REVISED DRAFT

ANTELOPE VALLEY WATERMASTER

2016 ANNUAL REPORT

July ~~12~~ 24, 2017

First Annual Report, Calendar Year 2016

Antelope Valley Groundwater Cases, Judicial Council Coordination Proceeding No. 4408, Santa Clara Case No.: 1-05-CV-049053, Superior Court of the State of California, County of Los Angeles - Central District

Antelope Valley Watermaster Board of Directors

The Antelope Valley Watermaster is charged with administering adjudicated water rights and managing groundwater resources within the adjudicated portion of the Antelope Valley. The five-member Board includes:

Robert Parris, Chairperson
Dennis Atkinson, Vice Chairperson
Adam Ariki
John Calandri
Leo Thibault

Antelope Valley Watermaster Engineer

TODD GROUNDWATER

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List of Acronyms

AFY	acre-feet per year
AVEK	Antelope Valley-East Kern Water Agency
AVSWC/JPA	Antelope Valley State Water Contractors Joint Powers Authority
Cal Water	California Water Service Company
CIMIS	California Irrigation Management Information System
CSD	Community Services District
DDW	State Water Resources Control Board California Division of Drinking Water
District 40	Los Angeles County Waterworks District No. 40, Antelope Valley
DLCSD	Desert Lake Community Services District
DWR	California Department of Water Resources
DPW	Los Angeles County Department of Public Works
DRI	Desert Research Institute
EAFB	Edwards Air Force Base
ET	Evapotranspiration
GAMA	SWRCB Groundwater Ambient Monitoring and Assessment
InSAR	Interferometric Synthetic Aperture Radar
IRWMP	Antelope Valley Integrated Regional Water Management Plan
Kc	Crop coefficient
LACSD	County Sanitation Districts of Los Angeles County
LCID	Littlerock Creek Irrigation District
mg/L	milligram per liter
mgd	million gallons per day
msl	mean sea level
MWC	Mutual Water Company
NEWD	North Edwards Water District
NWIS	National Water Information System of the USGS
NWS	National Weather Service
PRID	Palm Ranch Irrigation District
PWD	Palmdale Water District
QHWD	Quartz Hill Water District
RCSD	Rosamond Community Services District
SWRCB	State Water Resources Control Board
SWRU	Semitropic Water Storage District Stored Water Recover Unit
SGMA	Sustainable Groundwater Management Act
SNMP	Salt and Nutrient Management Plan
SWP	State Water Project
Sy	specific yield
TDS	Total Dissolved Solids
USGS	U.S. Geological Survey
WRP	Water Reclamation Plant
WSSP-2	AVEK's Water Supply Stabilization Project No. 2 (also called Westside Water Bank)
WTP	Water Treatment Plant
WWTP	Wastewater Treatment

WSWB	Willow Springs Water Bank (formerly known as the Antelope Valley Water Bank)

MESSAGE FROM THE WATERMASTER BOARD

The Antelope Valley adjudication was finalized in December 2015. After a long and complicated process, the parties have laid the groundwork for implementation of the Judgment. In the 18 months since the Judgment, the Antelope Valley Watermaster notes numerous accomplishments – the seating of the Board, formation of the Advisory Committee, establishment of key administrative staff and functions, and the retention of the Watermaster Engineer following an extensive search and public interview process.

Perhaps the greatest achievement has been the ability of the Board, Advisory Committee, Watermaster Engineer, stakeholders, and the public to work together in a collaborative and transparent manner. The Advisory Committee (composed of representatives of parties) and other parties of the Judgment have taken an active role in advising the Watermaster Board on key issues.~~;~~ T~~t~~he Board, in turn, has considered this guidance and moved forward in its decision-making role. Following open discussion, every vote held to date by the Watermaster Board has led to a unanimous decision.

The Antelope Valley Watermaster Board would like to thank all involved for their assistance during this first year of organization. We are encouraged by the cooperative effort and appreciate the opportunity to work together toward our shared goal of achieving groundwater sustainability in an equitable manner.

Watermaster Board of Directors, June 28, 2017. From left to right:
John Calandri, Dennis Atkinson, Robert Parris (Chair), Leo Thibault, and Adam Ariki

1 INTRODUCTION

The Judgment and Physical Solution for the Antelope Valley Groundwater Adjudication represents more than 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. Through four phases, the adjudication defined the boundaries of the basin, considered hydraulic connection throughout the basin, established the safe yield, and quantified groundwater production. The Judgment identified a state of overdraft, established respective water rights among groundwater producers, and ordered a rampdown of production to the native~~ural~~ basin safe yield.

The adjudication provides a framework to sustainably manage the basin and reduce groundwater level declines and subsidence. The Judgment was entered in December 2015 and ~~. It~~ can be found on the Watermaster website (currently www.avek.org). To administer the Judgment, the Court directed appointment of the Watermaster (a five-member board). In 2016, the Watermaster Board and an Advisory Committee (both entities required under the Judgment) were formed. The Board finalized ~~the~~ hiring of Todd Groundwater as Watermaster Engineer (~~also~~ required by the Judgment) at the end of April 2017 to provide hydrogeological and technical analyses and to guide administrative functions to fulfill the Judgment.

Under the Judgment, the Watermaster Engineer has the responsibility of preparing annual reports to the Court; this document is the first ~~of~~ such report~~s~~. The first annual report was due April 1, 2017, but the Watermaster Engineer had not yet been retained. The Watermaster Board requested and was granted an extension to August 1, 2017 to allow time to prepare the first annual report, hold a public hearing, and file the report with the Court.

This first annual report has been prepared while many of the institutions required under the Judgment are still being formed and initiated, before Rules and Regulations have been developed, and before all procedures needed to collect and evaluate data are in place. Nonetheless, this report demonstrates progress to date in setting up the Watermaster and provides the first independent review and presentation of relevant information by the Watermaster Engineer.

1.1 BACKGROUND

The Antelope Valley Groundwater Basin is located in the western Mojave Desert. The Basin (DWR Basin Number 6-44) encompasses 1,580 square miles in Los Angeles, Kern and San Bernardino counties (DWR, 2004). Approximately two-thirds of the Basin lies in Los Angeles County, with small portions extending into San Bernardino County, and the remainder in southeastern Kern County (**Figure 1**).

The adjudicated area of the Antelope Valley is approximately 1,390 square miles. As seen on **Figure 1**, the adjudicated area is slightly smaller than the DWR-defined basin boundaries. The adjudicated area does not include the adjacent alluvial basins to the northeast and south and is truncated at the Los Angeles-San Bernardino County Line in the southeast. Flow from the adjacent alluvial valleys is considered nominal and the portion of the Antelope Valley Groundwater Basin that extends southeast into San Bernardino County is within the Mojave Basin Area adjudication.

The adjudicated area was divided into five subareas for management purposes (**Figure 1**):

- Central Antelope Valley Subarea
- West Antelope Valley Subarea
- South East Subarea
- Willow Springs Subarea
- Rogers Lake Subarea.

A native safe yield of 82,300 acre-feet per year (AFY) was established by the court for the Antelope Valley adjudicated area and the adjudication parties were divided into various classes to establish respective water rights among groundwater producers. To achieve sustainable levels, groundwater production would be reduced (ramped down) over a seven-year period (2016-2022) to a final Production Right. The diagram on the right side of **Figure 2**[1] shows the apportionment of native safe yield to the various Judgment classes.

The Physical Solution portion of the Judgment provides direction for the reduction of groundwater use within the adjudicated area. Certain parties to the Judgment are allowed credit for imported water return flows, carry over water, and stored water under the distinct circumstances defined in the Judgment. Certain parties can also pump more than their allowed Production Right provided they pay a Replacement Water Assessment. A schematic showing the five main potential production categories is shown on the left side of **Figure 2**.

- The Production Right is the portion of the Native Safe Yield assigned to each party (see diagram on the right of **Figure 2**). Production Rights for specific parties are defined in the Judgment in its Exhibit 3 (Non-Overlying Production Rights); Exhibit 4 (Overlying Production Rights); Sections 5.1.3, 5.1.4, and 5.1.5 for the Small Pumper Class, Federal Reserved Water Rights, and State of California, respectively; and Sections 5.1.7 through 5.1.10 for other occurrences such as entities switching to recycled water when available.
- Imported Water Return Flows represent water brought into the basin from outside the watershed that provides a net increase in groundwater supply (i.e., does not include consumed or evaporated imported water). Return flows for agriculture were established at 34 percent and at 39 percent for municipal and industrial uses.
- Carry Over Water is the right to an unused portion of an annual Production Right or a right to Imported Water Return Flows in a year after the year in which the right was originally available.
- Stored Water is water held in storage in the basin as a result of direct spreading or other methods for subsequent withdrawal and use pursuant to an agreement with the Watermaster. It does not include imported water return flows.

[1] The sum of the individual production rights is 82,280.63 AFY; this sum was rounded in the Judgment to 82,300 AFY.

- Finally, additional pumping could occur that would be subject to a Replacement Obligation; for such pumping, the producer would need to pay a Replacement Water Assessment. Replacement Water will be purchased by the Watermaster or otherwise provided to satisfy the Replacement Obligation.

1.2 Purpose and Scope

The Watermaster Engineer is responsible for preparation and submittal of annual reports to the Court. The purpose of the annual report is to document the progress and details regarding implementation of the Judgment. Information is provided regarding the operation and management of the groundwater basin and water supplies during the preceding year. A list of the minimum required elements to be compiled in the annual reports is provided in Section 18.5.18 of the Judgment; these elements are reproduced in **Table 1**, with reference to the associated location in this report.

Table 1. Minimum Required Elements for the 2016 Annual Report

Judgment Section	Element	Location
18.5.18.1	Replacement Obligations	Section 3.3.2, Appendix J
18.5.18.2	Hydrologic Data Collection	Section 3.2
18.5.18.3	Purchase and Recharge of Imported Water	Section 3.2.9, Appendix G
18.5.18.4	Notice List	Appendix C
18.5.18.5	New Production Applications	Section 3.3.5, Appendix M (New Production Application in progress)
18.5.18.6	Rules and Regulations	In progress; not completed
18.5.18.7	Measuring Devices	In progress; not completed
18.5.18.8	Storage Agreements	Section 3.3.3, Appendix K (Storage Agreement in progress)
18.5.18.9	Annual Administrative Budget	Section 1.5.1, Appendix B
18.5.18.10	Transfers	Section 3.3.4, Appendix L
18.5.18.11	Production Reports	Section 3.2.7.1, Appendix D
18.5.18.12	Prior Year Report	Not Applicable; 2016 is first report
18.5.18.13	Amount of Stored Water owned by each Party	Section 3.3.3, Appendix K (Storage Agreement in progress)
18.5.18.14	Amount of Stored Imported Water owned by each Party	Section 3.3.3, Appendix K (no stored water in 2016)
18.5.18.15	Amount of Unused Imported Water Return Flows owned by each Party	Section 3.2.9, Appendix H
18.5.18.16	Amount of Carry Over Water owned by each Party	Section 3.3.1, Appendix E, Appendix F
18.5.18.17	All changes in use	Section 3.3.6, Appendices ~~x~~ N and~~,~~ ~~Appendix~~ O

Section 1 of this report provides an introduction and context for the 2016 Annual Report, including this section on purpose and scope. **Section 1.3** summarizes the stakeholder review process including posting and notice of the Draft report and the public hearing. Information on the Watermaster management structure including an organization chart is provided in **Section 1.4**. That section also summarizes the roles and responsibilities of the Watermaster Board, administrative staff, the Advisory Committee, and the Watermaster Engineer. **Section 1.5** provides a ~~financial~~ summary of ~~the~~ Watermaster finances. **Section 2** of this report summarizes specific activities of the Watermaster in 2016 and discusses~~illustrates~~ the issues and topics addressed during its first year of implementing the Judgment.

Section 3 of this report presents relevant data from the monitoring of Safe Yield components in the basin. To provide context for these data, a summary of the safe yield calculation in the Judgment is provided in **Section 3.1**. This summary includes a brief review of the components of natural groundwater recharge relating to the hydrologic system (see Schematic Diagram on **Figure 3**). Components of both the Native Safe Yield and the Total Safe Yield are also discussed, including natural recharge, return flows from urban and agricultural water use, and imported water (including return flows from imported water use). Components of the Total Safe Yield are represented conceptually on **Figure 4**.

Section 3.2 of this report documents the monitoring of safe yield components and provides preliminary analyses on current groundwater levels and change in groundwater in storage for 2016. As illustrated in **Table 1** above, much of the water accounting – including reported groundwater production – is provided in appendices to this report. **Section 4** lists the technical documents reviewed and referenced in this 2016 Annual Report.

