An Evaluation of California's Adjudicated Groundwater Basins

An Evaluation of California's Adjudicated Groundwater Basins

Authors

Ruth Langridge is a faculty member at the University of California, Santa Cruz. Her research focuses on the processes and relations that enable access to water and create resilience to water scarcity; the legal and institutional issues related to water supply planning and groundwater management; and water supply security under climate change. She just completed a three-year term as a member of the California Department of Water Resources Climate Change Technical Advisory Committee.

Abigail Brown is a PhD student in Sociology at the University of California, Santa Cruz. Her forthcoming paper evaluates whether and why certain groups are excluded from groundwater management decisions, and what practices promote broader inclusion.

Kirsten Rudestam is a PhD candidate in Sociology at the University of California, Santa Cruz. Her current research analyzes the impacts of water-marketing strategies on water basins throughout the American West.

Esther Conrad received her PhD in 2015 in the Department of Environmental Science, Policy and Management at the University of California, Berkeley. Her dissertation focused on regional-level governance arrangements that emerged through California's Integrated Regional Water Management process.

Acknowledgments

A special thank you to Erik Ekdahl at the State Water Resources Control Board (SWRCB) for his support and input into this project. Additional SWRCB support came from scientists Tom Peltier and Jessica Bean, and administrator Lisa Marzan. The SWRCB generated the maps. At the University of California, Kate Aja, Suzanne Ziegler, and Ashlee Tewes provided extensive administrative support. We greatly appreciate the input of Watermasters and water agency staff who are managing the adjudicated basins, as well as lawyers and stakeholders who participated in a particular adjudication. Thank you to Mark Wilson who edited the final report. The cover photo is courtesy of the California Department of Water Resources. The State Water Resources Control Board provided funding for this report with additional funding from the John Randolph Haynes and Flora Haynes Foundation and the University of California Water Security and Sustainability Research Initiative.

Report Organization

The report is organized into five sections. The first section is an executive summary. The second section is an introduction to the report that describes the purpose of the study and includes our approach, methods, and challenges. The third section details the findings, including an overall discussion of the adjudication process and a detailed discussion of water rights, basin governance, and the overall condition of the groundwater basins. The fourth section presents a summary of the findings and recommendations. The fifth section provides a description and evaluation of each adjudicated basin, including the reason for the adjudication, a summary of the decree and any amendments, the management structure and strategies in the basin, overall groundwater level trends since adjudication, and a brief summary of the key points reflective of the basin's adjudication outcome and current condition. Summary tables are provided at the end of each basin review.

LIST OF ABREVIATIONS

AB	Assembly Bill
ACE	Army Corps of Engineers
AF	Acre-Foot
AFY	Acre-Feet per Year
AHHG	Area of Historic High Groundwater
APA	Allowed Pumping Allowance
ASR	Aquifer Storage and Recovery
ASY	Adjudicated Safe Yield
BAP	Base Annual Production
BCVWD	Beaumont-Cherry Valley Water District
BGWEMP	Basin Wide Groundwater Elevation Monitoring Program
BTAC	Basin Technical Advisory Committee
BVCSD	Bear Valley Community Services District
CASGEM	California Statewide Groundwater Elevation Monitoring
CBA	Colton Basin Area
CBMWD	Chino Basin Municipal Water District
CBWA	Central Basin Water Users Association
CBWCB	Central Basin and West Coast Basin
CCI	California Correctional Institution
CCP	Code of Civil Procedure
CDCR	California Department of Corrections and Rehabilitation
CPCN	Certificate of Public Convenience and Necessity
CDP	City Development Plan
CEQA	California Environmental Quality Act
CPUC	California Public Utilities Commission
CWRMA	Cooperative Water Resource Management Agreement
CSD	Golden Hills Community Services District
CVWD	Crescenta Valley Water District and Cucamonga Valley Water District
CWRMA	Cooperative Water Resource Management Agreement
DBCP	Dibromochloropropane
DFW	California Department of Fish and Wildlife
DPW	State Department of Public Works
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ELF	Environmental Law Foundation
EMWD	Eastern Municipal Water District
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FCD	Los Angeles County Flood Control Department
FPA	Free Production Allowance
GIS	Geographic Information System
GMP	Seaside Basin Groundwater Management Plan

GSA	Groundwater Sustainability Agencies
GSP	Groundwater Sustainability Plan
GSWC	Golden State Water Company
GWD	Goleta Water District
HDWD	Hi-Desert Water District
IEUA	Inland Empire Utilities Agency
IR	Irrigation District
IUDA	Industry Urban Development Agency
JPL	Jet Propulsion Laboratory
LA	Los Angeles
LACDPW	Los Angeles County Department of Public Works
LCWCA	Lytle Creek Water Conservation Association
LHMWD	Lake Hemet Municipal Water District
M&I	Municipal and Industrial
MAF	Million Acre-Feet
MCL	Maximum Contaminant Level
MCWD	Marina Coast Water District
MDRCD	Mojave Desert Resource Conservation District
mg/L	Milligrams per Liter
MPUD	Mojave Public Utility District
MPWMD	Monterey Peninsula Water Management District
MRWPCA	Monterey Regional Water Pollution Control Agency
MSL	Mean Sea Level
MWA	Mojave Water Agency
MWD	Mutual Water District, Municipal Water District, or Metropolitan Water District
MZ	Management Zone
NASA	National Aeronautics and Space Administration
NCMA	Northern Cities Management Area
NMMA	Nipomo Mesa Management Area
NSY	Native Safe Yield
OBMP	Optimum Basin Management Plan
OSY	Operating Safe Yield
PCE	Tetrachloroethylene
PSY	production safe yield
PUD	Public Utility District
PVPA	Pomona Valley Protective Association
RBA	Riverside Basin Area
RBMB	Raymond Basin Management Board
RCWD	Rancho California Water District
RDCIP	Regional Disadvantaged Communities Incentive Program
RGWMP	Regional Groundwater Monitoring Program
SAFE	Safe Water Supplies Ordinance
SAWC	San Antonio Water Company
SB	Senate Bill
SBBA	San Bernardino Basin Area

SBVMWD	San Bernardino Valley Municipal Water District
SCWC	Southern California Water Company
SFB	San Fernando Basin
SGMA	Sustainable Groundwater Management Act
SGPWA	San Gorgonio Pass Water Agency
SGVMWD	San Gabriel Valley Municipal Water District
SMVWCD	Santa Maria Water Conservation District
SMWC	South Mesa Water Company
SNG	Security National Guaranty, Inc.
SSWD	Shasta Valley Watermaster District
STWMA	San Timoteo Watershed Management Authority
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TCCWD	Tehachapi-Cummings County Water District
TCE	Trichloroethylene
TDS	Total Dissolved Solids
TMA	Twitchell Management Authority
TMDL	Total Maximum Daily Load
TVWMD	Three Valleys Municipal Water District
UC	University of California
ULARA	Upper Los Angeles River Area
USGS	United States Geological Survey
USMC	United States Marine Corps
UWCD	United Water Conservation District
VOCs	Volatile Organic Compounds
WBGCG	West Coast Basin Groundwater Conservation Group
WBMWD	West Basin Municipal Water District
WD	Water District
WECWC	West End Consolidated Water Company
WMWD	Western Municipal Water District
WRD	Water Replenishment District of Southern California
WSBCWD	West San Bernardino County Water District
YVWD	Yucaipa Valley Water District

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

INTRODUCTION

Groundwater is a critical resource in California, providing on average 30 percent of the state's total water supply and significantly more during dry years.[1] Many communities rely exclusively on groundwater, and it is an essential back-up source of water during droughts when pumping increases significantly to compensate for reduced surface supplies.

Local groundwater management agencies, special act districts, and court adjudications are the primary institutional arrangements to manage groundwater in California. Increasing groundwater declines in many areas of the state and concomitant negative impacts prompted the passage of the 2014 Sustainable Groundwater Management Act (SGMA). The SGMA established new requirements for 127 high- and medium-priority groundwater basins that are either in overdraft or vulnerable to overdraft to develop sustainable management programs with increased state oversight. The SGMA defines sustainable groundwater management as: "The management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results."[2] Undesirable results include: chronic lowering of groundwater levels; significant and unreasonable reduction of groundwater storage; significant and unreasonable seawater intrusion, degraded water quality, and land subsidence; depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.[3]

The SGMA exempts 388 basins categorized as low- and very-low priority, as well as all the adjudicated groundwater basins and 3 basins with pending groundwater adjudications. The SGMA was followed by the passage of Assembly Bill 1390 (AB 1390) and Senate Bill 226 (SB 226) in 2015 that provide some procedures for groundwater adjudications.

In the adjudication of a groundwater basin, the court generally defines and determines water rights for all users and provides court-supervised basin management by a Watermaster, who is usually appointed by the court to ensure that the basin is managed in accordance with the court's decree. Prior to adjudication, key stakeholders and users of the groundwater in a basin often negotiate a stipulation and physical solution to manage the basin, and the court can then accept it in whole or in part, or reject it and craft a different solution to manage the basin.

There is limited analysis of the history and current condition of California's adjudicated basins and the potential for future improvements to the adjudication process. This report for the State Water Resources Control Board (SWRCB) evaluates all of California's adjudicated basins[4] with respect to sustainable groundwater management as defined in SGMA including: accomplishments, challenges, how management can be improved, and whether there are common elements that result in the sustainable management of an adjudicated groundwater basin.

APPROACH

A four-person interdisciplinary team at the University of California, Santa Cruz, led by Ruth Langridge, utilized quantitative and qualitative methods. We reviewed existing literature and archival sources and conducted telephone interviews with key managers and participants engaged in the adjudication process. Each basin summary was reviewed by a stakeholder in the basin, often the Watermaster, technical expert, or lawyer who participated in the adjudication process. Key issues specified by the SWRCB that are evaluated for this report are whether an adjudication results in: overdraft conditions that are reduced or eliminated over the long term; a well-defined management structure that includes annual monitoring of groundwater conditions in the basin; and strategies that promote or hinder long-term sustainable management of the basin.

FINDINGS

Basin Sustainability

Groundwater adjudication is fundamentally not about the sustainable management of a groundwater basin. Rather, it is about the court addressing a controversy between parties about a "problem" in the basin and designating who should be responsible for providing a solution. Controversies can include whether the basin is in overdraft, who has a right to water in the basin, how much water can actually be withdrawn by the parties—individually and collectively; who should be responsible for providing or paying for sufficient water for future growth; and how overdraft and safe yield should be defined and calculated. As acknowledged in SB 226 and AB 1390 (2015), adjudication is rarely about the full spectrum of requirements for sustainable management addressed in the SGMA and needed to sustainably manage a basin over the long term. *This is a central issue with adjudications if the goal is the sustainable management of a groundwater basin.*

Adjudication is usually about the needs and interests of the individual parties with respect to water rights. The legislature noted the narrow reach of adjudication in its definition of "comprehensive adjudication" as "an action filed in superior court to comprehensively determine rights to extract groundwater in a basin."[5] The court may approve a physical solution to address the "problem" in the basin, sometimes drawn up by private parties, and the physical solution can overlap with some of the goals of the SGMA. However, the sustainable management of a groundwater basin is not the underlying purpose of the adjudication or the role of the court.

Adjudications focus on the past more than on the future. Withdrawal rights are often determined relative to a previous base period of pumping. There is also a heavy reliance on imported water, and imported water is generally included in determinations of allowable extractions. The issue is that both metrics generally do not fully account for *future* climate or demographic changes that will affect the sustainable management of a groundwater basin.

Environmental uses and the hydrologic links between surface and groundwater are rarely incorporated into the physical solution. The Mojave Judgment is the only one to include specific environmental considerations.

Water Rights

Water rights determinations in each basin vary considerably. While the court's focus is often on a determination of water rights, in many basins these are not quantified. Water rights can be based on California water law, or on other factors that include past pumping or what is perceived to be the needs of the individual parties. Calculations of base water use, safe yield, and overdraft, which are often determinants of specific water rights, are established differently in each basin, are often contested, and generally do not account for future climate change impacts or accumulated overdraft.

Conditions placed on water rights in each basin vary considerably. Requirements to reduce demand, approaches to pay for replenishment water if a water right is exceeded, carryover credits, and whether a water right can be transferred through lease or sales are different in each basin. Each condition can impact both the sustainable management of the basin and the communities that rely on the basin for their water supply. Thus, carry-over credits with no expiration date resulted in a large accumulation of stored water credits in some basins that if used could result in significant basin overdraft. Transfers are widely promoted as a way to facilitate the market-based exchange of water rights and generally reallocate water within the basin. Most transfers occurred from overlyers who were agricultural users to appropriators who were municipalities or water purveyors. Transfers in some adjudicated basins affected land use and resulted in changes that were both positive and negative depending on conditions.

Water rights often became concentrated in a small number of users in the years after the adjudication. Sometimes large water providers purchased smaller ones, and in some basins there were only a small number of entities that used a large percentage of allowable withdrawals.

Adjudication often does not resolve conflict in a basin. Parties frequently return to court, delaying the implementation of management strategies that could increase the sustainable management of a basin. Some areas of contention that resulted in further litigation were basin boundaries, definitions and calculations of safe yield and overdraft, and rights to storage space.

Governance

Adjudication generally establishes a management structure. The appointment of a Watermaster is one of the most positive features of adjudication. The Watermaster is required to comply with and enforce the court judgment, and generally has to monitor the basin and provide annual reports to the court, which has continuing jurisdiction. Watermasters in many basins provided strong oversight.

Appointment of a Watermaster did not always occur or did not occur in a timely manner, and reporting was not always required or was limited in scope. In some basins, a Watermaster was never appointed, or a Watermaster was not appointed for many years. Some basins had no annual reports or significant gaps in annual reports, while other basins had comprehensive reports that were readily available online.

Management is generally moving away from a single Watermaster to a committee or a group of committees. Committees generally represented interested parties, but also included parties who were not necessarily in agreement regarding basin management. Committees sometimes

increased cooperation among parties, but also resulted in gridlock. Moreover, while a committee generally reflected the goals and interests of its members, these were not always aligned with the sustainable management of a basin.

Small groundwater users and disadvantaged communities are rarely included in the physical solution. Large water users generally dominated negotiations for the physical solution, and small water users were generally not part of the final judgment. One reason given for the status of small users was that their overall withdrawals did not affect the condition of the basin. Only the Third Amendment to the Central Basin Judgment addressed disadvantaged communities, providing a priority right of storage space for their use or benefit.

Strategies to monitor the basin vary considerably. Some basins required that all wells be metered and results reported to the Watermaster who inspects wells on a regular basis. Other basins had voluntary monitoring and reporting was limited. Some basins utilized groundwater levels in index wells to monitor trends, while other basins compared extractions to safe yield. In both cases, the use of a designated time period influenced whether a basin was perceived to have declining groundwater levels and overdraft. Basins that are divided into different management areas and/or sub-basins created difficulties when determining the overall condition of the basin.

Most adjudicated basins rely on imported water as the key strategy to manage overdraft and/or to provide for future water needs. Many basins utilized the adjudicatory process as a means to obtain imported water. The heavy reliance on imported water is currently problematic for many basins as the cost of imported water has increased and it has become less available, and some basins anticipate that cost and scarcity will continue to be problems in the future.

Approaches to reduce demand are only required in some basins and vary significantly. With the exception of those basins under mutual prescription, requirements to reduce demand did not necessarily apply to all pumpers equally. Aligning with California water rights priorities, overlyers were often allowed to pump with only limited restrictions, generally did not have to reduce pumping until appropriators reduced their withdrawals, and sometimes did not have to reduce pumping at all, or only in an extreme drought.

Groundwater Trends

Over the last several decades, the concept of "sustainable yield" emerged as a way to incorporate both scientific and societal issues in determining a metric that can ensure the long-term resilience of groundwater systems.[6] While the term "sustainable yield" is invariably implied in court decisions, most groundwater adjudications utilize the term "safe yield."

Approaches to determining safe yield, overdraft, and groundwater trends vary considerably. There are no standards to determine these metrics. The time period used to assess each metric is critical to the result, but there are no guidelines for selection. Moreover, there were often varying and disputed conclusions in many basins regarding final determinations. Where the specific approach was clearly presented and where disputes were limited, basin trends were obtainable.

Safe yield is defined in multiple ways. "Safe yield," "native safe yield," "perennial safe yield," and "operating safe yield," are common terms, but these were generally defined differently in

each adjudicated basin. Artificial water—water not part of the natural recharge of the basin[7]—was often included in definitions of safe yield. This allowed for greater withdrawals and less impact on users, but there was often insufficient evidence that future replenishment by artificial water would be forthcoming.

Safe yield is neither calculated nor used in some basins. Safe yield was not formally determined for Riverside Basin, and there were conflicting reports of the safe yield. The West Coast Basin Judgment avoided a statement of the basin's safe yield, as reducing pumping to that amount would have required a very large reduction in withdrawals, and instead relied on a small percent reduction in groundwater extractions, inflows from other areas, and artificial replenishment. In the Central Basin, the natural safe yield initially represented the amount of water from native waters alone, but in the judgment it was equal to the allowable pumping allocation that was substantially higher than the natural safe yield, and included artificial recharge.

Accumulated overdraft is rarely addressed. Currently, the goal of most adjudications is just to bring a basin into equilibrium and reduce or halt declining groundwater levels.

Controlled overdraft is sometimes used to generate storage space for future inputs. But there were concerns in some basins regarding whether future inputs into the basin would be forthcoming.

RECOMMENDATIONS

There are areas where courts in adjudication could provide specific conditions that would improve groundwater management. Defining and establishing water rights, and concomitant pumping rights, is constrained to a large extent by California water rights law, but the conditions placed on water rights are not, and these can be important to the sustainable management of a basin. While each adjudication is unique, to improve groundwater adjudication processes so they result in more sustainable outcomes as defined by SGMA, the following should be included in adjudication judgments:

- **A sustainable management plan for the basin that is aligned with the SGMA and SB 226**
- **Appointment of a Watermaster**
- **Annual reports that are easily accessible, include groundwater trends, and have a standardized format with clearly specified conclusions**
- **Specification of the safe yield of a basin with realistic inputs and outputs that account for future climate and demographic shifts, and with standard definitions of native safe yield and operating safe yield**

- **Definition of overdraft that utilizes an historic period that realistically accounts for groundwater level trends**

- **Procedures whereby parties with water rights significantly reduce pumping over a specified time such that extractions do not exceed the safe yield of the basin**

- **Strategies to reduce accumulated overdraft**

- **Trigger points, as a critical component of monitoring groundwater levels**

- **Information on groundwater levels that follow a standard format, are updated annually, and are readily available online.**

- **Requirements to limit the duration of carry-over credits**

- **Requirements that the procedures for the transfer of water rights be part of a broader planning process**

- **Determinations of allowable extractions that account for the interconnections between surface and groundwater, and for negative impacts to relevant ecosystems**

- **Procedures to managing significant water quality problems**

- **Participation by all users in a basin in shaping decisions regarding groundwater management**

While many basins already incorporate particular recommendations, these recommendations are not necessarily what the court is required to address in resolving the lawsuit that led to adjudication. However, the above proposals point to areas that can be considered by all parties in moving a basin towards more sustainable management.

INTRODUCTION

RELEVANCE AND PURPOSE OF THE STUDY

Background

Groundwater is a critical resource in California, providing on average 30–40 percent of the state's total water supply, and significantly more during dry years.[8] Many communities rely exclusively on groundwater, and it is an essential back-up source of water during droughts when pumping increases significantly to compensate for reduced surface supplies.[9] In the 2014 drought, for example, requests for well permits more than doubled over the preceding year.[10]

The State of California has no permit requirement for groundwater withdrawals, and all landowners overlying a groundwater basin have a correlative right to the "reasonable and beneficial" use of the groundwater in the basin, so long as withdrawals are "reasonable" with respect to other overlying owners.[11] The problem is that the volume of groundwater withdrawn, especially during California's periodic droughts, generally exceeds both managed and natural recharge. This contributes to ongoing declines in groundwater levels in many areas of the state, with associated negative impacts to both communities and the long-term resilience of the groundwater basin. Impacts can include saltwater intrusion, subsidence, reduced surface water flows, water quality degradation, increased extraction costs, the stranding of shallower wells, and permanent loss of storage.[12] When groundwater extraction exceeds its sustainable limits, these negative impacts become acute.[13] Predictions of global climate change, including higher temperatures and an increase in extreme events such as drought, will exacerbate groundwater declines and associated negative impacts.[14]

Local groundwater management agencies, special act districts, and court adjudications are the primary institutional arrangements to manage groundwater in California. Increasing groundwater declines in many areas of the state and concomitant negative impacts prompted the passage of the 2014 SGMA. The Act establishes new requirements for 127 high- and medium-priority groundwater basins that are either in overdraft or vulnerable to overdraft to develop sustainable management programs with increased state oversight. The SGMA defines sustainable groundwater management as: "The management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results." Undesirable results include: chronic lowering of groundwater levels; significant and unreasonable reduction of groundwater storage; significant and unreasonable seawater intrusion, degraded water quality, and land subsidence; depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water. [15]

The SGMA exempts 388 basins categorized as low- or very-low priority, as well as all the adjudicated basins and 3 pending adjudications.[16] The SGMA was followed by the passage of AB 1390 and SB 226 in 2015 that provide some procedures for groundwater adjudications.

The principal concept in adjudication is the determination of water rights between competing users. One or more water users generally initiate an action including, but not limited to, actions

to quiet title or an action brought to impose a physical solution, and request that the court determine their respective rights to the water resource. The SWRCB can also initiate adjudication. The court sometimes defines water rights in the adjudicated basin, including associated conditions and priorities, and it can detail specific allocations. The court may establish a long-term "safe yield"[17] for the basin along with a plan to achieve the safe yield, and it usually establishes a management structure.

There are a variety of reasons why adjudication occurs. Two primary motivations are: negative impacts resulting from significant groundwater depletion; and the need for sufficient water to support current practices and future growth in a region. Defining water rights can determine the responsibilities of different users to reduce current or future impacts, and to provide for sufficient water to sustain a local economy and for future development. Impacts can include excessive groundwater depletion and chronic lowering of groundwater levels, subsidence, seawater intrusion, well interference or wells going dry, and water shortages.

Senate Bill 226 and Assembly Bill 1390

Groundwater adjudications are notoriously complex, and the process can be expensive and time consuming. AB 1390 and SB 226, passed by the California Legislature in the 2015–2016 Regular Session, provide some procedures for comprehensive groundwater adjudications. SB 226 is placed within SGMA's statutory framework in the California Water Code. AB 1390 appends a chapter to the Code of Civil Procedure (CCP) that adds the method and procedure for comprehensive groundwater adjudications.[18] The bill defines "comprehensive adjudication" as "an action filed in superior court to comprehensively determine rights to extract groundwater in a basin," and overall seeks to streamline groundwater adjudications. Assembly Bill 1390 also includes a provision for Groundwater Sustainability Agencies (GSAs) to intervene in comprehensive adjudications.[19] SB 226 adds to the CCP a provision allowing the state to intervene in comprehensive adjudications, and amends the California Water Code to provide legislative guidance to ensure the consistency of groundwater adjudications with SGMA objectives.

Provisions of SB 226 require a court that is conducting an adjudication to avoid interference with timely completion and implementation of a Groundwater Sustainability Plan (GSP) as required under SGMA, and to manage the proceedings consistent with the timeframes for groundwater sustainability established by SGMA. It specifies that the initial basin boundaries for purposes of the groundwater adjudication shall be the same as those found in the Department of Water Resources (DWR) publication Bulletin 118, but allows the court to recommend adjusting the boundaries with final approval by DWR. It requires parties to early and expeditiously disclose information regarding their preceding 10 years of groundwater use and any other relevant, associated, water use.[20] The court is also required to impose a physical solution that is part of a stipulated judgment as a component of the final judgment if the physical solution satisfies specific criteria, and if a party submits a proposed stipulated judgment that is supported by: more than 50 percent of all named parties in the adjudication action and groundwater rights holders holding title to at least 75 percent of the groundwater production during the past 10 years in the basin. It encourages parties to use a GSP developed pursuant to SGMA as the basis of a stipulated judgment. The legislature passed both AB 1390 and SB 226 on the grounds that each

would only be enacted if the other was also enacted, and Governor Brown signed them into law on October 9, 2015. AB 1390 will go into effect January 1, 2016.

Although the law now provides some general guidelines for adjudication, there is currently limited analysis of the history and current condition of most of California's adjudicated basins and the potential for future improvements that would incentivize more sustainable management of these basins. As one of the three main institutional arrangements for groundwater management in the state, a comprehensive assessment of these basins is essential. This report evaluates in detail all of California's adjudicated groundwater basins to illuminate those elements that result in sustainable management, the current challenges to both the adjudicatory process and to achieving sustainable outcomes, and how management of adjudicated basins can be improved.

RESEARCH APPROACH, METHODS, AND CHALLENGES

Key issues evaluated for this report are whether an adjudication results in: overdraft conditions that are reduced or eliminated over the long term; a well-defined management structure that includes annual monitoring of groundwater conditions in the basin; and strategies that promote long-term sustainable management of the basin. For each basin, the report summarizes the following:

1. the problem that precipitated the need for the adjudication
2. the decree and other actions that resulted in current management practices
3. the management structure for the governing body
4. how safe yield and overdraft are defined and determined
5. the monitoring and reporting of water use
6. the estimates of current groundwater extractions and safe yield
7. whether adjudication resulted in halting or reversing overdraft

Each basin section concludes with a discussion of the positive results of adjudication and where the adjudicatory process fell short. Of additional interest are: approaches to limiting production, reliance on imported water, whether transfers are permitted, monitoring protocols, whether water quality is impaired and addressed, land use trends related to adjudication, and whether a legal precedent was established.

A four-person interdisciplinary team utilized quantitative and qualitative methods to allow for a deeper understanding of various dynamics at play in the adjudication process. To gather data we reviewed existing literature and archival sources. These included judicial judgments and stipulated agreements from all groundwater adjudications in California; Watermaster reports; federal, state, and local agency reports; consultant reports; legal reports; media; and academic and trade journals. We also conducted telephone interviews with individuals managing an adjudication basin, attorneys who participated in adjudication litigation, water district managers, consultants who provided annual reports or participated in developing management plans, and Watermasters who directly administer court judgments. Basin evaluations were reviewed by a stakeholder in the basin, often the Watermaster or technical expert. Our final analysis utilized triangulation of data sources to provide a systematic analysis of patterns.

We encountered several research challenges in collecting data, including:

- *basin boundaries* are often difficult to define
- *basin interactions* are complex with interrelationships between adjacent basins, and sub-basins or sub-areas within an adjudicated basin
- *overlapping jurisdictions* exist, where an agency designated as Watermaster often manages a larger groundwater area and data for just the adjudicated area is not separated out
- *costs* are difficult to find and assess
- *water rights* can be opaque in judgments, and there can be pre-adjudication agreements that are not clear in the final stipulations and judgments
- *safe yield* and *overdraft* definitions and calculations vary considerably and are often contested
- *Watermasters* and *annual reports* are sometimes non-existent

This report was prepared for the State Water Resources Control Board and includes the specific scope of work authorized by the board. Limitations of our study include the relatively short time allotted for this project, the unavailability of some information, and conflicting accounts of basin issues.

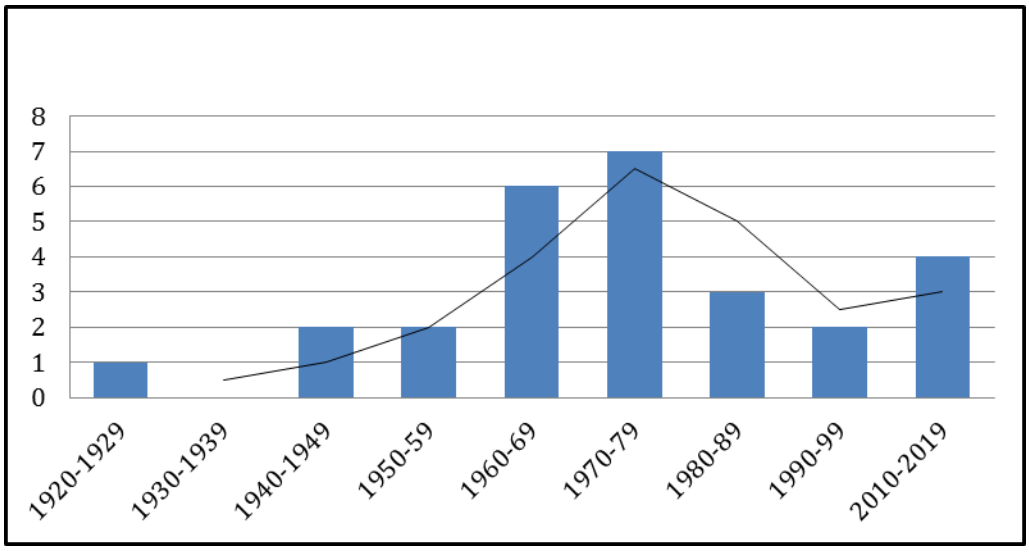
Our research team is a group of interdisciplinary scholars from the University of California, Santa Cruz, led by Ruth Langridge. One focus of our research team is on groundwater challenges across California, and the evaluation of key institutional strategies to proactively and sustainably manage groundwater. Our research, ongoing since 2010, highlights the need to assess the social, environmental, political, and economic factors impacting equitable and effective groundwater management across the state.

FINDINGS

ADJUDICATION

In the adjudication of a groundwater basin, the court generally defines and determines water rights for all users and provides court-supervised basin management by a Watermaster, usually appointed by the court to ensure that the basin is managed in accordance with the court's decree. Key stakeholders and users of the groundwater in a basin often negotiate a stipulation and physical solution prior to adjudication, and the court can then accept it in whole or in part, or reject it and craft a different solution to managing the basin. Figure 1 presents the number of adjudications in each decade. It is worth noting that the number of adjudications increased when imported water became available to Southern California, in part to facilitate receiving the imported water.

Figure 1: Adjudications Each Decade



Note: Some basins were re-adjudicated, and only their first adjudication is noted on the above chart. Those basins include: Santa Margarita (1940, 1963, 1966), San Jacinto (1954, 2013), West Coast Basin (1961, 1966), Rialto Colton (1961, 1969), and Chino (1978, 2012).

Reasons for Adjudication

Adjudication is initiated because there is a perceived "problem" in the basin and users turn to the court to determine who will be responsible for fixing the problem. A major problem was declining groundwater levels and associated impacts. Additional problems, including how to assure sufficient water to support future growth, or how to comply with requirements for water flows into or out of a basin, were also reasons to go to court. Groundwater users also wanted to resolve pumping disputes through a court determination of water rights. These reasons are discussed in more detail below.

Declining groundwater levels and associated impacts are often a "problem." The issue was who would be responsible to reduce pumping or pay for more expensive imported water in lieu of pumping. For coastal basins, adjudication was generally conducted to determine how to reduce or halt present or potential future saltwater intrusion. In the West Coast Basin, groundwater users went to court to determine who would be responsible for halting saltwater intrusion that had proceeded more than three miles inland by 1962 and threatened to invade the basin's major aquifers. The West Coast and Central basins were the first adjudicated basins to form a replenishment district, the Water Replenishment District of Southern California (WRD), whose primary responsibilities were to raise funds to obtain and manage supplemental water to stop the saltwater intrusion, and to figure out who would have to pay for the supplemental water. Other basins followed suit. In 1983, agencies in the San Gabriel River Watershed formed a Groundwater Replenishment Committee to coordinate deliveries of local and imported water and identify future needs and potential recharge facilities. Adjudication would determine who would have to pay for the new water.

Resolving disputes over water rights is a significant factor in going to court. In many basins, overlyers wanted to establish the superiority of their groundwater rights over appropriators. In other basins, there was a desire to determine priority of rights between different appropriators. Priority could determine who had the responsibility to fix a basin's problem. In the Upper Los Angeles River Area (ULARA) adjudication, Los Angeles also wanted to establish the City of Los Angeles's pueblo water right to all native groundwater in the basin derived from precipitation within the ULARA and a right to all groundwater in the San Fernando Basin derived from "return water" imported by the city from outside ULARA and either spread or delivered within this groundwater basin.

A desire to have new supplies to support potential development without impacting groundwater supplies is a motivation to go to court, even without existing overdraft. This was the case in the Beaumont Basin adjudication, where users needed to determine how to facilitate bringing in and paying for new water so that local groundwater supplies would not be impacted by regional development. In the Goleta Basin, several ordinances to restrict water use, including a moratorium on new water service connections and opposition to connecting to the State Water Project, were influential in precipitating the lawsuit. However, the Goleta Basin was unique in that post-adjudication—an ordinance prioritized recharging the basin over any new development.

The issue of who would provide any required water flows into or out of the basin is a reason to go to court. Many of California's adjudicated groundwater basins are hydrologically linked to each other, and sub-areas or sub-basins within an adjudicated basin can have hydrologic and political linkages. Water users went to court to determine how to distribute responsibilities to manage water flows between them. The Western Judgment was in part to determine which Riverside and San Bernardino interests that diverted water above Riverside Narrows would provide the requisite amount of water through surface and groundwater flows that were required by the Orange County Judgment. The Puente Basin interacts with several basins, and the 1965 Long Beach Judgment guarantees Central and West Coast Basins an average annual water supply through Whittier Narrows, and that includes underflow as per the Puente Narrows Agreement. The Puente Narrows Agreement in turn governs subsurface outflow from the Puente Basin into the Main San Gabriel Basin.

Conflicting views of the "problem" in a basin are common. In the Santa Maria adjudication there were differing views regarding whether the basin experienced overdraft in the past, and whether it was in overdraft at the time of adjudication, as this would determine whether some users had prescriptive rights. Additionally, the initial conflict in Santa Maria was over storage space, but the final adjudication was over a need to address the silt accumulation in the local reservoir that provided surface water for recharging the basin. The adjudication would help to resolve who would have to pay to fix the reservoir. In the Seaside adjudication there was a conflict between private pumper interests and the local special district over how to manage the basin, so the different interests went to court to determine both water rights and who would be responsible for managing the basin.

Adjudication Process

Areas that are often addressed in the adjudicatory process, in addition to determining complex claims to individual water rights, include defining the boundaries of the basin, defining and determining its "safe yield," determining who will manage the basin to ensure compliance with the judgment, and sometimes a plan to manage the basin. If parties settle before judgment and develop a physical solution to manage the basin, the court can accept it, accept it in part, or reject it and impose its own management plan.

Groundwater adjudications are frequently a drawn-out and expensive process. Early adjudications were time-consuming and expensive. The Raymond Basin took seven years for the initial judgment, and another five years on appeal. Subsequent adjudications in the Main San Gabriel and Chino Basins took less time (five years and three years, respectively), but Chino interests negotiated approaches to managing the basin for 18 years prior to the final judgment. In the West Coast Basin, one source estimated total costs at $5 million over a 19-year period.[21]

Parties are often back in court for additional attempts to resolve ongoing disputes. Areas of contention that resulted in further litigation included basin boundaries, definitions and calculations of safe yield and overdraft, and rights to storage space. The Central Basin saw significant litigation over rights to storage space after the 1965 adjudication, and a 2003 court decision was followed by two mediations, finally culminating in a 2013 Third Amendment to the Judgment. The Santa Margarita River watershed faced ongoing disputes for many years, and the judgments were followed by years of court cases between multiple parties, including the U.S. government. The first attempt at adjudication in the Mojave Basin failed, and while the basin was finally adjudicated, the City of Barstow is currently considering a return to court. Seaside Basin issues continued to be litigated after adjudication.

Disputes are sometimes alleviated when parties come together to work out solutions. In some adjudications, parties who perceived a problem with managing the groundwater basin formed local organizations. These organizations, generally representing major producers in the basin, often provided opportunities for collaboration to both satisfy the interests of their members and resolve the basin's problem. In the Santa Margarita Basin, a 2002 Cooperative Water Resource Management Agreement (CWRMA) initiated more active management of the basin, including establishment of a cooperative monitoring arrangement with the United States Geological Survey (USGS). In the Seaside Basin, conflicts over who should manage the basin were superseded by

concerns over an impending supply gap, incentivizing parties to work together to try to come up with solutions.

Groundwater adjudications generally present a series of compromises. Compromises that resolved disputes and moved a basin towards more sustainable groundwater management were positive features of some adjudications. Warren Valley and Main San Gabriel resolved issues through compromise, and their adjudications were brief.

But compromises also resulted in future impacts. In the Beaumont Basin, in order to come to a settlement, the compromise was that the appropriators agreed to give the estimated safe yield to the overlyers. In exchange, the appropriators were provided with access to a temporary surplus over a nine-year period. This extra allowable pumping for the appropriators was to provide the appropriators with sufficient groundwater to sustain their designated needs, as well as to create additional storage in the basin. However, it is not yet clear if sufficient basin replenishment will occur.

What Do Most Adjudications Omit?

Overall long-term and comprehensive basin management is not usually incorporated into adjudication judgments. Where the creation of a comprehensive plan to manage a groundwater basin was included, implementation of the plan did not always occur in a timely manner. In the San Jacinto Basin, a detailed Water Management Plan in the making since 1970 was released in 2007, and 43 years after initiation, finally incorporated into the 2013 Stipulated Judgment.

Consideration of environmental needs and protection is rare. One exception was the Mojave judgment, which contained provisions for the protection of the water needs of endangered and other species and of riparian habitat in the Mojave Basin Area. It also established groundwater level standards in several key areas along the Mojave River.

Adjudications sometimes account for interactions between surface water and groundwater with respect to determining water rights between parties. Interestingly, the first two adjudications of groundwater basins in California, the Lytle Creek Basin in 1924 and the Santa Margarita Basin in 1940, adjudicated surface water and groundwater that was hydrologically connected to surface water. In the Lytle Creek Basin, the parties were aware of strong surface and groundwater connections, and the adjudication was initiated because water diverted for a power plant was not being returned to a stream, resulting in dropping groundwater levels downstream. In the Santa Margarita River Watershed Basin judgments in 1940, 1963, and 1966, only groundwater connected to surface water was covered. The Scott River Basin adjudication of 1980 recognized a zone of interconnected ground and surface waters in the Scott River watershed.

Water quality is generally not considered. It was a significant issue in many basins at the time of adjudication, and contamination from volatile organic compounds, seawater, and nitrates continue to be problems. Five basins have superfund sites, 18 basins have water quality problems, and some lack potable water for consumption. This is especially problematic for communities that depend entirely on a groundwater basin for their water supply and have no direct access to imported water. Improving water quality in a basin can sometimes be complicated. Thus a rising

water table may bring the groundwater in contact with various contaminants in the soil, such as increased nitrate concentrations. Prevention of seawater intrusion may require a combination of strategic pumping, recharge, and creation of coastal barriers. Table 1 provides examples of water quality issues in several adjudicated basins.

Table 1: Examples of Water Quality Issues

ULARA - San Fernando Valley	4 superfund sites
Puente Basin	No potable groundwater
Six Basins	14 wells shut down due to impaired water quality
Main San Gabriel Basin	4 superfund sites
Mojave Basin	1 superfund site
Raymond Basin	1 superfund site

The Main San Gabriel Basin is one adjudication where the judgment included that the Watermaster should take all reasonable steps to assist and encourage appropriate regulatory agencies to enforce reasonable water quality regulations affecting the basin. As a result, since the mid-1980s, the San Gabriel Watermaster has coordinated with regulatory agencies to have groundwater remediation facilities constructed, permitted, and operated to protect and enhance the groundwater supplies.

Small producers and environmental justice communities are rarely addressed. The Seaside adjudication did not include small users because their pumping was deemed to not make a difference to the condition of the basin. In the Mojave Basin, well owners who pumped less than 10 acre-feet per year (AFY), more than 800 producers, were classified as *minimal producers* and were not part of the physical solution. The Mojave Water Agency (MWA) was to prepare an administrative program to address their water use but has not yet done that. In the Central Basin however, Section II.H of the Third Amended Judgment established the Regional Disadvantaged Communities Incentive Program (RDCIP), with a priority right of up to 23,000 acre-feet (AF) of storage space for use or benefit of disadvantaged communities, providing purpose and guidance for the program. The region's stakeholders will decide how it will be set up and implemented and RDCIP is currently under development.

WATER RIGHTS

"The question of who shall bear the burden of curtailing the overdraft, and in what proportion, depends upon the legal nature and status of the particular water right held by each party."[22]

A Brief Summary of Groundwater Rights in California

California law recognizes five types of groundwater rights: overlying rights; appropriative rights; prescriptive rights; pueblo rights; and federal reserved rights.

Overlying Rights are based on ownership of the land that lies above a groundwater source, and the landowner has a right to extract and use that groundwater on the overlying land for reasonable and beneficial use. The right is correlative, limiting withdrawals to an amount that is reasonable in light of the competing demands of other overlying users.

Appropriative Rights are where groundwater is diverted from its source to a non-overlying area or for municipal use. An appropriator can generally divert groundwater for reasonable and beneficial use if it is not needed for overlying users, so long as use will not create an overdraft condition. Thus appropriative groundwater rights are subordinate to overlying groundwater rights. Among appropriators, priority of right is: first in time is first in right.

Prescriptive Rights do not begin to accrue until a condition of overdraft begins, defined by the California Supreme Court as when extractions exceed the safe yield of a basin plus any temporary surplus.[23] If multiple prescriptive rights holders continue their prescriptive uses for an extended period of time, "mutual prescription" may apply, and all prescriptive users would bear proportionate reductions caused by water shortages, rather than on the basis of temporal priority. Prescription may not occur against public entities and public utilities.[24]

Pueblo Right can be possessed by a municipality that, as a successor of a Spanish-law pueblo, is entitled to the beneficial use of all needed, naturally occurring surface and groundwater of the original pueblo watershed.

A ***Federal Reserved Right*** is where the federal government reserves water for future use in an amount necessary to fulfill the primary purpose of a federal reservation (Indian reservations, national parks, etc.), with a priority dating to the establishment of the reservation.

All water use in California must be "reasonable and beneficial."[25] What constitutes unreasonable use may vary over time and depend on the overall context of the use.[26] The SWRCB and the courts have applied the Reasonable Use Doctrine to prevent excessive groundwater use in an overdrafted basin.[27]

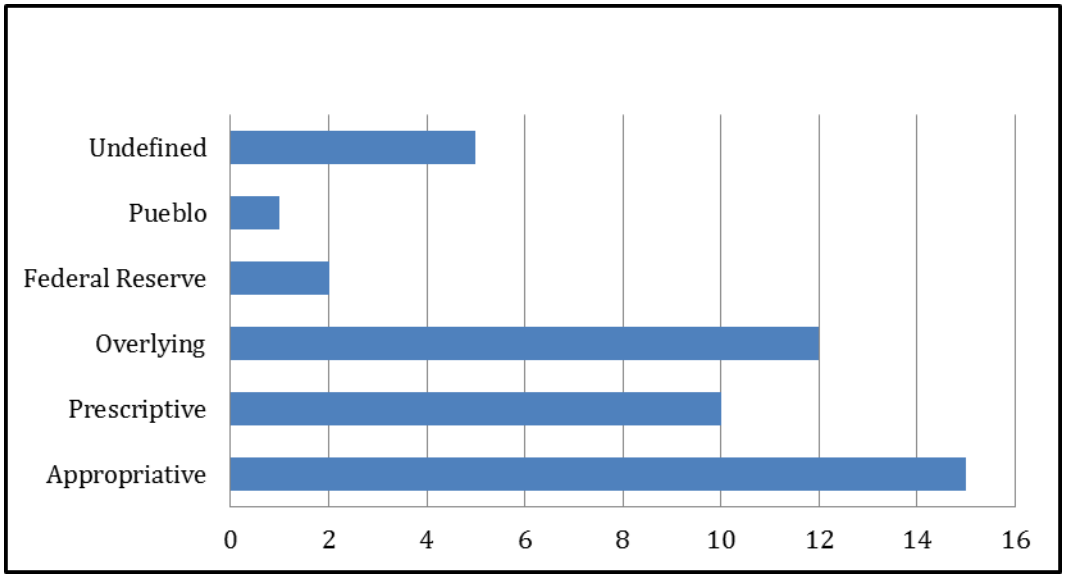
Water Rights Doctrines

Courts utilize a variety of legal doctrines to determine water rights based on conditions in the basin, past precedent, and California water law. This is illustrated in Figure 2. Additionally, a single judgment sometimes included water rights established under several different doctrines. In the Raymond Basin, the court established the Doctrine of Mutual Prescription, which awarded rights based on historical pumping and not on the usual priority system under California groundwater law. Prescription arguably benefits municipal producers who are generally

appropriators, and so junior to agricultural landowners. Without a lawsuit Pasadena would have needed to cut its own production in half while other users continued to withdraw groundwater from the basin. Mutual prescription also allowed the court to define individual water rights, including overlying rights that were often not defined in subsequent adjudications where California's priority system of water rights dominated. But prescription could only occur when users withdrew water over a five-year period after a basin was already in overdraft. In the ULARA adjudication, the court claimed that this was not the case and returned to common law doctrine to allocate groundwater rights in the basin. The ULARA judgment also awarded the only adjudicated pueblo groundwater right to the City of Los Angeles, and relying on Civil Code section 1007 it ruled out "acquisition of prescriptive title to property owned by the state or a local governmental body and devoted to a public use."[28]

Subsequent to the ULARA adjudication, courts have awarded rights depending on particular circumstances in a basin and have generally adhered to classic water law. Overlyers, who had priority over appropriators, generally hoped that their historical water rights would be upheld in adjudication. For the most part they were, with only limited restrictions on pumping and with priority over appropriators. Because overlying rights are correlative, requiring a shared approach to the basin resource, defining those rights at an individual level becomes difficult, and the quantity can change in the future. Moreover, overlying right holders may be free to increase their use if they can demonstrate a need to increase their beneficial use on their overlying land. Some adjudications resolve this by specifying water rights in gross. A few basins did not indicate the type of water right that was awarded.

Figure 2: Water Rights Doctrines



Water Rights Allocations

Water rights are not necessarily quantified in adjudication. One reason often cited for adjudication as an effective institutional approach to managing groundwater is that it will produce security through the establishment of defined water rights.[29] While some adjudications quantified all water rights (West Coast Basin, Seaside Basin), other judgments did not get to that

level of granularity and did not actually quantify individual rights. Rather than specifying rights, Santa Paula utilized a physical solution to allocate a specific amount of water to individual parties. Groundwater allocations in the Colton Basin Area under the Western Judgment were determined based on a review of pumping values up to 1969 that had never resulted in an overdraft condition.

Water rights are generally quantified looking backwards by using a "base water right." This is an average of how much water a person put to "reasonable and beneficial" use during a selected historical period. This was true not only for basins following the mutual prescription doctrine, but also for basins that utilized classic groundwater law priorities or other approaches as a basis, as noted in the examples in Table 2.

Table 2: Examples of Approaches to Quantifying Water Rights and Allocations

Tehachapi Basin	Individual pumping was limited to two-thirds of the highest continuous annual extractions over any five-year consecutive period after overdraft began.
Mojave Basin	Water allocations were based on historic pumping, and a Base Annual Production Right was defined as the highest amount of water produced by a party in one year during a five-year (pre-adjudication) period.
San Bernardino Basin Area	Water extraction limits for plaintiffs were estimated using the average amount of annual pumping during a five-year period ending in 1963.

Determining water rights, and consequently allowable extractions, based on past pumping can be problematic if that pumping was unsustainable and led to declines in groundwater levels and the associated impacts that triggered the adjudication, and if there are no requirements to reduce future extractions to bring a basin into balance. Moreover determinations of a base water right are dependent on the climatic and demographic conditions during the designated base period and may not be realistic metrics under future conditions. To improve accuracy, some basins utilize modeling to project into the future, as well as trigger levels to monitor groundwater conditions.

Specific water allocations are sometimes determined relative to the safe yield of a basin. The issue is that safe yield is variable and dependent on shifting inputs and outputs including: flows into and out of interconnected basins; more limited and expensive imported water supplies; and changes in precipitation, temperature, and more extreme events due to climate change. In determining safe yield and consequent allocations, some basins utilized a 30- to 40-year base period to account for climatic variation, but a past base period may not account for future climatic shifts, including increasing temperatures and more extreme droughts. Basins also utilized a variety of definitions for safe yield in establishing allocations. Differing definitions sometimes attempted to account for year-to-year variability, but inputs were not always assured.

The definition and distribution of water rights influence physical and social outcomes in a basin. Water rights sometimes provide security to users but some also are defined in ways that have privileged certain parties and have not benefitted others. Negotiations sometimes resulted in cooperative trade-offs, but not all stakeholders were always included in the negotiations. So

while the definition and distribution of water rights increased the welfare of many participants, some users have benefitted to the detriment of others, and unanticipated impacts to the basin sometimes have occurred.

Water Rights Conditions

In many adjudications specific conditions were placed on water rights, including who had to limit withdrawals; when withdrawals had to be limited; whether transfers (the selling or leasing of water rights) could occur; and whether water rights holders could carry over an unused right for one or more years. These conditions can have unanticipated future impacts, and may be more significant than the actual determination of water rights in affecting whether a basin is being sustainably managed. Specific conditions include the following:

Provisions to reduce allowable pumping: These are required in some basins, but with the exception of those basins under mutual prescription, they do not necessarily apply to all pumpers equally. Aligning with classic water law requirements, overlyers are often allowed to pump with only limited restrictions, generally do not have to reduce pumping until appropriators reduce their withdrawals, and sometimes do not have to reduce pumping at all.

In the Santa Maria Basin, overlyers in the Santa Maria Valley and the Nipomo Mesa Management Areas were granted priority water rights whether or not those rights were exercised, and only have to reduce their collective pumping if a severe water shortage occurs. A severe water shortage is defined as when groundwater levels show a chronic decline, not caused by a drought, for five or more years, and monitoring wells are below the lowest recorded level. Then overlying parties have to reduce production to no more than 110 percent of the highest amount they previously used in a single year.

Carry-over credits: These are permitted in many basins. The ULARA exemplifies a problem with carry-over credits that have unlimited duration. The cities of Burbank, Glendale, and Los Angeles were allowed to reduce their pumping and to carry over as storage any unused water rights into future years. These are accounted for as stored water credits. The current accumulation of a large quantity of these credits without sufficient "real" groundwater in storage to access these credits is now problematic for the San Fernando Basin.

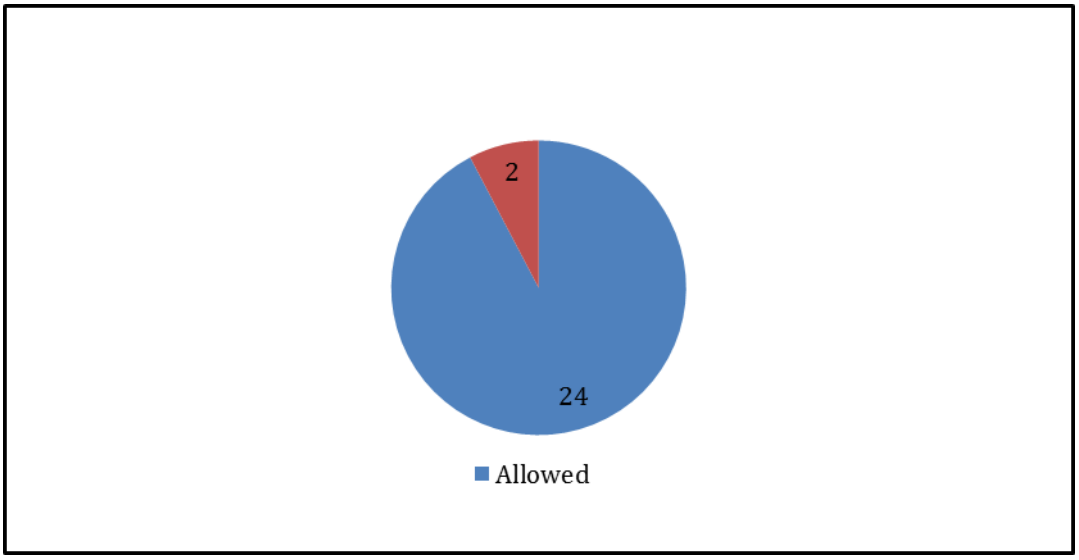
In other basins carry-over rights are allowed, but only over a limited time period. In Six Basins, carry-over credits are allowed for one year for up to 25 percent of unused production rights, and can be lost if the replenishment is discontinued or curtailed. Each year, the first water produced by the party is the carry-over right from the previous year. In the Mojave Basin, a carry-over of a free production allowance (FPA) must be used in the current year or it will be deemed "expired." In Puente Basin all principal parties are entitled to produce unpumped water rights from the previous year.

Transfers: These are allowed in many basins, as illustrated in Figure 3. Transfers are widely promoted as a way to facilitate the market-based exchange of water rights within an adjudicated basin,[30] and the ability to transfer a water right (or a portion of a water right) via sale or lease is permitted in most basins. Transfers generally reallocate water within the basin, and most transfers occur from overlyers who are agricultural users to appropriators who are

municipalities or water purveyors. No-injury rules and Watermaster approval is generally required.

Transfers can significantly affect land use and result in changes that can be both positive and negative depending on conditions. In the Mojave Basin, the ability to transfer water rights resulted in agricultural producers with numerous senior water rights in the Alto sub-area selling their land but retaining their water rights, which were then leased to municipalities in that sub-area. This supported an already existing trend from agriculture to municipal development, and the population in the Alto sub-area has increased tenfold. This could be a problem in a desert region where farmland can be fallowed, but a large urban area in the desert may have difficulty satisfying water needs during an extreme drought.

Figure 3: Water Rights Transfers



GOVERNANCE

Watermaster Structure and Responsibilities

Adjudications often result in a clear management structure for the basin with annual reports that track groundwater usage. The Watermaster is the entity designated by the court to ensure that the provisions of the judgment are adhered to, and to oversee management of the basin. Watermaster duties may include collecting data, overseeing monitoring, enforcing rules, assessing fees, and annual reporting on the basin's condition to parties and the court. However, in some adjudicated basins no Watermaster was designated and no reports were required.

Management is generally moving away from a single Watermaster to a committee or a group of committees. In early adjudications, the Watermaster was often the DWR, and its responsibilities were purely administrative. The trend is towards local management by a committee that represents basin interests, but a committee can also include parties who are not necessarily in agreement regarding basin management. Committees can increase cooperation among diverse stakeholders, but can also result in gridlock. Moreover, while a committee will

often reflect the goals and interests of its members, these are not always aligned with the sustainable management of a basin.

Table 3: Examples of Current Watermaster Committees

Raymond Basin	In 1984, the Raymond Basin Management Board (RBMB) took over as Watermaster. RBMB has a ten-member board representing its 16 members.
Main San Gabriel Basin	Watermaster is a nine-member committee composed primarily of elected water producers who exercise broad policymaking powers.
Seaside Basin	A number of different interest groups are represented on the Watermaster Board resulting in episodes of disagreement as well as more collaborative periods.
Central Basin	A new Watermaster in 2014 consists of three separate committees with different functions: 1. An administrative body appointed by the court to administer accounting and reporting functions 2. A water rights panel that enforces issues related to adjudicated pumping rights 3. A storage panel that approves certain large-scale groundwater storage efforts

The appointment of a Watermaster does not always occur or does not occur in a timely manner, and reporting is not always required or is limited in scope. In some basins a Watermaster was never appointed, or a Watermaster was not appointed for many years. Some basins had no annual reports or significant gaps in annual reports, while other basins had comprehensive reports that were readily available online.

Small groundwater users and disadvantaged communities are rarely included in the physical solution. Large water users generally dominated negotiations for the physical solution, and small water users were generally excluded from the final judgment. One reason given for excluding small users was that their overall withdrawals did not affect the condition of the basin. Only the Third Amendment to the Central Basin Judgment addressed disadvantaged communities, providing a priority right of storage space for their use or benefit.

Water Management Strategies

Approaches to limit pumping vary in each basin

Individual pumping may be limited over a defined period, but not all parties in a basin are required to reduce pumping; junior pumpers may be required to pay proportionally more for any supplemental supply; and reductions can be very modest. Some examples of strategies to reduce pumping are presented in table 4.

Table 4: Examples of Strategies to Reduce Pumping

Basin	Strategy
Raymond	The 1944 decree called for the proportional reduction in water rights of all users, to reach the safe yield. In 2008, members in the Pasadena Sub-area agreed to reduce their pumping incrementally over five years to help reverse declining water levels in that Sub-area and bring the pumping back within the safe yield.
Central Basin	Judgment provided for a 20 percent reduction of extractions by limiting the amount of groundwater each producer could extract annually (Allowed Pumping Allowance, APA), with carryover allowed into the following year.
Main San Gabriel	The judgment allowed for overproduction of specified withdrawals, but producers who pumped over their allowed production incurred charges to replace that water.
San Jacinto	Each public agency was required to reduce groundwater production by 10 percent in the first year after the Water Management Plan was entered into the Stipulated Judgment, and to adjust use periodically to meet the basin's safe yield. Private individuals with overlying agricultural and domestic groundwater rights could opt for one of three classes of participation, and each class had different requirements to address pumping, with some classes paying assessment fees for extractions over the allowed base yield.
Santa Paula	Production was on a seven-year rolling average, allowing parties to produce more or less of their allocation in any particular year as long as their rolling seven-year average did not exceed their allocation. The judgment also included modest production cut-back provisions in six stages, as needed to balance total production with safe yield.

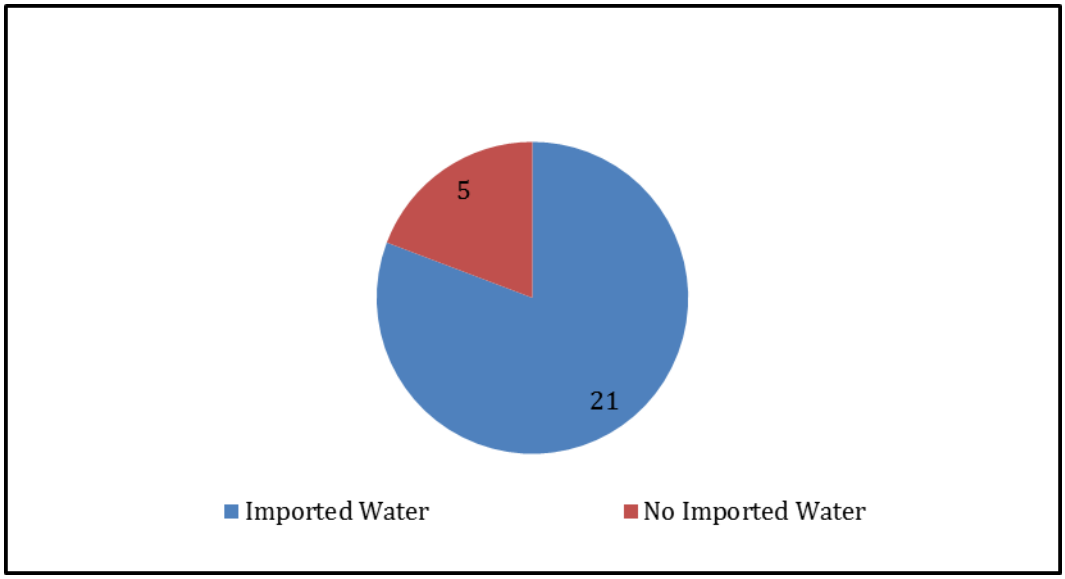
Approaches to increase supply vary in each basin

A large majority of the adjudicated basins are reliant on imported water, as illustrated in Figure 4. Some are heavily reliant, and the establishment of a process to access and pay for imported water was often a factor in deciding to adjudicate the basin. The few basins that do not receive imported water were either adjudicated prior to the availability of imported water or are coastal basins with no current access to imported water. A common pattern in many adjudications was to receive imported water via annexation to the Metropolitan Water District (MWD).

The use of imported water allowed adjudicated settlements to avoid strict restrictions on groundwater extractions, and groundwater withdrawals often increased. The common pattern is to allow overdraft in a basin in order to sustain the region's economy into the future and rely on the purchase of supplemental imported water supplies for replenishment, use and storage.

Imported water factored into the quantification of the operating safe yield, temporary surplus, and other management metrics. A key concern is that imported water is becoming more costly and less available.

Figure 4: Imported Water



Other strategies to increase supply included recycled water, recharge and recovery projects, desalination, and in-lieu recharge. The Goleta Basin was one of the first basins to augment natural recharge by injecting drinking water into wells whenever excess surface supplies are available. The Goleta Water District's wells can now be used as dual-purpose injection-extraction wells (e.g., Aquifer Storage and Recovery wells) to maximize injection capacity. This enhances the conjunctive use potential of the basin, where water that is injected becomes available for use in dry years when surface water supplies from the local Cachuma Reservoir are reduced.

Approaches to monitoring vary in each basin

The judgments generally require annual reporting, and often metering of the main pumpers in the basin, and this information is available to the public. While data are not always easily accessible, some websites, such as Six Basins and Main San Gabriel, have meeting minutes and annual reports for easy public download. Other basins do not have a website, making it difficult to locate relevant information to track groundwater management in the basin.

Some basins utilize groundwater levels in index wells to monitor trends. Other basins compare extractions to safe yield. In both cases, the use of a designated time period can influence whether a basin is perceived to have declining groundwater levels and overdraft. Dividing an adjudicated basin into different management areas and/or sub-basins made it difficult to determine the basin's overall condition.

Cooperation between management entities occurs in several basins. In 2011, the MWA extended a 2003 water storage program with the Metropolitan Water District (MWD), allowing up to 390,000 AF of MWD entitlement water from the State Water Project (SWP) to be stored in the Mojave Basin. Approximately 60,000 AF was stored, and the MWD has until December 31, 2035, to take the stored SWP water from the aqueduct during dry years. However, MWD must assure that at least 5 percent remains available to MWA.[31] This arrangement helps to temporarily recharge the Mojave Basin at a relatively low cost to MWA, using SWP water from MWD's

entitlement. Additionally, MWA can potentially use the stored water to help mitigate drought impacts depending on how much of its storage MWD takes during a drought.

Water Rights Consolidation

An interesting finding is that water production post adjudication was often concentrated in a small number of users. Sometimes large water providers purchased smaller ones, and sometimes over time there were only a small number of entities who used a large percentage of allowable withdrawals. Minimum pumpers were excluded in most adjudications.

Table 5: Examples of Water Rights and Water Use Consolidation

Cucamonga Basin	25 companies were allocated water rights. Today there are 3, as bigger water providers purchased smaller providers in the region.
West Basin	By 1990, large pumpers (pumping over 1,000 AFY) dropped from 16 to 11, and these pumpers used 95 percent of total production.
ULARA	214 parties were awarded water rights; today there are 24 active pumpers.
Santa Paula Basin	Between 2005 and 2011, 8 producers out of 125 extracted most of the groundwater.
Mojave Basin	97 percent of water is pumped by less than 15 percent of users.

GROUNDWATER TRENDS: SAFE YIELD AND OVERDRAFT

Safe Yield

The yield of a basin is a critical value in determining the amount of groundwater that can be pumped from a basin over the long term. If an excess of water is pumped from the storage of the basin without adequate replenishment, damage can occur to the aquifer, even if recharge eventually refills the basin. Determining basin boundaries is significant and influences a determination of safe yield and overdraft.

A basin yield was proposed for many of the adjudicated basins, although not for all basins. Calculating a yield is complex, and scientists can bracket, rather than precisely calculate, the metric. A distinction is made between safe yield as a purely physical metric defined by hydrologists and "sustainable yield," which accounts for both physical and social conditions in determining appropriate withdrawals to minimize declining levels and ensure the long-term resilience of groundwater systems. While the term "sustainable yield" is invariably implied in court decisions, most groundwater adjudications apply the term "safe yield" in determining water rights and basin management.

Safe yield is generally defined as the average quantity of water that can be extracted from an aquifer or groundwater basin over a period of time without causing undesirable results.[32] Undesirable results include permanently lowered groundwater levels, subsidence, degradation of water quality in the aquifer, or decreased stream flow. If water management in the basin changes, the yield of the basin may change.

A variety of concepts and definitions for safe yield are used in adjudicated basins. These include: "safe yield," "native safe yield," "perennial safe yield," and "operating safe yield," among others, and these terms are generally defined differently in each adjudicated basin. It is worth noting that including artificial water in definitions of safe yield allows for greater withdrawals, and there is less of an impact on users. However, there is also a risk that sufficient artificial water to recharge the basin will not be available in the future.

Table 6: Safe Yield Concepts and Definitions

Native Safe Yield	Usually just precipitation, but can also include return flows from artificial water
Safe Yield (Managed Safe Yield)	Often includes artificial water or return flows from artificial water "the long-term, average quantity of water supply in the management area that can be pumped without causing undesirable results, including the gradual reduction of natural groundwater in storage over long-term hydrologic cycles" (San Jacinto)
Perennial Safe Yield	Includes water for the injection well system and return flows (Goleta Basin)
Production Safe Yield	Equal to the average net natural water supply plus the expected return flow from the previous year's water production (Mojave)
Operating Safe Yield	The quantity of water which the Watermaster determines may be pumped from the basin in a particular fiscal year, free of the Replacement Water Assessment under the Physical Solution (Main San Gabriel). Factors that may be considered include water levels, subsurface flows, cost of availability of alternate sources of water, required flows to other areas, and groundwater pumping.
Cumulative Safe Yield	"…maximum average annual amount of water that could be extracted from the surface and subsurface water resources over a period of time sufficiently long to represent or approximate long-time mean climatological conditions...without resulting in long-term progressive lowering of groundwater levels." (Western Judgment - San Bernardino Basin Area)

In some basins, safe yield is neither calculated nor used. Groundwater rights for the Colton Basin Area under the Western Judgment were determined based on a review of pumping values up to 1969 that had never resulted in an overdraft condition. The West Coast Basin Judgment avoided a statement of the basin's safe yield, as reducing pumping to that amount would have required a very large reduction. Water users chose instead to attempt to restore a balance to the basin by relying on a combination of a smaller percent reduction in groundwater extractions, inflows from other areas, and artificial replenishment. In the Central Basin, the natural safe yield initially represented the amount of water from native waters alone. The safe yield defined in the physical solution, however, was equal to the allowable pumping allocation, which was substantially higher than the natural safe yield and included artificial recharge. In Warren Valley, groundwater pumping is not limited to safe yield, but rather to pumping amounts delineated in the Basin Management Plan developed by the Watermaster to ensure long-term sustainability of the basin taking into account imported water supplies.

In lieu of safe yield, the groundwater levels in key wells are used to monitor groundwater levels in some basins. In the Colton Basin, the Rialto Decree adjusts pumping amounts in the Rialto Basin based on the spring high water level.

In many basins there are varying estimates of the safe yield, and safe yield is frequently disputed. In the Santa Paula Basin, there were years of studies regarding the safe yield of the basin, but the metric remains contested. Safe yield was not formally determined for the Riverside Basin Area, and there are conflicting reports of the safe yield.

Overdraft

Overdraft definitions and calculations differ in each basin and are often contested. In Santa Maria, there were competing claims of historical use and definitions of overdraft often without a strong evidentiary record. The court defined "overdraft" flexibly as "a condition which exists when the total annual extractions of ground water from a basin exceed its safe yield, and when any temporary surplus has been removed."

Controlled overdraft, sometimes called temporary surplus, is defined as the amount that, when withdrawn, can create storage space for the capture of water in wet year. Thus a controlled overdraft strategy permits extractions exceeding safe yield to allow for extensive use of a groundwater basin as a storage facility, usually for imported water that can subsequently be used in dry years. A general requirement is that the controlled overdraft strategy has no adverse effects on the basin's long-term supply. But concerns are that sufficient replenishment during wet years to avoid ongoing overdraft may not occur as imported water is becoming more expensive and less available.

In the ULARA adjudication, Los Angeles argued for temporary surplus in a "new theory of overdraft," where the temporary surplus could be withdrawn. Otherwise, during wet periods water would escape and "be wasted." So the judgment determined that extracting more than nature replenished and allowing a basin's total water storage to be less than maximum actually constituted good groundwater management to allow for capture of excess water during wet periods.

In the Beaumont Basin, a compromise between overlyers and appropriators resulted in appropriators being allocated an additional "temporary surplus," totaling 160,000 AF from 2004–2013 to satisfy their needs, with some to be stored in the basin for future use. The temporary surplus is no longer available, and time is needed to assess whether users will be able to remain within the safe yield.

In the Goleta Basin, a *temporary surplus* is defined as "the amount of water that can safely be extracted from the basin in any year in excess of the safe yield."

Accumulated Overdraft is rarely addressed in adjudication. The goal of most adjudications is just to bring a basin into equilibrium and reduce or halt declining groundwater levels.

In the Mojave Basin, accumulated overdraft was not addressed in the adjudication. Rather the goal was to stabilize the basin and avoid further declines. By 1999, the cumulative amount of

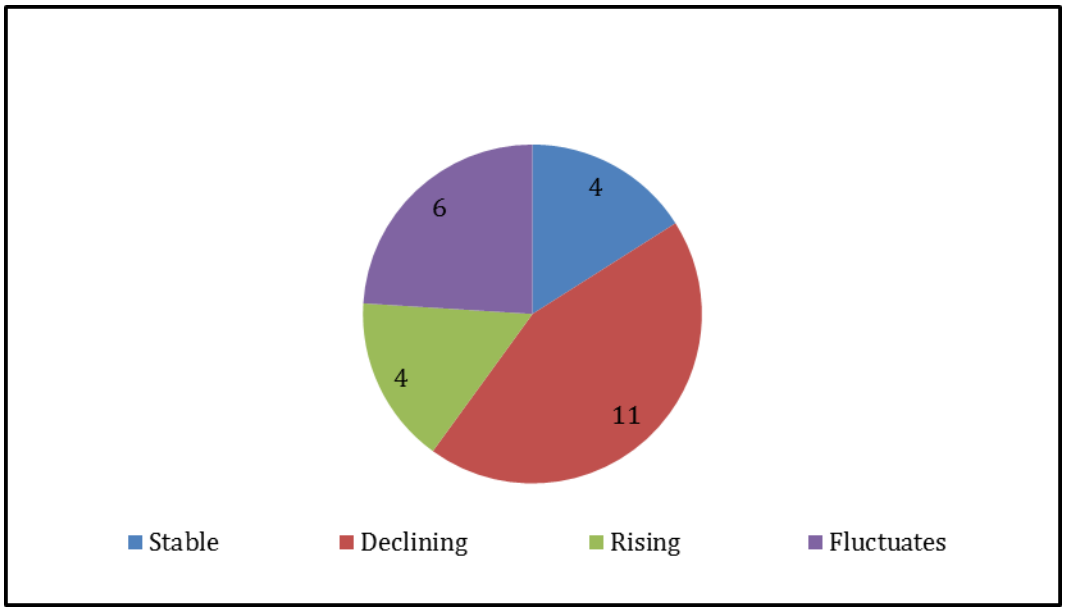
overdraft for the entire basin was about 2.5 million AF, primarily in the Centro (approximately 750,000 AF) and Baja (approximately 1.1 million AF) sub-areas.

In the West Basin, accumulated overdraft through 1957 was estimated at 832,000 AF, 50–75 percent of which was replaced by saltwater. Accumulated overdraft was reduced over time, and saltwater intrusion along the coast was halted using injection wells, but in 2012 overdraft remained significant, at 650,600 AF.

Groundwater Trends

Water levels in some adjudicated basins did not experience declines prior to adjudication. These basins are described in Figure 5 as stable. Where a basin's groundwater levels stabilized after adjudication, it generally did not return to historic averages. To a large extent the mitigation of overdraft was accomplished through increased reliance on water imports. Goleta was the only basin that initially used imported water to recover the basin to 1972 levels, where there had been no observed negative impacts. Concerns were expressed that as imports become less reliable and more expensive, overdraft may increase.

Figure 5: Groundwater Trends



Note: Most basins were rising only in parts of the basin, and most basins demonstrated declines only in parts of the basin. No information was available for the 1961 Rialto Colton adjudication.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

When using adjudication as an approach to sustainably manage a groundwater basin, the following issues are important to consider. Recommendations follow to better align adjudication with the sustainable management of a groundwater basin. These findings and recommendations are also highlighted in the Executive Summary.

FINDINGS

Basin Sustainability

Groundwater adjudication is fundamentally not about the sustainable management of a groundwater basin. Rather, it is about the court addressing a controversy between parties about a "problem" in the basin and designating who should be responsible for providing a solution. Controversies can include whether the basin is in overdraft, who has a right to water in the basin, how much water can actually be withdrawn by the parties—individually and collectively; who should be responsible for providing or paying for sufficient water for future growth; and how overdraft and safe yield should be defined and calculated. As acknowledged in SB 226 and AB 1390 (2015), adjudication is rarely about the full spectrum of requirements for sustainable management addressed in the SGMA and needed to sustainably manage a basin over the long term. *This is a central issue with adjudications if the goal is the sustainable management of a groundwater basin.*

Adjudication is usually about the needs and interests of the individual parties with respect to water rights. The legislature noted the narrow reach of adjudication in its definition of "comprehensive adjudication" as "an action filed in superior court to comprehensively determine rights to extract groundwater in a basin."[33] The court may approve a physical solution to address the "problem" in the basin, sometimes drawn up by private parties, and the physical solution can overlap with some of the goals of the SGMA. However, the sustainable management of a groundwater basin is not the underlying purpose of the adjudication or the role of the court.

Adjudications focus on the past more than on the future. Withdrawal rights are often determined relative to a previous base period of pumping. There is also a heavy reliance on imported water, and imported water is generally included in determinations of allowable extractions. The issue is that both metrics generally do not fully account for *future* climate or demographic changes that will affect the sustainable management of a groundwater basin.

Environmental uses and the hydrologic links between surface and groundwater are rarely incorporated into the physical solution. The Mojave Judgment is the only one to include specific environmental considerations.

Water Rights

Water rights determinations in each basin vary considerably. While the court's focus is often on a determination of water rights, in many basins these are not quantified. Water rights can be based on California water law, or on other factors that include past pumping or what is perceived to be the needs of the individual parties. Calculations of base water use, safe yield, and overdraft, which are often determinants of specific water rights, are established differently in each basin, are often contested, and generally do not account for future climate change impacts or accumulated overdraft.

Conditions placed on water rights in each basin vary considerably. Requirements to reduce demand, approaches to pay for replenishment water if a water right is exceeded, carryover credits, and whether a water right can be transferred through lease or sales are different in each basin. Each condition can impact both the sustainable management of the basin and the communities that rely on the basin for their water supply. Thus, carry-over credits with no expiration date resulted in a large accumulation of stored water credits in some basins that if used could result in significant basin overdraft. Transfers are widely promoted as a way to facilitate the market-based exchange of water rights and generally reallocate water within the basin. Most transfers occurred from overlyers who were agricultural users to appropriators who were municipalities or water purveyors. Transfers in some adjudicated basins affected land use and resulted in changes that were both positive and negative depending on conditions.

Water rights often became concentrated in a small number of users in the years after the adjudication. Sometimes large water providers purchased smaller ones, and in some basins there were only a small number of entities that used a large percentage of allowable withdrawals.

Adjudication often does not resolve conflict in a basin. Parties frequently return to court, delaying the implementation of management strategies that could increase the sustainable management of a basin. Some areas of contention that resulted in further litigation were basin boundaries, definitions and calculations of safe yield and overdraft, and rights to storage space.

Governance

Adjudication generally establishes a management structure. The appointment of a Watermaster is one of the most positive features of adjudication. The Watermaster is required to comply with and enforce the court judgment, and generally has to monitor the basin and provide annual reports to the court, which has continuing jurisdiction. Watermasters in many basins provided strong oversight.

Appointment of a Watermaster did not always occur or did not occur in a timely manner, and reporting was not always required or was limited in scope. In some basins, a Watermaster was never appointed, or a Watermaster was not appointed for many years. Some basins had no annual reports or significant gaps in annual reports, while other basins had comprehensive reports that were readily available online.

Management is generally moving away from a single Watermaster to a committee or a group of committees. Committees generally represented interested parties, but also included parties who were not necessarily in agreement regarding basin management. Committees sometimes

increased cooperation among parties, but also resulted in gridlock. Moreover, while a committee generally reflected the goals and interests of its members, these were not always aligned with the sustainable management of a basin.

Small groundwater users and disadvantaged communities are rarely included in the physical solution. Large water users generally dominated negotiations for the physical solution, and small water users were generally not part of the final judgment. One reason given for the status of small users was that their overall withdrawals did not affect the condition of the basin. Only the Third Amendment to the Central Basin Judgment addressed disadvantaged communities, providing a priority right of storage space for their use or benefit.

Strategies to monitor the basin vary considerably. Some basins required that all wells be metered and results reported to the Watermaster who inspects wells on a regular basis. Other basins had voluntary monitoring and reporting was limited. Some basins utilized groundwater levels in index wells to monitor trends, while other basins compared extractions to safe yield. In both cases, the use of a designated time period influenced whether a basin was perceived to have declining groundwater levels and overdraft. Basins that are divided into different management areas and/or sub-basins created difficulties when determining the overall condition of the basin.

Most adjudicated basins rely on imported water as the key strategy to manage overdraft and/or to provide for future water needs. Many basins utilized the adjudicatory process as a means to obtain imported water. The heavy reliance on imported water is currently problematic for many basins as the cost of imported water has increased and it has become less available, and some basins anticipate that cost and scarcity will continue to be problems in the future.

Approaches to reduce demand are only required in some basins and vary significantly. With the exception of those basins under mutual prescription, requirements to reduce demand did not necessarily apply to all pumpers equally. Aligning with California water rights priorities, overlyers were often allowed to pump with only limited restrictions, generally did not have to reduce pumping until appropriators reduced their withdrawals, and sometimes did not have to reduce pumping at all, or only in an extreme drought.

Groundwater Trends

Over the last several decades, the concept of "sustainable yield" emerged as a way to incorporate both scientific and societal issues in determining a metric that can ensure the long-term resilience of groundwater systems.[34] While the term "sustainable yield" is invariably implied in court decisions, most groundwater adjudications utilize the term "safe yield."

Approaches to determining safe yield, overdraft, and groundwater trends vary considerably. There are no standards to determine these metrics. The time period used to assess each metric is critical to the result, but there are no guidelines for selection. Moreover, there were often varying and disputed conclusions in many basins regarding final determinations. Where the specific approach was clearly presented and where disputes were limited, basin trends were obtainable.

Safe yield is defined in multiple ways. "Safe yield," "native safe yield," "perennial safe yield," and "operating safe yield," are common terms, but these were generally defined differently in

each adjudicated basin. Artificial water—water not part of the natural recharge of the basin[35]—was often included in definitions of safe yield. This allowed for greater withdrawals and less impact on users, but there was often insufficient evidence that future replenishment by artificial water would be forthcoming.

Safe yield is neither calculated nor used in some basins. Safe yield was not formally determined for Riverside Basin, and there were conflicting reports of the safe yield. The West Coast Basin Judgment avoided a statement of the basin's safe yield, as reducing pumping to that amount would have required a very large reduction in withdrawals, and instead relied on a small percent reduction in groundwater extractions, inflows from other areas, and artificial replenishment. In the Central Basin, the natural safe yield initially represented the amount of water from native waters alone, but in the judgment it was equal to the allowable pumping allocation that was substantially higher than the natural safe yield, and included artificial recharge.

Accumulated overdraft is rarely addressed. Currently, the goal of most adjudications is just to bring a basin into equilibrium and reduce or halt declining groundwater levels.

Controlled overdraft is sometimes used to generate storage space for future inputs, but there were concerns in some basins regarding whether future inputs into the basin would be forthcoming.

RECOMMENDATIONS

There are areas where courts in adjudication could provide specific conditions that would improve groundwater management. Defining and establishing water rights, and concomitant pumping rights, is constrained to a large extent by California water rights law, but the conditions placed on water rights are not, and these can be important to the sustainable management of a basin. While each adjudication is unique, to improve groundwater adjudication processes so they result in more sustainable outcomes as defined by SGMA, the following should be included in adjudication judgments:

- **A sustainable management plan for the basin that is aligned with the SGMA and SB 226**
- **Appointment of a Watermaster**
- **Annual reports that are easily accessible, include groundwater trends, and have a standardized format with clearly specified conclusions**
- **Specification of the safe yield of a basin with realistic inputs and outputs that account for future climate and demographic shifts, and with standard definitions of native safe yield and operating safe yield**

- **Definition of overdraft that utilizes an historic period that realistically accounts for groundwater level trends**

- **Procedures whereby parties with water rights significantly reduce pumping over a specified time such that extractions do not exceed the safe yield of the basin**

- **Strategies to reduce accumulated overdraft**

- **Trigger points, as a critical component of monitoring groundwater levels**

- **Information on groundwater levels that follow a standard format, are updated annually, and are readily available online.**

- **Requirements to limit the duration of carry-over credits**

- **Requirements that the procedures for the transfer of water rights be part of a broader planning process**

- **Determinations of allowable extractions that account for the interconnections between surface and groundwater, and for negative impacts to relevant ecosystems**

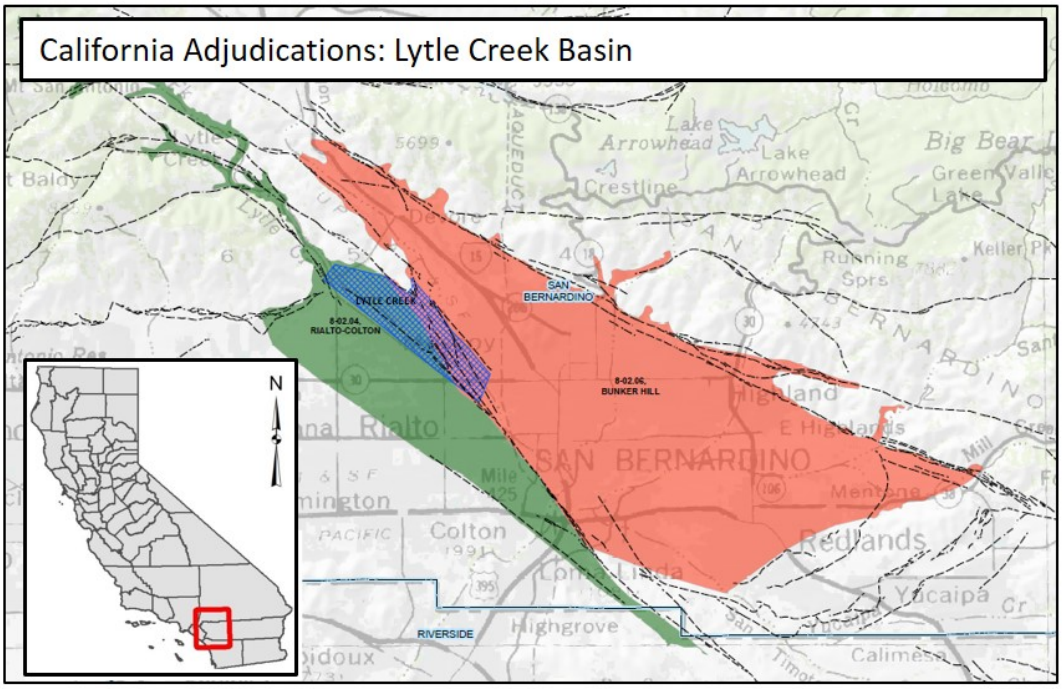
- **Procedures to managing significant water quality problems**

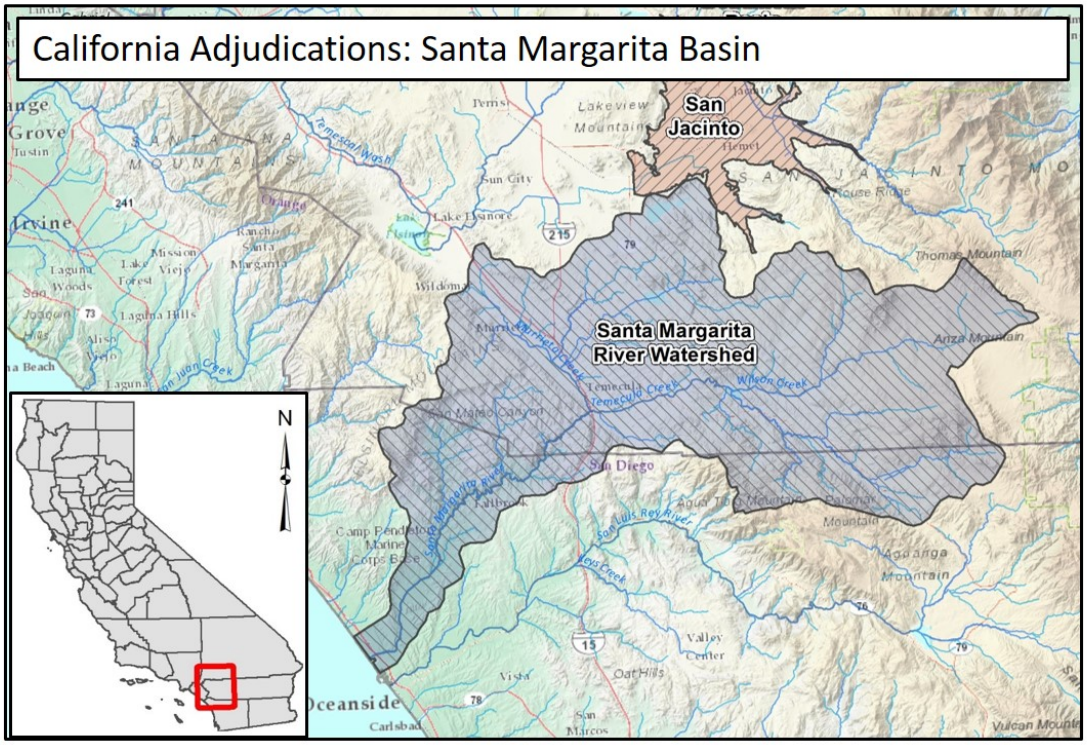
- **Participation by all users in a basin in shaping decisions regarding groundwater management**

While many basins already incorporate particular recommendations, these recommendations are not necessarily what the court is required to address in resolving the lawsuit that led to adjudication. However, the above proposals point to areas that can be considered by all parties in moving a basin towards more sustainable management.

ADJUDICATED BASIN REVIEWS

Early Adjudications





LYTLE CREEK BASIN

Few are aware of the Lytle Creek Sub-basin, even though it is the first groundwater adjudication in California. It entailed a forward-thinking groundwater recharge program without using imported water because people in the area were aware of strong surface and groundwater connections. The 1897 McKinley Decree and the 1924 Lytle Creek Judgment, which are still in effect, determined specific rights in the Lytle Creek Basin. The 1924 judgment restricted the place of use, rate of extraction, and export amount out of the Lytle Creek Region. It prohibited certain uses, including the irrigation of cereal crops and any use that would cause land to become saturated with water between November 15 and March 15, that new wells must never be constructed within 500 feet of any existing well, and that water use must be measured by all parties in the decree. The Lytle Creek Water Conservation Association (LCWCA), made up of the successors to the stipulated parties of the judgment, manages these requirements. While safe yield was not defined in this basin, LCWCA meets every two months to monitor groundwater levels. The judgment did not require annual reports.

Overview

County	San Bernardino
Area	22.3 square miles, 14,272 acres[36]
Population	Unknown
CASGEM	Medium (Upper Santa Ana Valley)[37]
Watermaster	Lytle Creek Water Conservation Association
Members	West Valley Water District, City of San Bernardino, City of Rialto, Fontana Water Company, Riverside Highland Water Company
Court Cases	*McKinley Decree (Lytle Creek Sub-basin*): Los Angeles Superior Court case No. 20790 **Lytle Judgment:** *City of San Bernardino v. Fontana Water Co. et al.* Judgment No. 17030 from the Superior Court of San Bernardino County

CASGEM = California Statewide Groundwater Elevation Monitoring

The Lytle Creek sub-basin is part of the Upper Santa Ana Groundwater Basin on the CASGEM priority list, but not listed as an official groundwater basin in Bulletin 118.[38] The Lytle Creek sub-basin is also part of the San Bernardino Basin Area, an adjudicated management area created in the 1969 Western Judgment adjudication.[39]

The Bunker Hill sub-basin is located to the east of the Lytle Creek sub-basin, and the Rialto-Colton Basin is located to the west. Lytle Creek is in a large southeast-trending canyon on the eastern portion of the San Gabriel Mountains. It is a porous groundwater sub-basin, and a number of faults act as barriers to groundwater flow, dividing the sub-basin into six subareas. Depth to groundwater varies from 50 to 400 feet, depending on precipitation.[40] Most of Lytle Creek's water comes from the percolation of stormwater runoff into natural underground aquifers and from the percolation of the State Project Water via the San Bernardino Valley Municipal Water District (SBVMWD). In general, groundwater moves toward the Santa Ana River from the Cajon Pass downstream through Lytle Wash in the northwest, and from the San Bernardino Mountains to the northeast.[41] The Lytle Creek Sub-basin is a major recharge area for the adjacent basins of Bunker Hill and Rialto-Colton.[42] The aquifer is highly

permeable, with high specific yield, and responds quickly to inflows from precipitation and streams, and outflows from groundwater pumping, stream-flows, and subsurface outflow.[43]

The lower portion of Lytle Creek flows through four cities: Fontana, Rialto, San Bernardino, and Colton, and through unincorporated areas of San Bernardino County. The three major water suppliers that draw from the waters of Lytle Creek are the West San Bernardino County Water District (WSBCWD), now known as West Valley Water District; the City of Rialto; and the Fontana Union Water Company (Fontana Union), serving a total of nearly 180,000 customers. The two companies depend primarily upon groundwater supplies from Lytle Creek and other groundwater basins, State Water Project imports, and surface water from Lytle Creek.

Reason for Adjudication

This decree was filed in the Superior Court of San Bernardino County on January 28, 1924. The City of San Bernardino brought this adjudication forward as plaintiff against 39 surface and groundwater users in the sub-basin, including Fontana Power Company. The city was concerned about groundwater level declines resulting from the Fontana Power Company's surface water diversions, as there were pronounced surface and groundwater connections in the region. The Fontana Power Company had an intake pipe on Lytle Creek below the mouth of the canyon where it was diverting surface water to provide power, and instead of the discharged surplus water from the powerhouse returning back to Lytle Creek, it was going to other users with surface water rights previously allocated under the 1897 McKinley Decree.[44]

Decree and Amendments

McKinley Decree (Lytle Creek Sub-basin)

Adjudication finalized: 1897

Decree Summary

This decree allocated the surface water rights from Lytle Creek, and had certain stipulations that reduced those water rights in accordance with stream flows. Water right users received less water if there was less water available in Lytle Creek.

Lytle Judgment (Lytle Creek Sub-basin)

Adjudication finalized: 1924

Decree Summary

This adjudication acknowledged earlier surface-water rights previously determined under the 1897 McKinley Decree, and it allocated groundwater rights in the Lytle Creek Region among various parties. It clarified surface and groundwater rights and outlined a groundwater recharge program. It restricted the place of use, rate of extraction, and the amount that could be exported out of the Lytle Creek Region.[45]

Fontana Power Company was diverting approximately 3,000 inches of water from an intake pipe on Lytle Creek for power production. Because the company was not returning the discharged water back to Lytle Creek as required,[46] the adjudication set limits on the company's ability to withdraw water from the intake pipe. During periods of variable flow on the creek, a stipulated amount of water was required to continue past the intake pipe down the creek into a gravel wash to replenish groundwater. Additionally, if there was less water

available in Lytle Creek, water right users received less water. Thus, between December 15 and April 15, 2,000 miner's inches of water from Lytle Creek could be sent to surface-water rights holders after power use. When creek flows were 4,000 inches, 2,500 inches could be diverted, and when creek flows were 5,000 inches, 3,000 inches could be diverted.

Surface and groundwater rights were also outlined for appropriators. Other provisions in the adjudication restricted diversions from specific tracts of land, and there were restrictions on irrigating grain crops or saturating the ground with water between November 15 and March 15. A well could not be built within 500 feet of another well in the region, and measuring devices were required to be installed by all parties listed in the decree.[47]

A Watermaster committee with members from five different water agencies, cities, and districts was appointed to oversee groundwater conservation and replenishment programs in the sub-basin. The Lytle Creek Water Conservation Association currently manages the requirements under the Lytle Creek Judgment. The LCWCA is made up of the successors to the stipulated parties of the judgment.

Water Users

Stipulated Users[48]

The plaintiff in this decree was the City of San Bernardino. Most of the 39 defendants were water companies. There were some businesses and municipalities, and a handful were individual landowners, with some giving false names.

Other

There are no environmental users listed as stipulated users. Water rights were not allocated to any small pumpers.[49]

Management Structure

Management structure outlined in the decree

The court designated a committee of five representatives to be the Watermaster:
(1) Improvement Company; (2) Citizen's Company; (3) Union Water Company; (4) Mutual Water Company, Rancheria Water Company, Riverside Water Company, or the City of San Bernardino; and (5) Terrace Water Company, James Barnehill Water Company, or the City of Colton. Each person serves on the committee for one year, and all vacancies are filled annually by appointment. No compensation is giving for serving on this committee.[50]

Current management structure

The current management structure was revised because larger water providers purchased some of the smaller water providers outlined in the case. The City of Rialto acquired ownership and water rights from the Citizens Land and Water Company, the Lytle Creek Water and Improvement Company, Rialto Domestic Water Company, Rancheria Water Company, and the Mutual Water Company.[51] The LCWCA is currently "made up of the successors to the stipulated parties of the Judgment,"[52] and includes representatives from West Valley Water District and the City of San Bernardino.

Management Strategies

Spreading Basins: All surplus water not allocated through surface-water rights and provided

to users after cycling through the "Power House" shall be used to recharge groundwater sources in the Lytle Creek area in gravel washes near the creek.[53]

Prohibited Uses: The irrigation of any cereal crop was prohibited, and irrigation could not cause land to become saturated with water between November 15 and March 15. New wells were never to be constructed within 500 feet of an existing well.[54]

Management Plans: Water users in the sub-basin are currently working with other regional groundwater management entities through the Basin Technical Advisory Committee, through the 2008 planning Integrated Regional Management Plan, and through the Urban Water Management Planning process.

It is noteworthy that the Lytle Creek Community Plan states, "The residents of Lytle Creek have a strong desire to maintain the present mountain lifestyle, preferring development to be mainly residential. They are opposed to commercial development and would like to keep tourism to a minimum. Preservation of natural resources and scenery is crucial to maintaining the current community character in Lytle Creek."[55]

Monitoring and Reporting

The 1924 judgment requires that water use should be measured. All parties using water shall maintain a measuring device which will show how much water is being used, and it shall be open at all times to the committee.[56] There is no reporting requirement, and no annual reports for this sub-basin are available.

