STETSON ENGINEERS INC.

DRAFT TECHNICAL MEMORANDUM

2171 E. Francisco Blvd., Suite K • San Rafael, California • 94901
TEL: (415) 457-0701 FAX: (415) 457-1638 e-mail: sr@stetsonengineers.com

TO:	**CMA GSA**	DATE:	**April 2021**
FROM:	**Stetson Engineers**	JOB NO:	**2711-04**
RE:	DRAFT **Central Management Area Water Budget**		

INTRODUCTION

The Sustainable Groundwater Management Act (SGMA) requires that a Groundwater Sustainability Plan (GSP) include: "a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored."[1] This Memorandum describes the water budget within the Central Management Area (CMA) of the Santa Ynez River Valley Groundwater Basin, herein referred to as the "Basin."

Two components of the Basin setting have been summarized in the following two related technical memoranda: Hydrogeologic Conceptual Model and Groundwater Conditions. The third major component of the Basin setting, a water budget, is an accounting tool that quantifies inflows (sources) and outflows (sinks) occurring within a groundwater basin (or specified management area) using the following equation:

$$\text{Inflows} - \text{Outflows} = \text{Change in Storage}$$

The water budget is a key component of overall understanding of the Basin and contributes to developing the following GSP elements:

- Identifying data gaps
- Evaluating monitoring requirements
- Evaluating potential projects and management actions
- Estimating the sustainable yield

[1] 23 CCR 354.18.

- Evaluating undesirable impacts
- Informing water management decision making

Annual water budget components for the period 1982-2018 were assembled, compiled, and summarized. Total inflow and outflow components are presented in the water budgets for the historical data period (1982–2018), "current conditions" (2011–2018), and "projected conditions" (2018–2072). These data are evaluated to identify potential long-term trends in groundwater basin supply and demand and estimates of inflows and outflows and groundwater storage changes. The results support interpretation of trends in measured water levels in wells, and a preliminary estimate of sustainable yield based on the perennial or safe yield.

Perennial yield, also referred to as safe yield, is defined as a long-term average annual amount of water which can be withdrawn from a basin under specified operating conditions without inducing a long-term progressive drop in water levels (Stetson, 1992). The estimated perennial yield for the base period is calculated as follows:

Perennial Yield = Average Annual Pumping + Average Annual Change in Storage

Perennial yield can also be defined as pumping but that does not impact the physical or chemical integrity of the groundwater, but as used here relates only to the chronic lowering of groundwater levels for a base period in which precipitation approximates long-term average precipitation[2].

Sustainable yield is defined in SGMA as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result." An undesirable result is defined as one or more of the following effects on the six sustainability indicators:

1. Chronic lowering of groundwater levels
2. Reduction of groundwater storage
3. Degraded groundwater quality
4. Seawater intrusion
5. Land subsidence

[2] The focus on long-term lowering of groundwater levels is also the focus of DWR's definition of overdraft in Bulletin 118: "Condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years."

6. Depletion of interconnected surface water

Because undesirable results metrics have not yet been defined upon by the GSA, the yield of the CMA groundwater basin will be discussed on a preliminary basis only for the historical period of 1982–2018. The volume of water that can be extracted from the CMA basin on a long-term basis without creating chronic and continued lowering of groundwater levels and depletion of groundwater in storage volumes is presented.

LIST OF ACRONYMS AND ABBREVIATIONS

AF	acre-feet
AFY	acre-feet per year
BCM	Basin Characterization Model
CIMIS	California Irrigation Management Information System
CMA	Central Management Area
EMA	Eastern Management Area
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrogeologic Conceptual Model
NCCAG	Natural Communities Commonly Associated with Groundwater
SGMA	Sustainable Groundwater Management Act
SWP	State Water Project
SWRCB	State Water Resources Control Board
SYRWCD	Santa Ynez River Water Conservation District
USGS	U.S. Geological Survey
WMA	Western Management Area

1. WATER BUDGET ELEMENTS

This section provides a summary of the data sources used for development of the water budget. A conceptual diagram showing the components of the surface water and groundwater systems in the Santa Ynez River Valley Groundwater Basin (Basin) is provided in Figure 1-1. Water supply and water use within the Central Management Area (CMA) of the Basin as well as groundwater conditions are dependent upon precipitation. Precipitation, either directly or as streamflow infiltration, recharges the groundwater supplies of the CMA. This Water Budget Technical Memorandum (Memorandum) quantifies groundwater flows into and out of the CMA, including natural conditions (runoff and recharge from precipitation, groundwater flow, riparian evapotranspiration) and human-made conditions (dam releases, groundwater pumping, and return flows).

1.1. Water Year Type Classification

Section 2.2 of the Groundwater Conditions Memorandum ("Classification of Wet and Dry Years") describes how water year types are classified in the CMA. For consistency, the hydrologic year type for the CMA is based on the methodology similar to the recent State of California Water Resources Control Board Order WR 2019-0148 (SWRCB 2019). Years are classified based on the rank in the period of record in one of five categories: critically dry (bottom 20th percentile), dry (20th to 40th percentile), below normal (40th to 60th percentile), above normal (60th to 80th percentile), and wet (80th to 100th percentile). **Table 1-1** compares the water year classification of the CMA and State Water Resources Control Board (SWRCB) WR 2019-0148 to the annual precipitation at Buellton Fire Station for the years 1982–2018.[3] Consistency between different stations throughout the basin is indicated in **Table 1-1**, except the CMA and SWRCB hydrologic year type based on surface water inflow reflects antecedent soil moisture conditions. For example, the annual precipitation in year 1997 was 81% of average at the Buellton Fire Station; however, because the precipitation occurred during a wet climatic trend following wet years 1993 and 1995, the water year is classified with above normal runoff and recharge conditions.

1.2. Water Budget Analysis Time Periods (Historical, Current, and Projected)

The historical water budget period, or base period, is selected to be water years 1982 through 2018 (37 years; see Figure 1-2). Water years start on October 1 of the previous year and run through September 30th of the current year.[4] This 37-year time period is in accordance with

[3] Buellton Fire Station, Gauge 233, Santa Barbara County Flood Control & Water Conservation District. Water Years 1955–2020. Period of record average is 16.6 inches per year.
[4] Per SGMA regulations, all years refer to water years; start in October 1st of the previous year through September 30ths of the current year.

TABLE 1-1 ANNUAL PRECIPITATION AND WATER YEAR CLASSIFICATION FOR CMA

			Hydrologic Year Type Classification [1]		
	Buellton Fire Station		CMA	Upper Santa Ynez River	
Water Year	Precipitation (in/year)	% of Average [2]	USGS Gage 11132500 (Salsipuedes Creek)	SWRCB WRO 2019-148	Climatic Trends [3]
1982	14.4	86%	Dry	Below normal	Wet
1983	38.8	233%	Wet	Wet	Wet
1984	10.0	60%	Below normal	Above normal	Dry
1985	12.2	74%	Dry	Dry	Dry
1986	19.3	116%	Above normal	Above normal	Dry
1987	11.2	67%	Dry	Critically Dry	Dry
1988	17.3	104%	Dry	Dry	Dry
1989	7.3	44%	Critically Dry	Critically Dry	Dry
1990	6.7	40%	Critically Dry	Critically Dry	Dry
1991	17.9	107%	Below normal	Above normal	Dry
1992	27.1	163%	Above normal	Wet	Wet
1993	27.4	165%	Wet	Wet	Wet
1994	12.6	76%	Below normal	Below normal	Wet
1995	34.3	206%	Wet	Wet	Wet
1996	13.3	80%	Below normal	Below normal	Wet
1997	13.5	81%	Above normal	Above normal	Wet
1998	40.9	246%	Wet	Wet	Wet
1999	14.5	87%	Above normal	Below normal	Normal
2000	18.4	111%	Above normal	Above normal	Normal
2001	28.4	171%	Wet	Wet	Normal
2002	8.5	51%	Dry	Dry	Normal
2003	17.5	105%	Below normal	Below normal	Normal
2004	9.4	57%	Dry	Dry	Normal
2005	39.6	238%	Wet	Wet	Normal
2006	19.2	115%	Above normal	Above normal	Normal
2007	7.0	42%	Critically Dry	Critically Dry	Normal
2008	19.3	116%	Above normal	Above normal	Normal
2009	10.8	65%	Critically Dry	Dry	Normal
2010	18.5	111%	Below normal	Above normal	Normal
2011	21.4	129%	Wet	Wet	Normal
2012	11.4	68%	Dry	Dry	Dry
2013	7.8	47%	Critically Dry	Critically Dry	Dry
2014	5.9	35%	Critically Dry	Critically Dry	Dry
2015	7.0	42%	Critically Dry	Critically Dry	Dry
2016	10.7	64%	Critically Dry	Dry	Dry
2017	20.4	122%	Above normal	Above normal	Normal
2018	7.9	48%	Critically Dry	Dry	Normal

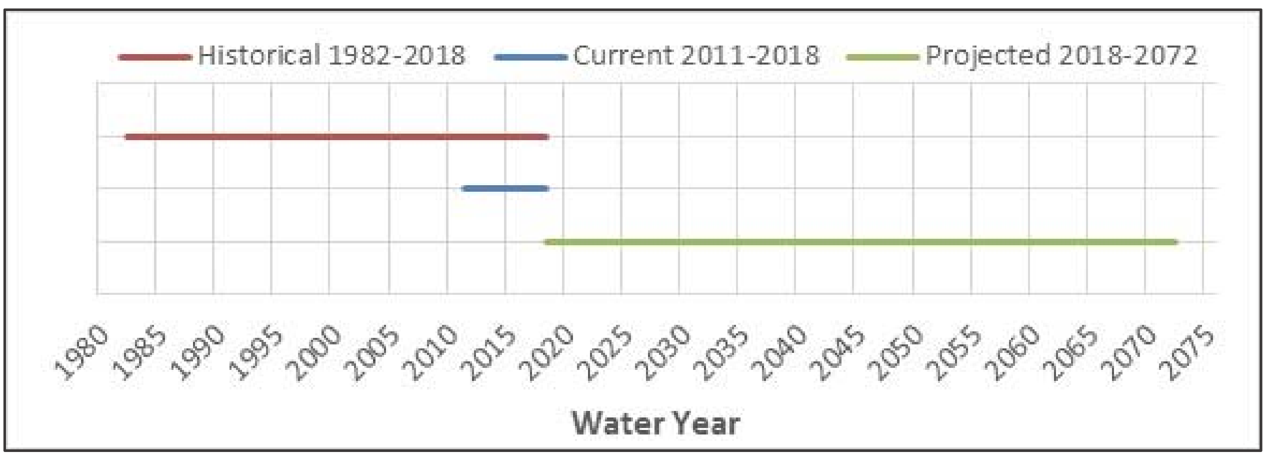
1 Dry and critically dry years are shaded yellow; wet years are shaded blue; and normal, below normal, and above normal years are unshaded. **Notes:** CMA = Central Management Area; USGS = U.S. Geological Survey; SWRCB = State Water Resources Control Board; WRO = Water Resources Order; in/year = inches per year.
2 Average for period of record (1955–2020) is 16.6 inches per year.
3 GSI 2020.

