 6 - Communications

Supporting Documents:

- Resolution No. R-21-08 adopting, directing the filing of, and implementing the Antelope Valley-East Kern Water Agency 2020 Urban Water Management Plan (UWMP), the 2021 Water Shortage Contingency Plan (WSCP), and Amendment to Appendix J of the 2015 Urban Water Management Plan.
- 2020 Urban Water Management Plan (UWMP)
- 2021 Water Shortage Contingency Plan
- Appendix J as an Addendum to the 2015 UWMP

RECOMMENDED BOARD ORDER 7(b-1)

To the Board of Directors **FOR BOARD ACTION**

ADOPT RESOLUTION NO. R-21-08
2020 URBAN WATER MANAGEMENT PLAN, 2021 WATER SHORTAGE CONTINGENCY PLAN, AND AMENDMENT TO APPENDIX J OF THE 2015 URBAN WATER MANAGEMENT PLAN

The Board of Directors adopted the following board order on August 24, 2021:

To adopt Resolution No. R-21-08, approving the 2020 Urban Water Management Plan, 2021 Water Shortage Contingency Plan, and Amendment to Appendix J of the 2015 Urban Water Management Plan, as presented and recommended.

Motion by Donato

Second by Parris

Carried 6-0-0-1 - aye (No response from G. Lane)

BOARD ORDER 7(b-1)

08-24-21

F

Appendix F: Antelope Valley Groundwater Adjudication

The judgement can be found at:
https://avwatermaster.net/resources/exhibits-charts/

G

Appendix G: Antelope Valley Watermaster 2019 Annual Report

Each annual report can be found at:
https://avwatermaster.net/new-annual-report/

H

Appendix H: Water Shortage Contingency Plan

ANTELOPE VALLEY-EAST KERN WATER AGENCY

2021 Water Shortage Contingency Plan

AUGUST 2021

Prepared by Water Systems Consulting, Inc.

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Water Shortage Contingency Plan

This WSCP is a detailed plan for how AVEK intends to respond to foreseeable and unforeseeable water shortages. A water shortage occurs when the water supply is reduced to a level that cannot support typical demand at any given time.

The Water Shortage Contingency Plan (WSCP) is used to provide guidance by identifying response actions to allow for efficient management of any water shortage with predictability and accountability. The tools in the WSCP enable the Antelope Valley-East Kern Water Agency (AVEK or Agency) to maintain reliable supplies and reduce the impact of supply interruptions due to extended drought or catastrophic supply interruptions.

The WSCP describes the following:

- **Water supply reliability analysis:** Summarizes the AVEK water supply analysis and reliability, and identifies any key issues that may trigger a shortage condition.
- **Annual water supply and demand assessment procedures:** Describes the key data inputs, evaluation criteria, and methodology for assessing the system's reliability for the coming year and the steps to formally declare any water shortage levels and response actions.
- **Standard shortage stages:** Establishes water shortage levels to clearly identify and prepare for shortages.
- **Shortage response actions:** Describes the response actions that may be implemented or considered for each stage to reduce gaps between supply and demand as well as minimize social and economic impacts to the community.
- **Communication protocols:** Describes communication protocols under each stage to ensure customers, the public, and government agencies are informed of shortage conditions and requirements.
- **Legal authority:** Lists the legal ordinance that grants AVEK the authority to declare a water shortage and implement and enforce response actions.
- **Financial consequences of WSCP implementation:** Describes the anticipated financial impact of implementing water shortage stages and identifies mitigation strategies to offset financial burdens.
- **WSCP refinement procedures:** Describes the factors that may trigger updates to the WSCP and outlines how to complete an update.
- **Plan adoption, submittal, and availability:** Describes the process for the WSCP adoption, submittal, and availability after each revision.

This WSCP was prepared in conjunction with AVEK's 2020 Urban Water Management Plan (UWMP) and is a stand-alone document that can be modified as needed. This document is compliant with California Water Code (CWC) Section 10632 and incorporates guidance from the State of California Department of Water Resources (DWR) UWMP Guidebook. The plan is intended to provide guidance, rather than absolute direction, for action in response to water shortages and provide options to responsibly manage water shortages.

1.1 Water Supply Reliability

Water supply reliability reflects the Agency's ability to meet the water needs of its retailers with water supplies under varying conditions. The analysis considers plausible hydrological and regulatory variability, climate conditions, and other factors that affect water supply and demand. The following is a concise narrative of the water supply reliability assessment. Chapter 7 of AVEK's 2020 UWMP describes the reliability of the water supply by comparing supply and demand projections through 2045 for normal, single dry, and multiple dry years. The section also assesses the drought risk over the next five years (2021 to 2025) assuming the driest five-year period is repeated over the next five years. Refer to the 2020 UWMP for the full assessment. As demonstrated in this section, AVEK has sufficient supplies to meet demand in normal year, single dry, and multiple dry years.

As a wholesale water supplier, AVEK provides water to retail water suppliers in the Antelope Valley. AVEK's supplies for this assessment consist of:

- The State Water Project (SWP), which is managed by DWR.
- Antelope Valley Groundwater Basin adjudicated rights, including production rights and imported water return flows, which are managed by the Antelope Valley Groundwater Basin Watermaster.
- Non-SWP water, from a 2017 long-term lease for 1,700 acre-feet, even in dry years.

AVEK's water reliability goal is to provide a level of regional water reliability that supports customers' water needs by developing groundwater banking programs to help increase the reliability of the Antelope Valley region's water supplies. This is achieved by storing excess SWP water during wet periods in the local groundwater basin and recovering it for delivery to customers during dry and high-demand periods or during a disruption in deliveries from the SWP.

For the water supply reliability analysis, the following supply availability assumptions were applied for SWP Table A allocation for normal, single dry year, and multiple dry conditions for each of the City's supplies:

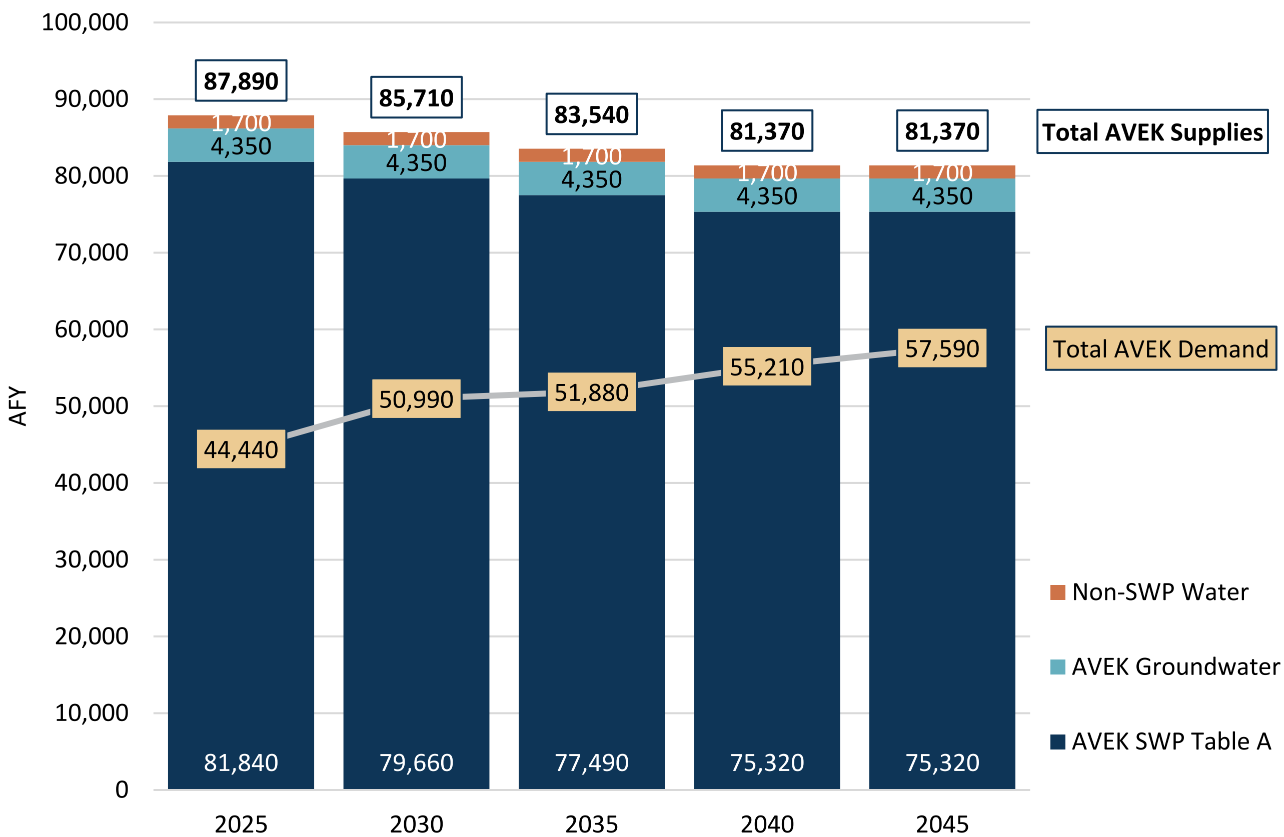
- **Normal Year:** Average yield based on DWR 2019 SWP Delivery Capability Report (DCR) (California Department of Water Resources 2020).
- **Single Dry Year:** The lowest Table A allocation was 5% in 2014 and 2021 (as of June 2021).
- **Multiple Dry Year:** The five-year historical sequence with the lowest available supply in the 2019 DCR was 1988 to 1992.

AVEK groundwater supplies are assumed to consist of 3,550 acre-feet per year (AFY) of production rights from the adjudication and 800 AFY of imported water return flows based on 2016 to 2020 return flows. Groundwater rights are not impacted by short-term drought conditions, so normal year groundwater yield assumptions are applied. In years with low SWP Table A allocations, the remainder of demand is met with groundwater bank supplies.

1.1.1 Normal Year

Average SWP Table A allocation is projected to decrease from 58% in 2020 to 52% in 2040 (California Department of Water Resources, 2020). Total normal year AVEK supplies are shown in **Figure 1**. Based on these assumptions, AVEK has sufficient supplies in normal years and could use available supplies to build groundwater storage for dry periods. For example, SWP water could be recharged when available, or unused groundwater rights can be carried over for use in future years.

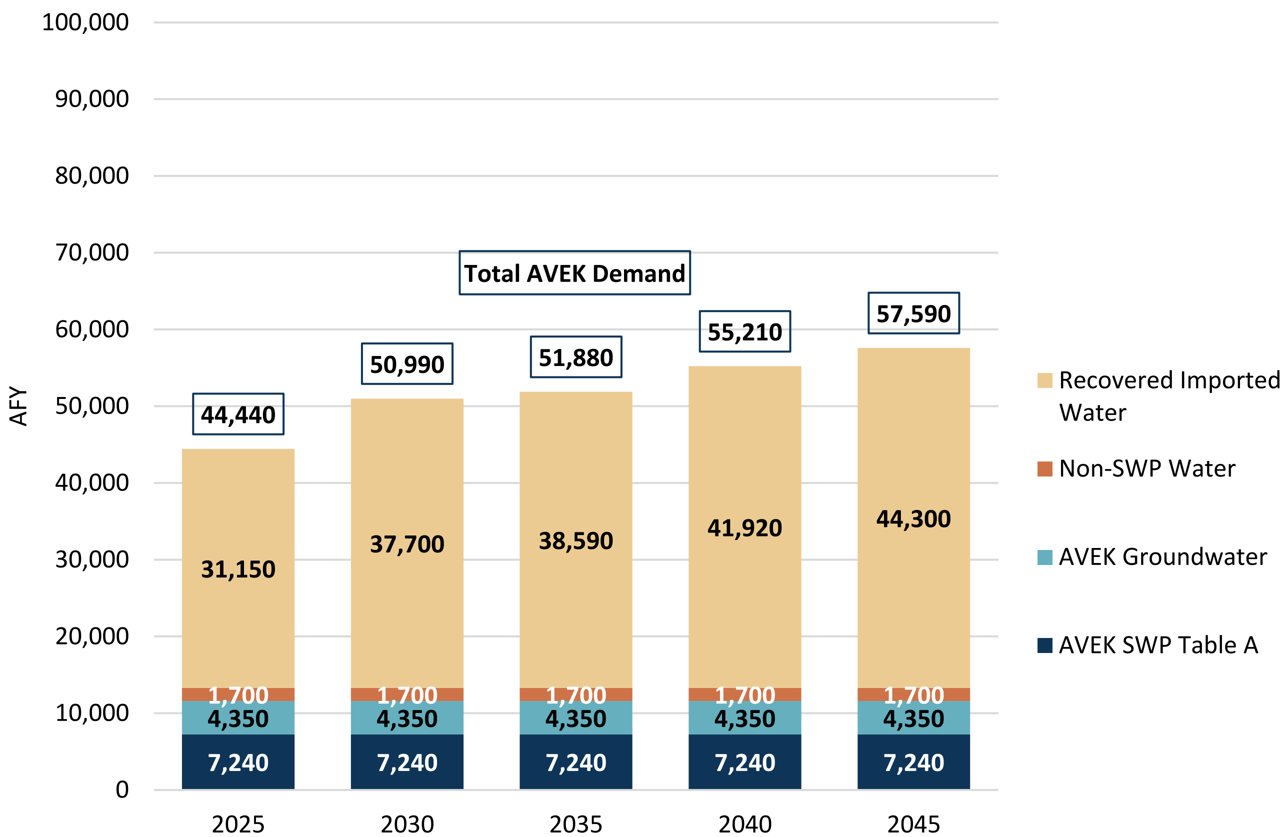
Figure 1. AVEK Supply and Demand Projections, Normal Year



1.1.2 Single Dry Year

Single dry year yield for SWP water is based on actual 2014 and 2021 allocations (as of June 2021) of 5%. Groundwater rights and non-SWP water are not impacted by short-term drought conditions, so normal year supply assumptions are applied. The remainder of demand is met with groundwater in storage. As shown in **Figure 2**, recovered imported water from AVEK groundwater banks enable AVEK to meet its demands in a single dry year.

Figure 2. AVEK Supply and Demand Projections, Single Dry Year



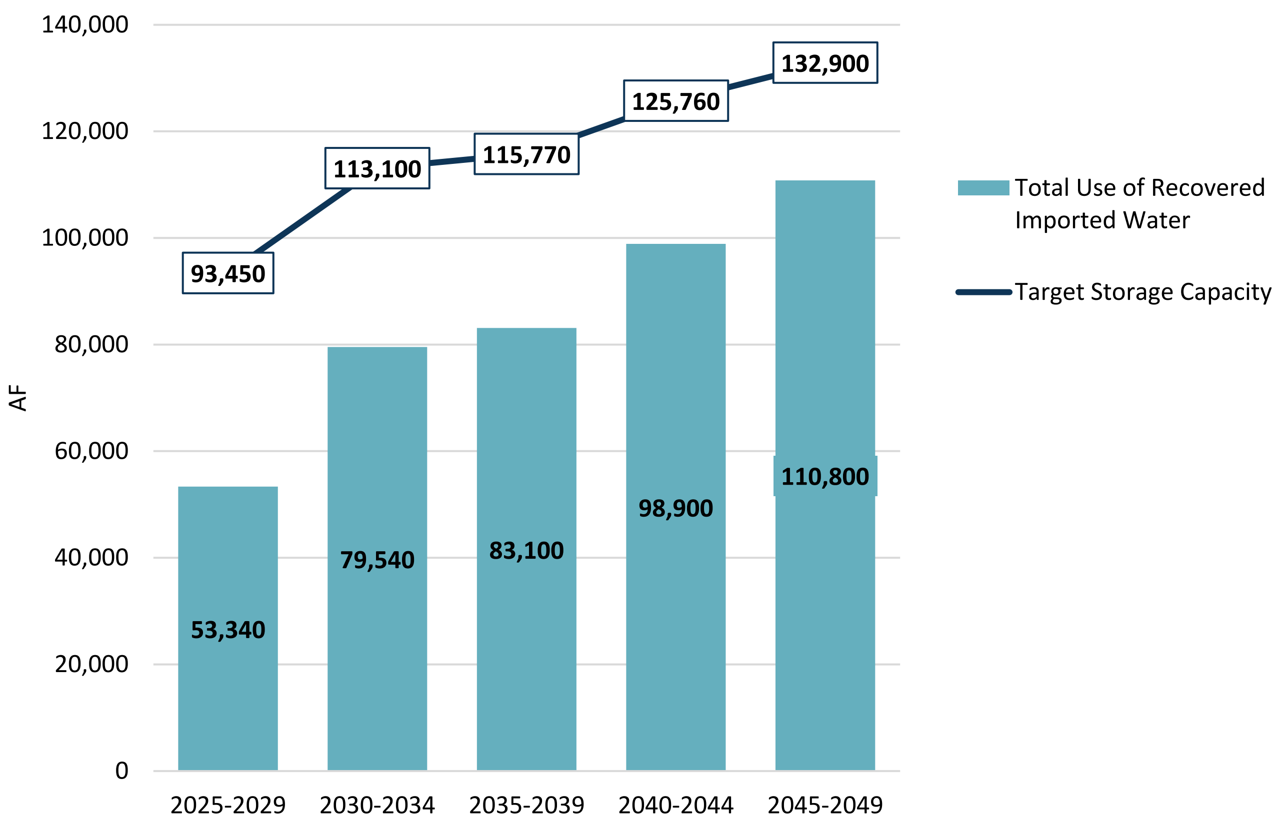
1.1.3 Five Consecutive Dry Years

For multiple dry years, SWP water availability is based on the five-year period with the lowest SWP simulated yield from the 2019 SWP DCR (1988–1992) and the following annual Table A allocation:

- Year 1 (1988) 12.3%
- Year 2 (1989) 32.2%
- Year 3 (1990) 13.3%
- Year 4 (1991) 25.6%
- Year 5 (1992) 18.0%

Similar to single dry year, groundwater rights and non-SWP water are not impacted by an extended drought, and recovered imported water from AVEK groundwater banks are used to meet remaining demands. **Figure 3** presents the total volume of imported water recovered from AVEK groundwater banks during a multiple-year drought in comparison with the target total storage volume. As shown in the figure, additional recovery of imported water from AVEK groundwater banks would be available if the five-year drought continued.

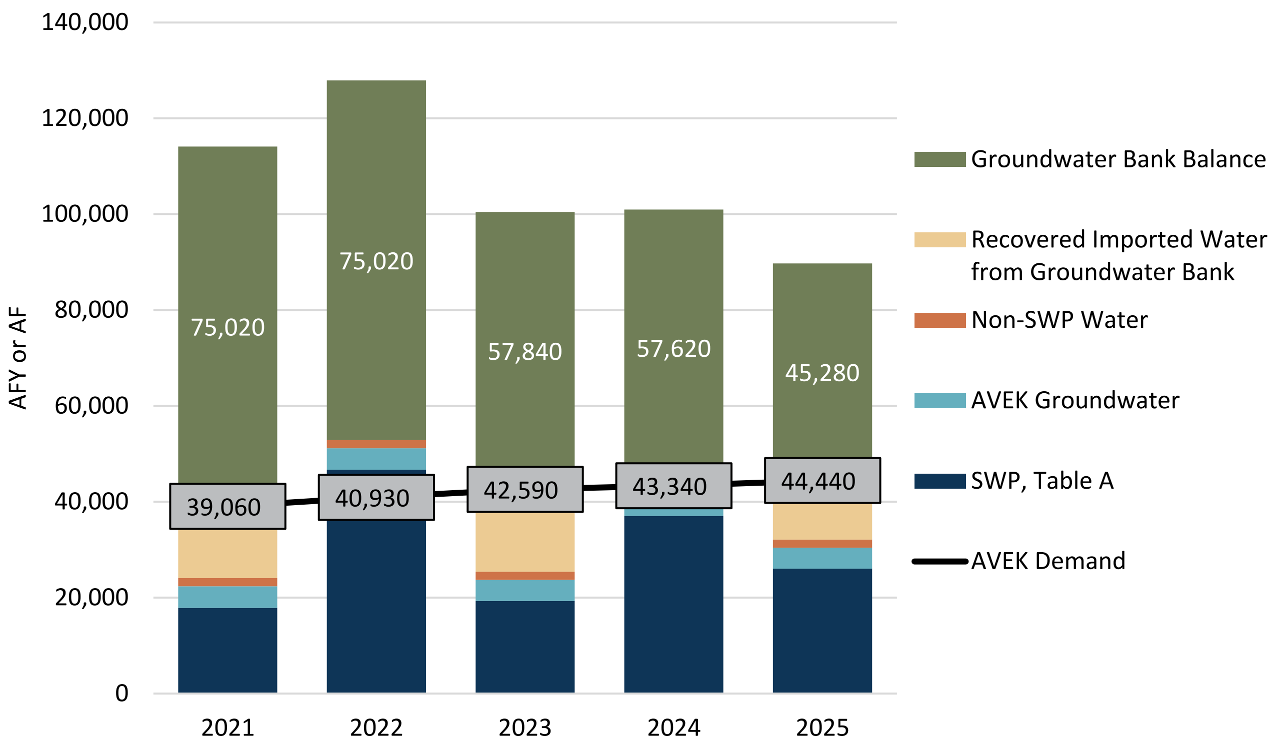
Figure 3. AVEK Groundwater Bank Use vs. Storage Capacity during Five Consecutive Dry Years



1.1.4 2021-2025 Drought Risk Assessment

The Drought Risk Assessment for the upcoming five years (2021–2025) is based on the five-year period with the lowest SWP simulated yield from the 2019 SWP DCR (1988–1992). **Figure 4** presents the projected supplies used to meet demands and the remaining available supply each year. AVEK currently has roughly 90,000 acre-feet (AF) of imported water stored within its banks for future recovery and is implementing infrastructure projects to expand its capacity to recharge water, recover water, and distribute recovered water. As shown in the figure, AVEK still would have over 45,000 AF of imported water remaining in storage at the end of a five-year drought that starts in 2021.

Figure 4. 2021–2025 AVEK Drought Reliability Assessment



1.2 Annual Water Supply and Demand Assessment

As established by CWC Section 10632.1, urban water suppliers must conduct annual water supply and demand assessments, and submit an annual water shortage assessment report to DWR with information on anticipated shortages, triggered shortage response actions, and compliance and enforcement actions consistent with the WSCP. Beginning July 1, 2022, AVEK must prepare its annual water supply and demand assessment and submit an Annual Water Shortage Assessment Report to DWR. The Annual Water Shortage Assessment Report will be due by July 1 of every year.

Per CWC, the annual assessment must include:

- The written decision-making process AVEK will use each year to determine its water supply reliability.
- The key data inputs and assessment methodology used to evaluate the supplier's water supply reliability for the current year and one dry year, including:
  - Current year unconstrained demand
  - Current year available supply in the current year and one dry year
  - Existing infrastructure capabilities and plausible constraints
  - A defined set of locally applicable evaluation criteria that are consistently relied upon for each annual water supply and demand assessment
  - A description and quantification of each source of water supply

AVEK regularly assess its water supply and demands. The following are AVEK's targets and goals when making decisions on managing AVEK's water supplies:

- Storage goals
  - SWP carryover goal of 15,000 to 20,000 AF in the event the following water year is below average or dry
  - Local groundwater storage goal to have enough local groundwater storage to meet customer demands for three years with a 10% SWP allocation for those three years
- During the fourth quarter of each year, AVEK requests a five-year demand projection from each of its customers. AVEK uses this information to calculate what the projected annual demand will be for AVEK and tracks the projected versus actual demand to adjust the plan for that year.
- AVEK's General Manager, Assistant General Manager, Water Resources Manager, and Operations Manager meet regularly to review the available water supplies and sources, customer demands, and transfer/exchange statuses. Decisions are discussed and made as to which water sources will be used and what facilities will be used to treat/distribute the water to meet the demands of its customers.

1.3 Water Shortage Stages

In the event of water supply shortages, the Agency will make water delivery reductions per this WSCP. The stages of action are summarized in **Table 1**. Actions to be taken as a result of a catastrophic water supply shortage are discussed in **Section 1.4.4**.

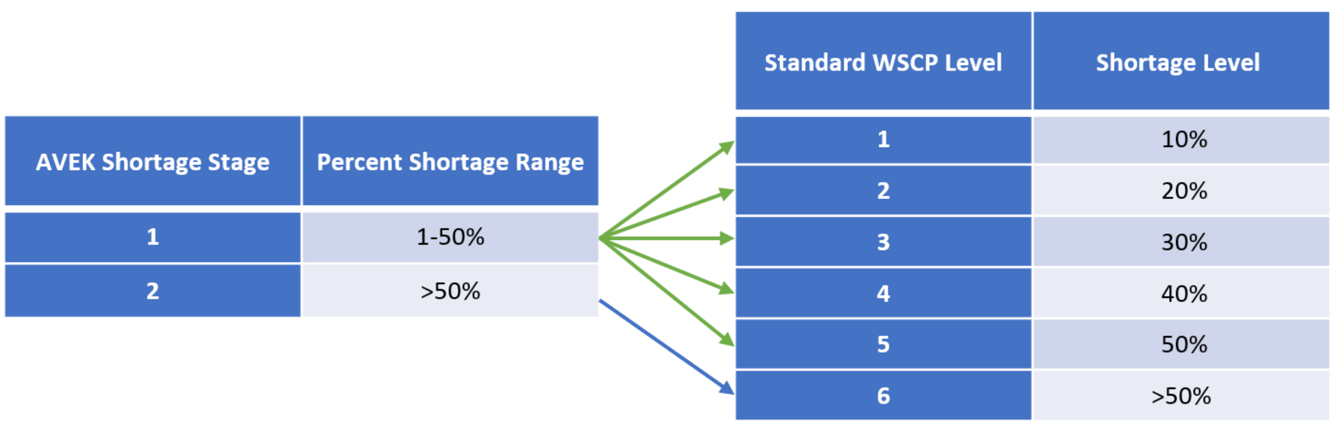
Table 1. WSCP Levels (DWR Table 8-1)

Shortage Level	Percent Shortage Range (Numerical Value as a Percent)	Water Supply Condition
1	Up to 50%	Reduction in SWP Allocation below Current Demand
2	>50%	Reduction in SWP Allocation below Current Demand or Catastrophic water supply shortage

1.3.1 Standard Water Shortage Level Crosswalk

CWC Section 10632(a)(3)(A) includes six standard water shortage levels corresponding to progressive ranges of up to 10%, 20%, 30%, 40%, and 50% shortages and greater than 50% shortages. If the supplier's water shortage levels do not correspond with the six standard levels, a crosswalk between the supplier's stages and the standard levels is required for compliance, as shown in **Figure 5**.

Figure 5. Water Shortage Level Crosswalk



1.4 Shortage Response Actions

CWC Section 10632 (a)(4) requires the WSCP to specify shortage response actions that align with the defined shortage levels. The Agency has defined specific shortage response actions that align with the defined shortage levels in **Table 1** and **Figure 5**. These shortage response actions were developed with consideration to the system infrastructure and operations changes, supply augmentation responses, customer-class- or water-use-specific demand reduction initiatives, and increasingly stringent water use prohibitions.

1.4.1 Demand Reduction

Although AVEK does not have the authority to implement consumer-level reduction methods, the Agency has adopted some consumption reduction measures to help retail water suppliers reduce water usage. These are listed in **Table 2** and described in more detail in the 2020 UWMP Chapter 9, Demand Management Measures.

Table 2. Demand Reduction Actions (DWR 8-2)

SHORTAGE LEVEL	DEMAND REDUCTION ACTIONS	HOW MUCH IS THIS GOING TO REDUCE THE SHORTAGE GAP?[1]	ADDITIONAL EXPLANATION OR REFERENCE	PENALTY, CHARGE, OR OTHER ENFORCEMENT
All	Expand Public Information Campaign	Up to 50%	Community outreach that includes educational information and water conservation tips	No

Note:
1. Reduction in the shortage gap is estimated and can vary significantly.

1.4.2 Supply Augmentation

The SWP conveyance infrastructure enables AVEK to convey supplemental water purchases to augment drought year supplies. Refer to the 2020 UWMP Section 6.2 for more information on supplemental water purchases and transfers. Supply augmentation actions are described in **Table 3**. These augmentations represent short-term management objectives triggered during a water shortage and do not overlap with the long-term new water supply development or supply reliability enhancement projects.

Table 3. Supply Augmentation & Other Actions (DWR 8-3W)

SHORTAGE LEVEL	SUPPLY AUGMENTATION METHODS AND OTHER ACTIONS BY WATER SUPPLIER	HOW MUCH IS THIS GOING TO REDUCE THE SHORTAGE GAP?	ADDITIONAL EXPLANATION OR REFERENCE
Agency Discretion	Water Purchases and Transfers	Varying	Supplemental water purchases from SWP

1.4.3 Emergency Response Plan

AVEK maintains emergency plans for activities required in the event there is an interruption in the SWP water supply or there is a major mechanical or electrical failure in one of the water treatment plants. In September 2020, AVEK adopted an Emergency Response Plan (ERP) in alignment with America's Water Infrastructure Act of 2018. An ERP describes strategies, resources, plans, and procedures utilities can use to prepare for and respond to an incident, natural or man-made, that threatens life, property, or the environment. The ERP is not attached to this WSCP due to sensitive information included, but key aspects are summarized in this section.

The emergency activities undertaken by AVEK depend upon the severity of the problem and how quickly it can be remedied. Response to a catastrophic event will always include contact and coordination with AVEK's customers. If the emergency can be resolved within the available water storage time frame, only a few of the larger customers need to be notified of the temporary decrease in water supply. If there will be a stoppage in the raw water deliveries to the various water treatment plants, all customers (Municipal and Industrial (M&I) and agriculture) will be notified of the stoppage and how soon water deliveries may be resumed.

Possible catastrophes affecting water supply may include:

- Widespread power outage
- Local earthquake
- Agency treatment plant shutdown due to vital component failure
- Aqueduct failure due to earthquake or other circumstances
- Delta levee failure

In the event of power loss, AVEK has permanent emergency power generation equipment that automatically starts to maintain water treatment operations. In the event of an earthquake, AVEK personnel will survey and assess damage and respond accordingly with shutdowns and repairs. Damaged Agency treatment plant components, whether mechanical or electrical, may be able to be circumvented due to the duplication of pumping and operations systems or the availability of manual override controls.

If raw water deliveries to water treatment plants are temporarily stopped, treated water from other plants may be able to be rerouted to the affected areas via interconnecting pipeline systems. Recovery of previously banked groundwater can be used to supply water in the event of SWP outages. The magnitude of reduced water deliveries and length of time before resumption of full water availability will determine the extent of customer (M&I and agriculture) notification and activities required by AVEK staff. In the event of a long-term outage of SWP supplies, AVEK will coordinate with the retail water agencies to develop and implement appropriate regional water conservation measures.

Failure of the aqueduct or Delta levees could result in significant outages and potential interruption in SWP service to AVEK for six months or longer. DWR has estimated that, in the event of a major earthquake in or near the Delta, regular water supply deliveries from the SWP could be interrupted for up to three years, posing a substantial risk to the California business economy. Accordingly, a post-event strategy has been developed which would provide necessary water supply protections. The plan has been coordinated through DWR, the Army Corps of Engineers (Corps), Bureau of Reclamation, California Office of Emergency Services (Cal OES), Metropolitan Water District of Southern California, and State Water Contractors. Full implementation of the plan would enable resumption of at least partial deliveries from the SWP in less than six months.

DWR has developed the Delta Flood Emergency Management Plan to provide strategies for a response to Delta levee failures, addressing a range of failures up to and including earthquake-induced multiple island failures during dry conditions when the volume of flooded islands and saltwater intrusion is large. Under such severe conditions, the plan includes a strategy to establish an emergency freshwater pathway from the central Delta along Middle River and Victoria Canal to the export pumps in the south Delta. The plan includes the pre-positioning of emergency construction materials at existing and new stockpiles and warehouse sites in the Delta, and development of tactical modeling tools (DWR Emergency Response Tool) to predict levee repair logistics, water quality conditions, and timelines of levee repair and suitable water quality to restore exports. The Delta Flood Emergency Management Plan has been extensively coordinated with state, federal, and local emergency response agencies.

DWR, in conjunction with local agencies, the Corps, and Cal OES, regularly conducts simulated and field exercises to test and revise the plan under real-time conditions.

DWR and the Corps provide vital Delta region response to flood and earthquake emergencies, complementing an overall Cal OES structure. Cal OES is preparing its Northern California Catastrophic Flood Response Plan, which incorporates the DWR Delta Flood Emergency Management Plan. These agencies use a unified command structure and response and recovery framework. DWR and the Corps, through a Draft Delta Emergency Operations Integration Plan (April 2015), would integrate personnel and resources during emergency operations.

The DWR Delta Levees Subvention Program has prioritized, funded, and implemented levee improvements along the emergency freshwater pathway and other water supply corridors in the central and south Delta region. These efforts have been complementary to the DWR Delta Flood Emergency Management Plan, which, along with use of pre-positioned emergency flood fight materials in the Delta, relies on the pathway and other levees providing reasonable seismic performance to facilitate restoration of the freshwater pathway after a severe earthquake. Together, these two DWR programs have been successful in implementing a coordinated strategy of emergency preparedness for the benefit of SWP and Central Valley Project (CVP) export systems.

Significant improvements to the central and south Delta levee systems along the Old and Middle Rivers began in 2010 and are continuing to the present time at Holland Island, Bacon Island, Upper and Lower Jones Tracts, Palm Tract, and Orwood Tract. This complements substantially improved levees at Mandeville and McDonald Islands and portions of Victoria and Union Islands. Together, levee improvements along the pathway and Old River levees consisting of crest raising, crest widening, landside slope fill, and toe berms meet the needs of local reclamation districts and substantially improve seismic stability to reduce levee slumping and create a more robust flood-fighting platform.

1.4.4 Seismic Risk Assessment and Mitigation Plan

AVEK completed a Risk and Resilience Assessment (R.E. Patterson and Associates, March 2020) in 2020 in alignment with America's Water Infrastructure Act of 2018 and conducted a focused seismic assessment as part of the 2020 AVEK Water System Master Plan (Carollo, September 2020). These documents, along with the AVEK ERP (discussed in the previous section) address the risk assessment and emergency response requirements for UWMPs in the water code.

1.5 Communication Protocols

AVEK strives to be proactive in communicating work strategy and conservation efforts with its retail customers. To support these efforts, AVEK developed a Strategic Communications Plan in 2020. For water shortages, AVEK would focus on key stakeholders, which include AVEK customers (public agencies, agricultural entities, water purveyors, and individuals), agency directors and staff, and State Water Contractors. AVEK would also engage with secondary stakeholders, such as constituents, government agencies (local, state, and federal), and elected officials (local, state, and federal).

Engagement would occur through owned media and earned media. Owned media is any communication channel that the Agency has control over, such as its website, social media pages, newsletters, or e-mail outreach. Owned media can be used to disseminate information and resonate messages.

The following media outlets have been identified and prioritized:

- Website, including news bulletins, press releases, news stories, and newsletter
- Newsletter
- Videos and photos
- Social media channels, including Facebook, Twitter, and LinkedIn

In addition, AVEK would emphasize water shortage conditions and measures at events. Earned media refers to publicity that is gained through unpaid promotional efforts, such as press placements or social media content shared by others. The Agency maintains a media distribution list.

1.6 Legal Authorities

In the event of water supply shortages, the Agency will make water delivery reduction per the Agency law for allocations and the Agency's water shortage contingency ordinance (Ordinance O-07-2), which is included in **Attachment 1**.

AVEK can declare a water shortage emergency in accordance with CWC Chapter 3 (commencing with Section 350) of Division 1 general provision regarding water shortage emergencies. AVEK will coordinate with any city or county within which it provides water supply services for the possible proclamation of a local emergency under California Government Code, California Emergency Services Act (Article 2, Section 8558).

1.7 Financial Consequences of WSCP

Revenues collected by the Agency are currently used to fund operation and maintenance of the existing facilities and fund new capital improvements. In dry years, the Agency will estimate a projected range of water sales versus shortage stage to quantify the impact the shortage stage may have on projected revenues and expenses.

Revenue reductions and an increase in expenses may occur during implementation of the water shortage contingency plan. The magnitude of the revenue reduction and expenditure increase will depend on the severity of the shortage. In some cases, AVEK may be able to absorb the revenue shortfall/expenditure increase by reallocating existing funds, such as delaying some capital projects. For more severe events, the Agency may enact a rate adjustment to its customers.

1.8 WSCP Refinement Procedures

AVEK intends to use this WSCP as an adaptive management plan to respond to foreseeable and unforeseeable water shortages. The WSCP is used to provide guidance to the Agency, its staff, and the public by identifying response actions to allow for efficient management of any water shortage with predictability and accountability. To maintain a useful and efficient standard of practice in water shortage conditions, the requirements, criteria, and response actions need to be continuously evaluated and improved upon to make sure the WSCP provides the tools to maintain reliable supplies and reduce the impacts of supply shortages.

AVEK deliveries are entirely metered. The meter readings will be used to monitor the actual reductions in deliveries to AVEK's customers in accordance with the water shortage contingency plan to measure effectiveness of implemented strategies.

1.9 Plan Adoption, Submittal, and Availability

Per CWC Section 10632 (a)(c), AVEK sent letters of notification of preparation of the 2021 WSCP to all necessary cities, counties, retail water agencies, and interested parties within its service areas 60 days prior to the public hearing. Copies of the notification letter and distributions list is included in **Attachment 2**. AVEK made the draft 2021 WSCP available for public review and held a public hearing on June 8, 2021. The notice of the public review hearing (**Attachment 2**) was advertised in the Valley Press on May 26, 2021 and June 2, 2021. The 2020 UWMP, 2021 WSCP, and 2015 UWMP addendum were adopted by AVEK's Board of Directors on June 22, 2021. A copy of the Resolution of Adoption is included as Attachment 3.

Once the 2021 WSCP is adopted, a copy will be submitted to the California State Library, DWR, and all cities and counties within 30 days of adoption. The Agency will also have a physical copy of the 2021 WSCP available for public review at the AVEK Office (see address below) during normal business hours.

The WSCP also will be posted on the Agency's website at **www.avek.org**.

Antelope Valley-East Kern Water
Agency 6500 W. Avenue N
Palmdale, CA 93551

Based on DWR's review of the WSCP, AVEK may make any amendments in its adopted WSCP as required and directed by DWR. If AVEK revises its WSCP after it is approved by DWR, an electronic copy of the revised WSCP will be submitted to DWR within 30 days of its adoption.

1.10 References

California Department of Water Resources. (2020). *2019 State Water Project Delivery Capability Report.*

Carollo. (September 2020). *DRAFT AVEK Water System Master Plan.*

R.E. Patterson and Associates. (March 2020). *AVEK Risk and Resilience Assessment.*

1

Attachment 1: AVEK Water Shortage Contingency Ordinance

ANTELOPE VALLEY-EAST KERN WATER AGENCY
ORDINANCE NO. O-07-2

AN ORDINANCE OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY TO ADOPT A WATER SHORTAGE CONTINGENCY PLAN

WHEREAS, the Board of Directors of the Antelope Valley-East Kern Water Agency ("AVEK") hereby finds:

I.
RECITALS

WHEREAS, the Antelope Valley-East Kern Water Agency was formed in 1959 by an act of the State Legislature. AVEK's powers, duties, authorities and other matters are set forth in its enabling act, which is codified at California Water Code, Uncodified Acts, Act 9095 (the "AVEK Enabling Act"); and

WHEREAS, AVEK's jurisdictional boundaries cover portions of three counties, Los Angeles, Ventura County and Kern County, and is more particularly described in Appendix E in the 2005 Urban Water Management Plan ("AVEK's Jurisdictional Boundaries"); and

WHEREAS, AVEK was formed for the purpose of providing water received from the State Water Project ("SWP") as a supplemental source of water to retail water purveyors and other water interests with AVEK's Jurisdictional Boundaries on a wholesale basis; and

WHEREAS, in order to effectuate the above-referenced purpose, AVEK, among other things, entered into a contract with the Department of Water Resources ("DWR"), which operates the SWP, in order for AVEK to receive water from the SWP ("SWP Water"); and

WHEREAS, AVEK has entered into contracts with various retail purveyors and other water interests in AVEK's Jurisdictional Boundaries that govern AVEK's delivery of SWP Water to those purveyors and other water interests (the "AVEK's Water Supply Contracts"). Article 19 in those contracts provides that "substantial uniformity" in those contracts is "desirable" and that AVEK will attempt to maintain such "uniformity" between such contracts; and

WHEREAS, AVEK does not provide SWP Water directly to any person or entity for domestic or municipal purposes; and

WHEREAS, AVEK does not own or operate any facilities that can produce reclaimed water or native groundwater from any area in AVEK's Jurisdictional Boundaries, and neither does AVEK possess any contractual right or matured water right to produce such waters; and

WHEREAS, the Urban Water Management Planning Act, California Water Code Section 10610 *et seq.* ("UWMP Act") provides that urban water management plans shall include a resolution or ordinance by the supplier that sets forth a water shortage contingency plan; and

WHEREAS, Section 61.1 of t he AVEK Enabling Act sets forth guiding principles for AVEK's distribution of SWP Water, which principles can be drawn upon in allocating such water in times of shortage (the provisions of Section 61.1 of the AVEK Enabling Act are set forth in Exhibit A to this Ordinance); and

WHEREAS, real property related taxes have been paid to AVEK since 1959 by entities in AVEK's Jurisdictional Boundaries.

WHEREAS, AVEK has circulated drafts of its proposed 2005 UWMP and the water shortage contingency plan set forth in this Ordinance ("WSC Plan") to the public for review and comment; and

WHEREAS, AVEK's Board of Directors ("AVEK Board") held duly noticed public hearings on its proposed 2005 UWMP on November 15, 2005 and December 20, 2005, and a public meeting on the WSC Plan on December 20. 2005; and

WHEREAS, the AVEK Board received written and verbal testimony and evidence from the public and others concerning its proposed 2005 UWMP and WSC Plan.

II.
FINDINGS

THEREFORE, AVEK finds as follows:

1. AVEK finds that there is a need to adopt a water shortage contingency plan given, among other things, the requirements of the UWMP Act and the potential that the amount of SWP Water made available to AVEK by DWR may not satisfy the demands for SWP Water by AVEK's customers (even though such demand for SWP water has only exceeded the available supply of SWP Water once since AVEK was formed).

2. The WSC Plan complies with all applicable laws and regulations, including but not limited to the UWMP Act, the AVEK Enabling Act, and the Guidebook to Assist Water Suppliers in the Preparation of a 2005 Urban Water Management Plan issued by

DWR and dated as of January 18, 2005.

3. AVEK finds that the WSC Plan is fair and equitable.

4. The WSC Plan is consistent with the intent and terms of the AVEK's Water Supply Agreement and the AVEK Enabling Act.

5. Each of the recitals contained in the Ordinance is approved as a finding of fact.

III.
ADOPTION OF WATER SHORTAGE CONTINGENCY PLAN

Therefore, be it resolved and ordained by the AVEK Board as follows:

1. AVEK adopts a WSC Plan that would be implemented when the aggregate
amount of SWP Water reasonably ordered by AVEK's customers in any water year exceeds the amount of SWP Water that DWR makes available to AVEK on that same water year (a "SWP Water Shortage Year"). When that contingency occurs (which contingency will be deemed to occur under both stages listed in Appendix 1 hereto), AVEK plans to allocate that amount of available SWP Water as follows:

(a) The available SWP Water shall first be allocated per each county (the
"County Allocation of SWP Water") in AVEK's Jurisdictional Boundaries based on a running historical average of the amount of taxes paid to AVEK by entities in each particular county since the formation of AVEK in 1959. (Attached as Exhibit B to this Ordinance is the historical amount of such taxes paid by county through June 30, 2005.) AVEK shall annually update and publish that running historical average of taxes paid to AVEK by county.

(b) Each County's Allocation of SWP Water shall be further allocated to each AVEK customer within that particular county based on its average annual percentage of SWP Water received in the two water years prior to the SWP Water Shortage Year relative to the amount of SWP Water received by all other AVEK customers in that particular county in those two prior water years. (For illustrative purposes, attached as Exhibit C to this Ordinance is a list of such relative percentages by AVEK customers by county for 2004.)

(c) In determining the amount of SWP Water that should be delivered by
AVEK to any customer in any SWP Water Shortage Year, AVEK will fill orders for SWP Water that will be used by the AVEK customer(s) for consumptive or agricultural uses in

that same water year prior to filling any order for SWP Water that would be used by an AVEK customer for banking or storage purposes.

(d) AVEK reserves the right to allocate SWP Water that it receives from DWR in a SWP Water Shortage Year in a manner that differs from the provisions of this WSC Plan based on a finding by the AVEK Board of unique or unusual circumstances or needs.

This Ordinance shall be in full force and effect upon the date of adoption, and shall be published in full in a newspaper of general circulation within ten (10) days from the date of adoption.

Passed and adopted this 19th day of June, 2007, by the following vote:

AYES: 6 **NOES:** 0 **ABSENT:** 1 **ABSTAIN:** 0

Andy D. Rutledge, President
Board of Directors
Antelope Valley-East Kern Water Agency

ATTEST:

Agency Secretary

EXHIBIT A

§ 61.1 Distribution and apportionment of water purchased from State, etc. The agency shall whenever practicable, distribute and apportion the water purchased from the State of California or water obtained from any other source as equitably as possible on the basis of total payment by a district or geographical area within the agency regardless of its present status, of taxes, in relation that such payment bears to the total taxes and assessments collected from all other areas. It is the intent of this section to assure each area or district its fair share of water based upon the amounts paid into the agency, as they bear relation to the total amount collected by the agency.

EXHIBIT B

AVEK Water Agency
Taxes Collected from Inception through 06/30/07

Description	Los Angeles Cty Taxes collected by Fiscal Year	Kern Cty Taxes collected by Fiscal Year	Ventura County Taxes collected by Fiscal Year	TOTALS
FYE 06/30/1961	58,306.69	20,846.13		79,152.82
FYE 06/30/1962	55,138.24	19,372.90		74,511.14
FYE 06/30/1963	156,220.27	53,906.15		210,126.42
FYE 06/30/1964	221,396.82	81,444.27		302,841.09
FYE 06/30/1965	174,560.93	69,835.70		244,396.63
FYE 06/30/1966	195,498.90	97,105.93		292,604.83
FYE 06/30/1967	417,054.54	234,620.40	201.75	651,876.69
FYE 06/30/1968	787,195.00	371,132.00	3,066.00	1,161,393.00
FYE 06/30/1969	969,673.00	396,253.00	3,319.00	1,369,245.00
FYE 06/30/1970	1,227,682.00	547,964.00	4,642.00	1,780,288.00
FYE 06/30/1971	1,233,111.00	600,115.00	3,555.00	1,836,781.00
FYE 06/30/1972	1,825,460.00	854,406.00	4,560.00	2,684,426.00
FYE 06/30/1973	1,948,561.00	862,025.00	2,512.00	2,813,098.00
FYE 06/30/1974	2,047,586.00	806,490.00	2,309.00	2,856,385.00
FYE 06/30/1975	2,586,924.00	890,533.00	9,396.00	3,486,853.00
FYE 06/30/1976	2,029,787.00	862,676.00	3,821.00	2,896,284.00
FYE 06/30/1977	1,720,809.00	721,466.00	3,770.00	2,446,045.00
FYE 06/30/1978	1,607,785.00	774,212.00	5,121.00	2,387,118.00
FYE 06/30/1979	1,784,643.00	997,363.00	3,663.00	2,785,669.00
FYE 06/30/1980	4,171,081.00	892,189.00	3,511.00	5,066,781.00
FYE 06/30/1981	4,995,491.00	1,351,056.00	4,834.00	6,351,381.00
FYE 06/30/1982	3,115,496.00	1,222,927.00	6,544.00	4,344,967.00
FYE 06/30/1983	4,311,370.00	1,722,635.00	8,196.00	6,042,201.00
FYE 06/30/1984	6,689,690.00	1,501,127.00	4,279.00	7,195,096.00
FYE 06/30/1985	9,769,574.00	3,575,437.00	18,208.00	13,363,219.00
FYE 06/30/1986	12,776,020.00	3,633,507.00	13,154.00	16,422,681.00
FYE 06/30/1987	12,730,936.00	3,073,228.00	10,767.00	15,814,931.00
FYE 06/30/1988	12,076,802.00	2,805,666.00	5,427.00	14,887,895.00
FYE 06/30/1989	13,700,634.00	2,928,709.00	48,066.00	16,677,409.00
FYE 06/30/1990	16,387,060.00	2,924,143.00	3,950.00	19,315,153.00
FYE 06/30/1991	14,757,446.00	3,236,690.00	0	17,994,136.00
FYE 06/30/1992	14,730,588.00	2,987,854.00	722.00	17,719,164.00
FYE 06/30/1993	14,795,789.00	2,895,327.00	722.00	17,691,838.00
FYE 06/30/1994	10,374,526.00	2,408,372.00	732.00	12,783,630.00
FYE 06/30/1995	11,757,593.00	2,215,878.00	747.00	13,974,218.00
FYE 06/30/1996	11,705,148.00	1,445,898.00	730.00	13,151,776.00
FYE 06/30/1997	9,078,884.00	1,843,601.00	721.00	10,923,206.00
FYE 06/30/1998	10,287,808.00	1,890,125.00	734.00	12,186,667.00
FYE 06/30/1999	8,893,825.00	2,623,064.00	674.00	11,517,563.00
FYE 06/30/2000	15,687,806.00	2,094,870.00	676.00	17,783,352.00
FYE 06/30/2001	10,233,359.00	2,184,558.00	685.00	12,418,602.00
FYE 06/30/2002	10,098,249.00	2,069,703.00	353.00	12,168,305.00
FYE 06/30/2003	10,853,001.00	3,394,512.00	269.00	14,247,782.00
FYE 06/30/2004	12,011,832.00	1,987,130.00	280.00	13,999,242.00
FYE 06/30/2005	12,275,847.00	2,290,255.00	0.00	14,566,102.00
FYE 06/30/2006	12,375,800.89	2,467,682.61	0.00	14,843,483.50
FYE 06/30/2007	12,548,965.69	2,783,514.23	260.29	15,332,740.21
FYE 06/30/2008	13,061,271.22	3,259,389.60	263.62	16,320,924.44
FYE 06/30/2009	14,660,938.81	3,615,857.26	269.44	18,277,065.51
FYE 06/30/2010	11,621,708.76	3,347,303.49	230.39	14,969,242.64
	362,591,932.76	85,933,874.67	186,040.49	448,711,847.92

EXHIBIT C

Kern County	%
Billiton Exploration U.S.A.	0.24
Boron CSD	4.66
City of California City	9.88
Desert Lake CSD	1.47
Desert Sage Apartments	0.09
Edgemont Acres MWC	0.31
Edwards AFB	37.79
Mojave Public Utility District	1.01
Rosamond CSD	17.88
US Borax	26.67

Los Angeles County	%
Antelope Valley Country Club	0.35
California Water Service Co	0.58
Landale MWC	0.13
Los Angeles County Waterworks Districts	84.98
Palm Ranch Irrigation District	0.71
Quartz Hill Water District	8.42
Shadow Acres MWC	0.61
Sunnyside Farms MWC	0.59
White Fence Farms MWC	1.71
Lake Elizabeth MWC	1.91

Appendix 1 to the Water Shortage Contingency Plan

Water Supply Shortage Stages and Conditions

Stage No.	Water Supply Conditions	% Shortage
1	Reduction in SWP Allocation Below Current Demand	1 %
2	Reduction in SWP Allocation Below Current Demand	50%

2

Attachment 2: Notifications and Notification List

ANTELOPE VALLEY - EAST KERN WATER AGENCY
AVEK
ESTABLISHED 1959
A PUBLIC AGENCY

April 6, 2021

NOTICE OF PUBLIC HEARING ON THE ANTELOPE VALLEY-EAST KERN WATER AGENCY DRAFT 2020 URBAN WATER MANAGEMENT PLAN, DRAFT 2021 WATER SHORTAGE CONTINGENCY PLAN, AND DRAFT APPENDIX J TO THE 2015 UWMP

Dear Recipient,

The Antelope Valley-East Kern Water Agency (AVEK) is in the process of preparing its 2020 Urban Water Management Plan (UWMP) and 2021 Water Shortage Contingency Plan (WSCP) as required by the Urban Water Management Planning Act (Act). In addition, AVEK is preparing an Appendix to both the 2015 UWMP and 2020 UWMP to demonstrate consistency with the Delta Plan Policy WR P1, Reduced Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit.23, §5003). The 2015 UWMP is being amended only to report reduced reliance on the Delta and this action is separate from adoption of the 2020 UWMP and adoption of the 2021 WSCP.

AVEK is required to notify its retailers as well as cities, and counties within its service areas that it is preparing its 2020 UWMP, 2021 WSCP, and Appendix J of the 2015 UWMP at least 60 days prior to holding a public hearing. The public hearing is scheduled as part of a regularly scheduled AVEK Board meeting on **June 8, 2021 at 5:30 p.m.**

This serves as your official public hearing notice and intent to adopt the 2020 UWMP, 2021 WSCP and Appendix J of the 2015 UWMP before the July 1, 2021 deadline. A draft of each document will be available for review by May 25, 2021. AVEK will distribute a public draft review notification on or before May 25, 2021 with information on how to access the draft documents. Until that time, if you have any questions or comments regarding the documents or this process, please contact me at (661) 943-3201 or mknudson@avek.org.

Very truly yours,

Matthew Knudson,
Assistant General Manager

6500 WEST AVENUE N • PALMDALE, CALIFORNIA 93551
(661) 943-3201 • www.avek.org • info@avek.org

From: Tom Barnes <tbarnes@avek.org>
Date: May 25, 2021 at 6:52:00 PM PDT
Subject: AVEK Water Agency 2020 UWMP-Notice of Public Hearing/Public Draft Documents

May 25, 2021

RE: NOTICE OF PUBLIC HEARING AND RELEASE OF PUBLIC DRAFT OF THE ANTELOPE VALLEY-EAST KERN WATER AGENCY DRAFT 2020 URBAN WATER MANAGEMENT PLAN, DRAFT 2021 WATER SHORTAGE CONTINGENCY PLAN, AND DRAFT APPENDIX J TO THE 2015 UWMP

Dear Recipient,

The Antelope Valley-East Kern Water Agency (AVEK) is releasing its Public Draft 2020 Urban Water Management Plan (UWMP) and 2021 Water Shortage Contingency Plan (WSCP) as required by the Urban Water Management Planning Act (Act). In addition, AVEK has prepared an Appendix to both the 2015 UWMP and 2020 UWMP to demonstrate consistency with the Delta Plan Policy WR P1, Reduced Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit.23, §5003). The 2015 UWMP is being amended only to report reduced reliance on the Delta and this action is separate from adoption of the 2020 UWMP and adoption of the 2021 WSCP.

AVEK is notifying its retailers as well as cities, and counties within its service areas that it is releasing its 2020 UWMP, 2021 WSCP, and Appendix J of the 2015 UWMP for public review and comment prior to holding a public hearing. The public hearing is scheduled as part of a regularly scheduled AVEK Board meeting on June 8, 2021 at 5:30 p.m. online via teleconference.

A copy of the Public Draft 2020 UWMP and mentioned documents will also be made available for public review on the Agency website at: www.avek.org<http://www.avek.org>.

This notice serves as your official public hearing notice and intent to adopt the 2020 UWMP, 2021 WSCP and Appendix J of the 2015 UWMP before the July 1, 2021 deadline. If you have any questions or comments regarding the documents or this process, please contact Matt Knudson/Tom Barnes at 661-943-3201 or info@avek.org<mailto:info@avek.org>.

Sincerely,

Dwayne Chisam
General Manager

Tom Barnes | Resources Manager
Antelope Valley-East Kern Water Agency
6450 West Avenue N, Palmdale, CA 93551
Main: 661-943-3201 | fax: 661-943-3204
Direct: 661-234-8437 | mobile: 661-810-9440
Email: tbarnes@avek.org<mailto:tbarnes@avek.org> | website: www.avek.org<http://www.avek.org/>

AVEK 2020 UWMP, 2021 WSCP, and 2015 UWMP Appendix J
PUBLIC HEARING NOTIFICATION (April 5, 2021)
PUBLIC DRAFT NOTIFICATION (May 25, 2021)
RECIPIENT LIST

Water Retailer Notification Letter:

- Antelope Valley Country Club
- Boron Community Services District
- California Water Service Company Antelope Valley District
- City of California City
- Desert Lake Community Services District
- Desert Sage Apartments c/o Rex Nishimura
- Edgemont Acres Mutual Water Co.
- Edwards Air Force Base
- El Dorado Mutual Water Co.
- Lake Elizabeth Mutual Water Co.
- Landale Mutual Water Co.
- Los Angeles County Waterworks Districts - Alhambra
- Los Angeles County Waterworks Districts - Lancaster
- Mojave Public Utility District
- Palm Ranch Irrigation District
- Quartz Hill Water District
- Rosamond Community Services District
- Shadow Acres Mutual Water Co.
- Sunnyside Farms Mutual Water Co.
- West Side Park Mutual Water Co.
- White Fence Farms Mutual Water Co.
- White Fence Farms Mutual Water Co. #3

Customer Notification Letter:

- Antelope Valley Water Storage, LLC c/o WDS
- CA Dept of Parks & Recreation (Poppy Reserve)
- Rancho Vista Golf Club
- Tejon Ranch Company
- US. Borax (Rio Tinto Minerals)

Public Notification Letter:

- Antelope Valley Watermaster
- Building Industry Association
- Littlerock Creek Irrigation District
- Mojave Water Agency
- North Edwards Water District
- Palmdale Water District

Cities/Counties Notification Letter:

- City of Lancaster Planning Division
- City of Lancaster City Manager
- City of Palmdale Planning Division
- City of Palmdale Public Works
- Kern County Planning Department
- Los Angeles County Department of Regional Planning Division
- Supervisor Kathryn Barger Antelope Valley Field Office
- Ventura County Resource Management Agency Planning Division

Valley Press Ad

NOTICE OF PUBLIC HEARING
ANTELOPE VALLEY-EAST KERN WATER AGENCY

NOTICE is hereby given that a Public Hearing will be held by the Antelope Valley-East Kern Water Agency (AVEK) on Tuesday, June 8, 2021 at 5:30 PM, as part of a regularly scheduled AVEK Board meeting online via teleconference.

The Board of Directors of AVEK will receive public comment regarding the Agency's adoption of its 2020 Urban Water Management Plan (2020 UWMP) and 2021 Water Shortage Contingency Plan (WSCP), which have been prepared in compliance with the Urban Water Management Planning Act. In addition, Appendix J of the AVEK 2015 UWMP, Reduced Reliance on the Delta Through Improved Regional Water Self-Reliance (California Code Reg., tit.23, §5003), will be amendment. A Draft copy of the 2020 UWMP and related documents are available for public review on the Agency website at: www.avek.org.
Publish: May 26 and June 2, 2021

3

Attachment 3: Resolution of Adoption

RESOLUTION NO. R-21-08

A RESOLUTION OF THE BOARD OF DIRECTORS OF ANTELOPE VALLEY-EAST KERN WATER AGENCY ("AVEK") ADOPTING, DIRECTING THE FILING OF, AND IMPLEMENTING THE ANTELOPE VALLEY-EAST KERN WATER AGENCY 2020 URBAN WATER MANAGEMENT PLAN, 2021 WATER SHORTAGE CONTINGENCY PLAN, AND APPENDIX J AS AN ADDENDUM TO THE 2015 URBAN WATER MANAGEMENT PLAN

WHEREAS, the Antelope Valley-East Kern Water Agency was formed in 1959 by an act of the State Legislature. AVEK's powers, duties, authorities and other matters are set forth in its enabling act, which is codified at California Water Code, Uncodified Acts, Act 9095 (the "AVEK Enabling Act"); and

WHEREAS, AVEK's jurisdictional boundaries cover portions of three counties, Los Angeles, Ventura County and Kern County, and is more particularly described in Section 3 and Figure 3-1 of the 2020 Urban Water Management Plan ("AVEK's Jurisdictional Boundaries"); and

WHEREAS, AVEK was formed for the purpose of providing water received from the State Water Project ("SWP") as a supplemental source of water to retail water purveyors and other water interests within AVEK's Jurisdictional Boundaries on a wholesale basis; and

WHEREAS, in order to effectuate the above-referenced purpose, AVEK, among other things, entered into a contract with the Department of Water Resources ("DWR"), which operates the SWP, in order for AVEK to receive water from the SWP ("SWP Water"); and

WHEREAS, AVEK has entered into contracts with various retail purveyors and other water interests in AVEK's Jurisdictional Boundaries that govern AVEK's delivery of SWP Water to those purveyors and other water interests (the "AVEK's Water Supply Contracts"); and

WHEREAS, AVEK has developed and does operate water banking facilities within AVEK's Jurisdictional Boundaries, and has right to produce waters from these facilities for the purpose of providing groundwater as a supplemental source of water to retail water purveyors and other water interests within AVEK's Jurisdictional Boundaries on a wholesale basis; and

WHEREAS, the California Legislature enacted Assembly Bill 797 during the 1983-1984 Regular Session of the California Legislature (Water Code Section 10610 et. seq.) known as the Urban Water Management Plan Act (the Act).

WHEREAS, the Act mandates that every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually prepare, and every five (5) years thereafter update, its Urban Water Management Plan (UWMP), the primary objective of which is to plan for the conservation and efficient use of water; and

WHEREAS, the California Water Code Section 10632 requires that every urban water supplier shall prepare and adopt a Water Shortage Contingency Plan (WSCP); and

WHEREAS, the WSCP is consistent with the California Water Code Sections 350 through 359 and Section 10632 and guidance provided by the California Department of Water Resources 2020 UWMP Guidebook; and

WHEREAS, Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs., tit. 23, § 5003, subdivision (c)(1)) need to be included in a water supplier's urban water management plan to support a certification of consistency for one or more future water supply covered actions in the Sacramento-San Joaquin Delta; and

WHEREAS, the 2020 UWMP, 2021 WSCP, and Appendix J as an Addendum to the 2015 UWMP (together known as the Plans) must be adopted by July 1, 2021 and filed with the California Department of Water Resources and entities specified in the UWMP Act within thirty days of adoption; and

WHEREAS, AVEK has circulated drafts of its proposed Plans for public review and comment; and

WHEREAS, AVEK's Board of Directors ("AVEK Board") held a duly noticed public hearing on its proposed Plans on June 8, 2021; and

WHEREAS, the AVEK Board received no written or verbal comment from the public or others concerning its proposed Plans; and

WHEREAS, AVEK retained technical and legal consultants to provide expert assistance concerning its Plans; and

NOW, THEREFORE, BE IT RESOLVED by the Board of the Directors of the Antelope Valley-East Kern Water Agency as follows:

1. The 2020 Urban Water Management Plan, the 2021 Water Shortage Contingency Plan, and Appendix J as an Addendum to the 2015 UWMP are hereby approved and adopted.

2. The General Manager is authorized and directed to file the Plans with the entities specified in the UWMP Act by the dates specified therein.

PASSED AND ADOPTED at the Regular Meeting of the Antelope Valley-East Kern Water Agency Board of Directors held on August 24, 2021.

Keith Dyas, President of the Board of
Directors of Antelope Valley-East Kern Water
Agency

ATTEST:

Board Secretary-Treasurer,
Antelope Valley-East Kern Water Agency

STAFF REPORT

To: Board of Directors	Date: August 20, 2021
From: Dwayne Chisam, General Manager	Prepared By: Matthew Knudson, Assistant GM M.K.
Subject: Consideration and possible action on Resolution No. R-21-08 – Approving and adopting the 2020 Urban Water Management Plan, 2021 Water Shortage Contingency Plan, and Appendix J as an Addendum to the 2015 Urban Water Management Plan	
Meeting Date: August 24, 2021 Agenda Items: 7 (b-1) Attachment(s): ☒ YES ☐ NO	

Recommendations:

Staff recommends that the Board:

1. Approve Resolution No. R-21-08 adopting, directing the filing of, and implementing the Antelope Valley-East Kern Water Agency 2020 Urban Water Management Plan (UWMP), the 2021 Water Shortage Contingency Plan (WSCP), and Appendix J as an Addendum to the 2015 Urban Water Management Plan.

Background:

The California Legislature enacted Assembly Bill 797 during the 1983-1984 Regular Session of the California Legislature (Water Code Section 10610 et. seq.) known as the Urban Water Management Plan Act that mandates every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually prepare, and every five (5) years thereafter update, its UWMP, the primary objective of which is to plan for the conservation and efficient use of water.

Also, the California Water Code Section 10632 requires that every urban water supplier shall prepare and adopt a WSCP.

Delta Plan Policy WR P1, Reduce Reliance on the Delta Through Improved Regional Water Self-Reliance (Cal. Code Regs., tit. 23, § 5003, subdivision (c)(1)) need to be included in a water supplier's urban water management plan to support a certification of consistency for one or more future water supply covered actions in the Sacramento-San Joaquin Delta.

Agency staff and consultants have prepared the 2020 UWMP, 2021 WSCP, and Appendix J as an Addendum to the 2015 UWMP. Water Code 10642 requires that prior to adoption, an urban water supplier shall make the plan available for public inspection and shall hold at least one public hearing. The subject documents were posted on the Agency's website on Tuesday, May 25, 2021, for public review and comment. Staff and the Agency's consultant (Water Systems Consulting, Inc.) also presented an overview or the documents at the June 8, 2021 Board Meeting / Public Hearing.

No public comments have been received to date.

Strategic Plan Element:

The 2020 UWMP and related documents will assist AVEK in meeting the following Strategic Plan Goals and Objectives:

- Goal 2 – Water Reliability
- Goal 6 - Communications

Supporting Documents:

- Resolution No. R-21-08 adopting, directing the filing of, and implementing the Antelope Valley-East Kern Water Agency 2020 Urban Water Management Plan (UWMP), the 2021 Water Shortage Contingency Plan (WSCP), and Amendment to Appendix J of the 2015 Urban Water Management Plan.
- 2020 Urban Water Management Plan (UWMP)
- 2021 Water Shortage Contingency Plan
- Appendix J as an Addendum to the 2015 UWMP

RECOMMENDED BOARD ORDER 7(b-1)

To the Board of Directors **FOR BOARD ACTION**

ADOPT RESOLUTION NO. R-21-08
2020 URBAN WATER MANAGEMENT PLAN, 2021 WATER SHORTAGE CONTINGENCY PLAN, AND AMENDMENT TO APPENDIX J OF THE 2015 URBAN WATER MANAGEMENT PLAN

The Board of Directors adopted the following board order on August 24, 2021:

To adopt Resolution No. R-21-08, approving the 2020 Urban Water Management Plan, 2021 Water Shortage Contingency Plan, and Amendment to Appendix J of the 2015 Urban Water Management Plan, as presented and recommended.

Motion by Donato

Second by Parris

Carried 6-0-0-1 - aye
(No response from G. Lane)

BOARD ORDER 7(b-1)

08-24-21

Antelope Valley
Integrated Regional Water Management Plan

FINAL
2019 Update

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Executive Summary

Antelope Valley Integrated Regional Water Management Plan Overview

This document is the 2019 Antelope Valley Integrated Regional Water Management (IRWM) Plan Update (2019 Plan Update). It includes new information as required by the California Department of Water Resources' (DWR) 2016 Integrated Regional Water Management Proposition 1 Guidelines as well as updates to previous information from the 2013 Antelope Valley IRWM Plan.

IRWM is a collaborative effort to manage all aspects of water resources in a region. The State recognizes that there is a need to consider a broader range of resource management issues, competing water demands, new approaches to ensuring water supply reliability, and new ways of financing. The State's IRWM program was developed beginning with Senate Bill 1672 which created the Integrated Regional Water Management Act to encourage local agencies to work cooperatively to manage local and imported water supplies to improve water quality, quantity and reliability.

Funding programs for IRWM planning were created when voters passed Proposition 50 in November 2002, Proposition 84 in November 2006, and Proposition 1 in 2014. These propositions set aside funds for IRWM planning and project implementation to be administered by the State. These grant programs state that IRWM Plans should include specific aspects, or "standards", as outlined in Table ES-1. This table also indicates where each standard may be located in the 2019 Plan Update.

Table ES-1: IRWM Plan Standards and Locations in AV IRWM Plan

IRWM Plan Standard	Location in Antelope Valley IRWM Plan
Governance	Section 1, Section 8
Region Description	Section 2
Objectives	Section 4
Resource Management Strategies	Section 5
Integration	Section 6
Project Review Process	Section 7
Impact and Benefit	Section 8
Plan Performance and Monitoring	Section 8
Data Management	Section 8
Finance	Section 8
Technical Analysis	Section 3, Section 8
Relation to Local Water Planning	Section 8
Relation to Local Land Use Planning	Section 8
Stakeholder Involvement	Section 1, Section 8
Coordination	Section 1, Section 8
Climate Change	Sections 2, 3, 4, 5, 6, 7, 8

Introduction (Section 1)

Several years ago, leaders and agencies in the Antelope Valley Region recognized the need for regional cooperation and planning. In an effort to represent the broad interests within the Antelope Valley Region, a number of organizations joined to form a Regional Water Management Group (RWMG) to work together and create this IRWM Plan. Members of the RWMG include the Antelope Valley-East Kern Water Agency (AVEK), Antelope Valley State Water Contractors Association (AVSWCA), City of Lancaster, City of Palmdale, Littlerock Creek Irrigation District, Los Angeles County Sanitation District (LACSD) Nos. 14 and 20, Los Angeles County Waterworks District No. 40 (LACWD 40), Palmdale Water District (PWD), Quartz Hill Water District (QHWD), and Rosamond Community Services District (RCSD). These 11 public agencies signed a Memorandum of Understanding (MOU) to define what their roles and responsibilities are in developing and moving forward with implementation of the AV IRWM Plan. The decision-making structure of the MOU provides the RWMG with the responsibility to make formal decisions regarding the scope and content of the AV IRWM Plan. These agencies agreed to contribute funds to help develop the AV IRWM Plan, provide and share information, review and comment on drafts, adopt the final AV IRWM Plan, and assist in future grant applications for the priority projects identified in the Plan.

In January 2007, the RWMG and other community participants (the Stakeholders) set about developing a broadly supported water resource management plan that defines a meaningful course of action to meet the expected demands for water within the entire Antelope Valley Region through

2035. They chose to create the AV IRWM Plan consistent with the State sponsored Integrated Regional Water Management Program that makes grant funds available to support sound regional water management. In 2012, the RWMG began development of an IRWM Plan Update to incorporate changes to the Region's water resources that occurred since 2007. The IRWM Plan was revisited in 2017 and updated once again in two phases. The first phase revised the Plan to comply with the 2016 IRWM Grant Program Guidelines. The second phase (referred herein as the "2019 IRWM Plan Update") conducted an extensive update of the IRWM Plan so that the Plan is reflective of the current conditions of the Region. The 2019 IRWM Plan Update extended the planning horizon through 2040. This IRWM Plan contains information to help take action to meet shared objectives for long-term water management for the entire Region.

Region Description (Section 2)

The Antelope Valley Region of California is home to approximately 461,000 people living in many different communities. Residents within this Region have experienced tremendous changes over the past generation due to rapid population growth in nearby large cities. Current forecasts of population growth suggest even larger changes will occur before 2040. Water plays a central role in the health and wellbeing of all residents within the Antelope Valley Region. People use water for drinking, bathing, household and outdoor activities, agriculture, business endeavors, recreation, and to sustain and enhance natural habitats. This common need for water links communities together in many ways. When anyone uses water, the ability of other people to use water within the Antelope Valley Region may be impacted.

The Antelope Valley Region encompasses approximately 2,400 square miles in northern Los Angeles County, southern Kern County, and western San Bernardino County. Major communities within the Antelope Valley Region include Boron, California City, Edwards Air Force Base, North Edwards, Lancaster, Mojave, Palmdale and Rosamond. All of the water currently used in the Antelope Valley Region comes from two sources: (1) naturally occurring water within the Antelope Valley Region (surface water and groundwater accumulated from rain and snow that falls in the Antelope Valley and surrounding mountains, and recycled water), and (2) State Water Project water (surface water that is collected in northern California and imported into the Antelope Valley and other areas around the state).

The number of residents within the Antelope Valley Region will expand by almost 350 percent between 1970 and 2020, growing from 103,000 people in 1970 to 461,000 people in 2020. Forecasters expect the population to continue to increase, potentially reaching 535,000 residents by the year 2040. As the number of people living and working in the Antelope Valley Region increases, the competition for water supply intensifies, and the challenge of maintaining good water quality and managing the interconnected water cycle becomes more challenging.

Creation of a proactive, "SMART[1]" approach for the fast-developing Antelope Valley Region makes this IRWM Plan essential to efficient and effective water management.

Issues and Needs (Section 3)

Water managers and local planners face many daunting challenges related to supporting the wellbeing of the Antelope Valley Region. Past activities have created problems that need to be addressed and expected increases in population growth make resolving these problems even more difficult. In order to help address the broad challenges, the AV IRWM Plan was organized to address issues and needs in the following categories. Section 3 of the Plan describes these issues and needs in detail.

Supplies are Variable and Uncertain

Determining the amount of water available for use at any given time (now or in the future) is challenging. All water supplies within the Antelope Valley Region come from two sources: (1) local rain and snowmelt that percolate into the groundwater aquifers or are captured in Littlerock Reservoir, or (2) imports of water from outside the Antelope Valley Region via the State Water Project. The amount of water supply available varies considerably due to changes in weather, rain and snow, and other conditions.

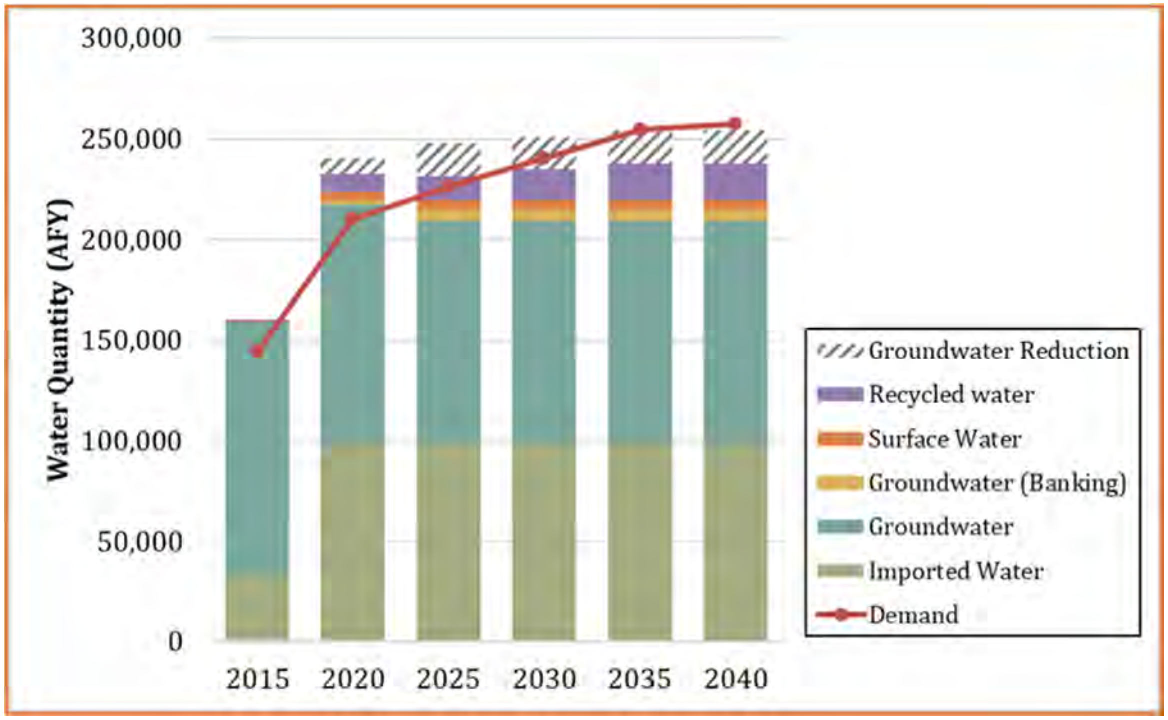
Demand is Greater than Supply in Average and Dry Years

One fundamental challenge in the Antelope Valley Region is that demand for water exceeds available supplies in future average and dry years. In average years beyond 2025, the mismatch between water supply and demand is currently approximated at 19,500 AFY, as shown in the figure below. In future single dry years, the supply demand mismatch is estimated to be 77,200 AFY, while in future multi-dry year periods the mismatch is estimated at 198,800 AF over four years. If communities do not implement projects to account for these mismatches, such as conservation, recycled water, stormwater capture, and water banking projects, the Region will not be able to meet its demands during future average years and dry periods. The Region also recognizes the need for other actions to reduce the mismatch, such as reducing reliance on imported water and improving conveyance facilities.

[1] A SMART approach includes objectives that are Specific, Measurable, Attainable, Relevant, and Time-Based.

Historically, water supplies within the Antelope Valley Region have been used primarily for agriculture; however, due to population growth, water demands from residential and business uses have increased significantly and this trend is expected to continue. The expected continuation of rapid growth in the Antelope Valley Region will affect water demand and increase the threat of water contamination from additional urban runoff. More residents will also lead to higher demand for water-based recreation.

Figure ES-1: Water Supply Summary for an Average Water Year



Note: "Groundwater Reduction" is the amount of groundwater production decreased as a result of the adjudication Judgment and therefore does not represent an additional supply source.

Much of the water used within the Antelope Valley Region is extracted from groundwater aquifers. The amount of water pumped within the Antelope Valley Region has varied tremendously since the early 1900's. The United States Geological Survey estimated that groundwater pumping in 1919 was about 29,000 AFY and reached as high as 400,000 AFY in the 1950's. For many of those years, the amount of water being pumped was greater than the amount of water being replenished, creating an imbalance within the groundwater aquifers. Because the amounts pumped were greater than the amounts being replenished, groundwater levels have declined significantly throughout the Antelope Valley Region. The long-term depletion of aquifers cannot be continued indefinitely without serious consequences. The historical declines in groundwater levels within the Antelope Valley Region have caused permanent damage to aquifers in some areas through land subsidence.

In order to prevent further damage from declining groundwater levels, many water providers and managers within the Antelope Valley Region recognize the need to balance the water being pumped from the aquifers with the water being put back. In response to this need, a legal process called adjudication was finalized in 2015. The adjudication process defined the Basin boundaries, quantified a safe yield, and established Production Rights in order to stabilize groundwater levels and prevent further damage that can result from declining groundwater levels. The Total Safe Yield of the Antelope Valley Groundwater Basin must be met by 2023 as defined in the adjudication Judgment.

Water Quality and Flood Management

The groundwater basin within the Antelope Valley Region is an un-drained, closed basin, meaning there is no outlet for water to flow to the ocean. When water enters a closed basin, any minerals or chemicals in the water typically accumulate in the basin. Currently, groundwater quality is excellent within the principal aquifer but is not as good toward the northern portion of the dry lake areas. Some portions of the basin contain groundwater with high fluoride, boron, total dissolved solids, and nitrate concentrations. Arsenic is another emerging contaminant of concern in the Antelope Valley Region and has been observed in the northern and eastern areas of the Region. Research conducted by the LACWD 40 and the United States Geological Survey has shown the problem to reside primarily in the deep aquifer, therefore it is not anticipated that the existing arsenic concentrations will lead to future loss of groundwater as a water supply resource for the Antelope Valley. In addition, a Salt and Nutrient Management Plan was developed in 2014 to monitor and maintain water quality conditions in the Antelope Valley groundwater basin.

Much of the Antelope Valley Region is subject to flooding from natural runoff through alluvial fans in the nearby foothills. Some of these flood waters eventually move into developed areas, many of which lack sufficient drainage capacity, causing impacts to infrastructure and other improvements. Runoff flowing across impervious surfaces can also become contaminated with constituents such as petroleum products. At the same time, the Region recognizes the downstream benefits of flood waters, including habitat preservation, dust control, and other uses. The need for regional coordination of flood control efforts with natural habitat protection and water supply is critical as urban development and the accompanying paved surfaces increase throughout the Region.

Environmental Resources

The Antelope Valley Region has many unique environmental features that are dependent on natural surface flows, such as the dry lakebeds (Rosamond, Buckhorn, Rogers), Piute Ponds, mesquite bosques, alkali mariposa lily, Joshua tree woodlands, desert tortoise, Le Contes thrasher, tricolored blackbirds, and others. Part of the Antelope Valley wash areas are incorporated into a Significant Ecological Area designated by Los Angeles County intended to provide added protection to sensitive natural resources. As the pressure for growth expands into undeveloped or agricultural lands, the need to balance industry and growth against the protection of endangered species and sensitive ecosystems requires a careful consideration of trade-offs, many involving water resources in the Region. The actions identified in the AV IRWM Plan can help to preserve open space and natural habitats in the Antelope Valley Region while maximizing the effective use of water resources.

Water Management and Land Use

What people do on the land of the Antelope Valley and how they do it directly impacts many aspects of life, including the water cycle, within the Antelope Valley Region. Historically throughout California, land use planning and water use planning have been done almost independently of one another. The challenges identified within the Plan clearly show a need for much closer collaboration between land use planning efforts and water management planning efforts.

Continued development within the Antelope Valley Region depends heavily on meeting the objectives presented in the Plan to balance the growing demand for development while preserving recreational opportunities and avoiding major impacts to natural resources, agriculture, and the loss of local culture and values.

Climate Change

The Antelope Valley Region's Stakeholders identified and prioritized a number of climate change vulnerability issues facing the Region's water resources based on the expected effects of climate change, including water demand, water supply, flooding, ecosystem and habitat, and water quality. The identified and prioritized vulnerabilities are discussed in Section 3.

Objectives (Section 4)

The Stakeholders worked together to identify clear objectives and planning targets they wish to accomplish by implementing the AV IRWM Plan (see Table ES-2). Although the AV IRWM Plan is intended to address the Antelope Valley Region's water resource management needs, this document also identifies several open space, recreation, and habitat targets as well. Refer to Section 4 of the AV IRWM Plan for details on how the objectives and targets were developed.

These objectives and planning targets represent the most important needs and issues the Stakeholders hope to address over the next several years. Everything done within the context of this IRWM Plan should contribute in some way to achieving these objectives. Also, because the planning targets are measurable, residents within the Antelope Valley Region can monitor how successfully the Plan is being implemented.

Table ES-2: Antelope Valley Region Objectives and Planning Targets

Objectives	Planning Targets
Water Supply Management	
Provide reliable water supply to meet the Antelope Valley Region's expected demand between now and 2040; and adapt to climate change.	Maintain adequate supply and demand in average years.
	Provide adequate reserves (77,200 AFY) to supplement average condition supply to meet demands during single-dry year conditions, starting 2009.
	Provide adequate reserves (198,800 AF/ 4-year period) to supplement average condition supply to meet demands during multi-dry year conditions, starting 2009.
	Adapt to additional 7-10% reduction in imported deliveries by 2050, and additional 21-25% reduction in imported water deliveries by 2100.
Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries.	Demonstrate ability to meet regional water demands over an average year without receiving SWP water for 6 months over the summer by 2025
Stabilize groundwater levels.	Manage groundwater levels throughout the basin such that Production Rights defined in the adjudication Judgment are met by 2023.
Water Quality Management	
Provide drinking water that meets regulatory requirements and customer expectations.	Continue to meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period.

Objectives	Planning Targets
Protect and maintain aquifers.	Prevent unacceptable degradation of aquifer according to the Basin Plan throughout the planning period.
	Map contaminated sites and monitor contaminant movement, by 2017.
	Identify contaminated portions of aquifer and prevent migration of contaminants, by 2017.
Protect natural streams and recharge areas from contamination.	Prevent unacceptable degradation of natural streams and recharge areas according to the Basin Plan throughout the planning period.
Maximize beneficial use of recycled water.	Increase infrastructure and establish policies to use 33% of recycled water to help meet expected demand by 2015, 66% by 2025, and 100% by 2035.
Flood Management	
Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future.	Coordinate a regional Stormwater Resources Plan and policy mechanism by the year 2025 and incorporate adaptive management strategies for climate change.
Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses.	
Environmental Resource Management	
Preserve open space and natural habitats that protect and enhance water resources and species in the Antelope Valley Region.	Contribute to the preservation of an additional 2,000 acres of open space and natural habitat, to integrate and maximize surface water and groundwater management by 2025.
Land Use Planning/Management	
Maintain agricultural land use within the Antelope Valley Region.	Preserve 100,000 acres of farmland in rotation[2] through 2040.
Meet growing demand for recreational space.	Contribute to local and regional General Planning documents to provide 5,000 acres of recreational space by 2040.
Improve integrated land use planning to support water management.	Coordinate a regional land use management plan by the year 2025 and incorporate adaptive management strategies for climate change.
Climate Change Mitigation	
Mitigate against climate change	Implement "no regret" mitigation strategies,[3] when possible, that decrease greenhouse gases (GHGs) or are GHG neutral

Resource Management Strategies (Section 5)

The State of California, through the 2009 California Water Plan, has identified 37 different Resource Management Strategies (RMS) to improve regional water resource management. In order to determine what regional water management strategies should be included in the IRWM Plan, the Stakeholders considered the RMS listed and defined in Section 5 of the IRWM Plan. The relationship

[2] The phrase "in-rotation" means that not all 100,000 acres will be in agricultural production at one time rather the land will be rotated in cycles to make most efficient use of the land.
[3] No regret projects are projects that would still be considered beneficial even if climate change weren't happening.

of these strategies (Table ES-3) to the Region's objectives (Table ES-2) was discussed for those strategies included in the IRWM Plan.

Table ES-3: RMS included in the IRWM Plan

Reduce Water Demand	Improve Operational Efficiency and Transfers
• Agricultural Water Use Efficiency • Urban Water Use Efficiency	• Conveyance – Regional/Local • System Reoperation • Water Transfers
Increase Water Supply	**Flood Management**
• Conjunctive Management and Groundwater • Recycled Municipal Water • Surface Storage – Regional/Local	• Flood Risk Management
Water Quality Management	**Practice Resources Stewardship**
• Drinking Water Treatment and Distribution • Groundwater and Aquifer Remediation • Matching Water Quality to Use • Pollution Prevention • Salt and Salinity Management • Urban Runoff Management	• Agricultural Lands Stewardship • Ecosystem Restoration • Forest Management • Land Use Planning and Management • Recharge Areas Protection • Sediment Management • Watershed Management
People and Water	**Other Strategies**
• Economic Incentives • Outreach and Engagement • Water and Culture • Water-dependent Recreation	• Crop Idling for Water Transfers • Irrigated Land Retirement

IRWM Project Integration, Evaluation and Prioritization (Sections 6 and 7)

Many local agencies and other community participants have worked well together to create a Plan that identifies challenging issues and needs being faced by all Antelope Valley residents. Fortunately, this IRWM Plan also identifies actions that can help meet the objectives for the Antelope Valley Region and identifies methods for cooperative implementation of those actions.

Table ES-4 lists the projects and actions that the Stakeholders believe will help meet the Regional objectives. In total, over 80 projects were submitted for inclusion in the IRWM Plan, and include implementation projects, plans and studies, and conceptual projects. All projects included in the IRWM Plan will help the Region to meet its goals and objectives. Implementation projects are programs or construction projects that have had some planning completed, such as facilities planning or cost analyses, and could potentially be implemented in the near future. Plans and studies may also be considered "implementation projects" because they are eligible under certain grant funding opportunities. Finally, conceptual projects are those projects identified by stakeholders that *could* contribute to meeting the Region's IRWM objectives but may not yet be developed enough to include in the IRWM Plan as an implementation project.

Implementing the IRWM projects will require focused effort, broad community support, political resolve, and funding. The Stakeholders are actively pursuing financial assistance through several grant programs designed to help leverage local investments. The RWMG is also working to establish a secure and long-lasting approach to coordinate resources to meet the growing needs of the entire Antelope Valley Region.

The projects proposed by Stakeholders are primarily expected to help the Region meet the water supply management objectives, some of the water quality management objectives, and the climate change objective described in Section 4. For the flood management, environmental resource management, land use planning/management, and climate change objectives, additional projects need to be developed and proposed to ensure progress in those management areas.

Table ES-4: Stakeholder Implementation Projects

Sponsor	Project Name	Project Type
Antelope Valley Resource Conservation District	Antelope Valley Regional Conservation Project	Implementation
AVEK	AVEK Strategic Plan	Study/Report
AVEK	South North Intertie Pipeline (SNIP) Phase II Project	Implementation
AVEK	South Antelope Valley Intertie Project	Implementation
AVEK	Water Supply Stabilization Project (WSSP) – Westside Expansion	Implementation
City of Lancaster	Antelope Valley Recycled Water Master Plan	Study/Report
City of Lancaster	Division Street and Avenue H-8 Recycled Water Tank	Implementation
City of Lancaster	Lancaster National Soccer Center Recycled Water Conversion	Implementation
City of Lancaster	Pierre Bain Park Recycled Water Conversion	Implementation
City of Lancaster	Whit Carter Park Recycled Water Conversion	Implementation
City of Palmdale	Upper Amargosa Creek Recharge and Channelization Project	Implementation
Palmdale Recycled Water Authority	Phase 2 Distribution System	Implementation
Palmdale Water District	Littlerock Dam Sediment Removal	Implementation
Palmdale Water District	Palmdale Regional Groundwater Recharge Project	Implementation
Rosamond CSD	Wastewater Treatment Plant Rehabilitation and Groundwater Project	Implementation
Willow Springs Water Bank	Willow Springs Water Bank	Implementation

In terms of supply, the implementation and conceptual projects proposed will allow the Region to maintain adequate supply and demand in average years. The IRWM projects identify approximately 24,400 AFY of new supply, while also identifying up to approximately 1,000,000 AFY of water bank storage capacity. These projects, if implemented, would help the Region to meet demands during single-dry years and multi-dry year periods, as well as during a plausible six month disruption of State Water Project deliveries.

A number of projects were proposed that would help the Region to meet its water quality targets, including improving drinking water quality, protecting and maintaining aquifers, protecting natural streams and recharge areas from contamination, and maximizing beneficial use of recycled water. As water quality issues are further studied and plans such as the Salt and Nutrient Management Plan are implemented, it is expected that additional projects will be identified to target specific water quality issues.

Additional projects may be necessary to help address the Region's flood management issues, particularly since a majority of the projects proposed to help improve flooding are conceptual and require further development. Section 6 lists a number of suggestions for improving flood management in the Region, including beneficial use identification, existing flood hazard mapping, development of policy actions, and flood mitigation.

The environmental resource management objective will also require more projects. Proposed projects that would help the Region to meet its environmental resource management targets are mainly multi-benefit projects that would provide water supply, water quality and/or flood improvements in additional to providing open space and habitat. Section 6 suggests development of a habitat conservation plan for the Region, and promotion of land conservation projects that enhance flood control, aquifer recharge and watershed and open space preservation to further identify projects to meet this objective.

Similarly, additional projects may be necessary to meet the Region's targets that include preserving farmland, increasing recreational space and coordinating a regional land use plan. Many of the projects identified would indirectly support these targets by providing water to irrigate farm and recreational lands, but few projects would directly support these targets.

A majority of the projects proposed would support the Region's climate change objective. For example, projects that increase local supply production are expected to reduce the embedded energy required to supply imported water. Projects that would increase habitat would allow for the sequestration of carbon through the increase in vegetation. Further planning and study would be necessary to numerically assess GHG reductions in the Region.

Framework for Implementation (Section 8)

The AV IRWM Plan is a dynamic document that identifies monitoring guidelines and sets forth procedures for measuring the success, benefits, and impacts of the Plan. The Region will continue with its current governance structure and continue its efforts to encourage stakeholder involvement in the IRWM program. An ongoing management process is proposed for evaluating, updating and maintaining the Plan, and a funding and financing plan has been established to implement the Plan. The stakeholders decided to continue using the current approach of facilitated broad agreement to implement and update the AV IRWM Plan.

Implementation of the priority projects in the IRWM Plan is currently the responsibility of individual lead agencies with the jurisdictional authority to approve projects. The Stakeholders and RWMG have chosen these projects because they directly address the objectives and planning targets for the most pressing issues and constitute the most well-developed projects to improve management of water resources within the Region. Furthermore, implementing the projects in an integrated fashion is understood to achieve greater benefits to the Region.

The collection, management, distribution and use of data collected as part of this IRWM Planning effort, and through implementation of the Plan, are essential to making this a sustainable effort that will benefit the Antelope Valley Region for years to come. Data regarding water quantity and quality are currently collected and distributed by a number of different agencies. The Stakeholders have identified strategies in this IRWM Plan to ensure quick identification of data gaps, avoiding duplicative (and costly) studies that result in the same information/findings, and successful integration with other important regional, statewide, and federal programs.

This IRWM Plan also identifies performance measures that will be used to evaluate performance, monitoring systems that will be used to gather actual performance data, and mechanisms to change these strategies if the data collected shows the Antelope Valley Region's IRWM objectives and planning targets are not being met. The Stakeholders also recognized that additional technical detail is needed for several of the IRWM Plan's performance measures to be properly implemented and measurable. The Stakeholder group has agreed to continue to refine these performance measures as the AV IRWM Plan is implemented.

Finally, the Region evaluated the funding and financing that would be necessary to implement this IRWM Plan. To meet the resource needs identified above, the Region will need to secure funding as both in-kind services and monetary resources. Given that local revenue sources will not be sufficient to fully fund all aspects of the IRWM Program's financing needs over the 20-year planning horizon, the Region intends to fund its activities using a combination of local, state and federal funds.

This IRWM Plan is a Stakeholder-driven planning process. The RWMG invites the public and interested Stakeholders to become active participants in the Region's ongoing efforts to:

- Identify, evaluate, prioritize, and implement solutions to the Region's complex water management issues, challenges, and conflicts; and
- Continue the development and evolution of this Plan.

For additional information on this IRWM Plan and the Antelope Valley Region, please visit www.avwaterplan.org.

Section 1 | Introduction

This Integrated Regional Water Management Plan (IRWM Plan)[1] defines a clear vision and direction for the sustainable management of water resources in the Antelope Valley Region (Region) through 2040. This version of the Plan includes 2019 updates to the 2013 version, and it complies with all requirements of the 2019 IRWM Grant Program Guidelines-IRWM Plan Standards.

Although the Antelope Valley IRWM Plan contains a viable action plan to provide a wide range of crucial water-related services necessary to support the well-being of people living in the Antelope Valley Region, this Plan is a planning and feasibility study only and no implementation or any project is being approved or required through its adoption. Implementation of this IRWM Plan will require further discretionary approvals either individually or jointly by the stakeholder group members. The IRWM Plan identifies existing key water-related challenges being faced by the residents of the Antelope Valley Region, along with projections of how these challenges will change by 2040. In response to current and expected challenges, this IRWM Plan provides a thorough inventory of possible actions to address the challenges, along with estimated costs and benefits of implementing each action. This IRWM Plan also documents an extensive collaborative process that led to the selection of a robust combination of actions that may be implemented cooperatively by the stakeholders in the Antelope Valley Region.

[1] All references to "IRWM Plan" in this document indicate the 2019 updated version.

Before the original IRWM Plan was adopted in 2007, individual water purveyors and users had been actively studying the effects of accelerated development of the Antelope Valley Region and were attempting to identify appropriate actions to address the increased need for water services. At the time, the acceleration of industrial and residential activity had stimulated demand for both more water supply and higher quality water. Attempts by individual agencies to meet the growing challenges had been frequently criticized and the atmosphere was not conducive to collaborative partnerships. Water managers and stakeholders in the Antelope Valley Region began to recognize that some of the challenges being faced by residents could not be addressed using a single-agency or single-purpose perspective.

These entities agreed that water resource needs in the Antelope Valley Region are highly interconnected and require a broad and integrated perspective in order to provide efficient and effective services.

The Stakeholders discuss funding opportunities from the California Department of Water Resources.

Acknowledging the need for a more comprehensive view, proactive stakeholders in the Antelope Valley Region (including agencies with an interest in water and other resource management) began meeting in May 2006 to improve communication and explore opportunities to leverage their resources. As a result, eleven public agencies signed a memorandum of understanding (MOU) to form the Antelope Valley Regional Water Management Group (RWMG). The MOU was amended in 2009, and again in 2018, to establish the organization and responsibilities of the IRWM governance structure, including the RWMG, the Advisory Team, and the Stakeholder Group. Copies of these two documents are included in Appendix A and may be found on the www.avwaterplan.org website.

During the early (pre-2007) discussions, the stakeholders decided to develop a plan with a regional focus designed to identify a set of integrated solutions addressing goals for water supply, water quality, flood management, environmental resource management including habitat improvement, and increased recreational park space and open space. These topics were re-examined during the 2013 Plan Updates, and climate change impacts were added to the discussion. In 2019, these topics were reevaluated and updated once again to reflect the evolving conditions of the Region.

This planning process acknowledges that a separate adjudication process was completed in 2015. The members of the RWMG have agreed that since the IRWM Plan and the adjudication are focused on different (but related) aspects of water management, they can and should proceed in parallel. This IRWM Plan contains information to help take action to meet shared objectives for long-term water management for the entire Region. The adjudication process helps provide important clarity and certainty for groundwater users about how the groundwater resources are utilized and managed. The Members of the RWMG agreed that no information developed for the purposes of the IRWM Plan should be interpreted to interfere in any way with the implementation of the adjudication

A variety of flora may be found in the Antelope Valley climate.

outcomes. Nothing in the IRWM Plan supersedes the adjudication of the Antelope Valley Groundwater Basin (Basin).

This IRWM Plan creates opportunities for new partnerships and collaboration and documents a collective vision to meet water resource needs and improve the ecological health of the Antelope Valley Region. The quantitative planning targets provide interested stakeholders the means to measure progress and account for tangible community benefits. This updated IRWM Plan describes a specific and financially feasible set of actions necessary to manage the precious water resources within this Antelope Valley Region through 2040.

1.1 Background

The Antelope Valley Region is a triangular-shaped, topographically closed basin bordered on the southwest by the San Gabriel Mountains, on the northwest by the Tehachapi Mountains, and on the east by a series of hills and buttes that generally follow the Los Angeles/San Bernardino County line (Figure 1-1, Antelope Valley IRWM Plan Region). The Antelope Valley Region encompasses approximately 2,400 square miles in northern Los Angeles County, southern Kern County, and western San Bernardino County, and it covers the majority of the service area of the Antelope Valley-East Kern Water Agency (AVEK), the largest water wholesaler in the Antelope Valley Region. Major communities within the Antelope Valley Region include Boron, California City, Edwards Air Force Base (EAFB), Lancaster, Mojave, Palmdale, and Rosamond.

On November 23, 2009, the Antelope Valley Region successfully completed the Region Acceptance Process (RAP) with the Department of Water Resources (DWR). The RAP was the first step in becoming eligible for Proposition 84 grant funding and helps to define certain aspects of the Region. Specifically, the RAP provides documentation of contact information, governing structure, RWMG composition, stakeholder participation, disadvantaged communities (DAC) participation, outreach, stakeholder decision-making, geographical boundaries and other features, water management issues, water-related components, and relationships with adjacent Regions. The Region boundary shown in Figure 1-1 was determined during the RAP.

Water supply for the Antelope Valley Region comes from three primary sources: the State Water Project (SWP), surface water stored in the Littlerock Reservoir, and the Antelope Valley Groundwater Basin. The Antelope Valley Region's SWP contractual Table A Amount is 168,444[2] acre-feet per year (AFY). With proper treatment, SWP water is generally high quality water well-suited for municipal and industrial (M&I) uses; however, the reliability of the SWP water supply is variable and is widely regarded to have decreased in recent years. Surface water stored at the Littlerock Reservoir, which has a storage capacity of 3,500 acre-feet (AF), is used directly for agricultural uses and for M&I purposes following treatment.

The State Water Project delivers imported water to the Antelope Valley.

The Antelope Valley Groundwater Basin is comprised of a principal aquifer that yields most of the current groundwater supplies and several less-used deep aquifers. The Basin encompasses 1,580 square miles in Los Angeles, Kern and San Bernardino counties. Groundwater levels in some areas have declined significantly since the early 1900s due to over-extraction. Groundwater quality is excellent within

[2] Includes the total Table A allocation for AVEK. Approximately 5 percent AVEK's supplies are delivered to customers outside of the Antelope Valley IRWM Region. Please see Section 3.1.1.2 for more details.

most of the principal aquifer but degrades toward the northern portion of the dry lakes areas. High levels of arsenic, fluoride, boron, and nitrates are a problem in some areas of the Basin. The groundwater in the Basin is currently supplied to both agricultural and M&I uses.

The Basin was adjudicated in December 2015 after 15 years of complex proceedings among more than 4,000 parties, including public water suppliers, landowners, small pumpers and non-pumping property owners, and the federal and state governments. The Antelope Valley Area of Adjudication covers approximately 1,390 square miles, or 90 percent of the groundwater basin. The Antelope Valley Groundwater Basin Adjudication Judgment (Judgment) determined the Basin is in a state of overdraft, established respective water rights among groundwater producers based on the Basin's Native Safe Yield, and ordered a rampdown of production to meet the Native Safe Yield by 2023. Following the adjudication, the Antelope Valley Watermaster was formed to implement the Judgment. The Watermaster is charged with administering the adjudicated water rights and managing of the groundwater resources within the adjudicated portion of the Antelope Valley. The adjudication process is discussed in more detail in Section 2.4.2.1 of this IRWM Plan.

Recycled water and stormwater are secondary sources of water supply. A portion of the recycled water from the Antelope Valley Region's two large water reclamation plants, Los Angeles County Sanitation Districts' (LACSD) plants in Palmdale and Lancaster, are used for maintenance of Piute Ponds wetlands, agricultural irrigation, landscape irrigation, and a recreational lake at Apollo Park. The expansion of recycled water use continues in the Region.

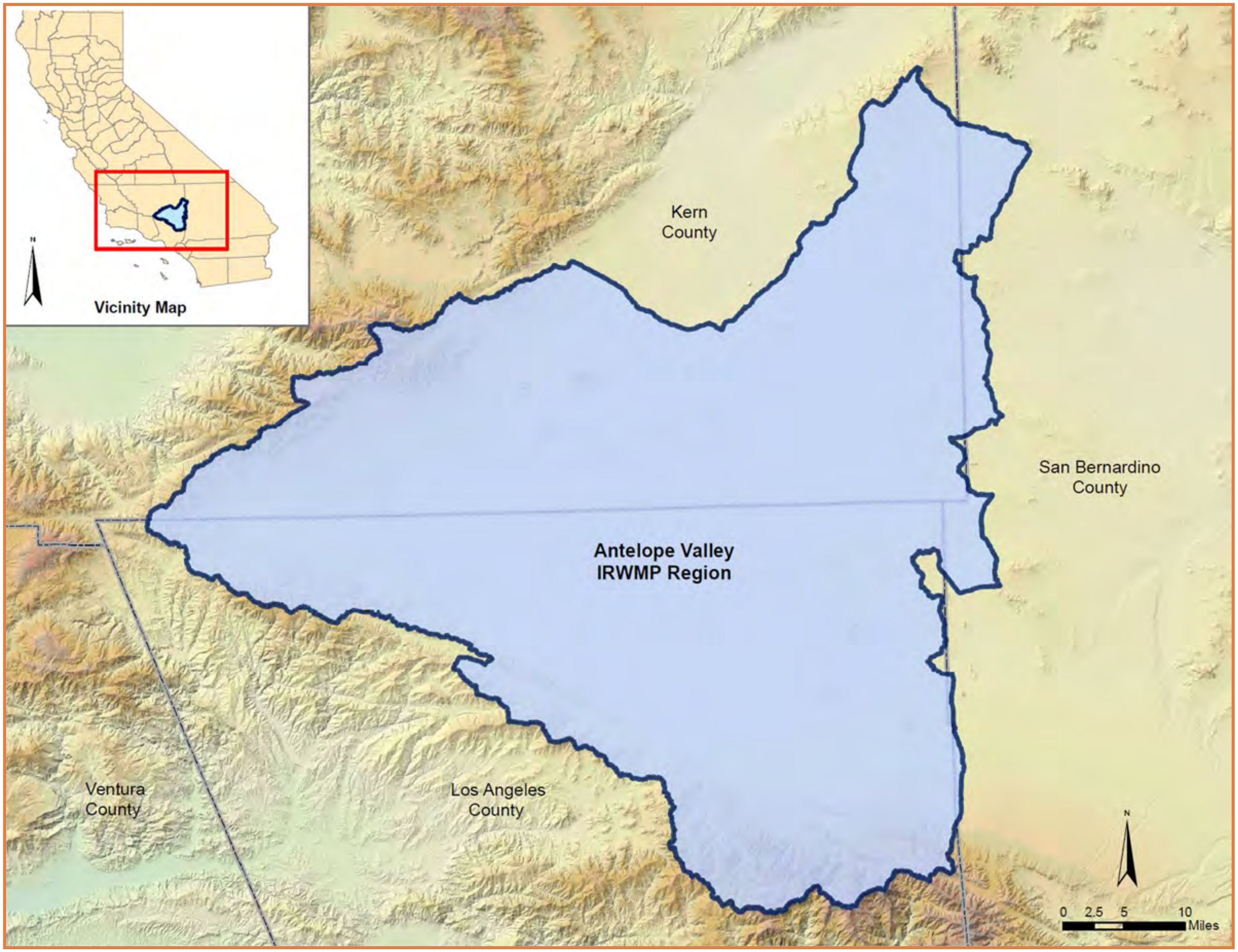
Surface flows (i.e., storm water runoff) from the surrounding San Gabriel Mountains, Tehachapi Mountains, and hills cross alluvial fans and flow through deeply excised washes. The flows make their way from the wash headwaters, filling vernal pool clay pan depressions and wetlands such as Piute Ponds, before either percolating into sand dune areas where water is sequestered for summer use or flowing to the lowest points in the Valley at Rosamond, Buckhorn, and Rogers dry lakebeds. As the surface flow makes its way to the lakebeds it allows the larger sediments to settle out first and transports smaller silty clay further into the Valley interior. The surface flow and silty clay helps to fill in and re-establish the soil surface structure, which protects the lakebed areas from wind erosion, sustains the surficial strength of the lakes (important to the operational mission of EAFB), and sustains local habitats. Some surface flows ultimately evaporate.

Historically, water supplies within the Antelope Valley Region had been used primarily for agriculture; however, due to population growth beginning in the mid-1980s, water demands from residential and industrial uses have increased significantly and this trend is expected to continue. Projections indicate that nearly 535,000 people will reside in the Antelope Valley Region by the year 2040, an increase of approximately 38 percent.

The expected continuation of growth in the Antelope Valley Region will affect water demand and increase the need for management of additional imported water, recycled water and urban runoff. More residents will also lead to higher demand for water-based recreation. Increasing demands coupled with periodic curtailments of SWP deliveries have intensified the competition for available water supplies. This competition has often limited the water available for natural habitats within the Antelope Valley. In addition, growth in the Valley will likely be influenced by climate change.

Thus, these potential impacts could affect most residents within the Antelope Valley Region. In order to establish a viable action plan, a broad representation of stakeholders throughout the Antelope Valley must be maintained to update this IRWM Plan.

Figure 1-1: Antelope Valley IRWM Region



1.2 Stakeholder Participation

An extensive stakeholder outreach process is crucial to ensure that this IRWM Plan reflects the needs of the entire Antelope Valley Region, promotes the formation of partnerships, and encourages coordination with state and federal agencies. One of the benefits of this planning process is that it brings together a broad array of groups into a forum to discuss and better understand shared needs and opportunities. Residents of the Antelope Valley Region are facing changing conditions that increase the likelihood of serious disruption in water-related services or long-term degradation of water supply or environmental resources. Agencies and planning jurisdictions must work closely together in order to assure the delivery of good quality, reliable water while maintaining the quality of life in the Antelope Valley Region.

The Stakeholder process was started during the original formation of the Antelope Valley RWMG. This is a Stakeholder meeting held on August 7, 2019.