As mentioned previously, the preparation of this first Annual Report occurred prior to the development of Rules and Regulations and other procedures for implementing the Judgment. In particular, many preliminary data sets were imperfect for the purposes of complete water accounting and reconciliation of water supply and demand. Recognizing these challenges and limitations, the preparation of the report has been useful in identifying procedures and steps to prioritize for future data reporting and analysis.

1.3 STAKEHOLDER AND PUBLIC REVIEW AND COMMENT

According to the Judgment, the first annual report is required to be submitted to the Court by April 1 of the year following the first full year after the final judgment. Due to the timing of the Watermaster Engineer contract (approved at the end of~~in~~ April 2017), the Court granted an extension with a revised report deadline of August 1, 2017.

To comply with this revised schedule, the Watermaster Engineer produced an Administrative Draft to the Watermaster at its regular board meeting on June 28, 2017. After incorporating comments from various parties in the litigation and the Advisory Committee, the Watermaster Engineer revised the Administrative Draft 2016 Annual Report to produce a Draft 2016 Annual Report that was posted on the Watermaster website on July 12, 2017. ~~Litigation p~~Parties and the public were noticed that the Draft 2016 Annual Report was available for download, review, and comment. Based on additional comments, a Revised Draft was posted on the Watermaster website on Monday, July 24, 2017.

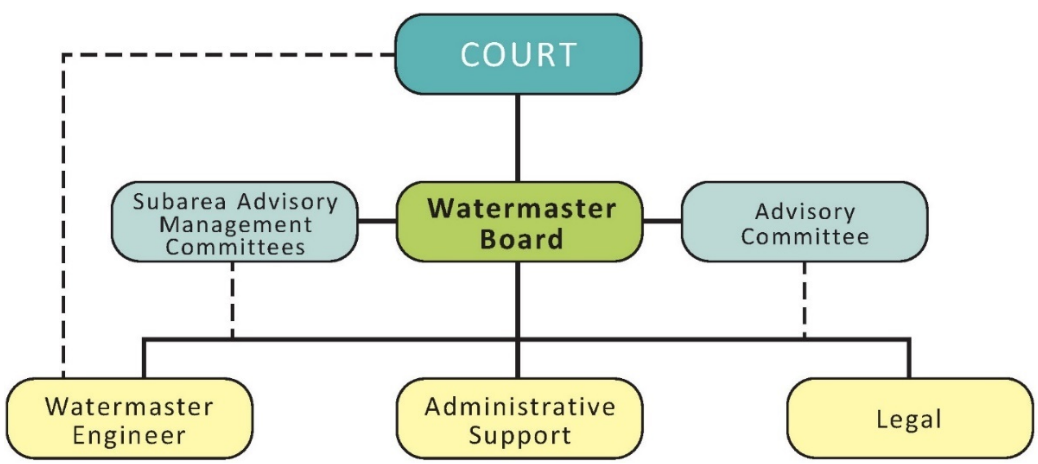
On July 26, 2017, the Watermaster Board will hold a public hearing to consider comments on the Revised Draft 2016 Annual Report. Based on these comments, the Watermaster will provide guidance to the Watermaster Engineer for development and submittal of the Final 2016 Annual Report by August 1, 2017.

1.4 ANTELOPE VALLEY ADJUDICATION MANAGEMENT

The Judgment identified the powers and duties of specific entities charged with carrying out the Physical Solution (i.e., the Watermaster Board, the Watermaster Engineer, the Advisory Committee, and the Subarea Advisory Management Committees). The Watermaster Board functions as the arm of the Court and is assisted by the Watermaster Engineer to implement the Physical Solution. The Advisory Committee acts in an advisory capacity and makes recommendations on discretionary determinations by the Watermaster Board. The Subarea Advisory Management Committees also act in an advisory capacity and make recommendations on discretionary determinations made by the Watermaster Engineer that may affect that Subarea. While not being given specific powers and duties in the Judgment, two other entities have (or will have in the future) significant importance in implementing the Judgment: 1. Administrative support staff and 2. Watermaster legal counsel.

An organization chart that illustrates the working relationships among these Watermaster entities is provided below. The roles and responsibilities of each entity are summarized in the following sections.

Antelope Valley Watermaster Organization Chart



1.4.1 Watermaster Board

The Court-appointed Watermaster Board is made up of five members including:

- One representative from the Antelope Valley-East Kern Water Agency (AVEK) - *Robert Parris*
- One representative from the Los Angeles County Waterworks District No. 40 (District 40) - *Adam Ariki*
- One public water supplier selected by District 40, Palmdale Water District (PWD), Quartz Hill Water District (QHWD), Littlerock Creek Irrigation District (LCID), California Water Service Company (Cal Water), Desert Lake Community Services District (DLCSD), North Edwards Water District (NEWD), City of Palmdale, City of Lancaster, Palm Ranch Irrigation District (PRID), and Rosamond Community Services District (RCSD) - *Leo Thibault*, and
- Two landowner representatives (exclusive of public agencies and members of the Non-Pumper and Small Pumper Classes) who are selected by majority vote of the landowners identified on Exhibit 4 of the Physical Solution (or their successors in interest) based on their proportionate share of the total Production Rights identified on Exhibit 4 - *John Calandri and Dennis Atkinson*.

There are also five Watermaster Board alternates (pending the outcome of the election for the two landowner alternates). The landowners are in the process of electing alternate representatives under the election rules and procedure approved by the Court December 7, 2016. The City of Palmdale is acting as Inspector of Elections.

The Watermaster Board has certain responsibilities and powers including:

- A responsibility to implement and enforce the Judgment through actions, motions, and service of notices, determinations, requests, demands, reports and other methods pursuant to the Judgment and the Rules and Regulations
- An obligation to carry out its duties in an impartial manner and to rely on best available information to support Judgment implementation
- Selection of Watermaster Engineer
- Preparation of Annual Administrative budgets and associated accounting and billing
- Recordation of groundwater use and transfers and other pertinent records
- Review of new production applications
- Maintenance of a notice list
- Conduct~~ion of~~ regular meetings at least quarterly and in accordance with the Ralph M. Brown Act
- Oversight of the preparation of annual reports and a Rules and Regulations document
- Powers and duties as provided in Sections 18.4 of the Judgment.

On June 30, 2016, the Court approved the Watermaster Board members on an interim basis and on September 8, 2016, approved the members on the terms provided by the Court-approved election rules. The Board held its first board meeting August 17, 2016 although there were informational meetings earlier, which were organized by some of the

Watermaster designees prior to the election of the landowner Watermaster representatives. The Board typically meets on the fourth Wednesday of the month, with all meetings conducted in compliance with the Ralph M. Brown Act. The Watermaster Board has conducted its affairs transparently, including holding interviews and deliberations to select the Watermaster Engineer in open session. All Watermaster decisions to date have been achieved through unanimous vote of the Board, although the Watermaster recently provided for meeting minutes to be approved using a simple majority vote.

The landowners are in the process of electing alternate representatives under the election rules and procedures approved by the Court December 7, 2016. The City of Palmdale is acting as Inspector of Elections.

1.4.2 Watermaster Engineer

~~The Watermaster Engineer~~Todd Groundwater was selected unanimously by the Watermaster Board as the Watermaster Engineer; its duties include:

- Monitor safe yield components and collect hydrologic data
- Require Producers (other than unmetered Small Pumper Class members) to submit Production Reports
- Ensure reduction in groundwater production to the Native Safe Yield during the 2016 to 2022 Rampdown period
- Propose measuring devices to monitor Production. Meters are to be installed by December 23, 2017 (within two years from the entry of the Final Judgment)
- Determine Replacement Obligations
- Purchase and recharge Replacement Water
- Establish a new production application procedure, review applications and recommend approval or denial of such applications
- Maintain accounting of water stored under Storage Agreements
- Ensure that no person reduces the amount of storm flows that would otherwise enter the Basin
- Encourage appropriate regulatory agencies to enforce reasonable water quality regulations affecting the basin
- Establish memoranda of understanding with Kern and Los Angeles counties regarding well drilling ordinances and reporting
- Beginning in 2034, consider and potentially recommend change to Native Safe Yield
- Beginning in 2034, consider and potentially recommend changes to the calculation of Imported Water Return Flow percentages
- Rely on best available information to support Judgment implementation.
- Prepare an Annual Report for filing with the Court by April 1. The Watermaster Board requested and was granted an extension to August 1, 2017 for the first Annual Report.

Although not specified in the Judgment, the Watermaster ~~Engineer will~~should also comply with the Sustainable Groundwater Management Act (SGMA) for adjudicated areas by reporting water use, groundwater monitoring and other information to California Department of Water Resources (DWR) by April 1 of each year (California Water Code section 10720.8). The Watermaster Board requested and was granted an extension to August 1, 2017 for the first SGMA submittal. Todd Groundwater will assist with this submittal.

Todd Groundwater was selected as Watermaster Engineer and a three-year contract was approved at the end of April, 2017.

1.4.3 Watermaster Legal Counsel

The Watermaster is currently exploring options to retain legal counsel for such legal services as the Board may identify, including provision of legal opinions on implementation of the Judgment. Qualified candidates are currently being identified for Board consideration. Until engagement of its own counsel, the Board will continue to consider input offered to it by staff and the interested public, (including from Producer attorneys), and to use volunteer services from Producer attorneys for certain matters, such as routine court filings.

1.4.4 Administrative Staff and Functions

As of 2016, administrative functions of the Watermaster are shared, on an interim basis, between AVEK and Palmdale Water District. The Watermaster is reimbursing actual costs. In 2018, the Watermaster will consider review of these activities and the potential to engage an independent firm to carry out administrative responsibilities. Currently, Administrative Staff assist the Watermaster with the following activities:

- Provide accounting services (accounts receivables and bill payments)
- Conduct assessment billing
- Provide first point of public contact (Information Officer services)
- Prepare Watermaster Budgets
- Prepare Watermaster staff reports
- Prepare Watermaster meeting agendas
- Maintain Notice List and manage announcements
- Post Watermaster items on website
- Coordinate Attorney input
- Coordinate Advisory Committee input
- Coordinate Subarea Advisory Management Committees input
- Assist Watermaster Landowner Board member elections
- Staff Watermaster meetings
- Prepare meeting minutes
- Administer meeting services and equipment
    - "Go To Meeting" setup
    - Audio/Visual Systems (e.g., computers, projection, PA system).

1.4.5 Advisory Committee

The Judgment directed Producers to form an Advisory Committee to act in an advisory capacity and make recommendations on discretionary determinations by the Watermaster Board. The Watermaster Board facilitated the formation of the Advisory Committee, which is formed and functioning, and has provided input into various Watermaster Board decisions. The Advisory Committee consists of 16 members representing a broad range of interests:

- Four from agricultural interests
- One industrial landowner
- One public landowner (LA County Sanitation Districts or Los Angeles)
- Two Los Angeles County public water purveyors (PWD, QHWD)
- One Kern County public agency (RCSD)
- Two mutual water companies (one each in Los Angeles and Kern counties)
- Two small pumpers
- Two ex-officio members per Judgment (Federal and State), and
- One ex-officio member to provide technical advice (Producer associated with ~~from~~ Rottman Drilling ~~(Technical Advisor)~~.

Advisory Committee meetings are open to the public, noticed on the same webpage as the Watermaster meetings, and held on a regular basis (typically monthly). The Advisory Committee developed a set of operating principles and procedures, which is in **Appendix A**.

~~The landowners are in the process of electing alternate representatives under the election rules and procedures approved by the Court December 7, 2016. The City of Palmdale is acting as Inspector of Elections.~~

1.4.6 Subarea Advisory Management Committees

Producers in each of the five Management Subareas are directed to form Subarea Management Advisory Committees. Each Subarea will have a committee of five Management Advisors to act in an advisory capacity and make recommendations on discretionary determinations made by the Watermaster Engineer that may affect that Subarea. Meetings should be held on a regular basis (at least semi-annually) with the Watermaster Engineer and should be open to the public.

Subarea Advisory Management Committees have not yet been formed, but will do so through candidate nominations and subsequent voting where every acre-foot of Production Right is entitled to one vote, according to the Judgment. There will be a need to determine what votes are available to each party associated with each subarea. Elections are to be held every three years.

1.4.7 Rules and Regulations Document

Development of a Rules and Regulations document is underway. A draft is anticipated to be available by the end of 2017. As required by the Judgment (Section 18.4.2), the

Watermaster shall hold a public hearing prior to approval of the draft Rules and Regulations. The draft document and public hearing notice must be sent to all parties 30 days prior to the date of the hearing. All Watermaster rules and regulations must be consistent with the Judgment and are subject to approval by the Court.

A preliminary draft list of topics for the Rules and Regulations document is being prepared for review by the Watermaster Board. The Watermaster Board plans to select and prioritize topics for rule development, especially those associated with a deadline such as the requirements for installation and maintenance of meters on production wells (required by December 23, 2017). Given the long lead time associated with the approval process of rules and regulations, the Watermaster Board may prepare rules for time-sensitive topics and hold a public hearing prior to completion of the entire Rules and Regulations document. These sections would be forwarded to the Court for approval when available. In this manner, the time-sensitive Rules and Regulations (such as meter installation) can be approved in time to comply with the Judgment.