Safe Yield

Safe yield was not defined in the judgment. The City of Rialto, the only entity that defines safe yield for the Lytle Creek Sub-basin, states that replenishment to the sub-basin occurs from storm runoff in the Lytle Creek Watershed and from percolation of State Water Project water, and safe yield does not appear to change due to replenishment water.[57] In 2010, the city estimated the long-term safe yield for the sub-basin as 35,000 to 45,000 AFY. This was less than the 1924 adjudicated rights, but there was no information available on this discrepancy.[58]

Groundwater Pumping and Overdraft

Twelve appropriators were granted groundwater rights in the 1924 Lytle Judgment. They are all water companies except for one individual, James Barnhill. A total of 5,145 inches, or about 97,000 AFY, was allocated. All parties and allocations are outlined in Table 7.

Table 7: Lytle Groundwater Basin Parties and Allocations

Company	Adjudicated Amount for Groundwater (inches)
Citizens Water Company	1,300
City of Colton	600
City of San Bernardino	225
Fontana Companies (Fontana Water Company, Fontana Union Water Company, Fontana Power Company, Fontana Farms Company, Fontana Land Company)	1,300
Improvement Company	700
Mutual Company	125
Rancheria Water Company	120
Rialto Domestic Water Company	100
Riverside Company	450
Terrace Water Company	150
James Barnhill	75
TOTAL	**5,145 (97,000 AFY)**

Current groundwater pumping data are difficult to find because many companies outlined in the judgment were purchased by larger entities, and the sub-basin was also adjudicated again as part of the Western Judgment in 1969. One entity, the City of Rialto, subsumed groundwater rights of other users by acquiring the following companies: Rialto Domestic Water Company, Citizens Water Company, Improvement Company, Mutual Company, and Rancheria Water Company.[59] Fontana Water Company took over Fontana Companies water rights of 1,300 AFY.[60] The Western Judgment of 1969 issued cumulative water rights in the San Bernardino Basin Area, which includes the Lytle Creek Sub-basin (noted in the description of that adjudication).[61] Overdraft was not defined in the 1924 judgment, and this aquifer fluctuates in groundwater levels each year. Groundwater levels are known to be anywhere between 50 and 400 feet below land's surface.[62]

Water Quality

The water quality in the sub-basin is good.[63]

Drought

The groundwater aquifer is particularly impacted during drought years, and the City of Rialto found that this aquifer dropped up to 300 feet during drought years. They find this particular groundwater supply very vulnerable to drought.[64]

Discussion

This was the first groundwater adjudication in California, but it is frequently overlooked, and Raymond Basin is often designated as the first groundwater adjudication. The Lytle Creek Basin was a combined surface and groundwater adjudication.

The adjudication was very forward thinking for 1924, as it considered complex linkages between surface and groundwater resources and also called for conservation to recharge the sub-basin without the use of imported water. Additionally, the Lytle Creek Judgment outlined

certain prohibited uses, including the irrigation of any cereal crops or any use that causes land to become saturated with water between November 15 and March 15, that new wells must never be constructed within 500 feet of any existing well, and that water use must be measured by all parties in the decree. The Lytle Creek Water Conservation Association, made up of the successors to the stipulated parties of the judgment, manages these requirements. While safe yield was not defined in the adjudication, LCWCA meets every two months to monitor groundwater levels. Annual reports were not required by the judgment.

The sub-basin was also subsequently adjudicated in the Western Judgment, and this adjudication determined cumulative extraction rights for both the Lytle Creek sub-basin and the Bunker Hill sub-basin.

LYTLE CREEK BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino Area: 22.3 sq. mi. Physical Characteristics: Part of the Upper Santa Ana Groundwater Basin; it has six subareas. Precipitation: 10″–14″ per year CASGEM: Medium (Upper Santa Ana Valley) Land Use: The lower portion of Lytle Creek flows through four cities. Reason for Adjudication: The City of San Bernardino brought this adjudication forward as plaintiff against 39 surface and groundwater users in the sub-basin, including Fontana Power Company. The court case ensued because Fontana Power Company, now Southern California Edison, had an intake pipe on Lytle Creek below the mouth of the canyon. They were diverting surface water to provide power. The City of San Bernardino was concerned that Fontana Power Company was not returning surplus water to the Lytle Creek area.	Adjudication Initiated: 1897 (McKinley Decree) Adjudication Finalized: January 28, 1924 (Lytle Judgment) Decree Summary: *McKinley Decree*: This decree allocated surface water rights from Lytle Creek, and had certain stipulations that reduced those water rights in accordance with stream flows. If there was less water available in Lytle Creek, water right users received less water. *Lytle Judgment*: This adjudication acknowledged earlier surface-water rights previously determined under the 1897 McKinley Decree and allocated groundwater rights in the Lytle Creek Region among various parties. It clarified surface and groundwater rights for appropriators, and outlined a groundwater recharge program. However, it restricted the place of use, rate of extraction, and the amount of water that could be exported out of the Lytle Creek Region. Twelve appropriators were granted groundwater rights in the 1924 Lytle Judgment. They are all water companies except for one individual, James Barnhill. A total of 5,145 miner's inches or about 97,000 AFY was allocated.	Watermaster: Lytle Creek Water Conservation Association Members: The Watermaster assigned at adjudication was a committee of five representatives: 1) Improvement Company; 2) Citizen's Company; 3) Union Water Company; 4) Mutual Water Company, Rancheria Water Company, Riverside Water Company, or the City of San Bernardino; and 5) Terrace Water Company, James Barnehill Water Company, or the City of Colton. The Lytle Creek Water Conservation Association (LCWCA) is currently "made up of the successors to the stipulated parties of the Judgment," and includes representatives from the West Valley Water District and the City of San Bernardino. Strategies: - Spreading basins - Prohibited uses - Management plans	Adjudicated Safe Yield: Undefined Current Safe Yield: 35,000 to 40,000 AFY Summary: It is not possible to know how safe yield has changed over time in this basin due to lack of data. Current Extractions: Unknown Extractions Summary: It is not possible to know how extractions have changed over time in this basin due to lack of data. Groundwater Levels: The groundwater level in the basin is known to be anywhere between 20 and 400 feet below the land's surface. Overdraft: Overdraft is not defined in the 1924 judgment. It is not clear that overdraft was ever determined for this basin, and this particular aquifer fluctuates in groundwater levels each year. Water Quality: The water quality in the sub-basin is good. Discussion: **- This was the first groundwater adjudication in California, but it is frequently overlooked.** **- The adjudication was very forward thinking for 1924, as it considered complex linkages between surface and groundwater resources and also called for conservation to recharge the sub-basin without the use of imported water.** **- The sub-basin was also subsequently adjudicated in the Western Judgment, and this adjudication determined cumulative extraction rights for both the Lytle Creek Sub-basin and the Bunker Hill Sub-basin.**

SANTA MARGARITA RIVER WATERSHED BASINS

The adjudication of the Santa Margarita River Watershed is the only federal groundwater adjudication in California. It was based on an awareness of strong surface and groundwater connections, and the judgment covered groundwater and sub-surface flows that would impact the Santa Margarita River. The adjudication began as a dispute between two large landholders in the Santa Margarita River Watershed. The original 1940 judgment was a state adjudication. Then, the U.S. government obtained a large portion of the original riparian land in the mid-1940s, and the litigation was expanded to include all water users within the Santa Margarita River Watershed, including the three Indian tribes: the Pechanga Band of Luiseño Mission Indians, the Ramona Band of Cahuilla Indians, and the Cahuilla Band of Indians. A federal adjudication was completed in the United States District Court of Southern California in 1966 with a modified judgment and decree. Neither the 1940 adjudication nor the 1966 modified judgment clearly quantified groundwater rights for parties.

Overview

County	Riverside, San Diego
Area	Santa Margarita (7,998 acres, 12.5 square miles), Temecula (88,338 acres, 138 square miles), Cahuilla (18,342 acres, 28.7 square miles) **TOTAL (114,678 acres, 179.2 square miles)**
Population	Santa Margarita (4,121), Temecula (219,431), Cahuilla (1,993) **TOTAL (225,545)**
CASGEM	Santa Margarita (Medium), Temecula (High), Cahuilla (Medium)[65]
Watermaster	Santa Margarita River Watermaster (i.e., U.S. District Court Appointee), Steering Committee
Members	United States, Eastern Municipal Water District, Western Municipal Water District, Fallbrook Public Utility District, Metropolitan Water District, the Pechanga Tribe, and Rancho California Water District
Court Cases	*United States of America v. Fallbrook Public Utility District et al.,* Civil No. 51-cv-1247-GPC-RBB, U.S. District Court, Southern District of California

CASGEM = California Statewide Groundwater Elevation Monitoring

The Santa Margarita River drains the watershed flowing west toward the Pacific Ocean. The river begins at the confluence of Temecula and Murrieta Creeks near the border between San Diego and Riverside Counties. There are three groundwater basins covered in the Santa Margarita River Watershed Adjudication.[66] The **Santa Margarita Basin** lies under the Santa Margarita Valley in north San Diego County. Groundwater is unconfined in the east and semi-confined in the west. Natural recharge is mostly from percolation of Santa Margarita River flows, with a small amount from precipitation. Total storage capacity is between 48,100 AF[67] to 61,600 AF.[68] The **Temecula Basin** (aka Murrieta-Temecula) lies under the Murrieta, Temecula, Pauba, Long, and Lancaster valleys in northwest San Diego County and

southwest Riverside County. The Pechanga Indian Reservation overlies part of this basin. Groundwater is generally unconfined. Natural recharge is from precipitation and percolation of Warm Springs, Tucalota, Santa Gertrudis, Murrieta, and Pechanga Creeks and the Temecula Creek. Total storage capacity is between 253,000 AF[69] to 2 million AF.[70] The **Cahuilla Basin** (aka Anza) lies under the Cahuilla, Anza, Duranso, and Duransna valleys in south Riverside County. Groundwater is semi-unconfined in the deeper aquifer and unconfined in the shallower aquifer. Sources of natural recharge are unknown. Total storage capacity is between 75,000 AF[71] to 165,500 AF.[72] Average annual precipitation in the area is 7 to 15 inches.[73]

Large communities include Camp Pendleton, a U.S. Marine Corps Base, Temecula, Murrieta, Lake Elsinore, and Fallbrook.[74] The lower watershed in San Diego County is undeveloped and Camp Pendleton is located there. The upper watershed in Riverside County is rapidly urbanizing.[75] Water use varies between the upper and lower watershed. Within the San Diego Region, surface water from the Santa Margarita River is diverted and used directly, and is also used to recharge local groundwater basins. Within Camp Pendleton, water from the Santa Margarita River is diverted to Lake O'Neill through a diversion weir, which also diverts surface water from the Santa Margarita River to recharge ponds that are used to recharge the Santa Margarita Valley Groundwater Basin.[76] Water users in the middle and upper watershed within the Temecula and Cahuilla Basins, respectively use surface water from the Santa Margarita River and groundwater. There are four Indian reservations in the upper watershed, including the Pechanga Band of Luiseño Mission Indians, the Ramona Band of Cahuilla Indians, the Cahuilla Band of Indians, and Pauma Yuima Band of Luiseño Mission Indians.[77]

Reason for Adjudication

In the 1920s, Rancho Santa Margarita sued Vail Ranch to determine surface-water rights to the Santa Margarita River and tributaries. In 1930, the court entered a judgment on that trial, but Vail appealed.[78] In 1940, a stipulated judgment between Rancho Santa Margarita and Vail Company was filed. This stipulated judgment allocated two-thirds of Santa Margarita River waters to Rancho Santa Margarita and one-third to Vail Ranch.[79] The United States acquired most of Rancho Santa Margarita in 1941, 1942, and 1943. The land is used for Camp Pendleton, a U.S. Naval Hospital, and a U.S. Naval Ammunition Depot. The Santa Margarita River flows through Camp Pendleton for 21 miles before discharging in the Pacific Ocean.[80]

Groundwater use in the Temecula Valley Groundwater Basin in upstream Riverside County gradually reduced downstream flows necessary to recharge the groundwater basins underlying Camp Pendleton. As a result, the United States filed a complaint in 1951, *United States of America v. Fallbrook Public Utility District et al.,* seeking to adjudicate all surface and groundwater water rights in the Santa Margarita River Watershed. This litigation eventually expanded to include all water users within the Santa Margarita River Watershed, including three Indian tribes (the Pechanga Band of Luiseño Mission Indians, the Ramona Band of Cahuilla Indians, and the Cahuilla Band of Indians). The United States, as trustee, represented all three tribes before the Court. The final judgment and decree from this adjudication was issued in 1963. It was soon appealed. After review by an appeals court, a modified judgment and decree was issued in 1966.[81]

Decree and Amendments

Adjudication initiated: January 25, 1951 (Final Judgment and Decree)
Adjudication finalized: 1940 (Stipulated Judgment), May 8, 1963 (Final Judgment and Decree), and April, 6, 1966 (Modified Judgment and Decree). Numerous agreements and interlocutory judgments were incorporated into the Modified Final Judgment and Decree.
Costs: Total Watermaster budget for first year of operations during 1988–89 was $138,096. Total Watermaster budget proposed for 2013–2014 was $658,840.[82]

Decree Summary

Three judgments affected this watershed: a **1940 Stipulated Judgment**, a **1963 Final Judgment and Decree**, and a **1966 Modified Judgment and Decree**. The **1966 Modified Judgment and Decree** incorporated and modified the 1940 Stipulated Judgment and 1963 Final Judgment and Decree,[83] as well as 44 previous interlocutory judgments filed in the Santa Margarita River Watershed.[84] The three judgments *do not* quantify groundwater rights but outline operational requirements and retain the ability for the court to quantify groundwater rights in the future. A variety of water rights are also described in the Interlocutory Judgments that were incorporated into the Modified Final Judgment and Decree.

The **1940 Stipulated Judgment** requires water users to report the amount of surface and groundwater used, but extraction is not restricted. The **1963 Final Judgment and Decree** states that only groundwater connected to surface water is covered by the adjudication, The **1966 Modified Judgment and Decree** further defines groundwater use, but does not quantify or apportion any water rights in the adjudication, reserving the right to do so in the future if it becomes necessary. It confirms that the Court has continuing jurisdiction "as to the use of all surface water within the watershed of the Santa Margarita River and all underground or sub-surface waters within the Santa Margarita watershed…that add to, contribute to, or support the Santa Margarita stream system." Additionally, the State Water Resources Control Board is to continue to exercise its statutory jurisdiction over all present and future appropriative rights to surface water in the Santa Margarita River and its tributaries. Overlying groundwater rights are divided into two categories based on where the water is obtained and used. In Interlocutory Judgment 41, the Court concluded that each of the three tribes have a recognized federally reserved water right, but it did not specify the amount of each of the tribe's water right, Federal reserved rights are also acknowledged for national forests in the watershed. [85] A Watermaster was not formally appointed (by court order) until 1975. This original Watermaster died in 1981.[86] Another Watermaster was appointed in 1989.[87]

Water Users

Stipulated Users

Major water purveyors listed in the 1988–89 annual report include Anza Mutual Water Company, Deluz Heights Mutual Water District (MWD), Eastern Municipal Water District, Elsinore Valley MWD, Fallbrook Public Utility District (PUD), Fallbrook Sanitary District, Murrieta County Water District, Ramona Water Company, Rancho California Water District, Western MWD, and Camp Pendleton. Other water users include the Cahuilla Band of Indians, Pechanga Band of Luiseño Indians, and Thousand Trails (a camping facility). Land

owners irrigating eight or more acres were determined, and 45 letters were mailed to these users.[88]

Current Users

Major water purveyors listed in the 2013–14 annual report include Anza Mutual Water Company, Eastern MWD, Elsinore Valley MWD, Fallbrook PUD, Lake Riverside Estates, Metropolitan Water District, Rainbow MWD, Rancho California Water District, Western MWD, Camp Pendleton, and the U.S. Naval Weapons Station. Indian tribes include the Cahuilla, Pechanga, and Ramona Bands. There are also a number of smaller water systems and private water users in the watershed.[89] Rancho California Water District (WD) produces groundwater under a variety of rights, as follows: recovery of water appropriated at Vail Lake; recovery of import return flows and recharged imported water; groundwater appropriative rights; and as agent on behalf of overlying landowners who established agreements with the District. Western MWD also pumps groundwater under an appropriative right.

Other

Annual reports do not report groundwater measurement for small pumpers or environmental users.[90]

Management Structure

The court, the Watermaster, and a steering committee administer the adjudication. The steering committee consists of representatives from the United States, Eastern Municipal Water District, Western Municipal Water District, Fallbrook Public Utility District, Metropolitan Water District, the Pechanga Band of Luiseño Indians, and Rancho California Water District.[91] A Watermaster was initially appointed from 1975 until 1981, but there was no Watermaster from 1981 until 1989 after the original one died.[92] Another Watermaster was formally appointed by the court in 1989, and a steering committee was also appointed in 1989 to assist the Watermaster.[93] The original steering committee was comprised of representatives from the United States (United States Marine Corps [USMC] Base Camp Pendleton), Fallbrook Public Utility District, and Rancho California Water District. The current steering committee is comprised of the United States (USMC Base Camp Pendleton), Eastern Municipal Water District, Fallbrook PUD, Metropolitan Water District of Southern California, Pechanga Tribe, Western Municipal Water District, and Rancho California Water District (RCWD).[94] Groundwater that does not support the Santa Margarita River stream system is outside the jurisdiction of the Watermaster.[95]

Management Strategies

Imported Water: Multiple agencies, including Elsinore Valley Water District, Western Municipal Water District, Eastern Municipal Water District, Rancho California Water District, Fallbrook PUD, and Rainbow Municipal Water District, use significant quantities of imported water in the Santa Margarita River Watershed. A major change from the early 1960s is the large-scale importation of water into the watershed by the Rancho California Water District.

Groundwater Storage: Surface water storage happens in three containment facilities in the basin: Lake Skinner, managed by the Metropolitan Water District; Vail Lake, managed by the Rancho California Water District; and Lake O'Neil, managed by the U.S. government at

Camp Pendleton.[96] During Water Year 2013–2014, a total of 81,785 AF of net imported supplies were distributed for use in the watershed, representing an increase of approximately nine percent from 2012–2013.[97]

Groundwater Recharge: Groundwater recharge occurs through direct releases from Vail Lake and Lake O'Neil in some years (e.g., 2009–2010 and 2010–2011).[98]

Monitoring and Reporting

Over the years, the USGS has measured flows in the Santa Margarita River Watershed, including operating stations under an agreement with the Watermaster as well as under contract with Camp Pendleton. The Watermaster prepares an annual report, and this report is required to include several line items (i.e., surface water availability, surface water imports and exports, a list of surface water users, surface water use by substantial users, unauthorized surface water use, threatening conditions, and surface water quality). The first annual report was published in 1990 for the 1988–1990 Water Year.[99]

Safe Yield

Native or operating safe yield was not defined or calculated in the **Santa Margarita Basin, Temecula Basin,** or **Cahuilla Basin.**

Groundwater Pumping and Overdraft

Groundwater pumping data are required only for groundwater uses affecting surface water supplies. Groundwater extractions were not specifically outlined in the first 1988–89 annual report of the Watermaster. In the most recent 2013–2014 annual report, the Watermaster keeps track of groundwater pumping. Groundwater pumping was 41,636 AFY in 2013–2014.[100] Large water purveyors used 35,998 AFY in 2012–2013 and 35,457 AF in 2013–2014, and substantial users used 6,179 AF in 2013–2014 and 6,623 in 2012–2013. The quantity of groundwater extractions by private irrigators is not directly measured and is based instead on the irrigated acreage and the crop type.

Overdraft was identified as a potential problem for this watershed in the 1988–1989 annual report of the Watermaster. There were dropping water levels and wells going dry in multiple parts of the watershed.[101] Overdraft was again identified as a potential problem in the Watermaster's 2013–2014 annual report. Temecula and Cahuilla Basins had the worst conditions, but 50-foot fluctuations in groundwater levels are normal in the Cahuilla area.[102] Water levels were measured in five index wells, and three out of five had water levels declines in Water Years 2012 and 2014.[103] See Table 8.

Table 8: Water Level Measurements from the Santa Margarita River Watermaster

Well	Water Elevation 2013 (Feet)	Water Elevation 2014 (Feet)	Change in Water Level (Feet)
RCWD 8S/2W-12H1	1,120.0	1,106.3	Down 13.7
USMC 10S/4W-7J1	87.2	86.7	Down 0.5
WMWD 7S/3W-20C9	1,026.0	1,029.0	Up 3.0
Anza MWC 7S/3E-21G1	3,757.6	3,795.6	Up 38.0
Pechanga IR 8S/2W-29B9	*974.1	971.4	Down 2.7

WMWD = Western Municipal Water District; MWC = Mutual Water Company

Water Quality

Groundwater quality in the **Santa Margarita Basin** is variable. Groundwater in the southwest basin is marginal to inferior for domestic and irrigation uses. Magnesium, sulfate, chloride, nitrate, and total dissolved solids (TDS) concentrations are too high for domestic use; and chloride, boron, and TDS concentrations are too high for irrigation use.[104] Groundwater quality in the **Temecula Basin** is impaired due to elevated nitrates, fluoride, sulfates, TDS, and volatile organic compounds (VOCs).[105] Groundwater quality in the **Cahuilla Basin** is also impaired, with high sulfates and nitrates making some water unavailable for domestic use.[106]

Drought

Climate change impacts in the watershed are expected to result in decreased imported water supply, decreased groundwater supply, decreased surface water supply, water quality concerns, sea level rise, saltwater intrusion, and decreased habitat availability.[107]

Disputes

The Santa Margarita River watershed has faced ongoing litigation. The judgments were followed by years of court cases between multiple parties, including the U.S. government. United States government issues were resolved when an agreement called the "Cooperative Water Resource Management Agreement" (CWRMA) between Camp Pendleton and Rancho California Water District was reached in March 2002. Many of these terms were incorporated in the 1966 Modified Final judgment. Recent disputes revolve around federal reserved water right claims by regional Indian tribes. Both the Cahuilla and Ramona Bands filed motions to intervene in the original case, to ask for quantification of their federal reserved water rights. The court asked the Cahuilla Band and the Ramona Band to serve notice of the litigation to all water right holders in the entire watershed, but the tribes filed motions to dismiss their claims against certain downstream defendants, opting to instead limit their water rights complaints to the Anza-Cahuilla Groundwater Area. These negotiations are still going on in late 2015. Settlement negotiations to quantify each band's federal reserved water rights in the Anza-Cahuilla Groundwater Area are in progress. The Pechanga Band had been engaged in settlement agreements with the Rancho California Water District and the U.S. government about their federal reserved rights since 1975. An agreement was recently reached but had not yet been approved by Congress at the time of this writing.[108]

Discussion

In the 1960s, when the final judgment and decree was issued, the area was largely rural. The result was that groundwater rights were established but not quantified and management was limited in the early years of adjudication. Safe yield was not determined for the groundwater basins, and as groundwater pumping was not quantified it was difficult to know who was over-pumping. This contributed to ongoing disputes for over a century. A traditional groundwater management plan was not required or prepared under the 1966 Modified Judgment and Decree.

After a long period with no Watermaster, the Watermaster was appointed in 1989 and began to issue annual reports. Currently, the Watermaster works to manage the basin on a watershed-wide basis through the Court jurisdiction. The annual groundwater production report includes a comprehensive groundwater model covering the area of the region's watershed. The 2002 formation of CWRMA serves to resolve disputes, and CWRMA has supported more active management of the basin, including the establishment of a cooperative monitoring arrangement with the USGS.

This was the only federal groundwater adjudication in California. After a long period where the Indian tribes attempted to secure their federal reserved rights, they are currently being quantified.

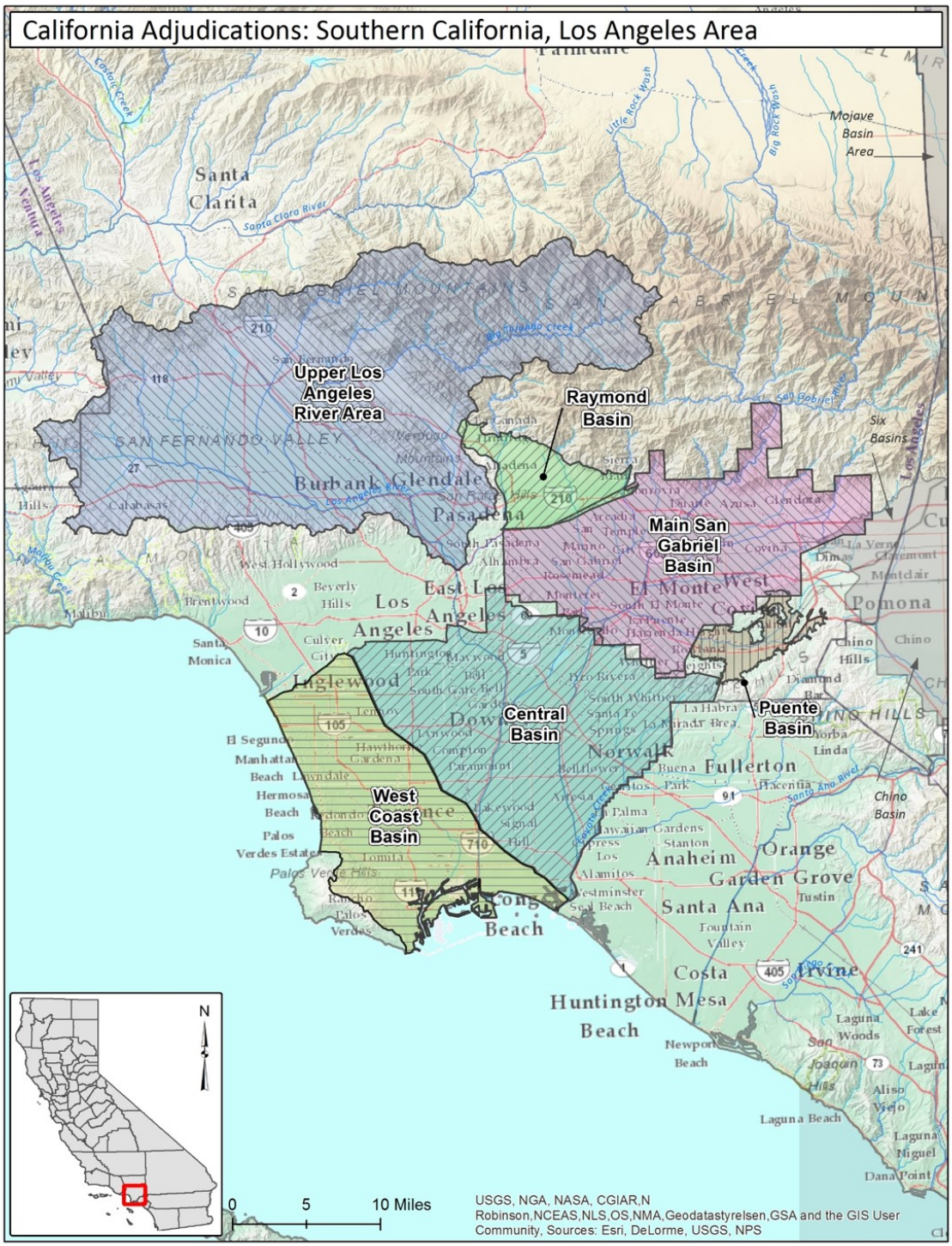
The adjudication recognizes the connection between surface and groundwater in the watershed and only includes groundwater that is hydrologically connected to surface water.

Currently, water levels are dropping in one of the basins.

SANTA MARGARITA RIVER WATERSHED BASINS

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Riverside, San Diego Area: 179.2 sq. mi. Physical Characteristics: Three basins: Santa Margarita, Temecula, and Cahuilla Precipitation: 7″–15″ per year CASGEM: Santa Margarita (Medium), Temecula (High), Cahuilla (Medium) Land Use: Lower watershed undeveloped with Camp Pendleton. Upper watershed rapidly urbanizing. Reason for Adjudication: Groundwater use in upstream Riverside County reduced downstream flows necessary to recharge the groundwater basins underlying Camp Pendleton, so the United States filed a complaint to adjudicate surface and groundwater water rights in the Santa Margarita River Watershed.	Stipulated Judgment: 1940 Adjudication Finalized: 1963 Modified Judgment: 1966 Decree Summary: *Stipulated Judgment:* Water users must report the amount of surface and groundwater used. Extractions are not restricted. *Final Judgment and Decree*: Only groundwater connected to surface water is covered, and groundwater rights are established but not quantified. The court acknowledges a federally reserved water right for each of the three tribes, but no amount is specified. *Modified Judgment and Decree:* Incorporates and modifies the 1940 and 1963 Judgments and Decrees, and 44 previously filed interlocutory judgments. Water rights are not apportioned but operational requirements are outlined. The court and retains the ability to quantify groundwater rights in the future.	Watermaster: A Watermaster was appointed from 1975–1981. There was no Watermaster from 1981–1989. Another Watermaster was appointed by the court in 1989 along with a steering committee to assist the Watermaster in administering the judgment. The committee consists of representatives from the United States, Eastern Municipal Water District, Western Municipal Water District, Fallbrook Public Utility District, Rancho California Water District, Metropolitan, the Pechanga Band of Luiseño Indians. Strategies: - Multiple agencies use significant quantities of imported water in the Santa Margarita River Watershed. - Surface water storage occurs in three containment facilities in the basin. - Groundwater recharge occurs through direct releases from Vail Lake and Lake O'Neil in some years.	Safe Yield Summary: The native or operating safe yield has not been defined nor calculated. Extractions Summary: Groundwater rights are not quantified but operational requirements are outlined. The court retains jurisdiction to quantify groundwater rights in the future. Overdraft: Overdraft was identified in the Watermaster's 1988–1989 annual report, and again in the Watermaster's 2013–2014 annual report. Groundwater Levels: Historically, there were dropping water levels and wells going dry in parts of the watershed. Temecula and Cahuilla Basins had the worst conditions, but 50-foot fluctuations in groundwater levels are considered normal in Cahuilla. In 2013–2014, water levels were measured in five index wells, and three out of five had water level declines. Water Quality: Groundwater quality is variable. Discussion: **- In the 1960s, when the final judgment and decree was issued, the area was largely rural, management was limited and groundwater rights were established but not quantified contributing to ongoing disputes for over a century. After a long period with no Watermaster, the Watermaster was appointed in 1989 and began to issue annual reports. The annual groundwater production report includes a comprehensive groundwater model covering the area of the region's watershed. The 2002 formation of CWRMA serves to resolve disputes and supports more active management of the basin, including the establishment of a cooperative monitoring arrangement with the USGS.** **- This was the only federal groundwater adjudication in California. After a long period where the Indian tribes attempted to secure their federal reserved rights, they are currently being quantified.** **- The adjudication only includes groundwater that is hydrologically connected to surface water.** **- Currently, water levels are dropping in one of the basins**

Los Angeles Basins



RAYMOND BASIN

This adjudication established the Doctrine of Mutual Prescription such that all overlying and appropriative users have rights based on their highest continual pumping amounts in the five years following the beginning of overdraft conditions with no priority. Under the judgment, appropriative and overlying users shared equally in the pumping reductions needed to remain within the basin's safe yield. The management structure developed for implementing the adjudication was relatively robust, such that over time parties voluntarily decreased their pumping when necessary to meet safe yield requirements. In addition, the Raymond Basin Management Board (RBMB) appears to have developed relatively strong relationships with neighboring basins, building a coalition with other entities that has been successful in advocating for federal funding for projects to improve groundwater recharge and access to imported surface water. Imported surface water has played a significant role in meeting demand, now accounting for over half of all water use in the basin, and this could be problematic if it is reduced. A Superfund site located within the basin has affected water quality in some areas.

Overview

County	Los Angeles
Area	26,310 acres[109]
Population	223,100[110] (2010)
CASGEM	Medium
Watermaster	1944–1984: DWR; 1984–present: Raymond Basin Management Board
Members	Currently, 16 entities are producing water from the basin, including four cities, six water companies, two irrigation districts, a water association, an association of cemeteries, a library, and a water district.
Court Cases	*City of Pasadena v. City of Alhambra,* Los Angeles Superior Court, Case No. Pasadena C-1323

CASGEM = California Statewide Groundwater Elevation Monitoring

This triangular-shaped basin is classified as unconfined to semi-confined, and is bounded by the San Gabriel Mountains in the north, the San Rafael Hills in the southwest, and by the Raymond fault in the southeast. Natural recharge occurs through percolation of precipitation and through ephemeral stream flow, some of which is diverted to spreading grounds to encourage recharge. A divide along the Eaton Wash separates flow in the eastern portion of the basin, where water levels are generally lower than in the western portion. The Raymond Basin is connected to the Main San Gabriel Basin to the south and east, and loses approximately 1 percent of water in storage per year.[111] Average annual precipitation over the basin is 21 inches. Total basin storage is estimated at 1.37 million AF.[112] The region was largely agricultural until the 1920s, when the area experienced significant urban growth.[113] Of the now eight cities overlying the basin, Pasadena has long been the dominant water user.[114]

Reason for Adjudication

The first wells were drilled in 1881 to supply water for irrigated agriculture and expanding municipalities.[115] Studies have estimated that safe yield was regularly exceeded by 1913. Pasadena began water spreading to encourage recharge, but as water levels continued to fall, it became a charter member of the Metropolitan Water District (MWD) in 1928 to secure additional supplies.[116] In 1937, Pasadena initiated proceedings in Superior Court against Alhambra and other major water users to curtail their pumping and gain quiet title to its own pumping rights. However, the trial court required Pasadena to add as defendants all entities in the basin pumping more than 100 AF annually, making this a general adjudication of water rights in the basin.[117] This was done in part to reduce the number of parties in an attempt to simplify the proceedings. The court appointed the Division of Water Resources at the Department of Public Works (later DWR) as a referee to determine the physical conditions of the basin and establish safe yield. Completed in 1943, the referee's report found the annual safe yield to be 21,900 AF, whereas annual pumping was 29,400 AF annually. Based on this report, the 31 parties negotiated a stipulated agreement, which became the basis of the adjudication.[118] The judgment was appealed by one party, the California-Michigan Land and Water Company, but in 1949 the California Supreme Court upheld the original judgment, and the Supreme Court declined to hear the case in 1950.[119]

Decree and Amendments

Adjudication initiated: 1937
Adjudication finalized: December 23, 1944
Revisions or amendments:

- 1955 (to increase decreed rights proportional to increased estimate of safe yield)
- 1974 (to allow credit for spreading water from canyon diversions)
- 1984 (to revise governance structure and grant authority to the board to manage stored water)

Stipulated judgment: 1944
Costs: Cost for the initial investigation was $53,275 in 1943 ($733,000 in 2014 dollars). Estimated legal costs to Pasadena were $100,000 (approximately $1.3 million in 2014 dollars). Legal costs to other parties are unknown.[120] In the 2013–2014 year, the total expenses of the RBMB were $714,592.[121]

Decree Summary

This adjudication established the doctrine of mutual prescription, where all overlying and appropriative users have rights based on their highest continual pumping amounts in the five years following the beginning of overdraft conditions. Using this approach, the 1944 decree called for the proportional reduction in water rights of all users so as to reach the safe yield of 21,900 AFY identified in the referee's report. Each party was assigned extraction rights to one of three subareas (Monk Hill and Pasadena subareas in the Western Unit, and the Santa Anita subarea in the Eastern Unit). The 1944 decree provided for the transfer and leasing of pumping rights among parties.[122] It also incorporated the 1943 Water Exchange Agreement, which established that a party who contracted with MWD to import water would make available to other parties any excess in its adjudicated groundwater rights, at no more than its own average pumping costs.[123]

In 1950, the court approved an agreement between the cities of Sierra Madre and Arcadia to allow Sierra Madre to receive credit for water that it spreads and stores in the Eastern Unit.[124]

In 1955, the court issued a Modification of Judgment, increasing the safe yield to 30,622 AFY, primarily due to increases in return flows from imported water. The modification also limited pumping in the Western Unit area during dry periods. In 1974, another modification granted parties credit for spreading of water in spreading grounds in the vicinity of the Arroyo Seco, Eaton Wash, and Santa Anita Creek Canyon.[125] Additional modifications include allowing carryovers of decreed rights of up to 10 percent (which must be used within the next year), establishing voluntary pumping control programs, and the creation of a water quality monitoring program.[126]

Water Users

Stipulated Users

There were 31 parties to the 1944 stipulated agreement.[127]

Current users

There are 16 remaining users who are parties to the agreement, including four cities, five mutual water companies, two private water companies, two irrigation districts, one cemetery, one library, and a county water district.[128] The RBMB's annual reports indicate that 15 out of the 16 parties are currently active producers. There are two active non-parties, one of which is the Las Encinas Hospital. Las Encinas was identified as a non-party producer in the original Report of Referee.[129] NASA's Jet Propulsion Laboratory (JPL), also a non-party, currently extracts, treats for perchlorate, and re-injects water on-site as part of an overall Superfund cleanup strategy.

Excluded users

The adjudication excluded any entities pumping less than 100 AFY. The number at the time of adjudication is unknown, but in 1984, all remaining non-parties were located in the Western Unit, and together pumped a total of less than 100 AFY.[130] The one non-party whose pumping is reported by the RBMB is the Las Encinas Hospital, which pumped between 4–19 AF annually between 2011–2014.[131] Environmental uses are not addressed in the judgment.

Three MWD member agencies service areas overlying the basin but are not RBMB members: Foothill MWD, Upper San Gabriel Valley MWD, and The City of San Marino. These entities are members of the Metropolitan Water District (MWD) and import surface water to the region. However, some of the members of the Foothill MWD and Upper San Gabriel Valley MWD are RBMB parties to the judgment. The City of Pasadena is both a direct member of MWD and a party to the judgment. The City of Sierra Madre, and the City of Alhambra, both parties to the judgment, are members of the San Gabriel Valley Municipal Water District (SGVMWD), which is a direct State Water Contractor.

Management Structure

Management structure outlined in the original decree

The Division of Water Resources at the then Department of Public Works (later the Department of Water Resources) served as Watermaster, monitoring water use and reporting all events to parties and to the court. A five-member Raymond Basin Advisory Board was established to provide input, and to approve the Watermaster's annual budget.[132]

Current management structure
In 1984, the RBMB took over as Watermaster. This entity oversees the adjudication and approves plans for storage of imported water in the basin. The RBMB has a ten-member board representing its 16 members. Each party with a decreed right of at least 1,000 AFY holds a seat on the board. Members with smaller decreed rights appoint one board member from their respective subarea (Monk Hill and Pasadena in the Western Area, and Santa Anita in the Eastern Area).[133]

Overlapping management structures
The Los Angeles County Department of Public Works operates the Eaton Wash, Santa Anita, and Arroyo Seco spreading basins. The JPL is responsible for implementing cleanup of the U.S. Environmental Protection Agency (EPA) Superfund site at Monk Hill.[134] The RBMB ensures that cleanup is done in compliance with the judgment and provides technical input to the EPA.

Management Strategies

Imported Water: The primary strategy for reducing groundwater pumping is the use of water imported from MWD, which now accounts for over half of all water use within the basin.[135] In addition, several parties to the agreement undertake spreading to encourage groundwater recharge. Pursuant to a 1974 modification to the judgment, parties receive credit for 80 percent of water spread in four main spreading basins. Between July 2013 and June 2014, a total of 1,405.3 AF of water was spread for recharge of the Raymond Basin.[136] The 80 percent spreading credit can be taken in lieu of surface diversion rights. In addition, there are seven injection wells in the basin with a total capacity of 10,500 AFY, but from 1985–2004, only 444 AFY had been injected.[137]

Water Storage: Beginning in 1984, RBMB assumed authority to manage water storage programs in the basin, allowing users in the Monk Hill and Pasadena subareas to establish long-term storage accounts to store water for future use. Users who store water are assessed a 1 percent loss each year due to natural outflows to the Main San Gabriel Basin.[138] This loss is approved by the board annually and may change from time to time. As of June 2014, 15 parties had a total of 46,592 AF of water in long-term storage.[139] In 2003, RBMB approved a conjunctive use program Foothill Municipal Water District and the Metropolitan Water District. Under this program, up to 9,000 AF of imported water from the Metropolitan Water District can be stored by five members of Foothill MWD in the Monk Hill subarea via injection or in-lieu methods. Metropolitan has the right to call up to 3,000 AF per year. In 2006, a similar conjunctive use program was approved for the Pasadena subarea, of up to 66,000 AF.

Finally, RBMB serves as the lead agency for the Foothill Water Coalition, a collaboration among 11 entities managing surface and groundwater in the foothill communities in southern California. The coalition's Water Supply Reliability Program includes projects to build interconnections between basins, a study to improve groundwater recharge, and assessments of new supplies. In 2007, $5 million in federal funds was authorized for these projects through the Water Resources Development Act.[140]

Monitoring and Reporting

Producers are required to meter their groundwater pumping and report well production on a monthly basis. The RBMB requires that these meters be tested each year. Meters that are

under-recording by 5 percent or more must be adjusted. Forty-six wells were tested in 2013–2014. Groundwater levels are also measured at representative wells every six months.[141]

Safe Yield

The 1943 referee's report stated the safe yield for the basin was 21,900 AFY. However, a new report filed on October 5, 1954 increased the estimated safe yield to a total of 30,622 AFY.[142] This is a native safe yield, including only natural recharge and returns from use.[143] The increase from the 1943 safe yield is largely due to increased return flows from imported water.[144] This safe yield is apportioned across the three subareas: Pasadena (17,843 AFY), Monk Hill (7,489 AFY), and Santa Anita (5,290 AFY).[145]

Groundwater Pumping and Overdraft

Between 1985–2004, users pumped an average of 32,969 AFY, exceeding the safe yield of 30,622 AFY.[146] In 2004, a study by Geosciences found that total water stored in the basin declined from 913,000 to 816,000 AF, representing a decrease of approximately 12 percent. Further, from 1994–2004, groundwater levels in the eastern portions of the basin decreased significantly, by as much as 14 feet per year in some areas. Increases occurred in the western portion of the basin, largely due to reduced production because of perchlorate contamination.[147]

To reverse these declines, the RBMB has pursued projects to gain more reliable access to surface water and to improve groundwater recharge with federal funding obtained through the Foothill Water Coalition. In addition, in 2008, RBMB members in the Pasadena subarea agreed to reduce their pumping incrementally over five years (6 percent per year) to reach an ultimate annual reduction of 30 percent per year by the fifth year. This was done to help reverse declining water levels in that subarea. The agreed-upon reduction now stands at 30 percent per year, and is still in place. These efforts have brought pumping back within the safe yield, with an average of 27,270 AFY pumped between July 2009 and June 2015.

Water Quality

Overall water quality in the basin is reasonable, although specific parts of the basin have contamination problems. Concentrations of total dissolved solids (TDS) range from 350–700 milligrams per liter (mg/L) in the Monk Hill and Pasadena subareas, and 300 mg/L or lower in the Santa Anita subarea. Nitrate concentrations are elevated in shallow areas of the Monk Hill Subarea that were previously agricultural areas. In 2004, ten wells tested for nitrate concentrations above the maximum contaminant level (MCL) of 10 mg/L. Cleanup is still ongoing for contamination from perchlorate and volatile organic compounds (VOCs) resulting from seepage pits used by the JPL in the 1940s and 1950s. The JPL has been managing a cleanup program since the site was designated as a Superfund site in 1992. Several users treat for VOCs and perchlorate at the wellhead or at a treatment facility.[148] In 2009, the RBMB established the Monk Hill Temporary Perchlorate Clean-Up Pool, which allowed users affected by this contamination to store water during the cleanup process. The five-year term of this cleanup pool ended in 2014.[149]

Drought

Data on water usage in the Raymond basin suggests that during the two most recent drought periods (2007–2009 and 2012–2014), groundwater extractions have mostly remained within

the safe yield, except for in 2007 and in 2013. Instead, water imports increased during all of these years.[150]

Disputes

Since the 1944 stipulated judgment, it appears that users have been able to resolve their problems and disputes through modifications to the agreement implemented by the Raymond Basin Management Board. Measures such as the creation of long-term storage accounts, allowing credit for spreading water for recharge, allowing for a 10 percent carryover, and other programs have provided users with flexibility in exercising their groundwater rights, which may have contributed to avoiding disputes.[151] In addition, parties have shown a willingness to curtail their pumping in response to basin conditions, such as the phased-in 30 percent reduction agreed to by Pasadena subarea users.

Discussion

The Raymond Basin played an important role in the evolution of groundwater management in California by establishing the precedent of mutual prescription, in which all overlying and appropriative users are allocated rights based on their highest continual pumping amounts in the five years following the beginning of overdraft conditions.[152] This approach allocates water proportionally across all users at the time of adjudication, rather than favoring those who asserted their rights earliest. However, mutual prescription provided incentives for groundwater users to increase their pumping prior to adjudication in order to establish their rights.[153]

In 2004, a study authorized by RBMB and prepared by Geoscience found that between 1985 and 2002, the total amount of water stored in the basin declined from 913,000 AF to 816,000 AF, representing a decline of about 12 percent.[154] Average annual withdrawals during that period regularly exceeded the safe yield of 30,622 AFY. However, RBMB users were able to reduce their pumping, conjunctive use programs were established, and projects were funded through the Foothill Water Coalition to increase the reliability of access to surface water.

Users have increasingly relied upon imported water to meet demands. In the late 1990s, groundwater extractions exceeded water imports, but since 2000 imports have exceeded extractions, while total water use has largely remained constant.[155] The reliance on imported water may be problematic as climatic conditions change, droughts become more extreme, and imported water becomes less reliable and more expensive.

Additionally, even though pumping is within the safe yield, the decline in overall storage in the basin has not yet been completely reversed. Data from 2013–2014 does not reveal a substantial change in groundwater levels from those observed in 2004.[156]

The stipulated agreement that was the basis for the adjudication has proved durable, and the management structure established to maintain it has been flexible enough to allow modifications to the agreement as conditions changed. Since a downward trend in groundwater levels became evident in the early 2000s, RBMB has taken steps to reverse this, including curtailing pumping and expanding access to imported water. This involved collaboration with neighboring groundwater basins and surface water suppliers, and these relationships will likely prove valuable for ensuring reliable water supplies in the future.

RAYMOND BASIN

Overview	Water Rights: Decree and Amendments	Management	Trends
County: Los Angeles Area: 26,310 acres; 41.1 sq. mi. Physical Characteristics: Unconfined to semi-confined, natural recharge through percolation of rainfall and surface runoff. *Storage Capacity:* 1.37 million AF *Precipitation:* 21" on average per year CASGEM: Medium Population: 223,100 Land Use: urban Reason for Adjudication: In early 1900s, usage expanded due to urban growth and agriculture. In 1937, Pasadena (the dominant user) filed suit against the City of Alhambra. The judge turned the case into a general adjudication of basin rights.	Stipulation for Judgment: 1944 Adjudication Initiated: 1937 Finalized: 1944 Amended: 1955, 1974, 1984 Decree Summary: Established doctrine of mutual prescription where water rights of all users were proportionally adjusted to within the safe yield. Extraction rights are assigned to 3 subareas: Monk Hill, Pasadena, and Santa Anita, and can be exchanged between the 31 parties to the agreement (currently 16 users) Amendment Summary: 1955: increased safe yield, accounting for return flows from imported water. 1974: allowed users credit for 80% of water spread for recharge in spreading basins. 1984: RBMB designated as Watermaster.	Watermaster: In 1984, the Watermaster shifted from DWR to Raymond Basin Management Board (RBMB), a 10-member board that represents user interests. RBMB has responded to changing conditions and made revisions as needed. Members: 16 member agencies including 4 cities, 6 water companies, 2 irrigation districts, a water association, a cemetery association, a library, and a water district. Extractions are for municipal use. Strategies: - Imported water (primary strategy), - Groundwater recharge through spreading basins and limited ASR well injection, - Conjunctive use	Adjudicated Safe Yield: 21,900 AFY Current Safe Yield: 30,622 AFY Safe Yield Summary: 1944 safe yield was 21,900 AFY. A 1955 revision reflected recharge and returns from use. The new and current safe yield of 30,622 AFY, includes natural recharge and returns from use. Adjudication Extractions: 1943 extractions were 29,400 AFY, above the safe yield of 21,900 AFY. Current Extractions: 1970–1990 extractions were 32,340 AFY, exceeding the new safe yield of 30,622. 1995–2000 extractions were 37,879 AFY. July 2009 - June 2014 average was 27,662 AFY (below the safe yield). Extraction Summary: Before adjudication, extractions regularly exceeded the safe yield. After adjudication, extractions gradually began to exceed it, and since 2005, extractions have been below the safe yield. Groundwater Levels: In 2008, RBMB members in the Pasadena Subarea agreed to reduce their pumping 6% per year over five years to help reverse declining water levels in that Subarea. The agreed-upon reduction now stands at 30% per year and is still in place. These efforts have brought pumping back within the safe yield, with an average of 27,270 AFY pumped between July 2009 and June 2015. Overdraft: From 1985–2004, users pumped an average of 32,969 AFY, exceeding the safe yield. In 2004, the total water stored in the basin had decreased approximately 12%. From 1994–2004, groundwater levels in the eastern portions of the basin decreased by as much as 14 ft per year in some areas. Increases in the western portion are largely due to reduced production because of perchlorate contamination. Water Quality: Elevated nitrate levels in shallow areas of the Monk Hill subarea that were previously agricultural. In 2004. Perchlorate and VOC contamination affected the Monk Hill subarea and parts of the Pasadena subarea due to the Jet Propulsion Lab Superfund site in the Monk Hill area. Drought: Water users have increased reliance on imported water rather than extracting groundwater. Discussion: **- Established the precedent of mutual prescription that was followed in many subsequent adjudications.** **- The stipulated agreement proved durable, and the management structure was flexible enough to allow for modifications to meet changing needs, including pumping curtailments.** **- Imported surface water plays a significant role in meeting demand, now accounting for over half of all water use in the basin. This may be problematic under climate change as imported supplies become more expensive and less reliable.** **- The area contains a Superfund site.**

WEST COAST BASIN

It is striking that overdraft was present in this basin almost a century ago. Total accumulated overdraft through 1957 was estimated at 832,000 AF, 50–75 percent of which was replaced by saltwater. Accumulated overdraft was reduced over time and saltwater intrusion along the coast was halted using injection wells, but in 2012 overdraft remained significant at 650,600 AF. The judgment provided for some reductions in extractions, and included imported water as a supplemental supply to meet growing water demands. A new Watermaster in 2015, replacing the California Department of Water Resources, consists of three separate divisions with different functions: (1) an Administrative Body (Water Replenishment District of Southern California, WRD) appointed by the court to administer accounting and reporting functions; (2) a Water Rights Panel that enforces issues related to the pumping rights within the adjudication, and (3) a Storage Panel that approves certain large-scale groundwater storage efforts. The basin is employing multiple strategies to increase supply including the expansion of local sources, but it is still very reliant on imported water for replenishment, and the biggest challenge currently facing the basin is the rising cost and unreliability of imported water. While groundwater extractions in 2013 were less than adjudicated rights, they were still more than double the initially recommended extraction limit. At that rate, the basin will reach safe/sustainable yield in 2053, or approximately 92 years after the 1961 judgment. Six oil companies received the majority of water rights in 1961, followed by water companies and cities. Today, there are significantly fewer water users in the basin, but the current major water users are still oil companies and water purveyors.

Overview

County	Southwest part of the Coastal Plain of Los Angeles County
Area	93,795 acres; 146.6 square miles
Population	1,195,195[157] (2010)
CASGEM	Medium
Watermaster	After adjudication: California Department of Water Resources (DWR). Currently: three divisions: (1) an administrating body (the Water Replenishment District of Southern California, or WRD); (2) the chair of a water rights panel; and (3) a storage panel consisting of the West Coast Water Rights Panel and the Board of Directors of WRD.
Court Cases	*California Water Service Company et al. v. Compton et al.,* L.A. County Superior Court, Case # 506,806

CASGEM = California Statewide Groundwater Elevation Monitoring

The West Coast Basin underlies 160 square miles in the southwestern part of the coastal plain of Los Angeles County. The basin is bounded on the west by the Santa Monica Bay, on the north by the Ballona Escarpment, on the east by the Newport-Inglewood Uplift, and on the south by the San Pedro Bay and the Palos Verdes Hills.[158] The West Coast Basin, the Central Basin, and the Main San Gabriel Basin to the north are part of the San Gabriel River Watershed and are interconnected. Long-term mean precipitation is 12.6 inches. The foothills of the San Gabriel Mountains receive the first benefit of rainfall. As the San Gabriel River winds toward the ocean, it first replenishes the Main San Gabriel Basin. It

then flows through Whittier Narrows to the Central Basin and through the Newport-Inglewood Uplift to the West Coast Basin.[159] Subsurface underflow from the Central Basin through the Newport-Inglewood Uplift and some surface inflow into the uppermost aquifers provide the primary natural sources of recharge. Additionally, artificial recharge water from spreading grounds in the Central Basin percolates into West Coast Basin aquifers. Seawater intrusion occurs in some exposed offshore aquifers, and water injected in seawater intrusion barrier projects contributes to the main source of artificial replenishment.[160] Storage capacity of the primary water producing aquifer, the Silverado aquifer, is estimated to be 6,500,000 AF.[161]

The West Coast Basin is the sixth largest water district in California, serving a population of nearly one million people. The area is highly urbanized and twenty incorporated cities and several unincorporated areas overlie the Basin including both public and private water agencies. Initially groundwater was the sole water supply source, but today the region also relies heavily on imported and recycled water.[162]

Reason for Adjudication

In 1905, the USGS reported that groundwater from the basin was discharging into the ocean. By 1912, groundwater flow direction had reversed in the Newport Inglewood Uplift due to pumping in the basin, and by 1918–1922, seawater was actively intruding into coastal aquifers.[163] Rapid urbanization after 1920 resulted in an increase in pumping that intensified after 1940 with the start of World War II. By the mid 1940s, the basin was experiencing serious water shortage problems and overdraft was continuous. In 1945, the California Water Company, the City of Torrance, and the Palos Verdes Water Company filed suit against 151 defendants to determine the water rights of all producers and control overdraft.[164]

The West Coast Basin Groundwater Conservation Group (WBGCG) also formed in 1945 with representatives from cities, private water utilities, and local industries. The group documented the significant overdraft and suggested finding a source of supplemental water.[165] To facilitate that, in 1947 West Basin formed a Municipal Water District and in 1949 became a member of the Metropolitan Water District (MWD) to obtain imported water.[166] In 1952, a Referee Report by an engineering-advisory committee organized by the WBGCG quantified annual extractions and the basin's recharge rate and recommended a physical solution, including that water producers reduce groundwater extractions from 90,000 AFY to 30,000 AFY. A voluntary cutback to 25 percent below 1952–1954 volumes was instituted, but despite this action, seawater continued to intrude into the basin.[167] In 1955, the court approved an Interim Agreement drafted by the basin's water users.[168]

In 1956, the seven largest producers in the basin filed a second action to prevent new pumpers from gaining prescriptive rights. Additionally, to raise funds to obtain and manage supplemental supplies, as well as fund injection wells to hold off the seawater intrusion, in 1959 the West Coast Basin joined with the Central Basin to form WRD.[169]

The two adjudication lawsuits were settled in 1961 and 1966, respectively. The first West Coast Basin Judgment was signed after the court rescinded the earlier Interim Agreement. Of the 120 producers that were named in the second lawsuit, many dropped out rather than pay the costs of defending their right to a small amount of groundwater production. By 1963 only 12 of the defendants in the second suit were still active. When that lawsuit was settled in

1966, the second suit parties were merged with the parties named in the original suit for administrative purposes.[170]

Decree and Amendments

First Action – Date initiated: 1945. **Date finalized:** 1961 with a Stipulated Judgment.
Second Action – Date initiated: 1956. **Date finalized:** 1966.
Appeal: 1964
Amendments: 1977, 1981, 1989, 1993, 1995, 2014
Costs: Estimated total costs to all parties was 5 million dollars [171] Watermaster expenses in 2013–2014 were $230,382.[172]

Decree Summaries

1961 Judgment
Water rights were based on the Doctrine of Mutual Prescription as set out in the Raymond Basin adjudication. The judgment provided for emergency over-pumping up to a total of 10,000 AF under specified conditions.[173] It also specified that pumping by the parties should be reduced to 64,042 AFY, but this rested on the availability of imported water. Moreover, total allocated rights, while less than the annual volume of extracted groundwater in 1955, were more than double the extraction limit recommended by the referee report (the court declared that an immediate reduction would result in undue hardship).[174]

The judgment established carryover provisions, an exchange pool and transferable rights, and enjoined new pumping. A member of an exchange pool who had supplemental water in excess of an adjudicated right and estimated need was required to offer to lease a portion of that right to those without supplementary water. The exchangees reimbursed the exchangers. This allowed those with surface water connections to cut back on groundwater use below their legal entitlement and be reimbursed for the higher cost they pay for imported water and those using more groundwater pay that higher cost.[175]

In 1955, the Superior Court of Los Angeles County appointed the Division of Water Resources as the Watermaster to administer an Interim Agreement, and in 1961, DWR was designated as the Watermaster of the final judgment.

1966 Judgment
All other pumpers were made party to the original judgment's terms, and annual pumping was adjusted to 64,468 AFY.[176] The judgment did not mention overdraft or safe yield.[177]

Amendment Summaries

1989
The 1989 amendment established water rights of 64,468.25 AFY and enjoined excess extractions but allowed WRD in some cases to permit additional over-extractions beyond the 10 percent allowed in the judgment.[178]

2014
Parties were now allowed to store water in the basin. All stored water could be transferred, assigned, licensed, or leased provided that the parties complied with appropriate procedures. The court had jurisdiction over groundwater storage and its allocation and governance.[179]

Available dewatered space was apportioned between a Basin Operating Reserve (49,100 AF) and adjudicated storage capacity (79,900 AF). The WRD had first priority to use the Basin Operating Reserve to manage available sources of water and otherwise fulfill its replenishment functions. The adjudicated storage capacity was allocated between: an individual storage allocation (25,800 AF), a community storage pool (35,500 AF), and a regional storage allocation (9,600 AF). Parties who had an adjudicated right were permitted to carryover the right to extract any unused water to the following year, reduced by any stored water credit, but could also convey the carryover to stored water upon payment of a replenishment fee to WRD. A party that fully occupied its individual storage allocation could place water into the community storage pool. Regional storage projects were the principal category of storage for potential storage projects sponsored by, or for the benefit of, entities that do not hold an adjudicated right, although any party to the judgment may also propose a regional storage project. Additional requirements applied to storage and recovery, exchange pools, and pumping under emergency situations. The amended judgment also established a "non-consumptive water use right," subordinate to the adjudicated rights, on specifically defined lands as part of a project to recover old refined oil or other pollutants that have leaked into the underground aquifers of the basin. Finally, a new Watermaster was appointed (discussed below under Management Structure).[180]

Water Users

Main water users in the basin are water purveyors (approximately 40–50 percent), oil companies (approximately 20–25 percent), and users with private wells. There are fewer parties and active pumpers today than there were before the adjudication. Some former pumpers abandoned production; most selling their adjudicated rights or leasing them to larger producers. There were 65 parties to the judgment, but in 2013–2014 there were only 24 active pumpers.[181] Moreover, there has been a concentration of water production in just a small number of pumpers, as seen in Table 9.

Table 9: Number of Pumpers and Percent of Total Production

Date	Small Pumpers (100 AFY or less)	Percent of Total Production	Large pumpers (1,000 AFY or more)	Percent of Total Production
1950	232	5	19	84
1961	NA	NA	16	87
1990	NA	NA	11[182]	95

Management Structure

In 1961, DWR was appointed as the Watermaster, with primarily ministerial duties to enforce the judgment, including monitoring of groundwater levels and extractions, and reporting all groundwater extractions to the court and to the parties to the judgment. The Watermaster did not have authority to develop, implement, or enforce sustainability measures.[183]

There are currently overlapping management structures in the basin, including: the WRD, the Regional Water Quality Control Board, and the Los Angeles County Public Works Department. The Regional Water Quality Control Board–Los Angeles Region regulates injection of recycled water and limits the amount of recycled water that can be injected. The Los Angeles County Public Works Department operates the West Coast Barrier Project and Dominguez Gap Barrier Project facilities. Other entities involved in managing some

aspects of the basin include the MWD and its member agencies and the West Basin Water Association.

Since its inception, WRD has provided significant management services in the groundwater basin. It collects data on water levels, pumping, and water quality, and replenishes the aquifers by purchasing all the barrier water. WRD also collects a replenishment assessment on all pumping to raise money to monitor groundwater quality and purchase supplemental water. Each groundwater producer must submit a report to WRD summarizing monthly production activities (quarterly for smaller producers), as the basis for determining each producer's replenishment assessment. As Watermaster, the DWR had cooperated closely with WRD because both were required to record all groundwater extractions from the basins, and they coordinated data collection to prevent duplication. Additionally, well reports were sent to DWR via WRD.[184]

In 2015 a new Watermaster was appointed, consisting of three divisions: (1) an administrating body, WRD); (2) the chair of a water rights panel; and (3) a storage panel consisting of the West Coast Water Rights Panel and the Board of Directors of WRD. The water rights panel consists of five members from representatives of the parties holding adjudicated rights. Three members are elected officers of the West Basin Water Association, two members are to be selected by their Board of Directors; and at least one member is a non-water purveyor adjudicated rights holder.[185]

Management Strategies

Sixty years ago the average customer agency in the West Coast Basin's service area relied completely on groundwater. Today, however, it relies on a more diverse mix of water resources: 21 percent groundwater, 65 percent imported water, 7 percent recycled water, and 7 percent conservation efforts.[186]

Seawater Barriers: One conundrum is that maximizing freshwater inflow from the Central Basin to the West Coast Basin requires keeping the West Coast Basin water levels below sea level. However, the depressed groundwater elevations expose the West Coast Basin to the threat of saltwater intrusion. In the 1940s, the Los Angeles County Flood Control Department (FCD) installed and operated a mile-long series of injection wells in the Manhattan Beach area, creating a freshwater wall against the ocean, which acted as a hydraulic barrier dam between the ocean and the groundwater aquifer. This allowed the basin's levels along the shoreline to be maintained above sea level, keeping seawater out. Water levels farther inland were maintained below sea level, maximizing freshwater inflow from the Central Basin. A second seawater barrier project operated by the FCD and Los Angeles County Public Works Department was established at Dominguez Gap. Imported and recycled water are used for these barriers,[187] and further seawater intrusion into the Basin was effectively halted by the joint barrier projects.

Imported Water: WRD purchases replenishment water from MWD member agencies and recycled water providers, and imported water has been the largest component of supply since the mid-1950s.[188] During 2013–2014, imported water totaled 172,953 AF.[189] The biggest water importers were City of Long Beach,[190] West Basin Municipal Water District (WBMWD), and the City of Los Angeles.

Recycled Water: There are several recycling facilities in the Basin: the City of Los Angeles's Hyperion treatment plant and Terminal Island Treatment Plant, and WBMWD's Recycling Facility.[191] Goal is to increase the utilization of treated sewage for indirect potable replenishment of the basin.

Desalination: When injection began, a freshwater ridge formed along the coast, trapping saltwater on the inland side and underlying approximately 10 square miles of the basin, or about 20 percent of the basin's usable storage. It began moving inland at a rate of approximately 300 feet per year, eventually reaching West Torrance. In response, in 1993 the WBMWD constructed the Brewer Desalter Treatment Facility in the City of Torrance. In 2001, WRD began operating its own desalter, the Goldsworthy Desalter, in Torrance.

In-Lieu Replenishment: MWD joined with WRD to replace groundwater with imported water. WRD reimburses pumpers who use in-lieu management with the difference in the cost between pumping groundwater and using imported water.

Storage: In 2000 and 2002, voter initiatives made money available for local groundwater storage projects.

Other: Judgment was amended to authorize non-consumptive water rights. This allowed industrial water users, particularly oil and aircraft companies, to perform cleanup operations to remove contaminants of old refined oil from beneath their land, and required intensive pumping for short periods in excess of their adjudicated rights, after which water with contaminants removed was returned.[192]

Monitoring and Reporting

The West Coast Basin Watermaster attempts to calibrate the water meters at every active extraction well at least once every two years and confirm water meter test results. Inaccurate meters must be repaired or replaced by the party within 30 days of the date of notification from the Watermaster. Follow-up tests on repaired meters and initial tests on new meters are scheduled whenever necessary. In 2013–2014, the Watermaster visited 16 parties and performed 28 meter tests, with 15 meters having registration accuracies within plus or minus 5 percent. The Watermaster also conducted investigations at 12 well sites.[193]

Additionally, each groundwater producer is required to submit a report to WRD summarizing monthly production activities (quarterly for smaller producers). This information is the basis by which each producer pays the replenishment assessment. The Regional Groundwater Monitoring Program (RGWMP) currently consists of a network of more than 300 monitoring wells at over 50 locations throughout the district.[194] Each fall and each spring, the Watermaster measures the depths to the static groundwater in more than 100 wells in the basin. These measurements, together with groundwater elevation data obtained from WRD, are used to prepare groundwater elevation maps.[195]

Safe Yield

Initially, native safe yield was estimated to be ~30,000 AFY, but by 1944, production was 69,476 AFY. In the 1950s, annual freshwater inflow was only 25,000 AFY, but groundwater extractions were more than 90,000 AFY. The adjudication did not fix annual pumping equal to the basin's estimated native safe yield. Rather, authorized pumping was nearly double native safe yield at 64,478 AFY, and the WRD was created to make up the deficit with

replenishment water. Because of this, use in the basin is heavily reliant on artificial water, as seen in Table 10.

Table 10: 2013–2014 Total Use[196]

Total Groundwater Extracted	Imported Water	Recycled Water	Purchased Locally	Total Used
41, 060	172,953	40,409	9,163	263,585

Groundwater Pumping and Overdraft

Total accumulated overdraft through 1957 was estimated at 832,000AF, 50–75 percent of which was replaced by seawater.[197] By 1959, annual production of groundwater had reached levels as high as 94,100 AFY, and the basin was in serious overdraft.[198] Water levels switched from a falling trend to a rising one after the adjudication and with the importation of water, with some variation over the basin. Between spring 2013 and spring 2014, groundwater levels rose as much as 9 feet between Carson and Long Beach and declined as much as 27 feet in Gardena.[199] On average, the decrease in groundwater levels over the entire West Coast Basin in 2014 is estimated to be approximately 2 feet.[200] But in 2012 accumulated overdraft was still significant, at 650,600 AF.[201]

Water Quality

Production wells with higher levels of total dissolved solids (TDS) are generally located near the coast and may be caused by seawater intrusion, connate brines, or possibly oil field brines. WRD monitors in both the Central Basin and West Coast Basin (CBWCB) for water quality. In the West Coast Basin, TDS detected was below the upper level secondary maximum contaminant level in 27 out of 31 production wells (87 percent). Overall, WRD states that groundwater in the CBWCB continues to be of high quality, suitable for potable and non-potable uses. However, localized areas of marginal to poor water quality that may require treatment prior to use exist.[202]

Drought

During emergency or drought conditions, WRD can allow an additional 10,000 AF of extractions for a four-month period. This provision has yet to be exercised but offers the potential use of additional supplies in the basin.[203]

Disputes

In May 2009, the Central Basin Municipal Water District; the cities of Downey, Signal Hill, and Cerritos; and the Tesoro Oil Company argued against the court's jurisdiction to rule on a state-mediated plan to tap into some 450,000 AF of groundwater storage capacity for the Central and West Coast groundwater basins. In 2009, the WRD and a group of pumpers filed a motion to amend a judgment on the allocation of storage space in the Central Basin. In 2012, the California Supreme Court declined to review state appeals court decisions from September and January, which had found that a trial court had jurisdiction over groundwater storage and its allocation and governance, and that it could authorize the transfer of water from one basin to another.

In 2013, Tesoro was barred from pumping groundwater for use at a local refinery until it paid more than $900,000 in back fees to the WRD. Tesoro stopped paying its monthly

replenishment assessment fees 2012 but continued pumping groundwater from the West Coast Groundwater Basin.[204]

Discussion

The adjudication halted groundwater declines, but with only limited demand reduction over time and utilizing artificial imported water to make up the difference between pumping and actual demand. While this strategy worked for the past 65 years, the increased cost and unreliability of imported water for groundwater replenishment may pose future challenges for basin sustainability.

Additionally, the cost of the barrier system to battle seawater intrusion is rising and may require alternatives to be developed. It is an aging infrastructure that may be difficult to replace due to the coastal community development that has occurred around the barrier wells.

WRD is actively managing the basin and is currently exploring the significant expansion of local sources for basin replenishment and use, including stormwater and recycled water.

In 2013, groundwater extractions were less than adjudicated rights, but were still more than double the referee's recommended extraction limit. On average, extractions have been declining by 385 AFY since 1961. At that rate, the basin will reach safe/sustainable yield in 2053, or approximately 92 years after the final decision.[205]

Until additional local sources become available, a long-term drought could increase reliance on groundwater withdrawals. This could be problematic, as the basin already has significant accumulated overdraft.

WEST COAST BASIN - Coastal Plain of Los Angeles County Groundwater Basin

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Los Angeles Area: 93,795 acres; 160 sq. mi. Physical Characteristics: Southwestern part of the Los Angeles Coastal Plain. Confined coastal aquifer not well suited to artificial replenishment. Bounded on north and east by the Central Basin. *Precipitation:* Long-term mean 12.6" per year CASGEM: Medium Population: 2010: 1,295,195 Land Use: Urban: 20 cities and several unincorporated areas Reason for Adjudication: The basin was in major overdraft with increasing salt water intrusion.	Adjudication First Action initiated: 1945 Second Action Initiated: 1956 First Action finalized: 1961 with a Stipulated Judgment Second Action Finalized: 1966 *Appeal*: *1964 Amendments* 1977, 1989, 2013 1966 Decree Summary: Limits on allowable annual extraction of groundwater per water rights holder; authorizes imported water, exchange pool, transferrable water rights, new pumping enjoined, carryover of 10% of annual pumping rights for one year, overpumping of 10% to be replaced the following year, and emergency overpumping up to a total of 10,000AF under specified conditions 1989 Amendment: Establishes water rights of 64,478 AFY and enjoins excess extractions. 2013 Amendment: Parties are now allowed to store water in the basin.	Management Structure: DWR was initial Watermaster. Ministerial duties including collecting and reporting data. Lacked authority to develop, implement, or enforce sustainability measures. In 2015, Three units: (1) an administrative division (WRD), (2) water rights panel (7 water rights holders selected by election), and (3) a storage panel composed of WRD and the water rights panel) with authority to levy an assessment on all pumping within the district for purchasing replenishment water, and to fund groundwater quality programs. Each producer must submit a report to WRD summarizing production activities used to calculate the producer's replenishment assessment. The Los Angeles County Public Works Department operates the Barrier Project facilities. Other entities involved in managing the basin include the MWD, the Central Basin Water Association, and the Los Angeles County Sanitation Districts. Management Strategies - Replenishment District pump tax used to buy imported water, from MWD (2013–2014 total imported water was 172,953AF) - Salt water intrusion barriers, - Recycled water, - Desalination plant, - In-lieu replenishment, - Spreading by LACFCD, - Monitoring of production, - Conservation.	Safe Yield: In 1957 the native safe yield was ~36,000 AFY. Adjudication did not fix annual extractions equal to the estimated safe yield. Rather authorized pumping was nearly double that amount. During emergency conditions, WRD can allow an additional 10,000 AF of extractions for a four-month period. Adjudication extractions were set at 64,042 AFY in the 1961 Judgment, with replenishment water to make up difference. Extractions were adjusted to 64,648 AFY in 1966 when pumpers overlooked in the initial adjudication were made party to the original judgment. In 2013, groundwater extractions were less than the adjudicated rights, but were still more than double the referee's recommended extraction limit. Current average extractions are at ~ 52,000 AFY. Overdraft Conditions: Basin overdraft was 29,000 AFY in the early 1940s. By 1957, annual production of groundwater had reached levels as high as 94,100 AF, and total accumulated overdraft was estimated at 832,000AF, 50%–75% of which was replaced by saltwater. Groundwater Levels: After adjudication, water levels switched from a falling trend to a slight rising one with variation over the basin. By 2012, accumulated overdraft was approximately 650,600 AF. Water Quality: Overall good, with some marginal to poor local areas Discussion: **- The basin has been in overdraft since the 1940s.** **- Since adjudication in 1961, average extractions have been declining by 385 AFY. At that rate, the basin will reach safe/sustainable yield in 2053, or approximately 92 years after the final decision.** **- WRD is actively managing the basin including developing new local sources of supply, but there is a heavy reliance on imported water that may be less reliable and more expensive in the future.** **- A long-term drought could affect groundwater storage and could be problematic, as the basin already has significant accumulated overdraft.** **- There is a concentration of pumpers since adjudication. Eleven pumpers used 95 percent of the basin's groundwater in 1990.**

CENTRAL BASIN

The problems confronting the Central Basin were similar to those that faced the West Coast Basin. Groundwater users in the basin opted for a "physical solution," a negotiated settlement using their own consultants, to avoid prolonged litigation. Similar to the West Coast Basin, the judgment provided for a 20 percent reduction in extractions, but included imported water as a supplemental supply to meet growing water demands. While water levels were relatively stable from 1987–2007, the basin experienced plummeting levels during 2014–2015 due to the drought. The basin is employing multiple strategies to increase supply, and the current management structure is more diverse. A new Watermaster in 2014 consists of three separate divisions with different functions: (1) an Administrative Body (Water Replenishment District of Southern California, WRD), appointed by the court to administer accounting and reporting functions; (2) a Water Rights Panel that enforces issues related to the pumping rights within the adjudication, and (3) a Storage Panel that approves certain large-scale groundwater storage efforts. The Third Amended Judgment established the Regional Disadvantaged Communities Incentive Program (RDCIP) with a priority right of storage space for use or benefit of disadvantaged communities.

Overview

County	Coastal Plain of Los Angeles County
Area	~227 square miles
Population	Over 1,000,000 residents[206]
CASGEM	High
Watermaster	After adjudication: California Department of Water Resources (DWR). 2014: three separate divisions: (1) an administrative division (WRD), (2) water rights panel (7 water rights holders selected by election), and (3) a storage panel composed of WRD and the water rights panel).
Court Cases	*Central and West Basin Water Replenishment District v. Charles E. Adams et al.,* Los Angeles County Superior Court Case No. 786,656

CASGEM = California Statewide Groundwater Elevation Monitoring

The Basin occupies approximately 227 square miles within central Los Angeles County. The Elysian, Repetto, Merced, and Puente Hills bound it on the northeast and east. The southeast boundary with the Orange County Basin is along Coyote Creek, and the Newport Inglewood fault system separates the West Coast Basin and the Central Basin.[207] Precipitation averages 14 inches annually (although the 2014 precipitation was 5 inches).[208]

The Los Angeles and San Gabriel Rivers drain inland basins and pass across the surface of the Central Basin on their way to the Pacific Ocean. The Central Basin is connected hydrologically to: the West Coast Basin, separated by the Newport Inglewood Uplift;[209] the Main San Gabriel Basin in the north via Whittier Narrows; and the San Fernando Basin, receiving subsurface inflow from the San Fernando Basin via downward percolation from the Los Angeles River that historically recharged the Los Angeles Forebay. Layers of low permeability materials overlie the primary water-producing aquifers in much of the basin.

Today, largely impermeable surfaces (i.e., pavement and buildings) cover most of the Los Angeles Forebay areas, and to prevent a repeat of devastating floods of the early 1900s, the

Los Angeles River is channeled and lined with concrete. This prevents downward percolation by eliminating a recharge zone and a stream channel through which water might percolate underground. Recharge capacity is thus reduced and precipitation now has relatively little direct influence on groundwater replenishment in the basin. Natural replenishment is largely from surface flow and underflow through Whittier Narrows from the San Gabriel Valley, where the Rio Hondo and San Gabriel River spreading grounds in the Forebay provide the vast majority of surface recharge to the Central Basin aquifers.[210]

The basin presently encompasses twenty-three incorporated cities and several unincorporated communities. The major cities of Los Angeles and Long Beach (a dominant party in this adjudication), along with Artesia, Bellflower, Cerritos, Compton, Downey, Huntington Park, Lakewood, Montebello, Paramount, Pico Rivera, Norwalk, Santa Fe Springs, Signal Hill, South Gate, Vernon, and Whittier, overlie the basin.[211]

Reason for Adjudication

As early as 1870 water users tapped artesian wells and springs east of the Newport-Inglewood Uplift until they stopped flowing. With the development of the deep-well turbine pump, groundwater production increased dramatically, and by the 1930s production was approximately 265,420 AFY. By the 1950s, urbanization had increased and production grew to approximately 300,000 AFY, and by 1957 overdraft was estimated at 103,200 AF.[212]

In 1950, The Central Basin Water Users Association (CBWA) was formed with Carl Fosette as Executive Secretary. He was also the Executive Secretary of the West Basin Water Association. The CBWA's seventeen original members accounted for about half of the Central Basin's groundwater extractions. A 1952 State Water Resources Control Board (SWRCB) report that recommended a two-thirds reduction in groundwater extractions raised concerns in the basin. Additional issues were the time and costs of previous adjudications, and that the costs were being charged to the parties. This led to an attempt to avoid adjudication and instead secure additional supplies to reduce or stabilize overdraft. To do that, residents voted to annex to MWD, and they began to receive imported water. However, groundwater production continued to expand and basin water conditions did not improve.[213] In 1953, an artificial replenishment program was established, using more than 500,000 AF of imported water.

At this point the Central Basin joined with the West Coast Basin and secured voter approval for the formation of the Water Replenishment District of Southern California (WRD) to take over the artificial replenishment program.[214] The WRD boundaries cover 420 square miles of the Central and West Coast basins.[215] Replenishment reduced cumulative overdraft in the Central Basin from over 1,000,000 AF in 1960 to 600,000 AF in 1965.[216] But by the spring of 1962, seawater intrusion had proceeded more than three miles up Alamitos Gap and threatened to invade the basin's major aquifers. The majority of water production was by fewer than 20 pumpers out of about 750 well owners, mostly cities (the City of Long Beach was the largest pumper) and water companies who wanted a secure water supply.

In 1962, WRD filed a lawsuit to determine groundwater rights and regulate withdrawals from the Central Basin.[217] Defendants were cities, including the City of Long Beach and water service companies. Together they provided potable water services to businesses and residents in western Los Angeles County. Adverse groundwater conditions prompted the CBWA to draft an interim agreement curtailing extractions. The agreement was approved by producers

owning over 75 percent of the rights within the basin. The court signed the "Stipulation and Interim Agreement" and appointed the Department of Water Resources (DWR) as Watermaster. Attorneys representing the principal parties worked together to draft a stipulated judgment that was approved by public utility companies, cities, and other main producers; again, 75 percent of total rights in the basin. The case went to trial in 1965, and after testimony regarding engineering, geology, hydrology, and safe yield, the adjudication was completed at the end of 1965, effective October 1, 1966.[218]

Decree and Amendments

Date initiated: 1962
Date finalized: 1965[219]
Date of stipulated judgment: 1961
Date of amendments: 1991,[220] 2013[221]
Other significant dates: In 1949, 340 more parties were added, and in October 1956 a second suit was filed to bring an additional 76 pumpers under the court's jurisdiction. In 2012 WRD adopted a new policy regarding Replenishment Assessment Exemptions.[222]
Costs: Legal and engineering costs: $225,000; total estimated costs: $1–$2/AF of an adjudicated right, with 272,000 AF of water rights.[223]

Decree Summary

The judgment set out the annual pumping rights of each of the parties; appointed DWR as Watermaster; specified the duties, powers, and responsibilities of the Watermaster; designated a physical solution for the basin; provided for carryover of 10 percent of annual pumping rights for one year, or 35 percent carryover under the "drought carryover" provisions; and 10 percent overpumping to be paid back the following year, or prorated over the following five years under specified conditions. It provided for an exchange pool where each party with direct access to import water must make available extraction rights to other parties without such access,[224] but made no provision for storage and recapture of water stored by an individual party, and expressly provided that extraction rights in the basin were limited to those specified in the judgment.[225] There was no provision in the judgment to use additional recycled water each year to enable an increase in groundwater pumping.

In 1965, the adjudicated rights were set at 267,900 AFY, and the amount of the adjudicated water rights that could be pumped each year (Allowable Pumping Allocation, or APA) was limited to approximately 80 percent of the total adjudicated amount, or 217,367 AF. Transfers through sales or leases were allowed. Study findings determined that 330,000 AF of unused storage space existed in the Central Basin.[226]

1991: Second Amended Judgment

Normal year-to-year carryover was increased from 10 percent to 20 percent. The WRD was afforded the power to declare a water emergency. The judgment declared that a water emergency altered the portion of a pumper's allocation of water that the pumper could "carryover" to another year. It also permitted a longer period to replace a pumper's over-extraction of groundwater (i.e., an extraction of an amount greater than the pumper's annual allotment).[227]

2013: Third Amended Judgment

Specified water rights in the Central Basin, enjoined extractions in excess of specified quantities and provided for the storage and extraction of water. The background to this

amendment involved Southern California Water Company and the cities party to the 1965 adjudication proposing in 2003 that they had a right to the storage space of the Central Basin in proportion to their current withdrawals.[228] Storage space was ambiguous in the 1965 Central Basin adjudication. The court held that WRD controlled the storage space for use in the most reasonable, beneficial use for the public, as the defendants failed to prove that their possession of such storage space would be in the best public interest.[229] Following the 2003 decision, the court directed all parties to a mediation that ended unsuccessfully. In 2006, WRD and other parties attempted another mediation resulting in a 2009 Storage Motion for both Central and West Coast Basin agreed to by all the parties in that mediation. It modified the storage/management system of Central Basin proposed by WRD, allowed for choosing a new Watermaster, and other changes. The trial court declined the 2009 Motion. In 2012, the court ruled that the Central Basin and the West Coast Basin Groundwater Storage Amendment cases were related, and in 2013, both cases were assigned to Superior Court.

This resulted in the Third Amendment Judgment to the Central Basin adjudication. It allowed parties holding water rights to store water in the Central Basin for later recovery; DWR was replaced with a new Watermaster consisting of three separate arms with different functions: Administrative Body, Water Rights Panel, and a Storage Panel.[230] It continued to limit extractions by each party via the Allowed Pumping Allowance (APA), but as in the original judgment allowed for over-extractions in some cases with prior approval from the Water Rights Panel, so long as over-extractions were made up in the following year.[231] Allowed Pumping Allowances and stored water could be transferred between parties through sales and leases, and the Exchange Pool was maintained. A new mechanism to provide protection against lease market shortfalls was created to provide additional water rights to parties without sufficient water.[232] Dewatered space (controlled overdraft) was permitted so that parties could store artificial water, with MWD having priority of right to a significant portion of this storage space.[233]

Water Users

Stipulated users

Public utility companies, cities, and other main producers made up 75 percent of the total rights in the basin.

Current users

There are 68 active pumpers and 3 active non-parties.[234] As of 2003, 148 entities had the right to extract water from the Central Basin (collectively Pumpers or Water Rights Holders). These entities included cities, municipalities, water companies, school districts, individuals, family trusts, landowners, businesses, religious institutions, cemeteries, nurseries, country clubs, and golf courses.[235] As of 2014, there were 131 parties to the judgment.[236]

Excluded users

There was no mention of small pumpers or environmental uses in the original judgment. However, Section II.H of the Third Amended Judgment established the Regional Disadvantaged Community Incentive Program (RDCIP), with a priority right of up to 23,000 AF of storage space for use or benefit of disadvantaged communities, providing purpose and guidance for the program. The RDCIP is currently under development, and the region's stakeholders are to determine how it will be set up and implemented. The court is expected to approve it during 2014–2015.[237]

Management Structure

Management structure outlined in the decree

The DWR initially served as Watermaster, with responsibilities to monitor extractions and report significant water-related events in the basin to the court and to the parties to the judgment.[238]

In addition to the Watermaster, the WRD, established in 1959, had the statutory authority to replenish the groundwater basin and address water quality issues. Each year WRD made a determination of the amount of supplemental recharge that was needed based on an estimation of the ensuing year's groundwater production and an estimation of the annual change in storage based on groundwater levels collected throughout the basin.[239]

As Watermaster, DWR cooperated closely with WRD because the Watermaster service areas in the Central and West Coast Basins closely match the district boundaries. Additionally, both WRD and DWR were required to record all groundwater extractions from the basins, and these two entities coordinated data collection to prevent duplication.

Current management structure

In July 2014, DWR was replaced with a new Watermaster consisting of three separate divisions with different functions: (1) an Administrative Body (WRD) appointed by the court to administer accounting and reporting functions; (2) a Water Rights Panel that enforces issues related to the pumping rights within the adjudication, insures accurate measurement of all extractions, and makes all reports to the court. (The panel is made up of seven water rights holders who are selected through election. Current members are: City of Downey, Golden State Water Company, City of Lakewood, City of Long Beach, Montebello Land and Water Company, City of Signal Hill, and City of Paramount); and (3) a Storage Panel that consists of a Water Rights Panel and a WRD Board of Directors who approve certain large-scale groundwater storage efforts.[240]

Additionally, the Los Angeles County Department of Public Works (LACDPW) owns and operates the Montebello Forebay Spreading Grounds and the portion of the Alamitos Barrier Project located within Los Angeles County; the Orange County Water District operates the Orange County section.[241]

Overlapping management structures

Central Basin governance is connected with:

- The San Gabriel River watershed adjudication where the CBMWD acts as the representative of the Central Basin water users, shares the costs, and participates in choosing two of the three members of the San Gabriel River Watermaster;
- the MWD;
- the County of Public Works; and
- the Los Angeles County Sanitation Districts.

The CBMWD holds a significant share of seats on the MWD Board of Directors

Management Strategies

Water supplies available to the communities overlying the basin include groundwater extracted from the basin, imported surface water, and recycled water. The APA established in the Judgment is 217,367 AFY. However, natural recharge does not support this annual amount of pumping, and the APA exceeds the natural safe yield of the basin and is dependent upon artificial recharge of imported and reclaimed water.[242]

Imported Water: In 2012–2013, 117,983 AF was imported to the area overlying the Central Basin.[243]

Recycled Water: Active replenishment is accomplished by spreading at the Rio Hondo and the San Gabriel River spreading grounds in the Montebello Forebay. Replenishment sources include local storm runoff, and recycled water from three reclamation plants located upstream of the basin. During 2012–2013, 14,318 AF of recycled water were used primarily for irrigation in the area overlying the basin. This amount is 560 AF more than that used in 2011–2012. These amounts do not include the recycled water used to replenish groundwater in the basin.[244] The goal is to increase reliance on recycled water to use for indirect potable replenishment of the groundwater basin.

In-Lieu Recharge: In 1965, WRD and MWD began an in-lieu replenishment program. The WRD may contract with any producer having access to supplemental water that could be used in lieu of extracting groundwater from the basin. Water is used to (1) alter pumping patterns within the basin, (2) replenish the groundwater in areas where conventional recharge techniques are ineffective, (3) heighten the effect of injecting water to form a seawater barrier by reducing extractions, (4) reduce the amount of replenishment water purchased by the WRD, and (5) reduce the annual extractions from the basin.

Seawater Intrusion Barrier: In 1991, levels remained below sea level, leaving the groundwater supply vulnerable to further saltwater encroachment up the Alamitos Gap.[245] The Alamitos Seawater Intrusion Barrier Project is designed to prevent seawater intrusion in to the freshwater aquifers of the basin. The LACDPW operates the barrier project, which is comprised of four extraction wells that can be used to create a groundwater trough, and 43 injection wells that create a groundwater ridge to halt seawater intrusion. The sources of the barrier injection water purchased by WRD and used by LACDPW are partially imported water and advanced treated recycled water. In addition, the project includes 220 observation wells that are used to monitor groundwater levels and quality in the area. The seawater intrusion problem was contained by the barrier project.[246]

Monitoring and Reporting

The Water Rights Panel requires an operative water meter to be installed at each extraction well. It is the responsibility of each party to ensure that its meter and test facilities are installed properly and maintained in good working condition. These meters are tested by DWR under contract with the Water Rights Panel with a goal to test the water meter at each active extraction well at least once every two years. The volume of water extracted from larger producing wells is reported monthly, and Watermaster calculates the monthly water production for each well using the meter readings and Unit of Measure Code reported for the well that month. During 2013–2014, the Department of Water Resources, under contract with the Water Rights Panel, visited 67 parties, tested 286 meters, and performed 49 well

investigations. There are 333 reported active extraction wells and 168 reported inactive extraction wells.[247] The volume of water extracted from most wells is reported monthly.[248]

Safe Yield

The judgment avoided a statement of the basin's safe yield (similar to the West Coast Basin Judgment). The DWR estimated the safe yield in 1957 as 137,300 AFY.[249] However, reducing pumping to that amount would have required a 50 percent cut, rather than the 20 percent cut that parties had negotiated. Water users chose instead to attempt to restore a balance to the basin by relying on a combination of a 20 percent reduction in groundwater extractions, a guaranteed minimum inflow from the Upper Area, and the artificial replenishment program.[250]

In 2007, the natural safe yield was defined as "the maximum quantity of ground water, not in excess of the long term average annual quantity of natural replenishment, which may be extracted annually from Central Basin without eventual depletion thereof or without otherwise causing eventual permanent damage to Central Basin as a source of ground water for beneficial use, said maximum quantity being determined without reference to Artificial Replenishment." At that time, the natural safe yield of the Central Basin was approximately 125,805 AFY,[251] which represented the amount of water from native waters alone. The managed physical solution safe yield of the Central Basin was defined as equal to the allowable pumping allocation (APA) amount of 217,367 AFY, which is substantially higher than the natural safe yield. This higher yield was considered possible because of the artificial recharge maintained by WRD.[252] Table 11 shows the total extractions:

Table 11: Central Basin Total Extractions, by Year

1962	1965	1990	2014
248,800 AF	211,600 AF	194,403 AF	200,120 AF[253]

Extractions were reduced after the adjudication and were significantly more than the natural safe yield (NSY) with artificial water used to make up the balance.

Groundwater Pumping and Overdraft

Historically, groundwater flow in the Central Basin was from the recharge areas in the northeast toward the Pacific Ocean on the southwest. Pumping patterns have lowered the water level in large portions of the Central Basin. Historical water levels in key wells in various locations in the basin suggest that the water levels were relatively stable from 1987–2007. In 2005, Central Basin water levels ranged from a high of about 160 feet above mean sea level (MSL) in the northeast portion of the basin up gradient of the spreading grounds to a low of about 90 feet below MSL in the Long Beach area.[254]

Groundwater levels decreased over most of the Central Basin during Water Year 2013–2014. Water levels decreased up to 15 feet, and on average about 11 feet in the unconfined Montebello Forebay. They decreased on average about 6 feet across the unconfined Los Angeles Forebay. Groundwater levels in the Central Basin Pressure Area decreased up to 20 feet, with an average decrease of 9 feet. The average decrease in the Whittier Area was around 7 feet.[255]

Water Quality

The most prevalent water quality issue in the Central Basin is manganese, a naturally occurring element that at elevated concentrations may impact the aesthetics of groundwater and can require treatment prior to delivery as drinking water. Elevated, naturally occurring arsenic impacts a number of Central Basin wells, especially along the coast. Trichloroethylene and tetrachloroethylene that can leak into groundwater from industrial and commercial facilities have also affected wells in the area and those are closely monitored. Emerging contaminants of concern, including hexavalent chromium, arsenic, and perchlorate, have relatively new drinking water standards and WRD has performed baseline screening and analysis of these to assess the potential threat to CBWCB groundwater.[256]

Drought Impacts

During emergency or drought conditions, WRD can allow, under certain conditions, an additional 27,000 AF of extractions for a four-month period (17,000 AF for Central Basin and 10,000 AF for West Coast Basin). The Central Basin Judgment also contains an additional drought carryover provision available to all Central Basin water rights holders after a declaration of a water emergency by the WRD Board of Directors. The drought carryover allows water rights holders to leave water in the ground by allowing carryover of an additional 35 percent of their APA (or 35 AF, whichever is larger) beyond the annual carryover described above during the period the Declared Water Emergency is in effect. The action seeks to (1) prevent further degradation of the groundwater basins by helping to restore groundwater levels, and (2) improve the water supply in the aquifers by providing an incentive to groundwater producers in the Central Basin, to reduce pumping for a particular period of time.

A Declared Water Emergency is defined in the Central Basin Judgment as: "A period commencing with the adoption of a resolution of the Board of Directors of the Central and West Basin Water Replenishment District [renamed Water Replenishment District of Southern California] declaring that conditions within the Central Basin relating to natural and imported supplies of water are such that, without implementation of the water emergency provisions of this judgment, the water resources of the Central Basin risk degradation. In making such declaration, the Board of Directors shall consider any information and requests provided by water producers, purveyors and other affected entities and may, for that purpose, hold a public hearing in advance of such declaration. A Declared Water Emergency shall extend for one (1) year following such resolution, unless sooner ended by similar resolution."[257]

In 2014, Ted Johnson, chief hydrogeologist for the Water Replenishment District, noted that groundwater levels were plummeting in the Central Basin. At one test well in Pico Rivera, the water level had dropped to 102 feet, 17 feet lower than recorded just half a year ago. Similar drops have been recorded across the basin, and Mr. Johnson noted that "One more foot, and it will be at the lowest level in 57 years."[258] Early in 2015 import water was finally made available for spreading and was purchased by WRD to help alleviate the situation.

Disputes

In 2013, CBMWD refiled the motion for an order declaring that extraction of non-native imported water does not diminish a party's APA under the judgment.

Discussion

Managed safe yield is substantially higher than natural safe yield due to the use of artificial water, a substantial portion of which is imported water. The reliance on imported water may be problematic in the future as imported water becomes more expensive and less reliable.

Until additional local sources of water become available, a long-term drought could increase reliance on groundwater withdrawals. This could be problematic, as the basin already has significant accumulated overdraft.

Pumping patterns historically lowered the water level in large portions of the Central Basin, but the water levels in key wells in various locations in the basin suggest that the water levels were relatively stable from 1987–2007. In 2005, Central Basin water levels ranged from a high of about 160 feet above MSL in the northeast portion of the basin up-gradient of the spreading grounds to a low of about 90 feet below MSL in the Long Beach area.

However, groundwater levels decreased significantly over most of the Central Basin during 2013–2014 when imported water was unavailable for replenishment. The WRD has purchased property and completed design to construct an advanced recycled water treatment plant that is planned to replace the need for imported water for spreading and adequate replenishment.

The Third Amended Judgment established the Regional Disadvantaged Communities Incentive Program, with a priority right of up to 23,000 AF of storage space for use or benefit of disadvantaged communities, and it provided guidance for the program. The program is not yet operable.

