MONITORING PROTOCOLS

GROUNDWATER MANAGEMENT PLAN OBJECTIVES, MANAGEMENT ACTIVITIES, AND MONITORING PROTOCOLS

Management Plan Objective 1: Understand the Basin Hydrology

Monitoring

Data Collection

Well Permitting and Registration

Extraction Measurement

GW Extraction Form Correction and adoption by the BOD

Self-reporting corroboration

Computer Modeling

Management Plan Objective 2: Protect and Manage the Basin

Water Exports from the Basin

Conjunctive Water Use Management

Develop Conjunctive Use Policy for coordination with CMWD

Establishment of Thresholds and Triggers

Water levels at key wells during springtime-high (proxy for basin wide storage)

Water quality (elevated chloride, sulfate, and odor issues)

New Well Location and potential interference
Well performance (sanding, scaling, aeration, cavitation, and dry issues) .................................. 20
Peak water level known and reported by June meeting each year: ensuing actions 20
Soft Allocation ......................................................................................................................... 20
Establish springtime high storage ......................................................................................... 21
Recommend total extraction by well ....................................................................................... 21
Recommend extraction totals per parcel .............................................................................. 21
INSIDE – INvasive Species IDentification and Eradication ..................................................... 21
Management Plan Objective 3: Encourage Supporting Activities .......................................... 21
Data Collection and Storage ................................................................................................. 21
Additional depth-discrete monitoring wells .......................................................................... 21
Additional data loggers ......................................................................................................... 22
Water Conservation ............................................................................................................. 22
Contour farming practice group ......................................................................................... 22
Abandoned Wells .................................................................................................................. 22
Abandoned Well Inspection program ................................................................................... 23
Artificial Recharge ............................................................................................................. 23
Lower basin spreading grounds – Libbey Bowl ..................................................................... 24
Watershed Management ........................................................................................................ 25
Stakeholder outreach ............................................................................................................ Error! Bookmark not defined.
List of known interested groups .......................................................................................... Error! Bookmark not defined.
Partner agency collaboration ................................................................................................. Error! Bookmark not defined.
Department of Water Resources ......................................................................................... Error! Bookmark not defined.
State Water Resources Control Board ............................................................................... Error! Bookmark not defined.
Upper Ventura River Groundwater Basin Sustainability Agency ........................................ 25
Co-operation Agreement (Inter-basin) with UVRBGSA ......................................................... 25
Management Plan Objective 4: Communicate Effectively .................................................... 25
Advisory Committees ............................................................................................................ 25
Annual Report ........................................................................................................................ 26
Website ................................................................................................................................. 26
Mailers ................................................................................................................................. 26
Monthly Meetings ................................................................................................................ 26
Newspaper outreach ............................................................................................................ 26
Presentations at stakeholder meetings .................................................................................. 26
Ojai Day participation ................................................................................................................................................. 26
Office, staff, and consultant access ................................................................................................................................. 26
Management Plan Objective 5: Administrate Efficiently ................................................................................................. 26
Funding ............................................................................................................................................................................. 26
Link Budget with extraction fees ........................................................................................................................................ 26
Development of fixed cost base wellhead fee and extraction rates .................................................................................. 27
SGMA Authorities and OBGMA Act ................................................................................................................................. 27
Recogniton and regulation of De Minimis Users ............................................................................................................... 27
Board Composition .......................................................................................................................................................... 27
Seat vacancy ...................................................................................................................................................................... 27

DESCRIPTION OF OJAI BASIN AND EXISTING CONDITIONS .................................................................................. 28
Ojai Basin Geology ............................................................................................................................................................ 30
Ojai Basin Groundwater Recharge .................................................................................................................................. 31
Ojai Basin Groundwater Storage and Key Water Levels ............................................................................................... 35
Ojai Basin Groundwater Extractions ................................................................................................................................ 39
Ojai Basin Groundwater Natural Discharge .................................................................................................................... 41
Instream flow studies and “requirements” ........................................................................................................................ 41

Summer pools at San Antonio Creek .................................................................................................................................. 42

Separation of deep well production aquifers from shallow stream-flow contributing aquifers .......................................................................................................................................................................................... 42

DDMW in southern portion of the Basin .......................................................................................................................... 42

Shallow Spreading grounds in City “Libbey Bowl” recharge .......................................................................................... 42

Latitude-Longitude Daylight And Infiltration (L^2DAI) ..................................................................................................... 42

Ojai Basin Groundwater Quality .......................................................................................................................................... 42
Introduction to Administrative Information

In September, 2014, Governor Jerry Brown signed into law a package of three bills (AB 1739, SB 1168, and SB 1319) known as the Sustainable Groundwater Management Act (“SGMA”). The SGMA provides a framework for sustainable management of groundwater supplies by local authorities, with a limited role for state intervention only if necessary to protect the resource.

The act requires the formation of local groundwater sustainability agencies that must assess conditions in their local water basins and adopt locally-based management plans. The SGMA provides local agencies with the tools and authority to require registration of groundwater wells, measure and manage extractions, require reports and assess fees, and request revisions of basin boundaries, including establishing new subbasins.

High- and medium-priority basins, as defined by the State of California Department of Water Resources (“DWR”), must adopt groundwater sustainability plans within five to seven years, depending on whether the basin is in critical overdraft. Statewide groundwater basins are prioritized based on eight criteria: (1) overlying population, (2) projected growth of overlying population, (3) public supply wells, (4) total water wells, (5) overlying irrigated acreage, (6) reliance on groundwater as the primary source of water (7) impacts on the groundwater, including overdraft, subsidence, saline intrusion, and other water quality degradation, and (8) any other information determined to be relevant by the DWR.

The Ojai Basin Groundwater Management Agency (“OBGMA” or “Agency”) has worked to preserve the quantity and quality of groundwater in the Ojai Valley Groundwater Basin (“Ojai Basin”) for sustainable long-term use since the agency’s establishment in 1991. Enabling Legislature is referred to herein as the “OBGMA Act.” Since the OBGMA already performs many of the tasks required by the SGMA, and can demonstrate sustainable conditions for a 10-year period, the Ojai Basin is well suited to meet SGMA requirements by providing this Alternative Groundwater Sustainability Plan (“AGSP”) under Section 10733.2.

Per OBGMA Resolution No. 2014-4, adopted by its Board of Directors on December 4, 2014 (copy included as Appendix A), the OBGMA is designated as the Groundwater Sustainability Management Agency (“GSMA”) for the Ojai Groundwater Basin.

To comply with SGMA, the OBGMA issued its December 23, 2016 “Report Supporting Alternative Demonstration Made Pursuant to Water Code 10733.6(b)(3). The alternative report demonstrated the conformance with the principles of SGMA and lack of undesirable results due to OBGMA’s implementation of past groundwater management plans.
GWMPs must contain a physical description of the basin, including groundwater levels, groundwater quality, land subsidence, information on groundwater-surface water interaction, data on historical and projected water demands and supplies, monitoring and management provisions, as well as a description of how the plan will affect other plans, including city and county general plans. GWMPs will be evaluated every five years.

General Information

Management Plan Executive Summary
This GWMP builds on the demonstration that the Ojai Basin has operated for decades in a sustainable fashion with no undesirable results observed over the long-term basin management period. In keeping with the SGMA requirements, the ten-year period of 2006 to 2016 was presented as a key metric in demonstrating sustainable operations, though monitoring for the better part of the past century is recognized as valuable information as well. The driving force behind groundwater conditions in the Ojai Basin is precipitation as rainfall; groundwater levels, amount of groundwater in storage, surface water flow, well production, etc. are all tied to the unifying precipitation input component. A long-term average safe yield of about 5,000 acre-feet per year is typically more than extracted via pumping over recent years.

Reference List

California Department of Conservation, California Geological Survey (CGS). 2003. Seismic Hazard Zone Report for the Matilija 7.5-Minute Quadrangle, Ventura County, California


Casitas Municipal Water District, 2016. O. mykiss survey data summarized for different life history stages as presence-absence during 2008-2016 for California Department of Fish Wildlife survey reaches in San Antonio Creek. (September 2016)


Tetra Tech, 2009, Ventura River HPSF model


VCWPD, 2008, 2008 Groundwater Section Annual Report, Ventura County Watershed Protection District, Water & Environmental Resources Division
VCWPD, 2009, 2009 Groundwater Section Annual Report, Ventura County Watershed Protection District, Water & Environmental Resources Division

Ventura County, Ventura County Plan, 2016 http://vcrma.org/planning/plans/general-plan/index.html


Agency Information

Agency Background

The OBGMA Board of Directors (“Board”) consists of five members and their alternates. The five seats comprise representatives of each of the following entities: Ojai Water Conservation District, City of Ojai, Golden State Water Company, Casitas Municipal Water District, and the mutual water companies (Gridley Road Water Group, Hermitage Mutual Water Company, Senior Canyon Mutual Water Company, and Siete Robles Mutual Water Company). Regular attendance at each of the Board meetings is required to form a quorum and attend to Board activities. Figure 1 presents a map of the OBGMA area of purview with the various water agency boundaries.

