Goleta Water District

Water Supply Management Plan

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4 Executive Summary

Key Findings

This Plan formulates a water supply strategy for Goleta Water District (GWD) by prioritizing use of GWD's various sources of supply, evaluating the reliability GWD's water supplies, and developing drought scenarios for current and future demand. The work determined that GWD's supplies exceed current demand under average conditions and are equal to demand when averaged over a complete multi-year drought period. However, in the driest single year of a drought there would be about a 7% shortfall in supply at today's demand level.

At projected 2030 demand, with the State-mandated conservation reduction in place and the 850 acre-feet per year of authorized future demand factored in, there would be sufficient water to meet demand during average conditions. In multi-year drought conditions at the projected 2030 demand levels, supply would be about 2,600 acre-feet per year short of demand, with the driest year having a somewhat larger shortfall. When a more-extensive drought was synthesized by extending the length of the last drought (1986-1991) by two years (with current infrastructure capacities), there would be a maximum shortfall of 26% (3,600 acre-feet) at current levels of demand and a maximum shortfall of 40% (6,500 acre-feet) at projected 2030 demand levels[1].

Methodology

A combination of the Santa Ynez River Model for Cachuma deliveries and the California Department of Water Resources (DWR) reliability studies for State Water deliveries were used in developing the Water Supply Management Plan (WSMP). The existing models use historic hydrologic data for the Santa Ynez watershed and State Project system and superimpose the various water resource facilities and policies on this hydrology. The WSMP model uses monthly time steps from 1922 through 2007. The model period includes both the last drought period and two severe droughts in the 1920s and 1950s. In addition, the WSMP model synthesizes a more-severe drought where the dry years of the late 1980s and early 1990s are extended by two years. Thus, the water supply plan formulated using the model is fairly protective for future drought periods.

Operating Plan

The WSMP recommends an operating plan for prioritizing the use of GWD's water supplies. The primary recommendation is during periods when Cachuma deliveries are reduced because of local drought conditions. In this situation, groundwater wells should be pumped at capacity and shared in priority with Cachuma water sources. In this manner, some of the Cachuma water is saved for the drier part of the year when demand is the highest and more groundwater can be pumped throughout the year (if groundwater is only pumped during the driest part of the year, well capacities significantly limit the amount of groundwater that can be supplied).

[1] As the San Ricardo well is rehabilitated, its additional capacity of 2 AF per day will partially mitigate these supply shortfalls.

Water Supply and Demand Conclusions

The WSMP modeling has led to the following conclusions:

Current Conditions	Average Conditions (AFY)	Drought Conditions (AFY)
Current Demand	**14,600**	**14,600**
Supply Sources		
Cachuma Potable & GWC	9,322	7,672
State Water	3,800	3,052
Groundwater	2,350	2,710
Recycled Water	1,000	1,000
Total Supply	**16,472**	**14,434**
Total Surplus (Deficit)	***1,872***	***(166)***

Table 4-1. Water supply during average and drought conditions at current levels of demand. The SAFE Ordinance requires that State Water deliveries of 3,800 acre-feet per year be used for planning purposes –it is a conservative assumption because GWD's full pipeline capacity of 4,500 acre-feet per year can be delivered most of the time. The 2,350 acre-feet per year of groundwater is GWD's portion of the yield of the groundwater basin.

2030 Forecast	Average Conditions (AFY)	Drought Conditions (AFY)
A. Base Forecasted Demand 2030	15,833	15,833
B. Authorized Future Demand	850	850
Total Demand 2030 (A+B)	**16,683**	**16,683**
Supply Sources		
Cachuma Potable & GWC	9,322	7,783
State Water	3,800	2,488
Groundwater	2,350	2,852
Recycled Water[2]	1,000	1,000
Total Supply	**16,472**	**14,123**
Total Surplus (Deficit)	***(211)***	***(2,560)***

Table 4-2. Forecast supplies and demand in 2030 under average and drought conditions. Average supplies are those available under existing water rights and allocations; the exception is State Water, where the SAFE Ordinance requires that 3,800 acre-feet per year be used for planning purposes – it is a conservative assumption because GWD's full pipeline capacity of 4,500 acre-feet per year can be delivered most of the time. Drought supplies are calculated from the WSMP Model, based on the average of the worse five consecutive years of drought.

[2] Recycled water supply is kept constant in the calculations. However, there is an additional 2,000 acre-feet per year of unused recycled capacity if additional customers are identified and additional pipelines are constructed.