1.5 WATERMASTER FINANCES

1.5.1 Watermaster Administrative Budgets

The Watermaster Board approved an administrative budget for 2016, which resulted in an administrative assessment of $1.00 per acre-foot administrative assessment.

AVEK and Palmdale Water District advanced start-up funds on behalf of the Watermaster in 2016. The Watermaster has now established a bank account to receive assessments and pay expenses. The Watermaster 2016 Budget is summarized below.

2016 Administrative Budget Summary

	Budgeted	Actual*
Operating Revenue	$71,374	$68,425
Operating Expenses	($67,700)	($53,266)
Net	$ 3,674	$ 15,159

*as of July 10, 2017.

Appendix B contains more detailed Watermaster financial budgets as follows:

- **Appendix B-1** is inserted as a placeholder for the Annual Fiscal Report of the preceding year's operation, to be used in future Annual Reports. The Judgment was finalized in December 2015; the preceding year's budget is not applicable for this first Annual Report.
- **Appendix B-2** contains the estimated 2016 Budget and Actual Administrative Budget in more detail. As of June 19, 2017, 96 percent of the non-deferred 2016 Administrative Assessments has been collected. All parties with Non-Overlying Production Rights have paid and 95 percent of the parties with Exhibit 4 Overlying Production Rights have paid.

As shown in Appendix B-2, four items have been deferred in the 2016 budget. Payment from Small Pumpers has been deferred due to the large cost associated with collection of an Administrative Assessment of $1.20/party for the more than 4,000 parties listed in Exhibit C of the Judgment. The Administrative Assessment for production by the Federal Government (Edwards Air Force Base and Air Force Plant 42) and the associated unused Federal Reserved Water Right have also been deferred for 2016 until actual production has been reported (requested and reportedly being compiled by Edwards AFB at the time of this report). Imported water return flows are deferred due to the difficulty in reconciling imported water use, as described in more detail in **Section 3.2.9**.

The Administrative Assessments in Appendix B-2 are listed as "fixed", relating to assessments associated with the fixed Production Right listed in the Judgment. Other Administrative Assessments are variable and depend on actual production amounts from preceding years. Those variable assessments are not applicable for this first annual report, but will be included in the 2017 Annual Report and future reports.

- **Appendix B-3** will contain an audit of all revenue and expenditures for 2016. The audit is underway and will be included in the final version of the Annual Report.

The Administrative budget for 2017 has recently been approved. The 2017 Administrative Assessment will be $5.00 per acre-foot.

1.5.2 Replacement Water Assessments

During the first two years of the Rampdown period (2016 and 2017), Producers are not subject to Replacement Water Assessment fees, and accordingly, respective payments are not expected. Phelan Pinon Hills Community Services District~~ is not a Producer and~~ does not have Production Rights, but according to the Judgment is allowed to pump up to 1,200 AFY from its Well #14 provided such use does not cause Material Injury and the District pays a Replacement Water Assessment and any other costs deemed necessary to protect Production Rights defined in the Judgment, on all water produced and exported~~and pay the concomitant Replacement Water Assessment and Administrative Assessment; the District will be invoiced appropriately~~. Phelan Pinon Hills CSD is questioning if it should be subject to Replacement Water Assessments in 2016 and 2017. The Judgment states:

8.3 Reduction of Production During Rampdown. During the first two Years of the Rampdown Period no Producer will be subject to a Replacement Water Assessment. During Years three through seven of the Rampdown Period, the amount that each Party may Produce from the Native Safe Yield will be progressively reduced, as necessary, in equal annual increments, from its Pre-Rampdown Production to its Production Right.

Phelan Pinon Hills CSD is a Producer but its Production is not part of the Native Safe Yield. The matter is being discussed by the Watermaster.

The Watermaster is also in the process of determining the acre-foot cost for Replacement Water Assessments. The price will be based on the costs to buy and recharge Replacement

Water. Imported water will be purchased from AVEK, PWD, LCID, or other entities. When finalized, appropriate parties will be invoiced these Replacement Water Assessments.

2 WATERMASTER ACTIVITIES IN 2016

The Court approved the Watermaster Board members on an interim basis on June 30, 2016, and on the terms provided by the Court-approved election rules on September 8, 2016. The Board held its first board meeting August 17, 2016 although informational meetings occurred earlier, which were organized by some of the Watermaster designees prior to the election of the landowner Watermaster representatives. In 2016, seven regular or special Board meetings were held between August and December 2016. During those meetings, the Board:

- Established that regular Watermaster Board meetings will be held on the fourth Wednesday of each month at 10 am and that meeting locations will be rotated.
- Elected Robert Parris as Chairperson and Dennis Atkinson as Vice Chairperson of the Watermaster Board.
- Agreed to conduct interim Watermaster Board business using Robert's Rules of Order as a guideline.
- Requested AVEK staff to prepare a website (www.avek.org) for the Watermaster to post notices, agendas and other pertinent information. This site will be replaced by a dedicated website, maintained by Glotrans (www.avwatermaster.org), which will also contain all Court filings.
- Contracted with Glotrans to maintain a web-based repository for Court documents and notifications and to maintain the notice list for both the Watermaster activities and trial Ccourt proceedings. This site requires additional review of its contents and functionality.
- Interviewed recruitment firms and selected Alliance Resource Consulting LLC for recruitment of the Watermaster Engineer. (AVEK paid these costs until sufficient operating revenue allows reimbursement by the Watermaster).
- Facilitated formation of Advisory Committee.
- Approved an interim administrative plan.
- Held a Public Hearing to approve a proposed calendar year 2016 Administrative budget of approximately $67,700 and an Administrative Assessment of $1 per acre foot.

On April 1, 2016, a letter was submitted to the California Department of Water Resources Adjudicated Basins Reporting System to comply with the Sustainable Groundwater Management Act (SGMA). The letter, submitted by Wagner & Bonsignore, stated that the Watermaster was still being formed and that is was not possible for the Antelope Valley parties to submit all the data requested by April 1, 2016.

The Watermaster is to annually certify a list of unpaid delinquent assessments. No assessments were collected for 2015. The Watermaster is finalizing collection of 2016 Administrative Assessments and will subsequently develop and certify a delinquent list.

Notice list. The Watermaster is to maintain a current list of parties to receive notice. The parties have an obligation to provide the Watermaster with their current contact information. For Small Pumper Class members, the Watermaster will initially use the contact information contained in the list of Small Pumper Class members filed with the Court by class counsel. Contact information was previously maintained on the Glotrans website, but currently requires significant review and updating. The current Notification List is in **Appendix C**. This list will be updated and refined as appropriate.

Measuring Devices. Meters are to be installed on all wells by the end of 2017 except the Small Pumper Class members that pump under 3 AFY. Discussions regarding appropriate measuring devices is underway. When available, details will be available on the Watermaster website (currently www.avek.org).

Rules and Regulations. A Rules and Regulations document is underway. It is anticipated that a draft will be available for review before the end of the year. The Judgment will be used to guide the implementation until the Rules and Regulations document has been finalized and approved by the Watermaster and the Court. Once complete, the Rules and Regulations document will be available on the Watermaster website (currently www.avek.org).

Prior Year's Report. The Annual Report is to include the Prior Year's report. This is the first Annual Report. This and all future Annual Reports will be available on the Watermaster website (currently www.avek.org).

3 SAFE YIELD COMPONENTS

The Antelope Valley Groundwater Basin underlies an alluvial valley with ground surface elevations ranging from 2,300 to 3,500 feet above mean sea level. The basin is boundedsurrounded on the southwest and northwest by the San Gabriel Mountains and the Tehachapi Mountains, respectively, and on the southeast by a series of low ridges, buttes, and hills. The southwest and northwest boundaries are controlled by two major geologic fault systems – the San Andreas fault at the base of the San Gabriel Mountains and the Garlock fault at the base of the Tehachapi Mountains. To the north, the basin is separated from the alluvial deposits in the Fremont Valley by a groundwater divide.

Prior to development, groundwater flowed from the surrounding uplands toward natural surface depressions at ephemeral lake beds in the north (Rosamond Lake) and northeast (Rogers Lake). These natural flow directions have been re-directed locally toward pumping wells. With very little water lost at the natural discharge area of the basin, the valley functions as an internally-drained, closed basin.

The basin has a long tradition of agricultural use dating back to the late 1800s. As pumping increased in the 1950s and 1960s to meet increased water demands, groundwater provided about 90 percent of the overall supply. Reliance on groundwater decreased somewhat in the 1970s and 1980s after imported water was available in the basin. But urban growth, an increase in irrigated acreage, and limitations on availability of imported water resulted in increases in pumping during the 1990s. In 2011, the Court ruled that the basin was in overdraft and required a physical solution to bring the basin into balance.

The physical solution in the Judgment establishes a safe yield for groundwater production and an allocation of that safe yield among basin producers. Two estimates of safe yield are provided in the Judgement:

- Native Safe Yield: 82,300 AFY
  Includes estimates of natural recharge plus return flows from groundwater use
- Total Safe Yield: 110,000 AFY
  Considers supplemental supply of imported water and associated return flows

Native Safe Yield, set by the Ccourt at 82,300 AFY, is based on estimates of natural groundwater recharge from the hydrologic system including subsurface inflows from the surrounding bedrock (referred to as mountain front recharge) and infiltration from precipitation and streamflow. Native Safe Yield also accounts for return flows from basin pumping (described below). As shown on **Figure 2**, the Native Safe Yield is the amount allocated among basin producers. Recognizing that the importation of supplemental surface water adds to the safe yield, a Total Safe Yield of 110,000 AFY was set by the Ccourt and based on average estimates of available imported water. Allocation of return flows from imported water are assigned to various parties as determined by the Judgment.

The Judgment requires the Watermaster Engineer to monitor components of the Total Safe Yield in the basin and to present those data sets to the Ccourt in the Annual Report. This section describes the existing data sets and the data collection process to date. To provide context for the collection of these data, a review of the safe yield calculation, as provided in the Phase 3 Summary Expert Report (Beeby, et al., 2010)[2], is summarized below.

3.1 Safe Yield Determination in the Judgment

The process to develop a safe yield for the adjudicated area of the groundwater basin involved years of detailed hydrogeologic analyses by numerous technical experts representing various parties in the litigation. The analyses involved delineation of basin boundaries, descriptions of the geologic and hydrogeologic setting, evaluation of aquifers and aquitards, examination of water levels, assessment of groundwater occurrence and flow, and detailed accounting of the water budget, including inflows and outflows from the groundwater system and change in groundwater in storage. These analyses culminated in a Summary Expert Report, published in July 2010 (Beeby, et al., 2010).

3.1.1 Natural Groundwater Recharge

Estimates of natural recharge to the groundwater basin were used as the foundation of the safe yield determination. For the purposes of this discussion, the use of *natural recharge* refers to recharge associated with the natural hydrologic environment such as precipitation and streamflow. It specifically excludes the concept of return flows from pumping or use of imported water.

For many groundwater basins, the amount of natural recharge does not always indicate the amount that can be pumped sustainably because it is difficult to capture all of the replenished water without losing a significant amount to natural groundwater discharge (e.g., subsurface outflow from a basin). However, the closed nature of the Antelope Valley groundwater basin allows for more efficient capture of natural recharge in production wells. Therefore, natural recharge estimates served as a first approximation of the average annual amount of groundwater that could be used sustainably.

The natural groundwater recharge components were estimated by the technical experts using two separate methods: 1. a mass balance (referred to as a water balance) approach, which estimated and tabulated each inflow and outflow associated with the groundwater system independently, while conserving the mass from the hydrologic cycle, and 2. comparisons of groundwater elevation contour maps to estimate changes in groundwater in storage over time. These two methods and results are described below.

[2] This report was prepared in association with Phase 3 of the trial. It is recognized that there were multiple phases that are not discussed herein; the Phase 3 Expert Report contains the most relevant information for summarizing the Safe Yield determination in the Judgment.

3.1.1.1 Natural Groundwater Recharge using a Mass Balance Method

A mass balance approach to the water budget for the basin involves tracking of water into (inflows) and out of (outflows) the groundwater basin. This water tracking is illustrated by a schematic diagram on **Figure 3** (modified from Beeby, et al., 2010). The diagram represents the physical system of the groundwater basin and surrounding watershed. The mountains or uplands that surround the groundwater basin are shown on the left side of **Figure 3**; the playas (dry lakes) that represent the natural discharge area of the groundwater basin are shown on the right. Annual average flows estimated by the 2010 analyses are shown on the diagram in AFY for illustration purposes. In general, groundwater flows northeasterly from the upland areas to the dry lakes.