Based upon the studies conducted by and for the OBGMA, and due to a relatively wet period from the mid-1990s through 2010, the water supplies and demands in the basin are largely in balance and capable of meeting the annual demands of overlying landowners and in-basin water users. However, after a series of dry years such as from 2011 to the present, water levels in some wells in the basin may decline to the point where an alternative water source must be used. In part, that is why water users presently import some 3680 acre-feet (1985 to 2012 average) of Lake Casitas water from the Casitas Municipal Water District (“CMWD”) into the basin annually, or about half of the total irrigation demand.

If Lake Casitas water was not available or not used in a series of dry years, considering the present understanding of the hydrology of the basin and the existing water uses, a number of negative consequences are possible. These include shallower and peripheral wells would probably not produce water, pumping lift costs to pump groundwater would be excessive, some wells would produce excessive amounts of sand, water quality of pumped groundwater would likely be compromised, and other detrimental effects associated with a reduced storage in the Ojai Basin.

Through the agency's efforts, many stakeholders better understand these conditions, and the importance of conjunctive use in action, whereby groundwater is used when available and Lake Casitas water is relied upon when basin storage is minimized. This practice has a somewhat self-regulating effect on the Ojai Basin, as the charges for purveyor water encourage conservation and good stewardship of the groundwater resource.

Therefore, the focus of the Agency's efforts is on protecting and preserving the basin groundwater resource for in-basin use, and guarding against export of water from the basin.

Two critical facts underline the importance of the OBGMA and this groundwater sustainability plan.

**Chronic drought is a climatic reality.** Over the last 100 years there were several serious droughts, and climate change may bring an increase in the frequency and intensity of
years with below the historic average rainfall. Local precipitation, the only source of water in the Ventura River watershed, is predicted by several models to decrease in annual averages. Extended periods of drought are likely.

The Ventura River watershed is depended upon by numerous competing interests. Most water allocated to the various water purveyors in the watershed is already claimed. It has been predicted that the Lake Casitas could go dry in a long-term drought. Existing wells already in the Ojai Basin are producing groundwater at a rate that is considered to be at or near the safe yield of the basin, and it is predicted (with historical precedence) that in a long term drought a significant number of the existing wells will go dry. Stakeholders in the Ojai Basin can depend on no economically reasonable new source of water.

The OBGMA has been given the responsibility for managing groundwater in the Ojai Basin and for conserving that groundwater in conjunction with its constituents, the well operators in the basin. The intent of this plan is to avoid or minimize adverse economic and social impacts while maximizing the long-term sustainable use of our valuable but limited water supply.

OBGMA is committed to a continued long term study of annual Basin recharge and sustainable yield in relation to the groundwater discharge rates to San Antonio Creek from shallow aquifers within the basin.

**OBGMA Mission Statement**

It is the mission of the Ojai Basin Groundwater Management Agency to preserve the quantity and quality of groundwater in the Ojai Basin in order to protect and maintain the long-term water supply for the common benefit of the water users in the Basin.

The mission of the OBGMA is derived from its enabling legislation, The Ojai Basin Groundwater Management Agency Act, which became law in 1991. The act was approved as a response to the needs and concerns of local water agencies, water users, and well owners of the Ojai Basin. The Agency was established in the fifth year of a drought, amidst concerns for potential Ojai Basin overdraft.

The mission is in keeping with the history of the Ojai Basin and the circumstances existing when the Agency was formed. Since that time, although there have been some good water years and the Ojai Basin has continued to provide sufficient water for its well owners, competition for scarce water resources in Southern California and Ventura County is ever expanding, water resource planning is intensifying, and the importance of the OBGMA mission is even greater today.
Fundamental Principles

The GWMP is very much like a General Plan for a City or a County. It is the document that governs the actions of the agency throughout its implementation horizon. Several “Fundamental Principles,” rooted in California Water Law and practice, experience, and local conditions, are presented here as further background to the guidance of this GWMP.

All water in the State of California, both surface and groundwater, is owned by the State and held in trust for the people of the State. (Water Code Section 102, enacted by Stats, 1943, Ch. 368.)
All water, both surface and groundwater must be put to beneficial use and that no waste or unreasonable method of use is permitted. (California Constitution Article 10, Water Code Section 100 and 100.5)

All water rights, both surface and groundwater, are usufructuary rights and are not property rights. The right is only to use the water for beneficial purposes, not actual ownership of the “body” of water. (California Constitution, United States Supreme Court (United States v. Willow River Power Co., 324 U.S. 499, 510 (1945), Water Code).

Overlying groundwater rights are correlative rights (tenancy in common) and are to be protected - the extraction of groundwater by one property owner cannot infringe upon or harm another property owner’s right to extract groundwater. (English, American, and California Common Law Principles, California Constitution Article 10, Water Code, Katz v. Walkinshaw 1903, the Doctrine of Correlative Water Rights, OBGMA Act 1991).

The health of the groundwater basin (quantity, quality, availability, and sustainability) is the responsibility of all users and it is managed by the GSA. (Ojai Basin Groundwater Management Act 1991, Sustainable Groundwater Management Act 2014).

**Functional Equivalency**

This GWMP update serves as a functionally equivalent document to a groundwater sustainability plan in that the Ojai Basin has demonstrated sustained yield as a medium priority basin, never been in overdraft, nor experienced any undesirable results ...etc

**Sustainable Groundwater Management**

In September of 2014, the California Legislature enacted comprehensive legislation aimed at strengthening local control and management of groundwater basins throughout the state. Known as the Sustainable Groundwater Management Act of 2014, the legislation provides a framework for sustainable management of groundwater supplies by local authorities, with a limited role for state intervention when necessary to protect the resource.

The Sustainable Groundwater Management Act of 2014 (“SGMA”) requires that all groundwater basins in California be managed sustainably. (Water Code §§ 10720.1(a).) 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.” (Water Code §§ 10721(v).)

SGMA uses the term “sustainability goal,” defined as the “implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield.” (Water Code § 10721(u).) A basin’s “sustainable yield” is calculated as “the maximum quantity of water . . . that can be withdrawn annually from a groundwater supply without causing an undesirable
result.” (Water Code § 10721(w).) SGMA defines “undesirable result” as any of the following effects:

- Chronic lowering of groundwater levels (not including overdraft during a drought, if a basin is otherwise managed properly);
- Significant and unreasonable reductions in groundwater storage;
- Significant and unreasonable seawater intrusion;
- Significant and unreasonable degradation of water quality;
- Significant and unreasonable land subsidence; and
- Surface water depletions that have significant and unreasonable adverse impacts on beneficial uses. (Water Code § 10721(x).)

**OBGMA Compliance**

The Ojai Basin Groundwater Management Agency (“OBGMA”) is one of fifteen (15) special act districts created by statute to manage groundwater within its statutory boundaries. Pursuant to its enabling legislation, the OBGMA has been managing the quantity and quality of groundwater in the Ojai Groundwater Basin since 1991. These management efforts have resulted in protection and maintenance of the long-term water supply for the common benefit of all water users in the Basin. As a result, the Ojai Basin has been operated within its “sustainable yield” for the past several decades with no evidence of “undesirable results.”

SGMA identifies OBGMA as an “exclusive local agency” within its statutory boundaries for purposes of implementing the requirements of the Act. (Water Code § 10723(c)(1).) This affords OBGMA the opportunity to demonstrate to the California Department of Water Resources (“DWR” or “Department”) that the Ojai Basin is already being sustainably managed and has been operating within its “sustainable yield” for a period of at least 10 years. SGMA authorizes OBGMA to make this demonstration as an alternative to and in lieu of preparing a Groundwater Sustainability Plan. (Water Code §§ 10723(c)(3); 10733.6(b)(3).) OBGMA has elected to proceed with such a demonstration, and has presented the key elements and received verbal comments on its proposed approach at four (4) public forums:

- Association of Water Agencies of Ventura County – Water Issues Committee, October 18, 2016
- OBMGA Board Meeting, October 27, 2016
- Ventura Watershed Council, November 3, 2016
- City of Ojai City Council Meeting, November 17, 2016
- OBGMA Meeting approving submittal December 16, 2016
- Submittal to DWR SGMA portal December 27, 2016

**Report Prepared Supporting Alternative Demonstration**

Water Code § 10733.6(b)(3) requires an analysis of Ojai Basin conditions that demonstrates the Basin has operated within its “sustainable yield” over a period of at least 10 years. The analysis must include a report prepared by a registered professional engineer or geologist who is licensed
by the state. In compliance with Section 10733.6(b)(3), OBGMA has sanctioned such a report. (Report Supporting Alternative Demonstration Pursuant to Water Code § 10733.6(b)(3) )
http://sgma.water.ca.gov/portal/service/alternativedocument/download/240  The Report demonstrates the Ojai Basin has operated within its “sustainable yield” for the past several decades with no evidence of “undesirable results.”

DWR is required to complete its evaluation of OBGMA’s Report Supporting Alternative Demonstration Pursuant to Water Code § 10733.6(b)(3), and issue a written assessment either approving or disapproving the Report, within two years of its submittal date. The written assessment will be posted on the Department’s website. (23 CCR § 355.2.)

GROUNDWATER MANAGEMENT PLAN OBJECTIVES, MANAGEMENT ACTIVITIES, AND MONITORING PROTOCOLS

The OBGMA is required by law to have a sustainable Groundwater Management Plan (“GWMP”) to guide its operations. The initial GWMP was prepared and published in 1995. An update in 2007 provided additional information based on studies performed for the OBGMA by contracted hydrogeologists and engineers, on input from well owners and water users, and on recommendations made by the Agency’s advisory committee and by the DWR, which led to a better understanding of the basin’s hydrogeology, demands, and hydrologic fluctuations that affect the stakeholders.