A new Watermaster established by the court in 2014 consists of three separate arms with different functions: (1) an Administrative Body (WRD) appointed by the court to administer accounting and reporting functions; (2) a Water Rights Panel that enforces issues related to the pumping rights within the adjudication, and (3) a Storage Panel that approves certain large-scale groundwater storage efforts.

CENTRAL BASIN

Overview	Decree: Water Rights and Conditions	Management	Trends
County: Coastal Plain of Los Angeles County Area: 227 sq. mi. Physical Characteristics: The Central Basin is connected hydrologically to: the West Coast Basin and the Main San Gabriel Basin, and receives subsurface inflow from the San Fernando Basin. Layers of low-permeability materials overlie the primary water-producing aquifers in much of the basin. Today, largely impermeable surfaces cover most of the Los Angeles Forebay areas, and the Los Angeles River is channeled and lined with concrete preventing downward percolation. *Precipitation:* 14" per year CASGEM: High Population: Over 1,000,000 residents Land Use: Municipal Reason for Adjudication: As groundwater production increased, overdraft resulted in seawater intrusion that threatened to invade the basin's aquifers. In 1962, the Water Replenishment District of Southern California (WRD) filed a lawsuit to determine groundwater rights and regulate basin withdrawals. Defendants were cities, including the City of Long Beach, and water service companies.	Adjudication Initiated: 1962 Finalized: 1965 Decree Summary: It set out annual pumping rights of each party; appointed DWR as Watermaster; designated the safe yield of the basin; provided for carryover of 20% of annual pumping rights for one year, or 35% carryover under "drought carryover" provisions; and designated that 20% overpumping be paid back the following year, or prorated over the next five years under specified conditions. It provided for an exchange pool, and transfers were allowed. No initial provision was made for storage and recapture of stored water beyond the specified extraction right. Amendments: 1991: Gave WRD the power to declare a water emergency and alter the carryover portion of a pumper's allocation. 2013: Provided for storage and recapture of water.	Watermaster: The judgment established DWR as Watermaster. In 2014, a new Watermaster consisted of: (1) an Administrative Body (WRD, appointed by the court); (2) a Water Rights Panel (to enforce issues related to pumping rights); and (3) a Storage Panel (consisting of a Water Rights Panel and WRD Board who approve certain groundwater storage efforts). Strategies: Imported & Recycled Water; In-Lieu Recharge; Seawater Intrusion Barrier; Metering	Pre-adjudicated Safe Yield (AFY): 1957 as 137,300 AFY Current Safe Yield (AFY): Native safe yield (NSY): 125,805 AFY Managed safe yield (MSY): 217,367 AFY (2007) Safe Yield Summary: NSY represented the amount of water from native waters alone. MSY was defined as equal to the allowable pumping allocation, which is substantially higher than NSY. This higher yield was considered possible because of the artificial recharge maintained by WRD. Extractions: 1962: 248,800 AFY; 1990: 194,403 AFY; 2014: 200,120 AFY Extraction Summary: Extractions were reduced after the adjudication and were close to the MSY but significantly more than the NSY, with artificial water used to make up the balance. Overdraft: The court defined "overdraft" flexibly to allow for extractions exceeding safe yield plus a temporary surplus. Groundwater Levels: Pumping patterns lowered the water levels in large portions of the Central Basin. After adjudication, water levels were relatively stable from 1987–2007 in some areas. During the drought for Water Year 2013–2014, groundwater levels decreased over most of the Central Basin, up to 15 feet and on average about 11 feet in the unconfined Montebello Forebay, and on average about 6 feet across the unconfined Los Angeles Forebay. Groundwater levels in the Central Basin Pressure Area decreased up to 20 feet, with an average decrease of 9 feet. The average decrease in the Whittier Area was around 7 feet. The basin experienced plummeting levels during 2014–2015 drought year. Water Quality: The basin experiences some water quality issues, both natural and industrial. Discussion: **- The managed safe yield is substantially higher than natural safe yield due to the use of artificial water, a substantial portion of which is imported water. This may be problematic as imported water becomes less reliable and more expensive. Until additional local sources of water become available, a long-term drought could increase reliance on groundwater withdrawals. This could be problematic, as the basin already has significant accumulated overdraft.** **- In 2014–2015, groundwater levels were plummeting due to the drought** **- Management strategies to increase supplies are comprehensive, and the new management structure should allow for more representative and comprehensive management.** **- The Third Amended Judgment established the Regional Disadvantaged Communities Incentive Program (RDCIP), with a priority right of storage space for use or benefit of disadvantaged communities. The program is not yet operable.**

UPPER LOS ANGELES RIVER AREA (ULARA)

This judgment set several legal precedents. First, it allowed the use of underground reservoirs for storage and later recapture of imported water by the party that imported and stored the water. Second, it modified the Doctrine of Mutual Prescription, changing the legal framework for subsequent adjudications. Third, it held that public agencies and utilities could not lose their groundwater rights by prescription. Fourth, Los Angeles's pueblo water right to all native groundwater in the San Fernando Basin derived from precipitation within the Upper Los Angeles River Area (ULARA) was upheld, and this right had priority over overlying owner rights. The court also defined safe yield to include temporary surplus—an amount extracted to create storage space for recapture in wet years. This justified increased withdrawals to allow for extensive use of the groundwater basins as storage facilities. The cities of Burbank, Glendale, and Los Angeles had the right to reduce their pumping and to store or "carry over" any unused water rights into future years, accounted for as "stored water credits". The current accumulation of a large quantity of these credits without an insufficient volume of "real" groundwater in storage to access these credits is problematic for the San Fernando Basin. An interesting note is that 214 parties were awarded water rights in the judgment but only 24 remain as active pumpers. Four sites in the San Fernando Subarea are designated as EPA Superfund sites.

Overview

County	Los Angeles
Area	328,500 acres (This number includes the watershed, tributaries of the Los Angeles River, and four groundwater basins [122,800 acres].)[259]
Population	San Fernando Valley: 1,745,338 (2010)[260]
CASGEM	Medium
Watermaster	Prior to 1979: DWR; 1980: Court-appointed Watermaster and an Administrative Committee
Members	The Administrative Committee consists of one voting member from five water agencies: Los Angeles, Glendale, Burbank, San Fernando, and the Crescenta Valley Water District.
Court Cases	*City of Los Angeles, Plaintiff, v. Cities of San Fernando et al., Defendants,* dated January 26, 1979 (San Fernando Judgment)

CASGEM = California Statewide Groundwater Elevation Monitoring

The ULARA encompasses the entire watershed of the Los Angeles River and its tributaries above a point in the river designated as Los Angeles County Department of Public Works (LACDPW) Gaging Station F-57C-R. The ULARA is bounded northwest by the Santa Susana Mountains; northeast by the San Gabriel Mountains; east by the San Rafael Hills; and south by the Santa Monica Mountains. The ULARA encompasses a total of 328,500 acres of hill and mountain areas and intervening valley-fill areas. Of this total watershed area, there are 122,800 acres of valley-fill areas, and the judgment defined four distinct groundwater basins within these valley-fill areas: the San Fernando, Eagle Rock, Sylmar, and Verdugo basins. "Each has physiographic, geologic and hydrologic differences…and extractions of water in the respective basins affect the other water users within that basin but do not significantly or materially affect the ground water levels in any of the other basins."[261]

The basins are replenished by deep percolation from direct rainfall, infiltration of surface water runoff, and infiltration of a portion of the water that is delivered for use within these basins. Artificial recharge also occurs in the San Fernando Basin via the use of spreading basins when excess rainfall and runoff are available. Average Precipitation is 18.6 inches per year (1985–1986 to 2004–2005 water years).[262] The total storage capacity for ULARA is 3.67 million AF. San Fernando, the largest, is 3.2 million AF;[263] Sylmar, north of San Fernando, is 310,000 AF; Verdugo, to the east, is 160,000 AF; and Eagle Rock, southeast, is insignificant.

Reason for Adjudication

In the early 1900s, the cities of Glendale, Burbank, and San Fernando were incorporated. During this period, the City of Los Angeles annexed the area and its municipal water system. Several flood control dams with a reservoir and spreading grounds supplemented the Los Angeles Department of Water and Power's (LADWP's) own spreading grounds,[264] and 150,000 AF were spread through the early 1930s.[265] To accommodate growth however, Burbank and Glendale increased their pumping, and in 1931 the rising water flows of the Los Angeles River stopped. Between 1933 –1936, Los Angeles sued Burbank and Glendale over water rights, and the cases were consolidated and appealed to the California Supreme Court. The court held in favor of Los Angeles on several issues, but did not issue an injunction to Glendale and Burbank. Subsequently, groundwater extractions in the San Fernando Valley increased from approximately 90,000 AFY to approximately 140,000 AFY, and Los Angeles continued to import over 300,000 AF of water annually. During the next dry period groundwater storage in the ULARA fell 300,000 AF from 1944–1950 levels.

In 1955, Los Angeles sued the cities of San Fernando, Glendale, Burbank and other pumpers, asserting a prior right to the San Fernando Valley groundwater basins in the northern part of the City of Los Angeles, including imported Owens Valley water stored there.[266] The court ordered a series of reports documenting the fall in water levels from the 1920s to the1950s. Pre-trial conferences were held, and a 1962 State Water Rights Board Referee Report served as the principal basis for hydrogeologic facts for the 1968 Trial Court Judgment, the 1975 California Supreme Court Decision, and the 1979 Final Judgment.[267] Principal contested issues were: Los Angeles's pueblo water right;[268] rights to return flows of imported waters; independence or interdependence of the subareas; the time an overdraft began, and thus whether a prescriptive period had run.[269] The Trial Court first ruled against the City of Los Angeles. The Appeals Court reversed that decision. The California Supreme Court agreed with the Appeals Court and remanded it back to Trial Court. On remand, the Trial Court Judgment mostly upheld the determination of water rights consistent with the opinion of the California Supreme Court.[270]

Decree and Amendments

Adjudication initiated: 1955
Adjudication finalized: Trial Court: 1968; [271] California Court of Appeal: 1972; California Supreme Court: 1975;[272] Final Judgment: 1979[273]
Stipulated judgments: 1958–1965 merged into the 1979 judgment[274]
Other dates: 2006 new Stipulation Agreement reevaluated safe yield; 2007: 10-year Interim Agreement for the Preservation of the San Fernando Basin Water Supply [275]
Costs: The referee's initial cost was $493,264.

Decree Summary

The court expressly recognized stored water (both imported or reclaimed water that is intentionally spread or safe yield water that is stored in-lieu), and it provided for separate accounting and recapture subject to specific requirements. An important precedent was that an entity could store imported water underground and recapture it when needed. So, the City of Los Angeles had a right to all groundwater in the San Fernando Basin derived from "return water" imported by the City from outside the ULARA and either spread or delivered within this groundwater basin.

The judgment defined San Fernando (SFB), Sylmar, Verdugo, and Eagle Rock as separate basins. Each had specific: safe yield determinations; rights to surface water, groundwater, and stored water; and separate accounting and recapture requirements. The court also adopted a definition of "overdraft" as " a condition that exists when the total annual extractions of ground water from a basin exceed its safe yield, and when any temporary surplus has been removed." Temporary surplus was the amount that, when withdrawn, could create storage space for recapture in wet years, but without adverse effects on the basin's long-term supply.[276] This permitted extractions over the "safe yield," to provide storage for artificial water.

The court modified the Mutual Prescription Doctrine established in the Raymond Basin, holding that public agencies and utilities could not lose their groundwater rights by prescription. The court relied on Civil Code section 1007, stating that between 1935 and 1968, this section stated that "no possession by any person, firm, or corporation no matter how long continued of any land, water, water right, easement, or other property whatsoever dedicated to or owned by any…city…shall ever ripen into any title, interest or right against such…city…." In the San Fernando Basin, the court upheld Los Angeles's pueblo water right to all native groundwater in the basin derived from precipitation within ULARA, evaluated to be 43,660 AFY. This right extended to all surface water runoff and groundwater underflow from the Sylmar and Verdugo basins, but did not extend to groundwater within the Sylmar and Verdugo basins,[277] and the pueblo right had priority over overlying owner rights. In the Sylmar Basin, overlying rights were established for two defendants, and appropriative rights were established for San Fernando and Los Angeles to native water in excess of the needs of overlying users. The court stated that the Sylmar Basin was not in overdraft, therefore no prescriptive rights existed in the basin against any overlying or appropriative water user. In the Verdugo Basin, Glendale and Crescenta Valley were declared to have prescriptive rights against each other and against all private overlying or appropriative parties in the basin to extract with equal priority specific quantities of water from the combined safe yield of native and imported waters.[278]

In the San Fernando Basin, the court stated that Los Angeles, Glendale, Burbank, and San Fernando caused imported water to be delivered to lands overlying the San Fernando Basin, and as this water became a part of the safe yield of the San Fernando Basin, each of these parties could extract that portion of the safe yield of the basin attributable to the import return waters. Glendale and Burbank were given rights to groundwater in the basin derived from "return water" that they imported from outside ULARA.[279] The cities of Burbank, Glendale, and Los Angeles had the right to reduce their pumping and to store, or "carry over," any unused water rights into future years. These "unpumped" water rights were accounted for as stored water credits. The judgment provided for a Watermaster appointed by the court (not LA), and an administrative committee.[280]

Stipulation Agreement (2007)

The cities of Burbank, Glendale, and Los Angeles entered into a 10-year Stipulated Agreement to address the long-term decline in stored groundwater in the San Fernando Basin. This 10-year interim agreement restricted the pumping of stored water credits, helped account for basin losses, and provided for the support of Los Angeles for enhancing the recharge of native water within this basin. It also provided for a reevaluation of the safe yield of the San Fernando Basin, but that project was never completed.[281]

Water Users

Stipulated users

Of 214 parties, water rights were awarded to 28 of these parties (others having disclaimed, defaulted, or stipulated previously). Of these, only 24 remained active pumpers.[282]

Current users

In 1992, there remained only 18 active pumpers and no actively pumping nonparties. In 2011–2012, there were 36 active pumpers that included both parties to the judgment and non-parties.

Excluded users

"Non-consumptive and Minimal Consumptive Use Parties" were enjoined from extracting water from San Fernando Basin with specified exceptions.[283] There was no mention of environmental uses.

Management Structure

The ULARA Watermaster is "...to assist the Court in the Judgment's administration and enforcement," and is given authority to require pumping meters, collect groundwater data, inspect measuring devices, and cooperate with other agencies. An Administrative Committee, with representatives from the five public agencies overlying ULARA, is to "...advise, request or consent to, and review actions of the Watermaster, and specify powers and duties of the Watermaster."[284]

Table 12: Summary of Management Agencies in the ULARA Basins

Agency	Role
ULARA Watermaster	Overall management authority under the Los Angeles Superior Court
City of Burbank	MWD member agency, water retailer, and ULARA administrative committee
City of Glendale	MWD member agency, water retailer, and ULARA administrative committee
City of Los Angeles	MWD member agency, water retailer, and ULARA administrative committee. Owns Tujunga Spreading Grounds.
City of San Fernando	MWD member agency, water retailer, and ULARA administrative committee
Crescenta Valley Water District (CVWD)	Water retailer and ULARA administrative committee
Los Angeles County Public Works (LACDPW)	Owns and operates spreading facilities

Management Strategies

Imported and Recycled Water: The basin relies heavily on imported water. The continued growth of residential, commercial, and industrial developments has required that more water be imported to supplement the local groundwater supplies in ULARA over time. Thus, for the 14 years prior to pumping restrictions (1954–1955 to 1967–1968), imported water volumes exceeded annual groundwater extractions by 50,000 to 90,000 AFY. In contrast, annual imported water volumes exceeded extractions by 110,000 to 250,000 AFY in the past 43 years (1968–1969 to 2011–2012). Table 13 shows a summary of net groundwater, net imports, and recycled water used in the ULARA in the 2010–2011 and 2011–2012 water years.

Table 13: Summary of Net Groundwater, Net Imports, and Recycled Water Used

Net Groundwater Used in ULARA	35,880 AF (2010–2011)	35,279 AF (2011–2012)
Net Imports Used in ULARA (AF)	253,052 AF (2010–2011)	273,523 AF (2011–2012)
Recycled Water Used (AF)	13,023 AF (2010–2011)	15,055 AF (2011–2012)

Spreading: A total of 14,948 AF of water was spread in ULARA in Water Year 2011–2012. The average annual spreading of native water during the period 1968 through 2012 was 32,848 AF.

Storage: There are no formal groundwater storage programs in the ULARA Basins. In late 2007, Glendale, Burbank, and Los Angeles entered into a 10-year agreement to help reverse the long-term decline in stored groundwater and concurrent accumulation of numerous unsupported stored water credits in the San Fernando Basin. Provisions of this agreement included: restrictions on pumping of stored water credits; rehabilitation of existing facilities and/or construction of new facilities to help increase recharge of stormwater runoff, and working to reduce losses to the basin due to rising groundwater and outflow out from ULARA.

Monitoring and Reporting

The judgment required that all production wells be equipped with a meter, and a party was required to check the production from all water wells operated by or for a party. The metering device was required to be tested for accuracy at least once within each three- to five-year period and the results filed with the Watermaster.[285]

Safe Yield

Safe yield in the judgment is distinguished from native safe yield, and defined as, “the maximum quantity of water which can be extracted annually from a ground water basin under a given set of cultural conditions and extraction patterns, based on the long-term supply, without causing a continuing reduction of water in storage.” The judgment distinguished between native safe yield (the portion of safe yield from native waters) and safe yield (which includes return flows from imported water), and divided annual extraction rights based on native and imported water origins.

As shown in Table 14, the Trial Court had restricted all groundwater extractions to a *total* maximum safe yield value of approximately 104,040 AFY for the four ULARA groundwater basins. This value amounted to a reduction of approximately 50,000 AF from the average

groundwater extractions by all parties for the six years prior to 1968. The State Supreme Court further restricted groundwater extractions.

Table 14: Safe Yield (1964–1965)

Native Safe Yield	San Fernando: 43,660 AFY; Sylmar: 3,850 AFY; Verdugo: 3,590 AFY; Eagle Rock: Negligible
Native + Imported	San Fernando: 90,680 AFY; Sylmar: 6,210 AFY; Verdugo: 7,150 AFY

As shown in Table 15, during the 2011–2012 Water Year, a total of 79,313 AF of groundwater was pumped from the four ULARA groundwater basins. It is noteworthy that while current extractions remain at or below the basin's safe yield (natural safe yield plus import return credits), they remain 45 percent higher than the basin's natural safe yield.

Table 15: Safe Yield/Extraction Rights and Extractions (2011–2012) [286]

Native Safe Yield	San Fernando: 43,660 AFY; Sylmar: 7,140 AFY; Verdugo:7,150 AFY	Total = 59,950 AFY
Native + Imported	San Fernando: 93,658 AFY; Sylmar: 7,140 AFY; Verdugo:7,150 AFY	Total = 107,938 AFY
Extractions	San Fernando: 69,768 AF; Sylmar: 4,295; Verdugo: 5,082; Eagle Rock: 169	Total = 79,314 AFY

In the Sylmar Basin the native safe yield is reevaluated every five years: 1962 native safe yield = 6,210 AFY; 2012 native safe yield = 7,140 AFY.

Groundwater Pumping and Overdraft

The court defined "overdraft" flexibly as "a condition which exists when the total annual extractions of ground water from a basin exceed its safe yield, and when any temporary surplus has been removed."[287] Temporary surplus was the amount that, when withdrawn, could create storage space for recapture in wet years, but without adverse effects on the basin's long-term supply. It thus permitted extractions exceeding safe yield to allow for extensive use of the groundwater basins as storage facilities.[288] In 2004–2015, however, despite heavy rains, the storage in the San Fernando Basin was approximately 113,000 AF below the lowest level of a defined regulatory storage requirement. However, this was considered to be a positive development, allowing for additional storage capacity to be available. In 2004–2005, ~ 504,475 AF (the decline in storage since 1928) was estimated to be available as additional storage capacity.[289]

Groundwater levels continue to trend down in some areas, increasing the need for recharge into the local groundwater basins by different methods, at different locations and depths, and by using different sources of water. This need for increased recharge is particularly important for the San Fernando Basin.[290] Regarding overall trends in groundwater levels and storage, the San Fernando Basin experienced a long-term decline in groundwater levels since 1944; essentially caused by more water leaving the basin than was recharged on a long-term average annual basis. A small declining trend is still present.[291]

The issue of stored water credits significantly affects overdraft in the basin. The judgment does not limit either the amount of stored water credits that a party can accumulate or the time period over which those stored water credits are allowed to accumulate in the San

Fernando Basin, and the basin cannot supply the total amounts of groundwater to which the parties are entitled under the judgment. As of October 1, 2012, a total of 570,031 AF of stored water credits were stored in the San Fernando Basin. If full water rights were pumped beginning in 1968, the San Fernando Basin (as of October 1, 2012) would be 364,234 AF below the 1968 level at which the court imposed safe yield operation, and this would return the basin to a condition of overdraft. In September 2007, a 10-year Interim Agreement for the Preservation of the San Fernando Basin Water Supply was to begin to address the imbalance between the decline in stored groundwater and the large accumulation of stored water credits.

In the Sylmar Basin, groundwater levels decreased and storage capacity was estimated to have increased by 1,941 AF between Water Year 2010–2011 and 2011–2012.

In the Verdugo Basin, groundwater levels decreased and storage capacity was estimated to have increased by 1,998 AF between Water Year 2010–2011 and 2011–2012. The overall decline in groundwater levels observed in Verdugo Basin since 1968 is likely caused by: increased urbanization and a resulting increase in runoff leaving the basin; and a significant reduction in annual groundwater recharge from the deep percolation of fluids from former cesspools and septic systems that were removed from service following the installation of sewers beginning in the mid-1980s.

In the Eagle Rock Basin, groundwater levels increased a little, and the volume of groundwater in storage was estimated to have decreased by 81 AF from Water Year 2010–2011 to 2011–2012.[292]

Water Quality

Shortly after the 1979 judgment, large areas were found to be contaminated by volatile organic chemicals, including areas most heavily pumped in the past. Four sites in the San Fernando subarea are designated as EPA Superfund sites.[293] Groundwater contamination from volatile organic compounds (VOCs), hexavalent chromium, and other contaminants continue to be a serious problem for water supply in the eastern portion San Fernando Basin. Burbank, Glendale, and Los Angeles continue to enlist the assistance of key regulatory agencies to expedite cleanup.[294] A system to contain and remove VOC contamination failed to fully contain the plumes, and newly emerging constituents were detected, including hexavalent chromium and 1,4-dioxane.[295] A number of the municipal-supply water wells had to be removed from active service due to excessive concentrations of contaminants. Strategies continue to address this contamination.[296]

Disputes

Controversy exists between the ULARA Watermaster and Glendale over Glendale dumping contaminated water into the Los Angeles River. In 2000, the EPA ruled that Glendale must take contaminated water out of the ground and treat it, but allowed the city to continue discharging the water into the river without any fines for a period of time.[297] The EPA began to address remediation in 2000, and currently their extraction and treatment systems are operationally functional and provide clean drinking water to the City of Glendale.[298]

Discussion

This adjudication process was long—more than 20 years.

Basin recharge is not keeping up with the pumping rights defined in the 1979-dated judgment. One cited explanation is that regulations required basin storage to be between 150,000 and 210,000 AF, to help prevent excess rising groundwater from leaving the basin, and to provide additional storage space for groundwater in wet years. However, with only a few brief exceptions, the San Fernando Basin rarely operated within the regulatory storage range after 1968.[299]

Stored water credits are a significant issue. The cities of Burbank, Glendale, and Los Angeles were given the right to reduce their pumping and to store or "carry over" unused water rights as stored water credits into future years with no limits on the amount of credits or the time period permitted for their accumulation. The result is an insufficient volume of "real" groundwater in storage in the basin to supply the total groundwater to which parties are entitled should they decide to withdraw their stored credits. This could affect long-term sustainability of the basin. In 2007, the parties entered into a 10-year, "Interim Agreement for the Preservation of the San Fernando Basin Water Supply" to begin to develop solutions to this issue. The Agreement concluded that: stored credits may not be pumped until the Basin has recovered sufficiently to allow their use; artificial recharge will be enhanced; and the basin will make an attempt to bring water rights into balance with basin hydrology.

The court defined safe yield to include temporary surplus, an amount extracted to create storage space for recapture in wet years without adverse effects on the basin's long-term supply. This permitted more withdrawals to create increased storage space, and to allow for extensive use of the groundwater basins as storage facilities. This was predicated on the continued availability of artificial water—and particularly imported water—but imported water may be less reliable and more expensive in the future.

New and/or ongoing contamination of groundwater in San Fernando, Verdugo, and Sylmar basins remains a problem.

Groundwater levels continue to trend down in some areas, increasing the need to increase recharge into the local groundwater basins by different methods, at different locations and depths, and by using different sources of water. This need for increased recharge is particularly important for the San Fernando Basin.

This case set several major legal precedents: (1) it allowed the use of underground reservoirs for storage and later recapture of imported water by the party that imported and stored the water, (2) it modified the Doctrine of Mutual Prescription changing the legal framework for subsequent adjudications. (3) public agencies and utilities could not lose their groundwater rights by prescription, effectively ruling out future "mutual prescription" settlements or judgments involving rights held by public entities, (4) it upheld Los Angeles's pueblo water right to all native groundwater in the San Fernando Basin derived from precipitation within ULARA; all surface water runoff and groundwater underflow from Sylmar and Verdugo basins were part of Los Angeles's pueblo water right; and pueblo rights had priority over overlying owner rights. While legal scholars subsequently questioned Los Angeles's pueblo right, this holding was not challenged.

UPPER LOS ANGELES RIVER AREA (ULARA)

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Los Angeles Area: 328,500 acres Physical Characteristics Four groundwater basins: San Fernando, Sylmar, Verdugo, and Eagle Rock *Precipitation:* 18.6" per year (1985/86–2004/05 Water Years) CASGEM: Medium Population: San Fernando Valley: 1,745,338 (2010) Land Use: Municipal Reason for Adjudication: Groundwater levels dropped as much as 300,000 AF from 1944–1950 levels. In 1955, LA sued the cities of San Fernando, Glendale, Burbank and other pumpers, asserting a prior right to the San Fernando Valley groundwater basins in the northern part of LA and a pueblo right to all the water in the LA River.	Adjudication Initiated: 1955 Finalized: 1968: Trial Court 1972: CA Appeals Court 1975: CA Supreme Court 1979: Final Judgment – Trial Court on Remand Decree Summary: The judgment set out a separate safe yield and overdraft conditions for each basin, along with the rights of parties to surface and groundwater. - LA, Glendale, Burbank, and San Fernando were given rights to a percentage of water from ULARA. - LA had a pueblo water right to native safe yield of ULARA, plus a percent of imported water. - Expressly recognized stored water, imported or reclaimed water that is intentionally spread, or safe yield water that is stored in-lieu, and that an entity can store imported water and recapture it when needed. - Burbank, Glendale, and LA had the right to reduce their pumping and to store, or "carry over" any unused water rights into future years as stored water credits.	Watermaster: (1) A court-appointed Watermaster who enforces the judgment and has authority to require pumping meters, collect groundwater data, inspect measuring devices, and cooperate with other agencies. (2) An administrative committee that specifies the Watermaster's powers and duties, and advises. Consists of one voting member from five municipal water agencies: LA, Glendale, Burbank, San Fernando, and Crescenta Valley Water District. Management Strategies No formal groundwater storage programs. In late 2007, Glendale, Burbank, and LA entered into a 10-year agreement to reverse long-term groundwater declines, including: increasing recharge of stormwater runoff, and working to reduce basin losses from underflow out of ULARA.	Adjudicated Safe Yield (AFY): San Fernando: 90,680; Sylmar: 6.210; Verdugo: 7,150; Eagle Rock: negligible Current Safe Yield (AFY): 2007 *Native Safe Yield:* San Fernando: 43,660 *Safe Yield (includes return flows from imported water)*: San Fernando: 90,680; Sylmar: 6,810; Verdugo: 7,150 Safe Yield Summary: The court defined *safe yield* to include temporary surplus. This permitted more withdrawals to create increased storage space to allow for extensive use of the basins as storage facilities. Pre-adjudication Extractions: 1930s increase is from ~90,000 AF to 140,000 AF. LA imports over 300,000 AF. Adjudication Extractions: 1977–1978: 81,552 AF; 1978–1979: 75,483 AF Extraction Summary: While current extractions remain at or below the basin's safe yield (natural safe yield plus import return credits), they are 45 percent higher than the basin's natural safe yield. Overdraft Conditions: The court defined "overdraft" flexibly, to allow for extractions exceeding safe yield plus a temporary surplus. Groundwater Levels: The basin experienced a long-term decline in groundwater storage since 1944 due to the basin rarely operating within the storage range established in the judgment Water Quality: There are four EPA Superfund sites in the San Fernando subarea. Discussion: **- Ongoing contamination of groundwater in San Fernando, Verdugo, and Sylmar basins** **- Groundwater levels trending down** **- Accumulation of stored water credits in the San Fernando Basin that if utilized would increase overdraft** **- Set several major legal precedents: (1) Allowed the use of underground reservoirs for storage and later recapture of imported water by the party that imported and stored the water. (2) Public agencies and utilities could not lose their groundwater rights by prescription. (3) LA was granted a pueblo water right to all native groundwater in the San Fernando Basin derived from precipitation within ULARA; all surface water runoff and groundwater underflow from Sylmar and Verdugo basins were part of LA's pueblo water right; and pueblo rights had priority over overlying owner rights.**

MAIN SAN GABRIEL BASIN

The Main San Gabriel Basin is one of the largest groundwater basins in southern California, providing residents of the greater San Gabriel Valley with about 240,000 AF per year. It is geographically situated in the southeasterly portion of Los Angeles County and bounded on the north by the San Gabriel Mountains, on the northwest by Raymond Basin, on the southeast by Puente Basin, and on the south by the Central Basin. The adjudication of the basin was deemed necessary by water producers to streamline administration, reduce overdraft, and adhere to the Long Beach Judgment and Puente Narrows Agreements, and the adjudication was relatively amenable. One of the most significant concerns in the basin is water quality, with four areas of the valley containing Superfund sites. The 1973 Judgment included water quality as one of the Watermaster's responsibilities, and since the mid-1980s the Watermaster has coordinated with regulatory agencies to have groundwater remediation facilities constructed, permitted and operated to protect and enhance the groundwater supplies. The 1992 Judgment amendment explicitly required coordination with EPA for a federal cleanup of the Superfund sites.

Overview

County	Eastern Los Angeles
Area	127, 278 acres / 198.9 square miles[300]
Population	1,275,187 (2010 Census)
CASGEM	High
Watermaster	Main San Gabriel Watermaster
Members	Nine-person board appointed by the Los Angeles County Superior Court; six members elected by water producers and three by water districts.
Court Cases	*Upper San Gabriel Valley Municipal Water District, Plaintiff, v. City of Alhambra et al., Defendants,* 1968, Superior Court of the State of California (Case #924128)

CASGEM = California Statewide Groundwater Elevation Monitoring

The Main San Gabriel Basin occupies most of San Gabriel Valley. It encompasses more than 127,000 acres, and storage is 8.6 million AF when the groundwater elevation at the Baldwin Park Key Well is 316 feet. The Main San Gabriel Basin is one of the largest groundwater basins in southern California, providing residents of the greater San Gabriel Valley with about 240,000 AF per year.[301] The physical San Gabriel groundwater basin is divided between three sub-basins: Main San Gabriel Basin, Puente Basin, and Six Basins. The Puente Basin is in the southeast and is tributary to the Main San Gabriel Basin. The Six Basins area is located in the northeast and a portion is tributary to the Main San Gabriel Basin. There are some barriers to groundwater movement between these three sub-basins, but they are adjudicated and managed separately. The aquifers are located inland (saltwater intrusion is not a risk) and are unconfined. The Main San Gabriel Basin, Puente Basin, and Six Basins are bounded on the north by the San Gabriel Mountains, on the east by the San Jose Hills, on the south by the Puente Hills, and on the west by the Raymond Fault. The San Gabriel River and Rio Hondo, a tributary of the San Gabriel River, drain the watershed. Average precipitation over the past 20 years is approximately 18.5 inches.[302] The major sources of natural recharge to the Basin are infiltration of rainfall on the valley floor and runoff from the nearby

mountains.[303] The Main San Gabriel Basin is the first of a series of basins (including the Puente, Central Coast, and West Coast basins) to receive the benefit of mountain runoff, and the basin interacts hydrologically and institutionally with adjoining basins, including the Puente, Central Coast, and West Coast Basins.

In the mid 1800s, agriculture and ranching were the dominant economies in the basin. The basin's current land use is primarily urban. Municipal water purveyors are the primary pumpers, although there is a lesser amount of production by rock and gravel companies. Most communities depend almost entirely on the groundwater basin for their water supply, with indirect access to untreated imported water.[304]

Reason for Adjudication

Beginning in the 1940s, the San Gabriel Valley experienced a period of rapid urbanization, as well as a decrease in recharged wastewater (due to an increase in sewage exports). This led to an increased demand for water drawn from the Main San Gabriel Basin.[305] By the 1950s, the basin was in a state of overdraft, and parties downstream from the basin, including agricultural and urban water purveyors in the Puente, Central Coast, and West Coast basins, became concerned. These downstream users (primarily the municipal providers for Compton, Long Beach, and the Central Basin) relied on the San Gabriel River system for their natural water supply as it flowed through the Whittier Narrows, and they initiated a legal action (the Long Beach Judgment of 1965). This resulted in a court decision requiring the Main San Gabriel Basin water users to guarantee a defined annual amount water to downstream basins. For several years, the Upper San Gabriel Valley Municipal Water District administered and took responsibility for the Main San Gabriel Basin's obligations to these lower basin water users. In 1968, the Main San Gabriel Basin municipal water producers requested that the Upper San Gabriel Valley Municipal Water District file a complaint that would adjudicate water rights in the basin and bring basin producers under control of one governing body. This complaint, initiated by municipal users and filed by the water district, became the basis for the 1973 Main San Gabriel Basin Judgment.[306] Rather than adjudicate based on mutual prescription with DWR as Watermaster, as was done in Central and West Coast basins, municipal users in the San Gabriel Valley chose to negotiate in a "friendly" adjudication. The water association commissioned a consultant and legal counsel to develop the negotiated settlement and management plan. This became the stipulated judgment, which was accepted by the court in 1973.[307]

Decree and Amendments

Adjudication initiated: 1968
Adjudication finalized: 1973
Revisions or amendments: 1979, 1980, 1987, 1988, 1991, 1992, 2000, and 2012
Other significant dates: 1965 Long Beach Judgment and 1972 Puente Narrows Agreement
Costs: $$4,000,000 to $5,000,000 per year[6]

Decree Summary

The Main San Gabriel Judgment defined water rights for about 190 original parties, created the Main San Gabriel Watermaster as the governing body, and described a physical solution for water management. The physical solution provides for Watermaster control of basin management, and flexibility in initiating cooperative agreements, regulating and controlling pumping, purchasing replacement water, and determining the natural and operating safe yields (see below). The judgment allowed for overproduction of rights, but overproduction

incurred a replacement water assessment. Subsequent amendments clarified and extended the Watermaster's role.

Both groundwater and surface water rights in the basin were adjudicated under five classes of water rights: (1) *groundwater rights,* based on mutual prescription (see Raymond Basin) that comprised about 95 percent of annual water rights for direct use, with each pumper's share calculated as a percentage of the total adjudicated rights, (2) *base annual diversion rights,* surface rights held by parties not having groundwater prescriptive pumping rights, (3) *integrated production rights,* producers with combined surface and groundwater rights, allowing for greater diversions of surface water in wet years while using less groundwater, and then carrying over unused prescriptive rights to the following year; (4) *special rights,* allocated to MWD for its dam and reservoir and to Los Angeles County Flood Control District for its reservoir, and (5) *non-consumptive user rights,* for parties operating spreading facilities. Pumpers whose production exceeded their water rights paid an assessment to finance the purchase of replenishment water. The judgment placed injunctions against unauthorized production, non-consumptive uses (not including spreading facilities), unauthorized recharge, and exporting of native water from the basin.

Amendment Summaries

In 1991 the Watermaster was given authority to allow recharge of up to 30,000 AFY of recycled water as supplemental water, and was also given authority to control pumping for water improvement purposes and enter into agreements with the EPA to facilitate groundwater cleanup.

Two other judgments were acknowledged in the Main San Gabriel Basin adjudication: the Long Beach Judgment and The Puente Narrows Agreement. **The Long Beach Judgment** rendered by the Superior Court in 1965 guarantees Central and West Coast Basins an average annual water supply of about 98,000 AFY through the Whittier Narrows. **The Puente Narrows Agreement** of 1972 between Puente Basin Water Agency and Upper San Gabriel Valley Municipal Water District calculates and governs subsurface outflow from Puente Basin to the Main San Gabriel Basin. This agreement calls for an average base underflow of 580 AFY from Puente Basin to the Main San Gabriel Basin. The Main San Gabriel Watermaster adheres to both rulings.[308]

Water Users

Stipulated Users

Stipulated users originally included about 190 parties, of which about 40 were municipal purveyors. Designated parties to the judgment included the Upper San Gabriel Municipal Water District, the Three Valleys Municipal Water District, the San Gabriel Valley Municipal Water District, about 40 other public and investor-owned water supply agencies, 15 industrial customers, 4 governmental agencies, and 8 agricultural and golf course pumpers.

Current Users

About 45 private parties or companies pump directly. A number of parties have rights to divert surface flows. According to the Main San Gabriel Watermaster office, there are very few agricultural uses left in the area.[309]

Management Structure

The Main San Gabriel Watermaster is a nine-person board, appointed by Los Angeles County Superior Court. It manages and controls the withdrawal of groundwater and surface water and coordinates water deliveries and recharge. The board is comprised of six individuals elected by water producers and three by water districts (two by Upper San Gabriel Valley Municipal Water District and one by the San Gabriel Valley Municipal Water District). Each member serves a one-year term. Several advisory committees were established to assist the Watermaster Board, and their membership includes Watermaster Board members and may also include advisory committee members who are not Watermaster Board members. The Watermaster has a staff and engages consultants for special projects. Current 2015 board members are primarily water company representatives.[310]

The Watermaster is responsible for all aspects of basin management. Specific responsibilities include managing and controlling the withdrawal and replenishment of water supplies in the basin; determining the operating safe yield annually; raising replenishment revenue by means of assessments and acquiring and spreading replacement water; coordinating local involvement in efforts to preserve and restore the quality of the basin's groundwater; assisting and encouraging regulatory agencies to enforce water quality regulations in the basin; collecting production, water quality, and other relevant data from producers; and preparing an annual report. Over the ensuing 40 years, the Watermaster has been responsible for the delivery of over 1,500,000 AF of untreated imported water for groundwater replenishment purposes.[311]

The Watermaster also works closely with other adjacent basins, and the three overlying municipal water districts. The Upper San Gabriel Valley Municipal Water District, Three Valleys Municipal Water District, and San Gabriel Valley Municipal Water District deliver supplemental SWP water to the basin. The County of Los Angeles Department of Public Works (LACDPW) plays a role in ensuring that recharge from local stormwater runoff is coordinated with recharge of supplemental SWP water. San Gabriel Basin Water Quality Authority obtains some funding for the basin's cleanup activities. The San Gabriel River Watermaster calculates credits and debits between the Main San Gabriel Basin and Central Basin.[312] Since the mid-1980s the Watermaster has coordinated with regulatory agencies to have groundwater remediation facilities constructed, permitted, and operated to protect and enhance the groundwater supplies.

Management Strategies

Imported and Recycled Water: Management of the Main San Gabriel Basin depends largely on local precipitation in the San Gabriel Mountains. Working closely with the Main San Gabriel Basin Watermaster (Watermaster), the Upper District, Three Valleys Municipal Water District, and San Gabriel Valley Municipal Water District are responsible for providing additional supplies as groundwater replenishment through Metropolitan Water District's imported water system and facilities owned and operated by the San Gabriel Valley Municipal Water District. The source of the groundwater replenishment is the State Water Project.[313] The basin demand consists of about 10 percent from treated imported water, 85 percent from local groundwater, and 5 percent from other local supplies (recycled water and local surface water diversions). In addition, an average of about 40,000 APY of untreated imported water is delivered for Basin replenishment.

Spreading: There are 17 spreading basins in the Main San Gabriel Basin, covering more than

1,100 acres. They are operated by LACDPW or other agencies capable of capturing stormwater runoff from adjacent canyons and/or imported water. Imported water can be spread when key well groundwater levels are above 250 feet. The typical basin operating range for water levels is between 200 and 250 feet MSL. The spreading capacity of existing facilities is more than 600,000 AFY. In 1983, the agencies in the San Gabriel River Watershed formed the Groundwater Replenishment Committee. They agreed to coordinate deliveries of local and imported water and identify future needs and potential recharge facilities.

Storage: The Watermaster, Upper San Gabriel Valley Municipal Water District, and MWD (who receives water from the SWP and the Colorado River) operate under a Cyclic Storage Agreement, where untreated imported water is stored in the basin and extracted when imported water supplies are short.[314] Imported water is credited to these cyclic storage accounts. Metropolitan also delivers replenishment water to the basin, and sells to the Three Valleys Municipal Water District and Upper San Gabriel Valley Municipal Water District.[315]

Monitoring and Reporting

There are 250 wells in the basin, 200 of which are active. There are about 20 non-municipal wells, and the Watermaster monitors most of these for water quality parameters. The recently established Basinwide Groundwater Elevation Monitoring Program (BGWEMP) is a network of wells in the basin that are regularly measured by the Watermaster on a permanent basis. The project is designed to facilitate coordination of existing water-level monitoring done by agencies.[316] In addition, each adjudicated party is obligated to file with the Watermaster a quarterly report showing the total pumping and diversion amounts.[317]

Safe Yield

The Main San Gabriel Basin Judgment determined the natural safe yield of Main San Gabriel Basin to be 152,700 AFY on the basis of 1967 conditions. The Watermaster annually determines the operating safe yield (OSY) as that amount of groundwater that can be pumped in a fiscal year without replacement water assessments. The main factors in making this determination are rainfall, runoff levels, and groundwater levels.[318] In 2005–2006 the OSY was 240,000 AFY, and in 2014–2015 the number was 150,000 AFY.[319] Producers may pump in excess of annual pumping right but must pay for supplemental imported water to recharge the basin. Any entity that wishes to spread or store supplemental water within the basin for later recovery must have a cyclic storage agreement with the Watermaster. These agreements have five-year terms.[320]

Groundwater Pumping and Overdraft

Groundwater production averaged about 230,000 AF between 2004–2005 and 2013–2014. The Watermaster established the OSY for 2015–2016 of 150,000 AF, but the annual pumping production in 2014–2015 was approximately 195,000 AF. Consequently, the replacement water obligation would be about 45,000 AF.

In 1944, water stored in the basin was approximately 8,600,000 AF and had decreased to 7,900,000 AF by 1960. Groundwater storage capacity was determined by DWR in 1975 to be 10,438,000 AF. Since then, there were subtractions and additions to suggest that the capacity is actually 10,740,000 AF.[321]

The basin was regarded as being overdraft since 1953, which prompted the adjudication. As part of the judgment, the Watermaster recharges replacement water to maintain the water level at the Baldwin Park Key Well above elevation 200 ft. Since the judgment in 1983, the highest operational groundwater elevation at the Key Well was 294 feet. In 2015, as a result of record low rainfall, the groundwater elevation at the well was 175 feet, which represents a historic low.

Water Quality Issues

Four areas of the San Gabriel Valley Groundwater Basin are Superfund sites. Trichloroethylene, perchloroethylene, and carbon tetrachloride contaminate the Whittier Narrows, Puente Basin, Baldwin Park, and El Monte areas.[322] A current project of the Watermaster (along with six other water entities) is to clean up the Baldwin Park Operable Unit. As a result of the negotiated agreement, parties have agreed to pay millions toward research, cost recovery, and treatment plant construction.[323] Those facilities have operated for over 10 years and continue to operate.

Drought

During the current drought, water levels in the Main San Gabriel Basin were currently over 160,000 AF below the low operating range established in the Main San Gabriel Basin Judgment.[324] According to the Upper San Gabriel Municipal Water District, in the current drought, the Main San Gabriel Basin groundwater levels "are at a current low and falling rapidly…municipal wells in the Main San Gabriel Basin are threatened and some have gone dry, and the Upper San Gabriel Valley Municipal Water District declared a water supply emergency in October of 2014."[325] The Watermaster has taken a number of initiatives to address water shortages. These include establishing a reliable storage program with a target reserve of 100,000 AF, implementing a new assessment to pay for this program, looking into imported Colorado River water for additional supply, and expanding conservation outreach efforts.[326]

Discussion

To manage the basin within the operating safe yield, pumpers whose production exceeds their water rights pay an assessment to finance the purchase of replenishment water.

The groundwater level in the Baldwin Park Key Well is also used by the Watermaster to monitor changes in groundwater supply for the basin. The water level in this well fluctuated over 100 feet in elevation over the last 20 years, from a high in 1983 to a low in 2015.[327] In 2015, the groundwater elevation at the well was 175 feet, representing a historic low, and during the 2014–2015 drought, some municipal wells went dry. While lowered groundwater levels trigger a requirement to purchase imported water, future long-term droughts and reduced imported water supplies could hinder this management strategy.

Overall, the management structure has been effective in its ability to work collaboratively with overlapping agencies and basins through the Long Beach Judgment and through joining regional and statewide drought and water supply programs.[328]

Water quality remains a serious problem, and the basin continues groundwater remediation at Superfund sites; but the Watermaster indicates that this has not affected water supply.

MAIN SAN GABRIEL BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Eastern Los Angeles Area: 198.9 sq. mi. Physical Characteristics: First of a series of basins (including Puente, Central Coast, and West Coast Basins) to receive the benefit of mountain runoff; an unconfined aquifer with ~8.6 million AF storage capacity Precipitation: 18.5″ per year CASGEM: High Land Use: Initially agricultural. Currently increasing municipal. Reason for Adjudication: Rapid urbanization led to an increased water demand and basin overdraft. The adjudication was to reduce overdraft, streamline administration, and adhere to the Long Beach Judgment and Puente Narrows Agreements regarding water flows.	Adjudication Initiated: 1968 Adjudication Finalized: 1973 Amended: 1979, 1980, 1987, 1988, 1991, 1992, 2000, and 2012 Decree Summary: The judgment defined water rights for the 190 original parties, created the Main San Gabriel Watermaster, and described a physical solution for water management. It placed injunctions against unauthorized production, non-consumptive uses (not including spreading facilities), unauthorized recharge, and exporting of native water from the basin. Both groundwater and surface water rights in the basin were adjudicated under five classes of water rights: (1) groundwater rights: based on mutual prescription comprised about 95 percent of annual water rights for direct use; (2) base annual diversion rights: surface rights held by parties not having groundwater prescriptive rights; (3) integrated production rights: producers with surface and groundwater rights; (4) special rights: to MWD for its dam and reservoir and to LA County Flood Control District for its reservoir and; (5) non-consumptive user rights: for parties operating spreading facilities. Pumpers whose production exceeds their water right have to pay an assessment to finance the purchase of replacement water.	Watermaster: Main San Gabriel Watermaster Members: A nine-person board appointed by the LA County Superior Court; six elected by water producers and three public representatives Strategies: About 400,000 AFY of imported water for basin replenishment, with 17 spreading basins with an existing capacity of 600,000 AF, covering more than 1,100 acres. Imported water can be spread when key well groundwater levels are above 250 feet. In 1983, the Groundwater Replenishment Committee was formed to coordinate deliveries of artificial water and provide additional supplies through MWD's imported water system.	Adjudicated Safe Yield: 152,700 AFY (natural safe yield - 1967 conditions Operating Safe Yield: Defined as the amount of groundwater that can be pumped in a fiscal year without replacement water assessments. 2005/06: OSY = 240,000 AFY2016: OSY (estimated) = 130,000 AF Summary: Current OSY is less than adjudicated safe yield and continues to drop. Current Extractions: 233, 298 (2013) AF Extraction Summary: Note that extractions are significantly higher than the OSY due to supplemental water. Groundwater Levels: In 1944 stored water was approximately 8,600,000 AF. By 1960, it had decreased to 7,900,000 AF. Groundwater recharge in the valley averaged 169,000 AFY between 1985–2004 and increased 2% between those years due to imported supplemental water. As per the judgment, the Watermaster recharges replacement water to maintain the water level at the Baldwin Park Key Well above a particular elevation (200 ft). The highest operational groundwater elevation at this well since the judgment occurred on 1983 was 294 feet. In 2015, as a result of record low rainfalls, the groundwater elevation at the well was 168 feet, which represents a historic low and is below the minimum operating criteria of 200 feet. Overdraft: The basin has been regarded as being in overdraft since 1953. Water Quality: There are four Superfund sites within the basin. A project of the Watermaster and six other water entities is to clean up the Baldwin Park Operable Unit. Discussion: **- The Watermaster works within a series of interdependent but separately adjudicated basins. 2012 amendments requested more agency partnerships.** **- The primarily urban basin has a large storage area, and is well suited to artificial replenishment.** **- The basin has accumulated overdraft and continues to experience significant problems with declining groundwater levels.** **- There are four Superfund sites within the basin.**

PUENTE BASIN

The Puente Basin is a very small basin. Groundwater produced from the basin is used primarily by municipalities and for the irrigation of green space and a golf course. There are no barriers to groundwater movement between the Puente Basin and the much larger Main San Gabriel Basin, but they are adjudicated and managed separately. Puente Basin groundwater is non-potable due to naturally high levels of total dissolved solids in excess of the State of California Water Quality Standards. Municipalities use imported water for consumption. The basin is not considered to be in overdraft.

Overview

County	Eastern Los Angeles
Area	8,870 acres / 138 square miles
Population	~40,000
CASGEM	High
Watermaster	Puente Basin Watermaster
Members	Three Watermasters; one is nominated jointly by Walnut Valley Water District and Rowland Water District, one is nominated jointly by City of Industry and Title Successor Agency to Industry Urban-Development Agency, and the third is nominated by those two appointees.[329] The Superior Court of Los Angeles appoints all Watermasters.[330]
Court Case	*Puente Basin Water Agency et al. v. The City of Industry et al.,* Superior Court of California, Case No. C 369 220.

CASGEM = California Statewide Groundwater Elevation Monitoring

The Puente Basin is a shallow basin that underlies the Puente Valley and is tributary to the Main San Gabriel Basin. It is bounded on the north by the San Gabriel Mountains, on the east by the San Jose Hills, and on the south by the Puente Hills. The San Jose Creek drains the watershed. The major sources of natural recharge to the basin are infiltration of rainfall on the valley floor and runoff from the nearby mountains. In addition, water is imported into the basin from the County Sanitation District of Los Angeles County (recycled water) and from The Metropolitan Water District of Southern California (MWD) to the Rowland Water District and Walnut Valley Water District. Average precipitation over the past 20 years is approximately 18.5 inches.[331]

There are no barriers to groundwater movement between the Puente Basin and Main San Gabriel Basin, but they are adjudicated and managed separately. Puente Basin occupies the western end of San Jose Valley and contains nearly 8,870 acres. The basin is primarily shallow, and bedrock is found in several locations at the surface. The shallow aquifer is unconfined.[332]

In the mid 1800s, agriculture and ranching became the primary economy in Puente Basin. Development increased following the Los Angeles Aqueduct, which began service in 1913. Industry, including electronics and aerospace factories, also moved into the area. Land use in the basin is primarily urban. The MWD member agency overlying the Puente Basin is Three Valleys, and the overlying communities are the City of Industry, Walnut, Rowland Heights,

and a small portion of Diamond Bar. The mouth of the Puente Basin is located in the San Gabriel Valley Area. There are four Superfund sites, primarily located in the Main San Gabriel Basin, with a small part of one in the Puente Basin, consisting of an area of contaminated groundwater that runs along San Jose Creek in La Puente.[333]

Reason for Adjudication

Puente is a very small basin, and could have been adjudicated with the Main San Gabriel Basin, initiated in 1968. However, producers desired to have their own management and established the Puente Narrows Agreement in 1972. It governs subsurface outflow from the Puente Basin into the Main San Gabriel Basin.[334] On June 1, 1981, Puente Basin Water Agency (Rowland Water District and Walnut Valley Water District) filed a complaint to determine the right to groundwater pumping from the Puente Basin in accordance with the Puente Narrow Agreement. Principal defendants were City of Industry, Title Successor Agency to Industry Urban Development Agency (formerly Industry Urban Development Agency) and Royal Vista Golf Course (formerly Los Angeles Royal Vista Golf Course). The plaintiffs were concerned with potential overdraft conditions and wanted to ensure adequate management of the groundwater over the long term.[335]

Decree and Amendments

Adjudication initiated: 1981
Adjudication finalized: 1986
Other dates: Puente Narrows Agreement of 1972

Decree Summary

The judgment determined that principal parties have the following rights to extract groundwater from the basin: Royal Vista Golf Course or its successor, an overlying landowner who has the right to pump groundwater from Puente, but may not exceed 306 AFY. This right is appurtenant to the land and is not transferrable except in connection with the property. It is not subject to increase or decrease in the operating safe yield (OSY)—defined as the quantity of water that the Puente Basin Watermaster determines may be pumped from the basin during a fiscal year. The plaintiffs, Rowland Water District and Walnut Valley Water District and defendants City of Industry and Title Successor Agency to Industry Urban Development Agency, were each awarded appropriative rights to extract 1,023.5 AFY "plus or minus 25 percent of the quantity by which the operating safe yield is greater than or less than the declared safe yield." The total of all these rights equals the declared safe yield. Minimum water users, who are also overlying users, were authorized to pump up to 3 AFY, and their pumping right was also appurtenant to the overlying land but was not transferrable.[336]

All principal parties are entitled to produce unpumped water rights, deemed carryover water rights, from the previous year. In addition, public agency principal parties are entitled to pump return flow credits up to 750 AFY. Water may be pumped by the public agency principal parties from anywhere in the Puente Basin, and may be delivered for use outside of the boundaries of the Puente watershed, so long as it is in the party's service area. Water rights may also be transferred by lease or sale to other principal parties. The judgment did not provide for storage of surplus supplies within the groundwater basin due to the lack of suitable areas for percolation. Typically percolation occurs along the reaches of river or creek beds. In Puente Basin the San Jose Creek is lined with concrete.[337]

The Puente Basin Judgment outlined the makeup of the Watermaster and charged the Watermaster with management of the groundwater basin, including determination of the annual OSY and biennial testing of water meters. The judgment defined the natural safe yield of the basin to be 4,400 AFY, with the OSY to be determined annually by the Watermaster. The court retained continuing jurisdiction.[338]

Puente Narrows Agreement of 1972

Subsurface outflow from the Puente Basin into the Main San Gabriel Basin is governed and calculated pursuant to the provisions of the Puente Narrows Agreement between the Puente Basin Water Agency (comprised of Walnut Valley Water District and Rowland Water District) and Upper San Gabriel Valley Municipal Water District. The agreement calls for an average base underflow of 580 AFY from Puente Basin to the Main San Gabriel Basin, with credits and debits accumulating. Credit is also given to the Puente Basin Water Agency for pumping associated with some water quality cleanup operations pursuant to the cleanup production agreement that discharges treated water to the concrete-lined San Jose Creek. Cleanup water is no longer discharged to the creek but is taken by Rowland Water District for distribution to customers of its recycled water system. The Puente Narrows Watermaster monitors these operations.[339]

Other

The Puente Basin interacts with adjoining basins, including the Main San Gabriel, West Coast, and Central basins. The Long Beach Judgment of 1965 guarantees Central and West Coast basins an average annual water supply of about 98,000 AFY through Whittier Narrows, and that includes underflow as per the Puente Narrows Agreement.[340]

Water Users

Stipulated users

Royal Vista Golf Course, City of Industry, Title Successor Agency to Industry Urban Development Agency, Rowland Water District, and Walnut Valley Water Districts.

Current users

The above users as well as minimum water users and one cleanup pumper (Carrier/BDP Corporation).

Management Structure

The Puente Basin Watermaster is a three-person board, appointed by the court that oversees the management of the groundwater basin as set forth in the Puente Basin Judgment. One Watermaster is nominated by the plaintiffs (Rowland Water District and Walnut Valley Water District) and another is nominated by the defendants (City of Industry and Title Successor Agency to Industry Urban Development Agency [IUDA]). The third is nominated by the first appointees.[341]

Management Strategies

Imported Water: Currently, Rowland Water District and Walnut Valley Water District import potable MWD water into the Puente Basin from Three Valleys Municipal Water District. In 2014, 14,311 AF of water were imported into the basin, and 1,959 AF of water was returned to the basin. Industry and Title Successor Agency to IUDA have not begun to import water

into the basin.[342]

Recycled Water: Rowland Water District and Walnut Valley Water District receive recycled water from the County Sanitation Districts of Los Angeles County. There are no spreading basins in Puente Basin, nor are there existing storage programs in Puente Basin.[343]

Monitoring and Reporting

The adjudication required the installation and maintenance of water meters by the principle parties. Minimum water user defendants are exempted from metering protocols. The Watermaster collects and maintains pumping data in order to determine the provisions of the judgment. In addition to ongoing Puente Basin Watermaster monitoring, Los Angeles County Department of Public Works (LACDPW) semiannually measures groundwater elevations at four wells in the basin and Puente Narrows Watermaster measures groundwater elevations at one well in Puente and one in the Main San Gabriel Basin. The Puente Narrows Agreement mandates that Puente Narrows Watermaster monitors subsurface outflow to the Main San Gabriel Basin on a long-term basis.[344]

Safe Yield

The court defined the safe yield as the quantity of water that can be extracted annually from the Puente Basin based on long-term supply, under present cultural conditions and extraction patterns without causing a continuing reduction of water in storage. This number includes return flows from imported water, and was found to be 4,400 AFY. The OSY is the quantity of water the Watermaster determines may be produced by or on behalf of the principal parties from the Puente Basin in a particular fiscal year and is determined annually by the Watermaster. The Watermaster determines the OSY by considering five factors specified in the judgment: water levels, the Puente Narrows Agreement, subsurface flows, the cost of availability of alternate sources of water, and groundwater pumping. In 1987 the OSY was 3,400 AFY, and in 2014 it had decreased to 1,530 AF.[345]

Groundwater Pumping

The Puente Basin is not considered to be in an overdraft condition, and groundwater levels in Puente have been relatively stable since 1985 (fluctuations less than 25 feet). There are no storage programs in the basin (unlike Main San Gabriel) because the San Jose Creek is concrete lined. The five main pumpers (City of Industry, Title Successor Agency to Industry Urban Development Agency, Royal Vista Golf Course, Rowland Water District, and Walnut Valley Water District) pumped a total of 1,589.7 AF in Fiscal Year 2013–2014. This number included carryover credits and return flow credits. Royal Vista Golf Course exceeded its annual pumping rights by 101 AF.[346] Rowland Water District and Walnut Valley Water District import potable MWD water into Puente Basin from Three Valleys Municipal Water District and recycled water from County Sanitation Districts of Los Angeles County. Rowland Water District imported 6,585 AF of MWD water and 1,046 AF of recycled water. Walnut Valley Water District imported 7,726 AF of MWD water and 913 AF of recycled water. Industry and IUDA have not begun to import water into Puente Basin.[347]

Water Quality

The western end of the groundwater basin is contaminated with volatile organic compounds and is located in the Puente Valley Operable Unit of the San Gabriel Valley Superfund Site. The Los Angeles Regional Water Quality Control Board oversees cleanup of groundwater

contamination, and EPA oversees the remediation of the Puente Valley Operable Unit component of the San Gabriel Valley Superfund Site. Rowland Water District and Walnut Valley Water District import potable water from Three Valleys Municipal Water District and recycled water from County Sanitation District of Los Angeles County into the basin. Water quality was monitored by LACDPW between 1986 and 1992, but monitoring has since been conducted by the Walnut Valley and Rowland Water districts. These data are reported in the Puente Basin Watermaster annual report. The quality of the native groundwater in the basin is not suitable for potable use due to high total dissolved solids and selenium without treatment. Groundwater is blended with recycled water to be allowed to be used for irrigation.[348]

Discussion

The judgment appears to have helped in providing a framework to reassess the basin's operating safe yield.

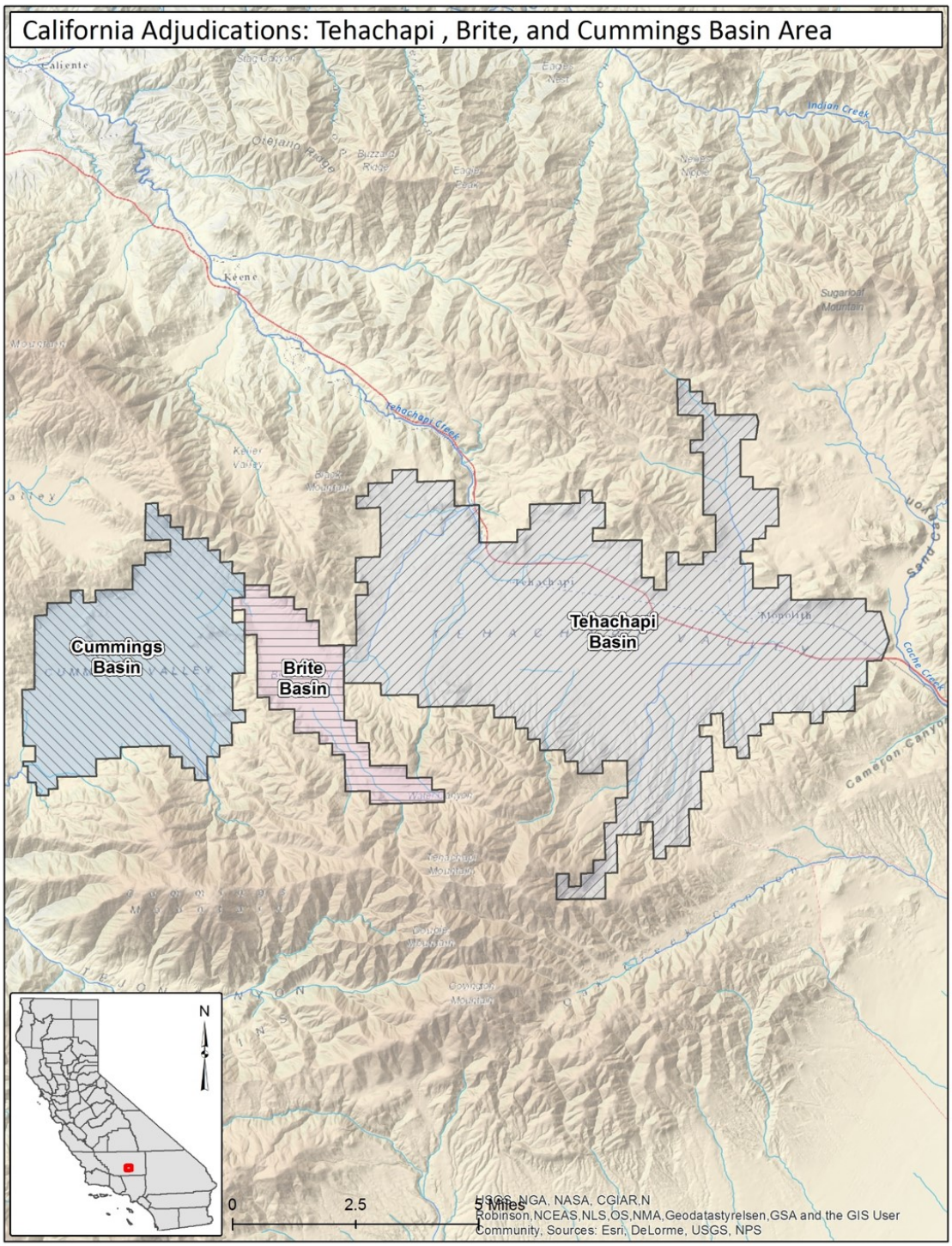
The mouth of the Puente Basin, along with portions of the Main San Gabriel Basin, is located in the Puente Valley Operable Unit of the San Gabriel Valley Superfund Site, one of the largest Superfund sites in the country. Without treatment, groundwater in the Puente Basin is unsuitable for direct potable use due to high levels of total dissolved solids and selenium.

The Watermaster has a long history of monitoring groundwater levels and quality in the basin.

PUENTE BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Eastern Los Angeles Area: 138 sq. mi. Physical Characteristics: The Basin is bounded on the north by the San Gabriel Mountains, on the east by the San Jose Hills, and on the south by the Puente Hills. The San Jose Creek drains the watershed. The shallow basin underlies the Puente Valley. Precipitation: 18.5" per year CASGEM: High Land Use: Urban and agricultural Reason for Adjudication: Rowland Water and Walnut Valley Water Districts, concerned with potential overdraft conditions, filed a complaint to determine rights to groundwater and ensure adequate management over the long term.	Stipulation: 1981 Adjudication Initiated: 1981 Adjudication Finalized: 1986 Other Agreements: 1972 Puente Narrows Decree Summary: The court found the safe yield of the basin to be 4,400 AFY, with the operating safe yield (OSY) to be determined annually by the Watermaster. Rowland Water District and Walnut Valley Water District, City of Industry, and Industry Urban Development Agency, were awarded appropriative rights to extract 1,023.5 AFY "plus or minus 25 percent of the quantity by which the operating safe yield is greater than or less than the declared safe yield." The total of these rights equaled the declared safe yield. The Golf Course, as an overlying landowner, had the right to pump groundwater from Puente not exceeding 306 AFY. Overlying minimum water users could pump up to 3 AFY, and their right was appurtenant to the overlying land and not transferrable. All principal parties were entitled to carryover water rights from the previous year. Public agency principal parties were entitled to pump return flow credits up to 750 AFY. Water rights could be transferred by lease or sale to other principal parties. The judgment did not provide for storage of surplus supplies within the basin due to the lack of suitable areas for percolation. Amendment Summary: 1972 Puente Narrows Agreement called for an average Base Underflow of 580 AFY from Puente Basin to Main San Gabriel Basin, but credits and debits could accumulate.	Watermaster: Puente Basin Watermaster Members: Three individuals nominated by principal parties and appointed by the court Strategies: Rowland and Walnut import MWD water into Puente Basin from Three Valleys Municipal Water District and recycled water from County Sanitation District of Los Angeles County. They also receive recycled water from the County Sanitation Districts of Los Angeles County. Industry and Title Successor Agency to IUDA do not import water into the basin. There are no spreading basins nor are there storage programs. The basin appears to be developing more systematic monitoring with overlapping jurisdictions.	Adjudicated Safe Yield: 4,400 AFY (includes import return flows) Operating Safe Yield: The quantity of water the Watermaster determines annually that may be produced by or on behalf of the principal parties from the Puente Basin in a particular fiscal year. 3,400 AFY (1987) Current Operating Safe Yield: 1,530 AFY (2014) Summary: The operating safe yield has varied and is currently less than the adjudicated safe yield. Current Extractions: The five main pumpers (City of Industry, Title Successor Agency to Industry Urban Development Agency, Royal Vista Golf Course, Rowland Water District, and Walnut Valley Water District) pumped a total of 1,589.7 AF in Fiscal Year 2013–2014. This number included carryover credits and return flow credits. Royal Vista Golf Course exceeded its annual pumping rights by 101 AF. Extraction Summary: Current extractions are less than initial extractions and groundwater levels have been stable over the long term despite routinely exceeding the basin's NSY and OSY. Groundwater Levels: Groundwater levels in Puente have been relatively stable since 1985, with fluctuations less than 25 feet. Overdraft: The basin is currently not considered to be in an overdraft condition. Water Quality: The western end of the basin in the Puente Valley Operable Unit of the San Gabriel Valley Superfund Site is contaminated with volatile organic compounds. Water quality was initially monitored by LACDPW. It is now monitored by Walnut Valley and Rowland Water Districts. The quality of the native groundwater in the basin is not suitable for potable use due to high total dissolved solids and selenium without treatment. Groundwater is blended with recycled water to be allowed to be used for irrigation Discussion: **- Groundwater in the basin is unfit for potable use.** **- In 2015, the basin is not considered to be in overdraft.** **- The judgment provides for carryover water for one year but not storage of surplus supplies.** **- The judgment required metering, and the basin appears to be developing more systematic monitoring with overlapping jurisdictions.**

Tehachapi Foothill Basins



BRITE BASIN

Tehachapi Basin, Cummings Basin, and Brite Basin are three small groundwater basins in Kern County. Although they were adjudicated as individual basins, the local Tehachapi-Cummings County Water District is the Watermaster for all three basins. Adjudication was deemed desirable so water users could tap into newly available imported water and also secure their water rights. To construct transmission facilities, a federal loan was needed, and adjudication was necessary to assure repayment. Overall, Brite Basin is in good shape. Groundwater levels remain stable, and studies indicate that the basin was never in overdraft. There is no land available for additional municipal or agricultural development in Brite Basin, so there is little opportunity for increased growth that could increase the risk for groundwater depletion. The basin also receives infiltration from the Jacobsen Reservoir (aka Brite Lake), which provides reliable inflow.

Overview

County	Kern
Area	3170 acres / 5 square miles[349]
Population	684 (2010 census)[350]
CASGEM	Very Low[351]
Watermaster	Tehachapi-Cummings County Water District (TCCWD)
Members	Five-person board of directors elected by registered voters
Court Cases	*Tehachapi-Cummings County Water District v. Austin et al.* Case Number 97211. Superior Court of California, Kern County. Filed December 9, 1970.

CASGEM = California Statewide Groundwater Elevation Monitoring

Brite Basin is bounded on the north by the Sierra Nevada and on the south by the Tehachapi Mountains. Low-lying ridges connect the two ranges on the east and west sides. The elevation of the low-lying ridges connecting the two ranges is from 4,200 to 5,000 feet. Precipitation ranges between 10 to 14 inches a year. Groundwater recharge is understood to occur primarily from percolating precipitation, as well as from seepage from Brite Lake.[352]

Brite Basin is connected hydrologically to Tehachapi on the east and Cummings Basins on the west. The three groundwater basins are located in the Tulare Lake Hydrologic Region, but are isolated from the Tulare Lake Groundwater Basin as they are located at an approximate elevation of 4,000 feet above mean sea level. The surface water from Brite drains in two directions; into Tehachapi from the west and into Cummings from the east, indicating that groundwater recharge of both is partially contingent upon percolation of precipitation from the Brite watershed. Because of these conditions, although the basins were adjudicated separately, a single entity, the Tehachapi-Cummings County Water District (TCCWD) has complete control and authority as Watermaster over the three distinct groundwater basins.[353] Brite Basin provides water primarily for small farms and small domestic users.[354]

Reason for Adjudication

The Tehachapi-Cummings Water Conservation District was formed in 1961 to carry out

basin groundwater and watershed studies in Brite, Cummings, and Tehachapi Basins, and was replaced by the TCCWD in 1965. A committee composed of community representatives (including representatives from agricultural and municipalities), TCCWD worked to develop a solution to groundwater overdraft in Tehachapi and Cummings Basins, and recommended that three separate adjudication actions be filed on Tehachapi, Brite, and Cummings basins. The purpose of these adjudications was to establish groundwater rights for all parties, establish a physical solution and a groundwater management plan to prevent further overdraft, and allow for integration of imported water with local groundwater supplies. A federal loan was needed to construct transmission facilities, and adjudication was also necessary to assure loan repayment.[355]

In 1966, the Tehachapi-Cummings County Water District filed suit in Superior Court, and later in the year, the Tehachapi-Cummings County Water District Board of Directors signed two contracts with the Kern County Water Agency for entitlement to State Water Project water. One contract was for an annual entitlement of 5,000 AF of agricultural water (4,300 AF firm and 700 AF surplus), and the other was for an annual entitlement of 15,000 AF of municipal and industrial (M&I) water. The Tehachapi Basin Case went to trial in late 1970, and the original judgment was filed March 22, 1971. A federal loan and a general obligation bond were subsequently approved to construct a water system to convey State Water Project water to the TCCWD.[356] It is unclear if Brite was experiencing overdraft conditions at the time of adjudication. Since the adjudication, however, Brite Valley has not been in overdraft.[357]

Decree and Amendments

Adjudication initiated: 1966
Adjudication finalized: 1970
Watermaster resolutions: 1973, 1992, and 1996
Costs: NA

Decree Summary

The judgment resulted in a safe yield of 500 AFY being established. Water rights were designated with no priority, and a total of 631 AF in "base water rights" (defined as the highest continuous extractions of water by a party from the basin for a beneficial use in any period of five consecutive years prior to the judgment) were awarded to several small agricultural users and several small M&I users. Base water rights were transferrable but only in connection with the transfer of the property on which the right was developed. There was an injunction against exporting native groundwater and diverting surface water out of the basin. In addition, the decree appointed TCCWD as Watermaster.[358]

In June 1971, voters approved the financing to import surface water from the State Water Project. When this water became available in 1973, the judgment was amended to establish allowable pumping allocations and an exchange pool, where farmers who had pumping rights could use imported water rather than use groundwater and receive a price differential. In 1992, an amendment to this resolution enabled the district to substitute return flows for surface water deliveries, and in 1996, the district adopted Resolution No. 30-96 that authorized pumping of recharged imported water in lieu of surface delivery imported water.[359]

Water Users

Stipulated users

Two agricultural users received the largest rights, along with ten individuals and one business.[360]

Current users

Small agricultural users and small M&I users, as well as a small mutual water company.[361]

Management Structure

The local water district, TCCWD, became the appointed Watermaster for the basin. The TCCWD is governed by a five-person Board of Directors, elected to four-year, staggered terms by registered voters in the five equal acreage divisions within TCCWD. The Board of Directors currently includes representatives from the Association of Water Industries, Waste Water and Sewage, Emergency Services, and Agriculture. The TCCWD governs water use in three basins: Tehachapi, Brite, and Cummings.[362]

Management Strategies

Imported Water: The TCCWD owns and operates a reservoir in Brite basin that receives State Water Project water and acts as a storage and recharge facility. It also constructed a delivery system for state water, formed the water availability preservation committee, constructed groundwater recharge facilities, and entered into long-term M&I contracts with Bear Valley Community Services District, Stallion Springs, Golden Hills, and the City of Tehachapi.[363]

Conjunctive Use: Conjunctive use of imported water and groundwater became a priority issue in the last several years.[364]

Monitoring and Reporting

There does not exist a published groundwater budget for Brite basin, but the district does track groundwater pumped for agricultural, municipal, and industrial uses in the adjacent Tehachapi Basin, as well as imported water to Brite Reservoir.[365] The adjudication of Brite did not require metered pumping.[366] The most recent estimates for total pumping in the basin by TCCWD are 328 AF (2010).[367]

Safe Yield

The safe yield was established by the adjudication as 500 AFY. This number has not been revisited.[368]

Groundwater Pumping and Overdraft

Groundwater levels in Brite Basin have been relatively constant. Studies demonstrate the "fullness" of the basin in that groundwater can be seen at the surface of the northwest portion. There is no information regarding total groundwater storage in the basin, but studies factoring the specific yield of the basin (averaging 7 percent), the area of the basin, and the depth of the basin (average 119 feet) calculate the storage area to be approximately 26,000 AF.[369] There are no restrictions on groundwater production currently in the basin. The most recent estimates for total pumping in the basin are 328 AF (2010). The basin is not considered to be

in overdraft. The TCCWD's reservoir, situated in Brite, contributes to its groundwater recharge.[370]

Water Quality

There are no groundwater quality impairments in the basin.[371]

Discussion

Brite Basin was never determined to be in overdraft (although it may have been experiencing declines before the addition of state water), and the pumping quantities remain stable since adjudication.

The Watermaster has a long history of management and monitoring in the basin, and appears to be effective in working with a broad spectrum of stakeholders over three connected basins. There are no published monitoring reports of Brite Basin.

There is no land available for additional municipal or agricultural development in Brite Basin, so there is little opportunity for increased growth that could increase the risk for groundwater depletion.

BRITE BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Kern Area: 3,170 acres; 4.95 sq. mi. Physical Characteristics: Bounded by mountains and difficult to access groundwater, Cretaceous rocks form a basement underlying Quaternary alluvium. Recharge occurs primarily through percolating precipitation. Precipitation: 10"–14" per year CASGEM: Very Low Land Use: No significant development; small farms and small domestic users Reason for Adjudication: Desire to secure a federal loan to construct transmission facilities and receive imported water.	Adjudication Initiated: 1966 Adjudication Finalized: 1970 Amended: 1973, 1992, and 1996 Decree Summary: The judgment established TCCWD as Watermaster for Tehachapi, Brite, and Cummings Basins; established an injunction against exporting native groundwater and against diverting surface water, and maintained groundwater extractions under continuing jurisdiction of court. The adjudication awarded pumpers 631 AF in "base water rights" (defined as the highest continuous extractions of water by a party from the basin for a beneficial use in any period of five consecutive years prior to the judgment) to several small agricultural users and several small municipal and industrial (M&I) users. These are prescriptive rights. Amendments: 1973: A ruling created "allowed pumping allocations" for each party, as well as party domestic rights which restricted annual extractions within the safe yield. 1992: The district can substitute return flows for surface water deliveries. 1996: Authorized pumping of recharged imported water in lieu of surface delivery imported water.	Watermaster: Tehachapi-Cummings County Water District (TCCWD) has been the governing agency for groundwater in the basin since 1961 and has served as Watermaster since adjudication. Members: A five-person board elected by registered voters; currently occupied by three members from the community, one water quality manager, and one agricultural representative. Strategies: TCCWD owns and operates a reservoir in Brite basin that receives State Water Project (SWP) water and acts as a storage and recharge facility. TCCWD also constructed a delivery system for SWP water, formed the water availability preservation committee, constructed groundwater recharge facilities, and entered into long-term M&I contracts with Bear Valley Community Services District, Stallion Springs, Golden Hills, and the City of Tehachapi. Conjunctive use of imported water and groundwater became a priority in the last several years.	Adjudicated Safe Yield: 500 AFY Current: 500 AFY Summary: Brite Basin has pumped less than its adjudicated safe yield and continues to do so. Current Extractions: 328 AF pumped in 2010 Extraction Summary: The demand has remained stable in the basin since monitoring began in the 1960s. Groundwater Levels: Groundwater levels have remained constant. Overdraft: There are no overdraft conditions in the basin. Water Quality: Water quality is good. Discussion: **- The basin is small and its water is difficult to access.** **- TCCWD does not provide monitoring data or annual reports for Brite Basin.** **- Brite Basin has not been in overdraft since the adjudication.**

TEHACHAPI BASIN

Tehachapi Basin, Cummings Basin, and Brite Basin are three small groundwater basins in Kern County. Although they were adjudicated as individual basins, they are managed by the same Watermaster—the local Tehachapi-Cummings County Water District. The basin experienced overdraft from about 1940, and the adjudication was deemed desirable so water users could tap into newly available imported water and also secure their water rights. To construct transmission facilities the district also needed a federal loan, and adjudication was necessary to assure repayment. A physical solution was established, including an exchange system to incentivize parties to use the more expensive imported water, and individual pumping was limited to two-thirds of the highest continuous annual extractions over any five-year consecutive period after overdraft began. Groundwater levels increased since the adjudication primarily due to imported water and the pumping limits.

Overview

County	Kern
Area	14,800 acres / 23 square miles (Tehachapi West) 24,000 acres / 37 square miles (Tehachapi East)[372]
Population	17,800 (2010)[373]
CASGEM	Medium[374]
Watermaster	Tehachapi-Cummings County Water District (TCCWD)[375]
Members	Five-member board of directors elected by registered voters[376]
Court Cases	*Tehachapi-Cummings County Water District v. City of Tehachapi et al.,* Superior Court of the State of California for Kern County

CASGEM = California Statewide Groundwater Elevation Monitoring

Tehachapi Basin, Brite Basin, and Cummings Basin are located in the Tulare Lake Hydrologic Region, but are isolated from the Tulare Lake Groundwater Basin due to their higher elevation, approximately 4,000 feet above mean sea level. Because of these conditions, although the basins were adjudicated separately, a single entity, the Tehachapi-Cummings County Water District (TCCWD), was given complete control and authority as Watermaster over three distinct groundwater basins.[377]

The Tehachapi groundwater basin surface is generally the Tehachapi Valley floor. The Tehachapi Mountains rise 8,000 feet to the south of the Tehachapi Basin, and it is bordered on the north by the Sierra Nevada.[378] A low-lying ridge connecting these two ranges forms the western boundary; a similar ridge with a narrow gap separates Brite Valley from Tehachapi Valley. Groundwater is recharged primarily through percolating stream flow, and the areas of Antelope, China, and Brite Creeks are the main recharge areas in the western portion of the basin. Blackburn and Mendiburu Creeks are the main recharge areas in the eastern portion of the basin. The eastern portion of the basin is in the South Lahontan Hydrologic Region. Brite Creek drains into northern Brite Valley, which then drains into Tehachapi Valley. Brite Creek joins Tehachapi Creek outside the northwest corner of Tehachapi Basin. This flow then exits the basin toward the San Joaquin Valley. The Tehachapi Basin is generally elongated east and west approximately nine miles long, and

approximately oval shaped and five miles wide at its widest. It is described as a bowl, the sides of which are composed of impervious materials. Surface outflow from Tehachapi Valley occurs during time of heavy storms via Tehachapi Creek to the west. Surface flows via and Cache Creek to the east are extremely rare, as water is impounded in Proctor Lake, which must spill prior to surface water flowing out of the basin via Cache Creek. Average precipitation in the region is 10–14 inches.[379] In 1996 the Watermaster introduced artificial recharge to the basin.[380]

The area is rural, and land use is primarily agricultural. Groundwater users include agricultural users, water purveyors, mutual water companies, industrial facilities, and public entities pumping for their own use. The entire region's population has grown from approximately 28,400 to approximately 35,000, but has tapered off in the past few years. The population of Tehachapi Basin is approximately 20,000.[381]

Reason for Adjudication

Groundwater levels in Tehachapi Basin declined from 1950 to the late 1970s, with levels dropping 25 feet in the 1950s. Concerned about overdraft, the Tehachapi-Cummings Water Conservation District was formed in 1961 to carry out basic groundwater and watershed studies. This was a continuation of the Tehachapi Soil Conservation District's efforts in seeking solutions to water shortages within the area. In 1965, the TCCWD was formed by popular vote, replacing the Tehachapi-Cummings Water Conservation District. A citizens advisory committee, composed of a cross section of community residents, was established and worked for more than a year to develop a solution to groundwater overdraft. It recommended that three separate adjudication actions be filed on Tehachapi, Brite, and Cummings Basins. Adjudication was deemed desirable so water users could prevent further overdraft by tapping into newly available imported water, secure their water rights, and establish a physical solution. A federal loan was needed to construct transmission facilities and adjudication was also necessary to assure loan repayment.[382]

In 1966, the Tehachapi-Cummings County Water District filed suit in Superior Court, and later in the year, the Tehachapi-Cummings County Water District Board of Directors signed two contracts with the Kern County Water Agency for entitlement to State Water Project water. One contract was for an annual entitlement of 5,000 AF of agricultural water (4,300 AF firm and 700 AF surplus). The other was for an annual entitlement of 15,000 AF of municipal and industrial (M&I) water. The Tehachapi Basin Case went to trial in late 1970, and the original judgment was filed March 22, 1971. A federal loan and a general obligation bond were subsequently approved to construct a water system to convey State Water Project (SWP) water to the TCCWD.[383]

Decree and Amendments

Adjudication initiated: 1966
Adjudication finalized: 1971
Revisions or amendments: 1973 and 1996
Costs: $300,000[384]

Decree Summary

The adjudication was initiated by TCCWD (the plaintiff) against numerous named defendants. Water rights were awarded based on the Doctrine of Mutual Prescription.[385] As such they were not based on priority but rather on each party's base water right, defined as the highest

continuous extractions of water by a party from the basin for a beneficial use in any period of five consecutive years after the commencement of overdraft in Tehachapi Basin. Base water rights were transferrable. Strictly domestic water rights shown in the judgment were transferrable, but only in connection with the transfer of the property on which the right was developed. There was an injunction against exporting native groundwater and diverting surface water out of the basin. The safe yield of the basin was calculated as 5,500 AFY, which was two-thirds of the total of these base water rights (8,250 AFY), and did not include artificial replenishment. A physical solution was developed to enforce the safe yield.[386]

When imported water became available in 1973, the judgment was amended by Resolution No. 8-73, which established the allowable pumping allocations (APA) for each party and restricted total annual extractions within the Tehachapi Basin to the safe yield of 5,500 AF. An exchange pool was created where farmers who had pumping rights could use imported water in lieu of pumping groundwater and receive a price differential. Operations of the exchange pool have since been suspended because of changes in land use and permanent transfers of agricultural water rights to municipal and industrial interests. The judgment allowed carryover rights for groundwater, whereas each party that pumped less than its APA during a particular calendar year could carryover water for the next two succeeding years an amount not to exceed 25 percent of its APA. Carryover that was not pumped by the end of the second year was to remain within the Tehachapi Basin. The judgment required metering and inspection by the Watermaster (but exempted domestic wells and those producing less than 25 AFY). In addition, the decree appointed TCCWD as Watermaster and created injunctions against exporting native groundwater from the basin or diverting surface water from the watershed.[387] In 1996, the district adopted Resolution No. 3-96, which revised the Watermaster's rules, authorizing pumping of recharged imported water in lieu of surface delivery of imported water and enabling the district to substitute return flows for surface water deliveries.[388]

Water Users

Stipulated users

Approximately 70 non-domestic users were awarded water rights, with the largest water rights awarded to the City of Tehachapi (753 AF), Golden Hills Community Services District (CSD) (159 AF), Mojave Public Utility District (76 AFY), J. G. Bisbee (701 AF), Jacobsen Bros. Turf Farms (579 AF), Tehachapi Orchards (625 AF), and Monolith Portland Cement Company (1,487 AF). Approximately 65 domestic users were each awarded 3 AFY. The total adjudicated water rights were approximately 8,000 AFY.[389] Each party's base water right was determined according to his highest continuous annual extractions over any five-year consecutive period after overdraft began. Once imported water became available, the judgment was amended to establish allowable pumping allocations to enforce the safe yield, as well as an exchange pool system (see Decrees and Amendments, above).[390]

Current users

There are two represented classes of users: municipal and industrial (M&I), and agricultural. Since the adjudication, water users shifted from agricultural to municipal. Municipal users who have accrued more rights since adjudication include Golden Hills CSD (1,299 AFY) and the City of Tehachapi (2,733 AFY). Annual urban extraction in 2014 was 4,419 AFY, and annual agricultural extraction was 1,136 AFY, including carryover from prior years.[391]

Management Structure

The local water district, TCCWD, became the appointed Watermaster for the Tehachapi Basin, as well as for the Brite and Cummings groundwater basins. Its main groundwater supply is located in the three adjudicated basins, and it governs water use in these basins. The TCCWD encompasses approximately 266,000 acres and provides an imported water supply, water resource management, and flood protection to the public. It is governed by a five-person Board of Directors, elected to four-year, staggered terms by registered voters in the five equal acreage divisions within TCCWD. The Board of Directors currently includes representatives from the Association of Water Industries, Waste Water and Sewage, Emergency Services, and Agriculture.[392] The TCCWD constructed a delivery system for SWP water, formed a water availability preservation committee, constructed groundwater recharge facilities, and entered into long-term contracts with Bear Valley Community Services District, Stallion Springs, Golden Hills, and the City of Tehachapi.[393]

Management Strategies

Imported Water: Tehachapi Basin receives imported water from the State Water Project. Golden Hills CSD, the City of Tehachapi and all other purveyors of potable water within the Tehachapi Basin are entirely dependent upon groundwater for domestic use. To fully utilize the imported SWP water, conjunctive use of imported water and groundwater became a priority issue.[394]

Spreading and Storage: To replenish the basin with imported water, procedures were established for any party to bank groundwater through the spreading and subsequently extraction of imported water. Golden Hills CSD spreads SWP water for replenishment in its China Hill recharge area.[395]

Recharge: The Tehachapi-Cummings County Water District in cooperation with the City of Tehachapi also constructed groundwater recharge facilities The Tehachapi groundwater basin is recharged with imported SWP water at two locations—Antelope Dam and China Hill—and this augments the water supplies in the basin.

Groundwater Modeling: The district, in cooperation with the City of Tehachapi and Golden Hills CSD retained Fugro West, Inc., to prepare a groundwater modeling study for the Tehachapi Basin as part of the Watermaster's ongoing program to better understand the hydrogeology of the Tehachapi Basin. That report was completed in 2009.

Monitoring and Reporting

The adjudication required that Mojave Public Utility District (MPUD) install water meters and make periodic reports to the Watermaster of all of its wells in the Tehachapi Basin; however, MPUD no longer operates any wells within the adjudicated basin. The TCCWD seasonally monitors selected wells throughout the basin, providing data that indicate groundwater elevation changes. Basin models were completed in 2009 using a calibrated model. These recent findings verified the safe yield.[396]

Safe Yield

The adjudication defined safe yield for the basin as "the maximum quantity of groundwater, not in excess of the long term average annual natural replenishment, which may be extracted annually from Tehachapi basin without eventual depletion." The adjudication established the

safe yield for the basin as two-thirds of the total of all individual's "base water rights," defined as the highest continuous extractions of water by a party from the Tehachapi Basin for a beneficial use in any period of five consecutive years after the commencement of overdraft.

The initial estimation of safe yield was 5,500 AF. The most recent estimate of safe yield, based on the groundwater model in 2009, was 5,317 AFY. The 2009 report shows natural recharge was calculated as 3,712 AFY. Imported water and applied water recharge comprise 1,217 and 380 AFY, (totaling 1,597 AF), and annual extraction is estimated at 3,591 AFY. This indicates that Tehachapi is operating lower than its adjudicated safe yield.[397]

Groundwater Pumping and Overdraft

Groundwater levels had dropped 25 feet by 1951 and dropped an additional 33 feet from 1961–1978. In the early 1970s, groundwater levels increased to those present during the late 1940s when the valley's groundwater overdraft problem became apparent. The importation of SWP water to supplement groundwater supplies starting in 1973 had a significant effect on reducing basin overdraft. While initially treated and used as municipal supply, most imported water is now used conjunctively in groundwater recharge programs. Since the 1972 adjudication, groundwater levels have increased and are now close to 1950 levels.[398]

Groundwater pumping in 2013 was approximately 5,302 AF, less than the basin's determined safe yield of 5,500 AF. In 2013, pumping allocations were 5,346.32 AF, which included recharged imported water. The 2003 update of Bulletin 118 does not identify Tehachapi Basin as overdrafted, nor does it project that it will become overdrafted if present management conditions continue and future climate variability and hydrologic conditions are similar to those of the base period. According to TCCWD manager John Martin, Tehachapi Basin has enough stored water that it is not considered to be in overdraft.[399]

Water Quality

Nitrate levels exceed 30 milligrams per liter (mg/L) in Tehachapi municipal wells. To remediate this nitrate plume, the water is extracted and piped to surrounding agricultural land for use as irrigation supply.[400] The Golden Hills CSD experienced increasing difficulty and costs in meeting California drinking water standards with treatment of imported SWP water. This led to a new resolution that permitted artificial replenishment of groundwater using imported water.[401]

Drought

The TCCWD is concerned that with the current drought and limits on imported water, pumping will increase. It is taking new approaches to conserving water, including substituting potable water with recycled water when possible.[402]

Discussion

Groundwater users worked together to provide a solution to overdraft in the basin through an adjudication that facilitated the importation of water into the basin to reduce pumping. Since the beginning of adjudication in the early 1970s, groundwater levels and groundwater storage has increased, and importation of SWP water, which began in 1973, significantly reduced overdraft and is relied on to sustain the basin's equilibrium over the long term. This could be problematic under climate change as imported water supplies become less reliable.

Water rights were not based on priority but on a pumper's highest use over a period of five years preceding overdraft in the basin. However, to reduce overall withdrawals in the basin, all users had to cut their use by two-thirds of the base water right, which then became the designated safe yield of the basin.

The Watermaster has a long history of management and monitoring in the basin, and appears to be effective in working with a broad spectrum of stakeholders over three connected basins.[403]

TEHACHAPI BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Kern Area: 14,800 acres; 23 sq. mi. Physical Characteristics: The basin is bordered on the south by the Tehachapi Mountains and on the north by the Sierra Nevada. A low-lying ridge connecting these two ranges forms the western boundary; a similar ridge with a narrow gap separates Brite Valley from Tehachapi Valley. Basin recharge is primarily through percolating stream flow, and areas of Antelope, China, and Brite Creeks are the main recharge areas. Precipitation: 10″–14″ per year CASGEM: Medium Population: 17,800 (2010) Land Use: Agricultural with Increasing municipal Reason for Adjudication: Groundwater levels in the Basin declined from 1950 to late 1970s. A committee of community residents recommended that three separate adjudication actions be filed on Brite, Tehachapi, and Cummings Basins to prevent further overdraft by tapping into imported water, securing water rights and establishing a physical solution. A federal loan was needed to construct transmission facilities and adjudication was also necessary to assure loan repayment.	Adjudication Initiated: 1966 Adjudication Finalized: 1971 Amended: 1973, 1992, and 1996 Decree Summary: Appointed TCCWD as Watermaster; injunction against exporting native groundwater; injunction against diverting surface water; under continuing jurisdiction of the court. Water rights were awarded based on the Doctrine of Mutual Prescription and based on each party's base water right, defined as the highest continuous extractions of water by a party from the basin for a beneficial use in any period of five consecutive years after the commencement of overdraft in the basin. Total adjudicated water rights were approximately 8,000 AFY. There are two represented classes of users: Municipal and industrial (M&I) and agricultural. Since the adjudication, water use shifted from agricultural to municipal Amendments: 1973: Once imported water became available, the judgment was amended to establish allowable pumping allocations to enforce the safe yield, and an exchange pool system. 1992, an amendment enabled the district to substitute return flows for surface water deliveries, and in 1996, the district authorized pumping of recharged imported water in lieu of surface delivery imported water.	Watermaster: Tehachapi-Cummings County Water District (TCCWD) has been the governing agency for groundwater since 1961 and has served as Watermaster since the adjudication. Composed of a five-person board elected by registered voters; it is currently occupied by three members from the community, one water quality manager, and one agricultural representative. Strategies: TCCWD maintains a delivery system for State Water Project water; established groundwater recharge facilities; and maintains an injunction against exporting ground and surface water from the basin.	Adjudicated Safe Yield: 5,500 AFY Current: 5,317 AFY Safe Yield Summary: Tehachapi appears to be operating within its safe yield, and this has been effective in reducing overdraft. Its ability to do so relies extensively on securing SWP water. Current Extractions: 3,302 AFY (2013) Extraction Summary: Extractions have decreased since adjudication, thanks to recycled water and state water additions. Groundwater Levels: Groundwater levels had dropped 25 feet by 1951 and dropped an additional 33 feet from 1961–1978. Since the start of basin adjudication in the early 1970s, groundwater levels increased to those present during the late 1940s when the valley's groundwater overdraft problem became apparent. Current groundwater levels are 3,870 ft. (2013) Overdraft: Since 1973 overdraft has decreased in the basin by approximately 2,000 AFY. Water Quality: Nitrate levels are exceeded in several municipal wells Discussion: - **Groundwater users worked together to provide a solution to overdraft in the basin through an adjudication.** **- A major reason for the adjudication was to facilitate importing water into the basin to reduce pumping, and to secure a federal loan to construct transmission facilities.** **- Water rights were not based on priority but on a pumper's highest use over a period of five years preceding overdraft in the basin, but to reduce overall withdrawals in the basin, all users had to cut their use by two-thirds, which then became the designated safe yield of the basin.** **- A significant amount of imported water is being used to replenish the basin and since the 1972 adjudication, groundwater levels have increased and are now close to 1950 levels. This could be problematic under climate change as imported water becomes more expensive and less available.**

CUMMINGS BASIN

Tehachapi Basin, Cummings Basin, and Brite Basin are three small groundwater basins in Kern County. Although the basins were adjudicated separately, a single entity, The Tehachapi-Cummings County Water District (TCCWD) serves as Watermaster over the three distinct groundwater basins. An interesting finding is that the Cummings adjudication was never completed. Because of this, its users rely on overlying rights with voluntary agreements, and there is no regulated curtailment of withdrawals. There are only a few big users so it is able to track its water use with relative accuracy, but the basin has significant overdraft. Two of its major users (Stallion Springs and Bear Valley) pump water from the basin that is delivered to offsite users, and they offset the export with imported water. Two-thirds of the residents within Cummings Basin are inmates at the California Correctional Institute.