The 2007 IRWM Plan benefited from active participation by a wide range of stakeholders. Members of the RWMG and other stakeholders participated in fifteen stakeholder meetings, reviewed draft document materials, and provided extensive collaborative input to shape the 2007 IRWM Plan. For those topics that required further discussion during Plan development, stakeholders engaged in smaller, focused group dialogue to ensure that all stakeholder concerns were being considered. Through participation in stakeholder meetings, stakeholders were exposed to a variety of opportunities for discovering and establishing mutually beneficial partnerships.

The 2013 updates to the Plan also benefited from extensive stakeholder participation. A total of 12 stakeholder meetings were held between February 2012 and December 2013. In addition, numerous special committee meetings were held to address specific topics (e.g., Advisory Team, integrated flood management, DAC outreach, climate change, salt and nutrient management). The 2013 updates continued to support the collaboration and partnerships that originated during the 2007 Plan development.

The IRWM Plan was revisited in 2017 and updated in two phases. The first phase (referred to as the 2018 update) revised the Plan to meet the IRWM Plan requirements described in the 2016 IRWM Grant Program Guidelines. Stakeholder meetings were held between September 2017 and February 2018 to discuss Plan updates and program guidelines. The second phase finalized in 2019 and referred to as the 2019 update, involved an extensive update of the IRWM Plan so that the Plan is reflective of the current conditions in the Region and met the updated 2019 IRWM Grant Program Guidelines. Stakeholder meetings were scheduled in 2018 and 2019 to involve the RWMG, stakeholder groups, DACs, and the general public in the IRWM Plan update process. The full Plan update is necessary to identify pertinent water management issues and adjust IRWM Plan objectives to better address existing Regional needs.

1.2.1 Regional Water Management Group

As described earlier, agencies in the Antelope Valley Region recognized the need for, and benefits of, regional cooperation and planning. In an effort to adequately represent the Antelope Valley Region, the RWMG was formed in 2007 through an MOU (Appendix A). By signing the MOU, the agencies agreed to contribute funds to help develop the original 2007 IRWM Plan, provide and share information, review, and comment on drafts of the IRWM Plan, adopt the final 2007 IRWM Plan, and assist in future grant applications for the priority projects selected.

The MOU was amended in April 2009 to establish the organization and responsibilities of the IRWM governance structure, including the RWMG, the Advisory Team, and the Stakeholder Group. The MOU was amended and restated again in 2018 to outline the amount of new funding to be provided by each of the participating entities of the RWMG.

The RWMG includes AVEK, the Antelope Valley State Water Contractors Association (AVSWCA), the City of Lancaster (Lancaster), the City of Palmdale (Palmdale), Littlerock Creek Irrigation District (LCID), LACSDs 14 and 20, Los Angeles County Waterworks District No. 40 (LACWD 40), Palmdale Water District (PWD), Quartz Hill Water District (QHWD), and Rosamond Community Services District (RCSD). These participants' roles and responsibilities for managing water, natural resources, and land use within the Antelope Valley Region are discussed below:

1.2.1.1 Antelope Valley-East Kern Water Agency

AVEK is a wholesale supplier of SWP water to the Antelope Valley Region. AVEK's service area encompasses nearly 2,400 square miles in northern Los Angeles and eastern Kern Counties as well as a small portion of Ventura County. AVEK was granted charter by the State in 1959 and became an SWP contractor in 1962.

AVEK is the third-largest SWP contracting agency with a current contractual Table A amount of 144,844 AFY. Table A water is a reference to the amount of water listed in "Table A" of the contract between the SWP and the contractors and represents the maximum amount of water a contractor may request each year. This volume includes both agricultural and M&I SWP water, which AVEK distributes in the Antelope Valley Region. AVEK currently provides water to a population of approximately 307,000 people through twenty-five retail water agencies and water companies. As of 2015, AVEK customers utilized approximately 47,500 AFY of the Table A Amount. In addition, AVEK provides a small amount of SWP water to areas outside of the Antelope Valley. The agency is also a partner in the Joint Powers Authority (JPA) for the AVSWCA.

AVEK began pumping groundwater during 2014. Prior to 2014, AVEK did not utilize groundwater as a source of supply and did not have groundwater production wells. The agency also operates a water bank, the Water Supply Stabilization Project No. 2 (Westside Water Bank), that started operations in 2010. The Westside Water Bank includes a 1,500-acre groundwater recharge and extraction field that recharges SWP water delivered to the Antelope Valley Region's Westside during wet years when supplies exceed demands. The maximum recharge capacity is estimated to be 36,000 AFY and the maximum recovery volume is the same. The project currently includes 9 groundwater recovery wells, but up to 20 new wells may be constructed as part of the Westside Water Bank Project.

AVEK also added the Eastside Water Banking and Blending Project, which started operations in 2016. Three 2-acre recharge basins and three groundwater wells have been constructed as a part of the project. The Eastside Water Banking and Blending Project allows for the recharge of raw water, which is later recovered and blended for delivery to the Eastside Water Treatment Plant. The Eastside Water Bank has a total withdrawal capacity of 5,700 AF per year. AVEK does not provide recycled water.

1.2.1.2 Antelope Valley State Water Contractors Association

The AVSWCA is a JPA of the three local SWP contractors of the Antelope Valley (AVEK, LCID, and PWD) that was formed in May 1999.

The AVSWCA has a declared "Statement of Principles and Objectives" to frame its roles and responsibilities as follows:

- to make optimum use of available water supplies to meet current and anticipated demands;
- to confirm that the AVSWCA will not take away any water rights within the Antelope Valley;
- to develop plans for maximum cooperative use of the available water resources;
- to establish an equitable means of apportioning the benefit and burdens of water resource management;
- to prevent the export of native surface water and groundwater from the Antelope Valley and to develop reasonable limitations upon the export of any other water from the Antelope Valley;
- to provide a mechanism for the storage and recovery of water;
- to encourage the protection and preservation of surface water and groundwater quality;
- to develop conservation plans to promote reasonable beneficial use of water;
- to respect existing jurisdictional authority of the public agencies and water suppliers in the Antelope Valley;
- to solicit and welcome the advice, council and support of interested parties and the public in the implementation of these principals and objectives; and
- to conduct regularly scheduled meetings to advance these principles and objectives and discuss other matters of common interest.

In August 2006, the AVSWCA accepted responsibility as the facilitator for groundwater banking projects in the Antelope Valley.

The Westside Water Bank, described in Section 1.2.1.1, is one of the groundwater basin banking projects that was selected for implementation during development of the 2007 IRWMP.

1.2.1.3 City of Lancaster

The City of Lancaster is a highly acclaimed, award-winning municipality with a thriving community of nearly 161,000 (SCAG 2019a). Located approximately one hour north of Los Angeles, Lancaster's clean air, attainable housing, wide open spaces, and close-knit community make it the ideal place for families. The City serves as a commercial, cultural and educational center for the Antelope Valley, as well as for northern Los Angeles County.

Lancaster's potential for growth, along with a strong commitment to business from local leaders, earned Lancaster the "Most Business-Friendly" Eddy Award from the Los Angeles Economic Development Corporation in 2007. Additionally, Lancaster has received twenty League of California Cities Helen Putnam Awards of Excellence; seventeen 3CMA Awards; numerous awards for its accomplishments in the areas of parks, recreation & arts, financial reporting, economic development, public works, and public safety. The City's most recent accolade hailed from the National Energy Globe Award committee, which recognized Lancaster's advancements in the solar energy arena.

The Planning Department is responsible for the development and implementation of a variety of short-, mid-, and long-range plans, including the City's General Plan, various specific plans, and the

City's zoning and subdivision ordinances. The Public Works Department has received National Awards for Economic Development Programs and innovative Public Works projects, and it is responsible for various environmental compliance and conservation projects, as well as flood control and stormwater management. The Parks, Recreation and Arts Department manages twenty City parks and facilities covering more than 450 acres, including athletic fields, swimming pools, playgrounds, and walking trails.

Lancaster is a Charter City, incorporated in 1977, and operates under a Council-Manager form of government. The City government provides various municipal services related to water and natural resources management. Utility services within Lancaster are provided by several public and private agencies. Water service is primarily provided by Los Angeles Waterworks District (LACWD) 40; and sewer service is provided by the City of Lancaster and LACSD 14.

1.2.1.4 City of Palmdale

Palmdale, the first community within the Antelope Valley to incorporate as a city in 1962, is located in the northeast reaches of Los Angeles County, separated from Los Angeles by the San Gabriel Mountain range. As of 2018, the population is estimated at approximately 159,000, making Palmdale the sixth-largest city in Los Angeles County and the largest "desert city" in California (SCAG 2019b). With 105 square miles of land in its incorporated boundaries, Palmdale is in the top 100 largest cities in the U.S. in geographic area.

The Palmdale government provides various municipal services related to water and natural resource management. The Planning Division is responsible for the development and implementation of a variety of short-, mid-, and long-range plans, including the City's General Plan, various specific plans, and the City's zoning and subdivision ordinances. The Public Works Department is responsible for the development and maintenance of the City's public infrastructure, including flood control and stormwater management facilities. The Recreation and Culture Department's responsibilities include the administration, management and implementation of programs that maintain and beautify Palmdale's parklands and recreational facilities.

Utility services within Palmdale are provided by several public and private agencies. Water service is primarily provided by PWD and LACWD 40; sewer service is provided by LACSD 20; and refuse pickup and disposal service is provided by Waste Management, Inc. of the Antelope Valley under a franchise agreement with the City. In 2012, the City of Palmdale created the Palmdale Recycled Water Authority (PRWA) in collaboration with PWD. The purpose of PRWA is to manage recycled water resources created by the Los Angeles County Sanitation District numbers 14 and 20 for any and all reasonable and beneficial uses. The City of Palmdale has an existing agreement with the LACSD for 2,000 AFY of recycled water to provide to customers throughout the City's service area. However, projects to maximize use of the available recycled water are still being developed.

1.2.1.5 Littlerock Creek Irrigation District

LCID is the smallest of the three SWP Contractors within the Antelope Valley. LCID's service area comprises approximately 17 square miles within the southeastern region of the Antelope Valley. The majority of LCID consists of unincorporated land east of the City of Palmdale, though a small portion of the city is within LCID's boundaries.

LCID receives raw water from the SWP, local surface water from Littlerock Reservoir and pumps groundwater. LCID's SWP contractual Table A amount is 2,300 AF and the agency provides water to approximately 1,200 active service connections for domestic and irrigation use (personal communication with James Chaisson, LCID, October 1, 2019).

LCID is a partner in the JPA for the AVSWCA and also participates in a joint use agreement with PWD for shared use of Littlerock Dam for treated water. LCID's surface water source is from surface runoff collected in Littlerock Reservoir. Littlerock Reservoir, which is co-owned with PWD, is fed by the runoff from the San Gabriel Mountains and has a useable storage capacity of 3,500 AF of water. PWD and LCID jointly have long-standing water rights to 5,500 AFY from Littlerock Creek flows (PWD 2015). LCID has an agreement with PWD to treat LCID's SWP and Littlerock Creek water when it is needed for potable use. LCID has one groundwater well for agriculture, four groundwater wells producing potable water and five (5) one-million gallon tanks to store potable water for residential use (personal communication with James Chaisson, LCID, October 1, 2019).

1.2.1.6 Los Angeles County Sanitation District Nos. 14 and 20

LACSD is a confederation of independent special districts serving about 5.6 million people in Los Angeles County. LACSD's service area covers approximately 850 square miles and encompasses 78 cities and unincorporated territory within the County. The agency is made up of 24 separate Sanitation Districts working cooperatively under a Joint Administration Agreement with one administrative staff headquartered near the City of Whittier. Each Sanitation District has a separate Board of Directors consisting of the Mayor of each city within that District and the Chair of the Board of Supervisors for county unincorporated territory. Each Sanitation District pays for its proportionate share of joint administrative costs. The Antelope Valley is served by the LACSD 14 and 20.

LACSD 14 was formed on August 31, 1938, to provide wastewater management services in the Antelope Valley. LACSD 14, whose service area is 59 square miles, serves a large portion of Lancaster as well as portions of Palmdale and adjacent unincorporated areas of Los Angeles County. LACSD 20 was formed on August 7, 1951, to provide wastewater management services for the Palmdale area. Its service area is approximately 41 square miles and serves the majority of residents within Palmdale, as well as adjacent unincorporated Los Angeles County areas.

The LACSD owns, operates, and maintains over 1,400 miles of main trunk sewers and 11 wastewater treatment plants with a total permitted capacity of 650.8 million gallons per day (mgd). The LACSD sewerage system currently conveys and treats approximately 390 mgd of wastewater. Approximately 135 mgd of the treated wastewater is available for reuse after receiving a tertiary treatment. Operation of LACSD facilities influence the community and environment in the Antelope Valley by providing effluent to landscape and agricultural irrigation, industrial process water, recreational impoundments (i.e., Apollo Lakes), wildlife habitat maintenance (i.e., Piute Ponds), and groundwater replenishment. The expansion of recycled water use in the Antelope Valley continues.

1.2.1.7 Los Angeles County Waterworks District No. 40

LACWD 40 is a public water agency that serves portions of the Cities of Lancaster and Palmdale, and several small communities in the eastern portion of the Antelope Valley. LACWD 40 was formed in accordance with Division 16 Sections 55000 through 55991 of the State Water Code to supply water for urban use throughout the Antelope Valley. It is governed by the Los Angeles County Board of Supervisors with the Waterworks Division of the

County Department of Public Works providing administration, operation and maintenance of LACWD 40's facilities.

LACWD 40 provides water service to approximately 208,068 residents with water that is imported to the Antelope Valley through the State Water Project and then treated at AVEK's Quartz Hill Water Treatment plant and Eastside Water Treatment Plant. This supply is supplemented by groundwater pumped from the Antelope Valley Groundwater Basin by approximately 50 wells owned and operated by the LACWD 40. LACWD 40's service area encompasses approximately 554 square miles which is comprised of eight regions serving customers in the communities of Lancaster (Region 4), Pearblossom (Region 24), Littlerock (Region 27), Sun Village (Region 33), Palmdale (Region 34), Northeast Los Angeles County (Region 35), Lake Los Angeles (Region 38), and Rock Creek (Region 39). It is noted that Regions 4 and 34 are integrated and operated as one system. Similarly, regions 24, 27, and 33 are also integrated and operated as one system.

In an effort to ensure supply reliability, LACWD 40 is undertaking projects to store excess imported water in the ground during wet years so that it can be extracted and used during dry years. LACWD 40 is also working with AVEK to store water at their Water Supply Stabilization Project No. 2 water bank.

Municipal wastewater is generated from a combination of residential and commercial sources. The Cities of Lancaster (District 14) and Palmdale (District 20) own, operate, and maintain the wastewater collection systems in their respective service areas. The majority of the wastewater currently collected from within the LACWD 40 service area is treated and discharged outside the LACWD 40 service area. However, recycled water from the Palmdale and Lancaster Water Reclamation Plants (WRPs) is projected to be a potential source of supply for LACWD 40. The Antelope Valley Backbone project will provide the necessary distribution infrastructure to convey recycled water to users, and thereby offset potable water demands in the Antelope Valley. To date, only a portion of the Antelope Valley Backbone has been constructed. As future funding sources are identified, the Antelope Valley Backbone will be connected to the Lancaster WRP and the Palmdale WRP and serve the proposed Palmdale Hybrid Power Plant and the Antelope Valley Country Club. This will ensure a reliable source of supply so that the recycled water service area can expand to serve additional recycled water demands.

1.2.1.8 Palmdale Water District

PWD is a wholesaler and retailer of potable water. PWD was established in 1918 as the Palmdale Irrigation District (PID). The name was changed in 1973 to reflect the absence of agricultural water service. As stated above, PWD is also a partner in the JPA for the AVSWCA. PWD boundaries encompass approximately 187 square miles. Approximately 46 square miles are directly served by PWD and an additional two square miles are served through agreements with AVEK (the majority of the remaining area falls within the Angeles National Forest).

PWD has three sources for water: (1) imported water from SWP, of which it has a contractual Table A amount of 21,300 AFY, (2) local groundwater, and (3) surface water (Littlerock Reservoir, which is jointly owned by LCID, and PWD). Littlerock Reservoir has a storage capacity of 3,500 AF of water. Palmdale Lake stores the SWP water and any Littlerock Reservoir discharges until treatment and distribution. Groundwater wells produce approximately 50 percent of PWD's water supply. PWD is also a member of the PRWA, which manages recycled water within the PWD service area. Recycled water available for use within the PWD service area is supplied from the LACSD Palmdale WRP. Recycled water production and use is projected to grow within the PWD service area and described further in Section 1.2.1.4.

In general, PWD serves the eastern half of the City of Palmdale and adjacent unincorporated areas of Los Angeles County, and maintains over 27,000 service connections.

1.2.1.9 Quartz Hill Water District

QHWD is an independent special district that was incorporated in 1954, with a service area of about 4.5 square miles located in the southwest end of the Antelope Valley at the north end of Los Angeles County.

QHWD's service area includes portions of the Cities of Lancaster and Palmdale as well as unincorporated County land. Water service is provided to residential, commercial, industrial, and agricultural customers, as well as for environmental and fire protection uses. QHWD is a retailer of imported water from AVEK and produces local groundwater to meet local water demands.

1.2.1.10 Rosamond Community Services District

RCSD was formed in 1966 under the Community Services District Law, Division 3, Section 61000 of Title 6 of the Government code of the State of California. RCSD's service area boundary encompasses approximately 31 square miles of unincorporated residential, industrial, and undeveloped land. The majority of the land located within the RCSD service area is undeveloped. The developed property focuses around central Rosamond, with the exception of the Tropico Hills.

RCSD provides water, sewer, and lighting services to residential, commercial, industrial, and agricultural customers, as well as water for environmental and fire protection uses.

RCSD is a retailer of imported water from AVEK and produces local groundwater.

Table 1-1: Participating Entities

Agency	Roles and Responsibility
AVEK	Wholesaler of imported water to the Antelope Valley Region, water banking
AVSWCA	Members provide imported water to the Antelope Valley
City of Lancaster	Provides land-use planning, environmental, flood management, and parks and recreation services
City of Palmdale	Provides land-use planning, environmental, flood management, and parks and recreation services
LCID	Supplies surface and imported water to the Antelope Valley Region
LACSD 14	Provides collection and treatment of wastewater and supplies recycled water to portions of the Antelope Valley Region
LACSD 20	Provides collection and treatment of wastewater and supplies recycled water to portions of the Antelope Valley Region
LACWD 40	Supplies water to portions of the Antelope Valley Region in Los Angeles County
PWD	Supplies water to portions of Palmdale and adjacent unincorporated areas of Los Angeles County
QHWD	Supplies water to portions of the southwest end of the Antelope Valley
RCSD	Supplies water to portions of unincorporated Kern County

RWMG Summary

The composition of the RWMG provides a good cross-sectional representation of all water/natural resource and land-use management activities for the Antelope Valley Region. Table 1-1 provides a summary of participating agencies' roles and responsibilities specific to this IRWM Plan development and implementation.

1.2.2 Stakeholder Group

In addition to the RWMG, this IRWM Plan has received the input of many other interested agencies and organizations. Membership in the stakeholder group has been broadly extended to a number of entities. Neither a financial contribution nor agency status are required to be part of the collaborative IRWM planning process. Through extensive outreach efforts, individuals from disadvantaged, small, and rural communities as well as other interested groups are continually encouraged to participate, and are being informed of IRWM Plan development efforts through presentations, media relations, and other outreach in their communities.

This IRWM Plan has been prepared through a collaborative process of many agencies and organizations with an interest in improving water supply reliability and sufficiency, water quality, water conservation, flood control, natural habitat, and land-use planning in the Antelope Valley

The Stakeholders are given a tour of the Rosamond Dry Lake bed by EAFB staff.

Region. This subsection lists all past and current stakeholders grouped into several categories and describes their roles in the planning process. The broad array of participants includes the agencies that comprise the RWMG as well as an extensive mix of other cities and regulatory, environmental, industrial, agricultural, and land-use planning agencies that represent all areas of the Antelope Valley Region. A brief discussion of coordination efforts with local planning, State, and Federal agencies is also provided where appropriate.

During the preparation of the 2013, 2017, and 2019 IRWM Plan updates, Stakeholder group meetings were held regularly to allow for discussion of issues facing the Antelope Valley Region. These meetings were open to the public and all other interested parties. Copies of the meeting agendas, minutes, and presentations are available on the project website (www.avwaterplan.org).

1.2.2.1 State Water Project Contractors

The State Water Project Contractors include agencies that provide distribution of SWP water to the Antelope Valley. Each of these agencies is a member of the RWMG and was described in Section 1.2.1. These agencies include the AVSWCA, AVEK, LCID, and PWD and all are currently active participants in the Stakeholder group.

1.2.2.2 Retail Water Purveyors

The retail water purveyors include agencies that have water management responsibilities in the Antelope Valley Region. A majority of these agencies are members of the RWMG and were described in Section 1.2.1. These agencies include LACWD 40, QHWD, and RCSD and all are currently active participants in the Stakeholder group.

1.2.2.3 Local Jurisdictions/Land-Use Planning Agencies

Several land-use planning departments and agencies have been involved in the development and implementation of the projects and objectives of this IRWM Plan. Their participation provides valuable input in meetings, ensures accurate and consistent land-use planning information, and helps to incorporate local planning documents and goals into the IRWM Plan objectives. Historically, representatives of the Cities of Palmdale, Lancaster and Boron, and the Los Angeles and Kern County Departments of Regional Planning have participated in the stakeholder meetings. All land-use planning department and agencies are continuously invited to attend Stakeholder meetings via email, as described in Section 1.2.3. The Cities of Palmdale and Lancaster remain active participants in the Stakeholder group.

1.2.2.4 Federal Agencies

Historically, several federal agencies have been involved in the development and implementation of the objectives and projects for the IRWM Plan. Coordination with federal regulatory agencies is essential to the development and implementation of all recommended projects due to the need for regulatory and environmental approval prior to implementation. The federal agencies that have historically been involved in the development and implementation of this IRWM Plan include: the United States Department of Agriculture, Natural Resources Conservation District, United States Geological Survey, and EAFB. The role of EAFB is to ensure that their natural resource management and other mission goals are incorporated into the IRWM Plan. EAFB remains an active participant in the Stakeholder group.

1.2.2.5 Regulatory Agencies/State Agencies

Several state regulatory agencies have been involved in the development and implementation of the objectives and projects for this IRWM Plan. Their participation has focused particularly on water quality issues pertaining to groundwater recharge within the Antelope Valley Region. Coordination with state regulatory agencies is essential to the development and implementation of all recommended projects due to the need for regulatory and environmental approval prior to implementation. The Lahontan Regional Water Quality Control Board (RWQCB) has participated in preparing and updating this IRWM Plan. Furthermore, these agencies have had the chance to address items of concern on these projects at the regularly scheduled stakeholder meetings. The roles and responsibilities of these agencies are to ensure that regulatory compliance standards and goals are incorporated in this IRWM Plan. The agencies include: DWR, the Lahontan RWQCB, the California Department of Public Health, the California State Parks, and the California State Department of Fish and Game. DWR specifically provided support during outreach calls with other Lahontan Regions. The Lahontan RWQCB remains an active participant in the Stakeholder group meetings.

1.2.2.6 Environmental/Conservation Community

The role and responsibility of the environmental/conservation community is to ensure that goals for conservation and protection of natural resources and habitat within the Antelope Valley are incorporated in this IRWM Plan. The stakeholder groups that have historically been involved with the development of the IRWM Plan include the Antelope Valley Conservancy, the Antelope Valley Water Conservation Coalition, Antelope Valley Resource Conservation District and the Sierra Club. The Antelope Valley Resource Conservation District remains an active participant in the Stakeholder group.

Natural resources conservation is a priority for the Region.

1.2.2.7 Building Industry

The Building Industry Association of Southern California – Los Angeles/Ventura Chapter's (BIA LA/V) role is to ensure land-use planning and growth management within the Antelope Valley is incorporated in this IRWM Plan. The building industry entities that have historically been involved with the development of this IRWM Plan include two chapters of the Building Industry Association, the Antelope Valley Chapter and the South Eastern Kern County Chapter.

The agricultural industry is integral to the Region's economy.

1.2.2.8 Agricultural/Farm Industry

Agricultural and Farm interests for the Antelope Valley Region have historically been represented by the Los Angeles County and Kern County Farm Bureaus as well as individual farm and land owners. Their role is to ensure that agricultural and farm interests are incorporated in this IRWM Plan.

1.2.2.9 Wastewater Agency

Wastewater management for the Antelope Valley is provided by RCSD and LACSD Nos. 14 and 20. The LACSD and RCSD are members of the RWMG and their roles and responsibilities are described in Section 1.2.1. Both RCSD and LACSD remain active members in the Stakeholder group.

1.2.2.10 Mutual Water Companies

There are several mutual water companies in the Antelope Valley that provide water-related services to the Antelope Valley Region. Their role is to ensure that their water management goals are incorporated in to this IRWM Plan. Mutual water companies that have historically been involved include: Antelope Park Mutual Water Company, Edgemont Acres Mutual Water Company, El Dorado Mutual Water Company, Evergreen Mutual Water Company, Golden Valley Mutual Water, Land Projects Mutual Water, Little Baldy Water Company, Westside Park Mutual Water Company, and White Fence Farms Mutual Water Company.

1.2.2.11 Media

Representatives of the Antelope Valley Press and the Mojave Desert News regularly attend RWMG stakeholder meetings in 2013 and informed their readership of the goals and objectives of this IRWM Plan. Progress was reported on in these two major area newspapers as well as other local newsletters.

1.2.2.12 Others

Other agencies that have been historically involved in the planning process include the Antelope Valley Board of Trade, Boron Community Services District (Boron CSD), the Mojave Chamber of Commerce, California City Economic Development Commission, the Association of Rural Town Councils, and individual town councils throughout the Antelope Valley Region. The various town councils' roles are to ensure that their water, natural resource, fire suppression, flood control, and land-use planning goals are incorporated in this IRWM Plan. Other groups promote commercial activity in the Region. A copy of a sign-in sheet from one of the many Stakeholder meetings can be found in Appendix B.

1.2.3 Activities

This IRWM Plan was developed to evaluate and address regional issues while recognizing and honoring local conditions and preferences. In order to accomplish this delicate balance, an effective process to involve stakeholders and incorporate their input has been implemented. The process centers on regular stakeholder meetings open to the public where attendees are invited to participate in several ways. During the preparation of the 2013, 2017, and 2019 IRWM Plan updates, attendees were asked to participate in facilitated discussions of major items of interest, to review draft Plan chapters and other prepared documents, and to provide input on the agenda for upcoming stakeholder meetings. These meetings were announced to a broad distribution list via e-mail and all materials developed for use in stakeholder meetings were made available on the project website. The methods for stakeholder involvement and input are described below:

- Notification of Intent (NOI): An NOI to prepare an update to the 2013 IRWM Plan was published in the Antelope Valley Press, a local newspaper, on August 20, 2019 and again on August 27, 2019. A copy of the notice is provided in Appendix C. The published NOI contained the following language:

> "Notice of Intent to update the Antelope Valley Integrated Water Management Plan 2019
>
> The Antelope Valley Integrated Regional Water Management (IRWM) group is updating the Antelope Valley IRWM plan in response to State integrated planning requirements. The update is designed to improve collaboration in water resources management among potable water wholesalers and retailers, wastewater agencies,

stormwater managers, watershed groups, private businesses, agriculture representatives and non-profit stakeholders.

For additional information, please contact Evelyn Ballesteros at eballesteros@dpw.lacounty.gov or visit avwaterplan.org”

- This public notice is being published in accordance with section 10543 of the California Water Code. Review of Plan Sections: This IRWM Plan synthesizes and extends a significant body of work related to water supply, water quality, flood management, environmental resources, and open space for the Antelope Valley Region. Stakeholders were provided the opportunity to review the draft IRWM Plan, and 2013 and 2019 updates, and the material was adopted only after the stakeholders reached facilitated broad agreement on the material. The subjects of the sections include the introduction, Region description, issues and needs, objectives, resource management strategy development, project integration and objectives assessment, Plan and project evaluation and prioritization, and framework for implementation. These sections incorporate and integrate stakeholder-generated information and aggregate this information from across the entire Antelope Valley Region.
- Stakeholder Meetings: These meetings provide background on the planning process; identify issues, opportunities, and constraints; consider opportunities for project integration, and identify comments on the chapters and draft plans. They also provide a forum for a more detailed discussion of the issues related to the revision of this IRWM Plan, including the prioritization and selection of projects for IRWM grant funding.
- Project Website: A project website was developed (www.avwaterplan.org) to facilitate the distribution of project information to stakeholders. The website contains background information about Plan development, a schedule of meetings, and contact information. The website also includes a database tool through which stakeholders can submit or review projects or project concepts. A print out of the home page is included in Appendix C.
- Electronic and Written and Communications: Electronic mail was the main tool used to maintain a high level of stakeholder communication and engagement. All meetings and public notices were sent as far in advance as possible to stakeholders. Various stakeholder groups also forwarded these messages to their constituencies, thereby reaching additional stakeholders. Historically, written communications in the form of letters to cities and press releases to the media have also been utilized to expand awareness of, and participation in, this IRWM Plan development. Regular attendance at stakeholder meetings by members of the local press also allowed the residents of the Antelope Valley Region to be informed. Sample email notifications are provided in Appendix C.

1.2.4 Community Outreach

Community outreach within the Antelope Valley Region has been a key component to a successful IRWM Plan. Simply stated, a regional plan should have regional input, and should incorporate the widest variety of stakeholders possible. Initial outreach efforts began in 2007 and were targeted at improving overall stakeholder participation through increased agency and organized committee involvement, including disadvantaged, underserved, and smaller communities in the Region. A DAC Outreach Subcommittee had been formed to assist in outreach efforts. More information about these early efforts may be found in the 2007 IRWM Plan, Section 1.2.4.

Public Outreach Subcommittee members meet to discuss various opportunities to involve more Antelope Valley communities, including DACs.

For the 2013 IRWM Plan updates, outreach was focused on DAC areas but also extended to underserved and other rural communities. Efforts included presentations to the Antelope Valley Board of Trade and Quartz Hill Chamber of Commerce, as well as booths at the Thursday Night on the Square event and the Antelope Valley Fair and Alfalfa Festival. Outreach materials for these events can be found in Appendix C.

While DAC outreach efforts were underway, additional steps to better identify environmental justice problems, underrepresented, and rural populations within the Region were taken.

Outreach to DAC and to rural and isolated communities is now incorporated in the general outreach efforts. Stakeholders identified through the focused outreach performed for the 2013 IRWM Plan updates receive information regarding the Stakeholder group meetings and 2019 IRWM Plan update via electronic mail.

1.2.4.1. Disadvantaged Communities

For the 2013 IRWM Plan updates, A DAC Outreach committee was formed to assist with data collection, outreach efforts, and project solicitation in DAC areas. The committee was composed of volunteer members representing a diverse cross-section of the active Antelope Valley IRWM Plan stakeholders including DACs, DWR, and mutual water companies. The members soon developed and implemented a multifaceted outreach campaign to support the IRWM Plan that would more actively address the needs of DACs. Overall, the two main goals of the committee were to:

- Encourage participation by DACs and solicit input into Antelope Valley IRWM Plan updates, and
- Educate target audiences in DAC areas about the purpose and benefits of the Antelope Valley IRWM Plan.

After DAC areas were identified using mean household income (MHI) data from the DWR website, a coordination effort to speak at DAC community meetings was initiated. Initial contact was made with representatives from Lake Los Angeles, Mojave Public Utility, Boron Community Services District, North Edwards Water District, Edgemont Acres Mutual Water Company, California City, and others. Subsequent presentations at local community meetings were also arranged. In addition to PowerPoint presentations, handouts were provided at each meeting that included detailed schedules, project eligibility criteria, IRWM Plan goals, plan objectives, and technical assistance listings with contact information. Table 1-2 contains a list of the DAC outreach meetings scheduled for the 2013 IRWM Plan updates.

Table 1-2: DAC Outreach Meetings

Meeting/Event	Meeting Date
DAC Committee Meeting No. 1	April 18, 2012
Boron CSD	July 24, 2012
Mojave Public Utility District	August 14, 2012
North Edwards/Desert Lake CSD	August 14, 2012
Lake Los Angeles Town Council	August 28, 2012
DAC Committee Meeting No. 2	March 20, 2013
DAC Committee Meeting No. 3	May 15, 2013
Quartz Hill Chamber of Commerce	June 5, 2013
Littlerock Creek Irrigation District	June 12, 2013
Rosamond CSD	June 13, 2013
Lake Los Angeles conference call	August 7, 2013
Littlerock Creek Irrigation District	August 7, 2013

As defined by the IRWM Grant Program Guidelines-IRWM Plan Standards, DACs are defined as having an annual MHI that is equal to or less than 80 percent of the statewide annual median household income. In 2012, DACs were defined as communities with an MHI of $48,706 or less using Census 2010 data. In 2016, DACs were redefined to be communities with an MHI of $51,026 or less, and severely disadvantaged communities (SDACs) were defined to be communities with an MHI that is less than or equal to 60 percent of the statewide MHI, or $38,270. To confirm DAC areas in the Antelope Valley Region, committee members conducted an initial assessment of the Antelope Valley Region using DWR's online DAC map for Census "places", "tracts", and "blocks". Listed below are a number of DAC areas identified in the Region, as well as a summary of the general concerns and interests identified in 2013. The current DAC and SDAC areas are identified in Figure 1-2.

Boron, Unincorporated Los Angeles County

- Concerns regarding high arsenic levels in groundwater – would like to implement groundwater projects that reduce the concentration of arsenic.

Lake Los Angeles, Unincorporated Los Angeles County

- Interest in restoring Lake Los Angeles - could create reservoir for farming, fire usage, recreation, tourism/commercial, possible groundwater recharge site, possible use of recycled water.
- Provide flood control at Big Rock Creek Wash - heavy rains cause flooding along local roads.
- Transition from septic systems to sewer - they have some sewer lines installed but have not been used.

Littlerock, Unincorporated Los Angeles County

- Would like to see the creation and enforcement of xeriscaping ordinances designed for their community.
- Interested in opportunities for water recharge, banking, and conservation – although no specific examples were cited at the time.
- Concern about growth of communities vs. water reliability for the Region.

Mojave, Unincorporated Kern County

- Water conservation concerns. Specifically, the Mojave School District is interested in constructing two new high schools in a water-efficient manner. The DAC Outreach Subcommittee put the School District in contact with Mojave Utilities District and Environmental Justice Coalition for Water (EJCW) representative, Cindy Wise.

Portions of the City of Lancaster

- Critical water-related needs to be determined at scheduled community meetings.

Portions of the City of Palmdale (Desert View Highlands)

- Critical water-related needs to be determined at scheduled community meetings.

Roosevelt, Unincorporated Los Angeles County

- Primarily concerned with protecting their wells, protecting agricultural water rights, and preventing LACSD from "wasting water" on "new farms." An LACSD Outreach Subcommittee member followed up directly with community member concerns about the current and future LACSD water usage in their area.

A subset of disadvantaged communities are underrepresented communities. These communities are composed of minority communities living within disadvantaged communities. There are two areas within the Antelope Valley Region that were identified to meet this criterion, and they are both contained within the Cities of Lancaster and Palmdale. These areas are represented in the IRWM process by stakeholders from each of the two cities.

Refer to Appendix D of the IRWM Plan for larger DAC Census Block and Residential Area Maps and Census data printouts developed in 2013. In addition, two technical memoranda were prepared in 2013 to characterize DACs and to define issues related to DAC areas. These documents are included in Appendix D:

- DAC Water Supply, Quality and Flooding Data Final Draft TM
- DAC Monitoring Plan Final Draft TM

The 2019 IRWM Plan update process leveraged the contacts identified through the 2013 outreach effort to inform interested parties of updates to the plan, calls for projects, and details on Stakeholder group meetings.

1.2.4.2 Rural/Isolated Communities

Many communities that do not face the economic constraints of disadvantaged communities must deal with obstacles due to limited resources and geographic location. Many smaller, rural communities in the Antelope Valley Region are isolated, both politically and physically, from the agency and organizational happenings in the Antelope Valley Region, and the committee agreed that these communities would also be incorporated into our IRWM Plan outreach efforts as a result of this isolation.

For the 2013 IRWM Plan update, outreach efforts were extended to all communities in the Region to take the IRWM Plan message to traditionally-isolated and more rural areas of the Antelope Valley, including the following communities :

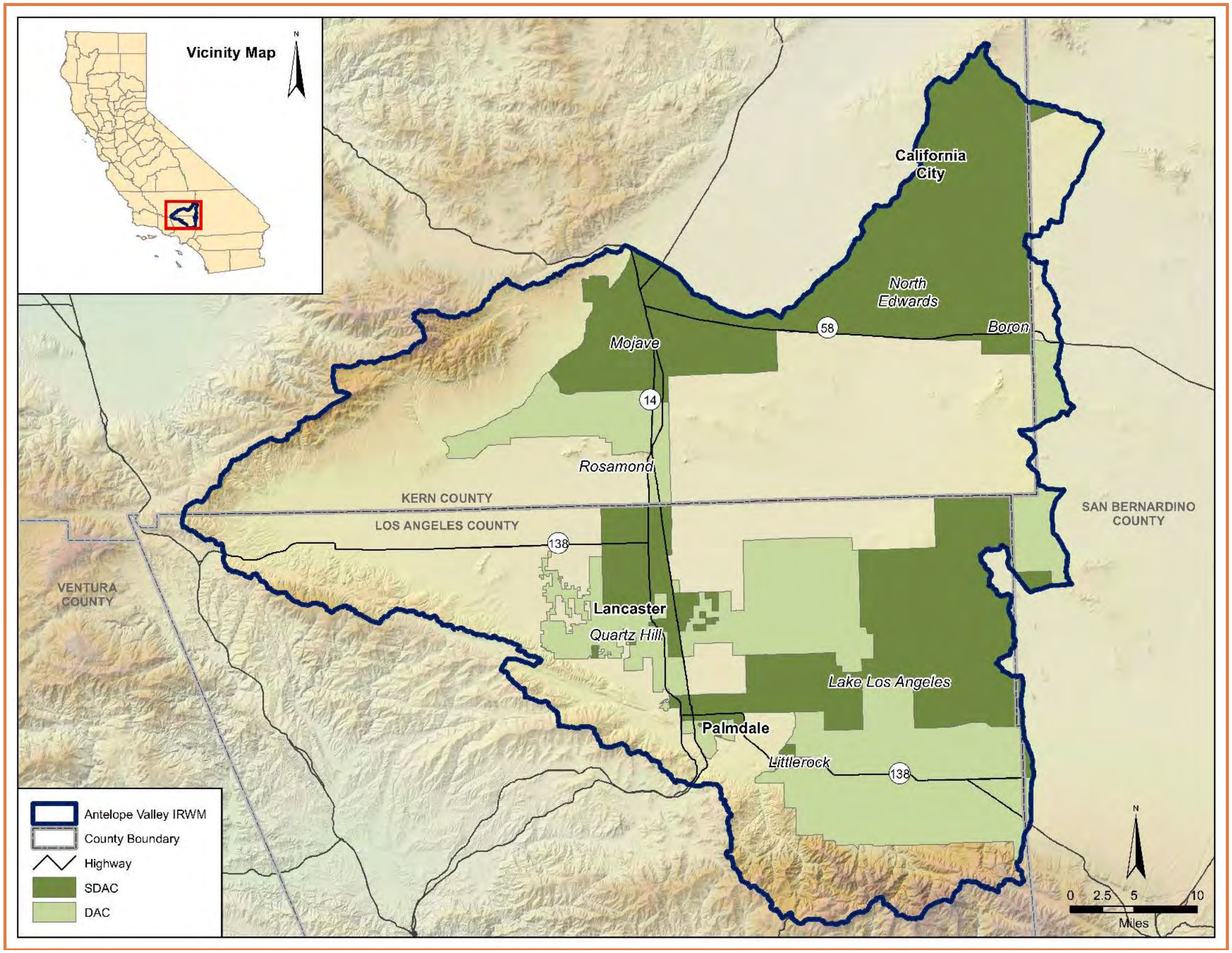
- Boron
- Lake Los Angeles
- Leona Valley
- Mojave
- Quartz Hill
- Sun Village
- The Lakes Community
- Three Points


Rural communities frequently face economic constraints that make it difficult to implement projects and programs.

Although they are not considered 'disadvantaged,' these are towns that are generally very small in population, have fewer resources, and thus, a smaller organizational structure. Most often, these towns are not able to participate in many of the larger projects that municipalities are engaging in with respect to water and environmental resource-related issues in the Antelope Valley Region. However, these communities are eager to participate in a Regional group that promotes a collaborative effort. Areas like Antelope Acres, Boron, Leona Valley, and Three Points have relatively high median household incomes but have been frustrated in trying to get specific projects implemented or tying into regional efforts because of the long distances which separate many communities in the Antelope Valley Region.

Outreach to rural and isolated communities has been integrated with the general outreach efforts. Stakeholders in these communities are invited to the Stakeholder group meetings and received information regarding the 2019 IRWM Plan updates via electronic mail.

Figure 1-2: Antelope Valley IRWM Disadvantaged Communities as Defined by Census Blocks and Population Densities



1.2.4.3 Native American Tribal Identification

Research and outreach efforts were also made to identify and contact local Native American tribal communities through contacts with other Antelope Valley community groups and research. Previous efforts at outreach had determined that some Native American individuals within the Antelope Valley Region had been contacted, but reported that their lineage groups were not landholders and, therefore, not recognized as tribes or nations.

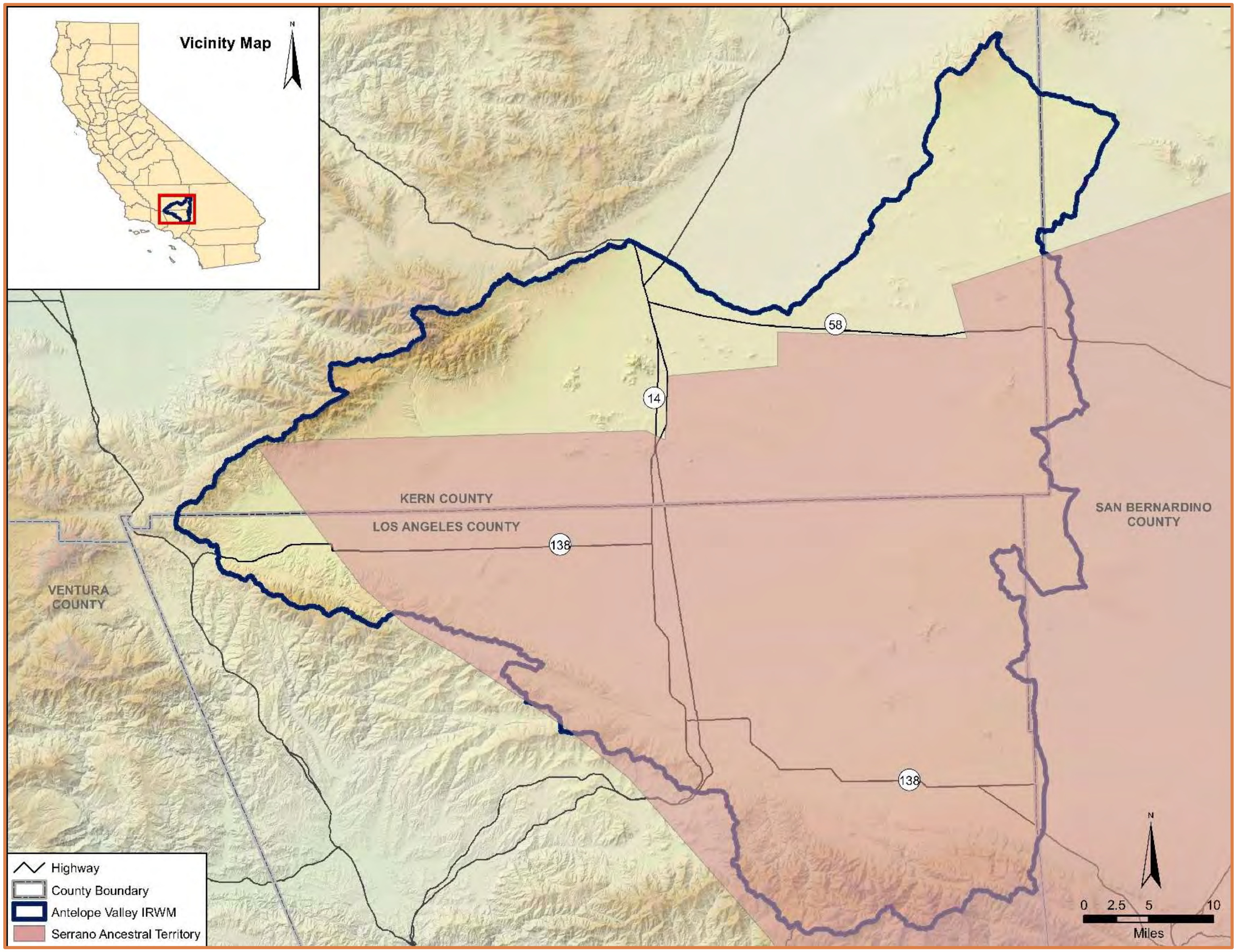
The Antelope Valley contacted the Native American Heritage Commission (NAHC) during the 2018 IRWM Plan update to obtain a Stakeholder contact list. The NAHC identified 12 organizations representing 7 tribes as potential stakeholders. The organizations, tribes, and outreach efforts are summarized in Table 1-3. Tribes are sovereign nations, and as such, coordination with Tribes is on a government-to-government basis. Representatives from the Serrano Tribe were invited to the stakeholder meetings after confirming interest and overlap between IRWM boundaries and ancestral territories, shown in Figure 1-3. There were no other tribal interests or water issues specific to Native American Tribal Communities identified through this outreach process.

The Antelope Valley Indian Museum further reports that during the late 19th and early 20th centuries, most American Indian residents remaining in the Antelope Valley integrated with the ever-expanding European culture in Southern California, and the binding group ties of earlier times began to erode the cultural base. As such, there are no formal reservations or rancherias in the Antelope Valley.

Table 1-3: Antelope Valley IRWM Region Tribal Notification

Organization	Tribe	Date of Initial Outreach	Response
Gabrieleno Band of Mission Indians - Kizh Nation	Gabrieleno	11/29/2017	No response
Gabrielino /Tongva Nation	Gabrieleno	11/29/2017	No response
Gabrielino Tongva Indians of CA Tribal Council	Gabrieleno	11/29/2017	No response
Gabrielino-Tongva Tribe	Gabrieleno	11/29/2017	No response
Kitanemuk & Yowlumne Tejon Indians	Kitanemuk; Southern Valley; Yokut	11/29/2017	No response
Morongo Band of Mission Indians	Cahuilla; Serrano	11/30/2017	Confirmed no tribal interests in Region
San Fernando Band of Mission Indians	Kitanemuk; Serrano; Tataviam	11/29/2017	No response
San Manuel Band of Mission Indians	Serrano	11/29/2017	Confirmed overlap with Serrano ancestral territory
Santa Rosa Rancheria Tachi Yokut Tribe	Southern Valley; Yokut	11/30/2017	No response
Serrano Nation of Mission Indians	Serrano	11/30/2017	No response
Table Mountain Rancheria	Yokut	11/30/2017	Confirmed no tribal interests in Region
Tule River Indian Tribe	Yokut	11/29/2017	No response

Figure 1-3: Serrano Tribe Ancestral Territory



1.2.4.4 Environmental Justice Outreach

Environmental justice (EJ) is important to every community, and the Antelope Valley Region is no exception to this rule. The United States Environmental Protection Agency (EPA) defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Simply stated, this means that no group of people should bear a disproportionate share of negative environmental consequences resulting from industrial, governmental, and commercial operations or policies.

To begin identifying potential environmental justice issues facing the Antelope Valley, subcommittee members performed independent research and contacted the EJCW in 2013 for further documented information and expert advice. The EJCW was not aware of any water-related environmental justice concerns in the Antelope Valley Region.

The EPA's Environmental Justice Screening and Mapping Tool was used for the 2019 IRWM Plan update to identify places that may have higher environmental burdens and vulnerable populations. The EJ Index quantifies the combination of demographic information with one of 11 environmental indicators to identify a community's burden relative to the rest of the nation. Air quality, particularly fine particulate matter particles (PM 2.5), ozone, and cancer risk from inhalation of air toxics places a higher environmental burden on some communities in Palmdale, Lancaster, and Lake Los Angeles. Potential exposure to lead paint is also higher in some communities in Palmdale. Communities in Lancaster and Quartz Hill have higher proximity to facilities that are required to file Risk Management Plans, and few communities in northern Lancaster and in Palmdale have a higher proximity to hazardous waste sites. Wastewater discharge and toxic chemicals do not place an undue burden on vulnerable communities within the Region.

Guidelines for incorporating DACs into the IRWM Plan to help prevent environmental justice issues from developing are detailed in the 2007 IRWM Plan and are repeated here.

The major suggestions made by the EJCW in 2013 were the following:

- Provide technical assistance to facilitate participation and to assist with project development.
- Include an Environmental Justice Community representative on the governing body.
- Ensure that the on-going governance structure defined in the Plan includes a prominent role for Environmental Justice communities, including some influence over which projects are selected for future implementation grants.
- Ensure that there is a mechanism for Environmental Justice communities to participate in the evaluation of the plan over time.

These suggestions were incorporated into the overall outreach strategy for the IRWM Plan except for the second bullet. There is no governing body representative for environmental justice.

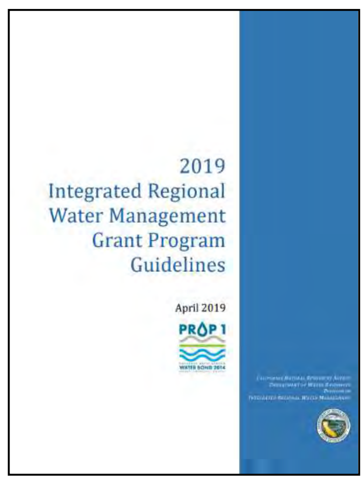
As the Antelope Valley communities expand and evolve, the IRWM Plan Stakeholder group will continue to assess environmental justice concerns through the implementation of the Plan.

1.2.4.5 Media Coverage of Plan Preparation

Historically, IRWM Plan updates have been covered by the local media. Progress of the 2013 IRWM Plan updates were covered by reporters who attended stakeholder meetings representing the Antelope Valley Press and the Mojave Desert News. Committee members found that many residents were already aware of this IRWM Plan because of the coverage by these newspapers. Their exposure has greatly helped keep members of the general public and DACs informed about the 2013 IRWM Plan updates.

1.3 Plan Updates

This subsection provides a brief overview of the planning process utilized to update the IRWM Plan to comply with the 2016 and 2019 IRWM Grant Program Guidelines-IRWM Plan Standards.



1.3.1 Region Goals and Planning Objectives

The primary reason for this IRWM Plan is to develop a broadly supported water resource management plan that defines a meaningful course of action to meet the expected demands for water and other resources within the entire Antelope Valley Region through 2040. Region goals were originally developed in 2007 and were updated during the 2013 and 2019 IRWM Plan updates. This IRWM Plan will address:

- How to reliably provide the quantity and quality of water that will be demanded by a growing population;
- Options to satisfy agricultural users' demand for reliable supplies of reasonable cost irrigation water; and
- Opportunities to protect, enhance, and manage current water resources and the environmental resources for human and natural benefit within the Antelope Valley Region.

In order to achieve these goals, a list of planning objectives for the IRWM Plan was developed back in 2007. This list is reproduced below. The 2013, 2018, and 2019 IRWM Plan updates were completed in a fashion that preserves the original intent of these planning objectives.[3]

1. Develop and Adopt an Integrated Regional Water Management Plan for a planning period between 2005 and 2035[4] by December 31, 2007 that:
    a. is written to be a useful tool to a broad range of organizations within our region;
    b. describes reasonably foreseeable water demands for our region during the planning period;
    c. characterizes the available water supplies for our region during the planning period;
    d. describes and evaluates potential management actions that we can take to meet the expected water demand of everyone within the Region during the planning period;
    e. sets workable planning targets to be accomplished by specified future dates within the planning period;
    f. identifies potential and promising sources of money to pay to implement this IRWM Plan;
    g. sets priorities for implementation;
    h. is flexible and responsive to changing conditions;
    i. satisfies the guidelines published by DWR for IRWM Plans;
    j. satisfies the requirements published by DWR for AB 3030 groundwater management plans[5]; and
    k. qualifies entities within our region to apply for water related grant funds from State sources such as Proposition 50, and Proposition 84, and Proposition 1E[6].
2. Discuss and describe how all broad-based regional planning efforts are related and how they will be coordinated:
    a. IRWM Plan;
    b. Adjudication;
    c. Water Storage District Proposal;
    d. Water Banking JPA; and
    e. others.
3. Establish cooperative relationships, new partnerships, and an optimistic approach to create a useful regional plan.
4. Each member of the RWMG will take ownership in this IRWM Plan and collaborate to produce, implement, and update a widely accepted plan.

[3] These planning objectives should not be confused with the Region Objectives in Section 4. Planning objectives apply to the IRWM Plan document itself. Region Objectives apply to the Antelope Valley.
[4] Planning period was extended through 2040 for the 2019 IRWM Plan Update.
[5] The 2019 IRWM Plan update does not satisfy AB 3030 as the basin was adjudicated in 2015.
[6] The IRWM Region is currently pursuing grant funds from Proposition 1.

5. Conduct strategic education and outreach to the public informing the target audiences of the following:
    a. the need for regional planning;
    b. benefits of a cooperative approach;
    c. the priorities for implementation;
    d. how the public can participate; and
    e. others?
6. Identify a back-up plan for meeting grant application deadlines.

Many of these objectives were reached by the end of 2007. Others are ongoing in nature and apply to the 2019 IRWM Plan updates. Again, it is the intent of these 2019 IRWM Plan updates to preserve the intent of the planning objectives.

1.3.2 Process for Subsequent IRWM Plan Updates

This planning process recognized the importance of three key elements to any successful public policy planning exercise: people, information, and action. It was designed to provide a forum for safe and effective dialogue among the various stakeholders. During the development of the 2007 IRWM Plan, the group agreed to the following steps for interaction through a professionally facilitated process. These steps were also implemented during the 2013 IRWM Plan updates and revisited during the 2019 IRWM Plan updates:

1. Adopt Specific Measurable Attainable Relevant Time-based (SMART) goals;
2. Create a safe place for interaction;
3. Establish a clear course of action;
4. Demonstrate tangible progress; and
5. Iterate until the group is satisfied.

The planning process was also designed to provide useful, broadly accepted information that supports clear action. The information gathering and generation portion of this process is summarized in Figure 1-4, Antelope Valley IRWM Plan Planning Process. It includes the following key steps that were repeated during the 2013 and 2019 IRWM Plan updates:

- <u>Identify the Antelope Valley Region's issues and needs</u>: Illustrate the issues and needs of the Antelope Valley Region related to water resources in a manner that reflects the majority of Stakeholder concerns. These issues and needs are what drive the Stakeholders into taking action, and are discussed in Section 3. The Region issues and needs were revised with more current information during the 2013 and 2019 IRWM Plan updates.
- <u>Identify clear plan objectives</u>: Collectively establish the quantifiable objectives that the regional entities will work together to accomplish between now and 2040. These Objectives and the Planning Targets that will be used to help measure their progress are discussed in Section 4. The Region Objectives and Planning Targets were revised during stakeholder meetings for the 2013 and 2019 IRWM Plan updates.
- <u>Resource Management Strategy Development</u>: Involves reviewing existing documents to identify projects within the following resource management strategies (RMS) that could satisfy these IRWM Plan Region Objectives: water supply, water quality, flood management, environmental management, land use management, and climate change. Resource

Management Strategy development is discussed in more detail in Section 5 and was revised during the 2013 and 2019 IRWM Plan updates.

- Integration: Includes intra- and inter- resource management strategy integration between projects. Integration is discussed in more detail in Section 6, and the integration process was revised during the 2013 and 2019 IRWM Plan updates.
- Evaluation and Prioritization: Includes identifying short-term and long-term regional priorities, evaluating and ranking Stakeholder-identified projects and management actions, and identifying which projects the group would take "action" on first. This step is presented in Section 7. This section also includes a discussion of the impacts and benefits of the IRWM Plan, and a discussion of the benefits and costs of the prioritized projects chosen for implementation. Project evaluation and prioritization were revisited during the 2013 and 2019 IRWM Plan updates.
- Plan for Implementation: Finally, this planning process must empower the entities within the Antelope Valley Region to take meaningful action. The implementation plan presented in Section 8 provides the linkage to local planning entities, the governance structure and framework for implementing the Plan, options for financing, sources of funding and a list of performance measures that will be used to gauge progress, data management tools, and a process for updating the Plan in the future. The implementation plan was updated during the 2019 IRWM Plan updates.

Throughout the development of the 2007 IRWM Plan and the subsequent 2013 and 2019 IRWM Plan updates, public comments and Stakeholder comments have been reviewed, evaluated, discussed amongst the Stakeholder group as necessary, and incorporated into the document as appropriate.

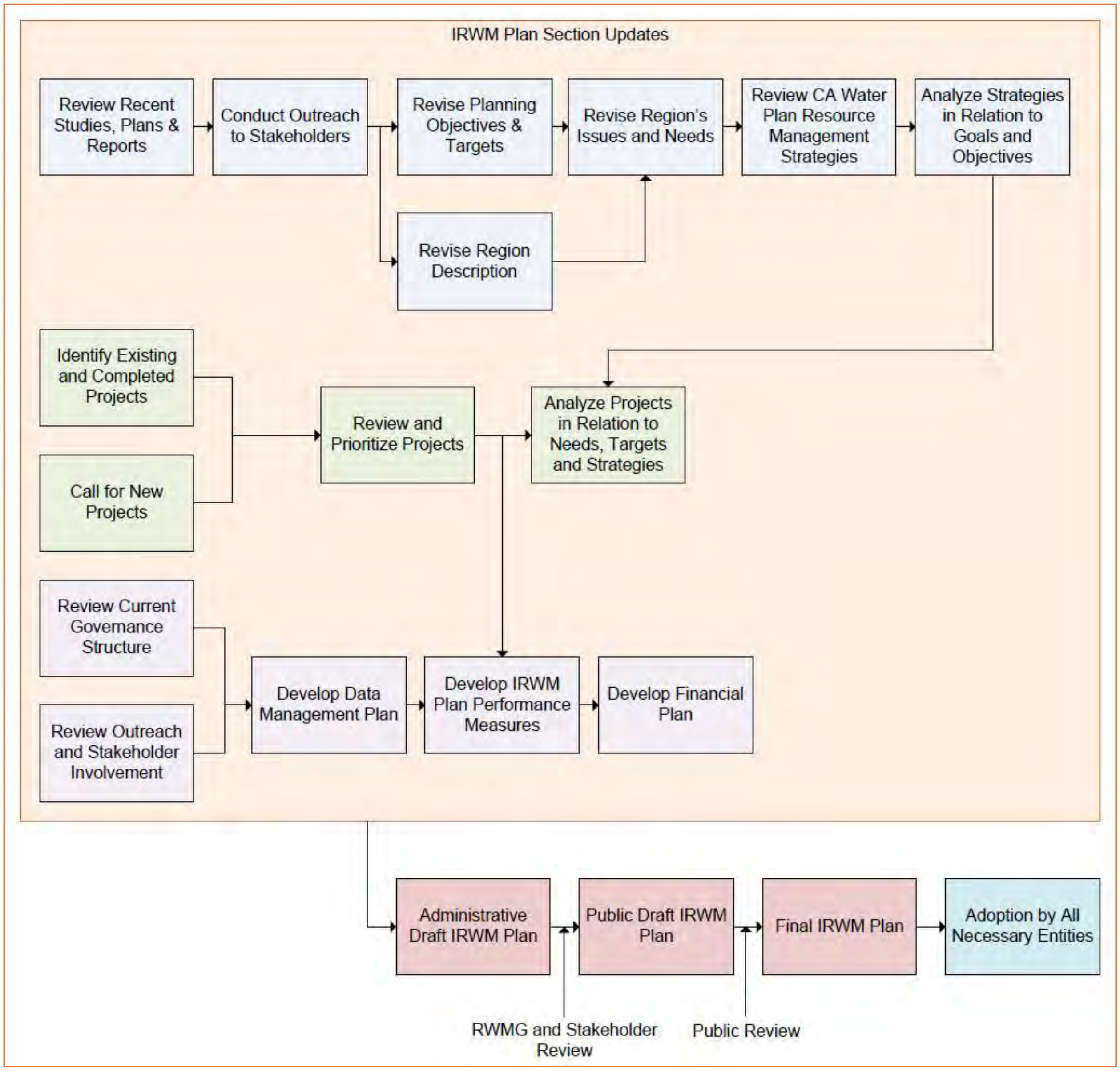
The 2019 Plan Updates were presented to the RWMG for review from October 3rd through October 17th, 2019. Comments received on the draft Plan were incorporated into a Final Plan that was completed by October 18th, 2019 and submitted to DWR. The comments for the Draft 2019 Plan updates have been summarized into a comment response matrix and can be found in Appendix E. After the Final IRWM Plan is approved by DWR, members of the RWMG plan to present the document (with 2019 updates) to their boards in the first quarter of 2019 for adoption during public meetings.[7]

1.3.3 Potential Obstacles to Plan Implementation

There are no potential obstacles identified for the implementation of the IRWM Plan. The Antelope Valley Groundwater Basin adjudication was finalized in December 2015 and is consistent with the overall purpose of the IRWM Plan. The objectives and planning targets in the 2013 IRWM Plan were revised in 2019 to support the adjudication framework outlined in the Judgment in order to sustainably manage the basin. The IRWM Plan's water supply analysis is also in-line with the adjudication as it is based on the native basin safe yield and production targets established by the Judgment. To date, the adjudication has not placed limitations on groundwater banking and recharge projects included in the IRWM Plan. However, the IRWM Plan is meant to be a dynamic planning document and as such will be updated at a minimum of every five years with the project priority list being kept up-to-date as discussed in Section 7.4.2.

[7] Other agencies/stakeholders that are not RWMG members may also adopt the 2019 IRWMP Update.

Figure 1-4: Antelope Valley Integrated Regional Water Management Planning Process



1.3.4 Groundwater Management Planning

This IRWM Plan defines a clear vision and direction for the sustainable management of water resources in the Antelope Valley Region through 2040. Inherent to this discussion is how groundwater will be managed to help meet the needs within the Antelope Valley Region now and into the future.

The Groundwater Management Act (California Water Code Part 2.75 Section 10753), originally enacted as Assembly Bill (AB) 3030 (1992) and amended by Senate Bill (SB) 1938 (2002), provided the authority to prepare groundwater management plans. The intent of AB 3030 was to encourage local public agencies and water purveyors to adopt formal plans to manage groundwater resources within their jurisdiction. Adoption of a Groundwater Management Plan was a prerequisite to obtaining funding assistance for groundwater projects from funds administered by DWR. Prior to the adjudication of the Basin in 2015, this IRWM plan served as a functional equivalent to a Groundwater Management Plan required in AB 3030 as it addressed all twelve technical components required in a Groundwater Management Plan.

The Sustainable Groundwater Management Act (SGMA) was enacted in 2014. Groundwater Management Plan requirements were largely replaced by SGMA and adoption of Groundwater Management Plans is no longer required under California law. Beginning January 1, 2015, no new Groundwater Management Plans can be adopted in medium and high-priority basins. Rather, in accordance with SGMA, Groundwater Sustainability Plans (GSPs) are required in their place. SGMA, however, does not apply to several adjudicated areas listed in Water Code Section 17820.8. As a result of the Antelope Valley Groundwater Basin Adjudication Judgment in 2015, the Antelope Valley Groundwater Basin is currently designated as a very low-priority basin and is not subject to SGMA requirements. Nothing in this IRWM Plan will supersede the Judgment.

1.3.5 Integrated Flood Management Planning

Integrated flood management (IFM) is an approach that varies from traditional flood protection by maximizing the efficient use of a floodplain while promoting public safety. IFM is a process that promotes an integrated, rather than fragmented, approach to flood management; and it recognizes the connection between flood management and water resources management, land use planning, environmental stewardship, and sustainability. Flood risk management balances current needs with future sustainability to enhance the performance of a watershed system as a whole.

The Region developed a set of comprehensive integrated flood management guidelines that identify the AV IRWM Region's flood protection needs. The guidelines prioritize opportunities to capture and utilize stormwater recharge in addition to mitigating flood impacts. The guidelines were developed in coordination with the Flood Management Committee formed from the AV IRWMP Stakeholder Group and AV RWMG. This group assisted with the technical development of the guidelines and provided recommendations for future flood management governance and funding strategies. Findings from this needs evaluation were then used to consider strategies for managing flood issues in the Region, and consider how flood management projects should be evaluated. A set of recommended actions for flood management in the Region was developed, including the recommendation that the Region take part in the National Flood Insurance Program (NIFP) Community Rating System (CRS) to better map the Region's flood plains, and become eligible for flood insurance discounts. Finally, an assessment of existing and potential flood protection activities versus water quality enhancement activities was completed in order to make recommendations for more integrated flood management. The findings of these tasks culminated in the development of the Integrated Flood Management Summary Document.

The Integrated Flood Management Summary Document is included with this Plan in Appendix F.

1.3.6 Climate Change

As part of the update of this IRWM Plan, the Region incorporated climate change considerations into various chapters, as shown below in Figure 1-5.

Figure 1-5: Incorporation of Climate Change into the Antelope Valley IRWM Plan

Chapter 2: Region Description
- Climate change effects and impacts

Chapter 3: Issues and Needs
- Climate change vulnerabilities

Chapter 4: Objectives
- Climate change related objective

Chapter 5: Resource Mangement Strategies
- Strategies to adapt to and mitigate against climate change

Chapter 6: Project Integration and Objectives Assessment
- Evaluation of how proposed projects will meet the Region's climate change related objective

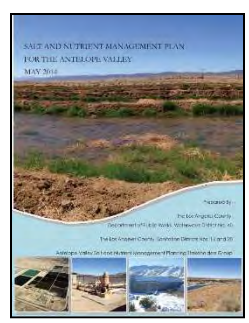
Chapter 7: Project Submittal, Review, and Prioritization
- Climate change adaptation and mitigation included as part of prioritization

Chapter 8: Implementation
- Plan for further data gathering and analysis of vulnerabilities

A climate change committee was established in order to provide input on the Region's vulnerabilities and strategies for responding to climate change. Three meetings were conducted between September 2012 and November 2012 to vet climate change impacts, determine and prioritize vulnerabilities of the Region's water resources to climate change, assess strategies for responding to climate change and mitigating greenhouse gases (GHGs), incorporate climate change considerations into objectives and targets, and incorporate climate change adaptation and mitigation into the project prioritization process. The climate change vulnerabilities of the Region were revisited during the 2019 IRWM Plan update but no changes were identified. Meeting agendas, notes, and presentation materials are available on the project website (www.avwaterplan.org).

1.3.7 Salt and Nutrient Management Plan

The AV IRWM Region developed a regional Salt and Nutrient Management Plan (SNMP) to manage salts and nutrients from all sources within the basin, maintain regional water quality objectives and support beneficial uses. The SNMP was developed under the guidance of the SNMP committee who are also active participants in the IRWM stakeholder group. A copy of the SNMP can be located in Appendix G and is available on the www.avwaterplan.org website.



Section 2 | Region Description

This section presents a regional description for the Antelope Valley Region, including location, climate, hydrologic features, land uses, water quality, population and demographic information, regional growth projections, and climate change information. The Antelope Valley Region Description emphasizes the combination of increasing population growth, the lack of adequate water-related infrastructure, the need to maintain existing water levels in the groundwater basin, and the opportunity to create a proactive growth strategy for the developing Antelope Valley Region. This description sets the stage for the issues and needs discussed subsequently in Section 3.

2.1 Region Overview

The 2,400 square miles of the Antelope Valley Region lie in the southwestern part of the Mojave Desert in southern California. Most of the Antelope Valley Region is in Los Angeles County and Kern County, and a small part of the eastern Antelope Valley Region is in San Bernardino County. Figure 2-1 provides an overview of the Antelope Valley Region. For the purposes of this IRWM Plan, the Region is defined by the Antelope Valley's key hydrologic features; bounded by the San Gabriel Mountains to the south and southwest, the Tehachapi Mountains to the northwest, and a series of hills and buttes that generally follow the San Bernardino County Line to the east, forming a well-defined triangular point at the Antelope Valley Region's western edge. The drainage basin (or watershed) was originally chosen as the boundary for the IRWM Plan because it has been used in several older studies such as "Land Use and Water Use in the Antelope Valley" by the United States Geological Survey (USGS) and "The Antelope Valley Water Resource Study" by the Antelope Valley Water Group. The area within the boundary also included key agencies dealing with similar water management issues such as increasing population, limited infrastructure, and increasing pumping costs with shared water resources and, therefore, it was an appropriate boundary to define the Antelope Valley Region for this IRWM Plan.

On November 23, 2009, the Antelope Valley Region successfully completed the Region Acceptance Process (RAP) with DWR. The RAP was the first step in becoming eligible for Prop. 84 grant funding and the process helped to further define certain aspects of the Region. Specifically, the RAP provides documentation of contact information, governing structure, RWMG composition, stakeholder participation, DAC participation, outreach, stakeholder decision-making, geographical boundaries and other features, water management issues, water-related components, and relationships with adjacent Regions. The Region boundary shown in Figure 2-1 was determined during the RAP and represents the Antelope Valley watershed. Water demands within the Antelope Valley Region are supplied by a variety of water purveyors, including large wholesale agencies, irrigation districts, special districts providing water primarily for M&I uses, investor-owned water companies, mutual water companies, and private well owners. Water supply for the Antelope Valley Region comes from five sources: the SWP, local surface water runoff that is stored in Little Rock Reservoir, the Antelope Valley Groundwater Basin, recycled water, and captured stormwater. Development demands on water availability and quality, coupled with the potential curtailments of SWP deliveries due to prolonged drought periods and other factors, have intensified the competition for available water supplies. Consensus is needed to maintain a water resource management plan and strategy that addresses the needs of the M&I purveyors to reliably provide the quantity and quality of water necessary to serve the continually expanding Antelope Valley Region, while concurrently addressing the needs of agricultural users to have adequate supplies of reasonably-priced irrigation water.

Highway 14 connects Los Angeles to the expanding communities of the Antelope Valley.

2.2 Location

As discussed above, the Antelope Valley Region encompasses most of the northern portion of Los Angeles County and the southern region of Kern County. The Region is located within the Lahontan DWR Funding Area. Bordered by mountain ranges to the north, south, and west and the hills and buttes along the east, the Antelope Valley Region is composed of the following major communities: California City, EAFB, Lancaster, Mojave, Palmdale, and Rosamond. Smaller communities include Boron, Lake Los Angeles, North Edwards, Littlerock and Quartz Hill. The communities are predominantly located in the eastern portions of the Antelope Valley Region.

The Lahontan Funding Area is bordered by the Tulare/Kern, Los Angeles-Ventura, Santa Ana, and Colorado River Funding Areas. Other Regions within the Lahontan Funding Area and adjacent Funding Areas are currently represented by IRWM Plans. These consist of the Mojave Water Agency IRWM Plan in the Lahontan Funding Area; the Fremont Basin IRWM Plan in the Lahontan Funding Area; the Upper Santa Clara River IRWM Plan in the Los Angeles-Ventura Funding Area; the Los Angeles IRWM Plan in the Los Angeles-Ventura Funding Area; and the Watersheds Coalition of Ventura County IRWM Plan, which includes the Ventura River, lower Santa Clara River and Calleguas Creek watersheds, also within the Los Angeles-Ventura Funding Area. These areas are shown in Figure 2-1 and Figure 2-2. “Funding areas” are large areas across the State that are designated by DWR; they are made up of smaller self-defined “Regions”.

The Fremont Basin IRWM Plan was developed in early 2019 in coordination with other Regions in the Lahontan Funding Area. The Fremont Basin IRWM Region boundaries were originally created to fill the existing void created by neighboring IRWM regions. During the development of the Fremont

Basin IRWM Plan, the Fremont Basin IRWM boundary was modified to reflect an overlap of two key hydrogeologic features: the Fremont Valley Groundwater Basin and the Fremont Valley Watershed. The Fremont Basin IRWM boundary modification caused an approximately 106,400-acre overlap with the Antelope Valley IRWM Region. Following discussions between key RWMG members, the two Regions decided to allow the overlap to remain. Additional coordination will occur, as needed, if any projects in the overlapping areas seek funding through the IRWM Program. Though the service areas for Mojave Public Utilities District and California City span across both IRWM Regions, the majority of the water supplies and demands are in the Fremont Basin IRWM Region. To avoid overestimating water supplies and demands, these projections were accounted for in the Fremont Basin IRWM Plan and excluded from the AV IRWM Plan. A letter of Support and Agreement between the two IRWM Regions was submitted to DWR in 2018.

Similarly, the relatively small portions of the Antelope Valley that are located in San Bernardino County are served by the Mojave Water Agency (MWA) and were included in the MWA IRWM Plan. Thus, demands from these areas and any proposed projects serving these areas were not accounted for in this IRWM Plan to avoid significant overlap with the MWA IRWM Plan. The MWA has submitted a letter of support for the Region boundary. Additionally, the AVRWMG submitted a letter of agreement which acknowledges both the AV IRWM and Kern IRWM regional boundary overlap and the respective RWMG's for the IRWM regions will work collaboratively to address any issues of common interest in this area. Letters of Support and Agreement may be found at the www.avwaterplan.org website (under "Grants"). These IRWM Regions nearly surround the Antelope Valley Region, which means that the Antelope Valley IRWM Plan will play an integral role in completing watershed analyses for the Lahontan Funding Area and provide an important link to the neighboring Los Angeles-Ventura Funding Area. The collective efforts of these interconnected IRWM Plans will not only benefit their respective regions, but the watersheds of Southern California as a whole.

Figure 2-1: Neighboring IRWM Regions

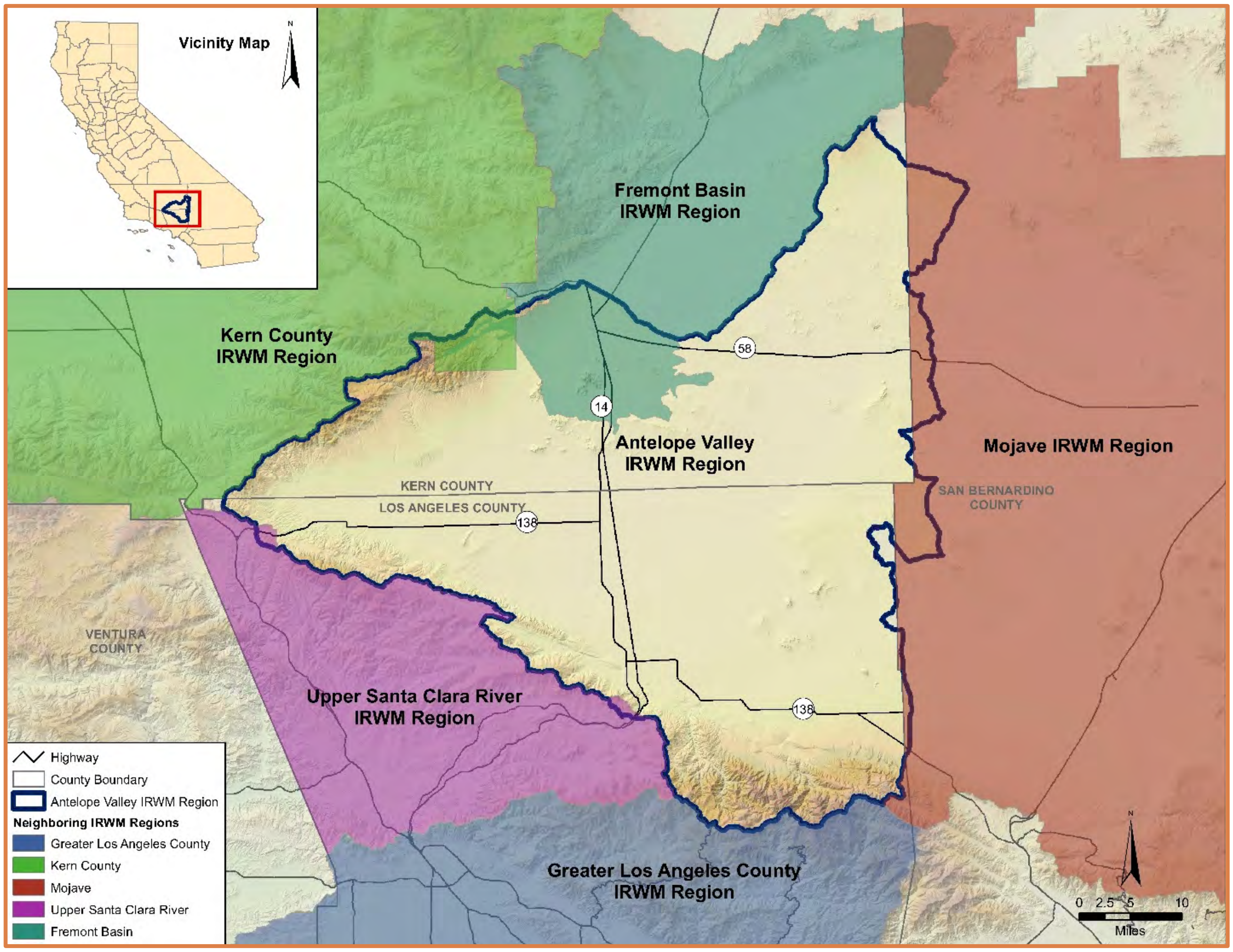
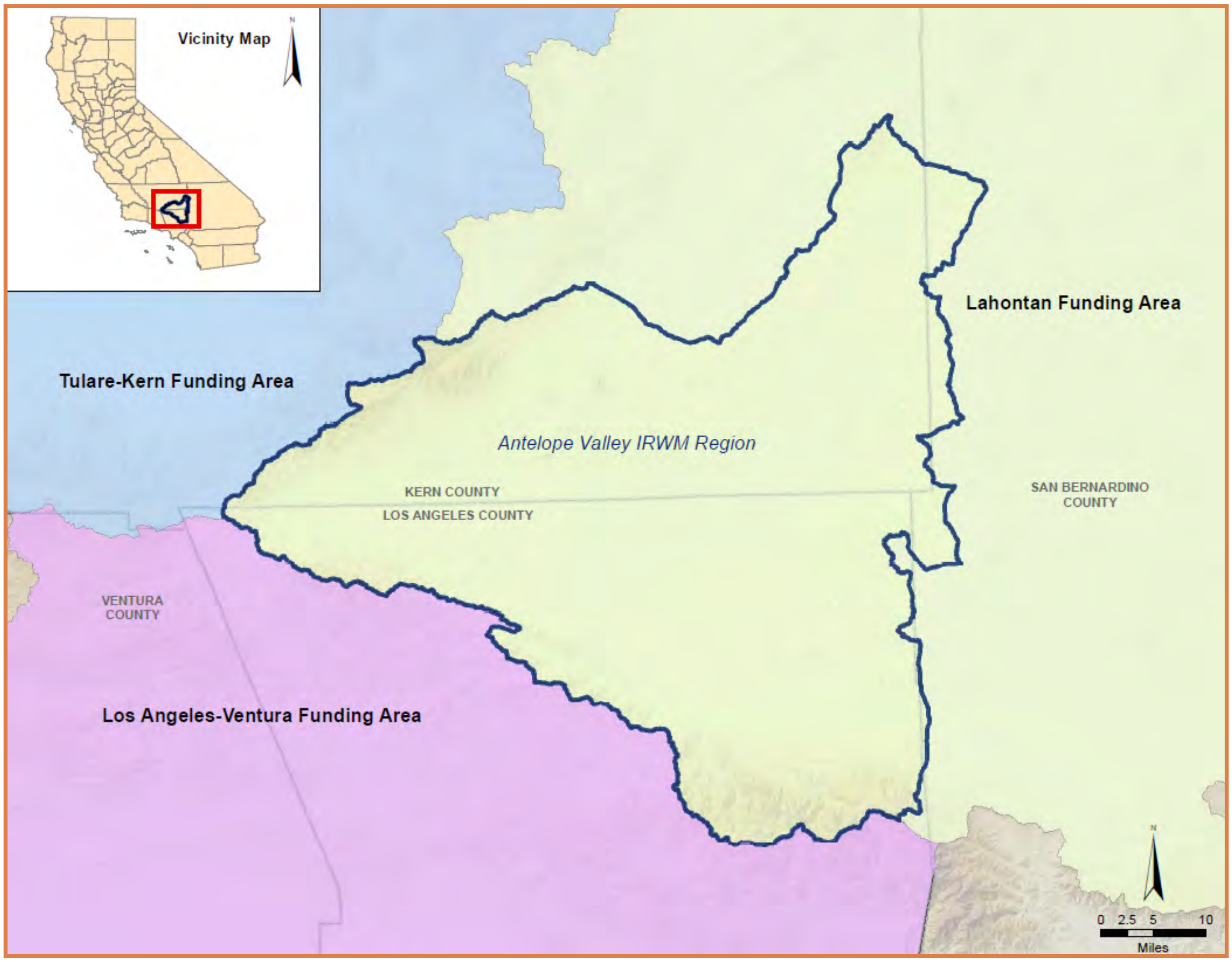


Figure 2-2: DWR IRWM Funding Areas



Four major roadways traverse the Antelope Valley Region. The Antelope Valley Freeway (State Route 14) and Sierra Highway both bisect the Antelope Valley Region from north to south. The Pearblossom Highway (Highway 138) traverses the southeastern and central-western portions of the Antelope Valley Region in an east-west direction. Highway 58 traverses the northern portion of the Antelope Valley Region in an east-west direction. Figure 2-3 shows the main Antelope Valley Service Districts, including counties, AVEK, EAFB, LACWD 40, LCID, PWD, Boron CSD, Mojave Public Utilities District, North Edwards Water District, West Valley County Water District, QHWD, RCSD, and mutual water companies. Figure 2-4 shows the Antelope Valley city boundaries, towns, flood control districts and sanitation districts. Both figures include the locations of the major roads, county lines, city lines, and Antelope Valley Region boundary.

2.3 Climate Statistics

Located in the southwestern portion of the Mojave Desert, the Antelope Valley Region ranges in elevation from approximately 2,300 feet to 3,500 feet above sea level. Vegetation native to the Antelope Valley Region is typical of the high desert and includes Joshua trees, saltbush, mesquite, sagebrush, and creosote bush. The climate is characterized by hot summer days, cool summer nights, cool winter days, and cool winter nights. Typical of a semiarid region, mean daily summer temperatures range from 64 degrees Fahrenheit (◦F) to 96◦F, and mean daily winter temperatures range from 35◦F to 60◦F. The growing season is primarily from April to October, though vegetation may begin to grow as early as January as the ground temperature increases.


Native vegetation includes the regal joshua tree.

Precipitation ranges from less than 4 inches on the valley floor to 20 inches in the mountains, running off the surrounding mountains through a number of canyons and watersheds. Most rainfall occurs between December and March, with little to no precipitation falling in summer months, meaning cultivated crops and non-native plants must rely heavily on irrigation. Annual variations in precipitation are important to the annual variations in applied water required for crop production and landscape maintenance. Rainfall records indicate that some runoff may be available for artificial groundwater recharge use (USGS 1995).

Figure 2-5, Annual Precipitation, summarizes the historical annual precipitation for the Antelope Valley Region, based on the data from EAFB. Table 2-1 and the following charts provide a summary of the Antelope Valley Region's climate. Climatic data is based on data collected from January 1982 to May 2019. Figure 2-5 present the average maximum and minimum temperature and the average rainfall and monthly evapotranspiration (ETo) in the Antelope Valley Region, while Figure 2-6 presents average rainfall throughout the valley.

Table 2-1: Climate in the Antelope Valley Region

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Standard Monthly Avg. ETo (inches)[a]	2.27	3.01	4.91	6.49	7.89	9.20	9.66	8.84	6.45	4.53	2.96	2.05	68.25
Avg. Rainfall (inches)[b]	1.34	1.71	1.04	0.35	0.10	0.04	0.10	0.06	0.18	0.40	0.45	1.22	6.99
Avg. Max Temperature (°F)[b]	59.9	63.3	69.7	76.0	83.9	92.2	97.9	97.7	92.0	81.0	67.5	58.2	78.3
Avg. Min Temperature (°F)[b]	34.3	37.1	41.3	45.8	52.8	60.0	66.5	65.3	59.4	49.7	39.5	33.5	48.8

Sources:
(a) CIMIS Data for Palmdale No. 197 Station from April 2005 to May 2019.
(b) Western Regional Climate Center, Palmdale Station (046624) from January 1982 to April 2019.

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Figure 2-3: Antelope Valley Service Districts

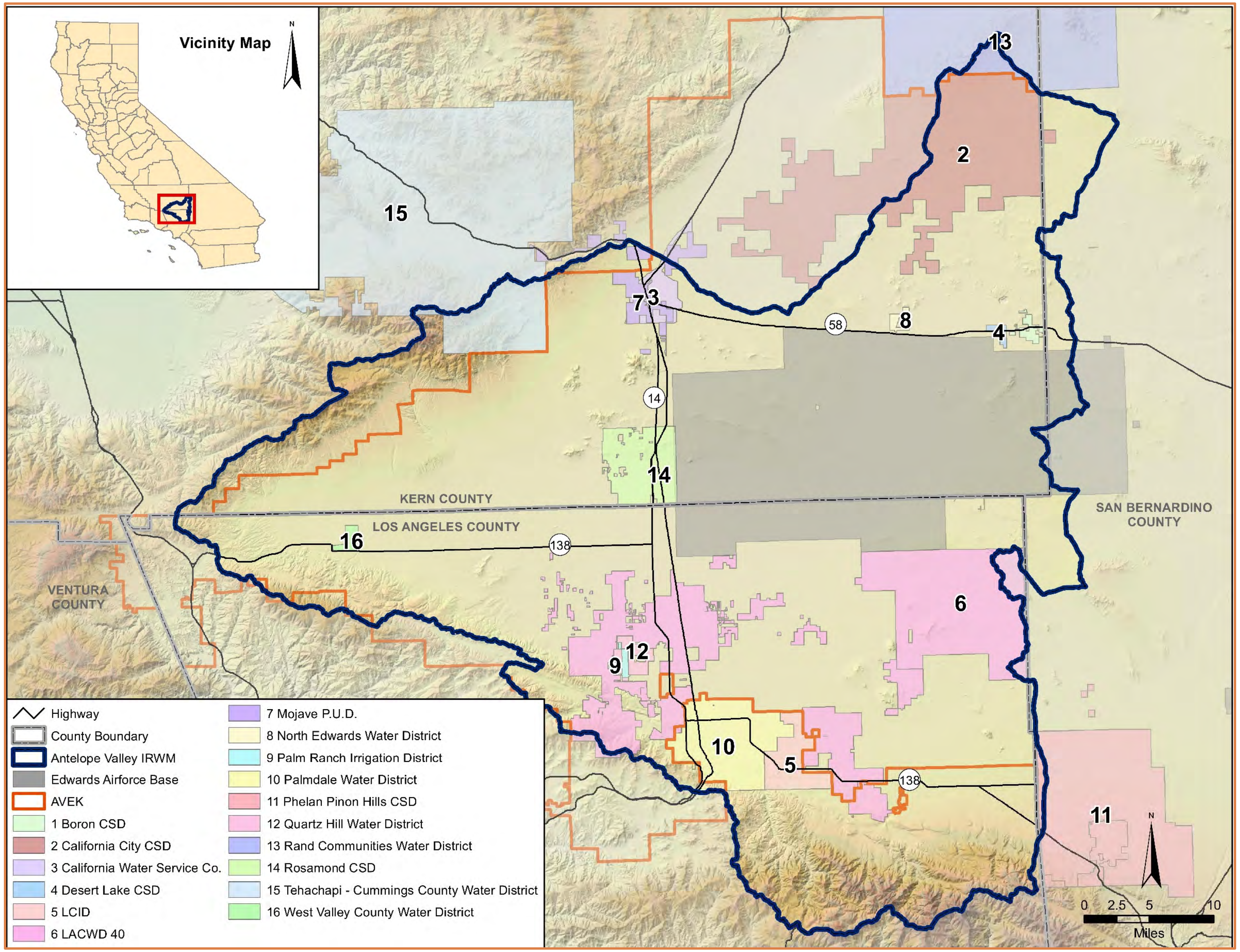


Figure 2-4: Antelope Valley City Boundaries and Special Districts

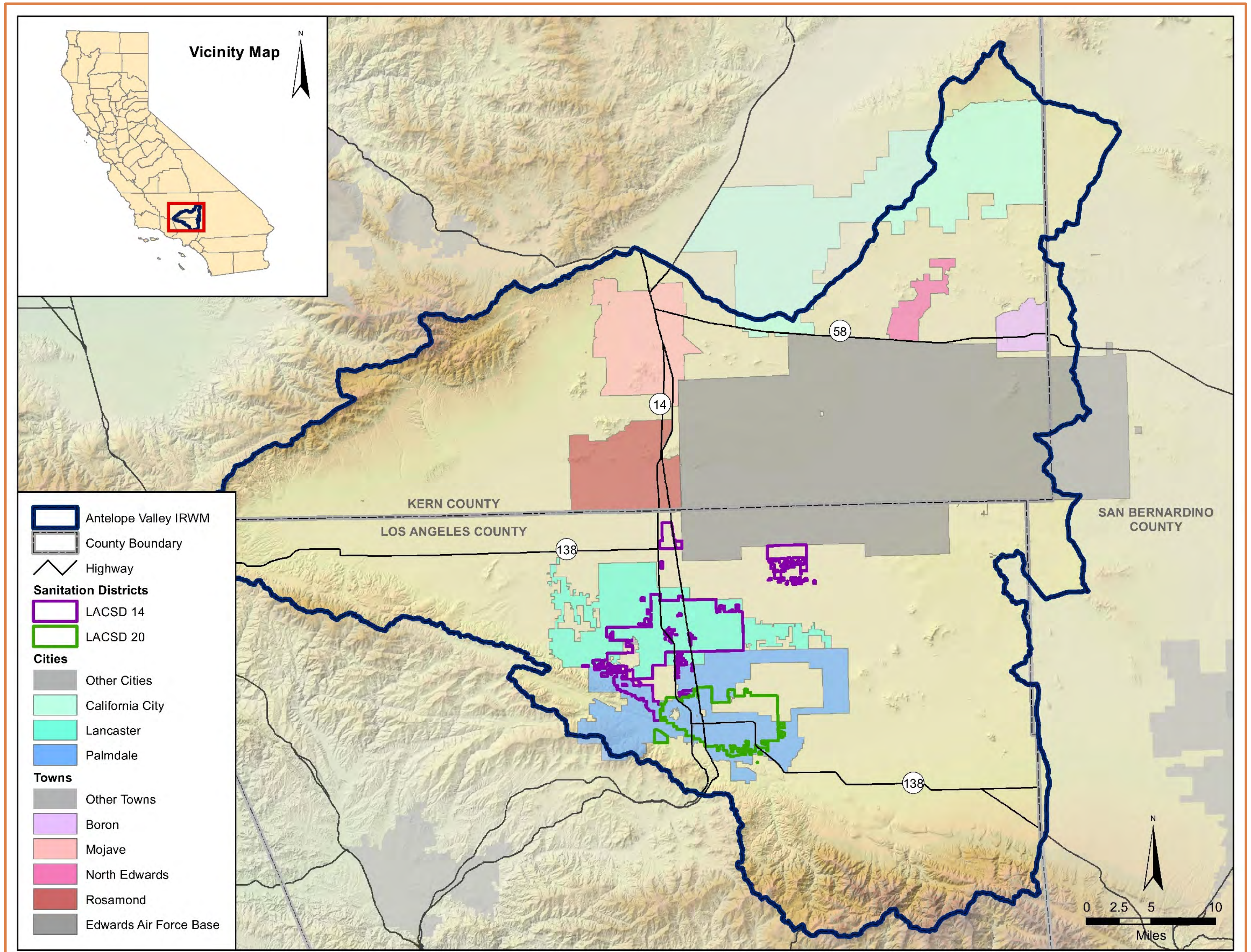
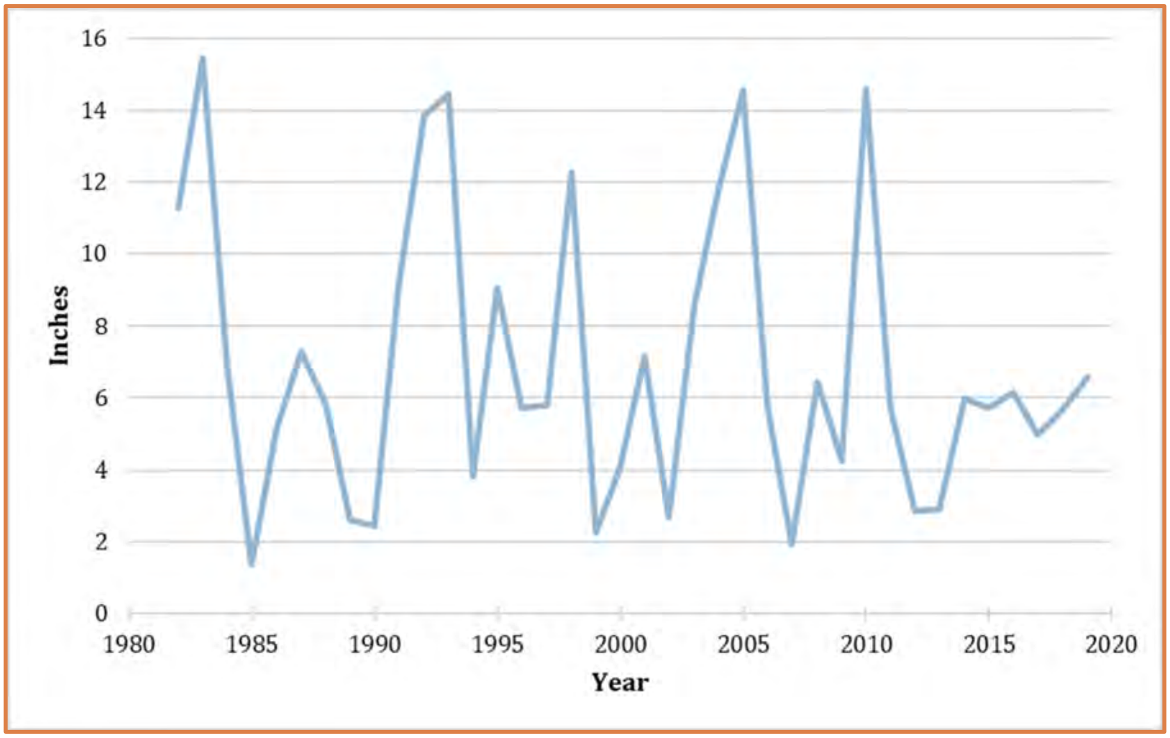
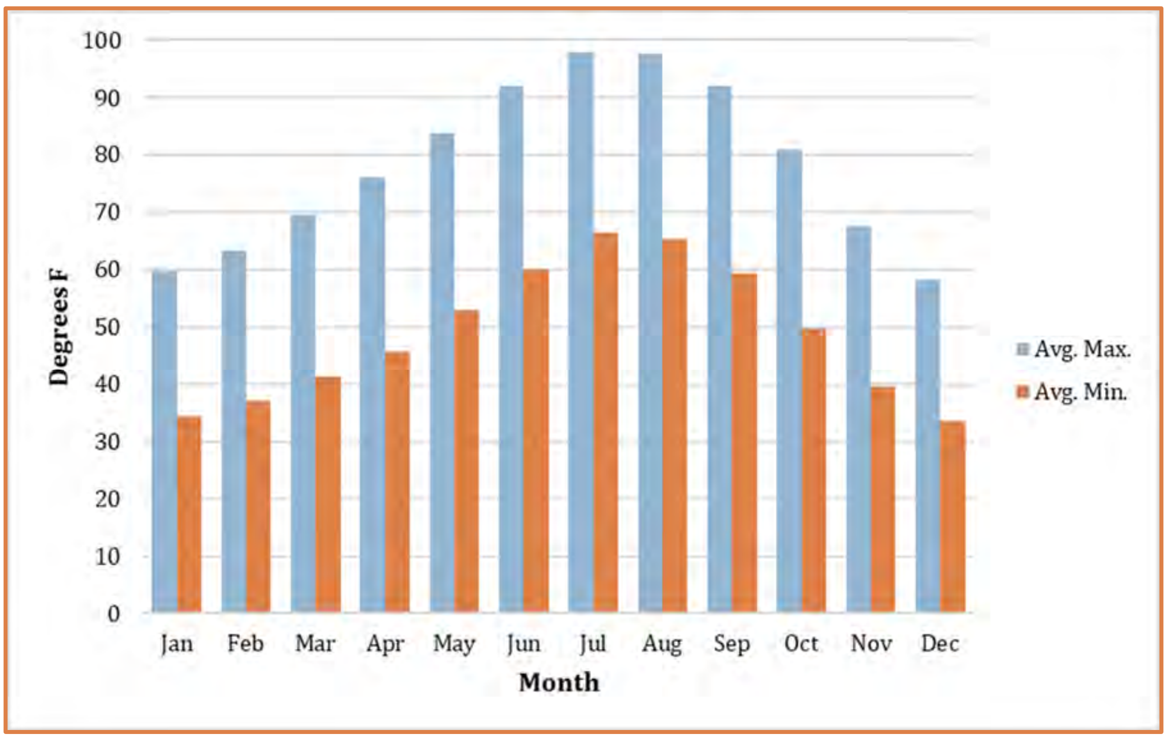


Figure 2-5: Annual Precipitation



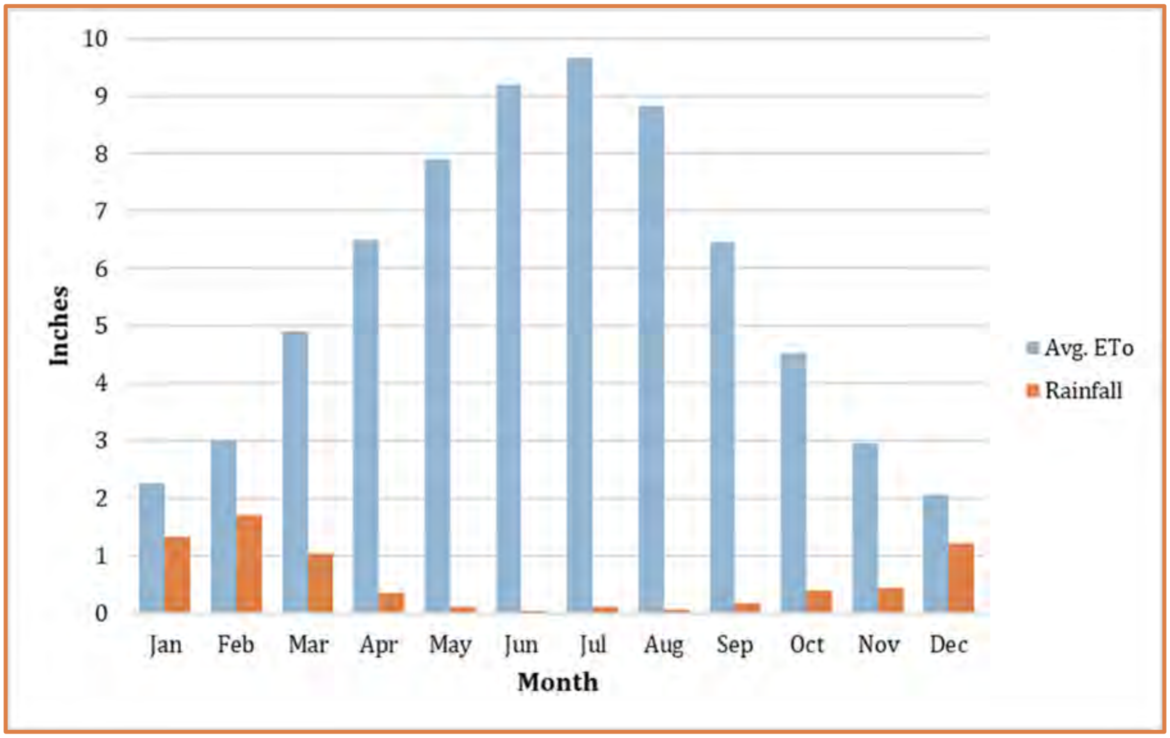
Source: Western Regional Climate Center, Palmdale Station (046624) from January 1982 to May 2019

Figure 2-6: Average Maximum and Minimum Temperature in the Antelope Valley Region



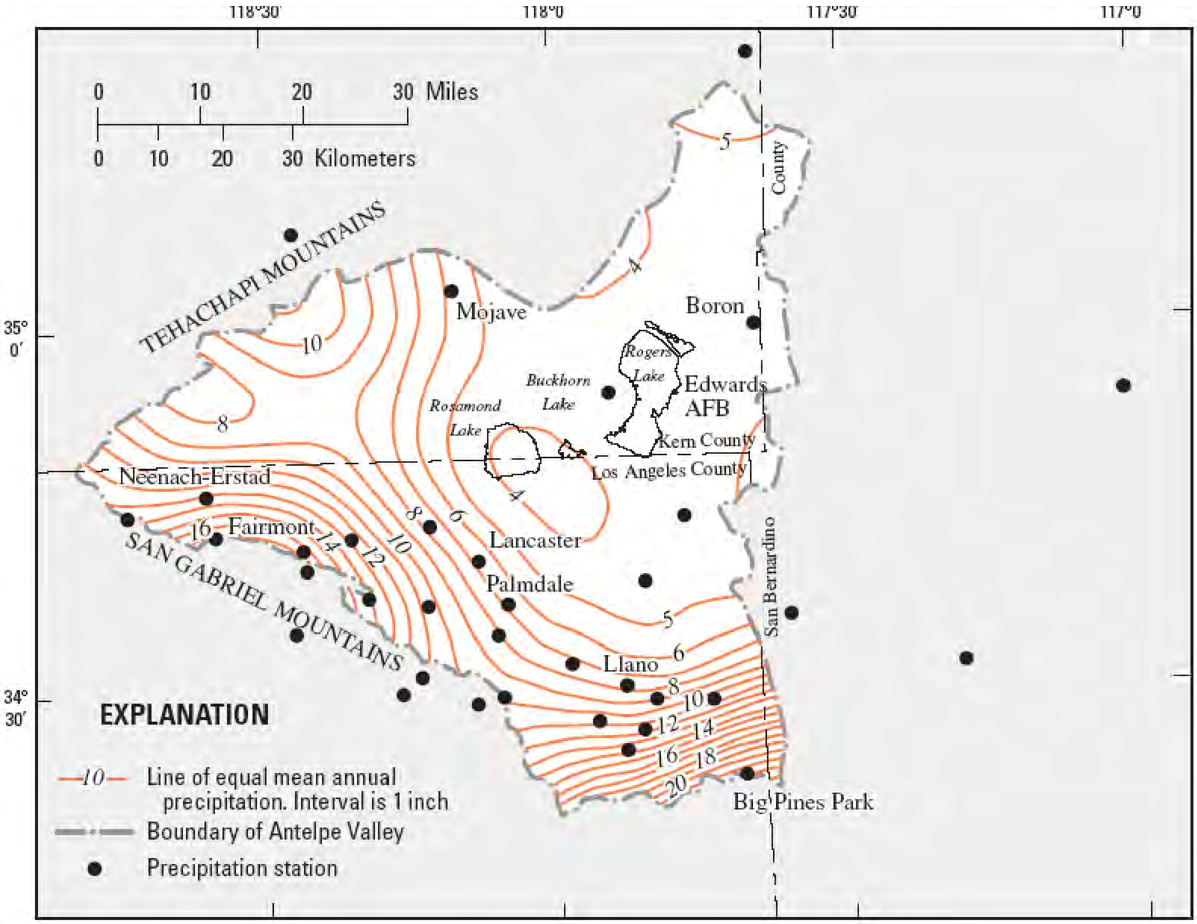
Source: Western Regional Climate Center, Palmdale Station (046624) from January 1982 to May 2019

Figure 2-7: Average Rainfall and Monthly Evapotranspiration (ETo) in the Antelope Valley Region



Source: CIMIS Data for Palmdale No. 197 Station from April 2005 to May 2019; Western Regional Climate Center, Palmdale Station (046624) from January 1982 to May 2019

Figure 2-8: Map of Annual Precipitation for the Antelope Valley Region



Source: "Precipitation depth-duration and frequency characteristics for Antelope Valley, Mojave Desert, California" Author(s): Blodgett, J. C., Los Angeles County (Calif.), Geological Survey (U.S.) Sacramento, Calif. : U.S. Geological Survey ; Denver, CO : Earth Science Information Center, Open-File Report Section [distributor], 1996.

2.4 Hydrologic Features

The Antelope Valley Region is a closed topographic basin with no outlet to the ocean. All water that enters the Valley Region either infiltrates into the groundwater basin, evaporates, or flows toward the three dry lakes on EAFB: Rosamond Lake, Buckhorn Lake, and Rogers Lake. In general, groundwater flows northeasterly from the mountain ranges to the dry lakes. Due to the relatively impervious nature of the dry lake soil and high evaporation rates, water that collects on the dry lakes eventually evaporates rather than infiltrating into the groundwater (LACSD 2005). The surface water and some groundwater features of the Antelope Valley Region are discussed in more detail below and are depicted in Figure 2-9.