The GWMP consists of five broad goals, each with a number of action elements, that provide the structure to the OBGMA’s management efforts and will be adopted for management objectives within this GWMP. Detailed action elements evolve as these efforts continue to progress. Approved elements will be implemented in the form of rules, regulations, or ordinances. Prior to implementation, additional criteria to guide these actions will be developed in a public process by the Board and added to this sustainability plan. Some elements, where noted, require more study and public review before specific implementation actions are approved.

Management Plan Objective 1: Understand the Basin Hydrology

The OBGMA must have a comprehensive understanding of the hydrology of the basin under its jurisdiction in order to carry out its mission for the sustainable long-term beneficial use of groundwater. To improve this understanding the Agency implements the following elements:

Monitoring.
The OBGMA has at its disposal several studies of the basin hydrology, including conceptual models. These models must be tested and updated regularly under a continuing monitoring program to serve as a basis for informed decision-making. Monitoring will also be conducted to
identify changing conditions and implement management programs when needed. Monitoring includes:

1. Surface water entering the basin
2. Recharge of the basin from rainfall
3. Stream flow seepage
4. Evapotranspiration
5. Discharge from the basin as surface flow at San Antonio Creek and subsurface flow
6. Extractions from the basin via public and private wells

Monitoring results are shared annually, at a minimum, by the Agency with owners, water users and the public.

Data Collection.
Previous studies identified significant gaps in the current monitoring activities in the basin. Specific areas identified for increased data collection are basin water level and water quality monitoring in stratified aquifers known to be present in the Ojai Basin based on aquifer testing and geophysical log correlations. In cooperation with the OBGMA, the Ventura County Watershed Protection District (“VCWPD”) may measure key wells routinely for water levels and water quality. Permission from the well owners is obtained by the OBGMA prior to monitoring if not already being conducted by Ventura County. OBGMA’s high-frequency temporal readings via automated data loggers in six key wells provides invaluable information with respect to the annual high groundwater levels, annual low water levels, and recharge/recession rates. Additional data collection actions, including surface water discharged from San Antonio Creek and surface water inflow into the Basin, has been assessed and will be considered in greater detail in the future. These data are analyzed and reported annually by the OBGMA. All results from each well measurement are shared with the respective well owner via either direct communication and/or provision of any Agency publication that contains such data.

Well Permitting and Registration.
The OBGMA adopted Ordinance No. 94-01 to require all wells in the Ojai Basin to be registered with the Agency. All new extraction facilities constructed within the OBGMA boundary must be registered with the Agency and must obtain a no-fee permit from the Agency prior to the issuance of a Well Permit by the VCWPD. Operators of extraction facilities shall register all wells by completing and returning the OBGMA Registration Form to the Agency within thirty calendar days following completion of construction and prior to any groundwater extraction. No extraction facility may be operated or otherwise utilized so as to extract groundwater within the boundaries of the Agency unless that facility is registered with the Agency, metered and permitted and all extractions reported to the Agency as required.

As of 2014, there are 182 active wells in the Ojai Valley Groundwater Basin, 64 of which have been drilled since 2000. The OBGMA will continue to seek to have all wells in the basin registered, under a formal agreement with Ventura County to ensure that their well records are
made available to the Agency and that any new well permits are registered with the Agency. The OBGMA is also planning to obtain delegated authority from the State Water Resources Control Board, Water Rights Division to handle groundwater recordation within OBGMA area of jurisdiction.

**Extraction Measurement.**

The OBGMA is mandated by its enabling act to monitor groundwater extractions. Operators extracting groundwater from the Ojai Basin must file a quarterly extraction report in January, April, July, and October of each year (based on the October 1 to September 30 water year) that accurately states the amount of water extracted during the prior quarter, in addition to all other relevant information requested on the OBGMA Groundwater Extraction Form, signed under penalty of perjury by the operator. A measurement of the amount of water extracted from the Ojai Basin is important, along with precipitation, groundwater recharge, and water level monitoring, to understand its hydrology and to implement effective management, such as to maintain a balance between water use and replenishment of supply. The OBGMA is also committed to implementing an effective, reliable method of monitoring well extractions. Currently, most well operators are required to report their water extractions, as precisely as possible, using waterflow measuring meters.

The OBGMA charges a $5 fee per quarterly reporting period for the recordation of groundwater extraction. Any person who intentionally violates the Agency ordinances is guilty of an infraction and may be required to pay a fine not to exceed $500. Any person who negligently or intentionally violates this Ordinance may also be liable civilly to the Agency for a sum not to exceed $1000 per day for each violation, in addition to any other penalties that may be prescribed by law.

*GW Extraction Form Correction and adoption by the BOD*

OBGMA continually updates its extraction forms to the highest and best means for collecting reliable and defensible data from pumpers. In 2015, OBGMA switched from semi-annual reporting to quarterly reporting, with the timing consistent with the Ventura County water year (October 1 through September 30).

**Self-reporting corroboration**

Because extraction forms are self-reporting, OBGMA has solicited photographs of well meters from pumpers who need clarification on their extracted volumes. This program allows the OBGMA to retain a record of extraction, which can be field-verified. Over the course of the year, OBGMA will send an intern or staff or consultant to field verify the production rates of key wells or wells that may be flagged as having higher or lower than “normal” extraction volumes. It is estimated that as many as 10 percent of wells may be spot checked in a given year, with still or video footage of meters in action.
Computer Modeling.

The OBGMA contracted Daniel B. Stephens & Associates, Inc. (“DBS&A”) to perform predictive model simulations to assess anticipated groundwater elevations following drought conditions in water years 2012 through 2014. The Ojai Basin model advances basin understanding and is used by the OBGMA in groundwater management planning. The model was developed by DBS&A for OBGMA, with funding from a DWR Local Groundwater Assistance grant and cost sharing by the OBGMA. The Ojai Basin model was developed using the MODFLOW-SURFACT computer code, which is an upgraded and proprietary version of the widely used U.S. Geological Survey (“USGS”) MODFLOW code. The Ojai Model is known as a Distributed Parameter Watershed Model (“DPWM”), which is an analytical watershed model developed by DBS&A used to estimate the transient distribution and magnitude of groundwater recharge. Most recently, the model calibration was updated to run from April 1, 1970 through December 31, 2013.

Management Plan Objective 2: Protect and Manage the Basin

In order to preserve the groundwater in the Ojai Basin, the OBGMA will take direct management actions based upon a factual knowledge of the basin and the needs and concerns of water users and well owners in the basin. The Agency implements the following elements:

Water Exports from the Basin.

The OBGMA’s enabling legislation mandates that no groundwater shall be exported from the Ojai Basin except under permit issued by the Agency in full compliance with the policy and intent of the law. The law mandates the preservation of the groundwater for the common benefit of water users within the basin. Based upon present hydrologic facts and circumstances, the OBGMA finds that there is no surplus water available for export. Under natural conditions, when surplus water is present in the basin, water flows under artesian pressure from wells and from exposed aquifers into San Antonio Creek along gaining reaches of the stream. Because this surplus has value to downstream stakeholders, and the surplus conditions are ephemeral (occurring only during years of heavy rainfall such as 1993, 1995, 1998, and 2005) and can change rapidly to conditions of deficiency, it is likely that surplus conditions will not exist in the foreseeable future.

Nevertheless, the Agency will review the existence of surplus from time to time, as dictated by the receipt and review of its annual report or as new, reliable information becomes available. The OBGMA will establish the conditions and criteria under which it would contemplate granting a permit for export, should a surplus be determined to exist. These conditions and criteria will include at least the following:

i. The applicant for a permit will bear the full financial and regulatory and legal burden of demonstrating that a surplus of water exists which, if exported, would not cause harm to any existing groundwater user in the basin, now or in the future.
ii. The export permit will be suspended in the event of a declared water shortage, basin storage threshold level, or upon other pre-established conditions.

iii. All export permits will contain conditions and criteria that will otherwise protect the in-basin users to the fullest extent allowable under the law.

**Conjunctive Water Use Management.**

Conjunctive water management involves the coordinated use of ground and surface water supplies to use the overall water supply more efficiently for improved use and protection. The purposes of conjunctive management are to coordinate water resource use in ways that reduce exposure to drought, to maximize water availability, to protect water quality, and to sustain ecological needs and aesthetic and recreational values. Other potential benefits are improved security of water supplies, reduced reliance on costly and environmentally disruptive surface water impoundment and distribution systems, and enhanced protection of aquatic life and habitat.

The CMWD is the primary water supplier in the Ventura River Watershed, providing water to both water resale agencies and retail customers. The City of Ventura is Casitas’ largest customer, and Lake Casitas water serves as one of the main sources of water for the City of Ventura. One of CMWD’s important functions is to serve as the “backup” water supply for a number of customers, including water suppliers and farmers, when groundwater supplies become depleted. The high-quality lake water is blended with poorer quality groundwater by some water purveyors to improve water quality and extend supplies. The annual variability of rainfall in the Ventura River Watershed affects both the total amount of water used each year as well as the relative amounts of surface water versus groundwater used. In very wet years, groundwater use goes up and demand on Lake Casitas goes down; in very dry years the reverse happens. Water demand in the watershed also varies seasonally. Demand is greater in the drier months of summer and fall, and lesser in the wetter months of winter and spring.