Precipitation provides the primary water source for the basin, including rainfall (or snowmelt) in the surrounding uplands and rainfall on the valley floor. In the uplands, rainfall either leaves the system through evapotranspiration (ET), runs off the surface into stream channels, or infiltrates into the fractured bedrock (upper left area of **Figure 3**). Some of the infiltrated water discharges back to the stream channels as baseflow; the remaining amount is available for groundwater recharge, also referred to as mountain front recharge. The 2010 analysis estimated this amount is estimated at about 19,800 AFY, as shown on **Figure 3**.

As mountain streams reach the valley floor, most of the water infiltrates into the permeable alluvium and serves as groundwater recharge (see the mass balance of streamflow on **Figure 3**). This component is considered the largest source of groundwater recharge with estimates of about 30,000 to 40,000 AFY (shown as 36,600 AFY from the mass balance on **Figure 3**). The water budget also recognizes that a small amount of streamflow is diverted for use prior to infiltration. During wet years, flood flows reach the playas, where water pools and evaporates. Some of the flood water may infiltrate the surficial deposits, but the low permeability of the lake bed sediments restricts deep percolation and groundwater recharge. When groundwater levels are high, small amounts of groundwater can also discharge to the playas.

Given the desert climate of the area, rainfall rates on the groundwater basin floor are small, with most of the area receiving less than eight inches per year on average. Given the corresponding high rates of ET in the basin, most of this rainfall evaporates quickly, limiting the available water for infiltration into the basin sediments and recharging groundwater. The 2010 analyses concluded that groundwater recharge from soil infiltration does not likely occur in basin areas with an average annual rainfall of less than eight inches (Beeby, et al., 2010); that conclusion is supported by numerous technical studies on groundwater recharge in desert basins. While minor recharge occurs from direct precipitation in localized alluvial fan deposits along the northwestern rim of the basin (western edge of the West Antelope Subarea, see **Figure 1**), the overall mass balance indicates that groundwater recharge from direct precipitation is small and thus it is not quantified on **Figure 3**.

In summary, the two primary sources of natural recharge were determined to be mountain-front recharge (about 19,800 AFY on **Figure 3**) and infiltration from streamflow (about 36,600 AFY on **Figure 3**), resulting in a total estimated natural recharge of 56,400 AFY.

3.1.1.2 Natural Groundwater Recharge using a Change in Groundwater in Storage Method

The estimates for groundwater recharge above were checked for reasonableness through a separate analysis using the change in groundwater in storage over time. This method involved preparation of nine groundwater elevation contour maps for nine years spanning a 59-year period from 1951 through 2009 (study period). These maps were used to assess water level changes (rise or declines) during eight specific time intervals and over the entire study period. Water level surfaces at the beginning and end of each period were electronically subtracted to estimate changes over the entire basin for each period (Beeby, et al., 2010).

In order to relate the water level changes to a volume of groundwater gain or loss, aquifer textures (e.g., percentages of sand, gravel, silt, and clay) were estimated using geologic logs. Textures were assigned a storage property, referred to as specific yield (Sy). Sy is defined as the ratio of the volume of water that will drain under gravity compared to a unit volume of the aquifer (expressed as a percentage) and is used to estimate the volume of water released from storage for a unit change in head. Because Sy varies throughout the aquifer system, the method determined the Sy that corresponded to the interval of the aquifer where water levels had changed. This analysis resulted in changes in groundwater in storage for various time intervals.

The change in groundwater in storage was applied to the water balance equation as shown below:

Change in Groundwater in Storage = Inflows (recharge) - Outflows

Because outflows consisted primarily of groundwater pumping, investigators estimated pumping for the same time intervals as the contour map analysis. With estimates for both Outflows and Change in Groundwater in Storage, the equation above could be re-arranged to solve for inflows (natural recharge). The change in storage method indicated average annual natural recharge between 55,000 to 58,000 AFY, results very similar to the results of the mass balance analysis described above (56,400 AFY). Recognizing uncertainty in the analysis, a natural groundwater recharge of 60,000 AFY was used by the technical experts for the purposes of the safe yield analysis (Beeby, et al., 2010).

3.1.2 Native Safe Yield

As defined in the Judgment, the safe yield is "the amount of annual extractions…over time equal to the amount of water needed to recharge…groundwater…and maintain it in equilibrium..." Because safe yield is defined in terms of groundwater extraction, the efficiency of groundwater use requires consideration.

All groundwater pumped from a well may not be consumed; if unused water is allowed to percolate back into the groundwater basin, the amount is referred to as *return flow*s. Almost all irrigation applications result in return flows including agricultural, municipal (e.g., landscaping, parks), and domestic (e.g., lawns). In addition to irrigation, other water use practices result in return flows including conveyance system losses, percolation of wastewater, or septic systems. A conceptual diagram of various groundwater uses and associated return flows is provided on **Figure 4**[3]. The amount of return flows varies with irrigation method, type of losses, soil properties, evapotranspiration, and other factors.

Because these return flows provide recharge to the groundwater basin in addition to the natural recharge components (also included on **Figure 4**), the amount of production from the Antelope Valley Groundwater Basin was determined to be higher than the 60,000 AFY estimate for natural recharge. For example, if return flows were 25 percent of pumping (indicating that 75 percent of production is consumed), then a safe yield allowing for consumption of 60,000 AFY of recharge would increase to 80,000 AFY (60,000/0.75 = 80,000).

Using a mix of historical and recent land use practices, the Summary Expert Report evaluated various return flow estimates for the purposes of developing a sustainable yield (Native Safe Yield) for the basin. Given the mix of land use practices observed over a recent 15-year period, an overall return flow of about 27.1 percent[4] was estimated to be reasonable. Applying this to the 60,000 AFY estimate for natural recharge, a Native Safe Yield of 82,300 AFY was derived. As shown on **Figure 2**, this value was used for the total Production Right in the groundwater basin.

3.1.3 Total Safe Yield

Total Safe Yield 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 (Section 3.5.51 of the Judgment). Beginning in the 1970s, supplemental surface water supplies were imported into the basin from the State Water Project (SWP). This supplemental water decreased the reliance on groundwater supply and provided water to meet the growing demand of the valley. Depending on use, the SWP water also provides an additional component of groundwater recharge through return flows, increasing the overall safe yield for the basin. This amount varies substantially with the availability and use of SWP water.

In order to consider this supplemental supply in the adjudication, the team of technical experts evaluated amounts of imported water and its use over time. This analysis led the team to conclude that return flows from imported water resulted in about 27,700 AFY of additional groundwater supply to the basin. Adding to the Native Safe Yield of 82,300 AFY, this amount provided a Total Safe Yield of 110,000 AFY.

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[3] As noted on Figure 4, the diagram was developed to illustrate the concepts of safe yield and does not depict the complexity of the multi-aquifer system of the Antelope Valley Groundwater Basin.

[4] These return flows are different from ~~the~~ I~~i~~mported W~~w~~ater R~~r~~eturn F~~f~~lows specified in the Judgment because of ~~to~~ a different land use mix associated with imported water (i.e., more imported water is used for municipal purposes than agricultural purposes).

Credits for imported water return flows are assigned in the Judgment according to use (see **Section 3.2.8** for a description of these credits). Some imported water may be delivered to a recharge facility (e.g., a spreading basin) and recharged directly into the groundwater basin for subsequent recovery and use; such a recharge facility is illustrated conceptually on **Figure 4**. When imported water is recharged directly, return flows do not occur unless and until the recharged water is recovered and used in the basin.

The technical analysis in 2010 recognized that safe yield is not necessarily a constant value and can change over time with varying land use and water management practices. As described above, the Native Safe Yield has embedded assumptions of land use and return flows. The Total Safe Yield will change based on average amounts of imported water available to the basin over time. The Judgment allows the Watermaster Engineer to initiate a recommendation to change the Native Safe Yield ten years after the seven-year rampdown period (Year 17 of the Judgment).

3.2 Safe Yield Component Monitoring

The Judgment requires monitoring of safe yield components. The primary data sets needed for ongoing analyses of natural recharge, use of imported water, and return flows are identified in this section, along with a description of data sources and monitoring programs. Some data sets represent components of the Safe Yield calculation that can be monitored directly. Other data sets support analyses to estimate components or check the reasonableness of components. The text below describes the types of data collected.

In addition to the 2016 data for this 2016 Annual Report, the Watermaster Engineer has been compiling historical hydrologic and hydrogeologic information to build a comprehensive database of the safe yield components for the Watermaster. This hydrologic and hydrogeologic database will supplement the water accounting database, also being developed by the Watermaster Engineer for the purposes of tracking production categories and other requirements of the Judgment.

For this first Annual Report, the 2016 data summaries are abbreviated. Retention of the Watermaster Engineer occurred at the end of April 2017, offering a limited amount of time to compile and review data sets in the Antelope Valley Adjudicated Area and to conduct a review of basin hydrogeology and the Judgment. The Antelope Valley Watermaster has approved further analyses of the monitoring program after submittal of this Annual Report. More detailed analyses of safe yield components are anticipated for future annual reports.

3.2.1 Climate Data

Precipitation is the primary source of natural groundwater recharge and controls the location and pathways of natural recharge in the basin. Average annual precipitation in the Antelope Valley watershed varies from 4 inches to 47 inches with an area-weighted average of 8.3 inches (Beeby et al., 2010). Upland areas within the watershed but outside of the groundwater basin account for most of the precipitation. Area-weighted average precipitation amounts in the upland watershed are listed below:

- San Gabriel Mountains – 15.4 inches per year
- Tehachapi Mountains – 13.1 inches per year
- Eastern buttes – 8.7 inches per year
- Northern buttes – 9.2 inches per year

Average annual precipitation on the valley floor is typically less than 8 inches per year. Most of the Central Antelope Valley, Rogers Lake, and South East subareas have an average annual precipitation rate less than about 5 inches per year.

For the 2010 analyses, precipitation data for 23 stations covering a 57-year period (1949-2005) were compiled and analyzed. Much of these historical data sets have been downloaded for Watermaster files, with an emphasis on active state or federal supported weather stations. Data were also obtained from additional stations with a focus on recent data to support this Annual Report (Calendar Year 2016). Many of these stations also contain other climate information such as reference ET (ET_o) and temperature.

Precipitation (and other climate) data for the Antelope Valley Adjudication Area and surrounding watershed are available from the following primary sources: Los Angeles County, California Irrigation Management Information System (CIMIS), and National Weather Service cooperative stations (data available through the Desert Research Institute). Data were downloaded from these sources for 46 stations. **Table 2** provides station summary information; station locations are shown on **Figure 5**.

Precipitation data for 2016 are used to determine whether the year was wet, dry or average to provide context to additional groundwater analyses. In general, precipitation for calendar year 2016 was below average in the Antelope Valley, reflecting the severe drought conditions experienced statewide over the last few years. However, a wet December resulted in many stations ending the year close to average conditions. Using 2016 data from the Palmdale Station (CIMIS 197) as an example, cumulative monthly precipitation for 2016 was compared to wet, average and dry conditions in the area (derived from nearby Palmdale DRI Station). These data are shown graphically in the top chart on **Figure 6**; the location of the Palmdale Station is highlighted on **Figure 5**.

As indicated on **Figure 6**, average annual precipitation in this area of the basin is about 7.1 inches per year; precipitation for 2016 was 6.1 inches. The variability in local precipitation is also indicated on the chart, ranging from 2.9 inches per year (example dry year 2012) to 15.4 inches per year (example wet year 1983).