5 Introduction

Goleta Water District ("GWD") has multiple sources of water supply for delivery to customers. These sources include Cachuma Reservoir, groundwater, State Water, and recycled water. Each of the sources has its own pattern of availability during wet and dry climatic cycles. The combination of the water sources provides more delivery reliability than each source alone. To optimize GWD's overall water delivery reliability at the least cost to customers, the interplay of these water sources must be understood over a range of climatic conditions.

As the first step in determining the optimum use of GWD's sources of water supply, a Groundwater Management Plan was formulated and adopted by the Board of Directors (Board) in 2010 (GWD, 2010). The Groundwater Plan provides guidance on how to operate the basin while meeting the requirements of the Wright Judgment and the SAFE Ordinance.

This Water Supply Management Plan ("WSMP") builds on the Groundwater Management Plan by adding the other sources of supply in GWD's water portfolio to the overall supply mix. This WSMP adds the results of modeling of Cachuma and State Water reliability over multiple wet and dry cycles to determine optimum use of the differing sources of supply and the supply reliability that results from this optimization.

5.1 Background

During the drought of the late 1980s and early 1990s, water supplies for the south coast of Santa Barbara County reached a critically low level. An emergency seawater desalination plant was constructed just prior to the end of the drought, and voters subsequently passed a bond issue to build the Coastal Aqueduct of the State Water Project to bring additional supplies into the area. These new supplies were aimed at drought-proofing the area into the future.

The customers of Goleta Water District reduced their water consumption significantly during this drought. Groundwater played an important supply role for GWD during the drought, with increased groundwater pumping resulting in groundwater elevations reaching historical low levels. This lowering of groundwater elevations was exacerbated by the fact that pumping prior to the drought had already lowered the elevations substantially. As a result of the low groundwater elevations, the customers of GWD voted to restrict GWD use of groundwater to drought periods or periods when groundwater elevations were high in the basin (see GWD, 2010, for further discussion of the SAFE Ordinance).

The current challenge for GWD is to ensure that use of its various sources of water supply is optimized to enhance reliability at the lowest cost, both now and in the future. This WSMP addresses that challenge.

5.2 Purpose and Goals of Plan

The purpose of the WSMP is to determine the most effective use of GWD's various sources of water supply, both in terms of reliability and cost. An additional purpose is to determine the best use of the water sources to satisfy potential increases in demand in the future.

There were several goals for this study:

1. Optimize GWD's use of its various sources of supply to balance cost and reliability;
2. Determine the critical components of GWD's supply system;
3. Develop a plan to have sufficient supplies during drought periods more severe than the drought of 1986 to 1991;
4. Determine the reliability of GWD's water supply under current water supply demand and potential future increases in demand.

The WSMP is meant to be used by GWD to:

1. Have a "road map" for the priority of using its various sources of water supply under different climatic and groundwater conditions.
2. Determine if additional facilities need to be constructed to optimize use of its sources of water, and what current or future conditions would trigger the need for these facilities.
3. Assist in determining the amount of future demand that can be accommodated by the existing water sources.
4. Determine the reliability of its water sources in a drought and how much conservation may be needed to avoid drought-related shortfalls in supply.
5. Provide input to other planning tools such as the Urban Water Management Plan.

5.3 Methods Used

This study used both the Santa Ynez River Model (for Cachuma supplies) and the State Water reliability modeling of the California Department of Water Resources ("DWR") as the basis for determining the availability of these water supplies over a 86-year time period. To mesh the results of this modeling, the period 1922 to 2007 was used in this Plan. In both models, current and future water resource facilities and policies were superimposed on the historical hydrology of the Santa Ynez River and the rivers within the State Water Project. The results of these models were then incorporated into a monthly spreadsheet model for the 86-year period that simulated GWD's operations. The spreadsheet model contains facility capacity limitations, SAFE and Wright operating rules, current and future water production demand, and the Central Coast Water Authority's ("CCWA") State Water storage project in San Luis Reservoir.

The spreadsheet model was used to experiment with priorities of water supply options, expansion of injection/extraction capabilities, and drought responses. The model evaluated the reliability and costs of these options.

5.3.1 Santa Ynez River Model

The Santa Ynez River Model ("River Model") was developed by the Santa Barbara County Water Agency over the past two decades or more to simulate flow rates along the river and dozens of tributaries, as well as capture and spilling of water from the three reservoirs along the river. The numerical model has been used for reservoir studies, to determine water rights issues, to plan conservation releases, and to assist in issues related to fish flows. A new daily time-step numerical model is currently being constructed, but was not yet ready for use in this Plan.

The River Model runs over the 76 water-year period from October 1917 through September 1993 in monthly time steps. Measured and estimated historic stream flows, rainfall, evaporation, and tunnel infiltration values provide the data base for a set of algorithms that simulate reservoir and river-course conditions. Changes in one portion of the model (such as increasing annual deliveries from a reservoir) result in changes throughout the model. Output from the model includes graphs of reservoir storage and flow rates through time, with monthly data for a variety of parameters downloadable into Excel spreadsheets for analysis.