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Figure 2-9: Antelope Valley Hydrologic Features

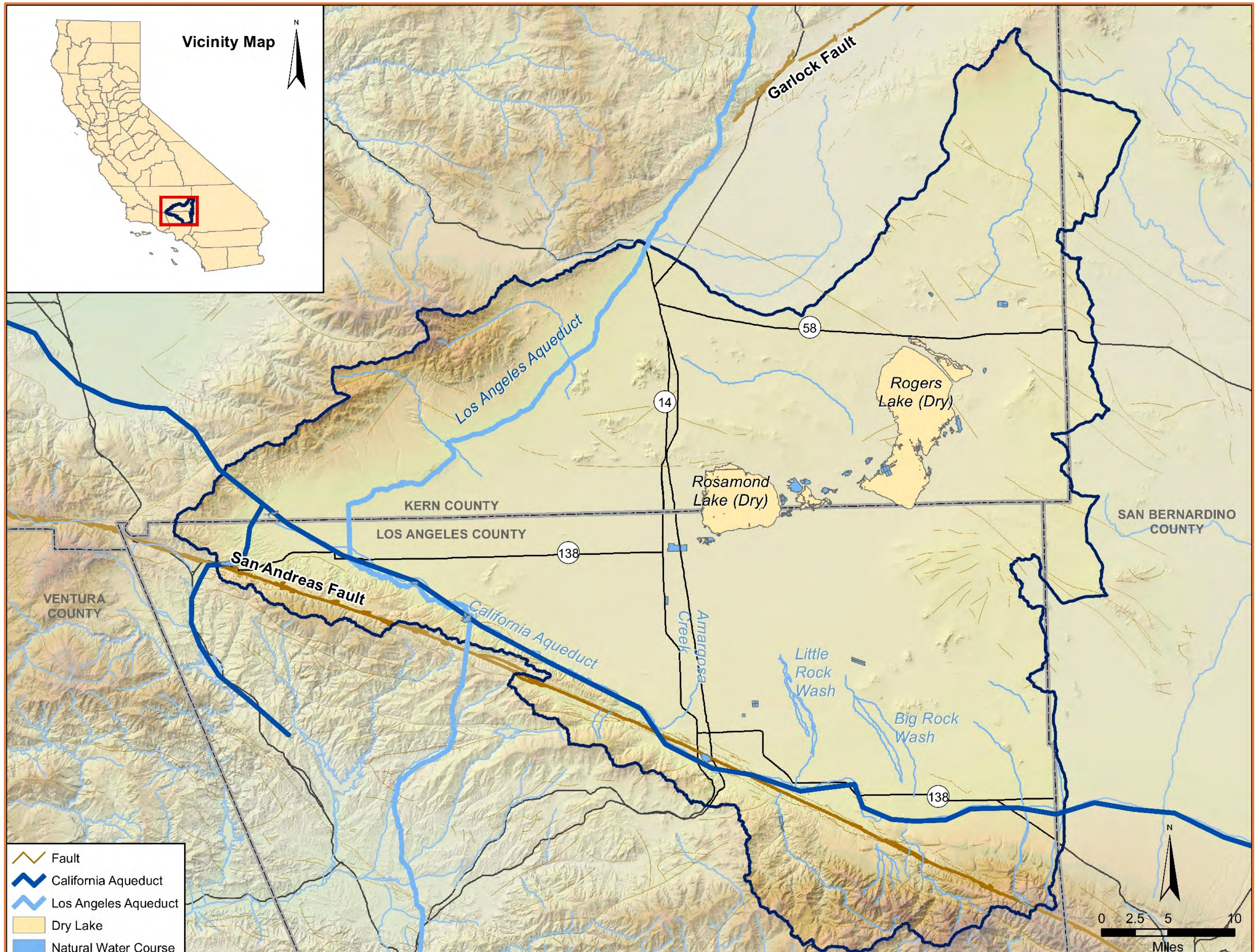
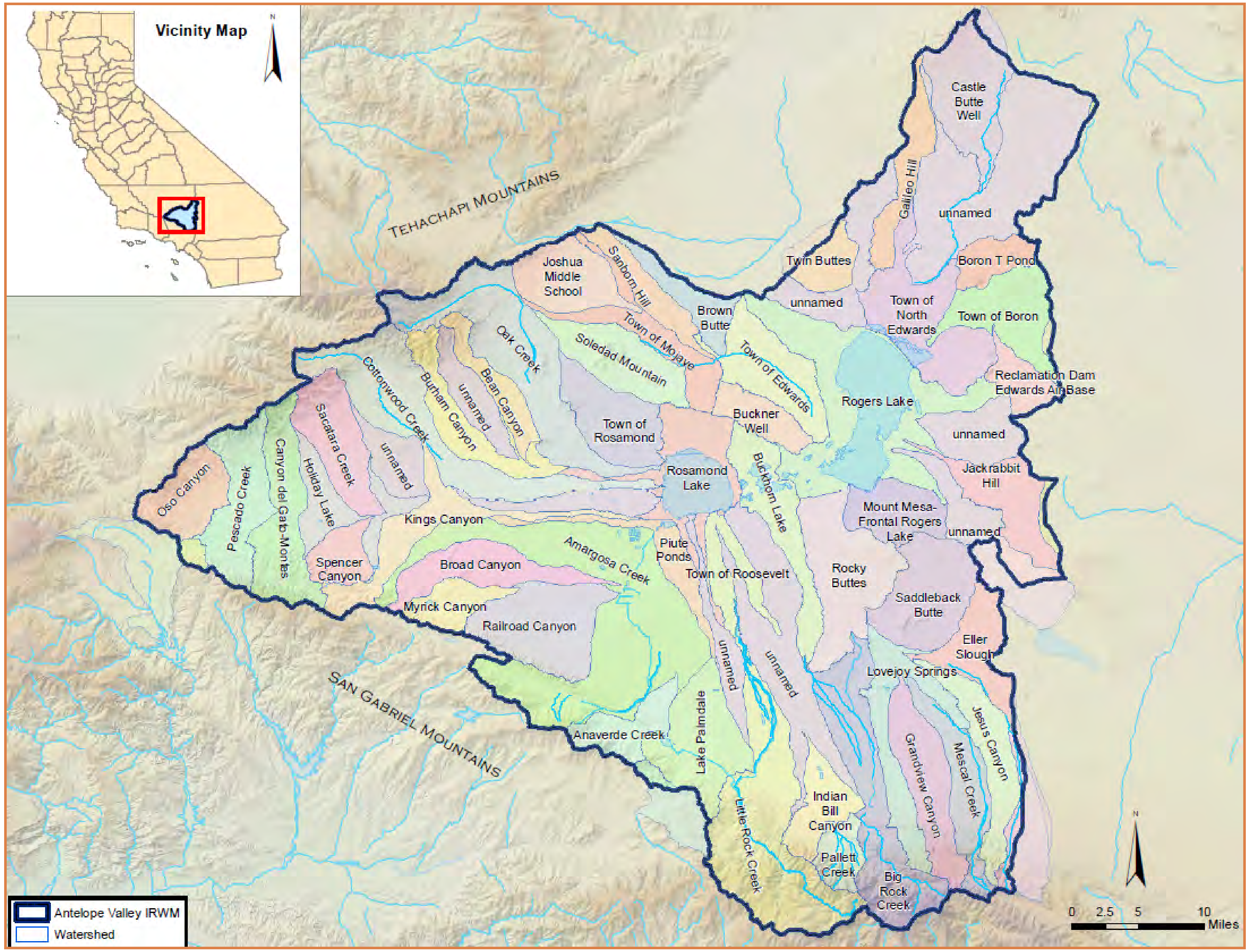


Figure 2-10: Antelope Valley Watersheds



2.4.1 Surface Water

Surface water flows are carried by ephemeral streams. The most hydrologically significant streams begin in the San Gabriel Mountains on the southwestern edge of the Antelope Valley Region and include Big Rock Creek, Little Rock Creek and Amargosa Creek from the San Gabriel Mountains; and Oak Creek and Cottonwood Creek from the Tehachapi Mountains. In addition, the fault lines surrounding the Valley form the Region's groundwater basin. These hydrologic features are shown on Figure 2-9.

2.4.1.1 Watersheds

The Antelope Valley's watersheds feed numerous ephemeral streams that originate in the surrounding mountains and meander across the alluvial fans that make up the valley floor. Stormwater runoff that doesn't percolate into the ground eventually ponds and evaporates in the dry lake beds on the Valley floor. There are a number of canyons and watersheds in the Valley, including Osos Canyon, Pescado Creek, Canyon del Gato-Montes, Sacatara Creek, Spencer Canyon, Kings Canyon, Cottonwood Creek, Burham Canyon, Bean Canyon, Oak Creek, Amargosa Creek, Railroad Canyon, Anaverde Creek, Little Rock Creek, Indian Bill Canyon, Pallett Creek, Big Rock Creek, Grandview Canyon, Mescal Creek, and Jesus Canyon. The most significant streams in the Valley begin in the San Gabriel Mountains on the southwestern edge of the Valley, and include Big Rock Creek, Little Rock Creek, and Amargosa Creek. Together, these streams drain an area of approximately 330 square miles. Surface water flows in Little Rock Creek are captured at Little Rock Reservoir, which is discussed further below. Big Rock Creek and Amargosa Creek are not diverted for supply at this time. The two major watersheds that begin in the Tehachapi Mountains, Oak Creek and Cottonwood Creek, drain an area of about 160 square miles. The Valley's watersheds are shown in Figure 2-10 and collectively drain the entire 2,400 square miles of the Region.

2.4.1.2 Little Rock Reservoir

Little Rock Creek is the only developed surface water supply in the Antelope Valley Region. The Little Rock Reservoir, jointly owned by PWD and LCID, collects runoff from the San Gabriel Mountains. As of 2005, the reservoir's useable storage capacity was estimated at 3,500 AF of water, reduced from its original design capacity of 4,300 AF due to the deposition of sediment. It is assumed that on average, 54,000 cubic yards of sediment are deposited in the reservoir per year (Aspen Environmental Group, 2005.) One of the priority projects in the 2019 IRWM Plan proposes to remove 1,165,000 cubic yards of accumulated sediment from behind the dam, adding approximately 500 AF of storage. Construction of a grade control structure at the sediment removal area to prevent erosion and other excavation-related impacts to the channel bed upstream has already begun (see Section 7).

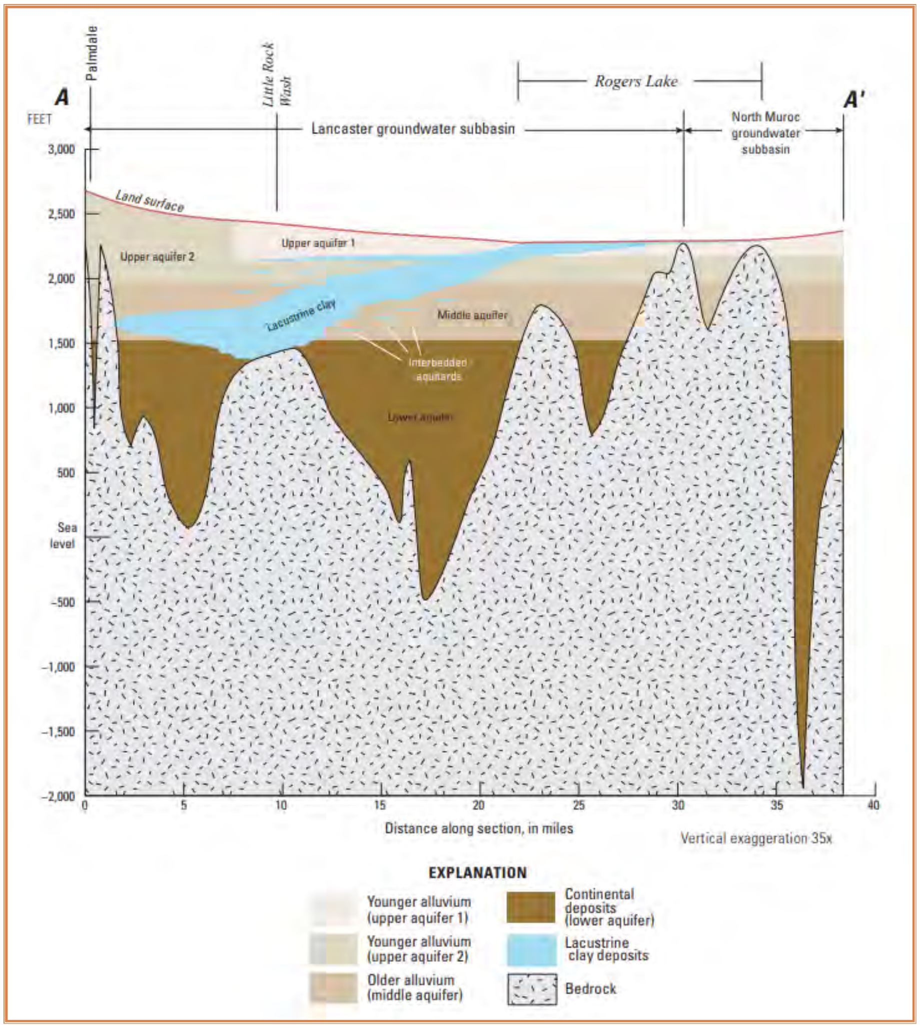
Historically, water stored in the Little Rock Reservoir has been used directly for agricultural uses within LCID's service area and for M&I uses within PWD's service area following treatment at PWD's water purification plant. PWD and LCID jointly hold long-standing water rights to divert 5,500 AFY from Littlerock Creek flows per an agreement between the two districts. In 1992, a renegotiation of the agreement gave PWD the authority to manage the reservoir as well as ownership of LCID's water rights for a 50-year period in-lieu of PWD contributing financial resources for the rehabilitation of the dam. The project was completed in 1995. LCID is currently entitled to purchase from PWD, in any one calendar year, 1,000 AF of water or 25 percent of the yield from Littlerock Dam Reservoir, whichever is less. On average, PWD has taken approximately 4,000 AF per year from Littlerock Dam Reservoir (PWD, 2016).

2.4.1.3 Dry Lakes and Percolation

Surface water from the surrounding hills and from the Antelope Valley Region floor flows primarily toward the three dry lakes on EAFB. Except during the largest rainfall events of a season, surface water flows toward the Antelope Valley Region from the surrounding mountains, quickly percolates into the stream bed, and recharges the groundwater basin. Surface water flows that reach the dry lakes are either used by the natural vegetation on the lake beds, or are lost to evaporation. It appears that little percolation occurs in the Antelope Valley Region other than near the base of the surrounding mountains due to impermeable layers of clay overlying the groundwater basin, though further investigations would be necessary to confirm the locations of impermeable areas. See Figure 2-11 for a sample cross-sectional illustration of the clay layer as it is positioned between the upper and lower aquifers in the Antelope Valley Region.

Previous USGS estimates indicate that approximately 5 percent of the precipitation that falls in the Antelope-Fremont Valley each year percolates to the groundwater basins, while the remaining water is lost to evaporation (USGS, 1987).

Figure 2-11: Cross Sectional View of the Clay Layer Between the Upper and Lower Aquifers in the Antelope Valley Region



Source: USGS 2014

2.4.1.4 Geology and Soils

The Antelope Valley represents a large topographic area and groundwater basin in the western part of the Mojave Desert in southern California. It is a prime example of a single, undrained, closed basin, and it is located at an approximate elevation of 2,300 to 2,400 feet above mean sea level. These elevations represent the surface areas overlying the groundwater basin only and do not include the larger area overlying the entire watershed (i.e., Region). In other words, the watershed has a larger "footprint" than the groundwater basin. The Antelope Valley Region occupies part of a structural depression that has been downfaulted between the Garlock, Cottonwood-Rosamond, and San Andreas Fault Zones. The Antelope Valley Region is bounded on the southwest by the San Andreas Fault and San Gabriel Mountains, the Garlock Fault and Tehachapi Mountains to the northwest, and San Bernardino County to the east. Consolidated rocks that yield virtually no water underlie the basin and crop out in the highlands that surround the basin. They consist of igneous and metamorphic rocks of pre-Tertiary age that are overlain by indurated continental rocks of Tertiary age interbedded with lava flows (USGS 1995).

Alluvium and interbedded lacustrine deposits of Quaternary age are the important aquifers within the closed basin and have accumulated to a thickness of as much as 1,600 feet. The alluvium is unconsolidated to moderately consolidated, poorly sorted gravel, sand, silt, and clay. Older units of the alluvium are somewhat coarser grained, and are more compact and consolidated, weathered, and poorly sorted than the younger units. The rate at which water moves through the alluvium, also known as the hydraulic conductivity of the alluvium, decreases with increasing depth.

During the depositional history of the Antelope Valley Region, a large intermittent lake occupied the central part of the basin and was the site of accumulation of fine-grained material. The rates of deposition varied with the rates of precipitation. During periods of relatively heavy precipitation, massive beds of blue clay formed in a deep perennial lake. During periods of light precipitation, thin beds of clay and evaporative salt deposits formed in playas or in shallow intermittent lakes. Individual beds of the massive blue clay can be as much as 100 feet thick and are interbedded with lenses of coarser material as much as 20 feet thick. The clay yields virtually no water to wells, but the interbedded, coarser material can yield considerable volumes of water.

Soils within the area are derived from downslope migration of loess and alluvial materials, mainly from granitic rock sources originating along the eastern slopes of the Tehachapi and San Gabriel Mountains. Additional detailed information on soil types and their distribution can be found in the Lancaster Water Reclamation Plant (WRP) 2020 Plan Final Environmental Impact Report (EIR). Figure 2-12 provides a soil map of the Antelope Valley Region.

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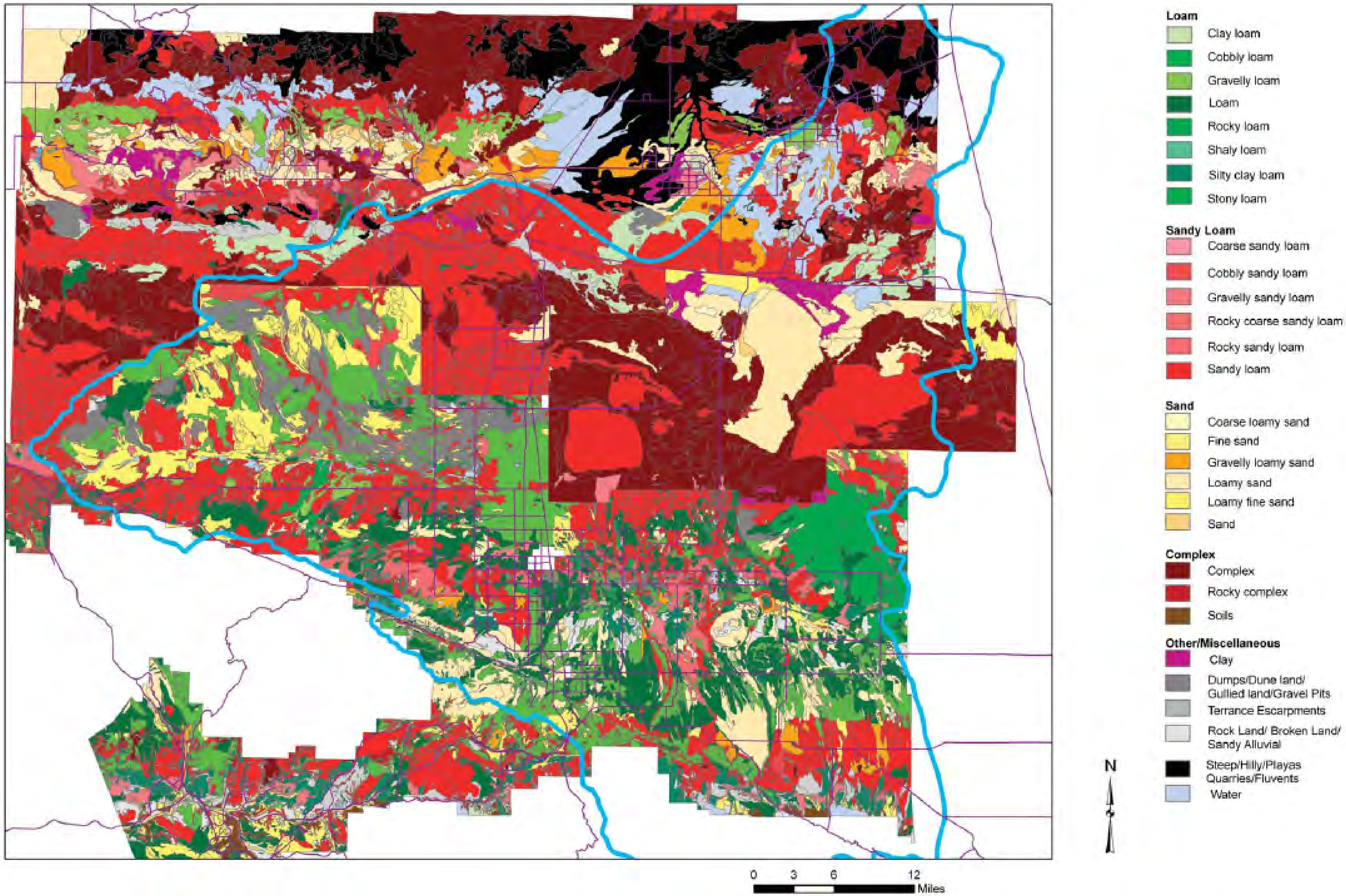
Figure 2-12: Antelope Valley Soils Map



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2.4.2 Groundwater

The Antelope Valley Groundwater Basin is comprised of two primary aquifers: (1) the upper (principal) aquifer and (2) the lower (deep) aquifer. The principal aquifer is an unconfined aquifer and historically had provided artesian flows due to perched water tables in some areas. These artesian conditions are currently absent due to extensive pumping of groundwater. Separated from the principal aquifer by clay layers, the deep aquifer is generally considered to be confined. In general, the principal aquifer is thickest in the southern portion of the Antelope Valley Region near the San Gabriel Mountains, while the deep aquifer is thickest in the vicinity of the dry lakes on EAFB.

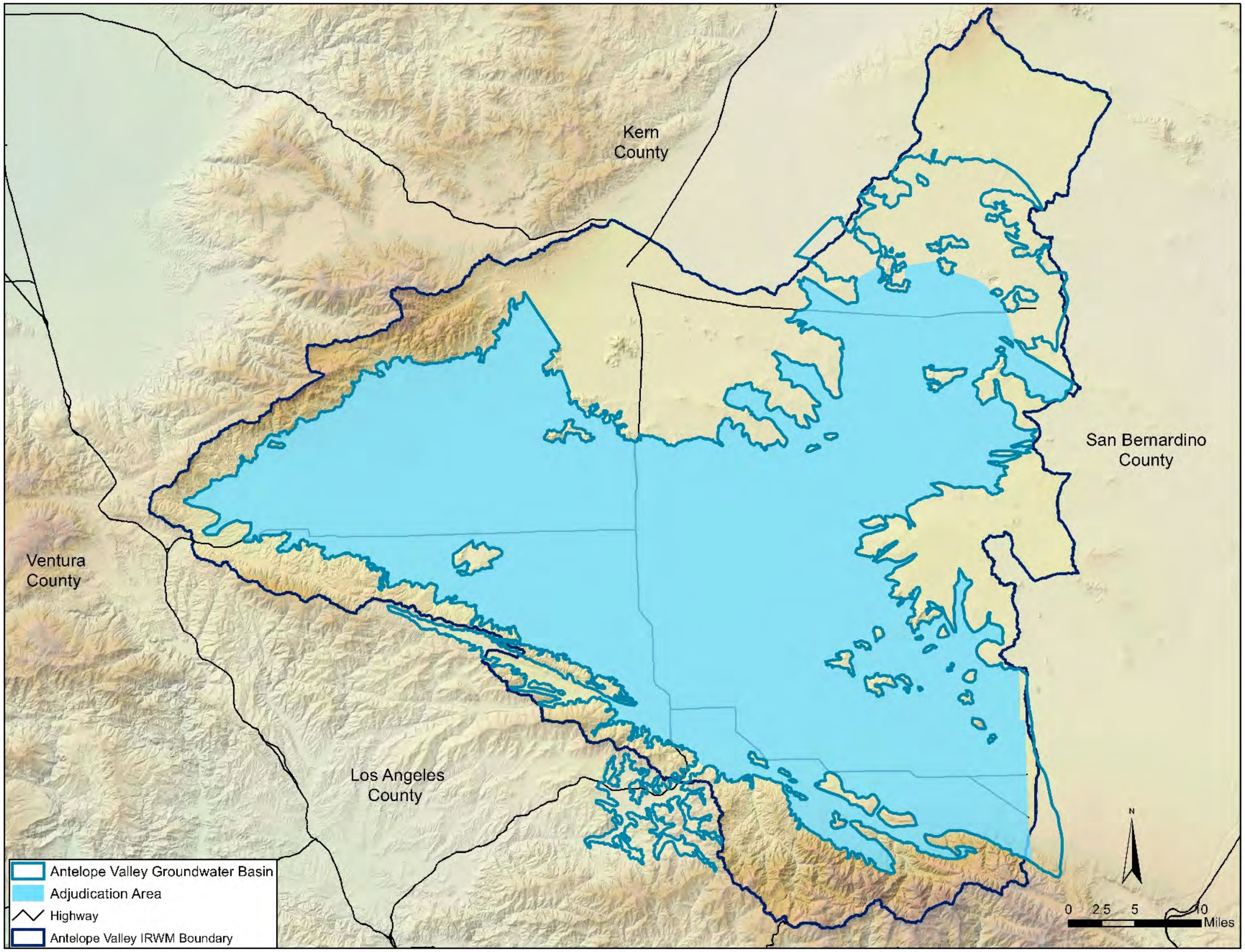
Groundwater has been, and continues to be, an important resource within the Antelope Valley Region. Prior to 1972, groundwater provided more than 90 percent of the total water supply in the Antelope Valley Region; since 1972, it has provided between 50 and 90 percent (USGS 2003). Groundwater pumping in the Antelope Valley Region peaked in the 1950s (USGS 2000a), and it decreased in the 1960s and 1970s when agricultural pumping declined due to increased pumping costs from greater pumping lifts and higher electric power costs (USGS 2000a). The rapid increase in urban growth in the 1980s resulted in an increase in the demand for M&I water and an increase in groundwater use. Projected urban growth and limits on the available local and imported water supply are likely to continue to increase the reliance on groundwater.

2.4.2.1 Antelope Valley Groundwater Basin Adjudication

The Antelope Valley Groundwater Basin was adjudicated in December of 2015 after 15 years of complex proceedings among more than 4,000 parties. The adjudication defined the Basin boundaries, considered hydraulic connection throughout the basin, established a safe yield, and quantified groundwater production. The Basin was determined to be in a state of overdraft as a result of these considerations.

Though the basin covers 1,580 square miles, the Adjudication Area only covers approximately 1,390 square miles. The Adjudication Area does not include the adjacent alluvial portions of the groundwater basin to the northeast and south because subsurface flows between these adjacent alluvial areas and the Adjudication Area are generally considered nominal. The Adjudication Area is also truncated at the Los Angeles-San Bernardino County Line in the southeast because the portion Basin that extends into San Bernardino County is within the Mojave Basin Area adjudication. The Adjudication Area is comprised of five management areas: Central Antelope Valley Subarea, West Antelope Valley Subarea, South East Subarea, Willow Springs Subarea, Rogers Lake Subarea. The Adjudication Area is shown in Figure 2-13. Under the Judgment, the Watermaster is required to report the changing hydrology of these management areas in annual reports to the Court.

Figure 2-13: Antelope Valley Groundwater Basin Adjudication



2.4.2.2 Groundwater Subunits

The complex Antelope Valley Groundwater Basin is divided by the USGS into twelve subunits as shown on Figure 2-14. Groundwater basins are generally divided based upon differential groundflow patterns, recharge characteristics, and geographic location, as well as controlling geologic structures. The Antelope Valley Groundwater Basin's subunits are: Finger Buttes, West Antelope, Neenach, Willow Springs, Gloster, Chaffee, Oak Creek, Pearland, Buttes, Lancaster, North Muroc, and Peerless. The USGS mentions that groundwater levels in these subunits have improved in some areas due to the importation of SWP water to the Antelope Valley Region, and declined in others due to increased groundwater pumping. Each subunit has varying characteristics, and the current conditions in each subunit are briefly summarized below (USGS 1987).

Subunit Characteristics, listed generally from north to south and west to east (USGS 1987):

Finger Buttes: A large part of this subunit is in range and forest lands. Flow is generally from southwest to southeast. Depth to water varies, but is commonly more than 300 feet.

West Antelope: Groundwater flows southeasterly to become outflow into the Neenach subunit. Depth to water ranges from 250 to 300 feet.

Neenach: Groundwater flow is mainly eastward into the "principal" and "deep" aquifers of the Lancaster subunit. Depth to water ranges from 150 to 350 feet.

Willow Springs: Groundwater flows southeast and ultimately enters the Lancaster subunit. This subunit receives recharge for intermittent surface flows from the surrounding Tehachapi Mountain area. Depth to water ranges from 100 to 300 feet.

Gloster: Groundwater flows to the east and southeast as outflow to the Chaffee subunit. Depth to water levels for the southeast area of the subunit are 50 and 100 feet; other water level data is sparse.

Chaffee: Groundwater moves into this subunit from Cache Creek, adjacent alluvial fans to the west and, in lesser amounts, from the Gloster subunit. Water moves eastward in the western part of the subunit, and northward in the southern part, generally toward the City of Mojave. Water levels range from 50 to 300 feet.

Oak Creek: This unit is recharged by flows from the Tehachapi Mountains. Groundwater flows are generally to the southeast, with some southward flows toward the Koehn Lake area. Data for depth to water is not available.

Pearland: Substantial recharge to this subunit comes from Littlerock and Big Rock Creeks. Groundwater generally moves from southeast to northwest, with outflow to the Lancaster subunit. Water levels range from 100 to 250 feet.

Buttes: Groundwater generally moves from southeast to northwest, with outflow to the Lancaster subunit. Depth to water ranges from 50 to 250 feet.

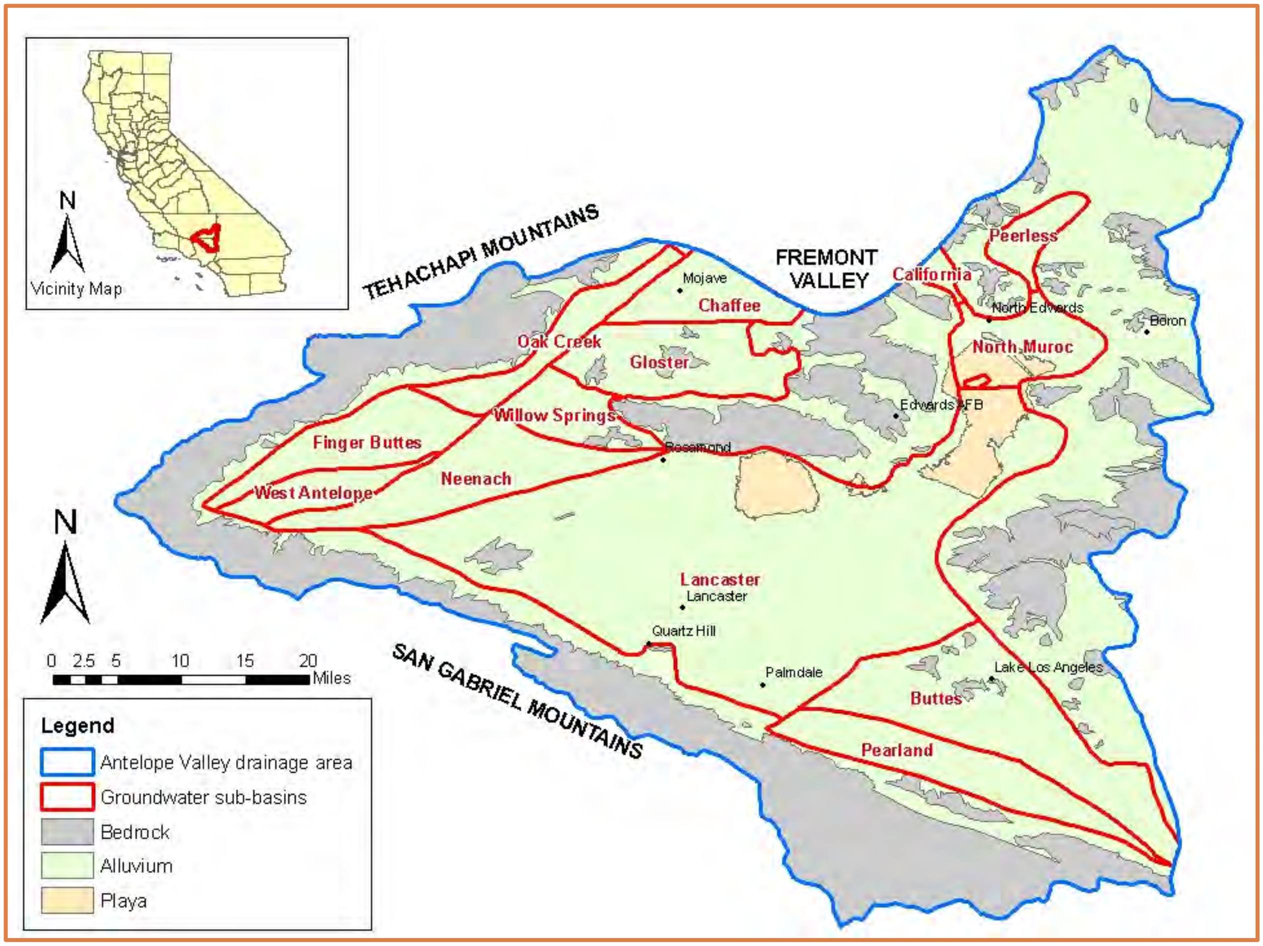
Lancaster: This is the largest and most economically important subunit, in both size and water use. Due to the use of this subunit, depths to water levels vary widely, being generally greater in the south and west. Pumping depressions can be observed in various locations. There are two major aquifers in the subunit, the "principal" and "deep" aquifers, separated by clay layers. As noted above, groundwater moves into the subunit from the Neenach, West Antelope and

Finger Buttes subunits. Groundwater also moves into the principal aquifer from the Buttes and Pearland subunits. The Lancaster subunit underlies Lancaster, Palmdale, Quartz Hill, Rosamond, Antelope Acres and other smaller communities.

North Muroc: This unit underlies part of the Rogers Lake and EAFB area. Groundwater moves north and west, then north again and possibly into the Peerless subunit. Data on depth to groundwater is not available.

Peerless: Little information is available on this subunit, which cannot be clearly delineated, but represents the eastern limit of highly developed water-bearing deposits. As of the date of the USGS report, water levels had declined by as much as 150 feet and flow was toward a pumping depression.

Figure 2-14: Antelope Valley Groundwater Sub-Basin Boundary Map



Source: Salt and Nutrient Management Plan for the Antelope Valley 2014

2.4.2.3 Groundwater Quality

Groundwater quality is excellent within the principal aquifer but degrades toward the northern portion of the dry lake areas. Considered to be generally suitable for domestic, agricultural, and industrial uses, the water in the principal aquifer has a total dissolved solids (TDS) concentration ranging from 200 to 800 milligrams per liter (mg/L). The deeper aquifers typically have higher TDS levels. Hardness levels range from 50 to 200 mg/L and high fluoride, boron, and nitrates are problematic in some areas of the basin. Identification and characterization of salts and nutrients is necessary for assessing constituent loads and analyzing impacts on groundwater quality. Sources of salts and nutrients in the basin include imported water, recycled water, and several others. The following provides a brief description of some of the significant salts and nutrients in the Antelope Valley Watershed. Refer to Appendix G for a more detailed description of the constituents in the Antelope Valley Salt and Nutrient Plan.

Total Dissolved Solids: Salts in groundwater are typically measured by TDS, which is the overall mineral content. Most TDS sources are anthropogenic in nature and include agricultural runoff, point source water pollution, and industrial and sewage discharge. Inorganic sources include minerals commonly found in nature through the weathering and dissolution of rocks and organic material from decaying organisms, plants, and animals.

There are no known health effects associated with the ingestion of TDS in drinking water. However, high TDS concentrations can negatively impact sensitive crops and cause corrosion and scaling in pipes.

Chlorides: Chlorides are widely distributed in nature as salts of sodium (NaCl), potassium (KCl), and calcium ($CaCl_2$). Chlorides in groundwater are naturally occurring from weathering of rocks, negligible atmospheric deposition, and as result of human use and wastes. Sources of chloride from human use include food condiments and preservatives, potash fertilizers, animal feed additives, production of industrial chemicals, dissolution of de-icing salts, and treatment of drinking water and wastewater. Release of brines from industry processes, leaching from landfills and fertilized soils, discharge of wastewater from treatment facilities or septic systems affect chloride in groundwater.

As with TDS, there are no known health effects associated with the ingestion of chloride in drinking water. Chloride concentrations in excess of approximately 250 mg/L can affect taste. Also, elevated chloride concentrations have substantial negative impacts on sensitive crops and cause corrosion in pipes.

Nitrogen: Nitrogen is ubiquitous in the environment and an essential nutrient for crops. Nitrate is the primary form of nitrogen found in groundwater and is a principal by-product of fertilizers. Other sources of nitrate include land use activities such as irrigation farming of crops, high density animal operations, wastewater treatment, food processing facilities and septic tank systems.

Nitrogen in the nitrate/nitrite form poses health hazards for infants and pregnant women. High nitrate levels in drinking water can result in methemoglobinemia, commonly known as "blue baby syndrome" which is a condition characterized by a reduced ability of the blood to carry oxygen to organs and tissue.

Arsenic: Arsenic is an odorless and tasteless semi-metal element that occurs naturally in rocks and soil, water, air, and plants and animals. It enters drinking water supplies from natural deposits in the earth or from agricultural and industrial practices. Higher levels of arsenic tend to be found more in groundwater sources than in surface water sources. The demand on groundwater from municipal systems and private drinking water wells may cause water levels to drop and release arsenic from rock formations.

Arsenic is a concern in the Antelope Valley Region and has been observed in LACWD 40, PWD, and QHWD wells. Research conducted by the LACWD 40 and the USGS has shown the problem to reside primarily in the deep aquifer, and it is not anticipated that the existing arsenic problem will lead to future loss of groundwater as a water supply resource for the Antelope Valley Region.

Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. Non-cancer effects of arsenic can include thickening and discoloration of the skin, stomach pain, nausea, vomiting; diarrhea; numbness in hands and feet; partial paralysis; and blindness.

Chromium: Chromium is an odorless and tasteless metallic element found naturally in rocks, plants, soil and volcanic dust, and animals. The most common forms of chromium that occur in natural waters in the environment are trivalent chromium (chromium-3) and hexavalent chromium (chromium-6).

Chromium-3 is an essential human dietary element and is found in many vegetables, fruits, meats, grains and yeast. Chromium-6 occurs naturally in the environment from the erosion of natural chromium deposits, and it can also be produced by industrial processes. There are demonstrated instances of chromium being released to the environment by leakage, poor storage or inadequate industrial waste disposal practices.

Drinking water standards have been set to protect consumers served by public water systems from the effects of exposure to chromium. In 2013, the California Department of Public Health (CDPH) adopted a maximum contaminant level (MCL) for chromium-6 of 10 ug/L (parts per billion). The MCL, however, was revoked in 2017 because it failed to consider the economic feasibility of compliance. The CDPH expects that the process for adopting a new MCL will be expedited given the large amount of data that was compiled between 2014 and 2017.

Perchlorate: Perchlorate is a naturally occurring contaminant that has been detected in arid environments in the Southwest United States. The chemical also forms naturally in the atmosphere. High levels of perchlorate can be attributed to the manufacturing or testing of solid rocket propellants, explosives, fireworks, road flares, and certain types of fertilizers. Common uses of perchlorate include leather tanning and electroplating. Perchlorate disrupts normal functions of the thyroid gland, interfering with the body's ability to regulate metabolism, blood pressure, body temperature, and physical growth. Fetuses and infants are most susceptible to perchlorate contamination because it can cause miscarriages or impaired central nervous system development.

Fluoride: Fluoride compounds are salts that form when the element, fluorine, combines with minerals in soil or rocks. Some fluoride compounds, such as sodium fluoride and fluorosilicates, dissolve easily into ground water as it moves through gaps and pore spaces between rocks. Most water supplies contain some naturally occurring fluoride. Fluoride also enters drinking water in discharge from fertilizer or aluminum factories. Also, many communities add fluoride to their drinking water to promote dental health.

Exposure to excessive consumption of fluoride over a lifetime may lead to increased likelihood of bone fractures in adults, and may result in effects on bone leading to pain and tenderness. Children aged 8 years and younger exposed to excessive amounts of fluoride have an increased chance of developing pits in the tooth enamel, along with a range of cosmetic effects to teeth.

Boron: Naturally-occurring boron is usually found in sediments and sedimentary rock formations and rarely exists in elemental form. Other forms of boron include boric acid, borax, borax pentahydrate, anhydrous borax, and boron oxide. The principal uses for boron compounds in the United States include glass and ceramics, soaps and detergents, algicides in water treatment, fertilizers, pesticides, flame retardants, and reagents for production of other boron compounds. The major sources of free boron in the environment are exposed minerals containing boron, boric acid volatilization from seawater, and volcanic material. Anthropogenic inputs of boron to the environment are considered smaller than inputs from natural processes and may include: agriculture, waste and wood burning, power generation using coal and oil, glass product manufacture, use of borates/perborates in the home and industry, borate mining/processing, leaching of treated wood, and sewage/sludge disposal. Contamination of water can come directly from industrial wastewater and municipal sewage, as well as indirectly from air deposition and soil runoff. Borates in detergents, soaps, and personal care products can also contribute to the presence of boron in water.

The available data for boron support its ubiquitous presence in the ambient environment. Based on the concentrations of boron in the groundwater compared to the health risk level, boron does not present a health risk (US EPA 2008).

2.4.2.4 Groundwater Storage Capacity and Recharge

The total storage capacity of the Antelope Valley Groundwater Basin has been reported at 68 million acre-feet (MAF) (Planert and Williams 1995 as cited in DWR 2004) to 70 MAF (DWR 1975 as cited in DWR 2004). The groundwater basin is principally recharged by deep percolation of precipitation and runoff from the surrounding mountains and hills (see Figure 2-14 for a depiction of groundwater basin boundaries). Other sources of recharge to the basin include artificial recharge and return flows from agricultural irrigation, urban irrigation, and wastewater management activities. Depending on the thickness and characteristics of the unsaturated zone of the aquifer, these sources may or may not contribute to recharge of the groundwater. As previously stated, precipitation over the Antelope Valley Region floor is generally less than 8 inches per year and ETo rates (along with soil requirements) are high; therefore, recharge from direct infiltration of precipitation on the Valley floor is considered negligible (Snyder 1955; Durbin 1978 as cited in USGS 2003; Antelope Valley Watermaster 2018).

The Judgment defined a Native Safe Yield and a Total Safe Yield for groundwater production to bring the basin back into balance. The Native Safe Yield, set by the Court at 82,300 AFY, is based on estimates of natural groundwater recharge from the hydrologic system, infiltration from precipitation and streamflow, and return flows from basin pumping. The Judgment recognizes that the Native Safe Yield has embedded assumptions of land use and return flows, which were estimated at 27 percent based on 15 years of recent land use data. Because of this, the Watermaster may initiate a recommendation to change the Native Safe Yield of the Basin in year 17 of the Judgment. The Court also determined the Total Safe Yield of the Basin to be 110,000 AFY. The Total Safe Yield considers supplemental supply of imported water and associated return flows in addition to the Native Safe Yield. A more detailed description of the Total Safe Yield and Native Safe Yield as defined by the adjudication and a list of documents that reference estimates for safe yield, natural recharge, and return flows are included in Appendix I.

The basin has historically shown large fluctuations in groundwater levels. Data from 1975 to 1998 show that groundwater level changes over this period ranged from an increase of 84 feet to a decrease of 66 feet (Carlson and Phillips 1998 as cited in DWR 2004).

USGS currently monitors water levels in approximately 185 wells within and adjacent to the Antelope Valley Adjudication Area. Groundwater level data is examined to determine the groundwater conditions of the Basin annually and reported in the Antelope Valley Watermaster Annual Reports. Previous data collected by the USGS (2003) indicated that groundwater levels appeared to be falling in the southern and eastern areas of the Antelope Valley Region and rising in the rural western and far northeastern areas of the Antelope Valley Region. This pattern of falling and rising groundwater levels correlates directly to changes in land use over the past 40 to 50 years. Falling groundwater levels are generally associated with areas that are developed and rising groundwater levels are generally associated with areas that were historically farmed, but have been largely fallowed during the last 40 years. However, recent increases in agricultural production, primarily carrots, in the northeastern and western portions of the Antelope Valley Region may have reduced rising groundwater trends in these areas (LACSD 2005).

The Antelope Valley Watermaster 2017 Annual Report concluded that the water levels near the Westside Water Bank experienced an increase of more than 20 feet between 2017 and 2018. On average, the West Antelope Subarea experienced an average change in groundwater elevation of 2.4 feet. The Central Antelope Valley Subarea experienced both increases and declines in groundwater levels with an average increase of groundwater elevation of 0.4 feet, whereas the groundwater levels in the South East Subarea decreased an average of 2.2 feet (Antelope Valley Watermaster 2018).

2.4.2.5 Groundwater Extraction and Subsidence

According to the USGS (2003), groundwater extractions have exceeded the estimated natural recharge of the basin during some periods since the 1920's. This overdraft has caused water levels to decline by more than 200 feet in some areas and by at least 100 feet in most of the Antelope Valley Region (USGS, 2003). Extractions in excess of the groundwater recharge can cause groundwater levels to drop and associated environmental damage (e.g., land subsidence). The Statement of Decisions for Phase Three Trial for the adjudication process has also determined that the groundwater basin is in overdraft and that overall, current extractions exceed recharge, though it also acknowledges that groundwater levels are increasing in some areas (Antelope Valley Groundwater Litigation (Consolidated Cases), Los Angeles Superior Court, Lead Case No. BC 325 201 (2011)).

Groundwater extractions are reported to have increased from about 29,000 AF in 1919 to about 400,000 AF in the 1950's, when groundwater use in the Antelope Valley Region was at its highest (USGS, 1995). Use of SWP water has since stabilized groundwater levels in some areas of the Antelope Valley Region. In recent years, groundwater pumping has resulted in subsidence and earth fissures in the Lancaster and EAFB areas, which has permanently reduced storage by 50,000 AF (DWR, 2004). Data estimates pertaining to groundwater production between 1951 and 2005 indicate that extractions were between 130,000 and 150,000 AFY (Antelope Valley Groundwater Litigation (Consolidated Cases), Los Angeles Superior Court, Lead Case No. BC 325 201 (2011)). The final Judgment determined that the Pre-Rampdown Production, or the amount of groundwater extracted for reasonable and beneficial use prior to the Judgment or Production Right, whichever is greater, is approximately 130,000 AFY.

In the Lancaster basin, the groundwater generally moves northeasterly from the San Gabriel and Sierra Pelona Mountains to Rosamond and Rogers dry lakes. Heavy pumping has caused large groundwater depressions that disrupt this movement (LACSD 2005). The historical decline of groundwater levels has been linked to land subsidence in the Basin. Water level declines cause a decrease in the aquifer pore pressure, allowing for re-arrangement and compaction of fined-grained units (i.e., clay) in the subsurface. As these sediments compact, the land surface sinks. Land subsidence from groundwater pumping has been documented by USGS and others in the Antelope Valley. Between 1930 and 1992, up to 6.6 feet of land subsidence occurred near Lancaster. At Edwards Air Force Base, land subsidence has caused cracked runways and accelerated erosion on Rogers lakebed. USGS reports that this subsidence has also permanently reduced groundwater storage capacity by about 50,000 AF. Land subsidence from groundwater level declines can be a relatively slow process and continue for years after the pore pressure changes have occurred (Antelope Valley Watermaster 2018).

2.5 Land Use

Figure 2-14 presents a map of major existing land use categories within the Antelope Valley Region, characterized and grouped together according to broad water use sectors. Land use is determined by the Region's counties and cities. The map was created with Los Angeles County and Kern County Planning Department Geographic Information System (GIS) parcel level data. Each major land use category is identified, below, including the types of "like water uses" assigned to each category.

- Agriculture: Agricultural uses includes areas devoted to the production of irrigated crops.
- Residential: Residential uses include a mix of housing developed at varying densities and types. Residential uses in the Antelope Valley Region include single-family, multiple-family, condominium, mobile home, low-density "ranchettes," and senior housing.
- Commercial/Office: This category includes commercial uses that offer goods for sale to the public (retail) and service and professional businesses housed in offices (doctors, accountants, architects, etc.). Retail and commercial businesses include those that serve local needs, such as restaurants, neighborhood markets and dry cleaners, and those that serve community or regional needs, such as entertainment complexes, auto dealers, and furniture stores. Also included in this category are government offices that have similar water duty requirements as a typical commercial/office use.
- Industrial: The industrial category includes heavy manufacturing and light industrial uses found in business, research, and development parks. Light industrial activities include some types of assembly work, utility infrastructure and work yards, wholesaling, and warehousing.
- Public and Semi-Public Facilities: Libraries, schools, and other public institutions are found in this category. Uses in this category support the civic, cultural, and educational needs of residents.
- Resources/Open Space: This category encompasses land used for private and public recreational open spaces, and local and regional parks. Recreational use areas also include golf courses, cemeteries, water bodies and water storage. Also included in this category are mineral extraction sites.
- Agriculture: Agricultural lands are those in current crop, orchard or greenhouse production, as well as any fallow lands that continue to be maintained in agricultural designations or participating in tax incentive agricultural programs.
- Rural/Vacant: Rural and vacant lands are undeveloped lands that are not preserved in perpetuity as open space or for other public purposes.

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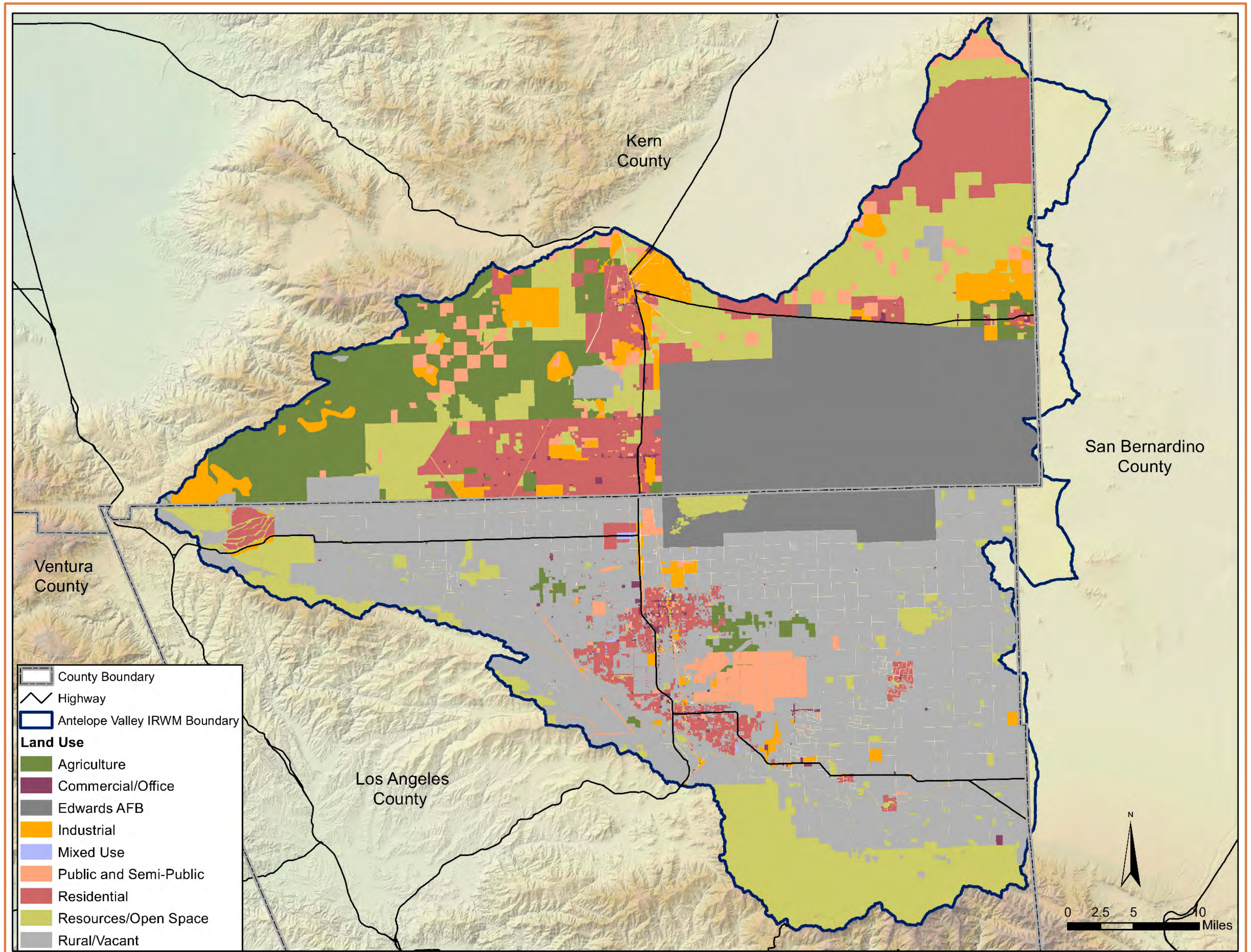
Figure 2-15: Current Land Use Designations for the Antelope Valley Region



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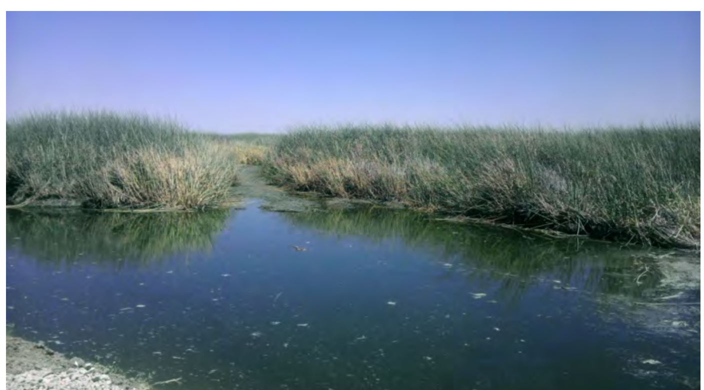
2.6 Flood Control

Flood control in the Region is managed at both the county level by Los Angeles County and Kern County, and at the municipal level by the cities. It should be noted that the Los Angeles County Flood Control District Boundary only extends as far north as Avenue S, as shown in Figure 2-4. Regional flood control facilities are limited and generally located in urban areas. The valley floor is essentially an alluvial fan, making much of it subject to inundation and shallow flooding with unpredictable flow paths. Additionally, "flashy" storms tend to occur in the area, leading to high stream flow volumes over short periods of time. Urban drainage facilities have limited hydraulic capacity which at times causes localized flooding problems. Urban drainage facilities generally consist of local detention basins, street drainage inlets, underground storm drain pipes, and culverts. There are no regional flood management facilities maintained in the Antelope Valley; however, a number of flood studies have been performed to assess the need for a more integrated, regional approach:

- Hydrologic Investigation for Feasibility Studies of the Los Angeles County Department of Public Works Master Drainage Plan, USACE, 1986.
- Antelope Valley Final Report on the Comprehensive Plan of Flood Control and Water Conservation, LACDPW, 1987.
- City of Palmdale General Plan, City of Palmdale, 1993.
- Flood Assessment for Rosamond Dry Lake, EAFB, 2004.
- Engineer's Report Relative to the Revised Master Plan of Drainage, City of Lancaster, 2005.
- Antelope Valley Integrated Regional Water Management Plan, AVSWCA, 2007.
- City of Lancaster General Plan 2030, City of Lancaster, 2009.
- General Plan Kern County, Kern County, 2009.
- Flood Assessment for Rosamond Dry Lake (Revision), EAFB, 2009.
- Surface Flow Study, Pre-Acquisition Report, EAFB, 2010.
- Quartz Hill Infrastructure Improvements Drain Alignment, LACDPW, 2011.
- Surface Flow Study, Technical Report, EAFB, 2012.
- Los Angeles County General Plan 2035, LACDPW, 2012.


The Piute Ponds provide over 300 acres of wetlands and provide habitat for waterfowl.

Looking forward, flood management in the Region should incorporate urban needs as well as habitat needs, and dry lakebed management needs to remain consistent with IRWM Objectives. For example, Amargosa Creek does not drain directly to Rosamond Dry Lake, but flows through Piute Ponds. Piute Ponds stores a portion of the runoff volume if capacity is available and traps a portion of the sediment delivered. The wetlands also provide habitat for a number of species. EAFB relies on stormwater reaching the Valley's dry lake beds to maintain the surface of the lakes for operational and emergency landing use, to maintain habitat, and to provide dust mitigation. An Integrated Flood Management Summary Document was developed during the 2013 IRWMP Updates and is included in Appendix F.

2.7 Wastewater and Recycled Water

Wastewater and recycled water in the southern portion of the Valley is managed primarily by LACSD, while in the northern portion of the valley wastewater and recycled water systems are managed by various local agencies including the RCSD. Wastewater service is primarily limited to urban areas, while rural areas of the Valley rely on septic systems.

The LACSD owns and operates the Lancaster WRP and Palmdale WRP which collect wastewater from the Cities of Palmdale and Lancaster, treating to tertiary levels that are suitable for non-potable uses and groundwater recharge. The RCSD treats wastewater at its Rosamond Wastewater Treatment Plant (WWTP). Rosamond WWTP currently produces secondary-treated water. In 2008, RCSD developed a plan to build a tertiary treatment plant with a potential for future expansion. Unforeseen events such as the economic recession, drought, and AVEK's banking projects caused RCSD to postpone the tertiary plant until production of tertiary water becomes economically viable, or the State mandates its production.

2.8 Social and Cultural Values

The story of the Antelope Valley Region's development helps to unveil the range of local cultural values that characterize the area. The continuing tradition of its historically rural character, combined with the emergent influence of the aerospace industry and metropolitan Los Angeles, give meaning to the diverse and, in some cases divergent, lifestyles and values that define the Antelope Valley Region's collective goals and challenges for the future.

2.8.1 Agriculture

Historically, agriculture was the predominant land use in the Antelope Valley.

Historically, agriculture was the Antelope Valley Region's predominant land use, characterized by dry wheat farming in the west, alfalfa on the Antelope Valley floor, and orchards on its southern fringes. The City of Palmdale was settled over 100 years ago as a residential community by Swiss and German migrants from the Midwest. At the time, land in the Antelope Valley Region sold for fifty cents an acre. The development of the Southern Pacific Railroad connected the Antelope Valley Region to Los Angeles and the Central Valley and spurred the first large influx of white settlers to the Antelope Valley Region. Most of the Antelope Valley Region's smaller communities emerged around this same time as agricultural settlements or local farm trade centers. Agriculture remains a significant industry in the Valley with approximately 16,000 acres actively farmed in the Region.

2.8.2 U.S. Military

In 1933, the U.S. Department of Defense established EAFB, (then called Muroc Army Airfield) east of Rosamond and roughly 60 kilometers northeast of Palmdale's current city limits. Because of the vast landing area provided by EAFB's dry lake beds, it was the original site of NASA space shuttle landings, as well as the site of other important aeronautical events. To this day U.S. military flight testing is a large and important part of EAFB operations.

As a result of increased governmental defense spending in the 1950's, the Antelope Valley Region underwent a dramatic change in character. In 1952, the aerospace industry officially took hold at U.S. Air Force Plant 42. Plant 42 in northeast Palmdale is home to Lockheed Martin, Boeing, and Northrop Grumman, among other significant aeronautical companies.

2.8.3 Housing Development

Increases in population and development bring more demand for cultural amenities.

Increasing development pressures in the 1980's were in part driven by the continuing appeal of the Antelope Valley Region's high desert climate as well as land values lower than those in the Los Angeles metropolitan area. As the Los Angeles population rapidly expanded into the Antelope Valley Region, the desire for more cultural amenities and new skills and resources increased and the Antelope Valley Region became more metropolitan in character. The increase in population and the development of tract housing, retail centers and business parks has altered the formerly low density, rural and agrarian character of many local communities. The Southern California Association of Governments (SCAG) 2019 Local Profiles Reports estimate that the number of occupied housing units has increased 28 percent in the City of Palmdale and 26 percent in the City of Lancaster since 2000.

Today, competing demands are placed on limited available resources. Many of these competing demands stem from the range of local cultural values that characterize the Antelope Valley Region. Decisions regarding future land use and the dedication of water resources will need to weigh varying agricultural, metropolitan, and industrial needs as they continue to develop and as the balance between these interests continues to change.

2.8.4 Alternative Energy

One growing and important industry in the Region is alternative energy production. Wind and solar power generation facilities can be found throughout the Valley, as shown in Clean Power Alliance

Established in 2017, the Clean Power Alliance is a locally operated electricity provider across Los Angeles and Ventura counties, offering clean renewable energy. Clean Power Alliance serves approximately three million customers and one million customer accounts across 31 communities throughout Southern California including unincorporated Los Angeles County. Customers can choose the percentage of renewable content in their energy. Clean Power Alliance purchases clean power that is then delivered by SCE.

Figure 2-16. Cities and towns such as Lancaster, Palmdale and Rosamond have set goals to promote alternative energy sources while protecting natural resources. Encouraging the growth of alternative energy production helps to meet the common goal of protecting resources by promoting alternative energy use within the Valley and beyond.

Lancaster Choice Energy

The City of Lancaster is at the forefront of the renewable energy transformation as it was the first city in the nation to require new construction to incorporate solar components. In 2014, the City created Lancaster Choice Energy (LCE), the first municipal community choice aggregator in the State of California. LCE provides almost all of Lancaster's business and residents with clean, renewable energy.

Antelope North Solar Project

In 2018, the Sustainable Power Group submitted the final Environmental Impact Report for the Antelope Valley North Solar Project. This project proposes to construct and operate a 72-megawatt utility-sale solar generating facility (SGF) on 430 acres in the City of Lancaster. Solar electricity generated by the proposed project would be delivered to previously approved collector substations and ultimately to the existing Southern California Edison (SCE) Antelope Substation south of the proposed SGF. The proposed project would operate year-round and produce electricity during daylight hours.

Los Angeles County Renewable Energy Ordinance

In 2016, the Los Angeles County Board of Supervisors adopted the Renewable Energy Ordinance (REO) to help California meet its goals for renewable energy generation and greenhouse gas reduction, while minimizing environmental and community impacts. The REO incentivizes small-scale solar and wind projects that generate energy for on-site use, and structure mounted projects such as on rooftops and over parking lots through a streamlined review process. It also regulates ground-mounted utility-scale projects to better address community concerns and minimize environmental impacts. In addition, the REO prohibits ground-mounted utility-scale solar facilities in the Significant Ecological Areas (SEAs) and Economic Opportunity Areas (EOAs) designated in the Los Angeles County's General Plan and Antelope Valley Area Plan.

Solar Star Projects

BHE Renewables owns the Solar Star projects that span 3,230 acres in the Antelope Valley. Combined, the Solar Star projects are the world's largest utility scale solar project with the ability to generate enough electricity to power the equivalent of approximately 255,000 homes. The generated electricity is delivered to SCE service territory.

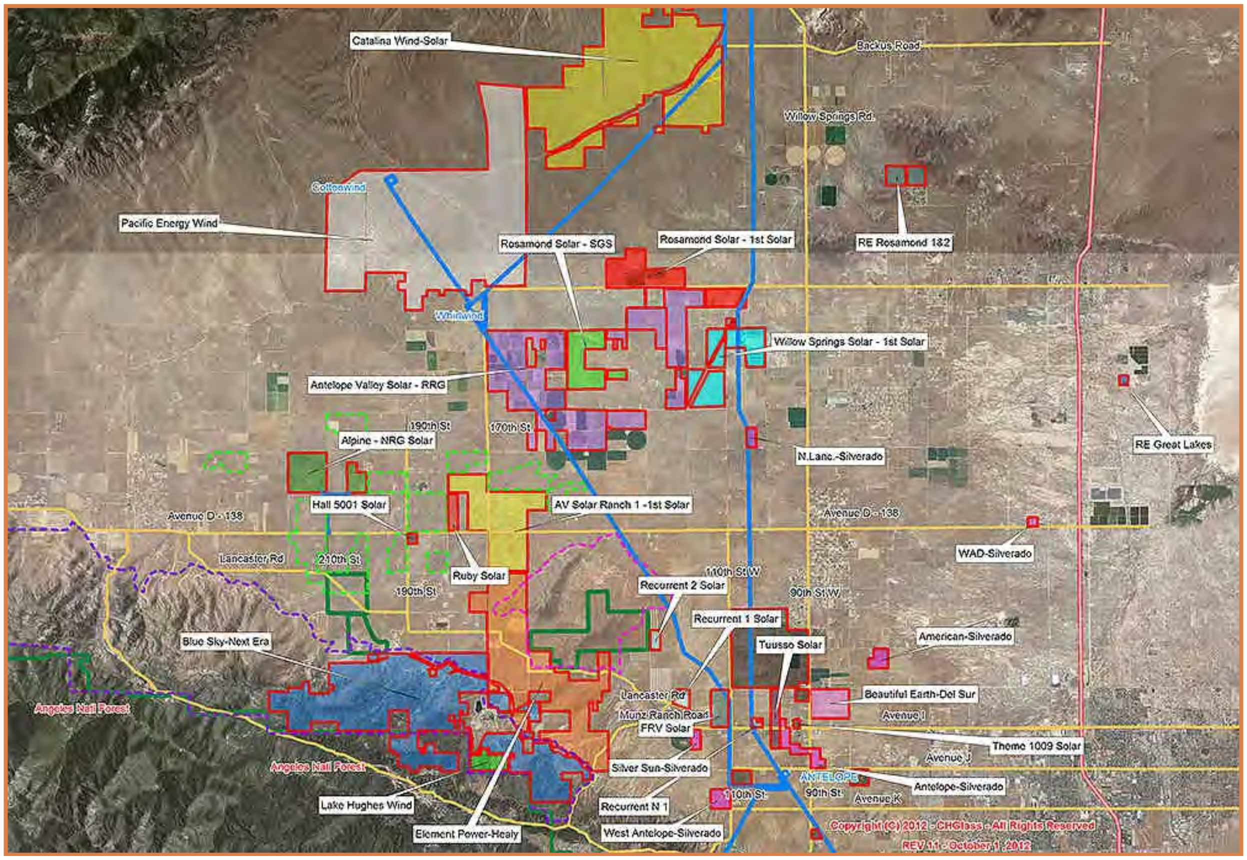
Tehachapi Renewable Transmission Project

SCE's Tehachapi Renewable Transmission Project (TRTP) is a series of new and upgraded transmission lines and substations that will supply renewable energy from the Tehachapi area to SCE customers in San Bernardino County. TRTP will strengthen SCE's electrical system and help meet California's renewable energy goals.

Clean Power Alliance

Established in 2017, the Clean Power Alliance is a locally operated electricity provider across Los Angeles and Ventura counties, offering clean renewable energy. Clean Power Alliance serves approximately three million customers and one million customer accounts across 31 communities throughout Southern California including unincorporated Los Angeles County. Customers can choose the percentage of renewable content in their energy. Clean Power Alliance purchases clean power that is then delivered by SCE.

Figure 2-16: Solar and Wind Generation Facilities in the Antelope Valley Region



Source: http://realestblog.com/wp-content/uploads/2014/10/2014.10.29_landbanking-map.jpg

2.8.5 Visioning Document

The Lancaster Community Visioning Report (2006) helps to shed light on the current interplay of these interests and how they may influence the direction of future planning and growth in the Antelope Valley Region-wide. The Visioning Report presents a common vision for the future of Lancaster and the Antelope Valley Region that is focused on the following priorities:

- Balancing growth
- Ensuring economic well-being
- Strengthening Community Identity
- Improving public safety
- Promoting Active Living
- Focusing on Education and Youth
- Supporting Environmental Conservation

Despite the need to ensure economic vitality and longevity by bringing new industry and employment opportunities to the Antelope Valley Region, residents of the Antelope Valley Region believe that preserving a hometown feel and developing a strong sense of neighborhood stability are critical to maintaining the identity of the community and, in turn, that of the Antelope Valley Region. The preservation of existing natural open space, achieved in part through a development strategy focused on infill and parcel redevelopment combined with environmental conservation, are key components of preserving the Antelope Valley Region's rural character and strengthening the health, vitality and security of growing urban areas.

2.9 Economic Conditions and Trends

Historically, the economy within the Antelope Valley Region has focused primarily on agriculture; and crops grown in the Antelope Valley Region have included alfalfa, wheat, barley, and other livestock feed crops. However, the area is in transition as the predominant land use shifts from agricultural uses to residential and industrial uses.

The increase in residential land use and its impact on the economy is evident from the population growth in the Antelope Valley Region, which is discussed in Section 2.7. With significantly lower home prices than in other portions of Los Angeles County, the Antelope Valley Region housing market has seen an increase as people choose to commute to the Los Angeles area. The SCAG 2019 Local Profiles estimate that approximately 18 to 24 percent of residents in Palmdale and Lancaster commute to the greater Los Angeles area. Even after acknowledging the recent slowing of the housing market, the California Building Industry Association recognized that the Antelope Valley Region is the last large available open space "opportunity" for development in Southern California, whether it be for residential, commercial/industrial/retail or agricultural land uses. This is supported by the SCAG 2012 Integrated Growth Forecast, which estimates that the number of households in Palmdale and Lancaster will increase between 27% and 40% from 2008 to 2035. The same forecast projects that employment will increase between 10% and 44% from 2008 to 2035.

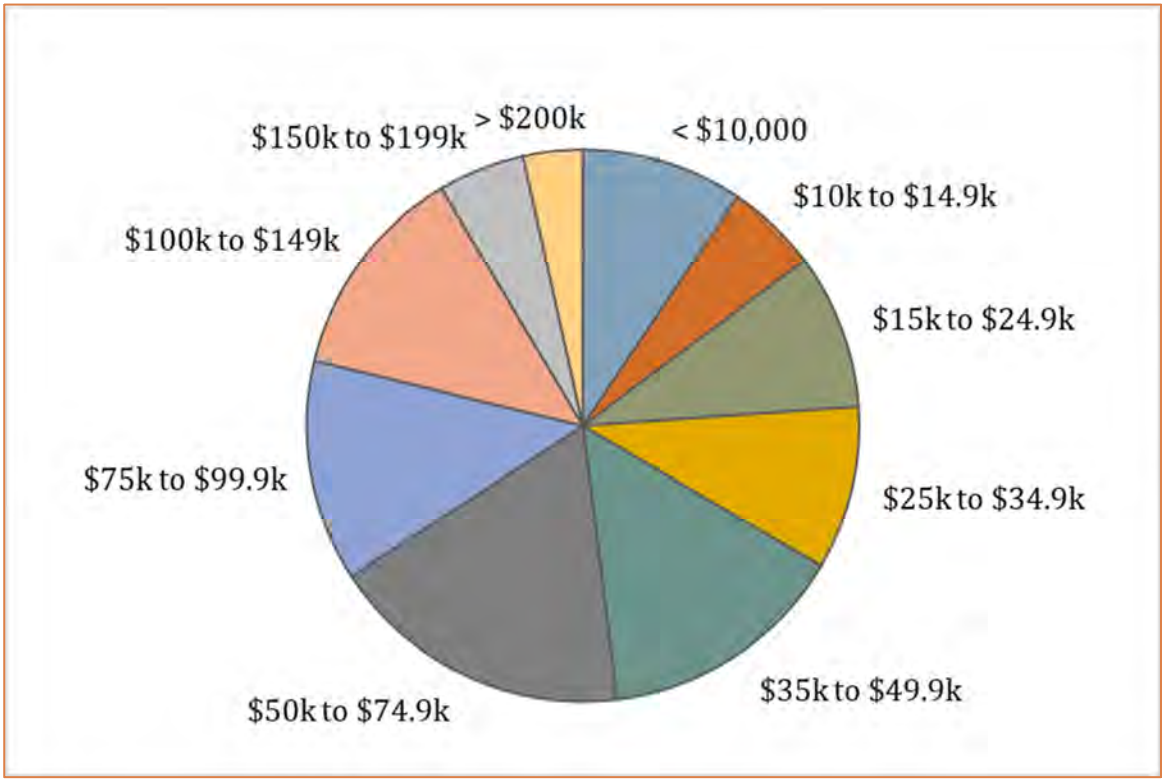
Industry in the Antelope Valley Region consists primarily of manufacturing for the aerospace industry and mining. EAFB and the U.S. Air Force Flight Production Center (Plant 42) provide a strong aviation and military presence in the Antelope Valley Region. Mining of borate in the northern areas and of salt extract, rock, gravel, and sand in the southern areas contribute to the Antelope Valley Region's industrial economy. Alternative energy is an emerging industry in the Region.

According to the SCAG 2019 Local Profiles, the education sector was the largest job sector in both the cities of Palmdale and Lancaster. Education accounted for approximately 20 to 35 percent of the total jobs in 2007 and 28 to 38 percent in 2017. Retail and leisure/hospitality were the second and third largest job sectors in the cities.

As previously mentioned, ensuring economic well-being is a key social and cultural value of the Antelope Valley Region's community.

As shown in Table 2-2 and Figure 2-17, approximately 48 percent of the Antelope Valley Region's population has a household income of less than $50,000, approximately 18 percent of the population has a household income between $50,000 and $74,999, and approximately 34 percent has a household income of $75,000 or higher.

Figure 2-17: Annual Income Levels for the Antelope Valley Region



2.10 Population

This subsection provides demographic information from the 2010 Census as well as the 2013-2017 American Community Survey and regional growth projections.

2.10.1 Demographics

Table 2-2 provides a summary of the human demographics for the Antelope Valley Region as determined by 2010 U.S. Census Bureau data and 2013-2017 5-year American Community Survey (ACS) data. Regional data was estimated from the data for the census tracts within the regional boundaries. Figure 1-2 shows several DACs throughout the Antelope Valley. DACs were defined as having an MHI less than $51,026 (80% of the statewide MHI according to 2012-2016 5-year ACS data). Severely Disadvantaged Communities (SDAC) are defined as having an annual MHI that is less than 60 percent of the statewide MHI. Approximately 71 percent of the population in the Antelope Valley Region meets the criteria for DACs. Of this, 40 percent of the population qualifies as an SDAC. Two technical memoranda were prepared for the 2013 IRWM Plan Update to characterize DACs and to define issues related to DAC areas. These documents are included in Appendix D:

- DAC Water Supply, Quality and Flooding Data Final Draft TM
- DAC Monitoring Plan Final Draft TM

Figure 2-17 shows the breakdown of the income levels in the Antelope Valley Region as laid out in Table 2-2 (U.S. Census Bureau, 2017).

Table 2-2: Demographics Summary for the Antelope Valley Region

Area	Lake Los Angeles	Lancaster	Littlerock	Palmdale	Quartz Hill	Sun Village	Unincorp. LA County	North Edwards	Boron	Mojave	Rosamond	Edwards AFB	Unincorp. Kern County	Antelope Valley Region
Age Structure (by %)														
under 5	7.1	6.2	9.4	8.5	5.3	9.1	6.3	1.4	6.5	10.1	6.9	20.4	8.2	7.3
5-9	9.0	6.4	7.0	8.8	5.7	6.8	6.1	6.7	6.4	11.4	7.4	12.9	8.4	7.5
10-14	9.3	6.5	10.2	8.5	7.8	8.0	6.2	5.8	9.5	3.1	7.4	5.9	8.0	7.4
15-19	8.2	6.6	16.1	8.3	9.7	8.9	6.6	4.6	7.2	4.1	6.3	3.6	7.5	7.4
20-24	5.0	7.0	2.9	7.1	6.4	9.7	7.5	1.4	7.4	9.5	8.4	8.1	7.9	7.1
25-34	13.0	13.7	8.2	13.2	13.5	14.5	15.7	15.0	11.2	14.1	15.1	28.8	15.2	13.8
35-44	10.5	12.7	15.5	12.3	9.6	9.2	13.9	11.0	6.2	11.5	14.4	16.9	12.5	12.5
45-54	14.4	13.4	10.6	14.2	14.7	10.8	13.7	17.1	16.1	12.0	13.1	3.4	11.8	13.6
55-59	7.1	6.7	6.7	6.2	8.4	7.0	6.2	9.9	8.3	6.8	7.4	0	5.5	6.5
60-64	5.9	6.0	5.7	4.5	6.5	6.7	5.3	4.8	4.4	6.5	4.9	0	4.7	5.3
65-74	7.0	8.6	4.7	5.1	7.2	5.4	7.0	17.0	10.7	7.1	5.7	0	6.1	6.8
75-85	2.5	4.4	1.0	2.6	3.2	3.0	3.7	5.5	5.0	2.4	2.6	0	3.0	3.4
85 and over	1.0	1.9	2.3	0.8	1.9	0.8	1.8	0	1.2	1.3	0.6	0	1.1	1.3
MHI	$42,803	$49,314	$37,241	$56,699	$58,409	$40,264	$61,015	$59,511	$45,382	$31,111	$56,952	$64,955	$50,826	$52,843
Income Levels (by %)														
< $10,000	13.8	13.3	2.2	6.4	9.3	5.5	6.1	10.5	15.2	17.1	6.5	3.2	6.7	9.4
$10k to $14.9k	6.3	4.9	14.3	5.4	6.2	8.1	5.4	5.0	9.9	11.2	3.9	-	6.0	5.4
$15k to $24.9k	10.1	8.1	8.7	9.7	6.0	10.8	9.7	2.0	13.4	15.4	10.0	1.8	11.9	9.1
$25k to $34.9k	12.8	9.1	19.1	9.7	9.7	14.1	8.9	11.4	5.3	11.4	7.4	12.3	10.9	9.6
$35k to $49.9k	18.2	15.2	27.0	13.5	15.3	19.4	12.0	6.7	10.3	11.7	15.5	12.7	13.8	14.5
$50k to $74.9k	18.3	18.5	1.7	18.0	12.2	12.4	16.4	33.5	17.6	15.8	17.9	29.5	17.6	17.8
$75k to $99.9k	8.1	12.1	13.7	14.6	13.8	10.2	11.8	13.4	14.5	5.0	14.4	12.0	11.4	13.0
$100k to $149k	8.5	11.5	3.9	13.0	15.0	16.1	14.5	14.9	11.3	10.7	16.3	21.0	12.9	12.7
$150k to $199k	2.8	4.3	-	6.2	4.9	1.7	6.8	-	1.4	1.2	6.1	2.3	5.1	5.1
$200k or more	1.3	2.9	9.3	3.5	7.7	1.8	8.4	2.6	1.3	0.6	2.1	5.1	3.7	3.5

Area	Lake Los Angeles	Lancaster	Littlerock	Palmdale	Quartz Hill	Sun Village	Unincorp. LA County	North Edwards	Boron	Mojave	Rosamond	Edwards AFB	Unincorp. Kern County	Antelope Valley Region
Population Density (persons per sq. mile)	13.8	13.3	2.2	6.4	9.3	5.5	6.1	10.5	15.2	17.1	6.5	3.2	6.7	9.4

Source: 2013-2017 5-Year American Community Survey 5-Year Estimates

2.10.2 Regional Growth Projections

Growth in the Antelope Valley Region proceeded at a slow pace until 1985. Between 1985 and 1990, the growth rate increased approximately 1,000 percent from the average growth rate between the years 1956 to 1985 as land use shifted from agricultural to residential and industrial. The historical and projected population for the Antelope Valley Region is shown in Table 2-3. Historical population estimates up to the year 1980 were based on the Geolytics normalization of past U.S. Census tract data to 2000 census tract boundaries. This normalization allows for a direct comparison of the past U.S. Census tract population data. These Census tracts were then assigned to the individual jurisdictions in the Antelope Valley Region to determine the jurisdiction's population. Populations in the years 1990, 2000 and 2010 are based on census data for those years, and adjusted according to the percentage of area within the Region, rounded to the nearest thousand.

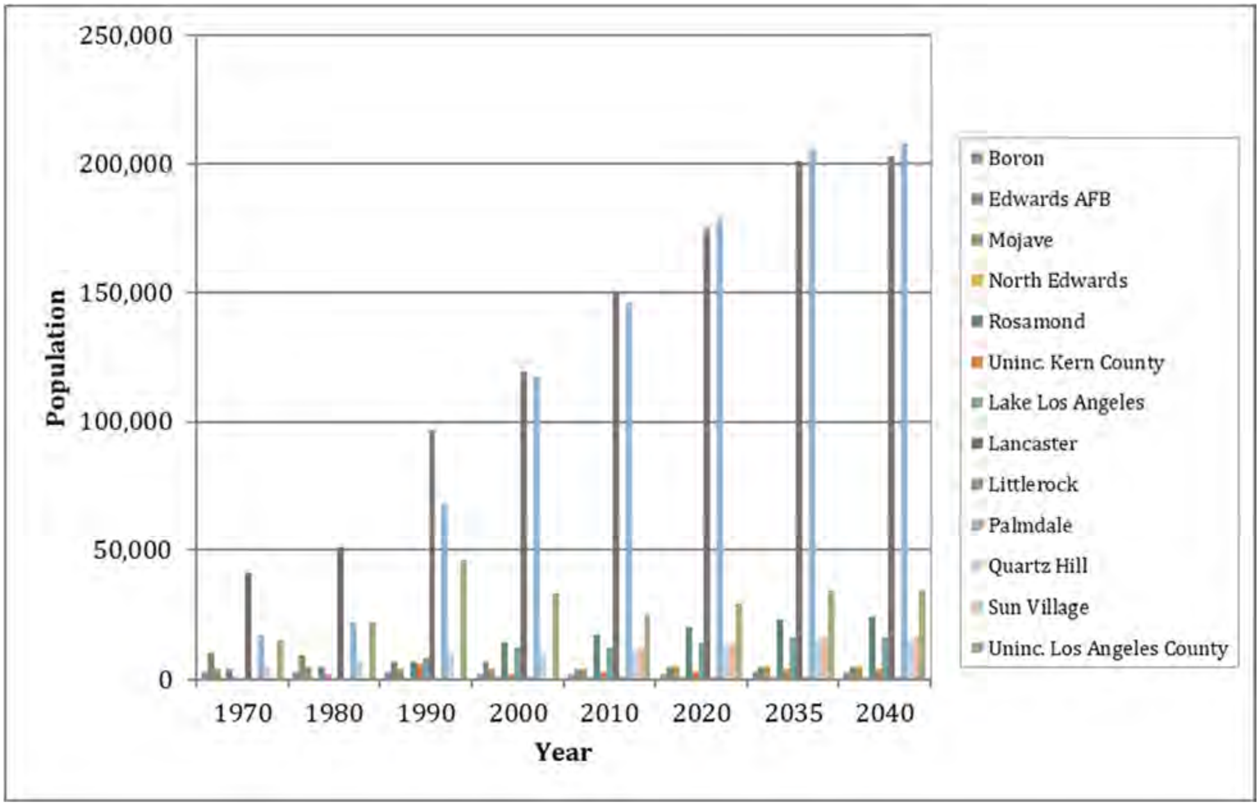
Projections for the Cities of Lancaster and Palmdale were derived from SCAG estimates. Population projections for the rest of the Antelope Valley Region assume an annual growth rate similar to the City of Lancaster, estimated as approximately 1.7 percent per year up to 2020, then 1.0 percent per year up to 2035 from SCAG projections. Population projections were extended through 2040 using California Department of Finance (DOF) data. It was assumed that the IRWM Region will have a similar growth rate to that of Kern County and Los Angeles County as a whole, which is estimated at approximately 6.3 percent in Kern County and 1.1 percent in Los Angeles County between 2035 and 2040 (CA Department of Finance 2019). Projections indicate that approximately 535,000 people will reside in the Antelope Valley Region by the year 2040. This represents an increase of approximately 38 percent from the 2010 population. Figure 2-17 below graphically depicts these population projections.

Table 2-3: Population Projections

	1970[a]	1980[a]	1990[b]	2000[c]	2010[d]	2020[e]	2035[e]	2040[f]
Boron	3,000	3,000	3,000	2,000	2,000	2,000	3,000	3,000
California City[g]	0	0	0	0	0	0	0	0
Edwards AFB	10,000	9,000	7,000	7,000	4,000	5,000	5,000	5,000
Mojave	4,000	5,000	4,000	4,000	4,000	5,000	5,000	5,000
North Edwards	n/a	n/a	n/a	1,000	1,000	1,000	1,000	1,000
Rosamond	4,000	5,000	7,000	14,000	17,000	20,000	23,000	24,000
Uninc. Kern County	1,000	2,000	6,000	2,000	3,000	3,000	4,000	4,000
Lake Los Angeles	n/a	n/a	8,000	12,000	12,000	14,000	16,000	16,000
Lancaster	41,000	51,000	97,000	119,000	150,000	175,000	201,000	203,000
Littlerock	n/a	n/a	n/a	1,000	1,000	1,000	1,000	1,000
Palmdale	17,000	22,000	68,000	117,000	146,000	179,000	206,000	208,000
Quartz Hill	5,000	7,000	10,000	10,000	11,000	13,000	15,000	15,000
Sun Village	n/a	n/a	n/a	n/a	12,000	14,000	16,000	16,000
Uninc. Los Angeles County	15,000	22,000	46,000	33,000[h]	25,000	29,000	34,000	34,000
Region	**100,000**	**126,000**	**256,000**	**289,000**	**388,000**	**461,000**	**530,000**	**535,000**

Notes: Projections Rounded to the nearest 1,000 people.
(a) Based on Geolytics Normalization of Past U.S. Census Tract Data to 2000 Census Tract Boundaries.
(b) Based on 1990 Census data, and normalized by percentage of area of Census Block Group or Census Place in the Region.
(c) Based on 2000 Census data, and normalized by percentage of area of Census Block Group or Census Place in the Region.
(d) Based on 2010 Census data, and normalized by percentage of area of Census Block Group or Census Place in the Region.
(e) Projections for Palmdale and Lancaster from the SCAG *Adopted 2012 RTP Growth Forecast*. For remaining areas, it is assumed the Antelope Valley Region would have a similar annual growth rate as the City of Lancaster, estimated as approximately 1.7 percent per year up to 2020, then 1.0% per year up to 2035.
(f) Based on DOF growth rates for Kern County and Los Angeles County.
(g) The portion of California City within the Antelope Valley Region has a population of less than 500 people, and therefore is rounded down to 0.
(h) Decrease in population in unincorporated Los Angeles County likely due to addition of Census Designated Places to the census County that had previously been counted as unincorporated area.

Figure 2-18: Population Projections



2.11 Climate Change

Climate change projections have shown that California's water resources will likely be impacted by changes to temperature, precipitation, and sea level rise. Even in the year 2019, California is beginning to experience these impacts. Water resource planners already face challenges interpreting new climate change information and determining which response methods and approaches will be most appropriate for their planning needs. However, in order for the Region to adapt to, or protect against, climate change, it must first identify the impacts. Knowing these changes will help to identify potential vulnerabilities in water resource systems, which can identify and inform planning measures. Future projects in the Region can be evaluated based on their ability to adapt to the anticipated climate change impacts and mitigate GHGs. These strategies will help the Region to be more robust in the face of a changing environment.

The following state-wide impacts are expected to impact local water resources in the Region (DWR, 2011):

- Temperature increases:
  - More winter precipitation falling as rain rather than snow (this includes precipitation for local and imported water sources), leading to reduced snowpack water storage, reduced long term soil humidity, reduced groundwater and downstream flows, and reduced imported water deliveries
  - Higher irrigation demands as temperatures alter evapotranspiration rates, and growing seasons become longer

    - Exacerbated water quality issues associated with dissolved oxygen levels, increased algal blooms, and increased concentrations of salinity and other constituents from higher evaporation rates
    - Impacted habitats for temperature-sensitive fish and other life forms, and increased susceptibility of aquatic habitats to eutrophication

- Precipitation pattern changes:
    - Increased flooding caused by more intense storms
    - Changes to growth and life cycle patterns caused by shifting weather patterns
    - Threats to soil permeability, adding to increased flood threat and decreased water availability
    - Reduced water supply caused by the inability to capture precipitation from more intense storms, and a projected progressive reduction in average annual runoff (though some models suggest that there may be some offset from tropical moisture patterns increasingly moving northward)
    - Increased turbidity caused by more extreme storm events, leading to increased water treatment needs and impacts to habitat
    - Increased wildfires with less frequent, but more intense rainfall, and possibly differently timed rainfall through the year, potentially resulting in vegetation cover changes
    - Reduction in hydropower generation potential

Although the extent of these changes is uncertain, scientists agree that some level of change is inevitable; therefore, it will be necessary to implement flexible adaptation measures that will allow natural and human systems to respond to these climate change impacts in timely and effective ways. In addition to adapting to climate change, the Region has the opportunity to mitigate against climate change by minimizing GHGs associated with provision of water and wastewater services. The following is a discussion of likely climate change impacts on the Region, as determined from a vulnerability assessment that was completed with a group of local stakeholders. Specific opportunities for adapting to and mitigating against climate change will be discussed in later chapters of this Plan.

2.11.1 Effects and Impacts of Climate Change on the Region

Estimating the impacts of climate change at a regional level is challenging due to the coarse spatial scale of the global models that project climate change impacts of temperature and rainfall. These global models also project estimates for the year 2100, which is well beyond typical planning horizons of 20 to 30 years. To incorporate climate change into water resources management, downscaled temperature and precipitation projections are input into hydrologic and water resources system models to project impacts to water supplies, water demand, snowpack, sea level rise, and wildfires.

To better comprehend climate change impacts at a local level, the California Energy Commission funded and advised the development of Cal-Adapt, a web-based resource for projecting local risks posed by climate change. Cal-Adapt projects climate change impacts under two potential GHG emissions scenarios outlined in the Intergovernmental Panel on Climate Change's (IPCC) Climate Change 2014 Synthesis Report, a leading international assessment of climate change. The first scenario, Representative Concentration Pathway (RCP) 4.5, assumes GHG emissions will peak around 2040 and then decline. The second scenario, RCP 8.5, assumes that GHG emissions will continue to rise through 2100. Cal-Adapt synthesizes robust scientific data under the two scenarios and applies four models selected by California state agencies as priority models for research contributing to California's Fourth Climate Change Assessment (California Energy Commission 2017).

Cal-Adapt climate change tools were used to project regional changes in temperature, precipitation, wildfire risk, and other impacts posed by climate change. The projections do not factor policy, technology, behavior, and other unidentified variables that influence the evolution of climate change in California. Climate change impacts were compared against historical annual means for 1961 to 1990, as was done by the IPCC when analyzing the global climate dataset. Where regional climate change impacts were not available through the Cal-Adapt website, other resources were utilized, including the Climate Change and Health Profile Report for Los Angeles County 2017 and the California Climate Change Center. Table 2-4 summarizes the impacts and effects of climate change on the Region by 2100 (unless otherwise indicated).

Table 2-4: Projected Climate Change Effects on the Region

Effect	Ranges
Temperature change[1]	• 5°F (RCP 4.5) to 6°F (RCP 8.5) increase by 2050[(a)] • 6°F (RCP 4.5) to 11°F (RCP 8.5) increase by 2100[(b)]
Extreme Heat Days[1(c)]	• Little change (RCP 4.5 and RCP 8.5) is projected above threshold by 2050[(d)] • 34 (RCP 4.5) to 63 (RCP 8.5) additional days above threshold by 2100[(b)]
Wildfire Risk[1]	• 524 (RCP 4.5) to 413 (RCP 8.5) more hectares burned by 2050[(b)] • 331 more (RCP 4.5) to 166 less (RCP 8.5) hectares burned by 2100[(c)]
Annual Average Precipitation[1]	• 1.6" (RCP 4.5) to 0.2" (RCP 8.5) increase by 2050[(d)] • 0.2" (RCP 4.5) to 0.1" (RCP 8.5) increase by 2100[(a)]
Snowpack[2]	• March snowpack in San Gabriel Mountains decrease from 0.7 inches to zero
Demand	• *Increases expected, but not quantified*
Supply[3]	• SWP delivery decrease of 7-10% by 2050, and 21-25% by 2100 • *Changes to local supply not quantified, but could be reduced based on snowpack effects described above and on climate change impacts to imported water supplies*

Sources: (1) Cal-Adapt Climate website http://cal-adapt.org/; (2) California Emergency Management & Natural Resources Agency 2012; (2) Climate Change and Health Profile Report Los Angeles County 2017; (3) California Climate Change Center 2009
Notes: (a) Average of 2045 to 2055 projections; (b) Average of 2095 to 2100 projections; (c) Impacts modeled for City of Palmdale; (d) 2050 projection only

For the Antelope Valley Region, climate change is expected to increase average temperature by at least 5 degrees Fahrenheit by 2100. The number of extreme heat days, which are the number of days when the daily maximum temperature is above the extreme heat threshold of 101.4 degrees Fahrenheit, may increase by at least 34 more days in a year by 2100 if greenhouse gas emissions peak around 2040 and then decline. Precipitation, however, is expected to remain relatively unchanged through 2100. Despite the minimal impact on total annual precipitation, climate change is expected to result in a larger proportion of precipitation coming in the form of intense single-day events (EPA 2017). High flow events will increase the risk of flooding as well as increase the difficulty of retaining water for flood attenuation and groundwater recharge (California Emergency Management & Natural Resources Agency 2012). Snowpack in the San Gabriel Mountains is expected to reduce slightly, while wildfire risk is expected to increase in mountainous areas. Imported water supplies feeding the Region are also anticipating delivery decreases as a result of climate change.

2.11.2 Climate Change Reporting and Registry Coordination

Individual agencies within the Region may individually decide whether to participate in the California Adaptation Strategy Process as part of further integrating the information derived from the local climate change studies being conducted and described above. Agencies that are part of the IRWM effort may consider joining the Climate Registry (Registry), http://www.theclimateregistry.org. The Climate Registry serves as a voluntary GHG emissions registry that has developed tools and consistent reporting formats which may aid agencies in understanding their GHG emissions and understanding ways to promote early actions to reduce GHG emissions. Both the State and the federal government require reporting of emissions for regulated entities of electricity and fuel use. These programs have reporting, certifying and verifying requirements that are separate from those under the voluntary programs.

Section 3 | Issues and Needs

The purpose of this section is to identify the issues, needs, challenges and priorities for the Antelope Valley Region through the year 2040 related to water supplies and other resources. The section will assess the current and projected water demands of the Antelope Valley Region, which include agricultural and M&I demands on groundwater, imported water, and recycled water as well as an analysis of the current and projected supplies[1] needed to meet those demands. In addition, an assessment of the water quality issues and challenges affecting these sources will be presented. A discussion of the flood management, environmental resource management, and land use planning issues will be presented, as these issues affect the water supply and demand requirements within the Antelope Valley Region. Finally, the issues and needs resulting from climate change are discussed.

3.1 Water Supply Management Assessment

As development has increased the demand for both quantity and quality water in the Antelope Valley Region, the competition for available water supplies has also increased. Development of new water supplies and protection of existing water supplies, provision of proper infrastructure, and the need to maintain the groundwater levels are crucial to successfully meeting the future water demands within the Antelope Valley Region.

In order to assess the water supply for the Antelope Valley Region, a water budget was developed. Figure 3-1 presents a schematic of the water budget elements and their relationships. The main components of the water budget include demands, water entering, surface storage, groundwater

[1] The analyses provided in the IRWM Plan are strictly for long-term planning purposes and have not been conducted to answer the questions being addressed within the adjudication.

storage, direct deliveries, recycle/reuse, and water leaving. Each of these components is discussed in more detail below.

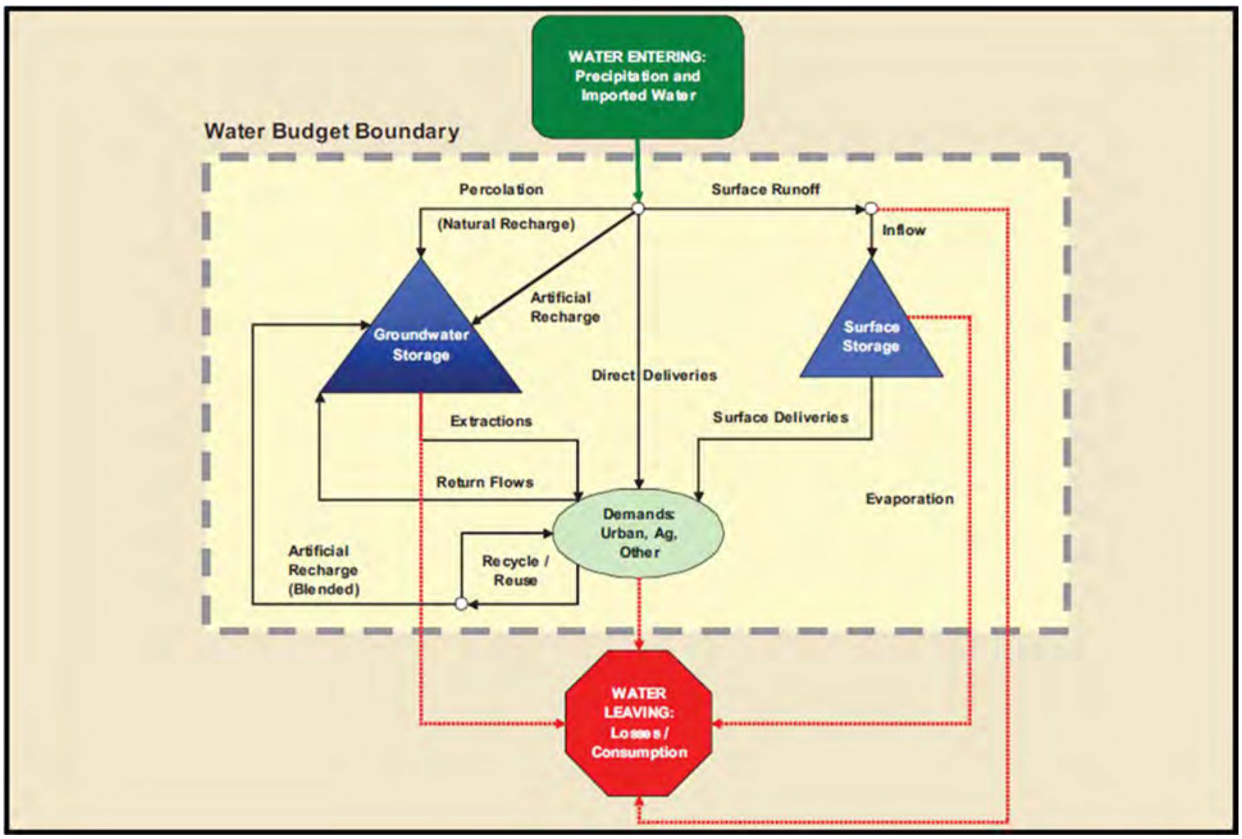
3.1.1 Water Supply

This component of the water budget includes sources of water from outside of the Antelope Valley Region entering the water budget boundary, such as precipitation and imported water.

3.1.1.1 Precipitation

As discussed in Section 2, the average annual precipitation for the Antelope Valley Region is approximately 7 inches per year. Precipitation entering the Antelope Valley Region is lost to evaporation (see Section 3.1.2.5), percolated to groundwater storage as natural recharge (see Section 3.1.1.5), or carried as runoff to surface storage (see Section 3.1.2.5).

Figure 3-1: Water Budget Schematic



Note: Some surface runoff provides water for environmental demands, including wetlands, clay pan/vernal pools, sand dune water sequestering, and dry lakebed resurfacing.

3.1.1.2 Imported Water

Imported water entering the Antelope Valley Region could come from a number of sources including the SWP, desalination, or transfers/exchanges with outside agencies. Currently, the only source of imported water to the Antelope Valley Region is SWP water. SWP water is used in the Antelope Valley Region for direct deliveries (see Section 3.1.1.2) or for artificial recharge to groundwater storage (see Section 3.1.1.5).

Imported Water Infrastructure

Imported water to the Antelope Valley Region is generally SWP water that is released from Lake Oroville into the Feather River where it then travels down the river to its convergence with the Sacramento River, the state's largest waterway. Water flows down the Sacramento River into the Sacramento-San Joaquin Delta. From the Delta, water is pumped into the California Aqueduct. The Antelope Valley Region is served by the East Branch of the California Aqueduct. Water taken from the California Aqueduct by local SWP Contractors is then treated before distribution to customers.

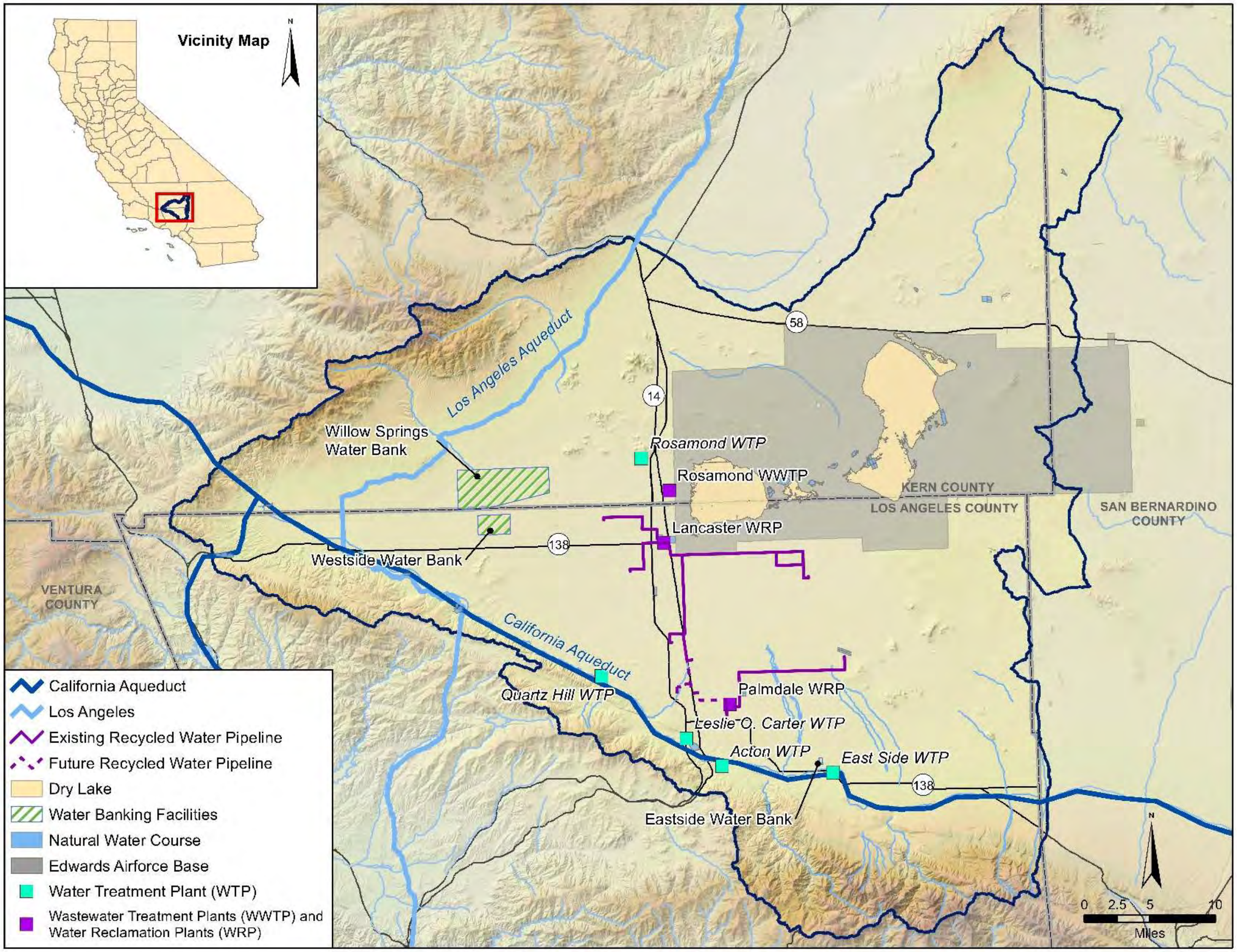
AVEK currently treats SWP water with four Water Treatment Plants (WTPs) that are capable of treating approximately 132,280 AFY of imported water. The main WTP, Quartz Hill WTP, is rated for 90 million gallons per day (mgd) (98,550 AFY). The Eastside WTP, expanded in 1988, provides a treatment capacity of 10 mgd (10,950 AFY). Rosamond WTP is a 14 mgd (15,330 AFY) capacity treatment plant. The fourth AVEK plant, Acton WTP, has a capacity of 4 mgd (4,380 AFY) and is located outside of the Antelope Valley Region boundaries. LACWD 40, QHWD, and RCSD all receive treated water from AVEK.

PWD's water treatment plant capacity is 35 mgd (39,205 AFY). Recent upgrades have improved nearly every phase of the treatment process. The most notable improvement has been the addition of granular activated carbon contactors that provide PWD with the capability to remove a wide range of naturally occurring and man-made contaminants from the water.

PWD has an arrangement with LCID to treat LCID's raw SWP water supply and then convey potable water to LCID customers.

Major water-related infrastructure in the Antelope Valley Region is shown on Figure 3-2.

Figure 3-2: Major Infrastructure



Reliability

The amount of SWP supply that would be available for a given water demand is highly variable and depends on hydrologic conditions in northern California, the amount of water in SWP storage reservoirs at the beginning of the year, regulatory and operational constraints, and the total amount of water requested by contractors. The variability of SWP deliveries is described in the California DWR "Final SWP Delivery Capability Report 2017" (Capability Report), the intent of which is to assist SWP contractors in assessing the reliability of the SWP component of their overall supplies.

In the Capability Report, DWR presents the results of its analysis of the reliability of SWP supplies, based on model studies of SWP operations. In general, DWR model studies show the anticipated amount of SWP supply that would be available for a given SWP water demand, given an assumed set of physical facilities and operating constraints, based on 82 years of hydrology. The results are interpreted as the capability of the SWP to meet the assumed demand over a range of historic conditions for that assumed set of physical facilities and operating constraints. Although new facilities are planned to increase the water delivery capability of the SWP (such as delta improvements), the analyses contained in the Capability Report assume no additional facilities. The effects of climate change were factored into the modeled future conditions.

The Capability Report shows that existing SWP facilities will, on average, receive 62 percent of their full Table A Amount for current demand conditions. This means that the SWP, using existing facilities operated under current regulatory and operational constraints, and with all contractors requesting delivery of their full Table A Amounts in most years, could deliver 62 percent of total Table A Amounts on a long-term basis. The Capability Report also projects that SWP deliveries during multiple-year dry periods could range between 28 percent of total Table A amounts during a 2-year drought to 33 percent during a 6-year drought. SWP deliveries could possibly be as low as 11 percent during an unusually dry single year (the driest in 82 years of historical hydrology) according to DWR's 2017 modeling results. (DWR 2018).

On August 31, 2007, a U.S. District Judge ruled that the SWP was in violation of the federal Endangered Species Act because it threatened the existence of the Delta smelt, a fish species living in the Sacramento Delta. To help protect the species, the Judge ordered water imports from the north to be cut by up to 35 percent from the SWP and the Central Valley Project, until the Biological Opinion for the species could be prepared. The U.S. Fish and Wildlife Service (USFWS) issued a Biological Opinion (BO) on the Long-Term Operational Criteria and Plan for the SWP and Central Valley Project on December 15, 2008, determining that the two water projects would likely jeopardize the continued existence of the species. The findings of this BO called for adaptively managed flow restrictions and have continued to influence pumping in the Delta despite ongoing debate and litigation. In 2009, the National Marine Fisheries Service (NMFS) issued a BO for winter-run and spring-run Chinook salmon and steelhead that put similar limits on pumping through part of the year and restrictions on total Delta exports during the months of April and May. In late 2016, USBR and DWR requested to reinitiate consultation with NMFS and USFWS on the operations of the CVP and SWP due to new information and science on declining listed fish species populations. During this reinitiated consultation that formally began in 2017, the CVP and SWP will continue to operate pursuant to the existing USFWS (2008) and NMFS (2009) BO requirements.

SWP reliability is expected to increase in the near future. The Bay Delta Conservation Plan, now known as the California "Water Fix", was a project proposed by DWR and led by State and federal agencies to build two large tunnels to improve water system reliability in California. In 2018, DWR withdrew proposed permits for the California Water Fix as a result of nine appeals alleging that the California Water Fix was inconsistent with the Delta Plan's coequal goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. DWR is now pursuing a new environmental review and planning process for the Delta Conveyance project, a single tunnel solution to modernize Delta conveyance. If constructed, the project would increase the reliability and resiliency of Table A deliveries for SWP contractors like AVEK.

The SWP supply estimates in this IRWM Plan rely on the projections made in DWR's 2017 Capability Report for future supply. DWR's projected supply estimates incorporate the restrictions set by both the USFWS and NMFS BOs, while acknowledging the challenge of accurately determining future water reliability as a result of adaptive management techniques and the potential for future changes in court rulings.

Direct Deliveries

Direct deliveries to the Antelope Valley Region consist of the SWP water contracted through AVEK, LCID, and PWD. The SWP is operated by DWR for the benefit of the SWP contractors. The SWP is the nation's largest state-built water and power development and conveyance system. The SWP includes approximately 700 miles of aqueduct and conveyance facilities from Lake Oroville in the north to Lake Perris in the south. It also includes pumping and power plants, reservoirs, lakes, storage tanks, canals, tunnels, and pipelines that capture, store, and convey water to 29 water agencies.

The SWP is contracted to deliver a maximum 4.17 million AFY of Table A water to the 29 contracting agencies. Table A water is a reference to the amount of water listed in "Table A" of the contract between the SWP and the contractors and represents the maximum amount of water a contractor may request each year. AVEK, which is the third-largest state water contractor, has a Table A Amount of 144,844 AFY as of 2018. Approximately five (5) percent of AVEK's Table A deliveries were supplied to AVEK customers outside of the Antelope Valley IRWMP Region boundary in 2015. Assuming 95 percent of AVEK's Table A allocation is delivered to the Antelope Valley Region, a maximum of about 137,600 AFY is available for AVEK customers inside the IRWMP Region boundary.

By October 1st of every year, each contractor provides DWR a request for water delivery up to their full Table A Amount for the next year. Actual delivery from DWR may vary from the request due to variances in supply availability resulting from hydrology, storage availability, regulatory or operating constraints. When supply is limited, water is allocated based on a percentage of full contractual Table A Amounts.

A summary of the historical deliveries of SWP to the Antelope Valley Region are provided in Table 3-1. The table illustrates the Antelope Valley Region's increasing dependence on SWP water.