Overview

County	Kern
Area	10,000 acres / 15 square miles[404]
Population	7,665 (2010 census)[405]
CASGEM	High[406]
Watermaster	Tehachapi-Cummings County Water District (TCCWD)
Members	Five-person board of directors elected by registered voters
Court Cases	*Tehachapi-Cummings County Water District v. Armstrong;* Civ. No. 1935. Court of Appeals of California, Fifth Appellate District. July 18, 1975.

CASGEM = California Statewide Groundwater Elevation Monitoring

Cummings Basin is bounded on the north by the Sierra Nevada and the south by the Tehachapi Mountains. Chanac Creek drains the region and flows southwest to the San Joaquin Valley. A small ephemeral creek enters from Brite Valley to the northeast. Precipitation ranges between 10 to 14 inches a year. Groundwater recharge is contingent upon infiltration of surface flows from Brite Valley, Cummings Creek, and the surrounding watershed. Thick layers of clay at the valley center inhibit recharge on the valley floor.

Cummings Basin, Tehachapi Basin, and Brite Basin are all located in the Tulare Lake Hydrologic Region, but are isolated from the Tulare Lake Groundwater Basin as they are located at an approximate elevation of 4,000 feet above mean sea level. Surface water from Brite Basin drains into Tehachapi Basin from the west and into Cummings from the east. Although the basins were adjudicated separately, a single entity—the TCCWD—serves as Watermaster over the three distinct groundwater basins.[407] Cummings Basin hosts three groundwater recharge sites that are supplied with State Water Project (SWP) water and are operated by the TCCWD. These are located on alluvial fan areas at the northeast and southeast sides of the basin.[408]

The economy of the three basins was historically linked to agriculture, and despite increasing municipal demand, this continues to be the case.[409] The California Correctional Institution (CCI) is located in the eastern portion of Cummings Basin. Two-thirds of the residents within

Cummings Basin are inmates at CCI.[410] Water for the facility is from a combination of imported water and local groundwater. Cummings Basin also supplies water to a scattering of residences throughout the basin and two out-of-basin water districts.[411]

Reason for Adjudication

Groundwater levels in Cummings Basin declined from 1950 to the mid 1970s, due to increasing agricultural demand. In Cummings, overdraft resulted in deepening of wells, an increase in pumping costs, and contraction of the watered, alluvial areas of the basin. In response to these concerns, the Tehachapi-Cummings Water Conservation District was formed in 1961 to carry out basin groundwater and watershed studies, and was replaced by the TCCWD in 1965.[412] A committee composed of community representatives (including representatives from agricultural and municipalities) worked to develop a solution to groundwater overdraft in the basin, and recommended that three separate adjudication actions be filed on Tehachapi, Brite, and Cummings basins. The purpose of these adjudications was to establish groundwater rights for all parties and to establish a physical solution and a groundwater management plan to prevent further overdraft and allow for integration of imported water with local groundwater supplies. A federal loan was needed to construct transmission facilities, and adjudication was also deemed necessary to ensure loan repayment.[413]

In 1966, the Tehachapi-Cummings County Water District filed suit in Superior Court, and later in the year, the Tehachapi-Cummings County Water District Board of Directors signed two contracts with the Kern County Water Agency for entitlement to State Water Project (SWP) water. One contract was for an annual entitlement of 5,000 AF of agricultural water (4,300 AF firm and 700 AF surplus), and the other was for an annual entitlement of 15,000 AF of municipal and industrial (M&I) water. A federal loan and a general obligation bond were subsequently approved to construct a water system to convey SWP water to the TCCWD.[414] The Cummings adjudication led to a dispute between TCCWD and the California Correctional Institution, also known as the State of California's Tehachapi Prison, who appealed the adjudication. The appellant (the prison) contended that because the basin was not in a condition of annual overdraft the year before the action, the court could not adjudicate the basin. The court dismissed this appeal, finding that there was indeed continued overdraft during the 15-year period between 1950 and 1965, and proceeded with its adjudication.[415]

Decree and Amendments

Adjudication initiated: 1966
Adjudication finalized: 1972 filed and appealed
Revisions or amendments: 1973 and 1996
Costs: unknown

Decree Summary

The adjudication judgment was filed March 6, 1972, and the State of California, California Department of Corrections and Rehabilitation (CDCR) appealed. A partial reversal followed and was remanded back to the trial court. The final hearings were never held, and the adjudication was never completed. The partially complete decree determined the safe yield of the basin to be 4,090 AFY. Because the present level of pumping was at that time less than the adjudicated safe yield there was no injunction on pumping. All water pumped by the owners was for overlying purposes. The user share is based on reasonable and beneficial use

rather than past use or overdraft conditions. In addition, the partial decree appointed TCCWD as Watermaster and created injunctions against exporting native groundwater from the basin or diverting surface water from the watershed. Extraction of SWP water is not counted as a portion of the native safe yield of the basin, nor does it count as an export of native groundwater.[416]

In 1973 Resolution 8-73 gave the TCCWD the right to extract return flows of SWP water from Cummings Basin. In 1996 Resolution 3-96 authorized the pumping of recharged imported water in lieu of surface delivery of imported water.[417]

Water Users

Stipulated users

At the time of the adjudication the principal users were the California Correctional Institution (CCI) and private agriculture. The prison owned 1,720 acres of the basin. By 1970 it was pumping approximately 565 AFY. The court awarded the prison 308 AFY of this amount as its prescriptive base right. The State of California appealed this determination.[418]

Current users

In Cummings Basin there are three principal users. They are (1) the California Department of Corrections and Rehabilitation, (2) Bear Valley Community Services District (BVCSD), which is a small municipal user (total consumption less than 1,000 AFY) adjacent to Cummings that imports water from Cummings Basin (Fairview Water Company), and (3) Stallion Springs Community Services District (their district partly overlies the basin). Farms and residences also pump from the basin as overlying users.[419] These populations are reliant on local groundwater pumped from individual domestic wells.[420]

Management Structure

The TCCWD, the local water district, became the appointed Watermaster for the basin in 1972. It is governed by a five-person Board of Directors, elected to four-year, staggered terms by registered voters in the five equal acreage divisions within TCCWD. The Board of Directors currently includes representatives from the Association of Water Industries, Waste Water and Sewage, Emergency Services, and Agriculture. The TCCWD governs water use in three adjacent basins: Tehachapi, Brite, and Cummings.[421]

Management Strategies

Imported Water: The TCCWD recharges Cummings Basin with imported water at three locations: the Chanac Creek recharge site, 19 acres in the Chanac Creek fan, and the Cummings Pond recharge site. The TCCWD also constructed a delivery system for SWP water, formed the water availability preservation committee, and entered into long-term M&I contracts with the California Correctional Institution, Bear Valley Community Services District, Stallion Springs CSD, Golden Hills CSD, and City of Tehachapi.[422]

In 2004, TCWWD completed operations of a new lateral, which delivers SWP water to the northern end of Cummings Valley, helping to correct a localized cone of depression, which had filled this region. In addition, farmers in this area agreed to use SWP water in lieu of groundwater, and BVCSD and the California Correctional Institution paid the farmers the differential costs. The in-lieu program is not operating at this time. Also in 2004, the district completed construction of additional recharge basins on 19 acres in Chanac Creek fan.[423]

According to the partial decree, groundwater cannot be exported. However, Stallion Springs and BVCSD purchase SWP water from TCCWD, and TCCWD delivers the SWP water to direct recharge in the basin. Stallion Springs and Bear Valley then extract this water, less a 6 percent spreading loss, from wells located in Cummings and export it to portions of their service areas that are outside the basin.[424]

Because the 1972 Cummings Judgment was never completed, the adjudication did not include the implementation of a physical solution. Thus the district relies on voluntary participation to encourage users to use less water. They contribute regular outreach and communications to the big well water users, who engage in an informal agreement that they will take no more than 50 percent from groundwater and other 50 percent from state water. Last year users took 38 percent from groundwater.[425] To help remedy the overdraft conditions, TCCWD would like to implement a new rate structure that lowers delivery costs for SWP water in key areas.[426]

Monitoring and Reporting

Until 2001, agricultural groundwater pumping was not metered. Beginning in 2002, agricultural pumping was metered and recorded on a monthly basis for each well in Cummings Basin. A key well for monitoring was established to monitor base levels in the basin (Cummings Basin Key Well No. 32S31E35N001M). Three additional wells aligned northeast to southwest were also established to detect trends in storage, and these data are used by TCCWD to evaluate the current safe yield of the basin, as well as pumping allocations.[427] The 2013 Cummings Basin Watermaster Report provides estimates of pumping amounts for the previous five years for agriculture, the State of California, and other users.[428] Fugro West Consultants completed an update to the Cummings Basin Groundwater Model report in 2015 (see detailed findings below).[429]

Safe Yield

The perennial safe yield is defined by Fugro West Consultants as "specific to a period of time and accounts for all sources of recharge to the basin."[430] This number can change over time as conditions change. This was estimated at 3,750 AFY since 1981 in a 2013 Fugro West Consultants and Etic Engineering Report,[431] whereas the adjudication stated this number to be 4,090 AFY.

The operational yield of the basin is considered to be "the amount of groundwater discharge that can occur on an average annual basis while maintaining no net change in groundwater storage and not requiring any supplemental recharge."[432] It accounts for natural recharge and return flows from agriculture and domestic water use. This number was estimated as approximately 2,990 AFY (equal to the perennial safe yield minus imported water recharge). To keep the basin in balance, pumping of more than 2,990 AFY must be compensated by artificial recharge.[433]

Groundwater Pumping and Overdraft

The total average annual groundwater pumping from Cummings Basin between 2002 and 2013 was approximately 5,084 AFY, an increase over the 1981–2001 estimated average of 2,208 AFY.[434] The 5,084 AFY significantly exceeded the perennial safe yield of the basin (3,750–4,090 AFY). One reason for the increase in pumping is that prior to 1995, TCCWD

used to directly deliver water to agricultural users and was able to make these deliveries for less than the cost of pumping groundwater. Since 1995, due to an increase in imported water costs caused by an increase in natural gas prices, agricultural users were able to pump for less than the cost of purchasing imported water, and this resulted in increasing groundwater pumping, [435] leading to increased overdraft.

A 2010 report showed that extractions exceeded the safe yield in four of the past nine years and hydrographs of key wells show that the water table was dropping for the last ten years. In addition, the basin transitioned to using more water for M&I than for agricultural, and spreading losses of the conjunctive use program were not recognized until 2010, when a 6 percent spreading loss factor was added to TCCWD's conjunctive use programs in Tehachapi and Cummings.[436]

Overall, groundwater levels declined from 2002 to 2013. The 2010 Tehachapi Urban Water Management Plan describes the basin as currently in overdraft, and states that extractions exceeded the safe yield in four of the past nine years, with hydrographs of key wells showing the water table dropping for the past ten years. Water levels in certain parts of the basin dropped about 50 feet in the past ten years.[437] The Fugro West Consultant's report states that "if current production patterns continue, it is apparent that the excessive groundwater pumping at these rates will soon result in long-term basin overdraft."[438]

Water Quality

One of Bear Valley's wells in Cummings Basin is off line because of high nitrate levels. Perchlorate contamination is being successfully managed and actively monitored.[439]

Drought

The district is taking some new approaches to conserving water, including substituting potable water with recycled when possible. In 2015, because of the drought, the basin counts on banked water that it has saved for over the 40 years in the basin (although they are selling this water out of the basin). A groundwater study from 2004 analyzed the impact of a five-year drought and anticipated that groundwater levels would significantly decline, but that groundwater pumping quantities could be sustained for up to three years.[440]

Disputes

The adjudication played out a dispute between TCCWD and the California Department of Corrections and Rehabilitation (as overseer of California Correctional Institute)

Discussion

After the adjudication, which occurred in 1972, groundwater levels increased, and importation of SWP water, which began in 1973, reduced levels of overdraft.[441] But extractions continue to exceed the safe yield of the basin, and recent reports suggest that the adjudicated safe yield is inaccurate and should be a lesser amount. The basin has experienced long-term overdraft.[442]

The adjudication of Cummings differed from the adjudication of Tehachapi, in that water users have overlying rights with voluntary agreements and no regulated curtailment, whereas Tehachapi operates under prescriptive rights.

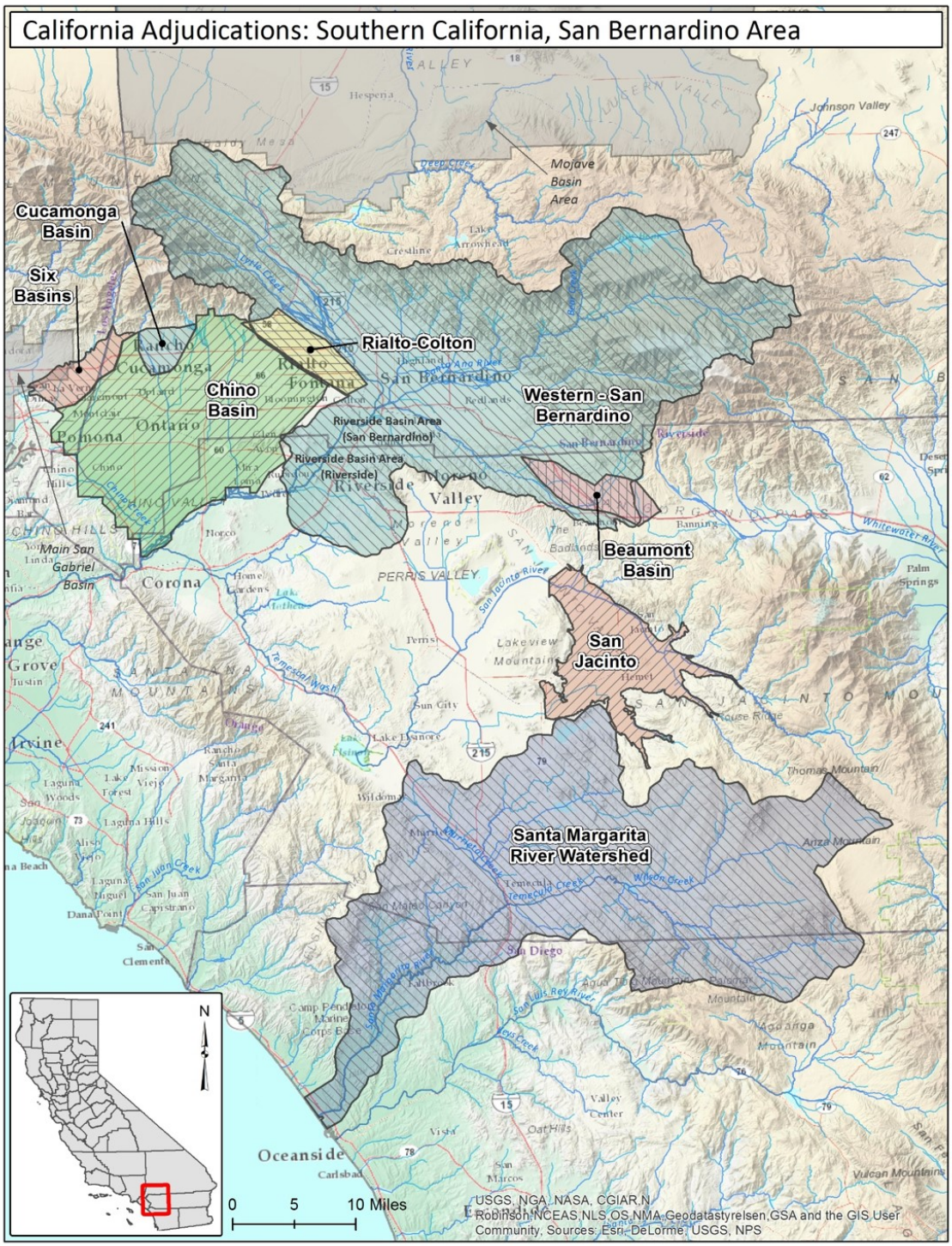
The basin is able to track its water use more easily than other basins in that it has only a few big water users, but it is also geographically situated in such a way that its water is difficult to recharge, thus it is at greater risk for overdraft concerns.

The TCCWD used to directly deliver water to agricultural users and prior to 1995 was able to make these deliveries for less than the cost of pumping groundwater. Since 1995, due to an increase in imported water costs caused by an increase in natural gas prices, agricultural users were able to pump for less than the cost of purchasing imported water, and this resulted in increasing groundwater pumping.

CUMMINGS BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Kern Area: 10,000 acres; 15 sq. mi. Physical Characteristics: Cummings Basin is bounded on the north by the Sierra Nevada and the south by the Tehachapi Mountains. Chanac Creek drains the region, and flows southwest to Tehachapi Valley. Groundwater recharge is contingent upon infiltration of surface flows from Brite Valley. Thick layers of clay at the valley center inhibit recharge on the valley floor. Precipitation: 10″–14″ per year CASGEM: High Land Use: Agricultural with increasing municipal Reason for Adjudication: Groundwater levels in Cummings Basin declined from 1950 to the late 1970s. In Cummings, overdraft resulted in deepening of wells, an increase in pumping costs, and contraction of the watered, alluvial areas of the basin.	Adjudication Initiated: 1966 Adjudication Filed: 1972 Appeal: 1972; adjudication never finalized Decree Summary: Established TCCWD as Watermaster for Tehachapi, Brite, and Cummings basins; injunction against exporting native groundwater, injunction against diverting surface water, and under continuing jurisdiction of court. All parties to the action were designated overlying owners, and all of the water pumped by the owners was for overlying purposes. The user share is based on reasonable and beneficial use rather than past use or overdraft conditions. Appeal: A judgment was filed March 6, 1972, which the State of California (California Department of Corrections and Rehabilitation) appealed. A partial reversal followed and was remanded back to the trial court. Due to cost limitations, the final hearings were never held, and the adjudication was never completed.	Watermaster: Tehachapi-Cummings County Water District (TCCWD) has been the governing agency for groundwater since 1961 and has served as Watermaster since the adjudication. Members: A five-person board elected by registered voters; currently occupied by three members from the community, one water quality manager, and one agricultural representative. Strategies: TCCWD maintains a delivery system for SWP water; established groundwater recharge facilities; and maintains an injunction against exporting ground and surface water from the basin. TCCWD recharges Cummings Basin with imported water at two locations: Chanac Creek recharge site and Cummings Pond recharge site. The district relies on voluntary participation to encourage users to use less water. They contribute regular outreach and communications to the big well water users, who engage in a informal agreement that they will take no more than 50% from groundwater and other 50% from SWP water.	Adjudicated Safe Yield: 4,090 AFY Current: 3,750 AF (2013) Summary: Current pumping extractions exceed the safe yield, but imported water recharge compensates for some of this loss. Current Extractions: 5,084 AFY average between 2002 and 2013. Extraction Summary: Overall, groundwater levels have declined between 2002–2013. The average pumping rate during this time was 5,084 AFY, significantly exceeding the perennial safe yield of 4,090 AFY. Groundwater Levels: The 2010 Tehachapi Management Plan states that extractions have exceeded the safe yield in four of the past nine years, with hydrographs of key wells showing the water table dropping for the past ten years. Water levels in certain parts of the basin have dropped about 50 feet in the past ten years. Overdraft: The 2010 Tehachapi Management Plan describes the basin as currently in overdraft. Water Quality: There are current issues with respect to high levels of nitrates. One of Bear Valley's wells in Cummings Basin is offline because of high nitrate levels. Perchlorate contamination is being successfully managed and actively monitored. Discussion: **- After the adjudication, groundwater levels increased as the importation of SWP water reduced overdraft. However, extractions continue to exceed the safe yield of the basin, and recent reports suggest that the adjudicated safe yield is inaccurate and should be a lesser amount. The basin is currently considered to be in overdraft.** **- The adjudication of Cummings differed from the adjudication of Tehachapi, in that it operates on an overlying rights premise with voluntary agreements and no regulated curtailment; whereas, Tehachapi operates under prescriptive rights.** **- The basin is able to track its water use more easily than other basins in that it has only a few big water users, but it is also geographically situated in such a way that its water is difficult to recharge, thus it is at greater risk for overdraft concerns.** **- TCCWD used to deliver water directly to agricultural users, and prior to 1995 was able to make these deliveries for less than the cost of pumping groundwater. Since 1995, due to an increase in water costs and decrease in energy costs, agricultural users have been able to pump for less than the cost of purchasing imported water, and this has resulted in increasing groundwater pumping.**

Inland Empire and Foothill Basins



CUCAMONGA BASIN

The Cucamonga Basin is a small groundwater basin located in San Bernardino County. In the 1950s, approximately 25 parties, mostly small local water companies and several individual water users, filed an action to adjudicate the rights to the basin's groundwater and certain surface waters tributary to the basin. The subsequent adjudication resulted in a 1958 Decree that contains some provisions for the metering and recording of water production, inspection of records, prohibitions against new water production, and potential reductions in water production. The court did not appoint an official Watermaster for the basin, and annual reports are not required. Since adjudication, water use in the basin has shifted from primarily agricultural use to primarily municipal use. Today there are three main water agencies—Cucamonga Valley Water District, San Antonio Water Company, and West End Consolidated Water Company—that hold nearly all of the adjudicated rights in the basin and jointly manage the basin pursuant to the 1958 Decree. Studies differ regarding the condition of the basin. A 2007 Metropolitan Water District review indicates that water levels in key wells have decreased about 120 feet and that the basin is experiencing long-term decline. Basin managers point to production data that also shows water production in the basin can trend below the total allocated rights production data.

Overview

County	San Bernardino
Area	15 square miles / 9,530 acres
Population	51,011[443]
CASGEM	Medium
Watermaster	The Watermaster is not officially appointed by the Superior Court. The management committee is comprised of public and regulated water agencies in the basin.
Members	Cucamonga Valley Water District, San Antonio Water Company, and West End Consolidated Water Company
Court Cases	*San Antonio Water Company v. Foothill Irrigation Company et al.,* Superior Court of California for the County of San Bernardino, Case No. 92645

CASGEM = California Statewide Groundwater Elevation Monitoring

The Cucamonga Basin underlies the northern part of the upper Santa Ana Valley. It is bounded on the north by the San Gabriel Mountains and on the west, east, and south by the Red Hill Fault,[444] and it is located directly north of Chino Basin. It is designated in the Department of Water Resources (DWR) Bulletin 118 as Basin Number 8-2.02. and DWR refers to it as a sub-basin of the Upper Santa Ana Valley Basin.[445] According to Bulletin 118, average annual precipitation is 18 to 32 inches. According to one study, groundwater in the basin is generally unconfined within unconsolidated to loosely consolidated sand, gravel, and silt with a few beds of compacted clay, where two aquifer units exist in the basin—the upper aquifer with younger alluvium and the lower aquifer with older alluvium.[446] Bulletin 118 states that total storage capacity of the basis is estimated to be 53,600 AF, while other reports state the capacity is not known. Recharge to the basin is said to be from infiltration of stream flow, percolation of precipitation, underflow from the San Gabriel Mountains, irrigation

return flows, and storm flows at spreading grounds along Cucamonga Creek and near Red Hill and Alta Loma.[447] The Red Hill fault is generally a barrier to groundwater flow. Groundwater flows southwards from recharge in the north to the fault in the south.[448] The Cucamonga Valley was an agricultural area over 100 years ago, and peak agricultural production was in the 1940s. Like most of western San Bernardino County, it saw rapid urbanization in the last few decades.[449]

Reason for Adjudication

During an extended dry cycled beginning in the late 1940s, many local water companies in Southern California struggled to provide sufficient and reliable water supplies to their customers.[450] This was the case in the Cucamonga Basin, and the San Antonio Water Company filed an action in Superior Court to determine the water rights of all the basin's water users and to facilitate annexations to the Metropolitan Water District of Southern California and enable the importation of State Water Project (SWP) water. A new public water agency, the Cucamonga Valley Water District (CVWD), was created in 1955 that could raise funds from property owners and water users to purchase the imported water.[451] The CVWD initiated a variety of measures to address the drought, including the ability to purchase imported water from the Inland Empire Utilities Agency that received imported water from the Metropolitan Water District.[452] In addition, a 3.7 million dollar bond allowed the CVWD to acquire many of the private water companies that previously serviced the area.[453] In adjudicating the water rights of the Cucamonga Basin, the plaintiff (San Antonio Water Company) and the defendant water companies and individuals[454] came together as stipulating parties and filed a stipulation for judgment which was accepted by the Superior Court in the form of the 1958 Decree.[455]

Decree and Amendments

Adjudication initiated: 1958[456]
Adjudication finalized: 1958[457]
Stipulated judgments: 1958 Decree

Decree Summary

The Cucamonga Basin's legal boundary, as outlined in the 1958 Decree, is smaller than the geologic boundary as defined by DWR's Bulletin 118. The eastern boundary of the basin was not based on geologic features, and thus a portion of the geologically defined basin is managed within the legally adjudicated boundary of the Chino Basin.[458]

The 1958 Decree allocated surface and groundwater rights among the parties that were producing water in the basin at that time, and also required the spreading of imported water to recharge the basin. The decree originally allocated groundwater rights and the right to divert water from Cucamonga Creek among 25 parties, totaling approximately 22,721 AFY, and subject to certain replenishment obligations imposed upon the San Antonio Water Company (see Table 16 below). Terms of the decree allow the parties to export water from the basin under certain circumstances[459] and to transfer and sell water rights as specified.[460] The court did not appoint an official Watermaster for the basin and did not require annual reporting. The decree contains provisions for the metering and recording of all water production, inspection of records, prohibitions against new water production, potential reductions in water production, and other protective measures.[461]

Today, the adjudicated water rights in the Cucamonga Basin are allocated to only three producers: West End Consolidated Water Company (WECWC), San Antonio Water Company (SAWC), and Cucamonga Valley Water District (CVWD).[462] The water rights of WECWC and some of the water rights of SAWC are currently pumped by the City of Upland. The 1958 Decree specifies the rights and limitations of the respective parties to export water from the basin and establishes certain obligations for SAWC to recharge the basin in relation to its adjudicated right.[463]

Water Users

Stipulated users

The San Antonio Water Company (plaintiff) brought the original action against numerous water companies and individual defendants, totaling approximately 25 parties.[464]

Current users

The primary water producers and water rights holders in the basin are SAWC, CVWD, and WECWC (where the City of Upland pumps and serves water pursuant to SAWC and WECWC rights).

Management Structure

Management structure outlined in the 1958 Decree

The decree did not designate a Watermaster, and annual reports were not required. The decree does contain some provisions for the metering and recording of water production, inspection of records, prohibitions against new water production, potential reductions in water production, and other measures.

Current management structure

The Cucamonga Basin has no court designated Watermaster, but is jointly managed by CVWD, SAWC, and WECWC (the primary water producers and right holders in the basin) pursuant to the 1958 Decree and the continuing jurisdiction of the Superior Court. There are also urban water management planning functions undertaken by CVWD, SAWC, WECWC, and the City of Upland. In addition, the Chino Basin Watermaster provides CASGEM reporting for the basin.[465]

Management Strategies

Imported Water

Imported water is defined in the judgment as "water derived from stream flow in an area outside of any watershed draining into the Cucamonga." The decree establishes certain obligations for SAWC to recharge the basin in relation to its adjudicated rights.[466]

Spreading Basins

Spreading in the Cucamonga Basin is at Cucamonga Creek and Upper Day Creek spreading basins. The SAWC imports water from San Antonio Creek for recharge to Cucamonga Creek Basins.[467]

Management indicates that efforts are currently under way to perform additional hydrologic investigations, update the safe yield of the basin, develop additional management strategies, and modernize the provisions of the 1958 Decree.[468]

Monitoring and Reporting

The 1958 Decree contains various provisions for the metering and recording of all water production and water recharge, inspection and exchange of records, prohibitions against new water production, potential reductions in water production, and other measures.[469] All of the Cucamonga Water District's and the San Antonio Water District's production wells are metered.[470] There are no annual reports, so it is difficult to access information.

Safe Yield

The native safe yield, safe yield, operating safe yield, and adjudicated safe yield were not specifically defined in the 1958 Decree, and the current safe yield is not defined.

As noted in Table 16 below, the Decree allocates groundwater rights and the right to divert water from Cucamonga Creek, totaling approximately 22,721 AFY, subject to certain replenishment obligations imposed upon the San Antonio Water Company. Dating back to the early 1990s, several studies were performed using varying base periods, varying geologic basin boundaries, and other varying factors that indicated an estimated basin yield between 13,800 AFY and 22,200 AFY[471] in comparison to the allocated rights of 22,271 AFY.[472]

Table 16: Water Rights in Cucamonga Basin Pursuant to the 1958 Decree

Name	Adjudication Allocation (AFY)
San Antonio Water Company	6,500
Alta Loma Mutual Water Company	600
Armstrong Nurseries	200
Banyan Heights Water Company	625
Camslian Water Company	600
Citrus Water Company	450
Cucamonga Water Company	6,500
Cucamonga Development Company	None
Foothill Irrigation Company	1,600
Hedges Well Company	732
Heilman Water Company	None
Hexmosa Water Company	600
Iamosa Water Company	920
Joya Mutual Water Company	390
Old Settlers Water Company	400
Rex Mutual Water Company	600
Charles Snyder	114
Sunset Water Company	400
Upland Water Company	750
Heirs and Devisees of Giovanni Vai	500
Hugh P. Crawford	120
Western Fruit Growers	120
Sapphire Mutual Water Company	None
G. N. Hamilton Ranch, a partnership	None
Aggregate Stipulated Water	**22,721**

Studies that were conducted resulted in varying estimates of the annual yield of the basin, some of which are lower than the total allocated rights under the 1958 Decree.[473] A 2007

report indicated that because the geologic boundaries of the basin are larger than the adjudicated area, the safe yield of the basin is likely less than the total allocated rights under the decree.

Overdraft was not clearly defined in this judgment, but numerous documents outline the state of groundwater levels in the basin. The Metropolitan Water District states that water levels in key wells have decreased about 120 feet and the basin is experiencing "long-term decline." However, CVWD points to production data that also shows water production in the basin can trend substantially below the total allocated rights.[474] The basin is small and known to react quickly to precipitation recharge, and dry periods will show great declines in water levels.

Water Quality

"Groundwater production in the basin is limited as a result of groundwater contamination."[475] Historic agricultural and other uses in the basin resulted in issues with nitrates, total dissolved solids (TDS), perchlorate, and dibromochloropropane (DBCP). High nitrates reported in 14 of 24 wells tested.[476] According to DWR's Bulletin 118, water sampled from 23 public supply wells have shown average TDS concentrations that range from 163 milligrams per liter (mg/L) to 446 mg/L, with an average of 261 mg/L. Low levels of perchlorate have also been found in some wells.[477] Wells that contain concentrations of nitrate and DBCP greater than the maximum contaminant levels are blended by CVWD to reduce the concentrations to levels that meet applicable drinking water standards.[478]

Discussion

No Watermaster or reporting requirements were outlined in the 1958 decree, and there is currently no Watermaster or annual reports. The 1958 Decree contains provisions for the metering and recording of water production and replenishment, inspection of records, prohibitions against new water production, and potential reductions in water production, but this information is not yet updated or readily available.

In lieu of a Watermaster, the basin is jointly managed by CVWD, SAWC, and WECWC (the primary water producers and right holders in the basin) pursuant to the 1958 Decree and the continuing jurisdiction of the Superior Court. Urban water management planning functions are also undertaken by CVWD, SAWC, WECWC, and the City of Upland. In addition, the Chino Basin Watermaster provides CASGEM reporting for the basin. Management indicates that joint efforts are currently under way to perform hydrologic investigations, update the safe yield of the basin, develop additional management strategies, and modernize the provisions of the 1958 Decree.

Studies differ on the basin's condition. A 2007 report indicated that because the geologic boundaries of the basin are larger than the adjudicated area, the safe yield of the basin is likely less than the total allocated rights under the decree. Moreover, water levels in key wells have decreased about 120 feet, and the basin is experiencing long-term decline. However, current management indicates that their data also show that water production in the basin can trend substantially below the total allocated rights.

Groundwater production in the basin is limited as a result of groundwater contamination.

CUCAMONGA BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino Area: 9,530 acres; 15 sq. mi. Physical Characteristics: Upper Aquifer, Lower Aquifer Precipitation: 18″–32″ per year CASGEM: Medium Land Use: The area used to be agricultural, with peak production in the 1940s. The area has seen rapid urbanization in the past few decades. Reason for Adjudication: The San Antonio Water Company (plaintiff) filed an action in Superior Court to determine the water rights of all water users in the Cucamonga Basin and to facilitate annexation to the Metropolitan Water District of Southern California to enable the importation of State Water Project water.	Adjudication Initiated: 1958 Finalized: 1958 Decree Summary: The 1958 Decree allocated surface and groundwater rights among the 25 parties that were producing water in the basin at that time, along with the right to divert water from Cucamonga Creek subject to certain replenishment obligations imposed upon the San Antonio Water Company. It also required the spreading of imported water to recharge the basin. Parties are allowed to export water from the basin under certain circumstances and to transfer and sell water rights as specified. Water rights totaled approximately 22,721 AFY. The decree contains some provisions for the metering and recording of water production, inspection of records, prohibitions against new water production, and potential reductions in water production. Today, the adjudicated water rights in the Cucamonga Basin are allocated to only three producers: West End Consolidated Water Company (WECWC), San Antonio Water Company (SAWC), and Cucamonga Valley Water District (CVWD). WECWC and some of the SAWC rights are currently pumped by the City of Upland.	Watermaster: The court did not appoint an official Watermaster for the basin and did not require annual reporting. The Cucamonga Basin is jointly managed by CVWD, SAWC, and WECWC, the primary water producers and right holders in the basin, pursuant to the 1958 Decree and the continuing jurisdiction of the Superior Court. Strategies: These include Imported water, spreading basins, and additional hydrologic investigations.	Safe Yield Adjudicated: Undefined Current: 13,800 AFY – 22,200 AFY (estimated) Summary: Dating back to the early 1990s, several studies were performed using varying base periods, varying geologic basin boundaries, and other varying factors that indicated an estimated basin yield between 13,800 AFY and 22,200 AFY in comparison to the allocated rights of 22,271 AFY. Extractions Summary: Current extractions are unknown because there is no comprehensive annual monitoring program in place to measure groundwater use. Groundwater Levels: The Metropolitan Water District states that water levels in key wells have decreased about 120 feet, and the basin is experiencing “long-term decline.” Basin managers indicate there are production data that also show that water production in the basin can trend below the total allocated rights. Overdraft: Overdraft conditions are unknown because there has been no clear evaluation of safe yield, and there is no comprehensive program for measuring annual groundwater use. Water Quality: Groundwater production in the basin is limited due to groundwater contamination with nitrates, total dissolved solids, perchlorate, and dibromochloropropane. Discussion: **- No Watermaster or reporting requirements were outlined in the 1958 decree, and there is currently no Watermaster or annual reports.** **- In lieu of a Watermaster, the basin is jointly managed by CVWD, SAWC, and WECWC, the primary water producers and right holders in the basin, pursuant to the 1958 Decree and the continuing jurisdiction of the Superior Court.** **- Studies differ on the basin’s condition.** **- Groundwater production in the basin is limited as a result of groundwater contamination.**

RIALTO COLTON BASIN

The Rialto Colton Basin was adjudicated shortly after the San Jacinto Basin with the Rialto Decree of 1961. The Rialto Decree only clarified water rights for appropriators, and these rights were unlimited if water levels in wells were above a certain required elevation. The basin was also adjudicated as part of the Western Judgment in 1969 (See Colton Basin adjudication). This adjudication was to ensure that entities who diverted water above Riverside Narrows on the Santa Ana River, including groundwater users in the Rialto Colton Basin, would provide required surface and groundwater flows below the Narrows that were required by the Orange County Judgment. The Western Judgment of 1969 for the Rialto Colton Basin did not reference the Rialto Decree of 1961.

Overview

County	San Bernardino, Riverside
Area	47.2 square miles / 30,224 acres[479]
Population	145,832[480]
CASGEM	Medium (Rialto-Colton)[481]
Watermaster	Western-San Bernardino Watermaster
Members	Fontana Water Company, City of Rialto, City of Colton, and West Valley Water District (**Rialto Decree**)[482] Western Municipal Water District and San Bernardino Valley Municipal Water District (**Western Judgment**)
Court Cases	*Lytle Creek Water & Improvement Company v. Fontana Ranchos Water Company, et al.* (81264)[483] (**Rialto Decree**) *Western Municipal Water District of Riverside County v. East San Bernardino County Water District, et al.* (78426) (**Western Judgment**)

CASGEM = California Statewide Groundwater Elevation Monitoring

The Rialto-Colton Basin (called the Colton Basin in the 1969 Western Judgment) was adjudicated in the Rialto Decree of 1961. It was also one of three basins adjudicated under the Western Judgment in 1969, along with the San Bernardino Basin Area (SBBA) and the Riverside Basin Area (RBA). Although the Western Judgment was a single court case, the three basins were provided with quite different requirements and are considered separate adjudications in the Sustainable Groundwater Management Act of 2014.

The Rialto-Colton Basin underlies a portion of the upper Santa Ana Valley in southwestern San Bernardino County and northwestern Riverside County. It is bounded by the San Gabriel Mountains in the northwest, the San Jacinto fault in the northeast, the Badlands in the southeast, and the Rialto-Colton fault in the southwest. The basin generally drains to the southeast toward the Santa Ana River that cuts across the southeastern part of the basin and flows to the Pacific Ocean through Riverside and Orange Counties. Warm and Lytle Creeks join near the southeastern boundary of the basin and flow to meet the Santa Ana River.[484] Groundwater in the basin is mostly unconfined and semi-unconfined in alluvial deposits. There is quick recharge and rapidly changing water levels in the northern part of the basin, fluctuating 40 feet or more, and slow recharge and stable water levels in the southern part of the basin, fluctuating only around 10 feet.[485] Main recharge areas are Lytle Creek, Reche

Canyon, and the Santa Ana River. There are also spreading basins for groundwater recharge in the area.[486] Average annual precipitation is 16.45 inches.[487]

Groundwater from the Rialto-Colton Basin provides a large portion of water for users in the region, and historically the area relied exclusively on natural groundwater.[488] The area is in the center of the Inland Empire, one of the fastest-growing areas in the nation, and land use is changing from agricultural to municipal and industrial. The population of the City of Rialto grew from 3,156 in 1950 to over 99,767 in 2008.[489]

Reason for Adjudication

The Rialto Colton Basin was adjudicated in the Rialto Decree of 1961 and again in the Western Judgment in 1969 (see Colton Basin Review for new requirements under the Western Judgment). The Rialto Decree adjudication was brought forward by the Lytle Creek Water and Improvement Company against Fontana Ranchos Water Company. Other water users included were Fontana Union Water Company, City of Rialto, City of Colton, and West Valley Water District.[490]

Decree

Adjudication initiated: Unknown
Adjudication finalized: December 22, 1961 (Rialto Decree)
Revisions or amendments: April 17, 1969 (Western Judgment)
Costs: NA

Decree Summary

Rialto Decree: This judgment quantified rights of stipulating parties who were appropriators, but did not quantify rights for non-stipulating parties who were overlyers. Sale and transfer of groundwater was authorized under the judgment, but any such right remains limited to restrictions outlined in the judgment. Pumping was based on levels in three index wells that were used to measure groundwater. If average elevation of spring water levels was above 1002.3 mean sea level (MSL), each stipulating party could pump in unlimited amounts. Between 1003.3 and 969.7, each stipulating party was only allowed to extract their stipulated amount. Below 969.7, each stipulating party was allowed extractions reduced by 1 percent for every foot below 969.7, to a maximum of 50 percent.[491] Extractions were allocated in the following amounts: Colton 3,010 AFY, Rialto 1,580 AFY, Citizens 3,260 AFY, Fontana 550 AFY, and Lytle Creek 3,600 AFY.

Water Users

Stipulated

Rialto Decree: Lytle Creek Water and Improvement Company, Citizens Land and Water Company, Fontana Union Water Company, City of Colton, City of Rialto, and the Semi-Tropic County Water District.[492]

Current

Rialto Decree: The water users for this basin are not listed in the decree. There are no current environmental users in the basin. There are some small pumpers listed in current monitoring data, but only one of these small pumpers is still using water.[493]

Management Structure

Rialto Decree

Well owners were originally responsible for monitoring compliance with the decree, but the San Bernardino Valley Municipal Water District (SBVMWD) conducted monitoring since the early 1990s.[494] The Rialto Decree outlines three index wells to be monitored for water levels during March, April, and May each year. Each well owner is responsible for measuring the water levels in index wells. Substitute wells may be used if three-quarters of the stipulating parties agree in writing. Other stipulating parties may be present during well measurement, if requested.

Management Strategies

Imported Water: The SBVMWD is responsible for groundwater recharge projects in the Rialto-Colton Basin after stipulations put forth in the Western Judgment. They import State Water Project water and replenish the Rialto-Colton Basin, and this water is paid for through property taxes collected in their service area in western San Bernardino County, with the balance collected through payments from other local water agencies.[495]

Spreading Basins: There are two main spreading basins: Linden Ponds and Cactus Basin.[496]

Monitoring and Reporting

It is not clear if monitoring and reporting is required in the Rialto Decree. Annual monitoring and reporting is required in the Western Judgment.

Safe Yield

Natural safe yield and *operating safe yield* were not defined in the Rialto Decree.
The City of Riverside determined the current safe yield for the Rialto-Colton Basin as 17,675 AF (2010).[497]

Groundwater Pumping and Overdraft

Extractions outlined in the Rialto Decree are unlimited if water levels in index wells are above 1002.3 MSL; limited to stipulated amounts[498] if water levels are between 1002.3 MSL and 969.7 MSL; and all parties must reduce their usage by 1 percent for each foot below the minimum water level if groundwater is below 969.7 MSL.[499] Overdraft is not defined for this basin in the Rialto Decree or Western Judgment.

Water Quality

There is extensive perchlorate contamination in basin.[500] Water sampled from 41 public supply wells show an average total dissolved solids (TDS) content of 264 milligrams (mg).[501] Two out of 38 public water-supply wells exceeded the maximum contaminant levels for nitrates, and three wells exceeded the standard for secondary inorganics, volatile organic compounds, and synthetic organic chemicals.[502] The Rialto-Colton Sub-basin contains a groundwater contaminant plume called the *Rialto Plume.*[503]

Disputes

A lawsuit was filed in 2013 by two cities and two water districts (SBVMWD, WVWD, City of Rialto, and City of Colton) against the San Gabriel Valley Water Company, which does

business under the name Fontana Water Company, alleging that this company was illegally extracting more than twice the amount of allocated water from the Rialto-Colton Basin.[504]

Discussion

There was no Watermaster in the Rialto Decree and monitoring, and reporting did not appear to occur under the Rialto Decree. There is a Watermaster for the Western Judgment, and the judgment does require monitoring of the Rialto-Colton Basin.

In the Rialto Decree of 1961, water rights are unlimited for appropriators if minimum water levels are met, but reductions are required if they are not met.

There is a lack of data regarding extractions under the Rialto Decree of 1961, but information about extractions is clearer under the Western Judgment of 1969.

RIALTO COLTON BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino, Riverside Area: 30,224 acres; 47.2 sq. mi Precipitation: 10”–14” per year CASGEM: Medium (Rialto-Colton) Land Use: Land use is changing from agricultural to municipal and industrial. Groundwater from the Rialto-Colton Basin provides a large portion of water for users in the region, and historically the area relied exclusively on natural groundwater. Reason for adjudication: Lytle Creek Water and Improvement Company brought this adjudication forward against Fontana Ranchos Water Company. Other water users included were the Fontana Union Water Company, City of Rialto, City of Colton, and West Valley Water District.	Adjudication Initiated: Unknown Adjudication Finalized: December 22, 1961 Decree Summary: This judgment quantified rights of stipulating parties who were appropriators, but did not quantify rights for non-stipulating parties who were overlyers. Sale and transfer of groundwater was authorized under the judgment, but any such right remains limited to restrictions outlined in the judgment. Extractions are unlimited if water levels in index wells are above 1002.3 MSL, but limited to stipulated amounts if water levels are between 1002.3 MSL and 969.7 MSL. If groundwater is below 969.7 MSL, all parties must reduce their usage by 1 percent for each foot below the minimum water level.	Watermaster: Well owners were originally responsible for monitoring compliance with the decree. Strategies: SBVMWD has conducted monitoring since the early 1990s. The Rialto Decree outlines three index wells to be monitored for water levels during March, April, and May each year. Each well owner is responsible for measuring the water levels in the index wells. Substitute wells may be used if three-quarters of the stipulating parties agree in writing. Other stipulating parties may be present during well measurement, if requested.	Safe Yield Adjudicated: Undefined Current: 17,675 AFY (2010) Summary: Safe yield for the Rialto-Colton basin was not required in the 1966 Rialto Decree. The City of Riverside determined the safe yield for the Rialto-Colton Basin as 17,675 AFY in 2010. Current Extractions: Unknown Extractions Summary: Extraction data are missing for the Rialto Decree. Groundwater Levels: To date, storage levels have fluctuated up and down with the hydrology and do not show a continuous trend downward. Overdraft: Overdraft is not defined for this basin in the Rialto Decree. Water Quality: There is extensive perchlorate contamination in basin. Discussion: - **There was no Watermaster in the Rialto Decree, and monitoring and reporting did not appear to occur under the Rialto Decree.** **- In the Rialto Decree of 1961, water rights are unlimited for appropriators if minimum water levels are met, but reductions are required if they are not met.** **- There are a lack of data regarding extractions under the Rialto Decree of 1961.**

RIVERSIDE BASIN AREA

The Western Judgment resolved how entities that diverted water above Riverside Narrows (Riverside and San Bernardino interests) would ensure that base flows required by the Orange County Judgment would be available for downstream interests. The Western Judgment, although a single decree, involved separate adjudications for three areas—the Colton Basin Area (CBA), the Riverside Basin Area (RBA), and the San Bernardino Basin Area (SBBA)—as these were thought to have surface and groundwater interconnections that would affect minimum flow requirements at Riverside Narrows. The adjudication of the three areas was also to determine groundwater extraction rights of the responsible parties and provide for the replenishment of the basins above Riverside Narrows.

Groundwater rights for the downstream CBA and the RBA under this adjudication were determined based upon a review of pumping values up to 1969 that had never resulted in an overdraft condition. Pumping limits are based on the average index water levels in three wells. The two index wells that are located in Riverside Basin Area are experiencing dropping water levels. A Watermaster assigned by the court performs an annual accounting of water use and publishes annual reports that are available online. Riverside County is highly urbanized and is the fourth-most populous county in California and the tenth-most populous in the nation.

Overview

County	San Bernardino, Riverside
Area	92 square miles / 58,903 acres[505]
Population	336,884[506]
CASGEM	High (Riverside-Arlington)
Watermaster	Western-San Bernardino Watermaster
Members	Western Municipal Water District (WMWD) and San Bernardino Valley Municipal Water District (SBVMWD)
Court Cases	*Western Municipal Water District of Riverside County v. East San Bernardino County Water District et al.* (78426) (Western Judgment)

CASGEM = California Statewide Groundwater Elevation Monitoring

The Western Judgment resulted from a single court case, but the management approach for the upstream SBBA is focused on groundwater pumping, while the management approach for the downstream CBA and the RBA is focused on groundwater levels.

The RBA does not have any groundwater obstructions or barriers, but is divided at the county line into Riverside North and South Sub-basins for administrative purposes.[507] The Riverside North Sub-basin is the portion in San Bernardino County within the San Bernardino Valley Municipal Water District, and the Riverside South Basin is in Riverside County within the service area of the Western Municipal Water District (WMWD).[508] The Rialto-Colton Basin is located to the north, the Bunker Hill Basin is located to the east, the Arlington Basin is located to the south, and the Chino Basin is located to the west. The Riverside Basin follows the course of the Santa Ana River. It has alluvial deposits of sand, gravel, silt, and clay, and groundwater is unconfined. Depth to groundwater ranges from 600 to 700 feet in the north

basin and to 400 feet in the south basin. Total groundwater storage is estimated at 1.15 million acre-feet (MAF). Average annual precipitation is 9.6 inches. Recharge to the groundwater basin is largely from mountain runoff via the Santa Ana River, underflow from surrounding basins, and some from direct precipitation.[509]

The RBA includes the community of Riverside, which was founded as Jurupa in 1870.[510] Orange production was prevalent in the area in the late 1800s.[511] The area used to be primarily agricultural but has gradually become more commercial and urban, with a significant population increase since 1970. Riverside County is the fourth-most populous county in California and the tenth-most populous in the nation.

Reason for Adjudication

The 1969 Western Judgment adjudicated three basins—the CBA (also known as Rialto-Colton Basin), RBA, and SBBA (with Lytle and Bunker Hill Basins)—as each of these three basin areas were thought to have surface and groundwater connections that could impact the minimum flows at Riverside Narrows required by the Orange County Judgment.[512] The flow requirements were that SBVMWD had to ensure a maximum base flow of 15,250 AF at Riverside Narrows, and Colton Basin Municipal Water District (CBMWD) and WMWD had to ensure a maximum base flow of 42,000 AF at Prado Dam.[513] Additionally, exporters in downstream Riverside County were concerned about the sustainability of groundwater withdrawals, over time. As a result, on March 1, 1963, a suit was filed in the Superior Court of the State of California in and for the County of Riverside (Riverside Court) seeking a general adjudication of water rights within the San Bernardino Area.

Decree and Amendments

Adjudication initiated: March 1, 1963
Adjudication finalized: April 17, 1969
Revisions or amendments: February 28, 1992

Decree Summary

The Western Judgment created a two-person Watermaster committee: the Western San Bernardino Watermaster (with representatives from SBVMWD, who represented the upstream SBBA interests—referred to as *non-plaintiffs* by the Watermaster) and WMWD (who represented the downstream Riverside and Colton interests—referred to as *plaintiffs* by the Watermaster). The Watermaster tracks compliance with the terms of the judgment and reports to the court annually.

Extraction limits in the CBA and RBA are based on groundwater levels. If the established criterion is not being met, recharge is required. Pumping by non-plaintiffs is not limited, as long as the average water level of three index wells (Johnson 1, Flume 2, and Flume 5) remains at, or shallower than, 1963 water levels. These three index wells are the same index wells used for the CBA. If the average water level falls below the required level, then recharge is required, and pumping may be temporarily transferred to the SBBA until water levels return above the threshold.[514]

Plaintiff extractions from the RBA were limited to historical average pumping amounts that had never resulted in overdraft conditions: 21,085 AF. If the plaintiff pumping limits were exceeded, then replenishment was required. If extractions exceeded the annual average, WMWD was required to replenish the groundwater basin, subject to a peaking allowance of

20 percent.[515] Extractions from the RBA for use within San Bernardino Valley were not limited if average water levels in index wells remained above 822.04 mean sea level (MSL).[516] SBVWMD was also required to maintain the water levels in the three index wells, by groundwater recharge or by reduced extractions if water levels fell below the minimum requirement. The adjudication required that water quality had to be maintained in the RBA.[517] Plaintiff exports out of the judgment area were limited to 42,535 AFY and non-plaintiff exports out of the judgment area were limited to 11,701 AFY. If exports exceeded these limits, recharge was required.

General transfers were allowed to change the place and kind of use as long as they upheld the Western Judgment.[518]

Water Users

Stipulated

Plaintiffs are the Western Municipal Water District, City of Riverside, Riverside Highland Water Company, Meeks & Daley Water Company, Agua Mansa, and Regents of University of California Santa Cruz. The defendant is the SBVMWD (currently referred to as the *non-plaintiff).*

Current

Plaintiffs include The Gage Canal Company, City of Riverside, Riverside Highland Water Company, Meeks & Daley Water Company, Agua Mansa, and the Regents of the University of California. The defendant is the SBVMWD.

Other

There are no environmental users allocated in the adjudication. There are some small pumpers allocated in the adjudication. Less than 20 small users were withdrawing 1 AFY from the basin in 2013, in at least one of their wells.[519]

Management Structure

SBVMWD and WMWD are the Watermaster for all three basin areas covered under the Western Judgment.[520] Each district has the right to nominate one person. The Watermaster has to report to the court annually. All Watermaster service costs must be borne by the two districts. SBVMWD and WMWD are responsible for recharge programs with imported SWP water, based on specified conditions. Recharge must include amounts based on extractions and the natural safe yield of groundwater.[521] The current Watermasters are Douglas Headrick from SBVMWD and John Rossi from WMWD.

Although not a requirement of the judgment, a Basin Technical Advisory Committee (BTAC), made up mostly of retail water agencies, meets monthly to collaboratively work on basin management. The BTAC creates a yearly management plan that is approved by SBVMWD and WMWD, the two agencies that represent the Watermaster, and the BTAC tracks the annual plan monthly.[522]

Management Strategies

The RBA, unlike the SBBA, has no recharge facilities. There are no aquifer storage and recovery (ASR) wells and no spreading basins. There are no current groundwater storage programs in the RBA.[523] However, there is a turnout on the State Aqueduct (Santa Ana

Valley Pipeline) just upstream from the Basin Area that could discharge water into the Santa Ana River, thereby recharging the basin through the river bottom. In addition, the City of Riverside, the San Bernardino Valley Municipal Water District and the Western Municipal Water District are presently developing the Riverside North Aquifer Storage and Recovery project that could recharge the basin area with both stormwater and imported water from the State Aqueduct.

Monitoring and Reporting

Annual monitoring and reporting is required in the Western Judgment. The following information must be reported:

- natural safe yield,[524]
- extractions by non-plaintiffs from SBBA,
- extractions by plaintiffs from SBBA,
- annual discharge from the City of San Bernardino wastewater treatment plant,[525]
- average annual extractions from the CBA for use outside San Bernardino Valley,
- average annual extractions from the RBA for use outside San Bernardino Valley,
- average annual extractions from the RBA that is tributary to Riverside Narrows,
- annual amounts of water extracted from the SBBA for use within WMWD that have been exported outside the area tributary to the Riverside Narrows,
- annual amounts of water extracted from the SBBA for use on areas not tributary to the Riverside Narrows and for use on areas within Colton and Riverside Basin areas,
- static water levels in the CBA and RBA's three key wells as determined in the judgement, and
- reduction in return flows contributing to base flows at Riverside Narrows.[526]

The Western San Bernardino Watermaster publishes this information on their website each year. Reports from 1969 to 1971 cover verifications and initial determinations of safe yield of the SBBA and adjusted rights of plaintiffs. Reports from 1972 to the present cover annual accounting.[527]

Safe Yield

Natural safe yield and *safe yield* were defined in the Western Judgment only for the SBBA.[528]

Current Safe Yield: The City of Rialto indicated that the safe yield of Riverside North is 27,200 AFY and Riverside South is 35,100 AFY. Total natural safe yield of the entire basin is estimated at 62,300 AFY.[529]

Groundwater Pumping and Overdraft

Overdraft is not defined for this basin. In 2007, the Metropolitan Water District of Southern California declared that groundwater levels in the Riverside Basin were "stable/decreasing." Specifically, water levels in Riverside North were stable, but water levels in Riverside South had dropped about 30 feet between 1985 and 2004.[530]

In 2013, water levels in Riverside Basin wells were below the required 822.05 MSL (at

820.75 MSL and 812.95 MSL), but including elevations for the Rialto-Colton Basin well at 872.72 MSL brings the average water level elevation for the three wells to 835.89 MSL.[531]

In 2014, water levels in the Riverside Basin wells were below the required 822.05 MSL (at 816.02 MSL and 808.00 MSL), but including elevations for the Rialto-Colton Basin well at 871.02 MSL brings the average water level elevation for the three wells to 831.79 MSL.[532]

Currently, management indicates that water levels in the index wells have fluctuated up and down with the hydrology, with no continuous downward trend.[533]

Water Quality

Due largely to past agricultural practices, the RBA can have higher total dissolved solids (TDS) and nitrate levels in some areas. The RBA also has isolated plumes of trichloroethylene (TCE) and tetrachloroethylene (PCE), perchlorate, and dibromochloropropane. Total dissolved solids levels are generally lower in the northern portion of the basin and increase toward the south. Nitrate concentrations generally increase from north to south. Seven wells have been affected by TCE, and 15 wells have been affected by PCE. Sixteen wells within the Riverside Basin are known to have been impacted by perchlorate.[534] Each of the plumes is currently in the process of being remediated.[535]

Discussion

The Watermaster for the Western Judgment requires annual accounting of the total production from RBA, along with the review of the index wells. Although not required by the judgment, basin management is done collaboratively through the Basin Technical Advisory Committee that is made up mostly of the water agencies within SBVMWD. The management structure is clearly delineated, and reporting is done frequently and systematically.

Although replenishment is not required per the terms of the judgment, water agencies are working together on the Riverside North Aquifer Storage and Recovery project that will provide a means for groundwater recharge.

There are conflicting data about actual safe yield of the basin. Extractions are below the allocated base amount, but the two index wells located in Riverside Basin for groundwater level monitoring were below target water levels in 2013 and 2014; both drought years.

RIVERSIDE BASIN AREA

Overview	Decree: Water Rights and Conditions	Governance	Groundwater Trends
County: San Bernardino, Riverside Area: 92 sq. mi. Physical Characteristics: Riverside North and Riverside South Sub-basins Precipitation: 9.6" per year CASGEM: High (Riverside-Arlington) Land Use: Once covered in citrus groves, Riverside County is now highly urbanized—the fourth-most populous county in California, and the tenth-most populous in the nation. Reason for Adjudication: The 1969 Western Judgment adjudicated three basins: Colton Basin Area (CBA), Riverside Basin Area (RBA), and San Bernardino Basin Area (SBBA), as each of these basin areas were thought to have surface and groundwater connections that could impact the minimum flows at Riverside Narrows required by the Orange County Judgment. Additionally, exporters in downstream Riverside County were concerned about increasing groundwater withdrawals, over time.	Adjudication Initiated: March 1, 1963 Adjudication Finalized: April 17, 1969 Amended: February 28, 1992 Decree Summary: The judgment provided the plaintiffs with extraction limits and provided the non-plaintiffs with unlimited extractions, provided that certain criteria were met. For the SBBA, Criteria were based on groundwater extractions, and for CBA and RBA criteria were based on groundwater levels. Pumping by non-plaintiffs is not limited as long as the average water level of three index wells remains at, or shallower than, 1963 water levels. If the average water level falls below the required level, recharge is required. Plaintiff extractions from the RBA are limited to historical average pumping amounts that had never resulted in overdraft conditions: 21,085 AF. If the plaintiff pumping limits are exceeded, then replenishment is required.	Watermaster: Western-San Bernardino Water Master Members: Western Municipal Water District and the San Bernardino Valley Municipal Water District The Watermaster requires annual accounting of the total production from RBA, along with the review of the index wells. Strategies: The RBA, unlike the SBBA, has no recharge facilities. There are no ASR wells and no spreading basins. Currently, there are no groundwater storage programs in the Riverside Basin. The City of Riverside, the San Bernardino Valley Municipal Water District, and the Western Municipal Water District are presently developing the Riverside North Aquifer Storage and Recovery project that could recharge the basin area with both stormwater and imported water from the State Aqueduct.	Adjudicated Safe Yield: Undefined Current Safe Yield: 62,300 AFY (estimated) Summary: Safe yield for the Riverside basin was not required in the 1969 Western Judgment, and only required for the SBBA. Extractions for the RBA are based on groundwater levels. Current Extractions: Extractions from Riverside Basin within San Bernardino County for use inside the valley (2013) were at 1,866 AFY. Extractions from Riverside Basin within San Bernardino County for use outside the valley (2013) were at 12,600 AFY. Extractions Summary: Extractions are below the allocated base amount, but the two index wells located in Riverside Basin for groundwater-level monitoring were below target water levels in 2013 and 2014, which were drought years. Groundwater Levels: In 2007, the Metropolitan Water District of Southern California declared that groundwater levels in the Riverside Basin were "stable/decreasing." Currently, management indicates that water levels in the index wells have fluctuated up and down with the hydrology with no continuous downward trend. Overdraft: Overdraft is not defined for this basin. Water Quality: Major groundwater containments in the Riverside basin include total dissolved solids, nitrate, volatile organic compounds, perchlorate, and dibromochloropropane. Discussion: **- Although not required by the judgment, basin management is done through the Basin Technical Advisory Committee primarily made up of the water agencies within SBVMWD. Reporting is done frequently and systematically.** **- Water agencies are working together on the Riverside North Aquifer Storage and Recovery project that will provide a means for groundwater recharge.** **- There are conflicting data about the safe yield of the basin. Extractions are below the allocated base amount, but two index wells located in Riverside Basin for groundwater level monitoring were below target water levels in 2013 and 2014, which were drought years.**

COLTON BASIN AREA

The Western Judgment resolved how entities that diverted water above Riverside Narrows (Riverside and San Bernardino interests) would ensure that base flows required by the Orange County Judgment would be available for downstream interests. The Western Judgment, although a single decree, involved separate adjudications for three areas—the Colton Basin Area (CBA), the Riverside Basin Area (RBA), and the San Bernardino Basin Area (SBBA)—as these were thought to have surface and groundwater interconnections that would affect minimum flow requirements at Riverside Narrows. The adjudication of the three areas was also to determine groundwater extraction rights of the responsible parties and provide for the replenishment of the basins above Riverside Narrows.

Groundwater extractions for the CBA under the Western Judgment were determined based upon a review of pumping values up to 1969 that had never resulted in an overdraft condition. A Watermaster assigned by the court performs annual accounting of water use and publishes annual reports that are readily available online. The basin had previously been adjudicated in 1961, resulting in the Rialto Decree, which generally established allowable extractions and a method for reducing pumping if water levels dropped below specified levels. The Rialto Decree was subsumed under the Western Judgment.

Overview

County	San Bernardino, Riverside
Area	47.2 square miles / 30,224 acres[536]
Population	145,832[537]
CASGEM	Medium (Rialto-Colton)[538]
Watermaster	Western-San Bernardino Watermaster
Members	Fontana Water Company, City of Rialto, City of Colton, West Valley Water District (**Rialto Decree**)[539] Western Municipal Water District, San Bernardino Valley Municipal Water District (**Western Judgment**)
Court Cases	**Rialto Decree:** *Lytle Creek Water & Improvement Company v. Fontana Ranchos Water Company et al.* (81264)[540] **Western Judgment:** *Western Municipal Water District of Riverside County v. East San Bernardino County Water District et al.* (78426)

CASGEM = California Statewide Groundwater Elevation Monitoring

The Rialto Decree resulted from the 1961 adjudication of the Rialto Basin (referred to as the Colton Basin Area in the Western Judgment). It generally establishes specific pumping rights and a method for reducing pumping levels if water levels drop below specified levels. **The Western Judgment** resulted from a single court case, but the management approach for the SBBA focused on groundwater pumping, while the management approach for the CBA and the RBA focused on groundwater levels.

The CBA underlies a portion of the upper Santa Ana Valley in southwestern San Bernardino County and northwestern Riverside County. It is bounded by the San Gabriel Mountains in

the northwest, the San Jacinto fault in the northeast, the Badlands in the southeast, and the Rialto-Colton fault in the southwest. The basin generally drains to the southeast toward the Santa Ana River that cuts across the southeastern part of the basin and flows to the Pacific Ocean through Riverside and Orange Counties. Warm and Lytle creeks join near the southeastern boundary of the basin and flow to meet the Santa Ana River.[541] Groundwater in the basin is mostly unconfined and semi-unconfined in alluvial deposits. Groundwater flow is from the foothills in the northern part of the basin to the southern part of the basin that includes the Santa Ana River.[542] Main recharge areas are Lytle Creek, Reche Canyon, and the Santa Ana River.[543] Spreading basins being developed for groundwater recharge in the area.[544] Average annual precipitation is 16.45 inches.[545]

Groundwater from the CBA provides a large portion of water for the overlying users.[546] The area is in the center of the Inland Empire, one of the fastest-growing areas in the nation. Land use continues to change from agricultural to municipal and industrial.

Reason for Adjudication

The 1961 Rialto adjudication was the result of a suit by the Lytle Creek Water and Improvement Company against Fontana Ranchos Water Company. Other water users included were Fontana Union Water Company, the City of Rialto, the City of Colton, and the West Valley Water District.[547]

The 1969, Western Judgment adjudicated three basins—CBA (also known as Rialto-Colton Basin), RBA, and SBBA (with Lytle and Bunker Hill Basins) —as each of these three basin areas were thought to have surface and groundwater connections that could impact the minimum flows at Riverside Narrows required by the Orange County Judgment.[548] The flow requirements were that San Bernardino Valley Municipal Water District (SBVMWD) had to ensure a maximum base flow of 15,250 AF at Riverside Narrows, and Colton Basin Municipal Water district (CBMWD) and Western Municipal Water District (WMWD) had to ensure a maximum base flow of 42,000 AF at Prado Dam.[549] Additionally, exporters in downstream Riverside County were concerned about the sustainability of groundwater withdrawals over time. As a result, on March 1, 1963, a suit was filed in the Superior Court of the State of California in and for the County of Riverside (Riverside Court) seeking a general adjudication of water rights within the San Bernardino Area.

Decree and Amendments

Adjudication initiated: Unknown
Adjudication finalized: December 22, 1961 (**Rialto Decree**); April 17, 1969 (**Western Judgment**)
Revisions or amendments: various

Decree Summary

Under the Rialto Decree, the pumping rights in the Rialto Basin were established for the City of Colton, the City of Rialto, West Valley Water District, and Fontana Union Water Company. Generally, the decree established a self-correcting plan for maintaining water levels in the basin by allowing unlimited extraction during wet years, capped extractions during normal years, and reduced extractions during dry years, as determined by the highest average water level of three index wells (Well #4, Plant No. 11, and Plant No. 16), which are measured during the spring (spring high-water level). The Rialto Decree adjusted pumping amounts in the Rialto Basin based on the spring high water level:

- When the spring high-water level is above 1002.3 mean se level (MSL), there is no pumping limit.
- When the spring high-water level is between 1002.3 and 969.7 MSL, then pumping limits are fixed for each party.
- When the spring high-water level is below 969.7 MSL, then pumping is reduced by 1 percent for each foot below 969.7 MSL, up to a cumulative reduction of 50 percent.[550]

Applicable pumping limits are: Colton 3,010 AFY, Rialto 1,580 AFY, Citizens 3,260 AFY, Fontana 550 AFY, and Lytle Creek 3,600 AFY.[551]

The Western Judgment. The Western Judgment created a two-person Watermaster committee: the Western San Bernardino Watermaster (with representatives from SBVMWD, who represented the upstream SBBA interests—referred to as the *plaintiffs* by the current Watermaster), and WMWD (who represented the downstream Riverside and Colton interests—referred to as the *non-plaintiffs* by the current Watermaster). The Watermaster tracks compliance with the terms of the judgment and reports to the court annually.

Extraction limits in the CBA and RBA are based on groundwater levels. If the established criterion is not being met, recharge is required. The adjudication does not provide specific pumping limits by well, and it is often described as an adjudication "in gross." This eliminates the administrative burden of tracking each individual well.

Plaintiff extractions from the CBA are limited to historical average pumping amounts that had never resulted in overdraft conditions: 3,381 AF. If the plaintiff pumping limits are exceeded, then replenishment is required. Plaintiff extractions for use outside the San Bernardino Valley were limited in any five-year period to five times the annual extraction of 3,349 AFY. If extractions exceeded the annual average, WMWD was required to replenish the groundwater basin, subject to a peaking allowance of 20 percent.[552] Extractions from the CBA for use within San Bernardino Valley were not limited if average water levels in index wells remain above 822.04 MSL.[553] Extractions by plaintiffs from the Rialto-Colton Basin could be transferred to the SBBA if water levels of 822.04 MSL were not maintained, and SBVMWD was required to replenish the basin for extractions that were transferred.[554] Other general transfers were allowed to change the place and kind of use as long as they upheld the judgment.[555] SBVWMD was also required to maintain the water levels in the three index wells, and recharge the Colton Basin with imported water or reduce their extractions if water levels fell below the minimum requirement. The adjudication required that water quality must be maintained in the Colton Basin.[556]

Pumping by non-plaintiffs is not limited as long as the average water level of three index wells (Johnson 1, Flume 2, and Flume 5) remains at, or shallower, than 1963 water levels. These three index wells are the same index wells used for the Riverside Basin Area. If the average water level falls below the required level, then recharge is required, and pumping may be temporarily transferred to the SBBA until water levels return above the threshold.

Exports

Plaintiff exports out of the judgment area are limited to 42,535 AFY, and non-plaintiff

exports out of the judgment area are limited to 11,701 AFY. If exports exceed these limits, recharge is required.

Water Users

Stipulated

Rialto Decree: Lytle Creek Water and Improvement Company, Citizens Land and Water Company, Fontana Union Water Company, City of Colton, City of Rialto, and Semi-Tropic County Water District.[557]

Western Judgment: WMWD, City of Riverside, The Gage Canal Company, Aqua Mensa Company, Meeks & Daley Water Company, Riverside Highland Water Company, Regents of University of California (referred to as the *plaintiffs* by the current Watermaster), and SBVMWD (referred to as the *non-plaintiffs* by the current Watermaster).[558]

Current

Rialto Decree: City of Colton, City of Rialto, West Valley Water District, and Fontana Union Water Company

Western Judgment: City of Colton, Fontana Union Water Company, Geo G. Hayes, La Sierra Water Company, Alfred H. Ledig, Meeks & Daley Water Company, Erik Melchiorre, Montecito Memorial Park, John A. Patterson, Perry and Sons, Reche Canyon Municipal Water Company, City of Rialto, Riverside Highland Water Company, City of Riverside, San Gabriel Valley Water Company, Sequoia Country Club, Southern California Edison, John Taylor, Villelli Enterprises, and West Valley Water District[559]

Other

There are no current environmental users in the basin. There are some small pumpers listed in current monitoring data, but only one of these small pumpers is still using water.[560]

Management Structure

SBVMWD and WMWD are the Watermaster for all three basin areas covered under the Western Judgment.[561] Each district has the right to nominate one person. The Watermaster has to report to the court annually. All Watermaster service costs must be borne by the two districts. SBVMWD and WMWD are responsible for recharge programs with imported state water, based on specified conditions. The current Watermasters are Douglas Headrick from SBVMWD and John Rossi from WMWD.

Although not a requirement of the judgment, a Basin Technical Advisory Committee (BTAC), made up mostly of retail water agencies, meets monthly to collaboratively work on basin management. The BTAC creates a yearly management plan which is approved by SBVMWD and WMWD, the two agencies that represent the Watermaster, and the BTAC tracks the annual plan monthly.[562]

Ongoing Management Strategies

Imported Water: SBVMWD is responsible for groundwater recharge in the Rialto-Colton Basin after stipulations put forth in the Western Judgment.

Spreading Basins: The primary recharge locations are the Lytle Creek wash and the proposed

Cactus Basins, which are scheduled for construction.[563]

Monitoring and Reporting

Well owners originally performed the monitoring for the basin. Currently, SBVMWD performs the monitoring and has since the early 1990s.[564] Annual monitoring and reporting is required in the Western Judgment. The following information must be reported:

- natural safe yield,
- extractions by non-plaintiffs from SBBA,
- extractions by plaintiffs from SBBA,
- annual discharge from the City of San Bernardino wastewater treatment plant,
- average annual extractions from the CBA for use outside San Bernardino Valley,
- average annual extractions from the RBA for use outside San Bernardino Valley,
- average annual extractions from the RBA which is tributary to Riverside Narrows,
- annual amounts of water extracted from the SBBA for use within WMWD which have been exported outside the area tributary to the Riverside Narrows,
- annual amounts of water extracted from the SBBA for use on areas not tributary to the Riverside Narrows and for use on areas within Colton and Riverside Basin areas,
- static water levels in the CBA and RBA's three key wells as determined in the judgment, and
- reduction in return flows contributing to base flows at Riverside Narrows.[565]

The Western San Bernardino Watermaster publishes this information on their website each year. Reports from 1969 to 1971 cover verifications and initial determinations of safe yield of the SBBA and adjusted rights of plaintiffs. Reports from 1972 to the present cover annual accounting.[566]

Safe Yield

Natural safe yield and *operating safe yield* were not defined in the Rialto Decree and only defined in the Western Judgment for SBBA. The City of Riverside determined the safe yield for the Rialto-Colton Basin as 17,675 (2010).[567]

Groundwater Pumping and Overdraft

Overdraft is not defined for this basin in the Western Judgment. Information is not available about current extractions under the Rialto Decree, but average five-year water use from 1959 to 1963 for Colton Basin was outlined as 17,300 AFY in the Western Judgment. Current water use is about 18,545 AFY, an increase from that original 1959–1963 average water use.[568] Since safe yield was not determined for the CBA in the judgment, the average five-year water use from 1959–1963 of 17,300 AFY was used as the available groundwater supply budget in a recent 2015 report on the basin.[569] Current groundwater use in the CBA is above this available groundwater supply budget. To date, storage levels have fluctuated up and down with the hydrology and do not show a continuous trend downward.[570]

Water Quality

The CBA is largely replenished by mountain runoff, so the water quality is very good

(average total dissolved solids [TDS] of 264 milligrams per liter[571]) with the exception of some isolated contamination plumes that are currently in the process of being remediated and have been largely contained. There is a perchlorate plume in the basin that is in the process of being removed.[572] Only two out of 38 public water-supply wells exceeded the maximum contaminant levels for nitrate, and only three wells exceeded the standard for secondary inorganics, volatile organic compounds, and synthetic organic chemicals.[573]

Disputes

The validity and extent of Fontana Union Water Company's water rights in Lytle Creek Basin, Rialto-Colton Basin, and the area known as "No Man's Land" are disputed, and are the subject of a lawsuit currently pending in the Superior Court for the County of San Bernardino. The suit is entitled *San Bernardino Valley Municipal Water District et al. v. San Gabriel Valley Water Co. et al.,* Case No. CVDS1311085.[574]

Discussion

The combined requirements of the Rialto Decree and the Watermaster require monitoring on an annual basis. The Watermaster for the Western Judgment requires annual accounting of the total production from the CBA and the review of the index wells. The decree requires review of the spring high water level each year. The Watermaster provides this information as required.

Although not required by the decree or the judgment, basin management is done collaboratively through the Basin Technical Advisory Committee that is made up mostly of the water agencies within SBVMWD. Reporting is done frequently and systematically. Although replenishment is not required per the terms of the judgment, water agencies are working together on the Cactus Basin recharge project and other recharge projects.[575]

COLTON BASIN AREA

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino, Riverside Area: 30,224 acres; 47.2 sq. mi. Precipitation: 10”–14” per year CASGEM: Medium (Rialto-Colton) Land Use: Land use is changing from agricultural to municipal and industrial. Reason for adjudication: The 1969 Western Judgment adjudicated three basins: the Colton Basin Area (CBA), Riverside Basin Area (RBA), and San Bernardino Basin Area (SBBA), as each of these basin areas were thought to have surface and groundwater connections that could impact the minimum flows at Riverside Narrows required by the Orange County Judgment. Additionally, exporters in downstream Riverside County were concerned about the sustainability of groundwater withdrawals.	Adjudication Initiated: March 1, 1963 Adjudication Finalized: April 17, 1969 Decree Summary: The Western Judgment adjudicated three separate basin areas: CBA (also known as Rialto Colton), RBA, and the SBBA and outlines groundwater rights for each basin separately. Prior to the Western Judgment, the 1961 Rialto Decree established pumping limits, and these limits are still used, along with the provisions of the Western Judgment. The criteria for groundwater extractions were based on groundwater levels, and extractions were based upon a review of pumping values up to 1969 that had never resulted in an overdraft condition: 3,381 AFY. If the plaintiff’s pumping limits are exceeded, replenishment is required. Plaintiff extractions for use outside the San Bernardino Valley were limited in any five-year period to five times the annual extraction. Extractions for use within San Bernardino Valley were not limited if average water levels in index wells remain above a designated mean sea level. Transfers were allowed to change the place and kind of use as long as they upheld the judgment. SBVWMD was also required to maintain the water levels in the three index wells and recharge the Colton Basin with imported water or reduce their extractions if water levels fell below the minimum requirement. The adjudication required that water quality be maintained in the Colton Basin.	Watermaster: Western-San Bernardino Water Master Members: Western Municipal Water District, San Bernardino Valley Municipal Water District Strategies: Imported water and spreading basins. The Watermaster provides annual reporting.	Adjudicated Safe Yield: Undefined Current Safe Yield: 17,675 AFY (2010) Summary: Natural safe yield and operating safe yield were only defined in the Western Judgment for SBBA. The City of Riverside determined the safe yield for the Rialto-Colton Basin as 17,675 (2010). Current Extractions: Extraction rights under the Rialto Decree are unlimited if water levels in index wells are above 1002.3 MSL and limited to stipulated amounts if water levels are between 1002.3 MSL and 969.7 MSL. If groundwater is below 969.7 MSL, all parties must reduce their usage by 1% for each foot below the minimum water level. Extractions for the Colton Basin were based on groundwater levels and equal to 21,000 AFY (2013) for use inside the valley, and 81 AFY (2013) for use outside the valley. Extractions Summary: Extractions are over the estimated 2010 safe yield. Groundwater Levels: Average five-year water use from 1959 to 1963 for Colton Basin was about 17,300 AFY. Current water use has increased to 18,545 AFY. The average five-year water use from 1959–1963 of 17,300 AFY was used as the available groundwater supply budget in a 2015 report on the basin. Current groundwater use in the Colton Basin is above this available groundwater supply budget. To date, storage levels have fluctuated up and down. The hydrology and management indicates that they do not show a continuous trend downward. Overdraft: Overdraft is not defined for this basin. Water Quality: There is extensive perchlorate contamination in basin. Discussion: **- Monitoring occurs on an annual basis.** **- Although not required by the decree or the judgment, the basin is managed collaboratively through the Basin Technical Advisory Committee that is made up mostly of the water agencies within SBVMWD.** **- Current groundwater use in the Colton Basin is above the available groundwater supply budget, but to date, storage levels have fluctuated up and down with the hydrology, and management indicates that they do not show a continuous trend downward**

SAN BERNARDINO BASIN AREA

The Western Judgment resolved how entities that diverted water above Riverside Narrows (Riverside and San Bernardino interests) would ensure that base flows required by the Orange County Judgment would be available for downstream interests. The Western Judgment, although a single decree, involved separate adjudications for three areas—the Colton Basin Area (CBA), the Riverside Basin Area (CBA), and the San Bernardino Basin Area (SBBA)—as these were thought to have surface and groundwater interconnections that would affect minimum flow requirements at Riverside Narrows. The adjudication of the three areas was also to determine groundwater extraction rights of the responsible parties and provide for the replenishment of the basins above Riverside Narrows.

The SBBA is the largest of the three basin areas and includes the Lytle Creek Basin and the Bunker Hill Basin. Long before this judgment, specific rights in the Lytle Creek Basin were determined by the 1897 McKinley Decree and the 1924 Lytle Creek Judgment, which are still in effect. Groundwater rights for the SBBA under this adjudication were based on the calculated safe yield for the SBBA. A Watermaster assigned by the court performs an annual accounting of water use and publishes annual reports that are available online. The extended drought in 2014 affected storage levels in the SBBA, which were at the lowest point in recorded history. However, basin management states that the SBBA basin could refill in a relatively short time based on models of past climatic conditions. Imported water is envisioned as a primary source of outside water to replenish the judgment area. This could be problematic in the future under climate change conditions.

Overview

County	San Bernardino, Riverside
Area	140.6 square miles / 98,984 acres[576]
Population	383,900[577]
CASGEM	High (Bunker Hill)
Watermaster	Western-San Bernardino Watermaster (SBBA)
Members	Western Municipal Water District, San Bernardino Valley Municipal Water District
Court Cases	*Western Municipal Water District of Riverside County v. East San Bernardino County Water District et al.* (78426) (Western Judgment)

CASGEM = California Statewide Groundwater Elevation Monitoring

The Lytle Creek Water Conservation Association (LCWCA) oversees the management of the Lytle Creek Basin.

The SBBA is the largest of the three basin areas adjudicated under the Western Judgment and upstream of the smaller RBA and CBA. While the judgment resulted from a single court case, the management approach for the SBBA focuses on groundwater pumping while the management approach for the CBA and the RBA focuses on groundwater levels.

The SBBA is bordered on the northwest by the San Gabriel Mountains and Cucamonga fault zone; on the northeast by the San Bernardino Mountains and San Andreas Fault zone; on the

east by the Banning fault and Crafton Hills; and on the south by a low, east-facing escarpment of the San Jacinto fault and the San Timoteo Badlands. The SBBA includes the Lytle Creek Basin and the Bunker Hill Basin. Lytle Creek Basin is one of the major sources for recharge for the Bunker Hill and Colton Basins. The northwestern border of SBBA is delineated by the San Gabriel Mountains, and runoff from the mountains flows southeast through Lytle and Cajon Creeks into the basin. The Lytle Creek Basin is porous, with six subareas, and sediments are permeable with high specific yield. The basin responds quickly to inflows from precipitation and streams, and outflows from groundwater pumping, stream-flow and subsurface outflow.[578] Bunker Hill Basin is the largest basin in the Upper Santa Ana River watershed. It has three water-bearing zones and consists of alluvial materials that underlie the entire valley.[579] Recharge to the Bunker Hill Basin is from run-off infiltration from the San Gabriel and San Bernardino Mountains into the Santa Ana River, Mill Creek, and Lytle Creek. These systems contribute about 50 percent of the total recharge to the basin.[580] Average annual precipitation in the Bunker Hill Basin ranges from 13 inches to 31 inches. The estimated storage capacity of this very large basin area is about 5,000,000 AF.[581]

The area continues to be urbanized, with a relatively small amount of agricultural land converting to municipal and industrial.[582]

Reason for Adjudication

The 1969 Western Judgment adjudicated three basins—CBA, RBA and SBBA—as each of these three basin areas were thought to have surface and groundwater connections that could affect the minimum flows at Riverside Narrows required by the Orange County Judgment.[583] The flow requirements were that San Bernardino Valley Municipal Water District (SBVMWD) had to ensure a maximum base flow of 15,250 AF at Riverside Narrows, and Colton Basin Municipal Water district (CBMWD) and Western Municipal Water District (WMWD) had to ensure a maximum base flow of 42,000 AF at Prado Dam.[584] Additionally, exporters in downstream Riverside County were concerned about the sustainability of groundwater withdrawals, over time. As a result, on March 1, 1963, a suit was filed in the Superior Court of the State of California in and for the County of Riverside (Riverside Court) seeking a general adjudication of water rights within the San Bernardino Area.

Decree and Amendments

Adjudication initiated: March 1, 1963
Adjudication finalized: April 17, 1969
Revisions or amendments: various
Costs: NA

Decree Summary

The Western Judgment created a two-person Watermaster committee: the Western San Bernardino Watermaster (with representatives from SBVMWD, who represented the upstream SBBA interests—referred to as the *non-plaintiffs* by the current Watermaster), and WMWD (who represented the downstream Riverside and Colton interests—referred to as the *plaintiffs* by the current Watermaster). The Watermaster tracks compliance with the terms of the judgment and reports to the court annually.

For the SBBA, the Watermaster provides annual accounting of the plaintiff extractions to ensure they are within limits. For the non-plaintiffs, the Watermaster compares the

cumulative extractions to the cumulative safe yield. In years when the cumulative extractions exceed the cumulative safe yield, replenishment is required, and in years where the cumulative extractions are less than the cumulative safe yield, a "credit" is given. Credits can be used to offset any year(s) when the cumulative extractions are higher than the cumulative safe yield until the credits are gone.[585] The natural safe yield has not changed since the initial determination. Although the non-plaintiffs have never been required to replenish the SBBA, per the terms of the judgment, substantial quantities of water have been recharged since the judgment was executed.

Water extraction limits for plaintiffs were first estimated using the average amount of annual pumping during a five-year period ending in 1963, which was 66,454 AFY. Original extraction rights, per the judgment, for non-plaintiffs equaled 165,407 AFY. Extraction rights were redetermined as described under safe yield. Transfers in the basin are allowed, but are utilized infrequently.[586]

Plaintiff exports out of the judgment area (all three Basin Areas) are limited to 42,535 AFY and non-plaintiff exports are limited to 11,701 AFY. If exports exceed these limits, recharge is required.

Water Users

Stipulated

Plaintiffs included WMWD, City of Riverside, Riverside Highland Water Company, Meeks & Daley Water Company, Agua Mansa, and Regents of the University of California. The defendant, or non-plaintiff, is SBVMWD, acting on behalf of most of the water agencies within its service area.

Current

Plaintiffs include The Gage Canal Company, City of Riverside, Riverside Highland Water Company, Meeks & Daley Water Company, Agua Mansa, and Regents of the University of California. The defendant (referred to as the *non-plaintiff* by the current Watermaster) is SBVMWD, acting on behalf of most of the water agencies within its service area.

Other

There are no environmental users allocated in the adjudication. There are some small pumpers included in the adjudication.[587]

Management Structure

SBVMWD and WMWD are the Watermaster for the three basin areas covered under the Western Judgment.[588] Each district has the right to nominate one person. The Watermaster has to report to the court annually. All Watermaster service costs must be borne by the two districts. SBVMWD and WMWD are responsible for recharge programs with imported state water, based on specified conditions. The current Watermasters are Douglas Headrick from SBVMWD and John Rossi from WMWD.

Although not a requirement of the judgment, a Basin Technical Advisory Committee (BTAC), made up mostly of retail water agencies, meets monthly to collaboratively work on basin management. The BTAC creates a yearly management plan that is approved by the two agencies (SBVMWD and WMWD) that represent the Watermaster, and the BTAC tracks the

annual plan monthly.[589]

Ongoing Management Strategies

Imported Water: Although imported water did not arrive for recharge until 1971,[590] it was on its way while the judgment was being crafted, and was envisioned as the primary source of outside water to replenish the judgment area, when required.[591]

Spreading Basins: Groundwater recharge activities have been implemented in the SBBA since 1912. Recharge rates are high because of the permeable sand and gravel deposits. There are about twelve different spreading basins located mostly at the base of the mountains throughout the entire judgment area, with about nine in the SBBA.[592]

Other: The potential for localized high groundwater conditions and the cleanup of isolated contamination plumes are also being addressed in the SBBA, through basin management. The SBBA can experience high groundwater in the southwest portion of the SBBA (Area of Historic High Groundwater, AHHG). High groundwater, combined with sandy soil, can cause liquefaction during an earthquake. Water levels in the AHHG are tracked monthly by BTAC and are currently deep enough that the liquefaction potential is low. The BTAC has also developed a "dewatering plan" should high groundwater levels return. The isolated contamination plumes are largely a result of the once-thriving defense industry in the area and are largely contained and in the process of being removed.[593]

Monitoring and Reporting

Annual monitoring and reporting is required, and the following information must be reported:

- natural safe yield,[594]
- extractions by non-plaintiffs from SBBA, extractions by plaintiffs from SBBA,
- annual discharge from the City of San Bernardino wastewater treatment plant,[595]
- average annual extractions from the CBA for use outside San Bernardino Valley,
- average annual extractions from the RBA for use outside San Bernardino Valley,
- average annual extractions from the RBA which is tributary to Riverside Narrows,
- annual amounts of water extracted from the SBBA for use within WMWD which have been exported outside the area tributary to the Riverside Narrows,
- annual amounts of water extracted from the SBBA for use on areas not tributary to the Riverside Narrows and for use on areas within Colton and Riverside Basin areas,
- static water levels in the CBA and RBA's three key wells as determined in the judgment, and
- reduction in return flows contributing to base flows at Riverside Narrows.[596]

The Western San Bernardino Watermaster publishes this information on their website each year. Reports from 1969 to 1971 cover verifications and initial determinations of safe yield of the SBBA and adjusted rights of plaintiffs. Reports from 1972 to the present cover annual accounting.[597]

Safe Yield

Natural safe yield: "That portion of the safe yield of the SBBA which could be derived solely

from natural precipitation in the absence of imported water and the return flows therefrom, and without contributions from new conservation."[598]

Cumulative safe yield: "…that maximum average annual amount of water that could be extracted from the surface and subsurface water resources of an area over a period of time sufficiently long to represent or approximate long-time mean climatological conditions... under a particular set of physical conditions or structures as such affect the net recharge to the ground water body...without resulting in long-term progressive lowering of ground water levels."[599]

New conservation water: "any increase in replenishment from natural precipitation which results from operation of works and facilities not now in existence, other than those works installed and operations which may be initiated to offset losses caused by increased flood control channelization."[600] The construction of Seven Oaks Dam, in part for flood control and to capture stormwater flows, resulted in new conservation water that is now available for extraction from SBBA. The Watermaster started adjusting water rights of plaintiffs in 2013 based on this new conservation.[601]

In 1972 the Watermaster redetermined the natural safe yield to be 232,100 AFY. Rights were adjusted accordingly (adjusted rights), and the rights of the plaintiffs and non-plaintiffs were determined to be 64,862 AFY (28 percent) and 167,238 AFY (72 percent), respectively. The rights for the plaintiffs and non-plaintiffs were again recently adjusted to 66,998 AFY and 172,745 AFY, respectively, based on an accumulated safe yield that included the new water available (new conservation) associated with the construction of Seven Oaks Dam.

Groundwater Pumping and Overdraft

Storage level fluctuations are associated with wet and dry periods, and the basin appears to be in balance. Table 17 shows a comparison of allowable extractions to actual extractions by plaintiffs and non-plaintiffs for the period 2010 through 2014 is as follows:

Table 17: A Comparison of Allowable Extractions to Actual Extractions

	Allowable Extractions 2010–2014 (AF)	Actual Extractions 2010–2014 (AF)
Plaintiffs	328,582	295,130
Non-Plaintiffs	847,204	818,277
Total	**1,175,786**	**1,113,407**

Water Quality

The groundwater basins in the Western Judgment are mostly replenished by mountain runoff, so the water quality is very good. The Newmark Groundwater Contamination site underlies approximately eight square miles of land in the northwestern and west-central portions of San Bernardino, California. It covers part of an essential groundwater aquifer for the City of San Bernardino, and the advancing plumes affected more than 25 percent of the municipal water supply. However, in 2013, the U.S. Environmental Protection Agency (EPA) concluded that the cleanup at the Newmark Site is controlled. There are several other isolated contamination plumes that are currently in the process of being removed and have been largely contained.

Disputes

The validity and extent of Fontana Union Water Company's water rights in Lytle Creek Basin, Rialto-Colton Basin, and the area known as "No Man's Land" are disputed and are the subject of a lawsuit currently pending in the Superior Court for the County of San Bernardino. The suite is entitled *San Bernardino Valley Municipal Water District et al. v. San Gabriel Valley Water Co. et al.,* Case No. CVDS1311085.[602]

Drought

In 2014, storage levels in the SBBA were at the lowest point in recorded history. This is believed to be due to the drought being experienced in the region and throughout the state. Through the BTAC, SBVMWD and WMWD indicate that they have put in place plans and tools to prepare for the next drought, including increasing water conservation efforts, developing stormwater capture, conjunctive use, and recycled water projects.

Discussion

The San Bernardino Basin Area has a delineated management structure, and reporting is done frequently and systematically. Although not a requirement of the judgment, the BTAC, made up mostly of retail water agencies, meets monthly to collaboratively work on basin management. The BTAC creates a yearly management plan that is approved by SBVMWD and WMWD, the two agencies that represent the Watermaster, and the BTAC tracks the annual plan monthly.

To avoid future overdraft conditions the judgment established trigger points to manage extractions. Cumulative extractions are compared to the cumulative safe yield. In years when the cumulative extractions exceed the cumulative safe yield, replenishment is required. In years where the cumulative extractions are less than the cumulative safe yield, a "credit" is provided. The credit can be used to offset any year(s) when the cumulative extractions are higher than the cumulative safe yield until the credits are gone.

The extended drought in 2014 affected storage levels in the SBBA, which were at the lowest point in recorded history But basin management states that the SBBA basin could refill in a relatively short time based on models of past climatic conditions. Additionally, as cumulative extractions are compared to the cumulative safe yield, the basin could monitor and respond to changing conditions. Recharge is already occurring in the basin, and management indicates that strategies to cope with future droughts are being developed.

Imported water is envisioned as the primary source of outside water to replenish the judgment area when needed. This could also be problematic in the future under climate change conditions.