Lake Casitas was constructed in 1959 by the United States Bureau of Reclamation and designed to hold 254,000 acre-feet of water. The long-term average annual demand on Lake Casitas is about 17,500 acre-feet, of which about 3680 acre-feet (or 21%) is typically imported to the Ojai Basin. Water from the Ventura River comprises a little less than half of the inflow into Lake Casitas; drainage from the reservoir’s surrounding watersheds comprises the rest. A significant amount of water is lost to evaporation from the surface area of Lake Casitas. CMWD takes daily evaporation pan measurements. Between 1959 and 2010, an average of nearly 8000 acre-feet per year evaporated from the lake.

*Develop Conjunctive Use Policy for coordination with CMWD*

The OBGMA will establish a conjunctive use policy with CMWD for surface water use and groundwater extraction largely in keeping with target volumes and established thresholds and triggers.
Establishment of Thresholds and Triggers.

Groundwater within the Ojai Basin is considered largely in balance, despite groundwater levels and storage volumes that can fluctuate dramatically from one year to the next. Water levels in the basin fluctuate considerably in response to groundwater extraction and recharge from seasonal rainfall. Review of precipitation, accumulative departure curves, and water level responses over time indicate that the basin has the hydrologic characteristics of quick discharge and quick recharge, when precipitation occurs. Typically, conditions in the watershed cycle between very wet years, which bring more water than drainage networks can hold, and multi-year dry periods, which strain available water supplies. This variability in supply poses significant challenges to long-term water supply management.

There is a great variation in location and depth of the wells in the basin, and their relative access to groundwater at low points in the hydrologic cycle. There is also variation in water quality in different parts of the basin. Based on aquifer testing, there is a significant amount of overlap of cones of depression created in the potentiometric surface by pumping wells. These features must be considered when establishing action levels of groundwater elevations or stream flow.

The OBGMA will establish multi-tiered basin storage thresholds that trigger special action by the Agency to assure protection of groundwater supplies in the basin as outlined in the above table. Storage thresholds will take into account the needs of the water users, overlying landowners and well operators in the basin, as well as the existing conjunctive relationship between groundwater from within the basin and Lake Casitas water imported into the basin. When groundwater levels or quality are low, the Agency will notify users to rely more heavily upon Lake Casitas water. This creates a somewhat self-regulating effect on the Ojai Basin, as the charges for purveyor water encourage conservation and good stewardship of the groundwater resource.
**Storage and Action Table**

<table>
<thead>
<tr>
<th>Stage</th>
<th>Casitas condition (WEAP elevation Stages)</th>
<th>Ojai Basin Condition</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt;50% capacity &gt;117,881 AF</td>
<td>&gt;90% Capacity &gt;80,000 AF Key Well WL spring High shallower than 50 ft</td>
<td>Groundwater first Excess of Basin Safe yield okay</td>
</tr>
<tr>
<td>2</td>
<td>40-50% capacity 118,881 AF - 95,104 AF</td>
<td>81% to 90% capacity: At or above long-term average in storage 72k to 80kAF in storage Key Well between 50 and 100 feet to water</td>
<td>Groundwater remains primary, target extraction of safe yield, prepare for reductions</td>
</tr>
<tr>
<td>3</td>
<td>30-40% capacity 95,104-71,328 AF</td>
<td>64000AF to 72k AF in basin, 70 to 80 % capacity, Key Well depth to water at Spring high: 120 to 180</td>
<td>20% reduction in pumping, targeting 4,000 acre feet annual extraction</td>
</tr>
<tr>
<td>4</td>
<td>25-30% capacity 71,328 AF - 59,440 AF</td>
<td>58500 AF to 64000 AF in basin, Spring high depth to key well water 180 to 250 ft</td>
<td>20% additional stage reduction in pumping targeted, 3,000 AF extraction annually</td>
</tr>
<tr>
<td>5</td>
<td>&lt;25% capacity 59,440 AF - 957 AF</td>
<td>Less than 50,000 AF storage spring time high; DTW in key well &gt;250 ft</td>
<td>20% additional stage reduction, 2,000 AF extraction target equal to recharge sans rain</td>
</tr>
</tbody>
</table>

Implementation of the actions in the above table are currently on a voluntary basis. However, they may be implemented in a compulsory fashion by Ordinance at the discretion of the OBGMA Board under authority granted by SGMA and the OBGMA Act. Following the annual high point in water level storage, established at its June meetings, the board will issue letters to pumpers informing them of the state of the basin and recommended – or compulsory – extraction volumes relative to past years’ reported extractions. The highest use constituents (estimated top 25) will be given target volumes specific to their wells.

Special actions will also include mandatory conservation measures that must be implemented at those points. The Agency will develop the procedures and pass the ordinances needed to put the conservation measures into effect. This will be done with full communication with, and the involvement and understanding of, the basin well operators. Additional special actions may be triggered on a well-by-well basis in response to high extraction rates. To do so, the Agency will
establish a database that contains the typical use for each registered well. Principal monitoring thresholds will include:

- **Water levels at key wells during springtime-high (proxy for basin wide storage)**
- **Discharge points of groundwater to surface water in San Antonio Creek**
- **Water quality (elevated chloride, sulfate, and odor issues).**

**New Well Location and potential interference**

OBGMA, as responsible agency for well location, establishes setbacks from contaminant sources per Water Well standards and uses knowledge of basin properties to recommend separations from existing wells.

When OBGMA new well permit applications are received, staff and consultants will review for potential interference issues and ensure that unreasonable overlapping cones of depression of the water table will not be created by adjacent wells pumping.

**Well performance (sanding, scaling, aeration, cavitation, and dry issues)**

State Well #04N/22W-05L08S is a key well monitored for water levels by Ventura County, with data available beginning in 1949. The historic low in basin storage (about 50% of maximum capacity) was in 1951 during a significant drought and before the current practice of conjunctive use, including CMWD water imports, was commonplace. This nadir is a significant threshold because the confined aquifer skeleton would have been maximally compacted at that time. Static water levels below that depth would increase compaction and potentially cause inelastic land subsidence and irrecoverable storage capacity in the Ojai Basin. To date, no surface or subsurface evidence of land subsidence has been observed in the Ojai Basin.

**Peak water level known and reported by June meeting each year: ensuing actions**

The OBGMA will measure the springtime-high water level (typically between March and June) at the key well annually. A percentage of groundwater storage in the basin will be estimated based on this water level. Based on the estimated volume of storage in the basin, the OBGMA will calculate a recommended extraction at each well from the typical usage records. This recommendation will be delivered to water users on June 30 each year. As shown on the SAT, for example, if the basin is estimated to be at 80% of its maximum storage capacity, the OBGMA will limit users to the typical average extraction. For every 20% reduction in estimated storage, the pumpers will be requested (or mandated by ordinance) to cumulatively reduce extractions by 1,000 acre feet annually.

**Soft Allocation**

Each year, OBGMA will evaluate the amount and intensity, as well as temporal distribution of rainfall, to establish a recharge quantity. From there, via a “soft allocation,” OBGMA will recommend the percentage of water that constituents should extract from the basin and
what percentage should be sourced elsewhere. This is summarized on the Storage and Action Table (SAT) above.

**Establish springtime high storage**
Based on the key well water levels, OBGMA will establish the date and time of the annual peak, as well as estimate the volume of water in storage in both acre feet and percentage of water in the basin.

**Recommend total extraction by well**
Hindcasting from previous years extraction reporting and

**Recommend extraction totals per parcel**

**INSIDE – INvasive Species IDentification and Eradication**
One of the largest means of output from the basin and especially along the riparian corridor is the evapotranspiration of shallow groundwater via native and non-native species. The non-native species tend to proliferate quickly and use much more water than natives. Hence, OBGMA is working on an INSIDE, an acronym for Invasive Species Identification and Eradication. Potential partners include the City, County, OVLC, the Green Coalition, and serval other entities.

**Management Plan Objective 3: Encourage Supporting Activities**

With its limited resources, the OBGMA must strive to achieve its goals in cooperation with and through the supporting activities of other agencies, and through the encouragement of supportive actions by water users. The Agency implements the following elements:

**Data Collection and Storage.**
Ventura County already routinely collects information on water levels and quality from wells in the Ojai Basin. In cooperation with the OBGMA, this effort is planned to continue to meet the monitoring needs of the basin. The OBGMA currently has dedicated data loggers that continually measure water levels and temperature at six key wells. This network will be expanded in the near future to include four additional loggers that will measure chloride concentrations in addition to temperature and water levels.

**Additional depth-discrete monitoring wells**
Depth discrete monitoring wells have been indispensable sources of data on the stratified water levels in Ojai and water quality. A new DDMW near the south side of the basin would provide information on deep water salinity, production zone use and storage, and shallow zone storage and discharge to surface water and habitats. One such well is planned in the Hansen Well Drilling yard, near the OBGMA offices. This would be a partner effort between the City, the OBGMA, the county, private constituents, and a funding agency.
Additional data loggers
Tremendous successes have been realized via the datalogger network. Additional loggers in new wells, especially depth-discrete monitoring wells, and a near discharge point shallow well, are planned. Water level, temperature, and conductivity are parameters that can be monitored via this network, and telemetry systems should be included in future settings to minimize time demands of data collection efforts.