The 76-year period of the River Model represents several wet and dry periods. All of the droughts of the 20th century are included in the modeling period except the 1901 through 1904 portion of a dry period which began in the mid 1890s. The modeling period begins and ends with years during which the Santa Ynez River surface water reservoirs are filled to capacity and the riparian alluvial deposits are in a generally wet and re-charged state.

Figure 5-1 indicates actual Santa Barbara-area hydrology during this period.

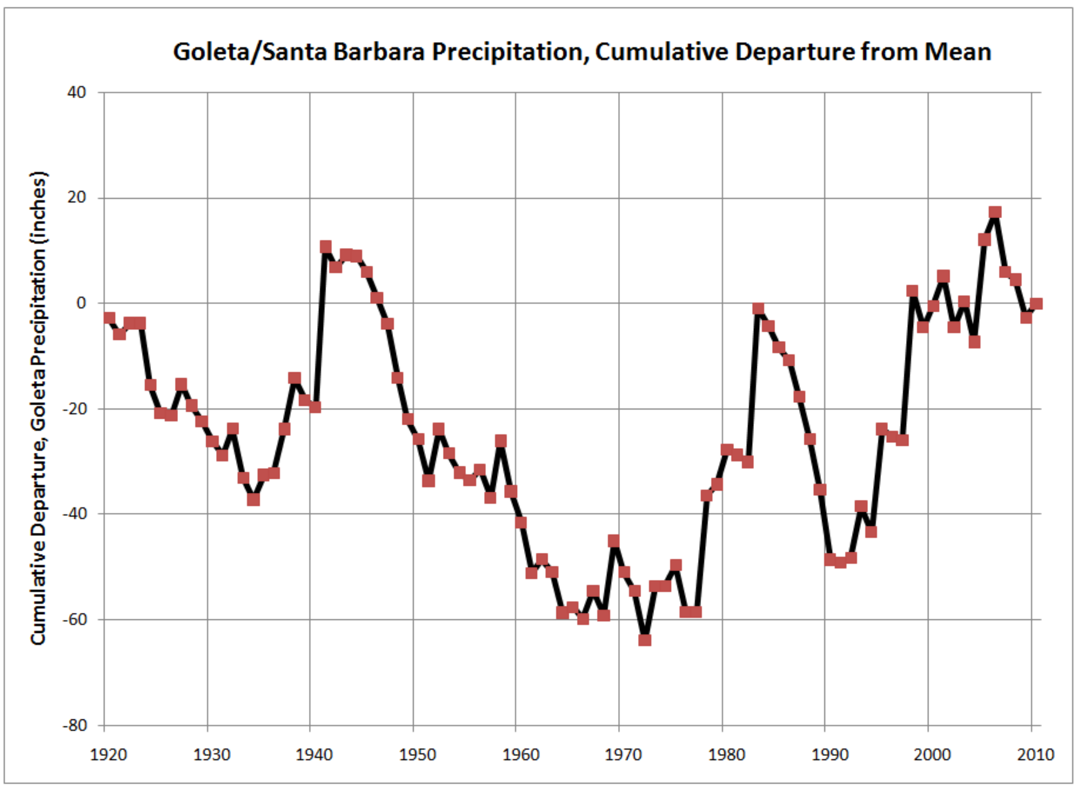

Figure 5-1. Cumulative departure of rainfall (Goleta Fire Station, extended by correlation with Santa Barbara data) that includes the 1922 to 2007 period of WSMP. Wet periods are indicated by rising values, whereas dry periods are indicated by falling values.

The Santa Ynez River Model was set up to represent Cachuma operations with downstream releases for fish, and a fixed 20% drought period delivery cutback. The River Model superimposes current or future water demand on the hydrology of the 76 years of Santa Ynez River hydrology as if current facilities and policies were in place during the entire period. This allows a simulation of the most recent 1986 to 1992 drought, as well as longer droughts during the model period.

The new daily-time step Santa Ynez River model will likely change some of the results from the original model. However, results are not yet available to make this comparison.

To correspond to the model period of GWD's Groundwater Model (1970-2007), this Water Supply Management Plan extended the hydrology of the Santa Ynez River through the year 2007 by using actual data for that extension period.