SAN BERNARDINO BASIN AREA

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino, Riverside Area: 98,984 acres; 140.6 sq. mi. Physical Characteristics: The San Bernardino Basin Area (SBBA) includes the Lytle Creek Basin and the Bunker Hill Basin. Precipitation: 13″–31″ per year (Bunker Hill) CASGEM: High (Bunker Hill) Land Use: Growing urbanization, with a relatively small amount of agricultural land converting to municipal and industrial. Reason for adjudication: The 1969 Western Judgment adjudicated three basins—Colton Basin Area (CBA) (Rialto-Colton Basin), Riverside Basin Area (RBA), and SBBA (with Lytle and Bunker Hill Basins)—as each of these three basin areas were thought to have surface and groundwater connections that could impact the minimum flows at Riverside Narrows required by the Orange County Judgment. Additionally, exporters in downstream Riverside County were concerned about the sustainability of groundwater withdrawals over time.	Adjudication Initiated: March 1, 1963 Adjudication Finalized: April 17, 1969 Decree Summary: The Western Judgment created a two-person Watermaster committee—the Western San Bernardino Watermaster—with representatives from SBVMWD (who represented the upstream SBBA interests) and WMWD (who represented the downstream Riverside and Colton interests). The Watermaster tracks compliance with the terms of the judgment and reports to the court annually. Water extraction limits were first estimated using the average amount of annual pumping during a five-year period ending in 1963. The Watermaster provides annual accounting of the plaintiff extractions to ensure they are within limits set by the judgment. For the non-plaintiffs, the Watermaster compares the cumulative extractions to the cumulative safe yield. In years when the cumulative extractions exceed the cumulative safe yield, replenishment is required, and in years where the cumulative extractions are less than the cumulative safe yield, a “credit” is given. Exports out of the judgment area are limited, and recharge is required if the limits are exceeded. Transfers in the basin are allowed	Watermaster: SBVMWD and WMWD are the Watermaster for the three basin areas covered under the Western Judgment. Members: Each district has the right to nominate one person. The Watermaster has to report to the court annually. All Watermaster service costs must be borne by the two districts Strategies: Imported water is used for replenishment. Spreading basins are used for recharge.	Adjudicated Safe Yield: Undefined Safe Yield Current: 232,100 AFY Summary: In 1972, the Watermaster redetermined the natural safe yield to be 232,100 AFY. Current Extractions: 1,113,407AF (2010–2014) Extractions Summary: In 1972, the Watermaster redetermined the natural safe yield to be 232,100 AFY. Rights were adjusted (adjusted rights) based on the re-determination of the safe yield. The rights of the plaintiffs and non-plaintiffs were determined to be 64,862 AFY (28%) and 167,238 AFY (72%), respectively. The rights for the plaintiffs and non-plaintiffs were again recently adjusted to 66,998 AFY and 172,745 AFY, respectively, based on an accumulated safe yield that included the new water available (new conservation) associated with the construction of Seven Oaks Dam. Groundwater Levels: Storage level fluctuations are associated with wet and dry periods, and the basin appears to be in balance. Overdraft: Unknown Water Quality: The Newmark Groundwater Contamination site underlies approximately eight square miles of land in the northwestern and west-central portions of San Bernardino, California. In 2013, the EPA concluded that cleanup at the Newmark Site is controlled. There are several other isolated contamination plumes that are in the process of being removed and have been largely contained. Discussion: **- The SBBA has a delineated management structure, and reporting is done frequently and systematically.** **- To avoid future overdraft conditions by SBBA pumpers, the judgment established trigger points to manage extractions.** **- The extended drought in 2014 affected storage levels in the SBBA, which were at the lowest point in recorded history.** **- Imported water is envisioned as the primary source of outside water to replenish the judgment area when needed. This may be problematic in the future as imported water becomes more expensive and less reliable.**

SIX BASINS

Six Basins was a short and relatively uncomplicated adjudication. The adjudication was spurred by producers' shared concerns over decreasing groundwater levels and overdraft, causing land subsidence and increased pump-lifts. The adjudication itself took less than a year to complete and limited further overdraft by ensuring that the operating safe yield is below the safe yield of the basin. The area is almost entirely urbanized, and the plaintiff and defendants accounted for essentially all of the current groundwater production in the basin. All nine producers are represented on the Watermaster board, leading to what appears to be an equitable and cooperative water management strategy with all key pumpers monitored. While water levels fluctuated over time with changes in imported water and pumping allocations, the basin continues to be in a deficit and has maintained its pre-adjudication state of overdraft. The biggest challenges facing the basin are water quality issues in Pomona Basin and decreasing water levels in Upper Claremont Heights Basin.

Overview

County	Eastern Los Angeles and western San Bernardino Counties
Area	Approximately 16 square miles[603]
Population	Approximately 2 million people in the San Gabriel Basin[604]
CASGEM	High
Watermaster	Wildermuth Environmental administers the adjudication through a contract with Six Basins Watermaster Board of Directors[605]
Members	The board is comprised of nine parties representing producers and interests in the basin, including four cities, four water companies, and Pomona College.[606]
Court Cases	*Southern California Water Company v. City of La Verne et al.* Case Number KC029152. Judgment: December 18, 1998

CASGEM = California Statewide Groundwater Elevation Monitoring

The Six Basins are a group of adjacent groundwater basins located just south of the San Gabriel Mountains in eastern Los Angeles and western San Bernardino Counties. They are referred to as a sub-basin of the San Gabriel Valley Groundwater Basin in the Department of Water Resources' (DWR's) Bulletin 118.[607] The basins are bounded on the southwest by the San Jose Hills, on the north by the San Gabriel Mountains, on the south and east by Chino Basin, and on the west by the Main San Gabriel Basin. The individual sub-basins are defined by faults. Due to differences in geologic conditions, groundwater is primarily confined in the four larger basins (Canyon, Upper and Lower Claremont Heights, and Pomona) and unconfined in the two smaller basins (Live Oak and Ganesh). In the larger basins, material is mostly younger alluvium; whereas, the smaller basins are composed of a layer of fine-grained silts and clays. These two areas are managed separately, but by the same Watermaster.[608]

Precipitation from 1985–2004 averaged approximately 23 inches per year and varied throughout the basin. Much of the precipitation in higher elevations falls as snow, yielding the beneficial effects of delayed runoff. The main source of groundwater replenishment to the Six Basins is surface-water runoff from precipitation that falls on the San Gabriel Mountains and recharges at spreading grounds located along the foot of the mountain range—

predominantly at the San Antonio Spreading Grounds. The water supply agencies also use imported surface water from the Metropolitan Water District (MWD) of Southern California for direct uses and for artificial recharge at the spreading grounds.[609]

Primary groundwater pumpers in the Six Basins include a private utility, mutual water companies, and member regional agencies. The former, the Southern California Water Company (renamed the Golden State Water Company in 2005),[610] is a private investor owned public utility in California that is a subsidiary of American States Water Company, an investor-owned utility publicly traded on the New York Stock Exchange.[611] Mutual water companies who pump in the basin include the San Antonio Water Company and the West End Consolidated Water Company. Three Valleys Municipal Water District (TVWMD) and Inland Empire Utilities Agency are member regional agencies that extract water in the basin. The area is primarily urban, and cities overlying the basin include Claremont, La Verne, Pomona, and Northern Upland.[612] In the 1920s Pomona was know as the "Queen of the Citrus Belt," with one of the highest per-capita levels of income in the United States. Today, Pomona is the fifth largest City in Los Angeles County, and about 21.6 percent of the population is living below the federal poverty line.[613]

Reason for Adjudication

Studies by the Pomona Valley Protective Association (PVPA) over a number of years indicated that cumulative overdraft in the basins was 20,000 AFY in each of the five years preceding the adjudication, exceeding the safe yield of the basin. Additionally, the native safe yield was continuously exceeded for two decades. In 1996, parties in the Six Basins began formal negotiations to adjudicate the Six Basins to ensure long-term, sustainable groundwater production through the management of replenishment, pumping, and storage. Historical groundwater production, surface-water spreading, groundwater quality, hydrogeology, and modeling information were reviewed. In the fall of 1998, the parties developed and filed a stipulated agreement with the Superior Court of California for the County of Los Angeles, and on December 18, 1998, a Stipulated Judgment was signed. Southern California Water Company (SCWC) was the plaintiff, and defendants were the cities of La Verne, Claremont, Pomona, and Upland; Pomona College; Pomona Valley Protective Association (PVPA); San Antonio Water Company; Simpson Paper Company; TVMWD; and West End Consolidated Water Company.[614] According to the Six Basins Watermaster technical advisor, the judgment was not precipitated by conflicts between users but by shared concern over decreasing groundwater levels.[615]

Decree and Amendments

Adjudication initiated: September 28, 1998
Adjudication finalized: December 18, 1998
Other significant dates: 2012: Watermaster parties began developing a strategic plan for the Six Basins; this was a voluntary effort not required by the judgment but was precipitated by concern over drought conditions.[616]
Costs: Watermaster expenditures for 2013 = $717,991[617]

Decree Summary

The decree found that the plaintiff and defendants accounted for essentially all of the current groundwater production in the basin. The court defined a natural safe yield, an operating safe yield (OSY), and a safe yield for the basin (discussed in greater details below), as well as a physical solution for meeting the operating safe yield.

The court determined that all parties had prescriptive rights, and as a result all parties' rights were deemed to be of equal priority. The decree limited groundwater pumping within the Four Basins Area. Each year, a party's total allowable production right is the sum of its share of the OSY, carryover rights from the previous year, total recoverable water in storage, transfers from other parties, water produced by an approved special project, and temporary surplus water. Annual overpumping was allowed, but to the extent that any party's total production exceeds its total allowable production, that party is obligated to recharge replacement water in an amount equal to the excess production. In the Two Basins region, production, replenishment, and storage and recovery rights were reserved solely for the City of La Verne and were not subject to any limitations, provided that activities in the Two Basins area did not substantially injure the rights of any other party.[618] Imported water deliveries were allowed for replenishment, and at the time of the decree facilities to spread and store imported water were not yet available.

Producers can export water upon approval, and production from the western edge of Pomona Basin is exported to Main San Gabriel Basin,[619] but groundwater stored and recovered in an ASR program may be produced and exported only in accordance with the terms and conditions of the storage and recovery agreement.[620]

Carry-over rights were allowed up to 25 percent of unused production rights, and these could be carried over to the subsequent operating year, but those rights could be lost if the replenishment is discontinued or curtailed. Each year, the first water produced by the party is the carryover right from the previous year. Any party's base annual production right, and its associated percentage of the OSY, as well as any carryover rights and water stored pursuant to a storage and recovery agreement can be transferred, in whole or in part, among the existing parties or to any other person that becomes a party on either a temporary or permanent basis, with some limitations (i.e., they may not injure other parties and water master approval is required).[621]

Water Users

Stipulated users

Southern California Water Company (plaintiff) filed a complaint against the cities of La Verne, Claremont, Pomona, and Upland; Pomona College; Pomona Valley Protective Association; San Antonio Water Company; Simpson Paper Company; TVMWD; and West End Consolidated Water Company.[622]

Current users

Current users include the above, except for the Simpson Paper Company, and the addition of the Los Angeles County Department of Public Works (LACDPW). The SCWC is now known as Golden State Water Company.

Other users

Minimal producers (those who may produce up to 25 AFY) are not bound by the adjudication. Those who wish to pump more may seek to become a party through a stipulation entered to the Watermaster.[623] Environmental uses are unknown. Given that this is an almost completely urbanized groundwater basin, there are very few other users.[624]

Management Structure

The Watermaster Board of Directors is composed of nine parties representing the stipulated producers in the basin, including Golden State Water Company, City of Pomona, City of Upland, City of La Verne, Pomona College, City of Claremont (with transfers rights to Golden State Water Company), San Antonio Water Company, TVMWD, and PVPA. The Board of Directors rotates positions annually. In addition to the Watermaster, other agencies involved in water management and distribution include LACDPW (who operates the Live Oak spreading grounds) and Pomona Valley Protective Association (who operates the San Antonio and Thompson Creek spreading grounds).[625] The TVMWD also provides drinking water to customers in eastern San Gabriel Valley.[626] The Six Basin Watermaster's primary duties include monitoring replenishment programs, protecting against rising groundwater, reporting and verification programs, determining the operating safe yield, managing storage and recovery agreements, water rights accounting, managing replacement water, water quality remediation, and financial management.[627]

Through 2011, TVMWD administered the adjudication through a contract with the Six Basins Watermaster Board of Directors. The Watermaster currently relies on a consulting firm for most of these duties.

Management Strategies

Imported Water: Water-supply agencies in Six Basins use imported surface water from the MWD for direct uses, as well as for artificial recharge at spreading grounds.

Spreading: Three types of spreading occur in the Six Basins area: replenishment, replacement, and storage and recovery. Replenishment is the spreading of native surface water flows, and these augment the native safe yield. Replacement is the spreading of imported (State Water Project, or SWP) water for parties who pump in excess of their production rights. Storage and recovery water is subject to the terms of an agreement made with the Watermaster. There are five spreading basins in the Six Basins area that replenish groundwater: San Antonio, Thompson Creek, Pedley, Live Oak, and Pomona.[628] Since the adjudication, total annual spreading in the Six Basins has ranged from a minimum of 254.1 AFY to a maximum of 31,676.5 AFY, and has averaged 4,480.2 AFY. In 2013, 521.6 AF was spread in the Six Basins (all in the Four Basin area).[629]

Conjunctive Use: The MWD implemented two conjunctive use programs in Live Oak and Upper Claremont Heights. The Live Oak project allows storage of up to 3,000 AF of water, and MWD can recover 1,000 AFY of this water. The Upper Claremont Heights project, initiated by TVMWD and MWD in 2005, stores up to 3,000 AF.[630]

Monitoring and Reporting

The Watermaster collects monthly meter reads and production data from each party for all active production wells in the Six Basins. PVPA can curtail replenishment when the index water level is at 1455 above mean sea level (MSL) or higher. For the adjudication, the parties all joined to review prior reports and studies and estimates for the technical foundation of the judgment. The PVPA conducted and continues to conduct technical studies of the Six Basins and develop groundwater models.[631] The Watermaster obtains precipitation data from the Army Corps of Engineers.[632]

Safe Yield

Adjudication definitions are as follows:
Safe yield: The amount of groundwater, including replenishment water and return flows from imported water that can be reasonably produced from Six Basins on an annual basis without causing an undesirable result. This number was determined to be 19,300 AFY.[633]

Operating safe yield (OSY): The OSY is the amount of groundwater the Watermaster determines can be produced from the basin by parties during any single year, free of replacement obligation under the physical solution. The OSY varies from year to year. When groundwater levels are high (demonstrated by cienegas and springs in the Four Basins area), withdrawals are higher to avoid rising water levels. When groundwater levels are low, as in the current drought, parties cannot pump to the safe yield, as levels in wells are too low. The estimate of OSY in 1998 was 24,000 AF. In 2005, this number dropped to 18,000 AF, and in 2013 it dropped to 16,500 AF.[634] The need for the lower OSY is to prevent the accumulation of stored water credits, which would lead to overpumping.

Native safe yield: The native safe yield is the amount of native groundwater that can be extracted from Six Basins without causing an undesirable result and without accounting for replenishment water. The adjudication recognized that the native safe yield had been augmented through spreading activities conducted by PVPA, Pomona, and La Verne, and return flows from water imported to the area through TVMWD. Because of this, there was no precise estimate of the native safe yield. However, the belief that augmentation would be available allowed the amount of allocated groundwater to be substantially more than the native safe yield.[635]

Groundwater Pumping and Overdraft

Past studies by PVPA indicated that cumulative overdraft in the basins was 20,000 AFY in each of the five years preceding the adjudication, exceeding the safe yield of the basin. Additionally, the native safe yield was continuously exceeded for two decades. The decree determined that the basin had been in a continuous state of overdraft, causing land subsidence and increased pump-lifts and triggering the adjudication. It was only ongoing replenishment undertaken by PVPA, Pomona, and La Verne, as well as the return flows from imported water, that avoided further decline in groundwater levels.[636]

Since the adjudication, total annual production in the Six Basins has ranged from a minimum of 13,559.2 AFY to a maximum of 23,535.7 AFY, and has averaged 17,790.2 AFY. During 2013, 16,178.6 AF was produced in the Six Basins: 15,120.5 AF in the Four Basins and 1,058.2 AF in the Two Basins. As noted above, the Watermaster modifies the OSY annually, taking into account the possibility of both rising and falling groundwater levels, and water rights are adjusted to meet the OSY. For example, in 1998 the City of La Verne was awarded 1,492 AF of pumping allotments, and in 2014, due to drought conditions, this dropped to 1,254 AF.[637] The Watermaster's 2013 Annual Report however demonstrates that while water levels fluctuated over time with changes in imported water and pumping allocations, the basin continues to be in a deficit and remains in a state of overdraft.

Water Quality

Water quality issues (nitrates and volatile organic compounds) in Pomona, Live Oak, and Ganesha Basins limit the productivity of these areas. In Pomona Basin, the lowest income

area of the Six Basin region, all wells are shut down for water quality concerns, leading to groundwater levels being higher than desired and concern about property damage from rising water. Fourteen wells in the basin as a whole have been shut down due to water quality issues. There is no formal groundwater quality monitoring program in the basin.[638] Potential sources of the nitrate are historical agricultural practices and individual wastewater disposal systems.[639] Six Basins would like to create more treatment facilities to be able to utilize the contaminated groundwater.[640]

Drought

In 2012, Watermaster parties began developing a Strategic Plan for the Six Basins; this was a voluntary effort not required by the judgment, precipitated by concern over drought conditions.[641]

Discussion

The adjudication determined that pre-judgment pumping was greater than 20,000 AFY in each of the five years preceding the action and that groundwater production thus exceeded the available safe yield. The adjudication succeeded in limiting further overdraft by ensuring that the operating safe yield is below the safe yield of the basin. Post-adjudication, in the years between 1999 and 2013, pumping averaged 17,790 AF. In 2013, pumping was 16,178 AF.[642] In the Four Basins, groundwater production only exceeded the OSY in 2006 and 2012, and in 2012, production only exceeded the OSY by approximately 262 AF.

Because of the basin's small size it is extremely vulnerable to annual fluctuations. This means that water in key wells decreased dramatically in dry years. The Watermaster's 2013 Annual Report demonstrates that while water levels fluctuated over time with changes in imported water and pumping allocations, the basin continues to be in a deficit and remains in a state of overdraft.[643]

This was a short and uncomplicated adjudication in a basin that is almost entirely urbanized. Post-adjudication management appears to be good, and all key principal pumpers are monitored. Although a single Watermaster manages Six Basins, Two Basins and Four Basins have different management practices and different concerns, making coordination potentially challenging.

Groundwater contamination is a very serious problem in Pomona, the lowest income region of the Six Basin area, and has resulted in wells being shut down.

SIX BASINS

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Eastern Los Angeles and San Bernardino Counties Area: 16 sq. mi Physical Characteristics: The Six Basins are comprised of six basins, divided by faults and physical boundaries. Groundwater generally flows from the Four Basin area to the Two Basin area. Primary recharge to the Two Basins is from subsurface flow. Precipitation: 23.5″–40″ per year CASGEM: High Land Use: Urban Reason for Adjudication: The safe yield of the basin had been exceeded for several years resulting in the lawsuit.	Adjudication Initiated: 1998 Adjudication Finalized: 1998 Decree Summary: All parties were granted prescriptive rights that were of equal priority The court affirmed a physical solution to meet the operating safe yield (OSY) that varies from year to year. In Four Basins, annual overpumping was allowed, but to the extent that any party's total production exceeds its total allowable production, that party is obligated to recharge replacement water in an amount equal to the excess production. In Two Basins, production, replenishment, and storage and recovery rights were reserved solely for the City of La Verne and were not subject to any limitations, provided that activities did not substantially injure the rights of any other party. Carry-over rights were allowed to the subsequent operating year, and up to 25 percent of unused production rights and could be lost if the replenishment is discontinued or curtailed. Each year, the first water produced by the party is the carryover right. Transfers and water exports were allowed under specific conditions, and upon approval.	Watermaster: A nine-member Board of Directors representing all parties to the judgment. Wildermuth Environmental administers the adjudication through a contract with the Six Basins. Members: Cities of La Verne, Claremont, Pomona, Upland, and Pomona College, Pomona Valley Protective Association, San Antonio Water Company, Simpson Paper Company, Three Valleys Municipal Water District, and West End Consolidated Water Company. Strategies: Imported water from MWD and artificial recharge at spreading grounds. MWD implements two conjunctive use programs. Monthly metering for all active production wells; protecting against rising groundwater; determining the OSY; managing reporting and verification programs, storage and recovery agreements, water rights accounting, replenishment programs, replacement water, water quality remediation, and financial management.	Adjudicated Safe Yield: Defined as the amount of groundwater, including replenishment water and return flows from imported water that can be reasonably produced from Six Basins on an annual basis without causing an undesirable result: 19,300 AFY (1998). Operating Safe Yield: Defined as the amount of groundwater the Watermaster determines can be produced from the basin by parties during any single year, free of replacement obligation under the physical solution: 16,500 AFY (2014). Summary: The Watermaster determines OSY on an annual basis. The estimate of OSY in 1998 was 24,000 AF. In 2005, this number had dropped to 18,000 AF, and in 2013, to 16,500 AF. Current Extractions: 16,500 AF (2014) Extraction Summary: Since the adjudication, total annual production in the Six Basins has ranged from a minimum of 13,559.2 AFY to a maximum of 23,535.7 AFY, and has averaged 17,790.2 AFY. Groundwater Levels: Conditions vary in each area. Because of the basin's small size, it is extremely vulnerable to annual fluctuations, and water in key wells has decreased dramatically in dry years. Overdraft Conditions: The decree determined that the basin had been in a continuous state of overdraft, causing land subsidence and increased pump-lifts. The adjudication limited further overdraft by ensuring that the operating safe yield is below the safe yield of the basin. The Watermaster's 2013 Annual Report demonstrates that while water levels fluctuated over time with changes in imported water and pumping allocations, the basin continues to be in a deficit and remains in a state of overdraft. Water Quality: Water quality issues in Pomona, Live Oak, and Ganesha basins limit productivity in these areas. In Pomona Basin, where wells are shut down for water quality concerns, groundwater levels are higher than desired. Fourteen wells in the basin as a whole were shut down due to water quality issues (nitrates and VOCs). The basin has no formal groundwater quality monitoring. Discussion **- Cumulative overdraft in the basins was significant in each of the five years preceding the adjudication, causing land subsidence and increased pump-lifts and triggering the adjudication. Ongoing replenishment and return flows from imported water avoided further decline in groundwater levels, but the basin remains in a deficit.** **- The basin is very vulnerable to annual fluctuations, and water in key wells decreases dramatically in dry years. Moreover, upstream basins are largely dependent on natural recharge.** **- Groundwater contamination is a very serious problem in Pomona, the lowest income region of the Six Basin area, and has resulted in wells being shut down.**

CHINO BASIN

Chino Basin is one of the largest groundwater basins in Southern California. It abuts Los Angeles County, Orange County, and Riverside County. Over the past few decades, the basin has experienced rapid growth. The southern area was once notable for containing the heaviest concentration of dairy farms in the United States. There is significant subsidence in areas of the basin due to overpumping. While it is often described as a basin with ongoing conflict, there were also significant collaborative efforts to address basin problems during and after the adjudication process. Three different stakeholder groups—overlying agricultural, overlying non-agricultural, and appropriators—negotiated a management plan prior to adjudication, and it was adopted in a 1978 stipulated judgment. Stakeholders agreed on water rights for each group of users. There were multiple additional amendments over the last twenty years adopted in a 2012 restated judgment.

Overview

County	San Bernardino, Riverside, Los Angeles
Area	235 square miles / 150,399 acres
Population	898,653
CASGEM	High[644]
Watermaster	Chino Basin Watermaster
Members	An advisory committee that represents all pumpers, and a Watermaster Board with nine directors
Court Cases	*Chino Basin Municipal Water District v. City of Chino et al.* (164327, now RCV 51010)

CASGEM = California Statewide Groundwater Elevation Monitoring

Chino Basin is one of the largest groundwater basins in Southern California. It currently holds 5,000,000 AF, with another 1,000,000 AF in additional storage capacity.[645] The basin is located in a valley situated within San Bernardino (80 percent), Riverside (15 percent), and Los Angeles (5 percent) counties.[646] It is encircled by other prominent basins: Cucamonga to the north, Rialto-Colton to the northeast, Riverside to the east, Arlington to the southeast, and Six Basins to the northwest. The Santa Ana River flows southwest through the Chino Basin from Riverside Narrows to Prado Dam. Downstream of Prado Dam, the Santa Ana River flows through the Orange County Basin and out to the ocean. Prado Dam, at the lower end of the basin across the Santa Ana River at the Chino Hills, impounds water for flood control and groundwater recharge. Recharge to Chino Basin is from precipitation and percolation from nearby creeks and the Santa Ana River. Primary areas of discharge include groundwater production, rising water in the Prado Basin, evapotranspiration when groundwater is near the surface, and underflow to adjacent basins.[647] Average annual precipitation is 16.9 inches.[648]

Major communities in Chino and nearby Cucamonga Basin include Rancho Cucamonga, Pomona, Upland, Fontana, Chino, Chino Hills, Montclair, Eastvale, Jurupa Valley, and Ontario. Land use shifted from primarily agriculture to mostly urban over the past century. The southern area is notable for once containing the heaviest concentration of dairy farms in the United States. The rapidly growing population reached approximately 1.1 million in 2001, and is projected to reach approximately 1.6 million in 2020.[649]

Reason for Adjudication

Groundwater in the Chino Basin has been a precarious resource since the early twentieth century. Dropping water levels were documented as early as the 1930s. The Chino Basin Conservation Association formed in 1948 to focus on water-supply issues; the Chino Basin Municipal Water District (CBMWD), now Inland Empire Utilities Agency (IEUA) formed in 1950 to gain access to imported water; and the Chino Basin Water Users Association (CBWA) formed in the 1960s and worked with CBMWD to manage the basin. A lawsuit filed in 1963 by the Orange County Water District against the City of Chino and others in the Superior Court of Orange County focused attention on connections between groundwater and the Santa Ana River, both upstream in the Chino Basin and downstream in the Orange County Basin. In 1968, the Orange County Water District dropped their complaint against everyone except CBMWD, Western Municipal Water District (WMWD) of Riverside County, and San Bernardino Valley Municipal Water District (SBVMWD). This was settled in 1969 with the Orange County Judgment, effective in 1970, which found that CBMWD and WMWD were responsible for ensuring a base flow of 42,000 AF at Prado Dam at the lower end of the Chino Basin (and SBWMD was responsible for ensuring a base flow of 15,250 AF at Riverside Narrows at the upper end of the Chino Basin). CBMWD sent a proposed management plan to CBWA in 1970, and a CBWA committee with representatives from the State of California, Pomona Valley Water Company, agricultural producers in the San Bernardino County area of Chino Basin, and agricultural producers from Riverside County reviewed and finalized the plan.

The Chino Basin adjudication was initiated to define water rights in the basin and to determine who would be responsible for any pumping reductions and other management strategies to control overdraft.[650] CBMWD filed suit to initiate the adjudication in 1975, and an advisory group reviewed the adjudication process. Three groups of users were represented: (1) agricultural users, (2) non-agricultural users (i.e., industry and commercial groups), and (3) appropriative users (municipal).[651]

Decree and Amendments

Adjudication initiated: January 2, 1975
Adjudication finalized: January 27, 1978
Revisions or amendments: 2012[652]
Costs: $626,000 in legal, engineering, and district costs[653]

Decree Summary

The 1978 adjudication:

(1) established a safe yield of the basin,
(2) allocated water rights for three pools of groundwater users: overlying agricultural representing dairymen, farmers, and the State of California; overlying non-agricultural representing area industries; and appropriators representing local cities, public water districts, and private water companies,
(3) allowed for water transfers,
(4) created a replenishment fee (pumping tax) program, and
(5) instituted a Watermaster with detailed responsibilities.[654]

Groundwater rights allocated in the basin equaled a natural safe yield of 140,000 AFY.

Water rights for the overlying agricultural pool were correlative and decided in aggregate, were established as 82,800 AFY, and were appurtenant to the land. Water rights for the overlying non-agricultural pool were 7,366 AFY, and then allocated to each water user. Water rights for the appropriative pool were determined after overlying rights had been satisfied, and they were determined individually as percentages of the remaining safe yield. All other unexercised overlying rights were lost by prescription. The State of California, through its Department of Corrections, Youth Authority, and Department of Fish and Game was a significant producer of groundwater from the basin and the largest owner of land overlying the basin. The judgment decreed that use on state lands was to be considered as part of the agricultural pool.

Water users were permitted to pump above safe yield if replenishment water was purchased and restored to the basin. Appropriators who produced less than their assigned share of the operating safe yield (OSY) could carryover the unexercised right in subsequent years. If the aggregate carryover exceeded an appropriator's OSY, to preserve the surplus carryover the appropriator could store the water as excess carryover. Appropriative rights, including shares of OSY, could be assigned, leased, or licensed to another appropriator in a given year. Pumping taxes were different for each pool, with overlying agricultural users paying a gross assessment for production, overlying non-agricultural users paying a net assessment for production, and appropriators paying a percentage of gross and net production. If any portion of the safe yield allocated to the overlying agricultural pool was not produced in a year, that water was available for reallocation to members of the appropriative pool and could be used as a supplement to the OSY for that particular year.[655] Subsequent to the judgment, appropriators agreed to pay overlying agricultural pool assessments, and in exchange they receive an early transfer of up to 32,800 AFY for use each year.[656]

The adjudication also required creation of an optimum basin management plan (OBMP) in 1998 to enhance basin water supplies, protect water quality, and improve basin management.[657] A 2012 restated judgment incorporated all amendments since 1978. Other agreements not included in the 2012 restated judgment were the Peace Agreement of 2000 (Peace Agreement I) and the Peace Agreement of 2007 (Peace Agreement II). The Peace Agreement I defined a transfer program for agricultural water rights, addressed areas of basin subsidence, evaluated funding for groundwater recharge, and outlined intent to implement the OBMP. The Peace Agreement II addressed basin de-salters (see under Management Strategies, below), evaluated basin replenishment, and examined recharge programs.[658] It also allowed an additional 400,000 AF to be pumped for the de-salters.[659]

Water Users

Stipulated users[660]

Overlying agricultural = approximately 1,200 users; Overlying non-agricultural = 12 users;[661] Appropriative = 22 users[662]

Current[663]

Overlying agricultural = approximately 300 users; Non-Ag = 19 users;
Appropriative = 23 users

Other

Environmental users are not included in the Chino Judgment. Many small pumpers are included in the overlying agricultural pool.

Management Structure

CBMWD was the original Watermaster outlined in the adjudication, with oversight on management enforced by an advisory committee and the courts.[664] CBMWD was appointed for a period of five years after the conclusion of the 1978 trial. The court used subsequent orders to appoint CBMWD to additional terms. The Watermaster's responsibilities included the creation of rules and regulations. The Watermaster employs experts and agents, installs water measuring devices, levies and collects assessments from pooling plans, invests funds, borrows funds, enters into contracts, collaborates with other agencies, conducts studies, adopts groundwater storage agreements, accounts for stored water, creates annual budgets, and works cooperatively with other agencies that own recharge basins.

CBMWD served as Watermaster for multiple terms, but the structure was revised according to recommendations made by a 1998 advisory committee. The current Watermaster structure, which is not completely independent of IEUA, has committees that represent each of the three groups of users; an advisory committee that represents all pumpers; and a Watermaster Board with nine directors. The Watermaster Board receives advice and assistance with enforcing the judgment from the advisory committee.[665] The Watermaster Board is formed of the following interest group representatives: three municipal water district representatives, three Appropriative Pool representatives, two Agricultural Pool representatives, and one Non-Agricultural Pool representative.[666]

Management Strategies

Imported Water: Imported water is used to provide water to appropriators and recharge the basin.[667] One of the larger imported water suppliers is IEUA, a member of the Metropolitan Water District (MWD). Imported water also comes from other sources. During 2011–2012, sources of supplemental and imported water were Colton, Rialto-Colton, and Lytle Creek basins through SBVWD; Rubidoux Basin; and Six Basins.[668] As an incentive to reduce groundwater pumping and use imported water, users who pumped more than their allocation were required to purchase replenishment water. This cost from MWD was initially low, so there was little incentive to remain within one's production right, but the cost increased in 2012, creating a disincentive to pump over the defined allocation.[669]

Recycled Water: Recycled water is managed by different entities in the basin.[670]

Spreading Basins: There are multiple spreading basins in the area. Some were retrofitted to accept larger quantities of water when available for recharge.[671] Numerous organizations in the basin jointly manage the Chino Basin Groundwater Recharge Program.

De-salters: Groundwater flow in the basin is south, and one challenge is to maximize the

yield of the Chino Basin by minimizing groundwater outflow in the Prado Dam area. As a legacy of agricultural use, there is also pollution in the lower end of the basin, and water quality could not be affected at Prado Dam under the Orange County Judgment. De-salters were put in to address both water quality and the potential outflows from the basin to the Santa Ana River. The de-salters pump groundwater to reduce water levels, treat it to remove contaminants, and provide it back to water users without replenishment obligations.[672] Brine is exported from the basin.

Groundwater Storage: The Watermaster started three programs around groundwater storage: a local storage program, a cyclic storage program, and a water exchange agreement program.[673]

Management Plans: The OBMP was drafted in the late 1990s around water quantity, water quality, basin management, and project financing.[674] The Watermaster proposed revisions to an existing water-quality plan in 2004 that address groundwater quality in the basin. A subsidence management plan for the basin was implemented in 2007.[675] A Recharge Master Plan Update was completed between 2008–2013 to ensure long-term water quality and supply.[676]

Monitoring and Reporting

Monitoring in the basin has been challenging. The judgment in 1978 required that all wells be measured, but it was difficult to get everyone to install meters. Utilizing the transfer provision approved in the original judgment, the appropriative pool wanted to receive the overlying agricultural pool's unpumped safe yield of groundwater at the end of the 1980s. Appropriators eventually paid to install meters on all overlying agricultural pool wells to ensure this groundwater could be transferred to them.[677] Transfer of overlying agricultural pool water rights to appropriative users was approved in the Peace Agreement of 2000 (Peace Agreement I).[678] The California Attorney General assisted in informal enforcement against 142 non-complying overlying agricultural users who refused to install meters on their wells. Current monitoring of groundwater production is done quarterly, and the Chino Basin Watermaster publishes these reports on an annual basis.[679]

Safe Yield

Native safe yield definition: Native safe yield is not defined in the judgment.

Safe yield definition: Safe yield is defined in the judgment as the "long-term average annual quantity of ground water (excluding replenishment or stored water but including return flow to the basin from use of replenishment or stored water) which can be produced from the basin under cultural conditions of a particular year without causing an undesirable result."

Operating safe yield definition: Operating safe yield is defined in the judgment as "the appropriative pool's share of safe yield of the basin plus any controlled overdraft of the basin which Watermaster may authorize."[680]

Adjudicated safe yield: The adjudicated safe yield was set at 140,000 AFY, and the operating safe yield is 145,000 AFY. The operating safe yield includes 5,000 AFY of additional water to appropriators for 40 years.[681]

Current safe yield: The basin safe yield is in the process of being reevaluated by several

scientists. One noted problem is that past evaluations used a base period of 1965 through 1974, a period of ten years where average annual precipitation for the base period was 14.64 inches, or 0.77 inches less than the long-term annual average. The 2015 Watermaster report indicated that the base period in which the safe yield was initially estimated was likely less than the yield that would be developed from a longer, more hydrologically representative period.[682] Only appropriators will have to cut back after the reevaluation of safe yield.[683] There is expected to be a long-term decline in safe yield, but the Watermaster anticipates that this will be made up with groundwater recharge.[684]

Groundwater Pumping and Overdraft

Groundwater pumping rights were allocated in the original adjudication with the overlying agricultural pool at 82,800 AFY; the overlying non-agricultural pool at 7,366 AFY; and the appropriative pool rights at 49,834 AFY.[685] Groundwater rights equaled safe yield at 140,000 AFY. The 35th annual report outlined groundwater pumping from 1974–1975 to 2011–2012. Pumping trends are shown in Table 18.

Table 18: Groundwater Extractions in 35th Annual Report

	Adjudicated Rights (AFY)	1980–1981 Pumping (AFY)	1990–1991 Pumping (AFY)	2011–2012 Pumping (AFY)
Overlying agricultural	82,800	68,040	48,085	34,353
Overlying non-agricultural	7,366	5,650	5,407	4,415
Appropriators	49,834	70,726	86,658	79,343
TOTAL	140,000	144,416	140,151	118,111

Groundwater levels are variable throughout the basin.[686] Before the adjudication, the basin experienced declining groundwater levels, but levels increased over time. Groundwater levels in 1980 were 80 feet lower than highs from the 1920s, but water levels increased by 20 feet in 2000.[687] The MWD found water levels in the Chino Basin were stable in 2007, stating that the Central and Chino Basins are examples of basins operated such that water levels are generally very stable from year to year. Each of these basins has areas that are declining, but overall water levels are consistent.[688] Water level data is now being collected in 700 wells in the basin.[689]

Overdraft is defined in the judgment as a condition where "total annual production from the basin exceeds the safe yield."[690] The 1978 judgment allocated an additional 5,000 AFY (200,000 AF over 40 years from 1978 to 2017) above the safe yield for appropriative pool users to ensure maximum beneficial use of groundwater in the basin.[691] The 2007 Peace Agreement II allowed for an additional 400,000 AF to be extracted by 2030 for the de-salter program to maintain hydraulic control of the southern basin, to reduce contaminated (e.g., with nitrates) groundwater discharge to the Santa Ana River.[692]

Long-term overdraft in the western basin resulted in subsidence and fissuring.[693] An accelerated occurrence of ground fissuring ensued after 1991 and resulted in damage to existing infrastructure. In 1999, the OBMP Phase I Report identified pumping-induced drawdown and subsequent aquifer-system compaction as the most likely cause of land subsidence and ground fissuring observed in Management Zone 1 (MZ-1), the southwestern area of Chino Basin. In 2000, The 2001 Peace Agreement I called for an aquifer-system and

land subsidence investigation in the southwestern region of MZ-1, and noted that land subsidence was occurring in other parts of the basin.[694] Current investigations are under way.

Water Quality

Main water quality problems in the basin have to do with nitrate contamination from agricultural land use. Concentrations are highest in the northwest and southern portions of the basin. The groundwater storage program may have exacerbated issues with groundwater quality due to higher-than-normal water tables and nitrate-laden soils. Water users in the southern part of the basin, where the depth to groundwater is typically around 50 feet, are most affected.[695] There are also several contamination plumes, mostly volatile organic compounds, in the basin in various stages of remediation.[696]

Drought

A dry-year yield program is considering how to balance maximizing the yield of the Chino Basin by minimizing groundwater outflow in the Prado Dam area while also minimizing outflow to the Santa Ana River when water is being stored for dry-year use. Groundwater withdrawals in excess of the safe yield are allowed if water users purchase replenishment water that is then used to recharge the basin.[697] Drought led to the curtailment of imported water for replenishment, and this could result in long-term groundwater level declines if the situation does not change.

Disputes

There are some disputes among appropriators about the reevaluation of safe yield. This evaluation was supposed to be completed in 2011, but is still in progress. Appropriators are concerned about the reduction of their existing water-right allocations.[698]

Discussion

The Chino Basin adjudication was complicated. Previous positive negotiations among different water-user groups beginning in the 1960s eventually resulted in a stipulated agreement in 1978, about three years after the action was filed. Multiple ordinances and agreements after the adjudication, as well as a revised judgment in 2012, continued to address ongoing disagreements among water users.

The adjudication used innovative management strategies, including different pool committees to represent the different user groups with checks and balances over Watermaster control.

The current Chino Basin Watermaster appears effective at ensuring adequate monitoring and reporting in the basin, but there are problems with reevaluation of the safe yield due to disagreements.

Extractions during 2011–2012 were below the original safe yield outlined in the judgment, and water levels in the basin are generally stable, with fluctuations in different parts of the basin.

The area is also dealing with water-quality contamination problems. Subsidence, due to ongoing pumping of the underlying groundwater system in some areas, is a serious concern.

CHINO BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino, Riverside, Los Angeles Area: 150,399 acres; 235 sq. mi. Physical Characteristics: One of the largest groundwater basins in Southern California. Precipitation: 16.9" per year CASGEM: High Land Use: Shift from mostly agriculture to mostly urban and some industry. Reason for Adjudication: Dropping water levels were documented as early as the 1930s. The adjudication was initiated to define water rights in the basin and to determine who would be responsible for any pumping reductions and other strategies to control overdraft.	Adjudication Initiated: January 2, 1975 Adjudication Finalized: January 27, 1978 Amended: Restated Judgment 2012 1978 Decree Summary: The 1978 adjudication: (1) established a safe yield of the basin, (2) allocated water rights for three pools of groundwater users: overlying agricultural, overlying non-agricultural, and appropriators, (3) allowed for water transfers, (4) created a replenishment fee (pumping tax) program, and (5) instituted a Watermaster. Groundwater rights equaled natural safe yield of 140,000 AFY. Water rights for the overlying agricultural pool were decided in aggregate, were correlative, established as 82,800 AFY, and appurtenant to the land. Water rights for the overlying non-agricultural pool were 7,366 AFY, and then allocated to each water user. Water rights for the appropriative pool were determined after overlying rights had been satisfied, and they were determined individually as percentages of the remaining safe yield. All other unexercised overlying rights were lost by prescription. Subsequent to the judgment, appropriators agreed to pay overlying agricultural pool assessments and in exchange they receive an early transfer of up to 32,800 AFY for use each year. Amendment Summary: A 2012 restated judgment incorporated all amendments since 1978 and the Peace Agreements of 2000 and 2007 that addressed transfers, subsidence, funding for groundwater recharge, basin de-salters, basin replenishment, and recharge programs. It also allowed an additional 400,000 AF to be pumped (controlled overdraft) for the de-salters.	Watermaster: Chino Basin Watermaster Members: Overlying agricultural pool, Overlying non-agricultural pool, and Appropriators The Watermaster Board receives advice and assistance enforcing the judgment from the advisory committee. Strategies: - Imported water - Recycled water - Spreading basins - De-salters - Groundwater storage - Groundwater management plan	Adjudicated Safe Yield: Natural Safe Yield (NSY): 140,000 AFY; Operating Safe Yield (OSY): 145,000 AFY Current Safe Yield: In process of re-evaluation Summary: The OSY includes 5,000 AFY of controlled overdraft for 40 years. Groundwater rights in the basin equaled the NSY of 140,000 AFY. Current Extractions: Overlying agricultural pool users used 34,353 AFY; overlying non-agricultural pool users used 4,415 AFY; and appropriative pool users used 79,343 AFY (2011–2012). Extractions Summary: Total extractions of 118,111 AFY (2011–2012) are below the natural safe yield of 140,000 AFY. Groundwater Levels: Before the adjudication, the basin experienced declining groundwater levels, but levels increased over time. Groundwater levels in 1980 were 80 feet lower than highs from the 1920s, but water levels increased by 20 feet in 2000. Overdraft: Defined in the judgment as a condition where "total annual production from the basin exceeds the safe yield." The 1978 judgment allocated an additional 5,000 AFY (200,000 AF over 40 years from 1978 to 2017) above the safe yield for appropriative pool users to ensure maximum beneficial use of groundwater. Long-term overdraft in the western basin resulted in subsidence and fissuring. Water Quality: Nitrate contamination from agricultural land use is a problem. There are also several contamination plumes that are mostly VOCs. Discussion: **- Chino Basin is one of the largest groundwater basins in Southern California. It currently holds 5,000,000 AF, with additional storage capacity of 1,000,000 AF.** **- The adjudication established different pool committees to represent the different user groups with checks and balances over Watermaster control.** **- The current Chino Basin Watermaster appears effective at ensuring adequate monitoring and reporting in the basin.** **- Extractions during 2011–2012 were below the original safe yield outlined in the judgment.** **- The area is also dealing with water-quality contamination problems.**

SAN JACINTO BASIN

Groundwater problems in the San Jacinto Basin were first addressed by the court in a 1954 judgment that allocated pumping rights for the Fruitvale Mutual Water Company in the upper San Jacinto Basin. Declining groundwater levels persisted into the 1970s, and local water purveyors attempted to develop a groundwater management plan to address the declines. Eastern Municipal Water District (EMWD), which had acquired the Fruitvale Company in 1972, worked with the water purveyors in the 1990s to implement an AB 3030 groundwater management plan for the West San Jacinto Groundwater Management Area. In 2001, a Memorandum of Understanding between the Department of Water Resources (DWR) and local agencies required a water management plan for the Hemet/San Jacinto Groundwater Management Area, the eastern portion of the San Jacinto Basin, and a plan was released in 2007. At the same time, the Soboba Band of Luiseño Indians, negotiating with the local agencies to specify their groundwater rights from the Hemet/San Jacinto Groundwater Management Area, also pushed for a management plan. These negotiations culminated in the 2008 Soboba Settlement Agreement Act that established their water rights. A 2013 stipulated judgment allocated pumping rights for public water agencies, provided for water rights outlined in the Soboba Settlement Agreement, incorporated the Water Management Plan, and mandated a Watermaster.

Overview

County	Riverside
Area	90 square miles / 57,600 acres[699]
Population	474,317[700]
CASGEM	High (San Jacinto)[701]
Watermaster	Hemet-San Jacinto Watermaster
Members	Eastern Municipal Water District, Lake Hemet Municipal Water District, City of Hemet, City of San Jacinto, and private groundwater producers
Court Cases	*The City of San Jacinto et al. v. Fruitvale Mutual Water Company, et al.* (**Fruitvale Judgment**) The Soboba Band of Luiseño Indians Settlement Act (**Soboba Settlement Agreement**) *Eastern Municipal Water District v. City of Hemet, City of San Jacinto, Lake Hemet Municipal Water District et al.* (**Stipulated Judgment**)

CASGEM = California Statewide Groundwater Elevation Monitoring

The Hemet/San Jacinto Groundwater Management Area is located within San Jacinto River Watershed in western Riverside County. The area consists of four sub-basins: Hemet South, Hemet North, Canyon, and San Jacinto Upper Pressure. The entire Hemet/San Jacinto Groundwater Management Area is bordered by the San Jacinto Mountains on the east, the Box Springs Mountains on the north, the Santa Rosa Hills and Bell Mountain on the south, and unnamed hills on the west. The San Jacinto River rises and drains the western slopes of the San Jacinto Mountains.[702] Average annual precipitation is 13 inches.[703] Primary sources of recharge are precipitation infiltration and percolation flows from the San Jacinto River.[704] Total groundwater storage capacity is 1.3 MAF.[705]

The lower portion of the 765-square-mile San Jacinto watershed is urban and agricultural. The sub-basins provide groundwater for the cities of San Jacinto and Hemet, as well as unincorporated areas of Riverside County (Winchester, Valle Vista, and Cactus Valley). Land use is about 28 percent urban and suburban, 31 percent irrigated crops and recreational, 35 percent non-irrigated crops and native vegetation, and 7 percent unmapped.[706]

Reason for Adjudication

Disputes and litigation over water resources in the San Jacinto Basin date back to the late 1800s due to multiple water diversions from the San Jacinto River. In the 1930s, the Metropolitan Water District of Southern California (MWD) constructed the San Jacinto Tunnel, a component of the Colorado River Aqueduct that transports water from the Colorado River to Southern California, and the Eastern Municipal Water District (EMWD) began importing Colorado River water in the 1950s. These imports stimulated further growth, and groundwater relied upon by the Soboba Band of Luiseño Indians (Soboba Tribe) and Hemet and San Jacinto communities began to decline.[707]

In 1951, the State Department of Public Works (DPW), predecessor to the State Water Resources Control Board, was appointed by the court to investigate the ongoing overdraft. The court approved the 1954 Fruitvale Judgment that ended the DPW investigation, and issued water rights to Fruitvale Mutual Water Company. In the late 1960s, "the Lake Hemet Municipal Water District (LHMWD) and then the City of Hemet threatened to take over the Fruitvale Company by eminent domain," and Fruitvale's directors asked EMWD for assistance.[708] EMWD purchased Fruitvale in 1972 and was subject to provisions of the 1954 Fruitvale Judgment.

Groundwater problems persisted in the basin, and EMWD attempted to create a Water Management Plan with the cities of San Jacinto and Hemet and LHMWD in the 1970s that never came to fruition.[709] Eventually in 2001, a memorandum of understanding between the California Department of Water Resources (DWR) and local agencies was executed to formulate a water management plan for the Hemet/San Jacinto Groundwater Management Area.[710]

A settlement agreement initiated in 2006 and signed in 2008 allocated water rights to the Soboba Tribe. It also echoed the call for a water management plan, stating that local agencies "shall develop and implement a Water Management Plan for the basin that will address the current basin overdraft and recognize and take into account the tribal water right."[711] This water management plan was formally released in 2007. It was developed by multiple stakeholders to support responsible water management into the future.[712] It also included specific language that prescribed a stipulated judgment to be approved in court that would supersede the 1954 Fruitvale Judgment.

The stipulated judgment[713] was entered with the Superior Court of Riverside County in 2013 adopting the water management plan and creating a Watermaster. This stipulated judgment superseded the original 1954 Fruitvale Judgment and outlined a physical solution.

Decree and Amendments

Adjudication initiated: 1951
Adjudication finalized: 1954
Stipulated Judgments: 2013, Stipulated Judgment and Complaint, Superior Court, Riverside County[714]
Costs: $505,164 (2013 Watermaster operations)[715]

Decrees

Three primary actions affected this basin: the Fruitvale Judgment of 1954, the Soboba Settlement Act of 2008, and the Stipulated Judgment of 2013.

Fruitvale Judgment

The Fruitvale Judgment of 1954 was approved after a court assigned DPW to investigate overdraft in the basin. This judgment only covered two of the four Hemet/San Jacinto Groundwater Management Area sub-basins: Canyon and San Jacinto Upper Pressure.[716] It did not apply to the other two sub-basins: Hemet South and Hemet North. The Fruitvale Judgment relied on groundwater levels in index wells to manage the basin. Fruitvale Mutual Water Company, now EMWD, was required to limit pumping in the Canyon Sub-basin to 4,500 AFY when static water levels in an index well were 25 feet or more below an elevation of 1665.42 feet. Litigants pumping over their allocation were required to purchase imported water for replenishment, and the judgment limited exporting pumped water outside the Canyon and San Jacinto Upper Pressure sub-basins to 12,000 AFY. EMWD acquired the Fruitvale Mutual Water Company in 1972, including all wells, water rights, and distribution systems.[717] Other groundwater users were not affected by this 1954 Fruitvale Judgment and were allowed to pump groundwater with overlying rights equaling about 25,000 AFY.[718] This Fruitvale Judgment was subsumed in the 2013 Stipulated Judgment that states "the Court hereby finds that the rights and obligations of the Fruitvale Judgment have been subsumed in, and superseded by, this judgment and are no longer enforceable; that the limitations upon the place and amounts of water use in the Fruitvale Judgment."[719]

Soboba Settlement Act

The 2008 Soboba Settlement Agreement terminated litigation filed in 2000 by the Soboba Tribe against MWD for the construction of the San Jacinto Tunnel that was draining water from their reservation.[720] The settlement quantified groundwater rights of 9,000 AFY for their 6,000-acre reservation, facilitated an agreement for delivery of 7,500 AFY of imported water for recharge for fifty years, established a framework for regional groundwater management, and encouraged active management of the basin. About $21 million of federal funding was made available in 2011 to help meet requirements of the settlement.[721]

Water Management Plan and 2013 Stipulated Judgment

A detailed Water Management Plan, in the making for years, was incorporated into the 2013 Stipulated Judgment for the Hemet/San Jacinto Groundwater Management Area. Officially released in 2007, participants in the planning process included public agencies (EMWD, LHMWD, and the cities of Hemet and San Jacinto) and private individuals with overlying agricultural and domestic groundwater rights.[722] The plan covered all four sub-basins in the Hemet/San Jacinto Groundwater Management Area: Canyon, San Jacinto Upper Pressure, Hemet South, and Hemet North. It addressed overdraft and dropping groundwater levels, provided for the Soboba Tribe's prior water rights, ensured reliable water supplies, prepared

for urban growth, developed cost-effective water supplies, and required water quality and quantity monitoring.

Groundwater rights to public agencies were allocated using a base-year equation from 1995 to 1999 that took into account recharge activities, San Jacinto Tunnel seepage, Fruitvale Judgment water sold from EMWD to LHMWD and the cities of Hemet and San Jacinto, river diversions, conveyance deliveries, and other considerations.[723] A total of 32,283 AFY was issued to EMWD, LHMWD, and the cities of Hemet and San Jacinto.

From the beginning, this Water Management Plan was developed with the intention that it would be adopted in a stipulated judgment. The stipulated judgment was approved in the Superior Court of Riverside County in 2013. Each public agency was required to reduce groundwater production by 10 percent in the first year after the water management plan was entered into the stipulated judgment, and adjust use periodically to meet the basin's safe yield. The stipulated judgment also authorized the Hemet-San Jacinto Watermaster. The Groundwater Management Plan did not impact private individuals with overlying agricultural and domestic groundwater rights, but they could opt for one of three classes of participation: Class A, Class B, or non-participant. Class A participants are private water producers who have their wells metered, are allowed to serve on the Hemet-San Jacinto Watermaster Board, and do not have assessments for water put to beneficial use. They acknowledge the existence of the water management plan, but are not required to participate in implementation. Class B participants are private water producers who have their wells metered and are allowed to serve on the Hemet-San Jacinto Watermaster Board, but elect to limit pumping to a base yield amount paying assessment for any overages. Class B participants have additional benefits, such as the ability to transfer water to public agencies.[724]

Water Users

Current

Water users were not clearly defined until the Water Management Plan of 2007 and the later Stipulated Judgment of 2013. Current groundwater users in the Hemet/San Jacinto Groundwater Management Area include EMWD, LHMWD, the City of Hemet, the City of San Jacinto, the Soboba Tribe, and private individuals with overlying rights.

Other

Environmental users are not accounted for in litigation in the Hemet/San Jacinto Groundwater Management Area. Small pumpers are not restricted under litigation either, and only water production over 25 AFY is measured. Preceding groundwater rights of private overlying users were recognized in the Stipulated Judgment of 2013.[725] Private users are listed in the annual reports of the Watermaster.[726]

Management Structure

No Watermaster was outlined in the Fruitvale Judgment of 1954. Groundwater was managed first by the Fruitvale Mutual Water Company and after the 1970s by EMWD. It was not until the Stipulated Judgment of 2013 that the court established a Watermaster and approved a Watermaster board.[727] The Hemet-San Jacinto Watermaster Board includes representatives from EMWD, LHMWD, City of Hemet, City of San Jacinto, and private groundwater producers.[728] The Hemet-San Jacinto Watermaster monitors groundwater production, levies replenishment assessments, monitors water transfers, and establishes future safe

yields to ensure long-term sustainability of the basin.[729] Private water users are not subject to the stipulated judgment unless they decide to voluntarily participate in the water management plan.[730]

Management Strategies

Imported Water: EMWD, one of 26 member agencies of the MWD, imports and sells State Water Project (SWP) water from northern California and the Colorado River, both as raw and treated water.[731] Imported water use in the Hemet/San Jacinto Groundwater Management Area totaled 9,169 AF, with 5,415 AF to meet demand and 3,754 AF to recharge groundwater sources in 2014.[732]

Recycled Water: Recycled water in the basin is generally supplied by the San Jacinto Valley Regional Water Reclamation Facility, but can also be supplied from the Moreno Valley Regional Water Reclamation Facility, the Perris Valley Regional Water Reclamation Facility, or the Temecula Valley Regional Water Reclamation Facility. Recycled water use in the Hemet/San Jacinto Groundwater Management Area totaled 12,196 AF in 2014.[733]

Spreading Basins: EMWD has diverted surface water from the San Jacinto River into recharge ponds to replenish the San Jacinto Basin since 1972. River water can only be recharged when there are significant flows.[734] The newer Hemet/San Jacinto Integrated Recharge and Recovery Program consists of 35 acres of basins or ponds for recharging SWP water; three extraction wells; three monitoring wells; modifications to two existing pumping stations; and pipelines around the San Jacinto River.[735]

Management Plans: A water management plan was drafted in 2007 and entered into a 2013 Stipulated Judgment. This plan addresses reducing groundwater production, implementing the Hemet/San Jacinto Integrated Recharge and Recovery Program, groundwater replenishment, in-lieu water use, additional water conservation measures, and water monitoring.[736]

Monitoring and Reporting

Monitoring and reporting of the Fruitvale Mutual Water Company production was required on an annual basis under the 1954 Fruitvale Judgment. There was no formal Watermaster outlined in that judgment, and the Fruitvale Mutual Water Company filed these reports until 1971. EMWD took over the Fruitvale Mutual Water Company in 1971 and started filing the annual reports afterwards.

The Stipulated Judgment of 2013 also required annual reporting,[737] and the Hemet-San Jacinto Watermaster took on responsibility for filing these reports in 2013. Extensive groundwater monitoring in the Hemet/San Jacinto Groundwater Management Area now includes groundwater level monitoring, groundwater quality monitoring, groundwater extraction monitoring, and inactive well capping and sealing.[738] Groundwater extraction monitoring includes about 118 wells.[739] Water-use estimates for additional wells not monitored are generated based on a number of factors, including acreage, crop type, and number of livestock.[740]

Safe Yield

Safe Yield Definition: The Water Management Plan of 2007 describes safe yield as "the long

term, average quantity of water supply in the management area that can be pumped without causing undesirable results, including the gradual reduction of natural groundwater in storage over long-term hydrologic cycles."[741] The Water Management Plan of 2007 indicates that safe yield includes both natural and artificial recharge.[742]

An updated model that looked at the hydrology of the basin over a 30-year period provided an estimate of safe yield at 40,000 to 45,000 AFY. Average annual production exceeds this amount by approximately 10,000 to 15,000 AF each year.[743]

Groundwater Pumping and Overdraft

In the Fruitvale Judgment of 1954, the Fruitvale Mutual Water Company (now EMWD) had to limit groundwater extractions in the Canyon Sub-basin to 4,500 AFY. The 2008 Soboba Settlement Act allocated 9,000 AFY and long-term delivery of 7,500 AFY of imported water to the Soboba Tribe. The Stipulated Judgment of 2013 allocated 32,283 AFY to water management agencies.[744] Although they are sometimes measured, rights of private overlying groundwater users are not affected by this judgment.[745]

Overdraft for the Hemet/San Jacinto Groundwater Management Area was defined in a 2000 report when "the amount of groundwater pumped exceeds natural recharge from rainfall and the San Jacinto River." Over an extended period of about 30 years prior to the 2013 Stipulated Judgment, and noted in 2000 and 2007 reports, the basin's overdraft averaged 10,000 AF each year.[746] MWD found groundwater levels to be in "long-term decline." Trends from 2005–2014 demonstrated an overall decline in depth to water in groundwater wells from 504 feet to 612, with some variation between sub-basins.[747] By 2013, accumulated overdraft was 300,000 AF.

To reduce annual overdraft, the 2013 Stipulated Judgment required that beginning in 2014 each agency had to reduce their adjusted base production right such that over a six-year period reduced pumping would bring the basin into equilibrium with no annual overdraft. It was anticipated that some entities would also pump less than their reduced production right due to reduced demand.

Groundwater extractions in 2014 equaled 42,588 AF, with the majority of water produced from the San Jacinto Upper Pressure Sub-basin (24,764 AF).[748] This total amount is within the range of the estimated safe yield, 40,000–45,000 AFY that includes both natural and artificial recharge. The 2014 extractions were divided among the following users: EMWD at 8,021 AF, LHMWD at 12,608 AF, City of Hemet at 4,477 AF, City of San Jacinto at 2,824 AF, private landowners at 12,968 AF, and the Soboba Tribe at 1,690 AF.[749]

The 2013 Stipulated Judgment aims to continue to reduce annual overdraft in the Hemet/San Jacinto Groundwater Management Area through cost-effective projects.[750] These include reduction in native groundwater production; enhanced recharge with local runoff, imported and/or recycled water; and water conservation programs.[751]

Water Quality

The best water quality is located in the Canyon Sub-basin. Contaminants of concern include total dissolved solids (TDS), nitrate, hydrogen sulfide, iron, and manganese. EMWD, LHMWD, City of Hemet, and City of San Jacinto collect water-quality samples in the area.[752]

Discussion

The Fruitvale Judgment of 1954 only allocated water rights for one water user and was subsumed in the 2013 Stipulated Judgment, and for many years there was limited management of the basin with estimated annual overdrafts of 10,000 AFY.

The Soboba Settlement Act of 2008 and Stipulated Judgment of 2013 will likely improve groundwater management in the region. The Soboba Settlement Agreement clarified tribal water rights and ended over a decade of negotiations between the tribe and EMWD.

The Stipulated Judgment of 2013 instituted a Watermaster and requirements to reduce what had been an ongoing annual deficit of about 10,000 AFY by utilizing reductions in the base production right of producers. The goal is to bring the basin into equilibrium in approximately six years.

Extractions in 2014 were within the range of the estimated safe yield of 40,000 AFY to 45,000 AFY. Moreover, the Hemet-San Jacinto Watermaster is currently engaging in detailed groundwater accounting of the Hemet/San Jacinto Groundwater Management Area on an annual basis.

Accumulated overdraft in the basin since 1984 is estimated to be 300,000 AF. This could be problematic in an extreme drought.[753]

SAN JACINTO BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Riverside Area: 90 sq. mi. Physical Characteristics: Hemet South, Hemet North, Canyon, and San Jacinto Upper Pressure sub-basins. Precipitation: 13" per year CASGEM: High (San Jacinto) Land Use: 28% urban/suburban, 31% crops/recreational, 35% non-irrigated crops/native vegetation, and 7% unmapped Reason for Adjudication: Disputes and litigation over water resources date back to the late 1800s due to multiple water diversions from the San Jacinto River. In 1951, the court assigned the Department of Public Works (DPW) to investigate overdraft in the basin. In 1954, the court approved the 1954 Fruitvale Judgment that issued water rights to Fruitvale Mutual Water Company. However, overdraft persisted. A settlement agreement in 2008 allocated water rights to the Soboba Tribe. After many attempts to craft a groundwater management plan, it was released in 2007.	Adjudication Initiated: 1951 Adjudication Finalized: 1954 Stipulated Judgment: 2013 1954 Decree: Only covered two of the four Hemet/San Jacinto Groundwater Management Area sub-basins: Canyon and San Jacinto Upper Pressure. The Fruitvale Mutual Water Company, later bought by Eastern Municipal Water District, had to limit groundwater pumping in the Canyon Sub-basin to 4,500 AFY at certain static water levels in index wells. There were limits on exporting water. 2013 Stipulated Judgment: Covers all four sub-basins. The judgment supersedes the 1954 Judgment and it adopted the water management plan drafted in 2007. It addresses pumping, overdraft, and dropping groundwater levels; plans for a reliable and cost effective supply and for urban growth; and provides for the monitoring of water quality and quantity. It requires annual reductions in the base production right of producers to reduce what had been ongoing estimated annual overdrafts of 10,000 AFY. It Recognizes Soboba Band's water rights of 9,000 AFY for their 6,000-acre reservation and 7,500 AFY of imported water for recharge for fifty years. A total of 32,283 AFY was issued to EMWD, LHMWD, and the Cities of Hemet and San Jacinto.	Watermaster: Hemet-San Jacinto Watermaster Members: - Eastern Municipal Water District - Lake Hemet Municipal Water District - City of Hemet - City of San Jacinto - Private groundwater producers Strategies: - EMWD is one of 26 member agencies of the MWD, and imports water. - Recycled water is generally supplied by the San Jacinto Valley Regional Water Reclamation Facility. - EMWD has diverted surface water from the San Jacinto River into recharge ponds to replenish the San Jacinto Basin since 1972.	Adjudicated Safe Yield: No safe yield was defined in the 1954 Judgment. Current Safe Yield: The Water Management Plan of 2007 describes safe yield as "the long term, average quantity of water supply in the management area that can be pumped without causing undesirable results, including the gradual reduction of natural groundwater in storage over long-term hydrologic cycles." The Water Management Plan of 2007 indicates that safe yield includes both natural and artificial recharge. Summary: An updated model that looked at the hydrology of the basin over a 30-year period provided an estimate of safe yield at 40,000 to 45,000 AFY. Current Extractions: Groundwater extractions in 2014 equaled 42,588 AF, with the majority of water produced from the San Jacinto Upper Pressure Sub-basin (24,764 AF). Extractions Summary: This total amount is within the range of the estimated safe yield, 40,000–45,000 AFY, but there is still an approximate 300,000 AF of accumulated overdraft. Groundwater Levels: Trends from 2005–2014 demonstrate an overall decline in depth to water in groundwater wells from 504 feet to 612 feet, with some variation between sub-basins. Overdraft: Over an extended period of about 30 years prior to the 2013 Stipulated Judgment, and noted in 2000 and 2007 reports, the basin's overdraft averaged 10,000 AF each year. By 2013, accumulated overdraft was 300,000 AF. Water Quality: The best water quality is located in the Canyon sub-basin. Discussion: **- Court and government actions conducted over a 50-year period to develop a groundwater management plan illustrate how difficult it can be to develop a workable solution.** **- The Water Management Plan of 2007 provided the framework for the 2013 Stipulated Judgment.** **- The 2013 Stipulated Judgment requires annual reductions in the base production right of producers to reduce what had been ongoing estimated annual overdrafts of 10,000 AFY with current accumulated overdraft at 300,000 AF.**

BEAUMONT BASIN

A critical driver behind the Beaumont Basin adjudication was recognition that the region's water demand was expected to exceed existing resources due to plans for significant residential development in the area. A friendly lawsuit was filed in 2003 to establish water rights and develop a storage program for the basin. Parties to the judgment entered into agreements with the Watermaster to store 260,000 AF in the basin. The safe yield of the basin, estimated at 8,650 AFY, was distributed to overlying users who only incurred water replacement charges if they pumped more than five times their share of the safe yield over a five-year period. Allocation to the five appropriative users included any portion of the safe yield available after overlying users satisfied their needs. If they pumped more than their allotment they also had to pay to replace that water. Appropriators were allocated an additional "temporary surplus" totaling 160,000 AF from 2004–2013 to satisfy their needs, with some to be stored in the basin for future use. The temporary surplus is no longer available, and time is needed to assess whether users will be able to remain within the safe yield.

Overview

County	Riverside
Area	Approximately 28 square miles[754]
Population	Beaumont Basin population unknown; City of Banning: 29,603 (2010); City of Beaumont: 36,877 (2010); City of Calimesa: 7,879 (2010)[755]
CASGEM	San Timoteo (Medium), San Gorgonio Pass (Medium)
Watermaster	Beaumont Basin Watermaster
Members	City of Banning, City of Beaumont, South Mesa Water Company (SMWC), Yucaipa Valley Water District (YVWD), and Beaumont-Cherry Valley Water District (BCVWD)
Court Cases	*San Timoteo Watershed Management Authority v. City of Banning et al.,* 2004

CASGEM = California Statewide Groundwater Elevation Monitoring

The Beaumont Basin (also referred to as the Beaumont Storage Unit) is defined by several faults, including the Banning and Cherry Valley faults to the north, and the Beaumont Barrier to the south. The water-bearing sediments consist of the unconsolidated Quaternary alluvium, and the upper portion of the San Timoteo Formation, which consists of folded semi-consolidated sediments. The basin underlies portions of the San Timoteo Watershed, and is recharged through percolation of precipitation in unlined portions of streambeds, subsurface seepage across fault boundaries, return flows from irrigation and septic tanks, and artificial recharge. Average precipitation is approximately 17 inches per year.[756]

There are three cities drawing on Beaumont Basin (Calimesa, Beaumont, and Banning), as well as unincorporated communities, open space, and winter cropland.[757] During the 1990s, the area experienced modest population growth, but after 2000, the growth rate was among the strongest in the Inland Empire. From 1990–2004, Banning's population grew from 20,572 to 27,192—a gain of 32.2 percent. Simultaneously, the San Gorgonio Pass area went from

75,255 to 110,232, up 46.5 percent.[758] Significant residential development is expected to continue in this region in the coming decades.[759]

Reason for Adjudication

In 2001, the City of Beaumont, the South Mesa Water Company (SMWC), Yucaipa Valley Water District (YVWD), and Beaumont-Cherry Valley Water District (BCVWD) formed the San Timoteo Watershed Management Authority (STWMA) to develop a comprehensive plan for managing the region's water resources. A critical driver behind initiating this process was a concern that plans for residential development in the area would require additional water supplies, including imported and recycled water. The agencies were concerned about the reliability of these supplies and wanted to develop capacity for groundwater storage to carry over supplies from year to year. All of the agencies relied at least in part upon the Beaumont basin for their supply, and they believed that the basin would be able to provide storage for imported supplies. As a result of this initiative, two groups representing overlying users and water agencies with interest in this basin began negotiations in 2002. The agencies initiated the San Timoteo Watershed Management Program, which included a study of the region's water supplies. Out of this emerged a program for addressing the water supply gap, which identified a need for a groundwater management entity. After discussion among participants, STWMA filed a friendly lawsuit in 2003 against the appropriative entities (the members of STWMA who were water purveyors), as well as overlying groundwater producers, in an effort to establish water rights and develop a storage program for the basin.[760] Over a period of 18 months, parties to the lawsuit developed a stipulated agreement, which the court approved in its judgment in 2004.

Decree and Amendments

Adjudication initiated: 2003
Adjudication finalized: 2004
Revisions or amendments: none
Stipulated Judgment: 2004
Other significant dates: 2014: when the period of temporary surplus and controlled overdraft ended; 2015: when a new safe yield was determined for the 2013–2022 Calendar Year Period.
Costs: Annual financial reports are available from the Beaumont Basin Watermaster each year. Watermaster expenses in 2007 = $447,224.95.[761] Administrative, engineering, and litigation expenses for 2013–2014 = $299,490.[762]

Decree Summary

Although the judgment defines overlying and appropriative rights in the Beaumont basin, it also states, "One fundamental premise of the adjudication is that all Producers shall be allowed to pump sufficient from the Beaumont Basin to meet their respective requirements."[763] This resulted in a period of controlled overdraft described below so that appropriators who were junior to overlyers would not be left without sufficient water after the adjudication. The goal was for the appropriators to bank some of that water for future use after the period of controlled overdraft was over.

The background for this arrangement was that in order to come to a settlement, the appropriators agreed to give all of the estimated safe yield, 8,650 AFY, to the overlyers. The share of each of the 17 overlying users is specified, but they do not incur any charges unless

they pump more than five times their allotted share of the safe yield over a five-year period, at which time they are required to pay the Watermaster to replace the water. According to the judgment, any unused water by individual overlyers not used during a five-year period shall be made available for allocation to the appropriators without diminishing the overlying user production rights.[764] Appropriators also had access to a "temporary surplus" totaling 160,000 AF over the period of 2004–2013 and divided among the five appropriative users. The temporary surplus was established to create additional storage capacity, and parties could enter into storage agreements with the Watermaster and receive credit for replenishing the basin. This provided an opportunity for the appropriators to store water from wet years to use in dry years, and 200,000 AF of storage capacity was reserved for conjunctive use. Any party to the judgment could use the storage capacity for storage of supplemental water provided that it was in accordance with a storage agreement with the Watermaster.[765] The appropriative water plus the temporary surplus was defined as the "operating yield."[766] If any appropriative user pumped more than its share of the operating yield, it was required to pay for replacing that water.[767]

The decree thus established controlled overdraft in the basin for the period of 2004–2013, with total annual extractions of approximately 24,650 AFY. At the end of the 10-year surplus period (beginning in 2014), withdrawals from the basin would return to the safe yield of the basin that was allocated to overlying users. At that time appropriators could only withdraw water they stored in the basin or that was credited to them by overlying users. After 2014, any groundwater pumped by an appropriator in excess of the amount of water in their storage account (taking into account all transferred water) is required to be replenished with imported water or other water (e.g., recycled water, captured stormwater from paved areas in new developments). This must be done on an acre-foot for acre-foot basis. If the water is not replaced, the appropriator will be invoiced in an amount sufficient to purchase the replenishment water.

There are three types of transfers: (1) transfer of water rights and/or water in storage between appropriator producers, (2) transfer of water rights from overlying producers to an appropriator producer in exchange for water service, and (3) the allocation of unused overlying water to the appropriator parties based on their share of the operating safe yield. Thus, overlying users could transfer their rights to appropriators, and if an overlying user requested water service from an appropriator, the overlying user effectively transferred its right to the appropriator. However, if an appropriator provided recycled water to an overlying user, this did not diminish the overlying water right.[768]

Water Users

Stipulated users

There are 17 overlying users (including individuals, golf courses/resorts, poultry farmers, private companies, and a church), and five appropriative users (retail water agencies).

Current users

The current users are the same as the stipulated users.

Excluded users

Minimal producers, defined as producing less than 10 AFY, are excluded from the judgment.

Management Structure

The judgment established a Watermaster Committee including representation from the five appropriators: the City of Banning, City of Beaumont, SMWC, YVWD, and BCVWD.

The Watermaster was granted discretionary powers to develop and implement a groundwater management plan for the Beaumont Basin, including water quality and quantity considerations and being reflective of the provisions of the judgment. In addition to administering the judgment, Watermaster responsibilities include collecting:

- information on water production, water level, and water quality information from the appropriator parties,
- water production and water level information from the overlying parties, and
- water level and water quality data from the City of Beaumont (collected by the city as part of their Maximum Benefit and Monitoring Program).

Additional Watermaster responsibilities include monitoring to determine whether ground subsidence may be occurring as a result of overpumping from the basin, and the maintenance and improvement of water quality.[769]

Overlapping management structures

The San Gorgonio Pass Agency's service area overlaps with the basin. It is the SWP contractor from which several members of the adjudication are purchasing imported water for direct delivery or for spreading and recharge of the groundwater basin.

Management Strategies

A key management strategy is the storage of imported and recycled water in the basin.

Imported Water: At the time of adjudication, the BCVWD planned to purchase significant amounts of imported water from the State Water Project (SWP) via the San Gorgonio Pass Water Agency (SGPWA) and store it in its Beaumont Basin storage account so that when the period of controlled overdraft ended there would be ample water in storage. However, due to the drought and other restrictions on imported water, BCVWD was not able to get all the water it had planned on from the SGWPA.

Storage: As of 2014, the Beaumont Watermaster had approved applications for storage of up to 260,000 AF of water in the basin by each of the five Watermaster members, as well as the Morongo Band of Mission Indians.

Spreading: BCVWD and the City of Banning purchased imported water from SGPWA since 2006 and 2008, respectively, and they spread this water at its Noble Creek spreading facility. Together they have spread 55,860 AF of imported water since 2006.[770] In 2010, the City of Beaumont began discharging small amounts of recycled water at a discharge point along a creek where it is believed that it will recharge the Beaumont Basin. However, studies need to be conducted in order for Beaumont to receive credit for recharging the basin.[771]

Monitoring and Reporting

In 2007, several of the overlying producer wells were not metered, or their meters were not working properly, and the Watermaster engineer recommended using a water duty method that is routinely used in the absence of metered production to estimate production based on

the type of use and the total acreage to which water was applied. In 2013, all 17 overlying producers were pumping from 22 groundwater wells. All active wells operated by the larger producers have meters, representing about 96 percent of the total production by overlying parties in 2014. Remaining wells of smaller producers do not have meters. Their production is estimated using the water duty method.[772]

Safe Yield

The decree established the safe yield as 8,650 AFY, which was to be reevaluated every 10 years. The judgment defined *safe yield* as "the maximum quantity that can be produced annually from a groundwater basin under a given set of conditions without causing a gradual lowering of the groundwater level leading eventually to depletion of the supply in storage."[773] The 8,650 AFY safe yield of Beaumont basin included only natural recharge. However, the decree also defined an "operating safe yield" (OSY) as "the maximum quantity of water which can be produced annually by the Appropriators from the Beaumont Basin, which quantity consists of Appropriative Water plus Temporary Surplus."[774] The temporary surplus was 160,000 AF over ten years, resulting in an annual operating safe yield of the basin of 24,650 AFY for 2004–2013. This period of controlled overdraft ended in 2014.

In 2015, the Beaumont Basin Watermaster voted to approve a revised safe yield of 6,700 AFY. The judgment provided appropriators with access to the difference between the safe yield and actual overlyer extractions. With the new safe yield at 6,700 AFY, appropriators will likely receive less water from the overlyers, depending on subsequent transfers from overlyers to appropriators.[775]

Groundwater Pumping and Overdraft

Prior to the adjudication, groundwater levels in the Beaumont Basin were declining.[776] But since 2004, production by overlying users decreased from 3,576 AF in 2004 to 1,922 AF in 2014. Production by appropriators fluctuated, but in recent years steadily increased. In 2010, appropriators produced 11,642 AF, while in 2014 they pumped 15,063 AF, which was the third-highest production in a year since inception of the judgment. Thus, even though the period of temporary surplus ended in 2013, pumping in 2014 exceeded the safe yield of 8,650 AFY (as of this year at 6,700 AFY), and totaled 16,985 AF.[777] Despite spreading operations for basin recharge by appropriators (5,029 AF in 2014),[778] groundwater levels declined in 2014 in many parts of the basin.[779]

There is some concern about the future potential for land subsidence that may occur as a result of past and future groundwater pumping from the basin. STWMA developed a monitoring program to assess the occurrence of subsidence from past groundwater pumping and future pumping and preliminary results of the program indicate that very little, if any, subsidence has occurred as a result of historic pumping and overdraft.

Water Quality

Water quality is acceptable, although some non-potable wells exceeded federal and state limits for nitrates in 2014.[780]

Discussion

Appropriators were allocated a "temporary surplus" over a 10-year period to allow for continued residential development in the area. This controlled overdraft was also to improve

water supply reliability during dry periods by generating storage space in the basin for future conjunctive use. Parties to the judgment have already entered into agreements with the Watermaster to store 260,000 AF in the basin.

While this arrangement was dependent on receiving sufficient imported water, imported water may be more expensive and less reliable under climate change. Thus, at the time of adjudication, the BCVWD planned to purchase significant amounts of imported water from the SWP via the San Gorgonio Pass Water Agency and store it in its Beaumont Basin storage account so that when the period of controlled overdraft ended there would be ample water in storage. However, due to the drought and other restrictions on imported water, BCVWD was not able to get all the water it had planned on from the Pass Agency.

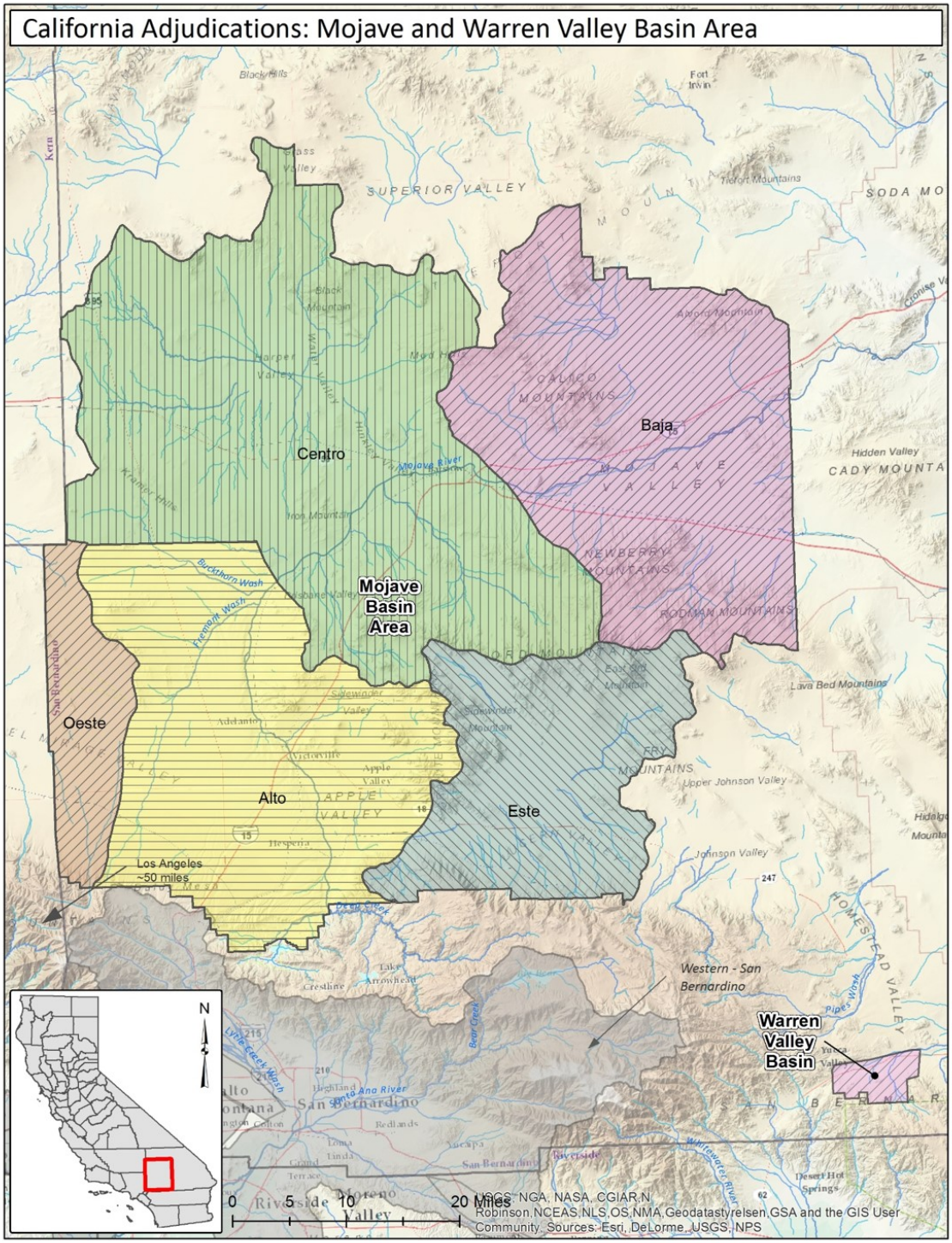
It appears that groundwater levels are still declining and appropriator extractions have been increasing and are significantly higher than the natural safe yield. However, the judgment intended to initially draw down the basin to create storage space. The issue is whether users will be able to remain within the safe yield now that the period of controlled overdraft has ended. It appears that in 2014, the first year after the end of the controlled overdraft, extractions exceeded the native safe yield.

In the 2013 Watermaster report it was noted that the Watermaster had not conducted a meter maintenance program to make sure groundwater production is reported accurately, had not enforced the procedures pertaining to the submittal of applications to recharge supplemental or new yield water in the basin, had not enforced the submittal of applications for the recapture of water in storage by appropriators, had not enforced the submittal of notices of transfers prior to accounting for said transfers, but had filed its annual reports with the court.[781]

BEAUMONT BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Riverside Area: About 28 sq. mi. Physical Characteristics: Beaumont Basin (also known as the *Beaumont Storage Unit*) is defined by several faults and underlies portions of the San Timoteo Watershed. It is Recharge is via percolation of precipitation, subsurface seepage across fault boundaries, return flows from irrigation and septic tanks, and artificial recharge. Precipitation: ~ 17″ per year CASGEM: Medium Population: 22,860 (2010) Land Use: Rapid residential development Reason for Adjudication: Plans for future significant residential development in the area would require additional imported and recycled water supplies, and a desire to develop the capacity for groundwater storage to carry over supplies from year to year.	Adjudication Initiated: 2003 Adjudication Finalized: 2004 Decree Summary: Established a period of controlled overdraft – a temporary surplus totaling 160,000 AF, so appropriators who were junior to overlyers would not be left without sufficient water after adjudication. The goal was for appropriators to bank some of that water for future use when the period of controlled overdraft ended. This was in exchange for the appropriators giving all of the estimated safe yield, 8,650 AFY, to the overlyers, who do not incur any charges unless they pump more than five times their allotted share of the safe yield over a five-year period, when they are required to pay the Watermaster to replace the water. Any water not used by individual overlyers during a five-year period is also made available to appropriators who have to pay for replacement water if they pump over their allotted share.	Watermaster: A committee with responsibilities that include: collecting water production, water level, and water quality data; monitoring for subsidence; and improvement of water quality. Members: Five appropriators: the City of Banning, City of Beaumont, South Mesa Water Company (SMWC), Yucaipa Valley Water District (YVWD), and Beaumont-Cherry Valley Water District (BCVWD). Strategies: Storage of imported and recycled water.	Adjudicated Safe Yield = 8.650 AFY Operating Safe Yield temporary surplus of 160,000 AF for 2004–13) = 24,650 AFY (2004–13) Current Safe Yield = 6,700 AFY (2015) Safe Yield Summary: The temporary surplus resulted in an annual operating safe yield of the basin of 24,650 AFY for 2004–2013. This period of controlled overdraft ended in 2014. Additionally, with the 2015 safe yield at 6,700 AFY, appropriators will likely receive less water from the overlyers, depending on subsequent transfers from overlyers to appropriators. Adjudication Extractions: Overlyers: 3,576 (2004) Current Extractions: Overlyers: 1,922 (2014); Appropriators: 11,642 (2010); 16, 985 (2015) Extraction Summary: Production by appropriators fluctuated, but in recent years steadily increased. 2014 extractions were the third highest yearly production since inception of the judgment. Thus, even though the period of temporary surplus ended in 2013, pumping in 2014 exceeded the safe yield of 8,650 AFY (as of 2015 at 6,700 AFY), and totaled 16,985 AF. Groundwater Levels: Groundwater levels are still declining, but the judgment intended to draw down the basin to create storage space. Overdraft: Since the controlled overdraft period just ended, it is probably too early to tell how effective this adjudication will be with respect to overdraft over the long term. Water Quality: Some non-potable wells exceeded federal and state limits for nitrates (2014) Discussion: **- This adjudication was concluded rapidly—just a year and a half after it was initiated.** **- Appropriators were allocated a "temporary surplus" over a ten-year period to allow for continued development in the area and improve water supply reliability during dry periods by generating storage space in the basin for future conjunctive use. This arrangement depended on receiving sufficient imported water. Parties to the judgment have already entered into agreements with the Watermaster to store 260,000 AF in the basin. More time is needed to assess how well these storage arrangements will work.** **- Importantly, appropriator extractions have been increasing and are significantly higher than the natural safe yield, so the issue is whether users will be able to remain within the safe yield now that the period of controlled overdraft has ended.** **- The region is relying on imported water To sustain the increased extractions and replenish the basin, the region is relying on imported water that may be more expensive and less reliable under climate change.**

Desert Basins



WARREN VALLEY BASIN

The Warren Valley Basin adjudication established the water rights of users, but since these rights far exceeded the very small safe yield of this desert groundwater basin, the judgment did not limit pumping to the safe yield. Instead, it required the Watermaster to develop imported water sources in order for economic activity to continue in the region. The basin was in significant overdraft prior to the importation of water, but groundwater levels improved significantly after the arrival of imported water, and in most years groundwater recharge now exceeds pumping rates. However, during drought years less water is likely to be available from the State Water Project for recharge, which may pose problems over the long term for this basin. The basin also experienced unexpected problems with high nitrate concentrations when groundwater recharge enabled seepage from septic tanks to reach the groundwater basin. The local agency, serving as Watermaster, recently obtained funding to build wastewater treatment and reclamation facilities to address this groundwater quality problem, as well as to provide additional recharge to the basin.

Overview

County	San Bernardino
Area	23,952 acres[782]
Population	22,860 (2010)[783]
CASGEM	Medium
Watermaster	Hi-Desert Water District (HDWD)
Members	HDWD, Blue Skies Golf Course (Hawk's Landing), the Institute of Mental Physics, and 16 minimal producers
Court Case	*High Desert County Water District v. Yucca Water Company* California Superior Court for the County of San Bernardino, Judgment 172103

CASGEM = California Statewide Groundwater Elevation Monitoring

Located in the Colorado Desert, this basin is bounded on the north by the Pinto Mountain fault, and to the south by a bedrock outcrop of the Little San Bernardino Mountains. Bedrock constrictions bound the basin to the east and west. The basin is composed of the upper, middle, and lower aquifers, and is divided into five hydrogeological units.[784] Average precipitation over the basin is 10 inches per year. Natural basin recharge is from the percolation of rainfall and ephemeral streams, and is limited to about 200 AFY.[785] In 1987, the estimated total usable storage capacity in the basin was 106,000 AF.[786] In 2013–2014, the total available basin storage within the West, Midwest, and Mideast aquifers was estimated to be 58,269 AF.[787]

There is little or no agriculture in this desert region, and the town of Yucca Valley accounts for the vast majority of the population. Except for irrigation of a golf course, groundwater pumped from the basin is for municipal use. Located near Joshua Tree National Park, tourism is important to the economy of the region.

Reason for adjudication

Given its location in the Colorado Desert, the Warren Valley basin has very low natural

recharge, and usage exceeded this recharge since the 1950s. In 1972, the United States Geological Survey (USGS) estimated that under current patterns of use, the basin's groundwater would be depleted by 2000.[788] In 1976, the Hi-Desert Water District (HDWD) filed a complaint against Yucca Water Company (the other major user of the basin), requesting adjudication of groundwater rights. The Superior Court of California for San Bernardino County issued a judgment in 1977, based on a stipulated agreement arrived at by the majority of groundwater users.

Decree and Amendments

Adjudication initiated: 1976
Adjudication finalized: 1977
Revisions or amendments:
1991 (Warren Valley Basin Management Plan adopted)
1992 (revision of the safe yield to 900 AFY)
1998 (revision to require annual reporting on conditions affecting groundwater supply and use, and implementation of groundwater monitoring)
Stipulated Judgments: 1977
Other dates: Watermaster Board restructured in 1990 and 1995

Decree Summary

The judgment declares that the basin was in overdraft during the period of 1970–1975, and that use by all parties was open and notorious during that time. With respect to overlying users (including the Blue Skies Golf Course and 17 individuals using approximately 1 AFY), the court determined that they had preserved by self-help the right to their average use during that five-year period. The judgment states that "overlying rights have been prescripted except to the extent of such maximum annual self-help by production during the prescriptive period," and that "by reason of said prescriptive circumstances, all unexercised overlying rights have been lost so long as Warren Valley basin remains in a state of overdraft."[789] Appropriative rights were documented for HDWD at 896 AFY and the Yucca Water Company at 726 AFY. These two users were deemed to have equal priority, but that per Section 1007 of the California Civil Code, prescription did not apply to these public agencies.[790] The court acknowledged that these combined uses far exceeded the safe yield of the basin (then estimated at 200 AFY), and that restricting usage to the safe yield would not be feasible. Instead, the court assigned HDWD the role of Watermaster, and ordered it to develop a proposal for supplemental water supplies.[791]

Amendment Summaries

By 1990, a plan for a physical solution had not yet been developed, so the court appointed six new non-voting members to the Watermaster Board and ordered a report on progress within six months. In 1991, HDWD submitted the Warren Valley Basin Management Plan to the court, which adopted it as part of the judgment. This document outlined plans for importing water from the State Water Project (SWP) through the construction of the Morongo Pipeline, to be built and managed by the Mojave Water Agency (MWA), whose jurisdiction includes the Warren Valley basin. HDWD was entitled to 2,250 AFY of SWP water, and Yucca Water Company was entitled to 2,032 AFY (HDWD bought Yucca Water Company in 1990). The plan also included water from a well in the Ames Valley Basin, which is partially included within HDWD's service area. Under a 1991 agreement with Big-Horn Desert View Water Agency, HDWD obtained title to 800 AFY from this source. In addition, the plan recommends that HDWD develop capacity for stormwater capture, groundwater recharge

facilities, a gray water use program, a wastewater treatment system, and extensive water conservation efforts. The plan also discusses the increase of production assessments and the creation of a replenishment assessment to cover the Watermaster's costs in implementing this plan.[792] In 1992, in response to two new engineering studies, the court revised the safe yield to be 900 AFY.[793] At that time, the court also ordered that the Watermaster report annually on conditions that might affect the safe yield. However, since users are not restricted to the safe yield, in 1998 HDWD requested and received approval from the court to report instead on the conditions affecting groundwater supply and use.[794]

Water Users

Stipulated users

HDWD, Yucca Water Company, Blue Skies Golf Course, and 17 individuals pumping 1 AFY or less

Current users

HDWD (which purchased Yucca Water Company in 1990), the golf course (now called Hawks Landing), Institute of Mental Physics, 16 individuals, and the Joshua Tree Retreat Center.

Excluded users

Environmental uses do not appear to have been considered. Joshua Tree Retreat Center does not appear to be represented on the Watermaster Board.

Management Structure

The 1977 decree designates HDWD as the Watermaster, through its Board of Directors. HDWD was responsible for administering the judgment, including development of supplemental supplies. The Watermaster Board was restructured in 1990 and again in 1995. Currently, the board includes the five members of the HDWD Board of Directors, and one non-voting representative each for the Hawk's Landing country club, the Institute of Mental Physics, and 16 minimal producers.[795] The Watermaster Rules and Regulations also indicate that there is an advisory committee to the Watermaster, but no agendas or meeting notes are available.[796] The service area of MWA, which operates the Morongo Pipeline to deliver SWP water for basin recharge, overlaps that of the HDWD. The MWA also has a storage account with HDWD to support its conjunctive water use efforts.

Management Strategies

Imported Water: Since water usage in the area vastly exceeds the natural recharge rate, the primary management strategy is the use of imported water to meet user needs and to recharge the basin. Although planning for a physical solution began with the original decree in 1977, additional water sources did not arrive until 1992, when HDWD began to receive approximately 800 AFY from a well in the neighboring Ames Valley Basin. In 1995, the MWA finished constructing the Morongo Pipeline and began to deliver SWP water, which is used for groundwater recharge. HDWD receives approximately 3,500 AF of SWP water in most years, although this supply is diminished in drought years.

Stormwater Management Program: In addition, HDWD implements a stormwater management program to promote recharge and public education to encourage water conservation.[797] In addition, HDWD is starting construction on a wastewater treatment and

reclamation system that will also increase groundwater recharge.[798]

Monitoring and Reporting

All parties pumping in excess of one acre-foot of water are required to install water meters, and must submit annual reports on to the Watermaster. Measurements must be made quarterly for water level, extraction, and recharge.[799]

Safe Yield

In the 1977 judgment defined safe yield as the "the long term average annual net native supply of water to the basin under cultural conditions of a particular year," and estimated it at 200 AFY.[800] In 1992 the court increased this native safe yield to 900 AFY, based on two new engineering studies. However, under the judgment, groundwater pumping is not limited to safe yield, but rather to pumping amounts delineated the Basin Management Plan developed by HDWD to ensure long-term sustainability of the basin, taking into account imported water supplies.[801] No specific operating safe yield has been defined.