SGMA by being longer than 10 years and includes the "most recently available information."[5] This period includes two major historical droughts (1985–1991 and, 2012–2018) and represents a balanced period. For example, the average precipitation at the Buellton Fire Station is 16.6 inches per year for the period of 1955–2020 and 17.0 inches for the period of 1982–2018, a difference of only 2%. Furthermore, this 37-year period also includes when the Santa Ynez River Water Conservation District (SYRWCD) began collection of self-reported groundwater pumping data in the Basin. This base period was also coordinated with the other management agencies in the Basin. The historical water budget is presented in Section 2 of this Memorandum.

The current water budget period is for water years 2011–2018 (8 years). The period has "the most recent hydrology, water supply, water demand, and land use information,"[5] including data from January 1, 2015, to current conditions. This period is very dry, which is why 2011, a wet year, is included in this data set to provide some balance. The average annual precipitation for the 8-year period is 11.6 inches per year (70% of average). The current water budget is presented in Section 3.

The projected water budget for the period of 2018–2072 extends 50 years past the 2022 submittal of this Groundwater Sustainability Plan (GSP), for a total of 55 years. The projected water budget is presented in Section 4.

FIGURE 1-2 HISTORICAL, CURRENT, AND PROJECTED WATER BUDGET PERIODS



[5] 23 CCR 354.18(c).

1.3. Surface Water and the Santa Ynez River Alluvium

In addition to groundwater inflows and outflows, GSP regulations state that the "Total surface water entering and leaving a basin by water source type" must also be accounted for.[6] This will include the Santa Ynez River, tributaries, and State Water Project (SWP) imports. In addition, as discussed in the Hydrogeologic Conceptual Model (HCM) Memorandum, the Santa Ynez River Alluvium Upper Aquifer is part of the subflow of the river, which is regulated by SWRCB. Because subflow is considered surface water, the Santa Ynez River Alluvium would not be classified as a principal aquifer or managed by a GSP under SGMA. Therefore, the Santa Ynez River Alluvium is considered part of the underflow of the Santa Ynez River and is treated as part of the surface water in the historical, current, and projected water budgets.

1.4. Water Budget Data Sources

The historical and current water budgets were developed using various publicly available data. The projected water budget was developed using the SGMA guidance, further described below. Table 1-2 presents a summary of the data sources employed for developing the historical and current water budgets and a description of each data set's qualitative data rating. Data that is measured is usually rated at a high quality, and data that is estimated is rated as from low to medium depending upon the data source of the estimate. Each of these data sets is described in further detail in the following sections.

[6] 23 CCR 354.18(b).

TABLE 1-2 WATER BUDGET DATA SOURCES

Water Budget Component	Data Source(s)	Comment(s)	Qualitative Data Rating
Surface Water Inflow Components			
Santa Ynez River Inflow	USGS	Solvang Gauge	Gauged – High
Tributary Inflow	Correlation with gauged data	Methods described in text	Calibrated Model – Medium
Imported: SWP	Central Coast Water Authority	—	Metered – High
Groundwater Inflow Components			
Deep Percolation of Precipitation: Overlying and Mountain Front Recharge	USGS BCM Recharge	BCM calibrated to Basin precipitation station data	Calibrated Model – Medium
Streamflow Percolation	Santa Ynez RiverWare Model, USGS BCM	Collaborative Modeling effort: Stetson and GSI	Calibrated Model – Medium
Subsurface inflow	Darcian flux calculation	Collaborative Modeling effort: Stetson and GSI	Estimated – Medium
Irrigation Return Flows	Land use surveys, self-reported pumping data	Basinwide Collaborative Estimation: Stetson and GSI	Estimated – Low
Percolation of Treated Wastewater	City of Solvang and City of Buellton	Received from cities	Metered – High
Percolation from Septic Systems	SYRWCD self-reported data, Santa Barbara County Water Agency return estimates	Methods described in text	Estimated – Low
Surface Water Outflow Components			
Santa Ynez River Outflow	USGS	Methods described in text	Calibrated Model - Medium
Streamflow Percolation	Santa Ynez RiverWare Model, USGS BCM	Collaborative modeling effort: Stetson and GSI	Calibrated Model - Medium
Riparian Evapotranspiration	Aerial photography, NCCAG/NWI data sets, CIMIS weather station	Methods described in text	Estimated – Medium/Low
Groundwater Outflow Components			
Agricultural Irrigation Pumping	Land use surveys, self-reported pumping data	Methods described in text	Estimated – Medium/Low
Municipal Pumping	City of Buellton self-reported pumping data	Methods described in text	High/Medium

TABLE 1-2 WATER BUDGET DATA SOURCES (CONTINUED)

Water Budget Component	Data Source(s)	Comment(s)	Qualitative Data Rating
Groundwater Outflow Components (continued)			
Rural Domestic/Small Public Water Systems Pumping	SYRWCD self-reported data, DRINC	Methods described in text	Estimated – Medium/Low
Riparian Evapotranspiration	Aerial photography, NCCAG/NWI datasets, CIMIS weather station	Methods described in text	Estimated – Medium/Low
Subsurface Outflow	Darcian flux calculations, groundwater model	Methods described in text	Estimated – Medium

Notes: USGS = U.S. Geological Survey; SWP = State Water Project; BCM = Basin Characterization Model; Stetson = Stetson Engineers; GSI = GSI Water Solutions, Inc.; SYRWCD = Santa Ynez River Water Conservation District; NCCAG = The Natural Communities Commonly Associated with Groundwater (NCCAG) Wetland dataset; NWI = National Wetlands Inventory; CIMIS = California Irrigation Management Information System; DRINC = Drinking Water Information Clearinghouse.

1.4.1. Sources of Surface Water Inflows

1.4.1.1. Santa Ynez River

Surface water inflows include both local and imported water entering the CMA. As discussed in Section 1.3, all of the inflow into the Santa Ynez River Alluvium is considered as part of the surface water inflow.[7] The Santa Ynez River Alluvium includes fluxes that are associated with groundwater data sources (e.g., subflow, recharge from precipitation), but in Sections 2, 3, and 4 of this Memorandum, all Santa Ynez River Alluvium fluxes will be accounted for as part of the total surface water in the water budget.

The U.S. Geological Survey (USGS) Solvang gauge (ID No. 11128500) measures the flow of Santa Ynez River water entering the CMA. Santa Ynez River flows in the CMA are substantially influenced by upstream dam and reservoir operations. Downstream releases and spillway flows from Lake Cachuma are controlled and monitored by the U.S. Bureau of Reclamation at Bradbury Dam. Flows at the Solvang gauge are the outflow from the Basin's Eastern Management Area (EMA).

[7] The Santa Ynez River Alluvium subarea corresponds to Zone A in the SYRWCD management and annual reports (HCM Memorandum, Figure 3-3). This alluvium is included as part of the Above Narrows area in the SWRCB Order WR 2019-148 (SWRCB 2019).

1.4.1.2. Tributaries

Watershed drainage areas and average precipitation for Santa Ynez River tributaries to the Santa Ynez River within the CMA are summarized in Table 1-3. In general, the tributaries to the south of the Santa Ynez River receive more precipitation and are on steeper slopes compared with the tributaries to the north of the Santa Ynez River.

Tributary flow was estimated using stream gauge data (if available) and correlation with nearby stream gauge data. Zaca Creek has a USGS gauge (ID 11129800; Groundwater Conditions Memorandum Figure 6-1) upstream of the CMA inflow boundary with data available for water years 1990–1992, 1995–2004, and 2006–present. For years with missing data, the USGS gauge on nearby Alamo Pintado Creek, in the EMA, was used to estimate flows by regression analysis (Stetson 2008). The tributary in the Lower Santa Ynez River with the longest period of record is Salsipuedes Creek (USGS 11132500), located in the WMA. Flows in ungauged areas are estimated based on the Salsipuedes Creek gauge prorated by drainage area and average annual precipitation, as shown in Table 1-3.

TABLE 1-3 TRIBUTARY CREEKS OF THE CMA

	Drainage Area (mi^2)	Average Annual Precipitation (in/year)[1]
North of the Santa Ynez River		
Adobe Canyon Creek	2.5	19.2
Ballard Canyon Creek	5.1	19.4
Zaca Creek	36.6	20.7
Canada de Laguna	4.1	18.7
Canada de los Palos Blancos	5.2	18.4
Santa Rosa Creek	8.3	18.6
Unnamed Tributaries	6.0	18.4
South of the Santa Ynez River		
Nojoqui Creek	15.9	25.1
Unnamed Tributaries	9.5	23.4
Salsipuedes Creek USGS Gauge	47.10	23.0

Notes: CMA = Central Management Area; USGS = U.S. Geological Survey.
1 PRISM 2014.

1.4.1.3.State Water Project Imports

Imported SWP water deliveries were provided by the Central Coast Water Authority for August 1997 through present. These volumes include imported SWP water to the City of Buellton in the CMA. Prior to 1997, no water was imported into the Basin.