Water Conservation.
The OBGMA encourages water conservation practices by both agricultural users and urban users. Market forces as well as good management practices are moving most agricultural users in the basin toward implementation of water conservation measures. Likewise, the Golden State Water Company (“GSWC”), the largest municipal supplier in the basin, has initiated a conservation plan approved by the Public Utilities Commission and supported by the City of Ojai. The OBGMA will encourage the development, publication and sharing of information with these users that will encourage the optimum use of water resources in the basin. Further, the Agency will seek the assistance of various local, state, federal, and private organizations to provide water conservation services and education programs for in-basin water users, including the pursuit of grant funds as available. The Agency will encourage in-basin water users to incorporate conservation practices and will consider development of a conservation plan in anticipation of drought conditions.

Contour farming practice group
As part of significant water conservation in agricultural settings, OBGMA encourages the establishment of contour farming and the ensuing slowing, spreading, and sinking of precipitation and runoff. Especially viable in the northern and eastern portions of the basin, where sandy and gravelly soils predominate, and slopes are steeper than in the central, western, or southern portions of the basin, OBGMA will work with partners such as the OWCD, the Citrus Research Board (CRB), among others, to educate and pursue grant funding to maintain existing groves in a fashion that favors groundwater recharge and grove health.
As an example, a not-uncommon practice among Ojai farmers is to remove 10 percent of the oldest fruit trees in a grove annually. When this is conducted, or a grove is replaced completely, new trees are planted in their place. If, with funding assistance from the OBGMA and its partners, the trees were planted along contour, then observations of runoff patterns and increased recharge, as well as water conservation, may be realized. Over a 10-year period, an entire grove could be replaced. Over time, the complete contour farming of the basin is realized.

Abandoned Wells.
Ventura County has a program to address abandoned wells as part of the water well ordinance. The OBGMA encourages a special program by the County to implement that program in the Ojai Basin to identify all abandoned wells, such as to determine if they pose any hazard to the
quantity or quality of groundwater in the basin, and to identify the actions needed and help obtain the resources to rectify any problems. The Agency supports evaluation of abandoned or idle wells to determine whether they can be converted to monitoring wells, rehabilitated, or properly destroyed in accordance with Ventura County standards.

**Abandoned Well Inspection program**

By permitting well construction, modifications and destructions, OBGMA will have an opportunity to review wells prior to changes in conditions. Some of these wells may be ideal candidates to convert to depth-discrete monitoring wells or other monitoring uses, as agreeable with the property owners, county, city, or funding agencies.

**Artificial Recharge.**

The artificial recharge of the basin from San Antonio Creek by the OWCD is strongly endorsed by the OBGMA. The Ojai Water Conservation District (“OWCD”) was involved in a program for enhanced percolation of stream flow at San Antonio Creek until 1985. This involved the diversion of surface flows into a series of percolation basins and was highly successful. The program was discontinued after the emergency construction of a debris basin on San Antonio Creek by Ventura County using Federal Emergency Management Agency funds, following the major “Wheeler Fire” in the watershed. The result of that debris basin was the destruction of most of the percolation basins.

To rehabilitate these spreading grounds, the OBGMA supports the San Antonio Creek Spreading Grounds Rehabilitation Project (“SA

C

SGRP”), one of the key projects of the Watersheds Coalition of Ventura County suite of applications. The SACSGRP is intended to increase groundwater storage and recharge in the Ojai Basin by rebuilding the abandoned diversion works, rehabilitating the existing spreading ground basins, and constructing aquifer recharge wells adjacent to San Antonio Creek, just southwest of the confluence of the Gridley and Senior Canyons. The project site is located on an 11.4 acre parcel of land owned by the VCWPD adjacent to San Antonio Creek, within the unincorporated portion of Ventura County, approximately 0.9 miles northeast of the City of Ojai. The project received $1,315,000 in grant funding from the State Water Resources Control Board through the Proposition 50 Integrated Regional Water Management Grant, which was awarded to the Watershed Coalition of Ventura County, and approximately $200,000 in local match contributions from the stakeholders. The stakeholder group is composed of the OBGMA, the OWCD, the GSWC, the CMWD and the VCWPD and was formed in January 2008 to collaborate on the implementation and maintenance of the project. The primary purpose of the project is to capture 25 cubic feet per second (cfs) of surface flow (when available) from San Antonio Creek to recharge groundwater in the Ojai Basin. This will result in greater groundwater storage and production from local water supply wells and less reliance on already-limited surface water supplies. A depth-discrete monitoring well (“SACSGRP DDMW”) was installed near the spreading grounds to monitor the effectiveness of this important groundwater project and obtain a better hydrogeologic understanding of the basin. The SACSGRP DDMW consists of a nested series of five 2-inch-
diameter PVC casings to discretely screen the intervals from 40 to 90 feet, 100 to 110 feet, 140 to 150 feet, 190 to 210 feet, and 255 to 295 feet below ground surface.

In later 2017, the final approval of regulatory agencies was granted to divert creek flow to the spreading grounds under permit. Though some maintenance will be necessary to mitigate debris from the Thomas Fire in the watershed, the winter and spring rains of 2017-18 may result in spread water via this system.

**Lower basin spreading grounds – Libbey Bowl**

Given the understanding that the upper stratigraphic portions of the basin near the City of Ojai contribute more directly to surface flow in San Antonio Creek than other portions of the basin, a collection of roof and hardscape water in a convenient location for shallow aquifer recharge (SHAQ) would benefit the basin discharge to the habitat and basins downstream.

A detailed feasibility study should be conducted, in partnership with the City, OBGMA, and a funding entity. Site selection, depths of excavations if needed, and multi-use considerations would all be essential components, in addition to hydrogeologic factors.

**Ojai Basin Desalter**

For decades, the deeper aquifers of the central portion of the Ojai Basin have been known to be saline in nature, with a high sodium chloride concentration potentially from evaporite deposits associated with drying lake beds on the order of 100,000 years ago. Today, several wells penetrate these deeper aquifers, which comprise a depth below 480 feet in well 4N/22W-6K12, below 505 feet in -6K13, below 590 feet in -6J7, 450 feet in -6H3.

Geophysical logs from -6H3 indicate high capacity aquifers from 510 to 700 feet, but of poor quality. Estimates of upwards of 10,000 acre feet of water in the basin may be comprised of these saline waters.

By using existing wells for sources that may not be usable untreated, running the water through a reverse osmosis or desalination facility, discharging of the brine to the Ojai Valley Sanitary District (OVSD), the water could be used to augment the municipal and/or agricultural supply of the valley.

Because the extracted water could be replaced with fresher water for shallower aquifers or recharge, a long-term benefit would be the desalination of the lower aquifers and increase in usable groundwater from the basin.

A more detailed feasibility study must be conducted, but partners such as Casitas MWD, the City, the Ojai Water Conservation District, and OVSD could all contribute and benefit from such a project.
Watershed Management.

The OBGMA will work with other stakeholders in the Ventura River Watershed to effectively understand and manage the drainage area that includes Ojai. Such a project is also included in the suite of tasks applied for by the Watersheds Coalition of Ventura County, under the Ventura River Watershed Management Plan (“VRWMP”). The OBGMA supports this endeavor and the understanding of the Ojai Basin will be ameliorated with additional monitoring wells provided under the project.

In compliance with Government Code Section 65350.5 the OBGMA will always have its Groundwater Management Plan available for review by the land use agencies in contact with the basin.

Upper Ventura River Groundwater Basin Sustainability Agency

Co-operation Agreement (Inter-basin) with UVRBGSA

Once the UVRB GSA develops its GSP, the OBGMA will review and provide comment as well as collaborate on linking projects. Of special concern is the shared boundary on the western side of the Ojai Basin and the discharge to San Antonio Creek from the Ojai Basin. Both agencies are implementing detailed studies to measure outflow and inflow via this waterway.

Management Plan Objective 4: Communicate Effectively

The effectiveness of the OBGMA depends upon its ability, within its limited means, to meet the needs of the water users and well owners of the Basin. This is dependent upon effective, two-way communication between the OBGMA and the users it serves. The Agency implements the following elements:

Ad hoc Advisory Committees

Ad hoc advisory committees with representatives of the well owners and water users in the basin have been periodically created by the OBGMA Board and have been a means of developing a dialogue between users and the Agency. Advisory committees will be used by the Board as a nucleus of interested and affected users to consider and develop the details of actions proposed under this Plan.
Annual Report
The OGBMA will prepare an annual report as required by law which it will publish itself at minimum expense. Technical contractors will only be used if required to perform technical analysis of data collected during the year. Information learned about the basin and water use in the basin will be shared by the Agency with all well owners directly and with water users in the basin through the general news media and the publications of local water purveyors. Actions or items of special interest will be shared with well owners by direct mailing newsletters, which will also include notice of OBGMA meetings and agendas. Board members will be available to meet with basin water users to address issues of concern and the ongoing management activities of the Agency.