Groundwater Pumping and Overdraft

Overdraft was defined in the 1977 judgment as total annual production that exceeds the native safe yield of 200 AFY.[802] The judgment did not limit users to the safe yield and instead ordered the development of new water supplies. However, these supplies did not arrive until 1992, and during that period, the basin was in controlled overdraft. Pumping steadily increased to over 2,500 AF in 1990, and groundwater levels decreased by up to 40 feet per year.[803] When supplies from a neighboring basin arrived in 1992, and then SWP water arrived in 1995, this trend began reverse, and by 2001, water levels had increased by about 250 feet compared to 1995.[804]

Data on storage in the aquifer also reflects this trend. In 1994–1995, just before SWP water began to arrive, total storage in the Upper Aquifer was 25,990 AF. By 2013, storage had risen to 59,442 AF, sufficient for about 24 years. If the middle aquifer is included, groundwater storage is at 95,882 AF, sufficient for 38 years. Compared to the estimated total storage capacity of the basin of 106,000 AF, the basin appears to be nearly full. In 2012–2013, an estimated 2,342 AF was pumped from the basin, and remaining demand was met through water from the Ames Valley basin (720 AF). Recharge from SWP water amounted to 2,982 AF.[805]

Water Quality

Prior to the arrival of SWP water in 1995, no significant water quality problems were reported in the basin. However, after SWP began to be used for recharge, HDWD observed a significant spike in the concentration on nitrates in wells near the recharge basins, at times exceeding the maximum contaminant levels (MCL). HDWD and MWA contracted with USGS to study the problem, and found that as groundwater levels rose as a result of the recharge, seepage from septic tanks began to flow into the saturated zone, leading to increased nitrate concentrations.[806] Since Yucca Valley was entirely reliant on septic tanks for disposing of wastewater, HDWD began working to develop a wastewater treatment and reclamation system, which help contribute to improved groundwater supplies, as well as quality. Through federal funds and low-interest loans, construction is scheduled for completion in 2022.[807]

Drought

The region relies heavily upon imported water from SWP, which may be reduced during drought years. For example, during the current drought, SWP contractors received 5 percent of their SWP allocations, and in 2015 were expected to receive approximately 20 percent. This means that HDWD's ability to recharge the groundwater basin will be limited in these years. Although the groundwater basin provides storage to withstand drought periods, if droughts become more frequent or severe, as expected under climate change, this may pose a risk to the long-term sustainability of the basin. However, the development of a wastewater treatment and reclamation system, currently under way, will provide an additional local source of groundwater recharge.

Disputes

One current user, the Joshua Tree Retreat Center, appears to have a dispute with HDWD over reporting requirements, such that HDWD was not able to include their water use in the 2012–2013 annual report.[808]

Discussion

The Warren Valley adjudication established the water rights of users, but since these rights far exceeded the very small safe yield of this desert groundwater basin, the judgment did not limit pumping to the safe yield. Instead, it required the Watermaster to develop imported water sources in order for economic activity to continue in the region.

Overall, with the importation of State Water Project water, it appears that the adjudication avoided serious depletion of the groundwater basin that had been projected in the 1970s. Although it took 18 years to develop the physical solution called for in the 1977 judgment, current SWP imports now enable HDWD to recharge the basin with more water than is used in most years, and groundwater levels have increased significantly from their low levels in the early 1990s. However, the basin is heavily dependent upon this imported water, whose deliveries are unreliable in drought years. The basin has enough storage at this point to withstand a multi-year drought, but if droughts become more frequent under climate change, recuperating from years with low recharge will become more difficult.

The basin experienced unexpected problems with high nitrate concentrations when groundwater recharge enabled seepage from septic tanks to reach the groundwater basin. HDWD has recently obtained the funding to build wastewater treatment and reclamation facilities that will address this groundwater quality problem, as well as provide additional recharge to the basin.

WARREN VALLEY BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino Area: 23,952 acres Physical Characteristics: The basin is divided into five hydrogeological units. Natural recharge from rainfall and runoff is limited to ~200 AFY. *Storage Capacity:* 106,000AF *Precipitation:* 10″ per year CASGEM: Medium Population: 22,860 (2010) Land Use: residential, unimproved, golf course Reason for Adjudication: Overdraft began in the 1950s. By the 1970s, estimates showed that water supplies in the basin might not last beyond 2000. Hi-Desert Water District filed a complaint against the other major water user, Yucca Water Co., requesting adjudication.	Adjudication Initiated: 1976 Finalized: 1977 Amended: 1991, 1992, 1998 Decree: Since economic activity would not be feasible if the safe yield of 200 AFY were adhered to, the court ordered HDWD, as Watermaster, to develop plans for importing water to the basin. Amendment: 1991: Warren Valley Basin Management Plan outlines plans to import water from the SWP through the Morongo Pipeline, which was operational by 1995. 1992: safe yield revised to 900 AFY. 1998: Watermaster no longer required to report on factors affecting safe yield.	Watermaster: Hi-Desert Water District (HDWD), governed by five members of HDWD's Board of Directors, and three non-voting members representing other water users. Adjudicated members included HDWD, Yucca Water Co., and 17 individuals pumping less than 1 AFY. Current members are HDWD, the Institute of Mental Physics (pumps from outflow of the basin), and 16 individual producers. HDWD purchased Yucca Water Co. in 1990. Reports indicate that Joshua Tree Retreat Center is a groundwater user, but it does not appear to be a member. Strategies: Imported water, stormwater capture, conservation	Adjudicated Safe Yield: 200 AFY native safe yield Current Safe Yield: 900 AFY Safe Yield Summary: Initially, native safe yield was estimated at 200 AFY. In 1992, this estimate was revised to 900 AFY, based on new studies. This is still the safe yield, but pumping is allowed in excess of this amount based on a management plan involving recharge through imported water. Adjudication Extractions: From 1970–1975 (period used to establish pumping rights), extractions ~ 2,224 AFY. Current Extractions: In 2012–2013, an estimated 2,342 AF was extracted. Extraction Summary: Current extractions are at a similar level to extractions prior to adjudication. However, because approximately 3,500 AFY is imported from the State Water Project in most years, current extractions are less than the amount of basin recharge. Overdraft: Overdraft was defined in the 1977 judgment as total annual production that exceeds the native safe yield. The judgment did not limit users to the safe yield and instead ordered the development of new water supplies. These did not arrive until 1992, and during that period, the basin was in controlled overdraft and pumping steadily increased. Groundwater Levels: During the controlled overdraft period, 1972–1990, groundwater levels declined from 7 ft/year to 40 ft/year. After SWP imports began in 1995, groundwater levels began to recover, and rose by 250 ft between 1995 and 2001. In 2012–2013, groundwater in storage in the upper and middle aquifers was 95,882 AF, sufficient for 38 years. Water Quality: After the arrival of SWP water in 1995, recharge caused seepage from septic tanks to flow into the saturated zone leading to increased nitrate concentrations in wells near the recharge basins, at times exceeding the MCL. HDWD has developed plans for wastewater treatment and reclamation. Drought: During droughts, SWP water imports are reduced, and in these years, extractions may exceed recharge. The planned wastewater reclamation facilities should provide additional local groundwater recharge. Discussion: **- Users were not restricted to the safe yield, but instead rely on imported water to manage the basin to ensure long-term sustainability. As imported water becomes more expensive and less reliable, especially during drought years, this may be problematic in the future.** **- Groundwater levels have improved since the arrival of SWP water. - An unexpected spike in nitrates occurred as a result of recharge efforts. This is being addressed through the construction of wastewater treatment and reclamation facilities, which will also improve groundwater recharge.**

MOJAVE BASIN

The Mojave Basin adjudication was initiated by a lawsuit filed May 30, 1990, by the City of Barstow and the Southern California Water Company. The complaint alleged that the cumulative increase in water use in the upper part of the Mojave Basin caused or threatened to cause a reduction in the natural flow of water to the central part of the Mojave Basin. Water users included downstream agriculture (many alfalfa farms), aquaculture, recreational lakes, homeowner associations, and upstream burgeoning municipalities. In the center of the basin is the smaller, low-income town of Barstow, which was concerned about its water supply. A 1993 Stipulated Judgment set forth a proposed physical solution that did not apportion production rights on the basis of preexisting legal water rights, and parties representing over 80 percent of verified water production in the basin agreed to its terms. However, some farmers with overlying rights chose not to stipulate to the judgment. On appeal, the court stated that in considering a stipulated physical solution involving equitable apportionment, the water rights of parties that did not join the stipulation must also be considered. The adjudication set out a complex system to reduce production a producer's free production allowance (FPA) over time, but withdrawals remain significant in three out of the five subareas. The judgment also contained unique provisions for assuring that the water needs of endangered and other species and their habitat would be protected. One outcome of the adjudication was that many farmers in the western Alto Subarea sold or leased their base annual production (BAP) rights or leased their FPA to municipalities, and population in the Alto Subarea almost doubled. The Barstow Marine Corps Logistics Base east of Barstow is a federal Superfund site.

Overview

County	San Bernardino
Area	3,400 square miles[809]
Population	(2010) Upper: 355,388; Middle Mojave River Valley: 6,654; Lower Mojave River Valley: 32,938
CASGEM	High (Upper Mojave River Valley); Low (Middle Mojave River Valley); Medium (Lower Mojave River Valley)[810]
Watermaster	Mojave Water Agency (MWA)
Court Cases	**Trial Court:** Physical Solution: *City of Barstow et al. v. City of Adelanto et al.,* Riverside County Superior Court Case No. 208568 (1996) **Final Judgment:** *City of Barstow et al. v. Mojave Water Agency,* California Supreme Court, 23 Cal. 4th 1224, 5 P.3d 853, 99 Cal. Rptr. 2d 294 (2000)

CASGEM = California Statewide Groundwater Elevation Monitoring

The adjudicated area of the Mojave Basin is located in San Bernardino County and is bounded south by the San Bernardino and San Gabriel Mountains, northeast by Afton Canyon, and west by Antelope Valley. For purposes of defining and implementing a physical solution, the basin was considered to consist of five distinct but hydrologically interrelated "subareas," and a transition zone of the Alto subarea. Each subarea was found to be in overdraft to some extent due to the use of water by all of the producers in that subarea. The five separate hydrologic subareas are: Este (East Basin), Oeste (West Basin), Alto (Upper

Basin), Centro (Middle Basin), and Baja (Lower Basin).[811] Alto has the largest water supply, primarily due to proximity to the Mojave River headwaters. Centro and Baja are dependent upon infrequent, very large storm events for groundwater recharge. Este and Oeste have the least amount of supply, most of which originates from surface water.[812] Rainfall averages between 4–6 inches annually.[813]

The primary source of natural recharge to the groundwater basin is the Mojave River, which is in hydraulic connection with the aquifer in many areas.[814] It flows inland north and east from the San Bernardino Mountains passing through the upper basin (Alto). Then it winds into the Mojave Desert before reaching Barstow in the middle basin (Centro) and terminating in the desert. The river is an undependable source of water, so basin residents rely almost entirely on groundwater for their water supply.[815] The total storage capacity for the Lower Mojave River Valley Groundwater Basin is approximately 9,010,000 AF.[816] The population rapidly increased in the middle twentieth century in the Alto area, reaching more than 60,000 by 1960, and approximately 250,000 by the 1980s, with many residing in new housing developments. Today, the Alto subarea population is over 450,000. The population increase was accompanied by an expansion of irrigated agriculture to approximately 20,000 acres, primarily in the Baja area. Alfalfa, a very water consumptive crop, was the primary crop grown in Baja. Located in the Centro area, the City of Barstow's population in 2013 was 23,219, with only a 9.9 percent increase since 2000. Barstow's median household income in 2012 was $41,379.[817]

Reason for Adjudication

Parts of the basin were already in overdraft by the end of the 1950s, and overdraft grew worse as development continued. By 1990, the basin's population was approximately 235,000—more than 10 times the population in 1950.[818] In 1960, the Mojave Water Agency (MWA) formed in part to contract for State Water Project (SWP) water.[819] The agency then initiated an adjudication to determine the water rights of all pumpers in the basin to resolve who was entitled to local supplies and who should pay for more expensive imported water.[820] In 1966, the first complaint to adjudicate water rights was filed,[821] and in 1970 a proposed stipulation was filed that limited pumping rights, provided for a net pump tax, and designated MWA as Watermaster. However, by the end of 1970 there was major opposition to the adjudication, including by the City of Barstow. In 1976 MWA was granted a motion to dismiss this first adjudication attempt.[822]

Population and farming increased throughout the Mojave basin in the late 1970s. By the 1980s overdraft reached alarming rates, with extractions exceeding the natural safe yield of the basin by nearly four-fold, resulting in problems downstream.[823] In 1990, the City of Barstow and Southern California Water Company filed a complaint in San Bernardino Superior Court that alleged that the cumulative increase in water use in the upper part of the Mojave Basin caused or threatened to cause a reduction in the natural flow of water to the central part of the Mojave Basin (the area in which the City of Barstow is physically located). Barstow contended that a major development project approved by the City of Hesperia would cause a further decline of the amount of water flowing from upstream users to downstream users. Barstow's lawsuit sought a guaranteed amount of water (30,000 AFY) from upstream users and a requirement that MWA request a writ of mandate to require the Agency to act pursuant to its statutory authority to obtain and provide supplemental water for use within the Mojave Basin Area. A cross-complaint was filed by MWA approximately one year after the initial lawsuit. The cross-complaint requested that the court declare the native natural water

supply of the Mojave Basin inadequate to meet the demands of cumulative water production within the basin, and determine individual water production rights of producers throughout the entire Mojave Basin Area. This action included not only those water producers upstream of the City of Barstow, but also those water producers downstream of the City of Barstow.[824]

Due to the magnitude and complexity of the case, and to avoid extensive and expensive litigation, in 1992 numerous water producers named as parties to the lawsuit[825] devised a proposed settlement in the form of a stipulated judgment. This set forth a proposed physical solution requiring a reallocation of already developed water to address the problem of overdraft. Regionally, the physical solution required each subarea within the basin to provide a specific quantity of water to the adjoining downstream subarea.

Significantly, the physical solution did not apportion production rights on the basis of preexisting legal water rights and did not include a well-by-well determination of water rights. The drafters of the physical solution believed such apportionment would lead to inequitable water allocation, and instead relied on the doctrine of equitable apportionment where water is shared based on concepts of equity and fairness. The court further concluded that allocating water based on asserted legal priorities would be "extremely difficult, if not impossible," and "that in the face of severe overdraft of an inter-related water source, all use was unreasonable, whether or not a user held riparian or overlying rights, and several factors justified the water right allotment on a non-priority basis." The court stated that article X, section 2 of the California Constitution required an equitable apportionment of all rights when a basin is in overdraft. The trial court approved the stipulated agreement as binding on all users in the basin, including pumpers who had not agreed to the settlement.

A "base annual production" (BAP)was established for each party, determined by the producer's maximum annual production prior to the adjudication over the five-year period from 1986 to 1990. The solution defines a producer's base annual production right as "the relative right of each producer to a free production allowance within a given subarea, as a percentage of the aggregate of all producers' base annual production in the subarea." The higher the base annual production right, the more water a producer can sell under transfer provisions and produce free of a replacement assessment. Though not part of the physical solution, the court also authorized MWA to create and administer a procedure for the participation of minimal producers.

After entry of the 1993 Stipulated Judgment, parties representing over 80 percent of verified water production in the basin agreed to its terms.[826] However, nine non-stipulating parties, referred to as the "Cardozo Group," appealed. In 1998, the Appellate Court's final opinion affirmed that judgment as to the stipulating parties, but stated that it saw no reason why it should not also "protect the rights of the Cardozo Appellants while also respecting the rights of the stipulating parties to agree to a [solution that] waives or alters their water rights in a manner which they believe to be in their best interest." So it reversed the Superior Court who had excluded the non-stipulating parties, Cardozo Group, and Jess Ranch Water Company, from the stipulated judgment, and granted Cardozo Appellants injunctive relief to protect their riparian and overlying water rights to the current and prospective reasonable and beneficial need for water on their respective properties.[827]

In 1998, the Supreme Court (in response to a petition for review by MWA) affirmed the 1998 Court of Appeal's decision in almost all aspects.[828] In 2002, the Cardozo appellants and MWA, on behalf of the stipulating parties, reached agreement regarding no interference with

the Cardozo Group's right to pump water from underneath their respective lands for current and prospective reasonable and beneficial use on their respective properties.[829]

Decree and Amendments

Adjudication initiated: 1990
Adjudication finalized: 2000
Stipulated judgments: 1993
Costs: Administrative costs 2014–2015: $393,665[830]

Decree Summary

The stipulating parties' declaration of water rights took into consideration the competing priorities as well as equitable principles. It considered the following in the formulation of each producer's base annual production (BAP) right: that the Mojave Basin area was for many years in a condition of overdraft, that all producers had contributed to the overdraft, and that "it would be difficult to apportion rights based on asserted priorities and would not result in an equitable apportionment of water."

The Appeals Court, however, noted that in considering a stipulated physical solution to be imposed on non-stipulating parties, it must consider the water rights of parties that did not join the stipulation,[831] and a physical solution must preserve water right priorities, but only to the extent those priorities do not lead to unreasonable use. The Supreme Court affirmed the Court of Appeal holding that the Cardozo appellants retained their overlying rights by pumping, and stated that "no parties have claimed prescriptive rights, and the parties that stipulated to the physical solution did not seek findings under the prescriptive rights doctrine," so no claim of prescription was asserted to reduce those retained overlying rights. The court stated that this protected the rights of the Cardozo Appellants while also respecting the rights of the stipulating parties to agree to a judgment that would waive or alter their water rights in a manner which they believed to be in their best interest.[832]

For purposes of administration, the judgment defined five distinct but hydrologically interrelated subareas: Este (East area), Oeste (West area), Alto (Upper area), Centro (Middle area) and Baja (Lower area).[833] Some subareas historically received a portion of their natural water supply flowing to them from upstream subareas. The judgment specified that: "To maintain that historical relationship, the average annual obligation of any subarea to another is set equal to the estimated average annual natural flow (excluding storm flow) between the subareas over the 60-year period 1930–1931 through 1989–1990. If the subarea obligation is not met, producers of water that do not bear a replacement obligation in the upstream subarea must provide makeup water." The judgment also required that minimum water levels be established in a transition zone primarily for the purpose of prioritizing recharge within the Alto Subarea. Until minimum water levels were established, recharge of supplemental water was required to be delivered to the transition zone first, if there was a mandatory replacement obligation in the transition zone. Since entry of the judgment there was no mandatory replacement obligation in the transition zone.[834]

An underlying assumption of the judgment was that sufficient water would be made available to meet the needs of the basin in the future from a combination of natural supply, imported water, water conservation, water reuse and transfers among parties. Water rights were based on historic pumping. Specifically, a base annual production (BAP) right was defined as the highest amount of water produced by a party in one year during a five-year (pre-adjudication)

period (1986–1990). A decreasing free production allowance (FPA) was established in each subarea based on the BAP to maintain proper water balances, with annual court review and adjustment. Water produced in excess of a producer's FPA was required to be replaced by the producer, or the producer was required to provide funds for the Watermaster to purchase replacement water.[835]

During the first five years that the judgment was in effect, each producer's share of the FPA in each of the five subareas, expressed as a percentage of that producer's BAP, was to be decreased as follows:

- Water Year 1993–1994: 100%
- Water Year 1994–1995: 95%
- Water Year 1995–1996: 90%
- Water Year 1996–1997: 85%
- Water Year 1997–1998: 80%

Before the end of the fifth year and each year thereafter, the Watermaster was required to analyze conditions in each subarea and recommend to the court any increase or further reduction in FPA. The MWA paid the Cardozo Group $500,000 in exchange for agreeing not to challenge this water-rationing plan.[836] However, enforcement of the judgment's provision of requiring users to reduce water use by 5 percent per year until it falls within 5 percent of the calculated production safe yield (PSY) was temporarily suspended after 2000 for agriculture users in the Baja area. It was later reinstated, and is now being reconsidered every year by the court until FPA is within 5 percent of the calculated PSY.[837]

The judgment provided a framework for carry over, transfers, selling, and leasing of rights within and between subareas. With respect to carry over of rights, a carryover of an FPA must be used in the current year, or it will be deemed "expired." With respect to transfers, producers who were assigned a BAP right in the judgment have the option to transfer the BAP right or any portion of it. There are basically two different categories of water transfers: permanent and temporary. A permanent transfer of BAP right assigns the right to produce the transferred amount of water from one producer to another indefinitely. A temporary transfer assigns the right to use a specified amount of water either on a year-to-year basis or for one year only. An FPA or carryover FPA can also be transferred from one producer to another in any given water year, or for a multiple-year lease term. Water produced in one subarea and exported to another subarea for use or disposal had a replacement water obligation, and no inter–subarea transfer could become operable until authorized by the Watermaster.[838]

The judgment contained unique provisions for assuring that the water needs of endangered and other species and of riparian habitat in the Mojave Basin Area were protected. Groundwater level standards were set in several key areas along the river. In the event standards were not met, a trust fund was established by the judgment to provide money to buy water, construct wells, or conduct other projects proposed by the California Department of Fish and Wildlife (DFW). The trust fund, capped initially at $1,000,000 (in 1993 dollars), was to be financed by an escalating per acre-foot assessment on production beginning at $0.50.[839] Moreover, the environmentally sensitive transition zone immediately down-gradient of the Alto sub-basin is currently experiencing historically high water levels with riparian habitat flourishing.[840]

Water Users

Stipulated User

Parties who represented over 80 percent of verified water production in the basin.

Non-Stipulated Users

Nine agricultural producers: "The Cardozo Group"

Other

Well owners who pumped 10 AFY or less (more than 800 producers) were classified as minimal producers, and were not part of the physical solution. The MWA was to prepare an administrative program, Ordinance 11, but it did not prioritize this task, and that program was rescinded July 11, 2013.[841] Ninety-seven percent of the water currently is pumped by less than 15 percent of users. Additionally, most people in the high desert get their water from an organized water system and are not individually affected by the adjudication or the minimal producer program.[842] Environmental uses were also considered.

Management Structure

The MWA was appointed Watermaster, with continuing court jurisdiction, and is responsible for monitoring and verifying water production, collecting assessments, conducting studies, and recording water transfers and changes in BAP ownership rights. Assessments are based on production, and there are additional charges for replacement and makeup water. The Watermaster must consider changes in water storage that relate to rising and falling water levels. During Water Year 2013–2014, the Mojave Basin Area Watermaster consisted of a seven-member committee. Every third year, the producers in each subarea elect a subarea advisory committee to advise the Watermaster on the administration of the judgment. The California Department of Fish and Wildlife is an ex-officio member of the Subarea Advisory Committees for the Alto and Baja subareas.[843]

Management Strategies

Imported Water: In the 2013–2014 Water Year, about 10 percent of MWA's water was imported via the SWP. This is a relatively small percent of Mojave's total use.[844]

Water Storage: In 2011, MWA extended a 2003 water storage program with the Metropolitan Water District (MWD), allowing up to 390,000 AF of MWD entitlement water from the SWP to be stored in the Mojave Basin. Approximately 60,000 AF was stored, and it will eventually be returned to MWD, who has until December 31, 2035, to take SWP water from the aqueduct during dry years. However, MWD must be sure that at least 5 percent remains available to MWA. This arrangement helps to temporarily recharge the Mojave Basin at a relatively low cost to MWA, using SWP water from MWD's entitlement, and can also potentially help mitigate drought impacts in Mojave, depending on how much of its storage MWD takes during a drought.

Recharge: The Oro Grande Wash Recharge Project will recharge up to 8,000 AFY in the western part of the Alto Subarea. The Regional Recharge and Recovery Project (R3), a conjunctive use project which began operating in 2013, will store SWP water in the local aquifer via recharge sites in the floodplain aquifer along the river, and later recover and distribute the water to upstream local water purveyors within the Alto Subarea to provide an option to offset their need to continue excessive pumping within the declining aquifer system.

Environment and Conservation: MWA entered into a memorandum of understanding with the Mojave Desert Resource Conservation District (MDRCD) for the removal of invasive, non-native plants along the Mojave River riparian corridor. Since 2000, conservation programs resulted in a 30 percent reduction in water consumption.

Monitoring and Reporting

The judgment provides for the collection, analysis, and verification of annual water production by producers within each of the five subareas beginning with Water Year 1993–1994. After three years, producers who provide piped water for human consumption to more than five service connections are required to install meters. All producers are required to file quarterly statements with production verification by the Watermaster staff, and the Watermaster produces an annual report on the condition of the basin. Verification of production is based on one or more of the following: flow meter readings, electrical power, or diesel usage records or estimated applied water duty from aerial imagery. Compliance with the rules and regulations is voluntary from each producer, and the USGS and the Army Corps of Engineers (ACE) work cooperatively with MWA to monitor the basin. Water Year 2013–2014 included verification of all parties to the judgment by the Watermaster staff.[845]

Safe Yield

Safe yield under the judgment was embodied in the concept of production safe yield (PSY). The goal of the judgment was to balance long-term supply and demand, under the assumption that supplemental water would be purchased and recharged to account for any shortages (deficit). Production safe yield is determined for each subarea for each year and is equal to the average net natural water supply plus the expected return flow from the previous year's water production. The judgment requires the Watermaster to recommend a decrease in the FPA for a subarea when that subarea is experiencing overdraft and the verified FPA exceeds its estimated PSY by 5 percent or more of base annual production.[846]

Verified production in 2013–2014 in Baja and Alto exceeded their PSY, but all other areas were less than BAP and FPA. The PSY and verified production for 2013–2014, Table 19, show that Alto and Baja exceeded their PSY while Centro, Este, and Oeste did not.[847] Because the FPA in the Alto subarea is currently within 5 percent of the PSY, it meets the judgment requirements for basin "balance," with no further reduction in FPA required.[848]

Table 19: Production Safe Yield and Verified Production 2013–2014

	Alto	Baja	Centro	Este	Oeste
Production Safe Yield	69,862	20,679	33,375	7,156	4,052
2014–2015 Free Production Allowance	73,032	37,461	41,155	16,376	5,727
Verified Production	77,631	27,858	19,616	5,712	3,421

The judgment provided that producers could pump an amount up to the producers' share of the subarea FPA without replacement water obligations. Producers who pump in excess of their FPA are required to buy replacement water from Watermaster or purchase FPA from another party in the subarea. The transfer provision allows producers who choose to not pump to sell FPA to parties who overpump in lieu of purchasing replacement water.

Groundwater Pumping and Overdraft

Overdraft started in the Centro and Baja subareas by the early 1950s, and was present in all subareas by 1960. By 1999, the cumulative amount of overdraft for the entire basin was about 2.5 million AF, most of which occurred in the Centro (about 750,000 AF) and Baja (about 1.1 million AF) subareas. Overdraft caused water-level declines in wells between 50 and 75 feet in the Alto Subarea since the mid-1940s, about 100 feet in the Centro Subarea near Harper Lake since the early 1960s, and almost 100 feet in the Baja Subarea south of the river since the early 1930s.[849] Cumulative overdraft was not addressed in the adjudication; rather, the goal was to stabilize the basin and avoid further declines. By 1999, the cumulative amount of overdraft for the entire basin was about 2.5 million AF, primarily in the Centro (approximately 750,000 AF) and Baja (approximately 1.1 million AF) subareas.

2013–2014 Water Levels

Alto (growing municipal): In general, water levels have been dropping since 2011–2012, but are predominately above recent historic lows. Added projects now recharge imported water in the western areas where declines occurred along with methods of redirecting pumping (when necessary) to the flood plain aquifer.

Centro (City of Barstow): Stable due to sustained reduction in pumping, and showing seasonal variability and variability during dry years, but generally recovering during wet periods.

Oeste (growing municipal near Los Angeles County line): Significant declines remain in some areas. The water levels in areas of pumping near the Los Angeles County line are falling over time.

Este: Stable for the past several years, indicating a relative balance between recharge and discharge.

Baja (mainly agricultural): Conditions have yet to stabilize, and there are continued declines due to overpumping and limited recharge opportunities with insufficient recovery after storms. The continuing overdraft since 1940 has resulted in a loss of riparian habitat, damage due to migrating sand, falling water levels, and reports of well failures. Minimal producers in the Baja subarea expressed their concerns to the Watermaster that their wells will go dry if overpumping continues, and water supply for the domestic users will become impaired.[850] The 2013–2014 Watermaster Report states that consumptive use exceeds the average net long-term supply in Baja.

Water Quality

The judgment requires the Watermaster to assist and encourage appropriate regulatory agencies to address water quality. In the Lower Mojave River Valley, water quality has been impaired from natural sources, leaking tanks, and Superfund sites from military bases. There are nine sites in the Barstow area where underground fuel storage tanks are leaking, and federal Superfund sites are located in the Nebo and Yermo Marine Corps depots.[851] In the Middle Mojave River Valley, groundwater quality impairments include volatile organic compounds, salts, nitrates, and irrigation effluents. In the Upper Mojave River Valley,

water quality impacts in the basin include nitrates, inorganics, and fuel additives and a Superfund site.[852]

Drought

Newspaper reports point to concerns by local residents that during the drought, farmers continue to use the same amount of water in their agricultural operations to grow a water-intensive crop.[853]

Disputes

Some residents in the desert community east of Barstow are considering a class-action suit to ban cultivation of water use-intensive crops (alfalfa) in arid zones such as the Mojave River drainage area. The concern is that MWA's Draft Baja Area Sustainability Plan ignores immediate issues and imposes unreasonable water use limitations and restrictions on the area's residents and small-scale farmers, while doing little to reduce future withdrawals by big farms that hold a large percentage of base annual yield rights, and that small farmers who cultivate less water-intensive crops will be put out of business.[854]

Discussion

The Watermaster (the Mojave Water Agency) provides active oversight, including detailed reports on the condition of the basin.

The adjudication set out a complex system to reduce production over time, but groundwater levels generally continue to decline in areas of the Alto, Baja, and Oeste sub-basins.[855] Moreover, the adjudication did not address accumulated overdraft.

Although not typical in adjudications, some environmental requirements are included in the judgment, including that the water needs of endangered species were to be considered with a trust fund to purchase water if needed. The environmentally sensitive transition zone immediately down-gradient of the Alto sub-basin is experiencing historically high water levels, with riparian habitat flourishing.

One trend is the concentration of water production in a very small number of very large users, and some parties in the basin are concerned that large pumpers dominate management decisions. Ninety-seven percent of the water is pumped by less than 15 percent of users, and minimal pumpers are not yet being fully considered.

One outcome of the adjudication was that some farmers sold off their production rights to other users; usually municipal producers. This generally occurred in the Alto subarea and resulted in a reduction in agricultural water use in that subarea, accompanied by substantial municipal growth in that area. While currently there has not been a material net increase in groundwater production,[856] extreme droughts in the future anticipated under climate change could be problematic. It is difficult to temporarily "fallow" a large municipal area to cope with an extreme drought.

A cooperative program with MWD stored their SWP water in the Mojave Basin during wet periods until MWD needed the water during a dry period. This temporarily recharged the Mojave Basin, decreasing pumping lifts, and it allowed for additional water distribution throughout the basin. It could potentially help mitigate drought impacts in Mojave, depending

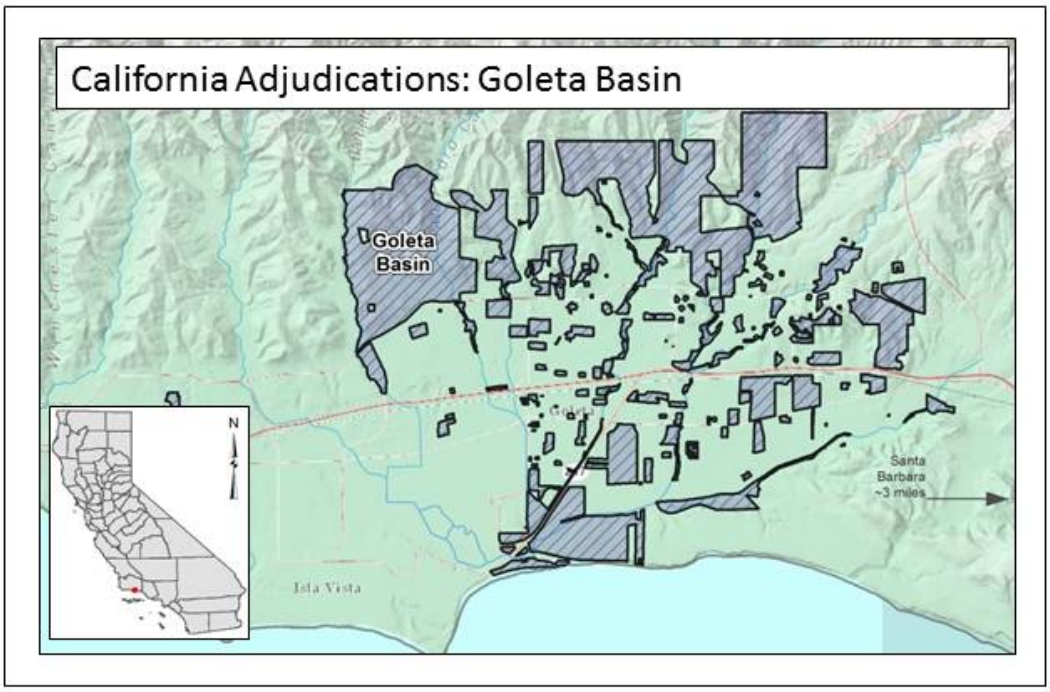
on how much SWP water the MWD takes from the aqueduct during dry years. However, MWD may not leave less than 5 percent to MWA.

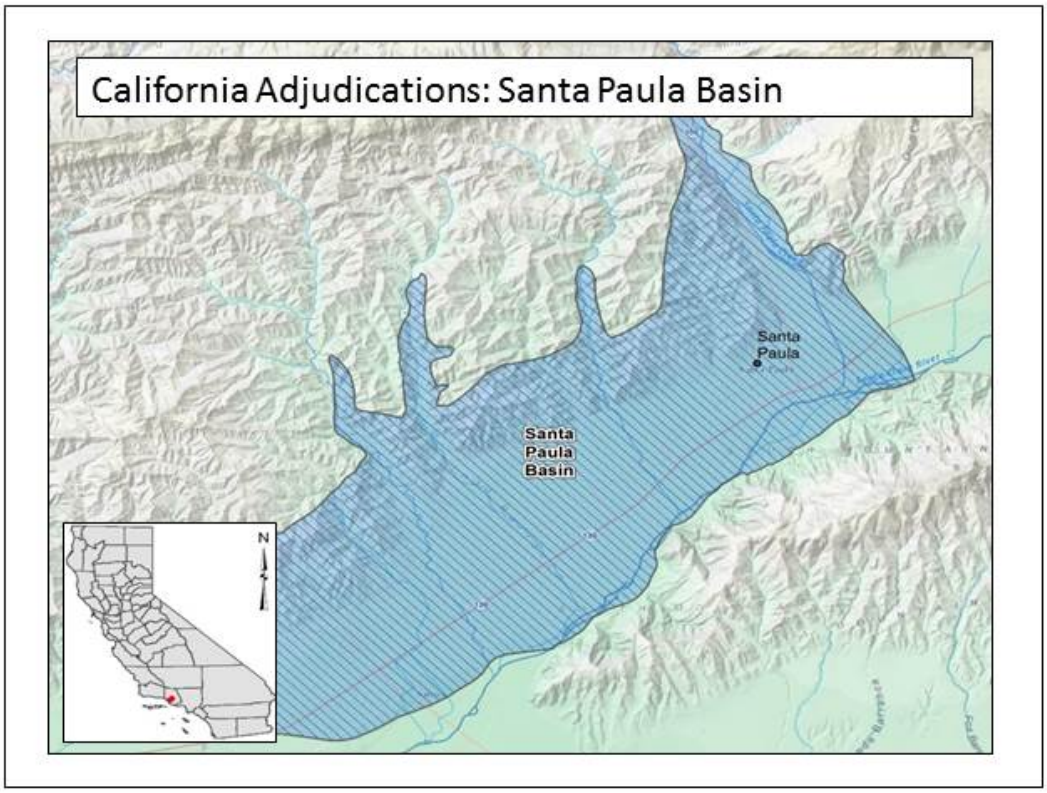
The stipulated judgment set forth a proposed physical solution that did not apportion production rights on the basis of preexisting legal water rights. On appeal, the court stated that in considering a stipulated physical solution involving equitable apportionment, the water rights of parties that did not join the stipulation must also be considered.

MOJAVE BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: San Bernardino Area: 3,400 sq. mi. Physical Characteristics: Bounded south by San Bernardino and San Gabriel Mountains where 90 percent of recharge originates. River flows north, and in areas is in hydraulic connection with aquifer system. Judgment categorized five separate subareas: Este (East area), Oeste (West area), Alto (Upper area), Centro (Middle area) and Baja (Lower area) Precipitation: Average 5" per year CASGEM: Upper Mojave River Valley: High; Middle Mojave River Valley: Low; Lower Mojave River Valley: Medium Population: (2010) Upper: 355,388; Middle: 6,654; Lower: 32,938; (2014) Upper: ~450,000 Land Use: Big alfalfa farms in Baja, growing urban in Alto, small municipalities in Centro, many individual pumpers Reason for Adjudication: First attempt at adjudication failed. With major growth of alfalfa farms in downstream Baja and population in upstream Alto, groundwater overdraft increased. The City of Barstow in the Centro subarea claimed the City of Hesperia's major development project in the upstream Alto sub-region would result in less water to Barstow and filed complaint.	Stipulation for Judgment: 1993 Adjudication Initiated: 1990 Finalized: 2000 Decree Summary: The Physical Solution: - Defined five subareas with obligations to assure that each area receives at least a part of their natural water supply; - Non-stipulating parties to abide by judgment, but riparian and overlying rights are protected. -Minimal producers (using 10 AFY or less) are excluded; MWA to plan for them to participate in physical solution. - Base annual production (BAP) established for each party, determined by the producer's maximum annual production prior to the adjudication from 1986 to 1990. A producer's BAP right was "the relative right of each producer to a free production allowance (FPA) within a given subarea, as a percentage of the aggregate of all producers' BAP in the subarea." The higher the BAP right, the more water a producer could transfer and produce free of a replacement assessment; but FPA was to gradually decrease to maintain proper water balances. - Some environmental protections	Watermaster: Mojave Water Agency Responsible for monitoring flows, verifying water production, reporting to the court, collecting assessments, and conducting studies. Clearinghouse for water transfers. Also subarea advisory committees. Strategies: -Imported water -Storage and conjunctive use -Recharge projects -Conservation - Restoration	Safe Yield Summary: Production safe yield (PSY) is determined for each subarea each year, equal to the average net natural water supply plus expected return flow from the previous year's water production. Watermaster recommends a decrease in the free production allowance when it exceeds the estimated PSY by 5% or more of the BAP. Current Extractions: 134,238 AF total verified production in all areas (2013–2014) Extraction Summary: In the Alto Subarea, agricultural extractions are declining and municipal extractions are increasing, in part due to agricultural producers leasing their water rights to growing municipalities. Baja exceeded its PSY in 2013–2014; other areas did not. Groundwater Levels: 2013–2014 Water Levels: - *Alto* (growing municipal): Declines mostly in the western portion - *Centro* (City of Barstow): Stable due to sustained pumping reduction; seasonal variability. - *Oeste* (growing municipal near LA County): Cont. declines, significant in some areas - *Este:* Stable for the past several years - *Baja* (mainly agricultural): Continued declines due to overpumping and limited recharge Overdraft Conditions: Cumulative overdraft was not addressed; rather, the goal was to stabilize the basin and avoid further declines. By 1999, cumulative overdraft was ~2.5 million AF. Water Quality: Some impairment in all subareas Discussion: **- Requirements to ramp down pumping over time, but withdrawals are still significant in some areas. Groundwater is declining in the expanding municipal areas (Alto and Oeste) and in the agricultural area (Baja). Cumulative overdraft is not addressed.** **- Water production is concentrated in very few pumpers—97 percent of the water is pumped by less than 15 percent of users.** **- Adjudication is premised on a 25 percent input of SWP water. This may be problematic as imported water becomes less reliable and more expensive.** **- Minimal pumpers are not being fully considered.** **- Watermaster provides good oversight.** **- Some environmental requirements were included in the judgment.** **- Ability to transfer and lease water rights likely supported the shift from farming to municipal development in the Alto Subarea.** **- Established the legal precedent that in considering a stipulated physical solution, a court must consider water rights of parties that did not join the stipulation.**

Central Coast Basins





GOLETA GROUNDWATER BASIN

Water shortages in the 1970s led to several moratoriums on new water connections in the Goleta Groundwater Basin, and in 1973 a group of landowners in the North-Central Basin sued the Goleta Water District (GWD) to adjudicate water rights. The final 1989 Judgment (after remand to the trial court) concluded that the basin was significantly overdrafted and authorized the importation of SWP water. To obtain funding for the construction of facilities to deliver SWP water, GWD voters approved the Safe Water Supplies Ordinance (SAFE) in 1991. Most noteworthy is that the ordinance prioritized basin replenishment to 1972 groundwater levels (where no negative impacts had been observed), and the establishment of a drought buffer. When the basin is replenished such that the average of its seven index wells is above the 1972 groundwater elevation, GWD may then provide new water services to customers. The adjudicated basin is currently managed under both the Wright Judgment and the Safe Ordinance. As is common in many adjudicated basins, overlying landowners were granted correlative rights that were superior to the two main appropriators who were limited to surplus waters. Overlying pumpers could transfer their water right and well(s) to GWD in return for service from GWD, and GWD had the exclusive right to store water in the basin.

Overview

County	Santa Barbara
Area	Basin area: 9,229 acres / 14.4 square miles[857] Goleta Water District area: 29,000 acres
Population	Goleta Groundwater Basin: 47,252 (2010 census)
CASGEM	Medium
Watermaster	The court has jurisdiction, with no designated Watermaster. The Goleta Water District oversees management.
Members	No members
Court Cases	*Wright v. Goleta Water Dist.,* 174 Cal. App. 3d 74 (1985); *Wright v. Goleta Water Dist.,* No. SM57969 (Cal. Sup. Ct. Nov. 17, 1989) (amended judgment)

CASGEM = California Statewide Groundwater Elevation Monitoring

The Goleta Groundwater Basin lies on Santa Barbara County's South Coast. It is about eight miles long and three miles wide, including the hydraulically connected alluvial materials extending into the drainages along the northern border. The judgment describes the Goleta Groundwater Basin as divided into three sub-basins, and boundaries vary among investigators. The North and Central sub-basins are the adjudicated basins and where the majority of extractions occur. The West sub-basin is shallower but has historically poorer water quality. An inferred low permeability barrier separates the Central and West sub-basins. The North Sub-basin is separated from the Central Sub-basin by a fault that appears to form a partial hydraulic impediment to groundwater flow. Goleta is an alluvial plain, bordered by the Santa Ynez Mountains to the north and the Pacific Ocean to the south. Surface drainage is to the south toward the Goleta Slough through several creeks that empty into the ocean.[858] The Santa Barbara Formation is the primary water-bearing unit in the basin and comprises primarily of marine sand, silt, and clay.[859] Major sources of natural recharge are infiltration from rainfall, percolation from streambeds, deep percolation of irrigation waters, and leakage

from adjacent (largely upslope) consolidated rock.[860] Average rainfall within the basin ranges from about 16 inches per year at the coast to about 20 inches per year at the basin's highest elevation in the foothills of the Santa Ynez Mountains. Useable storage of the North/Central Basin is estimated to be ~29,000 AF.[861]

The Goleta Water District (GWD) manages the adjudicated area, which is a subset of the area defined by the district's boundaries.

There was significant urban growth in the late twentieth century, and the GWD currently provides water service to approximately 87,000 residents. The City of Goleta, the University of California, the Santa Barbara Airport, and parts of unincorporated Santa Barbara County are all located within the district. Agriculture is still a significant presence in the basin, with avocados and lemons as the major crops. Agricultural customers account for approximately 1 percent of total accounts within the GWD, but they utilize approximately 30 percent of the total water supply (surface plus groundwater) on a yearly basis. In the last 12 months, agricultural customers used approximately 3,763 AF of water.[862]

Reason for Adjudication

The first shallow wells were drilled in the basin about 1890. Eventually deeper, larger-diameter wells were drilled, pumps were installed, and groundwater used to develop fruit and nut orchards. By the late 1930s, groundwater use was estimated to be approximately 3,000–6,000 AFY.[863] As urbanization replaced agriculture, public water producers became a larger factor in groundwater withdrawals. La Cumbre Water District formed in 1925, and for about 40 years groundwater was its sole source of water supply. The Goleta Water District also relied solely on local groundwater until the U.S. Bureau of Reclamation's Federal Cachuma Project on the Santa Ynez River began making water deliveries in 1955.[864] The Cachuma Project utilizes water from the Santa Ynez River, which is impounded in Lake Cachuma by Bradbury Dam.[865] A long, dry period from 1940–1970, coupled with significant population growth, reduced water supplies.[866] As a result, in the 1970s, GWD adopted several ordinances to restrict water use, including Ordinance 72-2 (which began a moratorium on new water service connections) and the Responsible Water Policy Ordinance (adopted by voter initiative in 1973 and largely aimed at preventing GWD from connecting to the State Water Project [SWP]).[867]

In 1973 a group of overlying landowners in the North-Central basin sued GWD to adjudicate water rights in the Goleta North-Central Groundwater Basin.[868] The Goleta Water District in turn cross-complained against 220 additional parties. The superior court divided the trial into two phases that covered the determination of each party's status and claims, a declaration of rights, whether any party was entitled to injunctive relief, and the determination of safe yield. In 1979, the court determined the safe yield for the basin and allocated extraction rights to the parties. On appeal, the appellate court reversed and remanded the initial judgment. Finally, the trial court issued its revised judgment in 1989, sixteen years after the start of the adjudication.

However, groundwater withdrawals had continued while the adjudication was going on, and they peaked in the latter half of the 1980s at between 6,000 to 8,000 AFY. Moreover, the drought in the 1980s and early 1990s resulted in water supplies for Santa Barbara County's south coast reaching a critically low level. While GWD customers reduced their water consumption during this drought, GWD relied more on groundwater to supply its customers,

and groundwater elevations reached historically low levels. In 1990, GWD adopted a Water Supply Management Plan that included the use of SWP water, and in 1991, GWD customers voted in the Safe Water Supplies Ordinance (SAFE). The ordinance authorized the construction and financing of facilities for the delivery of SWP water, but placed conditions on its use that prioritized basin replenishment and the creation of a drought buffer.[869]

Decree and Amendments

Adjudication initiated: 1973
Adjudication finalized: 1989
Revisions or amendments to the adjudication: 1992
Costs: 2013–2014 = $32,010,376; 2014–2015 = $30,870,049

Decree Summary

The final 1989 Judgment (after remand to the trial court) concluded that the basin was significantly overdrafted, and identified both public and private overlying owners. The judgment also stated that a court may not "subordinate an unexercised right to a present appropriative use" without authorization from the legislature (such as the statutory adjudication sections of the Water Code). Overlying landowners, were thus granted correlative rights that were superior to appropriators, including La Cumbre (who was the senior appropriator) and Goleta Water District—both of whom were limited to surplus waters over and above the water taken by the overlying users. Overlyers, primarily agricultural water users, were granted superior rights of 351 AFY, which could increase without court approval as long as there was no change in use (e.g., conversion of agricultural to urban use). That overlyers superior rights to groundwater could increase could be problematic for appropriators, but importantly, GWD was provided with the exclusive right to store water in the basin.

Goleta Water District and La Cumbre were also given defined appropriative rights (2,000 AFY for GWD and 1,999 AFY for La Cumbre Mutual Water Company), plus any temporary surplus, defined as "the amount of water that can safely be extracted from the basin in any year in excess of the safe yield." Subsequent transfers from other entities overlying the basin increased the GWD's annual allowable base extraction to 2,350 AFY. This excludes water GWD has stored in the basin, as well as the drought buffer (described below) available to GWD when the basin is above 1972 levels or when there are reduced deliveries of Cachuma water.[870] Additionally, overlying pumpers could transfer their water right and well(s) to GWD in return for service from GWD.

The safe yield of the basin was determined to be 3,410 AFY. "The Perennial yield, which included 350 AFY for GWD's injection well system (the source of water injected by GWD is spill water from Lake Cachuma) and 100 AFY of return flow (applied water that percolates back to the aquifer), was determined to be 3,700 AFY."[871] Goleta Water District was required to submit a water plan to the court, including development of supplemental supplies to bring the basin into hydrologic balance by 1998, and a status report was required on an annual basis.[872]

Amendments

In 1992, the court reaffirmed the continuing right of GWD to store up to 2,000 AFY in the basin. In 1998, the court found the basin to be in hydrologic balance and confirmed the district's total storage of 18,084 AF and that annual reports to litigation parties could replace

reports to the court.

Other

To authorize importing SWP water, GWD voters approved the Safe Water Supplies Ordinance (SAFE)[873] in 1991, and amended it in 1994. Key elements of SAFE are *basin replenishment* and a *drought buffer*. The GWD is authorized to acquire 4,500 AFY plus an additional 2,500 AFY. "Any excess water actually delivered over a planned for yield of 3,800 AFY is to be stored in the Goleta Central Basin until the basin is replenished to its 1972 level, for use during drought conditions." An "Annual Storage Commitment" of at least 2,000 AFY is required for replenishment to 1972 levels.

When the average of the seven index wells is above the historic 1972 groundwater elevation, the district may provide new water services to customers. When the average of the seven index wells is below the historic 1972 levels, or when the district is receiving less than 100 percent of Cachuma deliveries, the district may not provide any new water allocations.[874] For each year that all other obligations for water delivery are met, GWD may provide new service connections up to 1 percent of the total potable water supply. However, when new service is connected, the annual storage commitment made to the drought buffer must permanently increase by two-thirds of any release for new or additional uses "so that safe water supplies in times of drought shall not be endangered by any new or additional demands."[875]

Water Users

Stipulated and Current Users

Overlying landowners, La Cumbre Water District, and Goleta Water District. Specific landowners were identified in the judgment.

Excluded Users

No discussion of environmental uses specifically, but the SAFE ordinance requires replenishment of the basin with imported water before other uses. Some overlying private pumpers were not included in the adjudication.

Management Structure

The court assumed continuing jurisdiction of the basin with no official Watermaster. GWD was required to submit a water plan to the court that included development of supplemental supplies to bring the basin into hydrologic balance by 1998. Up until 1998, GWD had to file with the court an annual status report on the basin. The 1998 amendment stated that as the basin was in hydrologic balance, annual reports to litigation parties could replace reports to the court.

Management Strategies

Current strategies for groundwater storage in the basin follow the Wright Judgment (for GWD and La Cumbre) and the SAFE Ordinance (for GWD).

Imported Water: In a normal year, the majority of the GWD's water supply comes from imported water via the U.S. Bureau of Reclamation's Cachuma Project (approximately 56 percent)[876] and SWP water (approximately 23 percent).[877] In-lieu recharge and direct well injection are used to recharge the aquifer.[878]

Recycled Water: In 1995, with cooperation from the Goleta Sanitary District, GWD began delivering recycled water for irrigation to allow the groundwater supply to be reserved for drinking water.[879] The Goleta Basin is also one of the first basins to augment natural recharge by injecting drinking water into wells whenever excess surface supplies are available. GWD's wells can now be used as dual-purpose injection-extraction wells (e.g., aquifer storage and recovery wells) to maximize injection capacity and the conjunctive use potential of the basin and Cachuma Reservoir, where water that is injected becomes available for use in dry years when surface water supplies are reduced.[880]

In a normal year recycled water makes up approximately 7 percent of the district water supply, or about 1,150 AF. Storage is available to address daily fluctuations but not seasonal variability. The Goleta Sanitary District treats wastewater to tertiary recycled water levels, and the Goleta Water District distributes the tertiary recycled water to various customers. The GWD is permitted to distribute recycled water for landscape irrigation, toilet flushing, dust control, and industrial cooling. Utilizing recycled water for permitted uses in lieu of potable water increases the potable water supply available to customers.[881] GWD's recycled water capacity is greater than its normal use of recycled water, and the 2014 GWD Drought Management Plan stated that it is likely in wet, normal, dry years that GWD will have 1,150 AF of recycled water available primarily for use in drought mitigation.

Management Plan: The Goleta Water District drafted a Water Supply Management Plan in 2011 that outlined basin management objectives for the region: (1) optimize use of various water sources to balance out cost and reliability, (2) determine critical components of Goleta Water District's water supply system, (3) develop a plan to have sufficient water supplies during drought periods, and (4) determine the reliability of Goleta Water District's water supply under current and future demand scenarios.[882]

Monitoring and Reporting

The adjudication required GWD to submit a water plan to the court, including development of supplemental supplies that would bring the basin into hydrologic balance by 1998. Additionally, a status report was required to be filed with the court on an annual basis, and since 1998, status reports to litigation parties could replace annual reports to the court.[883] GWD and La Cumbre wells are metered, but GWD does not have access to or knowledge of other metered wells within the adjudicated basin boundaries. Santa Barbara County's Environmental Health Services regulates the permitting and installation process of new, private wells. Drilling logs and information are available to the district as requested. The district has 47 monitoring wells; and 7 of these are further identified as "index wells." The district's Groundwater Management Plan identified the average groundwater elevation of these index wells as representative of level of the Goleta Groundwater Basin. These seven index wells are the indicators for the basin's groundwater levels in relation to the SAFE Ordinance and the district's drought buffer.[884]

The United States Geological Survey (USGS) conducted a regional groundwater-level monitoring program in 2010 under contract to GWD. It collected manual measurements of water levels in 47 basin wells twice a year, in April and December (mostly in the Central Sub-basin), and in seven index wells representative of the basin. The wells have complete historical records dating back to 1972. The wells, along with their construction details, have been entered into a Geographic Information System (GIS) database, and groundwater

elevation records (including historic records as far back as the 1920s) are in digital form. In addition, purveyors' wells are commonly fitted with pressure transducers as part of their automated SCADA system; water levels measured by the transducers are preserved digitally. GWD is currently placing several pressure transducers in additional wells.[885]

Costs

The district does not receive property tax or other pass-through revenue. Accordingly, customer rates and charges are the primary source of revenue for funding water system operations, emergency reserves, and capital projects. District revenues are derived from meter charges (fixed) and commodity rates (variable). In September 2011, GWD adopted a rate structure designed to ensure rates effectively match actual costs of providing water service. Under the district rate structure, meter charges make up approximately 30 percent of revenues, and water sales make up approximately 70 percent of revenues. Total revenue from water sales was $22,067,071 (2013–2014) and $22,922,908 (2014–2015). Fixed costs for GWD (in 2011 dollars) could exceed $26 million. In 2011 the GWD Board of Directors adopted a policy for reserve funds that could be used to compensate for decreased revenues during a drought, but the reserve fund may be insufficient during extended droughts, requiring GWD to revise water rates or impose a surcharge to cover drought-related operational costs.[886]

Safe Yield

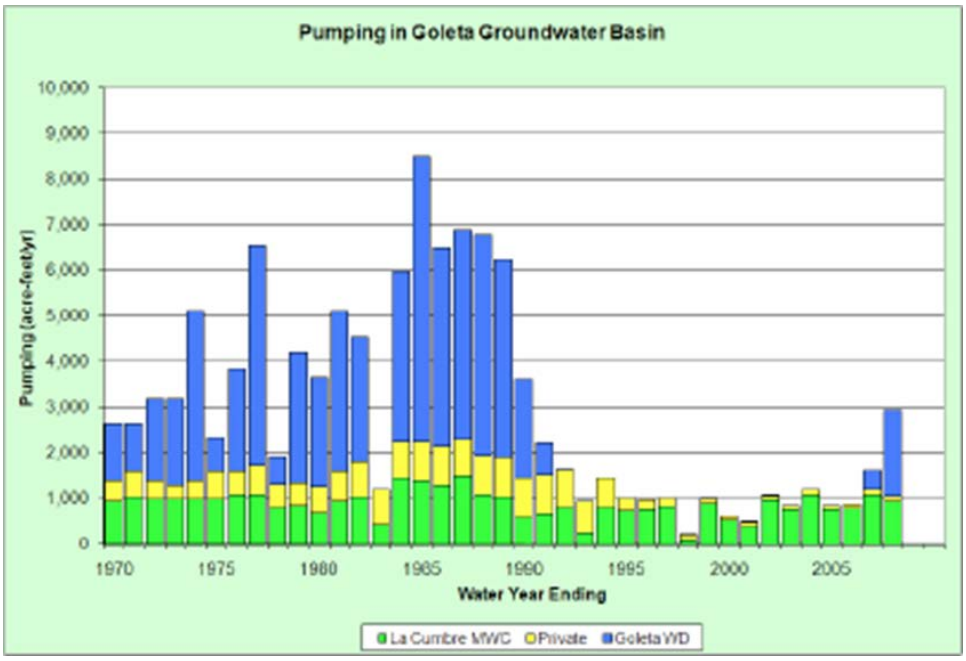
The safe yield of the Goleta Basin was defined as "the maximum quantity of water which in addition to the Temporary Surplus, if any, can be extracted annually from the Basin without resulting in an irreparable depletion of supply."[887] To calculate the safe yield in the basin, the "Hill Method," where the amount of pumping each year is plotted against the change in groundwater elevations caused by that pumping, was initially utilized. Theoretically, in a year when there is no net change in groundwater elevation, the amount of pumping in that year is the yield of the basin. Unfortunately, this method assumes that the recharge to the basin from year to year is relatively constant, making it problematic for use in California groundwater basins such as in Goleta. Using this method, a basin yield was calculated to be about 2,000 AFY for the years 1936 to 1950, but this period coincided with a long, dry climatic cycle when recharge was below average, so it likely underestimated the long-term basin yield. There were conflicting opinions of safe yield at the trial, primarily over the time period used to determine the metric. Subsequently, a basin yield was calculated using several different periods where rainfall was near, above, or below average. The conclusion was that the yield of the Goleta Basin was likely less than 3,700 AFY. [888]

Prior to the filing of the lawsuit, GWD had publicly announced 5,800 AFY as the safe yield of the entire Goleta Groundwater Basin. However, pumping by GWD and cross-defendants in the Central Basin did not exceed 3,410 AFY, and this was the safe yield established by the trial court. After review, the appeals court supported the trial court's determination of safe yield. This number did not include any water stored in the basin by GWD or La Cumbre as a drought buffer.[889] Perennial safe yield was set at approximately 3,700 AFY.

Groundwater Pumping and Overdraft

The GWD has pumped a minimal amount from the basin since the early 1990s, as shown in Figure 6. The historical pattern of fluctuations suggests that the Central Sub-basin was pumped less than its yield before 1972, above its yield in the 1970s and early 1980s, and within its yield since that time.

Figure 6: Historical Pumping in the Goleta Groundwater Basin[890]



As a result of the reduced pumping, groundwater elevations in much of the Central Sub-basin have been rising, and by 2008, a total of 42,530 AF was added to basin storage through a combination of direct injection and using other water supplies in lieu of pumping groundwater. Groundwater elevations are generally above sea level in the North Sub-basin.[891] If groundwater elevations should not go below historical lows where no undesirable effects occurred, then the total storage is estimated as between 40,000 and 80,000 AF, with the majority of that storage in the Central and North sub-basins. The amount of water stored in the basin by GWD and La Cumbre in 2010 is just over 44,000 AF—within the estimated range of useable storage.[892] There are concerns that "Although groundwater elevations are near historical high in the Central Sub-basin, they are well below land surface elevation and below sea level. Groundwater elevations below sea level in coastal basins that abut the ocean have the potential to result in seawater intrusion into the aquifer, but the More Ranch Fault (the southern boundary of the Goleta Groundwater Basin is defined by the trace of the More Ranch Fault) apparently provides protection from seawater intrusion by uplifting a block of older material across what could be a pathway for seawater to move inland in the aquifer." Groundwater elevations are lowest in the southeastern portion of the Central Sub-basin (deeper than 25 feet below sea level).

With respect to pumping from storage, the Wright Judgment only requires that there is storage available that was accumulated by either injection in wells or by deliveries of other supplies in lieu of pumping GWD's water right. The SAFE Ordinance is more restrictive, limiting pumping of stored water in specified circumstances.

Water Quality

Potential exists in parts of the basin for poor-quality water to be pulled in from areas outside the aquifers (e.g., seawater intrusion or high salts from surrounding sediments).[893] The More Ranch Fault prevents any saltwater intrusion into the Central Sub-basin. Although there are contamination sites within the Goleta Groundwater Basin (largely due to leaking fuel tanks

and spills), the required restoration and mitigation on these sites prevents contamination of underlying aquifers. The district is notified of any such contamination sites. Overall, the potential of poor water quality may still exist due to overdrafting or deep contamination spills.[894]

Disputes

The district is investigating the potential connection between the Goleta Groundwater Basin and groundwater within the Slippery Rock Ranch property. The owners of Slippery Rock Ranch propose selling and banking water for water agencies in the region from the ranch's large groundwater basin.[895]

Drought

The "normal operations" range for the basin is between the 1972 and 2007 elevations (~26 feet to ~4 feet mean sea level [MSL]). Groundwater elevations below ~26 feet MSL, the 1972 level, indicate drought or other water shortage conditions, and the "Drought Plan for Groundwater Pumping" included in the Goleta Groundwater Basin Groundwater Management Plan is required to be followed.[896]

The biggest stress on local water supplies occurs when both the SWP and Cachuma have reduced supplies, and an extended drought might require pumping groundwater to below historical elevations. However, the drought buffer has been particularly effective in enabling GWD to cope well with the current drought. The combination of the Wright Judgment's groundwater storage component and GWD's SAFE Ordinance established a large storage bank in the Central Sub-basin for use during potential supply shortages and drought. In 2014–2015, GWD has had to pump from its drought buffer, but at the start of the drought, the district had accumulated a buffer of approximately 50,000 AF in storage, which it is now relying upon to help firm up supplies to meet customer needs.[897] As of July 2015, the district instituted a tiered rate structure for single-family residential customers and a drought surcharge for all customer classes, to encourage conservation and to cover decreased revenue and increasing operational costs due to the drought.[898]

Discussion

The SAFE ordinance to authorize construction and funding of facilities to import SWP water was an innovative approach to using the SWP water to replenish the basin before other uses were permitted. An additional innovation was the creation of a drought buffer, one of the few basins to set up a groundwater drought reserve.

The basin appears to be managed very thoughtfully and sustainably under both the Wright Judgment and the associated SAFE Ordinance. Moreover, in 2012, prior to the Groundwater Sustainability Act, GWD developed a comprehensive sustainability plan with "inter-generational benefits to customers and the greater community."[899]

Legal precedent established that "...a court may not "subordinate an unexercised right to a present appropriative use" without authorization from the legislature (such as the statutory adjudication sections of the Water Code).

As of 2008, a total of 42,530 AF of water was added to basin storage through direct injection and using other water supplies in lieu of pumping groundwater. In 2008, storage in the

Central sub-basin was 6,000 to 12,000 AF above 1972 levels. That allowed for new service connections that added 559 AFY of demand, resulting in an increase of the annual storage commitment to 2,373 AFY.[900] The basin is currently managed under both the Wright Judgment (that allowed importation of SWP water) and the SAFE Ordinance (that authorized the construction and funding of facilities to import the SWP water). The result is a sustainable approach to managing a groundwater basin given California's periodic droughts.

The 2014 Drought Management Plan states that "given the robust GWD drought buffer, it is assumed that in all year types (wet, normal, dry) GWD's base extraction will be available." During the current drought, the SAFE Ordinance requirements enabled Goleta to fare significantly better than surrounding areas, and GWD is only now beginning to use its drought buffer.[901]

GOLETA GROUNDWATER BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Santa Barbara Area: Goleta Groundwater Basin 14.4 sq. mi. Physical Characteristics North and Central Sub-basins are the adjudicated basins and where the majority of extractions occur. *Precipitation:* ~16" per year CASGEM: Medium Population: Goleta Water District ~47,252 (2010 census) Land Use: Agriculture, increasing municipal. Area relied solely on local groundwater until the Federal Cachuma Project began making water deliveries in 1955. Reason for Adjudication: Moratorium on new water service connections required that groundwater declines be addressed. Reduced water supplies led to conflicts over water rights.	Adjudication Initiated: 1973 Finalized: 1989 Amended: 1992, 1998 Decree Summary: Overlyers, primarily agriculture, were granted superior rights of 351 AFY, which could increase without court approval as long as there was no change in use (e.g., conversion of agricultural to urban use). La Cumbre Mutual Water Company was given a senior appropriative right of 1,000 AFY plus any temporary surplus. Temporary surplus was defined as "the amount of water that can safely be extracted from the basin in any year in excess of the safe yield." GWD was given an appropriative right to 2,000 AFY from the basin, plus any temporary surplus. Overlying pumpers could transfer their water right and well(s) to GWD in return for service from GWD. Other Dates: 1991: GWD voters pass the Safe Water Supplies Ordinance (SAFE). Authorizes importing water from the SWP (~3,800 AFY), but water must first be used to replenish basin to 1972 levels. Also authorizes an additional entitlement of 2,500 AFY as a drought buffer.	Structure: No designated Watermaster. GWD manages the basin as per the judgment. Strategies: Importation of State Water Project water; complying with the SAFE Ordinance requirements for basin replenishment and a drought buffer; Use of recycled water for irrigation. One of the first basins to enhance natural recharge by injecting drinking water into wells. Water is spill water from Bureau of Reclamation's Lake Cachuma (a source of surface water supply to the area). Currently using ASR with dual-purpose injection-extraction wells to maximize injection capacity and conjunctive use.	Adjudicated Safe Yield: 3,410 AFY Perennial Safe Yield: 3,700 AFY Current Safe Yield: Approximately the same Safe Yield Summary: There were conflicting opinions of safe yield at the trial, primarily over the time period used to determine the metric. Pre-adjudication Extractions: 1930s: ~ 4,600 AFY; 1980s: ~ 6,000-8,000 AFY Current Extractions: GWD: ~ 2,350 AFY Groundwater Levels: Levels in the Central Sub-basin fluctuated by almost 150 feet over the last 70 years. Lowest levels were in 1960s–1970s, but surprisingly as rainfall increased in 1970s–1983, groundwater elevations also dropped. In the 1988–1992 drought, groundwater elevations reached historically low levels. In 2008, post-adjudication, storage in the Central Sub-basin rose from 6,000 to 12,000 AF above 1972 levels. By 2010, the basin had reached historically high groundwater elevations. Overdraft: Although overall groundwater elevations are near historical highs in the Central sub-basin, they are nevertheless below land surface elevation and sea level, with the potential for seawater intrusion into the aquifer. Groundwater elevations are generally above sea level in the North Sub-basin. Water Quality: Overlying contamination sources have leaked into the aquifers and underground tanks) are primarily a problem in the recharge areas. Drought: During the current drought, the SAFE Ordinance requirements enabled Goleta to fare significantly better then surrounding areas. Additionally, GWD instituted drought curtailments and is not worried about running out of water. It is only now beginning to use its drought buffer. Discussion: **- The SAFE ordinance right after the adjudication was an innovative approach to using SWP water that was authorized by the adjudication to replenish the basin before other uses were permitted.** **- An additional innovation was the creation of a drought buffer, one of the few basins to set up a groundwater drought reserve. The combination of the Wright Judgment's groundwater storage component and GWD's SAFE Ordinance established a large storage bank in the Central Sub-basin for use during potential supply shortages and drought.** **- The basin appears to be managed thoughtfully and sustainably. In 2012, prior to the Groundwater Sustainability Act, GWD developed a comprehensive sustainability plan with "inter-generational benefits to customers and the greater community."**

SANTA PAULA BASIN

A gradual, long-term decline in groundwater elevations is evident in the Santa Paula Basin since the mid-1990s, both in previous historical observations as well as in current data, but the decline has been modest, and some areas of the basin have stabilized. A Technical Advisory Committee (TAC) serves as Watermaster, consisting of the City of Ventura, the Santa Paula Basin Pumpers Association (SPBPA, a consortium of overlying farming interests but including the City of Santa Paula), and the United Conservation Water District (a water conservation district for several basins in the region). The TAC monitors the basin under the reserved jurisdiction of the court. The stipulated judgment did not determine water rights, and the physical solution roughly followed common-law water right priorities, with appropriators junior to overlyers. To reduce pumping, the court established a step-down model with production cutback provisions in six stages as needed to balance total production with the basin's actual safe yield. The City of Ventura, a junior appropriator, was required to remove all of its production before the SPBPA members were required to take material reductions. The safe yield provided in the judgment was an "assumed" safe yield that corresponded to the amount of recent pumping. It was disputed but was to remain in effect over seven years until the actual safe yield of the basin was determined, at which time the TAC, or any party, could recommend a "more flexible management plan for operation of the basin." However, a comprehensive groundwater management plan has not yet been developed. Disagreements continue over the safe yield of the basin, but there is potential for the parties to reach agreement on safe yield, overdraft, and management protocols after studies are complete.

Overview

County	Ventura
Area	Approximately 22,899 acres / 35.8 square miles
Population	46,816 (2010)
CASGEM	Medium[902]
Watermaster	Technical Advisory Committee
Members	United Water Conservation District (UWCD), City of San Buenaventura (City of Ventura), and Santa Paula Basin Pumpers Association
Court Cases	*UWCD v. City of San Buenaventura,* original March 7, 1996, amended August 24, 2010

CASGEM = California Statewide Groundwater Elevation Monitoring

Santa Paula Basin is a sub-basin of the larger Santa Clara River Valley Basin that includes five other groundwater basins.[903] Groundwater flow is generally east to west down the axis of the basin, parallel to the Santa Clara River, the second largest river in Southern California.[904] The basin contains two distinct aquifer systems. One consists of relatively shallow unconfined alluvial deposits associated generally with the floodplain of the Santa Clara River. The other is comprised of deeper, confined aquifer systems within the San Pedro Formation.[905] The Oak Ridge and Country Club faults appear to partially restrict groundwater movement across the southwestern and western boundaries, respectively, of the sub-basin, and the Country Club fault creates a 50 to 100 foot drop in water level between the Santa

Paula Basin and the Mound basin. Recharge to the basin is derived primarily from groundwater underflow from the upgradient Fillmore basin, infiltration of surface water from the Santa Clara River and Santa Paula Creek, direct percolation of precipitation, and household and agricultural irrigation return flows. State Water Project (SWP) water released from Lake Piru also percolates into the basin.[906] Underflow from artificial recharge at the United Water Conservation District's (UWCD's) spreading grounds in the adjacent Oxnard Plain Forebay Sub-basin also contribute to the recharge of the Santa Paula Basin. Average precipitation (1890–2011) is approximately 17.51 inches.[907] Fluctuations in groundwater levels correlate with precipitation trends.[908]

Agricultural land use accounts for approximately 12,000 acres,[909] and the Santa Paula Basin is a major distribution point for citrus in the United States. Groundwater from the basin is the sole source of water for the City of Santa Paula.[910]

Reason for Adjudication

In May 1991, the last year of a six-year drought, the City of Ventura began pumping increased amounts of water from its wells in the east end of the city that draw from the Santa Paula Basin. Groundwater pumpers in the basin, including the City of Santa Paula and local agricultural interests, became concerned about this increase in groundwater extractions. The UWCD, a water conservation district for several basins in the region, was approached by the local stakeholders who expressed their concern that water supplies in the Santa Paula Basin were threatened by the City of Ventura's proposed increase in groundwater extractions to 6,000 AFY, and that overdraft could increase. Water levels had already dropped to historical lows in 1990 at the end of the dry period.[911] In 1991, UWCD, on behalf of the local stakeholders, initiated court action against the City of Ventura, alleging a violation of the California Environmental Quality Act (CEQA) with respect to the installation of the new wells in the Santa Paula Basin. There was disagreement regarding the safe yield of the basin between UWCD, which does not produce water from the basin, and the Cities of Santa Paula and Ventura. UCWD alleged that the basin was "in a condition of overdraft or threatened overdraft," and that Ventura's additional pumping would exceed the safe yield of the basin.[912] In addition to the involvement of the cities of Ventura and Santa Paula and UWCD, the court action also brought in as plaintiffs groundwater pumpers in the basin that were represented by the Santa Paula Basin Pumpers Association (SPBPA). The SPBPA is a consortium of water users, primarily farming interests but including the City of Santa Paula. In 1996, the Superior Court of the State of California for the County of Ventura entered a stipulated judgment to establish pumping allocations within the Santa Paula groundwater basin and potentially create a plan to manage the basin.[913] The pumping allocations were declared after approximately five years of studying the basin's potential yield during the litigation process.[914]

Decree and Amendments

Adjudication initiated: 1991
Adjudication finalized: 1996[915]
Revisions or amendments: 2010
Stipulated Judgment: 1988

Decree Summary

The court's 1996 judgment provided an "assumed initial yield" of 33,500 AFY, corresponding to the amount of recent pumping. That figure was disputed by UWCD. The

assumed safe yield was to remain in effect for a seven-year period. The judgment also established a Technical Advisory Committee (TAC) that was tasked with the responsibility to "consider and attempt to agree upon the safe yield of the basin," during this period. After TAC studies determined the safe yield of the basin, the TAC (if in full agreement), or any party, could recommend "a more flexible management plan for operation of the basin." The court then has the authority to modify pumping allocations accordingly, provided that modifications would not result in overdraft or harm to existing users.

The stipulated judgment did not determine water rights, and the physical solution roughly followed common-law water right priorities with appropriators junior to overlyers. Thus the assumed yield of 33,500 AFY was allocated between the junior appropriator, the City of Ventura, who received 3,000 AFY, and the SPBPA, who received 27,515 AFY. Several agricultural members of the SPBPA received the majority of water: Farmer's Irrigation Co. received 9,913 AFY; two smaller irrigation companies received 1,431 AFY; and Limoneira Co. received up to 3,173 AFY. There was an unallocated reserve of 2,985 AF. Production was on a seven-year rolling average, allowing parties to produce more or less of their allocation in any particular year as long as their rolling seven-year average did not exceed their allocation.

The judgment also included production cutback provisions in six stages, as needed to balance total production with the basin's safe yield, with the City of Ventura as a junior appropriator required to remove all of its production before the SPBPA members were required to take material reductions. Transfers were permitted and storage was permitted with the approval of the TAC. The judgment also required the TAC to establish a monitoring program and empowered the TAC to determine the basin's safe yield.[916]

The judgment did not explicitly require a management plan, and did not consider environmental water uses or the impact of surface water diversions from the Santa Clara River and Santa Paula Creek.

Amendment Summary

The 2010 amendment added pumpers not previously included as parties to the adjudication, and it clarified shortage conditions, responsibilities, and groundwater production of SPBPA and members, as well as pumping allocation transfer procedures. The SPBPA received an additional 280.2 AFY for pumpers not previously parties to the judgment.

2015 Court Ruling

The City of San Buenaventura legally challenged UWCD's fee assessments (district-wide, not just in the Santa Paula basin) and the compliance of those fees with Proposition 218 and/or Proposition 26, as well as the Water Conservation Act of 1931 (specifically Water Code section 75594 that dictates no less than a 3:1 ratio between the rates imposed on non-agricultural versus agricultural pumpers of groundwater). In *City of San Buenaventura v. United Water Conservation District* in 2015, the Court of Appeals ruled that UWCD's fees from groundwater pumpers (based on the volume of water they pump)[917] do not fall within the scope of Proposition 218 and are not taxes per Proposition 26. The City of Ventura appealed this decision to the California Supreme Court, and the issue is currently being heard.

Water Users

Stipulated Users

Santa Paula Basin Pumpers Association, City of Ventura

Current Users

Production averages 2005–2011: Total of 8 producers = ~22,000 AF; Total of all 125 producers = ~27,513 AF.[918] As of 2011 (after 2010 amendment), there were 6 de minimis producers.

Other

No environmental use is indicated.

Management Structure

The judgment established a TAC that is responsible for managing the adjudication with representatives of UWCD, SPBPA, and the City of Ventura. In practical effect, the TAC serves the same role as Watermaster in other basins. The TAC is required to monitor hydrologic conditions in the basin, initiate studies to better understand the factors affecting basin yield, and consider and attempt to agree upon the safe yield of the basin.[919]

Management Strategies

The TAC has not developed a comprehensive groundwater management plan for the basin. Proposed studies in the 2011 annual TAC report included: delivery of surface water in lieu of pumping groundwater; delivery of recycled water from the City of Santa Paula's wastewater treatment plant to basin irrigators in lieu of pumping groundwater; and an investigation of shifting pumping in the basin from the west end toward the east end, with existing and/or new pipelines delivering this water toward the west.[920]

Monitoring and Reporting

The judgment required the TAC to establish a monitoring program, including future pumping amounts, measurements of groundwater levels, changes in storage, and analyses of groundwater quality. UWCD has the primary responsibility for collecting, collating, and verifying the data required under the monitoring program; this includes verification of pumping amounts, measuring groundwater levels, and estimating inflows and outflows from the basin and increases and decreases in groundwater storage. UCWD presents the results in annual reports to the TAC for review, comment, and approval prior to submittal to the court. UWCD's data archive has historical water level data for ~150 wells in the basin. Extensive records exist for ~ 90 of these wells, and UWCD currently measures ~60 wells.[921]

Safe Yield

The judgment provided an "assumed initial yield" of the basin at 33,500 AFY that corresponds to the maximum amount of pumping at the time of the judgment, but according to the court did not necessarily represent the long-term safe yield.[922] Based on a seven-year yield study in 2003, required by the judgment, the TAC concluded that continued pumping at current average rates (1996–2003) of approximately 26,000 AFY "should not adversely affect the basin." Therefore, the TAC did not make any recommendation to the court to change the

basin yield at that time.[923] From 2005–2011, 8 producers (out of 125) extracted most of the groundwater (approximately 22,000AF, with the total extractions at approximately 27,500 AF).[924] Agricultural interests were the primary producers.[925] In 2012, the total combined pumping allocations of the SPBPA and the City of Ventura were at 30,780.28 AFY.[926] From 1997–2003, parties *cumulatively* produced 42,111 AF less than their combined total allocation for this period.[927] Table 20 illustrates a recent trend in groundwater extractions.

Table 20: Comparison of groundwater extractions 1980–2011

Year	Extractions	Year	Extractions	Year	Extractions	Average
1980	26,820 AF	1991	27,056 AF	2011	24,202 AF	25,695 AF

There have been ongoing disagreements regarding the actual safe yield of the basin.[928] UCWD has commissioned a third-party, independent evaluation of the safe yield, and the SPBPA is focused on how to increase the yield of the basin as opposed to implementing groundwater extraction cutbacks, including how to distribute pumping and how to increase storage.[929] One issue is that if the safe yield is less than the amount established in the adjudication, groundwater pumpers (i.e., City of Ventura and the SPBPA) may have to cut back on withdrawals pursuant to the six-stage cutback protocol proscribed by the judgment.

Groundwater Pumping and Overdraft

In the past, the Santa Paula Basin was considered in a state of potential overdraft, but a seven-year yield study by UCWD and the other TAC members concluded that the basin was not in a state of overdraft.[930] The Department of Water Resources' (DWR's) Bulletin 118, Update 2003, also does not state that any portion of the Santa Paula Basin is or was in overdraft. Hydrographs showed an annual cyclic rise and fall of water levels of approximately 20 feet, with variations following precipitation cycles.

However, during the 1983–1995, the average drop in water levels was 4.9 feet, with the drop most pronounced in far west end of the basin. Wells also experienced a gradual groundwater level decline, albeit modest, from 1998–2005 and 2005–2010, and the prevalent trend was for 70–100 percent of the wells to display declines.[931] Every evaluation period in a 2013 study showed a modest decline in groundwater levels for the majority of wells represented. Some wells declined over every evaluation period, but no well showed recovery over every evaluation period. This was consistent with previous observations of a gradual long-term decline in groundwater levels within the basin.[932] By 2011, UCWD staff noted that groundwater elevations in many (43 of 57) of the wells in both the eastern and western portions of the Santa Paula basin failed to fully recover to 1998 levels after near-record precipitation in 2005,[933] and concluded that: "The water level fluctuations observed in the Santa Paula Basin from 1998–2009 cannot be attributed solely to spatial or temporal variations in pumping."[934]

In 2015, UCWD's Groundwater Conditions Update for its entire management area also noted that the Oxnard Forebay Basin available storage had increased to 107,500 AF from 98,000 AF. An available storage of 80,000 AF equates to groundwater elevations at approximately sea level. The document stated that "In the absence of sustained precipitation, the Forebay available storage is likely to continue to increase and the Piru, Fillmore and Santa Paula basins will experience lower water levels."[935]

Water Quality

Water quality is variable throughout the basin; generally worse in the western portion due to total dissolved solids (TDS) but usable for irrigation for most crops. Nitrates and other inorganics can fluctuate significantly in the basin. Total dissolved solids are known to be high. Deeper wells tend to have elevated iron and manganese, and the cities of Santa Paula and Ventura operate treatment facilities to reduce these constituents in delivered municipal water. Groundwater pumped by the City of Santa Paula on the eastern end and City of Ventura on the west ends of the basin met maximum contaminant levels (MCLs) for primary or health-based constituents, but water quality concerns that continue include: relatively high chloride, TDS, and boron concentrations in the City of Santa Paula water recycling facility discharge that is percolated into the groundwater basin.[936] Water quality in the basin has not changed substantially since 2007.[937]

Disputes

In *City of San Buenaventura v. United Water Conservation District,* issued March 17, 2015, the Second District Court of Appeals held that a water conservation district's groundwater pumping fees, established at a rate for non-agricultural users that is three times higher than that for agricultural users, are not property-related fees subject to the restrictions imposed under Proposition 218 (California Constitution article XIII D, section 6). The court also rejected the argument that the challenged fees are taxes under Proposition 26 (California Constitution, article XIII C, section 1(e)). Rather, the court found that the fees are valid fees imposed under two exceptions to the definition of "tax" established under Proposition 26.[938] The City of Ventura appealed this decision to the California Supreme Court, and the issue is currently being heard by that court.

Discussion

When gravel mining ceased and the Freeman Diversion (1991) was built, groundwater levels in the Santa Paula Basin largely recovered from a low period; but downstream from the Freeman Diversion, levels did not recover to pre-1950 levels.[939] Currently, groundwater extractions are less than the allocations set forth in the stipulated judgment; however, a gradual, long-term decline in groundwater elevations is evident since the mid-1990s. While the basin's water levels have stabilized in some areas, there are still declining levels in parts of the basin that remain of concern.

Eight water producers out of 125 extract most of the groundwater.

Disagreements continue over the safe yield of the basin, but currently there is potential for the parties to reach agreement on safe yield, overdraft, and management protocols after studies are complete. The TAC produces an annual report, and if present yield studies determine that overdraft is occurring, the parties may seek an order form the court pursuant to the court's continuing jurisdiction to reduce the cumulative pumping allocation allowed under the judgment, which will trigger reductions pursuant to the six-stage cutback protocol proscribed by the judgment.

Overall basin management is relegated to the court through its continuing jurisdiction with input from the TAC and its members.[940]

Currently, the TAC and the separate committee members provide comprehensive monitoring of basin conditions, but there is no overall basin management plan.

It is worth noting that the stresses that cause long-term overdraft in a particular basin may be occurring only within that basin, or they may be occurring in several connected basins. For example, the seawater intrusion that occurred in a portion of the Oxnard Plain Basin can be aggravated by increases in pumping from that basin, but it can also be aggravated by decreases in the replenishment supply coming from the upstream basins caused by the hydraulic continuity between adjacent groundwater basins. The DWR pointed to hydraulic continuity of UWCD's several groundwater basins, and concluded in 1980 that these basins should be considered as one groundwater basin, the Ventura Central Basin, albeit with individual management regimes.

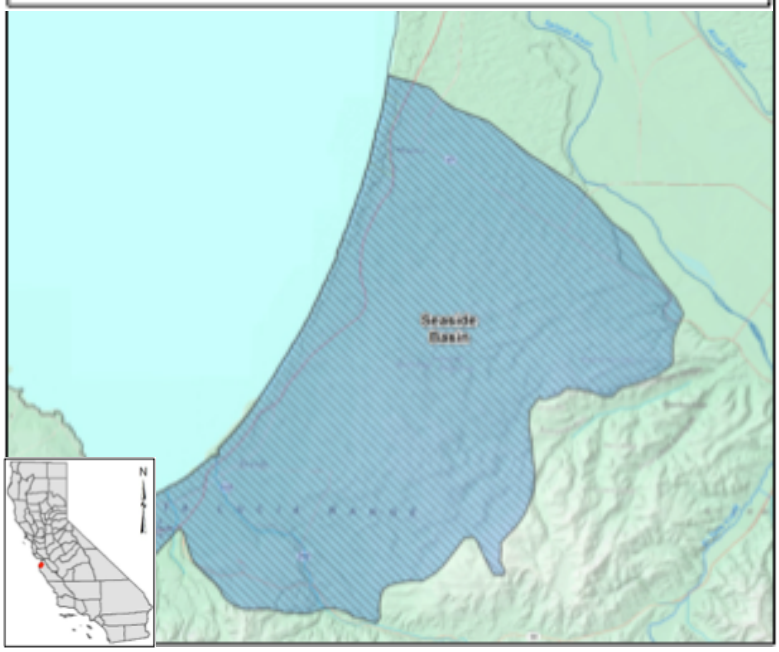
SANTA PAULA BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Ventura County Area: 13,000 acres Physical Characteristics: Oxnard Plain Forebay, recharged from rainfall percolation and Santa Clara River flows; underflow from Fillmore Basin, Santa Paula Creek and tributary streams; artificial recharge from United Water Conservation District (UWCD)'s spreading grounds; and irrigation return flows *Precipitation:* 17.5" per year average CASGEM: Medium Population: 77,866 Land Use: Agricultural (12,000 acres) and City of Santa Paula Reason for Adjudication: UWCD was concerned that water supplies were threatened by City of Ventura's proposed increase in groundwater extractions, and that overdraft could increase.	Stipulated for Judgment: 1988 Adjudication Initiated*:* 1991 Finalized: 1996 Amended: 2010 Decree Summary: The Stipulated Judgment did not determine water rights, and the physical solution established appropriators as junior to overlyers. Allocations: Santa Paula Basin Pumpers Assoc. (SPBPA), primarily farming and City of Santa Paula: 27,500 AFY. Each SPBPA member is entitled to an "Individual Party Allocation." (City of Ventura: 3,000 AFY; Limoneira-big agricultural landowner: up to 3,173 AFY.) Rights determined using average annual water use 1981–1990. Management includes cutback provisions in six stages as needed to balance total production with the basin's safe yield, but through Stage 5, cumulative pumping reduction would be less than 10% of current allocations. 2010 Amendment: Joined pumpers not previously included in the judgment; clarified shortage conditions, responsibilities, and production for SPBPA; and clarified water rights transfer procedures. Provided SPBPA with 280.2 additional AFY for pumpers not previously party to the judgment.	Watermaster: Technical Advisory Committee (TAC) Members: UWCD, City of Ventura, and SPBPA.The TAC determines safe yield; provides monitoring with verification of future pumping amounts; estimates groundwater levels, inflow, and outflow from the basin, and changes in groundwater storage; and analyzes groundwater quality. UWCD is a replenishment district that does not produce water from the basin, but manages replenishment, data collection and verification, and produces annual reports. Strategies: - 1980–1990 UWCD constructed the Freeman Diversion project for surface water diversions to recharge groundwater in the Oxnard Plain basin -TAC Working Group was established to initiate studies of basin yield. - UWCD's archive has historical water level data for ~150 wells and UWCD currently measures ~60 wells in the basin.	Initial safe yield: 1956–15,600 AFY Current Safe Yield: 33,500 AFY; 2003: ~26,000 AFY Safe Yield Summary: Safe yield is currently being reevaluated. Extractions: 1936–1957: 18,581 AFY; 1983: ~16,700 AFY; 1990: ~33,500 AFY The 1980–1999 average is 25,900 AFY. Current Extractions:Total 2011–2012: 30,800 AFY.Primarily SPBPA: ~24,202 AFY, with 75% agriculture and 25% City of Santa Paula.Combined pumping allocations of the SPBPA (party and non-party) and the City of Ventura are now at 30,780.28 AFY. Extractions Summary: Extractions peaked in the early 1990s, almost double from 1936–1957. Current extractions are a little lower than the peak. Groundwater Levels: When gravel mining ceased and the Freeman Diversion was built, basin water levels largely recovered from a low period, but below the diversion, groundwater did not recover to pre-1950 levels. Basin reached a low in 1991–1992, then recovered after that and remained stable. Overdraft: Some studies conclude that the basin is not in overdraft, but conclusions are mixed. Currently, water level declines in wells are modest, but the trend is for 70–100% of wells to display some decline, with the majority experiencing gradual groundwater level declines during 1998–2005 and 2005–2010, and declines continue to the present. Water Quality: Water quality is generally worse in the western portion, with relatively high chloride, TDS, and boron concentrations in City of Santa Paula WWTF effluent, which percolates into the basin. Discussion: **- Past observations show a gradual long-term decline in groundwater levels. After adjudication, water tables stabilized and appear to be sufficient to support groundwater rights set forth in the judgment, although the modest trend in declining levels in some areas of the basin remain of concern.** **- Safe yield has been disputed and is currently being reevaluated.** **- The basin appears to be comprehensively managed by the TAC, UWCD, and the reserved jurisdiction of the court.**

North and Central Coast Basins

California Adjudications: Scott River Stream System

California Adjudications: Seaside Basin



SCOTT RIVER BASIN

The 1980 Scott River Basin adjudication recognized a zone of interconnected ground and surface waters in the Scott River watershed, and included only areas of the Scott River Valley watershed where the SWRCB believed extractions would affect surface flows during parts of the year. Prior to determining water rights, the California Water Code was changed by the legislature to declare that groundwater supplies that are interconnected with the Scott River are part of the stream system. This determination was the catalyst for a subsequent lawsuit that argued that the public trust doctrine applies to groundwater hydrologically connected to navigable waters and therefore the county is required to consider the effect of the issuance of well permits on the Scott River as a public trust resource. The Scott Valley Watermaster currently only regulates adjudicated surface water rights for two tributaries of the Scott River (French and Wildcat creeks). There are nonprofit and other institutions interested in safeguarding groundwater supplies in the watershed and providing monitoring. The adjudication does not govern or cover any monitoring or data collection. Data collection is limited by the unwillingness of some residents to be monitored.

Overview

County	Siskiyou
Area	63,780 acres. This includes the larger Scott River Valley Basin.[941]
Population	3,520 (2010 Census) [942]
CASGEM	Medium
Watermaster	No current groundwater Watermaster. Siskiyou County has applied to be the monitoring entity for CASGEM.[943]
Court Cases	Scott River Adjudication. Decree Number 30662. Superior Court for Siskiyou County. January 30, 1980.

CASGEM = California Statewide Groundwater Elevation Monitoring

Scott Valley, located in the Klamath Mountains of western Siskiyou County, is drained by the federally designated Wild and Scenic Scott River, which is a tributary to the Klamath River. The drainage is bordered on the west and south by 7000–8000 foot mountain ranges. Average precipitation is 36 inches a year. The Scott River and its tributaries support several species of anadromous fish. A water trust works actively in the area to try to maintain stream flow for fish habitat. The largest water storage in the watershed occurs in the alluvial aquifer of Scott Valley, a groundwater basin that is recharged annually by Scott River and adjacent tributaries.