Table 2. Precipitation and Evapotranspiration Stations

ID	Station Name	Elevation	Latitude	Longitude	Source	Period of Record		Frequency
						Min	Max	
117	Victorville	2,890	34.47591	-117.26351	CIMIS	Jan-2003	Jun-2017	Daily
197	Palmdale	2,550	34.61498	-118.03249	CIMIS	Apr-2005	Jun-2017	Daily
220	Palmdale Central	2,630	34.59222	-118.1275	CIMIS	Mar-2011	Jun-2017	Daily
1	Mojave		35.04917	-118.16194	DRI	Jan-1904	Dec-2017	Monthly
2	Lancaster FF		34.74111	-118.21167	DRI	Jan-1974	Dec-2017	Monthly
3	Pear Blossom		34.50278	-117.89444	DRI	Jan-2015	Jun-2017	Monthly
4	Palmdale DRI		34.61498	-118.03249	DRI	Jan-1903	Jan-2017	Monthly
1005B	County Fire Station #81	2,767	34.51917	-118.28694	LA County	Oct-2016	Jun-2017	Daily
1017B	Little Rock Crk Above Dam Percip	3,267	34.47778	-118.02472	LA County	Oct-2016	Jun-2017	Daily
1058B	Palmdale W.D.	2,627	34.58806	-118.09194	LA County	Oct-1999	Jun-2017	Daily
1060B	Little Rock-Sycamore Camp Pcp	4,012	34.41722	-117.97028	LA County	Oct-2016	Jun-2017	Daily
1166B	Mile High Ranch	5,280	34.41111	-117.77083	LA County	Jan-2003	Jun-2017	Daily
120	County Fire Station #80	3,120	34.48833	-118.14194	LA County	Oct-2016	Jun-2017	Daily
1212	Lancaster Fss/Faa	2,320	34.73333	-118.21667	LA County	Oct-1999	Apr-2017	Daily
1240	Pearblossom-CALI.DW.R. Booster	3,050	34.50889	-117.92083	LA County	Oct-1999	May-2017	Daily
1242	Rocky Buttes Precip	2,540	34.64611	-117.84528	LA County	Oct-2016	Jun-2017	Daily
1243	Redman Precip	2,387	34.76500	-117.92611	LA County	Oct-2016	Jun-2017	Daily
1244	Roper Ranch Precip	2,438	34.67306	-118.01083	LA County	Oct-2016	Jun-2017	Daily
1245	Quartz Hill Precip	2,427	34.64944	-118.21722	LA County	Oct-2016	Jun-2017	Daily
1246	Scott Ranch Precip	2,718	34.79056	-118.45972	LA County	Oct-2016	Jun-2017	Daily
1247	North Lancaster Precip	2,340	34.76111	-118.10722	LA County	Oct-2016	Jun-2017	Daily
1248	Mescal Smith Precip	3,810	34.46667	-117.71111	LA County	Oct-2016	Jun-2017	Daily
1249	G-168 Pump Station	2,941	34.73444	-117.82833	LA County	Oct-2016	Jun-2017	Daily
1250	Avek Precip	2,825	34.52333	-117.92389	LA County	Oct-2016	Jun-2017	Daily
125B	House No.	2,105	34.59028	-118.45417	LA County	Oct-1999	Oct-2016	Daily
1267	Lancaster Reclamation Plant	2,302	34.77722	-118.15306	LA County	Oct-1999	Oct-2016	Daily
1268	Palmdale Reclamation Plant	2,565	34.59167	-118.08611	LA County	Oct-2016	Jun-2017	Daily
128B	Pcp	2,075	34.60833	-118.55944	LA County	Apr-2005	Jun-2017	Daily
1291	Rollin Ranch - Valyemo	5,040	34.41722	-117.75722	LA County	Mar-2011	Jun-2017	Daily
299F	Little Rock - Schwab	2,800	34.53667	-117.97861	LA County	Oct-2016	Jun-2017	Daily
321	Pine Canyon Patrol Station # 78	3,304	34.67417	-118.43083	LA County	Oct-1999	Apr-2017	Daily
322	Munz Valley Ranch	2,600	34.71389	-118.35417	LA County	Oct-1999	Oct-2016	Daily
409B	Pyramid Reservoir	2,505	34.67611	-118.77972	LA County	Oct-2016	Jun-2017	Daily
455B	Sta.	2,395	34.68250	-118.13389	LA County	Oct-1999	Apr-2017	Daily
517B	Lewis Ranch Precip	4,615	34.41972	-117.88611	LA County	Oct-2016	Jun-2017	Daily
542	Fairmont	3,050	34.70417	-118.42778	LA County	Oct-2016	Jun-2017	Daily
564C	Llano	3,394	34.48556	-117.83444	LA County	Oct-2016	Jun-2017	Daily
598D	Neenach - Check 43	2,973	34.79472	-118.62222	LA County	Oct-1999	Apr-2017	Daily
747	Sanberg - Airways Station	4,510	34.74333	-118.72500	LA County	Oct-1999	May-2017	Daily
82F	Table Mountain	7,420	34.38222	-117.6775	LA County	Oct-2016	Jun-2017	Daily
83B	Big Pines Recreation Park Pcp	6,860	34.37889	-117.68889	LA County	Oct-2016	Jun-2017	Daily
AL388	Fire Station 114 (Lake Los Angles)	2,710	34.60667	-117.82556	LA County	Oct-2016	Jun-2017	Daily
AL468	Fire Station 77	3,459	34.75972	-118.79778	LA County	Oct-2016	Jun-2017	Daily
AL480	Fire Station #112 (Antelope Acres)	2,428	34.75444	-118.28833	LA County	Oct-2016	Jun-2017	Daily
AL481	Fire Station # 140 (Leona Valley)	3,172	34.61778	-118.28500	LA County	Oct-2016	Jun-2017	Daily
AL485	Lancaster Waterworks	2,460	34.66694	-118.12528	LA County	Oct-2016	Jun-2017	Daily

~~Precipitation data for 2016 are used to determine whether the year was wet, dry or average to provide context to additional groundwater analyses. In general, precipitation for calendar year 2016 was below average in the Antelope Valley, reflecting the severe drought conditions experienced statewide over the last few years. However, a wet December resulted in many stations ending the year close to average conditions. Using 2016 data from the Palmdale Station (CIMIS 197) as an example, cumulative monthly precipitation for 2016 was compared to wet, average and dry conditions in the area (derived from nearby Palmdale DRI Station). These data are shown graphically in the top chart on **Figure 6**; the location of the Palmdale Station is highlighted on **Figure 5**.~~

~~As indicated on **Figure 6**, average annual precipitation in this area of the basin is about 7.1 inches per year; precipitation for 2016 was 6.1 inches. The variability in local precipitation is also indicated on the chart, ranging from 2.9 inches per year (example dry year 2012) to 15.4 inches per year (example wet year 1983).~~

The bottom chart on **Figure 6** shows average monthly precipitation compared to 2016 monthly precipitation. The graph has been extended beyond 2016 to include March 2017 for purposes of the discussion of groundwater levels, presented in **Section 3.2.3**. As shown on the bottom chart on **Figure 6**, 2016 rainfall was below average for every month of the year, although December was very close to the average. December accounted for almost one-quarter of the total annual rainfall at the Palmdale station. The high rainfall continued into 2017, with above-average rainfall in both January and February.

3.2.2 Streamflow Data

As described above, runoff from the surrounding watershed provides significant groundwater recharge to the basin. Streams originate in the uplands and flow out onto the valley floor, where most of the water infiltrates into the basin sediments (see **Figure 4**). The most hydrologically significant streams include drainages in the San Gabriel and the Tehachapi mountains as summarized below (IRWMP, 2013):

- San Gabriel Mountains
  - Big Rock Creek
  - Little Rock Creek
  - Amargosa Creek
- Tehachapi Mountains
  - Oak Creek
  - Cottonwood Creek

The 2010 analyses compiled streamflow data from 18 gage stations spanning a 61-year period (1949-2009). These data were supplemented with characteristics of channel geometry at gaged and ungaged sites to allow for a more comprehensive assessment of runoff. Almost all historical data from these stations have been downloaded to supplement our files. Only six of these stations remain active. Data are summarized in **Table 3**. Streamflow gage locations are shown on **Figure 5**.

As shown in **Table 3**, discharge volumes are available for 18 streams at 24 measuring points in the Antelope Valley Adjudication Area and surrounding watershed. In addition, we have stream infiltration data for three sites along Amargosa Creek, where the City of Palmdale is investigating potential sites for recharge (see first three sites on **Table 3**).

The USGS National Water Information System (NWIS) had previously compiled stream gage data at all stations listed in Table 3 with historical data from 1988 to 2005. Currently, USGS monitors only one remaining station (Big Rock C Near Valyermo Ca). Los Angeles County has begun monitoring five of the former USGS stations including Big Rock Creek, Little Rock Creek, Mescal Creek, Pallett Creek, and Santiago Canyon Creek (**Table 3**).

Table 3. Streamflow Gaging Stations

ID	Station Description	Source	Period of Record	
			Min	Max
	Amargosa C Nr Leona Siphon Nr Palmdale, CA	USGS		
	Amargosa C A 25th Street W Nr Palmdale, CA	USGS		
	Amargosa C Nr Palmdale, CA	USGS		
10264503	Barrel Springs Trib A Ca Aq Xing Nr Palmdale Ca	USGS	10/21/88	2/13/92
10263630	Big Rock C Ab Pallett C Nr Valyermo Ca	USGS/LA County	11/2/88	3/31/17
10263500	Big Rock C Nr Valyermo Ca	USGS	1/25/69	6/18/17
10263675	Big Rock C Wash A Hwy 138 Nr Llano Ca	USGS	12/12/88	3/17/93
10264640	Buckhorn C A E 120th Ave Nr Rogers Lake Ca	USGS	12/10/96	3/7/01
10263900	Buckhorn C Nr Valyermo Ca	USGS	5/8/91	5/8/91
10264550	City Ranch C Nr Palmdale Ca	USGS	1/13/93	1/13/93
10264555	Estates C Nr Quartz Hill Ca	USGS	5/1/89	2/18/93
10264510	Inn C A Palmdale Ca	USGS	12/16/88	1/13/93
10264605	Joshua C Nr Mojave Ca	USGS	4/1/92	3/16/93
10264501	Little Rock C A Hwy 138 Nr Littlerock Ca	USGS	4/10/89	2/24/92
10264000	Little Rock C At Little Rock Res Nr Littlerock Ca	USGS/LA County	1/1/00	3/31/17
10264682	Mescal C Nr Pinon Hills Ca	USGS/LA County	1/1/00	3/31/17
10264658	Mojave C A Forbes Ave A Edwards AFB Ca	USGS	12/6/97	9/27/00

10264660	Mojave C A Rosamond Blvd A Edwards Ca	USGS	12/6/97	3/7/01
10264600	Oak C Nr Mojave Ca	USGS	12/21/88	3/16/93
10263665	Pallett C A Big Rock C Nr Valyermo Ca	USGS/LA County	11/3/88	3/31/17
10264502	Peach Tree C Nr Littlerock Ca	USGS	12/16/88	3/31/92
10264530	Pine C Nr Palmdale Ca	USGS	1/13/90	3/18/93
10264675	Rogers Lk Trib A Edwards Afb Ca	USGS	2/3/98	2/3/98
10264100	Santiago Cyn C Ab Little Rock C Nr Littlerock Ca	USGS/LA County	1/1/00	3/31/17
10264636	Sled Track Cyn A Lancaster Blvd Nr Rogers Lake Ca	USGS	12/10/96	3/7/01
10264508	Somerset C A Palmdale Ca	USGS	1/24/89	2/17/94
10264560	Spencer Cyn C Nr Fairmont Ca	USGS	2/14/92	2/14/92

~~The USGS National Water Information System (NWIS) had previously compiled stream gage data at all stations listed in **Table 3** with historical data from 1988 to 2005. Currently, USGS monitors only one remaining station (Big Rock C Near Valyermo Ca). Los Angeles County has begun monitoring five of the former USGS stations including Big Rock Creek, Little Rock Creek, Mescal Creek, Pallett Creek, and Santiago Canyon Creek (**Table 3**).~~

Little Rock Creek contains an upstream reservoir, Littlerock Reservoir, jointly owned by PWD and LCID. PWD diverts water from the reservoir and maintains records of the discharge. There were no diversions recorded for 2016.

Although data are limited with respect to the number of streams being actively monitored, data from Big Rock Creek and Little Rock Creek provide consistent, long-term data for analysis. In addition, recent work by USGS for the City of Palmdale provides direct infiltration rates along Amargosa Creek for estimating groundwater recharge.

3.2.3 Groundwater Levels

Groundwater elevation data throughout the valley are cataloged in the USGS NWIS online. Those data represent the most comprehensive database of water levels in the valley. In addition, USGS currently monitors approximately 200 wells within and adjacent to the Antelope Valley Adjudication Area. Wells in recent USGS monitoring programs are shown on **Figure 7**. The network contains relatively good coverage for each of the Management Subareas. The network also contains wells adjacent to the Adjudication Area, such as Fremont Valley and alluvial areas north of the Rogers Lake Subarea (**Figure 7**). These wells were used to assist in contouring along the northern Adjudication Area boundary.

This ongoing monitoring program is part of the California Statewide Groundwater Elevation Monitoring (CASGEM) program and is funded by the Antelope Valley State Water

Contractors Association (District 40, 2014[5]). Previously, monitoring costs for this work were shared by AVEK, LCID, and PWD, with additional funding from USGS. Recognizing its benefits for the safe yield component monitoring, the Antelope Valley Watermaster has recently agreed to negotiate with the Antelope Valley State Water Contractors Association to share in the costs of the USGS monitoring program and has earmarked $25,000 in its 2017 budget.

The USGS monitoring program involves measurement of water levels in approximately 200 wells in the spring and 30 index wells in the fall of each year. In addition to this basin-wide monitoring, USGS has selected 35 wells to be formally designated as CASGEM monitoring wells, based on the decades-long record of water level measurements in those wells. A table of those 35 wells is provided in the CASGEM Monitoring Plan (District 40, 2014). All data are available on both the USGS website (NWIS) and the CASGEM website maintained by DWR.