1.4.2. Sources of Groundwater Inflows

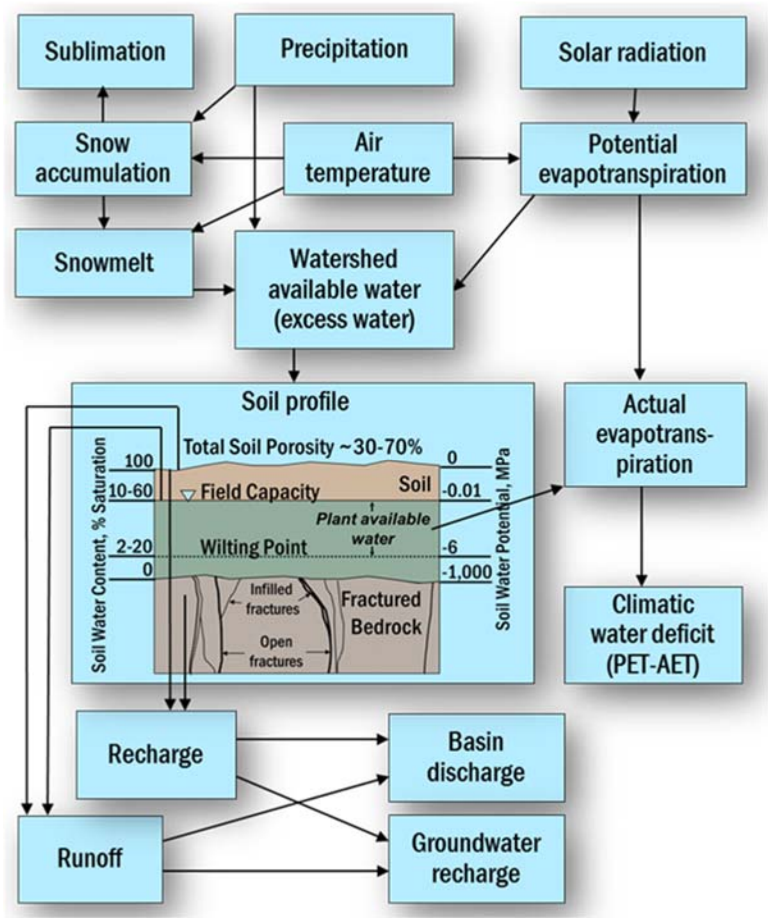
The data sources used for the groundwater budget inflow terms are described below.

1.4.2.1.Recharge from Precipitation

Precipitation that infiltrates into the soil zone and eventually recharges the regional groundwater table can be broken into two components: overlying recharge and mountain front recharge (also referred to as mountain block recharge). Overlying recharge occurs on the land surface that directly overlies the principal aquifer. Mountain front recharge occurs from subflow from the adjacent bedrock or the older consolidated formations that are not part of the basin. Both types of recharge relate to the amount of precipitation in the drainage basin that infiltrates into the soil and drains to the groundwater aquifer. As is typical of a Mediterranean climate, the CMA experiences many months in the summer and fall with no precipitation. The area also goes through periodic dry cycles, with as many as 7 consecutive years with below normal precipitation.

Recharge to groundwater from deep percolation of precipitation was determined using the USGS Basin Characterization Model (BCM) for California (Flint and Flint 2017). BCM uses a soil budget based on monthly climate data and soils information to estimate the recharge, as shown on Figure 1-3, which is reproduced from the BCM website https://ca.water.usgs.gov/projects/reg_hydro/basin-characterization-model.html(Flint and Flint 2017):

FIGURE 1-3 CONCEPTUAL BASIN CHARACTERIZATION MODEL



(Note: Santa Ynez River Valley Groundwater Basin does not utilize the snow subroutines in the BCM).

The BCM data are provided statewide on roughly 20-acre cells. This BCM recharge data set is the same data set being used in the EMA (GSI 2020) and WMA. As described in GSI 2020, the BCM recharge data set has been adjusted based on comparison to monthly precipitation records at weather stations across the entire Basin. A correction was applied to the BCM values for each monthly timestep such that the adjusted BCM data exactly matched all recorded weather station monthly precipitation values. These monthly adjustments were also applied to the BCM-generated recharge data sets. The timing of overlying recharge was modified from the BCM output. The BCM recharge output was very concentrated in wet years, but local well hydrographs indicate a more attenuated recharge flux across many years. The average annual recharge from the BCM was utilized and disaggregated based on percentage of rainfall at Buellton for any particular year compared to the average rainfall for the period of 1982–2018.

The BCM does not route flows downstream. For areas outside the Basin and not within the major tributaries (i.e., Nojoqui, Zaca, and Santa Rosa Creeks), mountain front recharge areas are estimated based on the Salsipuedes Creek gauge prorated by drainage area and average annual precipitation.

1.4.2.2.Percolation of Streamflow to Groundwater

Streamflow percolation, or the deep percolation of surface water to groundwater through the Santa Ynez River streambed, was estimated using the calibrated Santa Ynez River RiverWare flow model (Stetson 2008) for percolation in the Santa Ynez River Alluvium subarea. Percolation occurring in the tributary channels in the Buellton Upland was estimated using the studies from the Buellton Upland Groundwater Management Plan (SYRWCD 1995).

1.4.2.3.Subsurface Inflow from Adjacent Aquifers

Subflow is estimated using Darcy's Law for two areas into the CMA, along the Santa Ynez River and in the Buellton Upland. Darcy's law is an equation that quantifies the flow of fluid through a porous medium (i.e. groundwater geologic materials like sand and gravel). The flow rate calculated by the law depends on three main variables, including the permeability of the medium, the cross-sectional area of the medium through which the fluid flows, and gradient (change in elevation) that is present over a given distance as shown in the equation below:

$$Q = K * I * A \quad \text{(Equation 1)}$$

where

Q = flow in cfs

K = hydraulic conductivity in ft/sec

I = hydraulic gradient in ft/ft

A = cross-sectional area in ft2

The subflow at the CMA/EMA boundary is estimated at 1,800 acre-feet per year (AFY) along the Santa Ynez River. This estimate was coordinated with the water budget of the EMA. This subflow includes the underflow in the Santa Ynez River gravels and alluvium.

The Buellton Upland basin is separated from the Santa Ynez Upland basin by older non-water bearing deposits. Groundwater is likely discharged from the Santa Ynez Upland basin through creeks draining the uplands and underflow in shallow deposits of the aquifer material between bedrocks outcrops. The subflow at the CMA/EMA boundary in the Buellton Upland is estimated at 85 AFY, which has also been coordinated with the water budget of the EMA.

1.4.2.4.Irrigation Return Flows

Irrigation return flow is the excess water from water applied to crops that percolates below the root zone and returns back to the groundwater aquifer. Irrigation return flow is related to the irrigation efficiency. The portion of applied water that is utilized to satisfy crop ET demand is equivalent to the irrigation efficiency, expressed as a percentage. The remaining percentage of applied water is equivalent to the irrigation return flow. For example, if the irrigation efficiency is 60%, then 60% of the applied water would be used by the crops and 40% could be assumed as return flows. Irrigation return flows can either recharge the groundwater or leave the field as surface water in drains or tail water and discharge to a nearby creek or river. It is assumed that most of the irrigation return flow percolates to groundwater within the CMA. Similar to Basin wide assumptions in other parts of the Santa Ynez River Groundwater Basin in the EMA and WMA, an irrigation efficiency of 80% is assumed for all crops except vineyards, which are assumed to be irrigated using drip at an efficiency of 95%. The total inefficiency of 20% for all crops except vineyards and 5% for vineyards is assumed to recharge the groundwater. The urban landscape irrigation efficiency is assumed to be 70% but only 15% is assumed to return to groundwater based on historical estimates (Stetson 1992). Irrigation return flow volumes have been calculated using these efficiencies multiplied by the calculated annual volumes of irrigation water applied to each crop type, based on self-reported pumping data and assumed crop-specific water duty factors.

Based on self-reported pumping and parcel coverage, this analysis assumes 5% of the agricultural water pumped from the Santa Ynez River Alluvium is applied to lands in the Buellton Upland where the irrigation return flows would be inflow to the Buellton Upland groundwater. Of this 5% pumped from the River and applied to the Upland, 10% is assumed as return flow to the lower aquifer in the Upland. For the City of Buellton, all of the return flows from urban irrigation are assumed to return to the Santa Ynez River Alluvium based on the City boundary and the wide alluvial boundary in this reach.

1.4.2.5.Percolation of Treated Wastewater

There are two wastewater treatment plants within the CMA (see HCM Memorandum, Figure 4-7). The City of Solvang and a portion of the township of Santa Ynez, west of Highway154, are connected to sewer service. Wastewater flows are collected by the City of Solvang and the Santa Ynez Community Services District and are transmitted to the Solvang wastewater treatment plant, which is within the CMA near the boundary with the EMA. The treated wastewater is held in percolation ponds that subsequently recharge the Santa Ynez River alluvium and become subflow.

Similarly, City of Buellton has a wastewater treatment plant downstream of the confluence of Zaca Creek and the Santa Ynez River. The treated wastewater is held in percolation ponds that subsequently recharge the Santa Ynez River alluvium and become subflow. The measured treated wastewater quantities were obtained from the City of Solvang and Buellton, respectively, for the historical period of 1982–2018.

1.4.2.6.Percolation from Septic Systems

Outside of the sewer service areas within the CMA, domestic wastewater is discharged to septic systems. Return flows from the septic systems recharge the groundwater. The recharge from septic systems is calculated using estimates from previous SYRWCD and County of Santa Barbara (County) studies (Stetson 1992). These previous analyses assumed that 40% of domestic water is used indoors and that 87% of this water will return to the groundwater. After accounting for the 60% for urban irrigation (outdoor water use) with 15% return flow, the total return flow from domestic/rural residential pumping for both indoor and outdoor use is estimated at 44%.

1.4.3. Surface Water Outflows

The data sources used for the surface water budget outflow terms are described below.

1.4.3.1.Santa Ynez River Outflow

Santa Ynez River surface water outflows were calculated as the sum of the Santa Ynez River inflows plus tributary inflows minus streamflow infiltration to groundwater. Each of these terms are described in the sections above.

1.4.3.2.Percolation of Streamflow to Groundwater

The calculation of streamflow percolation to groundwater is discussed in Section 1.4.2.2.

1.4.4. Groundwater Outflows

The data sources used for the groundwater budget outflow terms are described below.