Key avenues for outreach and communications
The OBGMA continually communicates with its constituents via the following means:

- Website (www.obgma.com)
- Mailers
- Monthly Meetings (including posted agendas)
- Newspaper outreach
- Presentations at stakeholder meetings
- Ojai Day participation
- Office, staff, and consultant access

Management Plan Objective 5: Administrate Efficiently
The resources available to the OBGMA to carry out its mission and serve the water users of the basin are limited. Therefore cost containment measures are essential. The Agency implements the following elements:

Funding.
The OBGMA is funded by extraction charges levied onto pumpers in the Ojai Basin to initiate, carry on, and complete the powers, purposes and groundwater management activities of the Agency. The present legislative ceiling on extraction charges is $25 per acre-foot (Resolution #2013-2). The approved budget for the 2014/2015 fiscal year is $60,000 based on 4000 acre-feet of extractions. The OBGMA operates from a one room office, with one part time office assistant
who also acts in the capacity of secretary and treasurer. The agency must have one professional, technically qualified staff person as a manager at least part time. These expenses, along with regular audits, legal services, and required insurance consume the majority of the funding. The agency is also a participant in funding projects that are within its purview, such as groundwater basin models, the SACSGRP, and grant applications.

**Link Budget with extraction fees**

Facing budget shortfalls with conservation, OBGMA developed a comparative cost of service analysis linking budget expenditures with its fee structure. It was clear that as conservation increased, groundwater pumping decreases, and resulting in decreased revenues without raising fees.

**Development of fixed cost base wellhead fee and extraction rates**

The OBGMA elected to modify its fee collection from a use-based format to a per-wellhead base fee with additional fees based on well extraction volumes. Per SGMA authorities, a public hearing was held on October 26, 2017 in which no majority protest was raised. The OBGMA approved this fee modification by resolution at its November 30, 2017 meeting.

**Recognition and regulation of De Minimis Users**

While SGMA defines and allows for limited regulation of de minimis groundwater users, and the OBGMA recognizes de minimis user as those extracting 2 AF/yr or less, these parties remain regulated as their numbers in sum can potentially be a significant component of groundwater extraction from the basin.

Hence, Per Ordinance 9, the OBMGA requires metering of all extraction facility regardless of volume extracted. This is in keeping with the relatively small total extraction volumes from the Ojai Basin, compared to larger basins in California where two orders of magnitude greater than Ojai – in acre feet – may be extracted annually.
DESCRIPTION OF OJAI BASIN AND EXISTING CONDITIONS

The Ojai Valley Groundwater Basin (DWR Bulletin 118 Groundwater Basin Number 4-2) stretches over 10.1 square miles (6471 acres) in mountains north of the Pacific Ocean. The basin one of the most important basins in the Ventura River Watershed in terms of serving a large number of people and agricultural acres. As of 2014, there are 182 active wells in the basin that supply water to tree crops (mostly citrus and avocados), residents, and businesses in the City of Ojai and surrounding areas (Figure 2). Some water from the basin is also naturally discharged to San Antonio Creek, providing critical base flow and supporting its riparian habitat, as well as downstream water users. San Antonio Creek has been designated as critical habitat for the endangered southern California steelhead.

The Ojai Basin a relatively deep, bowl-shaped basin, which is bounded on the west and east by non-water-bearing Tertiary aged rocks, on the south by the Santa Ana Fault and Black Mountain, and on the north by the Topatopa Mountains. Major surface drainages that contribute influx or
recharge to the basin include San Antonio Creek and the various tributary streams that drain the
East End of the Ojai Valley and flow into San Antonio Creek. Steep slopes in these creek,
especially those flowing out of Senior Canyon and Thacher Creek, are responsible for forming
extensive alluvial fan deposits as the fast-moving, debris-laden water coming out of the
mountains slows, spreads out, and deposits suspended sediment. These deposits of sand and
gravel, thickest closest to the mountains in the northeastern portion of the basin, are largely
responsible for filling the Ojai Basin over time and forming the water-bearing aquifers of the
basin. The basin is deepest in the center and southern areas where sediments have built up
against the boundary defined by the Santa Ana Fault. The thickness of the water-bearing
alluvium is as much as 715 feet. The primary storage areas are approximately four sand and
gravel units that are each on the order of up to 100 feet thick.

The basin has areas of confined, semi-confined, and unconfined groundwater. Unconfined
conditions exist in the northern and eastern portions of the basin, in the areas of the alluvial fan
heads. Groundwater in the rest of the aquifer system is, depending on the amount of water in
storage and groundwater level position, mostly confined to semi-confined in the central,
southern, and western portions of the basin. Groundwater generally flows in a southwesterly
direction; however, it also flows towards the municipal wells in the central portion of the basin.
Depth to water can be on the order of 300 feet in the eastern and northern alluvial fan-head
portions of the basin (with seasonal variations between 50 and 90 feet). In the southern and
western portions of the basin, depth to water is typically less than 50 feet (with seasonal
variations on the order of 15 feet). During wet periods, artesian conditions or springs can occur
in the southwestern part of Ojai Basin when the elevation to which groundwater will naturally
rise exceeds the ground surface elevation.

The Ojai Basin has the largest capacity of the Ventura River Watershed’s four groundwater
basins. It has a maximum capacity of approximately 85,000 acre-feet, with a safe annual year of
approximately 5026 acre-feet. A “maximum capacity” does not reflect the amount of usable or
recoverable fresh water, only that the basin has the capacity to hold this gross volume. Not all of
the storage capacity contains economically recoverable water or water that is of acceptable
quality for use.
The Ojai Basin is part of the Transverse Ranges geomorphic province. Rocks in this region have been folded into a series of predominantly east-west-trending anticlines and synclines associated with thrust and reverse faults. Late Eocene to Miocene sedimentary rocks of dominantly marine origin are deformed in a series of folds and faults to form the Ojai Basin and its surrounding mountains (Figure 3). Exposed bedrock units within the basin are non-water-bearing, Late Eocene to Miocene sedimentary rocks of mostly marine origin. From oldest to youngest, these units include the Juncal Formation, Matilija Sandstone, Cozy Dell Shale, Coldwater Sandstone, Sespe Formation, Rincon Shale, and Monterey Shale. Minor groundwater production is yielded from the consolidated bedrock formations, as the groundwater is stored only in fractures.

The primary water-bearing units are Quaternary surficial sediments that unconformably overlie the older sedimentary rocks along valley floors and stream channels. These include historical, Pleistocene-aged dissected gravel terraces and active, Holocene-aged deposits. Active sedimentation occurs as stream channel deposits of gravel and sand, such as at San Antonio Creek, alluvial fan deposits of gravel, and floodplain alluvium of clay, silt, sand and gravel. The
alluvial deposits may reach several hundred feet of thickness, with typical well yields that range from 100 to 600 gallons per minute (GPM).

Coarse grained sand and gravel aquifer units appear to be thickest near the north and east portions of the basin (the alluvial fan heads) and thinnest to the south and west where fine grained lacustrine and floodplain deposits predominate as confining layers, separating the water-bearing zones into as many as a half-dozen correlative aquifer units. Groundwater in the alluvial sediments may be unconfined or confined, depending on water levels and the presence of clay-rich confining units. With the exception of higher elevation areas associated with the alluvial fan heads, the aquifer system is capable of being under confined conditions in most of the basin, but may be confined or unconfined at different times depending on the degree of saturation and the thicknesses of aquifer and aquitard units.

Regional deformation was caused by north-south compression, which may have began during the late Pliocene or as late as 700,000 years ago and continues today. Regional crustal shortening due to this compression is largely taken up locally by faults and associated folds. Major faults are the San Cayetano, Santa Ana, Santa Ynez, Lion, Big Canyon, and Sisar. The importance of structural geology is relevant from a hydrogeologic standpoint for several reasons. During pumping, faults and bedrock folds provide no-flow boundaries. Faults can also provide zones of fracture in consolidated rocks from which groundwater can be extracted at wells. Where not cutting the overlying alluvium, faults can cause deeper formation groundwater to rise and subcrop into the overlying alluvial formations.

**Ojai Basin Groundwater Recharge**

In the Ventura River Watershed, no significant water is imported for human uses including agricultural, irrigation, or municipal supplies. Virtually all water to the Ojai Valley Groundwater Basin derives from the hydrologic cycle as precipitation within the mountainous area surrounding the basin and precipitation on the valley floor itself. The majority of recharge to the basin is from infiltration of precipitation on the valley floor and percolation of surface waters through alluvial channels. Some additional recharge is provided by excess irrigation flow (with a little more than half typically sourced from Lake Casitas) and a minor amount of subsurface flow. The OBGMA's monitoring of the basal alluvial aquifer at the SACSGRP DDMW indicate a favorable component of "recharge without rainfall," as discharges from adjacent bedrock aquifers contribute spring flow and subterranean contributions to the alluvial aquifers.

The Ojai Basin is located within a Mediterranean-type climatic zone characterized by long, dry summers and short, mild winters. The vast majority of precipitation occurs in the winter months. Precipitation rates within the Basin are variable, and cyclic patterns occur, sometimes with deficient rainfall over several consecutive winters (droughts). Recharge from precipitation within the basin is considered to also be variable and to follow similar trends.