Most of the wells in the monitoring program are production wells rather than dedicated monitoring wells. Measurements in active production wells can be significantly affected by pumping drawdowns and well inefficiency and may not accurately reflect the actual water levels in the aquifer. Recently, some well owners have expressed concerns regarding the accuracy of water level data in the USGS monitoring program. In particular, some active pumping wells may not have been allowed to recover sufficiently prior to USGS measurements. It is clear that the basin would benefit from a comprehensive set of standardized procedures for measuring static water levels in the monitoring program wells. The Watermaster Engineer will be working with USGS to develop reasonable and appropriate monitoring protocols and practices to ensure that accurate water level data are being collected.

In addition to the water levels measured by USGS, water level data have been provided by many of the public water suppliers and mutual water companies. Well records and/or water level data from more 130 wells have been provided by numerous agencies including:

AVEK	Centennial Founders LLC	City of Lancaster	Colorado MWC
District 40	Littlerock Creek ID	Palmdale WD	Quartz Hill WD
Rosamond CSD	Shadow Acres MWC	Sundale MWC	West Side Park MWC
White Fence Farms MWC			

These data are being reviewed and included in the Watermaster hydrologic and hydrogeologic database, prioritizing the data sets with the most complete well information.

[5] District 40 prepared the CASGEM Monitoring Plan for the Antelope Valley State Water Contractors Association on file with DWR.

3.2.3.1 Groundwater Elevation Contour Maps

To further examine groundwater conditions for the Annual Report, two basin-wide groundwater elevation contour maps have been prepared for March 2016 and March 2017. These time periods were selected based on the large number of water levels available. In addition, March measurements are typically taken prior to the summer irrigation season[6] when pumping wells would be less likely to alter water levels significantly. By developing these two maps one year apart, a change in groundwater in storage can be approximated for calendar year 2016, the period covered in this Annual Report.

Well locations with water level measurements in either March 2016 or 2017 are shown on **Figure 8**. Wells are color-coded by the agency (source) that provided the data. The number of wells for each of these data sets is summarized in **Table 4**.

Table 4. Water Level Data by Source

Source of Water Level Data	Wells Measured in 3/2016 or 3/2017
U.S. Geological Survey	168
District 40	49
Quartz Hill Water District	9
Palmdale Water District	19
City of Lancaster	1

Contours were generated using an electronic contouring program and adjusted locally, as needed. Wells outside the Adjudication Area were used to ~~assist~~ slightly adjust~~with~~ the orientation of the contours along the northern edge of the Adjudication Area, but those wells are not shown on the contour maps to avoid confusion. ~~were~~ These areas outside of the Adjudication Area were not ~~removed from the contour maps for~~included in the change in storage analysis. Wells with measurements in only one of the two time periods were reviewed to determine if artificial differences in the two contour maps were created. These anomalies could suggest unsubstantiated changes in storage locally. This review resulted in removing about 50 wells from the data sets for the purposes of the change in storage analysis.

[6] It is recognized that March irrigation occurs for some crops in the Antelope Valley, such as alfalfa and carrots, among others. According to a land use study by California State University, Los Angeles (Qiu, 2013), October appears to be the month when most crops in the Antelope Valley are not irrigated (i.e., end of the growing season for carrots and onions and prior to irrigation for winter grains). However, late fall measurements may be complicated by recovering water levels. In addition, other water supply wells may be pumping more in October than in spring. Data are being reviewed to recommend an optimal time for future water level measurements in the basin.

Management Subareas listed in the Judgment are included on the groundwater elevation contour map (subarea names are on **Figure 8**). Previous investigators have divided the basin into as many as 13 separate subareas with boundaries based on the surrounding uplands and along known and inferred geologic faults, which created areas of groundwater level discontinuities. The 2010 analysis indicated that many of the previously-defined subarea boundaries did not appear to disrupt water levels; accordingly, many of these former subareas are no longer used. The five subareas shown on **Figure 8** are retained in the Judgment for purposes of groundwater management.

The contour maps for March 2016 and March 2017 are presented on **Figures 9** and **10**, respectively and discussed below.

March 2016 Water Levels: As shown on **Figure 9**, groundwater elevation contours in the southeast and west-northwest portions of the map indicate relatively large hydraulic gradients (contours closely spaced) and groundwater flow toward the central portion of the basin. Water levels are lowest in the Lancaster-Palmdale area and adjacent areas to the northeast – areas where much of the basin groundwater production occurs. The lowest water levels during March 2016 are below 2,000 feet msl in Palmdale (**Figure 9**).

A relatively large area of the South East Subarea is excluded from the contouring (see red-outlined area on **Figure 9**). In this area, groundwater is relatively shallow and contours must be manually controlled to prevent water levels appearing higher than the ground surface elevation. The area is sparsely populated and production or monitoring well data are unavailable. The lack of data, shallow depth to groundwater, and large hydraulic gradients produce inaccurate contours in this area (for example, showing groundwater levels above the ground surface). Therefore, the area was excluded from the analysis to prevent artificial changes in groundwater in storage from being calculated[7].

As indicated by the contours on **Figure 9**, there are two subarea boundaries that appear to impede water levels and create discontinuities in water levels. In the northwest, the boundary between the Willow Springs Subarea and the West Antelope Subarea creates such a discontinuity as indicated by a break in the contours (**Figure 9**). This boundary generally is located along the Willow Springs, Cottonwood, and Rosamond faults, indicating that the faults disrupt water levels in the subsurface. The change in water levels across the faults range from about 200 feet on the eastern part of the boundary to more than 400 feet in the west.

In the southeast, the boundary between the Central Antelope Valley Subarea and the South East Subarea also indicates a disruption in water levels. Although no known geologic faults have been mapped along this boundary, the presence of the buttes and bedrock outcrops near and along the boundary suggest the possible presence of faults (inferred). The water level declines around pumping wells northwest of the boundary do not appear to be

[7] There is at least one well in the excluded area of the South East Subarea that could be prioritized for water level monitoring in the future. The Watermaster Engineer is reviewing the current water level monitoring program for potential improvements to future monitoring events.

affecting water levels southeast of the boundary. Water level differences of about 100 feet (northeast part of the boundary) to more than 300 feet (southeast part of the boundary) are indicated on **Figure 9**. The remaining Management Subarea boundaries do not appear to indicate a disruption in water levels.

March 2017 Water Levels: Groundwater elevation contours for March 2017 are shown on **Figure 10**. Given the scale and contour interval of the maps, water levels on **Figure 10** appear almost identical to water levels on **Figure 9**. This is because water levels typically do not change significantly (more than a few feet) on an annual basis (exceptions include areas of localized recharge or in pumping wells). Patterns of groundwater flow and hydraulic gradients are also similar on both contour maps. The two Management Subarea boundaries that created breaks in the contours for 2016 on **Figure 9** are also seen on **Figure 10**.

The area of shallow groundwater excluded from contouring in the South East Subarea is also excluded from contouring on **Figure 10**. As explained above, this exclusion prevents the need to artificially lower contours to some unspecified depth to prevent water levels from appearing to be above the ground surface. This also prevents a calculation of change in groundwater in storage that would be an artifact due to the lack of data.

Water Level Change from March 2016 to March 2017: Notwithstanding the similarities in **Figures 9** and **10**, water levels have changed from March 2016 to March 2017, especially in key areas of the basin. For illustration purposes, the two contour maps have been electronically subtracted to develop a contour map of water level change, as presented on **Figure 11**. The changes are color-coded with areas of water level rise shown in blue, and water level declines shown in orange. Light yellow represents areas where water levels are generally unchanged. Contours have also been added to the map to more clearly differentiate among the areas of water level changes.

In the Central Antelope Valley Subarea, water levels have risen along the southern basin boundary as indicated by the blue shading on **Figure 11**. For example, the low water levels in the Palmdale area in 2016 (**Figure 9**) are up to 30 feet higher in 2017 (**Figures 10 and 11**). The rise in water levels may be the result of less pumping during the wet period or local basin recharge from runoff associated with high amounts of rainfall in January and February 2017 or both (see lower chart on **Figure 6**). Water levels in other part of the Central Antelope Valley Subarea have experienced either no change or minor declines. One area in the central portion of the Central Antelope Valley Subarea indicates a water level decline of more than 10 feet locally associated with groundwater pumping.

The South East Subarea also indicates areas of water level rise and declines. Water levels are higher along the subarea boundary with the Central Antelope Valley Subarea and in the northeastern subarea where groundwater use is limited. Water level declines are noted in the southern portions of the subarea. As discussed above, the area of shallow groundwater and limited data is excluded from the analysis to prevent artificial estimations of change in groundwater in storage.

The Willow Springs Subarea contains only a few wells to estimate water level changes. Although wells outside of the subarea were used to control contours, the actual changes in water levels from 2016 to 2017 are less certain than areas where the change can be observed directly in subarea-measured wells. Based on sparse data, subarea wells indicate a rise in water levels.

Water levels in the West Antelope Subarea and the Rogers Lake Subarea did not change significantly from 2016 to 2017, although most wells indicated a slight decline. On an area-weighted basis, water levels rose about 0.5 feet over the entire Adjudication Area.

3.2.3.2 Change in Groundwater in Storage

The surface of water level change on **Figure 11** was used to estimate the volume of groundwater change for each subarea and over the entire Adjudication Area. For these estimates, a methodology was developed similar to the one used in the 2010 Summary Expert Report (Beeby, et al., 2010).

For this analysis, the Watermaster Engineer obtained the basin-wide specific yield analyses developed for the 2010 analyses (as discussed previously – see **Section 3.1.1.2** above). The intervals of change from the March 2016 and March 2017 maps (prepared by the Watermaster Engineer) were exported and compared to the specific yield (Sy) analyses. A Sy value was selected from the 2010 data for each interval where water levels had either risen or declined. In this manner, textures affected by the 2016-2017 water level changes were the same textures used to derive a Sy value.

This analysis indicated a total increase in groundwater in storage from March 2016 to March 2017 of approximately 53~~.~~,761~~71,123~~ AF in the groundwater basin. There are a number of factors that may account for t~~T~~his increase in storage, including ~~is likely due to~~ the end of the severe drought conditions in California with increased rainfall in late 2016 and early 2017 (see **Figure 6**) and~~. Areas of rising water levels could also indicate~~ decreases in local groundwater pumping. The change of groundwater in storage for each Management Subarea is summarized in **Table 5**.

Table 5. Change in Groundwater in Storage for Management Subareas

Management Subarea	Area (acres)	Average Specific Yield[1]	Ave. Change Groundwater Elevation (ft)[1]	Change in Groundwater in Storage (AF)[1]
West Antelope Subarea	166,150	0.13	-0.2	-4,973
Central Antelope Valley Subarea	286,780	0.13	1.6	60,993
South East Subarea	167,658	0.13	-0.1	-1,461
Willow Springs Subarea	52,740	0.11	0.6	3,235
Rogers Lake Subarea	177,708	0.15	-0.2	-4,032
TOTAL	**851,036**			**53,761**

[1]Area-weighted averages are provided for the specific yield and change in groundwater elevation; calculations of change in groundwater in storage were performed continuously over the entire water level change surface and do not match a simple multiplication of the averages and the acres.

The largest change in water levels for 2016 was observed in the Central Antelope Valley Subarea; accordingly, that subarea contains the largest change in groundwater in storage – an increase of 60,993 AF. An increase in groundwater in storage is also estimated for Willow Springs Subarea (3,235 AF). A loss of groundwater in storage was indicated for the West Antelope Subarea (-4,973 AF), the Southeast Subarea (-1,461 AF), and the Rogers Lake Subarea (-4,032 AF), although the changes were relatively small, given the large area covered by these three subareas.

3.2.4 Subsidence Monitoring

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 can sink.

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 (fissured) runways and accelerated erosion on Rogers lakebed. USGS reports that this subsidence has also permanently reduced groundwater storage capacity by about 50,000 AF[8].

Figure 12 shows the distribution of land subsidence in the Antelope Valley from 1930 to 1992 (Ikehara and Phillips, 1994). Historical land subsidence has primarily affected the northern half of the Central Antelope Valley Subarea, and small portions of the West Antelope and Rogers Lake Subareas (**Figure 12**). An analysis of satellite-based InSAR (interferometric synthetic aperture radar) data indicate an additional 0.2 to 0.6 feet of land subsidence occurred between 1993 to 2005 in sections of the subsidence-prone area.

Additional information and data on historical land subsidence is available through USGS, which has established a network of 85 elevation benchmarks for the purposes of monitoring land subsidence, as shown on **Figure 12**. In addition, three extensometers have been installed at Edwards Air Force Base to measure land subsidence directly. However, other than at Edwards Air Force Base, there is no formal subsidence monitoring program that can be accessed for the purposes of the Antelope Valley Watermaster to analyze subsidence on an ongoing basis. A periodic subsidence monitoring program, conducted in cooperation with USGS and using either benchmark surveys or InSAR data could be explored in the future, if warranted.