1.4.4.1.Agricultural Irrigation Pumping

The largest source of water for irrigating crops in the CMA is pumped groundwater. The entire CMA is within the boundaries of the SYRCWD. Groundwater pumpers located within the SYRWCD boundaries are required to self-report their estimated pumping volumes to SYRWCD for each 6-month period. These estimates are based on multiple methods, including application of water duty factors specified in SYRWCD's Groundwater Production Information and Instructions pamphlet (SYRWCD 2010); metered pumping records; and metered electricity records. The groundwater users specify which type of water they are using (agricultural, special irrigation [parks, schools, and golf courses], or other [municipal and industrial]). This reported pumping was checked against available land use surveys in 1985, 2014, and 2016 from sources provided by the California Department of Water Resources (DWR).[8] For example, in 2016 a total of 2,730 acre-feet (AF) was reported to the SYRWCD for agricultural pumping from the Buellton Upland. DWR identified 1,373 acres of irrigated land in the Buellton Upland in 2016, which would total 2,747 AF using an average crop duty of 2.0 AF per acre. Monthly irrigation pumping was disaggregated from the biannual (6-month) totals using monthly multipliers based on historical average monthly irrigation, precipitation, temperature and monthly crop water demands (HCI 1997). Pumpage for rural domestic and small public water systems are reported to SYRWCD as derived from the Santa Ynez River Alluvium (surface water) or the Lower Aquifer (Paso Robles Formation and Careaga Formation).[9]

1.4.4.2.Municipal Pumping

Municipal pumping includes all pumping for municipal, industrial, and domestic use that occurs within the City of Buellton, including water used for urban landscape irrigation. The measured monthly pumping quantities were obtained from the City of Buellton for the historical period of 1982–2018. This pumping by the City combines the two categories reported to the SYRWCD: "other" water, which includes municipal, industrial, small public water systems, and domestic use, and "special irrigation" water, which refers to urban landscape irrigation. These municipal pumping volumes are reported by SYRWCD in the annual reports. Pumpage for municipal pumping is derived from the Santa Ynez River Alluvium (surface water) and the Lower Aquifer (Paso Robles Formation and Careaga formations).

1.4.4.3.Rural Domestic and Small Public Water Systems Pumping

Besides the City of Buellton, the "other" water reported in the SYRWCD annual reports includes all other domestic uses, including rural domestic and small public water systems in the CMA. The biannual pumping quantities of rural domestic and small public water systems were disaggregated using the City of Buellton monthly average pumping distribution. Pumpage for rural domestic and small public water systems are reported to SYRWCD as derived from the Santa Ynez River Alluvium (surface water) or the Lower Aquifer (Paso Robles Formation and Careaga Formation).

1.4.4.4.Riparian Vegetation Evapotranspiration

[8] LandIQ delineated the data for years 2014 and 2016 from imagery provided by the National Agriculture Imagery Program. The data are derived from a combination of remote sensing, agronomic analysis, and ground verification. The data set provides information for resource planning and assessments across multiple agencies throughout the state and serves as a consistent base layer for a broad array of potential users and multiple end-uses.

[9] In the CMA, pumping is reported to the SYRWCD for the Santa Ynez River Alluvium (Zone A) or the Buellton Lower Aquifer (Zone D). Again, for the purposes of SGMA, pumpage from the Santa Ynez River Alluvium is considered a surface water diversion and is not subject to management by SMGA or the GSAs.

Riparian evapotranspiration was calculated using three sources to determine acreages of riparian vegetation types occurring within the CMA:

- The Natural Communities Commonly Associated with Groundwater (NCCAG) Wetland data set (https://gis.water.ca.gov/app/NCDatasetViewer/)
- The National Wetlands Inventory (NWI) dataset (https://www.fws.gov/wetlands/Data/Data-Download.html)
- An analysis of color-infrared aerial photos from 2012 that was completed for this study by Stetson Engineers

Color-infrared aerial photography shows a range of electromagnetic waves that the human eye cannot see and is widely used for interpretation of natural resources. Very intense reds indicate dense, vigorously growing vegetation, which is commonly associated with riparian evapotranspiration related to groundwater use. The infrared aerial photos were the primary method of detecting vegetation along the Santa Ynez River. In the upland areas, the combination of the NCCAG and NWI data sets were relied on. Surface geology and topography data were used to avoid acreage on hillsides, which would be above the regional water table.

The riparian acreage analysis is multiplied by a monthly riparian water duty based on a weather station operated by the California Irrigation Management Information System (CIMIS). The station closest to the CMA is the Santa Ynez station. CIMIS has daily evaporation data for the station located near the township of Santa Ynez since November 1986. Table 1-4 shows the monthly average CIMIS data. The riparian water duty factor used is 4.2 feet per year, which is similar to the 4.5 and 3.7 feet per year rates used in the EMA and WMA, respectively.

TABLE 1-4 CIMIS MONTHLY AVERAGE REFERENCE EVAPOTRANSPIRATION (1986–2019)

Month	Reference Evapotranspiration (inches)
January	1.9
February	2.4
March	3.9
April	5.1
May	6.0
June	6.4
July	6.6
August	6.1
September	4.9
October	3.7
November	2.3
December	1.7
Total **inches**/year	51.0
Total **feet**/year	4.2

Note: CIMIS = California Irrigation Management Information System.

1.4.4.5.Subsurface Groundwater Outflows

Subsurface groundwater outflows (or subflow) occur at the southwestern corner of the CMA along the border with WMA. Because of the constriction by the bedrock north and south of the river, this site was previously chosen for the proposed Santa Rosa Dam on the Santa Ynez River, which was never built. The magnitude of the subflow has been calculated using Darcy's law, with estimated values for hydraulic conductivity, the average hydraulic gradient, and outflow plane cross-sectional area (based on saturated thickness estimates). This estimate was made in coordination with the downstream WMA, and the flows will be updated with results from the numerical groundwater model.

Subsurface outflow from the Buellton Upland occurs along the southern boundary with the Santa Ynez River Alluvium subarea. Based on the length of this contact and low permeability of the Paso Robles and Careaga Formations, the subflow was estimated using Darcy's law. The flows will be updated with results from the numerical groundwater model.

The amount of subflow between the Buellton Upland and Santa Rita Upland, not much information is known. The USGS (Hamlin 1985) estimated groundwater flow following the surface topography (i.e., south along Santa Rosa Creek) with no subflow estimated between Santa Rosa Creek and Santa Rita Creek. Locally there are anecdotes about groundwater levels being higher within the Santa Rosa

Creek drainage compared to the Santa Rita Creek drainage, which indicates that there might be some structural impediment to flow near the surface divide between the two upland basins. Results from the AEM geophysics study currently being compiled for the project area is expected to provide additional data, but currently no subflow is assumed in the upland area.

2. HISTORICAL WATER BUDGET

The SGMA regulations require that the historical surface water and groundwater budget be based on at least the most recent 10 years of data. The period of 1982–2018 was selected as the period for the historical water budget (also referred to as the historical base period) because it represents average conditions with several different dry and wet periods.

Estimates of the surface water and groundwater inflows and outflows, and changes in storage for the historical base period, are summarized in this section.

2.1. Historical Surface Water component

The SGMA regulations (Section 354.18) require that the water budget include the total annual volume of surface water entering and leaving the basin. The surface water component of the water budget quantifies important sources of surface water and evaluates their historical and future reliability.

The CMA relies on two surface water source types identified in DWR's Best Management Practices (DWR 2016): local supplies and SWP.

2.1.1. Inflows: Local Surface Water (Santa Ynez River and Tributaries) and Imported Surface Water

Local surface water supplies include surface water flows that enter the CMA from precipitation runoff within the watershed and Santa Ynez River inflow to the CMA, regulated by SWRCB as outflows from Lake Cachuma. In addition, as discussed in the HCM Memorandum, the Santa Ynez River Alluvium Upper Aquifer is part of the subflow of the river, which is regulated by SWRCB.

Imported surface water through the SWP became available after completion of the Coastal Branch pipeline in 1997. The City of Buellton has an SWP allocation of 578 AFY and a drought buffer of 58 AFY.

Table 2-1 summarizes the average, minimum, and maximum inflow from surface water from all sources. The estimated average annual total inflow over the historical base period is approximately 100,200 AFY. The large difference between the minimum and maximum inflows reflects the climatic variability between dry and wet years. The largest components of this average local inflow are releases from Bradbury Dam and flow in the Santa Ynez River upstream of the CMA, which represent about 86% of the average annual surface inflow. Inflow from the Buellton Upland and the Santa Ynez Mountains contributes 9% of the total surface water inflow. The remaining surface flow components make up 5% of the total surface water inflow (Table 2-1).

TABLE 2-1 ANNUAL SURFACE WATER INFLOW, HISTORICAL PERIOD (1982–2018)

Surface Water Inflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Santa Ynez River Inflow from EMA	85,720	630	655,470
Santa Ynez River Tributary Inflow	9,060	70	61,820
Imported SWP	230	0	670
Santa Ynez River Alluvium Subarea (Surface Water Underflow)			
Subflow[1]	2,490	1,970	2,920
Recharge from Precipitation (Overlying and Mountain Front)	880	530	1,490
Recharge from Agricultural Return Flows to Underflow	480	340	710
Recharge from Municipal Return Flows to Underflow[2]	1,240	1,000	1,460
Recharge from Domestic Return Flows to Underflow	100	30	170
TOTAL	**100,200**	**4,570**	**724,710**

1 Includes subflow in from the Santa Ynez River Alluvium in the EMA and Buellton Upland.
2 Includes percolation return flow from both City of Buellton and City of Solvang wastewater treatment plants.

The annual average, minimum, and maximum volumes of imported local surface water during the historical base period (1982–2018) are presented Table 2-1. The average value of 230 AFY does not represent the typical SWP imports by the City of Buellton because deliveries did not start until 1997. The average amount of SWP imports for the shorter time period of 1998–2018 was approximately 400 AFY. The imported water supply provides approximately zero to 2% of the total volume of surface water that enters the CMA.

2.1.2. Surface Water Outflows

The estimated annual average total surface water outflow leaving the CMA as flow in the Santa Ynez River, within the Santa Ynez River Alluvium Upper Aquifer, and percolation into Lower Aquifer over the historical base period is summarized in Table 2-2. Similar to inflows, the Santa Ynez River surface outflow represents the majority (91%) off the average annual surface flow out of the CMA.