Table 3-1: Summary of Historical Wholesale (Imported) Supply (AFY) in the Antelope Valley Region

Year	AVEK Deliveries	AVEK Table A	PWD Deliveries	PWD Table A	LCID Deliveries	LCID Table A	Region Deliveries	Region Table A
1975	8,068	35,000	0	5,580	520	520	8,588	41,100
1980	72,407	69,200	0	11,180	191	1,150	72,598	81,530
1985	37,064	40,000	1,558	14,180	0	1,730	38,622	55,910
1990	47,206	132,100	8,608	17,300	1,747	2,300	57,561	151,700
1995	47,286	138,400	6,961	17,300	480	2,300	54,727	158,000
2000	83,577	138,400	9,060	21,300	0	2,300	92,637	162,000
2005	59,831	141,400	11,712	21,300	0	2,300	71,543	165,000
2010	57,713	141,400	10,969	21,300	0	2,300	68,682	165,000
2015	26,727[a]	144,844	2,446	21,300	460[b]	2,300	29,862	168,444

Source: DWR 2018

Notes:

(a) Total delivery normalized for water districts within the IRWMP Region boundaries and excludes groundwater supplies and exchanges with LCID (AVEK 2016).

(b) LCID's allocation delivered to AVEK with return of water to LCID expected by 2025 (AVEK 2016).

Future availability of the SWP water was estimated by DWR in its 2017 Delivery Capability Report (2018). For an average water year, it is anticipated that 62 percent of the Table A Amount would be available for delivery to contractors. For a single dry water year, delivery of Table A water decreases to 8 percent. For a multi-dry water year, delivery of Table A water is estimated between 29 percent for a 2-year drought and 34 percent for a 4-year drought. Maximum Table A water that could be available for the Region includes 137,600AFY from AVEK (inside the IRWMP Region), 21,300 AFY from PWD, and 2,300 AFY from LCID. Projected imported water supplies are shown in Table 3-2 for an average year.

Table 3-2: Projected Average Imported Water Supplies in the Antelope Valley Region (AFY)

Agency	2020	2025	2030	2035	2040
AVEK [(a)]	75,565	75,609	75,503	75,399	75,459
California Water Service	*119*	*143*	*167*	*191*	*215*
LACWD 40	*61,000*	*61,000*	*61,000*	*61,000*	*61,000*
QHWD	*3,064*	*2,994*	*2,983*	*2,972*	*2,972*
RCSD	*611*	*1,786*	*1,822*	*1,858*	*1,894*
Remaining Service Area	*10,771*	*9,686*	*9,531*	*9,378*	*9,378*
LCID [(b)]	1,426	1,426	1,426	1,426	1,426
PWD [(c)]	19,400	19,100	19,100	19,100	19,100
Total	**96,391**	**96,135**	**96,029**	**95,925**	**95,985**

Notes:
(a) Projections from the California Water Service, LACWD 40, QHWD, RCSD, and AVEK 2015 UWMPs normalized for remaining water districts within the IRWMP Region. Projections for 2035 in the 2015 UWMPs are assumed to remain constant through 2040 for AVEK, LACWD 40, and QHWD.
(b) Assumes Table A allocation of 62% based on DWR 2018 Delivery Capability Reliability Report.
(c) PWD 2016.

In addition to SWP reliability constraints, AVEK is currently unable to beneficially apply its entire Table A amount of SWP water, even during years when the full Table A amount is available. This inability to fully use available supply is caused by the variability of demand during winter and summer and the limitations on existing infrastructure to receive, store, and deliver water to users. AVEK currently provides most water supply through direct deliveries to meet current demand (i.e., without storage). When demand is high during summer months, the aqueduct bringing water to AVEK has a conveyance capacity below the demand for water. Conversely, during the winter months, demand is much lower than aqueduct capacity.

To accommodate the need to store water during the winter months for use in the dry summer months, AVEK plans to use water banking projects to increase their ability to fully use the SWP allotment. AVEK and various partners completed the Water Supply Stabilization Project No. 2 (Westside Water Bank) in 2016 that allows storage of up to 36,000 AF of water in the ground per year with a total banking capacity of 120,000 AF. Currently, the maximum recovery volume in any one year is 36,000 AFY and plans are underway to increase that annual withdrawal capacity to approximately 40,000 AFY during dry years. Excess SWP water may be placed in the water bank during winter months when municipal and industrial demands are low.

AVEK also added the Eastside Water Banking and Blending Project to allow for recharge of raw water which is later recovered and blended for delivery to the Eastside WTP. The Eastside Water Banking and Blending Project started operations in 2016 and currently consists of three 2-acre recharge basins and three groundwater wells. Currently, the total withdrawal capacity is estimated at 5,700 AFY. (AVEK 2016). AVEK currently has approximately 73,750 AF of water banked in the Westside

Water Bank and approximately 2,000 AF banked in the Eastside Water Bank (personal communication with Matt Knudson, AVEK, August 6, 2019).

AVEK is also in the process of developing a High Desert Water Bank adjacent to the East Branch of the California Aqueduct, enabling water delivery and return without development of additional conveyance. The bank, which is currently in the preliminary design stage, is expected to have a total storage capacity of 280,000 AF and an annual recharge and recovery capacity of 70,000 AF. However, the bank will likely be used to store water for partners outside the Region and is not planned to supply the AV IRWM Region (personal communication with Matt Knudson, AVEK, August 7, 2019).

To determine the most reasonable amount of available SWP water for AVEK, this analysis assumes that SWP reliability is the limiting factor (i.e., not conveyance capacity). To amount of SWP water available is obtained by multiplying the SWP reliability factor of 62 percent to the available Table A amount of 137,600 AFY for AVEK customers inside the IRWMP Region (AVEK 2016; DWR 2018). These projections also assume that the Westside Water Bank will be replenished in average years, and that only one-third of the banked groundwater supplies will be used to supplement AVEK imported supplies in a dry year. Because AVEK is unable to determine the duration of a drought period until the drought ends, this assumption applies to both single-dry and multi-dry year projections. In comparison, the Eastside Water Bank is a smaller operation that will generally replenish and extract groundwater within the same year but does provide some additional water storage for the region.

Table 3-3 provides a summary of projected SWP availability to the Antelope Valley Region based on these assumptions. These projections include Table A allocations for AVEK, LCID, and PWD.

Table 3-3: Summary of Imported Water Supply Reliability in the Antelope Valley Region

	2015	2020	2025	2030	2035	2040
Maximum Table A[(a)]	160,450	160,450	160,450	160,450	160,450	160,450
Average Year						
Reliability[(b)]	62%	62%	62%	62%	62%	62%
Supply[(c)]	99,480	99,480	99,480	99,480	99,480	99,480
Single-Dry Year						
Reliability[(b)]	8%	8%	8%	8%	8%	8%
Supply[(c)]	12,840	12,840	12,840	12,840	12,840	12,840
Multi-Dry Year (4-year period)						
Reliability[(b)]	34%	34%	34%	34%	34%	34%
Supply[(c)]	54,550	54,550	54,550	54,550	54,550	54,550

Notes: Numbers rounded to nearest 10 AFY.

(a) Total Table A amounts for LCID, PWD, and AVEK, normalized by water deliveries within the IRWM Region boundaries.

(b) Determined from DWR's Final SWP Delivery Capability Report 2017 (DWR 2017).

(c) Assumes supply equivalent to the Antelope Valley Region's maximum Table A Amount available to the IRWM Region (160,452 AFY) multiplied by the SWP reliability of 62% for an average year, 8% for a single dry year, and 34% for a 4-year drought period. This assumption relies on another assumption that conveyance constraints can be overcome by using the Westside Water Bank to supplement small amounts of water during single-dry year and multi-dry year periods.

3.1.1.3 Recycle/Reuse

Recycled Water Sources

Recycled water in the Antelope Valley is available from two primary sources: the Lancaster WRP and the Palmdale WRP. Both plants treat wastewater to a tertiary level. Only existing recycled water users are included in the Water Budget estimates for this Plan. Significant investments have been made to expand and upgrade the treatment plants to develop these recycled water supplies. Figure 3-3 shows the locations of the facilities and proposed infrastructure necessary to provide the recycled water quantities shown in Table 3-4.

EAFB has two treatment plants that distribute recycled water to the base. These include the EAFB Air Force Research Laboratory Treatment Plant which is a secondary wastewater treatment plant that discharges all its effluent to the evaporation ponds at the base.

The second plant is the EAFB Main Base WWTP which produces tertiary treated effluent for landscape irrigation at the base golf course with excess effluent discharged to the evaporation ponds when irrigation demand is low. Recycled water from these plants is not included in supply and demand calculations since all water is used on the base.

Table 3-4 provides a summary of the projected availability of the recycled water to the Antelope Valley Region from the Lancaster and the Palmdale WRPs through 2040.

Table 3-4: Potential Availability of Recycled Water (AFY) to the Antelope Valley Region

	2015	2020	2025	2030	2035	2040
LA County District 40[a]	250	8,200	10,900	13,600	16,300	16,300
PWD[b]	100	500	1,000	1,500	2,000	2,000
Total Study Area	**350**	**8,700**	**11,900**	**15,100**	**18,300**	**18,300**

Sources:

(a) LA County District 40 2015 UWMP; 2035 projections assumed to remain through 2040

(b) Palmdale Water District 2015 UWMP; excludes volume available for Palmdale Regional Groundwater Recharge and Recovery Program

Recycled Water Infrastructure

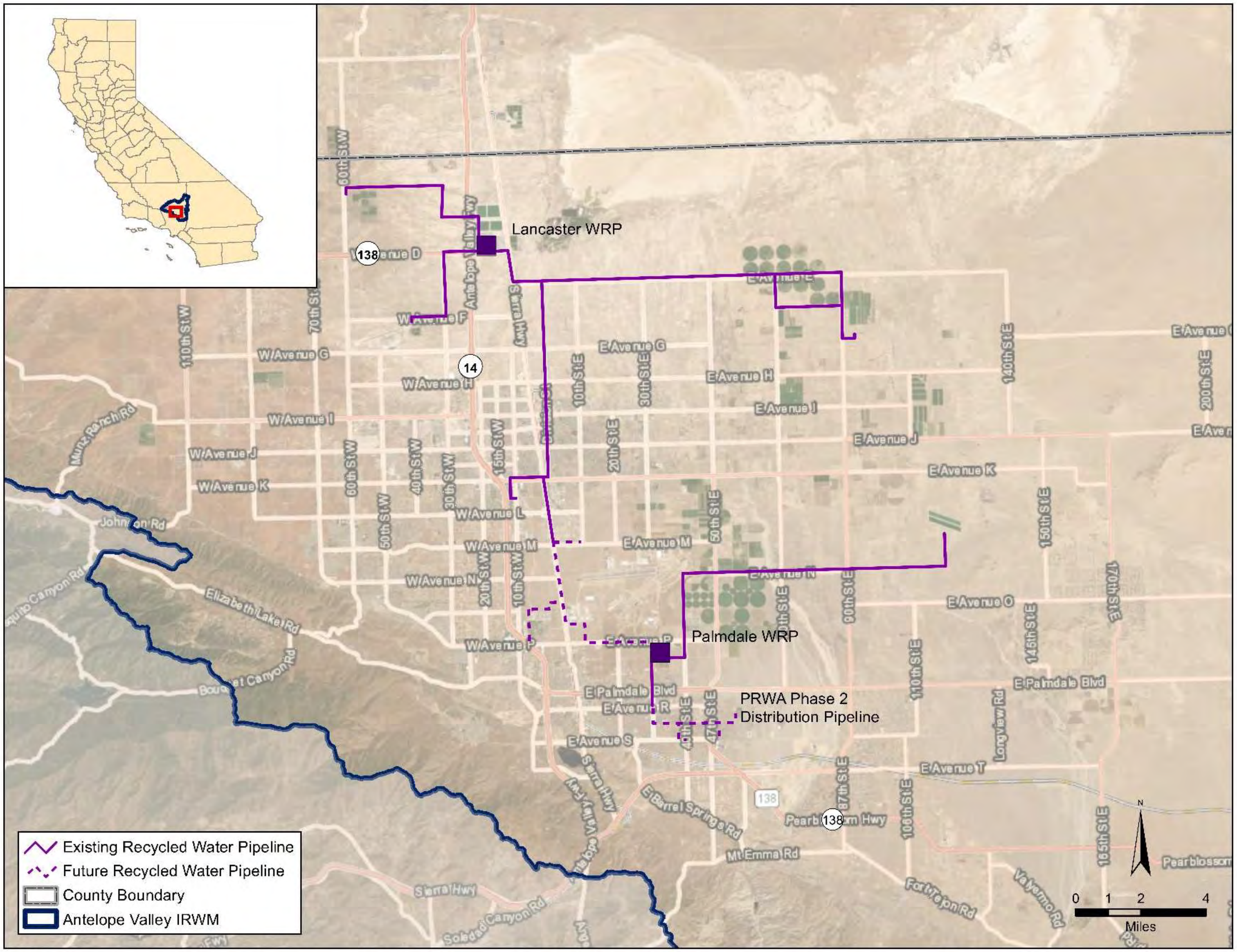
Distribution Pipeline: Figure 3-3 provides an overview of the existing and designed facilities providing (or that will provide) recycled water to the PRWA service area in the southeastern area of the City of Palmdale. The Lancaster WRP system maintains 200 acres of wetland wildlife refuge, preserves water levels in the Apollo Lakes Regional Park, and provides recycled water for irrigation of fodder crops through a pipeline primarily in Avenue E between Sierra Highway and 90th Street East. The Palmdale WRP provides recycled water for irrigation of fodder crops through a pipeline located primarily in Avenue N between 30th Street East and 120th Street East. Figure 3-3 also shows the LACWD 40 Recycled Water Backbone (Backbone) distribution pipeline which extends the system along Sierra Highway and East Avenue P to connect the Lancaster and Palmdale WRP systems, and is intended to further expand urban reuse in the Antelope Valley Region. Portions of the Backbone have already been constructed by the City of Lancaster and City of Palmdale. This expansion throughout the Antelope Valley Region is a direct result of the substantial coordination and cooperation between Kern and Los Angeles Counties.

Lancaster WRP: The Lancaster WRP, built in 1959 and located north of the City of Lancaster, is owned, operated, and maintained by Los Angeles County Sanitation District No. 14. The Lancaster WRP, which has a permitted capacity of 18.0 mgd, treated an average flow of 17,900 AF in 2015 to tertiary standards for agricultural and landscape irrigation, municipal and industrial (M&I) reuse, wildlife habitat, maintenance, and recreation. Recycled water produced at the Lancaster WRP is used for irrigation, agriculture, urban reuse, wildlife habitat, maintenance, and recreational impoundments.

Palmdale WRP: The Palmdale WRP, built in 1953 and located on two sites adjacent to the City of Palmdale, is owned, operated, and maintained by LACSD 20. Palmdale WRP, which has a permitted capacity of 12.0 mgd. The plant treated approximately 10,770 AF of wastewater in 2015 to tertiary standards. All tertiary treated water is used for agricultural and M&I reuse.

Rosamond WWTP: The Rosamond WWTP, located in the City of Rosamond, is owned, operated, and maintained by the RCSD. Rosamond WWTP has a permitted capacity of 1.27 mgd. RCSD is currently implementing a Wastewater Treatment Facility Wastewater Treatment Plant (WWTP) Rehabilitation and Groundwater Protection Project. The upgrade to the plant will allow it to treat raw wastewater to undisinfected secondary treated water with denitrification acceptable for percolation disposal. The Waste Discharge Permit was approved by the State Water Board on July 10, 2019.

Figure 3-3: Existing and Designed Recycled Water Pipelines



Reliability

Recycled water is assumed to be 100 percent reliable since it is based on a consistent water supply and is not expected to change for average, single-dry, or multi-dry year water conditions. Use of recycled water as a supply is limited more by recycled water infrastructure and demand for recycled water than reliability of such water as a supply.

3.1.1.4 Surface Storage

Runoff

Surface water supplies in the Antelope Valley Region generally consist of runoff from Littlerock and Santiago Canyons in the Angeles National Forest that is intercepted by the Littlerock Dam and Reservoir. Littlerock Creek is a perennial stream supported by annual rainfall and snowmelt from the nearby slope of Mount Williamson. Inflow to Littlerock Reservoir is seasonal and varies widely from year to year depending on stream flows and snow melt from the Angeles National Forest. Littlerock Reservoir is co-owned by PWD and LCID. PWD and LCID jointly have long-standing water rights to divert 5,500 AFY from Littlerock Creek flows. Raw water is conveyed to Lake Palmdale for treatment and use via the Palmdale Ditch.

PWD is currently undergoing actions to increase the yield at Littlerock Reservoir. The initial design capacity of the Reservoir was 4,300 AF; however, this capacity has been substantially reduced over time by the deposition of sediment behind Littlerock Dam. PWD's Littlerock Creek Sediment Removal Project proposes to restore the reservoir capacity through the removal of 1,165,000 cubic yards of sediment from behind the dam to provide 500 AF of additional storage capacity and additional work to reduce sedimentation in the future.

Surface Deliveries

LCID is currently able to purchase 1,000 AFY, or 25 percent yield from the reservoir from PWD, whichever is less (PWD 2001). This amount is effective until the 1992 reservoir rehabilitation agreement between PWD and LCID ends in 2042. When the 50-year term of the agreement expires, LCID regains its water rights according to the 1922 agreement between PWD and LCID. The 1922 agreement states that LCID has the exclusive right to the first 13 cubic feet per second (cfs) measured at the point of inflow to the reservoir. Flows greater than 13 cfs will be shared by PWD and LCID, with 75 percent to PWD and 25 percent to LCID. In addition, each district is allotted 50 percent of the Littlerock Reservoir storage capacity (PWD 2016). Currently, water from Littlerock Reservoir is only used for M&I uses.

Table 3-5 provides a summary of the historical surface deliveries from Littlerock Reservoir.

Table 3-5: Historical Surface Deliveries from Littlerock Reservoir (AFY)

Year	PWD Diversions	LCID Diversions	Total Diversions
1975[(a)]	1,586	1,513	3,099
1980[(a)]	913	1,950	2,863
1985[(a)]	1,460	1,375	2,835
1990[(a)]	110	200	310
1995[(a)]	3,771	0	3,771
2000[(a)]	6,500	0	6,500
2005[(a)]	6,900	0	6,900
2010[(b)]	1,861	0	1,861
2015[(c)]	500	0	500

Sources:
(a) PWD 2001.
(b) PWD 2010 UWMP.
(c) PWD 2015 UWMP.

Surface Water Infrastructure

The surface water storage facilities in the Antelope Valley Region include Littlerock Reservoir and Lake Palmdale. Littlerock Reservoir has an average seasonal inflow of approximately 3,500 AFY but an estimated storage capacity of only 2,765 AF due to sediment accumulation behind the dam. Calculations conducted by PWD indicate the Reservoir capacity has been further reduced by siltation at an annual rate of approximately 54,000 cubic yards of sediment amounting to a loss of approximately 35 AFY of water.

Littlerock Reservoir discharges into Lake Palmdale, which has a capacity of approximately 4,129 AF. Lake Palmdale stores both surface water runoff and SWP imported water until the water is conveyed from the lake through a 42-inch pipeline to PWD's water treatment plant.

Reliability

In the PWD 2015 UWMP, historical data were used to determine how the reliability of the Littlerock Dam and Reservoir surface water supplies would be affected for average, single-dry, and multi-dry water years. PWD expects to use 4,000 AFY of its diversion rights in average, dry, and multi-dry water years. This was calculated as 50 percent of the average available yield from the Reservoir of 8,000 AF.

According to the PWD 2016 Water System Master Plan, a reliability analysis was performed for the reservoir yield using actual hydrology from 1950 to 2013. This analysis estimated that Littlerock Creek surface water would decrease to a minimum of 200 AFY based on 1951 hydrology (PWD 2016).

3.1.1.5 Groundwater Production and Storage

Groundwater Infrastructure

LCID has four (4) groundwater wells that supplied approximately 1,350 AFY of water in Fiscal Year 2018 with half the supply going to agriculture. The wells have a maximum pumping capacity of 4,800 gpm (personal communication with James Chaisson, LCID, October 1, 2019). The 2015 Judgment, however, established an Allocation of Rights of the Native Safe Yield and assigned LCID a groundwater production right of 797 AFY. The Judgment allows LCID until 2023 to ramp down groundwater extractions to the new production right.

LACWD 40 has 50 active wells. The combined groundwater extraction capacity is estimated at 30,000 AFY (26.8 mgd). The 2015 Judgment ruled that LACWD 40 has a Pre-Rampdown Production and a production right of 6,789 AFY, therefore LACWD 40 will not have to ramp down groundwater production by 2023.

PWD has twenty-two (22) active groundwater wells throughout the Lancaster and Pearland groundwater subunits, and the San Andreas Rift Zone. The total instantaneous capacity for all PWD wells operating is approximately 16,000 gpm (25,958 AFY). Since 1994, the PWD has produced an average of approximately 9,500 AF of groundwater per year. PWD's total groundwater pumping in 2015 was 11,200 AFY. The 2015 Judgment, however, assigned PWD a groundwater production right of 2,770 AFY. Prior to the Judgment, PWD had an unquantified right to pump water for beneficial use, and assumed projected pumping volumes at 12,000 AFY based on pumping capacity (PWD 2016).

QHWD currently operates eleven (11) wells for a total maximum pumping capacity of 9,165 AFY (5,681 gpm) (LACWD 40 & QHWD 2011). As per the adjudication, QHWD has a Pre-Rampdown Production of 2,397 AFY and must ramp down groundwater production to its production right of 564 AFY by 2023.

RCSD has three (3) wells with a combined maximum pumping capacity of 2,825 gpm (4,557 AFY). RCSD relies on groundwater produced by two of these wells and the third is maintained as a standby/emergency source. . RCSD was allocated 404 AFY of Production Rights as a result of the adjudication and purchased an additional 150 AFY of Production Rights for a total of 554 AFY. RCSD will reduce groundwater production to its production right of 554 AFY by 2023, unless it purchases additional groundwater production rights through the Federal Reserve Water Rights, Carryover, Return Flows, and Transferred Production Rights (RCSD 2017).

Reliability

Since long-term recharge is expected to be stable, it is anticipated that groundwater pumping, and hence supply, will be reliable even in short-term and multiple year droughts. Thus groundwater is considered a very reliable supply for the Antelope Valley Region. However, how much groundwater can physically be supplied to the Antelope Valley Region in the future will decrease per the Judgment. It is important to note that the return flows are dependent upon anticipated demand and may fluctuate with changes in the anticipated demand. The return flow estimates are meant to indicate a sense of the impact of return flows to the groundwater basin.

Percolation

For purposes of this IRWM Plan, direct percolation from precipitation on the Antelope Valley Region floor is assumed to be negligible. However, indirect percolation from irrigation, conveyance system losses, wastewater discharge, and septic system return flows on the Antelope Valley Region floor do occur. There is the potential for direct percolation on the Antelope Valley Region floor to have an impact to the overall water budget. This component of the water budget is currently being studied in the Antelope Valley Region, and if new information is discovered that greatly differs from this assumption, this IRWM Plan may be amended to reflect this.

Native Safe Yield and Total Sustainable Yield

Safe Yield is the amount of annual extractions over time that equal the amount of water needed to recharge groundwater and maintain the Basin in equilibrium. The Basin's Native Safe Yield includes both natural recharge and return flows from unused groundwater that is pumped and then percolates back into the groundwater basin. Natural recharge can be variable and difficult to quantify. Historical estimates of natural recharge have ranged from 30,300 AFY to 81,400 AFY based on a variety of approaches (USGS 2003, USGS 1993). The earliest estimates of natural recharge ranged from 50,000 AFY to 81,400 AFY and were based on limited streamflow and rainfall data (USGS 1993). Later estimates were based on developing a relationship between rainfall and runoff and ranged from

40,280 AFY to 53,000 AFY (USGS 1993). An alternative method used a groundwater model, and found a natural recharge estimate of 30,300 AFY achieved a balance within the model (USGS 2003). The Judgment concluded that the Antelope Valley Groundwater Basin has an estimated natural recharge of 60,000 AFY. Estimates for return flows are typically calculated using a percentage of applied water used for M&I irrigation, agricultural irrigation, and agricultural irrigation with recycled water. These estimates are added to the natural recharge to get a total sustainable yield (TSY). Given the mix of land use practices observed over a recent 15-year period, an overall return flow of about 27.1 percent was estimated for the Basin. This resulted in a Native Safe Yield of 82,300 AFY.

TSY is defined in the Judgment as the amount of groundwater that may be safely pumped from the Basin on a long-term basis and is specified as the sum of the Native Safe Yield plus return flows from imported water. The Judgment concluded that return flows from imported water resulted in about 27,700 AFY of additional groundwater supply to the Basin. The TSY (i.e., recharge and return flows) was determined to be 110,000 AFY in the final Judgment. The 2017 Watermaster Report that references estimates for TSY, natural recharge, and return flows is included in Appendix I. This IRWM Plan is consistent with the adjudication finding for TSY (110,000 AFY). The TSY is used to determine the amount of water that may be sustainably pumped from the basin and represents the combination of natural recharge and return flows from M&I, agricultural, and agricultural reuse. Therefore, these components of TSY are not calculated separately. This Plan acknowledges that other estimates have been developed for TSY in the Valley as mentioned above.

The Production Right for groundwater users in the Basin was defined in the Judgment as a portion of the Native Safe Yield. Production Rights for specific parties are defined in the Judgment for both Non-Overlying and Overlying Producers. The Judgment determined that the sum of the individual production rights is approximately 82,300 AFY.

As determined by the Stakeholder Group at the May 1, 2019 stakeholder meeting, the discussions that follow in Sections 3 and 6 will utilize the NSY, TSY, and Production Rights for water balance and projection purposes. The projected water supplies also incorporate the rampdown schedule outlined in the Judgment to meet the determined Production Rights, shown in **Table 3-6**.

Table 3-6: Current and Projected Groundwater Supplies

	2015	2020	2025	2030	2035	2040
Production Rights [(a)]	126,250	118,125	82,300	82,300	82,300	82,300
Return Flows [(b)]	18,581	27,700	27,700	27,700	27,700	27,700
Total Safe Yield	**144,831**	**145,825**	**110,000**	**110,000**	**110,000**	**110,000**

Notes:

(a) 2015 supplies are assumed to be "Pre-Rampdown Production" estimates in the Antelope Valley Watermaster 2017 Annual Report; 2020 is a linear extrapolation from 2015 and 2025; 2025-2040 is the sum of non-overlying and overlying producers and is equivalent to the Native Safe Yield.

(b) Assumed return flows from imported water per Antelope Valley Watermaster 2017 Annual Report.

Artificial Recharge

One typical source of artificial recharge is water banking through spreading basins that allow the water to infiltrate into the ground. Several water banking projects have been proposed in the Region and are discussed in later Sections of this Plan. AVEK's Westside Water Bank project was completed in 2010 and can store up to 120,000 AFY. This project is a collaboration between several agencies. The partners can currently withdraw a maximum of approximately 40,000 AFY. AVEK also added the Eastside Water Banking and Blending Program which started operations in 2016. The Eastside Water Bank currently has a total estimated capacity of 5,700 AFY (AVEK 2016).

The Southern California Water Bank Authority (SCWBA) is in the process of expanding the Willow Springs Water Bank (WSWB) and Conjunctive Use Project approximately a mile from the AVEK West Feeder and 8 miles from the East Branch of the SWP California Aqueduct. The WSWB will provide 1 million AFY of storage in the Antelope Valley Groundwater Basin and the ability to recharge 280,000 AFY and to recover up to 225,000 AFY during dry periods (personal communication with Zachary Ahinga, Willow Springs, February 7, 2019). Releases are made from the WSWB to the East Branch to 1) provide "backstop" flows to mitigate potential SWP supply reductions; 2) to allow pulse flow releases from Oroville Reservoir for fishery enhancement, and 3) for improved water supply reliability (SCWBA 2017). A South North Intertie Pipeline (SNIP) connects the WSWB to AVEK and is currently available for use by either AVEK or WSWB to convey imported or banked groundwater. The existing connection to the AVEK SNIP Treatment System could potentially integrate up to 60 cfs of the extraction and return capacity with the AVEK system. Though this connection may allow exchanges to occur among SWP contractors and local AVEK customers in the future, the WSWB currently does not have an agreement with AVEK to provide an average annual supply from the WSWB. For the purposes of this IRWM Plan, WSWB supplies will be conservatively excluded from the water supply projections for the Antelope Valley IRWM Region until there is an agreement between the two parties (personal communication Zachary Ahinga, Willow Springs, August 13, 2019).

Another type of artificial recharge is through ASR projects. ASR projects involve the storage of water in an aquifer via artificial groundwater recharge when water is available (usually during spring runoff), and recovery of the stored water from the aquifer when water is needed (usually late summer). The source of water used for ASR can vary. Currently, the only source of ASR water available to the Antelope Valley Region is SWP water, but blended and non-blended recycled water are potential future sources. Although the Region plans to develop groundwater recharge projects with blended recycled water in the future, currently only SWP water is utilized for ASR in the Antelope Valley to a very limited extent.

LACWD 40 is the only agency within the Antelope Valley Region that has attempted to utilize ASR as a water supply management practice. Their program includes the use of new or existing wells for direct injection of water into the aquifer. LACWD 40's ASR program operated under a Conditional Waiver of Waste Discharge Requirements, for a period of 5 years with groundwater monitoring requirements stipulated in the waiver. The 2004 waiver stipulated that LACWD 40 could only inject water to fill the basin to the 2,150 feet groundwater contour interval. This groundwater depression has a radius of approximately 2 miles centered around the middle of Lancaster. As a condition of the waiver, LACWD 40 could only inject up to 6,843 AFY. For the first few years of the project, LACWD was only able to inject approximately 1,500 AFY. In 2010, another five-year Conditional Waiver was approved.

As of December 2010, all injection activities were halted as a result of operational and financial restraints.

For the purposes of this Plan, ASR extraction of banked water will be considered to be negligible since injection has been discontinued.

Extractions

Groundwater for the Antelope Valley Region is extracted from the Antelope Valley Groundwater Basin, as described in Section 2. Historically, groundwater has been the primary water supply source for the Antelope Valley Region.

When significant pumping in the Antelope Valley Region began (early 1900's), a decline in groundwater levels ensued in response to the change in the extraction versus recharge ratio. These changes varied spatially and temporally across the Antelope Valley Region. For instance, the eastern portion of the Buttes and Pearland subunits (described in Section 2.4.2.2) had relatively unchanged groundwater levels (declines of approximately 20 feet), whereas the western portion of these subunits had declines up to 100 feet. The groundwater level changes in the Lancaster subunit were more dramatic and varied with land use, with depressions of up to 200 feet in 1961 in areas with increased agricultural pumping (City of Lancaster 2007). With the introduction of SWP water and increasing urbanization, the water table depressions have either stabilized or increased in the Antelope Valley Region. Figure 3-4 to Figure 3-8 provide a set of contour maps of the groundwater levels for the Antelope Valley Region from 1915 to 2006.

The Judgment mandates annual reports to monitor groundwater extractions and changes in groundwater levels. According to the 2017 Watermaster report, water levels are the lowest in the Palmdale area and adjacent areas to the northeast; areas where much of the groundwater production occurs in the Basin. Relatively low groundwater levels were also observed in the Rogers Lake Subarea beneath EAFB in the north.

Figure 3-4: 1915 Groundwater Level Contour Map of the Antelope Valley Region

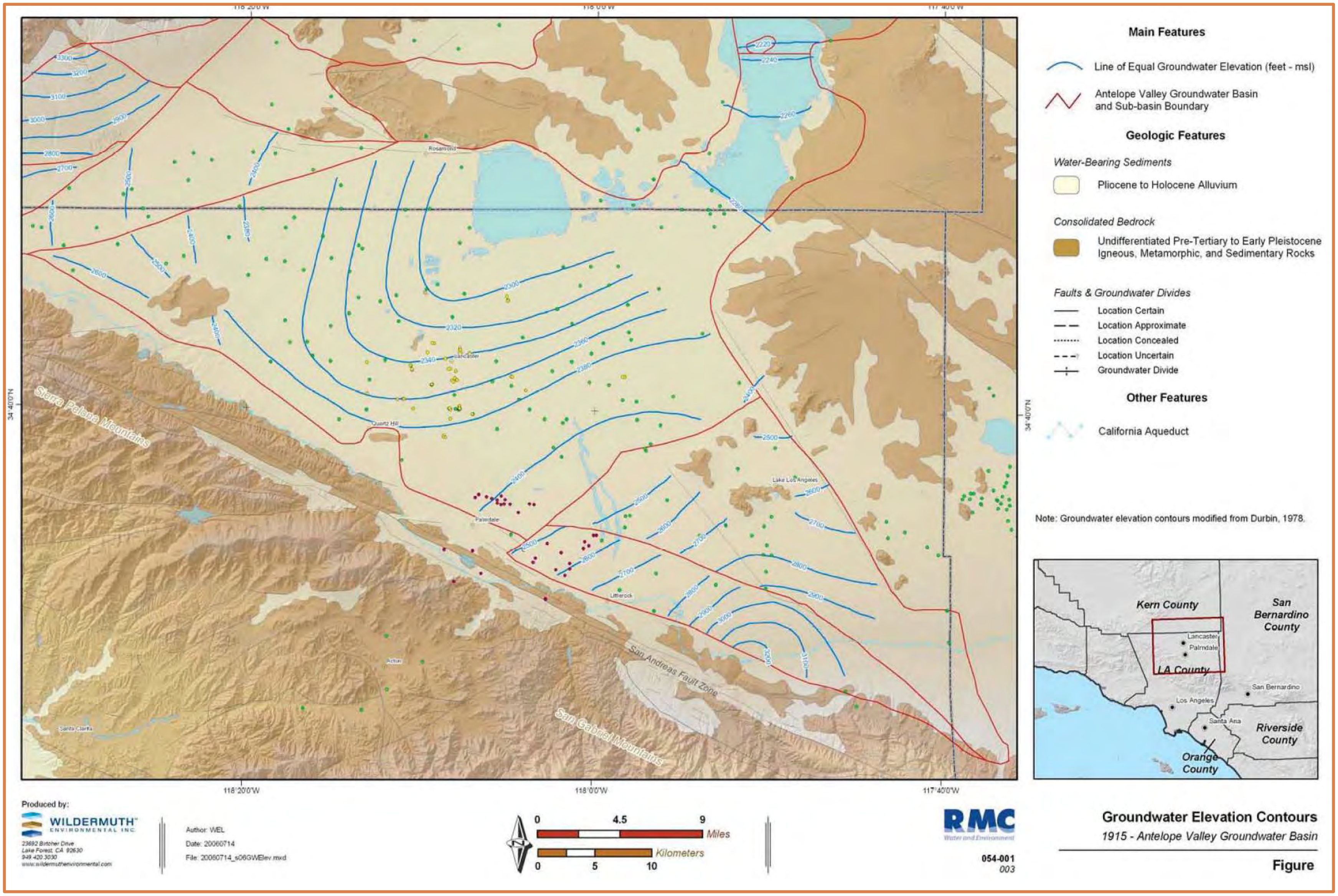


Figure 3-5: 1961 Groundwater Level Contour Map of the Antelope Valley Region

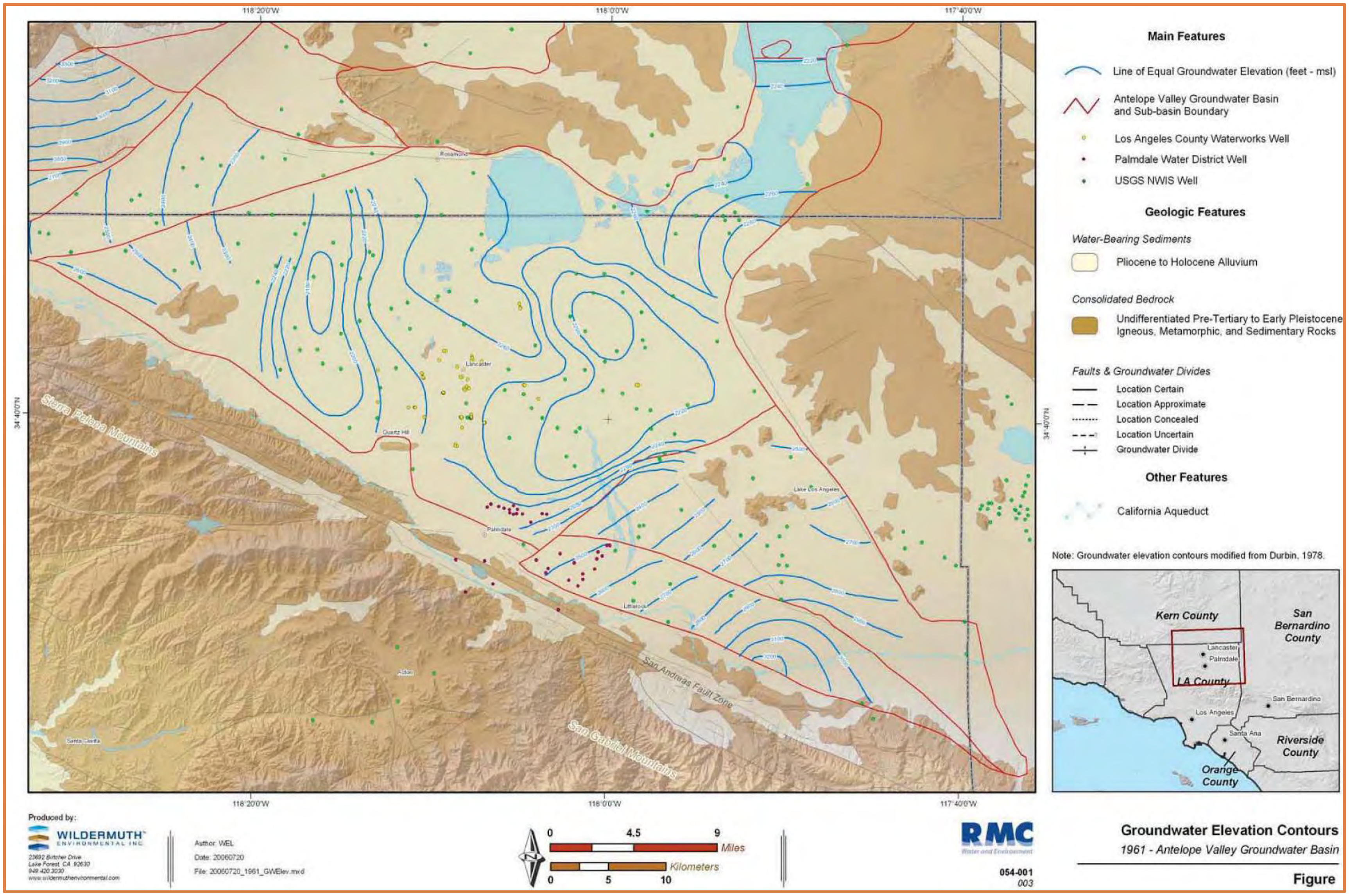


Figure 3-6: 1979 Groundwater Level Contour Map of the Antelope Valley Region

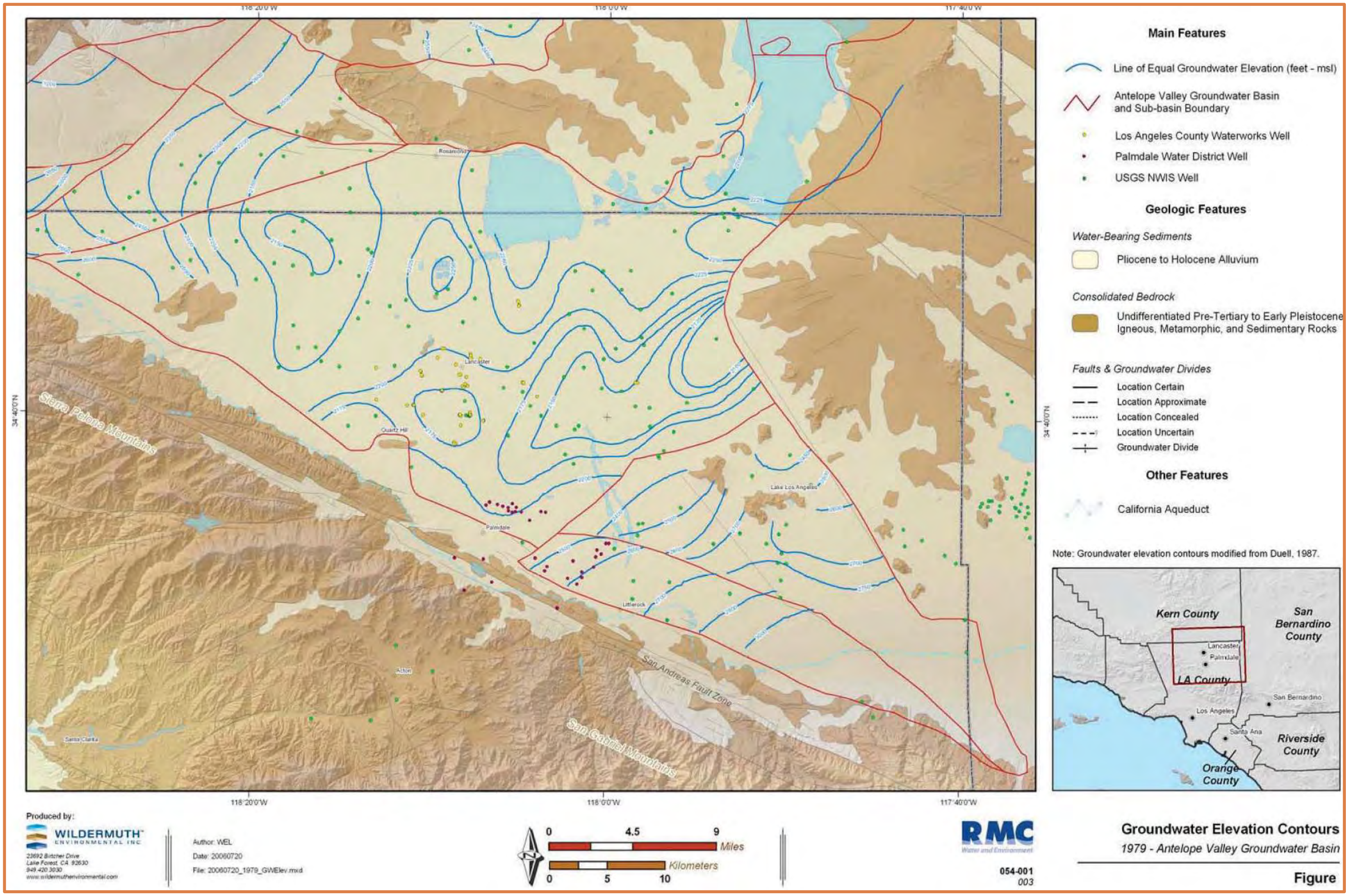


Figure 3-7: 1988 Groundwater Level Contour Map of the Antelope Valley Region

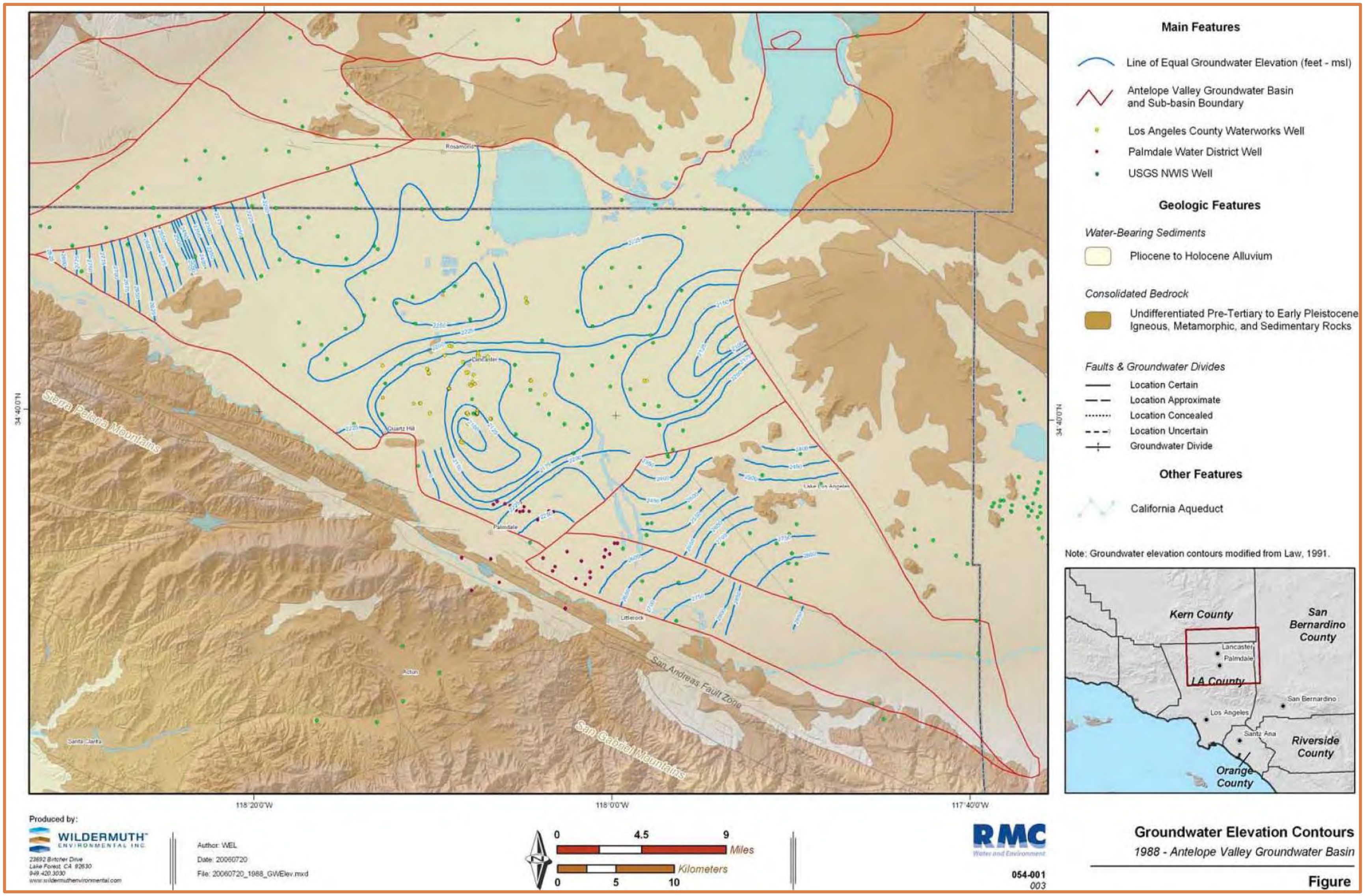
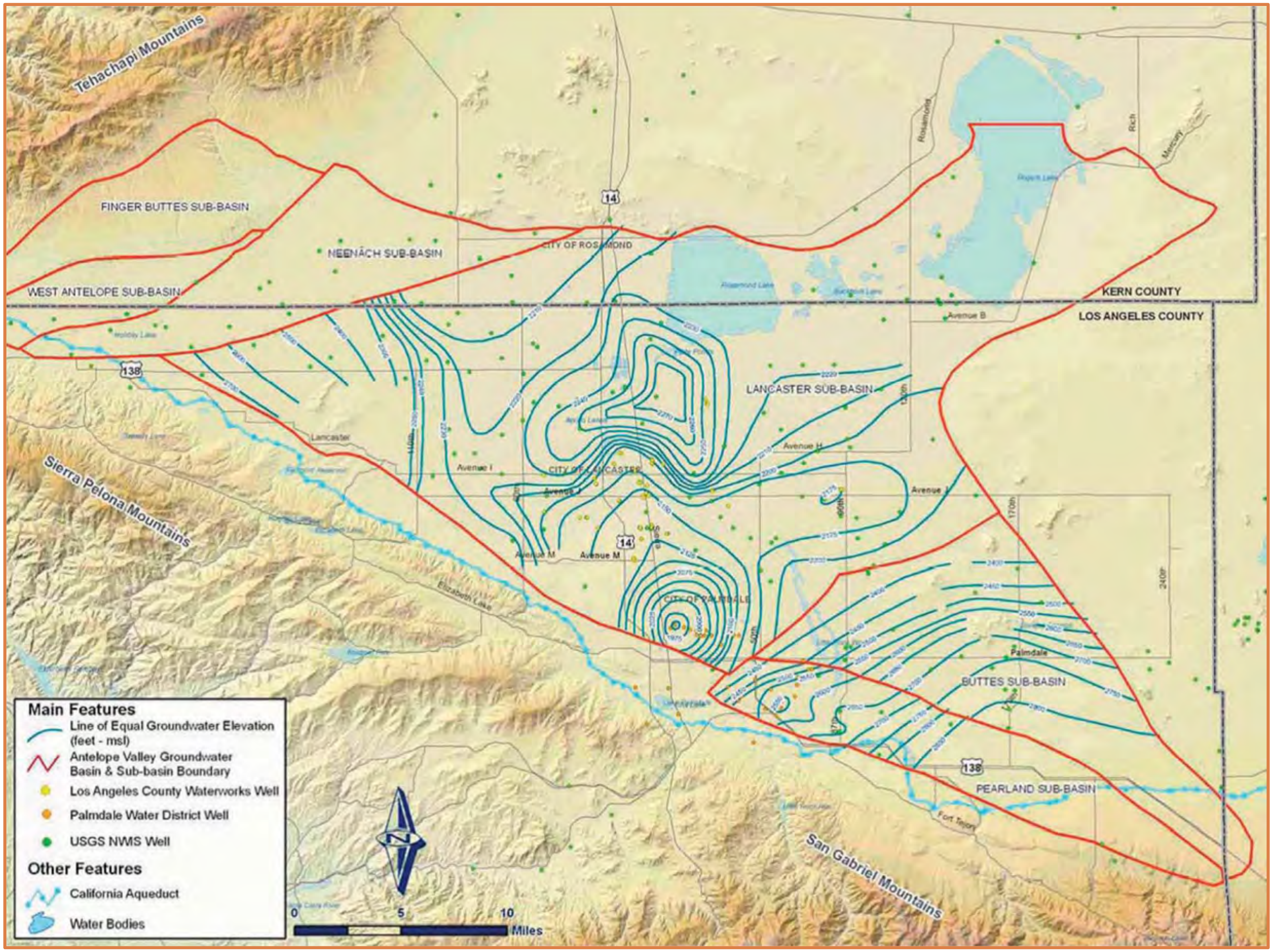


Figure 3-8: 2006 Groundwater Level Contour Map of the Antelope Valley Region



3.1.2 Water Demands

The following subsection discusses the current and projected water demands for the Antelope Valley Region. In the 2013 AV IRWM Plan, the demands were presented with urban demand (based on per capita estimates) and two agricultural scenarios (average and dry year estimates). The 2019 AV IRWM Plan Update reevaluated this methodology and updated the water demand projections to better reflect the existing conditions and planning efforts of the Region. Urban demands were updated to also include industrial demands from Rio Tino Minerals. Projected water demands for the Antelope Valley Region are presented in Table 3-7. Later in this Section, water budgets are developed for the Region that compare average water years, dry water years, and multi-dry water years.

Table 3-7: Water Demand Projections (AF) for the Antelope Valley Region

	2015	2020	2025	2030	2035	2040
Urban Demand						
Boron CSD[(a)]	400	400	400	500	500	500
California City CSD[(b)]	0	0	0	0	0	0
California Water Service	500	1,000	1,000	1,000	1,000	1,100
LA County Waterworks District 40[(c)]	38,700	96,500	108,000	119,400	130,800	132,200
Rosamond CSD	2,200	2,300	2,300	2,400	2,400	2,400
Palmdale WD	17,000	23,300	26,900	28,400	30,000	31,000
Quartz Hill WD[(c)]	4,700	5,400	6,100	6,800	7,600	7,700
Rio Tinto Minerals	1,100	1,400	1,400	1,400	1,400	1,400
Remaining Areas[(d)]	7,100	7,200	7,500	7,700	8,000	8,200
Total Urban Demand	**71,700**	**137,500**	**153,600**	**167,600**	**181,700**	**184,500**
Agricultural Demand						
Agricultural Demand Average Year	73,000	73,000	73,000	73,000	73,000	73,000
Agricultural Demand Dry Year	84,000	84,000	84,000	84,000	84,000	84,000
Total Region Average Year Demand	**144,700**	**210,500**	**226,600**	**240,600**	**254,700**	**257,500**
Total Region Dry Year Demand	**155,700**	**221,500**	**237,600**	**251,600**	**265,700**	**268,500**

Notes: All numbers rounded to nearest 100. Based on values provided in the 2015 UWMPs.

(a) 2015 value provided by Boron CSD; projections based on Department of Finance (DOF) growth rates for the unincorporated Kern County.

(b) California City CSD has a population center outside the Region and only minimal population inside the Region.

(c) 2040 projections based on DOF population growth rates for Los Angeles County.

(d) Projections based on DOF growth rates for the unincorporated Los Angeles and Kern Counties.

3.1.2.1 Urban (Municipal and Industrial) Demand

Urban water demands for 2015 were developed using the population projections presented in Table 2-3 (in Section 2) and utilizes a regional water use per capita estimate of 153 gallons per day (gpd) per person (or 0.17 AFY per person). This is a significant reduction from the 199 gallons per capita day (GPCD) estimated in the 2013 IRWM Plan. This per capita water use estimate was determined using a weighted average of total per capita water use estimates for the major water supply agencies in the Antelope Valley Region as shown in Table 3-8. As discussed in Section 2, growth rates within an agency are consistent and thus an average per capita water use is an appropriate estimate of demand. The rates of water use in areas that receive water from sources other than those included in Table 3-8 were assumed to have minimal impact on the average per capita rate and therefore were not included in the calculations to determine the average for the Region.

The per capita water use values could be reduced in the future with the implementation of more robust demand management measures. With the implementation of Senate Bill x7-7 in 2009, water suppliers have been required to reduce their average per capita daily water use rate by 20 percent from a baseline value by December 31, 2020. Indoor residential water use must also decrease to meet a target of 55 GPCD by 2025 and 50 GPCD by 2030 as mandated in California's Senate Bill 606 and Assembly Bill 1668. Each water purveyor may calculate their baseline per capita water use rate a number of ways. To meet these targets, many agencies have outlined and implemented water conservation programs to further reduce per capita consumption. The Region has already experienced significant reductions in GPCD in the past 5 years due to increased conservation in response to the severe state-wide drought and the associated mandatory water use restrictions. The current estimated regional water use is 46 GPCD lower than the GPCD estimates reported in the 2013 IRWM Plan. With the implementation of these programs, it is expected that the average per capita water use in the Region will continue to decrease

Table 3-8: Per Capita Urban Water Use in the Antelope Valley IRWM Region

	2015 Population	Percent of Region Population	2015 Urban Water Demand (AF)	Average per Capita Water Use (GPCD)
Boron CSD	2,300	1%	400	152
California Water Service	3,400	1%	500	139
LACWD 40	208,100	51%	38,700	166
PWD	118,200	29%	17,000	128
QHWD	18,400	5%	4,700	227
RCSD	18,000	4%	2,200	111
Total[(a)]	**368,400**	**90%**	**63,500**	**153**

Notes: All numbers rounded to the nearest 100. Numbers do not include private well owners. It is assumed that the demand and population numbers reported in the 2015 UWMPs provide an approximate per capita estimate for the Region.
(a) Antelope Valley Region per capita water use was determined by dividing total water demand by total population in the purveyor service areas. These numbers do not include private well owners.

3.1.2.2 Private Pumping/Small Mutual Water Demand

Water demands from private pumping and from small mutual water companies in the Antelope Valley Region are difficult to quantify as accurate data is not readily available. These demands were accounted for in Table 3-7 since people served by private wells and by small mutual water companies were included in the population projections. The Antelope Valley Region average per capita water use that was estimated in Table 3-4 was assumed to represent these populations.

3.1.2.3 Agricultural Water Demand

Historical total applied agricultural water demand (1999 to 2005) for the Antelope Valley Region is summarized in Table 3-9. Historical agricultural demand was determined by multiplying estimated crop water requirements from the County Farm Advisors by the crop acreages provided by the Los Angeles and Kern County Agricultural Commissioners' Inspection Reports. The crop water requirements are discussed in more detail below.

Prior to 2000, an accounting of the agricultural acreage within the Kern County portion of the Antelope Valley Region was not available. For the 2007 IRWMP, it had been assumed that Kern County agricultural groundwater demand was 18 percent of Los Angeles County agricultural groundwater demand. The 18 percent was determined by the USGS in 2003 from land use maps and agricultural pumping data for Los Angeles County in 1961 and 1987. For the 2013 IRWMP Update, data from the Kern County Farm Bureau were used in the calculations in lieu of the 18 percent estimate. The 2019 IRMWP Update relied on 2016 data from both the Kern County Farm Bureau and the Los Angeles County Department of Agricultural Commissioner / Weights and Measures.

Table 3-9: Historical Agricultural Water Use in the Antelope Valley Region

Year	Los Angeles County Ag Demand (AF)	Kern County Ag Demand (AF)	Total Ag Demand (AF)
1999	97,000	35,000	132,000
2000	109,000	36,000	145,000
2001	101,000	37,000	138,000
2002	105,000	39,000	144,000
2003	110,000	34,000	144,000
2004	104,000	27,000	131,000
2005	98,000	29,000	127,000

Note: Numbers rounded to the nearest 1,000 AF and assume average water year crop requirements.

Crop Water Requirements

Crop water use in the Antelope Valley Region can vary significantly from State-wide averages due to the unique requirements presented by the Antelope Valley Region's climate and physical characteristics, including low rainfall, sandy soils, and heavy winds. Thus, it is appropriate to develop crop water requirements specific to the Antelope Valley Region.

The first step in determining the crop water requirements involves determining the evapotranspiration for each crop (ETc) using the following equation:

$$ETc = Kc * ETo$$

Where Kc is the crop coefficient and ETo is the reference evapotranspiration.

An estimate of the ETo for Lancaster was developed based on data from the California Irrigation Management Information System (CIMIS) weather station in Palmdale, CA and historical water use ETo values for Palmdale. The Kc varies with the crop, its stage of development, and the frequency of irrigation; but it is independent of the location. Crop coefficients were adapted from a variety of published reports. The crop coefficients are presented in Table 3-10.

Table 3-10: Crop Coefficient (Kc) Estimates

Date	Pasture	Alfalfa[a]	Sudan[b]	Sod	Onions	Deciduous Fruit Trees[c]	Carrots	Potatoes	Pistachios
1-Jan	1.0	0.40		1.0					
15-Jan	1.0	0.40		1.0					
1-Feb	1.0	1.00		1.0			0.31		
15-Feb	1.0	1.15		1.0			0.31		
1-Mar	1.0	1.15		1.0	0.30	0.25	0.31	0.55	
15-Mar	1.0	1.05		1.0	0.30	0.54	0.55	0.61	0.04
1-Apr	1.0	1.05		1.0	0.30	0.60	0.82	0.88	0.08
15-Apr	1.0	1.05		1.0	0.53	0.66	1.03	1.16	0.20
1-May	1.0	1.05		1.0	0.83	0.72	1.11	1.21	0.32
15-May	1.0	1.05		1.0	1.14	0.79	1.13	1.19	0.47
1-Jun	1.0	1.05		1.0	1.14	0.84	1.05	0.87	0.55
15-Jun	1.0	1.05	0.3	1.0	1.14	0.86	1.00	0.55	0.51
1-Jul	1.0	1.05	0.85	1.0	1.04	0.92			0.38
15-Jul	1.0	1.05	1.10	1.0	0.92	0.94			0.28
1-Aug	1.0	1.05	0.85	1.0	0.80	0.94			0.37
15-Aug	1.0	1.05	1.10	1.0	0.68	0.94			
1-Sep	1.0	1.05	0.85	1.0		0.94			
15-Sep	1.0	1.05	1.00	1.0		0.91			
1-Oct	1.0	1.05	1.10	1.0		0.85			
15-Oct	1.0	1.05	1.10	1.0		0.79			
1-Nov	1.0	1.05		1.0		0.70			
15-Nov	1.0	0.40		1.0					
1-Dec	1.0	0.40		1.0					
15-Dec	1.0	0.40		1.0					

Sources: Hansen, B.R.; Shwannkl, L.; and Fulton, A. "Scheduling Irrigation: When and How much Water to Apply," Water Management Series Publication Number 3396, Department of Land, Air & Water Resources, University of California, Davis. Pruitt, W.O.; Fereres, E.; Kelta, K.; and Snyder, R.L., "Reference Evapotranspiration (ETo) for California," UC Bull. 1922.

Notes:

(a) Kc of 1.05 takes into account reduced ETo during the cuttings throughout the season.

(b) Sudan was cut on 7/1, 8/16, and 10/16. ETo reduced for 1 to 2 weeks after cutting.

(c) Deciduous Fruit Tree Crop Coefficient were adapted from Orloff, S.B., "Deciduous Orchard Water Use: Clean Cultivated Trees for a Normal Year in Littlerock," Local Extension Publication.

Table 3-11 provides the ETc estimates for the Antelope Valley Region. The ETc is an estimate of the net water requirements for a crop (i.e., the amount of water) that is required for proper plant growth. Additionally, there are net water requirements for the crop which occur outside of the growing season. These include water applied to prepare the soil for planting, fumigation, and to prevent wind erosion. The sum of the ETc and these non-growing water requirements consist of the overall net crop requirement. The net water requirement does not account for water losses from inefficient irrigation systems, deep percolation, or runoff. In order to determine the gross water requirement, or the total amount of water which must be applied to the crop, the following calculation is used:

Gross Water Requirement = Net Water Requirement/Irrigation System Efficiency

Table 3-11: Crop Evapotranspiration (ETc) Estimates for the Antelope Valley Region

Date	Pasture/ Sod ETo[(a)]	Alfalfa	Sudan	Sod	Onions	Deciduous Fruit Trees	Carrots	Potatoes	Pistachios
1-Jan	0.90	0.36	0.00	0.90	0.00	0.00	0.00	0.00	0.00
15-Jan	1.35	0.54	0.00	1.35	0.00	0.00	0.00	0.00	0.00
1-Feb	1.45	1.45	0.00	1.45	0.00	0.00	0.45	0.00	0.00
15-Feb	1.63	1.87	0.00	1.63	0.00	0.00	0.50	0.00	0.00
1-Mar	2.01	2.31	0.00	2.01	0.60	0.50	0.62	1.11	0.00
15-Mar	2.99	3.14	0.00	2.99	0.90	1.61	1.64	1.82	0.12
1-Apr	2.83	2.97	0.00	2.83	0.85	1.70	2.32	2.49	0.22
15-Apr	3.87	4.06	0.00	3.87	2.05	2.55	3.99	4.49	0.78
1-May	3.55	3.73	0.00	3.55	2.95	2.56	3.94	4.30	1.12
15-May	4.71	4.95	0.00	4.71	5.37	3.72	5.33	5.61	2.22
1-Jun	4.10	4.31	0.00	4.10	4.68	3.44	4.31	3.57	2.27
15-Jun	5.08	5.33	1.52	5.08	5.79	4.37	5.08	2.79	2.60
1-Jul	4.34	4.56	3.69	4.34	4.51	3.99	0.00	0.00	1.66
15-Jul	5.21	5.47	5.73	5.21	4.79	4.90	0.00	0.00	1.47
1-Aug	4.11	4.31	3.49	4.11	3.29	3.86	0.00	0.00	1.51
15-Aug	4.64	4.87	5.11	4.64	3.16	4.36	0.00	0.00	0.00
1-Sep	3.29	3.45	2.79	3.29	0.00	3.09	0.00	0.00	0.00
1-Sep	3.26	3.42	3.26	3.26	0.00	2.97	0.00	0.00	0.00
1-Oct	2.30	2.41	2.53	2.30	0.00	1.95	0.00	0.00	0.00
15-Oct	2.24	2.35	2.46	2.24	0.00	1.77	0.00	0.00	0.00
1-Nov	1.57	1.65	0.00	1.57	0.00	1.10	0.00	0.00	0.00
15-Nov	1.38	0.55	0.00	1.38	0.00	0.00	0.00	0.00	0.00
1-Dec	0.99	0.39	0.00	0.99	0.00	0.00	0.00	0.00	0.00
15-Dec	1.05	0.42	0.00	1.05	0.00	0.00	0.00	0.00	0.00
TOTAL (inches)	68.84	68.89	30.58	68.84	38.93	48.45	28.18	26.17	13.98

Note:
(a) Pasture ETo from the California Irrigation Management Information System (CIMIS), Palmdale Station 197 from January 2008 to December 2018.

The irrigation system efficiency used in this study, 75 percent, was developed from field observations by the University of California researchers and the Natural Resources Conservation Service (NRCS). Irrigation efficiency is the ratio of irrigation water used in evapotranspiration to the water applied or delivered to a field or farm. Greater controls are utilized by agricultural operations that use recycled water that justify higher irrigation efficiencies (discussed later in this document).

A summary of the crop water requirements is presented in Table 3-12. The crop water requirements for a single dry year and multi-dry years are the same. It is assumed that approximately 7 inches of net water demand would be met by rainfall for average water years and thus average year water requirements include a reduction in the total net water requirements.

Table 3-12: Crop Water Requirements for the Antelope Valley Region

Water Requirements	Pasture	Alfalfa	Sudan	Sod	Onions	Deciduous Fruit Trees	Carrots	Potatoes	Pistachios
Net ETo	68.84	68.89	30.58	68.84	38.93	48.45	28.18	26.17	13.98
Net Soil					3.54		4.46		
Net Non-Growing	0.00	2.00	4.00	4.00	6.00	0.00	6.50	4.00	5.00
Total Net Dry Years (in.)	68.84	70.89	34.58	72.84	48.47	48.45	39.14	30.17	18.98
Total Net Average Years[(c)] (in.)	61.85	63.90	27.60	65.85	41.48	41.46	32.15	23.18	11.99
Irrigation Efficiency (%)	75%	75%	75%	75%	75%	75%	75%	75%	75%
Total Gross for Dry Years (in.)	91.78	94.51	46.11	97.12	64.63	64.60	52.18	40.23	25.30
Total Gross for Dry Years (AF/acre)	7.65	7.88	3.84	8.09	5.39	5.38	4.35	3.35	2.11
Total Gross for Avg. Years (in.)	82.47	85.20	36.79	87.80	55.31	55.28	42.87	30.91	15.99
Total Gross for Average Years (AF/acre)	6.87	7.10	3.07	7.32	4.61	4.61	3.57	2.58	1.33

Notes:
(a) Assumes a 5-year life of an alfalfa stand. Includes the water requirement for pre-irrigation before field preparation and planning, and irrigation before and after application of herbicides.
(b) Includes water requirements for pre-irrigation before field preparation, fumigation, and "water capping" after fumigation.
(c) It is assumed that approximately 7 inches of net water demand would be met by rainfall for average water years and thus average year water requirements include a reduction in the total net water requirements.

Crop Acreages

Data regarding crop acreages in the Antelope Valley Region was provided by the Los Angeles County Department of Agricultural Commissioner/Weights and Measures and Kern County Farm Bureau. Table 3-13 provides a comparison of historical crop acreages in the Antelope Valley Region.

Table 3-13: Comparison of the Historical Crop Acreages

	1999	2000	2001	2002	2003	2004	2005	2010
Ag Commissioner[(a)]								
Field Crops	NA	NA	11,592	11,234	11,305	10,624	11,975	13,080
Vegetable/Root Crops	NA	NA	12,282	15,804	14,763	13,312	10,760	4,906
Fruits/Nut/Grapes Crops	NA	NA	2,866	1,947	1,955	1,920	2,117	603
Misc. Nursery	NA	NA	621	617	599	608	675	450
Antelope Valley Region Total	---	---	**27,361**	**29,602**	**28,622**	**26,464**	**25,526**	**19,040**

Notes:
(a) Acreages for Kern County were estimated using the ratios of LA County Ag to Kern County Ag from the Inspection Reports (from 2007 IRWMP).

Projected Agricultural Demand

Projected water year agricultural demand is summarized in Table 3-14. Projections assume that crop acreages will remain approximately the same as in 2016 with the understanding that some shifting of acreages between crops may occur, particularly during dry periods. Table 3-14 provides the estimates of agricultural water use for average and dry water years.

Table 3-14: Agricultural Water Use in the Antelope Valley Region

		Average Water Year		Dry Water Years	
Crop	**Acreage[(a)]**	**Gross Crop Water Requirements (AF/acre)[(b)]**	**Gross Water Demand (AFY)[(c)]**	**Gross Crop Water Requirements (AF/acre)[(b)]**	**Gross Water Demand (AFY)[(c)]**
Field Crops					
Alfalfa Hay	5,319	7.10	37,800	7.88	41,900
Grain Hay	3,852	3.07	11,800	3.84	14,800
Sudan Hay	1,090	3.07	3,300	3.84	4,200
Irrigated Pasture	480	6.87	3,300	7.65	3,700
Other Crops					
Onions	1,199	4.61	5,500	5.39	6,500
Fruits/Nuts/Grapes	219	4.61	1,100	5.38	1,200
Root Crops	519	3.57	1,900	4.35	2,300
Misc. Nursery (mostly sod)	1,067	7.32	7,800	8.09	8,600
Pistachios	444	1.33	600	2.11	900
Idle	1,321	0.00	0	0.00	0
Total	**16,000**		**73,000**		**84,000**

Notes: Totals rounded to the nearest 1,000 AF.
(a) Data from the Los Angeles Department of Agricultural Commissioner / Weights And Measures and the Kern County Farm Bureau. Acreage does not include land cultivated for recycled water purposes.
(b) From Farm Advisor gross crop water requirements specific to Antelope Valley Region.
(c) Acreage multiplied by crop water requirements.

3.1.2.4 Recycled Water Demand

Table 3-15 summarizes the existing and projected recycled water demand as listed in the 2014 SNMP for the Antelope Valley (Appendix G) and the UWMPs prepared for water providers in the Region. While expanded recycled water use in the Antelope Valley Region is highly likely, only current recycled water uses are included in this IRWM Plan's supply and demand calculations to show the need for increased end use of recycled water supply. Recycled water used for environmental and recreational area maintenance at Piute Ponds and Apollo Community Regional Park is not included in demands since it was excluded from the recycled water availability in Table 3-15. The Palmdale WRP currently has a permitted capacity of approximately 13,440 AFY to provide recycled water for agriculture, irrigation, and maintenance, and the Lancaster WRP has a permitted capacity of 20,163 AFY to provide recycled water for irrigation, agriculture, urban reuse, wildlife habitat, maintenance, and recreational impoundments. Approximately 350 AFY of recycled water was used in 2015.

Current demands for recycled water include those for the North LA/Kern County Regional Recycled Water Project with approximately 700 AFY used in 2015. The Division Street Corridor uses an average of 2 AFY (personal communication with Aracely Jaramillo, LACWD 40, August 2013) with approximately 3 AFY used in 2010. The Palmdale Regional Recycled Water Authority's water line to McAdam Park in Palmdale uses about 110 AFY (personal communication with Gordon Phair, City of Palmdale, November 6, 2013), but the Palmdale water line was not built until after 2010.

Although the two plants have a combined permitted capacity to provide 33,500 AFY of recycled water, this is not an accurate estimate of future recycled water supply since distributions systems and end users are required to make use of that supply. Thus, while Table 3-15 provides the anticipated future recycled water demand to be served by the backbone system, those supplies not currently in use are not included in the Plan's supply and demand calculations.

Another future user of recycled water in the Region includes the Palmdale Hybrid Power Plant. The recycled water demand estimate for this project is included in Table 3-15. The Palmdale Hybrid Power Plant Project involves the construction of a 570 mega-watt (MW) natural gas and solar thermal electricity generating facility that would use recycled water for its cooling water demands. It should be noted that the Palmdale Hybrid Power Plant constitutes new uses of water, meaning that supplying these facilities with recycled water would not offset potable water that is currently being used.

The 2013 IRWM Plan included recycled water demand projections for the RCSD WWTP. These projections were removed in the 2019 IRWM Plan update because construction to upgrade the tertiary treatment capacity is on hold indefinitely due to lack of funding and other economic considerations. Expected demands for the eSolar Sierra Sun Tower Power Plant, a solar thermal pilot project in the City of Lancaster, were also removed because the plant is currently non-operational.

Table 3-15: Summary of Current and Projected Recycled Water Use Demands (AFY) in the Antelope Valley Region

	2015	2020	2025	2030	2035	2040
North LA/Kern County Regional Recycled Water Project [(a)]	700	1,800	3,600	4,700	7,100	7,100
Palmdale Hybrid Power Plant [(b)]	3,200	3,200	3,200	3,200	3,200	3,200
Palmdale Regional Groundwater Recharge and Recovery Project [(c)]	---	2,000	4,000	4,000	4,000	4,000
Total Recycled Water Demand	**3,900**	**7,000**	**10,800**	**11,900**	**14,300**	**14,300**

Note: Demands do not include recycled water use for environmental maintenance.
Source:
(a) Salt and Nutrient Management Plan for the Antelope Valley, Table 3-4 (portion). 2035 projections are assumed to remain constant through 2040.
(b) PRWA 2015. 2035 projections are assumed to remain constant through 2040.
(c) PWD 2016.

3.1.2.5 Water Leaving

The final component to the Water Budget is water leaving the Antelope Valley Region. This includes water lost (either to evaporation or from subsurface flow) and water consumed. Total losses in the Antelope Valley Region have been estimated at approximately 10,000 AFY (USGS 1993). This estimate includes losses attributed to streambed wetting, riparian evapotranspiration, surface and soil evaporation, and diversions. However, further investigation and study are needed to more accurately determine the water losses in the Antelope Valley Region.

Surface Storage Evaporative/Conveyance Losses

There is an estimated conveyance loss of 9 percent for surface water deliveries (PWD 2001). Additionally, there are evaporative losses at the reservoir site. In the PWD 2001 Water Master Plan, evaporative loss was estimated using monthly data for the Antelope Valley Region and reservoir area-capacity curve. Evaporative losses were incorporated into the expected annual surface deliveries and therefore do not need to be accounted for separately.

Groundwater Storage Losses/Subsurface flow

Losses from evaporation and riparian evapotranspiration are discussed in Section 3.1.2.5 and have been included in the overall estimate of water loss for the water budget. Since the basin is a closed basin, losses from subsurface flow are assumed to be negligible for the purposes of this IRWM Plan.

3.1.3 Water Budget Comparisons

3.1.3.1 Average Water Year

Figure 3-9 and Table 3-16 provide a comparison of the supply and demand for the Antelope Valley Region for an average water year. It is assumed that water banks will only be replenished in average or wet years, and no banked groundwater supplies in the Westside Water Bank will be extracted to mitigate a mismatch in an average water year (if demand exceeds supply). It is assumed that Eastside Water Bank will provide supply reliability in an average year as groundwater will be replenished and extracted within the same year. For an average water year, supplies are projected to exceed demands through 2025. However, demands are projected to exceed water supplies beyond 2025 as a result of increased population growth coupled with reduced groundwater Production Rights prescribed in the Judgment. The reduction in Production Rights is shown as "Groundwater Reduction" in Figure 3-9 and does not represent an additional supply source. The range of mismatch between supply and demand is 5,800 AFY to 19,500 AFY. Because of the uncertainty in several supply and demand estimates, including SWP deliveries and projected demand, there is still potential for a larger deficit to occur.

Water purveyors are currently exploring opportunities to utilize new sources of water to augment the available water supplies in the Region. Developers in the Region are also required to secure additional imported water supplies to meet increased demands as a result of population growth. They may pay a fee for AVEK to increase their SWP Table A allocation, or developers may secure more imported water themselves. SWP water supplies would be conveyed using AVEK's distribution system. Alternatively, entities such as PWD and LACWD 40 may enter agreements for short-term and long-term water transfers (personal communication with Matt Knudson, AVEK, September 24, 2019). Water conservation measures may also be implemented to reduce regional water demands and bridge the mismatch between water supplies and demands. Additional projects and management actions to remedy any potential supply deficits are discussed in Section 5, Resource Management Strategies, and Section 6, Project Integration and Objectives Assessment.

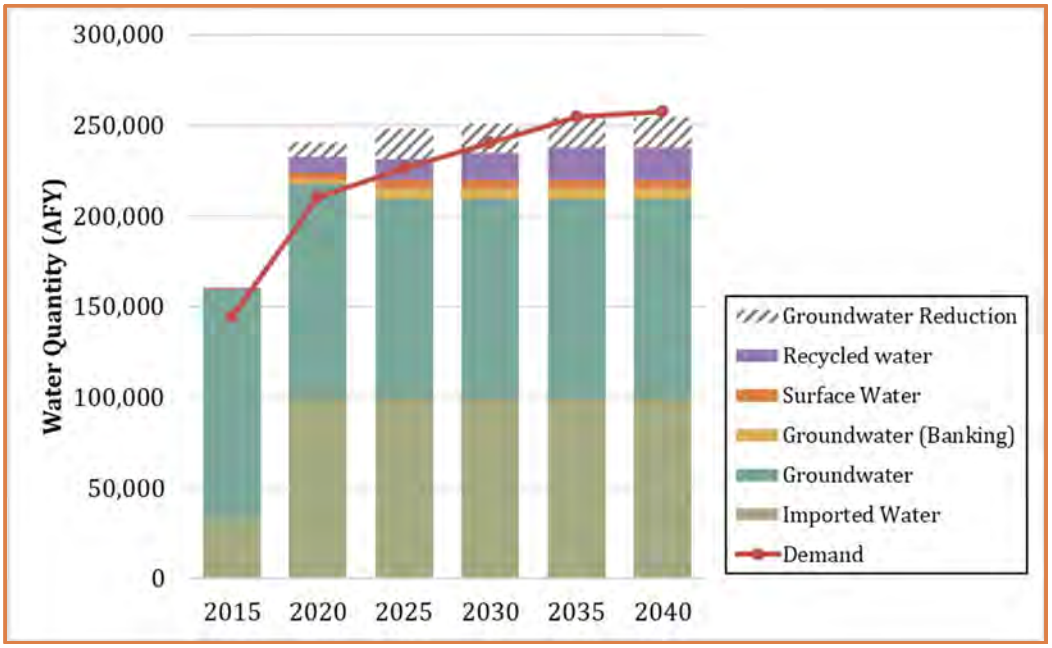
3.1.3.2 Single-Dry Water Year

Figure 3-10 and Table 3-17 provide a comparison of the supply and demand for the Antelope Valley Region for a single-dry water year. As shown by the comparison, future demand exceeds the existing and planned water supplies through 2040. For a single-dry water year, the range of mismatch between supply and demand is 51,300 AFY to 77,200 AFY. Though the Westside Water Bank currently has 73,750 AF of banked groundwater, this Plan assumes that a sufficient amount of wet years or water transfers will have occurred between dry year periods to keep the bank at full capacity of 120,000 AF by 2025 prior to a single-dry year. Because the duration of drought periods are unknown until the drought ends, AVEK estimates that the maximum withdrawal in any one year will only be one-third of the total banked supplies. It is also assumed that Eastside Water Bank will improve supply reliability in a single-dry year. Figure 3-10 assumes 26,600 AFY of water bank supply in 2020 and 45,700 AFY thereafter. It is possible that banked water will not be available during dry years, in which case the mismatch would be more severe (up to 122,900 AFY). Additional projects and management actions to remedy these supply deficits are discussed in Section 5, Resource Management Strategies, and Section 6, Project Integration and Objectives Assessment. These findings for a single dry year indicate the need to secure additional water supplies for the Region.

3.1.3.3 Multi-Dry Water Year

Figure 3-11 provides a comparison of the supply and demand for the Antelope Valley Region for a multiple-dry water year, and Table 3-18 provides a comparison of the supply and demand for the Antelope Valley Region for a multi-dry water year. Each year shown is assumed to be the average of a 4-year dry period. As shown by the comparison, future demand exceeds the existing and planned water supplies through 2040. For multi-dry water years the range of mismatch between supply and demand is 17,200 AFY to 49,700 AFY. It is assumed that the Eastside Water Bank will only provide supply reliability the first year of a 4-year drought. Though the Westside Water Bank currently has 73,750 AF of banked groundwater, this Plan assumes that a sufficient amount of wet years or water transfers will have occurred between dry year periods to keep the bank at full capacity of 120,000 AF by 2025 prior to a four-year dry period. The maximum banking capacity in the Westside Water Bank is currently 120,000 AFY; therefore it is assumed that approximately one-third of this amount would be used each year of the first three years of the 4-year dry period (40,000 AFY) and no banked groundwater supplies would be available for the fourth year of the 4-year dry period. Therefore, the Eastside and Westside water banks are assumed to provide, on average, 18,900 AFY in 2020 and 31,400 AFY thereafter in a 4-year drought. It is possible that banked water will not be available during a multi-dry year, in which case the mismatch would be more severe (up to 81,100 AFY). Additional projects and management actions to remedy these supply deficits are discussed in Section 5, Water Management Strategies, and Section 6, Project Integration and Objectives Assessment. These findings for a multi-dry year period indicate the need to secure additional water supplies for the Region.

Figure 3-9: Water Supply Summary for an Average Water Year



Note: “Groundwater Reduction” is the amount of groundwater production decreased as a result of the Judgment and therefore does not represent an additional supply source.

Table 3-16: Water Budget Comparison for an Average Water Year

	2015	2020	2025	2030	2035	2040
Groundwater						
Recharge + Return Flows (TSY)	126,300	118,100	110,000	110,000	110,000	110,000
Westside Water Bank (a)	0	0	0	0	0	0
Eastside Water Bank (b)	0	2,000	5,700	5,700	5,700	5,700
Direct Deliveries	33,000	99,500	99,500	99,500	99,500	99,500
Recycle/Reuse	350	8,700	11,900	15,100	18,300	18,300
Surface Water	500	4,000	4,500	4,500	4,500	4,500
Total Supply	**160,100**	**232,300**	**231,600**	**234,800**	**238,000**	**238,000**
Demands						
Urban Demand	71,700	137,500	153,600	167,600	181,700	184,500
Ag Demand	73,000	73,000	73,000	73,000	73,000	73,000
Total Demand	**144,700**	**210,500**	**226,600**	**240,600**	**254,700**	**257,500**
Supply and Demand Mismatch	**0**	**0**	**0**	**-5,800**	**-16,700**	**-19,500**

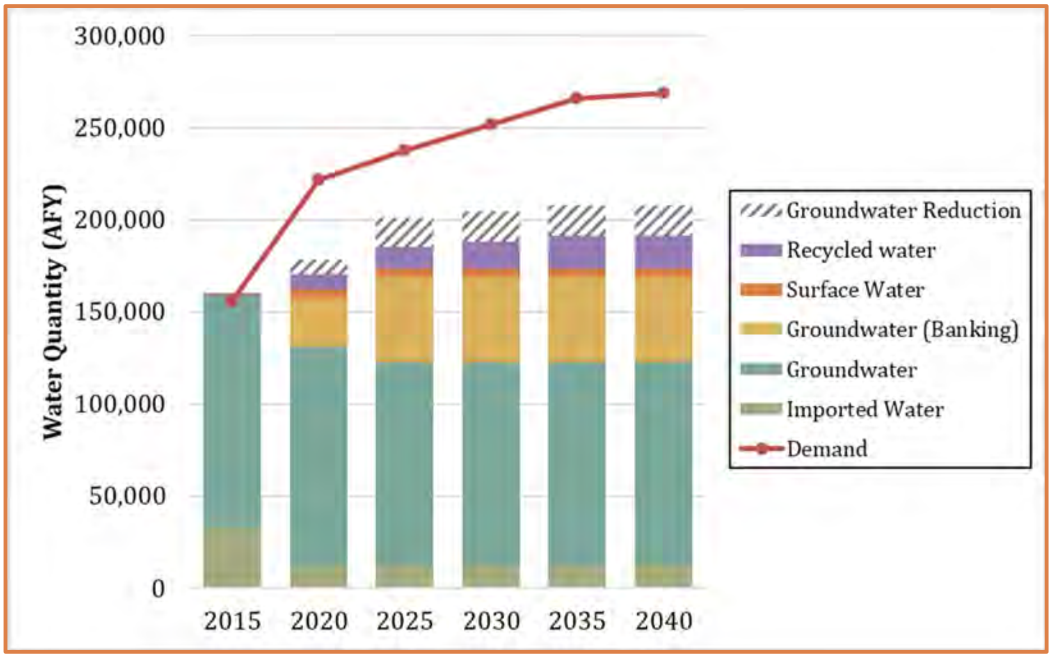
Notes: Values are rounded to the nearest 100.

(a) Assumes banked groundwater will not be used in an average year.

(b) Assumes banked groundwater supplies will be replenished and extracted the same year.

(c) 2015 deliveries represent actual deliveries in the Region; future projections assume the maximum Table A Amount available to the IRWM Region (160,452 AFY) multiplied by the SWP reliability of 62% for an average year.

Figure 3-10: Water Supply Summary for a Single-Dry Water Year



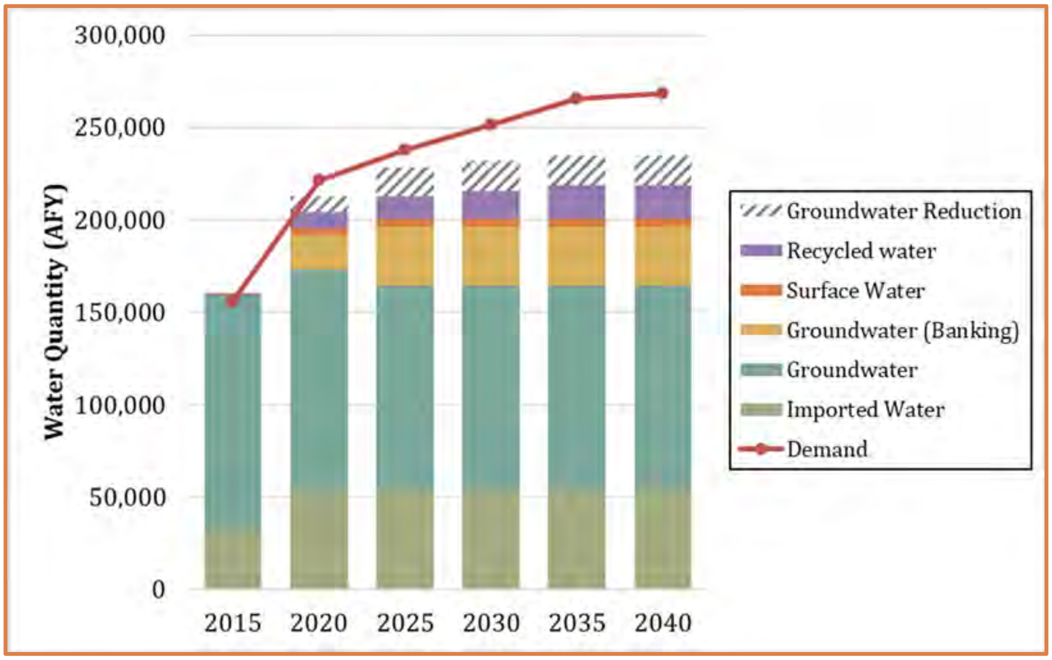
Note: "Groundwater Reduction" is the amount of groundwater production decreased as a result of the Judgment and therefore does not represent an additional supply source.

Table 3-17: Water Budget Comparison for a Single-Dry Water Year

	2015	2020	2025	2030	2035	2040
Groundwater Storage						
Recharge + Return Flows (TSY)	126,300	118,100	110,000	110,000	110,000	110,000
Westside Water Bank [a]	0	24,600	40,000	40,000	40,000	40,000
Eastside Water Bank [b]	0	2,000	5,700	5,700	5,700	5,700
Direct Deliveries [c]	33,000	12,800	12,800	12,800	12,800	12,800
Recycle/Reuse)	300	8,700	11,900	15,100	18,300	18,300
Surface Water	500	4,000	4,500	4,500	4,500	4,500
Total Supply	**160,100**	**170,200**	**184,900**	**188,100**	**191,300**	**191,300**
Demands						
Urban Demand	71,700	137,500	153,600	167,600	181,700	184,500
Ag Demand	84,000	84,000	84,000	84,000	84,000	84,000
Total Demand	**155,700**	**221,500**	**237,600**	**251,600**	**265,700**	**268,500**
Supply and Demand Mismatch	**0**	**-51,300**	**-52,700**	**-63,500**	**-74,400**	**-77,200**

Notes: Values are rounded to the nearest 100.
(a) Assumes periodic wet years have occurred to allow quantities of SWP deliveries above AVEK demands to fill the water bank.
(b) Assumes banked groundwater supplies will be replenished and extracted the same year.
(c) 2015 deliveries represent actual deliveries in the Region; future projections assume the maximum Table A Amount available to the IRWM Region (160,452) multiplied by the SWP reliability of 8% for a single-dry year.

Figure 3-11: Water Supply Summary for a Multi-Dry Water Year



Note: "Groundwater Reduction" is the amount of groundwater production decreased as a result of the Judgment and therefore does not represent an additional supply source.

Table 3-18: Water Budget Comparison for a Multi-Dry Water Year

	2015	2020	2025	2030	2035	2040
Groundwater Storage						
Recharge + Return Flows (TSY)	126,300	118,100	110,000	110,000	110,000	110,000
Westside Water Bank (a)	0	18,400	30,000	30,000	30,000	30,000
Eastside Water Bank (b)	0	500	1,425	1,425	1,425	1,425
Direct Deliveries (c)	33,000	54,600	54,600	54,600	54,600	54,600
Recycle/Reuse	300	8,700	11,900	15,100	18,300	18,300
Surface Water	500	4,000	4,500	4,500	4,500	4,500
Total Supply	**160,100**	**204,300**	**212,400**	**215,600**	**218,800**	**218,800**
Demands						
Urban Demand	71,700	137,500	153,600	167,600	181,700	184,500
Ag Demand	84,000	84,000	84,000	84,000	84,000	84,000
Total Demand	**155,700**	**221,500**	**237,600**	**251,600**	**265,700**	**268,500**
Supply and Demand Mismatch	**0**	**-17,200**	**-25,200**	**-36,000**	**-46,900**	**-49,700**

Notes: Values assume 4-year dry period begins in the year shown and are rounded to the nearest 100.
(a) Assumes periodic wet years have occurred to allow quantities of SWP deliveries above AVEK demands to fill the water bank. Full bank storage is evenly distributed over the first three years of the 4-year dry period, rounding to 40,000 AFY the first three years and 0 AFY the fourth year. This is an average of 30,000 AFY over the 4-year dry period.
(b) Assumes banked groundwater supplies will be available only the first year of a 4-year dry period.
(c) 2015 deliveries represent actual deliveries in the Region; future projections assume the maximum Table A Amount available to the IRWM Region (160,452) multiplied by the SWP reliability of 34% for a multi-dry year.

3.1.4 Regional Water Supply Issues and Needs

The water management issues consider and incorporate information contained in local plans, including but not limited to local UWMPs, the SNMP, and the PWD Strategic Plan. Supplemental information from other plans, however, is limited since many local plans rely on this Antelope Valley IRWM Plan for guidance. The key issues, needs, challenges, and priorities for the Antelope Valley Region with respect to water supplies include the following, which are discussed in greater detail below:

- Regional reliance on imported water;
- Groundwater use has not been managed in the past;
- Mismatch between supplies and demands
- Existing facility limitations; and
- Land subsidence effects

3.1.4.1 Reliance on Imported Water

As shown from the supply and demand comparisons, the Antelope Valley Region relies on SWP for approximately 42 percent of its total supply in an average year, approximately 25 percent of its total supply in a multi-dry year, and approximately 7 percent of its total supply in a single-dry year.

The availability of SWP supply is known to be variable. It fluctuates from year to year depending on precipitation, regulatory restrictions, legislative restrictions, and operational conditions, and is particularly unreliable during dry years. The DWR Capability Report (2017) anticipates that water deliveries during dry years could range between 8 percent of full Table A Amounts in a single dry year with 1977 conditions up to 34 percent of full Table A Amounts during a 6-year drought, as experienced between 1929 and 1934. The Antelope Valley Region likely cannot meet expected demands without imported water, and the variable nature of the supply presents management challenges to ensure flexibility.

3.1.4.2 Groundwater has not been Managed Historically

One of the more prevalent concerns in the Antelope Valley Region relates to management of the Antelope Valley Groundwater Basin. Groundwater has and continues to be an important resource within the Antelope Valley Region. As discussed in Section 2, groundwater has provided between 50 and 90 percent of the total water supply in the Antelope Valley Region since 1972 (USGS 2003). Projected urban growth, coupled with limits on the available local and imported water supply, are likely to continue to increase the reliance on groundwater.

Groundwater use in the Antelope Valley Groundwater Basin was not managed prior to the Basin's adjudication in 2015. As a result of years of unsustainable groundwater extractions, the Court determined that the Basin is in a state of overdraft. If the rampdown of groundwater production is not successfully implemented to meet the Native Basin Safe Yield, the basin will continue to be overdrafted and reduce the long-term viability of the groundwater supply.

3.1.4.3 Mismatch between Supplies and Demands

The population in the Antelope Valley is expected to increase through the planning horizon resulting in an increase in water demand. The 2013 IRWM Plan determined that decreases in estimated population growth had reduced the mismatch between supply and demand since the 2007 IRWM Plan. However, the recent groundwater use reduction mandated in the Judgment has once again reopened a gap between projected water supplies and demands for the Region. Water supply is still a limiting factor for the Region, especially during dry periods. In order to maintain supplies and meet the growing needs of the region, agencies will need to diversify the Region's water supply portfolio with additional imported sources, additional water conservation, additional recycled water, and groundwater recharge and recovery projects.

The Antelope Valley Region water agencies have typically relied on imported water and/or groundwater for their water supply needs. Currently, these water supplies are limited by SWP supply fluctuations, groundwater basin overdraft and the need for facility improvements. The water agencies and municipalities are pursuing various alternatives, such as recycled water and recharge programs, to decrease their vulnerability to short-term variances in imported water and groundwater sources.

SWP water reliability is a function of hydrologic conditions, state and federal water quality standards, protection of endangered species and water delivery requirements. Though the SWP contracts contain maximum Table A Amounts for each contractor, this is not a guarantee of how much imported water will be available for delivery each year.

Water agencies in the Antelope Valley Region cannot entirely rely on groundwater pumping because excessive pumping for many years has stressed the basin. According to the USGS, groundwater pumping in the Antelope Valley Region has exceeded the recharge rate in many years since the early 1920s (USGS 2003). As a result of the recent Judgment that established groundwater rights, groundwater users are expected to decrease groundwater pumping to meet the Basin's Native Safe Yield by the year 2023.

Additionally, as detailed below in Section 3.5, "Land Use Management Assessment" water is a limiting factor of the Antelope Valley Region's growth rate. In order to accommodate this projected growth, the supply of water in the Antelope Valley Region for dry and multi-dry year periods must be increased.

3.1.4.4 Limitations of Existing Facilities

In order to address the deficiency in supply, the water supply agencies in the Antelope Valley Region will need to modify existing infrastructure to accommodate an increase in delivery and storage capacity for new supply.

AVEK has capacity constraints in the summer and limited demand for water during the winter months. Thus, additional storage or recharge in the winter months is required in order for them to beneficially use their full Table A amount in some years. It may also be possible for some AVEK customers to regulate their water supply deliveries such that more could be taken during winter months when demands are typically low.

LACWD 40's facilities improvements will include well efficiency and rehabilitation projects, and reservoirs and pipelines throughout its system to meet current and projected water supply requirements. LACWD 40 is pursuing the use of recycled water as alternative source for irrigation and recharge purposes.

PWD's plan for improvements and expansion of its existing infrastructure was developed in its 2010 Strategic Water Resources Plan and supported in its 2018 Strategic Plan. According to the 2018 Strategic Plan, PWD is identifying additional water sources and opportunities to increase the reliability of water supply by investigating the potential to increase the storage capacity of Littlerock Reservoir, establishing groundwater recharge and water banking facilities, maximizing the use of recycled water (tertiary treated recycled water for irrigation and industrial/commercial uses), and implementing water conservation programs while simultaneously implementing the Antelope Valley Groundwater Adjudication Judgment. It also outlines a strategic initiative to ensure that the PRWA is fully operational by year 2020. PRWA's 2014 Recycled Water Facilities Plan details construction and operation of distribution pipelines and pumping facilities for expanding recycled water as a water supply option.

To meet long-term water demands, QHWD purchased land for additional wells. QHWD also plans to increase capacity at existing wells. There are no plans for QHWD to invest in recycled water in the near future because tertiary treatment and recycled water pipelines are too costly.

RCSD is evaluating projects that will contribute to a reliable source of supply and meet projected demands. Future water supply project plans will focus on expanding conservation efforts, requiring developers to pay for the purchase of groundwater rights, acquiring additional groundwater rights following implementation of adjudication, creating a combination of local surface spreading facilities to percolate intreated SWP water, and adding groundwater extraction facilities to recover stored water.

Furthermore, the current planned regional recycled water distribution system would only deliver water to M&I users and groundwater recharge projects. Additional infrastructure would be required to deliver recycled water to any potential agricultural users other than the LACSD effluent management sites or adjacent users.

3.1.4.5 Effects of Land Subsidence

Groundwater use in the Antelope Valley Region was at its highest in the 1950s and 1960s as a result of agricultural demands (USGS 2003). According to USGS, land subsidence in Antelope Valley Region was first reported by Lewis and Miller in the 1950s (USGS 1992). Since then, studies have shown subsidence levels of up to 7 feet occurring in some areas of Antelope Valley Region (see Figure 3-12). Conversations held with various agencies and companies indicate that within the Antelope Valley Region, the Lancaster and EAFB areas are currently experiencing problems or damages that appear to be related to land subsidence (see Figure 3-13). EAFB has been actively involved in projects aimed at preventing future land subsidence. The adjudication process has as one of its primary goals the permanent stabilization of groundwater levels and prevention of overdraft.

Land subsidence results in the following impacts:

- Development of cracks, fissures, sink-like depressions and soft spots.
- Change in natural drainage patterns often resulting in increased areas of flooding or increased erosion.
- Degradation of groundwater quality.
- Permanent reduction in groundwater storage capacity.
- Change in gradient in gravity pipelines (sanitary and storm sewers) or canals often resulting in lost capacity.
- Damage to well casings, pipelines, buildings, roads, railroads, bridges, levees, etc.
- Costs associated with repairs and rebuilding.
- Costs associated with construction of new facilities such as pumping stations for gradient changes.
- Reduction in land value.
- Legal actions.
- Increased pumping costs.

Table 3-19 lists land subsidence problems identified in Antelope Valley Region.

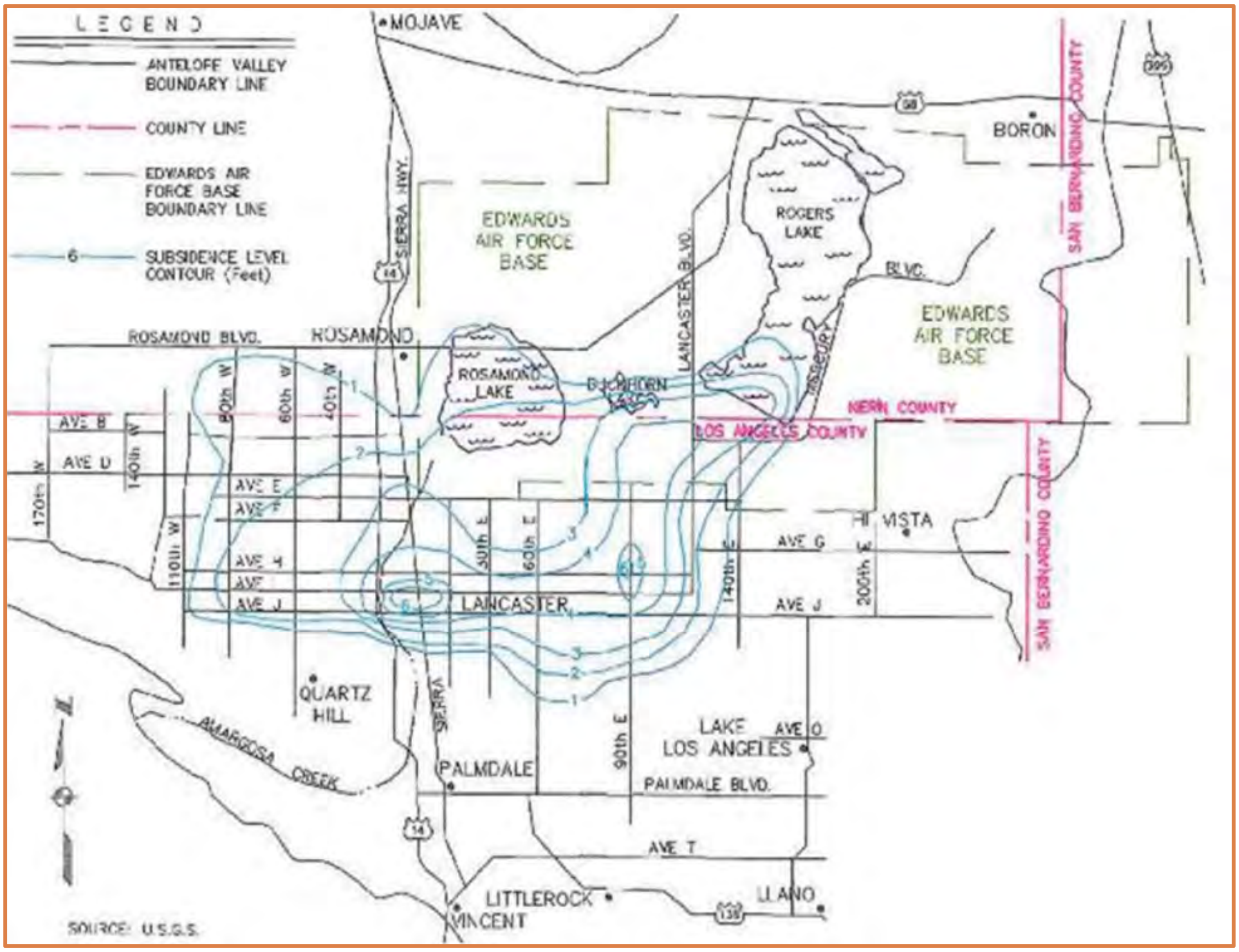
The following paragraphs present brief discussions on several studies done on land subsidence in the Antelope Valley Region.

Geolabs, February 1991. A study done by Geolabs - Westlake Village (1991) studied a 10 square mile area in Lancaster identified to have fissures and sink-like depressions (see Location 2 on Figure 3-15). The report identified fissures ranging in width from one inch to slightly over one foot. The lengths of the fissures ranged mainly between 50 to 200 feet, with the longest continuous fissures in the 600-700 foot range. Sinkholes ranged mainly between one to five feet deep and less than four feet in diameter. One sinkhole measured 20 feet long and 15 feet wide. The report concluded that the fissures were due to tensional forces created by subsidence, which may be related to groundwater withdrawal due to the correlation between areas of significant subsidence and areas of pronounced groundwater level decline. Areas of concern identified in the report are included in Table 3-19.

USGS Report 92-4035. USGS (1992) reported that as much as 2 feet of land subsidence had affected Antelope Valley Region by 1967 and was causing surface deformations at EAFB. Fissures, cracks and depressions on Rogers Lake were affecting the use of the lakebed as a runway for airplanes and space shuttles. In addition, depressions, fissures and cracks on the lakebed may not be detected until aircraft or space shuttles exceed the load capacity of the soil. Another concern was potential contamination of the water table through fissures which can provide direct access for toxic materials.

To determine the significance of land subsidence conditions, benchmarks were surveyed using a Global Positioning System (GPS) in 1989. Differential levels were surveyed for 65 benchmarks from 1989 to 1991. It was discovered that total land subsidence ranged from 0.3 to 3.0 feet.

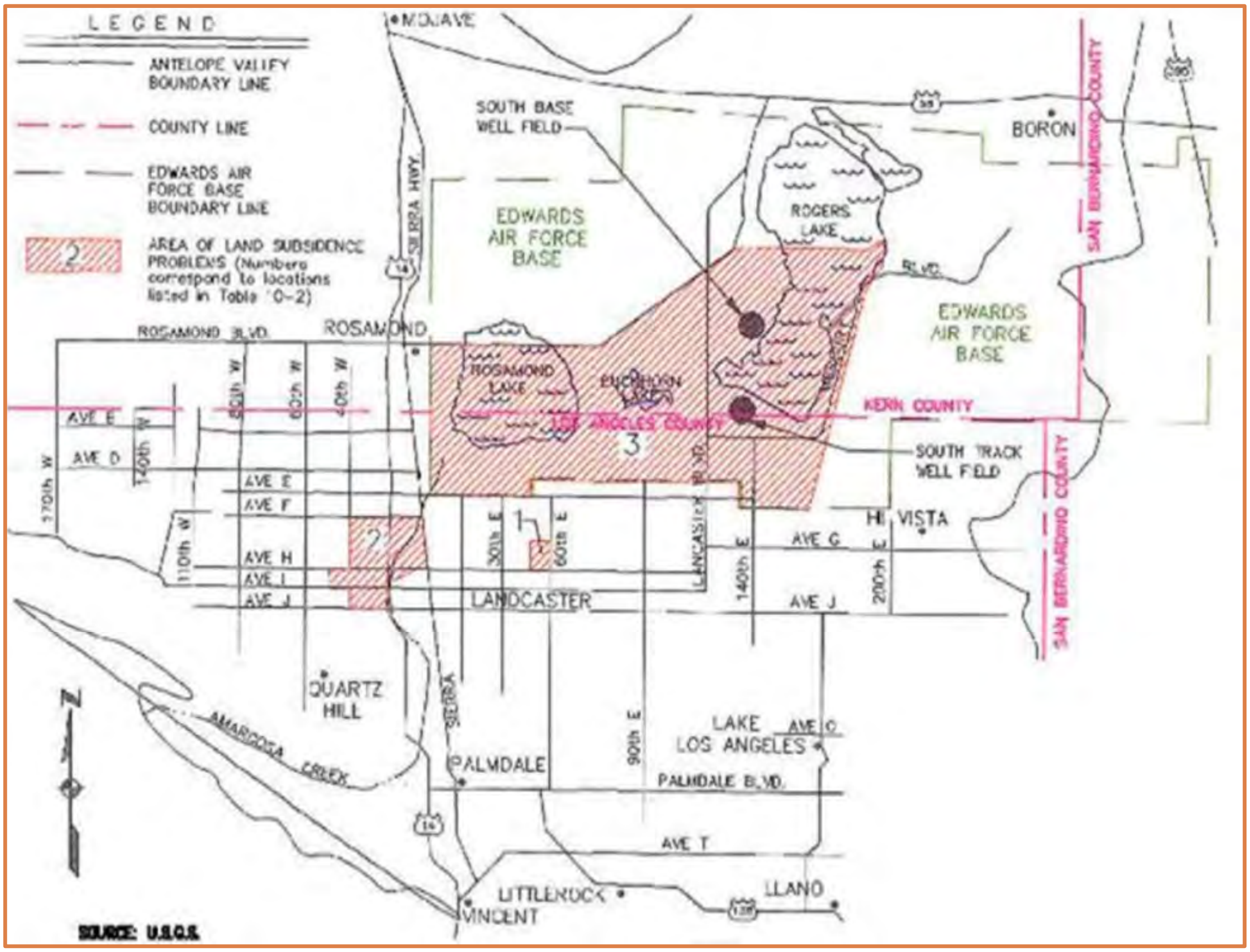
Figure 3-12: Subsidence Levels in the Antelope Valley Region



USGS Report 93-4114. USGS (1993b), reported that land subsidence effects had been noted on Rogers Lake in the form of depressions, fissures and cracks. The report identified pumping of groundwater as the cause of the land subsidence. As much as 90 feet of groundwater level decline has occurred in the South Base well field, and an average annual compaction rate of 5.57×10^{-2} feet was measured at the Holly site near the South Track well field (see Location 3 on Figure 3-15).

USGS 1994 Draft Report. USGS (1994) revealed that land subsidence throughout Antelope Valley Region has reached nearly 7 feet. As shown on Figure 3-15, USGS indicated that subsidence levels of 6.6 feet have occurred near Avenue I and Division Street, and Avenue H and 90th Street East. The draft report stated that there was a general correlation between groundwater level declines and the distribution and rate of subsidence. In addition, the report estimated a conservative loss of approximately 50,000 AF of storage in the groundwater subbasin in the area that has been affected by 1 foot or more of land subsidence.