Groundwater levels within the basin have been observed to exhibit relatively large fluctuations that correlate with wet and dry periods. The drainage area for the Ojai Basin is relatively large.
(36 square miles) compared to the alluvial surface area of about 10 square miles, and as such the amount of groundwater in storage responds quickly to heavy precipitation. Most of this recharge occurs where Horn Canyon (Thacher Creek), Gridley Canyon and Senior Canyon (San Antonio Creek), and Reeves Creek enter the basin at alluvial fan heads. Each of these intermittent streams merge as they flow southwest across the basin and exit as San Antonio Creek, the second largest tributary to the Ventura River after Matilija Creek. The headwaters of San Antonio Creek and its tributaries originate in the Topatopa Mountains north of the basin. San Antonio Creek has nearly perennial flow as it leaves the basin, sourced by effluent groundwater from the Ojai Basin. Lion Canyon Creek drains the Upper Ojai Valley and also contributes a significant amount of flow to San Antonio after it exits the Ojai Valley. Surface water in San Antonio Creek then joins the Ventura River system and flows south before discharging into the Pacific Ocean.

![Figure 4. Precipitation at the Ojai Valley Floor.](image)

The average annual precipitation within Ojai Basin is about 21 inches. In addition to the precipitation bar chart presented above (Figure 4), the accumulative departure from average annual precipitation (Figure 5) is an indicator of drought periods versus periods of "normal" or "wet" periods. As the curve declines to the right, a period of drought is realized. Locally, it appears that a drought period began after the end of the 2011 calendar year, but it follows an approximately 15 year period of relatively wet conditions.
Based on the amount of precipitation measured within the watershed, and modeled recharge estimates, the OBGMA estimates that the 21 inches of annual average precipitation accounts for about 6000 acre-feet of groundwater recharge (Figure 6). During the 2011 calendar year, 29.31 inches of rain fell on the valley floor and upwards of 10,000 acre-feet of water recharged to the basin. During the following three calendar years of drought conditions, where 11.35, 9.07, and 15.12 inches of rain fell on the valley floor, respectively, a maximum of around 6700 acre-feet of total recharge was added to the basin storage, assuming no evapotranspiration.

Recharge is primarily focused in the area of alluvial fan heads on the northern and eastern boundaries of the basin and within stream channels, including alluvial channels that extend into the bedrock areas to the north and east (Figure 7). Modeled and observed phenomena indicate that any precipitation less than 11 inches on the valley floor is taken up by evapotranspiration and soil storage, among other factors, and that significant recharge is limited to subsurface flow or excess irrigation flow during these drier years.

The model mass balance indicates that the vast majority of water inflow into the basin is from recharge and the primary outflows are groundwater extraction in wells and groundwater discharge to surface streams. Over the model calibration period, a significant amount of the total mass of water within the system was released from and entered into storage due to fluctuations in hydraulic head, and these respective amounts were approximately equal. This indicates that although the amount of groundwater in storage fluctuated widely during the calibration period, the average amount of groundwater in storage was almost unchanged from the beginning to the end of the model run.

The lateral groundwater model extent was assigned to cover the geographic and vertical extent of alluvial deposits in the Basin. Vertically, the model extends to the estimated depth of the alluvial deposits, and vertical model discretization is based on analysis of geophysical logs from 24 wells located within the Basin. Ten model layers were used to represent discrete aquifer and semiconfining units. The model is discretized into time periods, termed “stress periods,” that correspond to 3-month water year quarters. Model boundary conditions were established to represent surrounding features that may provide inflow to or outflow from the model domain.
Boundary conditions included recharge from precipitation, irrigation, septic systems and historical spreading grounds, evapotranspiration by riparian vegetation, groundwater discharge to stream channels, groundwater exchange between bedrock and alluvial aquifers, groundwater extraction (i.e., pumping) in wells, and downgradient alluvial outflow. Model parameters associated with the boundary conditions were established based on basin-specific data, where available. The DPWM was used to estimate the distribution of recharge from precipitation based on site-specific climatological, geologic, soils, and vegetation factors.

Figure 6. Model-Predicted Relationship between Precipitation and Recharge.
Ojai Basin Groundwater Storage and Key Water Levels

Monitoring of water levels by the County and OBGMA in several key wells provide a direct insight into basin storage and the effects of drought on portions of the basin. Generally, peripheral northern and eastern areas appear to be less affected by the droughts as they store the bedrock-derived recharge first as compared to central and southern portions of the basin. Additional storage capacity and extraction from the central portions of the basin compared to the peripheral areas also contribute to this phenomenon of discrepancy in water levels.

Figure 8 presents the historic and predicted groundwater levels at the key observation well, one of four observation wells used in the DPWM. The objective of the predictive model simulations is to evaluate anticipated groundwater elevations in the Ojai Basin through water year 2020 (until
September 30, 2020) by assuming three future scenarios: median precipitation conditions, continued dry conditions, and wet conditions. At Observation Well #1, the observed December 2013 groundwater levels at this location were as low as they have been since 1965. For the median-precipitation predictive simulation, groundwater levels are modeled to rise approximately 40 to 50 feet following hypothetical wet years (assumed 2015, 2018), decline following hypothetical dry years, and are similar to 2013 levels at the end of the model simulation period. For the wet-weather simulation, groundwater levels rise significantly in the hypothetical extremely wet year (assumed 2018, 48.6 inches precipitation) and are similar to 2012 levels at the end of the simulation period, still relatively low compared to the longer historical record. For the dry-weather simulation, groundwater levels are lower at the end of the simulation period than observed groundwater levels since 1961.

As expected, groundwater levels fluctuate based on precipitation increases during hypothetical wet years (2015, 2018), and decline during hypothetical dry years (2016, 2019, 2020). The predicted total precipitation from 2015 to 2020 ranges from around 111 inches in the dry conditions simulation, 132 inches in median conditions, and 146 inches in wet conditions.

Median precipitation condition scenarios predict (1) an overall net decline over the simulation period for the central portion of the basin near the Ojai City municipal well field and in the southern portion of the basin, (2) a net groundwater level rise in the northwestern portion of the basin, and (3) no significant net change in the eastern-central portion of the basin. In all cases, wet-weather scenario simulations result in a predicted net increase in groundwater levels; however groundwater levels are predicted to continue to be generally lower than those observed over the last forty years. Dry-weather simulations result in a predicted continued net decline in groundwater elevations.
Based on hydrographic data, the OBGMA estimates that the amount of groundwater in storage in the Ojai Basin at the spring high point is as follows (red font where estimated without published record):

**Figure 8. Historic Groundwater Levels at Key Observation Well**
These calculations were prepared for the OBGMA by the VCWPD using groundwater levels at the key well. The historic low in basin storage was in 1951 during a significant drought and before the current practice of conjunctive use, including CMWD water imports, was
commonplace. Water levels in the key well fell to their lowest point of 580 ft AMSL in September 1951. An estimated 43,741 acre-feet of groundwater was in storage in the basin at that time. The springtime-high water level that year was 652 ft AMSL. This nadir is a significant threshold because the confined aquifer skeleton would have been maximally compacted at that time. Static water levels below that depth would increase compaction and potentially cause subsidence and irrecoverable storage capacity in the Ojai Basin. In 2014, static water levels fell to about 665 ft AMSL, the lowest levels since 1965. Figure 9 presents the relationship between estimated groundwater storage in the basin and the springtime-high water level at the key observation well.

![Figure 9](image)

*Figure 9. Relationship between Basin Storage and Springtime-High Water Level at Key Well.*
The primary discharge mechanism for the basin is groundwater pumping. The OBGMA has kept a record of the reported groundwater extractions in the basin since 1993. These data are divided into two columns: extractions by the GSWC for residences and businesses in the City of Ojai, primarily for domestic use (column E), and extractions from private wells, primarily for irrigation use (column D). These are added together to show total groundwater extractions (column F). Importations from Lake Casitas are reported to OBGMA and shown in column C. Since 1993, water imported from Lake Casitas and water extracted from private wells have been added together to show the “Estimated Irrigation Demand” (column B). Prior to 1993, an estimate of irrigation demand based on land use, crop water requirements, evapotranspiration, and rainfall was made, then the Lake Casitas importations were subtracted, to come up with an estimate of private well extractions in the basin. All units in the table are in acre-feet.