According to Harter and Hines (2008), "The Scott River Adjudication of 1980 recognized a zone of interconnected ground and surface waters in its water rights determination in the Scott River watershed below Fay Lane."[944] The adjudication included only areas of the Scott River Valley watershed where the SWRCB believed extractions would affect surface flows during parts of the year. The interconnected zone was designated with limited available information, and as the Scott Valley aquifer is situated in an alluvial valley, researchers posit any withdrawal may affect surface flow.[945]

Scott Valley was occupied by the Shasta Tribe of Native Americans prior to European contact in the 1830s, and was historically a gold mining area after European settlement. The

groundwater basin hosts approximately 3,520 residents[946] and includes the main towns of Etna and Fort Jones.[947] Until the late 1960s, agricultural water was mainly derived from surface water, and wells were primarily used for domestic and stock supplies. Water use for agriculture transitioned to groundwater and well use in the 1970s.[948]

Reason for Adjudication

In 1971 there was a conflict between agricultural users over surface water supply that led water users (primarily agricultural) to petition the State Water Resources Control Board (SWRCB) to adjudicate surface and interconnected groundwater water rights in the basin. The plaintiffs were concerned that groundwater pumping was interfering with their surface water supplies. Subsequently, the adjudication defined interconnected groundwater as "all ground water that is so closely and freely connected with the surface flow of the Scott River that any extraction of such groundwater causes a reduction in surface water flow in the Scott River prior to the end of irrigation season." The SWRCB's Order of Determination included a map delineating the surface projection of interconnected groundwater in the basin. The adjudication did not place limits on groundwater pumping, but on acreage that can be irrigated with groundwater within the areas specified by the map.[949]

Decree and Amendments

Adjudication initiated: 1970
Adjudication finalized: 1980
Other dates: 1998 established the first Groundwater Advisory Committee; 2005 established Scott Valley Community Groundwater Measuring Program; 2010 lawsuit regarding groundwater extraction and the public trust (see "Disputes" section below)
Costs: Unknown, but less than most adjudications because ground and surface water were adjudicated at the same time.[950]

Decree Summary

All surface water rights for the Scott watershed were determined under three adjudications: Shackleford Creek (1950), French Creek (1958), and Scott River (1980). In 1953 a groundwater study of Scott River basin confirmed the linkage of ground and surface waters, and concluded that managing groundwater supplies would cost less than developing surface storage projects.[951] The 1980 Scott River Adjudication applied to all water right holders in Scott Valley, with the exception of those in the Shackleford/Mill Creek and French Creek drainages, and water rights in the Scott River Decree consisted of all surface water rights, all rights supporting underflow, and all rights to groundwater that is interconnected with the Scott River Valley watershed, as delineated by the SWRCB map.[952] Use of groundwater that is not considered to be interconnected with the Scott River is not adjudicated. The Scott River adjudication recognized 680 diversions that can divert 894 cubic feet per second (cfs) from Scott River and its tributaries, excluding Shackleford and French creeks. The adjudication specified the acreage that could be irrigated, but did not quantify groundwater rights, nor did it specify any reporting to the court. Parties with surface water rights were allowed to switch to groundwater so long as new wells were located at least 500 feet from the Scott River or the most distant part from the river on land that overlies the area of interconnected groundwater. The decree provided for the creation of a Watermaster service area, but did not specify Watermaster duties with respect to groundwater extractions.[953]

In 1998, Siskiyou County passed a groundwater ordinance that established a local Groundwater Advisory Committee for each aquifer in the county. The only one established so

far is in the Scott Valley.[954]

Water Users

Stipulated users
In the Scott River Judgment, users are differentiated as either post-1914 appropriators or pre-1914 priority class users. The former can only use water after pre-1914 priority users have taken their share. There were 78 post-1914 stipulated users and approximately 300 stipulated pre-1914 priority users for surface water rights. Groundwater uses are only adjudicated insofar as they are delineated in the SWRCB map.[955]

Current users
Current users are primarily irrigated agriculture (approximately 31,800 irrigated acres), followed by residential use (both non-urban and urban), in-stream uses by the U.S. Forest Service, and industrial users.[956]

Other users
The adjudication decree defines a minimum flow that varies by month to maintain the fishery, and an additional flow for recreation, scenic, and aesthetic purposes. However, these rights are only equal and correlative with surface diversions in the lower reaches of the main Scott River.[957]

Management Structure

Although the decree envisions the creation of a Watermaster to ensure that the decree is implemented in accordance with the order of determination, no Watermaster was ever required by the court under the 1980 adjudication decree, except for two water users on Wildcat Creek. The water users on Oro Fino and Sniktaw creeks requested the Department of Water Resources (DWR) to provide Watermaster service for those adjudicated streams as well. The DWR also provided Watermaster service under the previous adjudications for French and Shackleford creeks and oversaw the surface water diversions from these five tributaries to the Scott River until 2012. In October 2007, the California legislature adopted legislation (AB 1580) allowing creation of the Scott Valley and Shasta Valley Watermaster District (SSWD), which took on all the duties that DWR had been performing in 2012.[958] In 2011, the water users from Sniktaw and Oro Fino creeks petitioned SSWD to discontinue Watermaster service, and the district approved their request beginning April 1, 2012. In 2013, the water users from Shackleford Creek also petitioned SSWD to discontinue Watermaster service, and the district approved their request beginning April 1, 2013. Beginning in 2012, SSWD has contracted its administration to a local private nonprofit company, the Northern California Resource Center's Business Division, and its duties as "deputy Watermaster" to GEI Consultants, Inc.[959] Additionally, Siskiyou County asserts that it has the right to govern the management and extraction of groundwater resources within its jurisdiction.[960]

Management Strategies

Management Plan: Scott Valley's Groundwater Advisory Committee has 11 members who are geographically distributed throughout the basin. They represent commercial agriculture (7 members), the City of Fort Jones, representatives of agricultural organizations (2 members), and a domestic groundwater user. In 2012 the Scott Valley Groundwater Advisory Committee approved a voluntary groundwater management and enhancement plan to provide locally driven direction for the management and enhancement of the Scott Valley

groundwater basin. This plan includes improving public understanding of agriculture and irrigation, applying for grants, and reducing conflict between groundwater and other uses of water.[961] In 2002, a leasing program, the Scott River Water Trust, was developed that leases water from water rights holders to keep it in-stream, to support ecosystem health.[962] Water users can also file complaints with the SWRCB regarding management in the basin.[963]

Monitoring and Reporting

Groundwater pumping is considered the biggest impact on groundwater supplies. Approximately 350–500 groundwater wells are equipped to pump more than 0.2 cfs for agricultural use. Currently a majority of landowners with medium- to large-sized wells are opposed to metering, which is voluntary.[964]

In 2005, the Scott Valley Community Groundwater Measuring Program was formed at the request of Siskiyou County and Scott Valley stakeholders, as set forth in the Action Plan for the Scott River total maximum daily load (TMDL). The action plan asked for a better understanding of groundwater dynamics in the basin, and the measuring program sets out to develop baseline data and monitoring of groundwater levels in the basin. The groundwater measuring program released a study plan that was developed through five partners: Siskiyou Resource Conservation District, Natural Resource Conservation Service, Scott River Watershed Council, University of California Cooperative Extension, and Siskiyou County. Monthly data collection is currently implemented at 36 wells, volunteered by local residents, and funding was initially secured from state and federal sources but is now privately and locally funded. Data are submitted to the University of California (UC) Davis Groundwater Cooperative Extension Program. The program completed a preliminary framework for a water balance study in 2004, and a spreadsheet calculation has been maintained to estimate the groundwater balance. Their work indicates that several data gaps are still present. Currently there are sufficient data to estimate the basin's average monthly water balance at the watershed scale, but not sufficient data to estimate groundwater pumping or the current status of the groundwater system. The UC Davis Groundwater Model is a project that is currently undertaking this task.[965]

Safe Yield

There is no safe yield established for the Scott Valley Groundwater Basin. Scott Valley was divided into six groundwater storage units, and groundwater storage capacity was calculated in 1958 to total 400,000 AF. The precise amount of usable groundwater is unknown, but it is lower than this number.[966]

Groundwater Pumping and Overdraft

According to the Scott Valley Groundwater Advisory Committee, the basin was never in long-term overdraft conditions.[967] However, the Scott Valley Groundwater Management plan notes that pumping in Scott Valley increased significantly since the 1950s and is the main cause for changes in groundwater levels.[968] A private well water level monitoring program monitored well levels between 2006 and 2015, and indicates that well levels were dropping since 2006, with a significant decrease in 2009. Narrative interpretations of these data cite the long-term groundwater levels as remaining fairly constant over the last forty years, with seasonal fluctuations. Future studies aim to better understand the dynamics of groundwater pumping by using meters or calculating via a water-balance method.

During the adjudication, surface water agricultural users voiced concern that pumping of the groundwater was interfering with surface water flows. There is no documentation that points to concern about dropping groundwater levels (e.g., increased pumping costs, well shut-downs, etc.). The Scott Valley Community Groundwater Study Plan notes that Scott Valley's groundwater levels drop each summer and then recover in the following fall/winter for the wells that have long-term records. Well monitoring data are not available prior to the 1950s. While there was a documented connection between surface and groundwater, the Community Groundwater Study Plan states that "it is unknown how quickly the interconnection occurs or its extent, and thus the exact nature of the impacts of groundwater pumping on streamflow."[969] One goal of the Groundwater Study Plan is to better understand the dynamics of groundwater withdrawals on surface water. Currently there is little research to adequately document this connection.[970]

Water Quality

Total maximum daily loads established in accordance with the CWA and the State of California determined that water quality standards for the river are exceeded due to excessive sediment and elevated water temperature. The Scott Valley Community Groundwater Measuring Program was formed in response to the action plan for the Scott River Temperature TMDL.[971]

Drought

The area is very concerned with drought impacts, and in 2014 considered enlisting federal and/or state emergency aid.[972]

Disputes

A lawsuit was initiated in 2010 by the Environmental Law Foundation (ELF), Pacific Confederation of Fishermen's Associations, and Institute for Fisheries Resources against the SWRCB and Siskiyou County for failing to protect the public trust resources by allowing groundwater extractions that are injurious to salmon populations. The litigation applies only to groundwater outside of the adjudicated basin. The plaintiffs argued that that under the Public Trust Doctrine the state must regulate groundwater pumping to protect public trust values in rivers that are hydrologically connected to groundwater. These groups asked the court to require the county to undertake a public trust analysis for new well permits and to declare that the SWRCB has authority to regulate groundwater use (which is not currently subject to permitting requirements for withdrawals). In July 2014, a Sacramento court ruled in favor of ELF on some of these issues, holding that the public trust doctrine applies to groundwater extractions to the extent they affect public trust uses in navigable waters, and that the county has a duty to apply the public trust doctrine.[973] In August 2014 Siskiyou County filed a petition in the California Supreme Court to overturn the decision. The court denied the request in February 2015.[974] The results of the lawsuit on the Scott River Basin are still ambiguous. The decision only holds that plaintiffs have an opportunity to make their case, and there are questions as to what kind of relief they would receive and how the county would balance irrigation needs with environmental needs.[975]

Discussion

The adjudication succeeded in curtailing surface water diversions, but since the decree, extractions of interconnected groundwater increased, resulting in diminished surface water flows.

A problem is that there is little information regarding groundwater withdrawals, and all metering initiatives are voluntary. Increased monitoring is contingent upon cooperation of landowners, a centralized data collection infrastructure, and annual inspection and maintenance. Currently a majority of landowners with medium to large wells are not interested in a metering approach. Despite the lack of regulatory oversight, the Scott Valley Community Groundwater Measuring Program was commendable in engaging citizen participation and resident scientists to help better understand groundwater dynamics.

For the Scott River Adjudication Decree to be implemented, the California Water Code had to be altered to declare that groundwater and surface water supplies that are interconnected are part of the stream system. This is the only stream system with such a determination.

California's Fish and Game Code and Endangered Species Act (ESA) rules and regulations are focusing on providing sufficient stream flow for salmon and steelhead. The ESA is a potential tool to regulate the taking of endangered species through limiting groundwater use. Additionally, a 2010 lawsuit by ELF and other plaintiffs argued that that under the Public Trust Doctrine the state must regulate groundwater pumping to protect public trust values in rivers that are hydrologically connected to groundwater. In July 2014, a Sacramento court ruled in favor of ELF. In August 2014 Siskiyou County filed a petition in the California Supreme Court to overturn the decision and the court has not yet acted on this request.

SCOTT RIVER BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Siskiyou Area: 63,780 acres Physical Characteristics: Geologic formations are divided between surficial alluvial deposits and underlying bedrock. Scott River was an actively degrading stream, cutting down in response to regional uplift. Precipitation: 36" per year CASGEM: Medium Land Use: Dominated by agriculture, beef cattle raising, forage production, and dairies. Reason for Adjudication: Water users petitioned the Water Board to adjudicate water rights in the basin in 1971. Irrigators were concerned that groundwater pumping diminished surface water supplies.	Adjudication Initiated: 1970 (surface water) Finalized: 1980 Decree Summary: The Scott River adjudication recognized 680 diversions that divert 894 cfs from Scott River and its tributaries. Water rights in the decree consist of all surface water rights, all rights supporting underflow, and all rights to groundwater that is interconnected with the Scott River as delineated by the SWRCB map. The adjudication specifies acreage that can be irrigated but does not quantify groundwater rights. In the Scott River Judgment, users are differentiated as either post-1914 appropriators or pre-1914 priority class users. The former can only use water after pre-1914 priority users have taken their share. There were 78 post-1914 stipulated users and approximately 300 stipulated pre-1914 priority users for surface water rights. Groundwater uses are only adjudicated insofar as they are delineated in the SWRCB map. Disputes: A lawsuit was initiated in 2010 by the Environmental Law Foundation (ELF), Pacific Confederation of Fishermen's Associations, and Institute for Fisheries Resources against the SWRCB and Siskiyou County for failing to protect the public trust resources by allowing groundwater extractions injurious to salmon populations. In July 2014, a Sacramento court ruled in ELF's favor, but Siskiyou County filed a petition in the California Supreme Court to overturn the decision. The court has not yet acted on this request.	Watermaster: No Watermaster was ever required by the court under the 1980 adjudication decree except for two water users on Wildcat Creek. DWR provided Watermaster service under the previous adjudications for French and Shackleford creeks and oversaw the surface water diversions from these five tributaries to the Scott River until 2012. Beginning in 2012, SSWD has contracted its administration to a local, private nonprofit (the Northern California Resource Center's Business Division), and its duties as "deputy Watermaster" to GEI Consultants, Inc. Additionally, Siskiyou County asserts that it has the right to govern the extraction and management of groundwater resources within its jurisdiction. Strategies: Water users can file complaints with the SWRCB. In 2012 the Scott Valley Groundwater Advisory Committee approved a voluntary groundwater management plan to: provide locally driven direction for the management of the Scott Valley groundwater basin, improve public understanding of agriculture and irrigation, obtain funding, and reduce conflict between groundwater and other water uses.	Adjudicated Safe Yield Summary: There was no information on safe yield for this basin. Current Extractions: 23,000 AF for agricultural and 1,300 AF for municipal/industrial (1991) Extraction Summary: Groundwater pumping is not monitored in this basin, and researchers are attempting to estimate groundwater pumping via a mass water balance approach. Groundwater Levels: According to the Scott Valley Groundwater Management plan, pumping in Scott Valley significantly increased since the 1950s and is the main cause for changes in groundwater levels. However, long-term groundwater levels have remained constant over the last forty years, with seasonal fluctuations. Future studies aim to better understand groundwater pumping dynamics by using meters or calculating via a water balance method. Overdraft: No information was available for this basin. Water Quality: North Coast Regional Water Quality Control Board incorporated the Action Plan for TMDLs for temperature and sediment, which precipitated a groundwater study plan for the basin. Also, California's Fish and Game Code and Endangered Species Act rules and regulations focus on providing sufficient stream flow for salmon and steelhead. Discussion **- Groundwater pumping is not monitored in this basin, and increased monitoring is contingent upon cooperation of landowners, a centralized data collection infrastructure, and annual inspection and maintenance.** **- For the Scott River Adjudication Decree to be implemented, the California Water Code had to be changed by the legislature to declare that groundwater and surface water supplies that are interconnected are part of the stream system.** **- Pumping in Scott Valley significantly increased since the 1950s and is the main cause for changes in groundwater levels. However, long-term groundwater levels reflect seasonal fluctuations and have remained constant over the last forty years.**

SEASIDE BASIN

The adjudication of Seaside Basin was contentious and played out underlying tensions between the local management district (Monterey Peninsula Water Management District, MPWMD) and development interests. The MPWMD did not become the Watermaster, as occurred in a number of other basins where water management agencies took on Watermaster duties after adjudication. Instead, the Watermaster is a committee that represents the diverse interests in the region. In a 2008 post-adjudication lawsuit, upheld on appeal, the court acknowledged that MPWMD retained certain powers to regulate the Seaside Basin, including developing a Groundwater Management Plan, but stated it could only do so in a manner consistent with the 2007 adjudication judgment and physical solution that "governs the environmental aspects of Seaside Basin [groundwater] usage." The Seaside Basin does not receive imported water, so other strategies are utilized to reduce overdraft and the threat of seawater intrusion, including conservation, aquifer storage and recovery, and a small desalination plant in Sand City. A proposed Monterey Peninsula Water Supply Project, consisting of a larger desalination plant to serve the Monterey region, still faces numerous hurdles and is not anticipated to be operational before 2019 at the earliest.

Overview

County	Monterey
Area	12,300 acres / 19 square miles[976]
Population	56,899 (2010)[977]
CASGEM	Medium/High[978]
Watermaster	Seaside Groundwater Basin Watermaster[979]
Members	A nine-member board represents municipal water suppliers, cities, individual pumpers, and water management agencies.
Court Cases	*California American Water (Cal-Am) v. City of Seaside et al.;* Filed August 14, 2003. Trial Date December 13, 2005. Judgment filed March 26, 2006; amendment filed February 9, 2007; Case Number M66343 Superior Court of California, Monterey[980]

CASGEM = California Statewide Groundwater Elevation Monitoring

The Seaside Basin lies beneath an approximately 19-square mile area at the northwest corner of the Salinas Valley, adjacent to Monterey Bay. The basin underlies a hilly coastal plain that slopes northward toward the Salinas Valley and westward toward Monterey Bay. Land surface elevations range from sea level at the beach to approximately 900 feet near the eastern boundary of the basin.[981] The western boundary is comprised of sand dunes forming the shoreline of Monterey Bay, and the eastern boundary is defined by the flow divide in the Paso Robles aquifer that approximately coincides with the surface drainage divide between Canyon del Rey and the El Toro creek watersheds. The northern boundary of the basin also follows a groundwater flow divide, separating groundwater flowing toward the Salinas Valley from groundwater flowing toward the coastal subareas of the Seaside Basin. The southern boundary of the basin follows the trace of the Chupines fault, where the relatively impermeable Monterey Formation is uplifted to near or above sea level. The drainage of the basin is primarily internal, within small depressions between sand dunes, and very few

streams exit the region. Historically, the Paso Robles aquifer was the primary water-producing unit in the basin, but more recently (i.e., since 1995) the deeper Santa Margarita aquifer has become the principal water-producing unit.[982] Annual precipitation ranges from 17 (coastal) to 15 (inland) inches per year. Groundwater recharges from percolation of precipitation, subsurface inflow from the east, and minor seepage from creeks.[983]

The coastal communities of Seaside and Marina, as well as the western portion of the former Fort Ord, overlie portions of the basin, and about 37 wells extract water from the basin. Seaside is an area in Monterey County with significantly lower income and higher poverty levels than the western/southern parts of the peninsula. The area is primarily urban, but has historically hosted agricultural operations as well.[984] Several water management entities play a major role in the basin. The Monterey Peninsula Water Management District (MPWMD), established by the legislature as a special district in 1977, was provided with broad powers to augment the area's water supply through replenishment, as well as to promote integrated management of ground and surface water resources, conservation, water reuse, reclamation of storm and wastewater, and environmental values.[985] MPWMD was also empowered to approve the establishment or expansion of water distribution systems.[986] California American Water Company (Cal-Am) is an investor-owned public utility that produces groundwater from the Seaside Basin and delivers it for use on land both within and outside the Seaside Basin area, all within Monterey County. The Monterey County Water Resources Agency (MCWRA) is a county water manager. It has its own appointed board that is overseen by the Monterey County Board of Supervisors.[987] MPWMD and MCWRA have an agreement that the district handles Seaside Basin groundwater management issues, while the agency handles Salinas Basin groundwater management issues.[988] Other water service providers include Marina Coast Water District (MCWD) and Seaside Municipal Water System.[989]

Reason for Adjudication

Information regarding groundwater production and water levels in the different subareas of the Seaside Basin became available after 1973 due to improved monitoring, and data from MPWMD showed drops in the basin's water table, with many areas in overdraft. Groundwater extraction near the coast increased beginning in 1995 when Cal-Am was given an order by the State Water Resources Control Board (SWRCB Order 95-10) to reduce drawing more water from the Carmel River than they were allocated, and the utility relocated a greater portion of its water supply from the Carmel River to the Seaside Groundwater Basin.[990] In 2002, MPWMD initiated development of two interim ordinances focused on management of the Seaside Basin groundwater resources, and later that year began preparing a draft environmental impact report (EIR) needed to comply with the two ordinances that were to be interim measures protecting groundwater while the Seaside Basin Groundwater Management Plan (GMP) was being prepared. In 2003, the MPWMD board decided not to proceed with implementation of the proposed ordinances at that time, and subsequently convened a Seaside Groundwater Basin Advisory Committee comprised of basin stakeholders to help guide implementation of the GMP.[991]

Concerned that both the ordinances and MPWMD's GMP would potentially limit Cal-Am's pumping, on August 14, 2003, Cal-Am sought a declaration of rights among parties interested in the production and storage of groundwater from the Seaside Basin and requested an adjudication of the basin, including a determination of the Seaside Basin's safe yield, an operating plan for the management of the basin, a determination of water rights to the basin and the appointment of a Watermaster. Cal-Am's complaint named a number of defendants,

including the cities of Seaside; Sand City; Security National Guaranty, Inc. (SNG), a real estate developer; and other landowners that historically extracted groundwater from the basin. MCWRA intervened in the adjudication as a plaintiff against all parties, and MPWMD intervened as a defendant against Cal-Am and cross-complained against the other parties as a plaintiff. In October 2003, Cal-Am joined with defendants to execute a stipulated agreement. The agreement was opposed by MPWMD and MCWRA, who did not join in the stipulation. The Monterey County Superior Court granted MPWMD's motion to intervene and then adjudicated the rights of the parties. In 2004, the City of Seaside filed a cross-complaint, requesting that the court impose a physical solution. In its 2006 decision (amended in 2007), the court accepted parts of the stipulation and set forth its findings regarding the status and permissible use of Seaside Basin.[992]

Decree and Amendments

Adjudication initiated: action filed 2003, trial began 2005
Adjudication finalized: 2006 judgment, 2007 amended judgment
Amendments: 2007; 2010
Other significant dates: 2008, Cal-Am and SNG applied to MPWMD for a water distribution permit to allow Cal-Am to pump SNG's adjudicated rights and deliver such water for an eco-resort proposed by SNG[993]

Decree Summary

The court determined that Seaside basin was in overdraft, and that in each of the preceding five years cumulative groundwater production in the basin as a whole was between 5,100 and 6,100 AFY, exceeding its natural safe yield (NSY) of approximately 2,581–2,913 AFY and potentially contributing to saltwater intrusion. The stated objective of the adjudication was "to ultimately reduce the drawdown of the aquifer to the level of the Natural Safe Yield; to maximize the potential beneficial use of the Basin; and to provide a means to augment the water supply for the Monterey Peninsula."[994] The court created and defined the role of the Watermaster Board, a nine-member group to provide coordinated management of the groundwater resources. Member votes are weighted, with a total of 13 votes possible among the nine members. A physical solution was adopted that identified pumping amounts, imposed a deliberate and gradual ramp-down of allowed pumping over time, required annual monitoring and reporting to the Watermaster, and set guidelines for storage and recovery and artificial replenishment programs. The Watermaster's function was to oversee the process and implement regulations to ensure compliance with the physical solution.[995]

An operating safe yield (OSY) was defined and established to assure that pumping would not cause "Material Injury to the Seaside Basin or to the Subareas or … to a Producer due to unreasonable pump lifts." An initial OSY of 5,600 AFY[996] was established, with the mandate that groundwater pumping from the basin be reduced by 2,600 AFY by 2021 to bring the basin into balance and reduce the risk of seawater intrusion. The OSY was to be maintained for three years, at which point the Watermaster would reassess. Depending on the basin's condition, cutbacks for the OSY were to be 10 percent beginning in 2009, to reduce the initial OSY of 5,600 AFY to 5,180 AFY. The 2007 amendment required that subsequent reductions were to occur triennially. The court required that artificial means, water transfers, recycled water, and a reduction in extractions could all be instituted to meet the OSY, determined annually.[997]

With respect to water rights, the court held that the parties had produced groundwater from

the basin adversely for more than five years, and that they therefore "collectively possess a variety of rights based in prescription and other original rights (including overlying and appropriative rights)." The court based each party's right to produce native groundwater from the basin on their historical production and the priority of a right was defined in accordance with California law. Water rights were based on a percent of the OSY established in the judgment.

Standard production for parties was outlined in the judgment, and standard producers had to reduce production over time until OSY was equal to the NSY. Standard production rights were designed to resemble the characteristics attributable to appropriative rights under the common law. Water rights for standard producers were transferrable. Certain parties asserting overlying rights elected to participate as "alternative producers" and alternative production rights were designed to resemble the characteristics attributable to overlying rights under the common law. These alternative producers had a prior and paramount right to the standard producers and were required to reduce production only if the NSY was not met by the standard producer's reductions, and additional reductions were required to reach the NSY of the subarea. Their right was limited to use on their property. Alternative producers could permanently choose to change to a standard production allocation, enabling them to transfer their water and obtain other benefits attendant to standard producers, such as storage and carryover rights.[998]

The court also held that carryover credits were allowed for a standard producer's production allocation that was not extracted from the basin during a particular year. Additionally, a standard producer that stored artificial water in a basin had the exclusive right of recapture as long as the recapture did not materially harm the basin or a producer in the basin.[999] The court exempted from the judgment's production limits those parties whose production of groundwater was less than 5 AFY, stating that it was unlikely to significantly contribute to material injury in the basin.[1000]

Amendments

A 2007 amendment required an ongoing triennial step-down of the OSY. A 2010 amendment enhanced the scope of Watermaster duties.

Other

In 1998, SNG applied to Sand City to develop an eco-resort. Sand City certified a final EIR and approved the project, but MPWMD denied a proposal that would have used wells on SNG's property to create a water distribution system for the eco-resort, due to the hydrologic impacts of the plan and SNG's lack of water rights. SNG subsequently acquired adjudicated water rights in the Seaside Basin. In 2008, Cal-Am again applied to the MPWMD for a permit to allow the company to pump water from the Seaside Basin to serve the proposed eco-resort. MPWMD conducted hearings on the application and voted to deny the application because the coastal commission had denied it, until, pursuant to the California Environmental Quality Act (CEQA), a new EIR could be prepared that focused on the potential impacts of the project on the Carmel River and the Seaside Basin, and that included an evaluation of possible alternatives. The court found that, although the MPWMD had authority to issue water distribution permits, it "cannot exercise that authority in contravention of the Physical Solution imposed by the Amended Decision for management of the Basin." Accordingly, the court ruled that "the Physical Solution governs the environmental aspects of Seaside Basin [groundwater] usage, and…no [p]arty to this adjudication can require environmental review under [CEQA] with regard to such usage…."[1001] The court went on to state that "clearly the

[L]egislature contemplated that courts had the power to develop management plans for aquifer management even if a water management district already existed in a geographical area," and that Water Code section 10753 precluded any local agency's adoption and implementation of groundwater management plans to the extent that its service area is already managed by "a court order, judgment, or decree."[1002] Thus while acknowledging that MPWMD retained certain powers to regulate water distribution permits for water supplied from the Seaside Basin, the court stated it could only do so in a manner consistent with the 2007 adjudication judgment.[1003]

Water Users

Stipulated users

Production allocations for standard producers in the Coastal Subarea included: California American Water, the development company SNG, City of Seaside-Municipal, City of Seaside-Golf Courses, City of Sand City, Granite Rock Co., DBO Development No. 27, Calabrese, and Mission Memorial Park.[1004] Cal-Am received the highest percentage of OSY (77.55 percent). Production allocations were also initially set for Standard Producers in the Laguna Seca subarea and included: Cal-Am, Pasadera Country Club, Bishop, York School, and Laguna Seca County Park. Cal-Am again received the highest percentage of OSY (45.13 percent). Some parties with overlying rights chose to participate in an alternative production allocation, including Seaside with regard to water it produces for irrigating its golf courses, Sand City, SNG, Calabrese Mission Memorial, Pasadera, Bishop, York School, and Laguna Seca.[1005]

Current users

Seaside Basin supplies water for about 25 percent of Cal-Am's distribution, the City of Seaside's municipal system, two golf courses, and several industrial users. Cal-Am exports an average of 881 to 1,662 AFY from coastal subareas of the Seaside Basin for customers that do not overlie those areas. This accounts for approximately 40 percent of Cal-Am's annual water production from the Seaside Basin (which means that 40 percent of water pumped by Cal-Am from the Seaside Basin is used outside the basin).[1006]

Management Structure

The Seaside Watermaster is composed of nine members. The current board of directors includes: Mayor of Seaside, landowners from Laguna Seca and Coastal subareas, an MPWMD representative, Mayor of Sand City, Cal-Am representative, Mayor of Del Rey Oaks, Monterey County Water Resources Agency representative, and the Mayor of Monterey. The adjudication allows the Watermaster to collect fees for overproduction. The total estimated administrative Watermaster costs through the end of 2014 Fiscal Year amounted to $85,000, including a $19,000 dedicated reserve. Costs include maintaining an office and paying a part-time administrator and some part-time staff to take and transcribe minutes of the Watermaster Board meetings during 2014.[1007]

Management Strategies

The basin does not receive imported water from the state and thus relies on other strategies to supplement water supplies and reduce overdraft. The adjudication set guidelines for pumping limits, storage and recovery plans, and artificial replenishment. Several small projects were instituted to provide modest solutions to overdraft in the basin. Major golf courses have begun to consider using reclaimed water and limit their water use during drought, and

MPWMD and Cal-Am have a water conservation program that reduced per capita demand. Sand City built a small desalination project that Cal-Am operates to provide water for the City's future use; it became operational in 2010.[1008] MPWMD built an aquifer storage and recovery program (ASR) that Cal-Am and MPWMD jointly operate that injects excess flow from the Carmel River into the Seaside Basin. In 2013, a total of 294.47 AF of water was diverted from the Carmel River during periods of excess flow and stored at the ASR site, which has an estimated annual yield of 1,920 AFY. This was considerably less than that diverted in 2011, due to low rainfall.[1009]

A looming problem is the SWRCB Cease and Desist Order (Order 2009-0060) to Cal-Am that mandates forced reductions of its Carmel River diversions. Despite a moratorium on new connections, there is a concern in the region that demand will exceed available supplies. In 2013, stakeholders in the basin, including Cal-Am, MPWMD, MCWRA, and the Monterey Regional Water Pollution Control Agency (MRWPCA), joined together to address their concerns regarding this "supply gap" in the region. Current plans to increase supply include identifying and developing new ASR sites and the development of an expanded groundwater replenishment project—the Pure Water Monterey Groundwater Replenishment Project—that includes a new advanced water treatment plant for highly purified replenishment water.[1010] Additionally in 2012, Cal Am submitted a second application to the California Public Utilities Commission (CPUC) for a desalination plant to serve the Monterey Peninsula (the first application had been withdrawn). The CPUC prepared a draft EIR for this project, and it is currently undergoing public review and comment.[1011] There remain some significant hurdles for these proposed strategies, including:

- the CEQA review resolving water rights complaints pertaining to source water from the slant wells in the Salinas Basin under the beach/ocean,
- obtaining a CPCN (Certificate of Public Convenience and Necessity) from the CPUC,
- obtaining a CDP (City Development Plan) from the California Coastal Commission,
- and approval from National Marine Sanctuary.

Monitoring and Reporting

Water level data from wells were collected by MPWMD for more than 30 years, and they show that groundwater levels in the Santa Margarita aquifer declined 20 feet between 1988 and 2003, from 5 feet above sea level to 15 feet below sea level. Between 1960 and 2002, the Cal-Am Luxton Well showed drops from 50 feet above sea level to 10 feet below sea level.[1012] Coastal monitor wells are checked quarterly by MPWMD and the Watermaster for saltwater intrusion. The Seaside Basin Watermaster uses an enhanced monitoring well network to fill in data gaps in the previous monitoring well network used by MPWMD. Water-sample collection in 2015 from the MPWMD coastal monitor wells utilized the low-flow method following a 2009 recommendation of the Watermaster Technical Advisory Committee (TAC). The advantage of this method is that it can limit vertical mixing and volatilization of any volatile organic compounds in solution within the well casing or borehole, as compared to the air-lift sampling method that was used previously. Additionally, the Watermaster requested that producers collect and report "static," i.e., non-pumping, water-level measurements that will more closely approximate ambient groundwater-level conditions, and facilitate the plotting of well water-level hydrographs. MPWMD provides monitoring information in its annual report. So far there has been no noticeable saltwater intrusion since the adjudication.[1013]

Safe Yield

A 2005 study utilized a method of estimating the potential yield of the basin through the development of a complete groundwater balance and evaluation of the percentage of recharge that could be captured by wells. The groundwater balance consisted of an itemization of inflows, outflows, and storage changes for each of the Seaside Basin subareas.[1014] In 2006, the judgment determined the NSY to be based on natural percolation from precipitation and surface water bodies overlying the basin. The estimation of this NSY was 2,581–2,913 AFY. The court also determined that cumulative groundwater production of the parties from the basin in each of the preceding five years (between 5,100 and 6,100 AFY) exceeded the NSY of the basin during that period. The court defined an OSY of the basin as the maximum amount of groundwater resulting from natural replenishment that the Watermaster determined should be allowed to be produced. The court's objective was for the OSY to eventually match the NSY, and a "step-down" model was put in place to reduce withdrawals.[1015] The initial OSY was 5,600 AFY, and an amendment in 2007 required triennial 10 percent ramp-downs. In 2014 the OSY was 3,626 AFY, signifying a considerable ramp-down. Total pumping for 2013 did not exceed the OSY for the basin, but it did exceed the NSY of the basin.[1016]

Groundwater Pumping and Overdraft

Groundwater-level monitoring shows declines from the 1960s to the present, with a brief respite in the 1980s. Historical highs were last seen in the late 1940s. Groundwater levels are currently over 20 feet below the mean sea level in key wells in the coastal area of the basin,[1017] and they have remained at these levels since the early 2000s. Coastal subarea pumping allocations were initially set at approximately 77 percent Cal-Am, 6 percent Seaside municipal use, 10 percent Seaside Golf Courses, 0.2 percent Sand City, 0.6 percent Granite Rock Company, 3 percent SNG, 1 percent DBO Development, 0.3 percent Calabrese, and 0.6 percent Mission Memorial Park. Overall, groundwater pumping increased from 1,600–5,700 AFY to 4,600–6,000 AFY between 1990 and 2010.[1018]

The Watermaster's 2009 Annual Report documented a downward trend in groundwater levels, although no seawater intrusion was reported at that time as a result of these lowering groundwater levels.[1019] Long-term water-level hydrographs for coastal wells show that groundwater levels have declined in the deeper wells but stabilized in the shallower Paso Robles aquifer. Modeling work performed by HydroMetrics assessed Cal-Am's in-lieu replenishment program and found that it falls short of achieving protective elevations in these wells, but that protective elevations can be achieved by injecting an additional 1,000 AFY of water into existing ASR wells. Some ideas for obtaining the water include additional desalination plants, improving Cal-Am's distribution system, and recycled water treatment. A current plan is 700 AFY of in-lieu replenishment by Cal-Am over a 25-year period with water from the MPWSP or a combined effort with pure water.[1020] In 2013, the Watermaster found that there were no noticeable signs of increased seawater intrusion, but continued pumping in excess of recharge and freshwater inflows, pumping depressions near the coast, and ongoing seawater intrusion in the nearby Salinas Valley all suggest that seawater intrusion could occur in the Seaside Groundwater Basin.[1021]

Water Quality

Water from Santa Margarita Sandstone aquifer is high in hydrogen-sulfide gas. High levels of iron were found south of Seaside.[1022]

Discussion

Groundwater-level monitoring in production and monitoring wells within the Seaside Basin show declines since the 1960s. One well considered representative of the Fort Ord area experienced a decline of approximately 1 foot per year from the 1950s to at least 1997.[1023] The judgment resulted in decreased overdraft, and it established plans to phase out overdraft by 2021. It provided an institutional structure to potentially replenish the basin and achieve positive off-shore gradients to avoid the seawater intrusion threat. However, the OSY continues to exceed NSY, and this may not be sustainable over the long term if replenishment water fails to materialize, resulting in prolonged on-shore water gradients at the coast.

There remain concerns regarding a potential supply gap for the region, and potential projects to increase supply face challenges and will not come online for a while. A proposed Monterey Peninsula Water Supply Project, consisting of a larger desalination plant to serve the Monterey region, still faces numerous hurdles and is not anticipated to be operational before 2019 at the earliest.

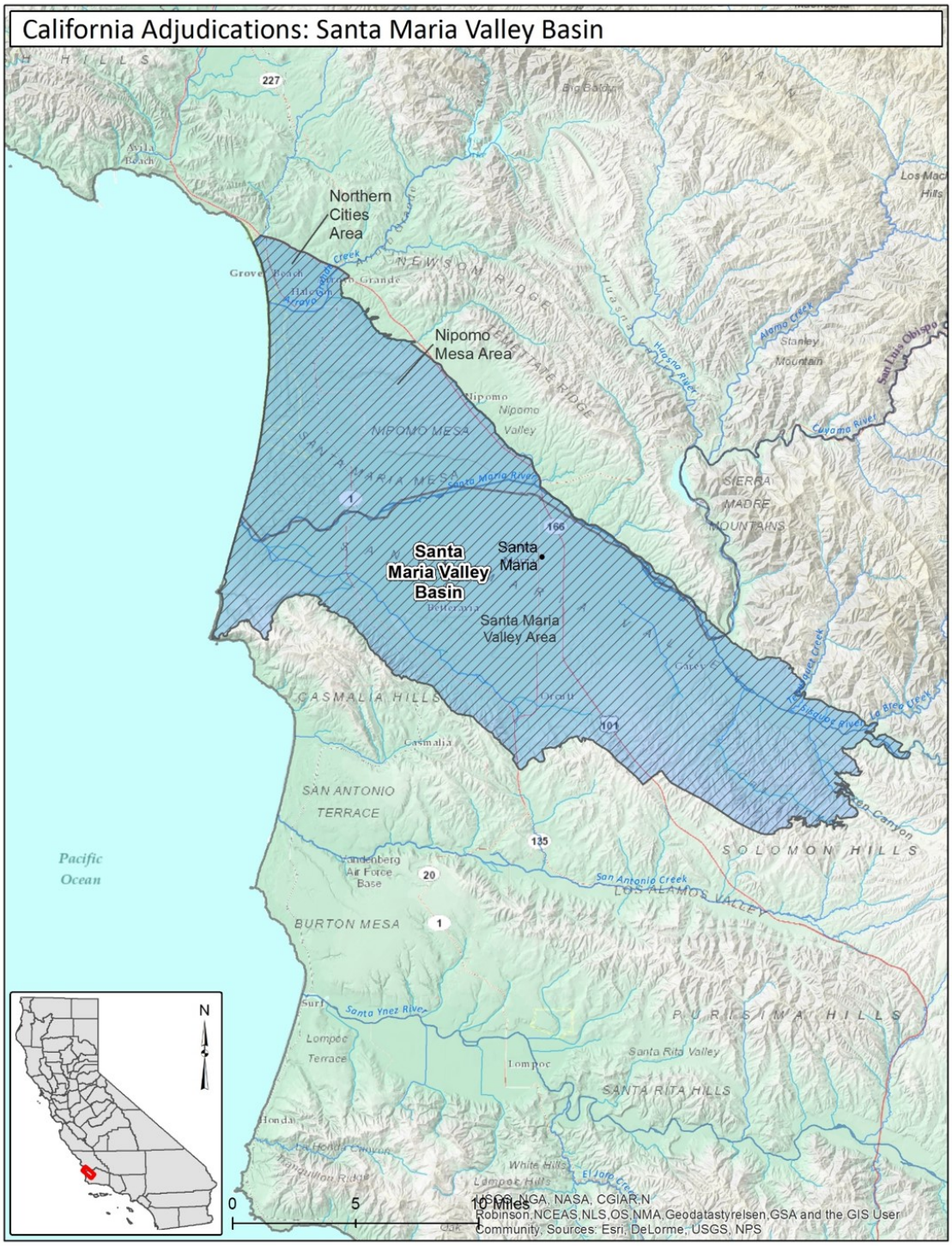
The management structure of the Watermaster is clear and well delineated, and reporting is done on an annual basis. The creation of a Watermaster committee composed of diverse interests appears to have led to a more collaborative and cooperative approach to resolving some of the region's water problems.[1024]

The 2008 case established the precedent that the actions of a water district affecting a groundwater basin need to be consistent with the adjudication judgment's specifications for that basin.

SEASIDE BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Monterey Area: 40 sq. mi. Physical Characteristics: The western boundary is the shoreline of Monterey Bay, the northeast boundary is the aquifer sub-basin of Salinas Valley, the southeast border is the Corral de Tierra Sub-basin. Precipitation: 15"–17" per year CASGEM: Medium/High Land Use: Increasingly urban Reason for Adjudication: The basin's water table was dropping since 1987. A major decrease was in 1995 when Cal-Am, an investor-owned utility that extracts groundwater from the basin, switched its water supply from the Carmel River to the Seaside Basin.	Stipulation: Partially accepted by the court Adjudication Initiated: 2003 Adjudication Finalized: 2006 Amended: 2007 and 2010 Decree Summary: The judgment defined the position of Watermaster and adopted a "physical solution." An initial OSY of 5,600 AFY was established. After three years the Watermaster would reassess. The 2007 amendment required subsequent reductions to occur triennially and depending on the basin's condition. Cutbacks for the OSY were to be 10 percent beginning in 2009 to reduce the initial OSY of 5,600 AFY to 5,180 AFY, to bring the basin into balance by 2021 and reduce the risk of seawater intrusion. The court held that the parties "collectively possess a variety of rights based in prescription and other rights (including overlying and appropriative rights)." The court based each party's right to produce native groundwater from the basin on his/her historical production. Priority of right was defined by California law. Water rights were based on a percent of the OSY established in the judgment. Standard producers (designed to resemble appropriative rights) had to reduce production over time until OSY was equal to NSY, rights were transferrable, and carryover credits were allowed. Parties asserting overlying rights could elect to participate as "alternative producers," with a prior and paramount right to the standard producers. They were required to reduce production only if NSY was not met by the standard producer's reductions, and additional reductions were required to reach the subareas' NSY. Their right was limited to use on their property.	Watermaster: A nine-member board. Members: Currently: Mayor of Seaside, landowners from Laguna Seca and Coastal subareas, a Monterey Peninsula Water Management District, Mayor of Sand City, Cal-Am, Mayor of Del Rey Oaks, Monterey County Water Resources Agency, and the Mayor of Monterey. Strategies: Seaside Basin does not receive imported water. Strategies to reduce the threat of seawater intrusion include a 2010 small desalination plant in Sand City (a proposed larger desalination plant to serve the Monterey region is not expected to be operational before 2019); and a water conservation program (MPWMD and Cal-Am) to reduce per capita demand. MPWMD built an aquifer storage and recovery (ASR) program that Cal-Am and MPWMD jointly operate. It injects excess flow from the Carmel River into the Seaside Basin.	Adjudicated Safe Yield: 3,000 AFY Operating Safe Yield: A "step-down" model with the goal that OSY equals NSY. The 2014 OSY was 3,626 AFY. Summary: The operating safe yield is updated triennially. Total pumping for 2013 did not exceed OSY for the basin, but it did exceed NSY of the basin. Current Extractions: Average 4,600–6,000 AFY for past five years Extraction Summary: Four main standard producers (Cal-Am, Seaside, Granite Rock, and DBO Development) pumped the majority of the groundwater in the basin in 2013 (3,334 AF). This was 642 AF over their NSY. Alternative producers pumped 561 AF in 2013. Overall, groundwater pumping has increased from 1,600–5,700 AFY to 4,600–6,000 AFY since adjudication. Groundwater Levels: Groundwater level monitoring shows declines from the 1960s to the present. Levels are around 300 feet below the mean sea level in key wells, and have remained at these levels since the early 2000s. Long-term water-level hydrographs for coastal wells show that groundwater levels have declined in the deeper wells but stabilized in the shallower Paso Robles aquifer. Overdraft: The court determined that Seaside basin was in overdraft, and that in each of the preceding five years cumulative groundwater production in the basin as a whole exceeded its natural safe yield, potentially contributing to saltwater intrusion. In 2013, the Watermaster found that there were no noticeable signs of increased seawater intrusion; but there was evidence that seawater intrusion could occur in the Seaside Basin. Water Quality: High hydrogen-sulfide gas in the Santa Margarita Sandstone aquifer. Discussion: **- The judgment resulted in decreased overdraft and provided an institutional structure to potentially replenish the basin and avoid seawater intrusion. However, OSY continues to exceed NSY, and this may not be sustainable over the long term if replenishment water fails to materialize.** **- Potential projects to address a supply gap face challenges and will not be online for a while.** **- The management structure of the Watermaster is clear and well delineated, and reporting is done annually.** **- The 2008 case established the precedent that the actions of a water district affecting a groundwater basin need to be consistent with the adjudication judgment's specifications for that basin.**

Final Adjudication



SANTA MARIA GROUNDWATER BASIN

This complex adjudication was completed in 2008. It focused on a number of issues, including pumping of native water, water banking, the right to return flows from imported water, storage space, the definition of overdraft, and who should pay to fix the Bureau of Reclamation's Twitchell Reservoir that augmented the basin's water supply, as well as the rights to that water. The judgment divided the basin into three management areas with quite different issues, requirements, and adjudication outcomes, and put into place a mechanism to pay for the maintenance of Twitchell Reservoir. A physical solution was established with a basin engineer to monitor water levels in key wells, and the judgment created a process for limiting pumping and protecting the basin if well levels drop to certain trigger levels. If there are severe water shortage conditions in the basin, the court may order reductions in water use. As the basin was not in overdraft at the time of litigation, all parties were allowed to pump water for reasonable and beneficial uses without reductions, and all stipulating parties owning and exercising appropriative rights had a right to the reasonable and beneficial use of native water that was surplus to the reasonable and beneficial uses of stipulating parties that were overlyers. The only quantified rights were: prescriptive rights that were determined for certain parties, and water rights to Twitchell Water and to return flows from imported water. Several legal precedents were established, including that a party can acquire a prescriptive right without showing a permanent groundwater reduction if pumping exceeded safe yield for five continuous years, and that an overdraft condition did not need to exist in order to impose a physical solution.

Overview

County	Santa Barbara, San Luis Obispo
Area	184,248 acres / 288 square miles
Population	201, 759 (2010)[1025,1026]
CASGEM	High[1027]
Watermaster	No Watermaster is designated in the decree.
Members	There are three management areas within the adjudicated boundary: Santa Maria Valley, Nipomo Mesa Management Area (NMMA), and Northern Cities Management Area (NCMA). They are managed by various entities.
Court Cases	S*anta Maria Water Conservation District v. City of Santa Maria et al.,* 1997, filed in Santa Clara County Superior Court

CASGEM = California Statewide Groundwater Elevation Monitoring

The Santa Maria Groundwater Basin underlies much of the northern and southern sections of Santa Barbara County and San Luis Obispo County. Well owners in Nipomo, Oceano, Arroyo Grande, Grover Beach, and Pismo Beach all draw water from the coastal basin that extends from the Santa Maria Valley, northwest beyond the Nipomo Mesa, to the Northern Cities area. The Santa Maria Basin has been described as one of the largest agricultural and historically important oil-producing coastal valleys of California. The adjudication defines three areas: Northern Cities Area (north), Nipomo Area (southeast), and the Santa Maria Valley Management Area (predominantly agriculture along with the City of Santa Maria and other smaller cities). Annual precipitation averages 13–15 inches. Total groundwater storage capacity is approximately 14,900,000 AF, and available storage is approximately

1,100,000 AF.[1028] Groundwater satisfies a large percentage of demand in the region. Twitchell Dam and Reservoir in the Santa Maria Valley (1959), and Lopez Dam and Reservoir in the Northern Cities area (1967) store imported water that is used to recharge the groundwater basin, primarily through infiltration with some direct transmission from Lopez Reservoir to users. Land use is predominately agricultural. The trend is increasing suburbanization and municipal use of groundwater.[1029]

Reason for Adjudication

There was substantial overdraft in the basin from 1900–1960s with severe water shortages after 1930. Groundwater levels declined significantly in the northern part of the Nipomo Mesa Subarea from 1968–2000, and as much as 58 feet below ground surface in the central part of the subarea. Water levels were stable in the western and southeastern parts of the basin, generally following rainfall cycles.

These groundwater shortages were relieved by the importation of State Water Project (SWP) water in 1997, and the construction of Twitchell Dam and Reservoir and Lopez Dam and Reservoir. However, in the Nipomo Mesa Management Area (NMMA), where there was no reclamation project, groundwater declines continued.

Additionally, over time Twitchell Reservoir silted up and lost about 50 percent of capacity. The Santa Maria Water Conservation District (SMVWCD), which managed Twitchell, levied assessments for the project's construction and maintenance. However, the cost to fix Twitchell was high, estimated to be $5 million in the first year and $1 million yearly after that. A major controversy was who would pay the costs to fix the system. The City of Santa Maria in the Santa Maria Valley did not want to be alone paying for the "fix" if they were not going to have a right to the Twitchell water, and wanted the farmers in the Santa Maria Valley, who also benefited from the recharge provided by Twitchell, to help pay. Certain farmers claimed they were "overlying users" and entitled to the water.[1030]

The SMVWCD filed the first case in 1997 against the City of Santa Maria over Santa Maria's right to bank SWP water and storage space. In 1999, the case expanded to Nipomo Mesa, and brought in all basin pumpers. The case was tried in five phases that focused on basin boundaries, overdraft, and water rights (prescriptive rights; rights to imported, salvaged, and developed water: storage rights: groundwater rights: and some surface water rights). In Phase III, the trial court concluded that the basin was not in a condition of overdraft and had not suffered overdraft in the past; therefore, the public water producers could not have acquired prescriptive rights.

In 2005, before the Phase IV Trial in the adjudication commenced, the public water producers and most of the owners of land overlying the sasin agreed to a stipulation and physical solution that resolved conflicting water rights claims and allocated the various components of the groundwater (native groundwater, return flows of imported water, and salvaged water) among the stipulating parties. It also set up a basin-wide groundwater management program with continuing judicial oversight.
In the trial court's Phase IV statement of decision, it reversed its previous conclusion on the public water producers' prescriptive rights claim and found that the basin had been in overdraft throughout several periods and that during those periods, Santa Maria and Golden State Water Company (GSWC) had continued to pump water in the valley, and therefore had established prescriptive rights in the native supply. The trial court then approved the

allocation of the Twitchell Yield as set forth in the stipulation, and calculated the total volume of groundwater to which the prescriptive rights would attach. In the stipulation, the public water producers had waived their prescriptive rights against the stipulating landowners, so prescriptive rights would only be enforceable against non-stipulating parties. Then the trial court approved the physical solution as "necessary and appropriate to provide for future exigencies," and its water management plan as necessary and appropriate to provide a solution to the basin's current and future problems. The trial court entered a final judgment on January 25, 2008, incorporating most of the stipulation.[1031]

Of more than 1,000 parties, 750 agreed to the stipulation, but 70 landowners did not join, and in 2008 they sued, challenging the trial court's approval of the stipulation. In 2012, the Appeals Court held that the Trial Court had properly approved the physical solution proposed by the stipulating parties, but that the Trial Court should affirm that the appellants' overlying rights to the native groundwater superseded that of the purveyors, minus the allocated prescriptive amounts.[1032]

Decree and Amendments

Adjudication initiated: 1997, Expanded in 1999
Adjudications finalized: 2008 Declaratory Judgment and Physical Solution
Stipulated Judgment: 2005
Appeals: 2008, 2012
Costs: More than $11 million in the first 12 years of litigation (approximately $5 million for the City of Santa Maria, approximately $3 million for NCSD, and approximately $7 million for GSWC. Nipomo Community Service District incurred $3 million in adjudication expenses and another $20 million for a required water piping project.[1033]

Stipulation

The stipulation called for the creation of the Twitchell Management Authority (TMA) to manage the Twitchell Yield, described in detail under the decree summary

The stipulation specified that all stipulating landowners had a paramount overlying right to the basin's groundwater; public water producers had no prescriptive rights against stipulating landowners, and had appropriative rights only to native groundwater that was surplus to the reasonable and beneficial needs of the stipulating overlying landowners. The only quantified rights were prescriptive rights that were determined for certain parties, and the water rights to Twitchell Yield and to return flows from imported water. The stipulation did not quantify overlying or appropriative rights.

It set out a physical solution that divided the basin into three management areas—Northern Cities, Nipomo Mesa, and Santa Maria Valley—and each subarea had its own management regime and monitoring requirements, including the filing of annual reports. It described the factors used to identify a water shortage and the responses that must be taken, and it provided for continuing judicial oversight.

Decree Summary

The 2008 Judgment incorporated the stipulation and affirmed overdraft and a physical solution. It enforced prior agreements among settling parties, and adjudicated water rights between the non-settling landowners and the public water purveyors that acknowledged water rights priority under California law. Thus all stipulating parties owning and exercising

appropriative rights had a right to the reasonable and beneficial use of native water that was surplus to the reasonable and beneficial uses of stipulating parties that were overlyers. It specified rights regarding the importation and recapture of water, return flows, and salvaged water. The court established that the three subareas would be individually managed and it retained overall jurisdiction.[1034] A process was created for limiting pumping and protecting the basin utilizing trigger levels in key wells, with a basin engineer to monitor levels. If there are severe water shortage conditions in the basin, the court may order reductions in water use. As the basin was not in overdraft at the time of litigation, all parties were allowed to pump water for reasonable and beneficial uses without reductions.

The court affirmed *water rights* as follows: In the ***Santa Maria Valley***, all overlying owners that were also stipulating parties were entitled to prior and paramount overlying rights whether or not those rights had been exercised, and could continue to pump for reasonable and beneficial uses subject to severe water shortage condition limitations (see below). All stipulating parties owning and exercising appropriative rights had a right to the reasonable and beneficial use of native water that was surplus to the reasonable and beneficial uses of stipulating parties that were overlyers. The City of Santa Maria and GSWC had waived their right to seek prescriptive rights against any stipulating parties, but were awarded prescriptive rights against the non-stipulating parties, including rights to store and recapture return flows from their imported SWP water. Specific quantities were: City of Santa Maria 5,100 AFY, and GSWC 1,900 AFY, but both could only extract a portion of these prescriptive rights against the non-stipulating parties.[1035] ***Northern Cities*** were granted a prior and paramount right to 7,300 AFY from the Northern Cities Area of the basin, and non-stipulating parties were not granted groundwater rights in the area. Water could not be exported outside the area without written agreement of all the northern cities. ***NMMA*** landowners, including Conoco-Phillips, were granted overlying rights to extract groundwater without limitation except during a severe water shortage (see below). The City of Santa Maria was also allowed to sell water to the NMMA area because their groundwater basin was in danger of seawater intrusion.[1036]

Who would pay to fix *Twitchell reservoir* centered on which parties were defined as Twitchell participants. The stipulation called for the creation of the Twitchell Management Authority (TMA), whose members were the stipulating parties with rights to 100 percent of the Twitchell yield (they were described as "the rescuers" in the stipulation and judgment). They had a prior right to the salvaged (or rescued) water from Twitchell reservoir, which was limited to Twitchell Yield. Members are Santa Maria, GSWC, Guadalupe, and stipulating landowners located within SMVWMA boundaries. It specified that, on average, the Twitchell project added 32,000 AFY to the basin, referred to as the "Twitchell Yield." It allocated 100 percent of the yield to the TMA members. Santa Maria, GSWC, and Guadalupe were allocated 80 percent and stipulating overlying landowners were allocated 20 percent, proportionate to their owned acreage. Twitchell Yield could be transferred, temporarily or permanently, but only between stipulating parties in an open and competitive process, and Twitchell Yield water not used in a given year could not be carried over for use in any subsequent years. Additionally, Twitchell participants were deemed financially responsible for combating the siltation problem and maintaining the productivity of the project.[1037] Each participant was subject to an additional assessment in proportion to its share of Twitchell Yield to fund projects necessary to maintain the Twitchell Yield and deal with the siltation problem that reduces the Twitchell Yield.[1038] Twitchell Management Authority was also obligated to prepare an annual report analyzing water supply and demand, and to "provide recommendations for capital and maintenance projects" to maximize recharge of the basin

and address silt accumulation.[1039]

Regarding *limits on withdrawals*, overlying users (including agricultural users in the SMVWMA and Conoco Phillips in NMMA), were granted rights to use groundwater for reasonable and beneficial uses without limitation unless a "severe water shortage" occurred. This was defined as when groundwater levels showed a chronic decline, not caused by a drought, for five or more years, and monitoring wells were below the lowest recorded level. Then overlying parties had to reduce production to no more than 110 percent of the highest amount they had previously used in a single year. If use by agriculture was converted to residential use, additional pumping volumes were to be allocated to a "pool" for other overlying users. The court also reserved jurisdiction over access to aquifer *storage space* and had to approve its use before a party could claim a right to stored water, with the exception of return flows.[1040]

The court held on several issues related to water rights:

1. A party can acquire a prescriptive right without showing a permanent reduction in groundwater levels if pumping exceeded safe yield for five continuous years, and a basin need not be irreversibly depleted before an appropriator's use is adverse. In this case, general public evidence of a long-term severe water shortage was sufficient for putting overlying users on notice that the basin was in overdraft and that the public water producers were using groundwater in a manner adverse to overlying users.[1041]
2. In order for the court to impose a physical solution to resolve groundwater rights claims, an overdraft condition does not need to exist, but only an actual controversy among groundwater users.
3. Rights to developed water supplies, i.e., those which would not naturally arise but for the efforts of man, were clarified. These supplies may manifest when water is imported from another watershed. A developed water supply may also arise when water is stored during high flow periods and released during drier times such that the water is allowed to infiltrate a groundwater basin when it would not otherwise do so.[1042]

Appeal Summary

In 2008, two groups of non-settling landowners appealed the judgment. They challenged the trial court's approval of the stipulation, arguing that the physical solution was unnecessary because there was no present water shortage and there was insufficient evidence to support the award of prescriptive rights to purveyors that were acquired years ago. They maintained that the trial court erred in refusing to declare their overlying rights to be paramount, and disagreed regarding allocation of return flows and salvaged water. In 2012, the landowners lost this appeal and the court affirmed most of the 2008 judgment with some modifications. Specifically, the trial court was directed on remand to modify the judgment to clarify that rights to the Twitchell Yield would not invade the overlying rights of the non-stipulating parties to native groundwater.[1043] The case was appealed to the Supreme Court, but in 2013, the court did not grant certiorari.[1044]

Water Users

Stipulated Users/Current Users

The SMWCD, local cities, and water companies (public water producers) in the basin, and most of the owners of land overlying the basin.

Other Users

The decree makes no mention of allocations for environmental uses or small pumpers.

Management Structure

The Watermaster is a committee representing the three management areas:

Santa Maria Valley Water Conservation District oversees maintenance and operations of Twitchell Dam in the Santa Maria Valley Management Area, and is divided into seven divisions with directors elected by citizens.[1045]

Northern Cities Management Area manages local water in their area, including monitoring, as well as collecting and analyzing data.

Nipomo Mesa Management Area Technical Group is responsible for promoting monitoring and sustainable management practices and preparing an annual report.[1046]
The non-stipulating parties are required to participate in, and be bound by the applicable management area monitoring program, including monitoring its water production, maintaining records, and making the data available to the court.

Management Strategies

Imported Water: Imported water from the SWP is stored in Lopez Reservoir in the Northern Cities, and in Twitchell Reservoir in the Santa Maria Valley.[1047] The NMMA is the only area without imported water, and it is the area with the most serious overdraft. It relies on deep percolation of precipitation for recharge and is looking into obtaining additional supplemental supplies to reduce pumping, allow groundwater elevations to recover, and to enable the long-term sustainable basin management.[1048]

Recycled Water: The NMMA also receives recharge water that percolates back into the ground from the wastewater treatment plant.

Monitoring and Reporting

The court established the groundwater monitoring provisions and management area monitoring programs for each area with specific monitoring responsibilities. The NMMA periodically gathers elevation data on a large number of local wells, maintains the data in a digital database, and provides an annual monitoring report to the court for approval. All municipal wells are metered.[1049] The City of Santa Maria monitors water use, and the majority of water meters are on a system that meters every hour electronically. Stipulating parties are required to provide monitoring and other production data at no charge. The judgment requires non-stipulating parties to "participate in and be bound by, the applicable management area monitoring program. Each non-stipulating party is also required to monitor its water production, maintain records, and make the data available to the court or its designee, and NMMA can seek a court order requiring non-stipulating parties to monitor

production, maintain records, and provide data to the court.[1050]

Safe Yield

Groundwater budgets are available for each county but not for the basin as a whole. The trial court concluded that average annual recharge is not safe yield, and safe yield is not a fixed quantity, and did not provide any figures.[1051] The estimate for safe yield of the entire basin in 1992 was 118,500 AFY, with net consumptive use at 83,800 AFY,[1052] but each area had different estimates for safe yield and extractions. In lieu of safe yield, trigger levels in key wells are being used to monitor the basin.

Nipoma Mesa Management Area: In 2002, DWR estimated that total extractions would have to become stabilized at 6000 AFY to maintain the sustainability of the basin.[1053] Production in the NMMA in 2013 was 16,350 AF.[1054]

Northern Cities Management Area: In 2013, estimated historical native safe yield from the groundwater basin was 9,500 AFY. Additional artificial sources of water were estimated at 6,400 AF, providing a total supply of approximately 15,900 AF. The total estimated 2013 NCMA water demand was approximately 10,720 AF.[1055]

Santa Maria Valley: Groundwater is the sole source of water for agricultural irrigation in the SMVMA, with about 60,000 acres in production in 2013, and a total estimated agricultural water requirement of almost 116,000 AFY. Municipal groundwater use is about 32,000 AFY. Overall groundwater use is approximately 120,000–150,000 AFY; it was 139,220 AFY in 2013.[1056]

Groundwater Levels and Overdraft

Claims regarding overdraft were contested. Initially, the Trial Court did not find overdraft, but then reversed itself in Phase V of the trial, declaring that evidence showed that the basin had been in overdraft, stating that historical declines, if long enough, despite subsequent recovery, constituted overdraft.[1057] The judgment noted that evidence of historical overdraft showed that overdraft was apparent in the years (1944–1951, 1953–1957, and 1959–1967), and by the 1960s, the cumulative deficit was very large, and "conditions of depleted water levels within the basin, during the drought years, were themselves well known, or should have been known, to all who used water within the basin." The court also noted that a current crisis or shortage was not needed for the court to impose a physical solution in a groundwater adjudication. In this case, evidence of the potential problem of the accumulation of silt in Twitchell Reservoir, which threatened the 32,000 AFY portion of the basin's supply, was deemed a sufficient basis for court intervention.[1058]

Santa Maria Valley: There is a long-term trend of gradually increasing municipal water demand, although less than the peak historical municipal demand of 25,600 AFY in 2007. Groundwater pumping for municipal water supply in 2013 is less than 50 percent of the amount 17 years ago, when groundwater pumping met the entire municipal water requirement of approximately 23,000 AFY. However, this decrease in municipal groundwater pumping to about 11,800 AFY on average (1997–2013) is attributed to the importation and use of SWP water beginning in 1997. In 2013, those importations exceeded the minimum annual amount specified in the stipulation for the Cities of Santa Maria and Guadalupe as well as the GSWC. Groundwater levels throughout the SMVMA repeatedly recovered during past years to near or above previous historical-high levels, but in 2014 groundwater levels did

not recover fully, and year-end levels are 3–5 feet lower than those observed in the beginning of the year, likely reflecting the effects of beginning a fourth year of the current drought.[1059]

Nipomo Mesa Management Area: Overall, reports consistently indicate that demand exceeds the ability of the supply to replace water pumped from the aquifers. In 2004, current and projected pumping beneath Nipomo Mesa exceeded inflow (average annual natural recharge plus subsurface inflow).[1060] NMMA's 2010 annual report stated that a number of direct measurements "indicate that demand exceeds the ability of the supply to replace the water pumped from the aquifers." A 2012 report indicates that demand exceeds the ability of the supply to replace water pumped from the aquifers, and describes a persistent northwest/southeast-trending depression in water level contours in the northern portion.[1061] Additionally, in 2013, groundwater elevations declined sharply from 2012 levels, continuing a general decline from 1999. Moreover, the period of analysis (1975–2013) used by NMMA was roughly 9 percent "wetter" on average than the long-term record (1920–2013) indicating a slight bias toward overstating the amount of local water supply resulting from percolation of rainfall.[1062]

Northern Cities Management Area: Withdrawals reached a peak in 2007, and then declined in 2008, 2009, and 2010. Since 2010, although there was a slight but steady increase in pumpage every year, overall groundwater use remained significantly lower than historic annual pumpage. From 1999–2013, total estimated groundwater use averaged approximately 5,087 AFY and exceeded 6,000 AFY in 2007 and 2008. In 2013, groundwater pumping accounted for approximately 4,206 AF. Total water use in 2013, including urban use by the Northern Cities' agencies, as well as applied irrigation and private pumping by rural water users, was 10,722 AF. Based on an estimated safe yield (native plus artificial water), the total available supply for all uses in 2013 was 15,699 AF.[1063]

The ongoing drought has resulted in a lowering of groundwater levels throughout the NCMA, most notably in the agricultural production area. Averaging the groundwater elevations from the three deep sentry wells provides the single, representative index for tracking the status of groundwater in the NCMA. Previous studies suggest that the deep well index is 7.5 feet. The measured index values of the three deep wells remained below 7.5 feet between October 2007 and August 2009, during which high concentrations of chloride and sodium occurred in two sentry wells in late 2009. In April 2013, the measured index level was as much as 6 feet below the index value of 7.5 and remained at or below the index from early June 2013 until mid-December 2013. Continued average values below the index create a potential environment for increased risk of seawater intrusion, but in 2013, there was no indication of seawater intrusion in the deeper levels of the groundwater production zone.[1064]

Water Quality

Irrigated agriculture poses the greatest salt and nutrient threat to the Santa Maria Valley's water.[1065] Historically, the Santa Maria Valley Basin was subject to high nitrate concentrations, particularly near Guadalupe and City of Santa Maria.[1066]

Drought

Monitoring by Santa Barbara County between 2002 and 2011 suggests that current usage may make the basin more susceptible to overdraft under drought conditions.[1067] The U.S. Drought Monitor says Santa Maria has been in "exceptional drought" conditions since February 2015, but the City of Santa Maria disagrees, stating that no farm fields are going

fallow in this area and the basin has plenty of water to see the area through the drought, and points to the city's significant conservation practices and the monitoring done by the city.[1068] Twitchell Reservoir, which releases water to recharge the groundwater basin, released no water for recharge in 2013 because "groundwater levels did not fall enough to define a severe water shortage."[1069]

Discussion

This adjudication was complicated, long, and expensive. For the basin as a whole, the judgment supported existing uses and priorities under California water law. Overlyers can pump for reasonable and beneficial uses and only have to reduce their collective pumping if a severe water shortage occurs. Purveyors, who pay for supplemental water, must cut back if long-term drought causes a significant drop in the water table.[1070]

There is a significant reliance on imported water and it is unclear whether the judgment requirements will be sufficient during a severe drought to prevent further groundwater level declines.[1071]

While provisions were established to monitor the basin and to utilize trigger levels to avoid overdraft, there was no long-term management plan. The individual areas have both different issues and different strategies to address these issues discussed below.

Santa Maria Valley Management Area: Some assessments indicate that in much of this area groundwater levels demonstrated long-term stability, but they also show significant declines since the beginning of the current drought. The lower 2014 groundwater levels did not trigger stipulation provisions for a severe water shortage because they remained within the historical range of groundwater levels throughout the SMVMA. Additionally, coastal groundwater levels remained above sea level through 2014, indicating the absence of potential for seawater intrusion.[1072]

Nipomo Mesa Management Area: A number of measurements indicate that demand exceeds the ability of supply to replace the water pumped from the aquifers. The Key Wells Index fell below the elevation criterion for potentially severe water shortage conditions with the spring 2008 water level measurements, and remained so through spring 2013.[1073]

Northern Cities Management Area: The ongoing drought resulted in a lowering of groundwater levels throughout the NCMA, most notably in the agricultural production area. Spring 2013 groundwater level elevations, as compared with spring 2012, were 10–15 feet lower.[1074] In April 2013, municipal groundwater pumpage increased to replace temporarily unavailable supplies from Lake Lopez, and the groundwater level in a sentry well declined by approximately 14 feet in 7 days and was below sea level for 6 days. Water level declines were also observed in other deep wells, creating the potential for increased seawater intrusion.

Additionally, a growing deficit between supply and demand may result in water level elevations along the NMMA and NCMA boundary below current levels. As the historical subsurface inflow recharge from the NMMA to the NCMA declines (or is reversed), the agricultural users in the southeastern portion of the NCMA may see declining water levels, and potential seawater intrusion. Although clearly exacerbated by the drought, this was already a trend.[1075]

The court held on several issues related to water rights.

1. A party can acquire a prescriptive right without showing a permanent groundwater reduction if pumping exceeded safe yield for five continuous years, and a basin need not be irreversibly depleted before an appropriator's use is adverse. In this case, evidence of a long-term severe water shortage was sufficient for putting overlying users on notice that the public water producers were using groundwater in a manner adverse to overlying users.[1076]
2. In order for the court to impose a physical solution to resolve groundwater rights claims, an overdraft condition does not need to exist, but only an actual controversy among groundwater users.
3. Rights to developed water supplies, i.e., those which would not naturally arise but for the efforts of man, were clarified. These supplies may manifest when water is imported from another watershed. A developed water supply may also arise when water is stored during high flow periods and released during drier times such that the water is allowed to infiltrate a groundwater basin when it would not otherwise do so.[1077]

SANTA MARIA GROUNDWATER BASIN

Overview	Decree: Water Rights and Conditions	Governance	Trends
County: Santa Barbara, San Luis Obispo Area: 288 sq. mi. Physical Characteristics: Three hydrologic elements: Santa Maria Valley (largest area, mostly farming, and the City of Santa Maria and a few smaller cities), Nipomo Mesa, and Northern Cities subareas Precipitation: 13″–15″ per year CASGEM: High Land Use: Agricultural, with increasing municipal Reason for Adjudication: Overpumping in the Nipomo area, disputes over water banking and storage space, and disputes over who would pay to fix the silt accumulated in Twitchell Reservoir.	Stipulation: 2005 Adjudication Initiated: 1997 Adjudication Finalized: 2008 Appeal: 2012, denied certiorari in 2013 Decree Summary: Court: -Divided basin into three management areas: Northern Cities (NCMA), Nipomo Mesa (NMMA), and Santa Maria Valley (SMVMA)—each with its own managing, monitoring, and reporting requirements. With respect to water rights: - All overlying owners that were also stipulating parties were entitled to prior overlying rights, whether or not yet exercised. City of Santa Maria and Golden State Water Company waived their right to seek prescriptive rights against any stipulating parties, but were awarded prescriptive rights against non-stipulating parties, including rights to store and recapture return flows from their imported SWP water. Agriculture was awarded overlying rights to use groundwater without limitation, unless a "severe water shortage" occurred; Northern Cities had a prior right to 7,300 AFY from the NCCA (non-stipulating parties had no rights in that area). City of Santa Maria was required to provide water to Nipomo due to the danger of saltwater intrusion. - Developed and salvaged water was defined, and the court reserved jurisdiction over storage space and had to approve its use. Appeal: Non-settling landowners retained their priority overlying rights.	Watermaster: Representatives from the three management areas. Members: - SMVWCD: It oversees the maintenance and operation of Twitchell. - NCMA: It monitors local water use. - NMMA: Monitors the basin, and prepares reports. The court retains jurisdiction. Strategies: Imported SWP water stored in: Twitchell Reservoir/Santa Maria area (1959); and Lopez Reservoir/ Northern Cities area (1967). NMMA has no imported water.	Adjudicated Safe Yield: No numbers were provided. Current Safe Yield: 1992 estimate was 118,500 AFY, with net consumptive use at 83,800 AFY, but each area had different estimates for safe yield and extractions. Summary: Conflicting studies on safe yield. Trigger levels in key wells are being used to monitor the basin. Extractions: 2002 Extractions: *NCMA*: 3,900 AF; *NMMA*: 6,300 AF; *SMVA*: 12,900 AF. Total: 23,100 AF. 2013 Extractions: *NCMA*: Total Production: 4,206 AF; *NMMA*: Production: 16,350 AF*: SMVMA*: Decrease to ~11,800 AFY (1997–2013), attributed to the importation and use of SWP water beginning in 1997. Extraction Summary: Overall, basin production has progressively increased. Groundwater Levels: Conditions vary in each area. *NCMA*: Spring 2013 groundwater level elevations compared with spring 2012 were 10–15 feet lower, notably in the agricultural area. Also municipal pumpage increased to replace temporarily unavailable supplies from Lake Lopez. The groundwater level in a sentry well declined by ~14 feet in 7 days and was below sea level for 6 days. Water level declines occurred in other deep wells, creating the potential for seawater intrusion. *NMMA:* Levels show a general decline from 1999. Reports indicate that demand exceeds the supply to replace pumped water. In 2008, the Key Wells Index fell below the elevation criterion for Potentially Severe Water Shortage Conditions, and remained so through spring 2013. *Santa Maria Valley Area:* Levels deemed relatively stable and repeatedly recovered to near or above historical highs. In 2014, groundwater levels did not recover. Overdraft: Overall overdraft claims were contested, but individual basins appear to have had overdraft. However, the court stated that there did not need to be overdraft for it to impose a physical solution, and in this case, evidence of the potential accumulation of silt in Twitchell Reservoir threatening a portion of the basin's supply was sufficient basis for court intervention. Water Quality: There are some high nitrate concentrations in SMVMA. Discussion: **- There is a significant reliance on imported water to make up the difference between groundwater pumping and demand; a potential problem as imported water becomes more expensive and less reliable.** **- The judgment did not provide for a long-term local management plan.** **- Adjudication was complicated and expensive, and disputes continue.** **- Santa Maria Valley shows a long-term trend of gradually increasing municipal water demand and a decrease in pumping due to the use of imported water. NCMA and SMVMA had lowered levels during the current drought.** **- The Court held that a party can acquire a prescriptive right without showing a permanent groundwater reduction if pumping exceeded safe yield for 5 continuous years. Clarified rights to developed water.**

[1] California Department of Water Resources. 2013. Water Plan Update: Groundwater Enhancements and Recommendations. http://www.waterplan.water.ca.gov/docs/meeting_materials/plenary/2013.10.29-30/12-Workbook-GroundwaterEnhancements.pdf.
[2] http://www.water.ca.gov/groundwater/sgm/definitions.cfm
[3] http://www.water.ca.gov/groundwater/sgm/definitions.cfm#uu
[4] The SWRCB provided the list of the basins for this report. The Rialto Colton Basin was subsumed under the Western Judgment adjudication of the Colton Basin Area but is evaluated as a separate adjudication in this report so the total basins reviewed are 27.
[5] Senate Bill 226 and Assembly Bill 1390 passed by the California Legislature in the 2015–2016 Regular Session.
[6] Rudestam, Kirsten, and Ruth Langridge. 2014. "Sustainable Yield in Groundwater Management: Bridging Science and Mainstream Vernacular." Ground Water DOI: 10.1111/gwat.12160.
[7] *Artificial water* is defined as water moving through the groundwater system under the boundary conditions imposed by natural topography and climate. See W. P. Balleau (1988) Water Appropriation and Transfer in a General Hydrogeologic System," *Natural Resources Journal,* vol. 28, p. 269. Examples of artificial water to recharge a groundwater basin include imported water and recycled water.
[8] California Department of Water Resources. 2013. Water Plan Update: Groundwater Enhancements and Recommendations. http://www.waterplan.water.ca.gov/docs/meeting_materials/plenary/2013.10.29-30/12-Workbook-GroundwaterEnhancements.pdf.
[9] Famiglietti, J. S., M. Lo, S. L. Ho, J. Bethune, K. J. Anderson, T. H. Syed, S. C. Swenson, C. R. de Linage, and M. Rodell. 2011. "Satellites measure recent rates of groundwater depletion in California's Central Valley." *Geophysical Research Letters* 38 (February 5): 4 pp. doi:201110.1029/2010GL046442.
[10] California Department of Water Resources. 2014. Public Update for Drought Response.
[11] *Katz v. Walkinshaw* (1903), establishing the Doctrine of Correlative Rights for groundwater. Groundwater users must also comply with the reasonable and beneficial use requirements of Article X, Section 2 of the California Constitution, affirmed by the California Supreme Court in 1935 in *Peabody v. City of Vallejo* (1935, 2 Cal. 2d 351, 375–76) and *Tulare Irr. Dist. v. Lindsay-Strathmore Irr. Dist.* (3 Cal. 2d 489, 525).
[12] Seawater intrusion is already identified all along California's coast. Ashley, Jeffrey S., and Zachary A. Smith. 1999. Groundwater Management in the West. University of Nebraska Press: Lincoln and London.
[13] California Water Plan Update. 2013.
[14] California Climate Adaptation Study. 2009. Report to the Governor of the State of California in Response to Executive Order S-13-2008–2009.
[15] http://www.water.ca.gov/groundwater/sgm/definitions.cfm.
[16] California Water Code § 10720.8.
[17] *Safe yield* is defined in a variety of ways. One common definition is the amount of groundwater that can be produced (extracted) without significant harm to the rights of water users or to the basin. See Rudestam, Kirsten, and Ruth Langridge. 2014. "Sustainable Yield in Groundwater Management: Bridging Science and Mainstream Vernacular." Ground Water DOI: 10.1111/gwat.12160
[18] Assembly Committee on Judiciary. July 7, 2015. http://www.leginfo.ca.gov/pub/15-16/bill/sen/sb_0201-0250/sb_226_cfa_20150704_173226_asm_comm.html.
[19] Assembly Bill 1390, "Article 4. Intervention, 837. (a) A groundwater sustainability agency for the basin or a portion of the basin may intervene in a comprehensive adjudication conducted pursuant to this chapter."
[20] Deitchman, Richard S. 2015. "California Legislature Adopts Streamlined Groundwater Adjudication Procedures and Amends the Sustainable Groundwater Management Act." http://www.somachlaw.com/alerts.php?id=338.
[21] Lipson, Albert. 1978. *Efficient Water Use In California: The Evolution of Groundwater Management in Southern California.* Rand: Santa Monica, California.
[22] *City of Pasadena v. City of Alhambra et al.* Superior Court of California, County of Los Angeles, No. Pasadena C-1323, as amended in 1984.
[23] *City of Los Angeles v. Cities of San Fernando, et al.* January 26, 1979. "Safe yield" is defined in this case as the maximum quantity of water which can be withdrawn annually from a groundwater supply under a given set of conditions without causing a gradual lowering of the groundwater levels resulting, in turn, in the eventual depletion of the supply. "Temporary surplus" is the amount of water that can be pumped from a basin to provide storage space for surface water that would be wasted during wet years if it could not be stored in the basin.
[24] See Gary W. Sawyers, Esq. Undated. A Primer on California Water Rights. http://aic.ucdavis.edu/events/outlook05/Sawyer_primer.pdf.
[25] California Constitution, Article X, Section 2.
[26] California Constitution, Article X, Section 2. *Envtl. Defense Fund v. E. Bay Municipal Utility Dist.* 26 Cal. 3d 183 (1980).
[27] Wilson, Craig M. 2011. The Reasonable Use Doctrine & Agricultural Water Use Efficiency. SWRCB. http://www.waterboards.ca.gov/board_info/agendas/2011/jan/011911_12_reasonableusedoctrine_v010611.pdf.
[28] The court stated that "No legislative purpose appears for the enactment of the 1935 amendment to Civil Code section 1007 other than to extend to all property of the specified governmental entities, whether or not devoted to a public use, the exemption from prescriptive claims theretofore attached only to the property of such entities which was devoted to a public use. (See *Southern Pac. Co. v. City & County of San Francisco,* supra, 62 Cal.2d 50, 53, fn. 1.)" *City of Los Angeles v. City of San Fernando*, 14 Cal.3d 199, http://scocal.stanford.edu/opinion/city-los-angeles-v-city-san-fernando-27778.

[29] For example, "Water in the West" points to the need for "Groundwater property rights in California should be clarified, so they are predictable and transferable," and the provision of binding property rights are is one strategy to move towards sustainable groundwater management. http://waterinthewest.stanford.edu/sites/default/files/SGMA_RecommendationsforGWConflicts_2.pdf.
[30] Enion, Rhead. 2013. "Allocating Under Water: Reforming California's Groundwater Adjudications." Emmitt Center on Climate Change and the Environment. UCLA School of Law, Policy Brief No. 4.
[31] Ibid.
[32] Rudestam, Kirsten, and Ruth Langridge. 2014. "Sustainable Yield in Groundwater Management: Bridging Science and Mainstream Vernacular." Ground Water DOI: 10.1111/gwat.12160.
[33] Senate Bill 226 and Assembly Bill 1390 passed by the California Legislature in the 2015–2016 Regular Session.
[34] Rudestam, Kirsten, and Ruth Langridge. 2014. "Sustainable Yield in Groundwater Management: Bridging Science and Mainstream Vernacular." Ground Water DOI: 10.1111/gwat.12160.
[35] *Artificial water* is defined as water moving through the groundwater system under the boundary conditions imposed by natural topography and climate. See W. P. Balleau (1988) Water Appropriation and Transfer in a General Hydrogeologic System," *Natural Resources Journal,* vol. 28, p. 269. Examples of artificial water to recharge a groundwater basin include imported water and recycled water.
[36] Fontana Water Company. Urban Water Management Plan. 2011.
[37] Department of Water Resources. CASGEM. 2014.
[38] Kennedy-Jenks. San Bernardino Valley Regional Urban Water Management Plan. 2010.
[39] Superior Court of San Bernardino County. Lytle Judgment. 1924.
[40] City of Rialto. Urban Water Management Plan. 2010.
[41] City of Rialto. 2010.
[42] Upper Santa Ana Water Resources Association. Upper Santa Ana Watershed IWRM Plan. 2007.
[43] Upper Santa Ana Water Resources Association. 2007.
[44] Fontana Water Company. 2010.
[45] City of Rialto. 2010.
[46] The term "inch" in the judgment refers to a quantity of water in continuous flow that will supply one-fiftieth part of a cubic foot of water per second of time.
[47] Superior Court of San Bernardino County. 1924.
[48] Ibid.
[49] These individuals could hold overlying rights which were not quantified in this case.
[50] Superior Court of San Bernardino County. 1924.
[51] City of Rialto. 2010.
[52] Fontana Water Company. 2011.
[53] Superior Court of San Bernardino County. 1924.
[54] Ibid.
[55] County of San Bernardino. Lytle Creek Community Plan. 2007.
[56] Superior Court of San Bernardino County. 1924.
[57] Ibid.
[58] City of Rialto. 2010.
[59] Ibid.
[60] Fontana Water Company. 2011.
[61] Bob Tincher. San Bernardino Valley Municipal Water District, Personal Communication. May 2015.
[62] City of Rialto. 2010.
[63] Ibid.
[64] Ibid.
[65] Department of Water Resources. CASGEM. 2014.
[66] Regional Water Management Group. San Diego Integrated Regional Water Management Plan. 2013.
[67] Santa Margarita River Watershed. Annual Watermaster Report. Water Year 2013–14.
[68] Department of Water Resources. Bulletin 118 Santa Margarita. 2004.
[69] Department of Water Resources. Bulletin 118 Temecula. 2004.
[70] Metropolitan Water District. Groundwater Assessment Study. 2007.
[71] Department of Water Resources. Bulletin 118 Cahuilla. 2004.
[72] Santa Margarita River Watershed. Annual Watermaster Report. Water Year 2013–14.
[73] Department of Water Resources. 2004.
[74] Project Clean Water. Santa Margarita Watershed. 2015.
[75] Regional Water Management Group. 2013.
[76] San Diego IRWM. 2013. http://www.sdirwmp.org/2013-irwm-plan-update.
[77] Ibid.
[78] U.S. District Court for Southern District of California. 193 F. Supp. 342. 1961.
[79] *Rancho Santa Margarita v. Vail.* 11 Cal.2d 501. 1940. Case 42850. http://scocal.stanford.edu/opinion/rancho-santa-margarita-v-vail-24836.

[80] U.S. District Court for Southern District of California. 1961.
[81] Santa Margarita River Watershed. Annual Watermaster Report. Water Year 1990–91.
[82] Santa Margarita River Watershed. Annual Watermaster Report. Water Year 2013–14.
[83] Regional Water Management Group. 2013.
[84] Santa Margarita Watermaster. Water Rights Framework PowerPoint Presentation. 2014.
[85] Written Testimony of Matthew G. Stone, General Manager, Rancho California Water District Senate Committee on Indian Affairs. S.2956. July 22, 2010. http://www.indian.senate.gov/sites/default/files/upload/files/MatthewStoneRevisedTestimony.pdf.
[86] U.S. District Court for Southern District of California. Order for Appointment of a Watermaster. 1989.
[87] Regional Water Management Group. San Diego Integrated Regional Water Management Plan. 2013.
[88] Santa Margarita River Watershed. Annual Watermaster Report, Water Year. 1990–91.
[89] Santa Margarita River Watershed. Annual Watermaster Report, Water Year. 2013–14.
[90] Santa Margarita River Watershed. Annual Watermaster Report, Water Year. 1990–91.
[91] Regional Water Management Group. 2013.
[92] U.S. District Court for Southern District of California. 1989.
[93] Regional Water Management Group. 2013.
[94] San Diego IRWM. 2013. http://www.sdirwmp.org/2013-irwm-plan-update.
[95] Ibid.
[96] Ibid.
[97] Santa Margarita River Watershed. Annual Watermaster Report, Water Year 2013–14.
[98] Santa Margarita River Watershed. Annual Watermaster Report, Water Year 2013–14.
[99] Santa Margarita River Watershed. Annual Watermaster Report, Water Year 1990–91.
[100] Santa Margarita River Watershed. Annual Watermaster Report, Water Year 2013–14.
[101] Santa Margarita River Watershed. Annual Watermaster Report, Water Year 1990–91.
[102] E-mail from Alisa Nichols. Office of the Watermaster. 9/29/2015.
[103] Santa Margarita River Watershed, Annual Watermaster Report. Water Year 2013–14.
[104] Bulletin 118, Santa Margarita. 2004.
[105] Ibid.
[106] Ibid.
[107] Regional Water Management Group. 2013.
[108] Santa Margarita River Watershed. Annual Watermaster Report, Water Year 2013–14.
[109] CASGEM. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf.
[110] CASGEM. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf.
[111] MWD. 2007. Groundwater Assessment Study. Report 1308, p. IV-8-5. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[112] MWD. 2007, p. IV-8-2. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[113] Raymond Basin Management Board. About Us. http://raymondbasin.org/?page_id=25.
[114] Ostrom, E. 1990. *Governing the Commons: The evolution of institutions for collective action*. Cambridge: Cambridge University Press. p. 111.
[115] Raymond Basin Management Board. Background. http://raymondbasin.org/?page_id=39.
[116] Ostrom. 1990, p. 111.
[117] Raymond Basin Management Board. Chronology of the Raymond Basin. http://raymondbasin.org/?page_id=42.
[118] DWR. 2003. *California's Groundwater.* Bulletin 118, p. 41.
[119] Lipson. 1978. *Efficient water use in California: The evolution of groundwater management in southern California.* RAND Corporation, R-2387/2-CSA/RF, p. 28.
[120] Lipson. 1978, p. 33.
[121] RBMB. 2013–2014 Annual Report, p. 26–27. http://raymondbasin.org/?page_id=88.
[122] DWR. 2003. *California's Groundwater.* Bulletin 118, p. 41.
[123] Blomquist, W. 1992. *Dividing the Waters*. San Francisco, California: ICS Press, pp. 87–88. Purchases through the water exchange ended in the 1950s, although parties still lease water rights to one another.
[124] Lipson. 1978, p. 30.
[125] Raymond Basin Management Board. Chronology of the Raymond Basin. http://raymondbasin.org/?page_id=42.
[126] Lipson. 1978, p. 30.
[127] DWR. 2003. *California's Groundwater.* Bulletin 118, p. 41.
[128] Raymond Basin Management Board. Producers. http://raymondbasin.org/?page_id=54.
[129] RBMB. Annual Reports from 2011–2014 (pages 2 and 4 of each report). http://raymondbasin.org/?page_id=88.
[130] *City of Pasadena v. City of Alhambra et al.* Superior Court of California, County of Los Angeles, No. Pasadena C-1323, as amended in 1984, p. 11.
[131] RBMB. Annual Reports from 2011–2014 (pages 2 and 4 of each report). http://raymondbasin.org/?page_id=88.
[132] Lipson. 1978, p. 29.

[133] *City of Pasadena v. City of Alhambra et al.* Superior Court of California, County of Los Angeles, No. Pasadena C-1323, as amended in 1984, p. 26; RBMB. "About Us," and 2013–14 Annual Report. http://raymondbasin.org/. Subareas were originally defined in the 1943 referee report.
[134] MWD. 2007, p. IV-8-7. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[135] RBMB. 2013–2014 Annual Report, p. 11. http://raymondbasin.org/?page_id=88.
[136] RBMB. 2013–2014 Annual Report, p. C1-C3. http://raymondbasin.org/?page_id=88.
[137] MWD. 2007, p. IV-8-7. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[138] MWD. 2007, p. IV-8-5. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[139] RBMB. 2013–2014 Annual Report, pp. 7-8.
[140] RBMB. 2013–14 Annual Report, p. 41.
[141] RBMB. 2013–14 Annual Report, pp. 2, 17, and 29.
[142] Raymond Basin Management Board. Chronology of the Raymond Basin. http://raymondbasin.org/?page_id=42.
[143] MWD. 2007. p. IV-8-3. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[144] Lipson. 1978, p. 30.
[145] MWD. 2007, p. IV-8-2. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[146] MWD. 2007, p. IV-8-6. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[147] MWD. 2007. p. IV-8-9 and 8-10. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[148] MWD. 2007. p. IV-8-11. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[149] RBMB. 2013–14 Annual Report, p. 41–42.
[150] RBMB. 2013–14 Annual Report, p. 12.
[151] Lipson, A. J. 1978, p. 33.
[152] The use of mutual prescription has since been limited as a result of the San Fernando basin adjudication in 1975. Blomquist. *Dividing the Waters.* 1992.
[153] Lipson. 1978, p. 29.
[154] MWD. 2007. p. IV-8-3. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[155] RBMB. 2013–14 Annual Report, p. 12.
[156] RBMB. 2013–14 Annual Report, p. 17.
[157] 2014 CASGEM Basin Prioritization Results.
http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_BasinName_05262014.pdf.
[158] West Basin Watermaster Report 2014, Watermaster Service in the West Coast Basin. July 1, 2013–June 30, 2014;
http://www.water.ca.gov/watermaster/sd_documents/west_basin_2014/westcoastbasinwatermasterreport2014.pdf.
[159] Lipson, Albert. 1978. *Efficient Water Use In California: The Evolution of Groundwater Management in Southern California.* Rand. Santa Monica, California.
[160] West Coast Basin Watermaster Report 2014.
[161] DWR 1961, cited in California's Groundwater Bulletin 118. 2004.
http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/4-11.03.pdf.
[162] West Basin Municipal Water District. http://www.westbasin.org/about-west-basin.
[163] In Redondo Beach and into drinking water wells in El Segundo.
[164] *California Water Service Co. et al. v. City of Compton.* Superior Court, Los Angeles County # 596896. In 1949, 340 additional parties were named. Lipson. 1978.
[165] Fossette, Carl and Ruth. 1986. The Story of Water Development in Los Angeles County. Library of Congress Catalog Number 86-71265; Lipson. 1978. Earlier, in 1942, the West Basin Survey Committee forms to determine saltwater damage.
[166] Lipson. 1978.
[167] Blomquist. 1992. *Dividing the Waters.*
[168] Lipson. 1978.
[169] Water Replenishment District of Southern California (WRD). http://www.wrd.org/about/water-district-history.php.
[170] *Dominguez Water Company et al. v. American Plant Growers Association et al.* Case 668965. Blomquist. 1992; See also:
http://www.water.ca.gov/waterdatalibrary/docs/historic/Bulletins/Bulletin_179/Bulletin_179-69__1969.pdf.
[171] Lipson 1978.
[172] West Coast Basin Watermaster Report 2014.
[173] Bureau of Reclamation: Los Angeles Basin Groundwater Adjudication Summary. 2014.
http://www.usbr.gov/lc/socal/basinstudies/LA%20Adjudication%20Dec%202014.pdf.
[174] Lipson. 1978; See also California Groundwater, Bulletin 118.
[175] Lipson. 1978.
[176] MWD. Groundwater Assessment Study. 2007. Chapter IV.
http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[177] *California Water Service Company et al. v. City of Compton et al.*
http://www.waterboards.ca.gov/waterrights/board_decisions/adopted_orders/judgments/docs/westcoastbasin_jd.pdf.
[178] U.S. Bureau of Reclamation. 2014. LA Basin Adjudication.
http://www.usbr.gov/lc/socal/basinstudies/LA%20Adjudication%20Dec%202014.pdf.

[179] *California Water Service Company et al. v. City of Compton et al.* Amended Judgment. http://www.westbasinwaterassociation.com/AmendedJudgment_2014-12-05.pdf.
[180] *California Water Service Company et al. v. City of Compton et al.* Amended Judgment. http://www.westbasinwaterassociation.com/AmendedJudgment_2014-12-05.pdf.
[181] West Basin Watermaster Report 2014.
[182] Five oil companies, three private water companies, and three cities.
[183] *California Water Service Company et al. v. City of Compton et al.* 1961; also Lipson 1978.
[184] WRD Engineering Survey and Report. 2014.
[185] *California Water Service Company et al. v. City of Compton et al.* http://www.westbasinwaterassociation.com/AmendedJudgment_2014-12-05.pdf.
[186] West Basin Municipal Water District. http://www.westbasin.org/research-library.
[187] West Basin Municipal Water District. http://www.westbasin.org/water-reliability-2020/groundwater/west-coast-groundwater-basin.
[188] WRD Engineering Survey and Report. 2014.
[189] West Basin Watermaster Report. 2014.
[190] Water imported by the City of Long Beach is used in both the Central and West Coast Basins.
[191] Recycles 70,000 AFA of effluent from the City of Los Angeles's Hyperion treatment plant. West Basin Watermaster Report 2014; see also WBMWD http://www.westbasin.org/about-west-basin/history/formation-and-the-early-years.
[192] Blomquist, W. 1992. *Dividing the Waters*.
[193] West Basin Watermaster Report 2014.
[194] WRD. Engineering Survey and Report. See also http://www.wrd.org/engineering/reports/2014_RGWMR_Final%20_Web.pdf.
[195] West Basin Watermaster Report 2014.
[196] Ibid.
[197] DWR 1962:92, cited in Blomquist, W. 1992. *Dividing the Waters*.
[198] WRD Engineering Survey and Report, 2014.
[199] West Basin Watermaster Report 2014.
[200] Water Replenishment District of Southern California. Water Replenishment District of Southern California. Regional Groundwater Monitoring Report Water Year 2013–2014. WRD. February 2015. http://www.wrd.org/engineering/reports/2014_RGWMR_Final%20_Web.pdf.
[201] Water Replenishment District of Southern California (WRD). http://www.westbasin.org/water-reliability-2020/groundwater/overview; WRD. Engineering Survey and Report. 2012. http://www.wrd.org/March16_2012_WRD_ESR_for_Web.pdf.
[202] WRD. Engineering Survey and Report. 2014.
[203] WRD. Engineering Survey and Report. 2014.
[204] Law360. Tesoro Must Pay Water Bills Before Pumping For Refinery. April 26, 2013. http://www.law360.com/articles/436204/tesoro-must-pay-water-bills-before-pumping-for-refinery.
[205] SWRCB Adjudication Report.
[206] Blomquist, William. 1992. *Dividing the Waters.* ICS Press.
[207] MWD. Groundwater Assessment Study. 2007. Chapter IV. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf; Central Basin Watermaster Report 2013.
[208] WRD. 2014. Central Basin Watermaster Service. Central Basin Water Rights Panel Report.
[209] Groundwater moves across the uplift, but its movement is slow and restricted because of low permeability sediments along the fault.
[210] MWD Groundwater Assessment Study. 2007. Chapter IV. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf. 2014_cb_watermaster_report_6.pdf.
[211] MWD. Groundwater Assessment Study. 2007. Chapter IV. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf. Central Basin Watermaster Report 2002.
[212] Blomquist, W. 1992. *Dividing the Waters*.
[213] Ibid.
[214] Wat. Code, § 60000 et seq.
[215] The creation of the replenishment district is a statutory procedure established by the legislature and Division 18 of the California Water Code describes the duties and obligations of such a district.
[216] Blomquist, W. 1992. *Dividing the Waters*.
[217] *Central and West Basin Water Replenishment District, etc., v. Charles E. Adams et al.* Los Angeles County Superior Court Case No. 786,656. WRD Central Basin Water Rights Panel 2014_cb_watermaster_report_6. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf. The original suit had 150 parties.
[218] Central Basin Watermaster Report. 2002.
[219] *Central and West Basin Water Replenishment District, etc., Plaintiff, v. Charles E. Adams et al., Defendants, City of Lakewood, a Municipal Corporation, Cross-complainant, v. Charles E. Adams et al. Cross-defendants: Judgment, Declaring and Establishing Water Rights in Central Basin and Enjoining Extractions There from in Excess of Specified Quantities;* Consent Judgment (WRD I, supra, 109 Cal. App.4th at p. 898, 135 Cal. Rptr. 2d 486.)