5.3.2 State Water Projections

The amount of State Water available for GWD use in any year was based on California Department of Water Resources (DWR) simulations using northern California hydrology covering roughly the same period as the Santa Ynez River model. The availability simulations are currently being updated every two years. The most recent simulations (Figure 5-2; DWR, 2009) predict the ability of the Project to have delivered water over the historical hydrologic period given current and future facilities, policies, and environmental requirements (similar to the way the Santa Ynez River Model works). The reason that these simulations have to be updated so frequently is that judicial/environmental restrictions on the State Water Project continue to be changed almost annually. The latest simulations predict that between 60% and 70% of Table A water can be delivered about half (50%) of the time (Figure 5-2). The average Table A deliveries over the length of the State Water model period is 60% (DWR, 2009).

Future State Water availability was also evaluated by DWR for the year 2029. A wide range of future policies, facilities, climate change, and environmental requirements were evaluated, resulting in a range of availability results. This Plan used DWR's preferred simulation. The results of the latest simulations are that State Water availability is increased somewhat during dry years (left side of Figure 5-3) and markedly decreased in wet years (right side of Figure 5-3). The 2029 simulations predict that between 60% and 70% of Table A water can be delivered about half (50%) of the time. The average Table A deliveries over the length of the State Water model period is 60% (DWR, 2009).

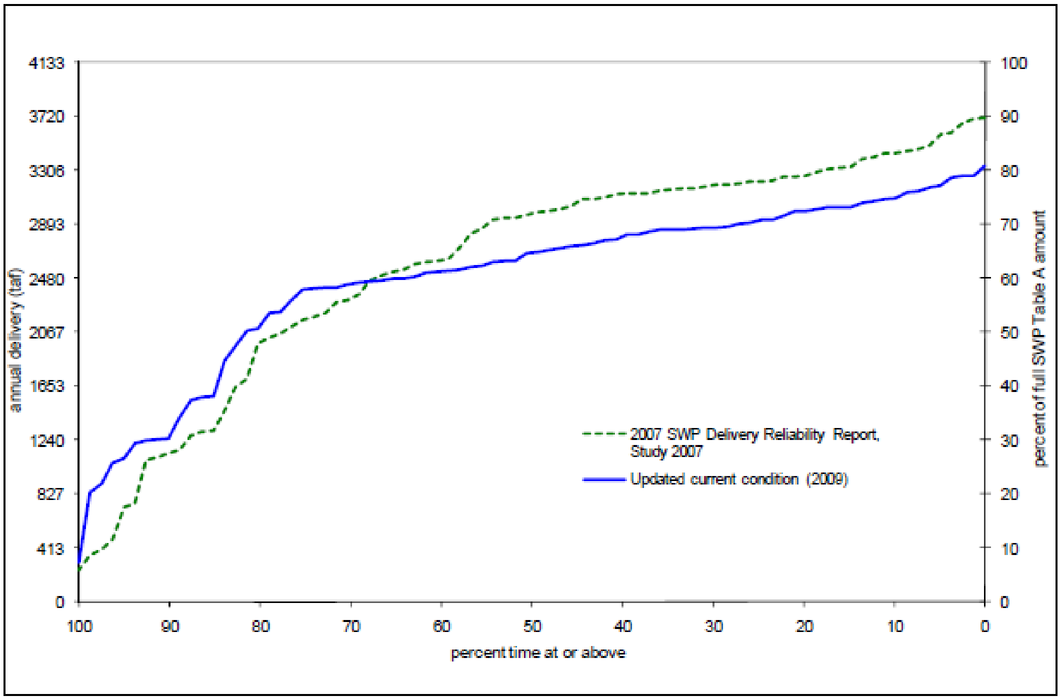

Figure 5-2. Results of simulation of State Water availability system-wide under current conditions (solid blue line) (DWR, 2009). Dry years are represented on the left side of the chart and wet years on the right side. To read the chart, choose the percent of annual Table A delivery on the right scale, move over horizontally to intersect the blue line, and read the probability of delivering that amount of water on the bottom scale. For instance, the probability of delivering 50% of Table A water in any year is about 80%. Potential deliveries were increased during dry years and decreased in wet years compared to previous estimates in 2007.