Figure 3-13: Areas of Potential Land Subsidence in the Antelope Valley Region



1995 Water Resource Study. In addition to reviewing the reports summarized above, companies and agencies within the Antelope Valley Region were surveyed regarding potential damages attributable to groundwater level declines and field visits of affected areas were conducted. Companies and agencies surveyed include the following:

- AVEK
- Calnev Pipelines
- Lancaster, Redevelopment Center
- Lancaster, Road Maintenance Department
- Palmdale, Engineering Department
- Palmdale, Road Maintenance Department
- LACSD
- EAFB
- Kern County Flood Plain Management Section
- Los Angeles County Waterworks District, Sewer Department
- RCSD

- Southern California Gas Company
- Southern Pacific Railroad
- State Fire Marshall, Pipeline Safety Division

2014 Groundwater-Flow and Land-Subsidence Model of Antelope Valley, California. To project the future impacts of groundwater pumping in the Basin, the USGS developed a land-subsidence model of Antelope Valley in cooperation with the LACDPW, AVEK, PWD, and EAFB. Results of the model simulations indicated that simulated groundwater extractions exceeded recharge in most years, causing compaction of aquitards and resulting in land subsidence. The model demonstrated land subsidence occurred throughout almost the entire Lancaster subbasin between 1915 and 2005, with a maximum of about 9.4 ft in the central and eastern parts of the subbasin. The model simulated future pumping scenarios based on the Judgment and determined that land subsidence will persist in the study area, though artificial recharge may help reduce the magnitude and extent of land subsidence (USGS 2014).

Antelope Valley Watermaster 2017 Annual Report. An analysis of satellite-based interferometric synthetic aperture radar data indicated an additional 0.2 to 0.6 feet of land subsidence occurred between 1993 to 2005 in sections of the subsidence-prone area. This determined that land subsidence from groundwater level declines can be a relatively slow process and continue for years after the pore pressure changes have occurred (Watermaster 2018).

Table 3-19: Land Subsidence Concerns for the Antelope Valley Region

Location	Description	Maximum Subsidence (ft)	Problems/Damages/Concerns
1	Area bounded by 50th and 60th Streets east and Avenues G and H (T7N-R11W-S3)	3-4	• Development of cracks and fissures
2	Northwest portion of Lancaster	4-5	• Development of cracks and fissures in the following areas of concern: • In the vicinity of KAVL and KBVM radio towers near the proposed site for High Desert Hospital complex • East of a residential project at the southeast corner of 30th St. West and Ave. "I" • In the vicinity of LA County Detention Facility south of Ave. "I" • The "H" Street Bridge over Amargosa Creek where up to 4" of lateral separation is present across the central expansion joint[a].
3	EAFB	3.3	• Failure of several well casings. • Increase in area subject to flooding. • Structural damage to wastewater treatment plant building. • Wells protruding above the ground. • Development of cracks, fissures, sinkholes and softspots on Rogers Lakebed, affecting use of the lakebed as a runway for planes and space shuttles.

Note:
(a) Geolabs reports that the separation may be due to differential settlement or, may be related to the same mechanism which is causing the fissuring in the area.

Other than the damages identified in the reports summarized above, structural damage to the wastewater treatment plant building on EAFB was the only other potentially significant damage identified and may or may not be attributable to land subsidence. Other minor existing damage that may or may not be attributable to groundwater level declines includes cracked sidewalks and pavement. To assess existing and potential degradation to the groundwater supply, an attempt was made to correlate typical stormwater runoff constituents and similar constituents in the groundwater supply. The hypothesis was that areas of fissuring should show higher degrees of contamination if runoff was reaching the aquifers through the fissures.

The Los Angeles County Watershed Management Division monitors surface water; however, it does not monitor typical stormwater constituents, only general minerals. Therefore, it is currently unknown whether groundwater degradation due to subsidence is occurring in the Antelope Valley Region. However, should fissuring continue, degradation to the groundwater supply could be a potential problem and should be investigated. Individual water purveyors servicing the area where fissuring is occurring may test for some of the constituents found in stormwater, from which data may be obtained.

In addition to subsidence-related problems, groundwater level declines of up to 200 feet in the Antelope Valley Region have resulted in increased pumping costs. USGS (1994) cites the increased pumping costs as the primary reason for a decline in agricultural production during the 1970s.

USGS has established a network of 85 elevation benchmarks for monitoring subsidence. In addition, three extensometers have been installed at EAFB to measure land subsidence directly. However, other than at EAFB, there is no formal subsidence monitoring program to analyze subsidence on an ongoing basis. The Watermaster Engineer is currently using the water level monitoring program as a proxy for subsidence monitoring. It is recommended that monitoring of subsidence levels groundwater levels continue in the Antelope Valley Region as indicators of future problems due to subsidence and current progress toward balancing groundwater use. Monitoring of groundwater quality for typical stormwater constituents in areas of fissures is recommended as an indicator of the degradation potential due to fissures.

3.2 Water Quality

Water quality is a major concern in the Antelope Valley Region. The Region's dependence on its groundwater source makes it vital that the quality of the groundwater be protected. With the increase of groundwater recharge projects, which are essential to ensuring the availability of groundwater and preventing land subsidence, it is crucial to monitor the quality of the recharged imported, local surface and recycled water. Water quality management in the Antelope Valley Region is therefore focused on maintaining and improving existing water quality and preventing future contamination.

3.2.1 Local Groundwater Quality

Groundwater quality in the Antelope Valley Region is excellent within the principal aquifer but degrades toward the northern portion of the dry lakes areas. The groundwater is typically characterized by calcium bicarbonate near the surrounding mountains and is characterized by sodium bicarbonate or sodium sulfate in the central part of the basin (Duell 1987 as cited in DWR 2004). In the eastern part of the basin, the upper aquifer has sodium-calcium bicarbonate type water and the lower aquifer has sodium bicarbonate type water (Bader 1969 as cited in DWR 2004). Considered to be generally suitable for domestic, agricultural, and industrial uses, the water in the principal aquifer has a TDS concentration ranging from 200 to 800 mg/L. The deep aquifer typically has a higher TDS level. Hardness ranges from 50 to 200 mg/L, and high fluoride, boron, nitrates, chromium and antimony are a problem in some areas of the basin. The groundwater in the basin is used for both agricultural and M&I purposes (SNMP 2014).

Arsenic is closely monitored in the Region. It is a naturally occurring inorganic contaminant often found in groundwater and occasionally found in surface water. Anthropogenic sources of arsenic include agricultural, industrial and mining activities. Arsenic can be toxic in high concentrations, and is linked to increased risk of cancer when consumed for a lifetime at or above the regulated MCL. Arsenic levels above the MCL of 10 ppb have been observed in the Antelope Valley Region, primarily in the northern and eastern areas of the Region. Twenty LACWD 40 wells have tested above the MCL. Of the twenty wells, one is not in use and the remaining are blended, with lower arsenic concentrated groundwater or surface water, to concentrations below 8 ppb or 80 percent of the MCL. QHWD has also observed levels above the MCL in a number of wells and utilizes the same blending method to manage arsenic levels. Similarly, RCSD has observed levels of arsenic in the range of 11 to 14 ppb in three (3) of its wells. RCSD is utilizing similar methods to LACWD 40 to manage arsenic levels so that delivered water meets the arsenic MCL. PWD has arsenic levels below 3 ppb or at Non-Detect (ND) concentrations. In total, there are 97 wells in the Basin that have reported concentrations above the arsenic MCL, reaching concentrations of up to 320 ppb near North Edwards. To date, most of the drinking water wells with elevated concentrations of arsenic have been shut down. The Salt and Nutrient Management Plan (SNMP) completed in 2014 does not anticipate that the existing arsenic problem will lead to future loss of groundwater as a supply for the Antelope Valley Region. Though arsenic is an issue in some DAC areas such as Boron, arsenic is generally expected to remain within an acceptable range over the next 25 years. Therefore, no new implementation measures are currently recommended to address the contamination.

An emerging contaminant of concern is hexavalent chromium or chromium-6. Chromium-6 can occur naturally in the environment from the erosion of natural chromium deposits, but can also be produced by industrial processes where it is used for chrome plating, dyes and pigments, and leather and wood preservation. This element has been known to cause cancer when inhaled and has also been linked to cancer when ingested. California set a public health goal (PHG) of 0.02 ppb for chromium-6 and adopted an MCL of 10 ppb in 2014. However, the chromium-6 MCL for drinking water was revoked in 2017 because the CDPH failed to consider the economic feasibility of compliance when adopting the MCL. More than 200 wells belonging to various agencies have tested in excess of the suggested PHG within the last ten years, with concentrations ranging up to 170 ppb in Willow Springs. These chromium-6 exceedances, however, cannot be attributed to specific anthropogenic emissions because hexavalent forms of chromium mainly originate from natural sources like rocks and soils in the Antelope Valley Groundwater Basin (LACWD and LACSD 2014). Because chromium-6 is a naturally occurring contaminant and there is no chromium-6 MCL to guide cleanup efforts, remediation projects are futile at this point. Nonetheless, these wells are and will continue to be monitored as the state moves forward with the adoption of a new MCL. Remediation actions to address the contamination will be identified in the future as new information and data becomes available (SWRCB 2017).

Perchlorate is also a pollutant of concern that is naturally occurring in some fertilizers and is used in the production of airbags, rockets, missiles, fireworks, matches, and other explosives. Levels above the MCL of 6 ppb present a public health concern as they can decrease production of the thyroid hormone, interfering with hormones needed for regulating heart rate, blood pressure, body temperature, and metabolism. Perchlorate can also affect prenatal and postnatal growth and development of the central nervous system. Within the past decade, two wells in the Region tested for perchlorate levels above the MCL of 6 ppb and 9 tested above the PHG of 1 ppb. Both MCL exceedances were reported at the Palmdale Regional Airport with one reporting a concentration of 17 ppb. Transportation, agricultural practices, and military activities have likely contributed to the elevated perchlorate levels (SWRCB 2017). Though there have been a few MCL exceedances in the Basin, perchlorate contamination is not a prevalent issue in the Antelope Valley Groundwater Basin as no MCL exceedances have been recorded within the last 5 years. Therefore, there is no need for additional remediation activities in the Basin.

In addition to arsenic, perchlorate, and chromium-6 issues, there have also been concerns with nitrate levels above the current MCL of 45 ppm and high TDS levels in portions of the Basin. Groundwater monitoring data from the mid-to-late 1990s indicate nitrate (as NO_3) concentrations periodically exceeding the primary MCL for drinking water of 45 ppm in two wells located in the southern portion of the groundwater basin near the Palmdale WRP. Six wells in Lancaster and Palmdale have also exceeded the nitrate (as N) MCL of 10 ppb within the past decade. Agricultural fertilization practices and discharge of treated wastewater has likely contributed to the elevated levels. Actions have already been implemented by LACSD to address these concerns and to minimize any impact from treated wastewater, including, treatment upgrades, a change in effluent management practices, the implementation of a recycled water distribution system, and performing groundwater remediation activities near the Palmdale WRP site.

3.2.2 Imported Water Quality

DWR must monitor the effects of diversions and SWP operations to ensure compliance with existing water quality standards, in particular the maintenance of salinity levels in key parts of the Delta to help maintain its natural ecosystem. DWR also regulates the quality of non-Delta water entering the SWP, known as "non-project turn-ins". These non-project turn-ins typically originate as groundwater, and in particular "pump back" projects that store imported water in groundwater banks, though other waters include excess surface flows or flood waters. DWR requires the proponents of any turn-in proposal to demonstrate that the water is of consistent, predictable and acceptable quality and that the comingled water does not result in a diminution of SWP water quality (DWR 2012a).

The current water quality conditions in the California Aqueduct (data taken from Station KA024454, Check 29 near Lake Webb) are compared to the current federal primary and secondary drinking water standards and are provided in Table 3-20 . It is important to note that while some constituents do not have a primary MCL (bromide, total organic carbon, TDS, and chloride) high levels of these constituents can be of concern, especially with regard to potential treatment costs to downstream users.

3.2.2.1 Imported Water Quality Infrastructure

SWP water is treated by PWD's treatment plant for use by PWD and LCID, and by the four AVEK facilities (Quartz Hill WTP, Eastside WTP, Rosamond WTP, and Acton WTP) prior to delivery to the other water purveyors.

PWD's water treatment plant (the Leslie O. Carter Water Treatment Plant) is a conventional design plant using chlorine as the disinfectant and has a permitted capacity of 28 mgd. Screening and metering are provided at the outlet of Palmdale Lake and head of the plant, followed by treatment chemical addition, flash mixing, three-stage tapered energy flocculation, clarification utilizing plate settlers and sediment removal systems, multi-media filters, and disinfection. Treated water is stored in a 6 million-gallon reservoir, which supplies water into the distribution system. Decanted water from the solids removal process is returned to Lake Palmdale. The plant is currently undergoing a second phase of improvements designed to meet Stage II Disinfection-by-Products regulations. Improvements include additional filters and adding granulated activated carbon contactors to the processes. This will allow the continued use of chlorine as the disinfectant and increase the capacity to 35 mgd.

Table 3-20: Comparison of SWP Water Quality Criteria (2019) to SWP Actual Data

Constituent	SWP Water Quality Data (Sta. KA030341)[a]			Current Drinking Water Standards (2019)
	Max.	Min.	Avg.	
Aluminum (ug/L)	0.01	<0.01	<0.01	50 - 200
Antimony (Dissolved) (ug/L)	<1	<1	<1	6
Arsenic (Dissolved) (ug/L)	8	1	2	10
Barium (Dissolved) (ug/L)	8	2	3	2000
Beryllium (Dissolved) (ug/L)	<1	<1	<1	4
Boron (Dissolved) (ug/L)	400	<100	110	No standard
Bromide (Dissolved) (ug/L)	370	30	184	No standard
Cadmium (Dissolved) (ug/L)	<1	<1	<1	5
Chloride (Dissolved) (mg/L)	121	10	61	250[b]
Chromium (Total) (mg/L)	0.005	0.001	0.002	0.1
Copper (Dissolved) (ug/L)	3	<1	1.5	1,000
Iron (ug/L)	38	5	16	300[b]
Manganese (ug/L)	<5	<5	<5	50[b]
Mercury (inorganic) (ug/L)	<0.2	0	<0.2	2
Nickel (Dissolved) (ug/L)	2	<1	1.2	No standard
Nitrate as N (mg/L)	14.4	<0.1	2.5	10
Selenium (dissolved) (ug/L)	1	<1	<1	50
Silver (ug/L)	<1	<1	<1	100[b]
Specific Conductance (uS/cm)	623	121	406	No standard
Sulfate (Dissolved) (mg/L)	109	9	34	250[b]
TDS (mg/L)	363	75	229	500[b]
Total Organic Carbon (mg/L)	6	0.8	3.5	No standard
Zinc (dissolved) (ug/L)	<5	<5	<5	5,000[b]

Notes:

(a) SWP Water Quality data collected by DWR between 1/1/2016 and 12/31/2018.

(b) Denotes secondary standard.

The Quartz Hill WTP was the first plant built by AVEK. The treatment plant receives water by gravity flow from the California Aqueduct. Screening and metering are provided at the head of the plant, followed by treatment chemical addition, flash mixing, tapered energy flocculation, clarification utilizing traveling bridges for sediment removal, dual media filters, and disinfection. Treated water is stored in a 9.2 million-gallon reservoir which supplies water by gravity into the distribution system. Decanted water from the solids removal process is returned to the plant influent. After the completion of a recent expansion, the Quartz Hill WTP became capable of producing 90 mgd of potable water for consumers.

Expansion of the Eastside WTP located between Littlerock and Pearblossom to 10 mgd was completed in late 1988. It can now serve the needs of about 44,000 consumers.

The 14 mgd Rosamond WTP was established to support the needs of consumers in southeastern Kern County, an area that includes Rosamond, Mojave, California City, EAFB and Boron. Rosamond WTP is capable of providing water for 60,000 consumers.

The 4 mgd Acton WTP was completed in 1989. Water is pumped from the plant site near Barrel Springs Road, on Sierra Highway, to Vincent Hill Summit. From there it is pumped into a Los Angeles County Waterworks pipeline for transport to the Acton area. The plant's capacity is sufficient to supply the needs of 17,000 consumers.

3.2.3 Wastewater and Recycled Water Quality

Tertiary treated effluent from the Region's three water reclamation plants will be of sufficient quality to meet unrestricted use requirements. It may then be used for irrigating landscapes of freeways, parks, schools, senior complexes and new home developments. The effluent will also meet all Waste Discharge Requirements (WDRs). Revised WDRs for the Lancaster WRP were issued in 2006 and in 2011 for the Palmdale WRP. For recharge of recycled water, blending or additional water quality requirements may be needed. The management of TDS and nutrients from recycled water is addressed by the SNMP for the Antelope Valley, which was developed in parallel with the 2013 IRWMP Update. Recycled water from the EAFB Air Force Research Laboratory Treatment Plant and the Main Base WWTP is not included in this discussion of recycled water quality since all water is used on the base.

3.2.4 Local Surface Water and Stormwater Runoff Quality

Littlerock Reservoir, jointly owned by PWD and LCID, is the only developed surface water source in the Antelope Valley Region. The reservoir discharges to Lake Palmdale via the Palmdale Ditch and the water is ultimately treated by PWD's WTP. Lake Palmdale also receives water directly from the SWP. The quality of the water in Lake Palmdale is considered good.

The Basin Plan for the Lahontan Region contains a specific ammonia objective for Amargosa Creek downstream of the LACSD 14 discharge point, and to the Piute Ponds and associated wetlands based on the USEPA 1999 freshwater criteria for total ammonia. This objective is pH and temperature dependent and shall not exceed the acute and chronic limits more than once every three years, on average. In addition, the highest four-day average concentration for total ammonia in a 30-day period cannot exceed 2.5 times the chronic toxicity limit.

The management of TDS and nutrients from imported water is addressed by the SNMP for the Antelope Valley.

3.2.5 Regional Water Quality Issues and Needs

The key issues, needs, challenges, and priorities for the Antelope Valley Region with respect to water quality include the following, which are discussed in greater detail below:

- Concern for meeting water quality regulations;
- Closed basin with no outfall for discharge;
- Must provide wastewater treatment for growing population;

3.2.5.1 Concern for Meeting Water Quality Regulations

The Region has a number of concerns regarding water quality regulations, including: (1) meeting water quality regulations for groundwater recharge, (2) meeting ever-evolving regulations, and (3) contaminants of concern.

Meeting Water Quality Regulations for Groundwater Recharge

There are a variety of source waters that could be available for recharge into the groundwater of the Antelope Valley Region. They include, but are not limited to:

- State Water Project:
  - Treated potable water
  - Untreated raw water direct from the California Aqueduct

- Reclaimed Water (for spreading only or blending):
    - Tertiary treated
- Captured Stormwater

The water quality of the recharged water depends on which supply is used. There are restrictions to the quality of the water recharged as outlined in the Lahontan RWQCB Basin Plan. Recharge source water would need to meet these requirements before recharge could occur. Additionally, requirements are stricter for water that is injected versus water that is percolated. Water that LACWD 40 recharged through its ASR program met the RWQCB's water quality requirement.

Meeting Evolving Regulations

In response to groundwater quality concerns, the RWQCB Lahontan Region is revising the WDRs for WRPs in the Antelope Valley Region. For example, the WDR for Palmdale WRP has been amended (Board Order R6V-2011-0012) to limit the reuse of secondary-treated effluent to only certain agricultural sites, and to list effluent concentration limits for both secondary and tertiary treated effluent. The ability to comply with these evolving regulations has been both economically and technologically challenging.

Contaminants of Concern

Contaminants such as arsenic, nitrate, perchlorate, and potentially chromium-6 will require water suppliers, WRPs, and WTPs to conduct routine monitoring and sampling of their systems and could impact their treatment methods. The ability to remove these contaminants also has a positive economic impact on the agricultural community since it reduces the impact to crops. It also benefits the WRPs and WTPs striving for compliance with more stringent WDRs.

3.2.5.2 Closed Basin with No Outfall for Discharge

As described in Section 2, the Antelope Valley Groundwater Basin is a closed topographic basin with no outlet to the ocean. Therefore, any treated effluent (recycled water) generated in the Antelope Valley Region must be percolated, reused, evaporated, or transpired by plants. This places great responsibility on the wastewater treatment providers in the Antelope Valley Region to provide alternative effluent management methods while still being compliant with their WDRs.

3.2.5.3 Must Provide Wastewater Treatment for Growing Population

Population increases in the Antelope Valley Region will result in higher wastewater flow rates and the need to provide additional wastewater treatment and effluent management capacity. As mentioned above, the groundwater basin is a closed basin, so all treated effluent must be managed (e.g., reuse, evaporation, and percolation) and cannot simply be discharged to an ocean outlet. Wastewater projections through the planning period are indicated above in Section 3.1.4.

3.3 Flood Management

The Antelope Valley Region is a closed watershed without a natural outlet for storm water runoff (LACDPW 1987). Precipitation in excess of 12 inches in the surrounding mountains creates numerous streams that carry highly erodible soils onto the valley floor, forming large alluvial river washes (Rantz, 1969 as cited in USGS 1995). Larger streams, including Big Rock Creek, Littlerock Creek, Amargosa Creek, Cottonwood Creek, and Anaverde Creek then meander across the alluvial fans in poorly-defined flow paths that change from storm event to storm event.

Stormwater runoff that does not percolate into the ground eventually ponds and evaporates in the impermeable dry lake beds at EAFB near the Los Angeles/Kern County line (LACDPW 1987). The 60 square mile playa is generally dry but is likely to be flooded following prolonged precipitation. Fine sediments carried by the stormwater inhibit percolation as does the impermeable nature of the playa soils (LACDPW 1987). Historical flooding has shown surface water to remain on the playa for up to five months until the water evaporates (LACDPW 2006).

Portions of the Antelope Valley floor are subject to flooding due to runoff from the nearby foothills (City of Lancaster 1997). The flooding sometimes exceeds the capacities of the limited drainage facilities and engineered flood channels. Examples of existing flood control facilities include the engineered channels and retention basins on Amargosa Creek. Storms of a 20-year frequency or greater can overflow these facilities (LACSD 2005). There is also a flood retention basin along Anaverde Creek; and when this basin is overtopped, flooding occurs in the vicinity of 20th Street East, 30th Street East, and Amargosa Creek. Summer thunderstorms also increase the potential for flash floods, creating a yearlong potential problem.

Following severe flooding in the Antelope Valley Region in 1980, 1983, and 1987, the LACDPW prepared the “Antelope Valley Comprehensive Plan of Flood Control and Water Conservation.” This plan proposed floodplain management in the hillside areas, structural improvements in the urbanizing areas and non-structural management approaches in the rural areas. In the hillside areas, the plan recommended restricting development to areas outside of entrenched watercourses. In the areas prone to flooding, the plan recommended improvements such as open channel conveyance facilities and storm drains through communities as well as detention and retention basins located at the mouths of the large washes (LACDPW 1987).

Both the City of Palmdale and the City of Lancaster have incorporated major elements of the LACDPW comprehensive plan into their own planning efforts; however, there are no identified funding mechanisms or schedule for major improvements except in the established areas of Palmdale, Lancaster, and along Amargosa Creek (City of Lancaster 2009, LACDPW 2004, City of Palmdale 2018). The cities have annexed portions of Los Angeles County, which coupled with a gradual decrease in housing construction since the early 1990s has limited County revenue from developer fees necessary to fund the construction of facilities in unincorporated areas of the Region.

In 1991, LACDPW teamed with the cities and unincorporated communities on a ballot measure whereby the portion of the Antelope Valley Region that lies within Los Angeles County would be included within the Los Angeles County Flood Control District, or a new Antelope Valley Flood Control District would be formed (LACDPW 2004). That measure failed as did a similar measure in Kern County; new measures proposed regionally in 2006 also failed. The lack of coordinated flood control is problematic and flooding will continue to increase in severity as urban development and associated impervious surfaces increase the potential amount of runoff and local flooding.

3.3.1 Regional Flood Management Issues and Needs

The key issues, needs, challenges, and priorities for the Antelope Valley Region with respect to flood management include the following, which are discussed in greater detail below:

- Lack of coordination throughout Antelope Valley Region;
- Poor water quality of runoff;
- Nuisance water and dry weather runoff;
- Difficulty providing flood control without interfering with groundwater recharge;
- Habitat and dry lakebed requirements to protect natural processes;
- Baseline flooding and sediment/erosion not well defined;
- No development guidelines for alluvial fans;

- Protection of habitat processes and sensitive habitats which rely on surface flow such as Antelope Valley Significant Ecological Areas (SEA), Piute Ponds, clay pans, mesquite woodlands, and dry lakes.

An Integrated Flood Management Summary Document was developed during the 2013 IRWMP Updates and is included in Appendix F.

3.3.1.1 Flood Management Efforts are not Well Coordinated throughout Antelope Valley Region

Flood management efforts are currently performed by local jurisdictions within their particular area (e.g., City of Palmdale undertakes flood control within its boundaries), but there is no regional entity that coordinates flood control for the entire Antelope Valley Region. In the past, Los Angeles County prepared a regional plan for flood control, but its implementation has been hindered by a lack of funds. Ballot measures that would result in the creation of regional flood control districts have failed in the region.

Flood management activities also need to be coordinated with other agencies, such as water purveyors, to support a multi-use perspective. For example, the development of stormwater capture and infiltration basins in the upper watershed areas will not only reduce flooding in the lower watershed (urban) areas but also contribute to groundwater recharge during the winter months. This groundwater recharge provides additional water supply in the summer months. In a similar fashion, activities of the development community will also need to be coordinated with flood management. New impervious surfaces not only increase peak surface flows but also decrease groundwater recharge capability.

3.3.1.2 Poor Water Quality of Runoff

Toxic pollutants are found within the Antelope Valley Region associated with the transport of sediment from the mountainous areas and mobilization of urban contaminants during storm events (Lahontan RWQCB 1994). Stormwater flows from the mountain areas to the Antelope Valley floor traverse highly erodible soils, which results in significant transport of sediments.

The sediment not only has the tendency to bulk peak flow and increase flood levels through sedimentation, but it also transports naturally-occurring contaminants such as arsenic and other heavy metals. Other contaminants, such as salts associated with de-icing of roads and parking lots are carried to the valley floor during rainfall events. In urban areas on the valley floor, contaminants such as pesticides, trash, oil, gasoline, radiator fluid, and animal wastes accumulate during dry months and are then mobilized at concentrated levels during storm events.

Runoff from urban areas is increasing as the Antelope Valley Region develops. The heavy sediment content and urban runoff contaminants make this storm water flow undesirable for many uses, and poorly planned urban development further upsets the natural system within a watershed as follows:

- Direct impacts such as filling of wetlands, riparian areas, drainages, and other natural waters;
- Generation of pollutants and sediment during and after construction;

- Alteration of flow regimes;
- Reduction of groundwater recharge by impervious surfaces and stormwater collector systems;
- Disruption of watershed-level aquatic functions including pollutant removal, flood water retention, and habitat connectivity.

These impacts typically degrade water quality, increase peak flows and flooding, and destabilize stream channels. The resulting condition then requires engineered solutions to the disrupted flow patterns which lead to near-total loss of natural functions and values in the affected basins. Impacts can be minimized through municipal stormwater programs that require use of Best Management Practices (BMPs) and conditions to be placed on new development proposals. Ideally stormwater programs would be developed through stakeholder involvement as part of an integrated program that would identify concepts and projects developed to maximize flood control benefits, water quality benefits, water supply benefits, and protection of natural surface flow routes and levels thereby protecting natural environments downstream.

3.3.1.3 Nuisance Water and Dry Weather Runoff

Stagnant or "nuisance" water is standing water that ponds and fails to infiltrate even after prolonged periods. In the Antelope Valley Region there are several areas with impervious soils (including the dry lakes at EAFB) and perched clay layers prone to supporting nuisance water.

Dry-weather runoff is defined as urban runoff water that enters the drainage system due to human activities (e.g., car washing, lawn irrigation). Dry-weather runoff can also result from illicit connections to the storm water or sewer systems. This type of runoff concentrates contaminants in urban runoff and can negatively affect the water quality of receiving waters (e.g., groundwater).

Nuisance water and other dry weather flows need to be managed to prevent accumulation of contaminants by providing short and long term solutions through an integrated approach.

3.3.1.4 Difficulty in Providing Flood Management without Interfering with Groundwater Recharge

The Antelope Valley Region is underlain by groundwater, which is a major source of water supply in the area. A poorly-designed flood management program could slow, limit, or direct groundwater recharge to unfavorable areas. In addition, groundwater recharge focused on recharge of stormwater flows could introduce urban runoff contaminants into the groundwater aquifer. Ideally, excess stormwater could be properly treated and directed to areas that allow recharge of groundwater through an integrated management program that combines flood management, water quality improvements, and water supply augmentation.

3.3.1.5 Habitat and Dry Lakebed Requirements to Protect Natural Processes

Stormwater runoff within the Antelope Valley is carried by ephemeral streams. Between 0.36 inches and 0.56 inches of rainfall in the first 24 hours is required to saturate the soils and initiate surface flow runoff. As runoff moves from the headwaters to the lakebeds, some of the flow percolates into the stream beds and recharges the groundwater. Other portions flow through well-defined washes that change to braided alluvial fan washes and then top the channels and move as sheet flow across the lower valley floor, filling clay pan depressions (similar to vernal pools and potholes) and wetlands (most notable being Piute Ponds). Some of this water percolates into sand dunes where the water is sequestered for later use; the remainder flows down to the valley floor into the dry lakebeds at EAFB. The amount of flow depends on the size of the storm and how much rainfall has already occurred recently. It has been documented in the "Surface Flow Study Technical Report" (EAFB 2012) that a 5-year storm (approximately 2.5 inches) is sufficient to provide 946 +/- 189-acre feet of surface water flow to Rosamond Dry Lake with the peak discharge measured at 92 cfs. The total sediment discharge measured was 1,542 metric tons. However the error rate is high at +/- 30%. Rogers and Buckhorn Dry Lakes were not measured. Stormwater runoff is important to downstream habitats throughout the Valley. These habitats are seen at EAFB as particularly valuable to sustain the surface structure of the dry lakebeds for their operational missions, the overall air quality of the Antelope Valley, and the Piute Pond Complex's wetland functions and values (Deal 2013).

3.3.1.6 Baseline Flooding and Sediment/Erosion Not Well Defined

Although the mechanisms of flooding and sediment transport and deposition are well known in the Antelope Valley Region, very little definitive information is available regarding flood extents, depths, velocities or areas of deposition and sedimentation. The Federal Emergency Management Agency (FEMA) conducted hydrologic and hydraulic analysis of the region starting in the early 1980s and ending in the late 1990s to prepare approved Flood Insurance Rate Maps (FIRM). The FEMA analysis was done at different times and to different levels of detail for different panels and does not include EAFB. The mapping FEMA provided for the different flooding zones should be viewed as approximate and is in need of an update.

3.3.1.7 No Development Guidelines for Alluvial Fans

Alluvial fans are classified as high flood hazard areas according to FEMA and development on alluvial fans is discouraged. Although development is discouraged, there are engineering techniques that can reduce the risk of property loss or loss of life. A guidelines document could be developed that presents the risks of alluvial fan flooding along with mitigation techniques and approximate costs for the Antelope Valley Region.

3.3.1.8 Protection of Habitat Processes and Sensitive Habitats which rely on Surface Flow such as Antelope Valley Significant Ecological Areas (SEA), Piute Ponds, Clay Pans, Mesquite Woodlands, and Dry Lakes

Habitat processes and sensitive habitats that rely on surface flow are discussed in more detail in Section 3.4.

3.4 Environmental Resources

The Antelope Valley Region is part of a subbasin within the Mojave Desert. The climate and physical environment is typical of the high desert with the exception of the southern edge of the Antelope Valley Region which includes a cooler upland area. The area has many unique environmental features and several plant and animal species are endemic to this desert area.

Unique Habitats

The Antelope Valley Region is generally flat and sparsely vegetated, but is interspersed with buttes, mountain ranges, and dry lakes (Bureau of Land Management [BLM] 2005). Rogers Lake is the largest and flattest playa in the world (BLM 2005). Freezing temperatures are limited to a few winter days but in the summer temperatures often exceed 100 degrees Fahrenheit. The Antelope Valley Region is characterized by creosote bush and saltbush plant communities which make up approximately 75 percent of the natural lands in the Western Mojave Desert. A small percentage of natural lands in the area can be characterized as Mojave mixed woody scrub community. A very small percentage of the Antelope Valley Region could be characterized as freshwater or alkali wetlands (BLM 2005). A comprehensive delineation of wetlands in the Antelope Valley Region has not been conducted. However, the Antelope Valley Region is home to numerous desert washes (Little Rock Creek, Big Rock Creek, Amargosa Creek, Cottonwood Creek System), as well as man-made lakes (Little Rock Creek Reservoir, Lake Palmdale), sag ponds (an enclosed depression formed where active or recent fault movement results in impounded drainage), and areas of rising groundwater. Freshwater marsh, wetland, and alkaline meadow habitat is present within the Piute Pond Complex. Wetland and wash areas are found within the Mesquite woodland. While wetland and riparian areas are limited in the Antelope Valley Region, these areas are important resources to birds migrating along the Pacific Flyway (LACSD 2004).

The unique habitat of the Antelope Valley Region means the Region is also home to several special status species, including plants, reptiles, birds, and mammals. Several regulatory protections and practices for these special status species are in place in the Antelope Valley Region, such as SEA designations by Los Angeles County, Desert Wildlife Management Area (DWMA) designations by USFWS, and development of a Habitat Conservation Plan (HCP) by the BLM.

Habitat Conservation

Habitat conservation activities in the Region include the establishment of SEAs and the development of habitat conservation plans such as the Antelope Valley Region Areawide Plan and the West Mojave HCP.

SEAs are defined by Los Angeles County and generally encompass ecologically important or fragile areas that are valuable as plant or animal communities and often important to the preservation of threatened or endangered species. Preservation of biological diversity is the main objective of the SEA designation. SEAs are neither preserves nor conservation areas, but areas where Los Angeles County requires development to be designed around the existing biological resources (Los Angeles County 2015). Design criteria in SEAs include maintaining watercourses and wildlife corridors in a natural state, set-asides of undisturbed areas, and retaining natural vegetation and open space (Los Angeles County 1986).

The three Significant Ecological Areas in the Antelope Valley Region according to the Los Angeles County General Plan Update include the Antelope Valley SEA, the Joshua Tree Woodland SEA, and the San Andreas SEA. (Los Angeles County 2012)

Antelope Valley SEA

The Antelope Valley SEA is located within the central portion of the Antelope Valley, primarily east of the cities of Palmdale and Lancaster, within a predominantly unincorporated area of Los Angeles County. This area includes tributary creeks to Littlerock and Big Rock Creeks downstream to the valley floor and floodplain zones of Rosamond, Buckhorn and Rogers dry lakes. Given the large area encompassed by this SEA, it has a highly diverse biota along with diverse desert habitats.

The watershed areas upstream of the dry lake beds provide wash, scrub, and desert riparian habitat for various plant, bird and burrowing mammal species. In particular, the South Fork of Big Rock Creek is part of the federally-designated critical habitat of the mountain yellow-legged frog, and serves as nesting area for bird species such as the gray vireo. The dry lake beds serve as habitat for many desert plants and wildlife species once found broadly across the Valley. The Piute Ponds and dry lakes have distributed habitat of marshy alkali grassland, alkali flats, and cattail and bulrush marsh augmented by wastewater treatment facilities that have additional ponds. The dry lake beds contain botanical features unique and limited in distribution, including the Mojave spineflower and the only healthy stands of mesquite in Los Angeles County.

The Desert-Montane area of this SEA, which centers on Mescal Creek, provides a combination of desert and montane habitats, making this one of the most diverse areas in the County. Beside creosote bush scrub, sagebrush scrub, and Joshua tree woodland found in the desert floor, this area also includes pinyon-juniper woodland, desert chaparral, and mixed conifer forest habitat. While some of these are considered common habitats, the area is valuable because this SEA is the only site where these communities are found in an uninterrupted band.

The Antelope Valley SEA also includes desert butte habitat which has increased biological diversity relative to surrounding areas. The steep slopes of buttes act as refuges for many biological resources. Desert buttes provide roosting and nesting areas for birds, den sites for mammals, and habitat for the desert wildflower and Joshua tree woodland areas. Suitable habitat for the Mohave ground squirrel (listed as “Threatened” under the California Endangered Species Act and “Special Concern” by the federal Endangered Species Act) is found in these butte areas.

Joshua Tree Woodland SEA

The Joshua Tree Woodland SEA is located in the western portion of the Antelope Valley in unincorporated Los Angeles County west and northwest of the Antelope Valley California Poppy Reserve. This SEA provides habitat to various plant and animal communities, particularly Joshua tree woodland. The scrubland, woodland and grassland habitats in this SEA provide foraging and cover habitat for year-round resident and seasonal resident song birds and raptors. In addition to Joshua trees, sensitive species in this SEA include the alkali mariposa lily, California horned lizard, golden eagle, Swainson’s hawk, burrowing owl, loggerhead shrike, western mastiff bat, and Tehachapi pocket mouse.

San Andreas SEA

The San Andreas SEA is located in the western portion of the Antelope Valley in unincorporated Los Angeles County, and includes a small portion of the western Tehachapi foothills and then stretches in a southeasterly direction to include Quail Lake, the northern foothills of Liebre Mountain and Sawmill Mountain, large portions of Portal Ridge, Leona Valley, Ritter Ridge, Fairmont and Antelope Buttes, Anaverde Valley, Lake Palmdale, and terminating at Barrel Springs (a sag pond near the City of Palmdale). Vegetation in this SEA is extremely diverse, and includes desert scrub, chaparral, grassland, wildflower fields, southern willow scrub, foothill woodland, Joshua tree woodland, oak woodlands, southern cottonwood-willow riparian forest, freshwater marsh, alkali marsh, alluvial wash vegetation and ruderal vegetation. Given this variety of vegetation, wildlife within this SEA is diverse and abundant, and includes a number of sensitive species such as the California red-legged frog, California horned lizard, prairie falcon, southwestern willow flycatcher, Mohave ground squirrel, and the California condor.

West Mojave Plan

The *West Mojave Plan* is an HCP developed by the BLM with collaboration from multiple other jurisdictions and agencies, including the City of Palmdale, City of Lancaster, Los Angeles County, the California Department of Fish and Game, and the USFWS. The *West Mojave Plan* also acts to amend the California Desert Conservation Area Plan. The Planning Area for the *West Mojave Plan* includes the entire Antelope Valley Region. The objective of this HCP is to develop a comprehensive strategy to preserve and protect the desert tortoise, the Mohave ground squirrel, and over 100 other sensitive plants, animals and habitats. The HCP would establish additional conservation areas for the desert tortoise and Mohave ground squirrel and alter allowable motorized vehicle routes on BLM managed lands. Jurisdictions that have adopted the HCP must follow the selected conservation strategies, but benefit from a streamlined process when permitting activities that may affect endangered species covered by the plan (BLM 2005).

Open Space Areas

The open space and rural character of the Antelope Valley Region is treasured by many of its residents. During a poll conducted as part of its General Plan Update, the City of Lancaster found that "open space," "views," and "desert environment" were commonly cited as key to the area's quality (City of Lancaster 2006). Typical population densities in southern California suburban areas generally range from roughly 2,500 persons per square mile and increase to more than 7,500 persons per square mile in urbanized areas. By comparison, the high desert area (Mojave Desert in general) only averages about 680 persons per square mile (BLM 2005). The Census Bureau utilizes a minimum threshold of 1,000 persons per square mile to denote an urbanized setting. The Antelope Valley Region is characteristic of a large rural environment.

Ecological Processes

The ecological integrity of the Antelope Valley Region includes a critical range of variability in its overall biodiversity, important ecological processes and structures, regional and historical context, and sustainable cultural practices. The ability to maintain biodiversity and ecosystem health while accommodating new growth is a challenge in the Antelope Valley Region, which is home to a variety of unique and sensitive species endemic to the area. An overriding consideration becoming more prevalent with the implementation of the West Mojave Plan is the promotion of ecosystem processes that sustain a healthy desert ecosystem. Knowledge to support management decisions will require improved understanding of desert ecology.

We need to understand processes that change ecosystem dynamics because they are the most effective tools available to land managers who are asked to maintain or restore the health of the natural environment. Important ecological processes in the Antelope Valley Region include competition (for nutrients, water, and light), fire, animal damage, nutrient cycling, carbon accumulation and release, and ecological genetics.

Understanding genetic structure is basic knowledge for implementing biologically sound programs dealing with breeding, restoration, or conservation biology, all of which is at the basis of the West Mojave Plan for endangered species in the Region (e.g., desert tortoise and Mohave ground squirrel). Genetic structure also determines responses to changing conditions regardless of whether change is induced by management, lack of management, fluctuating climatic gradients, or global warming.

3.4.1 Regional Environmental Resource Issues and Needs

The following is a list of the key issues, needs, challenges, and priorities for environmental management within the Antelope Valley Region, as determined by the stakeholders:

- Conflict among industry, growth, and preservation of natural areas and open space/Desire to preserve open space;
- Protection of threatened and endangered species; and
- Removal of invasive non-native species from sensitive ecosystems.

3.4.1.1 Conflict among Industry, Growth and Preservation of Natural Areas and Open Space/Desire to Preserve Open Space

As described earlier, because of its proximity to the Los Angeles Area, the Antelope Valley Region is subject to increasing demand for community development, recreation, and resource utilization. As described in Section 2.10, population in the Antelope Valley Region is expected to increase by 38 percent between 2010 and year 2040. Some of this growth will result in conversion of agricultural land, but more of this growth will occur in locations that are currently natural areas. Loss of both agricultural acreage and natural areas decreases the amount of open space in the Antelope Valley Region.

3.4.1.2 Protection of Threatened and Endangered Species

Pressures for growth and recreational activities in the Antelope Valley Region have been linked to significant declines in desert species such as the desert tortoise, Mohave ground squirrel and burrowing owl. Growth of urban areas results in loss of available or suitable habitat for sensitive species. For example, studies of the desert tortoise have shown a significant downward decline in the population from 1975 to 2000 related to urban growth (USFWS 2006). The desert tortoise is currently listed as Threatened by USFWS and by the CDFW. The Mohave ground squirrel is also listed as Threatened by the CDFW as a result of similar anthropogenic pressures, and the Burrowing Owl is considered a Bird of Conservation Concern by the USFWS and a Bird Species of Special Concern by the CDFW (USFWS 2003).

Besides loss of habitat, proximity to human development can be harmful to sensitive species. Human development introduces roadway traffic, pesticides, urban runoff, and non-native species, which degrade habitat and food sources for sensitive species. Land use practices, such as cattle and sheep grazing and mining are also considered harmful to many species. Recreational uses, such as off-highway vehicle use, are known to conflict with sensitive species habitat. For example, a vehicle traveling over a tortoise burrow could cause a desert tortoise to be trapped inside the burrow or make the burrow unusable when they are needed to escape predation or extreme weather conditions (USFWS 2006). In recreational areas, sensitive wildlife may seek shelter in the shade of vehicles and be crushed when those vehicles are subsequently moved. Improper disposal of food wastes and trash by recreational users often attracts predators of the sensitive species, such as common ravens. Dogs brought onto public lands by recreational visitors can also disturb, injure, or kill sensitive species. Other factors affecting the continued existence of threatened and endangered species include animal collection for personal or commercial purposes, disease, inadequate regulatory mechanisms for species protection, and climate change (USFWS 2014).

3.4.1.3 Removal of Invasive Non-native Species from Sensitive Ecosystems

Non-native species (such as arundo and tamarisk) are listed as 'A-1' invaders (the most invasive and widespread wildland pest plants) by the California Invasive Plant Council and as noxious weeds by the California Department of Food and Agriculture (CDFA). While the degree and specifics of problems associated with these species vary, general negative effects associated with the establishment of tamarisk within the Antelope Valley Region include the following:

- Water Quality: Reduction in the shading of surface water, resulting in reduction of bank-edge river habitats, higher water temperature, lower dissolved-oxygen content, elevated pH, and conversion of ammonia to toxic unionized ammonia.
- Water Supply: Loss of surface and groundwater through heavy consumption and rapid transpiration.
- Flooding: Obstruction of flood flows with associated damage to public facilities, including bridges and culverts, and to private property, such as farm land.
- Erosion: Increased erosion of stream banks, associated damage to habitats and farmlands due to channel obstructions, and decreased bank stability associated with shallow-rooted arundo.
- Fire Hazards: Substantially increased danger of wildfire occurrences, intensity, and frequency, and a decrease in the value that riparian areas provide as firebreaks or buffers when infested with arundo.
- Native Habitats: Displacement of critical riparian habitat through monopolization of soil moisture by dense monocultures of arundo and tamarisk (particularly near Piute Ponds).

- Native Wildlife: Reduction in diversity and abundance of riparian-dependent wildlife due to decreased habitat quality, loss of food and cover, and increased water temperatures.
- Threatened and Endangered Species: Substantial reductions in suitable habitat available for state and federally listed species such as the least Bell's vireo.

3.5 Land Use

Cities and counties (for unincorporated areas) are the regulatory agencies responsible for land use planning within the State of California. Land use regulations and policies such as general plans, zoning ordinances, California Environmental Quality Act (CEQA) compliance, and permit conditions can be valuable policy and implementation tools for effective water management. The California Government Code establishes requirements for the development of General Plans to guide land use decisions, of which water resources play an important role. "Water resources" is typically not an 'element' of a General Plan, but is discussed within the context of the General Plans required 'elements'; land use, circulation, housing, conservation, open space, noise, and safety.

Land uses within the Antelope Valley Region are provided for in local and regional policies and regulations, including the Los Angeles County General Plan (adopted October 2015), the Antelope Valley Area General Plan (adopted June 2015), Kern County General Plan (approved June 2004 and last amended September 2009), the City of Palmdale General Plan (last updated 1993, update pending) and the City of Lancaster General Plan (last updated 2009).

State legislation has also addressed the gap between land use planning and water resource management. In 2001, two water supply planning bills, Senate Bill 610 (SB 610) and Senate Bill 221 (SB 221), were enacted that require greater coordination and more extensive data to be shared between water suppliers and local land use agencies for large development projects and plans. SB 610, codified as Water Code sections 10910 and 10911, requires the public water system that may supply water to a proposed residential development project of more than 500 dwelling units (or a development project with similar water use), to prepare a water supply assessment for use by the lead planning agency in its compliance with CEQA. Such a water supply assessment (WSA) is performed in conjunction with the land use approval process associated with the project and must include an evaluation of the sufficiency of the water supplies available to the water supplier to meet existing and anticipated future demands. SB 221 requires projects which include tentative tract maps for over 500 dwelling units to obtain verification from the water system operator that will supply the project with water that it has a sufficient water supply to serve the proposed project and all other existing and planned future uses, including agricultural and industrial uses, in its area over a 20-year period, even in multiple dry years. SB 221 is intended as a "fail safe" mechanism to ensure that collaboration on finding the needed water supplies to serve a new large subdivision occurs before construction begins. Statutes making conservation a California way of life may also impact future land use development. As previously noted, Water Conservation and Drought Planning (SB 606 and AB 1668) mandates a target of 55 GPCD by 2025 and 50 GPCD by 2030. The two bills strengthen the state's water resiliency in the face of future droughts with provisions that include long-term standards for efficient water use that apply to retail water suppliers. Both urban and agricultural water supplies are required to set annual water budgets and prepare for future droughts. To meet these standards, water suppliers must consider future land uses and account for projected development in the Region. Also approved in 2018, the Landscape Water Use Efficiency bill (AB 2371) declared that approximately one-half of the urban potable water provided in California is used outdoors, primarily for landscape irrigation. AB 2371 enacted into law several measures to increase efficiency and sustainability of landscape water use. These outdoor water use efficiency measures may impact future landscape development in urban areas of the Region.

As growth in the Antelope Valley Region is rapidly increasing, and larger development projects are being proposed, the preparation of WSAs or written verifications pursuant to these bills is becoming increasingly more common, forcing water purveyors in the area to question their ability to provide service to these developments. If water supplies are deemed not available, developers in the Antelope Valley Region will be required to find water outside the Antelope Valley Region in sufficient quantities to serve their projects.

3.5.1 Regional Land Use Issues and Needs

The key issues, needs, challenges, and priorities for the Antelope Valley Region with respect to land use management include the following, which are discussed in greater detail below:

- Growing public demand for recreational opportunities;
- Pressure for growth in the Antelope Valley Region;
- Loss of local culture and values; and
- Dust control.

3.5.1.1 Growing Public Demand for Recreational Opportunities

The Antelope Valley Region offers many recreational opportunities. The Antelope Valley Region has over 410 acres of developed park land including 27 parks, 22 softball fields, five baseball fields, 21 soccer fields and 17 tennis courts. In addition there are over 3,000 acres of natural park land and approximately 5,600 acres of upland and wetland natural areas at Piute Ponds. The Antelope Valley Region is also home to the 1,700-acre California Poppy Reserve, the Arthur B. Ripley Desert Woodland State Park, and the Saddleback Butte State Park. The Antelope Valley Area Plan implemented the adopted Bikeway Plan for the Antelope Valley in cooperation with the cities of Lancaster and Palmdale to create a unified and well-maintained bicycle transportation system with safe and convenient routes for commuting, recreation, and daily travel. Many recreational activities take place in the eastern, less populated areas of the Antelope Valley Region. BLM has identified the following types of recreational activities in the high desert: motorcycle activities, four wheel drive exploring, sightseeing, target shooting, hunting, experimental vehicles/aircraft, model rocketry, dry land wind sailing, endurance equestrian rides, hiking, mountain biking, bird watching, botany, rockhounding, camping, and picnicking.

The Antelope Valley Region is located only 90 miles from downtown Los Angeles; the proximity allows residents to utilize the Antelope Valley Region as their "recreational backyard." The high desert Antelope Valley Region has attracted nearly 2 million visitor-trips a year for off-highway vehicle recreation and nearly 1.5 million visitors to State and National Parks in the area (BLM 2005). The Antelope Valley Poppy Reserve has become increasingly popular due to social media influences, particularly during the wildflower season when poppies cover the Reserve's hillsides. During the 2008 flower super bloom, approximately 65,000 people visited the Reserve during the entire season. In comparison, the 2017 flower super bloom attracted approximately 67,000 visitors between mid-March and early April, and a total of 164,000 visitors during the wildflower season (Cox 2017; Rosato 2019). BLM estimates that 85 percent of recreational visitors to the high desert are from the urban areas of Southern California. Demand for recreational resources in the Antelope Valley Region is particularly acute due to the lack of other similar resources near these urban areas and due to a decrease in recreational opportunities elsewhere. For example, since 1980 the number of acres of off-highway vehicle recreation areas has decreased by 48 percent in California. In the same time period off-highway vehicle registrations in California increased by 108 percent (BLM 2005). As population increases in Southern California and the Antelope Valley Region, there will be increasing pressure to maintain and expand the Antelope Valley Region's recreational opportunities.

3.5.1.2 Pressure for Growth in the Antelope Valley Region

Historically, land uses within the Antelope Valley Region have focused primarily on agriculture. This is partly dependent on the types of soils found in the area, the majority of which have been classified by the U.S. Soil Conservation Service as prime soils, which are best for agricultural production. Coupled with lower water costs and favorable climatic conditions, productivity has been maintained throughout the years, although pressures for developable land have also increased (Los Angeles County 1993). Approximately 73,000 acres of land in the Antelope Valley Region were in agricultural production in the early 1950s (USGS 1995). There was a surge in irrigated acreage when AVEK introduced SWP water to the western Antelope Valley Region in 1972 at prices competitive with the costs of pumping ground water (LACDPW 1989). However, the overall trend for agricultural land use continued to decrease through the 1980s and 1990s. During the late 1980s, carrot farmers in the San Joaquin Valley undertook marketing efforts to assess the acceptability of a potential new product, "baby carrots," to the public. Response was so positive that within only a few years, an entirely new market was created. Demand for these new, smaller carrots was so high, and they were so profitable, that farmers expanded into the Antelope Valley Region and other desert regions in search of additional planting acreage. The profit margin of this crop is such that cost of water is not a limiting factor for carrot farmers.

Currently, land uses within the Antelope Valley Region are in transition as the predominant land use is shifting from agriculture to residential and industrial. The increase in residential land use is evident from the population growth in the Antelope Valley Region. As presented in Section 2.10, growth in the Antelope Valley Region was slow until 1985, but increased rapidly (approximately 1,000 percent of the average growth rate between the years 1956 to 1985) as these land uses shifted. Population projections for the Antelope Valley Region indicate that nearly 535,000 people will reside in the Antelope Valley Region by the year 2040, an increase of approximately 38 percent from the 2010 population (refer to Section 2.10.2 for population projections analysis). The two most populous cities in the Valley Region are Lancaster and Palmdale. As residential development continues to grow within the middle of the Antelope Valley Region, the agricultural operations are now found farther to the west and east than in previous decades.

The large migration of people to the Antelope Valley Region is primarily based on economics. With significantly lower home prices than in other portions of Los Angeles County, the Antelope Valley Region has become an attractive and affordable alternative to living in the congested and expensive Los Angeles area. Additionally, it was recognized that the Antelope Valley Region is the last large available open space "opportunity" for development in Los Angeles County, including residential, commercial/industrial, retail, and agricultural.

3.5.1.3 Local Culture and Values Could be Lost

The Stakeholders of this IRWM Plan have expressed concerns about the changing land use trends in the Antelope Valley Region, and feel that with the tremendous pressure for growth in the Antelope Valley Region, local culture and values could ultimately be lost.

Currently, industrial land use in the Antelope Valley Region consists primarily of manufacturing for the aerospace industry and mining. EAFB and the U.S. Air Force Flight Production Center (Plant 42) provide a strong aviation and military presence in the Antelope Valley Region. Reductions or realignments in the defense industry could adversely affect this presence.

Mining operations also contribute to the Antelope Valley Region's industrial land uses. Mining, a large part of the history of the Antelope Valley, has been less prominent in recent years, yet there are several mines that still produce quantities of gold and silver. One such mine, the Golden Queen Mining Company (formerly known as the Silver Queen mine) began a full scale recovery of gold, silver and aggregate in 2015, and since then many jobs have been created from the mining operation. Golden Queen Mining Company uses conventional open pit mining methods to extract gold and silver at the Soledad Mountain Mine, which is located 5 miles south of Mojave. Activities at the site include construction of infrastructure to support exploration activities, drilling, and mining. Since 2006, Golden Queen Mining has also invested more than half a million dollars to cleanup illegal dumping and remnants from historical mining operations in the northern slopes of Soledad Mountain (Golden Queen Mining N.D.). Rio Tinto's Borax mine in the community of Boron is considered one of the largest employers in the Antelope Valley aside from the U.S. Government, employing over 600 workers (GAVEA 2016). Aside from these operations, rock and gravel quarrying is also conducted in the southeastern part of the Antelope Valley Region along the mountain foothills.

Land use shifts increase the demand for water supply and higher quality water, thereby increasing the competition for available water supplies. This change in land use and increase in supply competition affects the dependence on imported SWP and groundwater supply, impacts fluctuations in groundwater levels, and heightens concerns over the potential for contamination and reliability of these supply sources.

As the Los Angeles population rapidly expanded into the Antelope Valley Region, bringing with it the desire for more cultural amenities and new skills and resources, the Antelope Valley Region became more metropolitan in character. The increase in population and development of tract housing, retail centers and business parks has altered the formerly low density, rural and agrarian character of many local communities.

Today, competing demands are placed on limited available resources. Many of these competing demands stem from the range of local cultural values that characterize the Antelope Valley Region. Decisions regarding future land use and the dedication of water resources will need to weigh varying agricultural, metropolitan, and industrial needs as they continue to develop, and as the balance between these interests continues to change.

Stakeholders commonly expressed the need to develop a balance of resources, while preserving the area's natural environment and rural history. Despite the need to ensure economic vitality and longevity by bringing new industry and employment opportunities to the Antelope Valley Region, residents of the Antelope Valley Region believe preserving a "hometown" feel and developing a strong sense of neighborhood stability are critical to strengthening the identity of the community and Region. The preservation of existing natural open space, achieved in part through a development strategy focused on infill and parcel redevelopment combined with environmental conservation, are key components of preserving the Antelope Valley Region's rural character and strengthening the health, vitality and security of growing urban areas.

3.5.1.4 Dust Control

Dust control is a particular issue in the Antelope Valley as more land is disturbed and voided of vegetation by activities such as solar farming and mining. Disturbance to the soil causes a loss of soil protection that initiates dust issues and causes excessive runoff of soil particles and contaminants. Water supply can be impacted by a reduction of plant material in the soil that reduces soil permeability and water storage.

Water quality impacts from soil disturbance activities stem from an increase in runoff and a decrease in soil protection. Excessive runoff increases sediment and contaminant loading to streams and natural areas. Disturbed vegetation cover can also degrade ecosystems and delay the reestablishment of natural stream areas, which further impacts water quality.

Other environmental impacts from soil disturbance and vegetation cover loss include increased dust storms and lifestyle disturbance. Dust storms can cause road closures, a decline of populations in rural areas, and loss of utility services. It can also cause Valley Fever, which is an illness caused by a fungus that lives in the soil and dirt. Valley Fever is often found in cities like Palmdale and Lancaster, and other areas throughout Kern County. As land use in the Antelope Valley changes impacts to these resources need to be considered and balanced. As flood control and surface flow runoff diversion projects are considered, impacts to the dry lakebeds also need to be considered. A lack of surface water flow to maintain the cryptobiotic surface layer will cause breakdown of the lakebed surface structure and add to regional dust storm issues.

3.6 Climate Change

3.6.1 Identification of Vulnerabilities

Understanding the potential impacts and effects that climate change is projected to have on the Region allows an informed vulnerability assessment to be conducted for the Region's water resources. A climate change vulnerability assessment helps a Region to assess its water resource sensitivity to climate change, prioritize climate change vulnerabilities, and to ultimately guide decisions as to what strategies and projects would most effectively adapt to and mitigate against climate change. DWR has recommended IRWM Regions use the Climate Change Handbook for Regional Planning (developed by USEPA, DWR, Army Corps, and the Resource Legacy fund) as a resource for methodologies to determine and prioritize regional vulnerabilities. The Climate Change Handbook provided specific questions that help to identify key indicators of potential vulnerability, including:

- Currently observable climate change impacts (climate sensitivity)
- Presence of particularly climate-sensitive features, such as specific habitats and flood control infrastructure (internal exposure)
- Resiliency of a region's resources (adaptive capacity)

The Region's Climate Change Subcommittee conducted an exercise to answer vulnerability questions taken from Box 4-1 of the Climate Change Handbook and associated the answers with potential water management issues/vulnerabilities. The assessment is consistent with climate change issues identified in local water plans. See Appendix H for the completed vulnerability question worksheet. Included in this analysis are qualitative vulnerability questions framed to help assess resource sensitivity to climate change and prioritization of climate change vulnerabilities within a region. Answers to vulnerability questions are given for the Region with local examples provided as justification for the answer. Vulnerability issues are prioritized in the next section.

The Climate Change Subcommittee discusses the vulnerabilities of the Region's water resources to climate change

3.6.2 Prioritization of Vulnerabilities

The vulnerability issues identified in the climate change analysis discussed above were reviewed by the Climate Change Subcommittee in 2013, and some of the language was refined to better articulate the vulnerability issues of the Region. The revised vulnerability issues were then prioritized into three tiers based upon the perceived risk and importance of the issue. Those vulnerabilities posing the greatest risk of occurrence and resulting in the greatest impacts upon occurrence were ranked as the highest priority. The vulnerability issues were revisited by the stakeholder Group in 2019 as part of the IRWMP update to reflect the evolving conditions of the Region, but the priority remained the same.

The list of prioritized vulnerabilities developed and revised by the stakeholders in the Region is shown in Table 3-21, and they are discussed further below. Note that the vulnerability issues shown in Appendix H do not exactly match those in Table 3-21 since refinements and edits were made to the vulnerabilities during the prioritization process.

Table 3-21: Prioritized Regional Vulnerability Issues

Priority Level	Category and Vulnerability Issue
High	• Water Demand/Supply: Limited ability to meet summer demand and decrease in seasonal reliability • Flooding: Increases in flash flooding, with particular attention paid to the balance of flood control with habitat and lakebed needs which EAFB depends on • Water Supply: Lack of groundwater storage to buffer drought • Water Supply: Decrease in imported supply • Water Supply: Invasive species can reduce supply available • Ecosystem and Habitat: Increased impacts to water dependent species and decrease in environmental flows • Water quality: Increased constituent concentrations
Medium	• Water Supply: Decrease in local surface supply • Water Quality: Increased erosion and sedimentation • Water Supply: Sensitivity due to higher drought potential • Ecosystem and Habitat: Decrease in available necessary habitat
Low	• Water Demand: Industrial demand would increase • Water Demand: Crop demand would increase per acre • Water Demand: Habitat demand would be impacted • Flooding: Increases in inland flooding

The justifications as to why the following vulnerability issues were classified as high priority are provided below:

- *Limited ability to meet summer demand and decrease in seasonal reliability*: The Region has high irrigation demands during summers. Increases in temperature due to climate change would likely increase this already high demand, as well as decrease supplies available.

- *Increases in flash flooding, with particular attention paid to the balance of flood control with habitat and lakebed needs which EAFB depends on*: As discussed previously, flooding is common in the Region, particularly in the foothill areas. The projected increase in storm intensity will likely increase the occurrence, amount, and intensity of flash flooding and runoff. These changes will need to be managed carefully in light of habitats that depend on these seasonal flash floods and the needs of EAFB.
- *Lack of groundwater storage to buffer drought*: Groundwater levels are a longstanding issue in the Region. The Region is limited in terms of the groundwater stored from year to year, and has issues with groundwater quality in some areas. Should a prolonged drought occur, this resource may not be available to buffer supply needs during additional drought years.
- *Decrease in imported supply*: The Region is heavily dependent upon imported water supplies which are very susceptible to the impacts of climate change given their reliance on seasonal snowpack. The Region could not be solely dependent upon local resources to sustain the current economy, so some imported water must be secured. The supply is highly vulnerable at its source given the dependence upon the stability of the California Bay Delta levee system. Climate change impacts to this area from higher sea level rise and higher storm surges could be catastrophic to the supply.
- *Invasives can reduce supply available*: Invasive species are becoming more common in the Region, and may increase with the projected changes to temperature and precipitation. Certain invasive species, such as Tamarisk and Arundo, may reduce the water supply available for native species.
- *Increased impacts to water dependent species and decrease in environmental flows*: A number of water dependent species are present in the Region that require certain stream flows to maintain habitats, such as those species dependent on the Piute Ponds. The projected changes to local temperature and precipitation may impact these environmental flows, and impact water dependent species, particularly since these species have limited opportunity for migration.
- *Increased constituent concentrations*: Decreases in stream flows may reduce the ability for these streams to dilute water quality constituents. Should stream flows decrease due to increases in temperature and decreases in annual precipitation, the water quality of local streams may be impacted. In addition, the projected increase in wildfires in the surrounding mountains may lead to increased erosion and sedimentation in local streams.

It is the intention of the stakeholder group to maintain an ongoing process to gather data and revisit the prioritized vulnerabilities every five years along with other updates to the Antelope Valley IRWM Plan. This data collection and analysis will be directed by the A-Team.

The RWMG adopted Objectives and Resource Management Strategies that respond to the high priority vulnerabilities identified in this assessment. The RWMG also addressed the high priority vulnerabilities through the prioritization and integration of Projects into the IRWM Plan. Like the vulnerability assessment, the Objectives, Resource Management Strategies, and Projects will also be regularly updated to reflect the evolving climate change threats to the Region.

3.7 DAC Issues and Needs

To help characterize DAC areas in the Region, identify DAC water resource issues, and develop implementation strategies (including a monitoring plan), two separate technical memoranda were prepared during the 2013 IRWMP Updates:

- *DAC Water Supply, Quality and Flooding Data Final Draft TM* (August 2, 2013) – This document explains the methodology used to identify DAC areas in the Region with census and Geographical Information System (GIS) tools; develops maps for DACs; documents the DAC outreach efforts undertaken as a part of the 2013 IRWMP Updates; and outlines specific issues for DACs related to water supply, water quality, and flooding. Maps are included that further illustrate the scope of these issues. The document also provides a preview of monitoring studies that are needed to address data gaps in these three water-related areas.

- *DAC Monitoring Plan Final Draft TM* (September 25, 2013) – This document summarizes the water supply, water quality, and flood protection issues for DACs in the Region; develops monitoring objectives; and provides guidance for data dissemination and reporting.

  The monitoring objectives developed in this TM may be summarized as:

  - Water supply
    - Track volume of supplies delivered to DACs by water source and supplier
    - Assess conditions of aging facilities (wells, treatment systems and pipelines) to determine need for new or improved infrastructure
  - Water quality
    - Track the quality of drinking water delivered to DACs
    - Map groundwater quality issues in DACs to determine areas of poor groundwater quality and need for treatment
  - Flood protection
    - Track flood incidents in DACs to determine need for flood infrastructure improvements (flood incident date and location, storm intensity, and flood depth.

For additional details on these topics, these documents are included in Appendix D.

Section 4 | Objectives

The following section presents the Region's IRWM Plan objectives and establishes planning targets for the Antelope Valley Region that can be used to gauge success in meeting these objectives. Objectives refer to the general intent for planning within the Antelope Valley Region, whereas the targets refer to specific measurable goals intended to meet the objectives. These Objectives and Planning Targets were originally established in 2007 and were revised during the 2013 and 2019 IRWM Plan updates. This section describes how the objectives were developed, what information was considered, what groups were involved in the process, and how the final decision was made and accepted by the IRWM stakeholders.

4.1 Objectives Development

The primary focus of this IRWM Plan is to develop a broadly-supported water resources management plan that defines a meaningful course of action to meet the expected demands for water and related resources within the Antelope Valley Region between now and 2040. Goals to meet this primary focus were originally established in 2007 and were revised during the 2013 and 2019 IRWM Plan updates. The goals constitute the most general statement of intent and include maintaining a plan that will address:

- How to reliably provide the quantity and quality of water that will be demanded by a growing population;
- Options to satisfy agricultural users' demand for reliable irrigation water supplies at reasonable cost; and
- Opportunities to protect, enhance, and manage current water resources and the other environmental resources for human and natural benefit within the Antelope Valley Region.

These general goals were developed by the Stakeholder Group to provide broad direction. Soon after, the Stakeholder Group developed objectives to help clarify how the issues and needs of concern for the Antelope Valley Region would be addressed. These objectives were designed to be more specific than the general goals mentioned above. The list of objectives was developed in 2007 and then revised again during discussions at stakeholder meetings in August and October of 2012. The objectives were revisited once more during the January 2018 and August 2019 stakeholder meetings and revised to comply with the 2016 IRWM Program Guidelines. During these revisions, stakeholders indicated broad consensus on the changes to the objectives during the meetings, and this was recorded in the meeting notes that are published to the www.avwaterplan.org website. The IRWM objectives consider all Lahontan Basin Plan objectives, 20x2020 water efficiency goals, and the CWC 10540(c) requirements as well as the specific needs of the Antelope Valley as represented by regional and local planning documents.

During the August and October 2012 stakeholder meetings, a discussion about prioritization of objectives was conducted. It was decided that for the Antelope Valley Region, objectives would not be prioritized with the understanding that each objective is equally important relative to the others given that the IRWM Plan is intended to be a truly integrated plan that incorporates all areas of water resource management. In addition, stakeholders feel that a more equal level of importance placed on each of the objectives contributes to the success of the stakeholder group interactions. The Antelope Valley Region may choose, however, to prioritize these objectives relative to grant requirements to enhance project prioritization and selection in the future. In those cases, the type of funding program will dictate which objective should be emphasized.

After objectives were established, even more specific planning targets were developed to establish quantified benchmarks for implementation of the IRWM Plan. The planning targets include deadlines and describe quantitative measurements where applicable. The IRWM Plan addresses the Antelope Valley Region's water resource management needs, open space, recreation, habitat, and climate change related targets. The planning targets were originally established in 2007 and were revised by the Stakeholder group during the 2013 IRWM Plan updates at stakeholder meetings in August and October 2012. During these revisions, stakeholders indicated broad consensus on the changes to the planning targets during the meetings, and this was recorded in the meeting notes that are published to the www.avwaterplan.org website. In addition, objectives and targets related to climate change were developed by the Region's Climate Change Committee in a workshop held in November 2012.

The new climate change related objectives and targets were presented and agreed upon by stakeholders in the December 2012 stakeholder meeting as recorded in the meeting notes published to the www.avwaterplan.org website.

The targets, including those related to climate change, were revised once more during the 2019 IRWM Plan updates by the Stakeholder group during a stakeholder meetings held on January 2018 and August 2019. Targets were updated to satisfy 2016 IRWM Program updates and remain representative of the Region.

It is important to note that planning targets do not stipulate who is responsible for performing activities that will meet the numerical targets, nor do they specify exactly what projects will be implemented. The objectives and planning targets are presented below (and are summarized in Table 4-1).

Table 4-1: Antelope Valley Region Objectives and Planning Targets

Objectives	Planning Targets
Water Supply Management	
Provide reliable water supply to meet the Antelope Valley Region's expected demand between now and 2040; and adapt to climate change.	Maintain adequate supply and demand in average years.
	Provide adequate reserves (77,200 AFY) to supplement average condition supply to meet demands during single-dry year conditions, starting 2009.
	Provide adequate reserves (198,800 AF/ 4-year period) to supplement average condition supply to meet demands during multi-dry year conditions, starting 2009.
	Adapt to an additional 7-10% reduction in imported deliveries by 2050, and an additional 21-25% reduction in imported water deliveries by 2100.
Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries.	Demonstrate ability to meet regional water demands over an average year without receiving SWP water for 6 months over the summer by 2025
Stabilize groundwater levels.	Manage groundwater levels throughout the basin such that Production Rights defined in the adjudication Judgement are met by 2023.
Water Quality Management	
Provide drinking water that meets regulatory requirements and customer expectations.	Continue to meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period.
Protect and maintain aquifers.	Prevent unacceptable degradation of aquifer according to the Basin Plan throughout the planning period.
	Map contaminated sites and monitor contaminant movement, by 2017.
	Identify contaminated portions of aquifer and prevent migration of contaminants, by 2017.

Objectives	Planning Targets
Protect natural streams and recharge areas from contamination.	Prevent unacceptable degradation of natural streams and recharge areas according to the Basin Plan throughout the planning period.
Maximize beneficial use of recycled water.	Increase infrastructure and establish policies to use 33% of recycled water to help meet expected demand by 2015, 66% by 2025, and 100% by 2035.
Flood Management	
Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future.	Coordinate a regional Stormwater Resource Plan and policy mechanism by the year 2025 and incorporate adaptive management strategies for climate change.
Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses.	
Environmental Resource Management	
Preserve open space and natural habitats that protect and enhance water resources and species in the Antelope Valley Region.	Contribute to the preservation of an additional 2,000 acres of open space and natural habitat, to integrate and maximize surface water and groundwater management by 2025.
Land Use Planning/Management	
Maintain agricultural land use within the Antelope Valley Region.	Preserve 100,000 acres of farmland in rotation[1] through 2040.
Meet growing demand for recreational space.	Contribute to local and regional General Planning documents to provide 5,000[2] acres of recreational space by 2040.
Improve integrated land use planning to support water management.	Coordinate a regional land use management plan by the year 2025 and incorporate adaptive management strategies for climate change.
Climate Change Mitigation	
Mitigate against climate change.	Implement "no regret" mitigation strategies,[3] when possible, that decrease GHG's or are GHG neutral.

4.2 Water Supply Management Objectives and Planning Targets

Water supply management objectives and planning targets are directly related to addressing the key issues and needs identified in the water supply assessment in Section 3, including water supply and groundwater management issues.

[1] The phrase "in-rotation" means that not all 100,000 acres will be in agricultural production at one time; instead, the land will be rotated in cycles to make most efficient use of the land.
[2] The City of Palmdale and City of Lancaster's General Plans provide a standard of 5 acres of parkland per 1,000 City residents. The Kern County General Plan provides a standard of 2.5 acres per 1,000 residents. The other local and regional General Plans do not provide a standard for "recreation or parkland" preservation. This planning target assumes a 2040 population of 535,000 residents in the Antelope Valley Region.
[3] No regret projects are projects that would still be considered beneficial even if climate change weren't happening.

Water Supply Management Objectives and Planning Targets address the following CWC 10540(c) requirements:

- Protection and improvement of water supply reliability, including identification of feasible agricultural and urban water use efficiency strategies
- Identification of any significant threats to groundwater resources from overdrafting

Objective: Provide reliable water supply to meet the Antelope Valley Region's expected demand between now and 2040; and adapt to climate change.

Reliability is defined herein as the likelihood that a certain amount of water will be delivered to a specific place at a specific time. Reliability depends on the availability of water from the source, availability and capacity of the means of conveyance, and the level and pattern of water demand at the place of delivery.

As discussed in Section 3, the Antelope Valley Region's expected demand between 2015 and 2040 will increase from 144,700 to 257,500 acre-feet per year (AFY) for an average water year. The planned water supply for an average water year is approximately 160,100 to 238,000 AFY, respectively. This indicates a potential surplus of between 5,000 and 21,800 AFY for the Region through 2025, but a deficit of up to 19,500 AFY through 2040. There is also a mismatch of 77,200 AFY for a single dry water year and 198,800 AF/4-yrs for a consecutive 4-year multi-dry year condition. This mismatch could be further exacerbated by climate change as projected changes in the amount, intensity, timing, and quality of precipitation in the Region could have adverse impacts on local water supply recharge. Water supply reliability is further threatened by climate change as the Region is heavily dependent on imported SWP supplies. Sea level rise jeopardizes the California Bay Delta levee system, and levee failures would cause saltwater intrusion on vital freshwater supplies. Sea level rise is expected to cause significant declines in SWP allocations.

In order to assure a reliable water supply, the following three planning targets have been identified based on the regional population estimates shown in Table 2-3. However, if actual growth is less than projected or if average annual water use per capita decreases due to conservation efforts, then the overall demand for the Antelope Valley Region would decrease as well. Any reduction in demand would reduce the mismatches. Similarly, this target assumes the supply from only currently planned sources presented in Section 3 and that groundwater extractions are limited to the TSY of 110,000 AFY. Limitations on imported water, local surface water, and/or recycled water could reduce the available supplies.

Note that the second and third targets have been revised to reflect changed conditions since 2013.

- Target: Maintain adequate supply and demand in average years.
- Target: Provide adequate reserves (77,200 AFY) to supplement average condition supply to meet demands during single-dry year conditions, starting 2009.
- Target: Provide adequate reserves (198,800 AF/4-year period) to supplement average condition supply to meet demands during multi-dry year conditions, starting 2009.
- Target: Adapt to additional 7-10% reduction in imported deliveries by 2050, and additional 21-25% reduction in imported water deliveries by 2100.[4]

These Planning Targets may be measured by using the supply and demand information in the various UWMPs developed for water suppliers in the Antelope Valley, along with the other information

[4] Estimated imported water delivery reduction from California Climate Change Center, 2009. Using Future Climate Projections to Support Water Resources Decision Making in California. CEC-500-2009-052-F.

sources for demand and supply numbers described in Sections 2 and 3. These numbers will be updated each time the IRWM Plan is updated.

Objective: Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries.

Given the Antelope Valley Region's dependence on SWP water, as discussed in Section 3, all elements of its reliability should be considered. Fluctuations in SWP deliveries due to climatic changes have already been incorporated in the supply and demand comparisons for average, single-dry, and multi-dry year conditions, as provided in Section 3. However, impacts to the Antelope Valley Region in the event of an outage or disruption of SWP water due to emergency situations (e.g., a flood, earthquake, power outage, or other disaster) also need to be considered and a response planned. In the event of a temporary loss of SWP for 6 months over the summer, the Antelope Valley Region would be short an additional 65,000 AFY in an average water year. This estimate assumes that 33 percent (1/3) of demands occur during winter months (October through March) and 66 percent (2/3) occur in summer months (April through September); and it is based on the direct deliveries for AVEK discussed in Section 3.1.1.2.[5] This shortage would be in addition to the 19,500 AFY shortage already projected in an average year, as discussed in Section 3.1.3. The Antelope Valley Region needs to address and identify necessary actions to accommodate for such a loss and to ensure imported water supply; therefore, the following target has been identified.

- Target: Demonstrate ability to meet regional water demands over an average year without receiving SWP water for 6 months over the summer by 2025.

This Planning Target may be measured by using UWMPs and other capacity related planning documents to show that sufficient pumping capacity exists in the Region to provide 65,000 AFY of water over a six-month time period during the summer. This represents a "worst case scenario" since under dry year and multi-dry year scenarios, smaller allotments of imported water would be available to begin with. So 66 percent reductions in these smaller amounts would have less impact.

Objective: Stabilize groundwater levels.

As previously mentioned, a decrease in groundwater levels has led to incidences of land subsidence within the Antelope Valley Region, which may result in the loss of groundwater storage as well as a possible degradation of groundwater quality. Accordingly, maintaining groundwater levels is a key component to managing the groundwater basin and ensuring its reliability by preventing future land subsidence. The Antelope Valley Groundwater adjudication Judgment has already established groundwater production targets with the goal of achieving groundwater sustainability in an equitable manner. The objectives and targets set forth in this IRWM Plan support the adjudication Judgement.

- Target: Manage groundwater levels throughout the basin such that Production Rights defined in the adjudication Judgement are met by 2023.

This Planning Target may be measured by using the information provided in the Antelope Valley Watermaster Annual Reports. Under the Judgement, the Watermaster Engineer has the

[5] An average water year for the Region has approximately 96,000 AFY of direct deliveries from imported water providers. AVEK typically delivers 400 AF/day between June 15th and September 30th in any given year. During other times of year, AVEK typically delivers 150 AF/day. These values dictate that approximately 33% of annual demands occur in winter months (October to March) and 66% occur in summer months (April to September). Therefore, approximately 66% of average year direct deliveries (65,000 AFY) would not be available during a 6-month disruption over the summer.

responsibility of preparing annual reports for the Court, which provide groundwater level data and analyses.

4.3 Water Quality Management Objectives and Targets

This IRWMP aims to assist the Antelope Valley Region in achieving the following water quality concerns : identification and management of wellhead protection areas and recharge areas; regulation of the migration of contaminated groundwater; construction and operation by local agencies of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects; development of relationships with State and Federal regulatory agencies; and review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination.

Water Quality Management Objectives and Planning Targets were developed to address the following CWC 10540(c) requirements:

- Identification and consideration of the drinking water quality of communities within the area of the Plan
- Protection and improvement of water quality within the area of the Plan consistent with relevant basin plan
- Protection of groundwater resources from contamination

Objective: Provide drinking water that meets regulatory requirements and customer expectations.

As discussed in Section 3.2, water quality is generally good within the Antelope Valley except for the northeast portion of the dry lake areas. Groundwater in the principal aquifer generally meets the requirements for domestic, agricultural, and industrial uses. The exceptions to the good groundwater quality are some high concentrations of boron associated with naturally-occurring boron deposits, high nitrates associated with fertilizer use and poultry farming, and high arsenic levels that have been observed in water supply wells. The deeper aquifers typically have higher TDS levels.

In addition to meeting the Federal and State standards for water quality, other secondary standards (i.e., taste, color, and odor) may also affect a customer's overall satisfaction with the water. Although these constituents do not result in any health effects to the customer, they do impact the customer's desire to drink and use the water. Thus the following Planning Target has been identified.

- Target: Continue to meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period.

This Planning Target may be measured by using potable water quality data made available by the water purveyors in the Region through annual water quality reports, and using this information to track exceedances of drinking water quality standards.

Objective: Protect and maintain aquifers.

Groundwater is a main component of the Antelope Valley Region's water supply. Any loss of supply due to water quality degradation or contamination[6] would significantly hinder the Antelope Valley Region's ability to meet anticipated demands. As the Antelope Valley Region begins to reduce its exclusive dependence on imported water, utilize more recycled water, and implement additional recharge and storage projects, protecting the aquifer will become increasingly more important. All of

[6] For the purposes of this IRWM Plan, any increase in constituent levels over naturally occurring levels is considered "degradation"; any increase in constituent levels over the State or Federal standards is considered "contamination".

these non-groundwater sources can potentially cause degradation to the existing groundwater supply during recharge, possibly to the point of contamination. Identifying sources of degradation and taking appropriate measures to reduce or eliminate the potential for contamination is crucial to ensuring a reliable water supply. Where contamination has occurred, programs and projects must be implemented to prevent migration to other areas of the Basin. In some cases, treatment or remediation may be required to prevent migration. An area of the Basin that has been identified as contaminated is the portion of the aquifer near the Los Angeles World Airport where the spreading of wastewater effluent has resulted in a decline in water quality.[7] Other sources of potential degradation are from wells no longer in service that that have not been properly abandoned. These wells are suspected of drawing on water of a lesser quality from the deep aquifer to intermix with the water of the upper aquifer, degrading its quality. These areas and others should be identified, mapped, and monitored to prevent any future migration. The mapped information should include constituent concentrations in areas of concern, including TDS, nitrogen species (ammonia, nitrate, and nitrite), chloride, arsenic, chromium, fluoride, boron, and constituents of emerging concern (CECs; e.g., endocrine disrupters, personal care products or pharmaceuticals) consistent with the actions by the State Water Resources Control Board (SWRCB) taken pursuant to the Recycled Water Policy. Accordingly, the following Planning Target has been identified, which will involve monitoring these recharge sources to ensure they have negligible impacts to the groundwater supply.

- Target: Prevent unacceptable degradation of aquifer according to the Basin Plan throughout the planning period.
- Target: Map contaminated sites and monitor contaminant movement by 2017.
- Target: Identify contaminated portions of aquifer and prevent migration of contaminants by 2017.

These Planning Targets may be monitored by mapping data from SWRCB's Groundwater Ambient Monitoring and Assessment (GAMA) program which collects groundwater quality data from a number of sources to track changes in groundwater quality over time. The SWRCB is responsible for administering and maintaining the GAMA data. The Planning Targets to 1) map contaminated sites and monitor contaminant movement by 2017, and 2) identify contaminated portions of aquifer and prevent migration of contaminants by 2017, are both addressed in the 2014 SNMP for the Antelope Valley. These efforts are ongoing and will be revised with future SNMP updates.

Objective: Protect and maintain natural streams and recharge areas.

In addition to protecting the aquifer, it is also important to protect the surface water areas of the Antelope Valley Region from degradation and contamination[8]. Natural streams feed the Littlerock Creek, Amargosa Creek, Anaverde Creek, Cottonwood Creek, and others as well as recharge areas in the Antelope Valley Region. Thus, any degradation in water quality in the streams could result in contamination of this surface water supply as well as degradation in the recharge areas. Thus the following Planning Target has been identified.

- Target: Prevent unacceptable degradation of natural streams and recharge areas according to the Basin Plan throughout the planning period.

This Planning Target may be monitored by agencies already monitoring local surface waters, including PWD (which monitors Littlerock Creek), and the Los Angeles County Watershed

[7] As required by the November 2003 Cleanup and Abatement Order, and October 2004 Cease and Desist Order issued to LACSD by the Lahontan Region RWQCB.
[8] For the purposes of this IRWM Plan, any increase in constituent levels over naturally occurring levels is considered "degradation"; any increase in constituent levels over the State or Federal standards is considered "contamination".

Management Division and Kern County which monitor general surface water quality of surface waters (general minerals).

Objective: Maximize beneficial use of recycled water.

As discussed in Section 3, approximately 18,300 AFY of recycled water will be available for use by 2040, assuming treatment plant upgrades and distribution system development occur as planned. This estimate does not include current environmental maintenance uses. However, only approximately 350 AFY were utilized as of 2015. Beneficial use of additional recycled water would require additional infrastructure to treat and deliver the recycled water, as well as development of policies to encourage or require recycled water use for irrigation for existing beneficial uses or for groundwater recharge. The Los Angeles County and Antelope Valley Area General Plans currently identify general goals and policies to encourage groundwater recharge and reuse of recycled water. Moreover, the reuse of recycled water for municipal, industrial, and groundwater recharge end uses is critical for the long-term supply reliability of the Region. The development of this infrastructure and time to implement such policies is likely to occur in phases as resources are made available. Therefore, the following Planning Target has been identified.

- Target: Increase infrastructure and establish policies to use 33 percent of recycled water to help meet expected demand by 2015, 66 percent by 2025, and 100 percent by 2035.

This Planning Target may be measured by monitoring programs maintained by LACSD to record the amounts of recycled water delivered to customers. Documents such as annual reports for the Lancaster WRP and Palmdale WRP may be used to obtain the information.

4.4 Flood Management Objectives and Targets

Flood Management Objectives and Planning Targets address the following California Water Code (CWC) 10540(c) requirements:

- Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region

Objective: Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future.

Objective: Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses.

As described in Section 3.3, the Antelope Valley is prone to flash flooding, and this situation is aggravated by the lack of a coordinated and comprehensive drainage infrastructure system for managing stormwater and urban runoff. Stormwater tends to be of poor quality and high in sediment, and is further degraded by urban runoff. The Region recognizes that it may be vulnerable to potential increases in flooding due to projected changes in the amount, intensity, timing, quality, and variability of precipitation caused by climate change.

Extensive growth in the Antelope Valley has occurred in both major cities as well as unincorporated County areas. This growth both increases the amount of impervious surfaces in the Valley and the number of homes and businesses subject to the negative impacts of flooding and in need of flood protection. Flood waters are necessary to provide benefits in natural areas of the Region. One example of the importance of maintaining natural flood flow areas is Rosamond Dry Lake at the lowest elevation in the watershed. This lake requires significant flooding to maintain the biological crust that protects the lakebed surface from breaking down during high wind events. By protecting the lakebed surface, the air quality in the Antelope Valley is protected, and the operational mission of EAFB is protected by providing a suitable surface to test experimental aircraft and processes, which in turn provides jobs to Antelope Valley residents.

To adequately address the need for maintained flood effects, and to limit flood damage in a cost-effective manner, flood management efforts should take place on a regional scale and should be coordinated across jurisdictions. This scope and level coordination would also provide some consistency both in costs associated with flood prevention and mitigation, and in permitting requirements for Antelope Valley residents, businesses and developers. With the Antelope Valley Region having a great water supply need there is the added incentive for the flood management systems to convey waters of suitable quality to recharge systems to augment groundwater supply for the benefit of multiple communities. Additionally, as discussed in Sections 2 and 3, changes in precipitation brought on by climate change are predicted to increase flash flooding in the Valley. To help respond to this, the Region can implement adaptive flood management that will allow for the continued multi-benefit use of flood water while maintaining flood protection.

Furthermore, urban development and revitalization efforts implemented on a regional scale that can protect natural and man-made amenities, while avoiding severe hazard areas such as flood prone areas, would be consistent with the goals and policies of the various land use authorities including incorporated cities and Kern and Los Angeles counties. New development is encouraged to protect drainage courses in as natural a state as possible, while minimizing modification of the natural carrying capacity or production of excessive siltation. Flood Zones are identified within the Antelope Valley Area General Plan, and include areas that are subject to a high risk of flooding during storm events such as Amargosa Creek, Anaverde Creek, Big Rock Creek, Little Rock Creek, the frontal canyons on the north slope of the San Gabriel Mountains, drainages from the north face of Portal Ridge, and the upper reaches of the Santa Clara River through Acton. Development is regulated within these areas by either not permitting the development (due to extreme hazard) or by requiring new development to conform to special performance requirements in the flood fringe areas adjacent to a waterway.

While optimizing the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses, it is important to acknowledge that the natural habitats downstream (e.g., Piute Ponds) are very dependent on the natural flows. Although some natural habitats have been sustained through the years by recycled water, the dramatic stormflows are still a major component of the system. The magnitude of these stormflows provides needed clearing of vegetation, sediment, and water to wetland and wet meadow areas. A major alkali mariposa lily population exists in the Piute Pond Complex and requires surface water flow to maintain.

The local and regional General Plan policy documents pertaining to flood management within the Antelope Valley Region can be found in Table 8-1 in Section 8.

Effective storm water planning and management on a watershed basis involves collaboration of local and regional governments, utilities, and other stakeholder groups to analyze the hydrology, storm drain/runoff conveyances systems, opportunity sites, and other habitat or community needs within sub-watersheds. Development of a regional Storm Water Resource Plan (SWRP) could facilitate inter-agency efforts to maximize the beneficial use of storm water by establishing guidance for project implementation and providing a high-level analysis of the overall benefits and impacts of each project and program implemented in accordance with the SWRP.

Accordingly, the following Planning Target has been identified:

- Target: Coordinate a regional Storm Water Resource Plan and policy mechanism by the year 2025 and incorporate adaptive management strategies for climate change.

This Planning Target may be measured by the incorporation of regional integrated stormwater management strategies, including adaptive management strategies for climate change, into the 2019 IRWMP Update. The Update may also include recommendations for a policy mechanism.

4.5 Environmental Resource Management Objectives and Targets

Environmental Resource Management Objectives and Planning Targets address the following CWC 10540(c) requirements:

- Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region

Objective: Preserve open space and natural habitats that protect and enhance water resources and species in the Antelope Valley Region.

As described earlier, due to its proximity to the Los Angeles area, the Antelope Valley is subject to increasing demand for community development, recreation, and resource utilization. Population in the Antelope Valley is expected to increase by 38 percent between 2010 and year 2040. Some of this growth will result in the conversion of agricultural land, while some of this growth will occur in areas that are currently natural and undeveloped. Loss of both agricultural acreage and natural areas decreases the amount of open space in the Valley. Open space can mean natural open space, passive and active recreation which may or may not be compatible with natural habitats, or natural open space preservation. As an example, open space can mean soccer fields, playgrounds, etc. that should not be considered natural habitat. This growth and the associated loss of open space could adversely affect local water resources through the loss of wetland areas and the watershed functions these areas provide (e.g., filtration of surface water, stormwater detention, habitat), and the loss of groundwater recharge areas.

Also of concern is the negative effect of urban growth on the unique biological resources of the Antelope Valley. As discussed in Section 3, besides a direct loss of habitat, increasing proximity to urban development is harmful to sensitive desert species, several of which are found only in the Antelope Valley Region. Examples of species that are impacted include the desert tortoise, Mohave ground squirrel, Arroyo toad, burrowing owl, alkali mariposa lily, and Joshua tree.

Thus, the following Planning Target has been identified to preserve open space and natural habitats that protect and enhance water resources and species in the Antelope Valley Region.

- Target: Contribute to the preservation of an additional 2,000 acres of open space and natural habitat, to integrate and maximize surface and groundwater management by 2025.

This Planning Target needs to be consistent with local planning objectives such as those identified in the Antelope Valley Area General Plan, the Kern County General Plan, and other management plans approved for the Antelope Valley Region, some of which are discussed below. This target is not limited to 2,000 acres, and conservation of acreages greater than 2,000 acres is encouraged. For future consideration, it may be useful to set a Planning Target regarding the inventory, mapping, and protection of a minimum number of acres/linear area of remaining natural areas that are dependent on flooding and their connectivity to the headwaters.

This Planning Target will be measured using land acquisition information (including acreage of open space preserved and number of parcels acquired) obtained through the Los Angeles County Department of Regional Planning, the Kern County Planning and Community Development Agency, and the Antelope Valley Conservancy.

Policies within the Antelope Valley Area General Plan implement Los Angeles County's General Plan, and further specify objectives and goals specific to that Antelope Valley Region. The Antelope Valley

Area General Plan identified several priority areas for conservation and protection to promote biodiversity, including significant ecological areas (SEAs) such as the Joshua Tree Woodlands, wildlife corridors, and other sensitive habitat areas. Potential development in these areas is limited, and new development is required to consider all potential environmental impacts.[9] Educational, observational, and light recreational uses could be allowed in these preserves and the preserves would also act as open space areas, enhancing the rural character of the Antelope Valley.

Through the identification and designation of SEAs within the Los Angeles County General Plan and the Antelope Valley Area General Plan, new urban growth or encroaching uses and activities would be controlled to ensure protection of ecological resources and habitat areas by regulating and establishing compatible land uses, and requiring design and performance criteria to be met. Although SEAs are neither preserves nor conservation areas, requiring development to be located around the existing biological resources would help to ensure protection of sensitive species and their habitats as well as helping to make the location and size of the preserved area scientifically defensible.

The Kern County General Plan does not identify specific open space or habitat areas to be preserved (Kern County 2008). The Kern County General Plan does, however, state that "The County will seek cooperative efforts with local, state, and federal agencies to protect listed threatened and endangered plant and wildlife species through the use of conservation plans and other methods promoting management and conservation of habitat lands." Additionally, the open-space element of the Kern County General Plan contains measures for preserving open-space for natural resources.

The West Mojave Plan covers 9.4 million acres in the western portion of the Mojave Desert, including portions of Los Angeles and Kern counties. This habitat conservation plan and federal land use plan amendment presents a comprehensive strategy to conserve and protect the desert tortoise, the Mohave ground squirrel and over 100 other sensitive plants and animals and the natural communities of which they are a part. The West Mojave Plan accomplishes this by: designating 14 new Areas of Critical Environmental Concern (ACEC), adjusting four existing ACEC boundaries, and establishing other special management areas specifically designed to promote species conservation; designating allowed routes of travel on public lands to reduce species mortality from off-road vehicles; and, establishing other management prescriptions to guide grazing, mineral exploration and development, recreation, and other public land uses (BLM 2006). The West Mojave Plan is consistent with the existing conservation plans in the area, and would further the preservation of important species and their habitats that protect and enhance the Antelope Valley Region's watershed.

Conservation and protection of the desert tortoise, the Mohave ground squirrel and over 100 other sensitive plants and animals and the natural communities of which they are a part, as described within the West Mojave Plan[10], would help the area meet this Planning Target (BLM 2006). The Plan is consistent with conservation plans and local policies for furthering habitat protection by prescribing appropriate uses within protected ACEC areas that limit human and non-native animal interaction with sensitive species to reduce mortality and habitat degradation.

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[9] The SEA program is a component of the Los Angeles County General Plan Conservation/Open Space Element. SEAs are ecologically important land and water systems that support valuable habitat that plants and animals, often integral to the preservation of rare, threatened or endangered species and the conservation of biological diversity in Los Angeles County. Source: Los Angeles County Department of Regional Planning, http://planning.lacounty.gov/sea

[10] "While many of the general conservation concepts and species accounts are valid in the West Mohave Plan the Plan relies heavily upon habitat protection within BLM lands as mitigation for impacted habitats from development occurring elsewhere, perhaps many miles away……. the Department of Fish and Game did not endorse the WMP as a habitat protection planning document (personal communication, S. Harris, Department of Fish and Game.)"

Preservation lands in other areas could also be targeted, based on qualities that maintain and enhance the watershed and aquifer.

4.6 Land Use Planning/Management Objectives and Targets

Land Use Planning/Management Objectives and Planning Targets address the following CWC 10540(c) requirements:

- Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region

Objective: Maintain agricultural land use within the Antelope Valley Region.

As discussed in Section 3, there is an estimated 16,000 acres of irrigated crop land in the Antelope Valley Region. Agriculture is an important industry for the Antelope Valley area. In addition to direct production of food and fiber, secondary employment is created by the agricultural production, including transportation and food manufacturing. In Kern County it is estimated that one out of every six jobs is tied to the agricultural industry (American Census Bureau 2013-2017). In addition, agriculture plays an important role in community identity. The types of crops grown in an area may be unique to that place. Community festivals are often planned around the commodities unique to a place, or for which a community is known. The physical landscape of a place can be defined by its agriculture as the crops create a distinct color mosaic and pattern. Residents also can take advantage of the open space and views allowed by nearby agriculture. In addition, some agricultural crops may provide wildlife habitat (e.g., nesting, temporary foraging).

As described in earlier sections of this IRWM Plan, demand for urban development is resulting in a conversion of agricultural land, and is introducing conflicts between agricultural and residential development. As a result, agricultural land is increasingly found only on the urban fringes. There is a desire to preserve agriculture as an industry and as a cultural asset. Both Los Angeles County and Kern County have adopted policies intended to preserve agricultural resources. These policies include right-to-farm ordinances, reduced property tax programs for farm businesses, and policies discouraging provision of urban services in agricultural areas. The Los Angeles County General Plan and the Antelope Valley Area Plan have designated “Agricultural Resource Areas,” which consist of areas that have been historically farmed in the County, as well as farmland identified by the California Department of Conservation, that are protected by policies to prevent the conversion of farmland to incompatible uses. This is intended to be accomplished through use of incentives that establish a voluntary agricultural preserve. To encourage the retention and expansion of agricultural use both within and outside a potential agricultural preserve, the policies promote compatible land use arrangements and offer technical assistance in support of farming interests. In addition, expansion of agriculture into underutilized lands, such as utility rights-of-way and flood prone areas is encouraged. The Kern County General Plan also has policies in place to protect areas designated for agricultural use from incompatible residential, commercial, and industrial subdivision and development activities. The following Planning Target, which furthers these existing goals and policies, has been identified to maintain agricultural land use within in the Antelope Valley Region.

- Target: Preserve 100,000 acres of farmland in rotation[11] through 2040.

This Planning Target will be measured using farmland area shown in general plan map updates as compared to previous general plan maps.

[11] The phrase “in-rotation” means that not all 100,000 acres will be in agricultural production at one time rather the land will be rotated in cycles to make most efficient use of the land.

Objective: Meet growing demand for recreational space.

Demands for recreational space are similar to the demands for biological habitat and agricultural land. These demands for land uses are competing with one another due to an increasing population. Growth in the Antelope Valley threatens recreational lands and increases demands for recreational opportunities. However, population increases in Southern California as a whole also add to the pressure to maintain and expand the Antelope Valley Region's recreational opportunities, particularly since recreational resources found in the Antelope Valley, such as off-highway vehicle (OHV) use areas, are not found anywhere else in near proximity to Southern California population centers. Optimally, recreational resources could be preserved in a way that does not conflict with other land uses or resource protection.

Currently, recreation resources in the Antelope Valley are provided by multiple jurisdictions. Often recreational facilities are dedicated as part of a specific local development project or fees are paid in-lieu of providing recreational facilities. However, most local jurisdictions have policies in place that would encourage cooperation to develop, expand, or enhance regional recreation facilities. For example, several goals and policies within Los Angeles County's General Plan identify the need for development of community parks and recreational amenities within areas deficient in such resources, and suggest such could be accomplished through preserving large natural and scenic areas while focusing new urban growth into areas with suitable land. To achieve such a balance between increased intensity of development and the capacity of needed facilities to serve the population, the General Plan encourages use of open space easements and dedications, or recycling of "brownfield" sites (e.g., abandoned mineral extraction sites, remediated industrial or commercial areas, etc.) as a means of achieving recreational, open space and scenic needs.

Development of new regulatory controls, similar to those in place for SEAs to ensure compatibility of development adjacent to or within major public open space and recreational areas, including the Angeles and Los Padres National Forests are also encouraged.

Thus the following Planning Target has been identified to meet the growing demand for recreational resources in the Antelope Valley Region. It is the intent of this IRWMP to support and promote the preservation of recreational space in parallel with general plan efforts.

- Target: Contribute to local and regional General Planning documents to provide 5,000 acres of recreational space by 2040.

This Planning Target will be measured using current recreational area as provided through general plan maps and by cities, and tracking the increased acreage of recreational space created through implementation of projects.

Objective: Improve integrated land use planning to support water management.

Coordination between land use planning agencies and water management agencies is crucial to implementation of a successful IRWM Plan. A regional land use management plan to guide the Antelope Valley Region's physical development would be a key step towards improving coordination and identifying future water needs throughout the Antelope Valley Region. Growth management, the protection of various land uses and the efficient use of natural resources such as land, water and energy are three of the principal goals of regional land use planning. A regional land use management plan that directs the Antelope Valley Region's growth towards existing centers will not only encourage natural resource efficiency and the preservation of surrounding agricultural land uses and recreational open space but will also improve the efficient use of economic resources dedicated towards utilities infrastructure improvements and expansions.

A regional land use management plan would identify the actions necessary in order to gauge success on meeting the land use management objectives. Ideally, a regional land use plan would serve as a master plan for the Antelope Valley Region's physical development. As such, it could provide the opportunity to conduct design studies to test the physical capacity of the Antelope Valley Region's urban areas and centers of development. Such a focus on physical design can help regional agencies to understand and visualize the impact of new structures on the natural and built environment, and thus to better understand the consequences of planning policy. Consideration of building codes, zoning laws, and other regulations affecting development should also be a central component of the regional land use plan. The plan should provide for the periodic review of its major elements, in order to remain a useful tool as the Antelope Valley Region undergoes various changes. Additionally, the potential need to adapt to climate change in the future should be considered through the inclusion of adaptive management strategies that will allow the Region to be flexible in the implementation of the land use management plan. Accordingly, the following Planning Target has been identified.

- Target: Coordinate a regional land use management plan by the year 2025 and incorporate adaptive management strategies for climate change.

This Planning Target may be measured by the incorporation of regional land use management strategies, including adaptive management strategies for climate change, into the 2019 IRWMP Update. The Update may also include recommendations for development of a land use management plan.

4.7 Climate Change Mitigation Objectives and Targets

Objective: Mitigate against climate change

In addition to adapting to the effects of climate change (which have been incorporated into the above objectives and targets), the Region recognizes the need to mitigate against future climate change by implementing resource management strategies (to be discussed in Section 5) and projects (to be discussed in Section 6 and 7) that will increase energy efficiency, reduce greenhouse gas emissions, utilize renewable energy sources, and/or sequester carbon. In order to acknowledge the challenges of interpreting new climate change information and identify which response methods and approaches will be most appropriate for their planning needs, the Region has decided to target the implementation of "no regret[12]" mitigation strategies which are strategies that will provide benefits under current climate conditions, while also mitigating against future climate change impacts. This adaptation and mitigation target is consistent with strategies adopted by local water resources plans such as UWMPs and the SNMP.

Resource management strategies and projects adopted into the Plan are also consistent with the California Air Resources Board AB 32 Scoping Plan which aims to reduce GHG emissions in the State to 1990 levels by 2020. Project proponents are encouraged to consider the strategies adopted by CARB in its AB 32 Scoping Plan when developing projects to identify potential no regret strategies. The following Planning Target has been identified.

- Target: Implement "no regret" mitigation strategies, when possible, that decrease GHGs or are GHG neutral

This Planning Target will be measured by tracking the number of projects that involve climate change mitigation strategies and by tracking GHG emissions and energy usage by the Region's agencies.

[12] No regret projects are projects that would still be considered beneficial even if climate change weren't happening.

Section 5 | Resource Management Strategies

The following section introduces a diverse menu of resource management strategies (RMS) available to meet the Objectives for the Antelope Valley Region, and it goes on to examine the impacts and benefits of these strategies.

5.1 Consideration of Strategies

The State of California, through the 2016 California Water Plan[1], has identified 37 different RMS to improve regional water resource management. In order to determine what regional water management strategies should be included in the IRWMP, the Region considered the RMS listed and defined in Table 5-1 below in relation to the issues and needs determined by stakeholders and presented in Section 3 and the Region Objectives developed in Section 4. The RMS included as strategies in the IRWM Plan are those that have synergies with the Region's goals and objectives. Some RMS were not considered feasible or applicable for implementation in the Antelope Valley Region for the reasons listed below:

- Conveyance – Delta: Although this strategy could improve water supply reliability for the Region, it involves projects that would be implemented outside the Region and therefore it is not considered applicable.
- Desalination: There is no brackish groundwater or ocean water in the Region and therefore this strategy is not considered applicable.
- Precipitation Enhancement: This technology is unproven and was therefore not considered feasible for the Region.
- Surface Storage – CALFED Bay-Delta Program (CALFED): There are no CALFED storage facilities in the Region and therefore this strategy is not considered applicable.

[1] The 2018 California Water Plan did not provide further updates to the Resource Management Strategies.

- Dewvaporation or Atmospheric Pressure Desalination: Because this technology is unproven and there is no brackish water in the Region, this strategy was not considered feasible.
- Fog Collection: This technology is unproven and was therefore not considered feasible for the Region.
- Rainfed Agriculture: Because there is insufficient rainfall on the Valley floor to meet agricultural demands, this strategy was not considered feasible as a significant water supply measure. Rainfall is incorporated into the agricultural demand calculations in Section 3.
- Snow Fences: Because snow is extremely rare on the Valley floor, this strategy is unnecessary for the Region.
- Waterbag Transport/Storage Technology: This technology is not considered feasible because it is intended for use in coastal regions and has not been used in California.

Table 5-1: 2013 California Water Plan Resource Management Strategies

Resource Management Strategy	Description	Included in IRWM Plan
Reduce Water Demand		
Agricultural Water Use Efficiency	Agricultural water use efficiency is the use of incentives, public education, and other programs to achieve reductions in the amount of water used for agricultural irrigation.	Yes
Urban Water Use Efficiency	Urban water use efficiency is the use of incentives, public education and other programs to reduce potable water used for municipal, commercial, industrial, irrigation and aesthetic purposes.	Yes
Improve Operational Efficiency and Transfers		
Conveyance – Delta	The Delta conveyance strategy seeks to improve existing Delta conveyance systems by upgrading aging distribution systems, as well as to increase system flexibility and reliability through the addition of interconnections among water resources systems.	No
Conveyance – Regional/Local	The local/regional conveyance strategy seeks to improve existing local and regional conveyance systems by upgrading aging distribution systems, as well as to increase system flexibility and reliability through the addition of interconnections among water resources systems.	Yes
System Reoperation	System reoperation allows for better management and movement of existing water supplies, and includes managing surface storage facilities to optimize the availability and quality of stored water supplies.	Yes
Water Transfers	Water transfers are temporary or long-term changes in the point of diversion, place of use, or purpose of use due to contracting.	Yes
Increase Water Supply		
Conjunctive Management and Groundwater	Conjunctive management can help improve the long term and seasonal reliability of surface water supplies by recharging these supplies in groundwater basins when available, and recovering them through groundwater pumping when needed.	Yes
Desalination	Desalination is the removal of salts from saline waters, including ocean water and brackish groundwater.	No
Precipitation Enhancement	Precipitation enhancement artificially stimulates clouds to produce more rainfall or snowfall than they would naturally.	No

Resource Management Strategy	Description	Included in IRWM Plan
Recycled Municipal Water	Implementation of the recycled municipal water strategy develops usable water supplies from treated municipal wastewater.	Yes
Surface Storage – CALFED	CALFED surface storage increases imported water supply through the construction or modification of surface storage reservoirs to capture surface water to improve supply reliability to the Delta.	No
Surface Storage – Regional/Local	Regional and local surface storage increases local supply through the construction or modification of local or regional surface reservoirs or developing surface storage capabilities in out-of-region reservoirs.	Yes
Water Quality Management		
Drinking Water Treatment and Distribution	Drinking water treatment and distribution includes improving the quality of potable water supplied to customers and improving conveyance systems to improve the quality of supplies delivered from treatment facilities.	Yes
Groundwater and Aquifer Remediation	Groundwater and aquifer remediation removes constituents or contaminants that affect the beneficial use of groundwater.	Yes
Matching Water Quality to Use	Matching water quality to use recognizes that not all water uses require the same quality of water. Agricultural, municipal, landscape and residential water uses have different water quality needs.	Yes
Pollution Prevention	Pollution prevention controls or reduces pollutants from point and nonpoint sources that can affect multiple environmental resources, including water supply, water quality, and riparian and aquatic habitat.	Yes
Salt and Salinity Management	Salt and salinity management encourages stakeholders to proactively seek to identify the sources, quantify the threat, prioritize necessary mitigation action, and work collaboratively with entities with the authority to take appropriate actions.	Yes
Urban Runoff Management	Urban runoff management includes strategies for managing or controlling urban runoff, such as intercepting, diverting, controlling, or capturing stormwater runoff or dry season runoff.	Yes
Flood Management		
Flood Risk Management	Flood risk management focuses on protecting people, property and infrastructure from floods.	Yes
Practice Resources Stewardship		
Agricultural Lands Stewardship	Agricultural lands stewardship protects and promotes agricultural production through integrating best management practices that conserve resources.	Yes
Ecosystem Restoration	Ecosystem restoration aims to return a selected ecosystem to a condition similar to its state before any disturbance occurred.	Yes
Forest Management	Forest management aims to implement forest management projects and programs to help support water resources.	Yes
Land Use Planning and Management	Land use planning and management uses land controls to manage, minimize, or control activities that may negatively affect the quality and availability of groundwater and surface waters, natural resources, or endangered or threatened species.	Yes
Recharge Areas Protection	Recharge areas protection focuses on protection of lands that are important locations for groundwater recharge.	Yes

Resource Management Strategy	Description	Included in IRWM Plan
Sediment Management	Sediment management seeks to both protect sediment as a valuable natural resource and address excess sediments in the watershed.	Yes
Watershed Management	Watershed management utilizes planning, programs, and projects to restore and enhance watershed functions.	Yes
People and Water		
Economic Incentives	Economic incentives, in the form of loans, grants, or water pricing support, are important for successful implementation of projects as a lack of adequate funds can prevent a project from moving forward.	Yes
Outreach and Engagement	Outreach and engagement by water agencies facilitates contribution by public individuals and groups and provides insight to decision makers on the best approaches for water management.	Yes
Water and Culture	Water and culture links cultural considerations to water management by increasing awareness of how cultural values, uses, and practices affect and are affected by water management.	Yes
Water-dependent Recreation	Water-dependent recreation seeks to enhance and protect water-dependent recreational opportunities and public access to recreational lands through water resources management.	Yes
Other Strategies		
Crop Idling for Water Transfers	Crop idling is the removal of lands from irrigation with the aim of returning the lands to irrigation at a later time to allow for the temporary transfer of water supplies for other uses.	Yes
Dewvaporation or Atmospheric Pressure Desalination	Dewvaporation is the process of humidification-dehumidification desalination where brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall.	No
Fog Collection	Fog collection is the collection of water from fog using large pieces of material to make the fog condense into droplets and flow down to a collection trough.	No
Irrigated Land Retirement	Irrigated land retirement is the permanent removal of farmland from irrigated agriculture to free up water supplies for other uses.	Yes
Rainfed Agriculture	Rainfed agriculture is when all crop consumptive water use is provided directly by rainfall on a real time basis.	No
Snow Fences	Snow fencing is when fences are strategically placed in small openings to reduce drifting over roadways and improve watershed management.	No
Waterbag Transport/Storage Technology	The use of waterbag transport/storage technology involves diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them to an alternate coastal region.	No

Table 5-2 shows the relationship between the RMS and the Regional Objectives. In many instances, regional strategies can address multiple IRWMP Objectives and Planning Targets. The remainder of this chapter describes the RMS selected for inclusion in the Plan according to Objective, and is organized into the following categories:

- Strategies for water supply management

- Strategies for water quality management
- Strategies for integrated flood management
- Strategies for environmental resource management
- Strategies for land use planning/management
- Strategies for climate change mitigation

These categories align with the groupings for Regional Objectives shown in Table 5-2.