TABLE 2-2 ANNUAL SURFACE WATER OUTFLOW, HISTORICAL PERIOD (1982–2018)

Surface Water Outflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Santa Ynez River Outflow to WMA	91,320	40	699,280
Net Channel Percolation to Groundwater[1]	360	10	1,470
Santa Ynez River Alluvium Subarea (Surface Water Underflow)			
Santa Ynez River Underflow Out	800	800	800
River well pumping – Agriculture[2]	2,720	1,920	3,690
River well pumping – Municipal[2]	470	80	1,020
River well pumping – Domestic[2]	225	70	380
Riparian Vegetation Evapotranspiration	4,165	4,165	4,165
TOTAL	**100,070**	**7,085**	**710,805**

1) Does not include percolation to Santa Ynez River Alluvium, which is part of the surface water component.
2) River well pumping occurs from wells in the Santa Ynez River Alluvium. The wells pump from the subflow of the Santa Ynez River and are administered by the SWRCB as a surface water diversion.

2.1.3. Summary

As indicated in Tables 2-1 and 2-2, the average surface flow in and out averaged 100,200 AFY and 100,070 AFY, respectively, for the 1982-2018 period. The surface water inflow exceeded outflow by 130 AFY.

The surface water budget for the historical period in the CMA is presented on Figure 2-1 and Table 2-3. The inflows and outflows for the Santa Ynez River Alluvium shown in Tables 2-1 and 2-2 are totaled in Figure 2-1 and Table 2-3. The figure shows how flashy the hydrologic system is, with ten wet years showing orders of magnitude more flux of surface water than the other, drier, years. In these wet years, surface water inflows and outflows are extremely large in response to precipitation, compared with the drier years.

2.2. HISTORICAL GROUNDWATER BUDGET

The historical groundwater budget from 1982 through 2018 includes a summary of the estimated groundwater inflows and, groundwater outflows, followed by the change of groundwater in storage and discussion about the sustainable yield of the CMA.

TABLE 2-3 ANNUAL SURFACE WATER COMPONENTS, HISTORICAL PERIOD (1982–2018), AFY

		Inflows					Outflows				
Water Year	**Hydrologic Year Type**	**Santa Ynez River**	**Tributary**	**Imported SWP**	**River Alluvium Total Inflows**	**Total Inflows**	**Santa Ynez River**	**Net Percolation to Groundwater**	**River Alluvium Total Outflows**	**Total Outflows**	**Inflow - Outflow**
1982	Dry	3,916	1,403	0	5,125	10,445	3,402	161	9,239	12,801	-2,357
1983	Wet	511,215	35,305	0	5,721	552,242	539,648	1,137	8,890	549,675	2,566
1984	Below normal	24,859	2,955	0	5,236	33,049	26,082	262	9,126	35,470	-2,421
1985	Dry	2,677	937	0	5,129	8,742	562	139	8,656	9,358	-615
1986	Above normal	12,297	10,412	0	5,034	27,742	14,906	451	8,144	23,501	4,241
1987	Dry	1,853	1,374	0	4,735	7,961	1,392	124	8,228	9,743	-1,782
1988	Dry	4,119	720	0	4,995	9,834	1,320	114	8,209	9,643	191
1989	Critically Dry	1,758	155	0	4,765	6,677	109	34	8,568	8,712	-2,035
1990	Critically Dry	629	84	0	4,702	5,416	39	12	8,771	8,821	-3,406
1991	Below normal	12,361	5,477	0	4,816	22,654	11,091	227	8,429	19,747	2,907
1992	Above normal	40,134	8,366	0	5,085	53,585	43,968	446	8,039	52,453	1,132
1993	Wet	364,086	18,499	0	5,258	387,844	377,397	757	7,857	386,011	1,833
1994	Below normal	9,390	2,468	0	5,193	17,050	10,416	203	7,806	18,425	-1,375
1995	Wet	533,933	61,822	0	5,641	601,396	590,940	1,470	7,670	600,081	1,315
1996	Below normal	15,892	3,624	0	5,206	24,722	17,646	292	7,900	25,838	-1,116
1997	Above normal	15,294	6,532	74	5,584	27,484	19,711	424	8,042	28,176	-692
1998	Wet	655,470	49,154	609	5,905	711,137	699,276	1,361	7,199	707,836	3,301
1999	Above normal	10,953	5,491	569	5,522	22,535	14,156	408	7,914	22,478	57
2000	Above normal	24,183	9,991	602	5,579	40,356	32,004	488	8,170	40,662	-306
2001	Wet	157,890	22,082	384	5,825	186,181	176,979	771	7,867	185,617	564
2002	Dry	8,544	1,222	584	5,234	15,584	7,722	164	7,841	15,727	-143
2003	Below normal	7,711	3,344	530	5,409	16,994	9,747	270	7,970	17,987	-993
2004	Dry	10,147	1,484	511	5,521	17,663	6,017	121	8,674	14,812	2,851
2005	Wet	373,556	33,659	511	5,984	413,710	404,441	1,046	8,583	414,069	-359
2006	Above normal	96,498	5,477	641	5,528	108,144	98,411	364	8,332	107,108	1,036
2007	Critically Dry	10,885	469	665	5,173	17,192	7,714	65	8,632	16,411	781
2008	Above normal	49,596	10,337	513	5,238	65,684	57,782	451	8,497	66,730	-1,046
2009	Critically Dry	4,753	481	293	4,908	10,435	2,362	71	8,345	10,779	-344
2010	Below normal	18,594	4,572	226	5,091	28,483	18,906	259	8,246	27,411	1,071
2011	Wet	120,436	15,004	394	5,008	140,841	130,640	629	7,994	139,264	1,577
2012	Dry	4,862	763	582	5,003	11,210	3,107	118	8,734	11,959	-748
2013	Critically Dry	11,520	250	216	4,591	16,577	6,378	35	8,923	15,335	1,242
2014	Critically Dry	6,118	165	32	4,632	10,947	4,433	23	8,974	13,429	-2,483
2015	Critically Dry	9,518	73	0	4,633	14,224	3,370	10	8,719	12,099	2,125
2016	Critically Dry	8,006	116	82	4,638	12,842	3,823	16	8,649	12,488	354
2017	Above normal	18,652	10,820	293	5,255	35,020	24,538	410	9,026	33,974	1,046
2018	Critically Dry	9,315	162	224	5,035	14,735	8,527	22	9,239	17,788	-3,053
Average 1982 - 2018		**85,720**	**9,060**	**230**	**5,190**	**100,200**	**91,320**	**360**	**8,380**	**100,070**	**130**

2.2.1. Groundwater Inflows

Groundwater inflow components include subsurface inflow, deep percolation of direct precipitation and mountain front recharge, streamflow percolation, and return flows from agricultural irrigation and, municipal, and domestic water uses. The annual groundwater inflows during the historical base period are summarized in Table 2-4. During the historical base period, an average of 3,550 AFY of total groundwater inflow occurred. During this time, the groundwater inflow ranged from 1,990 AFY to 6,570 AFY, due to differences in rainfall in dry and wet years. The largest groundwater inflow component was recharge from precipitation overlying the Buellton Upland, which accounts for approximately 53% of the total annual average inflow.

TABLE 2-4 ANNUAL GROUNDWATER INFLOW, HISTORICAL PERIOD (1982–2018)

Groundwater Inflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Subflow	90	90	90
Recharge from Precipitation – Overlying	1,870	890	3,560
Recharge from Precipitation – Mountain Front	770	770	770
Net Channel Percolation from Surface Water	360	10	1,470
Agricultural Return Flows	380	210	530
Municipal/Domestic Return Flows	80	20	150
TOTAL	**3,550**	**1,990**	**6,570**

2.2.2. Groundwater Outflows

Groundwater outflow components include total groundwater pumping from all water use sectors, subsurface flow out of the Buellton Uplands, and phreatophyte (riparian vegetation) evapotranspiration. The estimated annual groundwater outflows for the historical base period are summarized in Table 2-5.

TABLE 2-5 ANNUAL GROUNDWATER OUTFLOW, 1982-2018 HISTORICAL PERIOD (1982–2018)

Groundwater Outflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Pumping – Agriculture	2,220	1,070	3,240
Pumping – Municipal	370	80	790
Pumping – Domestic	170	40	350
Total Pumping	2,760	1,190	4,380
Riparian Vegetation Evapotranspiration	90	90	90
Subflow	690	170	1,120
TOTAL	**3,540**	**1,450**	**5,590**

Groundwater pumping was the largest groundwater outflow component, totaling 78% of the total groundwater outflow. The estimated annual groundwater pumping by water use sector for the historical base period is summarized in Table 2-5 and on Figure 2-2. Agricultural and municipal pumping were the largest components of groundwater pumping, accounting for approximately 63% (agricultural) and 10% (municipal) of total pumping over the historical base period. As indicated on Figure 2-2, pumping fluctuated over time but increased overall during the historical base period. From 1998 to 2018, total pumping increased from 1,500 to 3,000 AFY. Domestic and small mutual water companies accounted for 5% of total pumping during the historical base period.

2.2.3. Summary and Change in Storage

Annual changes in groundwater in storage were calculated for each year of the historical base period of 1982–2018 (37 years). A summary of the average annual inflows and outflows within the groundwater for the CMA for the historical base period are presented graphically on Figure 2-3. Figure 2-4 shows the magnitude of the average annual flow for each individual water budget component. Recharge from precipitation and agricultural pumping are the two largest fluxes for inflow and outflow, respectively. The results of the water budget during the historical period show that the CMA has same amount of total inflow as total outflow. As shown on Figure 2-3, the average total inflow of approximately 3,500 AFY is the same as the average total outflow of approximately 3,500 AFY. The variability of the average inflow and outflow components are presented for each year of the historical period on Figure 2-5, which presents groundwater inflow components above the zero line and outflow components below the zero line. The annual variation on Figure 2-5 shows that the amount of recharge will fluctuate widely depending on precipitation (also shown in Table 2-4). Figure 2-5 also shows the increase in groundwater pumping in the Buellton Upland (also shown in Figure 2-2). These data are also presented in Table 2-6.

As shown on Figure 2-6, the cumulative change of groundwater in storage during each year and during the overall historical base period indicates no net change in storage.

There was zero accumulated water supply deficiency over the entire 37-year period, which is equal to an average surplus/deficit of zero AFY. The cumulative change in storage increased in the wet period from 1993 through 2006 for a net surplus, but then decreased from 2007 to 2018, for a net change of zero for the entire period.