Alternatively, the ongoing water level monitoring program could function as a proxy for subsidence monitoring. If water levels are maintained above historic lows, then decreasing pore pressures in previously un-compacted clay layers can be avoided. By monitoring water

[8] In general, this loss of capacity is due to a one-time compaction of fine-grained layers that did not likely store significant quantities of usable groundwater.

levels and maintaining levels above historic lows, further land subsidence from groundwater pumping can be mitigated.

3.2.5 Groundwater Quality

Groundwater provides a high-quality water supply for the beneficial uses in the Antelope Valley groundwater basin (SNMP, 2014). Total dissolved solids (TDS), an indicator of overall salts and mineral content, are present in groundwater at an average concentration of 300 to 350 milligrams per liter (mg/L) (DWR, 2004; SNMP 2014). In general, water quality is best in the southern and central parts of the basin; TDS concentrations increase in the northern basin and range up to about 800 mg/L near the dry lakes. Consistent with other desert basin aquifers in southern California, trace element concentrations can be elevated locally in the Antelope Valley, including arsenic and boron (USGS and SWRCB, 2013). In general, groundwater quality meets drinking water standards and management goals throughout most areas of the basin (SNMP, 2014).

As part of the CASGEM monitoring plan, USGS samples a subset of Antelope Valley wells for groundwater quality. Sampling occurs in the 35 CASGEM wells on a rotational 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. Each entity has groundwater quality monitoring requirements associated with its permit from the Division of Drinking Water, State Water Resources Control Board (DDW, SWRCB). Data are summarized in Consumer Confidence Reports prepared annually by the water purveyors. DDW (formerly Department of Public Health) also maintains these data in a public water quality database. Several public water suppliers have provided recent groundwater quality data to the Watermaster Engineer.

The SNMP has developed a groundwater quality monitoring plan using wells from the SWRCB Groundwater Ambient Monitoring and Assessment (GAMA) program (SNMP, 2014). The plan includes 23 wells owned and operated by established 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.

Data sources discussed above provide groundwater quality data that are publicly available. Additional data sources of groundwater quality are currently being reviewed.

3.2.6 Surface Water Quality

Numerous local agencies monitor the various sources of surface water in the Adjudication Area. Collection of the quality data for imported water (State Water Project water), recycled water, and stormwater is ongoing; data will be compiled into the Watermaster database.

SWP water is treated at the PWD Leslie O. Carter Water Treatment Plant (WTP) for use by PWD and LCID. SWP water is also treated at the four AVEK treatment facilities (Quartz Hill WTP, Eastside WTP, Rosamond WTP, and Acton WTP). SWP water is high quality with total dissolved solid (TDS) concentrations typically in the upper 200 mg/L range.

Recycled water is available from the Los Angeles County Sanitation District's (LACSD) Palmdale and Lancaster water reclamation plants (WRPs), Edwards Air Force Base (EAFB) Air Force Research Laboratory Treatment Plant and the Main Base Wastewater Treatment Plant (WWTP), and the RCSD's WWTP. Tertiary treated effluent from LACSD is used for agriculture, purple pipe system (parks, landscaping, etc.), and environmental purposes. Treated water from the two EAFB plants is used only on the base. The RCSD WWTP has the capacity to treat 1.3 million gallons per day (mgd) of secondary-treated water and 0.5 mgd of tertiary-treated water. The RCSD WWTP is in the process of being permitted and currently discharges all its wastewater in clay-lined ponds.

Recycled water in the Antelope Valley meets most drinking water standards (SNMP, 2014). EAFB recycled water quality tends to have higher salt and nutrient concentrations (e.g., TDS, nitrate, chloride); elevated TDS and chloride concentrations have been linked to the higher mineral content in ~~probably due to source water coming from~~ the lower aquifer, which serves as the source water for recycled water in that area~~has a higher mineral content~~ (SNMP, 2014).

Littlerock Reservoir, jointly owned by PWD and LCID, collects runoff from the San Gabriel Mountains. Water from Littlerock Reservoir discharges to Lake Palmdale and is subsequently treated at the PWD treatment plant. Water quality in Lake Palmdale is considered good with TDS concentrations of about 150 mg/L (SNMP, 2014).

3.2.7 Groundwater Production

In compliance with the Judgment, all Producers (except unmetered Small Pumper Class members) are required to report annual production to the Watermaster. Watermaster staff developed a Production Report form for Producers to standardize annual filings. A copy of this form is in **Appendix D**. The form was prepared for production reporting prior to the well meter installation deadline and allows for estimation of groundwater production. The form is being reviewed for possible revisions; the final form will be incorporated into the Rules and Regulations document.

3.2.7.1 2016 Reported Production

Appendices E and **F** present the reported ~~P~~production data for 2016. ~~as reported by the Non-Overlying) Producers (on Exhibit 3 of the Judgment), and Federal and State Production is in **Appendix E**. This appendix contains the reported production associated with the Production Rights on Exhibit 3 plus Federal, and State, and City of Lancaster Production Rights and~~ The appendices do~~es~~ not include other types of rights such as imported water return flows.

In **Appendix E**, **Table E-1** includes specific information for each Exhibit 3 Non-Overlying Producer including the pumping entity name, 2016 production, and the respective Production Right. Rampdown targets, allocation of unused Federal Reserved Rights, and AVEK-District 40 lease rights[9] (see **Appendix O**) are currently being determined and will be finalized by the end of 2017 for inclusion in future annual reports. As of July 10, 2017, nine of the eleven Producers on Exhibit 3 of the Judgment have reported 2016 production. The total 2016 production amount for Exhibit 3 Producers is 31,851528 AFY.

Appendix E also contains **Table E-2,** presenting Federal, and State, and otherthe City of Lancaster 2016 production. The Federal Government (Edwards Air Force Base and Air Force Plant 42) and the individual State departments are in the process of compiling production data to complete this table. As per the Judgment (Section 5.1.4.1) unused Federal Reserved Water Rights in any given year will be allocated to the Non-Overlying Production Rights holders, except for Boron CSD and West Valley County Water District, in the following year, in proportion to Production Rights set forth in Exhibit 3 of the Judgment. It is assumed that the unused portion of the Federal Reserved Government rRight will be used by the Non-Overlying parties in the year it is allocated and would not be subject to Carry Over since such allocation is not expressly included in the discussion of Carry Over rights in the Judgment (Section 15). The City of Lancaster is also listed on **Table E-2** sincebecause it can produce up to 500 AFY for use on the National Soccer Complex until recycled water becomes available.

Appendix F contains Production information for Exhibit 4 Overlying Producers. The table includes the Original Exhibit 4 Producer's name, Transferee name (if applicable), Pre-Rampdown Production, 2016-2022 target Rampdown Production, Production Right, 2016 production, and Carry Over Water (unused Production Right). Rampdown targets for 2016 and 2017 are the same as the Pre-Rampdown Production. Beginning in 2018, Pre-Rampdown Production is reduced linearly (20 percent per year) to reach the 2022 Production Right at the end of Rampdown.

Additional Production, not listed in **Appendices E** and **F**, and pursuant to potential Replacement Obligations is presented in **Appendix J**. In addition, there are reports of additional production in the basin by those without a Production Right in the Judgment. It is difficult to identify these pumpers and identifying methods are being developed.

As of July 2410, 2017, only 476 of the 104 Producers on Exhibit 4 of the Judgment (about 454 percent) have reported production (**Appendix F**). A second request for 2016 Production data was sent to the Producers in May 2017. Production reported to date totals 63,825.600,255.21 AF. About one-half of the reported production appears to be from

[9] District No. 40 has additional Production Rights from a lease with AVEK (**Appendix O**). As per Section 16.2 of the Judgment: Overlying Production Rights that are transferred to Non-Overlying Production Right holders shall remain on Exhibit 4 (**Appendix F** of this Annual Report) but may be used anywhere in the transferee's service area. Therefore, District No. 40's use of leased AVEK water will be footnoted on **Appendix E** in the future and tallied with AVEK's use on **Appendix F**.

agricultural landowners and about one-half appears to be from mutual water companies, industry, or other parties.

It is difficult to determine all of the reasons for the relatively low percentage of production reporting by Exhibit 4 parties in 2016. Contact information was apparently out of date for several landowners; some notices requesting information were returned undelivered and Watermaster Administrative staff has spent time researching and updating contact information. Some landowners may be unaware or confused about obligations under the Judgment. Other landowners may be uncertain about how to estimate an accurate production total on unmetered wells. It is also possible, that, given the impending rampdown, some landowners have either fallowed land or secured alternative water sources.

3.2.7.2 Production Metering for 2017

Much of the uncertainty in reported 2016 production will be mitigated by 2018 with the installation of meters on production wells (for Producers on Exhibits 3 and 4 in the Physical Solution of the Judgment). As required by the Judgment, all parties (except the Small Pumpers Class) shall install meters on their wells by December 23, 2017 (within two years after the Judgment) to measure production directly. The Watermaster Engineer is currently developing guidance and requirements for these measuring devices.

On May 31, 2017, the Watermaster Engineer met with the Advisory Committee to introduce preliminary requirements regarding meter selection, installation, calibration, reading, and maintenance. The Watermaster Engineer has also worked directly with the Technical representative from the Advisory Committee, who has advised on local conditions and metering considerations. Draft meter requirements will be presented at upcoming Watermaster Board meetings and Advisory Committee meetings to provide a forum for comments from well owners. When finalized, the requirements will be submitted to the ~~c~~Court for approval. The final meter requirements will also be incorporated in the Antelope Valley Watermaster Rules and Regulations document.

3.2.7.3 2016 Land Use Analysis for Small Pumper Class Evaluation

The Judgment defined a Small Pumper Class as all private (i.e., non-governmental) landowners that have been pumping less than 25 AFY from 1946 to present. The Judgment allows any Small Pumper Class Member to produce up to 3 AFY for reasonable and beneficial use on their overlying land without being subject to a Replacement Water Assessment (Section 5.1.3 of the Judgment).

The Watermaster is required to monitor the Small Pumper groundwater use by physical inspection, including the use of aerial photographs and satellite imagery (Section 5.1.3.2 of the Judgment). However, locations and parcel numbers for the more than 4,000 parties listed on Exhibit C of the Judgment are not readily available. In addition, parcel numbers are not readily available for all other producers in the basin, including the Overliers P~~p~~roduction; additional location information is currently being compiled.

To provide an independent estimate for groundwater use outside of the public water suppliers service areas, a preliminary analysis of land use and irrigation demand was developed for this Annual Report. The analysis may be helpful for an independent check on groundwater use by small pumpers once other groundwater production and irrigation water sources have been fully quantified (ongoing). For this report, the analysis is provided to better understand irrigation demand in the valley, This analysis also serves as an independent check for the largest type of 2016 un-metered pumping.

Acreages of crops grown in the valley were obtained from the agricultural commissioners of Kern and Los Angeles counties as summarized in **Table 6**. Note that the data provided for Los Angeles County combined carrots, onions, and potatoes; acreages allocated to these crops on **Table 6** are estimates only. However, for the general purposes of the analysis, the estimates do not significantly affect the overall irrigation demand.

Table 6. 2016 Estimated Agricultural Acreage in the Antelope Valley

Crop	Kern County (acres)	LA County[1] (acres)	Total 2016 (acres)
Alfalfa	320	6,000	6,320
Carrots	232	4,300	4,532
Grains	443	500	943
Deciduous	441	100	541
Melons	60		60
Onions	442	1,300	1,742
Potatoes	287	1,300	1,587
Grapes	6.5		6.5
TOTAL	**2,231.5**	**13,500**	**15,731.5**

[1] Total acres were subdivided for some crops; acres are estimated for carrots, onions, and potatoes.

Source: Kern County Department of Agriculture and Measurement Standards.
Los Angeles County Agricultural Commissioner/Weights & Measures.
Assistance with acreage allocation by crop provided by Dr. Gene Nebeker, personal communication.

These data indicate that the total irrigated agricultural acreage in the valley has declined over recent years. In the Summary Expert Report, irrigated agricultural acreage in the Antelope Valley was estimated to be about 23,000 acres for 2009 (Beeby, et al., 2010), a decrease of about 32 percent.

Irrigation demand was estimated for these crop acreages by applying crop coefficients (Kc) and reference ET data (ETo) at DWR CIMIS stations[10] to the following equation:

Crop Demand = Kc x ETo

The analysis indicates that the 2016 crop demand for the crops and acreages above was approximately 59,680 AFY. Assuming an overall irrigation efficiency of 75 percent (consistent with the Summary Expert Report), total irrigation demand for 2016 was about 79,574 AFY.