[220] *Second Amended Judgment. Central and West Basin Water Replenishment District, etc., v. Charles E. Adams, et al.,* Los Angeles County Superior Court Case No. 786,656, May 6, 1991. Like its predecessor, it not only declared the parties' rights but also appointed DWR as Watermaster. As in the 1965 judgment, the court retained continuing jurisdiction. http://caselaw.findlaw.com/ca-court-of-appeal/1591571.html.
[221] *Central and West Basin Water Replenishment District, etc., v. Charles E. Adams, et al.,* Los Angeles, County Superior Court Case No. 786,656 http://www.cbwatermaster.org/assets/Central_Basin_Third_Amended_Judgment.pdf.
[222] A party with a non-consumptive water use permit will not be granted a replenishment assessment exemption if the party extracts water and does not return the water to the basin.
[223] Lipson, Albert. 1978. *Efficient Water Use in California: The Evolution of Groundwater Management in Southern California.* Rand Corp.
[224] MWD Groundwater Assessment Study. 2007. Appendix B. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[225] Bureau of Reclamation 2014. Los Angeles Basin Groundwater Adjudication Summary. http://www.usbr.gov/lc/socal/basinstudies/LA%20Adjudication%20Dec%202014.pdf.
[226] MWD. Groundwater Assessment Study. 2007. Chapter IV. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[227] Court of Appeal, Second District, California. *Central Basin Municipal Water District v. Water Replenishment District of Southern California*. B235039, Decided: December 10, 2012.
[228] *Central and West Basin Water Replenishment District v. Southern California Water Company.* No. 135 Cal. Rptr. 2d 486 (Cal. Ct. App. 2003) No. B155143. https://www.courtlistener.com/opinion/2268600/central-and-west-bais-wrd-v-southern-california-wa/.
[229] Ibid.
[230] *Central and West Basin Water Replenishment District, etc. v. Charles E. Adams, et al.* Los Angeles. County Superior Court Case No. 786,656.
[231] Unless it would result in extreme hardship.
[232] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[233] *Central and West Basin Water Replenishment District, etc., Plaintiff, v. Charles E. Adams et al.* Third Amended Judgment, Case No.: 786,656.
[234] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[235] *Central and West Basin Replenishment District, Plaintiff and Respondent v. Southern California Water Company et al.* http://caselaw.findlaw.com/ca-court-of-appeal/1190333.html. Defendants and Appellants. No. B155143.
[236] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[237] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[238] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[239] MWD Groundwater Assessment Study 2007. Chapter IV. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[240] Central Basin Watermaster Report 2002.
[241] MWD Groundwater Assessment Study 2007. Chapter IV. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[242] MWD Groundwater Assessment Study 2007. Chapter IV. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[243] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf. WRD did not purchase seasonally discounted spreading water because the Metropolitan Water District of Southern California (MWD) discontinued the delivery of discounted water for groundwater replenishment in August 2011.
[244] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[245] Blomquist. 1993. Maintaining levels below sea level is partly to increase the hydraulic gradient between the Montebello Forebay and the pressure area to facilitate the transmission of water from the spreading grounds through the aquifers to the Newport-Inglewood Uplift.
[246] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[247] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[248] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[249] DWR 1962: 121
[250] Blomquist, W. 1992. *Dividing the Waters*.
[251] WRD. 2006.
[252] MWD Groundwater Assessment Study 2007. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[253] Central Basin Water Rights Panel. November 2014. http://lagroundwater.com/pdf/2014_cb_watermaster_report_6.pdf.
[254] Ibid.
[255] Regional Groundwater Monitoring Report Water Year 2013–2014. Water Replenishment District of Southern California. http://www.wrd.org/engineering/reports/2014_RGWMR_Final%20_Web.pdf.
[256] Ibid.
[257] WRD Engineering Report 2014.
[258] Healy, Patrick. "Groundwater Levels Plummet in Crucial LA County Basins." September 17, 2014. NBC News. http://www.nbclosangeles.com/news/local/Groundwater-Levels-Plummet-inCrucial-LA-County-Basins-275542761.html.

[259] Annual Report, ULARA. 2011–2012. http://ularawatermaster.com/public_resources/WY_2011-12_ULARA_WM_Rpt_-5-2013.pdf.
[260] CASGEM. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf.
[261] *City of Los Angeles v. Cities of San Fernando et al.* January 26, 1979. Defendants were cities of San Fernando, Glendale, and Burbank, plus ~ 200 private producers. http://ularawatermaster.com/public_resources/City-of-LA-vs-City-of-San-Fernando-et-al-JUDGMENT.pdf.
[262] URLA Watermaster. http://ularawatermaster.com/.
[263] State Water Rights Board in the Report of the Referee for the Judgment.
[264] Constructed and operated by the Los Angeles County Flood Control District (LACFCD) and the U.S. Army Corps of Engineers (ACE).
[265] State had authorized municipalities to spread and store water for later use–upheld by California Supreme Court (*Stevens v. Oakdale Irrigation District* 1939); Blomquist, William. 1992. *Dividing the Waters.* ICS Press, SF.
[266] *City of Los Angeles v. City of San Fernando et al.* 1979.
[267] Watermaster Annual Report ULARA. 2011–2012.
[268] California cities that are successors of Spanish or Mexican pueblos (settlements), and followed claim procedures establishing their pueblo rights, possess a paramount right to the beneficial use of all needed, naturally occurring surface and subsurface water from the entire watershed of the stream flowing through the original pueblo.
[269] Blomquist, W. 1992. *Dividing the Waters*.
[270] The exception was that the cities of Burbank, Glendale, and Los Angeles in 1978 agreed to use all delivered water, instead of only imported water, in the calculation of their Import Return Credit. This agreement among these cities has had a significant but adverse impact on groundwater in storage in the San Fernando Basin. Annual Report ULARA. 2011–2012.
[271] *City of Los Angeles v. City of San Fernando, et al.* 1968. Superior Ct. Case No. 650079, Ibid.
[272] California Supreme Court (14 Cal 3d 199), Ibid.
[273] Ibid.
[274] A separate stipulation in 1979 appointed the first Watermaster.
[275] Annual Report, ULARA. 2011–2012.
[276] *City of Los Angeles v. Cities of San Fernando et al.* January 26, 1979.
[277] Annual Report, ULARA. 2011–2012.
[278] Findings of Fact and Conclusions of Law, Superior Court of California. 1979.
http://ularawatermaster.com/public_resources/Findings-of-Fact-and-Conclusions-of-Law.pdf.
[279] The City of San Fernando had not yet imported any water from outside ULARA, so it had no right to capture "return water" in the San Fernando Basin. MWD. Groundwater Assessment Study. 2007.
http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[280] MWD. Groundwater Assessment Study. 2007. Chapter IV.
http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf. Additionally, the defendants have to pay all of the ~ $500,000 in referee's costs. Los Angeles was entitled to an injunction against private parties throughout the San Fernando subarea; ULARA Watermaster Report. 1980. http://ularawatermaster.com/public_resources/WY_1978-79_ULARA_WM_Rpt_5-1980.pdf.
[281] Annual Report, ULARA. 2011–2012.
[282] Blomquist, W. 1992. *Dividing the Waters*.
[283] *City of Los Angeles v. Cities of San Fernando et al*. January 26, 1979.
[284] MWD. Chapter IV. 2007. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[285] ULARA Policies and Procedures. 1998.
http://ularawatermaster.com/public_resources/ULARA_WM_Policies_and_Procedures_1998.pdf.
[286] Annual Report. ULARA 2011–2012; MWD Chapter IV, 2007.
http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[287] *City of Los Angeles v. Cities of San Fernando et al.* January 26, 1979.
[288] Lipson, A. J. 1978. " Efficient Water Use in California: The Evolution of Groundwater Management in Southern California." Rand Corp. Los Angeles argued a "new theory of overdraft," that there exists a temporary surplus that could be withdrawn. Otherwise, during wet periods water would escape and "be wasted." So extracting more than nature replenished and allowing a basin's total water storage to be less than maximum actually constituted good groundwater management to allow for capture of excess water during wet periods. Defendants argued that overdraft began when the groundwater extractions exceeded replenishment from all sources.
[289] Watermaster. 2006a. Cited in MWD 2007, Chapter IV.
[290] MWD. Chapter IV. 2007. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf. ULARA Watermaster Report 2012–2013.
[291] Annual Watermaster Report, ULARA, 2011–2012.
[292] Ibid.
[293] In a report by LADWP and California Department of Health Services. The EPA found Lockheed Aircraft to be "potentially responsible," and they agreed to partially pay to build and operate a treatment plant. Remaining costs will be shared by Burbank and Weber Aircraft Company, also potentially responsible.
[294] Annual Watermaster Report, ULARA. 2011–2012. The Los Angeles Department of Water and Power plans to build the world's largest groundwater treatment center over one of the largest Superfund pollution sites in the U.S. to restore groundwater pumping of drinking water from the San Fernando Valley wells that DWP began closing in the 1980s due to pollution.
http://articles.latimes.com/2013/jun/23/local/la-me-water-20130624.
[295] Annual Report ULARA. 2011–2012.

[296] Ibid.
[297] AGWA Newsletter. http://www.agwa.org/fall2000.pdf.
[298] U.S. Army Corps of Engineers. 2013. Five-Year Review Report for San Fernando Valley — Area 2 Superfund Site Glendale, Los Angeles County, California.
[299] Causes of this decline include: pumping in excess of long-term recharge; reduced natural recharge caused by increased urbanization and runoff leaving the basin; additional amounts of groundwater underflow and rising groundwater leaving the basin; and reductions in the volumes of artificial recharge due to restrictions at the spreading grounds located on the northeastern side of the Basin. ULARA Watermaster Report 2011–12 Water Year.
[300] California DWR CASGEM website; accessed 4/30/15 at http://www.water.ca.gov/groundwater/casgem/.
[301] Michael Touhey. Upper San Gabriel Municipal Water District. February 17. Letter to the SWRCB, 2015. http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/usgvmwd_touhey021715.pdf.
[302] Metropolitan Water District of Southern California, Groundwater Report September 2007. Accessed 4/30/15.
[303] California DWR Groundwater Bulletin 118; accessed 4/30/15 at www.water.ca.gov.
[304] Upper San Gabriel Valley Municipal Water District. February 17, 2015. www.waterboards.ca.gov/waterrights/water_issues/programs/drought/comments_tucp2015/docs/usgvmwd_touhey021715.pdf.
[305] Lipson, Albert. "Efficient Water Use in California: The Evolution of Groundwater Management in Southern California." RAND. November 1978.
[306] Main San Gabriel Watermaster website: http://www.watermaster.org/geninfo.html.
[307] Lipson, Albert. "Efficient Water Use in California: The Evolution of Groundwater Management in Southern California." RAND, November 1978.
[308] Long Beach Water Department website. Accessed online 4/30/2015 at http://www.lbwater.org/groundwater-supply-brief-history.
[309] Personal email with Kelly Gardner, District Watermaster for Main San Gabriel. June 2, 2015.
[310] Board members from 2015 represent California Domestic Water Company, Valencia Heights Water Company, San Gabriel Valley Water Company, Suburban Water Systems, City of Azusa, Golden State Water Company, Upper San Gabriel Valley MWD (2 members), and San Gabriel Valley MWD. Main San Gabriel Watermaster website: http://www.watermaster.org/geninfo.html.
[311] Main San Gabriel Watermaster website: http://www.watermaster.org/geninfo.html.
[312] California DWR Groundwater Bulletin 118; accessed 4/30/15 at www.water.ca.gov.
[313] Michael Touhey. Upper San Gabriel Municipal Water district. February 17 letter to the SWRCB.
[314] Metropolitan Water District of Southern California. Groundwater Report September 2007. Accessed 4/30/15.
[315] Green, Dorothy. 2007. *Managing Water: Avoiding Crisis in California.* University of California Press.
[316] Michael Touhey. Main San Gabriel 2013 Annual Report. Accessed 4/30/15 at http://www.watermaster.org/geninfo.html.
[317] Main San Gabriel 2013 Annual Report. Accessed 4/30/15 at http://www.watermaster.org/geninfo.html.
[318] Personal e-mail with Kelly Gardner, District Watermaster for Main San Gabriel. June 2, 2015.
[319] *Upper Main San Gabriel Valley Water District v. City of Alhambra et al.* Case number 924128. Amended Judgment 2012. Sup. Ct. of California, Los Angeles.
[320] Metropolitan Water District of Southern California. Groundwater Report September 2007. Accessed 4/30/15.
[321] California DWR Groundwater Bulletin 118; accessed 4/30/15 at www.water.ca.gov.
[322] California DWR Groundwater Bulletin 118; accessed 4/30/15 at www.water.ca.gov.
[323] Main San Gabriel 2013 Annual Report. Accessed 4/30/15 at http://www.watermaster.org/geninfo.html.
[324] Michael Touhey. Upper San Gabriel Municipal Water District. February 17 letter to the SWRCB.
[325] Michael Touhey. Upper San Gabriel Municipal Water Ddistrict. February 17, letter to the SWRCB.
[326] Main San Gabriel 2013 Annual Report. Accessed 4/30/15 at http://www.watermaster.org/geninfo.html.
[327] California DWR Groundwater Bulletin 118; accessed 4/30/15 at www.water.ca.gov.
[328] Main San Gabriel 2013 Annual Report. Accessed 4/30/15 at http://www.watermaster.org/geninfo.html.
[329] California DWR (2015) Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[330] *Puente Basin Water Agency v. The City of Industry.* Case number C369220. June 1, 1981. Superior Court of California, Los Angeles.
[331] Metropolitan Water District of Southern California. 2007. Groundwater Report.
[332] Metropolitan Water District of Southern California. 2007. Groundwater Report.
[333] EPA. 2015. Case Summary: EPA Issues for Main San Gabriel Basin. http://www2.epa.gov/enforcement/case-summary-epa-issues-order-san-gabriel-valley-superfund-site-area-4-puente-valley. Accessed 30 April, 2015.
[334] Interview with Donna Gunn.
[335] Puente Watermaster. 2014. Annual Report 2014; http://www.watermaster.org/geninfo.html. Accessed 30 April, 2015.
[336] *Puente Basin Water Agency v. The City of Industry.* Case number C369220. June 1, 1981. Superior Court of California, Los Angeles.
[337] Ibid.
[338] *Puente Basin Water Agency v. The City of Industry.* Case number C369220. June 1, 1981. Superior Court of California, Los Angeles.
[339] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[340] Long Beach Water Department. 2015. Groundwater supply history: http://www.lbwater.org/groundwater-supply-brief-history. Accessed 30 April, 2015.
[341] *Puente Basin Water Agency v. The City of Industry.* Case number C369220. June 1, 1981. Superior Court of California, Los Angeles.
[342] Puente Watermaster. 2014. Annual Report 2014; http://www.watermaster.org/geninfo.html. Accessed 30 April, 2015.

[343] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[344] Puente Watermaster. 2014. Annual Report 2014; http://www.watermaster.org/geninfo.html. Accessed 30 April, 2015.
[345] Metropolitan Water District of Southern California. 2007. Groundwater Report.
[346] Puente Watermaster. 2014. Annual Report 2014; http://www.watermaster.org/geninfo.html. Accessed 30 April, 2015.
[347] Ibid.
[348] Green, Dorothy. 2007. *Managing Water: Avoiding Crisis in California.* University of California Press.
[349] California DWR. 2015. CASGEM: http://www.water.ca.gov/groundwater/casgem/. Accessed 30 April, 2015.
[350] Ibid.
[351] Ibid.
[352] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April 2015
[353] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[354] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015
[355] Lipson, Albert. 1978. "Efficient Water Use in California: the Evolution of Groundwater Management in Southern California." RAND. November 1978.
[356] TCCWD. 2011. Tehachapi-Cummings Water Master Report 2011. http://tccwd.com/wp-content/uploads/Tehachapi%20Basin%20Watermaster%20Report%20-%202011-Compressed.pdf.
[357] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.
[358] *TCCWD v. Austin et al.* Case Number 97211 Superior Court of California, Kern County. Filed December 4, 1970.
[359] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.
[360] *TCCWD v. Austin et al.* Case Number 97211 Superior Court of California, Kern County. Filed December 4, 1970.
[361] Personal interview with John Martin, district manager for TCCWD. June 5, 2014.
[362] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.
[363] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[364] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[365] Ibid.
[366] *Tehachapi-Cummings County Water District v. Austin et al.* Case Number 97211. Superior Court of California, Kern County. Filed December 9, 1970.
[367] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.
[368] *Tehachapi-Cummings County Water District v. Austin et al.* Case Number 97211. Superior Court of California, Kern County. Filed December 9, 1970.
[369] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[370] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.
[371] Ibid. See also California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[372] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[373] Ibid.
[374] California DWR 2015. CASGEM: http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_BasinName_05262014.pdf. Accessed 30 April, 2015.
[375] California DWR 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[376] Ibid.
[377] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/lgagrant/. Accessed 30 April, 2015.
[378] 2010 Tehachapi Regional Urban Water Management Plan.
[379] Ibid.
[380] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.
[381] 2010 Tehachapi Regional Urban Water Management Plan.
[382] Lipson, Albert. 1978. "Efficient Water Use in California: The Evolution of Groundwater Management in Southern California." RAND. November 1978.
[383] TCCWD. 2011. Tehachapi-Cummings Water Master Report 2011. http://tccwd.com/wp-content/uploads/Tehachapi%20Basin%20Watermaster%20Report%20-%202011-Compressed.pdf.
[384] Lipson, Albert. 1978. "Efficient Water Use in California: the Evolution of Groundwater Management in Southern California." RAND. November 1978.
[385] Ibid.
[386] *Tehachapi-Cummings County Water District v. City of Tehachapi et al.* Superior Court of the State of California for Kern County.
[387] TCCWD. 2011. Tehachapi-Cummings Water Master Report 2011. http://tccwd.com/wp-content/uploads/Tehachapi%20Basin%20Watermaster%20Report%20-%202011-Compressed.pdf.
[388] *Tehachapi-Cummings County Water District v. City of Tehachapi et al.* Superior Court of the State of California for Kern County. Filed March 22, 1971. See also TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.

[389] *Tehachapi-Cummings County Water District v. City of Tehachapi et al.* Superior Court of the State of California for Kern County. Filed March 22, 1971.
[390] Lipson, Albert. 1978. "Efficient Water Use in California: the Evolution of Groundwater Management in Southern California." RAND. November 1978.
[391] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014; http://tccwd.com/documents. Accessed 30 April, 2015.
[392] TCCWD. 2015. http://tccwd.com. Accessed 30 April, 2015.
[393] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[394] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[395] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/wp-content/uploads/Tehachapi-Basin-Watermaster-Report-2014.pdf.
[396] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[397] Ibid.
[398] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[399] Personal interview with John Martin. June 2, 2015.
[400] California DWR (2015) Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[401] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[402] Personal interview with TCCWD Board Member Tom Eisler. April 15, 2015.
[403] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[404] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April, 2015.
[405] Ibid.
[406] California DWR 2015. CASGEM: http://www.water.ca.gov/groundwater/casgem/. Accessed 30 April, 2015.
[407] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[408] TCCWD. 2013. Tehachapi-Cummings Water Master Report 2013. http://tccwd.com/documents/. Accessed 30 April, 2015.
[409] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[410] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[411] TCCWD. 2010. Tehachapi Regional Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Tehachapi%20Regional%20Alliance/2010%20Tehachapi%20RUWMP%20-%20Final.pdf. Accessed 30 April, 2015.
[412] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[413] Lipson, Albert. 1978. "Efficient Water Use in California: The Evolution of Groundwater Management in Southern California." RAND. November 1978.
[414] TCCWD. 2011. Tehachapi-Cummings Water Master Report 2011. http://tccwd.com/wp-content/uploads/Tehachapi%20Basin%20Watermaster%20Report%20-%202011-Compressed.pdf. Accessed 30 April, 2015.
[415] *Tehachapi-Cummings County Water District v. Armstrong.* Civ. No. 1935. Court of Appeals of California, Fifth Appellate District. July 18, 1975.
[416] Ibid.
[417] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[418] *Tehachapi-Cummings County Water District v. Armstrong.* Civ. No. 1935. Court of Appeals of California, Fifth Appellate District. July 18, 1975.
[419] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[420] TCCWD. 2010. Tehachapi Regional Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Tehachapi%20Regional%20Alliance/2010%20Tehachapi%20RUWMP%20-%20Final.pdf. Accessed 30 April, 2015.
[421] TCCWD. 2014. "Our Mission." www.TCCWD.com. Accessed 30 April, 2015.
[422] TCCWD. 2012. LGA Grant Application for Tehachapi-Cummings County Water District. www.water.ca.gov/**lgagrant/**. Accessed 30 April, 2015.
[423] Ibid.
[424] Fugro Consultants. 2015. Groundwater Model Update, Cummings Groundwater Basin. March 2015.
[425] Ibid.
[426] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[427] *Tehachapi-Cummings County Water District v. Armstrong.* Civ. No. 1935. Court of Appeals of California, Fifth Appellate District. July 18, 1975.
[428] TCCWD. 2013. Cummings Basin Thirty-Ninth Report. No. 97209.
[429] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015.
[430] Fugro Consultants. 2015. Groundwater Model Update, Cummings Groundwater Basin. March 2015. p.26.
[431] Ibid.

[432] Fugro Consultants. 2015. Groundwater Model Update, Cummings Groundwater Basin. March 2015.
[433] Ibid.
[434] ibid.
[435] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents, Accessed 30 April, 2015.
[436] TCCWD. 2010. Tehachapi Regional Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Tehachapi%20Regional%20Alliance/2010%20Tehachapi%20RUWMP%20-%20Final.pdf. Accessed 30 April, 2015.
[437] TCCWD. 2010. Tehachapi Regional Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Tehachapi%20Regional%20Alliance/2010%20Tehachapi%20RUWMP%20-%20Final.pdf. Accessed 30 April, 2015.; p. 29.
[438] Ibid.
[439] TCCWD. 2014. Tehachapi-Cummings Water Master Report 2014. http://tccwd.com/documents. Accessed 30 April, 2015. See also California DWR. 2015. Groundwater Bulletin 118. www.water.ca.gov. Accessed 30 April, 2015.
[440] Ibid.
[441] Ibid.
[442] Personal interview with John Martin. June 3, 2015.
[443] Department of Water Resources 2014. CASGEM. http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm.
[444] Department of Water Resources 2004.
[445] Department of Water Resources 2004.
[446] Metropolitan Water District of Southern California Groundwater Assessment Study. 2007, citing CDM, 1999, http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[447] Department of Water Resources 2004.
[448] Ibid.
[449] Cucamonga Valley Water District 2011. Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Cucamonga%20Valley%20Water%20District/Cucamonga%20Valley%20Water%20District%20-%202010%20UWMP-FINAL.pdf.
[450] Cucamonga Valley Municipal Water District 2011. Blanco, Hilda. 2012. Water Supply Scarcity in Southern California: Assessing Water District Level Strategies.
[451] Cucamonga Valley Water District. 2011.
[452] Blanco, Hilda. 2012.
[453] Ibid.
[454] Defendants included Foothill Irrigation Company, Sunset Water Company, IOAMSCSA Water Company, Old Settlers Water Company, Alta Loma Water Company, Armstrong Nurseries, Banyan Heights Water Company, Carnelian Water Company, Citrus Water Company, Cucamonga Water Company, Hedges Water Company, Heilman Water Company, Hermosa Water Company, JCYA Mutual Water Company, Rex Mutual Water Company, Sapphire Mutual Water Company, Charles Snyder, Upland Water Company, Henry G. Bodkin, Bank of America National Trust and Savings Association Executors of Last Will of Giovanni Vai, Wester Fruit Growers, Huge P. Crawford, G. N. Hamilton Ranch, John Doe 1–30, Mary Roe 1–30, and Joe Doe Company 1–20.
[455] Superior Court of San Bernardino County (1958 Decree).
[456] Department of Water Resources. 2004.
[457] Metropolitan Water District. 2007.
[458] Cucamonga Valley Water District. 2011.
[459] San Antonio, Cucamonga, Upland, Old Settlers, and Sunset were allowed to use Cucamonga Basin water anywhere outside of the basin, and Hermosa, Foothill Irrigation-Company, and Alta Loma had certain limitations to their export quantities.
[460] Superior Court of San Bernardino County. 1958.
[461] Ibid.
[462] City of Upland. 2010. Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Upland,%20City%20of/2010%20UWMP.pdf.
[463] Metropolitan Water District. 2007.
[464] Defendants included Foothill Irrigation Company, Sunset Water Company, IOAMSCSA Water Company, Old Settlers Water Company, Alta Loma Water Company, Armstrong Nurseries, Banyan Heights Water Company, Carnelian Water Company, Citrus Water Company, Cucamonga Water Company, Hedges Water Company, Heilman Water Company, Hermosa Water Company, JCYA Mutual Water Company, Rex Mutual Water Company, Sapphire Mutual Water Company, Charles Snyder, Upland Water Company, Henry G. Bodkin, Bank of America National Trust and Savings Association Executors of Last Will of Giovanni Vai, Wester Fruit Growers, Huge P. Crawford, G. N. Hamilton Ranch, John Doe 1–30, Mary Roe 1–30, and Joe Doe Company 1–20.
[465] Maurizio, Danielle. June 2015. Personal Communication, Chino Basin Watermaster.
[466] Superior Court of San Bernardino County. 1958.
[467] Metropolitan Water District. 2007.
[468] Comment from Paeter Garcia, Best Best & Krieger LLP. November 13, 2015.
[469] Superior Court of San Bernardino County 1958.
[470] Yu, Branden (September 2015) Personal Communication. Cucamonga Valley Water District.
[471] Cucamonga Valley Water District. 2011; Metropolitan Water District 2007.

[472] Ibid.
[473] Metropolitan Water District. 2007.
[474] Cucamonga Valley Water District. 2011.
[475] Ibid. Section 4.3.2.4.
[476] Department of Water Resources. 2004.
[477] Metropolitan Water District. 2007.
[478] Ibid.
[479] Department of Water Resources. 2014. CASGEM. http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm.
[480] Ibid.
[481] Ibid.
[482] Kennedy/Jenks Consultants 2010. San Bernardino Valley Regional Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/West%20Valley%20Water%20District/West%20Valley%20WD%20UWMP%20%28San%20Bernardino%20RUWMP%29.pdf.
[483] Other defendants are Citizens Land and Water Company of Bloomington, City of Rialto, City of Colton, and Semi-Tropic County Water District.
[484] Kennedy/Jenks Consultants. 2012. West Valley Water District Local Groundwater Assistance Grant. http://www.water.ca.gov/lgagrant/docs/applications/West%20Valley%20Water%20District%20(201209870068)/Att03_LGA12_WestValleyWD_GWMP_1of2.pdf.
[485] Department of Water Resources. 2004. Bulletin 118. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/8-2.04.pdf; Total groundwater storage is estimated at widely differing numbers, including both 210,000 AF in 1934 and 2,517,000 AF in 1986.
[486] Ibid.
[487] Kennedy/Jenks Consultants. 2010.
[488] Ibid.
[489] City of Rialto (n.d.) Demographics. http://www.rialtoca.gov/redevelopment_781.php.
[490] West Valley Water District (n.d.) Sentinel Well Project Summary. http://www.water.ca.gov/lgagrant/docs/applications/West%20Valley%20Water%20District%20%282012098700 68%29/Att03_LGA12_WestValleyWD_GWMP_1of2.pdf.
[491] Superior Court of San Bernardino County. 1961. Rialto Decree.
[492] Superior Court of San Bernardino County. 1961.
[493] Ibid.
[494] Upper Santa Ana Water Resources Association. 2015. Upper Santa Ana River Watershed IRWM Plan. http://www.sbvmwd.com/home/showdocument?id=1468.
[495] Ibid.
[496] Ibid.
[497] City of Riverside (2011) Board of Public Utilities Report. http://www.riversideca.gov/utilities/admin-annualreports.asp
[498] Groundwater allocations were: City of Colton (3,010 AFY), City of Rialto (1,580 AFY), Citizens (3,260 AFY), Fontana Union (550 AFY), Lytle Creek (3,600 AFY), and Semi-Tropic (0 AFY).
[499] Superior Court of San Bernardino County. 1961.
[500] Department of Water Resources. 2014.
[501] Ibid.
[502] Upper Santa Ana Water Resources Association. 2015.
[503] City of Riverside. 2010. Urban Water Management Plan. http://www.riversideca.gov/utilities/water-umwp.asp.
[504] West Valley Water District. 2013. Lawsuit. http://www.courthousenews.com/2013/09/17/61224.htm.
[505] Department of Water Resources. 2014. CASGEM. http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm.
[506] Ibid.
[507] Metropolitan Water District. 2007. Groundwater Assessment Study. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[508] Ibid.
[509] Department of Water Resources. 2007. Bulletin 118. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/8-2.03.pdf.
[510] Blomquist. 1992. *Dividing the Waters,* pp. 47.
[511] Ibid. p. 48.
[486] *Orange County Water District v. City of Chino et al.* 1969. (1117628). The lawsuit that resulted in the Orange County Judgment was filed by the Orange County Water District (OCWD) against the City of Chino and others to adjudicate the surface water rights of over 2,500 named defendants and others on the Santa Ana River from the San Bernardino Mountains to Prado Dam. In 1968, OCWD dropped its complaint against everyone except Chino Basin Municipal Water District (CBMWD), Western Municipal Water District (WMWD) of Riverside County, and San Bernardino Valley Municipal Water District (SBVMWD). The ensuing adjudication was settled with the 1969 Orange County Judgment, effective in 1970. The Department of Water Resources. 2004.
[513] Ibid.

[514] *Western Municipal Water District of Riverside County v. East San Bernardino County Water District, et al.* (78426.) Western Judgment.
[515] Ibid.
[516] Ibid.
[517] Ibid.
[518] Ibid. p. 29.
[519] The following small users were withdrawing 1 AFY from the basin in 2013 in at least one of their wells: Batchelor, Boutcher, Allen Break Estate, Cram Patterson Well, Jack Dangermond, East Valley Water District, Hardison, Harrison Canyon, King, Larry Pane, City of San Bernardino, San Manuel India Reservation, Santoski, Smith, and Ward. See also Western San Bernardino Watermaster (2014) Volume One. http://www.wmwd.com/index.aspx?NID=294.
[520] Ibid.
[521] Superior Court of Riverside County. 1969.
[522] Information from Bob Tincher, Manager of Water Resources, San Bernardino Valley Municipal Water District, October 23, 2015.
[523] Department of Water Resources. 2007.
[524] The natural safe yield of the SBBA was determined initially by supplemental order of the court to be 232,100 AF per annum. Such amount is subject to the continuing jurisdiction of the court.
[525] Assumed for purposes of the Judgment to be 16,000 AF annually, verification not required.
[526] Western San Bernardino Watermaster. 2014.
[527] Ibid.
[528] Western San Bernardino Watermaster. 2014.
[529] City of Riverside (2011) Board of Public Utilities.
[530] Metropolitan Water District. 2007.
[531] Western San Bernardino Watermaster. 2014.
[532] Western San Bernardino Watermaster. 2015. Report of the Watermaster Volume Eight. p. 8 of 113 http://www.wmwd.com/DocumentCenter/View/2417.
[533] Comment from Bob Tincher, Manager of Water Resources, San Bernardino Valley Municipal Water District, October 23, 2015.
[534] Department of Water Resources. 2007.
[535] Department of Water Resources. 2007.
[536] Department of Water Resources. 2014. CASGEM. http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm.
[537] Ibid.
[538] Ibid.
[539] Kennedy/Jenks Consultants. 2010. San Bernardino Valley Regional Urban Water Management Plan. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/West%20Valley%20Water%20District/West%20Valley%20WD%20UWMP%20%28San%20Bernardino%20RUWMP%29.pdf.
[540] Other defendants are Citizens Land and Water Company of Bloomington, City of Rialto, City of Colton, and Semi-Tropic County Water District.
[541] Kennedy/Jenks Consultants. 2012. West Valley Water District Local Groundwater Assistance Grant. http://www.water.ca.gov/lgagrant/docs/applications/West%20Valley%20Water%20District%20(201209870068)/Att03_LGA12_WestValleyWD_GWMP_1of2.pdf.
[542] Department of Water Resources. 2004. Bulletin 118. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/8-2.04.pdf; Total groundwater storage is estimated at widely differing numbers including both 210,000 AF in 1934 and 2,517,000 AF in 1986.
[543] Ibid.
[544] Bob Tincher, Manager of Water Resources San Bernardino Valley Municipal Water District, Comment October 23, 2015.
[545] Kennedy/Jenks Consultants. 2010.
[546] Ibid.
[547] West Valley Water District (n.d.) Sentinel Well Project Summary. http://www.water.ca.gov/lgagrant/docs/applications/West%20Valley%20Water%20District%20%28201209870068%29/Att03_LGA12_WestValleyWD_GWMP_1of2.pdf.
[521] *Orange County Water District v. City of Chino et al.* 1969. (1117628). The lawsuit that resulted in the Orange County Judgment was filed by the Orange County Water District (OCWD) against the City of Chino and others to adjudicate the surface water rights of over 2,500 named defendants and others on the Santa Ana River from the San Bernardino Mountains to Prado Dam. In 1968, OCWD dropped their complaint against everyone except Chino Basin Municipal Water District (CBMWD), Western Municipal Water District (WMWD) of Riverside County, and San Bernardino Valley Municipal Water District (SBVMWD). The ensuing adjudication was settled with the 1969 Orange County Judgment, effective in 1970. The Department of Water Resources. 2004.
[549] Ibid.
[523] Fontana Water Company, City of Rialto, City of Colton, and West Valley Water District (Rialto Decree).
[524] Ibid.
[552] Ibid.
[553] Ibid.
[554] Ibid. p 18.

[555] Ibid. p 29.
[556] Ibid.
[557] Superior Court of San Bernardino County. 1961.
[558] Superior Court of Riverside County. 1969.
[559] Western San Bernardino Watermaster. 2014. Volume Two. http://www.wmwd.com/index.aspx?NID=294.
[560] Ibid.
[561] Ibid.
[562] Information from Bob Tincher, Manager of Water Resources, San Bernardino Valley Municipal Water District, October 23, 2015.
[563] Ibid.
[564] Upper Santa Ana Water Resources Association. 2015. Upper Santa Ana Watershed IRWM Plan. http://www.sbvmwd.com/home/showdocument?id=1468.
[565] Western San Bernardino Watermaster. 2014.
[566] Ibid.
[567] City of Riverside. 2011. Board of Public Utilities Report. http://www.riversideca.gov/utilities/admin-annualreports.asp.
[568] Ibid. p 71.
[569] Upper Santa Ana Water Resources Association. 2015, pp 3–9.
[570] Bob Tincher. Manager of Water Resources San Bernardino Valley Municipal Water District. Comment October 23, 2015.
[571] Ibid.
[572] Department of Water Resources. 2014.
[573] Upper Santa Ana Water Resources Association. 2015.
[574] San Bernardino Valley Municipal Water District, IRWMP, 2–8.
[575] Bob Tincher. Manager of Water Resources San Bernardino Valley Municipal Water District. Comment October 23, 2015.
[576] City of Colton. 2013. Water Supply Assessment. http://ca-colton.civicplus.com/DocumentCenter/View/1814.
[577] Population numbers based on 2010 census using boundaries for the SBBA as defined by the judgment.
[578] City of Colton. 2013. Water Supply Assessment. http://ca-colton.civicplus.com/DocumentCenter/View/1814.
[579] Ibid.
[580] Ibid.
[581] Department of Water Resources. 2004. Bulletin 118. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/8-2.06.pdf.
[582] City of Colton. 2013. San Bernardino Valley Municipal Water District (n.d.) IRWMP. http://www.sbvmwd.com/about-us/projects/irwmp.
[555] *Orange County Water District v. City of Chino et al.* 1969. (1117628.) The Orange County Water District (OWCD) filed the lawsuit against the City of Chino and others that resulted in the Orange County Judgment. The lawsuit was to adjudicate the surface water rights of over 2,500 named defendants and others on the Santa Ana River from the San Bernardino Mountains to Prado Dam. In 1968, OCWD dropped its complaint against everyone except Chino Basin Municipal Water District (CBMWD), Western Municipal Water District (WMWD) of Riverside County, and San Bernardino Valley Municipal Water District (SBVMWD). The ensuing adjudication was settled with the 1969 Orange County Judgment, effective in 1970. The Department of Water Resources. 2004.
[584] Ibid.
[557] *Western Municipal Water District of Riverside County v. East San Bernardino County Water District et al.* (78426.) Western Judgment.
[586] Ibid. p 29.
[587] The following small users were withdrawing 1 AFY from the basin in 2013 in at least one of their wells: Batchelor, Boutcher, Allen Break Estate, Cram Patterson Well, Jack Dangermond, East Valley Water District, Hardison, Harrison Canyon, King, Larry Pane, City of San Bernardino, San Manuel India Reservation, Santoski, Smith, and Ward. See also Western San Bernardino Watermaster. 2014. Volume One. http://www.wmwd.com/index.aspx?NID=294.
[588] Ibid.
[589] Information from Bob Tincher, Manager of Water Resources, San Bernardino Valley Municipal Water District, October 23, 2015.
[590] Upper Santa Ana Water Resources Association. 2007.
[591] Western San Bernardino Watermaster. 2014.
[592] Upper Santa Ana Water Resources Association. 2007.
[593] Western San Bernardino Watermaster Comments on draft report.
[594] The natural safe yield of the SBBA was determined initially by supplemental order of the court to be 232,100 AFY. Such amount is subject to the continuing jurisdiction of the court.
[595] Assumed for purposes of the judgment to be 16,000 AFY, verification not required.
[596] Western San Bernardino Watermaster. 2014.
[597] Ibid.
[598] Superior Court of Riverside County. 1969. Western Judgment.
[599] Ibid.
[600] Ibid. p 9.
[601] Western San Bernardino Watermaster. 2014.
[602] San Bernardino Valley Municipal Water District. IRWMP. 2–8.
[603] California DWR Groundwater Bulletin 118; accessed 4/30/15 at www.water.ca.gov.

[604] California DWR Groundwater Bulletin 118; accessed 4/30/15.
[605] *Southern California Water Company v. City of La Verne et al.* Case Number KC029152. December 18, 1998.
[606] *Southern California Water Company v. City of La Verne et al.* December 18, 1998.
[607] California DWR Groundwater Bulletin 118; accessed April 30, 2015.
[608] California DWR Groundwater Bulletin 118; accessed April 30, 2015.
[609] California DWR Groundwater Bulletin 118; accessed April 30, 2015.
[610] Golden State Water Company History, http://www.gswater.com/golden-state-water-company-history/.
[611] American States Water Company, http://www.aswater.com.
[612] Ibid. See also Six Basins Watermaster and the Golden State Water Company and American States Water Company websites: http://www.6bwm.com/info.php?pnum=2 and http://www.gswater.com/about-gswc/parent-company-information/.
[613] Davis, Mike. *Ecology of Fear: Los Angeles and the Imagination of Disaster.*
[614] *Southern California Water Company v. City of La Verne et al.* December 18, 1998.
[615] Personal interview with Andy Malone from Wildermuth Environmental. June 7, 2015.
[616] Six Basin 2013 Annual Report. Prepared by Wildermuth Environmental, Inc. May 28, 2014. Accessed April 30, 2015 at http://www.6bwm.com/.
[617] Ibid.
[618] Four Basins was determined to be hydrologically distinct from Two Basins, and the latter has high nitrate concentrations. La Verne is situated to remedy these conditions, and thus has the right to produce as much groundwater as it may without causing injury to another party.
[619] California DWR Groundwater Bulletin 118; accessed 4/30/15 at *www.water.ca.gov.*
[620] *Southern California Water Company v. City of La Verne et al.* Case Number KC029152. December 18, 1998. See also Six Basins Watermaster 2013 Annual Report.
[621] *Southern California Water Company v. City of La Verne et al.* Case Number KC029152. December 18, 1998. See also Six Basins Watermaster 2013 Annual Report.
[622] Ibid.
[623] *Southern California Water Company v. City of La Verne et al.* Case Number KC029152. December 18, 1998.
[624] Personal interview with Andy Malone from Wildermuth Environmental. June 4, 2015.
[625] California DWR Groundwater Bulletin 118; accessed 4/30/15 at *www.water.ca.gov.*
[626] Ibid.
[627] Six Basins 2013 Annual Report. P; prepared by Wildermuth Environmental. May 28, 2014.
[628] California DWR Groundwater Bulletin 118; accessed 4/30/15 at *www.water.ca.gov.*
[629] Six Basins 2013 Annual Report. Prepared by Wildermuth Environmental. May 28, 2014.
[630] California DWR Groundwater Bulletin 118; accessed 4/30/15 at *www.water.ca.gov.*
[631] *Southern California Water Company v. City of La Verne et al.* December 18, 1998.
[632] Six Basins 2013 Annual Report. Prepared by Wildermuth Environmental, Inc. May 28, 2014. Accessed 4/30/15.
[633] *Southern California Water Company v. City of La Verne et al.* December 18, 1998.
[634] Six Basins 2013 Annual Report. Prepared by Wildermuth Environmental, Inc. May 28, 2014. Accessed 4/30/15. Interview with Six Basins Watermaster staff, June 15, 2015.
[635] *Southern California Water Company v. City of La Verne et al.* December 18, 1998.
[636] *Southern California Water Company v. City of La Verne et al.* December 18, 1998.
[637] Six Basins 2013 Annual Report. Prepared by Wildermuth Environmental, Inc. May 28, 2014. Accessed 4/30/15.
[638] California DWR Groundwater Bulletin 118; accessed 4/30/15 at *www.water.ca.gov.*
[639] *Southern California Water Company v. City of La Verne et al.* Case Number KC029152. December 18, 1998.
[640] Personal interview with Andy Malone from Wildermuth Environmental. June 4, 2015.
[641] Six Basins 2013 Annual Report. Prepared by Wildermuth Environmental, Inc. May 28, 2014. Accessed 4/30/15.
[642] Ibid.
[643] Metropolitan Water District of Southern California, Groundwater Report September 2007.
[644] Department of Water Resources. 2014. CASGEM. http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm.
[645] Chino Basin Watermaster. 2015. http://www.cbwm.org.
[646] Blomquist, W. 1992. *Dividing the Waters*. p. 232.
[647] Ibid. There are two primary aquifer systems in the Chino Basin. The Shallow Aquifer System is unconfined and semi-confined with sands and gravels of high permeability. The Deep Aquifer System is confined with sands and gravels of low permeability.
[648] Ibid.
[649] Chino Basin Watermaster. 2015.
[650] Blomquist, W. 1992. *Dividing the Waters*. pp. 273–278.
[651] Chino Basin Watermaster. 2015.
[652] There have been multiple agreements since the original judgment. Some have been amendments to the judgment and some have been in addition to the judgment. The restated judgment simply incorporated all previous amendments into one place, but did not incorporate the other agreements outside of the judgment.
[653] Lipson, A. 1978. *Efficient Water Use in California.* http://www.rand.org/pubs/reports/R2387z1.html.
[654] Superior Court of San Bernardino County. 1978. Adjudication Judgment; Chino Basin Watermaster. 2015.

[655] Superior Court of San Bernardino County. 1978; Lipson, A. 1978.; Blomquist, W. 1992. *Dividing the Waters*, p. 281.
[656] Maurizio, Danielle. September 2015. Personal Communication. Chino Basin Watermaster.
[657] Metropolitan Water District. 2007. Groundwater Assessment Study. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[658] Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[659] Superior Court of San Bernardino County. 2012. Restated Judgement.
[660] Superior Court of San Bernardino County. 1978. Ibid.
[661] Users include Ameron Steel, San Bernardino County, Conrock Company, Kaiser Steel, Red Star Fertilizer, Southern California Edison, Space Center, Blue Seal Linen, Sunkist Orange, Carlsberg Mobile Home Company, Union Carbide, and Quaker Chemical.
[662] Users include Chino, Norco, Ontario, Pomona, Upland, Cucamonga County Water District, Jurupa Community Services District, Monte Vista County Water District, West San Bernardino County Water District, Etiwanda Water Company, Felspar Gardens Mutual Water Company, Fontana Union Water Company, Marygold Mutual Water Company, Mira Loma Water Company, Monte Vista Irrigation Company, Mutual Water Company of Glen Avon Heights, Park Water Company, Pomona Valley Water Company, San Antonio Water Company, San Antonio Water Company, Santa Ana River Water Company, Southern California Water Company, and West End Consolidated Water Company.
[663] Chino Basin Watermaster. 2014. Overview Presentation. http://www.slideserve.com/midori/chino-basin-improving-water-supply-reliability.
[664] Lipson, A. 1978. p. 6; Blomquist, W. 1992. *Dividing the Waters*, pp. 284–285.
[665] Chino Basin Watermaster. 2015.
[666] Interest groups include the following people: Steve Elie (attorney on groundwater contamination), Paul Hofer (Ontario resident farmer), J. Arnold Rodriguez (Santa Ana River Water Company), Robert Bowcock (consultant and wastewater plan operator), Jim W. Bowman (Ontario City Council), Donald D. Galleano (Galleano Winery), Mark Kinsey (General Manager of Monte Vista Water District), Bob G. Kuhn (Glendora City Council), and Geoffrey Vanden Heuvel (J and D Star Dairy).
[667] Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[668] Chino Basin Watermaster. 2011–2012. Annual Report. http://www.cbwm.org/rep_annual.htm.
[669] Maurizio, Danielle. September 2015. Personal Communication. Chino Basin Watermaster.
[670] Ibid.
[671] Ibid.; Chino Basin Watermaster. 2011–2012.
[672] Ibid.
[673] Blomquist, W. 1992. p. 286.
[674] Chino Basin Watermaster. 2015.; Blomquist, W. 1992. *Dividing the Waters*, p. 286.
[675] Chino Basin Watermaster. 2011–2012.
[676] Ibid.
[677] Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[678] Chino Basin Watermaster. 2015.
[679] Blomquist, W. 1992. *Dividing the Waters*, p. 294; Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[680] Superior Court of San Bernardino County. 1978.
[681] Metropolitan Water District. 2007.; Blomquist, W. 1992. *Dividing the Waters*, p. 182.
[682] Chino Basin Optimum Basin Management Program. 2015. State of the Basin Report. http://www.cbwm.org/docs/engdocs/State_of_the_Basin_Reports/SOB%202014/SOB_2014-c-General%20Hydraulic%20Conditions.pdf.
[683] Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[684] Chino Basin Watermaster. 2011–2012.
[685] Chino Basin Watermaster. 2015.
[686] Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[687] Department of Water Resources. 2006. Bulletin 118. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/8-2.01.pdf.
[688] Metropolitan Water District. 2007.
[689] Chino Basin Watermaster. 2011–2012.
[690] Superior Court of San Bernardino County. 1978.
[691] Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[692] Superior Court of San Bernardino County. 2012.
[693] Chino Basin Watermaster. 2011–2012.
[694] Chino Basin Watermaster. 2013. Land Subsidence Committee Annual Report. http://www.cbwm.org/docs/adviscommitagendmin/agendas/pdf/20140717%20Agenda%20Advisory%20Committee.pdf.
[695] Blomquist, W. 1992. *Dividing the Waters*, p. 289.
[696] Maurizio, Danielle. November 2015. Personal Communication. Chino Basin Watermaster.
[697] Maurizio, Danielle. May 2015. Personal Communication. Chino Basin Watermaster.
[698] Ibid.
[699] Hemet-San Jacinto Watermaster. 2014. Annual Report. http://emwd.org/meet-emwd/news-information/emwd-publications/reports-plans-and-studies/hemet-san-jacinto-water-management-area.

[700] Department of Water Resources. 2014. CASGEM. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/StatewidePriority_05262014.xlsx.
[701] Ibid.
[702] Water Resources & Information Management Engineering Inc. 2007. Hemet San Jacinto Water Management Plan. p. 41 http://www.water.ca.gov/groundwater/docs/GWMP/SC-12_Hemet-SanJacintoGWMArea_WMP_2007.pdf.
[703] Metropolitan Water District. 2007. Groundwater Assessment Study. http://edmsidm.mwdh2o.com/idmweb/cache/MWD%20EDMS/003697466-1.pdf.
[704] Department of Water Resources. 2006.
[705] Metropolitan Water District. 2007.
[706] Ibid.
[707] Department of Interior. 2011. "Salazar Announces Finalization of Soboba Tribal Water Rights Settlement." https://www.doi.gov/news/pressreleases/Salazar-Announces-Finalization-of-Soboba-Tribal-Water-Rights-Settlement-Triggering-Release-of-21-million-Benefiting-Reservation-and-Californias-San-Jacinto-River-Basin-Communities ; Eastern Municipal Water District. 2000. State of the Hemet-San Jacinto Basins White Paper. http://www.emwd.org/home/showdocument?id=122.
[708] Eastern Municipal Water District. 2000. Building the Future, p. 145 http://www.emwd.org/home/showdocument?id=111.
[709] Ibid.
[710] Hemet-San Jacinto Watermaster. 2014.
[711] Soboba Settlement Agreement. 2006, p. 13. http://repository.unm.edu/handle/1928/21884.
[712] Water Resources & Information Management Engineering Inc. 2007.
[713] Ibid.
[714] Ibid.
[715] Hemet-San Jacinto Watermaster. 2013.
[716] Metropolitan Water District. 2007.
[717] Eastern Municipal Water District. 2000.
[718] Ibid.
[719] Superior Court of Riverside County. 2013. Stipulated Judgment. p. 13.
[720] Hemet-San Jacinto Watermaster. 2013.
[721] Department of Interior. 2011.
[722] Ibid.
[723] Hemet-San Jacinto Watermaster. 2013.
[724] Water Resources & Information Management Engineering Inc. 2007, p. 18.
[725] Ibid.
[726] Ibid.
[727] Association of California Water Agencies. 2013. "Hemet-San Jacinto Watermaster Board Approved by Court," http://www.acwa.com/content/hemet-san-jacinto-watermaster-board-approved-court.
[728] Metropolitan Water District. 2007.
[729] Hemet-San Jacinto Watermaster. 2013.
[730] Ibid.
[731] Ibid.
[732] Hemet-San Jacinto Watermaster. 2014.
[733] Ibid.
[734] Eastern Municipal Water District. 2000.
[735] Hemet-San Jacinto Watermaster. 2013.
[736] Metropolitan Water District. 2007.
[737] Hemet-San Jacinto Watermaster. 2013.
[738] Ibid.
[739] Hemet-San Jacinto Watermaster. 2014. Annual Report. http://www.emwd.org/meet-emwd/news-information/emwd-publications/reports-plans-and-studies/hemet-san-jacinto-water-management-area.
[740] Ibid.
[741] Water Resources & Information Management Engineering Inc. 2007.
[742] Ibid. pp 83–84.
[743] Hemet-San Jacinto Watermaster. 2013.
[744] Superior Court of Riverside County. 2013.
[745] Ibid.
[746] Eastern Municipal Water District 2000; Metropolitan Water District 2007.
[747] Hemet/San Jacinto Groundwater Management Area. 2014. Annual Report. http://www.emwd.org/home/showdocument?id=13026.
[748] Hemet-San Jacinto Watermaster. 2015.
[749] Ibid.
[750] Water Resources & Information Management Engineering Inc. 2007.
[751] Hemet-San Jacinto Watermaster. 2013.
[752] Department of Water Resources. 2006.

[753] Behrooz Mortazavi. Personal Communication. Hemet-San Jacinto Watermaster. September 29, 2015.
[754] San Gorgonio Pass Water Agency. 2010 Urban Water Management Plan. p. 3–6. This is the area of the Beaumont Storage Unit of the San Gorgonio Pass Sub-basin. Many sources describe the Beaumont Basin as the same as the Beaumont Storage Unit. However, DWR's list of adjudicated groundwater basins clearly indicates that the Beaumont adjudication also includes some of the San Timoteo Sub-basin of the Upper Santa Ana Valley Basin. Maps showing how the Beaumont Basin overlaps with these the sub-basins defined in Bulletin 118 could not be located.
[755] Brightwell, Eric. California Fool's Gold — A Riverside County Primer. 2015. http://ericbrightwell.com/tag/san-gorgonio-pass/.
[756] Beaumont Basin Watermaster. 2014. Annual Report, pp. 3-2 and 3-3; San Timoteo Watershed Management Authority, Integrated Regional Water Management Plan. 2005. p. 2–8.
http://www.wildermuthenvironmental.com/featured_projects/water_mgmt/assets/reports/20050908_IRWMP_Final_Draft.pdf.
[757] San Gorgonio Pass Water Agency. 2010. Urban Water Management Plan. p. 3–6.
[758] Banning Section 2. http://www.ci.banning.ca.us/DocumentCenter/Home/View/89
[759] San Timoteo Watershed Management Authority. Integrated Regional Water Management Plan. 2005. p. 2-1.
[760] San Timoteo Watershed Management Authority. Integrated Regional Water Management Plan 2005. pp. ES-1 to ES-6.
[761] Beaumont Watermaster Report. 2007. http://documents.yvwd.dst.ca.us/bbwm/documents/annualreport4.pdf.
[762] Beaumont Basin Watermaster. 2014. Draft Annual Report. 2-7.
http://documents.yvwd.dst.ca.us/bbwm/documents/2014annualreport150731.pdf.
[763] Superior Court of California for the County of Riverside. *San Timoteo Watershed Management Authority v. City of Banning et al.* Case No. RIC 389197. 2004. p. 14.
[764] *San Timoteo Watershed Management Authority v. City of Banning et al.* 2004.
[765] Beaumont Basin Watermaster. 2014. Draft Annual Report, p. 1–3.
[766] *San Timoteo Watershed Management Authority v. City of Banning et al.* 2004, p. 4.
[767] *San Timoteo Watershed Management Authority v. City of Banning et al.* 2004, p. 15.
[768] Beaumont Basin Watermaster. 2014. Draft Annual Report, p. 3-7.
[769] Beaumont Basin Watermaster. 2014. Draft Annual Report.
[770] Beaumont Basin Watermaster. 2014. Draft Annual Report, pp. 3-2 and 3-3; San Timoteo Watershed Management Authority, Integrated Regional Water Management Plan. 2005, p. 3-6.
[771] Beaumont Basin Watermaster. 2014. Draft Annual Report, p. 3-7.
[772] Beaumont Basin Draft Annual Report. 2014, p. 3-4.
[773] *San Timoteo Watershed Management Authority v. City of Banning et al.* 2004, p. 5.
[774] *San Timoteo Watershed Management Authority v. City of Banning et al.* 2004, p. 4.
[775] Libi Uremovic. Banning Beaumont Patch. 4/1/2015. http://patch.com/california/banning-beaumont/watermaster-meeting-april-1st-0; Interview with engineer F. Anabel Blandon at ALDA Inc. 9/15/2015.
[776] USGS. 2006. Geology, groundwater hydrology, geochemistry and groundwater simulation of the Beaumont and Banning Storage Units, San Gorgonio Pass Area, Riverside County, California. p. 2.
[777] Beaumont Basin Watermaster. 2014. Draft Annual Report. Figure 3-4.
[778] Beaumont Basin Watermaster. 2014. Draft Annual Report. Table 3-4.
[779] Beaumont Basin Watermaster. 2014. Draft Annual Report, p. 3–10.
[780] Beaumont Basin Watermaster. 2014. Draft Annual Report, 4-2.
[781] Beaumont Basin Watermaster. 2014. Draft Annual Report, 3-14.
[782] CASGEM. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf.
[783] CASGEM. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf.
[784] Nishikawa, T., Densmore, J., Martin, P., and Matti, J. 2003. Evaluation of the Source and Transport of High Nitrate Concentrations in Groundwater, Warren subbasin, California. U.S. Geological Survey Water Resources Investigation Report 03-4009. Sacramento, California.
[784] Warren Valley Basin Watermaster. Annual Report. 2012–2013.
[785] DWR. 2003. Bulletin 118, Warren Valley Groundwater Basin.
[786] Warren Valley Basin Management Plan. 1991, p. 3-2.
[787] Warren Valley Annual Watermaster Report. 2013–2014.
http://static1.squarespace.com/static/5304d56be4b0c23125974a02/t/55f9af76e4b042bd928ceeb6/1442426742214/2013-2014+Annual+Report+Watermaster.pdf.
[788] Warren Valley Basin Management Plan. 1991, p. 3-2.
[789] *Hi-Desert County Water District v. Yucca Water Co. et al.* 1977. Judgment No. 172103. Superior Court of the State of California for the County of San Bernardino, pp. 4–6.
[790] *Hi-Desert County Water District v. Yucca Water Co. et al. 1977.* Judgment No. 172103. Superior Court of the State of California for the County of San Bernardino, p. 6.
[791] *Hi-Desert County Water District v. Yucca Water Co. et al. 1977.* Judgment No. 172103. Superior Court of the State of California for the County of San Bernardino, pp. 4–9.
[792] Warren Valley Basin Management Plan. 1991.
[793] Addendum to the Warren Valley Basin Management Plan. 1996.
[794] HDWD. Annual Reports. http://www.hdwd.com/annual-reports/.

[795] Addendum to the Warren Valley Basin Management Plan. 1996.
[796] Rules and Regulations of the Warren Valley Basin Watermaster. 2012. http://www.hdwd.com/watermaster1/.
[797] Warren Valley Basin Watermaster. Annual Report. 2012–2013.
[798] HDWD. Protect Our Groundwater: Project Summary. http://protectgroundwater.org/project-summary/.
[799] Rules and Regulations of the Warren Valley Basin Watermaster. 2012. http://www.hdwd.com/watermaster1/.
[800] Hi-Desert County Water District v. Yucca Water Co. et al. 1977. Judgment No. 172103. Superior Court of the State of California for the County of San Bernardino, p. 2-3.
[801] Warren Valley Basin Management Plan. 1991, and 1996 Addendum.
[802] *Hi-Desert County Water District v. Yucca Water Co. et al.* 1977. Judgment No. 172103. Superior Court of the State of California for the County of San Bernardino, p. 2.
[803] Warren Valley Basin Management Plan. 1991.
[804] Nishikawa, T., Densmore, J., Martin, P., and Matti, J. 2003. Evaluation of the Source and Transport of High Nitrate Concentrations in Groundwater, Warren Subbasin, California. U.S. Geological Survey Water Resources Investigation Report 03-4009. Sacramento, California.
[805] Warren Valley Basin Watermaster. Annual Report. 2012–2013.
[806] Nishikawa, T., Densmore, J., Martin, P., and Matti, J. 2003. Evaluation of the Source and Transport of High Nitrate Concentrations in Groundwater, Warren Subbasin, California. U.S. Geological Survey Water Resources Investigation Report 03-4009. Sacramento, California.
[807] HDWD. Protect Our Groundwater: Project Summary. http://protectgroundwater.org/project-summary/.
[808] Warren Valley Basin Watermaster. Annual Report 2012–2013.
[809] http://www.sbcounty.gov/uploads/lus/environmental/agincourt/trwatersupplyassessment.pdf.
[810] CASGEM Basin Prioritization Results. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf.
[811] *City of Barstow et al. v. Mojave Water Agency.* California Supreme Court. 23 Cal. 4th 1224, 5 P.3d 853, 99 Cal. Rptr. 2d 294 (2000); see also http://www.mojavewater.org/mojave_basin_area.html.
[812] Este Subarea receives the majority of its current water supply from wastewater imports. http://www.mojavewater.org/files/mwa_2004_rwmp_1.pdf.
[813] Water-Level and Land-Subsidence Studies in the Mojave River and Monogo Groundwater Basins. United States Geological Survey (USGS). 2007. http://ca.water.usgs.gov/mojave/.
[814] Bulletin 47, "The Mojave River Investigation" reported that the Mojave River received its principal water supply from 217 square miles of mountain headwaters from the northern slope of the San Bernardino Mountains. http://www.mojavewater.org/history-1.html.
[815] Stamos, Nishikawa, and Martin. 2001. "Water Supply in the Mojave Groundwater Basin, 1931–1999, and the Benefits of Artificial Recharge." USGS. http://pubs.usgs.gov/fs/fs-122-01/. Over 90 percent of the basin's natural recharge originates in the San Gabriel and San Bernardino Mountains.
[816] Lower Mojave River Valley Groundwater Basin. http://www.water.ca.gov/groundwater/bulletin118/basindescriptions/6-40.pdf.
[817] Barstow, California. http://www.city-data.com/city/Barstow-California.html#b.
[785] *City of Barstow et al. v. Mojave Water Agency.* 2000.
[819] By 1990, SWP water totaled 50,800. Blomquist, W. 1992. *Dividing the Waters*.
[820] MWA engaged in meetings with big pumpers—industry, public utilities, military, and farmers—to explore a physical solution, but lots of disagreements. Blomquist, W. 1992. *Dividing the Waters*, p. 226.
[821] *Mojave Water Agency v. Clarence L. Abbey et al.* Case 130759 in Superior Court for the County of San Bernardino.
[822] While MWA had an entitlement to SWP water, it had no means of transmission. Efforts to get water from the California aqueduct to the basin were opposed by a local citizen's group, Fairness in Bonding, on the ground that many residents of the proposed improvement district formed to pay for the pipeline were retired persons with fixed incomes who could not afford the substantial property tax increases.
[823] M. R. Llamas, and E. Custodio (eds.). 2002. *Intensive Use of Groundwater: Challenges and Opportunities.* See also Blomquist. 1992.
[824] *City of Barstow et al. v. City of Adelanto et al.* Riverside County Superior Court Case No. 208568, Mojave Water Agency: History of the Adjudication. http://www.mojavewater.org/history-1.html. Arc Las Flores Ltd. also filed a cross-complaint requesting a determination that their water rights were prior and paramount to any other rights within the basin.
[825] A group consisting of attorneys, engineers, and other individuals, generally representative of all types of producers and all subareas of the basin.
[826] Mojave Water Agency. History of the Adjudication. www.mojavewater.org/history.html.
[827] *City of Barstow et al. v. City of Adelanto et al.* Riverside County Superior Court Case No. 208568. 1996.
[828] Except it reversed the decision as to the Jess Ranch Water Company.
[829] Mojave Basin Area Watermaster Report. 2015. http://www.mojavewater.org/files/21AR1314.pdf.
[830] Mojave Basin Area Watermaster Report 2013–2014. May 2015.
[831] *City of Barstow v. Mojave Water Agency.* 2000. 23 Cal.4th. 1224, 1243.
[832] *City of Barstow et al. v. City of Adelanto et al.* Riverside County Superior Court Case No. 208568. 1996.; Id. *City of Barstow v. Mojave Water Agency*. 2000.
[833] 2004 Regional Water Management Plan. Mojave Water Agency. http://www.mojavewater.org/files/mwa_2004_rwmp_1.pdf.
[834] Mojave Basin Area Watermaster Report 2013–2014. May 2015.
[835] Either by payment to the Watermaster to purchase Replacement Water, or by transfer of unused FPA from another producer.

[836] Lovato, Vince. 2002. "Lawsuit Settled, Water Rationing Plan Preserved: Desert Cities Welcome Decision." *San Bernardino County Sun.* July 26, 2002.
[837] David Seielstad, Senior Watermaster Technician. MWA. Interview May 21, 2015.
[838] For instance, a party who was allocated 1 percent of the FPA in a subarea could lease that allocation to a second party in a private transaction. The second party could then produce additional water free of a replacement obligation. *City of Barstow et al. v. City of Adelanto et al.* Riverside County Superior Court Case No. 208568 (1996), F-3.
[839] Mojave Basin Watermaster 21st Annual Report for 2013–2014. Mojave Water Agency FAQs. http://www.mojavewater.org/faqs.html.
[840] Comment provided by Kirby Brill. November 13, 2015.
[841] Production Estimates from Item 12, April 25, 2013 MWA Board of Directors Meeting. http://www.mojavewater.org/meetings---agendas.html.
[842] Frequently Asked Questions About the Mojave Basin Adjudication. http://www.mojavewater.org/files/Mojave-Basin-Area-Adjudication-FAQs.pdf.
[843] Mojave Basin Watermaster 21st Annual Report for 2013–2014.
[844] In MWA's jurisdiction, about 10 percent of the available water supply was supplemental water in the Alto Subarea or less than 6 percent for all five subareas for the 2013–2014 Water Year (Table 5-2, 2013–14 Annual Report).
[845] Watermaster Annual Report for Water Year 2013–14. http://www.mojavewater.org/files/21AR1314.pdf.
[846] URS Water Supply Assessment. 2011. http://www.sbcounty.gov/uploads/lus/environmental/agincourt/trwatersupplyassessment.pdf.
[847] 2013–14 Watermaster Report. http://www.mojavewater.org/files/21AR1314.pdf.
[848] Kirby Brill, MWA Manager. Review comment. November 13, 2015.
[849] Stamos, C. L., T. Nishikawa, and P. Martin. 2001. USGS Water Fact Sheet 122-01.
[850] Ibid.
[851] California's Groundwater Bulletin 118. Last update February 27, 2004. South Lahontan Hydrologic Region Lower Mojave River Valley Groundwater Basin. http://www.water.ca.gov/groundwater/bulletin118/basindescriptions/6-40.pdf.
[852] CASGEM Basin Prioritization Results. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_Priority_05262014.pdf.
[853] Gutglueck, Mark. "Relations Between Newberry Springs Residents & Alfalfa Farmers Fray." Posted on 1/10/ 2015. *SB Sentinel.*
[854] Ibid.
[855] Gutglueck, Mark. "Relations Between Newberry Springs Residents & Alfalfa Farmers Fray." Posted on 1/10/ 2015. *SB Sentinel.*
[856] Comments provided by David Seielstad, 8/2015, and Kirby Brill, 11/13/15.
[857] Goleta Groundwater Basin. Bulletin 188. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/3-16.pdf.
[858] Santa Barbara County Groundwater Report. 2011. Public Works Department Water Resources Division. http://cosb.countyofsb.org/uploadedFiles/pwd/Water/WaterAgency/Report%20Document%20FINAL.pdf.
[859] "Some of the boundaries coincide with faults that are mapped at the surface or are inferred from hydrogeologic evidence such as large differences in groundwater elevations on each side of the "fault." Other boundaries are defined by the thinning edges of water-bearing strata against bedrock highs and upstream valleys. Steven Bachman. 2010. Groundwater Management Plan for GWD.
[860] Some boundaries coincide with faults that have large differences in groundwater elevations on each side of the fault. Others are defined by thinning edges of strata against bedrock highs and upstream valleys. http://www.water.ca.gov/pubs/groundwater/bulletin_118/basindescriptions/3-16.pdf.
[861] Goleta Water District. 2005, cited in Bachman. 2010.
[862] Interview with staff at the Goleta Water District.
[863] Upson. 1951. Cited in Bachman. 2010.
[864] Lake Cachuma provides about 85 percent of the water for the 250,000 residents and 12,000 acres of agriculture along the South Coast of Santa Barbara County. Supplies from Cachuma are also released for downstream water rights and federal fish protection requirements. GWD is entitled to 36 percent, or 9,322 AFY, of the lake yield, which provides for approximately two-thirds of district customer demand in normal years.
[865] Goleta Final Drought Management Plan. 2014.
[866] Between 1960 and 1970, Goleta Valley's population tripled from ~19,000 to ~60,000. See *Wright v. Goleta Water District.*
[867] Bachman. 2010.
[868] *Martha H. Wright et al. v. Goleta Water District et al.* 1989. Amended Judgment, Superior Court of Santa Barbara County Case No. SM57969. http://www.goletawater.com/assets/documents/water_supply/WRIGHT_JUDGEMENT_Case_No_SM57969_November_17-1989.pdf.
[869] An Amendment to the Safe Water Supplies Ordinance, Measure J94, and Measure H 91, the Safe Water Supplies Ordinance, http://www.goletawater.com/assets/documents/other/SAFE_ORDINANCE.pdf.
[870] Goleta Final Drought Management Plan. 2014.
[871] Bachman. 2010.
[872] *Martha H. Wright et al. v. Goleta Water District et al.* 1989.
[873] SAFE Ordinances No. 91-01 and 94-03. http://www.goletawater.com/assets/documents/other/SAFE_ORDINANCE.pdf.
[874] E-mail from the Goleta Water District. August 31, 2015.
[875] SAFE Ordinances No. 91-01. See also See Bachman. 2010.
[876] The amount of Cachuma Project water delivered to member units varies from year to year depending on winter runoff, stored lake

supplies, water demand, downstream releases for fish and other water supply sources. The SWRCB is currently considering modifications to the U.S. Bureau of Reclamation water rights permits 11308 and 11310 for the purpose of protecting public trust (fishery flows) and water right holders below Bradbury Dam. Another element of uncertainty is the available storage in Lake Cachuma as siltation has reduced lake capacity. Goleta Final Drought Management Plan. 2014.

[877] Goleta Final Drought Management Plan. 2014.

[878] GWD pumped a minimal amount from the basin since the early 1990s, allowing the basin to refill. La Cumbre pumped below their water right over the past 10 years, also allowing the basin to refill. As of 2008, a total of 42,530 AF was added to basin storage through direct injection and using other water supplies in lieu of pumping groundwater.

[879] DWR Water Plan Update, Chapter 5 Central Coast. www.waterplan.water.ca.gov/docs/groundwater/update2013/content/hydrologic_region/GWU2013_Ch5_CentralCoast_Final.pdf.

[880] Bachman. 2010.

[881] E-mail from the Goleta Water District. August 31, 2015.

[882] Bachman, Steven. 2011. Goleta Water District Water Supply Management Plan, p. 3. http://www.goletawater.com/assets/documents/water_supply/Water_Supply_Management_Plan_Final_3-31-11.pdf.

[883] For the basin as a whole, hydrologic balance exists when the perennial recharge exceeds the perennial extractions from the basin. Bachman. 2010.

[884] Interview with staff at the Goleta Water District. August 30, 2015, and e-mail from the Goleta Water District August 31, 2015.

[885] Bachman 2010. Goleta Final Drought Management Plan. 2014.

[886] Ibid.

[887] *Martha H. Wright et al. v. Goleta Water District et al.* 1989.

[888] Ellis's safe yield (based on 1938–1955) was 4,600 AF. Mann's, based on 1935–1973) was 4600 AF. See Bachman 2010.

[889] Bachman. 2010, p. 4-4.

[890] Bachman. 2010.

[891] Ibid

[892] Ibid.

[893] Ibid.

[894] E-mail from the Goleta Water District. August 31, 2015.

[895] Magnoli, Gina. January 21, 2015. Noozhawk.

[896] Goleta Final Drought Management Plan. 2014.

[897] Interview with staff at the Goleta Water District. August 30, 2015.

[898] E-mail from the Goleta Water District. August 31, 2015.

[899] Goleta Sustainability Plan. 2012. http://www.goletawater.com/assets/documents/conservation/Sustainability%20Plan%20FINAL%20120613.pdf.

[900] GWD 2008 and Bachman. 2010.

[901] Magnoli, Gina. February 20, 2014. Noozhawk.

[902] CASGEM. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/StatewidePriority_05262014.pdf.

[903] DWR recognized the hydraulic continuity of UWCD's several groundwater basins, and in 1980 concluded that these basins should be considered as one groundwater basin, the Ventura Central Basin, which was "subject to critical conditions of overdraft." DWR Bulletin 118-80, p. 73.

[904] UWCD. 2012. Groundwater and Surface Water Condition Report.

[905] *UWCD v. City of Ventura.* 1996 Judgment. Case 115611.

[906] UWCD. Surface and Groundwater Conditions report, Water Year 2000 Supplement.

[907] UCWD Professional Paper 2012-001. September 2013. Santa Paula Basin 2011 Annual Report. http://www.unitedwater.org/images/stories/reports/GW-Conditions-Reports/SP%20Basin%202011%20Annual%20Report%20Sept%202013%20-%20final.pdf.

[908] Study by UCWD and the other TAC members. UWCD Professional Paper 2012-001. September 2013.

[909] Includes lemons, avocados, strawberries, row crops, and nurseries that are irrigated by groundwater.

[910] UWCD Professional Paper 2012-001. 2013.

[911] Wilson, Tracy. March 8, 1996. Settlement May Delay Water Rate Increases for Years. *Los Angeles Times.* http://articles.latimes.com/1996-03-08/local/me-44495_1_water-supply.

[912] *UCWD v. City of San Buenaventura.* 1996 Judgment, Case 115611.

[913] The judgment did not specifically call for the development of a groundwater management plan; however, the judgment language implied that the court expected a plan would be forthcoming. UCWD Watermaster comment.

[914] City of Santa Paula, Water Supply Assessment and Verification Report. 2007. http://www.ci.santa-paula.ca.us/eastareaone/AppQ2-WaterSupplyAssess-VerifyReport.pdf.

[915] *UWCD v. City of San Buenaventura.* Original March 7, 1996, amended August 24, 2010 (hereinafter "Judgment").

[916] Ibid.

[917] *City of San Buenaventura v. UCWD.* 2d Civil No. B251810. 2015.

[918] UWCD Professional Paper 2012-001. September 2013.

[919] Ibid. p. 3.

[920] Ibid. p. 3.

[921] UWCD Professional Paper 2012-001. September 2013.
[922] *UCWD v. City of San Buenaventura.* 1996 Judgment, Case 115611.
[923] Subject to modification if technical information demonstrates a need for a change: Draft Water Supply Assessment and Verification for the East Gateway Project. 2012.
[924] UWCD Professional Paper 2012-001. September 2013.
[925] Agriculture: Farmer's Irrigation Co. 9,913 AF; Limoneira 3,611 AF; Riverbank Citrus 763 AF; Canyon Irrigation Co. 673 AF; Panamanian Seed 410 AF. Municipal: City of Santa Paula 5,483 AF; Alta Mutual Water Company 763 AF; Bender Realty 507 AF.
[926] UWCD Professional Paper 2012-001. September 2013. Pumping records used by the Santa Paula Basin Experts Group (2003) for 1983–1995 indicated an average pumping during this base period of ~26,000 AFY.
[927] City of Santa Paula, Water Supply Assessment and Verification Report. 2007.
[928] UCWD water manager interview May 8, 2015.
[929] Interview with UCWD staff hydrogeologist. June 22, 2015.
[930] UCWD, Piru and Fillmore Basins Annual Groundwater Conditions Report Water Year 2003. December 2004. p.3.
[931] UWCD 2009–2010 Santa Paula Basin Annual Report, Professional Paper 2011-001, p.2. See also UWCD Professional Paper 2012-001. September 2013. The periods 1944–2005, 1983–2005, 1980–2011, 1986–2011, and 1997–2011 also show groundwater levels declining in a majority of the wells with records for the evaluation periods, but some groupings of wells show increasing water levels over specific evaluation periods. Basin's eastern end where City of Santa Paula pumps recharges rapidly each year with water from the Fillmore Basin, Santa Paula Creek, and Santa Clara River. The basin's western end does not recharge as rapidly. Santa Paula Basin TAC, 2011 cited in: http://www.unitedwater.org/images/stories/reports/GW-Conditions-Reports/UWCD_OFR_2013-.
[932] Santa Paula Basin Groundwater Elevation Trend Assessment. UWCD Open-file Report 2-13-03, prepared by Groundwater Resources Department. February 2013. http://www.unitedwater.org/images/stories/reports/GW-Conditions-Reports/UWCD_OFR_2013-03_Santa_Paula_basin_water_level_trends_assessment.pdf.
[933] UWCD 2009–2010 Santa Paula Basin Annual Report. Professional Paper 2011-001, p.2.
[934] Annual Investigations and Report of Groundwater Conditions within United Water Conservation District: A summary of findings for the 2013–2014, 2014–2015, and 2015–2016, p. 12.
[935] UCWD Staff Report. March 3, 2015 (March 11, 2015 meeting, Groundwater Conditions Update, p. 124).
[936] 2011 http://www.unitedwater.org/images/stories/reports/GW-Conditions-Reports/SP%20Basin%202011%20Annual%20Report%20Sept%202013%20-%20final.pdf.
[937] City of Ventura. 2012. http://portal.countyofventura.org/, see also CASGEM, http://www.water.ca.gov/groundwater/casgem/pdfs/lists/SRO_BasinName_05262014.pdf.
[938] Best Best & Krieger. http://www.bbklaw.com/?t=40&an=38550.
[939] City of Santa Paula. Water Supply Assessment and Verification Report. 2007.
[940] *UCWD v. City of San Buenaventura.* 1996 Judgment, Case 115611, UWCD 2009-2010. Santa Paula Basin Annual Report, Professional Paper 2011-001, p.2.
[941] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April 2015.
[942] California DWR. 2012. CASGEM Groundwater Basin Prioritization Results. www.water.ca.gov. Accessed 30 April 2015.
[943] California DWR. 2012. CASGEM Designated Monitoring Entities. www.water.ca.gov. Accessed 30 April 2015.
[944] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008. Note that the Scott River Valley Groundwater Basin that is outside of the Scott River Adjudication is subject to the SGMA.
[945] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[946] California DWR. 2012. CASGEM Groundwater Basin Prioritization Results. www.water.ca.gov. Accessed 30 April 2015.
[947] Scott River Water Trust. 2015. Scott River Water Trust website: http://www.scottwatertrust.org/. Accessed 30 April 2015.
[948] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[949] Scott River Adjudication. Decree Number 30662. Superior Court for Siskiyou County. January 30, 1980.
[950] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[951] Mack, Seymor. 1958. Geology and Groundwater Features of Scott Valley, Siskiyou County, California. Geological Survey Water Supply Paper 1462.
[952] Scott River Adjudication. Decree Number 30662. Superior Court for Siskiyou County. January 30, 1980.
[953] Ibid.
[954] Siskiyou County. 2015. Siskiyou County Website: http://www.co.siskiyou.ca.us/content/natural-resources-agriculture. Accessed 30 April 2015.
[955] Scott River Adjudication. Decree Number 30662. Superior Court for Siskiyou County. January 30, 1980.
[956] Ibid.
[957] Ibid.
[958] The Watermaster district was authorized by a Superior Court judge in February 2012.
[959] Siskiyou County. 2015. Siskiyou County website: http://www.co.siskiyou.ca.us/content/natural-resources-agriculture. Accessed 30 April 2015.

[960] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[961] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[962] Scott River Water Trust. 2015. Scott River Water Trust website: http://www.scottwatertrust.org/. Accessed 30 April 2015.
[963] NCRC. 2015. Northern California Resource Center website: http://www.californiaresourcecenter.org/viewpage.php?page_id=94. Accessed 30 April 2015.
[964] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[965] Ibid.
[966] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April 2015.
[967] Scott Valley Groundwater Advisory Committee. 2012. Voluntary Groundwater Management and Enhancement Plan for Scott Valley. October 22, 2012.
[968] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[969] Ibid, p. 24.
[970] Harter, Thomas, and Hines, Ryan. 2008. Scott Valley Groundwater Study Plan. Groundwater Cooperative Extension Program. University of California, Davis. February 11, 2008.
[971] Ibid.
[972] Smith, Donald. 2014. "Scott River Watershed Council Looks for Solutions to Water Crisis." *Siskiyou Daly News.* http://www.siskiyoudaily.com/article/20140113/News/140119944/?Start=1. Accessed 30 April 2015.
[973] Environmental Law Foundation. 2015. ELF website: http://www.envirolaw.org/current. Accessed 30 April 2015.
[974] http://appellatecases.courtinfo.ca.gov/search/case/dockets.cfm?dist=0&doc_id=2085777&doc_no=S220764.
[975] Doremus, Holly. 2014. "Groundwater and the public trust doctrine." Legal Planet: http://legal-planet.org/2014/07/21/groundwater-and-the-public-trust-doctrine-california-style/. Accessed 30 April 2015.
[976] California DWR. 2015. CASGEM: http://www.water.ca.gov/groundwater/casgem/. Accessed 30 April 2015.
[977] California DWR. 2015. CASGEM: http://www.water.ca.gov/groundwater/casgem/. Accessed 30 April 2015.
[978] California DWR. 2015. CASGEM: http://www.water.ca.gov/groundwater/casgem/. Accessed 30 April 2015.
[979] California DWR. 2015. CASGEM: http://www.water.ca.gov/groundwater/casgem/. Accessed 30 April 2015.
[980] *California American Water, Plaintiff v. City of Seaside, City of Monterey; City of Sand City; City of Del Rey Oakes; Security National Guaranty, Inc.; Granite Rock Company Inc.; DBO Development Company No. 27, Inc.; Muriel E. Calabrese 1987 Trust; Alderwoods Group Inc.; Pasadera Country Club, LLC; Laguna Seca Resort, Inc.; Bishop Mc Intosh & Mc Intosh; The York School Inc.; and Does 1 through 1,000 Inclusive, Defendants;* Monterey Peninsula Water, Management District and Monterey County Water Resources Agency, Intervenors. March 27, 2006. #M66343.
[981] MPWMD. 2008. Seaside Basin Questions and Answers: www.mpwmd.dst.ca.us/seasidebasin/ord135/QAOrd135091108.pdf. Accessed 30 April 2015.
[982] Information from Joe Oliver, Water Resources Division Manager, Monterey Peninsula Water Management District. September 18, 2015.
[983] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April 2015.
[984] Personal Interview with MPWMD representative Henrietta Stern. June 9, 2015.
[985] These powers exceed those of most water agencies or other special districts in California. See Yates, Feeney, and Rosenberg. 2005. Seaside Groundwater Basin: Update on Groundwater Conditions. http://www.mpwmd.dst.ca.us/seasidebasin/TM_rev_14APR05.pdf. Accessed 30 April 2015. See also *Cal-Am Water v. City of Seaside.* Case Number M66343. December 13, 2005. Superior Court of California, Monterey.
[986] 2014 Implementation Guidelines for Processing Applications for Water Distribution Systems and Mobile Water Distribution Systems. Prepared May 21, 2014, pursuant to Ordinance No. 160. http://www.mpwmd.dst.ca.us/pae/wds/2014%20Imp%20Guidelines/ImpGuide_Text_20140516_HS.htm.
[987] MCWRA. 2015. Mission and Vision: http://www.mcwra.co.monterey.ca.us/mission_vision/mission_vison.php. Accessed 30 April 2015.
[988] Personal Interview with MPWMD representative Henrietta Stern. June 9, 2015.
[989] MPWMD. 2008. Seaside Basin Questions and Answers: www.mpwmd.dst.ca.us/seasidebasin/ord135/QAOrd135091108.pdf. Accessed 30 April 2015.
[990] *California American Water (Cal-Am), Plaintiff v. City of Seaside et al.* Superior Court of California. March 27, 2006.
[991] MPWMD. 2008. Seaside Basin Questions and Answers: www.mpwmd.dst.ca.us/seasidebasin/ord135/QAOrd135091108.pdf. Accessed 30 April 2015.
[992] *California American Water (Cal-Am), Plaintiff v. City of Seaside et al.* Superior Court of California. March 27, 2006.
[993] MPWMD. 2008. Seaside Basin Questions and Answers: www.mpwmd.dst.ca.us/seasidebasin/ord135/QAOrd135091108.pdf. Accessed 30 April 2015.
[994] *Cal-Am Water v. City of Seaside et al.* MPWMD Intervener and Appellant. Case Number H034335. State of California Sixth Appellate District. April 1, 2010. p.3.
[995] *Cal-Am Water v. City of Seaside et al.* March 27, 2006.

[996] The Operating Yield for the Coastal Subarea is: 4,611 AFY, with 743 AFY committed to alternative production allocations and 3,868 AFY committed to standard production allocations. The operating yield for the Laguna Seca Subarea is: 989 AFY, with 644 AFY committed to alternative production allocations and 345 AFA committed to standard production allocations (*Cal-Am Water v. City of Seaside et al.* March 27, 2006).
[997] *Cal-Am Water v. City of Seaside et al.* March 27, 2006.
[998] Ibid.
[999] Material injury is defined as a substantial adverse physical impact to the Seaside Basin or any particular producer(s) including but not limited to: seawater intrusion, land subsidence, excessive pump lifts, and water quality degradation (see *Cal-Am v. City of Seaside et al.* February 9, 2007).
[1000] *Cal-Am Water v. City of Seaside et al.* MPWMD Intervener and Appellant. Case Number H034335. State of California Sixth Appellate District. April 1, 2010.
[1001] *Cal-Am Water v. City of Seaside et al.* MPWMD Intervener and Appellate, Case Number H034335. State of California Sixth Appellate District. April 1, 2010.
[1002] Ibid, citing the Superior Court decision, p. 4.
[1003] Ibid.
[1004] Seaside Watermaster. 2015. Annual Report 2013. http://www.seasidebasinwatermaster.org/. Accessed 30 April 2015.
[1005] *Cal-Am Water v. City of Seaside et al.* February 9, 2007.
[1006] MPWMD. 2008. Seaside Basin Questions and Answers: www.mpwmd.dst.ca.us/seasidebasin/ord135/QAOrd135091108.pdf. Accessed 30 April 2015.
[1007] Seaside Watermaster Annual Report. 2014. http://www.seasidebasinwatermaster.org/Other/Final%20Annual%20Report%202014%2012-5-14.pdf.
[1008] Water Technology. 2015. "Sand City Coastal Desalination Plant." http://www.water-technology.net/projects/sand-city-plant/. Accessed 30 April 2015.
[1009] Seaside Watermaster Annual Report. 2013. http://www.seasidebasinwatermaster.org/. Accessed 30 April 2015.
[1010] Seaside Watermaster. 2015. Annual Report 2013. http://www.seasidebasinwatermaster.org/. Accessed 30 April 2015.
[1011] California Public Utilities Commission. http://www.cpuc.ca.gov/Environment/info/esa/mpwsp/index.html.
[1012] MPWMD. 2008. Seaside Basin Questions and Answers. www.mpwmd.dst.ca.us/seasidebasin/ord135/QAOrd135091108.pdf. Accessed 30 April 2015.
[981] Seaside Watermaster. 2015. Annual Report 2013; http://www.seasidebasinwatermaster.org/ Accessed 30 April 2015
[1014] Yates, E., M. Feeney, and L. Rosenberg. 2005. "Seaside Groundwater Basin: Update on Water Resource Conditions."
[1015] *Cal-Am Water v. City of Seaside et al.* February 9, 2007.
[1016] Seaside Watermaster. 2015. Annual Report 2013. http://www.seasidebasinwatermaster.org/. Accessed 30 April 2015.
[1017] HydroMetrics. 2014. Water Year 2014. *Seawater Intrusion Analysis Report, Seaside Basin, Monterey County, California*. Prepared for Seaside Basin Watermaster. December 2014, p. 60.
[1018] Seaside Watermaster. 2015. Annual Report 2013. http://www.seasidebasinwatermaster.org/. Accessed 30 April 2015.
[1019] Seaside Watermaster. 2009. Annual Report 2009. http://www.seasidebasinwatermaster.org/. Accessed 30 April 2015.
[1020] Russel McGlothlin. Brownstein Hyatt Farber Schreck, LLP. Comment. October 5, 2015.
[1021] Hydrometrics. 2014. Seawater Intrusion Analysis Report. http://www.seasidebasinwatermaster.org/Other/2014%20Seawater%20Intrusion%20Analysis%20Report_Final.pdf.
[1022] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April 2015.
[1023] California DWR. 2015. Groundwater Bulletin 118; www.water.ca.gov. Accessed 30 April 2015.
[1024] Personal Interview with MPWMD representative Henrietta Stern: June 9, 2015.
[1025] DWR California Water Plan Update. Chapter 5 Central Coast. http://www.waterplan.water.ca.gov/docs/groundwater/update2013/content/hydrologic_region/GWU2013_Ch5_CentralCoast_Final.pdf.
[1026] Santa Barbara County 2011 Groundwater Report. http://cosb.countyofsb.org/uploadedFiles/pwd/Water/WaterAgency/Report%20Document%20FINAL.pdf.
[1027] CASGEM Groundwater Basin Prioritization Results. http://www.water.ca.gov/groundwater/casgem/pdfs/lists/StatewideBasinName_05262014.pdf.
[1028] Ibid. Bulletin 118; see also http://longrange.sbcountyplanning.org/planareas/orcutt/documents/OCP%20EIR/OCP%20EIR%20Volume%201/5.6%20Water%20Resources.pdf.
[1029] Department of Water Resources Bulletin 118–Update 2003, at p. 115. See also Santa Maria Valley Management Area (SMVMA) 2013 Annual Report.
[1030] *City of Santa Maria v. Adam.* 2012. 211 Cal. App. 4th 266. See also Michael Winn, Santa Maria adjudication.
[1031] *Santa Maria Valley Water Conservation District v. City of Santa Maria et al.* Stipulation (2005), Final Judgment (2008); *City of Santa Maria v. Adam* 2012.
[1032] *City of Santa Maria v. Adam.* 2012.
[1033] *Santa Maria Valley WCD v. City of Santa Maria et al.* 2008. See also http://www.vineyardteam.org/files/resources/Winn,%20Michael.pdf.
[1034] *Santa Maria Valley Water Conservation District v. City of Santa Maria et al.* 2008; See also Robert Saperstein 2013 "Santa Maria

Groundwater Adjudication Lessons Learned." http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.
[1035] *Santa Maria Valley WCD v. City of Santa Maria et al.* 2008.
[1036] *Santa Maria Valley WCD v. City of Santa Maria et al.* Stipulation 2005; *City of Santa Maria v. Adam et al.* 2012.
[1037] Case was distinguished from the San Fernando case where water was abandoned by the Flood Control District so court considered it to be merged into safe yield which was available to all parties, subject to asserted priority rights (e.g., Los Angeles's Pueblo Right). James Markham 2013.
[1038] That assessment is levied on shares in equal proportions and is in addition to the annual maintenance assessment.
[1039] *City of Santa Maria v. Adam.* 2012.
[1040] *Santa Maria Valley WCD v. City of Santa Maria et al.* Stipulation. 2005.
[1041] Eric Garner. 2013. http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.
[1042] James Markham. 2013. http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.
[1043] *City of Santa Maria et al. v. Richard Adam et al.* 2012; See also Weinstock, Harvey. 2013.
[1044] Supreme Court tosses Santa Maria groundwater rights case. Cal Coast News.com. October 15, 2013. http://calcoastnews.com/2013/10/supreme-court-tosses-santa-maria-groundwater-rights-case/.
[1045] Santa Maria Valley Water Conservation District. http://www.smvwcd.org.
[1046] NMMA Technical Committee, 6th Annual Report. 2013. http://ncsd.ca.gov/wp-content/uploads/2014/03/2013-ANNUAL-REPORT-REDUCED-SIZE-PDF.pdf.
[1047] James Markham. 2013. http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.
[1048] Imported water is seen as the fastest and most viable alternative to sustain the basin. NMMA Technical Committee, 6th Annual Report. 2013.
[1049] SMVMA 2013 Annual Report. See also Michael Winn, Santa Maria adjudication. http://www.vineyardteam.org/files/resources/Winn,%20Michael.pdf.
[1050] *City of Santa Maria v. Adam et al.* 2012; NMMA Technical Committee, 6th Annual Report 2013.
[1051] Saxton, Steven. Lessons from the Santa Maria Basin Adjudication, Overlying Users Perspective. 2013. http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.
[1052] Orcutt Community Plan EIR, Safe Yield estimate compiled by P&D from recent reports by the Santa Barbara County Water Agency (Ahlroth 1992; Naftaly 1994), the Groundwater Resources section of the County Conservation Element and various unpublished county letters. http://longrange.sbcountyplanning.org/planareas/orcutt/documents/OCP%20EIR/OCP%20EIR%20Volume%201/5.6%20Water%20Resources.pdf.
[1053] Resource Capacity Study, Water Supply in the Nipomo Mesa Area. November 2004.
[1054] 2013 NMMA Annual Report.
[1055] NCMA 2013 Annual Monitoring Report.
[1056] SMVMA 2013 Annual Report.
[1057] *Santa Maria Valley Water Conservation District v. City of Santa Maria et al.* 2008. See also Michael Winn and Steven Saxton.
[1058] *Santa Maria Valley Water Conservation District v. City of Santa Maria et al.* 2008. See also James Markham. 2013. http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.
[1059] 2014 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies and Disposition, Santa Maria Valley Management Area. http://www.cityofsantamaria.org/home/showdocument?id=11806.
[1060] Resource Capacity Study Water Supply in the Nipomo Mesa Area. November 2004. http://www.slocounty.ca.gov/assets/pl/pdfs/nipomo+mesa+water+rcs.pdf.pdf.
[1061] NMMA 4th Annual Report CY 2011 Finding 4. NMMA 5th Annual Report CY 2012, Finding 3.
[1062] Ibid. Section 7.3.1 Climatological Trends.
[1063] Which is the sum of 10,729 AF for urban plus the allocation for applied irrigation and rural area of 4,970 AF. NCMA 2013 Annual Monitoring Report. 2014. http://pismobeach.org/DocumentCenter/View/42377.
[1064] Fugro Consultants, Inc., Northern Cities Management Area, 2013 Annual Report. https://ca-pismobeach2.civicplus.com/DocumentCenter/View/42377.
[1065] State of California Regional Water Quality Control Board Central Coast Region Draft Staff Report for Regular Meeting of May 28–29, 2015. http://www.waterboards.ca.gov/centralcoast/board_decisions/tentative_orders/2015/windset_farms/staff_report.pdf.
[1066] SWRCB 1995; DWR 2002.
[1067] Santa Barbara County 2011 Groundwater Report.
[1068] Fugro Consultants, Inc. 2014. "Northern Cities Management Area 2013 Annual Monitoring Report."
[1069] http://santamariatimes.com.
[1070] Michael Winn. 2013. www.vineyardteam.org/files/resources/Winn,%20Michael.pdf.
[1071] See Case Study 2: Orcutt, Northern Santa Barbara. http://waterinthewest.stanford.edu/sites/default/files/Case%20Study%202.%20Orcutt.pdf.
[1072] 2014 Annual Report of Hydrogeologic Conditions, Water Requirements, Supplies and Disposition Santa Maria Valley Management Area. http://www.cityofsantamaria.org/home/showdocument?id=11806.
[1073] NMMA Technical Committee. 6th Annual Report Calendar Year 2013, Section 7.1.2 Hydrologic Inventory.
[1074] They were highest in the eastern portion and about five feet above sea level along the shoreline. Fugro Consultants, Inc. 2014.

[1075] NMMA 5th Annual Report. 2012. NCMA 2013 Annual Monitoring Report. April 28, 2014. Project No. 04.62130129.
[1076] Garner, Eric. 2013. http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.
[1077] James Markham. 2013. http://www.acwa.com/content/thrs_930am-attorneys_lessons-santa-maria-groundwater-adjudication.