The cumulative change in storage based on the water budget components is different in magnitude than the cumulative change in storage in SYRWCD's Annual Reports (Figure 2-1 and Figure 2-4 in the Groundwater Conditions Technical Memorandum) because the Annual Report data is based on the eastern portion of the Buellton Uplands, which represents only about 20% of the entire Buellton Upland groundwater basin. However, the trends shown in both analyses are

TABLE 2-6 ANNUAL GROUNDWATER INFLOWS, OUTFLOWS, AND CHANGE IN STORAGE, HISTORICAL PERIOD (1982–2018)

		Inflows						Outflows						
Water Year	Hydrologic Year Type	Subflow In	Precipitation Recharge-Overlying	Mountain Front Recharge	Net Stream Percolation	Agricultural Return Flows	Urban Return Flows	Agricultural Pumping	Municipal Pumping	Domestic Pumping	Phreatophytes	Subflow Out	Change in Storage	Cumulative Change in Storage
1982	Dry	85	1,873	768	161	466	23	2,364	221	53	88	700	-51	-51
1983	Wet	85	3,557	768	1,137	442	19	2,240	266	44	88	700	2,670	2,619
1984	Below normal	85	2,088	768	262	510	21	2,582	405	48	88	683	-72	2,547
1985	Dry	85	1,998	768	139	527	19	2,659	335	43	88	673	-264	2,283
1986	Above normal	85	2,115	768	451	457	23	2,308	426	53	88	609	414	2,697
1987	Dry	85	1,463	768	124	482	26	2,438	487	60	88	504	-628	2,068
1988	Dry	85	1,779	768	114	464	28	2,347	326	63	88	610	-197	1,871
1989	Critically Dry	85	1,267	768	34	512	32	2,590	205	72	88	526	-783	1,089
1990	Critically Dry	85	1,044	768	12	531	40	2,683	288	91	88	483	-1,155	-66
1991	Below normal	85	1,634	768	227	465	44	2,357	90	100	88	504	84	18
1992	Above normal	85	2,321	768	446	367	45	1,859	315	103	88	483	1,184	1,201
1993	Wet	85	2,654	768	757	280	39	1,427	223	89	88	526	2,230	3,431
1994	Below normal	85	1,584	768	203	255	37	1,302	436	84	88	801	220	3,651
1995	Wet	85	2,834	768	1,470	208	39	1,068	385	88	88	780	2,993	6,645
1996	Below normal	85	1,668	768	292	242	38	1,241	301	86	88	695	681	7,326
1997	Above normal	85	1,677	768	424	250	39	1,280	374	88	88	1,056	356	7,682
1998	Wet	85	3,216	768	1,361	241	39	1,226	115	89	88	907	3,285	10,967
1999	Above normal	85	2,171	768	408	342	72	1,739	138	165	88	886	831	11,798
2000	Above normal	85	2,124	768	488	396	85	2,014	173	192	88	865	613	12,412
2001	Wet	85	2,676	768	771	429	91	2,232	362	206	88	928	1,004	13,415
2002	Dry	85	1,568	768	164	388	101	2,104	318	230	88	780	-446	12,969
2003	Below normal	85	1,757	768	270	291	107	1,676	325	243	88	844	102	13,071
2004	Dry	85	1,540	768	121	365	114	2,130	226	260	88	971	-682	12,390
2005	Wet	85	3,394	768	1,046	334	109	1,960	89	248	88	1,119	2,231	14,620
2006	Above normal	85	2,069	768	364	259	116	1,717	79	264	88	1,056	457	15,077
2007	Critically Dry	85	1,281	768	65	321	129	2,133	442	294	88	907	-1,215	13,862
2008	Above normal	85	2,119	768	451	444	154	2,729	663	351	88	632	-441	13,421
2009	Critically Dry	85	1,417	768	71	483	139	2,988	788	317	88	695	-1,913	11,507
2010	Below normal	85	2,056	768	259	403	118	2,617	718	268	88	441	-444	11,063
2011	Wet	85	2,075	768	629	310	120	2,194	667	272	88	399	367	11,430
2012	Dry	85	1,585	768	118	338	113	2,573	331	258	88	526	-768	10,663
2013	Critically Dry	85	1,236	768	35	397	112	2,925	546	255	88	165	-1,347	9,315
2014	Critically Dry	85	1,077	768	23	467	123	3,173	527	279	88	314	-1,839	7,476
2015	Critically Dry	85	968	768	10	437	122	3,244	786	278	88	504	-2,510	4,966
2016	Critically Dry	85	997	768	16	365	110	2,868	625	249	88	526	-2,016	2,950
2017	Above normal	85	1,552	768	410	360	112	2,856	296	255	88	886	-1,095	1,855
2018	Critically Dry	85	890	768	22	276	109	2,415	350	249	88	844	-1,796	60
Average 1982 - 2018		**90**	**1,870**	**770**	**360**	**380**	**80**	**2,220**	**370**	**170**	**90**	**690**	**0**	

the same in that there is a zero change in the cumulative groundwater storage over the 37-year period. The average annual groundwater storage increase or decline during the historical base period—or the difference between outflow and inflow to the CMA—is approximately zero AFY.

2.3. Sustainable Perennial Yield Estimate of the Basin

The water budget for the CMA during the base period indicates that total groundwater outflow was the same as the total inflow on average for the years 1982–2018. This indicates that there is not a net deficit occurring, which indicates that most likely a state of overdraft does not currently exist in the CMA.

Perennial yield is a long-term average annual amount of water which can be withdrawn from a basin under specified operating conditions (i.e., legal, economic, environmental, and management parameters) without inducing a long-term progressive drop in water levels.[10] The estimated perennial yield for the base period is calculated as follows:

Perennial Yield = Average Annual Pumping + Average Annual Change in Storage

The average annual pumping total of 2,760 AFY (Table 2-5) for the period of 1982–2018 resulted in zero net change in groundwater storage in the Buellton Upland basin, so this water budget analysis indicates that the perennial yield of the basin is approximately 2,800 AFY. It should be recognized that the definitions of safe/perennial/sustainable yield and overdraft reflect conditions of water supply and use over a long-term period. The historical period of 1982–2018 is representative of long-term average conditions.

While safe yield is difficult to estimate due to the inherent uncertainties in the estimates of recharge and discharge, this independent analysis corroborates the safe yield estimate in the SYRWCD Annual Reports of 2,800 AFY and the range of perennial yields in the Buellton Uplands Groundwater Management Plan (SYRWCD 1995) of 2,650 to 2,900 AFY. This estimate of perennial yield will be refined with the forthcoming predictive numerical groundwater model scenarios and will then be revisited through the planning and implementation phase of the SGMA process. Furthermore, the safe yield estimate will likely be revised to reflect a sustainable yield value that avoids undesirable results as defined by the Groundwater Sustainability Agency (GSA).

The perennial yield of 2,800 AFY does not include any imported water. All of the return flows from Central Coast Water Authority water imported by the City of Buellton are assumed to return to the Santa Ynez River Alluvium. This yield estimated also does not include any potential conjunctive use programs to store river water in the Buellton Upland aquifers.

When relating the perennial yield estimate of 2,800 AFY and the concept of sustainable yields, an evaluation of undesirable results must be performed. The undesirable results as defined in SGMA covers a broader range of criteria than the lowering of water levels and groundwater storage addressed by perennial yield, and also includes degraded groundwater quality, seawater intrusion, land subsidence, and depletion of interconnected surface water and groundwater dependent ecosystems. This estimate of sustainable yield based on the perennial yield will be refined with the forthcoming predictive numerical groundwater model scenarios. The next step will be an evaluation of avoiding undesirable results for the sustainable management criteria to further define the sustainable yield for the CMA.

2.4. Reliability of Historical Surface Water Supplies

The long-term reliability of the surface water from the local sources, including Bradbury Dam outflows and tributary runoff from the Buellton Uplands, is subject to climatic variability and is affected by exports out of the Santa Ynez River watershed to the Santa Barbara County south coast. The most recent drought, from 2012 through 2018, was very severe. The variability of the surface water flow from local and imported sources is summarized in Section 2.1.1 and Table 2-1.

The City of Buellton in the CMA has an SWP allocation of 578 AFY and a drought buffer of 58 AFY. This SWP supply is not as reliable as the local groundwater supplies in the CMA. The average import amount for the period of 1998–2018 was approximately 400 AFY. During the dry period of 2011–2018, the City was only able to import approximately 230 AFY, which is a 44% reduction. However, overall, imported water represents only a small fraction of the total water deliveries in the CMA (less than 6%).

3. CURRENT WATER BUDGET

The SGMA regulations require that a current water budget be developed based on the most recent hydrology, water supply, water demand, and land use information. For the GSP, the period selected to represent current conditions is water years 2011–2018. This period is a subset of the historical base period of 1982–2018 described in Section 2.

The current water budget period is dominated by a drought period when annual precipitation averaged about 70% of the historical average. As a result, the current water budget period represents drought conditions and is not representative of long-term, balanced conditions needed for sustainability planning purposes. The current water budget is used to project the future baseline and is based on current water demands and land use information.

Estimates of the surface water and groundwater inflow and outflow, and changes in storage for the current water budget period, are provided in this section.

3.1. CURRENT SURFACE WATER COMPONENT

Similar to the historical surface water inflow and outflow component, the current surface water component includes two surface water source types: SWP and local supplies.

3.1.1. Surface Water Inflows: Local and Imported

Local surface water supplies include surface water flows that enter the CMA from precipitation runoff within the watershed and Santa Ynez River inflow to the CMA, regulated by SWRCB as outflows from Lake Cachuma. In addition, as discussed in the HCM Memorandum, the Santa Ynez River Alluvium Upper Aquifer is part of the subflow of the river, which is regulated by SWRCB. Imported surface water through the SWP became available after completion of the Coastal Branch pipeline in 1997. The City of Buellton has an SWP allocation of 578 AFY and a drought buffer of 58 AFY.

Table 3-1 summarizes the average, minimum, and maximum inflow from surface water for all sources. The estimated average annual total inflow over the current period is approximately 32,040 AFY. The largest components of this average local inflow are releases from Bradbury Dam and flow in the Santa Ynez River upstream of the CMA, which represents about 74% of the average annual surface inflow for this period. Inflow from the Buellton Uplands and the Santa Ynez Mountains contributes 11% of the total surface water inflow.