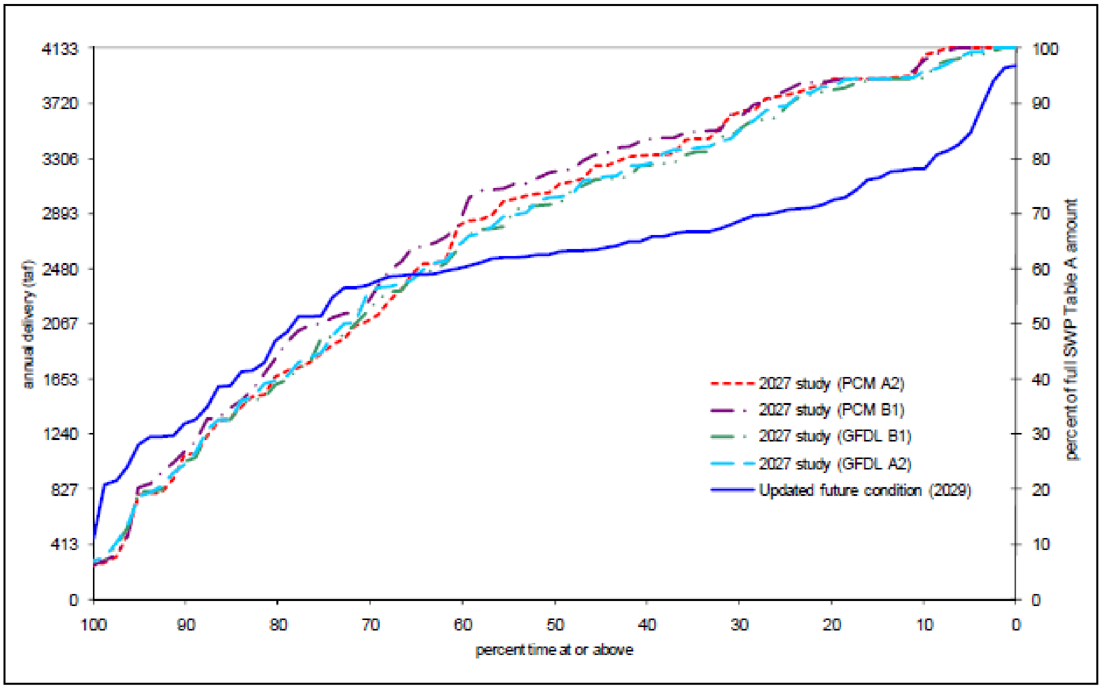

Figure 5-3. Results of simulation of State Water system-wide availability in 2029 (solid blue line) (DWR, 2009). Dry years are represented on the left side of the chart and wet years on the right side. To read the chart, choose the percent of annual Table A delivery on the right scale, move over horizontally to intersect the blue line, and read the probability of delivering that amount of water on the bottom scale. For instance, the probability of delivering 50% of Table A water in any year is a little less than 80%. Potential deliveries were increased during dry years and significantly decreased in wet years compared to previous estimates in 2007.

5.3.3 Water Supply Management Plan Model

A spreadsheet model was constructed to evaluate the reliability and costs of different priorities of use for GWD's sources of water supply. The model uses monthly time steps from 1922 through 2007. The period coincides with the period of modeling for the State Water Project (see previous section). The original scope was to end modeling after year 1993 (the end of the historical Santa Ynez River Model). However, GWD's Groundwater Model uses the period 1970 to 2007 and cross-correlation between the Groundwater Model and the WSMP model was necessary to predict changing groundwater elevations in the Goleta Groundwater basin under different supply management scenarios. Actual operational information from Cachuma Reservoir was used to fill in the 1994 to 2007 gap in the Santa Ynez River Model.

The WSMP thus uses the most-current prediction of supply availability over the hydrologic period 1922 through 2007. This long period of analysis allows the interaction of differing climate trends in northern and southern California, where drought and wet periods do not always coincide. It is important to note that the model functions by taking one set of operational criteria and customer demands over the entire hydrologic period – the model does not sequentially increase demand as if it was a time series through the next 86 years. To determine the results for future demand, a new model run must be performed with the new demand applied over the 86-year period. To predict the availability of supplies and the groundwater elevations in a drought (as required in an Urban Water Management Plan), a drought period can be selected during the 86-year period. The model also uses some scenarios where a more-intense drought than those during the 1922-2007 period is synthesized. These scenarios assume that the 1986-1991 drought extended two additional years, with significant reductions of Cachuma deliveries as the reservoir is drawn down further than actually occurred in the historical drought.

Monthly demand for GWD's water supplies was calculated in the model based on historical demands during wet, average, and dry climatic conditions. 2030 demand was estimated based on planning estimates (see Sections 13.1 and 14.2). The assumptions used in the model for water supply amounts, capacities, and costs are listed in Chapter 14.

The WSMP spreadsheet model takes into account both the Wright Judgment and the SAFE Ordinance in its calculations (see description of these in GWD's Groundwater Management Plan – GWD, 2010). Because the SAFE Ordinance requirements are based in part on groundwater elevations in the Goleta Groundwater basin, the WSMP predicts groundwater elevations each year depending upon the amount of pumping/injection that have occurred in the basin. The interaction of the Groundwater Model and the WSMP model is described in detail in Chapter 14. The set of equations generated from the Groundwater Model output are included within the WSMP.