As mentioned above, reported 2016 production from overlying landowners is about 63,826~~0,255~~ AFY, with about one-half estimated to be for reported production for irrigation (about 30,000 AFY). ~~This comparison suggests that 2016 irrigation production is currently under-reported; however, the exact amount is not readily quantifiable.~~ Other water sources are used for agriculture irrigation including recycled water and small amounts of imported water; data that document those uses are still being reconciled. The land use analysis for irrigation demand may be useful for ongoing monitoring of groundwater use by Small Pumpers in the future after other components of irrigation sources and production are better quantified and meters are installed on all production wells.

3.2.8 Production Right

The Non-Overlying Producers (Exhibit 3 of the Judgment) have a Production Right of 12,345 AFY. The Overlying Producers (Exhibit 4 of the Judgment) have a Production Right of 58,322.23 AFY. The totals of Pre-Rampdown Production in the Judgment allow Exhibit 4 Overlying Producers to pump 105,892.63[11] AFY in 2016. The Judgment does not stipulate Pre-Ramp-down Production for the Non-Overlying Producers.

Additional types of rights are provided throughout the Judgment. As per the Judgment (Section 5.1.4.1), unused Federal Reserved Water Rights in any given year will be allocated to the Non-Overlying Production Rights holders (except for Boron CSD and West Valley County Water District) in the following year, in proportion to Production Rights set forth in Exhibit 3 of the Judgment. Rights to imported water return flows are discussed in the following section. Rights to Carry Over water are discussed in ~~a subsequent~~ **Section 3.3.1**.

3.2.9 Imported Water Use and Return Flows

AVEK, PWD, and LCID are SWP contractors with turnouts along the east branch of the California Aqueduct to import water into the Antelope Valley. AVEK imports SWP water for treatment at one of its four water treatment plants for delivery to its customers. AVEK also

[10] As recommended for the Antelope Valley by Blaine Hanson, Ph.D., Extension Irrigation and Drainage Specialist, Department of Land, Air and Water Resources, University of California, Davis.
[11] Exhibit 4 of the Judgment shows a Pre-Rampdown Production total of 105,878.08 AF due to the inadvertent omission of the last two entries in the sum on Exhibit 4 (Donna Wilson and William Fisher Memorial Water Company). The corrected sum of 105,892.63 will be used going forward.

imports SWP water for agriculture use and recharge for subsequent recovery and delivery to its customers. PWD imports SWP water for treatment through its water treatment plant located at Lake Palmdale and delivers the treated water to its urban customers directly. PWD also wheels small amounts of imported water to AVEK and LCID. LCID does not have a way to treat its SWP allocation but has conducted exchanges with AVEK over the last several years.

Appendix G provides details on the amount of water imported into the Antelope Valley watershed, amounts recharged (banked), and the amounts sold to customers. In 2016, a total of 50,381.64 AF of SWP water was imported into the watershed. AVEK imported 39,867 AF, PWD imported 10,514, and LCID imported 0.40 AF. Note that these numbers are still being reconciled.

As provided in Section 5.2 of the Judgment, parties listed on Exhibit 8 of the Judgment have a right to produce Imported Water Return Flows in any year 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. This calculation does not include Imported Stored Water in the Basin pursuant to a Storage Water Agreement (see **Section 3.3.3**). AVEK has rights to the imported water return flows used by parties not on Exhibit 8 of the Judgment.

At the time of preparation of this 2016 Annual Report, it was not possible to calculate imported water return flows. Review of 2016 data of imported water from AVEK to individual customers was determined to contain mixtures of both imported water and groundwater. This made it difficult to reconcile the actual amounts of imported water used by each customer. AVEK is in the process of partitioning out imported water use by each customer. The 2016 data require a more complete understanding by the Watermaster Engineer prior to requesting data from the preceding five years (2011 – 2015) or assignment of 2016 imported water return flows.

Imported water use in 2016 by the 37 parties on Exhibit 8 is listed in **Appendix H**. Return flows from agricultural imported water use are set in the Judgment at 34 percent and return flows from municipal and industrial imported water use are set in the Judgment at 39 percent of the amount of Imported Water used. These return flows will be calculated once the 2016 imported water use data has been fully reconciled and 2011 through 2015 data are compiled and reconciled.

Imported water is also banked in the Antelope Valley for storage and subsequent recovery and use. Groundwater banking by AVEK and others is described in **Section 3.3.3** on stored water and storage agreements.

3.2.10 Wastewater and Recycled Water

Antelope Valley area wastewater is treated at LACSD's Palmdale and Lancaster WRPs, EAFB Air Force Research Laboratory Treatment Plant and the Main Base WWTP, and the RCSD's WWTP. Quantities for 2016 are tabulated in **Appendix I**.

3.3 Additional Water Accounting

3.3.1 Carry Over Water

Producers can carry over an unproduced portion of an annual Production Right or a right to Imported Water Return Flows to the next year under certain conditions as defined by the Judgment. Producers are also allowed to purchase imported water and forego a portion of the Production Right to the Carry Over Water account (In Lieu Production Right Carry Over, Section 15.1 of Judgment). Carry Over Water amounts for Producers with unused~~for~~ Exhibit 3 Non-Overlying Production~~ers~~ Rights for 2016 are documented in **Appendix E**. Carry Over Water amounts for Producers with unused Exhibit 4 Overlying Production~~ers~~ Rights for 2016 are documented in **Appendix F**. Carry Over water from Imported Water Return Flows has not been calculated yet as discussed in **Section 3.2.9**.

3.3.2 Replacement Obligations

During the first two years of the Rampdown period (2016 and 2017), Producers are not subject to Replacement Water Assessment fees, and accordingly, respective payments are not expected and Replacement Obligations are not calculated. Phelan Pinon Hills Community Services District ~~is not a Producer and~~ does not have Production Rights, but according to the Judgment, is allowed to pump up to 1,200 AFY from its Well #14 provided such use does not cause Material Injury and the District pays a Replacement Water Assessment and any other costs deemed necessary to protect Production Rights defined in the Judgment, on all water produced and exported~~and pay the concomitant Replacement Water Assessment~~. Phelan Pinon Hills CSD questions if it should be subject to ~~a~~ Replacement Water Assessments in 2016 and 2017. The Judgment states:

8.3 Reduction of Production During Rampdown. During the first two Years of the Rampdown Period no Producer will be subject to a Replacement Water Assessment. During Years three through seven of the Rampdown Period, the amount that each Party may Produce from the Native Safe Yield will be progressively reduced, as necessary, in equal annual increments, from its Pre-Rampdown Production to its Production Right.

Phelan Pinon Hills CSD is a Producer but its Production is not part of the Native Safe Yield. The matter is being discussed by the Watermaster. The District's potential Replacement Water Obligation for Well #14 2016 production is listed in **Appendix J**.

Additional production in the basin is also associated with a Replacement Water Obligation, but these producers have not yet been identified. As part of the Rules and Regulations, the Watermaster will explore actions to identify all Replacement Water Obligations and collect Replacement Water Assessments.

3.3.3 Stored Water and Storage Agreements

All parties have the right to store water in the basin pursuant to a Storage Agreement with the Watermaster. Both Carry Over Water~~Production Rights~~ and I~~i~~mported W~~w~~ater Return

Flows can be stored ~~recharged~~. Imported water can also be recharged and stored. AVEK may export any of its imported Stored Water to any area outside its jurisdictional boundaries and the basin, provided all water demands within its jurisdictional boundaries are met. Stored Water that originated as other imported water may also be exported, subject to a technical determination by the Watermaster of the percentage of the Stored Water that is unrecoverable; such unrecoverable Stored Water is dedicated to the basin (Section 14 of the Judgment). Production from Stored Water is not subject to an Administrative Assessment (Section 9.1 of the Judgment). Section 6.3 of the Judgment prohibits unauthorized parties to claim right to produce any Stored Water recharged in the basin, except pursuant to a Storage Agreement with the Watermaster.

Storage Agreements have not yet been finalized but will follow requirements of the Judgment (e.g., Section 14). Attorneys for Antelope Valley State Water Contractors Joint Powers Authority (AVSWC/JPA), AVEK, PWD and LCID have been asked to assist with development of a Water Storage Agreement. In future annual reports, **Appendix K** will contain Storage Agreement information and a spreadsheet of storage water volumes associated with each agreement.

Several banking projects involving Stored Water are currently in operation in the basin including some projects that were in existence prior to the Judgment. The Judgment does not modify operation of the pre-existing banking projects (listed in Section 14 of the Judgment).

AVEK's Westside Water Bank (formally referred to as Water Supply Stabilization Project No. 2 (WSSP-2)) has a capacity of 150,000 AF and a current usage of 1,000 acres of recharge basins in low-bermed agricultural fields. AVEK's Eastside Water Bank consists of three 2-acre recharge basins and three groundwater wells that are used for recharge and recovery of raw SWP water. The recovered water is blended for delivery to the Eastside Water Treatment Plant. In 2016, 13,204 AF of SWP water was recharged into the Westside Water Bank and 884 AF of SWP water was recharged into the Eastside Water Bank for a total of 14,088 AF of recharge. No banked water was recovered in 2016.

Another groundwater bank in Antelope Valley is the Willow Springs Water Bank (WSWB) (formerly called the Antelope Valley Water Bank). The WSWB is located on 1,838 acres of agricultural land near Rosamond in Antelope Valley. It consists of percolation ponds and has a storage space of 500,000 AF and recharge and recovery capacities of 100,000 AFY. The Southern California Water Bank Authority (formerly called the Semitropic-Rosamond Water Bank Authority) operates the WSWB and the Semitropic Water Storage District Stored Water Recover Unit (SWRU), which is not located in Antelope Valley. Operating both the WSWB and the SWRU, which are located in different areas in Kern County, provides more flexibility to acquire, exchange and deliver water. The combined storage space capacity is 800,000 AF with a 133,000 AFY recharge capacity and a 200,000 AFY recovery capacity. Banking information indicates that 200,000 shares will be issued to customers in the combined facilities. Each share will provide customers with the following capacities:

- 1 AFY recovery plus lower priority capacity when available

- 3 AF in SWRU or 5 AF in WSWB of storage plus lower priority capacity when available
- 0.33 AFY in SWRU or 1 AFY in WSWB of recharge plus lower priority capacity when available.

Water agencies can purchase shares in the water bank and pay annual fees per share plus fees for depositing water and for extracting water. Ten percent of all water deposited in the water bank is required to be left behind to keep the bank viable. The basin is also credited with evaporation losses based on actual conditions including temperature and wind conditions when the percolation occurs (Beuhler, 2017).

In 2016, no water was recharged and only a small amount (12 AF) of banked water was extracted from the WSWB. The only WSWB customer outside the Antelope Valley is the San Diego County Water Authority. That customer is currently inactive and has not recharged or extracted any water (Beuhler, 2017). Pumping of native groundwater (1,558.4465.40 AF) did occur in accordance with the bank's Exhibit 4 Production Right (1,772 AF) to support the agriculture on the water bank.

3.3.4 Transfers

Several transfers of Production Rights have occurred since the Judgment. All known transfers ~~and replacement wells~~ to date are listed in **Appendix L**. As required in the Judgment, **Appendix L** will contain a separate accounting for Antelope Valley United Mutuals Group transfers.

3.3.5 New Production Applications

There have been no formal requests for new production. A New Production Application form will be developed in the fall of 2017 and summaries of New Production Applications will be included in **Appendix M** of future reports.

3.3.6 Changes in Use

There have been no changes in purpose of use in 2016. Future changes of use will be documented in **Appendix N**~~, including notices of new wells~~.

4 REFERENCES

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Salt and Nutrient Management Plan (SNMP) for the Antelope Valley, 2014, prepared by Los Angeles County Department of Public Works Waterworks District No. 40, Los Angeles County Sanitation Districts Nos. 14 and 20, Antelope Valley Salt and Nutrient Management Planning Stakeholders Group, May.

U.S. Geological Survey (USGS) and the California State Water Resources Control Board (SWRCB), 2013, Groundwater Quality in the Antelope Valley, California, Fact Sheet 2012-3033, January.

Edits were also made in the following appendices. These changes were not done in strikeout form – please see revised appendices in Revised Draft Annual Report.

Appendix C: minor spelling corrections and revisions to contact information.

Appendix E: Title changes, addition of Pre-Rampdown Production, columns for Rampdown targets, Boron CSD and West Valley County Water District 2016 Production, addition of City of Lancaster to Table E-2.

Appendix F: Slight revision to Antelope Valley Water Storage LLC's 2016 Production, addition of Diamond Farming 2016 Production.

Appendix G: Added LCID imported water use to Direct Use box.

Appendix H: Revised PWD's 2016 imported water total, fixed formatting in footnotes.

Appendix J: Added columns for Production Right and 2016 total Groundwater Production, added PPHCSD footnote.