Table 5-2: Strategies that Support the Antelope Valley Region's Objectives

	Antelope Valley Region Objectives													
	Water Supply Management			**Water Quality Management**				**Flood Management**		**Environ. Resource Mgmt.**		**Land Use Planning/ Mgmt**		**Climate Change**
	Provide reliable water supply to meet the Region's expected demand between now and 2040; and adapt to climate change	Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries	Stabilize groundwater levels	Provide drinking water that meets regulatory requirements and customer expectations	Protect and maintain aquifers	Protect natural streams and recharge areas from contamination	Maximize beneficial use of recycled water	Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future	Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses	Preserve open space and natural habitats that protect and enhance water resources and species in the Region	Maintain agricultural land use within the Antelope Valley Region	Meet growing demand for recreational space	Improve integrated land use planning to support water management	Mitigate against climate change
Reduce Water Demand														
Agricultural Water Use Efficiency	•	•	•								•			•
Urban Water Use Efficiency	•	•	•											•
Improve Operational Efficiency and Transfers														
Conveyance – Regional/Local	•	•	•											•
System Reoperation	•	•	•											•
Water Transfers	•	•	•											•
Increase Water Supply														
Conjunctive Management and Groundwater	•	•	•		•		•						•	•
Recycled Municipal Water	•	•	•				•					•		•
Surface Storage – Regional/Local	•	•	•					•					•	•
Water Quality Management														
Drinking Water Treatment and Distribution				•										

	Antelope Valley Region Objectives													
	Water Supply Management			**Water Quality Management**				**Flood Management**		**Environ. Resource Mgmt.**		**Land Use Planning/ Mgmt**		**Climate Change**
	Provide reliable water supply to meet the Region's expected demand between now and 2040; and adapt to climate change	Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries	Stabilize groundwater levels	Provide drinking water that meets regulatory requirements and customer expectations	Protect and maintain aquifers	Protect natural streams and recharge areas from contamination	Maximize beneficial use of recycled water	Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future	Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses	Preserve open space and natural habitats that protect and enhance water resources and species in the Region	Maintain agricultural land use within the Antelope Valley Region	Meet growing demand for recreational space	Improve integrated land use planning to support water management	Mitigate against climate change
Groundwater and Aquifer Remediation	•	•		•	•									
Matching Water Quality to Use							•		•			•		
Pollution Prevention				•	•	•		•		•				
Salt and Salinity Management				•	•									
Urban Runoff Management	•		•		•	•		•	•				•	
Flood Management														
Flood Risk Management	•	•	•			•		•	•	•			•	
Practice Resources Stewardship														
Agricultural Lands Stewardship	•									•	•		•	•
Ecosystem Restoration					•	•		•	•	•		•	•	•
Forest Management						•				•		•	•	•
Land Use Planning and Management								•	•	•	•	•	•	
Recharge Areas Protection			•		•	•		•		•			•	
Sediment Management				•	•	•		•		•				•
Watershed Management					•	•		•	•	•	•	•	•	•
People and Water														

Antelope Valley Region Objectives	Water Supply Management			Water Quality Management				Flood Management		Environ. Resource Mgmt.		Land Use Planning/ Mgmt		Climate Change
	Provide reliable water supply to meet the Region's expected demand between now and 2040; and adapt to climate change	Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries	Stabilize groundwater levels	Provide drinking water that meets regulatory requirements and customer expectations	Protect and maintain aquifers	Protect natural streams and recharge areas from contamination	Maximize beneficial use of recycled water	Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future	Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses	Preserve open space and natural habitats that protect and enhance water resources and species in the Region	Maintain agricultural land use within the Antelope Valley Region	Meet growing demand for recreational space	Improve integrated land use planning to support water management	Mitigate against climate change
Economic Incentives	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Outreach and Engagement	•	•	•	•	•	•					•	•		•
Water and Culture	•	•		•							•	•		•
Water-dependent Recreation						•				•		•	•	
Other Strategies														
Crop Idling for Water Transfers	•		•											
Irrigated Land Retirement	•		•			•							•	

5.2 Strategies for Water Supply Management

Objective: Provide reliable water supply to meet the Region's expected demand between now and 2040; and adapt to climate change

The following RMS help to meet this Region Objective in the following ways:

- *Agricultural Water Use Efficiency* – reduces agricultural demands and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase agricultural demands and/or reduce available supplies
- *Urban Water Use Efficiency* – reduces urban demands and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase municipal demands and/or reduce available supplies

Outdoor uses such as irrigation account for most urban water demands in the Region.

- *Conveyance - Regional/Local* – increases reliability and control of water movement between imported water turnouts, surface and groundwater storage supply locations, and demand locations; minimizes losses that occur in the conveyance system
- *System Reoperation* – increases reliability and control of water movement between imported water turnouts, surface and groundwater storage supply locations, and demand locations and therefore increases overall reliability of water supplies
- *Water Transfers* – increase the amount of imported water supplies available to the Region and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase overall demands and/or reduce supplies
- *Conjunctive Management and Groundwater* – allows capture of previously unusable imported water, stormwater, and recycled water by providing storage capacity; increases the amount of overall supplies and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase overall demands and/or reduce supplies
- *Recycled Municipal Water* – increases the amount of recycled water supplies available to the Region and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase overall demands and/or reduce supplies
- *Surface Storage - Regional/Local* – increases the amount of surface water supplies (dry weather runoff and stormwater) available to the Region and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase overall demands and/or reduce supplies
- *Groundwater and Aquifer Remediation* – increases the amount of groundwater supplies available to the Region (previously unavailable due to contamination) and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase overall demands and/or reduce supplies

- *Urban Runoff Management* – increases the amount of surface water supplies (dry weather runoff and stormwater) available to the Region and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase overall demands and/or reduce supplies
- *Flood Risk Management* – increases the amount of surface water supplies (stormwater) available to the Region by using integrated flood management and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase overall demands and/or reduce supplies
- *Agricultural Lands Stewardship* – reduces agricultural demands and improves groundwater recharge using best management practices and therefore reduces the Regional gap between supply and demand; supports adaptation to climate change impacts that increase agricultural demands and/or reduce available supplies
- *Economic Incentives* – used to implement water supply and/or demand management projects and therefore reduce the Regional gap between supply and demand; this indirectly supports adaptation to climate change impacts that increase demands and/or reduce available supplies
- *Outreach and Engagement* – increases public awareness of where water comes from, as well as the value and importance of water conservation and water use efficiency to reduce regional water demand
- *Water and Culture* – helps project expected water demands for cultural activities and understand the perspectives that influence water conservation
- *Crop Idling for Water Transfers* – enhances water supply reliability by making water available for redistribution
- *Irrigated Land Retirement* – removes farmland from irrigated agriculture, decreasing agricultural water demands supplied by groundwater

Objective: Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries

The following RMS help to meet this Regional Objective in the following ways:

The operation of reservoirs may allow for increased water capture.

- *Agricultural Water Use Efficiency* – decreases agricultural demands during a plausible disruption of SWP deliveries; demand management programs typically include tiered strategies that can be implemented as needed under a variety of circumstances
- *Urban Water Use Efficiency* – decreases urban demands during a plausible disruption of SWP deliveries; demand management programs typically include tiered strategies that can be implemented as needed under a variety of circumstances
- *Conveyance - Regional/Local* – increases reliability and ability to move water throughout the Region and minimizes losses that occur in the conveyance system; greater flexibility allows for increased use of alternate supplies during a SWP disruption

- *System Reoperation* – increases reliability and ability to move water throughout the Region; greater flexibility allows for increased use of alternate supplies during a SWP disruption
- *Water Transfers* – may increase access to stored SWP water that could be delivered during a SWP disruption
- *Conjunctive Management and Groundwater* – allows capture of previously unusable imported water, stormwater, and recycled water by providing storage capacity; increases the amount of overall supplies that are controlled within the Region and therefore increases availability of supplies during a SWP disruption
- *Recycled Municipal Water* – increases the amount of recycled water supplies available to the Region; increases the amount of overall supplies that are controlled within the Region and therefore increases availability of supplies during a SWP disruption
- *Surface Storage - Regional/Local* – increases the amount of surface water supplies (dry weather runoff and stormwater) available to the Region; increases the amount of overall supplies that are controlled within the Region and therefore increases availability of supplies during a SWP disruption
- *Groundwater and Aquifer Remediation* – increases the amount of groundwater supplies available to the Region (previously unavailable due to contamination); increases the amount of overall supplies that are controlled within the Region and therefore increases availability of supplies during a SWP disruption
- *Flood Risk Management* – increases the amount of surface water supplies (stormwater) available to the Region by using integrated flood management and therefore increases the availability of supplies during a SWP disruption
- *Economic Incentives* – used to implement water supply and/or demand management projects and therefore increase the availability of supplies during a SWP disruption
- *Outreach and Engagement* – instills water conservation and water use efficiency as a public ethic, decreasing regional demands during a potential disruption of SWP deliveries

Objective: Stabilize groundwater levels

The following RMS help to meet this Regional Objective in the following ways:

Agricultural water use efficiency measures can reduce the Region's agricultural demand.

- *Agricultural Water Use Efficiency* – decreases agricultural demands and therefore reduces specific demands for agriculture that are supplied by pumped groundwater
- *Urban Water Use Efficiency* – decreases municipal demands and therefore reduces specific demands for municipal users that are supplied by pumped groundwater
- *Conveyance - Regional/Local* – increases reliability and ability to move water throughout the Region and minimizes losses that occur in the conveyance system; allows greater control of the draw and fill of water banks in relation to demands located throughout

the Region and therefore allows for groundwater supplies to be obtained from areas that are managed

- *System Reoperation* – increases reliability and ability to move water throughout the Region; allows greater control of the draw and fill of water banks in relation to demands located throughout the Region and therefore allows for groundwater supplies to be obtained from areas that are managed
- *Water Transfers* – increases the amount of imported water supply that could be available for groundwater recharge or in-lieu supply
- *Conjunctive Management and Groundwater* – allows capture of previously unusable imported water, stormwater, and recycled water by providing storage capacity; these additional supplies could be available for groundwater recharge or in-lieu supply
- *Recycled Municipal Water* – increases the amount of recycled water supplies available to the Region that could be available for groundwater recharge or in-lieu supply
- *Surface Storage* - Regional/Local – increases the amount of surface water supplies (dry weather runoff and stormwater) available to the Region that could be used for groundwater recharge or in-lieu supply
- *Urban Runoff Management* – increases the amount of surface water supplies (dry weather runoff and stormwater) available to the Region that could be available for groundwater recharge or in-lieu supply
- *Flood Risk Management* – increases the amount of surface water supplies (stormwater) available to the Region, by using integrated flood management, that could be made available for groundwater recharge or in-lieu supply
- *Recharge Areas Protection* – maintains lands that are most suitable for groundwater recharge, thus contributing to the stabilization of groundwater levels
- *Economic Incentives* – used to implement water supply and/or demand management projects that either decrease groundwater pumping demands or increase the capacity to recharge groundwater supplies
- *Outreach and Engagement* – instills water conservation and water use efficiency as a public ethic, decreasing demands supplied by groundwater
- *Crop Idling for Water Transfers* – decreases agricultural water demand and increases water available for redistribution, decreasing the net demands supplied by groundwater
- *Irrigated Land Retirement* – removes farmland from irrigated agriculture, decreasing agricultural water demands supplied by groundwater

5.3 Strategies for Water Quality Management

Objective: Provide drinking water that meets regulatory requirements and customer expectations

The following RMS help to meet this Regional Objective in the following ways:

- *Drinking Water Treatment and Distribution* – allows water providers to produce the needed quality of drinking water and to move it to the appropriate locations
- *Groundwater and Aquifer Remediation* – allows the Region to treat compromised groundwater supplies to a level where they are available for beneficial uses, including drinking

- *Pollution Prevention* – prevents contaminants and/or undesirable constituents from entering drinking water supplies at the source
- *Salt and Salinity Management* – reduces and/or manages the accumulation of salinity in drinking water supplies
- *Sediment Management* – decreases turbidity and suspended sediment concentrations in surface waters that provide drinking water supplies
- *Economic Incentives* – used to implement water quality improvement projects and therefore help to meet regulatory requirements and customer expectations
- *Outreach and Engagement* – educates the public about the dangers associated with leaking contaminants, preventing pollutants from entering drinking water supplies at the source
- *Water and Culture* – identifies customer expectations for water quality as they relate to subsistence activities, recreational activities, spiritual activities, historic preservation, public art, and lifeways

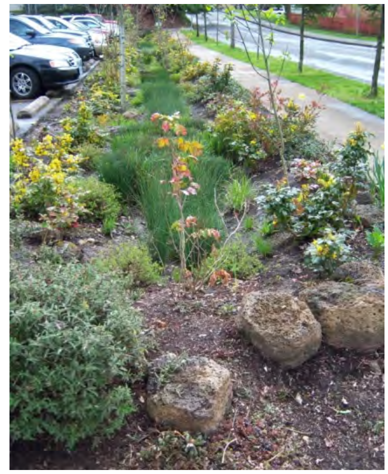
Objective: Protect and maintain aquifers

The following RMS help to meet this Regional Objective in the following ways:

- *Conjunctive Management and Groundwater* – allows capture of previously unusable imported water, stormwater, and recycled water by providing storage capacity; these additional supplies recharge groundwater, and high-quality sources can potentially improve or maintain water quality in the aquifer
- *Groundwater and Aquifer Remediation* – improves water quality in aquifers through groundwater treatment to restore beneficial uses
- *Pollution Prevention* – prevents contaminants and/or undesirable constituents from entering aquifers and degrading water quality
- *Salt and Salinity Management* – reduces and/or manages the accumulation of salinity in groundwater supplies
- *Urban Runoff Management* – reduces the amount of constituents from dry weather and stormwater runoff that move into groundwater and degrade aquifers
- *Ecosystem Restoration* – improves and protects water quality entering aquifers by restoring vegetation that act as a buffer and filter to many pollutants
- *Recharge Areas Protection* – maintains lands that are most suitable for groundwater recharge free of pollutants and therefore protects underlying aquifers from contamination
- *Sediment Management* – improves permeability of drainage areas by filtering water before it enters aquifers and reduces turbidity, suspended solids, nutrients, and concentrations of trace metals and organic contaminants present in the sediments before the water enters aquifers
- *Watershed Management* – protects ecosystem functions provided by natural systems including the natural filtration of runoff before it enters aquifers
- *Economic Incentives* – used to implement water quality improvement projects that protect and maintain aquifers
- *Outreach and Engagement* – educates the public about the dangers of leaking contaminants that can enter the aquifers

Objective: Protect natural streams and recharge areas from contamination

The following RMS help to meet this Regional Objective in the following ways:



- *Pollution Prevention* – prevents contaminants and/or undesirable constituents from entering streams and recharge areas
- *Urban Runoff Management* – reduces the amount of constituents from dry weather and stormwater runoff that move into streams
- *Flood Risk Management* – reduces erosion and sedimentation of natural streams and recharge areas through integrated flood management practices
- *Ecosystem Restoration* – restores and protects native habitats that can surround or encompass natural streams and recharge areas, many of which act as a buffer and filter to pollutants
- *Forest Management* – protects downstream water quality by maintaining upland forested areas and mesquite woodland areas which act as a buffer and filter to pollutants
- *Recharge Areas Protection* – maintains lands that are most suitable for groundwater recharge free of pollutants, protecting the areas from water quality degradation
- *Sediment Management* – protects water quality by reducing turbidity, suspended solids, nutrients, and concentrations of trace metals and organic contaminants present in the sediments
- *Watershed Management* – maintains and enhances ecosystem functions, including those provided by natural streams and recharge areas
- *Economic Incentives* – used to implement water quality improvement projects that reduce contaminant loading to natural streams and recharge areas
- *Water-dependent Recreation* – protects water quality in streams for recreational purposes
- *Outreach and Engagement* – educates residents of the dangers associated with leaking contaminants that harm streams and recharge areas
- *Water-dependent Recreation* - protects and maintains open space areas, both urban and natural, that have water-related recreational benefits
- *Irrigated Land Retirement* – improves water quality by reducing drainage volume in problem drainage areas

Objective: Maximize beneficial use of recycled water

The following RMS help to meet this Regional Objective in the following ways:

- *Conjunctive Management and Groundwater* – allows capture of previously unusable recycled water by providing storage capacity; recycled water that is percolated into groundwater supplies typically receives some level of water quality improvement from soil aquifer treatment

- *Recycled Municipal Water* – increases the amount of recycled water supplies available to meet demands in the Region
- *Matching Water Quality to Use* – recognizes the value of using lower quality recycled water for non-potable uses; increases the amount of recycled water supplies available to meet non-potable demands in the Region
- *Economic Incentives* – used to implement projects that expand the use of recycled water in the Region


The Antelope Valley Region has set a target to reuse 100% of recycled water by 2035.

5.4 Strategies for Integrated Flood Management

Objective: Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future

The following RMS help to meet this Regional Objective in the following ways:

- *Surface Storage - Regional/Local* – increases capacity to capture and retain flows from storm events and therefore reduces the negative impacts of flooding.
- *Pollution Prevention* – prevents contaminants and/or undesirable constituents from entering stormwater at the source and therefore reduces negative downstream impacts of poor stormwater quality
- *Urban Runoff Management* – utilizes low impact development and best management practices to allow the capture of some peak stormwater flows onsite to reduce the risk of negative downstream flooding and poor stormwater quality
- *Flood Risk Management* – reduces the risks of flooding by utilizing capture, retention, infiltration, limitations on building in flood zones, and other integrated flood management techniques
- *Ecosystem Restoration* – enhances and maintains natural areas that can filter or infiltrate stormwater and urban runoff, thus providing some level of attenuation for peak flood flows including the preservation of existing wetland areas along natural watercourses
- *Land Use Planning and Management* – promotes land use planning that incorporates flood risk considerations to reduce the negative impacts of flooding
- *Recharge Areas Protection* – maintains lands that are most suitable for groundwater recharge; reduces downstream flooding by providing capacity for stormwater capture and infiltration, thus providing some level of attenuation for peak flood flows
- *Sediment Management* – reduces negative impacts of stormwater runoff by maintaining natural production of sediment and improving permeability of drainage areas by controlling sediment levels
- *Watershed Management* – promotes integrative projects and planning that enhance ecosystem functions such as stormwater capture and infiltration

- *Economic Incentives* – used to implement stormwater management projects that improve stormwater and urban runoff water quality

Objective: Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses

The following RMS help to meet this Regional Objective in the following ways:

EAFB depends on stormwater flows to resurface the Rosamond Dry Lake Bed for operational and emergency landing uses.

- *Matching Water Quality to Use* – recognizes the beneficial use of stormwater for the maintenance of existing habitat, dust control, and lakebed resurfacing
- *Urban Runoff Management* – utilizes low impact development and best management practices to capture and use stormwater for recharge or reuse
- *Flood Risk Management* – utilizes capture, detention, and infiltration to minimize flooding and provide greater control over the fate and use of stormwater flows
- *Ecosystem Restoration* – enhances natural areas that can contribute to attenuation of peak flows, support habitat preservation, and provide greater control over the fate and use of stormwater flows
- *Land Use Planning and Management* – promotes land use planning that supports stormwater capture, diversion, reuse, or infiltration for beneficial uses
- *Sediment Management* – increases permeability of drainage areas, reducing the negative impacts of stormwater runoff and capturing stormwater
- *Watershed Management* – promotes integrative projects and planning that enhance ecosystem functions such as stormwater capture and infiltration
- *Economic Incentives* – used to implement projects that can provide multiple integrated flood management benefits

5.5 Strategies for Environmental Resource Management

Objective: Preserve open space and natural habitats that protect and enhance water resources and species in the Antelope Valley Region

The following RMS help to meet this Regional Objective in the following ways:

- *Pollution Prevention* – prevents contaminants and/or undesirable constituents from entering streams and degrading natural habitats
- *Flood Risk Management* – reduces erosion and sedimentation of natural streams and recharge areas through integrated flood management practices; restricts development in the floodplain which may allow natural habitats to redevelop or prevent damage to natural habitats
- *Agricultural Lands Stewardship* – promotes the conservation and improvement of open space and water resources through the use of agricultural best management practices

- *Ecosystem Restoration* – improves modified natural landscapes such as aquatic, riparian, and floodplain ecosystems that will impact water resources and species in the Region
- *Forest Management* – maintains upland forested areas to improve downstream water resources and species habitats
- *Land Use Planning and Management* – promotes planning that reduces the negative impacts of land use on flooding, water supply, water quality, and habitat; reduces development in the floodplain
- *Recharge Areas Protection* - maintains lands that are most suitable for groundwater recharge; conserves open space
- *Sediment Management* – protects sediment as a valuable resource for the restoration and renewal of stream habitats, wetlands, riparian vegetation, and floodplains and prevents excessive amounts from degrading water quality
- *Watershed Management* – promotes integrated projects and planning that enhance the water resources functions provided by ecosystems
- *Economic Incentives* – used to conserve, restore, and maintain natural habitats and open space
- *Water-Dependent Recreation* – protects and maintains open space areas, both urban and natural, that have water-related recreational benefits

5.6 Strategies for Land Use Planning/Management

Objective: Maintain agricultural land use within the Antelope Valley Region

The following RMS help to meet this Regional Objective in the following ways:

- *Agricultural Water Use Efficiency* – reduces agricultural water demands and therefore could potentially allow more land to stay in production in times of water scarcity
- *Agricultural Lands Stewardship* – maintains agricultural lands through the conservation of natural resources and watershed functions
- *Land Use Planning and Management* – promotes land use planning that balances other land uses with preservation of open space and agricultural lands
- *Watershed Management* - promotes integrative projects and planning that enhance the water resources functions including those provided by agricultural lands

Agricultural lands stewardship will help the Region to preserve existing agricultural land.

- *Economic Incentives* – used to support agricultural practices and stewardship projects
- *Outreach and Engagement* – identifies the needs of farmers and of the agricultural industry, and involves them in water resources and land use planning
- *Water and Culture* – preserves water resources for key cultural activities like ranching and agriculture

Objective: Meet growing demand for recreational space

The following RMS help to meet this Regional Objective in the following ways:

- *Recycled Municipal Water* – increases the amount of recycled water supplies available to the Region that could be used for park and field irrigation or for natural areas such as the Piute Ponds and lakebeds, therefore helping to maintain recreational space in times of water scarcity
- *Matching Water Quality to Use* – increases the amount of recycled water supplies available to the Region that could be used for park and field irrigation or for natural areas such as the Piute Ponds and lakebeds, therefore helping to maintain recreational space in times of water scarcity
- *Ecosystem Restoration* – improves and protects threatened natural landscapes such as aquatic, riparian, and floodplain ecosystems that can provide passive recreational benefits
- *Forest Management* – maintains forested and mesquite wooded areas with the intention of improving water resources; managed areas can be used for recreational purposes
- *Land Use Planning and Management* – promotes planning that balances the expansion of urban development with the preservation of open space areas
- *Watershed Management* – promotes integrative projects and planning that enhance ecosystem services
- *Economic Incentives* – used to implement projects that expand or enhance recreational space
- *Outreach and Engagement* – ensures the development of recreational spaces meets the needs of the community
- *Water and Culture* – preserves culturally significant spaces used for recreational activities that are dependent on water quality and quantity
- *Water-dependent Recreation* – protects and maintains open space areas that have water-related recreational benefits

Objective: Improve integrated land use planning to support water management

The following RMS help to meet this Regional Objective in the following ways:

- *Conjunctive Management and Groundwater* – allows the use of lands for groundwater recharge and recovery as well as other beneficial uses
- *Surface Storage - Regional/Local* – allows the use of lands for water resource needs, habitat preservation, and recreation
- *Urban Runoff Management* – allows the use of lands for supply, integrated flood management, and other beneficial uses with low impact development and best management practices to capture and infiltrate runoff
- *Flood Risk Management* – allows the use of lands for integrated flood management and beneficial water-dependent habitat uses
- *Agricultural Lands Stewardship* – promotes the conservation and improvement of open space and water resources through the use of agricultural best management practices

Spreading facilities will allow the Region to recharge the aquifer when imported, recycled, and storm waters are available.

- *Ecosystem Restoration* – improves modified natural landscapes to restore ecosystem uses and preserve natural areas; allows the preservation of habitats for recreation and other beneficial uses
- *Forest Management* – maintains upland forested and mesquite wooded areas to improve water resource conditions, preserve habitat, and provide other beneficial uses
- *Land Use Planning and Management* – promotes planning that balances the expansion of urban development with the preservation of open space, agricultural lands, habitats, and natural flood pathways; incorporates strategies to maintain water resources
- *Recharge Areas Protection* – maintains lands that are most suitable for groundwater recharge as well as other beneficial uses
- *Watershed Management* – promotes integrative projects and planning that enhance ecosystem services
- *Economic Incentives* – used to support land use planning projects
- *Water-dependent Recreation* – protects and maintains open space areas that have water-related recreational benefits
- *Irrigated Land Retirement* – removes farmland from irrigated agriculture and creates an opportunity to establish other beneficial uses of the land

5.7 Strategies for Climate Change Mitigation

Objective: Mitigate against climate change

The following RMS help to meet this Regional Objective in the following ways:

- *Agricultural Water Use Efficiency* – reduces agricultural demands and therefore reduces the Region's reliance on imported water; mitigates against climate change by reducing the energy use and greenhouse gas emissions associated with transporting water
- *Urban Water Use Efficiency* – reduces urban demands and therefore reduces the Region's reliance on imported water; mitigates against climate change by reducing the energy use and greenhouse gas emissions associated with transporting water
- *Conveyance* - Regional/Local – minimizes water losses in the conveyance system; reduces the energy use and greenhouse gas emissions associated with transporting water

Climate-friendly building design can reduce the Region's GHG emissions.

- *System Reoperation* – improves the efficiency of existing operation and management of existing reservoirs and conveyance facilities; reduces the energy use and greenhouse gas emissions associated with system inefficiency
- *Water Transfers* – reduces the energy use and greenhouse gas emissions associated with importing water when transfers originate from closer locations
- *Conjunctive Management and Groundwater* – increases local water supplies which mitigates against climate change by reducing the greenhouse gas emissions associated with the energy required to import water
- *Recycled Municipal Water* – increases the amount of recycled water supplies available to the Region; increases local water supplies which mitigates against climate change by reducing the greenhouse gas emissions associated with the energy required to import water
- *Surface Storage - Regional/Local* – increases local water supplies which mitigates against climate change by reducing the greenhouse gas emissions associated with the energy required to import water; however, the reduction in surface flow amplifies impacts to downstream natural areas
- *Agricultural Lands Stewardship* – promotes the conservation and improvement of agricultural lands through the use of agricultural best management practices; optimizes crop yield which may help to sequester carbon
- *Ecosystem Restoration* – increases local groundwater supplies by maintaining areas that allow for natural groundwater recharge, reducing the need to import water; restores and protects ecosystem processes in downstream areas
- *Forest Management* – maintains forested lands and mesquite woodlands which help sequester carbon
- *Sediment Management* – prevents GHG emissions from fossil fuel powered equipment utilized for continuous sediment removal
- *Watershed Management* – promotes integrative projects and planning that enhance ecosystem services such as groundwater recharge that increases local water supplies and reduces the need to import water; protects downstream surface water flows and habitats that can reduce GHGs
- *Economic Incentives* – used to encourage the use of renewable energy for water treatment and conveyance; may provide funds to develop more local supplies to offset imported water use
- *Outreach and Engagement* – increases climate change awareness and encourages public acceptance and investment in mitigation strategies, effectively reducing the communities' GHG emissions
- *Water and Culture* – provides financial and technical assistance to protect cultural resources while increasing a better understanding of carbon sequestration potential and water conservation and water use efficiency

5.8 Impacts and Benefits of Implementing Strategies

The Region has identified the IRWM Plan's potential impacts and benefits relative to the strategies discussed above. Given the integrated nature of the Region, it is difficult to determine what strategies would provide a benefit or disproportionate impact to DACs or create Environmental Justice (EJ) concerns. Identification of impacts and benefits to DACs and EJ concerns will improve as projects are closer to implementation, at which point a detailed project-specific impact and benefit analysis can occur as part of the NEPA and/or CEQA process. Updates to DAC/EJ project impacts and benefits will also be included during regular IRWM Plan updates that will occur every five years, as discussed in Section 8. Refer to Appendix D of the IRWM Plan for two technical memoranda that were prepared during the 2013 IRWM Plan update to characterize DACs and to define issues related to DAC areas:

- DAC Water Supply, Quality and Flooding Data Final Draft TM
- DAC Monitoring Plan Final Draft TM

Tables 5-3 through 5-10 below list each of the IRWM Plan strategies and their potential impacts and benefits that could occur over the next 20 years. Strategies are grouped consistent with the California Water Plan RMS as follows: reduce water demand; improve flood management; improve operational efficiency and transfers; increase water supply, improve water quality, practice resources stewardship.

Table 5-3: Impacts and Benefits of Strategies that Reduce Water Demand

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Agricultural Water Use Efficiency	Decreased flow to downstream users	Decreased potable water demand Decreased dry weather runoff and pollutant loads to waterways Reduced pumping costs Improved ability to meet water supply needs and decreased dependence on imported supply	Loss of flow to downstream users	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water
Urban Water Use Efficiency	Loss of revenue to water agencies	Decreased potable water demand Decreased dry weather runoff and pollutant loads to waterways Reduced pumping costs Improved ability to meet water supply needs and decreased dependence on imported supply	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water

Table 5-4: Impacts and Benefits of Strategies that Improve Operational Efficiency and Transfers

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Conveyance – Regional/ Local	Increased short-term construction and site-specific impacts	Reduced system loss Improved water system reliability Improved ability to meet water supply needs and decreased dependence on imported supply	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water
System Reoperation	Increased short-term construction and site-specific impacts	Improved water system reliability Improved ability to meet water supply needs and decreased dependence on imported supply Decreased energy consumption and associated GHG emissions for water conveyance	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water
Water Transfers	Reduced return flows Loss of agricultural land	Increased water supply in normal, drought and emergency conditions Improved economic stability and environmental conditions	Reduced return flows Loss of agricultural land	Financial (for seller of water) Beneficial use of resources otherwise unused

Table 5-5: Impacts and Benefits of Strategies that Increase Water Supply

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Conjunctive Management & Groundwater	Increased short-term construction and site-specific impacts Increased local energy and GHG emissions associated with pumping levels Environmental impacts to natural habitats and open space from removing flood flows Reduction in sediment for downstream needs Increased air pollution from deteriorating lakebed surfaces	Improved ability to meet water supply needs and decreased dependence on imported supply Improved water supply reliability Increased available water supply to meet demand from growth Improved groundwater basin yield and production flexibility Increased water quality protection	Increased air pollution from deteriorating lakebed surfaces	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Recycled Municipal Water	Increased construction-related and site-specific impacts Increased local energy use, and GHG emissions associated with higher treatment levels Reduced effluent discharge available for in-stream flows Increased need for recharge facility capacity Increased need for brine disposal	Improved ability to meet water supply needs and decreased dependence on imported supply Increased water quality and beneficial use of WWTP/ recycled water flows Improved groundwater basin yield and production flexibility Advancement of technology and application for use by other entities Decreased long-term water costs	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water Advancement of technology and application for use by other entities
Surface Storage – Regional/ Local	Increased short-term construction and site-specific impacts Altered riparian flows and habitat quality Increased evaporative losses Increased air pollution from deteriorating lakebed surfaces	Increased system operational flexibility Improved access to previously untapped local supply and increased reliability Increased capacity for flood management	Increased air pollution from deteriorating lakebed surfaces	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water

Table 5-6: Impacts and Benefits of Strategies that Improve Water Quality

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Drinking Water Treatment and Distribution	Increased short-term construction and site-specific impacts Increased local energy use, and GHG emissions associated with higher treatment levels	Improved water quality and local water supply availability Reduced drinking water-related health problems	None identified	Increased available Bay-Delta supply and/or environmental flows Decreased energy consumption for water treatment and conveyance associated with imported water
Groundwater and Aquifer Remediation	Increased short-term construction and site-specific impacts Increased local energy use, and GHG emissions associated with higher treatment levels	Improved water quality and local water supply availability Reduced drinking water-related health problems	None identified	Increased available Bay-Delta supply and/or environmental flows Decreased energy consumption for water treatment and conveyance associated with imported water
Matching Water Quality to Use	None Identified	Decreased water treatment costs Improved ability to meet water supply needs and decreased dependence on imported supply	None Identified	Increased available Bay-Delta supply and/or environmental flows Decreased energy consumption for water treatment and conveyance associated with imported water

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Pollution Prevention	Increased short-term construction and site-specific impacts Increased local energy, and GHG emissions associated with higher treatment levels	Improved water quality Reduced need for other water management and treatment options Enhanced recreation, water supply and habitat	None identified	Reduced pollutant loads Enhanced recreation, water supply and habitat
Salt & Salinity Management	Increased brine/ salt disposal issues	Decreased damage to crop yields and farmland Reduced corrosive damage to equipment Improved water quality Increased local water supply	None identified	Increased available Bay-Delta supply and/or environmental flows Decreased energy consumption for water treatment and conveyance associated with imported water
Urban Runoff Management	Increased construction of individual projects Reduced in-stream flows Natural habitat and open space deterioration from reduced flows Increased air pollution from deteriorating lakebed surfaces	Decreased urban runoff Reduced pollutants to receiving waters Improved habitat and recreation Improved ability to meet water supply needs and decreased dependence on imported supply Improved air quality through decreased GHG and other emissions relative to treated and pumped supplies	Increased air pollution from deteriorating lakebed surfaces	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water

Table 5-7: Impacts and Benefits of Strategies that Improve Flood Management

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Flood Risk Management	Increased short-term construction and site-specific impacts Changes in sediment loads and distribution Natural habitat and open space deterioration from reduced flows Increased air pollution from deteriorating lakebed surfaces	Reduced risk to property and life Reduced flood insurance costs Increased water supply, water quality, habitat and recreation Advancement of integrated flood management engineering and application for use by other entities	Increased air pollution from deteriorating lakebed surfaces	Advancement of integrated flood management engineering and application for use by other entities

Table 5-8: Impacts and Benefits of Strategies that Practice Resources Stewardship

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Agricultural Land Stewardship	Limited urban land use development	Increased water supply, quality, flood control, recreation and habitat benefits Reduced soil erosion	None identified	None identified

Strategy	Within IRWM Region		Inter-regional	
	Potential Impacts	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Ecosystem Restoration	Increased short-term construction and site-specific impacts Limiting urban land use development	Reduced invasive species, and increased native and endangered species Improved passive recreation, education, water quality, water supply and flood control Improved ability to increase or maintain habitat corridors	None Identified	None Identified
Forest Management	None identified	Improved water supply, water quality, flood control, habitat and recreation benefits	None identified	None identified
Land Use Planning and Management	None identified	Improved water supply, water quality, flood control, habitat and recreation benefits	None identified	None identified
Recharge Areas Protection	Increased short-term construction and site-specific impacts	Improved water supply, water quality, flood control, habitat and recreation benefits	None identified	None identified
Sediment Management	Increased short-term construction and site-specific impacts Changes in sediment loads and distribution	Improved water supply, water quality, flood control, habitat and recreation benefits	None identified	None identified
Watershed Management	Increased short-term construction and site-specific impacts	Improved water supply, water quality, flood control, habitat and recreation benefits	None identified	None Identified

Table 5-9: Impacts and Benefits of Strategies to People and Water

	Within IRWM Region		Inter-regional	
Strategy	**Potential Impacts**	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Economics Incentives	None identified	Increased project implementation	None identified	None identified
Outreach and Engagement	None identified	Decreased water demand and increased water quality Decreased energy consumption and associated GHG emissions with water transportation and treatment	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with water treatment and conveyance
Water and Culture	None identified	Decreased water demand and increased water quality Decreased energy consumption and associated GHG emissions with water transportation and treatment	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with water treatment and conveyance
Water-dependent Recreation	Increased human activity in natural areas Increased potential for water quality degradation Increased potential impacts to cultural resources Increased potential for disrupting or displacing wildlife	Increased water supply, water quality, flood control, habitat and recreation benefits Reduced overuse and improved quality of existing recreation facilities, enhancing the recreational experience Improved potential economic benefits to recreation-supporting businesses	None identified	None Identified

Table 5-10: Other Impacts and Benefits of Strategies

	Within IRWM Region		Inter-regional	
Strategy	**Potential Impacts**	**Potential Benefits**	**Potential Impacts**	**Potential Benefits**
Crop Idling for Water Transfer	Loss of crop productivity Loss of revenue to local community	Stable revenue to the agricultural sector Decreased potable water demand Decreased dry weather runoff and pollutant loads to waterways Reduced pumping costs Improved ability to meet water supply needs and decreased dependence on imported supply	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water
Irrigated Land Retirement	Loss of agricultural lands Loss of revenue to local community	Decreased drainage-related problems Improved water quality Decreased potable water demand Decreased dry weather runoff and pollutant loads to waterways Improved ability to meet water supply needs and decreased dependence on imported supply	None identified	Increased available Bay-Delta supply and/or environmental flows Improved air quality through decreased GHG and other emissions associated with imported water Decreased energy consumption for water treatment and conveyance associated with imported water

Section 6 | Project Integration and Objectives Assessment

Resource management strategy integration is a process to design resource management strategy alternatives to maximize regional benefits by identifying potential synergies, linkages, and gaps between the projects, actions and studies subsequently identified in Section 7. The aim of this section is to assess whether the strategies identified in Section 5 and the projects identified in Section 7 are sufficient to meet the needs and objectives of the Antelope Valley Region as defined by Sections 3 and 4, respectively. In cases where needs and objectives may not be met, Section 6 identifies future planning actions that are needed to meet this purpose. Below is a discussion of the identified projects evaluated against their specific objectives and planning targets (i.e., projects benefiting water supply are compared to water supply objectives).

It was important to the Stakeholder group to identify objectives that were SMART[1], and one way to be *Measurable* is to be quantifiable. Therefore, the objectives in Section 4 include quantifiable planning targets, where possible, to help gauge whether a particular objective has been met. For those projects that were far enough along in the planning stages to quantify the benefit, their benefit could be evaluated against its respective planning target. However, many of the projects submitted identified qualitative benefits only at this point because they are conceptual in nature. These projects were therefore evaluated according to whether they could contribute to the attainment of a particular objective qualitatively.

For example, one project concept submitted by Boron CSD for evaluation is the construction of an arsenic-removal treatment plant. Because this program was submitted as a project concept, with the number of potential users and other technical details not yet quantified, the water quality benefits from this program would have to be determined as the project scope was more clearly defined. However, it is logical to assume that the program would result in some reduction of arsenic loading

[1] A SMART objective is one that is Specific, Measurable, Attainable, Relevant, and Time-Based.

in groundwater supplies, which would allow Boron CSD to improve local groundwater quality and help achieve state and federal compliance guidelines for drinking water, and would therefore help to meet the water quality planning target of continue to meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period.

Gaps are areas where the suite of current and proposed projects identified in Section 7 fail to meet or contribute to the IRWM Plan objectives. In order to address these gaps, alternative project concepts and ideas are presented. As the AV IRWM Plan is updated and as project scopes are refined, opportunities exist to re-evaluate these projects, and evaluate whether this IRWM Plan is meeting the issues and needs of the Antelope Valley Region.

6.1 Water Supply Management

Issues and needs relating to the water supply for the Antelope Valley Region generally involve providing a reliable water supply to meet demands (primarily utilizing water banking, water transfers, conservation, and recycled water) and protecting the groundwater resource.

Progress to Date and Revisions to Regional Objectives

Since the 2007 IRWM Plan was adopted, the Region's supply and demand estimates have changed due to a number of factors. First, various projects have been implemented to increase the Region's supply reliability and diversification and to reduce demand through conservation measures. Additionally, the Judgment determined that a total sustainable yield for the groundwater basin would be used to determine pumping rights. Therefore, supply projections were updated to incorporate total sustainable yield in lieu of the previous numbers in the Regional water balance. Given these developments, the Region updated its supply related objectives from the 2013 IRWM Plan update which resulted in a increase in the Region's 2040 supply mismatch Water banking projects such as the Willow Springs Water Bank and the Westside Water Bank have also been implemented with the intention to store up to approximately 650,000 AF of imported water. The data presented in Section 3 still indicate mismatches between supply and demand in single dry and multiple dry years. The Region's water supply targets were adjusted accordingly in Section 4. In addition, it was recognized that water supplies may be impacted by climate change in the future. Therefore, climate change adaptation was included as a part of the water supply objectives.

Assessment of IRWM Projects' Potential to Meet Water Supply Objectives

As detailed in Section 3, the Antelope Valley Region will need to maintain supplies and demand management measures for average water years between 2015 and 2040. The Region will need to implement supply and demand management projects in order to reduce the mismatch between supply and demand during single dry and multiple dry years. Section 4 presented objectives and planning targets identified by the Stakeholder group in order to address this deficit.

Most of the water supply projects proposed by the stakeholders involve the implementation of recharge projects, water banking programs, conservation programs, water transfers, and recycled water projects. For these supply-related projects, it should be noted that in some cases many project components have to come together to realize a supply benefit. For example, recycled water does not provide supply benefits until a treatment plant source is identified (and in some cases, upgraded), conveyance pipelines are constructed, and some kind of end use is established (e.g., a customer conversion or a groundwater recharge project). The necessary components for each type of supply-related project are described in Table 6-1.

Table 6-1: Projects with Water Supply Benefits

Type of Project	Necessary components to realize water supply benefit
Recycled water	1. Water reclamation plant construction, expansion, and/or upgrades AND 2. Conveyance pipelines (backbone and smaller laterals) AND 3a. Site conversions (industrial, environmental, irrigation customers) OR 3b. Groundwater recharge sites (considered part of potable water supply once introduced to aquifer)
Imported Water	1. Transfer opportunity, Article 21, or increase in Table A amount must be identified AND 2a. Water banking facility, including recharge and recovery capability OR 2b. Distribution facilities to make use of increased volume of imported water
Stormwater	1. Facilities to capture and route storm water AND 2. Facilities to infiltrate storm water
Conservation	1. No additional measures required

These supply projects, shown in Table 6-2, demonstrate that the stakeholders view conjunctive use operations and recycled water use as essential in order to meet the water supply needs in the Antelope Valley Region and to lessen the gap between supply and demand for single dry and multiple dry years. Several of the submitted projects will also help the Region to develop its local supplies and reduce the Region's reliance on the Delta.

A number of water conservation projects were also submitted by the stakeholder group. These projects aim to reduce the gap between supply and demand by managing the demand side of the water balance equation. Thus, integration of those projects that manage the supply side with those that manage the demand side is essential for meeting the Region objectives for supply.

Water Supply Objective 1. Provide reliable water supply to meet the Antelope Valley Region's expected demand between now and 2040; and adapt to climate change.

- *Target:* Maintain adequate supply and demand in average years.
- *Target:* Provide adequate reserves (77,200 AFY) to supplement average condition supply to meet demands during single-dry year conditions, starting 2009.
- *Target:* Provide adequate reserves (198,800 AF/4-year period) to supplement average condition supply to meet demands during multi-dry year conditions, starting 2009.

Table 6-2: Projects with Water Supply Benefits

Project	Supply Created	Status
Recycled Water Production	**Amount Produced**	
Lancaster WRP Stage V	16,000 AFY	Complete
Palmdale WRP Stage V	10,000 AFY	Complete
Recycled Water Conveyance	**Amount Conveyed**	
North Los Angeles/Kern County Regional Recycled Water Project – Division Street Corridor	786 AFY[a]	Complete
North Los Angeles/Kern County Regional Recycled Water Project – Phase 1b	2,161 AFY[a]	Complete
North Los Angeles/Kern County Regional Recycled Water Project – Phase 2	2,076 AFY[a]	Complete
Antelope Valley Recycled Water Master Plan	Not quantified	Implementation
Division Street and Avenue H-8 Recycled Water Tank	3 AF	Implementation
Palmdale Recycled Water Authority – Phase 2 Distribution System	500 AFY	Implementation
Avenue K Transmission Main, Phases I-IV	Not quantified	Conceptual
Avenue M and 62th Street West Tanks	37 AFY	Conceptual
Tertiary Treated Water Conveyance and Incidental Groundwater Recharge of Amargosa Creek Avenue M to Avenue H	100 to 1,000 AFY	Conceptual
KC & LAC Interconnection Pipeline	Not quantified	No Longer Pursued
North Los Angeles/Kern County Regional Recycled Water Project – Phase 3	up to approx. 1,300 AFY[a]	No Longer Pursued
North Los Angeles/Kern County Regional Recycled Water Project – Phase 4	up to approx. 7,000 AFY[a]	No Longer Pursued
Place Valves and Turnouts on Reclaimed Water Pipeline	Not quantified	No Longer Pursued
RCSD Wastewater Pipeline	Not quantified	No Longer Pursued
Tropico Park Pipeline	Not quantified	No Longer Pursued
Recycled Water Conversions	**Amount Reused**	
McAdam Park Recycled Water Conversion	80 AFY	Complete
Division Street Corridor Recycled Water Conversions (various)	2 AFY	Complete
Whit Carter Park Recycled Water Conversion	50 AFY	Implementation
Pierre Bain Park Recycled Water Conversion	75 AFY	Implementation
Lancaster National Soccer Center Recycled Water Conversion	500 AFY	Implementation
Lancaster Cemetery Recycled Water Conversion	40 AFY	Conceptual
Recycled Water Recharge	**Amount Recharged**	
Palmdale Regional Groundwater Recharge Project	6,500 AFY[b] / AF storage not quantified	Implementation
Wastewater Treatment Plant Rehabilitation and Groundwater Protection	1,500 AFY	Implementation
Lower Amargosa Creek Recharge Project	1,000 AFY / AF storage not quantified	Conceptual
Tertiary Treated Water Conveyance and Incidental Groundwater Recharge of Amargosa Creek Avenue M to Avenue H	1 to 100 AFY / AF storage not quantified	Conceptual
Imported Water Conveyance Infrastructure	**Amount Conveyed**	

Project	Supply Created	Status
South Antelope Valley Intertie Project	Not quantified	Implementation
South North Intertie Pipeline (SNIP) Phase II	33,600 AFY	Implementation
AVEK Strategic Plan	Not quantified	Implementation
SWP Turnout Upgrade	Not quantified	Conceptual
Gaskell Road Pipeline	100 – 1,000 AF	No Longer Pursued
Imported Water Recharge	**Amount Recharged**	
Willow Springs Water Bank	43,500 AFY / 500,000 AF of storage[(c)]	Partially Complete[(d)]
Aquifer Storage and Recovery Project: Additional Storage Capacity (Westside Water Bank)	Up to 150,000 AF of storage	Complete
Aquifer Storage and Recovery Project: Injection Well Development	12,000 AFY / AF storage not quantified	Complete
Eastside Banking & Blending Project	5,700 AFY / AF storage not quantified	Complete
Water Supply Stabilization Project – Westside Project (Westside Water Bank)	Up to 120,000 AF of storage; currently 36,000 of withdrawal capacity	Complete
Palmdale Regional Groundwater Recharge Project	38,000 AFY[(c)] / AF storage not quantified	Implementation
Upper Amargosa Creek Recharge and Channelization Project	15,000-54,000 AFY[(e)] / AF storage not quantified	Implementation
Water Supply Stabilization Project (WSSP) – Westside Expansion	6,000 AFY / 500,000 AF storage	Implementation
Expansion of the Eastside Water Bank	Not quantified	Conceptual
Hunt Canyon Groundwater Recharge and Flood Control Basin	3,000 AF	Conceptual
Big Rock Creek Recharge and Recovery Project	Not quantified	Conceptual
Purchasing Spreading Basin Land	Not quantified	No Longer Pursued
Stormwater Capture	**Amount of Capture**	
Littlerock Dam Sediment Removal	500 AFY	Implementation
Stormwater Harvesting	25 AFY	Conceptual
Stormwater Recharge	**Amount Recharged**	
Upper Amargosa Creek Recharge and Channelization Project	400[(c)] AFY / AF storage not quantified	Implementation
45th Street East Groundwater Recharge and Flood Control Basin	2,000 AFY / AF storage not quantified	Conceptual
Amargosa Creek Pathways Project	100 AFY	Conceptual
Avenue Q and 20th Street East Groundwater and Flood Control Basin (Q-West Basin)	1,600 AFY / AF storage not quantified	Conceptual
Avenue R and Division Street Groundwater Recharge and Flood Control Basin	Not quantified	Conceptual
Barrel Springs Groundwater Recharge and Flood Control Basin	Not quantified	Conceptual
Big Rock Creek In-River Spreading Grounds	1,000 AFY / 5,500 AF storage	Conceptual
Littlerock Creek In-River Spreading Grounds	1,000 AFY / 7,600 AF storage	Conceptual
Multi-use/Wildlife Habitat Restoration Project	Not quantified	Conceptual

Project	Supply Created	Status
Groundwater	**Amount Pumped**	
Partial Well Abandonment of Groundwater Wells for Arsenic Mitigation	Not quantified	Complete
BCSD Arsenic Management Feasibility Study and Well Design	Not quantified	Complete
QHWD Partial Well Abandonment	Not quantified	Conceptual
Fremont Valley Basin Potable Groundwater Well Treatment Project	1,500 AFY	Conceptual
RCSD Arsenic Consolidation Project	Not quantified	No Longer Pursued
Deep Wells to Recapture Banked Water	Not quantified	No Longer Pursued
Conservation	**Amount Conserved**	
Antelope Valley Regional Conservation Project	12 AFY	Implementation
Antelope-Fremont Valleys Stealth Watershed Rapid Response Program	Not quantified	Conceptual
Implement ET Controller Program	Not quantified	Conceptual
Precision Irrigation Control System	150 AFY	Conceptual
Water Conservation School Education Program	Not quantified	Conceptual
ET Based Controller Program	240 AFY	No Longer Pursued
Ultra-Low Flush Toilet Change-out Program	100 to 1,000 AFY	No Longer Pursued
Waste Water Ordinance	Not quantified	No Longer Pursued

Notes:
(a) Source: *Final Facilities Planning Report, Antelope Valley Recycled Water Project,* August 2006.
(b) Assumes that the Palmdale Regional Groundwater Recharge Project will use approximately 6,500 AFY of recycled water and 38,000 AFY of imported water for recharge.
(c) Not all of the future capacity in the Willow Springs Water Bank will be allocated to entities in the Region.
(d) Expansion of the Willow Springs Water Bank is currently ongoing.
(e) The Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project will use approximately 400 AFY of stormwater and 14,600-53,600 AFY of imported water for recharge.

As shown in Table 6-1, the water supply projects submitted by the stakeholders show a range of quantified supply benefits, from 1 AFY to 100,000 AFY. Included in these projects are new recycled water facilities, imported water recharge, stormwater capture and recharge, and conservation. It should be noted that most projects will not alone provide a supply benefit. As stated above, recycled water projects will require projects to increase recycled water supply coming from water reclamation plants, pipes and pump stations to convey the recycled water to users and groundwater recharge facilities, and conversions to enable customers to use the recycled water.

The recycled water projects shown in Table 6-2 are classified as recycled water production, recycled water conveyance, recycled water conversion, and recycled water recharge. As discussed in Section 3, approximately 21,000 AFY of recycled water is currently produced at water reclamation facilities are currently available for non-potable reuse. Currently, approximately 350 AFY of this recycled water supply is used.

A number of implementation projects were identified that can utilize this water, including approximately 500 AFY of conveyance facilities, 625 AFY of conversion for non-potable reuse, and 8,000 AFY of groundwater recharge. It should be noted that additional conveyance, conversion, and recharge facilities would be necessary to reuse all of the available recycled water.

It is expected that by 2040 conceptual recycled water conveyance projects would provide up to an additional 503 AFY of recycled water conveyance. Conceptual recycled water recharge projects were identified for up to an additional 1,100 AFY.

In total, approximately 21,000 AFY of recycled water will be available in 2040 and projects (implementation and conceptual) have been identified that could use up to approximately 14,300 AFY as shown in Section 3 (Table 3-15). Many of these projects still need further development before they can be implemented. It is likely that as groundwater recharge regulations evolve, much of the available recycled water will be reused in future groundwater recharge projects. Ultimately, recycled water will be limited by future population growth which impacts wastewater flows and, in turn, recycled water production. It should also be noted that projects that could recharge with recycled water will likely require blending with imported water or stormwater as diluent flow.

Imported water projects that increase available supplies can include both water transfers and imported water banking projects. There were no projects proposed to acquire additional imported water through transfers; however, there are existing banking projects that have the capacity to bank up to 120,000 AF of imported water (Westside Water Bank) and implementation projects that could bank up to an additional 500,000 AF (Willow Springs Water Bank). Other water banking projects are also proposed, which could increase the total storage capacity in the Antelope Valley groundwater basin. Annual recharge and withdrawal capacities vary as shown in Table 6-2. In order to obtain additional water for banking, imported water purveyors in the area would need to acquire water transfers or capture excess imported water during wet years.

Stormwater supply projects proposed include projects to capture additional stormwater and stormwater recharge projects. Stormwater capture projects include the Littlerock Dam Sediment Removal Project which is estimated to increase stormwater capture by 500 AFY, and Leona Valley's Stormwater Harvesting Project which would capture an additional 25 AFY for treatment and direct use. Stormwater recharge projects include proposed spreading grounds on Amargosa Creek, Littlerock Creek, Big Rock Creek, and at numerous flood control basins in urban areas. Of these recharge projects, only the Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project has implementation project status. This project is estimated to recharge 400 AFY of stormwater. An additional 5,700 AFY of conceptual stormwater recharge projects were also proposed. Some stormwater recharge projects also estimated the total acre-feet of water that would be stored in groundwater aquifers; potentially up to 13,000 AF of stormwater could be stored. It is assumed that projects that would recharge Littlerock Creek water would be operated in conjunction with the Littlerock Creek Dam Sediment Removal Project. In total, stormwater recharge projects with approximately 6,000 AFY of capacity were identified that could store up to approximately 13,000 AF.

Finally, several conservation projects that would reduce water demand were proposed, including programs to install ET based irrigation controllers, develop conservation ordinances, and implement conservation education programs. In total, the proposed conservation projects are estimated to reduce demand by up to 1,510 AFY.

The implementation and conceptual projects described in this IRWM Plan can help to achieve the Supply Planning Targets as follows:

- *Average Year: Provide up to an additional 24,400 AFY of new supply for average years with increased recycled water use (16,000 AFY), stormwater capture (6,625 AFY), and conservation (1,750 AFY). Some of these new supplies can also serve as sources of water for banking.*
- *Single Dry Year: Provide up to an additional 24,400 AFY of new supply for a single dry year and approximately 1,000,000 AF of storage capacity (potentially more) with recharge and recovery capability of up to 250,000 AFY; use of water banked in storage would require the Region to have obtained and recharged supplies prior to a single dry year event, potentially including transfers*

- *Multi-Dry Year Period: Provide up to an additional 24,000 AFY of new supply in multi-dry year periods and approximately 1,000,000 AF of storage capacity (potentially more) with recharge and recovery capability of up to 250,000 AFY; use of water banked in storage would require the Region to have obtained and recharged supplies prior to a multi-dry year event, potentially including transfers*

Water Supply Objective 2. Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP water deliveries.

- *Target:* Demonstrate ability to meet regional water demands without receiving SWP water for 6 months over the summer by 2025.

This scenario is, in some sense, a variation on the dry year scenario if it is assumed that it represents a "very dry 6-month period" during summer months. In the event of a temporary loss of SWP for 6 months over the summer, the Antelope Valley Region would be short approximately 65,000 AFY in an average water year. This estimate assumes that 33 percent (1/3) of demands occur during winter months (October through March) and 66 percent (2/3) occur in summer months (April through September); and it is based on the direct deliveries for AVEK discussed in Section 3.1.1.2.

This Planning Target may be measured by using UWMPs and other capacity-related planning documents to show that sufficient pumping capacity exists in the Region to provide 65,000 AFY of water over a six-month period during the summer. This represents a "worst case scenario" since under dry year and multi-dry year scenarios, smaller allotments of imported water would be available to begin with. So 66 percent reductions in these smaller amounts would have less impact.

Water Supply Objective 2 was more difficult to evaluate in terms of whether the proposed projects adequately met this objective without a developed contingency plan. In order to meet this objective, the Antelope Valley Region would be required to rely on groundwater, recycled water, and demand management measures to meet supply needs. Given that many of the projects proposed were recharge programs, some of which have quantifiable benefits of up to 120,000 AFY of recharge and recovery capacity and/or 500,000 AF of storage capacity (potentially more) as mentioned above, it is likely that this IRWM Plan will contribute towards meeting this objective.

Additionally, each water purveyor in the Antelope Valley Region has already developed Contingency Plans to address emergency situations as discussed in their Urban Water Management Plans. These are not included in the Plan as implementation projects. Emergency demand management measures listed in water districts' urban water management plans include:

- Ordinances prohibiting water waste (e.g. allowing water to run off of property from landscape areas)
- Ordinances controlling landscape irrigation
- Ordinances restricting outdoor water uses (e.g. washing of sidewalks, motor vehicles, decorative fountains)
- Prohibitions on new connections of the incorporation of new areas
- Serving of drinking water in restaurants only when requested
- Rationing of water supplies
- Limiting use of fire hydrants to only firefighting and related activities
- Water shortage pricing

These measures, in conjunction with the proposed recharge programs, would further help the Region to meet the objective to accommodate a six-month stoppage of SWP water over the summer period.

Water Supply Objective 3. Stabilize groundwater levels.

- *Target:* Manage groundwater levels throughout the basin such Production Rights defined in the adjudication Judgment are met by 2023.

As mentioned above, many of the projects proposed by the stakeholders are groundwater recharge projects and water banking programs. These projects and programs will require monitoring to identify which regions of the aquifer are best suited for these activities, and will require continued monitoring to ensure they are operating effectively. Monitoring and data collection is the first step in managing groundwater levels throughout the basin.

As discussed in Section 3, adjudication proceedings established pumping rights and restrictions to account for groundwater recharge. Groundwater recharge, banking, water rights transfers, in-lieu recharge, and conservation projects are all intended to help meet the target to maintain or increase groundwater levels. Actual stabilization of groundwater levels is monitored by the Court through the Antelope Valley Watermaster.

Future Planning Efforts and Actions to Fill the Identified Water Supply Management Gaps

Because it is difficult at this stage in the IRWM Plan process to quantify the potential benefits of all the projects, it is difficult to assess whether the water supply projects will adequately meet this IRWM Plan objective. However, given the projected supply deficits, the following future planning efforts and actions are additional options that could help to meet this objective in addition to the proposed projects described in Section 7.

Aggressive Conservation. Implementing an aggressive water conservation program (i.e., beyond current and planned measures) could conserve up to 15,400 AFY in the Antelope Valley Region, assuming an additional 10 percent per capita reduction in urban water demand by 2025. A determination would need to be made as to whether the amount of conservation that is required under this alternative would be achievable or insufficient.

As discussed in Section 5, all water agencies in the Antelope Valley Region currently utilize water conservation methods as a means to reduce demand during drought conditions. However, only LACWD 40 is a member of the California Urban Water Conservation Council (CUWCC) and a signatory of the MOU Regarding Urban Water Conservation in California. AVEK, PWD, QHWD, and RCSD are not signatories to the CUWCC MOU and are not members of CUWCC; however, they have each implemented their own conservation methods.

An aggressive water conservation program would also include agricultural water conservation. On-farm water use can be reduced substantially without decreasing productivity through improved irrigation technologies and efficient water management practices.

Develop Further Conjunctive Use Management. The amount of planned and conceptual conjunctive use capacity is considerable for the Region. The number of water banking and ASR projects proposed by the Stakeholders are an indication of how important conjunctive use operations will be in order to meet the water supply needs in the Antelope Valley Region. Below is a discussion of additional conjunctive management project options that may expand water banking and ASR in the Region even further. Successful conjunctive use programs include both new supplies of water as well as storage capacity to accommodate seasonal and wet/dry year variations.

The first option is to increase the amount of imported SWP water into the Antelope Valley Region for direct use or water banking. The main issues associated with increasing use of imported SWP for conjunctive uses include cost, availability, and quality of SWP water (generally high in TDS compared to local stormwater and groundwater).

The capture and recharge of surface water is another conjunctive use method available to the Antelope Valley Region. Most of the runoff into the Antelope Valley Region originates in the surrounding mountains. Rainfall records indicate that runoff sometimes may be available that could be retained and used for artificial groundwater recharge (USGS 1995). Surface water recharge could be increased by limiting development in key recharge areas of the Antelope Valley Region as well as by establishing effective methods to capture surface water. Surface water capture and recharge would need to be evaluated for feasibility prior to implementation to identify recharge areas, as discussed above.

Lastly, conjunctive uses could be expanded to the treatment of poor quality groundwater which could be extracted, treated, and then re-injected into the aquifer. The extraction would be accomplished through the increased use of existing wells and by the installation of additional wells, pumps, and wellhead treatment facilities. Existing or new distribution facilities such as pipelines and pumping stations would be used to transport this water to existing and planned treated water distribution facilities. Pumps and treatment facilities would use electrical power. A detailed geohydrologic investigation would be necessary prior to drilling on a site-by-site basis. Field studies and groundwater modeling activities would be needed to hydraulically evaluate where in the aquifer the additional extraction should come from and if the basin could handle increased pumping without negatively affecting groundwater levels. The pending adjudication would determine the feasibility of this alternative, and to what extent it could be implemented in the Antelope Valley Region.

Participate in Water Banks Outside of the Antelope Valley Region. Another potential water supply option is to participate in water banking programs outside of the Antelope Valley Region to bring water into the Antelope Valley Region. Such additional banks could include the Wheeler Ridge Maricopa Water Storage District, the Arvin-Edison Water Storage District, the Chino Basin Groundwater Basin Storage and Recovery Program, the Semitropic Groundwater Storage Bank, the West Kern Water District Groundwater Banking Project, Mojave Water Agency Program, Calleguas Municipal Water District (CMWD) and Metropolitan Water District of Southern California (MWD), Las Posas Aquifer Storage and Recovery, and the Rosedale-Rio Bravo Water Storage District. It should be noted that while water banks operating outside of Antelope Valley Region are possibilities for the Antelope Valley Region, the feasibility of utilizing each still needs to be determined. Benefits to the Antelope Valley Region from utilization of these banks would be to increase water supply reliability for the Antelope Valley Region by increasing the number and mix of sites potentially available in which to bank water for later withdrawal and use. The Region would still need to identify and procure additional water supplies to store in an outside water bank.

Use Alternative Sources of Water. Groundwater and imported SWP water make up the majority of the water supplies in the Antelope Valley Region, with groundwater historically providing between 50 and 90 percent of overall supply. The adjudication and variability of SWP in light of global climate change conditions calls into question the reliability of these sources. Another solution is to use alternative sources of water to meet demands. These other sources could include water from the Central Valley of California (Central Valley Project [CVP] water) transfers from other water rights holders in the Sacramento Valley, water from other water supply systems (Los Angeles Department of Water and Power [LADWP]), recycled water, Article 21 water, treated stormwater captured and recharged into the ground, and desalinated water. In addition, alternative imported water sources from SWP contractors other than AVEK could be considered. There are a number of issues involved with the use of these other sources. The use of water from the CVP water would be transported to AVEK via SWP facilities, and as non-SWP water, transmission by these facilities would have low priority. Therefore, the water supply could be less reliable than that of water that AVEK currently supplies. Additionally, the permanent conveyance of this water through the Bay-Delta could result in economic and social impacts associated with transferring water from agricultural use to urban use. Water transfers from CVP contractors also would not likely be feasible because their water already has been allocated for other uses, including environmental restoration projects, and is not available for long-term, reliable sale or exchange.

Various SWP contractors (or their member agencies) hold contractual SWP Table A Amounts in excess of their demands. Due to the high annual fixed costs of SWP Table A Amounts, these agencies may wish to sell this excess to another contractor. Such Table A Amounts would be subject to the SWP annual allocation and SWP delivery reliability constraints. Potential sellers include the County of Butte and Kern County Water Agency (from its member agencies). Article 21 water refers to the SWP contract provision defining this supply as water that may be made available by DWR when excess flows are available in the Delta (i.e., when Delta outflow requirements have been met, SWP storage south of the Delta is full, and conveyance capacity is available beyond that being used for SWP operations and delivery of allocated and scheduled Table A supplies). Article 21 water is made available on an unscheduled and interruptible basis and is typically available only in average to wet years, generally only for a limited time in the late winter. Due to the short duration of its availability and capacity constraints at Edmonston Pumping Plant, Article 21 water is generally delivered most readily to agricultural contractors and to San Joaquin Valley banking programs. Therefore, Article 21 water is not considered a long-term reliable supply for the Antelope Valley Region.

The SWP Contractors Authority (Authority) Dry-year Water Purchase Program allows for the purchase of water from many agents within the California water system on a one-time or short-term basis. Participants could increase reliability during drought years by participating in this program to supplement supplies. This program has historically operated only in years when the SWP allocation is below 50 percent, or when a potentially dry hydrologic season is combined with expected low SWP carryover storage; it thus provides a contingency supplemental water supply. Typical water costs include an option payment (to hold water); the call price (actual purchase price); and loss of water due to movement through the Sacramento/San Joaquin Delta, in addition to SWP transmission costs. Turn-back Water Pools are a means by which SWP contractors with excess Table A Amounts in a given hydrologic year may sell that excess to other contractors. This is included in a provision in the SWP water supply contracts. This provision is available in all year types, but is most in demand during dry periods when Table A allocations are low and almost all contractors are seeking additional supplies. Of course, in those year types, less water is made available to the Turn-back Water Pools. The program is administered by DWR and requires selling and buying contractors to adhere to a specific schedule by which options to water must be exercised. The total amount of water placed into the pools by the selling contractors is allocated to the participating buying contractors based on their contractual Table A Amounts. The water supply contract provides for Turn-back Water Pools in a given water year. Pool "A," which must be purchased by March 1, is priced at 50 percent of the current SWP Delta water rate and the later Pool "B," which must be purchased by April 1, is priced at 25 percent of the current Delta water rate. All of the above mentioned supply alternatives have issues related to capacity and delivery priority in the California Aqueduct and other SWP facilities. SWP contractors, via their water supply contracts with DWR, are allocated specified shares of "reach repayment" capacity in various reaches of the SWP system, starting at Banks Pumping Plant in the Delta and proceeding through the main stem of the Aqueduct and the Aqueduct branches to each contractor's delivery turnout(s). This share of capacity pertains to SWP supplies only, and provides each contractor with delivery priority for its SWP supplies. The water supply contracts also provide for the delivery of non-SWP supplies through the SWP system, provided that other contractors are not coincidentally utilizing all available capacity; these non-SWP supplies are delivered at a lower priority than SWP supplies. Reach repayment capacity is often less than the actual constructed physical capacity of SWP facilities.

It is generally accepted among the SWP contractors that, based on future demand forecasts for all contractors, wet years (which tend to lower service area demands), will result in ample capacity in the southerly reaches of the SWP system, even though Table A allocations are high (i.e., not all water will be needed in the contactors' service areas, and much of it will be banked in other locations or sold into the SWP Turn-back Water Pools). During times when dry years occur in the Antelope Valley (which tend to cause higher service area demands), SWP capacity constraints may occur as southern contractors take water from the various banking programs in the San Joaquin Valley or from various dry year supply programs and attempt to deliver them within the same window of time (i.e., peak demand periods), in addition to Table A allocations. It is also generally accepted that all contractors in a given repayment reach will work cooperatively with DWR and each other to attempt delivery of all requested supplies, whether SWP or non-SWP. As additional contractors obtain additional supplies through time, this cooperative arrangement will be tested.

Utilization of desalinated water is also an alternate source of water that could be made available in the Antelope Valley Region. It is not likely that a desalination plant would be constructed in the Antelope Valley Region due to the distance from the ocean and the associated construction and operation costs. However, it is plausible to obtain desalinated water by exchange. For example, in this situation, AVEK could contribute a portion of the funds needed by another agency to develop a seawater desalination facility along the southern California coast, and water produced by this facility would be exchanged with AVEK for SWP water. A likely partner in such an arrangement could be MWD. If both parties agreed, AVEK would enter into a contract with MWD indicating that a portion of MWD's annual SWP Table A Amount would be delivered to AVEK in exchange for AVEK's contribution to a desalination facility to be constructed by MWD. AVEK would treat and distribute SWP water in existing AVEK facilities, and MWD would use water from the desalination facility in lieu of the SWP water exchanged with AVEK. All of these options present challenges in terms of conveyance, water quality, and cost.

Make Further Use of Recycled. Many of the Stakeholder-identified projects involve the use of recycled water. Increasing this amount beyond what is already planned could help to further reduce the gap between future supply and demand. Since the use of recycled water in the Region is currently limited to landscaping and other non-potable uses, it would be important to identify uses for the water beyond those for which its uses are currently dedicated or planned. Another important use for recycled water is groundwater recharge. Particular concern should be paid to salinity concentrations in recycled water. Numerous factors contribute to salinity in recycled water, including imported potable water sources and salts entering with each cycle of urban use for residential, commercial, or industrial purposes. Management of the salt imbalance is important because as salinity increases, irrigation water use must also increase to flush out salts that accumulate in the root zone. Furthermore, industrial users incur extra costs for cooling towers, boilers, and manufacturing processes to deal with the higher salinity water. In addition, groundwater recharge can also be affected when source water quality does not satisfy regulatory requirements (i.e., Basin Plan Objectives). To make full use of recycled water and to realize a water supply benefit, water reclamation plants would need to be expanded to treat increased sewer flows as population increases, additional conveyance pipelines would need to be constructed, and additional end uses (irrigation, industrial, and recharge) would need to be developed.

6.2 Water Quality Management

The issues and needs for water quality management in the Antelope Valley Region generally involve providing drinking water that meets current and future standards, protecting existing and future water sources from potential contamination, and making beneficial use of treated wastewaters for recycled water applications.

Progress to Date and Revisions to Regional Objectives

The Region has implemented several projects since 2007 to improve the water quality of the Valley's groundwater and surface water, as well as increase the beneficial use of recycled water. For example, treatment upgrades and effluent management at the Lancaster WRP and Palmdale WRP have been implemented to support efforts to maximize the beneficial use of recycled water. Additionally, construction of additional portions of the recycled water backbone expanded the availability of recycled water. LACWD 40's aquifer storage and recovery project helped to improve the quality of the Region's aquifers by increasing available groundwater and reducing constituent concentrations.

Assessment of IRWM Projects' Potential to Meet Water Quality Management Objectives

As detailed in Section 3, the Region has a number of water quality concerns regarding the quality of groundwater, local surface water and stormwater runoff, recycled water, and imported water. Section 4 presented objectives and planning targets identified by the Stakeholder group in order to address these concerns. The projects, shown in Table 6-3, will help the Region to address these concerns.

The objectives and planning targets identified for water quality management are:

Water Quality Objective 1. Provide drinking water that meets regulatory requirements and customer expectations.

- *Target:* Continue to meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period.

Table 6-3: Projects with Water Quality Management Benefits

Project	Status
Aquifer Storage and Recovery Project: Additional Storage Capacity	Complete
Aquifer Storage and Recovery Project: Injection Well Development	Complete
BCSD Arsenic Management Feasibility Study and Well Design	Complete
BCSD Arsenic Removal Treatment Plant (Construction)	Complete
Eastside Banking & Blending Project	Complete
Lancaster WRP Effluent Management Sites	Complete
Lancaster WRP Stage V	Complete
North Los Angeles/Kern County Regional Recycled Water Project – Division Street Corridor	Complete
North Los Angeles/Kern County Regional Recycled Water Project – Phase 1b	Complete
North Los Angeles/Kern County Regional Recycled Water Project – Phase 2	Complete
Palmdale WRP Effluent Management Sites	Complete
Palmdale WRP Stage V	Complete
Partial Well Abandonment of Groundwater Wells for Arsenic Mitigation	Complete
Water Supply Stabilization Project – Westside Project (Westside Water Bank)	Complete
Willow Springs Water Bank	Partially Complete
Antelope Valley Recycled Water Master Plan	Implementation
AVEK Strategic Plan	Implementation
Division Street and Avenue H-8 Recycled Water Tank	Implementation
Lancaster National Soccer Center Recycled Water Conversion	Implementation
Littlerock Dam Sediment Removal	Implementation
Palmdale Regional Groundwater Recharge Project	Implementation

Project	Status
Pierre Bain Park Recycled Water Conversion	Implementation
South Antelope Valley Intertie Project	Implementation
South North Intertie Pipeline (SNIP) Phase II	Implementation
Upper Amargosa Creek Recharge and Channelization	Implementation
Wastewater Treatment Plant Rehabilitation and Groundwater Protection	Implementation
Water Supply Stabilization Project (WSSP) – Westside Expansion	Implementation
Whit Carter Park Recycled Water Conversion	Implementation
42nd Street East, Sewer Installation	Conceptual
45th Street East Groundwater Recharge and Flood Control Basin	Conceptual
Antelope Valley Watershed Surface Flow Study	Conceptual
Arsenic Contamination Project	Conceptual
Avenue Q and 20th Street East Groundwater and Flood Control Basin (Q-West Basin)	Conceptual
Avenue R and Division Street Groundwater Recharge and Flood Control Basin	Conceptual
Barrel Springs Groundwater Recharge and Flood Control Basin	Conceptual
Big Rock Creek Recharge and Recovery Project	Conceptual
Ecosystem and Riparian Habitat Restoration of Amargosa Creek Ave J to Ave H	Conceptual
Expansion of the Eastside Water Bank	Conceptual
Hunt Canyon Groundwater Recharge and Flood Control Basin	Conceptual
Lancaster Cemetery Recycled Water Conversion	Conceptual
Lower Amargosa Creek Recharge Project	Conceptual
Multi-use/Wildlife Habitat Restoration Project	Conceptual
New PWD Treatment Plant	Conceptual
QHWD Partial Well Abandonment	Conceptual
Stormwater Harvesting	Conceptual
Tertiary Treated Recycled Water Conveyance and Incidental Groundwater Recharge of Amargosa Creek Avenue M to Avenue H	Conceptual
KC & LAC Interconnection Pipeline	No Longer Pursued
North Los Angeles/Kern County Regional Recycled Water Project – Phase 3	No Longer Pursued
North Los Angeles/Kern County Regional Recycled Water Project – Phase 4	No Longer Pursued
Place Valves and Turnouts on Reclaimed Water Pipeline	No Longer Pursued
RCSD Arsenic Consolidation Project	No Longer Pursued
RCSD Tropico Park Pipeline	No Longer Pursued
RCSD Wastewater Pipeline	No Longer Pursued
Recycled Water Pipeline at Power Plant Project	No Longer Pursued

Projects that would help to meet this first water quality objective include many of the projects shown in Table 6-3. Projects that recharge the Region's aquifers, such as the Palmdale Regional Groundwater Recharge Project and Eastside Banking and Blending Project, will provide soil aquifer treatment and some degree of blending with other groundwater sources. This can support improvements to the quality of drinking water. Other projects may directly treat surface water and imported water to meet drinking water standards, such as the New PWD Treatment Plant.

Water Quality Objective 2. Protect and maintain aquifers.

- *Target:* Prevent unacceptable degradation of aquifer according to the Basin Plan throughout the planning period.
- *Target:* Map contaminated sites and monitor contaminant movement by 2017.

- *Target:* Identify contaminated portions of aquifer and prevent migration of contaminants by 2017.

As with the 2nd water supply objective mentioned above, many of the projects proposed by the stakeholders are groundwater recharge projects and water banking programs. These projects and programs will require monitoring to identify which regions of the aquifer are best suited, and they will require continued monitoring to ensure they are operating effectively. Monitoring and data collection are the first steps in protecting the aquifer from contamination. Additional projects submitted that will help to meet these objectives include RCSD's Wastewater Treatment Plant Rehabilitation and Groundwater Protection Project and QHWD Partial Well Abandonment. Another project that will support water quality objectives is the City of Palmdale 42nd Street East Sewer Installation Project which will reduce groundwater pollution by eliminating septic tanks currently in use by homes in the vicinity of 42nd Street East.

Water Quality Objective 3. Protect natural streams and recharge areas from contamination.

- *Target:* Prevent unacceptable degradation of natural streams and recharge areas according to the Basin Plan throughout the planning period.

Projects proposed by the stakeholders to address this objective include groundwater recharge projects, retention and detention basin projects, and flood control projects. These projects and programs will require monitoring to identify which locations best suited and will require continued monitoring to ensure they are operating effectively. Monitoring and data collection are the first steps in protecting the natural streams and recharge areas from contamination. Examples of these projects include the City of Lancaster's Ecosystem and Riparian Habitat Restoration of Amargosa Creek Ave J to Ave H Project and the Lower Amargosa Creek Recharge Project, both of which will restore riparian habitat along Amargosa Creek (a natural stream and known recharge area).

Water Quality Objective 4. Maximize beneficial use of recycled water.

- *Target:* Increase infrastructure and establish policies to use 33% of recycled water to help meet expected demand by 2015, 66 percent by 2025, and 100 percent by 2035.

Currently, the Region uses a small amount (350 AFY) of the available 21,000 AFY of recycled water to meet non-potable customer demands. These numbers do not include recycled water currently used for environmental maintenance. A number of the proposed projects in the IRWM Plan involve enhancements to treatment facilities. Additionally, a number of the stakeholder-identified projects specify the use of recycled water for irrigation, effluent management, and recharge projects; many of which benefit not only water quality objectives, but also water supply and land use management objectives. There are a number of opportunities for integration between water quality projects, including proposed recharge basins that use effluent from the Palmdale or Lancaster WRPs as a source of recharge water.

Future Planning Efforts and Actions to Fill the Identified Water Quality Management Gaps

Future efforts are needed to protect the groundwater aquifer from contamination, which includes identifying and mapping the contaminated portions of the aquifer and identifying potential future sources of contamination. The following future planning efforts and actions are suggested to better meet the objectives identified for this strategy.

Identify Contaminated Portions of the Aquifer. The planning target, which is provided in order to gauge success on meeting the water quality management objectives, is to identify and prevent migration of contaminated portions of the aquifer. The 2014 SNMP for the Antelope Valley identified and analyzed various constituents found in the Region's aquifer. Additional monitoring and evaluation efforts may be necessary to further study those contaminants that jeopardize the Region's water quality objectives. Refer to the SNMP for information about the Region's groundwater quality.

Map Contaminated Portions of Aquifer. The planning target is to map the contaminated portions of the aquifer and monitor contaminant movement. The SNMP mapped the concentrations for select constituents. Additional monitoring, evaluation and mapping efforts may be necessary to better understand the Region's groundwater issues. Refer to the SNMP for available contaminant concentration maps.

Amend Existing Well Abandonment Ordinance. Abandoned wells in the Antelope Valley Region present water quality problems in that they act as conduits for surface and subsurface pollutants. The Los Angeles County Code of Ordinances Section 11.38.330 and the Kern County Code of Ordinances Section 14.08.360 specify regulations for the destruction of water wells. Amending these existing well abandonment ordinances would provide the policing authority to enforce the timely destruction of abandoned wells. The ordinances could provide the authority to require well destruction or rehabilitation as a condition upon sale of property, change of ownership or change of use. The ordinances could also require that new well applications be processed only after the applicant has demonstrated that all existing wells on all property they own are not in violation of the well ordinance.

Develop and Implement a Regional Groundwater Wellhead Protection Program. A Wellhead Protection Program (WPP) is a pollution prevention and management program used to protect underground sources of drinking water. A national WPP was established in 1986 by the Federal Safe Drinking Water Act. Some of the elements of these types of programs include the identification of recharge areas, zones of influence, groundwater flow directions, and potential contamination sources. This information is then compiled into a management plan, based on the assessment of alternatives for addressing potential sources of contamination, describing the local ordinances, zoning requirements, monitoring program and other local initiatives. The development of a regional WPP could additionally promote smart land use practices, including prohibiting new industrial, commercial and residential development in areas of sensitive groundwater recharge.

Develop Management Program for Nitrate and TDS. TDS and nitrate are of particular concern with regard to water quality in the Antelope Valley Region. TDS is concentrated in the groundwater when SWP water is imported and used for irrigation purposes, especially since the Antelope Valley Region is a closed basin. Nitrates are also present from historical irrigation practices and effluent management. Suggested management measures for these constituents include:

- TDS management measures:
    - Reducing the amount of salts imported into the sub-basins – imported water treatment/processes
    - Reducing the amount of salts added to groundwater via source water - wastewater treatment, modified processes such as increased retention time, or blending prior to use for irrigation or basin recharge
    - Reducing the amount of salts added to water via anthropogenic sources – BMPs, public outreach, land management guidelines
    - Natural treatment such as wetland systems
    - Transporting and exporting salts to a landfill
    - Disposing of salts via brine sales or deep well injection
    - Water softener ban

- Nitrate management measures:
    - Developing BMPs such as limiting excess fertilizing (set realistic goals for maximum crop yield) and eliminating over-irrigation to curtail the leaching transport process
    - Developing nutrient management programs and crop-specific nutrient application rates to improve crop fertilizer efficiency (decrease the total residual mass of nitrogen in the soil by using nitrification inhibitors or delayed-release forms of nitrogen)
    - Evaluating activities such as animal operations, food operations, and septic system discharges

Development of a management program and projects for these pollutants of concern, as well as for other emerging contaminants as they are identified, would contribute to meeting the objective of protecting the aquifer from contamination. Additionally, the SNMP for the Antelope Valley found that, based on the Antelope Valley Groundwater Basin's baseline water quality and project source water quality, managing salt and nutrient loadings on a sustainable basis is feasible with a minimal number of implementation measures.

Expand the Water Quality Monitoring Program. Monitoring activities in the Antelope Valley Region include groundwater levels, groundwater quality, land surface subsidence, aquifer compaction, and stream flow. According to the Antelope Valley Watermaster 2017 Annual Report (2018), the USGS actively monitors 185 wells for groundwater levels within and adjacent to the Antelope Valley Adjudication Area. USGS also samples a subset of Antelope Valley CASGEM wells for groundwater quality on a rotating basis. Typically, about 10 wells are selected for chemical analyses, with the remaining wells sampled for specific conductance and temperature. In addition to the USGS analyses, public water suppliers are required to sample groundwater quality in public supply wells and summarize data in Consumer Confidence Reports annually. . Expansion of the existing water quality monitoring efforts would allow for more current data collection to better assess the state of the Antelope Valley Region's water quality and other groundwater parameters. These groundwater quality monitoring programs need to be continued in order to capture the effects of changes in management practices. As Phillips states in his 1993 USGS report, "the need for an ongoing monitoring program transcends the importance of the selection of management alternatives." Further, in order for a water quality monitoring program to be successful in the Antelope Valley Region, the information collected needs to be shared regionally (i.e., by establishing a clearinghouse) in order to integrate and synthesize the data.

The SNMP includes a monitoring component to ensure the groundwater quality is consistent with applicable SNMP water quality objectives. The SNMP developed a groundwater quality monitoring plan using wells from the SWRCB Groundwater Ambient Monitoring and Assessment (GAMA) program. The plan includes 23 wells owned and operated by water utilities or the U.S. Air Force in central and southeast portions of the Basin. The program supplements ongoing groundwater monitoring programs by monitoring constituents associated with management goals in the Basin including TDS, nitrate, chloride, arsenic, total chromium, fluoride, and boron. Refer to the SNMP for monitoring and reporting details.

6.3 Flood Management

Progress to Date and Revisions to Regional Objectives

Flood management issues in the Antelope Valley Region generally relate to management of stormwater flows of variable water quality and the management of nuisance water that ponds after a storm event and eventually evaporates. As part of the 2014 IRWM Plan Update, the Region evaluated its flood management needs in order to update its objectives. The Region recognized that stormwater flow has beneficial uses that may be impacted by upstream flood control, and therefore added a second objective to protect, restore and improve the stewardship of aquatic, riparian and watershed resources in the Region.

Though an integrated flood management summary document was developed in conjunction with the 2013 IRWM Plan Update (see Appendix F), the target set to coordinate a regional flood management plan and policy mechanism by 2017 was not met. For this IRWM Plan Update, the Region revised the target to specifically call for the coordination of a regional Stormwater Resource Plan and extend out the goal year to 2025.

Assessment of IRWM Projects' Potential to Meet Water Quality Management Objectives

The objectives and planning targets identified for flood management include:

Flood Management Objective 1: Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future.

Flood Management Objective 2: Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses.

- *Target:* Coordinate a regional Stormwater Resource Plan and policy mechanism by the year 2025 and incorporate adaptive management strategies for climate change.

Current integrated flood management practices include the identification of infrastructure improvement projects necessary to reduce localized flooding, mitigate poor water quality and/or to enhance localized recharge. Projects proposed as part of this IRWM Plan that will have flood benefits are shown in Table 6-4.

Future Planning Efforts and Actions to Fill the Identified Flood Management Gaps

The small scale view typically taken in flood management has a tendency to move projects forward prematurely or to ignore other benefits a project may provide if operated or designed with multi-benefits in mind. Examples of the two tendencies include:

- Example 1: Concurrent water supply retention and flood control projects that could each meet the same objectives if combined and designed in an integrated fashion.
- Example 2: Concurrent groundwater recharge and flood control projects that could each meet the same objectives if combined and designed in an integrated fashion.

Table 6-4: Projects with Flood Management Benefits

Project	Status
Quartz Hill Storm Drain	Complete
Water Supply Stabilization Project – Westside Project (Westside Water Bank)	Complete
Littlerock Dam Sediment Removal	Implementation
Upper Amargosa Creek Recharge and Channelization Project	Implementation
45th Street East Groundwater Recharge and Flood Control Basin	Conceptual
Amargosa Creek Pathways Project	Conceptual
Antelope Valley Watershed Surface Flow Study	Conceptual
Avenue Q and 20th Street East Groundwater and Flood Control Basin (Q-West Basin)	Conceptual
Avenue R and Division Street East Groundwater and Flood Control Basin	Conceptual
Barrel Springs Groundwater Recharge and Flood Control Basin	Conceptual
Big Rock Creek In-River Spreading Grounds	Conceptual
Big Rock Creek Recharge and Recovery Project	Conceptual
Build a bridge at the existing dip crossing of Mt. Emma Road at Littlerock Creek	Conceptual
Flooding Issues Avenue P-8 between 160th and 170th Street East	Conceptual
Flooding Issues Avenue W. near 133rd Street East	Conceptual
Hunt Canyon Groundwater Recharge and Flood Control Basin	Conceptual
Implement ET Controller Program	Conceptual
Littlerock Creek In-River Spreading Grounds	Conceptual
Precision Irrigation Control System	Conceptual
Stormwater Harvesting	Conceptual
ET Based Controller Program	No Longer Pursued

These examples illustrate just a few of the concepts that provide support for regional planning. Regional planning begins with stakeholders getting together and formulating a plan to develop a regional plan from flood control, water quality and water supply perspectives, mixing all the components together to optimize the benefits of the program. Typical components of a Storm Water Resource Plan include:

Beneficial Use Identification. In-stream and downstream beneficial uses need to be identified so that the uses can be protected during the Flood Mitigation component. In-stream and downstream beneficial uses would include:

- Diversions for agriculture and stock watering.
- Diversions to percolation ponds.
- Flood flows to maintain the "biological crust: and resurfacing of Rosamond Dry Lake at EAFB.
- Flood flows overbank for riparian habitat.
- Dust control.

Existing Flood Hazard Mapping. Existing flood hazards need to be well understood and mapped to inform policy and zoning guidelines and identify locations of potential flood mitigation projects. The flood hazards would be developed through hydrologic and hydraulic modeling to create base maps that show flood extents and hazard ratings based on depth and velocity predictions. Potential stakeholders that may contribute financing to the effort would be FEMA and/or the U.S. Army Corps of Engineers (USACE).

Development Policy. Standard policy for the Region would need to be enacted for new development projects. The policy would be based on the Existing Flood Hazard Mapping component and would specify criteria for eliminating increased peak flow and volume due to new impervious surfaces and present guidelines for techniques such as Low Impact Development (LID), source control and BMP designed to improve water quality and decrease runoff volume and peak flow. The policy would also address building within the floodplain by setting finished floor elevation criteria with respect to flood event water surface and upstream and downstream impact criteria associated with floodplain encroachment.

Flood Mitigation. Areas prone to flooding that were built prior to the Development Policy component would need to be protected through flood mitigation. Flood mitigation techniques include capacity, detention and diversion techniques such as levees, flood walls, detention basins and upsized infrastructure to increase conveyance capacity. The mitigation options would be tested using the existing hydrologic and hydraulic models developed for the Existing Flood Hazard Mapping component. The design and operation of the infrastructure improvements would be conducted to insure beneficial uses and to optimize the other integrated components of water quality improvements and increases in water supply through groundwater recharge.

6.4 Environmental Resource Management

Progress to Date and Revisions to Regional Objectives

Since the 2007 IRWM Plan was completed, the entities in the Region have worked to preserve open space and natural habitat. For example, the Antelope Valley Conservancy preserved 40 acres of wetlands in 2011 near the community of Pearblossom, in addition to ensuring hundreds of miles of recreational trail preservation. PWD's Littlerock Sediment Removal Project and the Antelope Valley Resource Conservation District's Antelope Valley Regional Conservation Project are also expected to add open space and preserve natural habitat in the near future. Despite this, as of the 2019 IRWM Plan Updates, the Region was unable to meet its target of preserving an additional 2,000 acres of open space and natural habitat. The Region updated the target goal date from 2017 to 2025.

Assessment of IRWM Projects' Potential to Meet Environmental Resource Management Objectives

The main issues of concern regarding environmental resource management in the Antelope Valley Region are protection and preservation of open space and protection of endangered species. The following objectives and planning targets were identified to address these concerns:

Environmental Resource Objective 1. Preserve open space and natural habitats that protect and enhance water resources and species in the Antelope Valley Region.

- *Target:* Contribute to the preservation of an additional 2,000 acres of open space and natural habitat to integrate and maximize surface and groundwater management by 2025.

A number of proposed projects, shown in Table 6-5, will help the Region to meet its environmental resource management objective. A number of the projects include components to restore habitat. In addition, projects that will recharge the aquifer using spreading grounds will have the secondary benefit of preserving open space. In total, the projects propose to conserve over 2,000 acres of open space and habitat, which exceeds the Region's target.

Future Planning Efforts and Actions to Fill the Identified Environmental Resource Management Gaps

To better meet the objectives identified for this strategy, the following future planning efforts and actions are suggested.

Develop a Habitat Conservation Plan for the Antelope Valley Region. HCPs are developed to outline what steps must be taken to minimize and mitigate the impact of a permitted "take" on a threatened or endangered species. Many HCPs designate open space or habitat as mitigations of "take." Therefore, an HCP is a tool that could be used in the Antelope Valley Region for preserving and protecting open space and habitat.

Table 6-5: Projects with Environmental Resource Management Benefits

Project	Open Space and Habitat Conserved	Status
Antelope Valley Regional Conservation Project	5 acres	Implementation
Littlerock Dam Sediment Removal	Not quantified	Implementation
Upper Amargosa Creek Recharge and Channelization Project	15 acres	Implementation
45th Street East Groundwater Recharge and Flood Control Basin	208 acres	Conceptual
Amargosa Creek Pathways Project	Not quantified	Conceptual
Antelope Valley Watershed Surface Flow Study	Not quantified	Conceptual
Avenue Q and 20th Street East Groundwater and Flood Control Basin (Q-West Basin)	161 acres	Conceptual
Avenue R and Division Street Groundwater Recharge and Flood Control Basin	93 acres	Conceptual
Barrel Springs Groundwater Recharge and Flood Control Basin	40 acres	Conceptual
Ecosystem and Riparian Habitat Restoration of Amargosa Creek Ave J to Ave H	100 acres	Conceptual
Hunt Canyon Groundwater Recharge and Flood Control Basin	300 acres	Conceptual
Multi-use/Wildlife Habitat Restoration Project	Not quantified	Conceptual
Antelope-Fremont Watershed Assessment Plan	2,000 acres	No Longer Pursued
Tropico Park Pipeline Project	Not quantified	No Longer Pursued

Promote Land Conservation Projects that Enhance Flood Control, Aquifer Recharge, and Watershed and Open Space Preservation. Though a number of agencies are pursuing groundwater recharge projects, additional promotion of conservation projects could be accomplished through the adoption of a MOU with municipalities in the Antelope Valley Region to elicit and promote compliance with plans approved for the Antelope Valley Region including the area General Plans and the Mojave HCP.

6.5 Land Use Planning/Management

Progress to Date and Revisions to Regional Objectives

Since the 2007 IRWM Plan was developed, the Region has had little growth due to the economic downturn, limiting the Region's ability to meet its land use objectives and targets. The Region has maintained the same objectives and targets, extending out the target date for preserving farmland in rotation through 2040, providing additional acres of recreational space by 2040, and developing a regional land use management plan to 2025.

Assessment of IRWM Projects' Potential to Meet Environmental Resource Management Objectives

The main issues of concern regarding land use management in the Antelope Valley Region relate to the preservation of agricultural land, which includes a recognition of the historical relationship to the land and a support of a right to farm as well as the private property rights of all owners to economic benefits from their property, and the ability to provide recreational opportunities for a growing population. The following objectives and planning targets were identified to address these concerns:

Land Use Management Objective 1. Maintain agricultural land use within the Antelope Valley Region.

- *Target:* Preserve 100,000 acres of farmland in rotation through 2040.

Land Use Management Objective 2. Meet growing demand for recreational space.

- *Target:* Contribute to local and regional General Planning documents to provide 5,000 acres of recreational space by 2040.

Land Use Management Objective 3. Improve integrated land use planning to support water management.

- *Target:* Coordinate a regional land use management plan by the year 2025 and incorporate adaptive management strategies for climate change.

Several projects were submitted for inclusion in the AV IRWM Plan that provide direct benefits associated with land use management. Projects such as the Multi-use/Wildlife Habitat Restoration Project will directly create recreational area. Projects that recharge groundwater and expand recycled water availability will help to preserve agricultural lands by continuing to provide a reliable water source. These types of projects indirectly benefit land use management, but do not directly meet the objectives identified for the Antelope Valley Region. Employing land use planning as a strategy provides a way to better manage and protect local water supplies. Programs can be developed to assist in water conservation, protect and improve water quality, address stormwater capture and flooding, protect and enhance environmental habitat areas and recreational opportunities. Thus, implementing land use planning strategies can assist in achieving not only the land use management objectives but also the overall AV IRWM Plan objectives. The projects shown in Table 6-6 will help the Region to meet its land use planning/management objectives.

Table 6-6: Projects with Land Use Planning/Management Benefits

Project	Status
Eastside Banking & Blending Project	Complete
North Los Angeles/Kern County Regional Recycled Water Project - Division Street Corridor	Complete
North Los Angeles/Kern County Regional Recycled Water Project - Phase 1b	Complete
North Los Angeles/Kern County Regional Recycled Water Project - Phase 2	Complete
Water Supply Stabilization Project – Westside Project (Westside Water Bank)	Complete
Willow Springs Water Bank	Partially Complete
Amargosa Creek Pathways Project	Implementation
Antelope Valley Regional Conservation Project	Implementation
AVEK Strategic Plan	Implementation
South Antelope Valley Intertie Project	Implementation
South North Intertie Pipeline (SNIP) Phase II	Implementation
Water Supply Stabilization Project (WSSP) – Westside Expansion	Implementation
Lancaster National Soccer Center Recycled Water Conversion	Implementation
Littlerock Dam Sediment Removal	Implementation
Palmdale Recycled Water Authority – Phase 2 Distribution System	Implementation
Palmdale Regional Groundwater Recharge Project	Implementation
Pierre Bain Park Recycled Water Conversion	Implementation
Whit Carter Park Recycled Water Conversion	Implementation
Upper Amargosa Creek Recharge and Channelization Project	Implementation
Antelope Valley Watershed Surface Flow Study	Implementation
Big Rock Creek In-River Spreading Grounds	Conceptual
Ecosystem and Riparian Habitat Restoration of Amargosa Creek Ave J to Ave H	Conceptual
Expansion of the Eastside Water Bank	Conceptual
Multi-use/Wildlife Habitat Restoration Project	Conceptual
North Los Angeles/Kern County Regional Recycled Water Project - Phase 3	No Longer Pursued
North Los Angeles/Kern County Regional Recycled Water Project - Phase 4	No Longer Pursued
Recycled Water Pipeline at Power Plant Project	No Longer Pursued
Tropico Park Pipeline Project	No Longer Pursued

Future Planning Efforts and Actions to Fill the Identified Land Use Management Gaps

Below are additional future planning efforts and actions that have been identified in order to better meet the land use management objectives.

Preserve Farmland. The planning target, which is provided in order to gauge success in meeting the land use management objectives, is to preserve 100,000 acres of farmland in rotation through 2040. The 2013 IRWM Plan update estimated approximately 19,000 acres of farmland actively farmed in the Antelope Valley Region. However, recent agricultural data suggests that active farmland decreased to approximately 16,000 acres in 2016. While some of the proposed projects include farmland as a component that would contribute to this target, it is still being suggested as a future planning effort for the Antelope Valley Region because the planning target was not entirely met.

Build Public Parks and Recreational Amenities. The planning target, which is provided in order to gauge success in meeting the land use management objectives, is to increase public parks and recreational amenities by providing 5,000 acres of recreational space by 2040. As this planning target was not met by the projects proposed in this IRWM Plan, it is being suggested as a future planning effort for the Antelope Valley Region. As part of this planning effort, an Antelope Valley Region-wide inventory of existing water-related recreational opportunities could be developed that would aid in providing a needs assessment for future opportunities. Implementation of LID techniques where feasible are recommended.

Create a Watershed Management Plan. There is currently no watershed management plan for the Antelope Valley Region. Watershed management plans are similar to this IRWM Plan in that they bring together a wide range of stakeholders, including city and county staff, resource managers and policy officials, and community organizations to protect and restore the aesthetic and function of the watershed where needed. Watershed management plans focus on the 'function' of a watershed, and thereby assess the health and value of watershed components.

Create Incentives for Landowners to Protect/Restore/Preserve Open Space. Land use agencies have the ability to create incentives and/or eliminate disincentives for landowners to protect and restore open spaces and habitat on their property. Technical assistance and financial incentives have proven effective in protecting and restoring privately held natural areas, which in turn helps to meet regional water quality, flood management and environmental management objectives. Implementation of LID techniques where feasible are recommended.

Coordinate a Regional Land Use Management Plan. Traditionally, cities and counties have the responsibility for land use planning, much of which is continued in the local and regional General Plans. These planning documents to some extent address water and environmental resources in the context of land use planning. However, through the coordination of a regional land use plan, these efforts can be combined to better manage and protect local water supplies, improve water quality, reduce flooding, restore habitats and ecosystems, and provide recreational, educational, and access opportunities to the public for a potentially greater regional benefit.

6.6 Climate Change Mitigation

Progress to Date and Revisions to Regional Objective

The Region did not include a climate change mitigation objective as part of its 2007 IRWM Plan. As part of the 2013 Plan Update, the Region considered climate change throughout the various Plan sections, including the addition of a climate change mitigation target in Section 4.

Assessment of IRWM Projects' Potential to Meet Environmental Resource Management Objectives

The objective and planning target identified for climate change mitigation include:

Objective 1: Mitigate against Climate Change

- Target 1: Implement "no regret" mitigation strategies, when possible, that decrease GHGs or are GHG neutral

The projects shown in Table 6-7 will help the Region to decrease GHG emissions caused by water resources management projects or will help the Region to become GHG neutral. Some projects will directly reduce GHG emissions, such as the Solar Power System at K-8 Division which will reduce GHG emissions caused by power generation. Projects that restore habitat will produce carbon sequestration benefits through the introduction of plants to the area. Projects that offset imported water supply will indirectly reduce GHG emissions by reducing the amount of energy required to move water south from the Delta.

Table 6-7: Projects with Climate Change Mitigation Benefits

Project	Status
Aquifer Storage and Recovery Project: Injection Well Development	Complete
BCSD Arsenic Management Feasibility Study and Well Design	Complete
BCSD Arsenic Removal Treatment Plant	Complete
Eastside Banking & Blending Project	Complete
Lancaster WRP Stage V	Complete
North Los Angeles/Kern County Regional Recycled Water Project - Division Street Corridor	Complete
North Los Angeles/Kern County Regional Recycled Water Project - Phase 1b	Complete
North Los Angeles/Kern County Regional Recycled Water Project - Phase 2	Complete
Palmdale WRP Stage V	Complete
Partial Well Abandonment of Groundwater Wells for Arsenic Mitigation	Complete
Solar Power System at K-8 Division	Complete
Water Supply Stabilization Project – Westside Project (Westside Water Bank)	Complete
Willow Springs Water Bank	Partially Complete
Antelope Valley Recycled Water Master Plan	Implementation
Antelope Valley Regional Conservation Project	Implementation
AVEK Strategic Plan	Implementation
Division Street and Avenue H-8 Recycled Water Tank	Implementation
Lancaster National Soccer Center Recycled Water Conversion	Implementation
Littlerock Dam Sediment Removal	Implementation
Palmdale Recycled Water Authority – Phase 2 Distribution System	Implementation
Palmdale Regional Groundwater Recharge Project	Implementation
Pierre Bain Park Recycled Water Conversion	Implementation
South North Intertie Pipeline (SNIP) Phase II	Implementation
Upper Amargosa Creek Recharge and Channelization Project	Implementation
Wastewater Treatment Plant Rehabilitation and Groundwater Project	Implementation
Water Supply Stabilization Project (WSSP) – Westside Expansion	Implementation
Whit Carter Park Recycled Water Conversion	Implementation
45th Street East Groundwater Recharge and Flood Control Basin	Conceptual
Amargosa Creek Pathways Project	Conceptual
Avenue Q and 20th Street East Groundwater and Flood Control Basin (Q-West Basin)	Conceptual
Avenue R and Division Street Groundwater Recharge and Flood Control Basin	Conceptual
Barrel Springs Groundwater Recharge and Flood Control Basin	Conceptual
Big Rock Creek In-River Spreading Grounds	Conceptual
Big Rock Creek Recharge and Recovery Project	Conceptual
Ecosystem and Riparian Habitat Restoration of Amargosa Creek Ave J to Ave H	Conceptual
Expansion of the Eastside Water Bank	Conceptual
Fremont Valley Basin Potable Groundwater Well Treatment Project	Conceptual
Hunt Canyon Groundwater Recharge and Flood Control Basin	Conceptual
Implement ET Controller Program	Conceptual
Lancaster Cemetery Recycled Water Conversion	Conceptual
Littlerock Creek In-River Spreading Grounds	Conceptual
Lower Amargosa Creek Recharge Project	Conceptual
Multi-use/Wildlife Habitat Restoration Project	Conceptual

Project	Status
Precision Irrigation Control System	Conceptual
QHWD Partial Well Abandonment	Conceptual
Stormwater Harvesting	Conceptual
Tank 3 Hydro Turbine Generation Feasibility Study	Conceptual
Tertiary Treated Water Conveyance and Incidental Groundwater Recharge of Amargosa Creek Avenue M to Avenue H	Conceptual
Water Conservation School Education Program	Conceptual
ET Based Controller Program	No Longer Pursued
KC & LAC Interconnection Pipeline	No Longer Pursued
North Los Angeles/Kern County Regional Recycled Water Project - Phase 3	No Longer Pursued
North Los Angeles/Kern County Regional Recycled Water Project - Phase 4	No Longer Pursued
Place Values and Turnouts on Reclaimed Water Pipeline	No Longer Pursued
Purchasing Spreading Basin Land	No Longer Pursued
RCSD Arsenic Consolidation Project	No Longer Pursued
RCSD Wastewater Pipeline	No Longer Pursued
Recycled Water Pipeline at Power Plant Project	No Longer Pursued
Tropico Park Pipeline Project	No Longer Pursued
Ultra-Low Flush Toilet Change-out Program	No Longer Pursued
Waste Water Ordinance	No Longer Pursued

Future Planning Efforts and Actions to Fill the Identified Land Use Management Gaps

Below are additional future planning efforts and actions that have been identified in order to better meet the climate change mitigation objective.

Create or Update Climate Action Plans. Climate Action Plans are used by municipalities to define how municipal operations can reduce energy and greenhouse gas emissions. The Region's municipalities may consider creating a climate action plan or continuing to update their Climate Action Plans, particularly focusing on how water operations impact the climate.

Implement Additional Projects to reduce GHG emissions. The projects proposed will help the Region to reduce its GHG emissions. It may be possible to further reduce GHG emissions or become GHG neutral through the implementation of strategies that are not considered no-regret strategies.

Section 7 | Project Evaluation and Prioritization

This section presents the process used by the Region to submit, review, and prioritize projects. In general, the Region seeks to include projects in the IRWM Plan that support the Regional Objectives and Planning Targets described in Section 4. Section 7.1 provides a discussion of the Project Submittal Process, including the types of projects encouraged, how projects can be submitted, and the information required. Section 7.2 discusses the Project Review Process for the acceptance of projects into the IRWM Plan, and Section 7.3 discusses how the project list will be communicated to the public. Section 7.4 discusses the criteria and methodology used to prioritize the project list.