TABLE 3-1 ANNUAL SURFACE WATER INFLOW, CURRENT PERIOD (2011–2018)

Surface Water Inflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Santa Ynez River Inflow from EMA	23,550	4,860	120,440
Santa Ynez River Tributary Inflow	3,420	70	15,000
Imported SWP	230	0	580
Santa Ynez River Alluvium Subarea (Surface Water Underflow)			
Subflow[1]	2,320	1,970	2,690
Recharge from Precipitation (Overlying and Mountain Front)	670	530	950
Recharge from Agricultural Return Flows to Underflow	480	420	500
Recharge from Municipal Return Flows to Underflow[2]	1,220	1,130	1,330
Recharge from Domestic Return Flows to Underflow	150	150	170
TOTAL	**32,040**	**9,130**	**141,660**

1 Includes subflow in from the Santa Ynez River Alluvium in the EMA and Buellton Upland.
2 Includes percolation return flow from both City of Buellton and City of Solvang wastewater treatment plants.

3.1.3. Surface Water Outflows

The estimated annual surface water outflows in the CMA over the current water budget period is summarized in Table 3-2.

TABLE 3-2 ANNUAL SURFACE WATER OUTFLOW, CURRENT PERIOD (2011–2018)

Surface Water Outflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Santa Ynez River Outflow to WMA	23,100	3,110	130,640
Net Channel Percolation to Groundwater[1]	160	10	630
Santa Ynez River Alluvium Subarea (Surface Water Underflow)			
Santa River Underflow Out	800	800	800
River Well Pumping – Agriculture	3,040	2,580	3,220
River Well Pumping – Municipal	420	100	700
River Well Pumping – Domestic	350	330	380
Riparian Vegetation Evapotranspiration	4,170	4,170	4,170
TOTAL	**32,040**	**11,100**	**140,540**

1) Does not include percolation to Santa Ynez River Alluvium, which is part of the surface water component.

3.1.4. Summary

During this period (2011-2018), precipitation was well below average, which resulted in very little surface water flow. The current period of 2011–-2018 had 32% of the total surface flows in the historical period of 1982–-2018. The imported water supplies were still a minor component of the overall surface water inflows, 0.2% in the 1982–-2018 historical period and 0.7% in the 2011–-2018 current period.

3.2. CURRENT GROUNDWATER BUDGET

The current water budget includes a summary of the estimated groundwater inflows, groundwater outflows, and change in groundwater in storage.

3.2.1. Groundwater Inflows

Groundwater inflow components include subsurface inflow, deep percolation of direct precipitation and mountain front recharge, streamflow percolation, and return flows from agricultural irrigation and, municipal, and domestic water uses. The annual groundwater inflows during the current period are summarized in Table 3-3. During the current period, an average of 2,810 AFY of total groundwater inflow occurred. During this time, the groundwater inflow ranged from 2,150 AFY to 4,160 AFY, due to differences in rainfall in dry and wet years. The largest groundwater inflow component was recharge from precipitation overlying the Buellton Upland, which accounts for approximately 46% of the total annual average inflow. The current period of 2011–-2018 had 79% of the total groundwater inflows in the historical period of 1982–-2018.

TABLE 3-3 ANNUAL GROUNDWATER INFLOW, CURRENT PERIOD (2011–2018)

Groundwater Inflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Subflow	90	90	90
Recharge from Precipitation – Overlying	1,300	890	2,080
Recharge from Precipitation – Mountain Front	770	770	770
Net Channel Percolation from Surface Water	160	10	630
Agricultural Return Flows	370	280	470
Municipal/Domestic Return Flows	120	110	120
TOTAL	**2,810**	**2,150**	**4,160**

1) Does not include percolation to Santa Ynez River Alluvium, which is part of the surface water component.

3.2.2. Groundwater Outflows

Groundwater outflow components include total groundwater pumping from all water use sectors, subsurface flow out of the Buellton Upland, and phreatophyte (riparian vegetation) evapotranspiration. The estimated annual groundwater outflows for the current period are summarized in Table 3-4.

TABLE 3-4 ANNUAL GROUNDWATER OUTFLOW, CURRENT PERIOD (2011–2018)

Groundwater Outflow Component	Average	Minimum	Maximum
	(Acre-Feet per Year)		
Pumping – Agriculture	2,780	2,190	3,240
Pumping – Municipal	520	300	790
Pumping – Domestic	260	250	280
Riparian Vegetation Evapotranspiration	90	90	90
Subflow	520	170	890
TOTAL	**4,170**	**3,000**	**5,290**

For the current water budget period, estimated total groundwater outflows ranged from 3,000 to 5,290 AFY, with an average outflow of 4,170 AFY. This is 118% more than the total average groundwater outflows estimated for the historical base period (3,540 AFY average).

Total average annual groundwater pumping in the current period was 3,560 AFY, an increase of 29% compared with the historical baseline period, which was 2,760 AFY. Agricultural, municipal, and domestic sectors accounted for 78%, 15%, and 7% of total pumping, respectively, during the current period.

3.2.3. Summary and Change in Storage

Average groundwater inflows and outflows for the current water budget period are presented on Figure 3-1. Figure 3-2 shows the magnitude of the average annual flow for each individual water budget component during the current period. Precipitation from recharge and agricultural pumping are two largest fluxes for inflow and outflow, respectively. More details regarding the data for each year from 2011 to 2018 are presented in Table 2-5.

The current groundwater budget is directly influenced by the drought conditions from 2012 to 2018, which is one of the driest periods on historical record in the Santa Ynez River Valley. The results of the water budget during the current period show that the CMA experienced more total outflow than inflow. As shown on Figure 3-1, the average total inflow of 2,810 AFY is 1,360 AFY less than the average total outflow of 4,170 AFY. During the current period, the amount of percolation of direct precipitation was diminished and at the same time, total groundwater pumping increased. Over the 8-year current water budget period, an estimated net decline of groundwater in storage of approximately 10,880 AFY occurred (Figure 2-6). The annual average groundwater storage decline during the current water budget period was approximately 1,360 AFY.

The short-term depletion of groundwater in storage indicates that the total groundwater outflows exceeded the total inflows during the current period. As summarized in Table 3-4, total groundwater pumping averaged approximately 3,560 AFY during the current period. Due to the drought conditions, the current water budget period is not appropriate for long-term sustainability planning.

4. PROJECTED WATER BUDGET

The SGMA regulations require the following regarding projected water budgets:

> "3. Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components."
>
> "(A) Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology…"
>
> "(B) Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand…"
>
> "(C) Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate."

4.1. PROJECTED ESTIMATION METHODOLOGY

The future water budget in the CMA was estimated utilizing estimated future population forecasts and future factors prescribed by DWR for future hydrology projection of climatic conditions through 2030 and 2072. The effects of climate change were evaluated using DWR-provided climate change factors. This section describes the estimated components of the future water budget that includes land use, water demand, and climate change.

The 2030 and 2070 precipitation and ET climate change factors are available on 6-kilometer resolution grids. The climate data sets have been routed to the subbasins defined by 8-digit Hydrologic Unit Codes (HUCs), and the resulting downscaled hydrologic time series are available on the DWR SGMA Data Viewer (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). Precipitation and ET data used in this analysis were downloaded from the DWR SGMA Data Viewer for climate grid cells covering the CMA within HUC 18060010, which is the HUC for the Santa Ynez River. These change factors are available on a monthly basis from 1915 to 2011 for the Santa Ynez River watershed. The monthly change factors for the Santa Ynez River watershed were applied to the historical hydrology for the CMA. Mean monthly and annual values were then computed from the subbasin time series to show projected patterns of change under 2030 and 2070 conditions.

4.1.1. Projected Hydrology and Surface Water Supply

DWR has provided SGMA Climate Change Data and published a Guidance for Climate Change Data Use for Groundwater Sustainability Plan Development as the primary source for developing the future water budget.

A common approach to forecast the new water resources balance under climate change conditions in the future is the use of global circulation model (GCM) outputs, downscaled to local geographic scales. There are more than 30 GCMs, each with different ways of representing aspects of the climate system. DWR's Climate Change Technical Advisory Group (CCTAG) has identified the most applicable and appropriate GCMs for water resource planning and analysis in California.

DWR has provided a dataset based on an average of 20 GCMs to project change in precipitation and evapotranspiration around 2030 and 2070. This dataset is identified as the Central Tendency scenario and used in this analysis. The central tendency scenarios were developed using an ensemble of climate models such that the entire probability distribution at the monthly scale was transformed to reflect the mean of the 20[11] climate projections (DWR, 2018). The DWR data set also includes two additional simulation results for extreme climate scenarios under 2070 conditions. Use of the extreme scenarios, which represent Drier/Extreme Warming (2070DEW) and Wetter/Moderate Warming (2070WMW) conditions in GSPs is optional.

Due to the concentration of greenhouse gases in the atmosphere, temperatures under the Central Tendency are estimated to rise by 3 to 7^{o} Fahrenheit between 2020 and 2070 as show in Figure 4-1 showing the range of the GCMs forecasted maximum daily temperatures for Buellton (https://cal-adapt.org/tools/local-climate-change-snapshot/). Generally, change factors under the Central Tendency scenario have a seasonal pattern with wetter conditions in the winter months, and drier during the spring and fall months when compared to historical conditions. Within the Santa Ynez Basin, streamflow is projected to increase slightly by 0.5 percent in 2030 and 3.8 percent in 2070.

Crops require more water to sustain growth in a warmer climate, and this increased water requirement is characterized in climate models using the rate of ET. Under 2030 conditions, the CMA is projected to experience average annual ET increases of 3.8 percent relative to the baseline period. Under 2070 conditions, annual evapotranspiration is projected to increase by 8.3 percent relative to the baseline period.

The seasonal timing of precipitation in the CMA is projected to change. Sharp decreases are projected early fall and late spring precipitation accompanied by increases in winter and early

[11] 10 GCMs selected are combined with two emission scenarios for a total of twenty scenarios utilized. The two emissions scenarios include a "middle" scenario (RCP 4.5) with emissions peaking around 2040 and a "business as usual" scenario with emission peaking around 2080 (RCP 8.5).

summer precipitation. The CMA is projected to experience minimal changes in total annual precipitation. No changes for annual precipitation are projected under 2030 conditions relative to the baseline period. Under 2070 conditions, small decreases in annual precipitation are projected by 3 percent.

4.1.1. Projected Water Demand for CMA

Based upon the historical and current water budget, the total water demands within the CMA were estimated for the future period extending for 20 years through the implementation period (2022-2042) and further through 50 years into the future, through 2072.