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Estimated Irrigation Demand</th>
<th>Casitas Importation</th>
<th>Estimated Groundwater Extraction (Private Wells)</th>
<th>Groundwater Extraction (GSWC)</th>
<th>Estimated Total Groundwater Extractions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>7200</td>
<td>4181</td>
<td>3019</td>
<td>1638</td>
<td>4657</td>
</tr>
<tr>
<td>1986</td>
<td>7500</td>
<td>3633</td>
<td>3867</td>
<td>1663</td>
<td>5530</td>
</tr>
<tr>
<td>1987</td>
<td>7800</td>
<td>4473</td>
<td>3327</td>
<td>1744</td>
<td>5071</td>
</tr>
<tr>
<td>1988</td>
<td>7796</td>
<td>4635</td>
<td>3161</td>
<td>1839</td>
<td>5000</td>
</tr>
<tr>
<td>1989</td>
<td>7093</td>
<td>5169</td>
<td>1924</td>
<td>1766</td>
<td>3690</td>
</tr>
<tr>
<td>1990</td>
<td>9804</td>
<td>4961</td>
<td>4843</td>
<td>1804</td>
<td>6647</td>
</tr>
<tr>
<td>1991</td>
<td>7631</td>
<td>3377</td>
<td>4254</td>
<td>1819</td>
<td>6073</td>
</tr>
<tr>
<td>1992</td>
<td>8769</td>
<td>2744</td>
<td>6052</td>
<td>1645</td>
<td>7697</td>
</tr>
<tr>
<td>1993</td>
<td>6829</td>
<td>2800</td>
<td>4029</td>
<td>2070</td>
<td>6099</td>
</tr>
<tr>
<td>1994</td>
<td>7072</td>
<td>3433</td>
<td>3639</td>
<td>1946</td>
<td>5585</td>
</tr>
<tr>
<td>1995</td>
<td>6117</td>
<td>3530</td>
<td>2587</td>
<td>1846</td>
<td>4433</td>
</tr>
<tr>
<td>1996</td>
<td>6801</td>
<td>4468</td>
<td>2333</td>
<td>1569</td>
<td>3902</td>
</tr>
<tr>
<td>1997</td>
<td>8017</td>
<td>5272</td>
<td>2745</td>
<td>1583</td>
<td>4328</td>
</tr>
<tr>
<td>1998</td>
<td>5071</td>
<td>3115</td>
<td>1956</td>
<td>1913</td>
<td>3869</td>
</tr>
<tr>
<td>1999</td>
<td>6185</td>
<td>3922</td>
<td>2263</td>
<td>2181</td>
<td>4444</td>
</tr>
<tr>
<td>2000</td>
<td>7054</td>
<td>4044</td>
<td>3010</td>
<td>2080</td>
<td>5090</td>
</tr>
<tr>
<td>2001</td>
<td>7204</td>
<td>3195</td>
<td>4009</td>
<td>2258</td>
<td>6267</td>
</tr>
<tr>
<td>2002</td>
<td>7021</td>
<td>4249</td>
<td>2772</td>
<td>2220</td>
<td>4992</td>
</tr>
<tr>
<td>2003</td>
<td>6450</td>
<td>3428</td>
<td>3022</td>
<td>2066</td>
<td>5088</td>
</tr>
<tr>
<td>2004</td>
<td>7058</td>
<td>4185</td>
<td>2873</td>
<td>1824</td>
<td>4697</td>
</tr>
<tr>
<td>2005</td>
<td>5462</td>
<td>2768</td>
<td>2694</td>
<td>1955</td>
<td>4649</td>
</tr>
<tr>
<td>2006</td>
<td>5462</td>
<td>2796</td>
<td>2666</td>
<td>1818</td>
<td>4484</td>
</tr>
<tr>
<td>2007</td>
<td>6877</td>
<td>3770</td>
<td>3107</td>
<td>1963</td>
<td>5070</td>
</tr>
<tr>
<td>2008</td>
<td>6492</td>
<td>3176</td>
<td>3316</td>
<td>1736</td>
<td>5052</td>
</tr>
<tr>
<td>2009</td>
<td>7054</td>
<td>3411</td>
<td>3643</td>
<td>1751</td>
<td>5394</td>
</tr>
<tr>
<td>2010</td>
<td>5633</td>
<td>2404</td>
<td>3229</td>
<td>1742</td>
<td>4971</td>
</tr>
<tr>
<td>2011</td>
<td>5867</td>
<td>2990</td>
<td>3191</td>
<td>1934</td>
<td>5125</td>
</tr>
<tr>
<td>2012</td>
<td>6292</td>
<td>2986</td>
<td>3664</td>
<td>1646</td>
<td>5310</td>
</tr>
<tr>
<td>2013</td>
<td>4093</td>
<td>1376</td>
<td>5469</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014*</td>
<td>2460</td>
<td>1085</td>
<td>3546</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*through 9/14/2014
Groundwater use in the Ojai Basin between 1985 and 2012 averaged approximately 5100 acre-feet annually, of which some 1850 acre-feet (or 36%) was pumped by the GSWC for municipal and domestic supply. In addition to GSWC, the mutual water companies and active private wells supply both agricultural and domestic water in the basin. During the 1985 to 2013 period, the highest production was 7697 acre-feet (1992, with 1645 AF from GSWC and 6052 AF from private wells) and the lowest was 3690 acre-feet (1989, with 1766 AF from GSWC and 1924 AF from private wells). Figure 10, above, presents the estimated total annual basin water demand. Total basin demand is the calculated as the sum of groundwater extraction (by both GSWC and private wells) and surface water importation from Lake Casitas.

**Ojai Basin Groundwater Natural Discharge**

Because of the basin’s relatively limited storage capacity, the basin may be depleted rapidly during drought periods by groundwater pumping and groundwater outflow to San Antonio Creek at the basin’s natural discharge points.

Groundwater rising above the level of a stream bottom results in what is called a "gaining stream," where groundwater seeps out of the surface and flows downstream, thus depleting the aquifer. For much of the year, including almost all of the dry-season, all of the water in the Ventura River and its tributaries is from groundwater and springs (excluding the lower stretch of...
the river that is fed by treated wastewater). Only during storms, and for a relatively short period of time afterwards, do surface runoff and flows from soil water add to the base flow.

Modeled discharge to surface streams is reported to average about 2280 acre-feet per year. Smaller components of discharge are to evapotranspiration (about 260 acre-feet/yr) and outflow to downgradient bedrock and alluvium (about 130 acre-feet/yr). In the 2010-2011 water year, a total of nearly 10,600 acre-feet are calculated to have discharged at San Antonio Creek beneath the Casitas Springs bridge at Highway 33. This compares to about 900 acre-feet at the same point for water year ending 2012. The Ojai Basin comprises approximately 70% of the surface water tributary area to this gauge and is one of the only groundwater basins that provides perennial discharge to the creek system. Although no active gauge is present to date near the discharge point from the Ojai Basin, monitoring of the San Antonio Creek at Creek Road is within the purview of the OBGMA and a planned activity.

**Instream flow studies and “requirements”**

**Summer pools at San Antonio Creek**

To augment potential habitat capacity, the OBGMA supports the creation of artificial pools along the bedrock reaches of San Antonio Creek. By excavating pools into the bedrock, along the stream channels, perennially discharged groundwater from the Ojai Basin could fill these pools and allow for areas of over-summering during drier periods.

Feasibility studies should be conducted, and partnerships with OVLC and regulatory agencies may be highly beneficial.

**Ojai Basin Groundwater Quality**

Groundwater supplies a significant percentage of the water used for drinking and irrigation in the watershed, and is the principal source of streamflow for most of the year except in very wet years. The quality of groundwater is important for drinking, irrigation, aquatic ecosystem health, and other uses. Groundwater in the watershed is generally of good enough quality for drinking and irrigating, though a few parameters must be regularly monitored, and water from some wells must be blended with water from other sources to meet drinking water quality standards. Average concentration of total dissolved solids (TDS) is 812 mg/L and ranges from 671 to 1090 mg/L in county-sampled and reported wells.

The quality of the watershed’s groundwater is greatly influenced by the quality and quantity of surface water runoff that recharges the groundwater basins, and by the natural interaction of groundwater with sediments in the surrounding geologic formations. Other factors that can influence groundwater quality include impacts from land uses overlying groundwater basins, use and density of septic systems, well depth, and age of groundwater.

Regional groundwater has been analyzed less frequently and at fewer locations than surface
Public supply wells in California are required by law to be sampled for inorganic, organic, radiological, and microbiological constituents on a routine basis. These data are submitted to the SWRCB and integrated into the State’s GeoTracker GAMA (Groundwater Ambient Monitoring & Assessment Program) database. In addition, water suppliers are required to prepare for their customers annual water quality consumer confidence reports, which contain information on the quality of their water supply sources. The VCWPD performs annual water quality monitoring at seven to eight wells within the Ojai Basin. Groundwater quality monitoring is also required of property owners subject to violation-related cleanup requirements; this monitoring is overseen by the Regional Water Quality Control Board or the Ventura County Environmental Health Division.

Figure 11 presents the Piper diagrams of selected inorganic constituent from sampled well in the basin. Groundwater chemistry in the Ojai Basin is quite variable. Constituents include TDS, sodium (Na\(^+\)), potassium (K\(^+\)), calcium (Ca\(^{2+}\)), magnesium (Mg\(^{2+}\)), chloride (Cl\(^-\)), bicarbonate (HCO\(_3^\)), carbonate (CO\(_3^{2-}\)) and sulfate (SO\(_4^{2-}\)) for the wells sampled by the County of Ventura in the Ojai Basin in 2014.

Water samples from three wells were analyzed for inorganic chemicals (Title 22 metals) in previous years. No inorganic chemical was above the primary maximum contaminant level ("MCL") for drinking water. Two wells had iron (Fe) concentrations above the MCL for drinking water. Depth-discrete information indicates a higher chloride concentration in deep aquifers in the central and southwestern portion of the basin. Nitrate is the main groundwater quality concern for most of the Ventura River Watershed.

San Antonio Creek drains the Ventura River Watershed’s largest urban area, the City of Ojai, as well as the most intensively farmed area in the watershed, the Ojai Valley’s East End. San Antonio Creek is on the Clean Water Act’s Section 303(d) list of impaired waterbodies for bacteria, nitrogen, low dissolved oxygen, and total dissolved solids. High concentrations of chlorides and total dissolved solids are commonly seen during dry conditions when groundwater, high in dissolved salts, is the main source of flow. San Antonio Creek is also one of the tributaries that has been designated as critical habitat for the endangered southern California steelhead.
Figure 11. Stiff Water Quality Diagrams depicting sodium-chloride character water at depth in the central portion of the Ojai Basin, obtained during drilling of a pilot hole for a municipal supply water well during the high groundwater storage period of March 2005.