7.1 IRWM Project Submittal Process

The Antelope Valley IRWM Region allows proponents to submit projects and project updates for consideration on an ongoing basis, and it has a process in place to review submittals on a semi-regular basis utilizing the A-Team and Stakeholder Group. In addition, the Region periodically conducts open "calls for projects". These calls for projects are intended to encourage updates to existing projects and to solicit information about new projects that could be accepted into the IRWM Plan. They primarily occur prior to IRWM Plan Updates and/or grant funding opportunities. Whenever new or revised projects are being considered for acceptance into the IRWM Plan, notices are posted on the Region's website (www.avwaterplan.org), and email notifications are sent to the Region's stakeholders.

Generally speaking, projects that have already been accepted into the IRWMP are considered "grandfathered" in and may be updated by project proponents as appropriate. Revisions to these existing projects will be reviewed by the A-Team as needed, and questions may be presented to the Stakeholder Group for discussion if needed.

New projects must go through the submittal process. New projects selected for inclusion in the 2019 IRWM Plan Update were submitted in three ways: (1) by email using an electronic or scanned form, (2) on the www.avwaterplan.org website using an electronic form, and (3) with in-person meetings between project proponents and consultants during the Plan Updates. After submittal, the website information was updated with the assistance of LACDPW. The master list of IRWM projects (i.e., accepted into the IRWMP) is maintained on the www.avwaterplan.org website. Before projects are considered to be accepted into the IRWM Plan, they must go through the review process described below. A database of submitted projects that have not yet been accepted into the IRWM Plan is maintained separately from the master projects list on the website. Once projects go through the review process, they may be included in the master projects list. During the 2019 IRWM Plan Update process, all project proponents were encouraged to submit new projects and updates by logging in to the website and entering project information directly.

The Stakeholders are presented with the projects proposed for inclusion in the Plan

What types of projects are encouraged?

Projects eligible for inclusion in the plan include implementation projects, plans and studies, and conceptual projects. Projects at all levels of development are encouraged so that a thorough inventory of ideas can be made available on the website.

IRWM Plan projects that support the following Antelope Valley Regional Objectives are encouraged:

- Provide reliable water supply to meet Antelope Valley's expected demand between now and 2040; and adapt to climate change
- Establish a contingency plan to meet water supply needs of the Antelope Valley Region during a plausible disruption of SWP deliveries
- Stabilize groundwater levels
- Provide drinking water that meets regulatory requirements and customer expectations
- Protect and maintain aquifers
- Protect natural streams and recharge areas from contamination
- Maximize beneficial use of recycled water
- Reduce negative impacts of stormwater, urban runoff, and nuisance water, and adapt to climate change impacts in the future
- Optimize the balance between protecting existing beneficial uses of stormwater and capturing stormwater for new uses
- Preserve open space and natural habitats that protect and enhance water resources and species in the Antelope Valley Region
- Maintain agricultural land use within the Antelope Valley Region
- Meet growing demand for recreational space
- Improve integrated land use planning to support water management

- Mitigate against climate change

The 2016 update to the IRWM Program Guidelines requires that stormwater and dry weather runoff capture projects must be included in a Stormwater Resource Plan (SWRP) and comply with the provisions to receive grant funding. The SWRP must be incorporated into the IRWM Plan to be eligible for funding. The SWRP has not yet been developed for the watersheds in the Region.

How can projects be submitted and/or updated?

The projects selected for inclusion in the 2019 IRWM Plan Update were submitted in one of three ways: (1) via email using an electronic or scanned form, (2) via online form through www.avwaterplan.org, or (3) via in-person or phone call interviews. Project proponents were then contacted by the Region to collect additional information on the projects. In the future, all regional stakeholders will be encouraged to submit projects using the web interface project form as follows:

1. Register for an account at www.avwaterplan.org in the "Projects" section of the website or, if the applicant does not have internet access, contact the Los Angeles County Department of Public Works at (626) 300-3353 for a hard copy of the project submittal form.
2. Collect the required project information (described below).
3. Upload the required project information to the website; or, if a hard copy form was requested, submit the form to Los Angeles County Department of Public Works by emailing a scanned copy of the form to eballesteros@dpw.lacounty.gov, or sending the form to the County of Los Angeles Department of Public Works, Waterworks Districts, 1000 South Fremont Avenue, Building A9-E, 4th Floor, Alhambra, CA 91803.

Once a project has been submitted, it will be retained in a list of "submitted projects" for subsequent review by the Region's A-Team and Stakeholder Group for potential acceptance into the IRWM Plan.

What information is required?

Projects at all levels of development are eligible for submittal to the IRWM Plan. For grant funding opportunities, well-developed projects are preferred because they are more competitive in terms of satisfying the typical scoring criteria. Projects eligible for inclusion in the plan include implementation projects, plans and studies, and conceptual projects.

Implementation Projects

For implementation projects, the basic project information is required:

- Project title
- Project proponent
- Project partners
- Project contact information
- Proponent's IRWM Plan adoption status
- Project description (2-3 paragraphs)
- Project location (using GeoTracker)
- Project integration information

The following narrative and technical information is also required:

- **How the project will contribute to IRWM Plan objectives**: The project must help the Region to achieve its IRWM Plan objectives, as discussed in Section 4. To demonstrate this, the project sponsor must indicate which objectives the project will support.
- **How the project is related to resource management strategies**: The IRWM Plan identifies the RMS selected for use in the Plan with the goal of diversifying the Region's water management portfolio, as indicated in Section 5. The project sponsor must indicate which of these RMS that the project aligns with.
- **Technical feasibility of the project:** Technical feasibility is related to the knowledge of the project location; knowledge of the water system at the project location; or with the material, methods, or processes proposed to be employed in the project. The project sponsor must cite supporting documents to demonstrate that there is enough known about existing conditions where the project will be located and that there is sufficient technical data to indicate that the project will result in a successful outcome.
- **Specific benefits to critical DAC water issues:** Identification and consideration of water-related needs of DACs in the area must be addressed by the Region in the IRWM Plan. Therefore, it is required that the project sponsor indicate if and how the project will address such needs.
- **Specific benefits to critical water issues for Native American tribal communities:** Identification and consideration of water-related needs of Native American tribal communities in the area must be addressed by the Region in the IRWM Plan. Therefore, it is required that the project sponsor indicate if and how the project will address such needs.
- **Environmental justice considerations[1]:** As IRWM plans contain multiple projects that will affect stakeholders in the Region, environmental justice concerns must be considered. The Region is required to ensure that project sponsors are aware of the impacts of the project on stakeholders, and therefore the project sponsor is required to indicate whether there are known environmental justice concerns or whether these concerns are unknown.
- **Project costs and financing:** The project's estimated costs and how it will be financed must be indicated by the project sponsor. If a cost estimate has been prepared for the project, a link to that estimate must be provided.

- **Economic feasibility:** The economic feasibility of the project must be discussed by the project sponsor. This can take the form of either a cost-effectiveness or benefit-cost analysis, and should include the types of benefits and the types of costs including capital costs, O&M costs, and potential adverse effects to others from the project.
- **Project status:** The status of the project, also referred to as the project's readiness to proceed, should be indicated by specifying whether the project is conceptual (minimal

[1] Environmental justice is the "fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies" (California Government Code §65040.12(e)).

planning has been completed), in the design phase (design drawings are being prepared, or more detailed planning is underway), or ready for construction. The project sponsor must also indicate whether CEQA is complete. As the planning horizon for the 2019 IRWM Plan Update is 21 years (to 2040), projects at all levels of development will be considered for inclusion in the IRWM Plan.

- **Contribution of the project in adapting to or mitigating against the effects of climate change:** The Region is dedicated to adapting to and mitigating against future climate change impacts. Project sponsors should indicate whether the project may help the Region to adapt to the predicted impacts of climate change (see Section 2), or will mitigate against climate change by reducing GHG emissions or providing greater energy efficiency as compared to project alternatives.

Once the project is submitted, it will be considered for inclusion in the IRWM Plan by the A-Team and Stakeholder Group. A copy of the Project Submittal Form is included in Appendix J.

Plans and Studies

The above discussion applies to implementation projects. Plans and studies may also be submitted as projects, but the level of detail discussed above may not be applicable.

For plans and studies, the basic project information is required:

- Project title
- Project proponent
- Project partners
- Project contact information
- Proponent's IRWM Plan adoption status
- Project description (2-3 paragraphs)
- Project location (if applicable, using GeoTracker)
- Project integration information

The following narrative and technical information is also required (see above for descriptions of these items):

- How the project will contribute to IRWM Plan objectives
- How the project is related to RMS
- Specific benefits to critical DAC water issues
- Specific benefits to critical water issues for Native American tribal communities
- Project costs and financing
- Contribution of the project in adapting to or mitigating against the effects of climate change

Conceptual Projects

Projects that do not meet the basic review criteria for implementation projects may still be admitted as "conceptual" projects. These are projects that the A-Team and Stakeholder Group determine could contribute to meeting the Region's IRWM objectives, but may not yet be developed enough to include in the IRWM Plan as an implementation project. For the purposes of this Plan, the Stakeholder Group has determined that if a preliminary economic analysis has not been conducted the project will be considered conceptual. For conceptual projects, the following basic information is required:

- Project title
- Project proponent
- Project partners
- Project contact information
- Proponent's IRWM Plan adoption status
- Project description (1 paragraph) – should indicate how the project could provide the Region with at least one benefit, address at least one regional IRWMP objective, and utilize at least one of the RMS
- Project location (using GeoTracker, if appropriate)
- Project integration information

Conceptual projects will be revisited should additional information be provided.

7.2 IRWM Project Review for Inclusion in the Plan

As with project submittal, project review is intended to be an ongoing process. The A-Team is responsible for reviewing new projects and project updates and for making recommendations to the Stakeholder Group about acceptance into the IRWM Plan. This is done on an ongoing basis as projects are submitted.

Projects are reviewed by the A-Team using the process shown in Figure 7-1 and based on the required criteria listed below in Table 7-1. Those projects that meet the minimum requirements may be recommended for inclusion in the Plan as conceptual projects. If a preliminary economic analysis has been conducted, the A-Team may recommend a project to be accepted as an implementation project. The list of projects recommended by the A-Team for acceptance in the Plan is then approved by the Stakeholder Group at regular stakeholder meetings.

Figure 7-1: IRWM Project Review Process

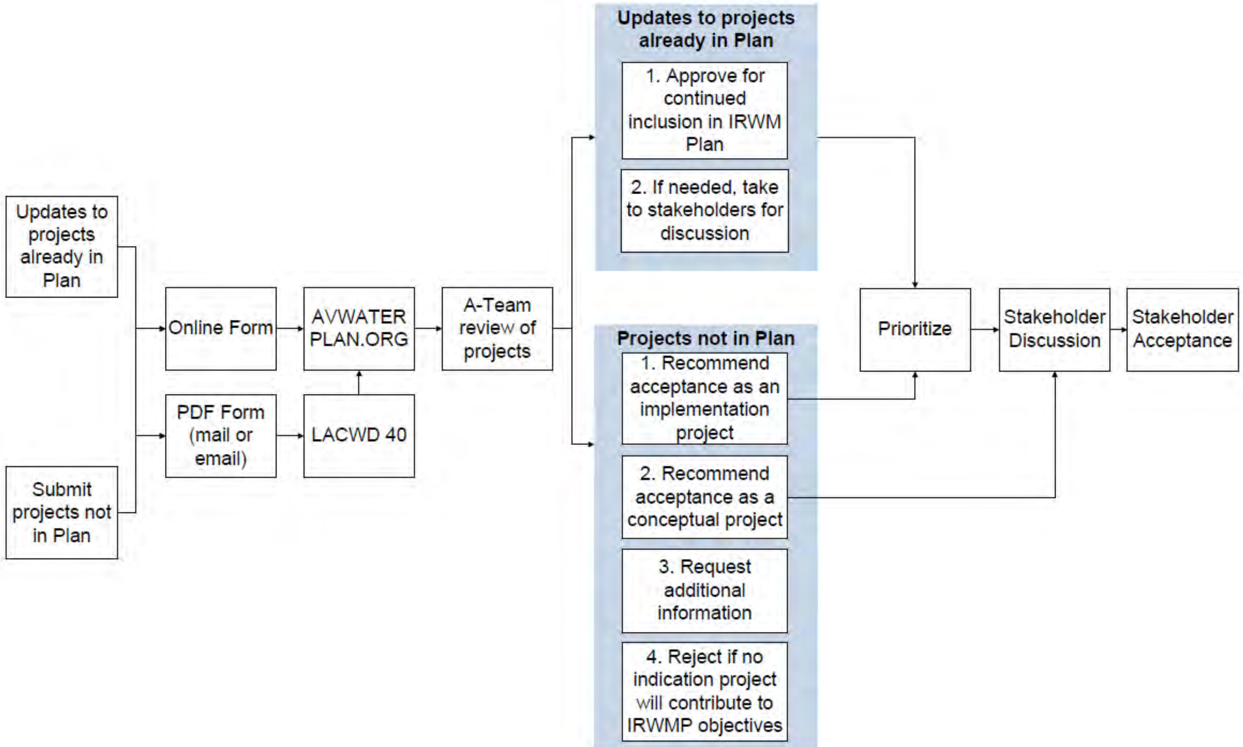


Table 7-1: Project Review Factors for Acceptance into the IRWM Plan

Review Factor[2]	Criteria and Comments
General Information	Has general information been provided? This includes project title, proponent, partners, contact information, and proponent's IRWM Plan adoption status.
Project Description	Has a complete project description been provided? This includes a project description, project integration information, and project document sources.
Project Location	Has the project location been provided?
Project Benefits	Is a minimum of one quantifiable benefit identified?
IRWMP Objectives[3]	Will at least one Antelope Valley IRWMP objective be addressed?
Resource Management Strategies[4]	Will at least one Resource Management Strategy be addressed?
Technically Feasible	Is at least one study/report/document identified that justifies technical feasibility?
DAC Benefits	If the project will benefit a DAC, has the proponent described how the project addresses the needs of the DAC?
Native American Tribal Community Benefits	If the project will benefit a Native American tribal community, has the proponent described how the project addresses the needs of the Native American tribal community?
Environmental Justice Considerations	If the project has environmental justice issues, have they been described?
Project Costs and Financing	Have the project capital cost, operations and maintenance costs, and funding/financing sources been provided? If a cost estimate has been completed, has it been provided?
Economic Feasibility	If a cost-effectiveness or benefit-cost analysis has been performed, has it been provided?
Readiness to Proceed	Is the project status identified (i.e., conceptual, design, ready for construction, CEQA Compliance)?
Benefits to Multiple Stakeholders	Will the project benefit more than one stakeholder or are there multiple project benefits?
Climate Change Adaptation/GHG Mitigation	Has the proponent indicated how the project will help the Region adapt to climate change and/or aid the Region in reducing GHG emissions?

[2] Shaded review factors indicate those criteria that are required to be accepted into the plan as a conceptual project.
[3] See *2019 Antelope Valley IRWMP, Section 4 Objectives* for more information.
[4] See *California Water Plan Update 2018*, https://water.ca.gov/Programs/California-Water-Plan/Water-Resource-Management-Strategies

7.3 Procedures for Communicating the Project List of Selected Projects

The project list in the original 2007 IRWM Plan was included in that document as an appendix. However, the updated project list is meant to be a "living document" and will therefore be maintained on the www.avwaterplan.org website as both a database of "submitted" projects and a listing of "accepted" projects. The Region's A-Team will evaluate submitted projects based on the previously discussed information. After review of a given project, the A-Team may take one of three actions: (1) recommend the project to the Stakeholder Group for acceptance into the IRWM Plan, (2) hold the project and request additional information, or (3) maintain the project within the database as a "submitted" project.

As the AV IRWM Plan is updated, the opportunity exists to reevaluate the projects included in this IRWM Plan as their project scopes are refined, and a continual assessment of whether this IRWM Plan is meeting the issues and needs of the Antelope Valley Region will be conducted. Additionally, this IRWM Plan provides a mechanism for identifying new projects designed in accordance with the regional objectives, priorities, and management strategies.

7.4 IRWM Project Prioritization

The projects included in the IRWM Plan are projects that will implement the Plan and help to achieve the Plan objectives. The intent of the project prioritization process is to identify those projects and management actions the Region's stakeholders would like to pursue first to address the Region's issues and needs. Projects should embody the priorities of the planning effort and are intended to represent a prudent investment for sources of grant funding. For the purposes of this plan, only implementation projects were prioritized. The general process and criteria used to determine the priority level of implementation projects are described below. These criteria could be superseded by specific grant criteria as grant opportunities become available.

7.4.1 Project Prioritization Criteria

Each project is assessed using the project review criteria described below. The methodology for applying the criteria is also described. Studies and reports are considered "implementation" projects since for some grant programs certain studies/reports are eligible for implementation funding. If a project or plan is not far enough along to have a preliminary economic analysis available, then it is considered conceptual and not scored with the implementation projects. Projects that promote the beneficial use of stormwater and alleviate flooding were integrated into this 2019 IRWM Plan Update but were not evaluated with the implementation projects since the Region has not yet developed an SWRP for the Region. Table 7-2 summarizes the criteria and scoring used to categorize and prioritize the implementation projects.

<u>Project Benefits</u>: Each project is evaluated on the number of quantifiable water-related benefits it could produce that would help the Region meet its objectives. There is no limit to the number of quantifiable benefits as long as adequate justification is provided. Each benefit is assessed as having "good", "fair", or "poor" justification. Projects that could contribute more benefits and/or that have more substantial technical justification are favored over projects that have less. Recharge projects with spreading basins are assumed to have water quality benefits because of soil aquifer treatment. This benefit is not assumed for projects that inject water into the basin (ASR). Projects that increase local supply are assumed to also offset water supply from the Sacramento-San Joaquin Delta and thereby also reduce energy consumption/greenhouse gas emissions by decreasing water conveyance energy requirements.

<u>IRWM Plan Objectives</u>: Each project is evaluated on the number of IRWM Plan Objectives it would help the Region meet. Projects with more IRWM Objectives are preferred over projects with fewer.

Recharge projects are assumed to support the objective of "protect and maintain aquifers" when they recharge groundwater with water from high quality sources, such as imported water. Projects that offset water supply from the Sacramento-San Joaquin Delta are also assumed to mitigate climate change impacts since they reduce the energy consumption and greenhouse gas emissions associated with pumping and transporting imported water. Projects that increase the transport or storage of recycled water to recreational areas are assumed to support the objective of "meet the growing demand for recreational space". These types of projects would help recreational areas remain operational during droughts when potable supplies may be rationed.

Resource Management Strategies: Each project is evaluated on the number of RMS it would help to implement. These RMS are listed in the 2016 update of the DWR's California Water Plan.[5] Projects that support more RMS are favored over those that support fewer.

DAC Benefits: Projects that provide water supply, quality, and/or flood management benefits to DACs are favored over projects that do not. Projects that produce region-wide benefits were assumed to also benefit DACs if it can be demonstrated that DAC areas lie within the regional influence.

Native American Tribal Community Benefits: Projects that provide benefits to Native American tribal communities are favored over projects that do not. No Native American Tribal Communities have been identified in the watershed at this time.

Environmental Justice Considerations: Projects that address environmental justice issues are favored over projects that do not.

[5] An update to the 2016 California Water Plan was completed in 2018. However, the 2018 California Water Plan did not provide further updates to the RMS listed in the 2016 California Water Plan.

Table 7-2: Prioritization Method and Scoring

Criterion	Conceptual	Implementation	Prioritization Scoring
General Information	Project description, location, and general info	Project description, location, and general info	---
Prelim. Economic Analysis	NO	YES	---
Project Benefits	At least one	At least one	Per Benefit: 3 pts = good justification 2 pts = fair justification 1 pts = poor justification
IRWMP Objectives	At least one	At least one	1 pt. per Objective
Resource Mgmt. Strategies	At least one	At least one	1 pt. per RMS
DAC/Tribal/Env. Justice	Sufficient information	Sufficient information	For each: Yes = 3 pts No = 0 pts
Project Costs	Sufficient information for level of design	Sufficient information for level of design	---
Technically Feasible	At least one supporting document	At least one supporting document	---
Readiness to Proceed	Status clearly defined	Status clearly defined	---
Climate Change	Sufficient information	Sufficient information	---

Other criteria not directly addressed in the project prioritization include a project's technical feasibility, project costs and financing, benefits to multiple stakeholders and climate change adaptation and greenhouse gas mitigation. These additional criteria include considerations to the project's ability to adapt to climate change vulnerabilities, changes in runoff and recharge, and the effects of sea level rise on imported water supply, as well as the project's contribution to reducing GHG emissions as compared to project alternatives and reducing the Region's overall energy consumption. These criteria are already captured in the other prioritization criteria. Additionally, a project's economic feasibility is incorporated into the judgment of whether it is considered an implementation or conceptual project through the requirement of a preliminary economic analysis.

7.4.2 Prioritized Projects

The Antelope Valley IRWMP project list should be considered a "living document" to be continually modified and updated on the IRWMP website. The projects listed below are only a snapshot of the projects as of the development of this IRWMP and should only be considered as such. For more updated project information, please consult the website at www.avwaterplan.org.

The projects shown in Table 7-3 are classified as studies or plans and implementation projects and are scored according to the prioritization method. Those projects that received higher scores are shown at the top of the table. Projects that were accepted into the Plan as conceptual projects were not scored but are listed in Table 7-4. Table 7-3 and Table 7-4 both contain stormwater-related projects that may require development of an SWRP in order to receive grant funds for project implementation. Projects that have been completed or are no longer pursued have been excluded from these lists. For a more detailed table of the projects accepted into the Plan, including completed projects and detailed scoring of the implementation projects, please see Appendix K.

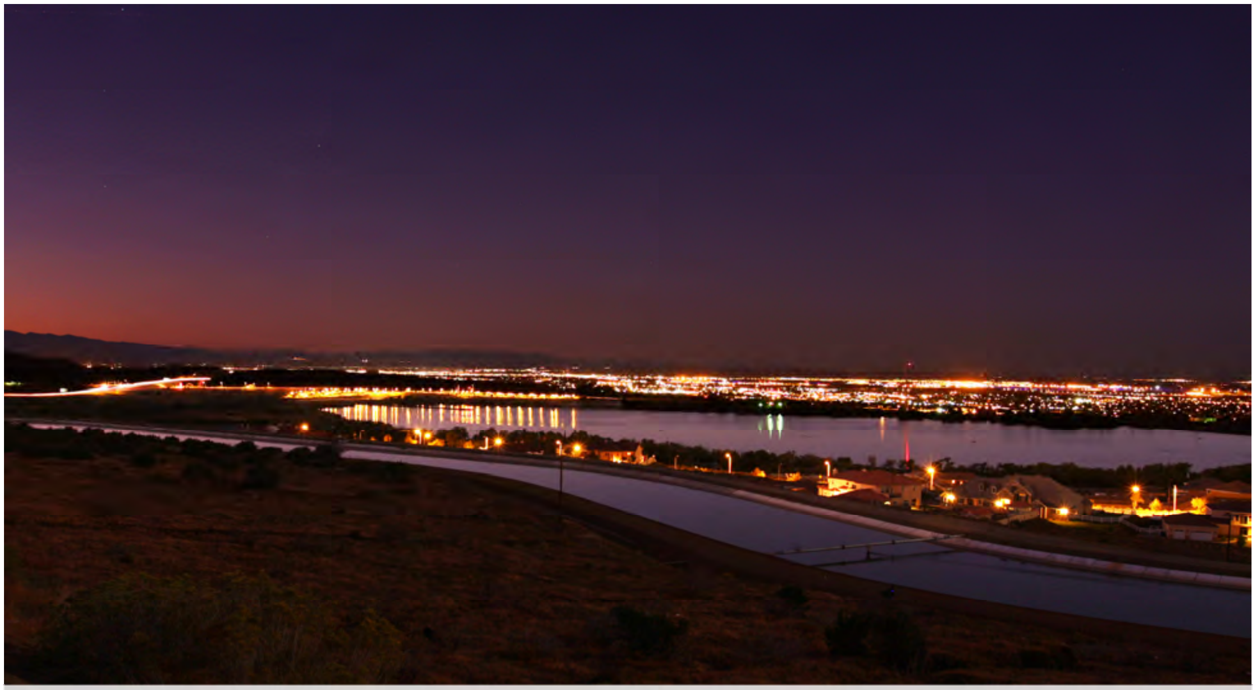
Table 7-3: Prioritized Implementation Projects Accepted into the Antelope Valley IRWM Plan

Sponsor	Project Name		Benefits Score	Objectives Score	RMS Score	DAC	Total Score
Willow Springs Water Bank	Willow Springs Water Bank	Implementation	17	7	4	3	**35**
City of Palmdale	Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project	Implementation	13	11	8	3	**35**
Palmdale Water District	Littlerock Dam Sediment Removal	Implementation	14	8	4	3	**29**
Palmdale Water District	Palmdale Regional Groundwater Recharge Project	Implementation	10	8	8	3	**29**
Antelope Valley Resource Conservation District	Antelope Valley Regional Conservation Project	Implementation	10	5	9	3	**27**
Palmdale Recycled Water Authority	Phase 2 Distribution System	Implementation	12	6	5	3	**26**
AVEK	Water Supply Stabilization Project (WSSP) – Westside Expansion	Implementation	8	8	4	3	**23**
Rosamond CSD	Wastewater Treatment Plant Rehabilitation and Groundwater Protection	Implementation	6	7	6	3	**22**
AVEK	AVEK Strategic Plan	Study/Report	6	6	7	3	**22**
AVEK	South Antelope Valley Intertie Project	Implementation	5	6	7	3	**21**
AVEK	South North Intertie Pipeline (SNIP) Phase 2	Implementation	6	6	6	3	**21**
City of Lancaster	Antelope Valley Recycled Water Master Plan	Study/Report	9	4	5	3	**21**
City of Lancaster	Whit Carter Park Recycled Water Conversion	Implementation	9	5	3	3	**20**
City of Lancaster	Division Street and Avenue H-8 Recycled Water Tank	Implementation	9	5	3	3	**20**
City of Lancaster	Lancaster National Soccer Center Recycled Water Conversion	Implementation	9	5	3	3	**20**
City of Lancaster	Pierre Bain Park Recycled Water Conversion	Implementation	9	5	3	3	**20**

Table 7-4: Conceptual Projects Accepted into the Antelope Valley IRWM Plan

Sponsor	Conceptual Projects
Antelope Valley Duck Hunting	• Multi-use/Wildlife Habitat Restoration Project
Antelope Valley Resource Conservation District	• Antelope-Fremont Valleys Stealth Watershed Rapid Response Program
AVEK	• Big Rock Creek Recharge and Recovery Project • Expansion of the Eastside Water Bank
City of Lancaster	• Amargosa Creek Pathways Project • Ecosystem and Riparian Habitat Restoration of Amargosa Creek Ave J to Ave H • Lancaster Cemetery Recycled Water Conversion • Tertiary Treated Water Conveyance and Incidental Groundwater Recharge of Amargosa Creek Avenue M to Avenue H
City of Palmdale	• 42nd Street East, Sewer Installation • 45th Street East Groundwater Recharge and Flood Control Basin • Avenue R and Division Street Groundwater Recharge and Flood Control Basin • Avenue Q and 20th Street East Groundwater and Flood Control Basin (Q-West Basin) • Barrel Springs Groundwater Recharge and Flood Control Basin • Hunt Canyon Groundwater Recharge and Flood Control Basin • Lower Amargosa Creek Recharge Project
EAFB	• Antelope Valley Watershed Surface Flow Study
LACDPW	• Big Rock Creek In-River Spreading Grounds • Little Rock Creek In-River Spreading Grounds
LACWD 40	• Avenue K Transmission Main, Phases I-IV • Avenue M and 62th Street West Tanks • Implement ET Controller Program • Water Conservation School Education Program
Leona Valley Town Council	• Precision Irrigation Control System • Stormwater Harvesting
Little Rock Creek Irrigation District	• SWP Turnout Upgrade
North Edwards WD	• Arsenic Contamination Project
Palmdale Water District	• New PWD Treatment Plant
QHWD	• QHWD Partial Well Abandonment
Road Maintenance Division (LACDPW)	• Build a bridge at the existing dip crossing of Mt. Emma Road @ Littlerock Creek • Flooding issues Avenue P-8, between 160th and 170th Street East • Flooding issues Avenue W, near 133rd Street East

Rosamond CSD	• Fremont Valley Basin Potable Groundwater Well Treatment Project • Tank 3 Hydro Turbine Generation Feasibility Study



Section 8 | Implementation

This section develops a comprehensive implementation plan for the IRWM Plan. The objectives of this section are to describe how the governance structure of the Region operates now and in the future, develop a financial plan for implementation of the Plan and projects selected as implementation projects, describe how the Region will manage and report data, describe the technical information used in developing this plan and data gaps found, identify a means for monitoring progress in meeting Plan objectives, and describe how the Plan will be updated and maintained throughout the planning horizon.

8.1 Framework Introduction

This subsection discusses the agencies and stakeholders that develop plans or participate in the development of plans in the Antelope Valley Region, and it identifies the different scales at which planning occurs. How local agencies and stakeholders choose to link regional water issues and challenges with the IRWM Plan priorities, strategies, and objectives noted in Section 4; combine water management strategies; or determine which specific activities should occur for any specific water management strategy may vary based on the scale of planning. It is within this framework that the stakeholders intend to move toward the shared resource management objectives, following a course of greater integration and coordination of water projects and programs in the Region.

8.1.1 Existing Plans and Programs

A substantial number of federal, state and local/regional agencies and jurisdictions are responsible for, or participate in, the development and implementation of plans and programs that satisfy the resource management strategies developed earlier in this report.

Land use decisions have the potential to affect the resource management strategies utilized in the AV IRWM Plan, as land use can affect population growth, water demand, and surface water quality. The implementation of stormwater capture projects may require acquisition of land which could displace existing uses and may warrant consideration of modifications to land use policies and practices. In addition, the passage and implementation of water conservation or floodplain management ordinances can further address IRWM Plan objectives. In developed areas, the land use decision makers are primarily the cities and the counties. In open space areas, the Forest Service, National Park Service, and California State Parks have regulatory responsibility for the conservation and preservation of those spaces. Additionally, many 'open spaces' in the Antelope Valley Region are undeveloped rural lands under Los Angeles and Kern County jurisdiction. All of these agencies and jurisdictions have been involved in the AV IRWM Plan as part of the stakeholder process or are active members of the Antelope Valley RWMG (e.g., cities and counties).

The stakeholder process allows for interactive feedback to occur between local land use and water resources planning, and regional IRWM Plan planning. Local planning is conducted by cities, counties, and local agencies and districts. Most of the cities and counties in the Antelope Valley Region have participated either directly, or through the participation of a regional representative. Through the stakeholder workshops, the cities, counties and municipal agencies have advocated for their respective local planning needs and issues, which have been incorporated into the IRWM Plan through stakeholder feedback and project solicitation. Subsequently, the outcomes from the AV IRWM Plan process have been disseminated by the representatives back to their local decision makers, allowing the IRWM Plan priorities, objectives and planning targets to be considered in local planning efforts where appropriate. For example, the AV IRWM Plan was used to inform the Los Angeles County General Plan update in 2015 in areas related to water resource management.

Stakeholder meetings facilitate information sharing and collaboration with regional land use planning to manage multiple water demands throughout the State, adapt to water management systems to climate change, and offset climate change impacts to the water supply. Given this interactive opportunity and plan review processes, numerous plans and studies related to water resources and land use management in the Antelope Valley Region have contributed to the development of the IRWM Plan. Thus, the AV IRWM Plan has been developed from and is consistent with local planning efforts in the Antelope Valley Region shown in Table 8-1.

8.2 Governance Structure

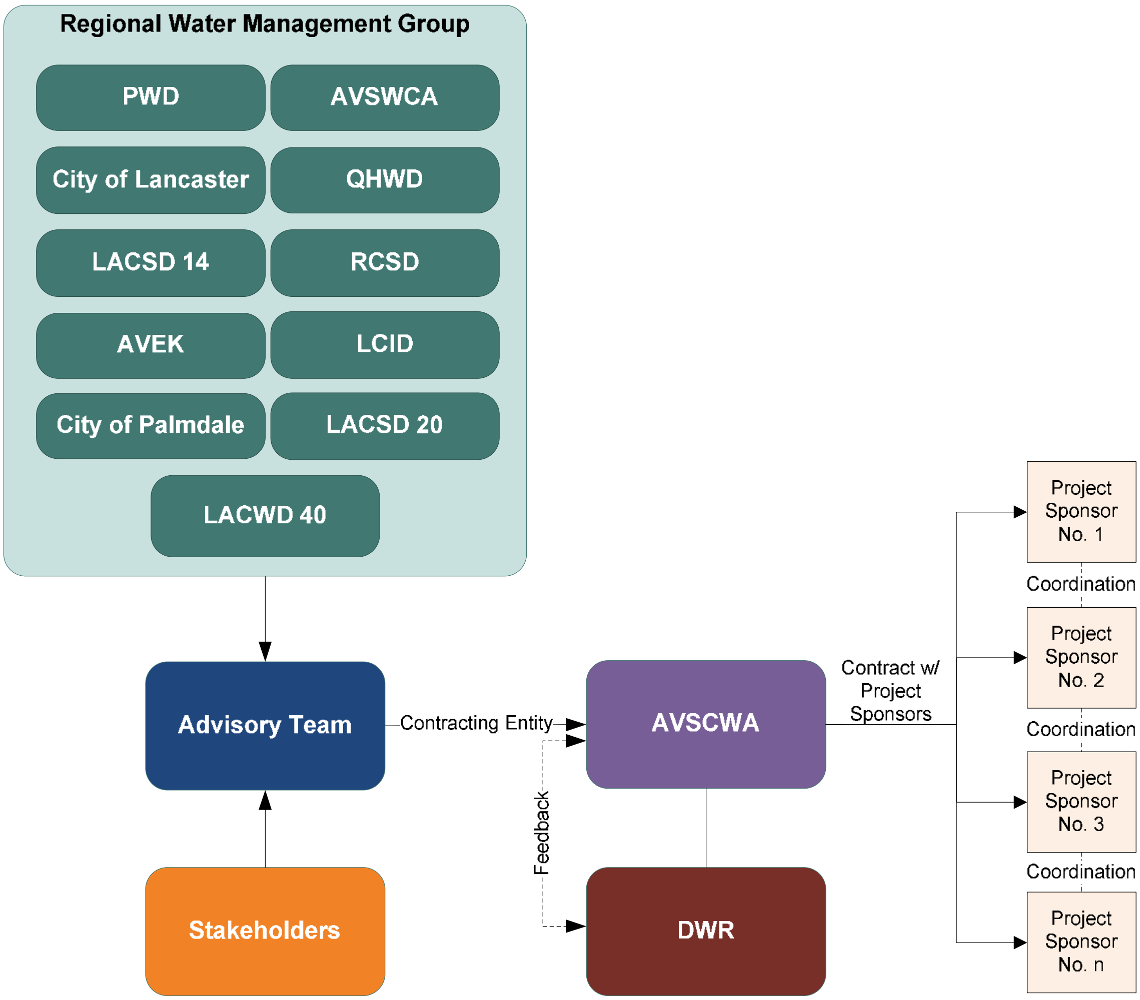
Governance structure means "decision-making" structure or management structure. As described in Section 1, the RWMG uses a governance structure established through an MOU that prescribed the roles and responsibilities for the RWMG. The MOU identifies how the RWMG will incorporate new members. When approved by all parties, new members may join the RWMG by adopting the IRWMP and executing the MOU. The MOU also states that, when appropriate, new members may pay a reasonable financial contribution as the existing RWMG members shall determine. Any action of the RWMG requiring funding from the members, including updates to the IRWMP, public noticing, and preparation of grant applications, will require a separate agreement approved by the governing boards of each respective member.

As shown in Figure 8-1, the RWMG is the governing body, and invites stakeholder involvement beyond the MOU signatories through regularly scheduled stakeholder meetings and participation in the Advisory Team and subcommittees. The RWMG has engaged a balance of interested persons or entities representing sectors or interests by conducting all business in consultation with the larger Stakeholder Group in meetings which are open to the public. The Stakeholder Group includes all participants within the IRWMP process including agencies that comprise the RWMG as well as an extensive mix of other cities and regulatory, environmental, industrial, agricultural, and land-use planning agencies that represent all areas of the Antelope Valley Region. Any interested person may participate in Stakeholder meetings and provide input. The Stakeholder Group meets at least once per quarter (i.e., 4 times per year) to review progress on IRWMP implementation and to consider updates to the IRWMP (such as newly proposed projects or management actions that address the Regional Plan objectives).

Table 8-1: IRWM Plan Relationship to Local Planning Documents

Planning Document	Jurisdiction	Relationship to IRWM Plan	Updates
General Plans	Land use and zoning	Include land use and zoning information, significant ecological areas and growth projections for Antelope Valley cities and counties.	As needed
Lahontan Regional Water Quality Control Board Basin Plan	Water quality	Includes water quality information on local surface waters such as 303(d) listings, beneficial uses, non-point source pollution, and total maximum daily loads.	As needed
Urban Water Management Plans	Water supply	Provides current and 25-year projected water supply and demand, drinking water supply/quality issues, population and facilities	Every 5 years
State Water Project Delivery Capability Report	Water supply	Contains information on projected reliability of imported water from the Delta.	Every 5 years
Antelope Valley Watermaster Annual Reports	Water supply	Includes information on ongoing monitoring per the Antelope Valley Groundwater Basin adjudication Judgment, including historical and current pumping patterns, conditions of overdraft, and total sustainable yield.	Every 5 years
Recycled Water Facilities Plans (Lancaster, Palmdale, Palmdale Water District, LA County Waterworks District 40)	Water supply	Includes information on current and projected available recycled water supply and plans for future recycled water system expansion.	As needed
2016 Resource Management Strategies Update and 2018 California Water Plan Update	Water resources planning	Includes statewide discussion of water resources in California, including resource management strategies, strategic planning, and regional discussions.	Every five years
Species Recovery Plans	Habitat	Contains information on the locations of habitats of local endangered species.	As needed
Water Reclamation Plant Facilities Plans	Wastewater planning	Includes information on current and projected available recycled water supply and plans for future water reclamation plant expansion.	As needed

Figure 8-1: Antelope Valley IRWM Governance Structure



The RWMG has agreed to evaluate the effectiveness of the Region's governance structure periodically, and to explore additional options for governance structures for integrated regional water management in the Antelope Valley if needed. The following discussion provides additional detail on how the Region's governance structure performs various activities.

8.2.1 Public Involvement Process

The Region encourages public involvement in both the IRWM Plan development process and implementation process. The regional planning and public involvement process, described in Section 1, provided useful, broadly accepted information that supported development of the IRWM Plan Update. The public is encouraged to participate in the implementation of the updated IRWM Plan. To ensure continued participation, the Region will continue to hold regular stakeholder meetings open to the public. These meetings will allow the Region to accept project proposals on an ongoing basis, to continue to reach out to DACs, and to provide technical assistance when needed. DACs will be continually represented in the Stakeholder group so that the AV IRWM Plan will address the diverse issues and needs of the Antelope Valley Region.

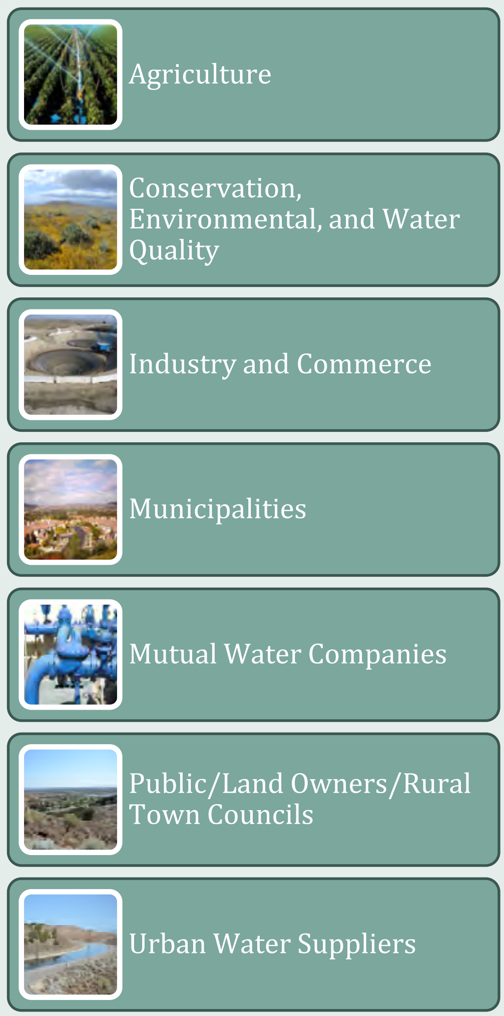
8.2.2 Effective Decision Making

The RWMG has operated since its inception using a systematic approach called "facilitated broad agreement." Whenever a decision needs to be made, the discussion between the RWMG members and the Stakeholder Group is facilitated until all members come to a consensus on an acceptable course of action.

8.2.3 Balanced Access and Opportunity for Participation

The Region's planning efforts involve a diverse group of people with differing expertise, perspectives and authority of various aspects of water management to ensure balanced access and opportunity for participation. The RWMG itself is composed of various entities that represent water suppliers, wastewater service providers, land-use managers, flood managers, parks and recreation service providers, and environmental services. The Region's stakeholders represent a diverse group of entities that actively participate in regular stakeholder meetings and other IRWM program related activities, as described in Section 1.2.2.

Figure 8-2: Advisory Team Interest Representation



Meeting materials for the Plan Update were developed by a consultant team in cooperation with RWMG members and other stakeholders, and made available for review and comment by the stakeholders. For the 2013 IRWM Plan Update, the Region formed various subcommittees that stakeholders participated in to provide further input, including the advisory team (A-Team), a public outreach subcommittee, a DAC subcommittee, a flood management subcommittee, an SNMP subcommittee, and a climate change subcommittee. While all subcommittees provided invaluable support during the 2013 IRWM Plan update, only the A-Team resumed for the 2019 IRWM Plan Update. These subcommittees are described below.

8.2.3.1 Advisory Team

The MOU created an A-Team to provide focused initiative and effort to implement the IRWM Plan. The A-Team is not a decision-making body but is responsible for tasks such as:

- Organizing stakeholder meetings
- Maintaining the AVIRWM Plan website
- Identifying grant opportunities for which the RWMG or its members may apply
- Developing a list of short-term implementation objectives for consideration and approval by the RWMG and stakeholders[1]

[1] This task was completed when the first IRWMP was developed in 2007.

- Maintaining a list of long-term implementation objectives for the RWMG to address and update at stakeholder meetings
- Recommending an annual scope and budget for the RWMG
- Distributing information to stakeholders

The A-Team includes seven members selected by the Stakeholder Group to serve a three year term, and represent the categories of water-related interests shown in Figure 8-2.

The current list of A-Team seats and active members is maintained on the www.avwaterplan.org website.

8.2.3.2 Public Outreach Subcommittee

The Public Outreach Subcommittee was formed in order to provide public outreach for the Region's IRWM Program. For the 2013 IRWM Plan update, this subcommittee was responsible for:

- Assisting with community events
- Assisting with outreach presentations
- Assisting with public notices
- Collaborating with DAC outreach

This subcommittee provided recommendations to the stakeholder group and RWMG for inclusion of the above items in the 2013 IRWM Plan Update and reporting on public outreach activities as needed at stakeholder meetings. There is no limit to the term of service for serving on this subcommittee. These responsibilities have largely been assumed by the A-Team for the 2019 IRWM Plan update.

8.2.3.3 DAC Subcommittee

The DAC Subcommittee was formed in order to encourage participation by DACs in the IRWM Program and to solicit feedback in DAC-related issues. For the 2013 IRWM Plan update, this subcommittee was responsible for:

- Helping coordinate DAC meetings
- Assisting with outreach discussions
- Reviewing technical memorandums related to DAC water supply and water quality needs
- Collaborating with the Public Outreach subcommittee

All stakeholders were invited to participate in this subcommittee through the duration of the 2013 IRWM Plan update process. This subcommittee provided recommendations to the stakeholder group and RWMG for inclusion of these items in the 2013 IRWM Plan Update and reporting on DAC outreach activities. These responsibilities were transferred to the A-Team for the 2019 IRWM Plan update.

8.2.3.4 Flood Subcommittee

The Flood Subcommittee was formed in 2013 to incorporate integrated flood management concepts into this Plan Update. This subcommittee was responsible for:

- Participating in flood/stormwater discussions related to existing flood plans, flood needs, project priorities, multiple-benefits, stormwater quality, NFIP, and FloodSAFE
- Reviewing technical memorandums related to existing flood plans, flood needs, project priorities, multiple-benefits, stormwater quality, NFIP, and FloodSAFE

All stakeholders were invited to participate in this subcommittee through the duration of the 2013 IRWM Plan update process. This subcommittee provided recommendations to the stakeholder group and RWMG for inclusion of these items in the 2013 IRWM Plan Update. This subcommittee was not reconvened for the 2019 IRWM Plan update as all flood related information is still accurate.

8.2.3.5 Climate Change Subcommittee

The Climate Change Subcommittee was formed in 2013 to incorporate climate change projections and impacts into this Plan Update. This group was responsible for:

- Reviewing and vetting projected effects and impacts of climate change
- Determining and prioritizing the Region's climate change vulnerabilities
- Assessing strategies for responding to climate change
- Developing climate change related objectives and targets

All stakeholders were invited to volunteer to participate in this subcommittee through the duration of the 2013 IRWM Plan update process. This subcommittee provided recommendations to the stakeholder group and RWMG for inclusion of these items in the 2013 IRWM Plan Update. This subcommittee was not reconvened for the 2019 IRWM Plan update as all information related to climate change remains accurate.

8.2.4 Communication

The Region's IRWM program fosters communication with various functional groups both within the Region and outside the Region. Communication among the Region's stakeholders (including RWMG representatives, governmental agencies, project proponents, general stakeholders, and neighboring RWMGs) regarding the IRWM program typically occurs through email notifications, announcements posted to the Region's website (www.avwaterplan.org), public presentations, stakeholder workshops, subcommittee workshops and A-Team meetings. In addition, several one-on–one meetings were conducted in support of this IRWM Plan update to encourage participation by DACs (see Section 1 for additional information regarding DAC outreach), develop projects, and evaluate regional needs and issues (e.g., groundwater adjudication).

8.2.5 Long-term Implementation of the IRWM Plan

The Antelope Valley IRWM Program is committed to ensuring long-term implementation of the IRWM Plan to ensure sustainability of the Region's water supply, water quality and natural resources. All interested stakeholders will continue to be invited to participate in IRWM program meetings and planning efforts. The Region's MOU reflects the commitment to ensure long-term implementation of the IRWM Plan given that the MOU signed by each RWMG member does not expire for 20 years after the date of execution (i.e., January 2027).

It is expected by the stakeholder group that each member of the RWMG will adopt the 2019 IRWM Plan Update in early 2020. Project proponents who plan to submit grant funding applications are also encouraged to adopt the 2019 IRWM Plan Update prior to the grant awards. Other members of the stakeholder group may also adopt the Plan.

8.2.6 Coordination with Neighboring IRWM Efforts, State Agencies, and Federal Agencies

The Region's governance structure allows for coordination with neighboring IRWM Regions, State Agencies, and Federal Agencies. Representatives from neighboring IRWM regions, state agencies, and federal agencies are included in the Region's email list to receive meeting notifications and updates on IRWM program activities. When necessary, the Region coordinates directly with neighboring IRWM efforts and state and federal agencies by electing an appropriate RWMG or A-Team member to represent the Region. In the past, the Antelope Valley Region has coordinated with the Mojave

IRWM, Kern IRWM, and Fremont Basin IRWM Regions on regional boundary overlaps and city and agency overlaps for the Region Acceptance Process. The Antelope Valley Region has also coordinated with the Mojave, Inyo-Mono, Tahoe-Sierra, and Fremont Basin Regions on potential fund-sharing ideas within DWR's Lahontan funding area.

Additionally, the Region coordinates with state and federal agencies on grant and planning efforts by electing appropriate representatives. For example, the RWMG selected the AVSWCA to interface with DWR for the Proposition 84 and Proposition 1 grant efforts. Grant administration includes the ability to receive and administer funds to the awarded sponsored projects, to prepare the necessary progress reports and invoicing reports, to make investigations, and to execute, and file such documents and agreements with DWR as required.

8.2.7 Changes and Updates to the IRWM Plan

The AV IRWM Plan is a dynamic planning document. Given that the Region will continue the IRWM Program into the future, it will be possible to perform interim and formal changes to the IRWM Plan in response to changing conditions, and/or update or amend the IRWM Plan as needed. Should a change in the Region's water resources occur, stakeholders will have the opportunity to provide feedback at stakeholder meetings where the A-Team will determine necessary action items.

The AV IRWM Plan at a minimum will be updated every five years[2] as further study and planning is conducted, projects continue to be developed and objectives and priorities are adjusted. There will be an ongoing process for keeping the proposed project list up-to-date through regular quarterly updates with additional meetings. Revisions to the project list will be made as needed before major grant applications, as conditions change, as funding is identified, as projects are implemented, and as objectives are revised. The process for revising the project list is detailed in Section 7.

8.2.8 Future Governance Structure

Though no changes were made to the existing governance structure since 2007, in the future, the Region may consider formation of a JPA to replace the MOU. A JPA is formed when it is to the advantage of two or more public entities (e.g., utility or transport districts) with common powers to consolidate their forces to acquire or construct a joint-use facility. Their bonding authority and taxing ability is the same as their powers as separate units. A JPA is distinct from the member authorities, as they have separate operating boards of directors, yet these boards can be given any of the powers inherent in all of the participating agencies. In setting up a JPA, the constituent authorities must establish which of their powers the new authority will be allowed to exercise. A term and the membership and standing orders of the board of the authority must also be laid down. The joint authority can employ staff and establish policies independently of the constituent authorities. A prominent JPA in the Antelope Valley Region is the AVSWCA, formed in May 1999 by the three local SWP contractors of the Antelope Valley.

8.3 Funding and Financing of the IRWM Plan

Funding and financing needs for implementation of the IRWM Plan falls into the three categories of IRWM program, projects, and planning, as shown in Figure 8-3. IRWM Program activities meet the most basic requirements necessary for the Region to exist and implement the Plan according to DWR standards. These activities include outreach/communication activities discussed in Section 1 and 8.2 (e.g., website maintenance, email list and notifications management, participation in the public outreach subcommittee), data management activities discussed in Section 8.4, governance activities

[2] The 2007 IRWMP originally said that updates would be completed every two years. This was adjusted to every five years in the 2013 IRWMP Update to coordinate with UWMP updates and SNMP updates.

discussed in Section 8.2 (e.g., A-Team and stakeholder meeting preparation and attendance, program administration), and regular plan updates every 5 years.

Figure 8-3: Antelope Valley IRWM Financing Needs

IRWM Program	Projects	Additional Planning
• Outreach/communication • Plan performance • Data management • Governance • Plan updates (every 5 years)	• Project review • Project prioritization • Grant application preparation • Grant management • Project implementation • Project O&M	• Regional planning needs • More frequent Plan updates

Activities related to the Region's projects include project review and prioritization (discussed in Section 7), grant application preparation and management (which the Region intends to continue), project implementation, and project operations and maintenance (O&M). Additional planning activities in the Region beyond IRWM and project activities allow the Region to further enhance regional planning and coordination activities. Since these additional planning activities are not required, the resources dedicated to them would be discretionary and only provided after the IRWM and project related activities are funded. Additional planning activities may include implementation of plans and studies in response to regional needs such as preparing a Region-wide watershed management plan or a groundwater master plan and more frequent Plan updates.

8.3.1 Funding/Financing Options

To meet the resource needs identified above, the Region will need to secure funding as both in-kind services and monetary resources. Potential funding sources and methods include:

- Sources
  - Ratepayers
  - Operating Funds
  - Water Enterprise Funds
  - Assessments/Fees/Taxes
  - Loans/Grants
  - Bonds
- Methods
  - In-Kind Time
  - Annual Dues
  - As-Needed Assessments
  - Grants/Loans

Given that local revenue sources will not be sufficient to fully fund all aspects of the IRWM Program's financing needs over the 20-year planning horizon, the Region intends to fund its activities using a combination of local, state and federal funds. The following is a program-level description of the sources of funding which will be utilized for the development and ongoing funding of the IRWM Plan; and it includes potential funding sources for projects that implement the IRWM Plan, including project O&M costs.

Local Financing

Local in-kind services provided by representatives of the Region's RWMG, A-Team and Stakeholder Group are the most important resource used by the Region. All of the Region's governance, outreach, communication, data management, plan review, plan performance and project development work is contributed as in-kind services. The capability of these entities to continue to dedicate staff resources for implementation of the IRWM Plan is critical to the Region's success.

In addition to in-kind services, members of the RWMG will continue to contribute funds to the Region as defined in the MOU, and provide local funds to finance projects included in the IRWM Plan. While existing funding mechanisms are in place for development of water supply and wastewater facilities and operation and maintenance of these facilities, the funds may not be sufficient to achieve the planning targets described in Section 4 of this IRWM Plan Update. It will be necessary for local agencies to implement additional local funding measures and/or pursue state and federal opportunities to fully fund implementation of the Plan.

O&M costs for specific implementation projects in this IRWM Plan will be funded by the project proponents/agencies from ratepayers, operating funds, water enterprise funds, assessments, fees, and taxes. The certainty of O&M funding is dependent on the particular project and project proponent. Additional detail on O&M costs may be found in Appendix K.

State Financing

The Region has pursued funding to implement projects in its IRWM Plan in the past, including grant opportunities through Propositions 50, 84 and 1E. The Region will continue to evaluate and apply for state funding opportunities such as the Proposition 1, Round 1 grant program for IRWM Plan project implementation and state revolving fund (SRF) loans. The Region will also participate in opportunities to provide leadership on statewide funding measures such as statewide discussions regarding the future of the IRWM Program and discussions on the language of future funding measures.

Federal Financing

Local agencies may seek federal funding opportunities to fund projects as they become available.

8.3.2 Funding/Financing Plan

Table 8-2 shows the Region's funding and financing plan to achieve the IRWM Program O&M and Project activities discussed above. Note that additional planning needs are not included here as they have not been determined at this time.

Table 8-2: IRWM Plan Financing Plan

Activity	Approximate Total Cost	Sources and % of Total Cost	Funding Certainty/Longevity	Assumptions
IRWM Program				
Outreach/ communication	48 hours/year $5,000/year	*In-kind* 100% RWMG agencies and/or A-Team members *Funds* 100% RWMG agencies	Contingent on on-going agency staff allocations MOU program fund sharing in place for 20 years from date of execution	• 4 hours/month for regular communication to stakeholder group = 48 hours/year • $5,000 per year to maintain program website
Plan performance	24 hours/year	*In-kind* 100% RWMG agencies and/or A-Team members	Contingent on on-going agency staff allocations MOU program fund sharing in place for 20 years from date of execution	• 24 hours/year (completed on annual basis by A-Team or subcommittee)
Data management	120 hours/year	*In-kind* 100% RWMG agencies and A-Team members	Contingent on on-going agency staff allocations MOU program fund sharing in place for 20 years from date of execution	• 10 hours/month = 120 hours/year
Governance	760 hours/year	*In-kind* 100% RWMG agencies and A-Team members	Contingent on on-going agency staff allocations MOU program fund sharing in place for 20 years from date of execution	• Stakeholder meeting attendance: 6 meetings/year * 4 hours * 25 attendees = 600 hours • Program administration: 8 hours/month = 96 hours/year • A-Team meeting attendance: 4 meetings/year * 2 hours * 8 attendees = 64 hours/year
Plan update: stakeholder review and consultant assistance	128 hours/update $500,000/ update	*In-kind* 100% RWMG agencies and A-Team members *Funds* 50% RWMG agencies 50% State grant funds	Contingent on on-going agency staff allocations MOU program fund sharing in place for 20 years from date of execution Contingent on success in obtaining future grant funds for IRWM planning	• Stakeholder review of plan update: 4 reviewers/section * 8 sections * 4 hours/section = 128 hours/update • Consultant assistance with plan update: $160,000/update

Activity	Approximate Total Cost	Sources and % of Total Cost	Funding Certainty/Longevity	Assumptions
Projects				
New projects: Initial review and prioritization, and stakeholder approval of new projects	12 hours/year	*In-kind* 100% RWMG agencies and A-Team members	Contingent on on-going agency staff allocations MOU program fund sharing in place for 20 years from date of execution	• Initial review and prioritization of new projects: 7 person* 2 hours/year = 14 hours/year • A-Team and stakeholder approval of new projects: 0 hours (approval will occur at regular stakeholder and A-Team meetings)
Grant application preparation	40 hours/project application $20,000/ project application	*In-kind* 90% Project proponents 10% Program manager *Funds* 100% project proponents or RWMG	Contingent on on-going agency staff allocations MOU program fund sharing in place for 20 years from date of execution	• Project proponents: 40 hours/project application • Consultant assistance: $20,000/project application
Grant management	620 hours/year	*In-kind* 25% Project proponents 75% Program manager	Contingent on continued success in grant programs.	Program manager: 40 hours/month = 480 hours/year Project proponent reporting: 12 hours/month = 144 hours/year
Project implementation	Between $70 million and $80 million capital costs Between $1 million/year and $2 million/year O&M costs	*In-kind* 100% Project proponents *Funds* 25% Project proponents 75% State grant assistance	Contingent on on-going agency staff allocations and agency funds. Contingent on continued success in grant programs.	Total capital and O&M costs for implementation projects that have provided cost estimates

8.4 Data Management

This section discusses the importance of collecting, managing, disseminating and utilizing data to create a sustainable integrated plan. A comprehensive data management approach will help to quickly identify data gaps, detect and avoid duplication, support regional data collection, and integrate with other regional and statewide programs.

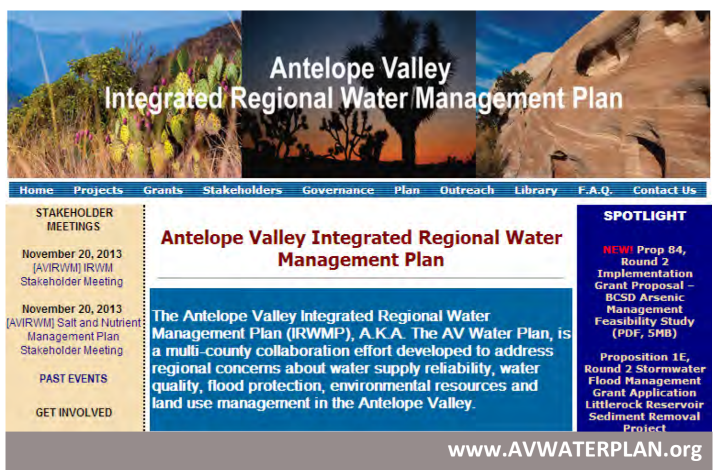
A wide variety of information is necessary to effectively manage water. The kinds of data needed include information regarding water quality, quantity, population demographics, climate and rainfall patterns, treatment plant effluent, habitat locations and needs, water costs, and more. Data is vitally important to agencies trying to maximize operating efficiency and design projects with limited budgets. The types of data available, current relevance and trends, and knowledgeable people that can interpret the data are all important. Equally important is the opportunity for Federal and State agencies to view local data for their own monitoring needs and to better understand local conditions.

The collection, management, dissemination and utilization of data (e.g., information gathered from studies, sampling events, or projects) are essential elements to creating a sustainable integrated plan. Information needs to be available to regional leaders, stakeholders, and the public to facilitate effective planning and decision-making.

As part of this IRWM Plan, the data management strategies described below will be applied to coordinate data collection between implementation projects, leverage existing data available from ongoing statewide and regional programs, provide timely data to stakeholders and the public, and consolidate information to be used in other state programs. These strategies are explained in more detail below.

8.4.1 Management and Data Reporting

Dissemination of data to stakeholders, agencies, and the general public is integrated into the AV IRWM Plan process to ensure overall success. A requirement of the Proposition 1 Guidelines is the routine reporting on project performance. The routine collection of this data naturally lends itself to the routine collection and reporting that is required as part of the AV IRWM Plan process. The AVSWCA, as the grant contracting entity, will compile the reporting of this IRWM Plan and work individually with the project proponents to receive updates on individual project progress. The AVSWCA will also ensure that all submitted monitoring data has undergone a robust quality assurance and quality control (QA/QC) process by requiring the agencies and organizations to provide a certification that states an appropriate level of QA/QC has been performed. A standardized reporting format will be created which the AVSWCA could use to compile this data, which will then be uploaded to the project website described in more detail below. Data collected or produced as part of the AV IRWM Plan will then be presented and disseminated during bi-monthly stakeholder meetings.



A public website has been created to store data and information about the AV IRWM Plan process so that the public can find information about public meeting dates, agendas, and notes. The website provides information on the AV IRWM Plan process and posts annual reports and relevant documents. Data collected during the AV IRWM Plan process is available on the website as well. The website also provides links to other existing monitoring programs to promote data sharing between these programs and the AV IRWM Plan. This provides a means to identify data gaps (e.g., information needed to provide a more complete assessment of the status of a specific issue or program) and to ensure that monitoring efforts are not duplicated between programs.

The AV IRWM Plan website, www.avwaterplan.org, provides a mechanism for stakeholders to upload project information regarding water supply, water quality, and other benefits of projects which will be collected in a database to manage, store, and disseminate information to the public. A data collection template will be available on the website in the future so that data collected during the AV

IRWM Plan can be stored and managed in a consistent format. This template will be compatible with those used in state databases, discussed further in subsection 8.4.4. The Region expects that project proponents will ensure the quality of their data prior to upload to the IRWM Plan website.

8.4.2 Regional Data Needs

This subsection identifies regional data needs including information required to evaluate the effectiveness of projects that produce non-traditional data.

As part of this IRWM Plan Update, data sets and reports were reviewed for their applicability to the Antelope Valley IRWM Region. This knowledge has provided the information necessary to identify data gaps which represent information crucial to a greater understanding of the Antelope Valley IRWM Region and help develop context for future projects (as discussed in Section 8.5 below). Data gaps identified through this IRWM Plan Update include:

- Water demands for users served by small, mutual water companies or private well owners
- Actual agricultural pumping
- Outdoor verses indoor water use
- Consumptive use losses in the basin
- Consolidated regional data on flooding issues, including flood hazard mapping
- Flood mitigation needs identification
- Groundwater recharge loss due to septic removal
- Subsurface flow
- Stormwater beneficial use identification
- Water available for recovery from surface water runoff, particularly from Amargosa Creek
- Baseline embedded energy use and GHG emissions emitted by water resources-related activities

It is recommended that additional monitoring and studies be conducted to fill in these data gaps.

In the future, the AV IRWM Region will also collect non-traditional data (i.e., summarizing the effectiveness of water conservation programs throughout the Antelope Valley Region) in a comprehensive way that can be a powerful contribution to statewide water management efforts. Comprehensive data collection and measurement of these efforts will provide leadership and guidance to growing metropolitan areas throughout California.

8.4.3 Existing Monitoring Efforts

This subsection will provide the existing surface and groundwater level and quality monitoring efforts in the Antelope Valley Region and will identify opportunities for additional monitoring and/or for partnership.

8.4.3.1 Surface Water

Surface water for the Region comes from the state aqueduct and Littlerock Reservoir. Water from the state aqueduct is monitored by both DWR and by local water purveyors receiving the water. Surface water from Littlerock Reservoir is monitored by PWD. Data on the quantity of surface water in the Region is available through UWMPs and DWR reporting. See Section 8.4.3.2 below for a discussion of drinking water quality monitoring.

8.4.3.2 Drinking Water

Drinking water quality is monitored through the following means:

- Safe Drinking Water Act (SDWA) compliance monitoring and reporting: All public water systems are required to produce water that complies with the SDWA. To this end, specific monitoring information is required and conducted routinely. Results of the monitoring are reported to the California DPH. In addition, monitoring information is required to be published in the annual Consumer Confidence Report (also required by the SDWA).
- Unregulated Contaminant Monitoring Rule Results: The 1996 SDWA Amendments mandate that EPA publish a list of unregulated contaminants that may pose a potential public health risk in drinking water. This list is called the Contaminant Candidate List (CCL). The initial 1998 accounting listed 60 contaminants. USEPA uses this list to prioritize research and data collection efforts for future rulemaking purposes. The 1996 SDWA amendments incorporated a tiered monitoring approach. The rule required all large public water systems and a nationally representative sample of small public water systems serving less than 10,000 people to monitor the contaminants. The information from the monitoring program for the Antelope Valley IRWM Region will be compiled and submitted to the State as well as be available on the website.

8.4.3.3 Groundwater

AVEK and the USGS have coordinated groundwater monitoring efforts in the Antelope Valley Region for several years. Groundwater monitoring is also required in areas on and surrounding the EAFB as well as regional landfills. The Region's SNMP includes a groundwater monitoring component for tracking of groundwater quality with a focus on water supply wells and areas proximate to large water projects. These data will be reported to the CDPH, and compiled through the State's GAMA program. The following is a summary of the ongoing monitoring programs for groundwater levels and groundwater quality in the Region:

- Geotracker-GAMA: The Geotracker- GAMA groundwater information system is California's comprehensive groundwater quality monitoring program that was created by the SWRCB in response to the Groundwater Quality Monitoring Act of 2001. The SWRCB was required to incorporate and display existing water quality data through a publicly accessible interactive online map from various monitoring programs throughout the State. Geotracker-GAMA is based on interagency collaboration with the SWRCB, Regional Water Boards, DWR, Department of Pesticide Regulations, USGS, and Lawrence Livermore National Laboratory. It also relies on cooperation from local water agencies and well owners. Data reporting frequencies under Geotracker-GAMA range from every three years, to annual, to quarterly, depending on the well and constituent. Groundwater quality is typically monitored by public agencies at their wells in addition to the data reported on the Geotracker-GAMA online website.

- USGS: In addition to the Geotracker-GAMA website, USGS maintains water quality data for groundwater basins in the National Water Quality Information System. USGS reports concentration values every three years. USGS also monitors water levels in approximately 185 wells within and adjacent to the Antelope Valley Adjudication Area. The USGS monitoring program was developed, in part, to comply with the California Statewide Groundwater Elevation Monitoring (CASGEM) program for the groundwater basin. The CASGEM program was developed by DWR to track seasonal and long-term trends in groundwater elevations in

California's groundwater basins and establish collaboration between local monitoring parties and DWR. The number of wells in this regional monitoring program varies from year to year based, in part, on access and well status/operation. Water level monitoring occurs in all wells in March, and in a smaller subset of wells monitored in October.

- Antelope Valley Watermaster: Under the adjudication Judgment, the Watermaster Engineer has the responsibility of preparing annual reports for the Court. The reports present relevant data from the monitoring of Safe Yield components in the basin and provide preliminary analyses on current groundwater levels and change in groundwater storage annually. The reports also provide details on water accounting for Parties to the Judgment, including production, imported water use and return flows, transfers, stored water, and other relevant practices that may impact groundwater levels.

8.4.4 Integration of Data into Existing State Programs

Data collected as part of this IRWM Plan can be used to support existing state programs such as:

- California Environmental Data Exchange Network (CEDEN)
- Water Data Library (WDL)
- California Statewide Groundwater Elevation Monitoring Program (CASGEM)
- Surface Water Ambient Monitoring Program (SWAMP)
- GAMA
- California Environmental Information Catalog (CEIC)
- Integrated Water Resources Information System
- California Environmental Resources Evaluation System (CERES)
- California FloodSAFE

To facilitate the integration of the Region's data with state databases, the Region's data collection templates discussed under subsection 8.4.1 will be compatible with state databases. The Region assumes that project proponents will ensure the quality of their data and that project proponents will upload their data to the appropriate state databases.

8.5 Technical Information

This subsection describes the technical information used in the development of the 2019 IRWM Plan Update which relied on an extensive list of plans, studies, and other documents and information sources. In addition, several technical memoranda were prepared for the 2013 IRWM Plan Update to further study the Region's DAC and flood management related needs and develop an SNMP. These memoranda are included as Appendix D, F, and G, respectively. Table 8-3 provides a summary of the documents and data sources used, the method of analysis, the results derived, and how they were used in the 2019 Plan Update.

Table 8-3: Technical Information

Technical Information	Analysis Method	Results/Derived Information	Use in IRWM Plan	Reference or Source
Population Projections	Extracted 2017 populations using 2010 census block group data and 2013-2017 American Community Survey data Extracted projected population information using 2019 Department of Finance data for Kern and Los Angeles Counties Extracted projected population information using Southern California Association of Government data for Palmdale and Lancaster	2015 population estimates Projected population increases between 2015 and 2040	Used to describe regional characteristics, estimate future demand	US Census Bureau, 2010. 2010 US Census statistics. US Census Bureau, 2019. 2013-2017 5-Year American Community Survey. Southern California Association of Governments, 2012. Adopted 2012 RTP Growth Forecast, by City.
DAC identification	Extracted income information by census block group and place	Median household income	Used to identify DACs within the Region	US Census Bureau, 2019. 2013-2017 American Community Survey 5-year Estimates. RMC, 2013. Task 2.1.2 DAC Water Supply, Quality, and Flooding Data. Antelope Valley IRWMP 2007 Update.

Technical Information	Analysis Method	Results/Derived Information	Use in IRWM Plan	Reference or Source
Water Supply Projections	Reviewed 2015 Urban Water Management Plans	Water supply by source projected between 2015 and 2035 or 2040 by water district	Used to project water supply availability for the Region, and identify water supply needs and issues	AVEK, 2016. 2015 Urban Water Management Plan. California Water Service, 2016. 2015 Urban Water Management Plan. LACWD 40, 2017. 2015 Urban Water Management Plan. PWD, 2016. 2015 Urban Water Management Plan. QHWD, 2016. 2015 Urban Water Management Plan. RCSD, 2017. 2015 Urban Water Management Plan.
Urban Water Demand Projections	Review of 2015 urban water management plans Extrapolated using Department of Finance population growth rates for Kern and Los Angeles County	Projected total demand and per capita demand	Used with population projections to project demand for the Region	AVEK, 2016. 2015 Urban Water Management Plan. California Water Service, 2016. 2015 Urban Water Management Plan. LACWD 40, 2017. 2015Urban Water Management Plan. PWD, 2016. 2015 Urban Water Management Plan. QHWD, 2016. 2015 Urban Water Management Plan. RCSD, 2017. 2015 Urban Water Management Plan. DOF, 2019. County Population Projections (2010-2060).

Technical Information	Analysis Method	Results/Derived Information	Use in IRWM Plan	Reference or Source
Agricultural Water Demand Projections	Review of existing records of agricultural land use Estimation of crop evapotranspiration using Palmdale area ETo station Calculation of crop water requirements using ETo, crop types, crop area, historical rainfall	Estimated crop water requirements for the Antelope Valley	Used to describe current water demands, and estimate future supply needs	Hansen, B.R., et al. 2004. "Scheduling Irrigation: When and How much Water to Apply," Water Management Series Publication Number 3396, Department of Land, Air & Water Resources, University of California, Davis Pruitt, W.O., et al. "Reference Evapotranspiration (ETo) for California," UC Bull. 1922. CIMIS, 2012. Evapotranspiration Estimates. Palmdale Station 197 from Jan. 2008 to Dec. 2018. Kern County Agricultural Commissioner, 2019. Crop acreage reports for Kern County Portion of the Antelope Valley for 2016. Los Angeles County Agricultural Commissioner, 2019. Crop acreage reports for Kern County Portion of the Antelope Valley for 2016.
Total Sustainable Yield	Review of Antelope Valley groundwater basin adjudication documents Discussion with stakeholders	Estimated range of the total sustainable yield of the Antelope Valley Groundwater Basin	Used to estimate groundwater supply availability	Appendix I documents
Groundwater Quality	Extraction of groundwater quality data by well for select constituents	Wells that exceed drinking water limits for select constituents within the Antelope Valley	Used to describe current groundwater quality, and determine drinking water quality issues and needs	SWRCB, 2017. GeoTracker GAMA. Groundwater Ambient Monitoring & Assessment Program. LACWD 40, 2014. Salt and Nutrient Management Plan for the Antelope Valley.
Regional Flood Needs	Review of existing records of localized flooding Review of FEMA flood zones	Locations of localized flooding Locations of 100 year flood zone	Used to determine flood infrastructure or management needs	RMC, 2013. Task 2.3.2 Flood Protection Needs. Antelope Valley IRWMP 2007 Update.

Technical Information	Analysis Method	Results/Derived Information	Use in IRWM Plan	Reference or Source
DAC water resources needs	Review of existing records supply availability, groundwater quality, and flooding records for DAC areas in Antelope Valley	Identified water supply, water quality and flood related needs in the DAC areas of Antelope Valley	Used to determine DAC related issues and needs.	RMC, 2013. Task 2.1.2 DAC Water Supply, Quality, and Flooding Data. Antelope Valley IRWMP 2007 Update.
SWP reliability	Review of DWR's State Water Project Final Delivery Capability Report	Projected state water project deliveries under various hydrologic scenarios	Used to project imported water supplies under average year, singly dry year, multiple dry year scenarios.	DWR, 2018. The State Water Project Final Delivery Capability Report 2017.

8.6 IRWM Plan Performance

This subsection develops measures that will be used to evaluate Plan and project performance, monitoring systems that will be used to gather performance data, and mechanisms to adapt strategy implementation and operations based on performance data collected.

8.6.1 Performance Measures

Generally, the success of the AV IRWM Plan will depend on how well the individual plan objectives are accomplished. Achievement of all of these objectives will, in large part, determine the success of local integrated regional water management planning processes. Additionally, the success may be attributed to the AV IRWM Plan when individual projects meet their goals and objectives and help to cumulatively and positively address Regional plan objectives.

This IRWM Plan is a dynamic document, part of an ongoing local effort to achieve integration of local water management. The process, through stakeholder participation and plan revisions, will continue for many years and will be an effective mechanism for addressing the water management issues facing the Antelope Valley Region. On an ongoing basis, plan objectives and statewide priorities will be reviewed for relevance and modified as needed to ensure the overall IRWM Plan reflects changing needs and continues to be effective. Additionally, the projects identified for future implementation will be reviewed and evaluated periodically to ensure that current plan objectives will be met and that the proposed projects offer the greatest benefit possible. Periodically, a new set of projects will be developed to address plan objectives and State and regional priorities.

Performance measures for each of the planning targets discussed in Section 4 are addressed below. These measures are based on the AV IRWM Plan objectives and were developed to allow progress of the overall IRWM Plan to be measured. This section describes the monitoring methods and programs that will be used to collect data and the mechanisms by which this data will drive future improvements to projects and the AV IRWM Plan.

It is recognized that more detail is needed for a number of these performance measures in order for them to sufficiently be measured and implemented. Therefore, the Stakeholder group agrees to continue to refine these performance measures. The A-Team, in conjunction with a potential committee made up of stakeholder group members, will be taking primary responsibility for organizing the tracking and evaluation of IRWM Plan performance, though tracking of individual output indicators may be completed by different entities.

Water Supply Management Targets

Maintain adequate supply and demand in average years. Implementation of a project with a quantifiable benefit, either supply enhancement, or demand reduction with a known timeline for implementation or realization of the benefit will allow for measurement of this planning target. For example, on the demand management side, the performance of this planning target could be measured through the number of water conservation devices installed. Each agency participating in a water conservation program would maintain records of water conservation devices provided to customers for installation, such as ultra-low flush toilets (ULFT), high-efficiency clothes washers (HECW), rotary sprinkler nozzles (RSN), and weather-based irrigation controllers (WBIC). The number of water conservation devices provided on an annual basis would be recorded and the estimated water savings per unit determined through use of existing documentation and accepted methodologies, such as CUWCC worksheets, and would be submitted on a monthly or quarterly basis for inclusion in a central data management program as described in Section 8.4. The volume of recycled water produced will be monitored by the treatment plants and Wastewater Operations Reports maintained by the governing agency. Recycled water served to customers will be measured and reported in water purveyor annual reports and in UWMPs every five years. This target will also be met by additional potable water produced and stored. Potable water served to customers will also be measured and reported in these ways. Annual precipitation data for groundwater and surface water conditions, total volumes of recycled water produced, potable water produced, and potable or recycled water stored will be recorded on a monthly or quarterly basis by the individual agencies managing the projects and included in the central data management program, as described in Section 8.4.

Provide adequate reserves (77,200 AFY) to supplement average condition supply to meet demands during single-dry year conditions, starting 2009. The performance of this planning target can be measured through monitoring the amount of water in reserve each year along with the volumes of groundwater banked and withdrawn quarterly. The cumulative total amount of water banked may also be recorded quarterly. As water is put into storage, the total mismatch and reduction in demand for meeting this single-dry year target volume would be recorded and included in the central data management program.

Provide adequate reserves (198,800 AF/4-year period) to supplement average condition supply to meet demands during multi-dry year conditions, starting 2009. The performance of this planning target would similarly be measured through monitoring the amount of water in reserve each year and by recording the volumes of groundwater banked and withdrawn quarterly, with the cumulative total amount of water banked also recorded quarterly. As water is put into storage, the total mismatch and reduction in demand for meeting multi-dry year conditions would be recorded and included in the central data management program.

Adapt to additional 7-10% reduction in imported deliveries by 2050, and additional 21-25% reduction in imported water deliveries by 2100. The performance of this planning target would be monitoring in the same way as the target above to reduce mismatch of expected supply and demand in dry and multi-dry years by providing new water supply and reducing demand, starting 2009.

Demonstrate ability to meet regional water demands over an average year without receiving SWP water for 6 months over the summer, by 2025. The ability to provide a diversity of water supply sources to meet peak demands over the summer without receiving SWP water can be measured by first refining the estimate of how much imported water is used during that time period and then comparing that number to how much water is available as an emergency supply or demand-reduction source. The total volume of water required during the 6-month peak summer period would be measured through monitoring SWP deliveries from AVEK, LCID, and PWD under current average conditions. Once the demand is determined, the current reserve supply can be quantified by measuring the total water supply available as emergency supply sources, such as banked water reserves, emergency transfer contracts, short-term paid non-use contracts, the maximum demand reduction that can be achieved through an aggressive water conservation program, and the overall storage capacity of recharge and extraction facilities. Annual total volumes would be recorded and included in a central data management program and the demand may be compared against the supply reserves to show whether there is sufficient supply (or potential to reduce demand) to accommodate the loss of SWP supply.

Manage groundwater levels throughout the basin such that Production Rights defined in the adjudication Judgment are met by 2023. Per the Antelope Valley adjudication Judgment, the Watermaster is responsible for monitoring groundwater levels in the Basin. The Production Rights defined in the adjudication Judgment aim to stabilize long-term groundwater levels in the region by showing groundwater recharge and extractions are within the Native Safe Yield of the Basin. Progress can be measured through monitoring groundwater extractions, recharge. and return flows as reported in the Antelope Valley Watermaster Annual Reports. Groundwater levels should be monitored, at a minimum, on a quarterly basis to account for seasonal variations. In order to sufficiently measure the performance of this planning target. Watermaster Annual Reports have incorporate a number of details about measuring, including: the number of groundwater monitoring wells, which wells to be monitored, which subbasins to be monitored, who will collect the data, and how it will be coordinated.

Water Quality Management Targets

Continue to meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period. To measure the performance of this planning target, water quality will be tested in accordance with EPA and Consumer Confidence Reporting (CCR) Protocols and the data compared to adopted water quality standards such as California Drinking Water Standards established by the CDPH. If the measurements indicate that compliance is not being achieved, additional water quality monitoring of taste and odor causing compounds, such as geosmin (a compound found in soils that is responsible for the earthy, musty odor and taste in water) and algae could be undertaken. To monitor overall customer satisfaction and perceived taste and aesthetics, consumer input would be solicited at community fairs and in semi-annual mail-in surveys. The data acquired through these monitoring efforts will be recorded by the local water districts and agencies responsible for providing drinking water and included in the central data management program.

Prevent unacceptable degradation of aquifer according to the Basin Plan throughout the planning period. To preserve the acceptable quality of groundwater, with close attention paid to potential contaminants such as arsenic, nitrate, salinity and other problem pollutants, monitoring of groundwater quality would be undertaken, using GAMA Program methodology, as appropriate. The quality of groundwater in recharge zones will also be monitored to ensure that the non-impacting activities that help meet Basin Plan requirements are sited appropriately. These monitoring efforts would align with SNMP monitoring efforts. The difference between the baseline groundwater quality measured and the Basin Plan goals will be an indicator of plan performance. In order to sufficiently measure the performance of this planning target, a number of details about measuring need to be identified including, but not limited to: identification of sampling sites, establishing groundwater monitoring wells, the number of wells to be monitored, the frequency of monitoring, who will collect the data, and how it will be handled. The data acquired through the groundwater monitoring, as well as monitoring of areas where impacting activities are located near recharge zones, will be included in the central data management program.

Map contaminated and degraded sites and monitor contaminant movement, by 2017. This planning target aligns with existing SNMP monitoring efforts in the Region. The 2014 SNMP already mapped the concentrations for select constituents. Additional monitoring, evaluation and mapping efforts may be necessary to better understand the Region's groundwater issues. Advancing this planning target beyond 2017 requires updating maps and continuing monitoring of contaminated sites. To measure program performance, general groundwater quality monitoring of the Region would be conducted to continue identifying locations of contaminated sites and to support the establishment of a monitoring program in the problem area to document the change in contaminant plume over time and rate of migration. Sites can be identified by reviewing historical land use to search for potential high risk uses including industrial, agricultural or military, as well as through databases listing known pollutant leaks, spills or contamination issues. Additional details needed for measuring performance include determination of water quality constituents of concern, the number of groundwater monitoring wells needed per site, the frequency of monitoring, who will map and collect the data, and how it will be recorded in the central data management program.

Identify contaminated portions of aquifer and prevent migration of contaminants, by 2017. This planning target aligns with existing SNMP monitoring efforts in the Region. The 2014 SNMP for the Antelope Valley has already identified and analyzed various constituents found in the Region's aquifer. To prevent migration of existing contaminants to currently uncontaminated portions of the aquifer, groundwater quality monitoring will be used to collect data to determine the potential sources of contaminants and the drivers influencing migration, such as seasonal variation. The data would be input into a database for continual monitoring and modeling, if required, to help evaluate management alternatives to prevent further migration. To measure the performance of this planning target, a number of details to be further defined include the identification of a groundwater modeling expert, determination of the number of groundwater monitoring wells needed, and identification of who will collect and incorporate the data into the central data management program.

Prevent unacceptable degradation of natural streams and recharge areas according to the Basin Plan throughout the planning period. This planning target is being completed through ongoing SNMP monitoring efforts. To preserve the ecosystem health of current stream systems and groundwater recharge areas, the sources of flow that could carry contaminants would be measured through surface water monitoring efforts. Potential contamination sources and mechanisms and areas that need protection and additional monitoring would be identified using standard methods and procedures for water quality testing, such as GAMA Program methodologies, as appropriate. Additional information to be developed in support of this planning target include establishing groundwater monitoring wells, determining the number of wells to be monitored and how frequently, as well as identifying who would collect and disseminate the data for the central data management program.

Increase infrastructure and establish policies to use 33 percent of recycled water to help meet expected demand by 2015, 66 percent by 2025, and 100 percent by 2035. To increase the use of recycled water, and thereby reduce the demand on imported water or groundwater resources, the annual volume of recycled water produced and the annual volume of recycled water banked or delivered would be measured using flow meters. The recycled water infrastructure is already planned for expansion, as shown by the Los Angeles/Kern County Regional Recycled Water Project and the LACSD's tertiary treatment facility upgrades. Additional urban and agricultural recycled water users should also be identified through ongoing planning efforts. The data acquired through these monitoring efforts would then be included in the central data management program.

Flood Management Targets

Coordinate a regional Storm Water Resource Plan and policy mechanism by the year 2025 and incorporate adaptive management strategies for climate change. Development of a Storm Water Resources Plan and policy mechanism would require identification of data gaps related to flood management; preparation of detailed flood use maps for the Region; identification of policies to protect aquifers, natural streams and recharge areas from contamination in the area; and identification of flood management opportunities. The progress of this planning target would be measured by monitoring the progress of development of the plan on a section by section basis. The signing of an MOU (or other suitable governance structure) and the commitment of funds for the regional flood management plan would also be indicators of program performance. Progress would be included in the central data management program to ensure close coordination of efforts.

Environmental Resource Management Targets

Contribute to the preservation of an additional 2,000 acres of open space and natural habitat to integrate and maximize surface water and groundwater management by 2025. This planning target will be measured by recording the existing acres of open space and natural habitat and comparing those totals to the newly developed acres of open space and natural habitats created, restored or enhanced annually. The change between baseline acreage and new, measured open space and natural habitat created or preserved through community-based projects would be reported and included in the central data management program. A stakeholder process would further help to identify projects, create awareness for, or provide financial contributions towards the development of open space, and this information could be compiled and mapped for future project concepts or integration with other IRWM Plan projects.

Land Use Planning/Management Targets

Preserve 100,000 acres of farmland in rotation through 2040. To measure the economic health of the Agricultural community in the Region, and the land remaining in agricultural use, the existing acreage of agricultural land in rotation will be compared to the future, measured agricultural land in rotation. Landowners working would work with local water agencies in coordinated water banking rotation projects, and the resulting number of acres of farmland and the number of water resource projects that integrate agricultural land with irrigation practices would be indicators of progress. This data would be included in the central data management program.

Contribute to local and regional General Planning documents to provide 5,000 acres of recreational space by 2040. Providing low impact recreational opportunities for residents and visitors into the future will require the measurement of existing acreage of recreational space to compare against future acreage. A stakeholder process would contribute to the identification of community-based projects that could be developed to increase recreational space, and coordination with General Plan updates and policy directives would further build consensus. The annual acreages would then be included in the central data management program.

Coordinate a regional land use management plan by the year 2025 and incorporate adaptive management for climate change. Development of a Regional Land Use Management Plan would require identification of data gaps, preparation of detailed land use maps for the Region, identification of policies to protect and enhance land uses in the area, and identification of land use management opportunities. The progress of this planning target would be measured by monitoring the progress of development of the plan on a section by section basis. The signing of an MOU (or other suitable governance structure) and the commitment of funds for the regional plan would also be indicators of performance. Quarterly progress reports on the development of the plan would be included in the central data management program to ensure close coordination of efforts.

Climate Change Mitigation Target

Implement “no regret” mitigation strategies, when possible, that decrease GHG’s or are GHG neutral. To measure GHG reductions in the Region, the existing GHG emissions created through water resources management will be compared to the future GHG emissions created. Water purveyors would estimate the GHG emissions reductions created through the implementation of mitigation strategies, or the reduction of embedded energy used to imported water and associated GHG emissions. This data would be included in the central data management program. GHG emission reductions will also be monitored by tracking of the number of projects that help mitigate climate change and meet key elements of the Scoping Plan.

Table 8-4 summarizes project monitoring and program performance measures.

Table 8-4: Project Monitoring and Program Performance Measures

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	Measurement Tools and Methods *What needs to be measured:*	*How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
Maintain adequate supply and demand in average years.							
Supply and demand balance in average years (no mismatch) over the planning horizon	Update estimated supply and demand each year (for that year and future years) using similar approach to that used in the IRWM Plan including any updated information such as new population estimates, per capita use, etc.	Create an "accounting table" that starts with the estimated mismatch from the IRWM Plan and report expected changes to the mismatch that would result from management actions (e.g., a groundwater banking project, a low flow toilet rebate program, etc.). This would allow quarterly reporting of expected adjustments to the mismatch based on project actions being implemented. In addition to accounting for the expected changes to the mismatch, require projects that are estimating increases in supply, or reductions in demand to track tangible metrics that demonstrate the progress they are making over time.	Precipitation measurement to determine if it is an average, single dry or multiple dry year ETo from CIMIS weather stations in Palmdale and Victorville.	Rain gauges in mountains and stream/run-off gauges for groundwater conditions and recharge estimates (still need to determine how many, where to place these, who will operate, and how to report the data.) Littlerock precipitation data for surface water conditions Northern California conditions for imported water conditions	Daily/Annually	Western Regional Climate Center, EAFB	Measurement to be reported: Total reduction in mismatch Reporting: Report quarterly with updates to regional board and compare against objectives
			Imported water delivered to AVEK, PWD, LCID, how much they deliver, and how much water is banked	Annual Water Production Reports	Monthly/ Quarterly	AVSWCA	
			Inflows to and deliveries from Littlerock Reservoir (including water levels in reservoir, delivered water, spill over, and amount evaporated)	PWD	Monthly/ Quarterly	PWD	
			Amount of recycled water produced, delivered (by water use category), and banked (including quantity, timing, and location)	Wastewater Operations Reports flow meters at reuse sites	Monthly/ Quarterly	LACSD	
			Population Projections	Census statistics SCAG population projections Department of Finance projected growth rates	Annually	Counties and cities	
			M&I Demand	Recalculate the regional average per capita demand. Then use this number and the projected population estimates to calculate total demand.	Annually	Water purveyors	
			Agricultural Demand	Obtain annual agricultural acreage by crop type from LA and Kern County Agricultural Commissioners and calculate demand using the crop use requirements in the Plan. Update crop estimates with release of new data (Use actual demand measurements when available.)	Annually	Los Angeles County Farm Bureau, Kern County Farm Bureau	

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	*What needs to be measured:*	Measurement Tools and Methods *How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
			Proposed/Actual amount of new water supply	All Projects: Estimated in 5-year intervals from project information • Amount of water produced from project (operation records) • Amount delivered from project (billing records) • For projects with banking/ recharge element: monitored daily, reported monthly • Overall Project injection, storage, and pumpback capacity • Actual amount injected • Actual amount pumped from bank • Total amount in storage • Percent remaining in storage to improve groundwater levels For Water Deals/Transfers: • Amount agreed/allotted (water right) • Actual amount transferred.	Monthly/ Quarterly	Project Proponents	
			Planned and actual reduction in demand	Proposed/Actual number of units installed/lines replaced/ rebates planned (est. water savings per unit from existing documentation such as CUWCC worksheets and methods for estimating water savings for various BMPs) Also need to consider impacts of demand reduction on wastewater inflows and recycled water availability. Should try to reduce outdoor use as much as possible.	Monthly/ Quarterly	Project Proponents	
Provide adequate reserves (77,200 AFY) to supplement average condition supply to meet demands during single-dry year conditions, starting 2009.							
Establish a mechanism to dedicate supply in groundwater for dry year use. Start banking water in average year conditions to meet the expected quantity by 2009 and beyond.	Amount of water in reserve each year.	Amount of water banked and withdrawn quarterly and a cumulative total in bank quarterly.	Amount of water banked	Water put in storage for purpose of reserve	Quarterly	Water bank operators	Measurement to be reported: Total mismatch and reduction in demand Reporting: Report every five years minimum

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	*What needs to be measured:*	Measurement Tools and Methods *How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
Provide adequate reserves (198,800 AF/4-year period) to supplement average condition supply to meet demands during multi-dry year conditions, starting 2009.							
Establish a mechanism to dedicate supply in groundwater for dry year use. Start banking water in average year conditions to meet the expected quantity by 2009 and beyond.	Amount of water in reserve each year.	Amount of water banked and withdrawn quarterly and a cumulative total in bank quarterly.	Amount of water banked	Water put in storage for purpose of reserve	Quarterly	Water bank operators	Measurement to be reported: Total mismatch and reduction in demand Reporting: Report every five years with update of the Plan and compare against objectives
Adapt to additional 7-10% reduction in imported deliveries by 2050, and additional 21-25% reduction in imported water deliveries by 2100.							
Increased local supply development.	Amount of local water supply development each year.	Amount of groundwater, local surface water and recycled water used each year.	Local water supply accessibility.	Use deliveries of groundwater, local surface water, and recycled water from annual reports. Estimation of local supplies made accessible by implemented projects.	Annually	AVSWCA in conjunction with water purveyors	Measurement to be reported: Total increase in local water supply delivery and development. Reporting: Report every five years with update of the Plan and compare against objectives.
Demonstrate ability to meet regional water demands without receiving SWP water for 6 months over the summer by 2025.							
Provide a diversity of water supply sources to meet peak demands over the summer	Estimated SWP demand during 6-month summer period Estimate of maximum savings from emergency conservation program Estimate of recycled water demand Estimate of banked water amount	Percent change in SWP water deliveries over the 6-month period Percent change in groundwater extractions from using banked water Quantification of additional water transported to Region (i.e. banked water from outside region, transfers from south of Delta Water Supplies during emergency conditions from trade agreements) Quantification of reduction in demand from emergency conservation measures	Amount of SWP received in a 6-month summer period (updated from estimate provided in Section 4.2)	Use deliveries from AVEK, LCID, and PWD during 6-month summer periods.	Annually	AVEK, LCID, PWD	Measurement to be reported: The difference between how much water is needed, compared to how much water is available during the 6-month summer period. Reporting: Report every five years with update of the Plan and compare against objectives Need to show have sufficient reserves (or potential to reduce demand) to meet the loss of SWP supply.
			Total water supply available over 6-month summer period without above	Account for available emergency supply sources, such as banked water reserves, emergency transfer contracts, short-term paid non-use contracts, etc.	Annually	Water bank operators	
			Maximum reduction in demand that can be reasonable achieved	Using Contingency/Water Conservation Plans and Emergency Response Plan assuming highest level of water shortage Compare economic tradeoffs of aggressive short-term rationing to the cost of securing other supplies	Annually	Local water purveyors	
			Overall storage capacity within existing or proposed recharge and extraction facilities.	Master Plans/Infrastructure Reports	Annually	Water bank operators, agencies implementing local groundwater recharge	

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	*What needs to be measured:*	Measurement Tools and Methods *How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
Manage groundwater levels throughout the basin such that Production Rights defined in the Judgment are met by 2023.							
Stabilize long-term groundwater levels in region, meaning groundwater recharge and extractions are in balance.	Observed groundwater levels in a monitoring network that provides representative view of entire groundwater basin Coordination with the Lahontan RWQCB for continued compliance with new or changes to existing discharge permits, regulations, etc.	Annual change in groundwater level (+ / -) from previous year averaged over past 10 years	Groundwater levels	Well monitoring (CASGEM Monitoring Plan)	Annual	Antelope Valley Watermaster Engineer	Measurement to be reported: Observed groundwater level improvements; calculate 10-year average Reporting: Antelope Valley Watermaster Annual Report
Continue to meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period.							
Meet Federal and State water quality standards and achieve high levels of customer satisfaction	Monitoring to ensure compliance Coordination with Regional Boards for continued compliance with new or changes to existing discharge permits, regulations, etc.	Compliance with Consumer Confidence Reporting (CCR) and EPA's unregulated contaminant monitoring rule reporting Customer Satisfaction	Standard lab methods for water quality testing, EPA Protocols, CCR Reporting Protocols	See EPA and CCR Protocols	See EPA and CCR Protocols	See EPA and CCR Protocols	Measurement to be reported: Comparison of measured water quality data to water quality standards. For taste & aesthetics, overall consumer satisfaction with water quality. Reporting: Taste & aesthetics collect annual data, report with updates, could also add to CCR Reporting.
			Taste & aesthetic	Solicit consumer input at a community fair	Monthly/Annually	Local water districts	
			Overall customer satisfaction	Include a bi-annual mail-in survey in the monthly water bill	Semi-annually	Local water districts	
Prevent unacceptable degradation of aquifer according to the Basin Plan throughout the planning period.							
Preserve acceptable quality of groundwater paying special attention to potential contaminants such as arsenic, nitrate, salinity and other problem pollutants	Monitoring of groundwater quality Coordination with Regional Boards for continued compliance with new or changes to existing discharge permits, regulations, etc. Monitor areas where impacting activities are located near recharge zones.	Difference between background or baseline groundwater quality and goals for arsenic, nitrate, salinity and other problem pollutants Promote non-impacting activities in recharge zones (not allow impacting activity in recharge zones)	Bacteria, Coliform, Radioactivity, Taste and Odor, Ammonia, Biostimulatory, Substances, Chemical Constituents, Chlorine, Total Residual Color, Dissolved Oxygen, Floating Materials, Oil and Grease, Non-degradation of Aquatic Communities, Pesticides, pH, as required by Basin Plan and additionally measure pollutants of concern such as arsenic, nitrate, TDS	Standard methods and procedures for water quality testing; GAMA Program methodology will be followed, when applicable. The Basin Plan requires that all drinking water requirements (MCL and Secondary MCL) are to be met	Monthly or more frequently, can refer to Title 22 for additional monitoring requirements Report quarterly	RWQCB	Measurement to be reported: water quality limits Reporting: Report with update of the Plan and compare against objectives

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	Measurement Tools and Methods *What needs to be measured:*	*How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
Map contaminated and degraded sites and monitor contaminant movement, by 2017.							
Set up a process for identifying, mapping and monitoring contaminated sites. *Note: Groundwater quality monitoring is being completed as part of ongoing SNMP efforts.*	Locations, constituents, and constituent concentrations Coordination with Regional Boards for continued compliance with new or changes to existing discharge permits, regulations, etc. Records database search for pollutant leaks, spills, contamination, etc. Enhance monitoring system to detect identified potential pollutants (i.e. modify sampling plan to include identified potential pollutants or indicators of those pollutants, perform vertically discrete sampling, etc.).	Change in contaminant plume over time and rate of migration of contaminant	Water quality of Region to identify contaminated sites. Do a general sweep, then monitor more often in problem areas.	Database with location of the well, contaminants and detection levels, continually monitor that, monitoring of a few wells near it. Upstream and downstream well. May require additional monitoring wells.	Quarterly for common contaminants, if no contamination found for 5-10 years, then go to annually for that well.	Groundwater pumpers in conjunction with RWQCB	Measurement to be reported: Record of contaminated sites Reporting: Report every year with update of the Plan and compare against objectives

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	*What needs to be measured:*	Measurement Tools and Methods *How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
Identify contaminated portions of aquifer and prevent migration of contaminants, by 2017.							
Provide information for groundwater management that will prevent migration of existing contaminants to currently uncontaminated portions of the aquifer *Note: Groundwater quality monitoring is being completed as part of ongoing SNMP efforts.*	Locations, constituents, and constituent concentrations Potential sources of contaminants Potential drivers influencing migration (e.g., nearby cone of depression) Coordination with Regional Boards for continued compliance with new or changes to existing discharge permits, regulations, etc. Install monitoring wells (need several years of data to know if the contamination is due to seasonal variation or not)	Change in contaminant plume over time and rate of migration of contaminant Locate production wells geographically and with respect to depth in order to manipulate groundwater movement	Water quality of Region to identify contaminated sites. Do a general sweep, then monitor more often in problem areas. Migration of the contaminant	Database with location of the well, contaminants and detection levels, continually monitor, monitoring of nearby wells.	Quarterly	Groundwater pumpers in conjunction with RWQCB	Measurement to be reported: water quality data, contour level data, TBD Reporting: Report with update of the Plan and compare against objectives
Prevent unacceptable degradation of natural streams and recharge areas according to the Basin Plan throughout the planning period.							
Preserve ecosystem health of current stream systems Preserve opportunity to use existing and promising future groundwater recharge areas *Note: Groundwater quality monitoring is being completed as part of ongoing SNMP efforts.*	Identification of potential contamination sources and mechanisms Identification of areas that need to be protected and monitored. Coordination with Regional Boards for continued compliance with new or changes to existing discharge permits, regulations, etc.	Sources of flow that could carry contaminants Contaminants in flows entering areas desired to protect	Bacteria, Coliform, Radioactivity, Taste and Odor, Ammonia, Biostimulatory, Substances, Chemical Constituents, Chlorine, Total Residual Color, Dissolved Oxygen, Floating Materials, Oil and Grease, Non-degradation of Aquatic Communities, Pesticides, pH, as required by Basin Plan and additionally measure pollutants of concern such as arsenic, nitrate, and TDS	Standard methods and procedures for water quality testing; GAMA Program methodology will be followed, when applicable. The Basin Plan requires that all drinking water requirements (MCL and Secondary MCL) are to be met.	Monthly or more frequently, can refer to Title 22 for additional monitoring requirements Report quarterly	RWQCB, purveyors	Measurement to be reported: water quality limits Reporting: Report with update of the Plan and compare against objectives

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	*What needs to be measured:*	Measurement Tools and Methods *How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
Increase infrastructure and establish policies to use 33% of recycled water to help meet expected demand by 2015, 66% by 2025, and 100% by 2035.							
Increased use of recycled water, which would decrease demand on other resources, such as imported water or groundwater.	New users for 7,700 AFY in 2015, 18,000 AFY in 2025, and 31,000 AFY of recycled water under contract by 2035. These numbers do not include recycled water used currently for environmental maintenance.	Volume of recycled water available: 23,000 AFY in 2015, 27,000 AFY in 2025, and 31,000 AFY in 2035 that will be used in the M&I, GWR, or agricultural setting where it is not currently used.	Amount of recycled water delivered and banked.	Deliveries would be measured using flow meters. Monitoring will be consistent with the permit requirements for the use sites.	Monthly/ Quarterly	LACSD	Measurement to be reported: Total volume of recycled water banked or delivered compared to 33%, 66%, 100% Reporting: Report with update of the Plan and compare against objectives
Coordinate a regional Stormwater Resource Plan and policy mechanism by the year 2025 and incorporate adaptive management strategies for climate change.							
Identification of data gaps, preparation of detailed flood use maps for the Antelope Valley Region, identification of policies to protect aquifer, natural streams and recharge areas from contamination in the Valley, and identification of flood management opportunities.	Identification of entities that would be involved in coordination of the regional Stormwater Resource Plan; the establishment of a regional flood management committee; and the identification of the funding mechanism for creating and implementing a plan.	Signing of an MOU (or other suitable governance structure) and commitment of funds for the regional Stormwater Resource Plan.	Monitoring progress of development of the Plan and policy mechanism	Monitoring of localized flooding incidents Monitoring of new flood control projects Development of an integrated flood management plan	Quarterly	Counties and Cities	Measurement to be reported: Measuring progress of a flood management plan development. Reporting: Report with update of the Plan and compare against objectives
Contribute to the preservation of an additional 2,000 acres of open space and natural habitat, to integrate and maximize surface water and groundwater management by 2025.							
Help contribute through identification of, awareness for, financial contribution towards, or similar for creating, restoring, or preserving near-term open space and natural habitat in the Antelope Valley.	Stakeholder-coordinated meetings with implementation partners to develop community projects. Increase in restoration plantings or mitigation planting sites.	Community consensus and agreement on project list/alternative, as developed through meetings and coordination Work with individual landowners to re-vegetate the areas Number of acres preserved & treated for open space and natural habitat; measurement of the health of open space and natural habitat	To measure 'preservation': existing acres of open space and natural habitat to measure additional open space and natural habitat acreage Fugitive dust management (measured and mapped); tons of soil per acre (particulate matter pm10, pm2.5) Acreage of new plantings	Land use maps; satellite imagery; AV conservancy database; General Plan GIS data Measure fugitive dust according to Air Quality Management District (AQMD) standards	Annually Soil data measured daily/reported annually	Counties, AVRCD	Measurement to be reported: Comparison between existing (2005) acreage of open space and natural habitat and measured open space and natural habitat. Reporting: Report with update of the Plan and compare against objectives

Desired Outcome	Output Indicators *(measures to effectively track output)*	Outcome Indicator *(measures to evaluate change that is a direct result of the work)*	*What needs to be measured:*	Measurement Tools and Methods *How it should be measured:*	*Measurement/ Reporting Frequency*	*Who should measure*	Measurement to be Reported and Overall Reporting Guidelines
Preserve 100,000 acres of farmland in rotation through 2040.							
The agricultural community in the Antelope Valley stays economically healthy and land use remains in agriculture.	Landowners working with local water agencies in coordinated water banking rotation projects.	Number of water-resource integrated projects The number of acres of farmland in active rotation	Existing acreage in rotation and current land use by type (active farming, fallowing, recharge, etc.) Fugitive dust management (measured and mapped); tons of soil per acre (particulate matter pm10, pm2.5)	land use maps; satellite imagery; survey of landowners; General Plan GIS data, County commissioner reports Measure fugitive dust according to Air Quality Management District (AQMD) standards	Quarterly/ Annually Soil data measured daily/reported annually	Los Angeles County Farm Bureau, Kern County Farm Bureau	Measurement to be reported: Comparison between existing (2005) acreage of agricultural land in rotation and measured agricultural land in rotation. Reporting: Report with update of the Plan and compare against objectives
Contribute to local and regional General Planning documents to provide 5,000 acres of recreational space by 2040.							
Provide low impact recreational opportunities for residents and visitors into the future.	Stakeholder-coordinated meetings with implementation partners to develop community projects	Community consensus and agreement on project list/alternatives, as developed through meetings and coordination	Existing acreage of recreational space and future acreage	Land use maps; satellite imagery; General Plan GIS data	Quarterly/ Annually	Counties and cities	Measurement to be reported: Comparison between existing acreage of recreational land and measured recreational land. Reporting: Report with update of the Plan and compare against objectives
Coordinate a regional land use management plan by the year 2025 and incorporate adaptive management strategies for climate change.							
Identify data gaps, prepare detailed land use maps for the Antelope Valley Region, identify policies to protect land uses in the Valley, identify land use management opportunities	Identification of entities that would be involved in coordination of the regional land management plan; the establishment of a regional land management committee; and the identification of the funding mechanism for the plan.	Signing of an MOU and commitment of funds for the regional land use management plan. A broadly supported regional land use management plan.	Monitoring progress of development of the plan and policy mechanism	Plan development	Quarterly	Counties and cities	Measurement to be reported: Measuring progress of land use management plan development. Reporting: Report with update of the Plan and compare against objectives
Implement "no regret" mitigation strategies, when possible, that decrease GHGs or are GHG neutral.							
Decrease or neutralize GHG emissions from water resources management activities.	Records of GHG emissions from water and wastewater treatment and distribution. Records of imported water use versus local water supply use. Records of projects that meet key elements of the Scoping Plan.	Reported decrease in estimated GHG emissions from water/wastewater distribution systems. Decrease in imported water usage. Increase in projects that decrease GHG emissions.	Monitoring of GHG emissions from local activities and import of water.	Existing reporting through annual reports, UWMPs, and Air Resources Board reporting.	Annually	AVSWCA and purveyors	Measurement to be reported: Reduction in GHG emissions Reporting: Report with update of the Plan and compare against objectives

8.6.2 Project Specific Monitoring Plans

Project-specific monitoring plans will be developed for projects as they are implemented. They will be required to track each project's progress in meeting the Region's objectives and targets as well as in meeting the individual project's expected benefits. Table 8-5 describes the types of information that may be monitored for the implementation projects described in Section 7.

Table 8-5: Implementation Project Potential Monitoring Activity

Sponsor	Project Name	Potential Monitoring Activity
Willow Springs Water Bank	Willow Springs Water Bank	• Volume of water recharged • Acres of habitat and open space created • Acre-feet of imported water used before and after project implementation, and associated energy use reduction
City of Palmdale	Upper Amargosa Creek Flood Control, Recharge, and Habitat Restoration Project	• Volume of water recharged • Volume of imported water used before and after project implementation • Water quality in Amargosa Creek upstream and downstream of project • Acres of habitat and open space created • Acres of improved flood protection
Palmdale Water District	Littlerock Dam Sediment Removal	• Volume of water recharged • Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Water quality in Littlerock Creek upstream and downstream of project • Acres of habitat and open space created • Acres of improved flood protection
Palmdale Water District	Palmdale Regional Groundwater Recharge Project	• Volume of water recharged • Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Acres of habitat and open space created • Acres of improved flood protection
Antelope Valley Resource Conservation District	Antelope Valley Regional Conservation Project	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Acres of recreation and open space created • Square feet of turf removed • Number of education lessons and outreach events
Palmdale Recycled Water Authority	Phase 2 Distribution System	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Volume of new recycled water use
Rosamond CSD	Wastewater Treatment Plant Rehabilitation and Groundwater Protection	• Acre-feet of water recharged • Acre-feet of water treated • Groundwater quality before and after project
AVEK	AVEK Strategic Plan	• Not applicable – planning document

Sponsor	Project Name	Potential Monitoring Activity
AVEK	South Antelope Valley Intertie Pipeline (SNIP) Phase 2	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • THM levels in drinking water before and after project
City of Lancaster	Antelope Valley Recycled Water Master Plan	• Not applicable – planning document
AVEK	Eastside Banking & Blending Project	• Volume of water recharged • Acre-feet of imported water used before and after project implementation, and associated energy use reduction • THM levels in drinking water before and after project
City of Lancaster	Whit Carter Park Recycled Water Conversion	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Volume of new recycled water use
City of Lancaster	Division Street and Avenue H-8 Recycled Water Tank	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Volume of new recycled water use
City of Lancaster	Lancaster National Soccer Center Recycled Water Conversion	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Volume of new recycled water use
City of Lancaster	Pierre Bain Park Recycled Water Conversion	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Volume of new recycled water use
AVEK	Expansion of the Eastside Water Bank	• Volume of water recharged • Acre-feet of imported water used before and after project implementation, and associated energy use reduction
City of Lancaster	Lancaster Cemetery Recycled Water Conversion	• Acre-feet of imported water used before and after project implementation, and associated energy use reduction • Volume of new recycled water use

Project proponents will be expected to monitor at the locations and frequency required by regulatory agencies and permitting. As described under Section 8.4.1, the AV IRWM Plan website, www.avwaterplan.org, provides a mechanism for stakeholders to upload project information regarding water supply, water quality, and other benefits, which will be collected in a database to manage, store, and disseminate information to the public. A data collection template will be available on the website in the future so that data collected during the AV IRWM Plan can be stored and managed in a consistent format.