The average annual pumping for agricultural irrigation in 2018 was 2,415 AFY. For this analysis of projected water demand, no changes in future irrigated acres and type of crops is assumed. However, based on the climate change Central Tendency scenario, described above, irrigation demands will increase by 3.8% by 2030 and 8.3% by 2070. Using these same increases in crop water demand, future projection of agricultural demand in the Buellton Upland will increase to 2,840 AFY in 2042 and 2,940 AFY in 2072.

Future M&I and rural domestic demands were estimated based on demand to satisfy the non-agricultural demand for the City of Buellton, small mutual water companies, and rural domestic users. The Santa Barbara County Association of Governments Regional Growth Forecasts estimate large increases in population for the Buellton area (SBCAG, 2007). For example, the population of the City of Buellton is forecasted to increase to 7,400 by the year 2040, which represents a 45% increase from the current population of 5,100 in 2020. However, current water use demand by the City of Buellton has been relatively steady compared with population increases. For example, the population of the City of Buellton grew by about 6% between 2010 and 2020, but the water use by the City was about the same.

This analysis assumes an increase in water use by the City of Buellton of 15% by 2042, which is about a third of the SBCAG population projected percentage increase but more in-line with the 2010 to 2020 population trend. Assuming build-out conditions would be approached after 2040, an increase in water use by the City of Buellton of only 20% by 2072 compared with 2018 levels is assumed for this analysis. Based on 2018 pumping from the Buellton Upland of 350 AFY, future projection of the City of Buellton demand from the Buellton Upland will increase to 403 AFY in 2042 and 420 AFY in 2072. These same percentage increases are also assumed for the rural domestic water users who pump from the Buellton Upland. Based on 2018 pumping from the Buellton Upland of 250 AFY for domestic use, future projection of the rural domestic demand from the Buellton Upland will increase to 288 AFY in 2042 and 293 AFY in 2072.

The total demand from the CMA Buellton Upland groundwater during 2018 and projected values for 2042 and 2072 are presented on Table 4-1. By 2042, at the end of the GSP implementation period, total demand in the CMA may increase by **17** percent relative to 2018 to 3,531 AFY, and further by a total of **21** percent by 2072 to 3,653 AFY due to a combination of increased temperatures due to climate change and increases in population. Using the same increase in demands for each sector, the surface water demands in the Santa Ynez River Alluvium subarea are similarly projected to increase by 17 and 21 percent in years 2042 and 2072, respectively, as shown in Table 4-1.

TABLE 4-1 PROJECTED WATER DEMAND FOR CMA

	2018 Demand	Estimated 2042 Demand	Estimated 2072 Demand
	(Acre-Feet per Year)		
Groundwater Demand			
Pumping – Agriculture	2,415	2,840	2,940
Pumping – Municipal	350	403	420
Pumping – Domestic	250	288	293
TOTAL Groundwater Demand	**3,015**	**3,531**	**3,653**
Santa Ynez River Alluvium Subarea Surface Water Demand			
River well pumping – Agriculture	3,223	3,790	3,924
River well pumping – Municipal and SWP Imports	897	1,033	1,076
River well pumping – Domestic	376	434	441
TOTAL Surface Water Demand	**4,497**	**5,257**	**5,441**
TOTAL	**7,512**	**8,788**	**9,094**

4.2. Projected Water Supply

The water demands in Table 4-1 will be supplied from the same historical sources of groundwater in the Buellton Upland and surface water in the Santa Ynez River Alluvium subarea. Based on current planning from the Central Coast Water Authority and DWR's Delivery Capability Report, a 58 percent delivery allocation for SWP to the CMA for the projected future period has been assumed. Based on the City of Buellton's current SWP allocation of 578 AFY and a drought buffer of 58 AFY, the total imports to meet future demands is assumed at 432 AFY. The remaining demand for surface water supplies by the City of Buellton (601 and 644 AFY, respectively for 2042 and 2072) is assumed to come from river well pumping similar to historical conditions.

The source for surface water supplies, the Santa Ynez River, is projected to continue to be a reliable source of water for the Santa Ynez River Alluvium Subarea due to Cachuma Reservoir operations located about 11 miles upstream of the CMA. The ability to store water in Cachuma Reservoir will help attenuate the effects of the flashier runoff forecasted to occur under the Central Tendency scenario. Downstream water rights releases and releases for endangered steelhead from Bradbury Dam are assumed to be able to mitigate impacts downstream caused by climate change. Detailed climate change studies and impacts to the operations of Cachuma Reservoir are currently not available. However, releases from Cachuma Reservoir did sustain Santa Ynez River underflow during the recent critical drought of 2012-2018 and is expected to provide similar mitigation during future droughts. Although, if climate change does not continue under the Central Tendency scenario but rather is more like the Hot and Dry Climate scenarios, then the water supply for the entire region will be affected and have to be re-evaluated.

The source for groundwater supplies in the Buellton Upland is primarily recharge from precipitation which will be affected by climate change to an uncertain degree. Because recharge is the resultant after three key processes including precipitation, runoff, and evapotranspiration, which among themselves have associated uncertainty, the combined uncertainty is compounded. Under the Central Tendency scenario in the CMA, no changes for annual precipitation are projected under 2030 conditions relative to the baseline period, and under 2070 conditions, small decreases in annual precipitation are projected by 3 percent. Recharge from precipitation to the Buellton Upland groundwater aquifer is assumed to be affected by climate change by these same percentages of zero percent by 2042 and 3 percent reduction by 2072. Recharge from streamflow infiltration is assumed to be similar to the projected increases in runoff by 0.5 percent in 2042 and 3.8 percent increase by 2072. The net effect of decreased recharge and increased runoff by these small percentages is that the current estimate of the perennial yield of 2,800 AFY for the Buellton Upland is assumed to be roughly the same for this analysis under climate change conditions.

4.3. SUMMARY OF PROJECTED WATER BUDGET

Groundwater supplies are projected to be about the same under projected future conditions, while overall demand is projected to increase up to 21 percent by 2072 to 3,653 AFY due to a combination of increased temperatures due to climate change and increases in local population. Table 2-2 summarizes the projected total groundwater budget and average change in storage in the future.

Average groundwater inflows and outflows for the projected future water budget period are presented on Figure 4-2 and Figure 4-3 for years 2042 and 2072, respectively. The results of the water budget during the future period show that the CMA has more total outflow than inflow. As shown on Figure 4-2, in the year 2042 the average total inflow of 3,700 AFY is 420 AFY less than the average total outflow of 4,120 AFY. Similarly, as shown on Figure 4-3, in the year 2072 the average total inflow of 3,650 AFY is 600 AFY less than the average total outflow of 4,250 AFY. The next steps in the GSP process will be to discuss the potential undesirable results from losing approximately 400 to 600 AFY in groundwater storage in the Buellton Upland in the future and developing a monitoring system for the GSP.

TABLE 4-2 PROJECTED GROUNDWATER BUDGET FOR CMA

	Baseline Hydrology and 2018 Demands	Estimated 2042 Hydrology and Demands	Estimated 2072 Hydrology and Demands
Subflow	85	85	85
Recharge from Precipitation- Aerial (Overlying)	1,870	1,871	1,814
Recharge from Precipitation- Mountain Front	770	770	747
Net Channel Percolation from Surface Water	360	362	374
Agricultural Return Flows	413	486	503
Municipal/ Domestic Return Flows	110	127	129
TOTAL Inflows	**3,610**	**3,700**	**3,650**
Pumping - Agriculture	2,415	2,840	2,940
Pumping - Municipal	350	403	420
Pumping - Domestic	250	288	293
Riparian Vegetation Evapotranspiration	88	91	95
Subflow to Santa Ynez River Alluvium	500	500	500
TOTAL Outflows	**3,600**	**4,120**	**4,250**
TOTAL Inflows - Outflows	**10**	**-420**	**-600**

5. REFERENCES

DWR (California Department of Water Resources). 2016. *Groundwater Sustainability Plan Regulations*.

Flint, L.E., and A.L. Flint. 2017. *California Basin Characterization Model: A Dataset of Historical and Future Hydrologic Response to Climate Change*. Version 1.1. U.S. Geological Survey Data Release. Published in 2014; updated in May 2017. https://ca.water.usgs.gov/projects/reg_hydro/basin-characterization-model.html.

GSI (GSI Water Solutions, Inc.). 2020. Eastern Management Area Groundwater Sustainability Agency Santa Ynez River Valley Groundwater Basin – Eastern Management Area Groundwater Sustainability Plan. DRAFT Section 3 – Basin Setting: Groundwater Budget. December 8, 2020.

Hamlin, S.N. 1985. *Ground-Water Quality in the Santa Rita, Buellton, and Los Olivos Hydrologic Subareas of the Santa Ynez River Basin, Santa Barbara County, California.* USGS Water-Resources Investigations Report 84-4131. doi: 10.3133/wri844131.

Hydrologic Consultants, Inc. (HCI). 1997. *Development of a System of Models for the Lompoc Ground-Water Basin and Santa Ynez River for the City of Lompoc.*

PRISM (PRISM Climate Group). 2014. "Average Annual Precipitation 1981–2010."

Santa Barbara County Association of Governments. 2. *Draft Water Resources Management Plan Santa Ynez Water Conservation District*.

Stetson (Stetson Engineers). 1992. *Draft Water Resources Management Plan Santa Ynez Water Conservation District*.

Stetson Engineers. 2008. *Description and Documentation for Santa Ynez River RiverWare Model Task 2: Operations Model*.

Stetson. 2020. *Forty-Second Annual Engineering and Survey Report On Water Supply Conditions of the Santa Ynez River Water Conservation District 2019–2020.* Prepared for Santa Ynez River Water Conservation District.

SWRCB. 2019. *Order WR 2019-0148. In the Matter of Permits 11308 and 11310 (Applications 11331 and 11332) held by the United States Bureau of Reclamation for the Cachuma Project on the Santa Ynez River.* State of California, SWRCB. https://www.waterboards.ca.gov/waterrights/water_issues/programs/hearings/cachuma/docs/wro2019_0148_withagreement_final.pdf.

SYRWCD (Santa Ynez River Water Conservation District). 1995. *Buellton Uplands Groundwater Management Plan*.

SYRWCD. 2010. "Groundwater Production Information and Instructions."