5.3.4 Management Strategies Tested

To test the reliability and cost of each of GWD's sources of water under different priority-of-use and capacity scenarios, a number of model runs were performed. These scenarios are listed below and summarized in Table 5-1. Detailed descriptions of the input for each scenario and the results of each scenario are included in Chapter 14. In all cases, Cachuma water is used first because the reservoir spills on average every three years and any unused water is lost. The three classifications of Cachuma water are always prioritized in the following order: 1) spill water (the quantity of spill water usually far exceeds water supply and environmental demands); 2) carry-over water (unused entitlement from previous years which are lost when the reservoir spills); and 3) annual Cachuma entitlement. The amount of spill water that can be used by customers and for groundwater storage through injection is limited by customer demand and treatment/injection capacity. An increase in treatment/injection capacity in the future is one of the strategies tested.

State Water and groundwater are used in differing priorities in the differing scenarios, all within the rules of the SAFE Ordinance and the Wright Judgment. There is a trade-off between the two sources of water – State Water is the most expensive supply source for the District, allows maximum groundwater storage for drought protection, whereas use of more groundwater is more cost-effective, but results in less stored water available for a drought.

A hybrid of water use priorities that optimized uses was also analyzed. GWD's groundwater pumping capacity was also varied in the scenarios from current capacity to increased capacities for current and future demands.

Scenarios for current demand levels also test the efficacy of CCWA's storage program in San Luis Reservoir for unused State Water allocation. This stored water is always used first before GWD's regular Table A allocation because it is possible to lose this storage during a spill.

The scenarios used in the modeling are listed below, with a matrix of the elements in each scenario indicated in Table 5-1.

Current Demand – Current Pumping/Injection Capacity

Groundwater Used Last

Scenario #1: With CCWA Storage Program: Current demand, current pumping and injection capacity, CCWA storage program in place, State Water used preferentially before groundwater (groundwater only used when demand cannot be met by Cachuma and State Water – within SAFE operating rules).

Scenario #1a: Without CCWA Storage Program: Same as Scenario #1, but without CCWA storage program.

State Water Used Last

Scenario #1b: With CCWA Storage Program: Current demand, current pumping and injection capacity, CCWA storage program in place, groundwater used preferentially before State Water (State Water only used when demand cannot be met by Cachuma and groundwater – within SAFE operating rules).

Scenario #1c: Without CCWA Storage Program: Same as Scenario #1b, but without CCWA storage program.

Hybrid Priorities

Scenario #1d: With CCWA Storage Program: Current demand, current pumping and injection capacity, CCWA storage program in place, use of Cachuma, State Water, and groundwater are optimized to lessen the impact of infrastructure capacities (this strategy is discussed in section 12.2.2).

Extended Drought

Scenario #1b-drght: Scenario #1b with drought of 1986-1991 extended by two years with Cachuma deliveries reduced to as low as 20% of allocation.

Scenario #1d-drght: Scenario #1d with drought of 1986-1991 extended by two years with Cachuma deliveries reduced to as low as 20% of allocation.

Current Demand – Increased Pumping Capacity

Groundwater Used Last

Scenario #2: With CCWA Storage Program: Current demand, CCWA storage program in place, State Water used preferentially before groundwater (groundwater only used when demand cannot be met by Cachuma and State Water – within SAFE operating rules), but with pumping capacity increased by varying amounts as discussed in Section 12.2.1.

State Water Used Last

Scenario #2a: With CCWA Storage Program: Current demand, CCWA storage program in place, groundwater used preferentially before State Water (State Water only used when demand cannot be met by Cachuma and groundwater – within SAFE operating rules), but with pumping capacity increased by varying amounts as discussed in Section 12.2.1.

Hybrid Priorities

Scenario #2b: With CCWA Storage Program: Current demand, CCWA storage program in place, use of Cachuma, State Water, and groundwater are optimized to lessen the impact of infrastructure capacities (this strategy is discussed in section 12.2.2), but with pumping capacity increased by varying amounts as discussed in Section 12.2.1.

Extended Drought

Scenario #2c: Scenario #2b with drought of 1986-1991 extended by two years with Cachuma deliveries reduced to as low as 20% of allocation.

2030 Demand

Hybrid Priorities

Scenario #3: With increased pumping capacity: Increased demand as discussed in Section 13.1, CCWA storage program in place, use of Cachuma, State Water, and groundwater are optimized to lessen the impact of infrastructure capacities (this strategy is discussed in section 12.2.2), but with pumping capacity increased as discussed in Section 13.5.

Scenario #3a: With current pumping capacity: Increased demand as discussed in Section 13.1, CCWA storage program in place, use of Cachuma, State Water, and groundwater are optimized to lessen the impact of infrastructure capacities (this strategy is discussed in section 12.2.2).