8.7 Adaptive Management

The Antelope Valley Region will use an adaptive management process in its analysis of Plan and project performance and will utilize a methodology to update the Plan and modify projects. The Region will perform reviews of Plan performance at the frequency described in the above monitoring plan in addition to IRWM Plan updates that will occur every five years. The IRWM Plan is not static; it will be adjusted as more effects of climate change manifest, new tools are developed, and new information becomes available. The integration of new information will ensure that the IRWM Plan and the adopted objectives are consistent with regional needs.

At the Plan level, the Region will review its progress in meeting the planning targets to determine whether they are being met. If the Region's planning targets are not being met, then a review of the original targets, verification of submitted project data, a request for additional data, and/or consideration of a broader mix of strategies and or projects may be warranted. The Region will perform a more in-depth examination of its targets and objectives during its five-year Plan updates that will incorporate new studies and data relevant to the Region, and the Region will re-evaluate its issues and needs (i.e., the Region's prioritized vulnerabilities to climate change).

At the project level, project proponents will be responsible for tracking project performance and adjusting project operations for maximum benefit. Those projects that are funded through IRWM program grants will be expected to report on project performance to the Region.

If both project and plan level responses do not lead to satisfactory results, then a change in the Region's governance structure may be considered. This could involve identifying and inviting additional stakeholders whose participation would improve success. Changes to the stakeholder process could be explored to bring new ideas. Finally, a change in the decision-making process could be considered.

Section 9 | References

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Section 10 | Glossary & Acronyms

10.1 Glossary of Terms

Term	Definition
- A -	
ACRE-FOOT	The quantity of water required to cover one acre to a depth of one foot; equal to 43,560 cubic feet, or approximately 325,851 gallons.
ADJUDICATION	A case that has been heard and decided by a judge. In the context of an adjudicated groundwater basin, landowners or other parties have turned to the courts to settle disputes over how much groundwater can be extracted by each party to the decision.
ADOPTED IRWM PLAN	The version of the IRWM Plan that is adopted by the governing bodies of at least three or more member agencies to the Regional Water Management Group (RWMG), two of which have statutory authority over water supply, as evidenced by resolutions.
AGRONOMIC RATE	The rate of nutrient application to fulfill a plant's nitrogen requirements while minimizing the amount of nutrients that passes to groundwater.

ALLUVIUM	Sediment deposited by flowing water, such as in a riverbed, flood plain or delta.
ALLUVIAL AQUIFER	Earth, sand, gravel or other rock or mineral materials laid down by flowing water, capable of yielding water to a well.
ANTELOPE VALLEY REGION	The Antelope Valley Region, as defined for the purposes of this IRWM Plan, follows the Antelope Valley's key hydrologic features, bounded by the San Gabriel Mountains to the south and southwest, and the Tehachapi Mountains to the northwest, forming a well-defined triangular point at the Valley's western edge. The Region covers portions of northern Los Angeles and southeastern Kern Counties, and encompasses the majority of the AVEK service area.
APPLIED WATER DEMAND	The quantity of water that would be delivered for urban or agricultural applications if no conservation measures were in place.
AQUIFER	An underground layer of rock, sediment or soil, or a geological formation/unit that is filled or saturated with water in sufficient quantity to supply pumping wells.
ARID	A term describing a climate or region in which precipitation is so deficient in quantity or occurs so infrequently that intensive agricultural production is not possible without irrigation.
ARTICLE 21 WATER	Refers to the SWP contract provision defining this supply as water that may be made available by DWR when excess flows are available in the Delta. Article 21 water is made available on an unscheduled and interruptible basis and is typically available only in average to wet years, generally only for a limited time in the late winter.
ARTIFICIAL RECHARGE	The addition of water to a groundwater reservoir by human activity, such as irrigation or induced infiltration from streams, wells, or recharge/spreading basins. See also GROUNDWATER RECHARGE, RECHARGE BASIN.
- B -	
BEDROCK AQUIFER	A consolidated rock deposit or geological formation of sufficient hardness and lack of interconnected pore spaces, but which may contain a sufficient amount of joints or fractures capable of yielding minimal water to a well.
BENEFICIAL USES	Include fish, wildlife habitat, and education, scientific and recreational activities which are dependent upon adequate water flow thorough rivers, streams and wetlands. The Regional Water Quality Control Board's Basin 4A Plan categorizes beneficial uses per water quality standards.

BEST MANAGEMENT PRACTICE (BMP)	An urban water conservation (water use efficiency) measure that the California Urban Water Conservation Coalition agrees to implement among member agencies. The BMP's are intended to reduce long-term urban water demand.
BRACKISH WATER	Water containing dissolved minerals in amounts that exceed normally acceptable standards for municipal, domestic, and irrigation uses. Considerably less saline than sea water.
- C -	
CLOSED BASIN	A topographic water basin with no outlet to the ocean
CONFINED AQUIFER	A water-bearing subsurface stratum that is bounded above and below by formations of impermeable, or relatively impermeable, soil or rock.
CONJUNCTIVE USE	The operation of a groundwater basin in coordination with a surface water storage and conveyance system. The purpose is to recharge the basin during years of above average water supply to provide storage that can be withdrawn during drier years when surface water supplies are below normal.
CONSERVATION	*Urban water conservation or water use efficiency* includes reductions realized from voluntary, more efficient, water use practices promoted through public education and from state-mandated requirements to install water-conserving fixtures in newly constructed and renovated buildings. *Agricultural water conservation or agricultural water use efficiency*, means reducing the amount of water applied in irrigation through measures that increase irrigation efficiency. See NET WATER CONSERVATION.
CRITICAL DRY PERIOD	A series of water-deficient years, usually an historical period, in which a full reservoir storage system at the beginning is drawn down (without any spill) to minimum storage at the end.
CRITICAL DRY YEAR	A dry year in which the full commitments for a dependable water supply cannot be met and deficiencies are imposed on water deliveries.
CUBIC FEET PER SECOND (cfs)	A unit of measurement describing the flow of water. A cubic foot is the amount of water needed to fill a cube that is one foot on all sides, about 7.5 gallons.
- D -	
DECISION 1641	An action by the State Water Resources Control Board (SWRCB) to establish water quality objectives for water users in the Delta. The Bay/Delta Water Quality Control Plan was developed as a means to attain these water quality objectives.

DESALTING/DESALINATION	A process that converts sea water or brackish water to fresh water or an otherwise more usable condition through removal of dissolved solids.
DISADVANTAGED COMMUNITY	A community with an annual median household income that is less than 80 percent of the statewide annual median household income (CWC § 79505.5 (a)).
DISTRIBUTION UNIFORMITY (DU)	The ratio of the average low-quarter depth of irrigation water infiltrated to the average depth of irrigation water infiltrated, for the entire farm field, expressed as a percent.
DRAINAGE BASIN	The area of land from which water drains into a river; as, for example, the Sacramento River Basin, in which all land area drains into the Sacramento River. Also called, "WATERSHED."
DRY-WEATHER RUNOFF	Urban runoff that enters the drainage system due to human activities such as car washing and lawn irrigation. Dry-weather runoff can also result from illicit connections to the stormwater or sewer systems.
- E -	
EFFICIENT WATER MANAGEMENT PRACTICE (EWMP)	An agricultural water conservation measure that water suppliers could implement. EWMPs are organized into three categories: 1) Irrigation Management Services; 2) Physical and Structural Improvements; and 3) Institutional Adjustments.
EFFLUENT	Waste water or other liquid, partially or completely treated or in its natural state, flowing from a treatment plant.
EMPIRICAL YIELD	See SAFE YIELD (GROUNDWATER)
EPHEMERAL	An ephemeral water body is one that exists for only a short period of time following precipitation or snowmelt. This is not the same as an intermittent or seasonal water body which exists for a longer period of time.
EVAPOTRANSPIRATION (ET or ETo)	The quantity of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces. Quantitatively, it is expressed in terms of depth of water per unit area during a specified period of time.
- F -	
FINAL IRWM PLAN	The version of the IRWM Plan that is deemed ready for adoption by 50 percent or more of the representatives from the RWMG member agencies.
FIRM YIELD	The maximum annual supply of a given water development that is expected to be available on demand, with the understanding that lower yields will occur in accordance with a predetermined schedule or probability.

FOREBAY	A groundwater basin immediately upstream or upgradient from a larger basin or group of hydrologically connected basins. Also, a reservoir or pond situated at the intake of a pumping plant or power plant to stabilize water levels.
- G -	
GROUNDWATER	Water that occurs beneath the land surface and completely fills all pore spaces of the alluvium or rock formation in which it is located.
GROUNDWATER BASIN	A groundwater reservoir, together with all the overlying land surface and underlying aquifers that contribute water to the reservoir.
GROUNDWATER MINING	The withdrawal of water from an aquifer greatly in excess of replenishment; if continued, the underground supply will eventually be exhausted or the water table will drop below economically feasible pumping lifts.
GROUNDWATER OVERDRAFT	The condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that replenishes the basin over a period of years.
GROUNDWATER RECHARGE	Increases in groundwater quantities or levels by natural conditions or by human activity. See also ARTIFICIAL RECHARGE.
GROUNDWATER STORAGE CAPACITY	The space contained in a given volume of deposits. Under optimum use conditions, the usable groundwater storage capacity is the volume of water that can, within specified economic limitations, be alternately extracted and replaced in the reservoir. (Directly related to SAFE YIELD).
GROUNDWATER TABLE	The upper surface of the zone of saturation (all pores of subsoil filled with water), except where the surface is formed by an impermeable body.
- H -	
HYDRAULIC CONDUCTIVITY	A property of vascular plants, soil or rock, that describes the ease with which water can move through pore spaces or fractures. It depends on the permeability of the material and on the degree of saturation.
- I -	

IMPORTED WATER RETURN FLOWS	Water brought into the basin from outside of the watershed that provides a net increase in groundwater supply (i.e., does not include consumed or evaporated imported water).
INSTREAM USE	Use of water that does not require diversion from its natural watercourse. For example, the use of water for navigation, recreation, fish and wildlife, esthetics, and scenic enjoyment.
IRRIGATION EFFICIENCY	The efficiency of water application. Computed by dividing evapotranspiration of applied water by applied water and converting the result to a percentage. Efficiency can be computed at three levels: farm, district, or basin.
IRRIGATION RETURN FLOW	Applied water that is not transpired, evaporated, or deep percolated into a groundwater basin, but that returns to a surface water supply.
- J -	
JUDGEMENT	Judgement is a decision of a court regarding the rights and liabilities of parties in a legal action or proceeding. In the context of the adjudication, the Judgement guides the long-term management of the basin.
- L -	
LACUSTRINE	In geology, the sedimentary environment of a lake.
LAND SUBSIDENCE	Land subsidence is the lowering of the land-surface elevation from changes that take place underground. Overdrafting of aquifers is the major cause of subsidence in the southwestern United States.
LEACHING	The flushing of salts from the soil by the downward percolation of applied water.
- M -	
MAXIMUM CONTAMINANT LEVEL (MCL)	The maximum level of a drinking water contaminant allowed under the federal Safe Water Drinking Act. MCLs set under National Primary Drinking Water Regulations are legally enforceable standards that apply to public water systems.
M&I	Municipal and Industrial (water use); generally urban uses for human activities.
MILLIGRAMS PER LITER (MG/L)	The mass (milligrams) of any substance dissolved in a standard volume (liter) of water. One liter of pure water has a mass of 1000 grams. For dilute solutions where water is the solvent medium, the numerical value of mg/l is very close to the mass ratio expressed in parts per million (ppm).

MINERALIZATION (OF GROUNDWATER)	The addition of inorganic substances, usually dissolved from surface or aquifer material, to groundwater.
NATURALLY OCCURRING CONTAMINANTS (IN GROUNDWATER)	A deleterious substance present in groundwater which is of natural origin, i.e., not caused by human activity.
- N -	
NATIVE SAFE YIELD	A safe yield estimate provided in the Judgement based on estimates of natural groundwater recharge from the hydrologic system including subsurface inflows from the surrounding bedrock and infiltration from precipitation and streamflow. It also accounts for return flows from basin pumping. See SAFE YIELD.
NATURAL HABITAT	See OPEN SPACE.
NET WATER CONSERVATION	The difference between the amount of applied water conserved and the amount by which this conservation reduces usable return flows.
NET WATER DEMAND	The applied water demand less water saved through conservation efforts (= net applied water = actual water used).
NON-POINT SOURCE POLLUTION	A diffuse discharge of pollutants throughout the natural environment. See POINT SOURCE.
- O -	
OPEN SPACE	Open space can mean natural open space, passive and active recreation which may or may not be compatible with natural habitats or natural open space preservation. As an example, open space can mean soccer fields, playgrounds, etc. and should not be considered as natural habitat. See also NATURAL HABITAT.
OVERDRAFT	Withdrawal of groundwater in excess of a basin's perennial yield. See also PROLONGED OVERDRAFT.
- P -	
PARTS PER MILLION (PPM)	A ratio of two substances, usually by mass, expressing the number of units of the designated substance present in one million parts of the mixture. For water solutions, parts per million is almost identical to the milligrams per liter.
PER-CAPITA WATER USE	The amount of water used by or introduced into the system of an urban water supplier divided by the total residential population; normally expressed in gallons per-capita-per-day (gpcd).

PERCHED GROUNDWATER	Groundwater supported by a zone of material of low permeability located above an underlying main body of groundwater with which it is not hydrostatically connected.
PERCOLATION	The downward movement of water through the soil or alluvium to the groundwater table.
PERENNIAL YIELD	Perennial yield is an estimate of the long-term average annual amount of water that can be withdrawn without inducing a long-term progressive drop in water level. The term “safe yield” is sometimes used in place of perennial yield, although the concepts behind the terms are not identical: the older concept of “safe yield” generally implies a fixed quantity equivalent to a basin’s average annual natural recharge, while the “perennial yield” of a basin or system can vary over time with different operational factors and management goals.
PERMEABILITY	The capability of soil or other geologic formation to transmit water.
PLAYA	A dry lakebed, also known as an alkali flat. Playas consist of fine-grained sediments infused with alkali salts and are devoid of vegetation.
PLAYA DEPOSIT	A thick salt deposit that forms over time through the accumulation of layers of dissolved minerals from rocks. Dissolved salts that form a playa deposit are laid by rainfall that rapidly evaporates once reaching the earth’s surface.
POINT SOURCE	Any discernable, confined and discrete conveyance site from which waste or polluted water is discharged into a water body, the source of which can be identified. See also NON-POINT SOURCE.
POLLUTION (OF WATER)	The alteration of the physical, chemical, or biological properties of water by the introduction of any substance into water that adversely affects any beneficial use of water.
POTABLE WATER	Water suitable for human consumption without undesirable health consequences. Drinkable. Meets Department of Health Services drinking water requirements.
PRODUCTION RIGHT	The portion of the Native Safe Yield assigned to each groundwater user. Production Rights for specific parties are defined in the adjudication Judgment.
PROLONGED OVERDRAFT	Net extractions in excess of a basin’s perennial yield, averaged over a period of ten or more years.
PROPOSITION 50	The “Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002”, as set forth in Division 26.5 of the California Water Code (commencing with § 79500).

- Q -	
QUATERNARY GEOLOGY	Younger of the two geologic periods of the Cenozoic era of geologic time lasting from 2 million years ago to the present. Comprising all geologic time from the end of the Tertiary period to today.
- R -	
RAMPDOWN PERIOD	In terms of the Antelope Valley Groundwater Basin adjudication, the rampdown period outlined in the Judgement is a mandatory reduction in groundwater production between 2016 and 2022 to meet the Native Safe Yield by 2023.
RAMPDOWN PRODUCTION	The reasonable and beneficial use of groundwater, excluding Imported Water Return Flows, at a time prior to the Judgment, or the Production Right, whichever is greater. During the seven-year Rampdown Period, production is reduced – or ramped down – from the Pre-Rampdown Production Right to the Production Right for certain parties with Pre-Rampdown Production rights.
REACH REPAYMENT CAPACITY	SWP contractors, via their water supply contracts with DWR, are allocated specified shares of “reach repayment” capacity in various reaches of the SWP system. This share of capacity pertains to SWP supplies only, and provides each contractor with delivery priority for its SWP supplies. Reach repayment capacity is often less than the actual constructed physical capacity of SWP facilities.
RECHARGE BASIN	A surface facility, often a large pond, used to increase the infiltration of water into a groundwater basin.
RECYCLED WATER	Urban wastewater that becomes suitable for a specific beneficial use as a result of treatment.
REGIONAL PRIORITIES	The short-term and long-term issues and/or objectives that are determined to be most important on the Region’s needs.

REGIONAL WATER MANAGEMENT GROUP	A group that, at a minimum, includes three or more local public agencies, at least two of which have statutory authority over water management, which may include but is not limited to water supply, water quality, flood control, or storm water management. The Antelope Valley Regional Water Management Group includes Antelope Valley-East Kern Water Agency, Palmdale Water District, Quartz Hill Water District, Littlerock Creek Irrigation District, City of Palmdale, City of Lancaster, Los Angeles County Sanitation District Nos. 14 & 20, Rosamond Community Services District, and Los Angeles County Waterworks District No. 40, Antelope Valley.
REVERSE OSMOSIS	Method of removing salts from water by forcing water through a membrane.
RETURN FLOW	The portion of withdrawn water that is not consumed by evapotranspiration and returns instead to its source or to another body of water.
REUSE	The additional use of once-used water.
RIPARIAN	Of, or on the banks of, a stream or other of water.
RIPARIAN VEGETATION	Vegetation growing on the banks of a stream or other body of water.
RUNOFF	The surface flow of water from an area; the total volume of surface flow during a specified time.
- S -	
SAFE YIELD (GROUNDWATER)	The maximum quantity of water that can be withdrawn from a groundwater basin over a long period of time without developing a condition of overdraft. Sometimes referred to as sustained yield.
SAG POND	An enclosed depression formed where active or recent fault movement results in impounded drainage.

SALINITY	Generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids), electrical conductivity, or osmotic pressure. Where seawater is the major source of salt, salinity is often used to refer to the concentration of chlorides in the water. See also TDS.
SERIOUS OVERDRAFT	Prolonged overdraft that results, or would result, within ten years, in measurable, unmitigated adverse environmental or economic impacts, either long-term or permanent. Such impacts include but are not limited to seawater intrusion, other substantial quality degradation, land surface subsidence, substantial effects on riparian or other environmentally sensitive habitats, or unreasonable interference with the beneficial use of a basin's resources.
SEAWATER INTRUSION	Occurs when extractions exceed freshwater replenishment of groundwater basins and causes seawater to travel laterally inland into fresh water aquifers.
SECONDARY TREATMENT	In sewage treatment, the biological process of reducing suspended, colloidal, and dissolved organic matter in effluent from primary treatment systems. Secondary treatment is usually carried out through the use of trickling filters or by an activated sludge process.
SHEET FLOW	Shallow-depth, low velocity water flow.
SILT	A sedimentary material composed of very fine particles intermediate in size between sand and clay.
SILTATION	The deposition or accumulation of silt.
SPREADING BASIN	See RECHARGE BASIN.
SPREADING GROUNDS	See RECHARGE BASIN.
STAKEHOLDER	An individual, group, coalition, agency or others who are involved in, affected by, or have an interest in the implementation of a specific program or project.
SOLUTE	A substance dissolved in another substance, usually the component of a solution present in the lesser amount.
SUBSIDENCE	See LAND SUBSIDENCE.
SUSTIANABLE GROUNDWATER MANAGEMENT ACT (SGMA)	State legislation passed in 2014 that provides a framework for sustainable groundwater management in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.

- T -	
TABLE A AMOUNT	A reference to the amount of water listed in "Table A" of the contract between the State Water Project (SWP) and the contracting agencies and represents the maximum amount of water an agency may request each year.
TERTIARY GEOLOGY	Geologic time period between roughly 65 million and 2 million years ago.
TERTIARY TREATMENT	In sewage, the additional treatment of effluent beyond that of secondary treatment to obtain a very high quality of effluent.
TOTAL DISSOLVED SOLIDS (TDS)	A quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter (mg/l) or in parts per million (ppm). See also Salinity.
TOTAL SAFE YIELD	A safe yield estimate provided in the Judgement based that accounts for the Native Safe Yield and imported water return flows. See SAFE YIELD.
TURBIDITY	A measure of cloudiness and suspended sediments in water. Water high in turbidity appears murky and contains sediments in suspension. Turbid water may also result in higher concentrations of contaminants and pathogens, that bond to the particles in the water.
TURNBACK POOLS	A means in which SWP contractors with excess Table A Amount water in a given hydrologic year may sell that excess to other contractors. This is included in a provision in the SWP water supply contracts. The program is administered by DWR.
- W -	
WASH	A wash, also called an arroyo, is a usually dry creek bed or gulch that temporarily fills with water after a heavy rain, or seasonally.

WATER MANAGEMENT STATEGIES	Specified categories of approaches to meet regional objectives. According to the IRWM Grant Program Guidelines, the water management strategies include, but are not limited to, ecosystem restoration, environmental and habitat protection and improvement, water supply reliability, flood management, groundwater management, recreation and public access, storm water capture and management, water conservation, water quality protection and improvement, water recycling, wetlands enhancement and creation, conjunctive use, desalination, Imported water, land use planning, non-point source pollution control, surface storage, watershed planning, water and wastewater treatment, and water transfers.
WATER MANAGEMENT STRATEY ALTERNATIVE	A set of projects, project concepts, actions, and/or studies that when implemented together would fill the gaps, minimize the overlaps, maximize benefits for multiple water management strategies, and ultimately achieve the regional planning objectives.
WATER MANAGEMENT STRATEGY AREA	A group of similar or related water management strategies to make the Antelope Valley IRWM Plan development more efficient and manageable (data collection, management, and dissemination).
WATER MANAGEMENT STRATEGY INTEGRATION	A process to design water management strategy alternatives to maximize regional benefits by identifying potential synergies, linkages, and gaps between water management strategies and evaluating geographical distribution of project benefits.
WATER MANAGEMENT STRATEGY OBJECTIVE	A goal for the Region to achieve in order to meet the needs for a water management strategy. A quantifiable objective can be used to allow future measurement of progress towards accomplishment of the objectives (e.g., conserve 10,000 AFY of drinking water by 2030).
WATER QUALITY	A term used to describe the chemical, physical, and biologic characteristics of water with respect to its suitability for a particular use.
WATER QUALITY CONTAMINATION	For the purposes of the IRWM Plan, any increase in water constituent levels over the State or Federal standards is considered contamination.
WATER QUALITY DEGRADATION	Any increase in water constituent levels over naturally occurring levels is considered degradation.

WATER RECLAMATION	The treatment of water of impaired quality, including brackish water and seawater, to produce a water of suitable quality for the intended use.
WATER RIGHT	A legally protected right, granted by law, to take possession of water occurring in a water supply and to divert the water and put it to beneficial uses.
WATERMASTER	The governing body identified by the Judgement that ensures that the basin or portion of the basin that is adjudicated is managed in accordance with the court's decree. The Watermaster must report periodically to the court.
WATERSHED	The area or region drained by a reservoir, river, stream, etc.; drainage basin.
WATER TABLE	The surface of underground, gravity-controlled water.

10.2 Acronym List

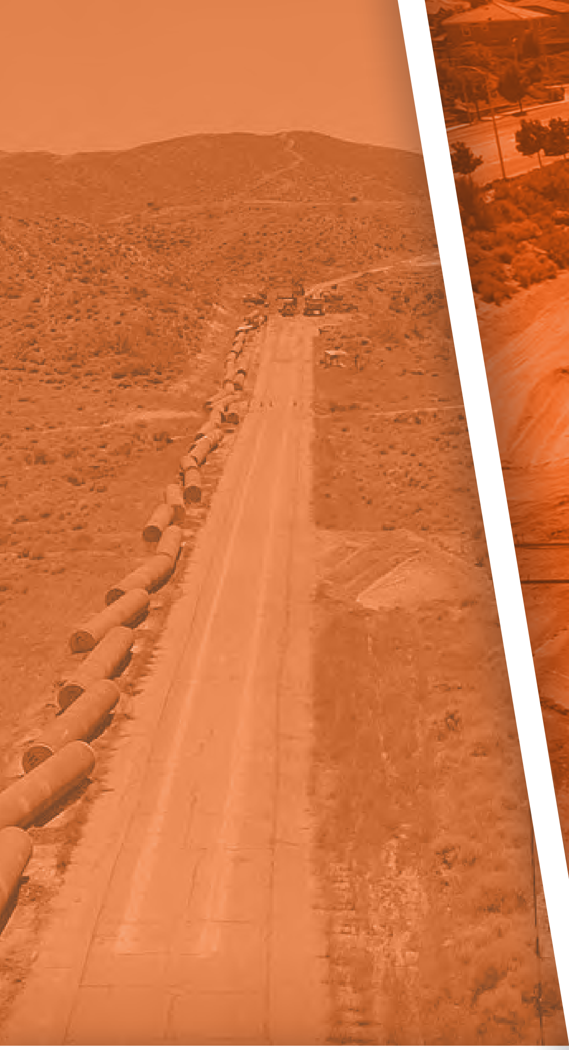
Acronym	Meaning
AB	Assembly Bill
ACEC	Areas of Critical Environmental Concern
AF	acre-foot
AFB	Air Force Base
AFY	acre-feet per year
AQMD	Air Quality Management District
ASR	Aquifer Storage and Recharge/Recovery
A-Team	Advisory Team
AV	Antelope Valley
AVEK	Antelope Valley-East Kern Water Agency
AVSWCA	Antelope Valley State Water Contractors Association
AVWCC	Antelope Valley Water Conservation Coalition
BIA	Building Industry Association
BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological opinion
Cal Water	California Water Service
CAS	Conventional Activated Sludge
CASGEM	California Statewide Groundwater Elev. Monitoring Program
CCD	Census County Division
CCL	Contaminant Candidate List
CCR	California Code of Regulations
CCR	Consumer Confidence Reporting
CDFG	California Department of Fish and Game
CDFA	California Department of Food and Agriculture
CDPH	California Department of Public Health
CEDEN	California Environmental Data Exchange Network
CEIC	California Environmental Information Catalog
CEQA	California Environmental Quality Act
CERES	California Environmental Resources Evaluation System
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CIP	Capital Improvements Plan
CLWA	Castaic Lake Water Agency
CMWD	Calleguas Municipal Water District
CRS	Community Rating System
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
CWA	Clean Water Act
CWC	California Water Code

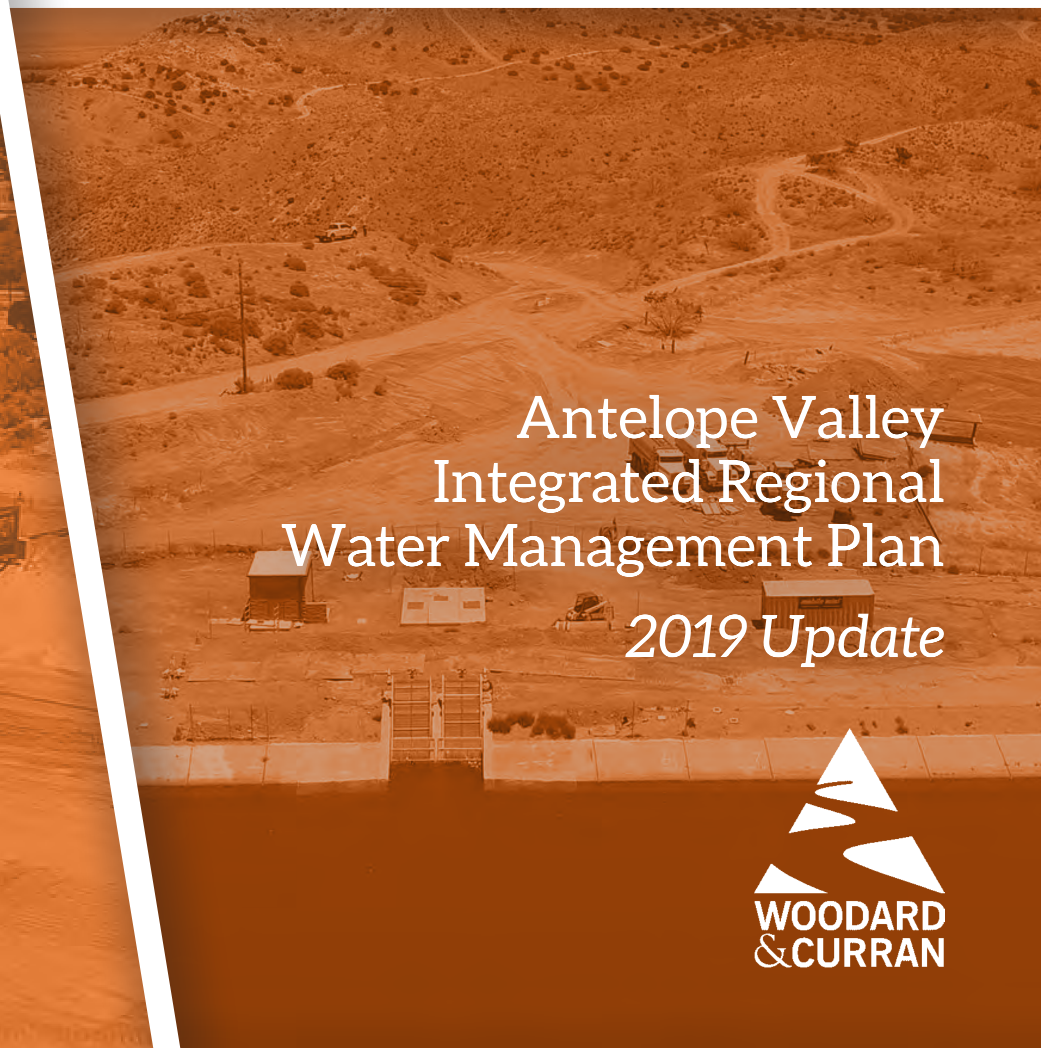
DAC	Disadvantaged Communities
DPH	Department of Public Health
DMM	Demand management measure
DU	Distribution Uniformity
DWMA	Desert Wildlife Management Area
DWR	Department of Water Resources
EAFB	Edwards Air Force Base
EIR	Environmental Impact Report
EJ	Environmental Justice
EJCW	Environmental Justice Coalition for Water
EPA	Environmental Protection Agency
ESA	Federal Endangered Species Act
ETc	Evapotranspiration (for a particular crop)
ETo	Evapotranspiration (general or reference)
EWMP	Efficient Water Management Practice
° F	degree Fahrenheit
FEIR	Final Environmental Impact Report
FEMA	Federal Emergency Management Agency
FIRM	Flood insurance rate map
FWSMPU	Final Water System Master Plan Update
gal	gallon
GAMA	Groundwater Ambient Monitoring and Assessment
GHG	Greenhouse gas
GIS	Geographic Information System
gpcd	gallons per-capita-per-day
gpd	gallons per day
gpm	gallons per minute
GPS	Global positioning system
GWR-RW	Groundwater Recharge Using Recycled Water
GWR	Groundwater recharge
HCP	Habitat Conservation Plan
HECW	High-Efficiency Clothes Washer
IFM	Integrated Flood Management
IRWM Plan (or IRWMP)	Integrated Regional Water Management Plan
IUWMP	Integrated Urban Water Management Plan
IWRP	Integrated Water Resources Plan
JPA	Joint Powers Authority
LACSD	Los Angeles County Sanitation District
LACWD 40	Los Angeles County Waterworks District No. 40
LACDPW	Los Angeles County Department of Public Works
LADWP	Los Angeles Department of Water and Power
LAFCO	Local Area Formation Commission
Lancaster	Lancaster, City of

LAWA	Los Angeles World Airports
LCID	Littlerock Creek Irrigation District
LID	Low Impact Development
LWRP	Lancaster Water Reclamation Plant
M&I	municipal & industrial
MAF	Million acre-feet
MBR	Membrane bioreactor
MCL	Maximum Contaminant Level
MG	million gallon
mgd	million gallons per day
mg/L	milligrams per liter
MHI	median household income
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MW	megawatt
MWA	Mojave Water Agency
MWD	Metropolitan Water District of Southern California
ND	Non-detect
NFIP	National Flood Insurance Program
NLFC	Newhall Land and Farming Company
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
O&M	operations and maintenance
OEHHA	Office of Environmental Health Hazard Assessment
OHV	Off-Highway Vehicle
NRCS	Natural Resource Conservation Service
PHG	Public Health Goal
ppb	parts per billion
ppm	parts per million
PAC	Performance Advisory Committee
Palmdale	Palmdale, City of
PID	Palmdale Irrigation District
Plant 42	U.S. Air Force Plant 42
PM	Particulate Matter
PWD	Palmdale Water District
PWRP	Palmdale Water Reclamation Plant
QHWD	Quartz Hill Water District
RAP	Region Acceptance Process
RCSD	Rosamond Community Services District
Region	Antelope Valley Region
RMS	Resource Management Strategy

RO	reverse osmosis
ROC	reactive organic compound
RRBWSD	Rosedale-Rio Bravo Water Storage District
RSN	Rotary Sprinkler Nozzle
RWMG	Regional Water Management Group
RWQCB	Regional Water Quality Control Board
RWQCB-LR	Regional Water Quality Control Board – Lahontan Region
SB	Senate Bill
SCAG	Southern California Association of Governments
SDWA	Safe Drinking Water Act
SEA	Significant Ecological Area
Semitropic	Semitropic Water Storage District
SGMA	Sustainable Groundwater Management Act
SMART	Specific Measurable Attainable Relevant Time-based
SNMP	Salt and Nutrient Management Plan
SRF	State Revolving Fund
SWAMP	Surface Water Ambient Monitoring Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
THM	Trihalomethanes
TTHM	Total Trihalomethanes
TMDL	Total Maximum Daily Load
TOC	total organic carbon
TSY	Total Sustainable Yield
TTP	Tertiary Treatment Plant
UCCE	University of California Cooperative Extension
ug/L	micrograms per liter
ULFT	Ultra Low Flush Toilet
(uS/cm)	microsiemens per centimeter
U.S.	United States
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan
WBIC	Weather-Based Irrigation Controller
WDL	Water Data Library
WDR	Waste Discharge Requirements
WPP	Wellhead Protection Program
WRP	Water Reclamation Plant
WSA	Water Supply Assessment

WSMP	Water System Master Plan
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant





Antelope Valley Integrated Regional Water Management Plan

2019 Update

WOODARD & CURRAN

Appendix E

Rosamond South Solar WSA – Consistency with DWR Guidelines

Rosamond South Solar WSA – Consistency with DWR Guidelines

Guidelines Section Number and Title (DWR, 2003)	Guidelines Direction	Relevant WSA Section and Response
Section 1 (page 2). Does SB 610 or SB221 apply to the proposed project?	Is the project subject to SB 610? Is the project subject to CEQA (Water Code §10910(a)? If yes, continue.	WSA Section 1.1. Yes, the project is subject to SB610 and CEQA.
	Is it a "Project" as defined by Water Code §10912(a) or (b)? If yes, to comply with SB 610 go to Section 2.0, page 4.	WSA Section 1.1. Yes, the Project is considered to meet the definition of "project" per Water Code §10912(a) or (b).
	Is the project subject to SB 221? Does the tentative map include a "subdivision" as defined by Government Code §66473.7(a)(1)? If no, stop.	No, the Project does not include a "subdivision", SB 221 does not apply to the Project, and no further action relevant to SB 221 is required.
Section 2.0 (page 4). Who will prepare the SB 610 analysis?	Is there a public water system ("water supplier") for the project (Water Code §10910(b)? If no, go to Section 3.0, page 6.	WSA Section 2.1. No, the project site is not connected to a public water system.
Section 3.0 (page 6). Has an assessment already been prepared that includes this project?	Has this project already been the subject of an assessment (Water Code §10910(h)? If no, go to Section 4.0, page 8.	No, the Project has not been the subject of an assessment.
Section 4.0 (page 8). Is there a current Urban Water Management Plan?	Is there an adopted urban water management Plan (Water Code §10910(c)? If yes, continue. If yes, the information from the UWMP related to the proposed water demand for the project may also be used for carrying out Section 5.0, Steps 1 and 2, Section 7; proceed to Section 5, page 10 of the Guidelines.	WSA Section 3.2. Yes, there is an adopted UWMP in the Project area. Information contained in the UWMP was used in the preparation of the WSA and cited accordingly.
	Is the project water demand for the project accounted for in the most recent UWMP (Water Code §10910(c)(2)? If no, go to Section 5.0, page 10.	No
Section 5.0 (page 10). What information should be included in an assessment?	Step One (page 13). Documenting wholesale water supplies.	The Project is not a retail water supplier and would not include the use of wholesale water supplies.
	Step Two (page 17). Documenting Supply if Groundwater is a Source.	The Antelope Valley Groundwater Basin is a proposed water supply. WSA Sections 1.3 and 2.3.

Guidelines Section Number and Title (DWR, 2003)	Guidelines Direction	Relevant WSA Section and Response
	Specify if a groundwater management plan or any other specific authorization for groundwater management for the basin has been adopted and how it affects the water supplier's use of the basin.	WSA Section 3.3 Multiple groundwater management plans are currently in place for the Antelope Valley Groundwater Basin, including a recently-approved Adjudication Judgement that is currently being implemented with AVEK acting as Watermaster.
	Description and analysis of the amount and location of groundwater pumped by the water supplier for the past five years. Include information on proposed pumping locations and quantities. The description and analysis is to be based on information that is reasonably available, including, but not limited to, historic use records from DWR.	Site-specific historic records are not available. WSA Section 1.3 provides a description of the Project's water requirements.
	Analysis of the location, amount, and sufficiency of groundwater that is projected to be pumped by the water supplier.	WSA Section 3.2. The quantity of water available in the Antelope Valley Groundwater Basin is sufficient for the Project.
	Step 3 (page 21). Documenting project demand (Project Demand Analysis).	WSA Section 1.3. Construction of the Project will require 50-acre feet operation, 3-acre feet per year.
	Step 4 (page 26). Documenting dry year(s) supply.	WSA Section 3.2. Addresses water supply availability including during dry years.
	Step 5 (page 31). Documenting dry year(s) demand.	WSA Section 3.2 addresses annual demands, including dry years and multiple dry years conditions including during dry year scenarios.
Section 6.0 (page 33). Is the projected water supply sufficient or insufficient for the proposed project		WSA Section 4.0 summarizes how the identified water supply/supplies are considered sufficient for the Project.
Section 7.0 (page 35). If the projected supply is determined to be insufficient.	Does the assessment conclude that supply is "sufficient"? If no, continue.	WSA Section 4.0 concludes that sufficient water supplies are available for the Project subject to adjudication approvals.

Guidelines Section Number and Title (DWR, 2003)	Guidelines Direction	Relevant WSA Section and Response
Section 8.0 (page 38). Final SB 610 assessment actions by lead agencies.	The lead agency shall review the WSA and must decide whether additional water supply information is needed for its consideration of the proposed project. The lead agency "shall determine, based on the entire record, whether projected water supplies will be sufficient to satisfy the demands of the project, in addition to existing and planned future uses."	The WSA for the Project must be approved prior to or in concurrence with the EIR.
	The description of the groundwater basin may be excerpted from the groundwater management plan, from DWR Bulleting 118, California's Ground Water, or from some other document that has been published and that discusses the basin boundaries, type of rock that constitutes the aquifer, variability of the aquifer material, and total groundwater in storage (average specific yield times the volume of the aquifer).	WSA Section 2.3.2 provides a description of the groundwater basin characteristics using all available resources, including DWR Bulletin 118.
	In an adjudicated basin the amount of water the urban supplier has the legal right to pump should be enumerated in the court decision.	WSA Section 4.0. The Antelope Valley Groundwater Basin is recently adjudicated and the court-appointed Watermaster has been appointed. The Project Applicant or contractor must receive Watermaster approvals to ensure that Project-related water uses occur in compliance with the Adjudication Judgement.
	The Department of Water Resources has projected estimates of overdraft, or "water shortage", based on projected amounts of water supply and demand (basin management) are projected by the Watermaster agency (AVEK) in WSA Section 3.2, the hydrologic region level in	WSA Section 3.2 Basin groundwater resources are discussed in WSA Section 3.2. The Antelope Valley-Groundwater Basin has, following Adjudication, been evaluated by AVEK.

Guidelines Section Number and Title (DWR, 2003)	Guidelines Direction	Relevant WSA Section and Response
	Bulletin 160, California Water Plan Update. Estimates at the basin or subbasin level will be projected for some basins in Bulletin 118. If the basin has not been evaluated by DWR, data that indicate groundwater level trends over a period of time should be collected and evaluated.	
	If the evaluation indicates an overdraft due to existing groundwater extraction, or projected increases in groundwater extraction, describe actions and/or program designed to eliminate the long term overdraft condition.	WSA Section 3.2. The referenced and Appendicized AVEK (Watermaster) 2015 Urban Water Master Plan describes in detail the subject actions and programs.

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Appendix K

Noise Assessment

ENVIRONMENTAL NOISE ASSESSMENT

ROSAMOND SOUTH SOLAR
KERN COUNTY, CALIFORNIA

WJVA Project No. 20-039

PREPARED FOR

QUAD KNOPF, INC./ QK
5080 CALIFORNIA AVENUE, SUITE 220
BAKERSFIELD, CALIFORNIA 93309

PREPARED BY

WJV ACOUSTICS, INC.
VISALIA, CALIFORNIA

wjv acoustics

AUGUST 26, 2021

Executive Summary

The Project would consist of the construction and operation of a utility-scale solar photovoltaic (PV) electricity generation and energy storage facility that would produce up to 154-megawatt (MW) alternating current (AC) and up to 200 MW of battery energy storage capacity on approximately 1,292 acres. The Project would utilize existing electrical transmission infrastructure that was built as a component of the existing adjacent solar projects.

Environmental Noise Assessment

This Environmental Noise Assessment (ENA) has been prepared to determine if significant noise impacts will be produced by the project and to describe mitigation measures for noise if significant impacts are determined. The ENA, prepared by WJV Acoustics, Inc. (WJVA), is based upon the project Site Plan (Figure 1), a review of noise data provided by the project applicant, a review of manufacturer-supplied noise level data, a review of noise analyses prepared by others for three (3) similar solar projects and project site noise levels collected by WJVA.

Appendix A provides definitions of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported in this analysis are A-weighted sound pressure levels in decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound ina manner similar to the human ear. Most community noise standards utilize A-weighted sound levels, as they correlate well with public reaction to noise. Appendix B provides typical A-weighted sound levels for common noise sources.

Impact Summary

- Based upon the above-described assumptions, noise level data provided by the project applicant and noise level data reviewed by WJVA from previous studies, WJVA calculated project-related noise levels at the closest off-site sensitive receptors to be in the range of 28-40 dB L_{50} (Willow Springs Specific Plan noise level standard is 55 dB L_{50} during daytime hour and 45 dB L_{50} during nighttime hours). Additionally, project related noise levels were calculated to be in the range of 34-46 dB L_{dn} (Kern County General Plan noise level standard is 65 dB L_{dn}). Calculated project-related noise levels would not be expected to exceed any Willow Springs Specific Plan or Kern County noise level standards at any nearby sensitive receptor location.

- Construction noise would not be considered a significant impact as long as any construction activities that occur within 1,000 feet of a residence are limited to between the hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends, as required by Kern County.

- Pile driving activities should not occur within 100 feet of an existing sensitive receptor location. After full project build out, it is not expected that ongoing project operational activities will result in any vibration impacts at nearby sensitive receptors.

1. INTRODUCTION

Project Description

The Project would consist of the construction and operation of a utility-scale solar photovoltaic (PV) electricity generation and energy storage facility that would produce up to 154 MW ac and up to 200 MW of battery energy storage capacity on approximately 1,292 acres. The Project would utilize existing electrical transmission infrastructure that was built as a component of the existing adjacent solar projects.

The Project site is located in the southeast portion of unincorporated Kern County, in the Antelope Valley region, within Section 24 Township 9 North, Range 15 West, Sections 20, 21, 27, and 28, Township 9 North, Range 14 West, and Section 30 and 31, Township 9 North, Range 13 West, San Bernardino Base and Meridian. The Project site isbounded by Rosamond Boulevard to the north, 125th Street West to the east, West Avenue A to the south and 170th Street West to the west. The project is located within the Willow Springs SpecificPlan Area.

The Project site is characterized as undeveloped and/or previously disturbed land. The site is surrounded by operational or approved solar projects on all sides interspersed with undeveloped land. There are scattered residences located in the vicinity as well.

2. THRESHOLDS OF SIGNIFICANCE

The CEQA Guidelines apply the following questions for the assessment of significant noise impacts for a project:

- **a.** Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

- **b.** Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

- **c.** For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

a. Noise Level Standards

Kern County

The Kern County Noise Element of General Plan[1] establishes noise level criteria in terms of the Day-Night Average Level (L_{dn}) metric. The L_{dn} is the time-weighted energy average noise level for a 24-hour day, with a 10 dB penalty added to noise levels occurring during the nighttime hours (10:00 p.m.-7:00 a.m.). The L_{dn} represents cumulative exposure to noise over an extended period of time and is therefore calculated based upon *annual average* conditions.

The Noise Element establishes a land use compatibility criterion of 65 dB L_{dn} for exterior noise levels in outdoor activity areas of residential uses. Outdoor activity areas generally include backyards of single-family residences and individual patios or decks of multi-family developments. The intent of the exterior noise level requirement is to provide an acceptable noise environment for outdoor activities and recreation.

The Noise Element also requires that interior noise levels attributable to exterior noise sources not exceed 45 dB L_{dn}. The intent of the interior noise level standard is to provide an acceptable noise environment for indoor communication and sleep.

Willow Springs Specific Plan

The project is located within the Willow Springs Specific Plan[2] (WSSP) area. The WSSP was adopted by Kern County in 2008, and provides noise-related policy, guidelines and standards applicable to the project. The WSSP establishes a daytime noise level standard of 55 dB L_{50} and a nighttime noise level standard of 45 dB L_{50}, for noise-sensitive land uses (residential). Additionally, the

WSSP establishes a 65 dB L_{dn}/CNEL standard (as established in the Kern County General Plan). The WSSP does not specially define daytime and nighttime hours, however, daytime hours are generally considered 7:00 a.m. to 10:00 p.m. and nighttime hours are generally considered 10:00 p.m. to 7:00 a.m. For the purpose of this analysis, these are the assumed daytime and nighttime hours applicable to the WSSP noise standards.

State of California

There are no state noise standards that are applicable to the project.

Federal Noise Standards

There are no federal noise standards that are applicable to the project.

b. Construction Noise and Vibration

Section 8.36 (Noise Control) of the Kern County Code of Ordinances limits construction to the hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends, when construction is within 1,000 feet of a residence. Certain exceptions to these hours are specified in the code.

Kern County does not have regulations that define acceptable levels of vibration. One of the most recent references suggesting vibration guidelines is the California Department of Transportation (Caltrans) Transportation and Construction Vibration Guidance Manual[3]. The Manual provides guidance for determining annoyance potential criteria and damage potential threshold criteria. These criteria are provided below in Table I and Table II, and are presented interms of peak particle velocity (PPV) in inches per second (in/sec).

TABLE I

GUIDELINE VIBRATION ANNOYANCE POTENTIAL CRITERIA

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely Perceptible	0.04	0.01
Distinctly Perceptible	0.25	0.04
Strongly Perceptible	0.9	0.1
Severe	2.0	0.4

Source: Caltrans Guidance Manual, 2013

TABLE II

GUIDELINE VIBRATION DAMAGE POTENTIAL THRESHOLD CRITERIA

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile, historic buildings, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Caltrans Guidance Manual, 2013

3. SETTING

The Project site is located approximately 11 miles west of the community of Rosamond in the western Antelope Valley, in the far western Mojave Desert. It is located approximately 50 miles southeast of the city of Bakersfield, within Kern County.

The project site consists of approximately 1,292 acres of undeveloped and/or previously disturbed land, spread across several parcels in the overall project vicinity. The site is surrounded by operational or approved solar projects on all sides interspersed with undeveloped land. There are scattered residences located in the vicinity as well.

a. Background Noise Level Measurements

Existing ambient noise levels within the project vicinity are dominated by traffic noise along adjacent roadways and occasional aircraft overflights (Edwards Air Force Base). Additional sources of noise observed during the ambient noise measurements included noise associated with birds, barking dogs and occasional high wind.

Measurements of existing ambient noise levels in the project vicinity were conducted on January 20, 2021. Long-term (24-hour) ambient noise level measurements were conducted at three (3) locations (LT-1, LT-2 and LT-3) and short-term (15-minute) ambient noise measurements were conducted at four (4) additional locations (Sites ST-1, ST-2, ST-3 and ST-4). The locations of the ambient noise measurement sites were selected as they represent residential land uses adjacent to or in the overall vicinity of project site boundaries. The locations of the ambient noise measurement sites are provided as Figure 2.

Noise monitoring equipment consisted of Larson-Davis Laboratories Model LDL-820 sound level analyzers equipped with B&K Type 4176 1/2” microphones. The equipment complies with the specifications of the American National Standards Institute (ANSI) for Type I (Precision) sound level meters. The meters were calibrated with a B&K Type 4230 acoustic calibrator to ensure the accuracy of the measurements.

Measured hourly energy average noise levels (L_{eq}) at site LT-1 ranged from a low of 40.2 dB between midnight and 1:00 a.m. to a high of 59.6 dBA between noon and 1:00 p.m. Hourly maximum (L_{max}) noise levels at site LT-1 ranged from 65.1 to 79.5 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 21.1 to 49.6 dBA. The L_{90} is a statistical descriptor that defines the noise level exceeded 90% of the time during each hour of the sample period. The L_{90} is generally considered to represent the residual (or background) noise level in the absence of identifiable single noise events from traffic, aircraft and other local noise sources. The measured L_{dn} value at site LT-was 60.6 dB L_{dn}. Figure 3 graphically depicts hourly variations in ambient noise levels at site LT-1 and provides a photograph of measurement site LT-1.

Measured hourly energy average noise levels (L_{eq}) at site LT-2 ranged from a low of 23.4 dB between 1:00 a.m. and 2:00 a.m. to a high of 56.5 dBA between 1:00 p.m. and 2:00 p.m. Hourly maximum (L_{max}) noise levels at site LT-2 ranged from 38.0 to 79.6 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 21.0 to 42.2 dBA. The measured L_{dn} value at site LT-2 was 48.5 dB L_{dn}. Figure 4 graphically depicts hourly variations in ambient noise levels at site LT-2 and provides a photograph of measurement site LT-2.

Measured hourly energy average noise levels (L_{eq}) at site LT-3 ranged from a low of 24.5 dB between midnight and 1:00 a.m. to a high of 60.5 dBA between noon and 1:00 p.m. Hourly maximum (L_{max}) noise levels at site LT-3 ranged from 38.2 to 77.3 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 19.5 to 47.2 dBA. The measured L_{dn} value at site LT-3 was 50.8 dB L_{dn}. Figure 5 graphically depicts hourly variations in ambient noise levels at site LT-3 and provides a photograph of measurement site LT-3.

Table III summarizes short-term noise measurement results. The noise measurement data included energy average (L_{eq}) maximum (L_{max}) as well as five individual statistical parameters. Observations were made of the dominant noise sources affecting the measurements. The statistical parameters describe the percent of time a noise level was exceeded during the measurement period. For instance, the L_{90} describes the noise level exceeded 90 percent of the time during the measurement period, and is generally considered to represent the residual (or background) noise level in the absence of identifiable single noise events from traffic, aircraft and other local noise sources.

TABLE III

SUMMARY OF SHORT-TERM NOISE MEASUREMENT DATA
ROSAMOND SOUTH SOLAR, KERN COUNTY
JANUARY 20, 2021

Site	Time	A-Weighted Decibels, dBA							Sources
		L_{eq}	L_{max}	L_2	L_8	L_{25}	L_{50}	L_{90}	
ST-1	12:20 p.m.	44.3	63.5	53.6	38.2	31.1	28.3	26.4	TR, B
ST-2	12:55 p.m.	54.6	77.4	58.4	47.1	36.2	30.7	27.5	TR, AC
ST-3	1:30 p.m.	58.8	75.7	71.5	53.8	37.8	33.1	28.9	TR,D
ST-4	1:55 p.m.	57.7	80.2	63.7	47.5	42.0	38.6	33.5	TR, AC

Source: WJV Acoustics, Inc.

The overall noise level measurements conducted in the project vicinity indicate that existing ambient noise levels in the project vicinity are relatively low, and are indicative of a rural area with land uses consisting mostly of solar activities with dispersed residential land uses.

4. PROJECT OPERATIONAL NOISE

Typical noise-producing equipment associated with the proposed project includes PV and BESS inverters and associated AC/chiller units, PV trackers and substation with step-up transformers. The expected equipment types and locations were provided by the project applicant. WJVA determined the associated noise levels based on a review of manufacturer-supplied noise level data and numerous acoustical analyses prepared for other similar projects incorporating similar project components. The noise levels described below should be considered generalized in nature in regards to project-related noise levels at nearby noise-sensitive land uses.

The project site is broken up into four (4) individual CUP (Conditional Use Permit) areas (CUP Area 1, CUP Area 2, CUP Area3 and CUP Area 4). These individual CUP areas are shown on Figure 1 (Site Layout). The analysis of project-related operational noise, presented below, will address project-related noise levels at the closest sensitive receptor locations to each individual CUP area. The manufacturer-supplied noise data and report excerpts referenced in this analysis are provided as Appendix C.

PV Inverters

According to the project applicant (Golden Fields Solar IV, LLC), the proposed project would utilize Power Electronics Freesun PV inverters. WJVA reviewed the manufacturer supplied technical specifications, which indicate that the inverters produce varying noise levels dependent on the angle and direction form the inverter unit, the loudest being from the rear of the unit, 80.5 dB at a distance of 1-meter (approximately 70 dB at ten (10) feet). According to the project applicant, the project would include approximately 47 PV inverters, which would be located throughout the PV arrays.

The PV inverters would be evenly distributed throughout the PV arrays. Reference to the project site plans indicate that the PV inverters would be located at distances of at least 600 feet from each other. At a distance of 600 feet, the noise associated with the PV inverter would be 34.5 dB. Because decibels are logarithmic in nature, they cannot be added arithmetically. A noise level 70 dB added to another noise level of 34.5 dB results in a combined noise level of 70 dB. Therefore, despite the overall incorporation of 57 PV inverters, due to the distance between each unit, noise levels at any one location would not be subject to the additive nature of multiple PV inverter noise levels.

Applying the noise levels associated with PV inverters, 70 dB at a distance of ten feet from the source, noise levels associated with inverters would not exceed the County's 65 dB L_{dn} exterior noise level standard provided that a minimum setback distance of 40 feet is maintained between inverter locations and any off-site noise-sensitive receptor. However, a minimum setback distance of 175 feet is required to comply with the WSSP nighttime noise level standardof 45 dB L_{50}. This determination applies the noise level of 70 dB at a distance of ten feet, assumes the standard rate of noise attenuation with increased distance from a point source (-6 dB/doubling of distance) and assumes constant, 24-hour production of such noise levels. The closest proposed PV inverter location to a sensitive receptor (vicinity of R-7) is approximately 500 feet. At this setback distance the associated noise levels would be approximately 42 dB L_{dn} and 36 dB L_{50}.

Trackers

The project would potentially include the use of Gemini Tracker System by Nextracker. According to information provided by through correspondence with Nextracker staff, the tracker motor produces noise levels of approximately 70-72 dB at a distance of one (1) meter from the motor. These applied noise levels were provided through direct dialogue with Nextracker representatives. Taking into account the standard rate of noise attenuation with increased distance from a point source (-6 dB/doubling of distance), noise levels associated with the Gemini Trackers would be in the range of approximately 40-42 dB at a distance of 100 feet from the source. Such noise levels would not exceed any applicable noise level standards or be audible over existing ambient noise levels at any nearby sensitive receptor locations. The closest locations of the PV trackers to noise sensitive receptors would be a distance of approximately 100 feet (vicinity of R-5), at which distance noise levels associated with the intermittent tracker noise would be approximately 40-42 dB.

Substation/Transformer

According to the project site plan, there would be up to five (5) substation locations. Substations typically include step-up transformers. WJVA has reviewed noise level data associated with various models of inverters, previously analyzed for other projects and noise studies prepared by others (Dudek, 2017[4] and ICF, 2019[5]). Based upon this review, WJVA estimates that noise levels associated with inverters typically range from approximately 70 to 75 dB at a distance of 3 feet from the source.

Applying the loudest reviewed noise levels associated with substation/transformer operations, 75 dB at a distance of three feet from the source, noise levels associated with inverters would not exceed the County's 65 dB L_{dn} exterior noise level standard provided that a minimum setback distance of twenty-five (25) feet is maintained between substation/transformer locations and any off- site noise-sensitive receptor. This determination assumes a constant noise level of 75 dB (L_{eq}) at a distance of three feet, over an entire 24-hour period, and applied to the calculation for the Day/Night Level (L_{dn}), the calculation is described above in Section 2.a. A minimum setback distance of 100 feet would be required to maintain compliance with the WSSP nighttime noise level standard of 45 dB L_{50}. This determination applies the worst-case noise level of 75 dB at a distance of three feet and assumes constant, 24-hour production of such noise levels.

Battery Energy Storage System (BESS)

According to the project applicant, the project would include site plan up to 57 BESS inverter skids, with each incorporating 28 chiller units per BESS skid. According to the project applicant, depending on final project design the BESS components could be entirely located at any one of the four (4) CUP areas or dispersed throughout multiple CUP areas. The project site plan provides a potential 5-acre BESS area within each of the four CUP areas. For the purpose of this analysis, project noise levels were calculated assuming all of the BESS components were entirely located at each of the four designated BESS areas in each CUP area.

The project would utilize Power Electronics PCSM 3510 BESS inverters, with Shenzen Envirocool Technology chillers (model EMW25HDNC1A). Manufacturer-supplied noise level data indicates that the associated noise levels of these components are 71 dB at one meter for the chiller units and 79 dB at one meter for the BESS inverter units. The data sheets for these components are provided as Appendix C.

Each BESS skid containing one BESS inverter (79 dB at one meter) and 28 chiller units (71 dB at one meter) would result in a total combined noise level of approximately 87 dB at a distance of one meter, when the noise sources are added (logarithmically) together. The inverter units would be evenly dispersed throughout the designated BESS areas. WJVA reviewed a typical BESS general layout provided by the project applicant, which indicates that BESS inverter spacing would be expected to be approximately thirty (30) feet offset from each other, within the overall BESS area. At a distance of thirty feet, the noise associated with each BESS skid would be approximately 68 dB (assuming the standard rate of attenuation with increased distance from a point source, -6db/doubling of distance). When 68 dB is added to 87 dB, the resulting combined noise level remains 87 dB. Therefore, as a result of overall equipment spacing within the BESS areas, noise levels associated with combined BESS units would never exceed that of one individual unit at any location. Therefore, the noise levels associated with BESS areas would not exceed 87 dB at a distance of one meter at any location.

Applying the combined BESS noise source noise levels of 87 dB at a distance of one meter from the source, noise levels associated with BESS operations would not exceed the County's 65 dB L_{dn} exterior noise level standard provided that a minimum setback distance of 90 feet is maintained between BESS locations and any off-site noise-sensitive receptor. A minimum setback distance of 400 feet would be required to maintain compliance with the WSSP nighttime noise level standard of 45 dB L_{50}. This assumes a constant 24-hour noise level of 87 dB at a distance of one meter, and therefore represents a worst-case assessment of project-related noise levels.

Electrical Transmission Lines (Gen-Tie Lines)

The project would include overhead electrical transmission lines, generally referred to as gen-tie lines. The exact gen-tie line routes are not known at this time, and a few options are being considered. Gen-tie lines are used to facilitate the transmission of generated electricity to off-site stations. Noise associated with gen-tie lines are considered negligible and are generally limited to noise associated with corona discharge. The noise is often described as a crackling or humming sound, and associated noise levels could be expected to be approximately 25 dB at a distance of 25 feet from the source. Such noise levels are negligible and inaudible outside of a few feet from the source.

Maintenance Activities

Maintenance activities associated with project operation would be minimal in nature. The project would include one O&M (operations and maintenance) building, located adjacent to the BESS/Substation area in CUP Area 2. The O&M facility would include a building and storage yard area. Noise associated with the O&M facility would generally be limited to HVAC (heating, ventilation and air conditioning) units, with an estimated noise level of approximately 75-80 dB at a distance of ten (10) feet from the source. Such noise levels are negligible and inaudible atany nearby sensitive receptor location.

Additionally, the washing of solar panels is expected to occur approximately twice per year. Noise levels associated with washing operations would be intermittent and temporal in nature, and would not result in a significant impact at any nearby sensitive receptor locations.

Project-Related Noise Levels at Closest Off-Site Sensitive Receptors

As described above, there are four (4) individual CUP Areas for the project. Project-related noise levels were calculated for sensitive receptors located in the proximity of each CUP Area, based upon proposed project equipment within each CUP Area and distances from the equipment to the sensitive receptor locations. Figure 6 provides the locations of these sensitive receptors. For the purpose of the calculations, WJVA applied the following assumptions:

- The loudest noise levels for the above-described range of noise levels for each noise-producing equipment was applied.

- All noise-producing equipment was in continuous, 24-hour operation.

- No acoustical shielding or atmospheric absorption was assumed. All noise levels applied attenuation with increased distance from a point source (-6 dB/doubling of distance).

- The distances from each noise-producing equipment to each sensitive receptor was determined based upon the project site plan provided by the applicant.

Using the above-described noise level data and assumptions, overall project noise level exposure was calculated for sensitive receptors located in the vicinity of each CUP Area (if applicable). Table IV provides the combined noise level exposure at each of the nine closest sensitive receptors to proposed project noise-producing equipment. Noise levels provided in Table IV are in terms of the L_{dn} metric (Kern County standard) and the L_{50} metric (WSSP standards).

TABLE IV

SUMMARY OF PROJECT-RELATED NOISE LEVELS AT RECEPTOR LOCATIONS
ROSAMOND SOUTH SOLAR, KERN COUNTY

Site	A-Weighted Decibels, dBA			Combined Noise Exposure		Noise Impact (Exceeds Standards?)
	PV Inverter	Substation	BESS	dB L_{50}	dB L_{dn}	
R-1	27	11	22	28	34	No
R-2	28	12	24	30	36	No
R-3	30	12	24	31	37	No
R-4	28	9	21	29	35	No
R-5	29	8	20	30	36	No
R-6	34	11	24	34	40	No
R-7	32	25	39	40	46	No
R-8	33	19	31	35	41	No
R-9	30	10	22	31	37	No

Source: WJV Acoustics, Inc.

Reference to Table IV indicates that project-related noise levels would not be expected to exceed any applicable Kern County or Willow Springs Specific Plan noise level standards. Additionally, the noise levels provided in Table IV would not exceed existing (without project) ambient noise levels at the locations of nearby sensitive receptors. Additional mitigation measures would not be required.

5. CONSTRUCTION NOISE

Construction noise could occur at various locations within and near the project site through the build-out period. There are numerous existing residential land uses in the general vicinity of the project sites, all of which are at distances of 300 feet or greater than. Table V provides typical construction-related noise levels at distances of 100 feet, 300 feet, and 500 feet.

Construction activities would be temporary in nature and would most likely occur only during the daytime hours. Per section 8.36 of the Kern County Code of Ordinances, any construction activities that occur within 1,000 feet of a residence must be limited to between the hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends. Construction noise impacts could result in annoyance or sleep disruption for nearby residents if nighttime operations were to occur or if equipment is not properly muffled or maintained.

Noise impacts associated with construction activities typically depend on the noise levels generated by the type of equipment in use, the duration of usage of the equipment and the distance at which the equipment is used in respect to nearby sensitive receptors. Noise impacts typically occur when construction activities occur beyond the limited hours of construction and/or within close proximity to sensitive receptors (residential land uses). However, noise levels associated with construction activities could be considered a short-term impact in regards to a temporary increase over existing ambient noise levels.

TABLE V TYPICAL CONSTRUCTION EQUIPMENT MAXIMUM NOISE LEVELS, dBA			
Type of Equipment	100 Ft.	300 Ft.	500 Ft.
Backhoe	72	62	58
Compactor (ground)	77	67	63
Compressor (air)	72	62	58
Concrete Batch Plant	77	67	63
Concrete Mixer Truck	73	63	59
Concrete Saw	84	74	70
Crane	75	65	61
Dozer	76	66	62
Dump Truck	70	60	56
Flat Bed Truck	68	58	54
Excavator	75	65	61
Front End Loader	73	63	59
Generator	75	65	61
Grader	79	69	65
Impact or Vibratory Pile Driver	95	85	81
Jackhammer	83	73	69
Paver	71	61	57
Pneumatic Tools	79	69	65
Pumps	75	65	61
Rollers	74	64	60
Tractor	78	68	64

Source: FHWA Construction Handbook, 2006

Potential Impact:
A noise impact could occur if construction activities do not incorporate appropriate mitigation measures and best management practices.

Mitigation Measures:
Noise levels associated with construction activities may be effectively mitigated by incorporating noise mitigation measures and appropriate best management practices. The following mitigation measures and best management practices should be applied during periods of project construction.

- Per the Kern County Code of Ordinances, any construction activities that occur within 1,000 feet of a residence must be limited to between the hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends

- All construction equipment shall be properly maintained and muffled as to minimize noise generation at the source.

- Noise-producing equipment shall not be operating, running, or idling while not in immediate use by a construction contractor.

- All noise-producing construction equipment shall be located and operated, to the extent possible, at the greatest possible distance from any noise-sensitive land uses.

- Locate construction staging areas, to the extent possible, at the greatest possible distances from any noise-sensitive land uses.

- Signs shall be posted at the construction site and near adjacent sensitive receptors displaying hours of construction activities and providing the contact phone number of a designated noise disturbance coordinator.

Decommissioning Noise

A typical solar project as that proposed has an anticipated operational life of 35 years. After this time period, the project owner may choose to either update project site equipment and technology (recommission) or demolish and remove project equipment (decommissioning). Noise associated with decommissioning activities would be expected to be comparable to those described above for construction activities associated with equipment types. Decommissioning activities would be considered construction activities, and must adhere to the same allowable hours of activity as provided in the Kern County Code of Ordinances. If project decommissioning occurs, associated noise levels would not warrant a specific noise analysis and should be assessed based upon the findings of this analysis.

6. VIBRATION IMPACTS

The dominant sources of man-made vibration are sonic booms, blasting, pile driving, pavement breaking, demolition, diesel locomotives, and rail-car coupling. Pile driving may occur during project construction. Vibration from construction activities could be detected at the closest sensitive land uses, especially during movements by heavy equipment or loaded trucks and during some paving activities (if they were to occur). Typical vibration levels at distances of 100 feet and 300 feet are summarized by Table VI.

The solar panels would be supported on posts or piers that would be driven into the ground. Vibration levels associated with pile driving activities could be considered between barely perceptible and strongly perceptible (dependent on frequency of use) at a distance of 100 feet from a sensitive receptor and have the potential to cause damage to buildings deemed fragile, extremely fragile, historic and ancient monuments (dependent on frequency of use) at a distance of 100 feet from the receptor, as provided above in Table I and Table II.

TABLE VI

TYPICAL VIBRATION LEVELS DURING CONSTRUCTION

	PPV (in/sec)	
Equipment	**@ 100´**	**@ 300´**
Bulldozer (Large)	0.011	0.006
Bulldozer (Small)	0.0004	0.00019
Loaded Truck	0.01	0.005
Jackhammer	0.005	0.002
Vibratory Roller	.03	0.013
Caisson Drilling	.01	0.006
Vibratory Pile Driver	0.14	0.042

Source: Caltrans Guidance Manual, 2013

After full project build out, it is not expected that ongoing project operational activities will result in any vibration impacts at nearby sensitive receptors. Additional mitigation is not required.

7. NOISE IMPACTS FROM NEARBY AIRPORTS OR AIRSTRIPS (NO IMPACT)

The Project site is not located within two miles of a public airport or private airstrip.

8. IMPACT SUMMARY

- Based upon the above-described assumptions, noise level data provided by the project applicant and noise level data reviewed by WJVA from previous studies, WJVA calculatedproject-related noise levels at the closest off-site sensitive receptors to be in the range of 28-40 dB L_{50} (Willow Springs Specific Plan noise level standard is 55 dB L_{50} during daytimehour and 45 dB L_{50} during nighttime hours). Additionally, project related noise levels were calculated to be in the range of 34-46 dB L_{dn} (Kern County General Plan noise level standard is 65 dB L_{dn}). Calculated project-related noise levels would not be expected to exceed any Willow Springs Specific Plan or Kern County noise level standards at any nearby sensitive receptor location.

- Construction noise would not be considered a significant impact as long as any construction activities that occur within 1,000 feet of a residence are limited to betweenthe hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends, as required by Kern County.

Potential Impact:
A noise impact could occur if construction activities do not incorporate appropriate mitigation measures and best management practices.

Mitigation Measures:
Noise levels associated with construction activities may be effectively mitigated by incorporating noise mitigation measures and appropriate best management practices. The following mitigation measures and best management practices should be applied during periods of project construction.

- Per the Kern County Code of Ordinances, any construction activities that occur within 1,000 feet of a residence must be limited to between the hours of 6:00 a.m. to 9:00 p.m. on weekdays, and between 8:00 a.m. and 9:00 p.m. on weekends

- All construction equipment shall be properly maintained and muffled as to minimize noise generation at the source.

- Noise-producing equipment shall not be operating, running, or idling while not in immediate use by a construction contractor.

- All noise-producing construction equipment shall be located and operated, to the extent possible, at the greatest possible distance from any noise-sensitive land uses.

- Locate construction staging areas, to the extent possible, at the greatest possible distances from any noise-sensitive land uses.

- Signs shall be posted at the construction site and near adjacent sensitive receptors displaying hours of construction activities and providing the contact phone number of a designated noise disturbance coordinator.

9. SOURCES CONSULTED

1. County of Kern, 2009, *Kern County General Plan Noise Element.* September 22, 2009

2. County of Kern, 2009, *Willow Springs Specific Plan.* April 1, 2008

3. California Department of Transportation, *Transportation and Construction Vibration Guidance Manual,* September 2013.

4. Dudek, *Acoustical Assessment Report for the Ord Mountain Solar and Energy Storage and Calcite Substation Project*. October, 2017

5. Federal Highway Administration (FHWA) *Construction Handbook*, August, 2006

6. ICF, *Final Noise Technical Report, Big Beau Solar Project.* July, 2019.

FIGURE 1: SITE PLAN

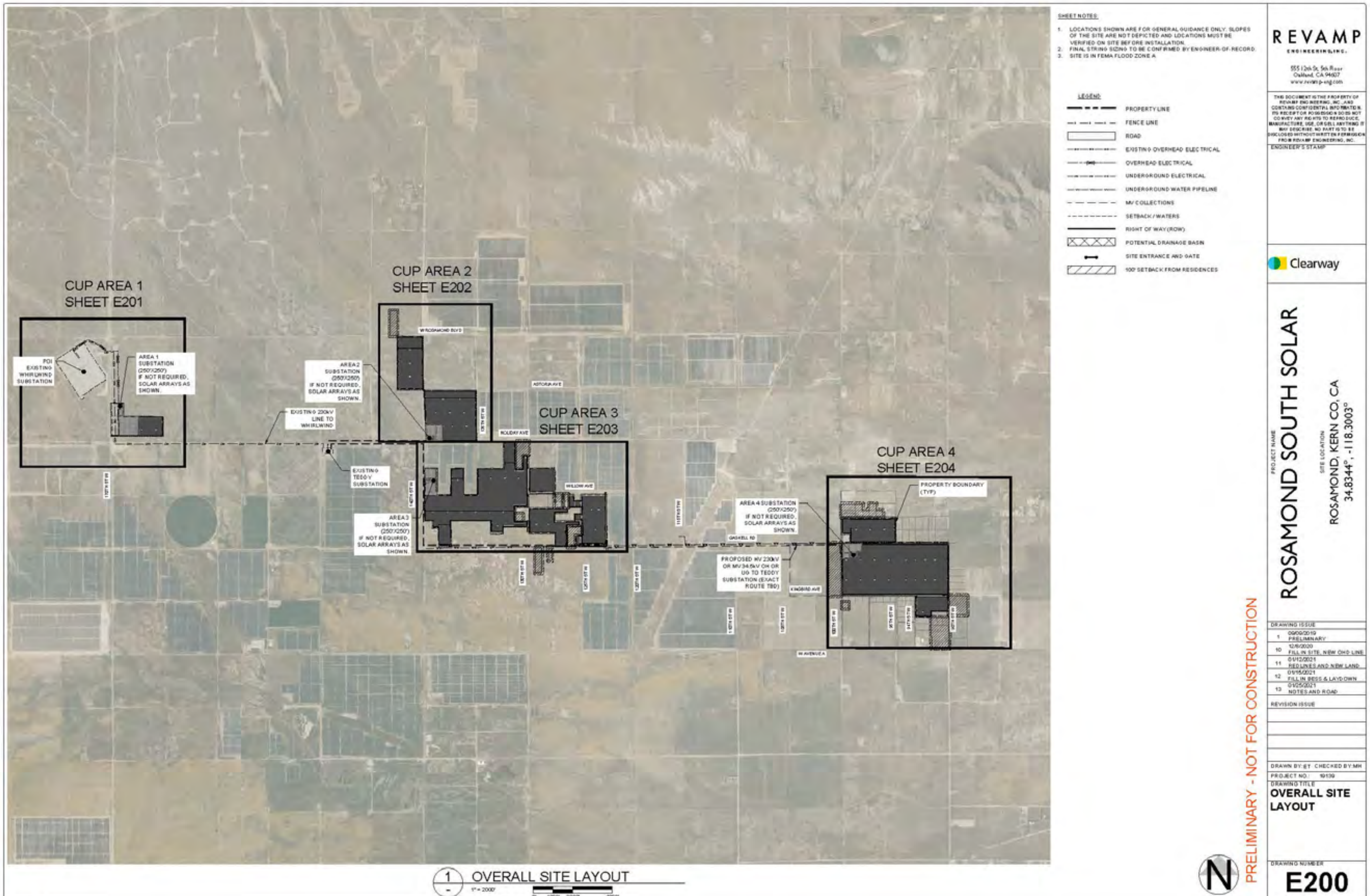


FIGURE 2: PROJECT SITE VICINITY AND AMBIENT NOISE MEASUREMENT LOCATIONS

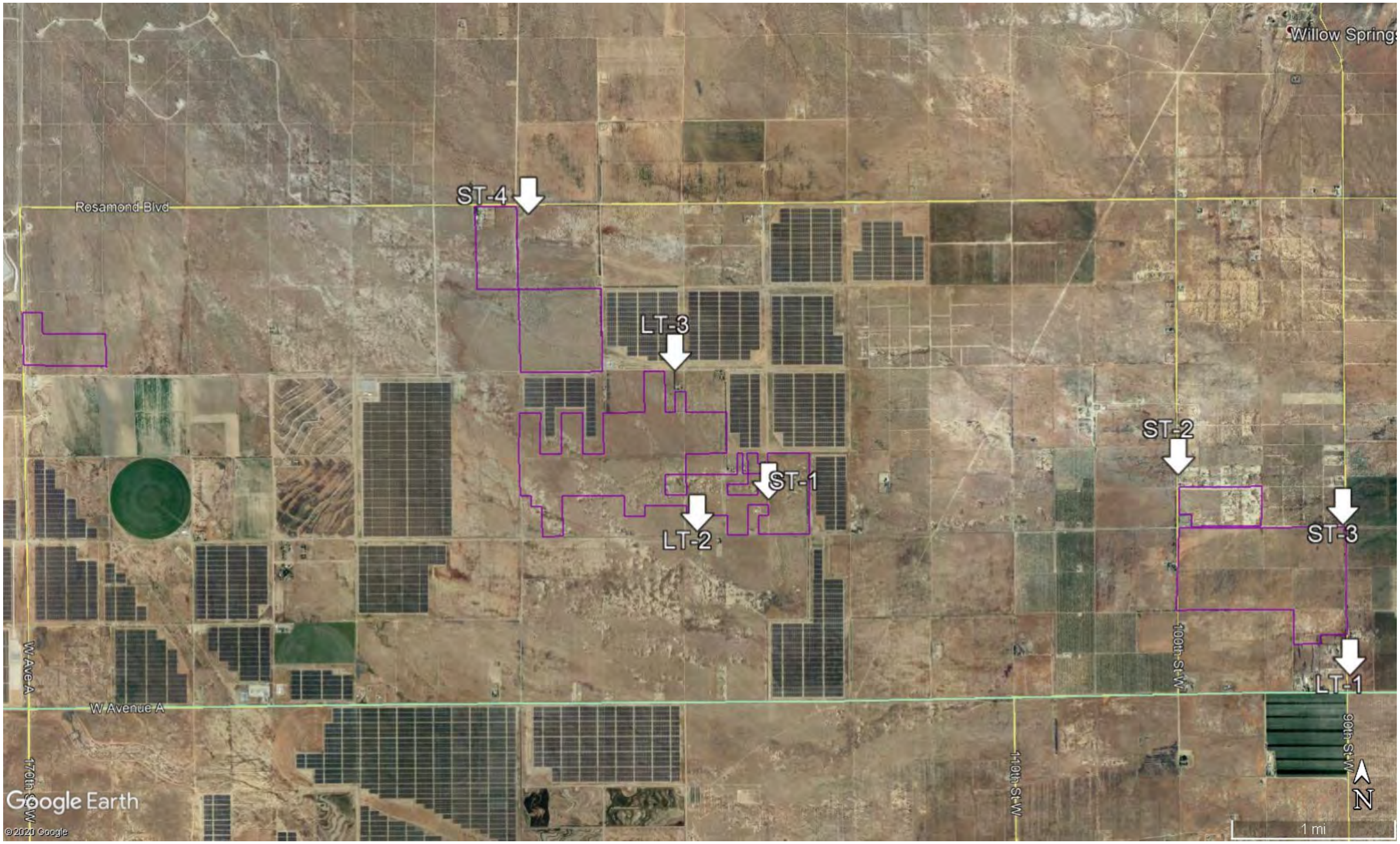


FIGURE 3: AMBIENT NOISE MONITORING SITE LT-1

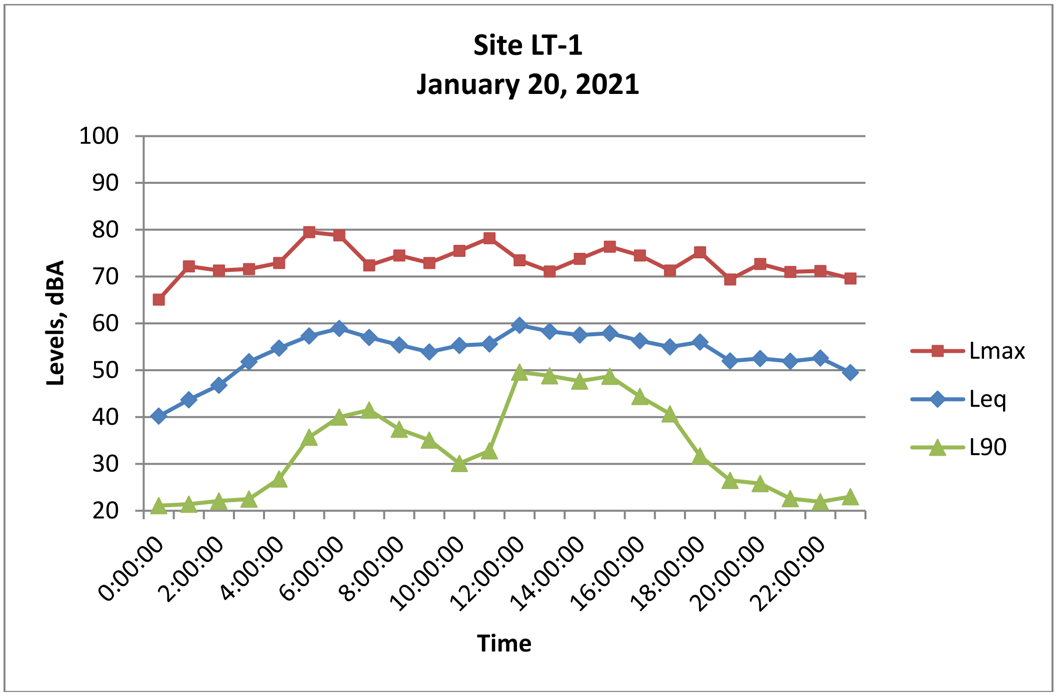


FIGURE 4: AMBIENT NOISE MONITORING SITE LT-2

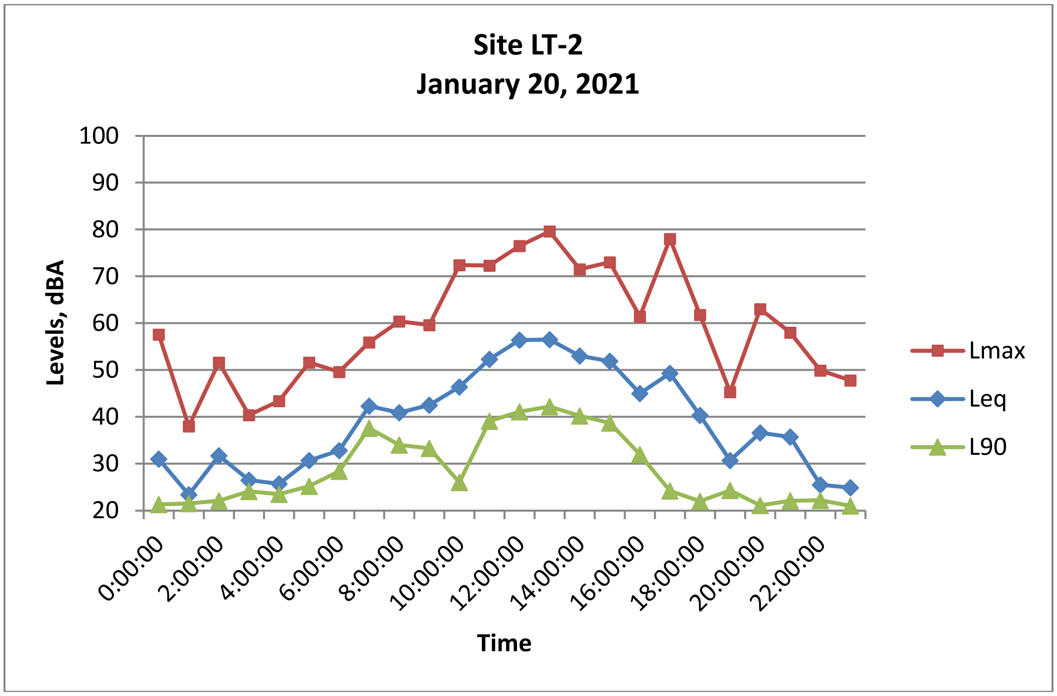


FIGURE 5: AMBIENT NOISE MONITORING SITE LT-3

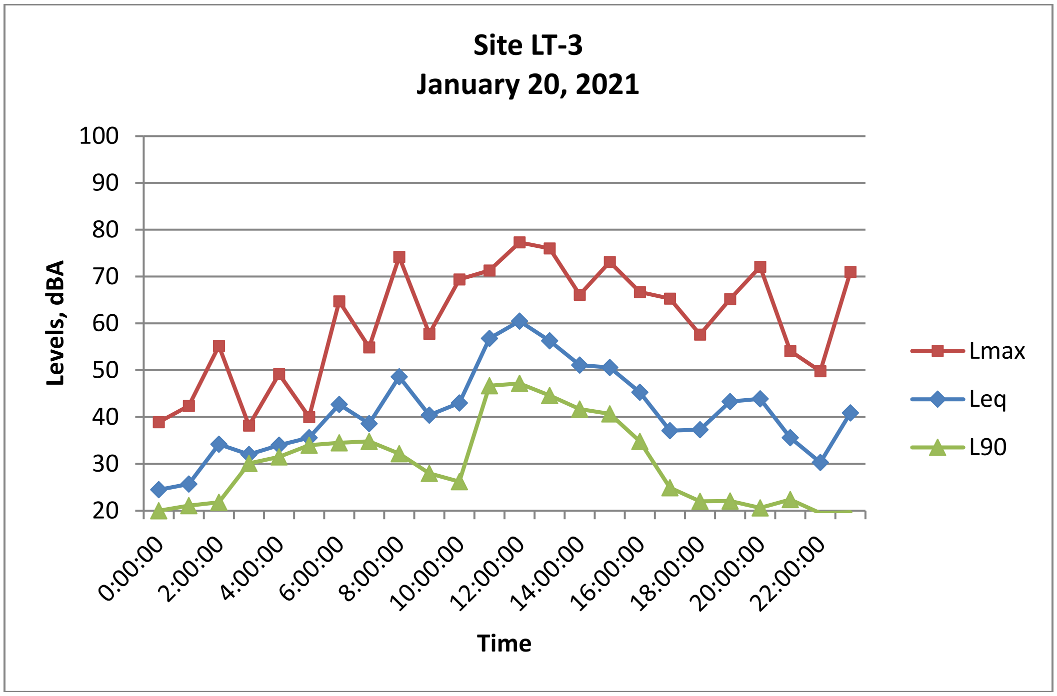
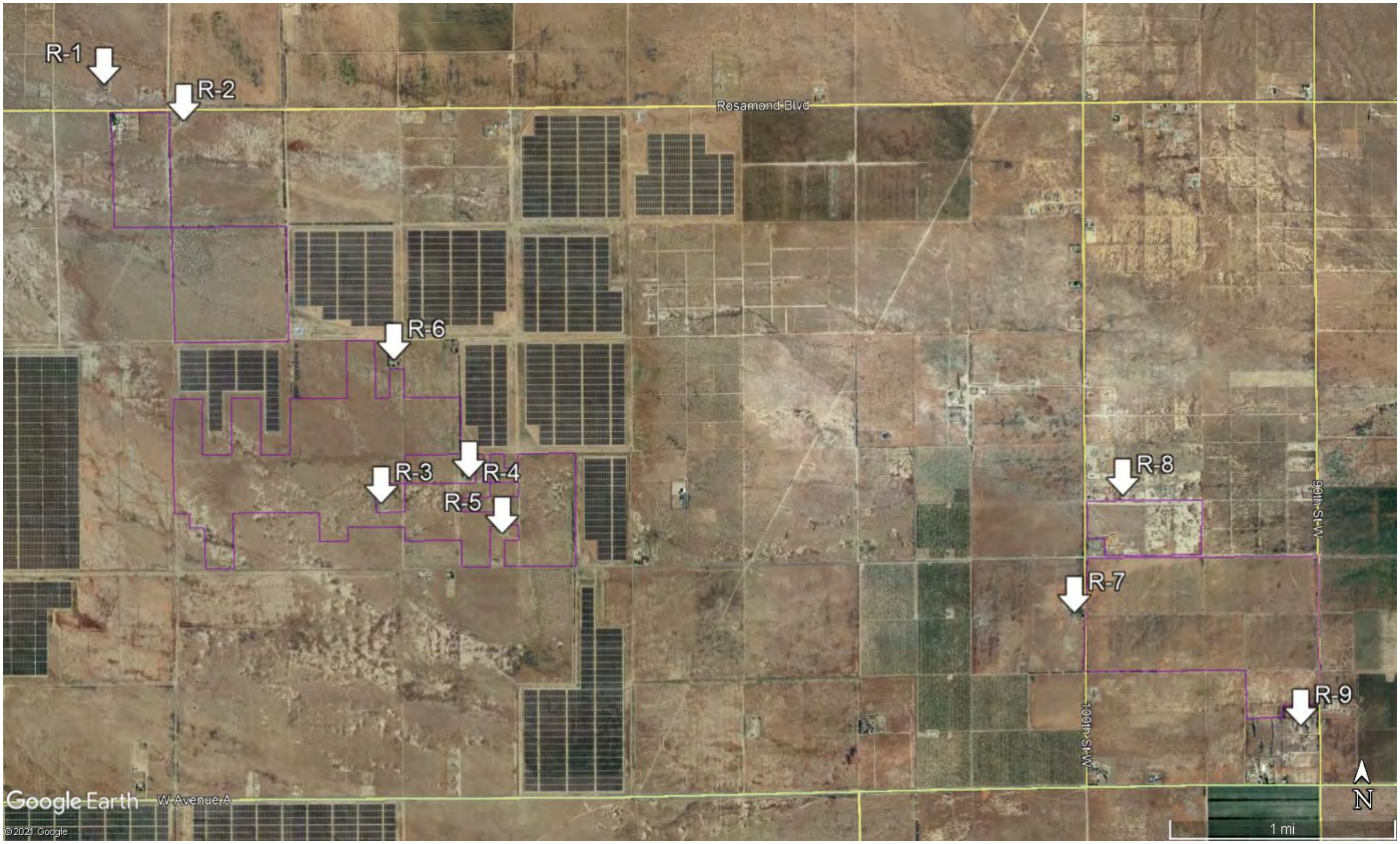


FIGURE 6: LOCATIONS OF ANALYZED SENSITIVE RECEPTORS



APPENDIX A

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/L_{dn}: Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum noise level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval (L_{90}, L_{50}, L_{10}, etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

A-2

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and L_{dn} contours are frequently utilized to describe community exposure to noise.

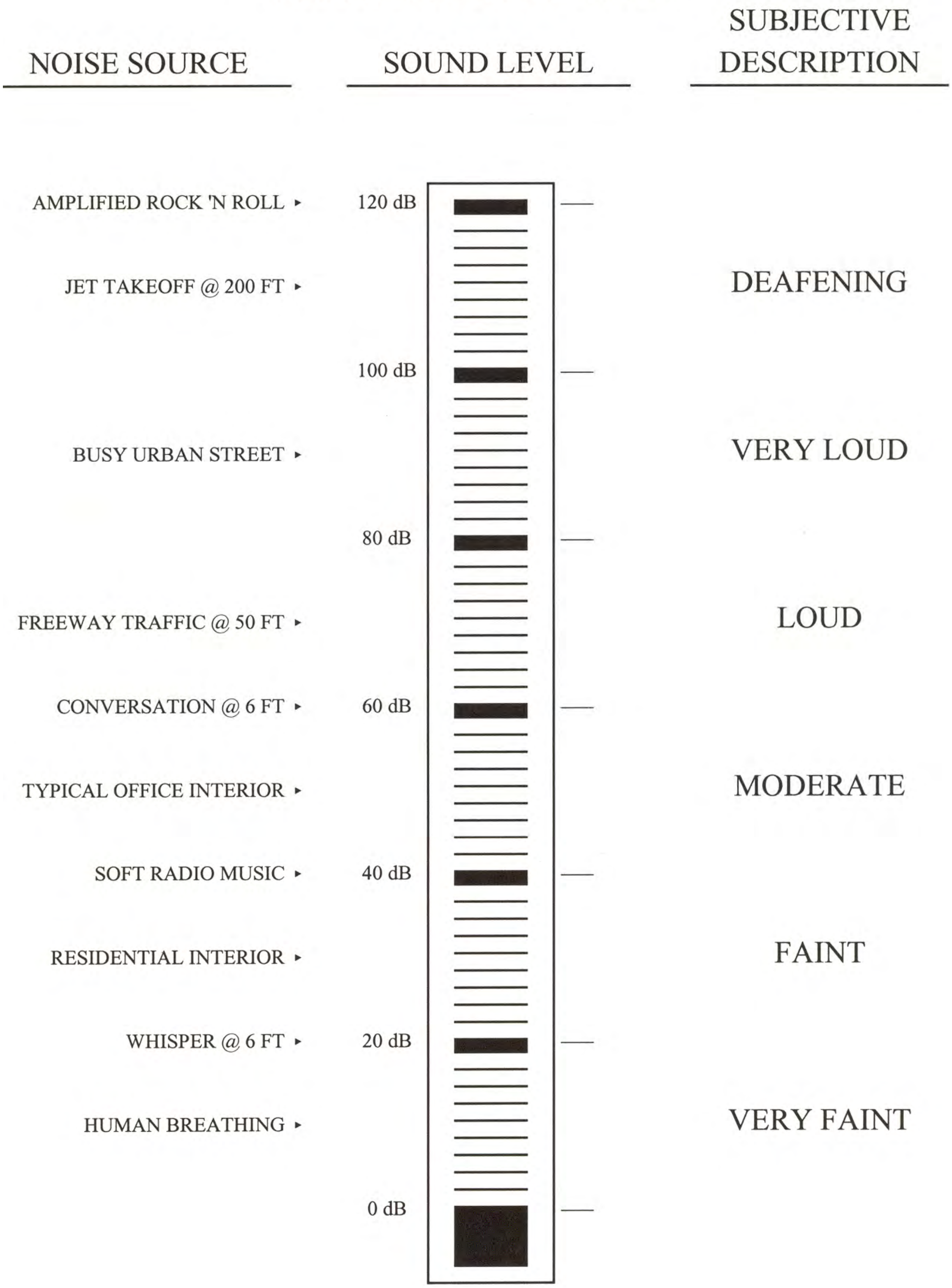
NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of "noise level reduction" combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC): The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.

APPENDIX B
EXAMPLES OF SOUND LEVELS



APPENDIX C:

EQUIPMENT NOISE LEVEL DATA

TECHNICAL CHARACTERISTICS

FREEMAQ PCSM

REFERENCE		FP3510M
AC	AC Output Power(kVA/kW) @50°C [1]	3510
	AC Output Power(kVA/kW) @40°C [1]	3630
	Operating Grid Voltage(VAC)	34.5kV ±10%
	Operating Grid Frequency(Hz)	60Hz
	Current Harmonic Distortion (THDi)	< 3% per IEEE519
	Power Factor (cosine phi) [2]	0.5 leading … 0.5 lagging adjustable
	Reactive power compensation	Four quadrant operation
DC	DC Voltage Range (full power)	934V-1310V
	Maximum DC voltage	1500V
	DC Voltage Ripple	< 3%
	Max. DC continuous current (A)	3970
	Max. DC shortcircuit current (A)	180kA / 5ms
	Battery technology	All type of batteries (BMS required)
	Battery connections	Up to 18 positive and 18 negative connections
EFFICIENCY & AUXILIARY SUPPLY	Max. Efficiency PAC, nom (η)	97.80% including MV transformer
	CEC (η)	97.51% including MV transformer
	Max. Power Consumption (KVA)	20
CABINET	Dimensions [WxDxH] (ft)	21.7 x 7 x 7
	Dimensions [WxDxH] (m)	6.6 x 2.2 x 2.2
	Weight (lb)	30865
	Weight (kg)	14000
	Type of ventilation	Forced air cooling
ENVIRONMENT	Degree of protection	NEMA 3R
	Permissible Ambient Temperature	-35°C to +60°C / >50°C Active Power derating
	Relative Humidity	4% to 100% non condensing
	Max. Altitude (above sea level) [3]	2000m
	Noise level [4]	< 79 dBA
CONTROL INTERFACE	Communication protocol	Modbus TCP
	Plant Controller Communication	Optional
	Keyed ON/OFF switch	Standard
PROTECTIONS	Ground Fault Protection	Isolation monitoring device
	General AC Protection	MV Switchgear (configurable)
	General DC Protection	DC switch [5]
	Overvoltage Protection	AC, DC Inverter and auxiliary supply type 2
CERTIFICATIONS	Safety	UL1741, CSA 22.2 No.107.1-16
	Compliance	NEC 2017
	Utility interconnect	UL 1741 SA - Feb. 2018, IEEE 1547.1-2005

[1] Values at 1.00•Vac nom and cos Φ= 1.
Consult Power Electronics for derating curves.
[2] Consult P-Q charts available: $Q(kVAr)=\sqrt{(S(kVA)^2-P(kW)^2)}$.
[3] Consult Power Electronics for altitudes above 1000m.
[4] Readings taken 1 meter from the back of the unit.
[5] Battery short circuit disconnection has to be done on the battery side.

Data Sheet

Datasheet	Model	EMW25HDNC1A
Dimensions, Weight & Installation		
External Dimensions (H x W x D)	mm	1110*500*200
External Dimensions (H x W x D) With Flange & Wiring Box	mm	1176×549×220
Weight (w/o refrigerant)	kg	57
Installation		Door mounted
Application		Enclosure
Environment Protection & Performance		
Working Temperature Range (Ambient)	ºC	-30 to +55
Working Temperature Range (Internal)		-30 to +55
Storage Temperature Range	ºC	-30 to +70
Working Humidity Range (Ambient)	%	5-100
Working Humidity Range (Internal)		5-95
Storage Humidity Range	%	5-95
Noise Level	dB(A)	71
IP Protection Level	/	IP 55
Refrigerant	/	R134a
Weight of Refrigerant	kg	0.58
Cooling Media	/	50% Aqueous Glycol
RoHS Compliance		Yes
Cooling/Heating		
Cooling Capacity @L35/W18℃ (Ambient Temp/Water Outlet)	W	2500
Water Flow@L35/W18℃ (Ambient Temp/Water Outlet)	LPM	25
Heating @L-30/W18℃ (Ambient Temp/Water Outlet)	W	2000
Output Water Temperature	ºC	15-18ºC
Power Consumption of Cooling		
Power Input @L35/W18	W	1070
Current @L35/W18	A	7.39
Power Consumption of Heating		
Power Input@L5/W18 (Ambient Temp/Water Outlet)	W	2175
Current @L5/W18 (Ambient Temp/Water Outlet)	A	9.79
Airflow		
External Airflow	m3/h	900
Voltage		
Voltage Range	VAC, Hz	220±15%,50/60
Rated Voltage - Controller	VAC, Hz	220, 50/60
Rated Voltage - Cooling/Heating	VAC, Hz	220, 50/60
Max. Current	A	11.0
Max. Power Consumption	W	2175

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Table 6-6. Project Stationary Equipment Noise Levels

Noise Source	Reference Distance (feet)	Reference Noise Level (dBA L_{eq}/L_{50})[1]		Distance to Noise Level Contour (feet)[2]		
		Nighttime	Daytime	Nighttime (45 dBA L_{eq}/L_{50})	Daytime (55 dBA L_{eq}/L_{50})	65 dBA L_{dn}
Substation transformer[3]	3	68	70	42	17	9
PCS[4]	10	55	70	32	56	15
BESS[5]						
Methods 1 and 3: 90 units consolidated	10	98	98	3,120	1,230	610
Method 2: Distributed throughout the solar arrays[6]	10	82	82	708	224	97
Transmission line corona discharge[7]	25	25	25	WC	WC	WC
Horizontal single-axis tracker & dual-axis tracker systems[8]	400	37	37	NA	50	13
O&M Building[9]	10	79	79	NA	158	40
Onsite Maintenance Activities[10]	10	82	82	NA	224	56

Source: Ambient Air Quality & Noise Consulting 2015.

1 With the exception of the BESS, reference noise levels for the stationary noise sources used by the proposed project were obtained from the *Noise and Groundborne Vibration Impact Assessment for the Proposed Valentine Solar Project* report document. The BESS reference noise level was obtained by ICF based on field measurements conducted on previous projects, and it represents noise levels generated by an enclosed BESS container equipped with batteries, a transformer, and an inverter with an exterior-mounted air conditioning (i.e., cooling) system and exhaust fan mounted on the rooftop. For the purpose of the evaluating the project's stationary equipment operational noise levels against the applicable WSSP noise standards, the L_{eq} and L_{50} noise levels are assumed to be equivalent.

2 Contour distances represent the distance from the noise source where resulting noise levels would comply with the daytime and nighttime noise standards established in the WSSP, which are 55 dBA L_{50} and 45 dBA L_{50}, respectively, and the County's 65 dBA L_{dn} exterior noise standard for noise sensitive land uses. Where contour distances would exceed 1,000 feet, an excess noise-attenuation rate of 1 dB per 1,000 feet was accounted for in the distance values.

3 Noise level of the substation transformers is lower at nighttime due to non-load conditions.

4 PCS representative daytime (full-load conditions) and nighttime (non-load conditions) noise levels include noise generated by two inverters located within an enclosed structure, one transformer mounted at the exterior of the structure, exterior mounted HVAC system, and an exhaust fan.

5 The noise levels for the BESS are analyzed under the following three scenarios based on the method used to incorporate the system at the project site: 1) all BESS containers consolidated within the project substation area; or 2) BESS equipment distributed throughout the proposed project's solar arrays by collocating a single BESS container with each of the project's block inverters, with the BESS and the inverter housed in the same container; or (3) BESS equipment collocated with the O&M facility. The HVACs associated with the BESS, which are the primary noise sources, are assumed to operate approximately 75 percent of the time (it is assumed that the 25 percent of the non-operation time would occur during the nighttime hours).

6 As the exact location of the BESS containers that would be distributed throughout the project's solar arrays within the 2,557-acre project site have not been determined at this time, it is assumed that an offsite sensitive receptor near the site may simultaneously be exposed to noise levels generated from two BESS container units. Therefore, the representative noise levels presented for this method of BESS incorporation at the project site account for noise levels generated by two BESS container units containing batteries and an inverter.

7 Transmission line corona discharge noise level based on a 230-kV line.

Building Block Inverters

The PV panels would be electrically connected to adjacent panels to efficiently increase the output voltage to 1,500 volts. An above- or below-ground DC collection system will deliver the electricity to an inverter station, where the electricity is converted into AC at an intermediate voltage, typically 34.5kV. From the inverter stations an above- or below-ground AC collection system will deliver the electricity to the on-site substation, where the voltage will be stepped-up to the interconnection voltage.

The inverters and other electrical equipment are proposed to be housed in up to 17 enclosures throughout the project site. The proposed GE 1500V 4MVA inverters have a noise level rating of 61.5 dBA at 3 feet, 49.5 dBA at 12 feet, and 37.4 at 50 feet (GE 2015).

Stepup Transformer (at Substation)

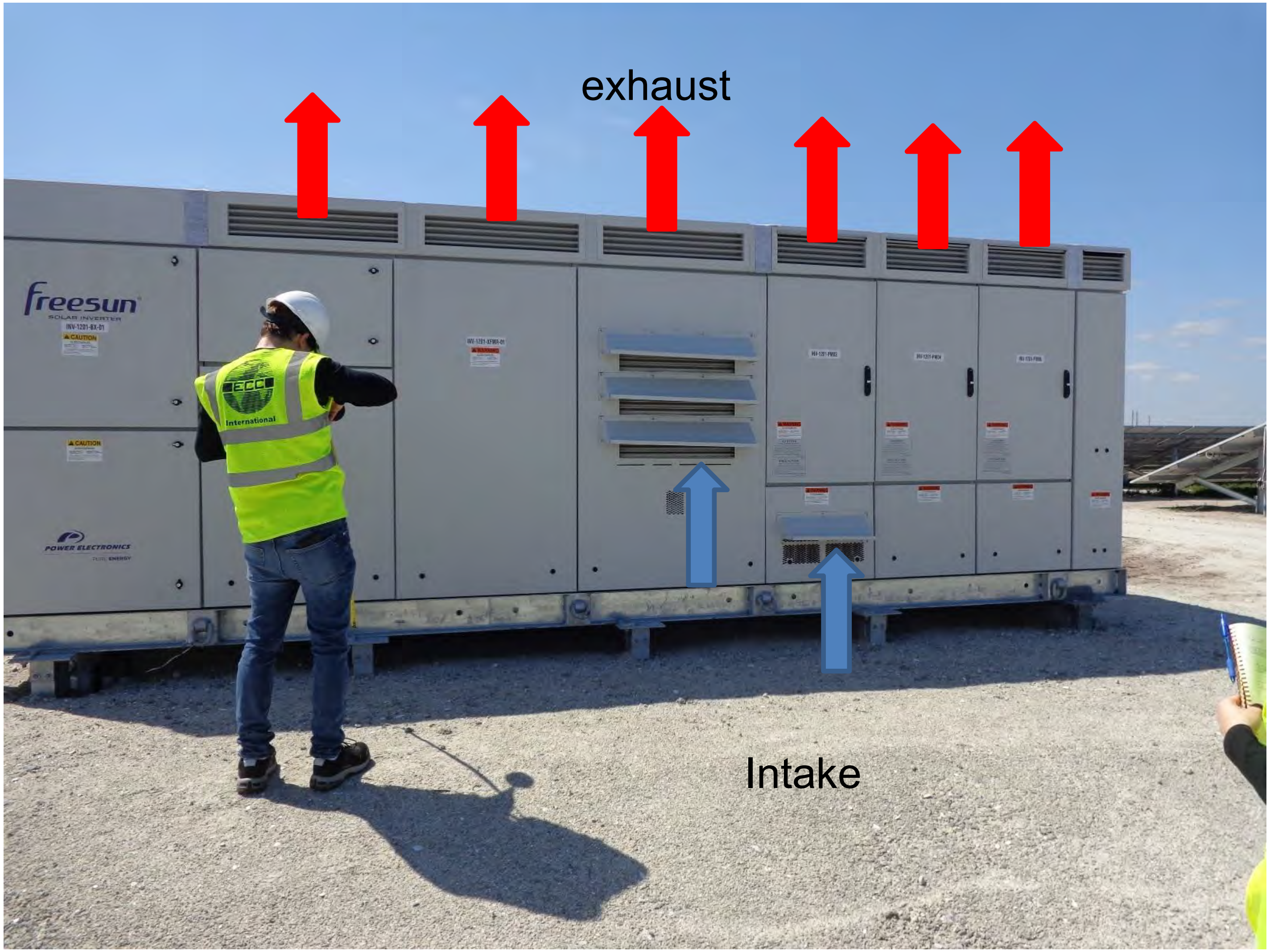
The output from the solar field would be passed through a final interconnection step-up transformer to convert it to the grid tie voltage at 220-kV. Based upon sound level emission data provided by the project applicant, the specification for the stepup transformer is a sound pressure level (SPL) of 75 dBA at a distance of 3 feet from the device in the horizontal plane.

Energy Storage System

Noise from the Energy Storage System would be created by the associated heating, ventilation and air conditioning (HVAC) units, power inverters, and transformers associated with this type of facility. Detailed plans are not yet available for the energy storage component, but using conservative estimates, it was assumed that 10 HVAC units, 30 stepup transformers and 15 power inverters would be utilized.

Information from the vendor for a similar energy storage project (Rugged LLC 2014) indicates the HVAC unit that is supplied as standard equipment for these types of projects produces 68 dBA at a distance of 50 feet during full operation (NACO Model 30RB120). The anticipated stepup transformer has a sound rating of 60 dB at 5 feet based on National Electric Manufactures Association ratings for the size of transformer anticipated to be used with storage battery systems (NEMA 2000). The anticipated power inverter is a Xantrex model, or equivalent, which has a noise level rating of 77 dB at 6 feet (Schneider Electric 2011).

HEM Acoustic Testing



Total Sound Pressure - dBA

Location	Laeq	Notes
Back	80.5	long side, rear of unit
Front	78.6	long side of unit with AC User cabinet
Left	78.9	DC Input Section
Right	69.9	AC MV side
TopFront	69.8	Top front of unit
TopBack	69.9	Top rear of unit

Measurements 1 M from surface