Extended Drought

Scenario #4: Scenario #3 with drought of 1986-1991 extended by two years with Cachuma deliveries reduced to as low as 20% of allocation.

Scenario	Demand: Current	Demand: 2030	GW Last	SWP Last	GW/SWP Hybrid	CCWA Bank	Pump & Inject Capac: Current	Pump & Inject Capac: Increase	Extended Drought
#1	√		√			√	√		
#1a	√		√				√		
#1b	√			√		√	√		
#1c	√			√			√		
#1b-drght	√			√		√	√		√
#1d	√				√	√	√		
#2	√		√			√		√	
#2a	√			√		√		√	
#2b	√				√	√		√	
#2c	√				√	√		√	√
#3		√			√	√		√	
#3a		√			√	√	√		
#4		√			√	√		√	√

Table 5-1. Matrix of Water Supply Management Plan model scenarios.

The results of the WSMP modeling are discussed in the following chapters.

6 Integration with Other GWD Plans

This WSMP is meant to interact with the other major planning tools that GWD uses for operations, operating and capital expenditures, and water rates. These interactions are discussed for each of the major planning and budgeting tools.

Groundwater Management Plan – The Groundwater Management Plan (GWD, 2010) explained and adopted the general rules by which the groundwater basin can be operated. This included how to calculate the 1972 groundwater elevation that is critical for determining when groundwater can be pumped in the WSMP, the calculations for determining the amount of Annual Storage Contribution required, and tracking the storage in the basin. There was also a discussion of the best areas to site new wells that may be part of GWD's expanded water supply for potential increased water demand in the future. The WSMP identified the possibility that the SAFE Ordinance may inadvertently cause a shortage of supply in some circumstance at higher levels of demand; a remedy to this would likely be considered in future updates to the Groundwater Management Plan.

Water Supply Management Plan Implementation Guidelines – These Guidelines will be prepared following the adoption of the WSMP. Results of the modeling will be used to determine the use of GWD's various sources of supply in any given year in response to supply, demand, and other factors. These Guidelines would be updated every five years or when certain triggers are met. Such triggers could include changes in operating or release criteria for Cachuma, changes in reliability of the State Water Project, emergencies that restrict import of water, groundwater elevations that drop faster than modeled when groundwater is extracted, and the like.

Urban Water Management Plan (UWMP) – It is a requirement that Urban Water Management Plans be revised every five years; GWD must revise its UWMP by mid-year 2011. The WSMP modeling of water reliability and drought scenarios can be used directly in the analyses of water supply required by the UWMP. Prior to the preparation of each UWMP, it may be prudent to update the WSMP modeling.

Water Supply Assessments – These assessments may be required for future development projects within GWD. The results of WSMP modeling of the water availability with increased demand will likely be one of the key analyses used in such assessments.

Rate Analyses – When rates are analyzed, the key calculation are usually how much water supplies cost, how they will increase, how should these costs be apportioned, and how should rate structures be used to encourage conservation. The WSMP calculates incremental costs of supply, what the source of supply would be with increased demand, how supply shortages may occur in the future, and the extent of such supply shortages. If projected increases in demand occur, the WSMP modeling should be updated regularly to provide feedback for periodic rate analyses.

GWD's Operating and Capital Budget – The WSMP identifies capital and operating costs for both current water demand and incremental future demand. In particular, the WSMP links increased demand to increased capital facilities such as new wells. These analyses can be used by GWD to plan for future capital costs associated with changing water demand.

7 Findings and Conclusions

WSMP modeling used the results from the Santa Ynez River Model, results from a similar model for northern California that predicts State Water availability, and operating requirements for the Goleta Groundwater basin for an 86-year period from 1922 through 2007 to a examine GWD's various sources of water supply. Even though these models are very sophisticated, actual results may vary from model predictions. As with any planning exercise, models used in the WSMP are intended to inform the decision-making process using the best available information and analytical techniques. Accordingly, this work led to the following principal findings and conclusions:

1. Allocations for Cachuma Reservoir, State Water, and groundwater supplies could yield almost 16,500 acre-feet per year (with current pumping and treatment facilities) under average hydrologic conditions, compared to a current demand for water of about 14,600 acre-feet per year.
2. During drought periods such as 1986 to 1991, these sources could supply about 14,500 acre-feet per year of supply (with current pumping and treatment facilities), about the same as current water use. However, in the driest year of a drought, there would be a supply shortfall of about 7%, given current demands.
3. At projected demand levels of about 16,700 acre-feet per year in the year 2030 and at current pumping and treatment capacities, existing GWD water supplies of 16,500 acre-feet per year are about equal to demand under average conditions. The availability of State Water, which is set by SAFE at 3,800 acre-feet per year for planning purposes, is considered as of this writing to be relatively conservative, meaning that there could be more water available than planned.
4. At 2030 projected demand levels of 16,700 acre-feet per year and at current pumping and treatment capacities, drought supplies of about 14,100 acre-feet per year would be significantly short of demand. In the driest year of a drought, there would be about a 22% shortfall in supply.
5. If there is a drought in the future that exceeds any in the past 86 years, water supplies will be reduced. When the drought of the late 1980s and early 1990s is extended by two years, there would be a maximum shortfall of 26% at current levels of demand and a maximum shortfall of 40% at projected 2030 demand levels (at current pumping and treatment capacities).
6. Increasing groundwater pumping capacity can partially offset the drought shortfalls. At current levels of demand, additional pumping capacity only slightly increases reliability; at higher levels of demand, increased pumping capacity becomes more important in ensuring supply reliability.
7. GWD's only new sources of water supply available in the future are recycled water and water saved through conservation. There is currently 2,000 acre-feet per year of unused additional recycled water production capacity, but there is presently limited

distribution capacity and known demand. As GWD customers implement the additional conservation mandated by the State by 2020, the opportunity for additional conservation beyond that becomes more critical for new supplies, but could be difficult to achieve[3].

Current Conditions	Average Conditions (AFY)	Drought Conditions (AFY)
Current Demand	**14,600**	**14,600**
Supply Sources		
Cachuma Potable & GWC	9,322	7,672
State Water	3,800	3,052
Groundwater	2,350	2,710
Recycled Water	1,000	1,000
Total Supply	**16,472**	**14,434**
Total Surplus (Deficit)	***1,872***	***(166)***

Table 7-1. Water supply during average and drought conditions at current levels of demand and current pumping and treatment capacities. The SAFE Ordinance requires that State Water deliveries of 3,800 acre-feet per year be used for planning purposes – it is conservative because there is a 50% chance that 60% to 70% of Table A water (more than the 4,500 acre-feet per year of GWD delivery capacity) can be delivered in any year (section 5.3.2). The 2,350 acre-feet per year of groundwater is GWD's portion of the yield of the groundwater basin.

2030 Forecast	Average Conditions (AFY)	Drought Conditions (AFY)
A. Base Forecasted Demand 2030	15,833	15,833
B. Authorized Future Demand	850	850
Total Demand 2030 (A+B)	**16,683**	**16,683**
Supply Sources		
Cachuma Potable & GWC	9,322	7,783
State Water	3,800	2,488
Groundwater	2,350	2,852
Recycled Water[4]	1,000	1,000
Total Supply	**16,472**	**14,123**
Total Surplus (Deficit)	***(211)***	***(2,560)***

Table 7-2. Forecast supplies and demand in 2030 under average and drought conditions. Average supplies are those available under existing water rights and allocations; the exception is State Water, where the SAFE Ordinance requires that 3,800 acre-feet per year be used for planning purposes – it is conservative because there is a 50% chance that 60% to 70% of Table A water (more than the 4,500 acre-feet per year of GWD delivery capacity) can be delivered in any year (section 5.3.2). Drought supplies are calculated from the WSMP Model, based on the average of the worse five consecutive years of drought (see Section 13.1.2). Current pumping and treatment capacities were used in the models.

[3] The District's forthcoming Urban Water Management Plan is required to include a target implementation program, whereby the California Urban Water Conservation Council's Best Management Practices or similar demand management measures are implemented to achieve conservation goals (Water Code Section 10610 – 10656).
[4] Recycled water supply is kept constant in the calculations. However, there is an additional 2,000 acre-feet per year of unused recycled capacity if additional customers are identified and additional pipelines are constructed.

8. The CCWA Bank of unused State Water stored in San Luis Reservoir is an important component in GWD's water supply reliability. The current bank should be strongly supported by GWD. Alternative banks must be examined individually – some of the existing groundwater banks are relatively expensive and have storage/delivery restrictions.
9. Cachuma sources of supply should generally be used first among supply sources. However, a modified approach of using groundwater first along with Cachuma water when Cachuma deliveries are reduced can significantly increase the reliability of GWD's water supplies.
10. The limitation on the amount of Cachuma water that can be injected during a spill event is limited by GWD's injection capacity. Increasing the injection capacity does increase the reliability of GWD's water supplies somewhat, but increases the melded variable costs of all supplies.
11. The State-mandated conservation goal by the year 2020 will be important to balance GWD's supply and demand in the future. With the conservation-related reduction in demand, GWD will lessen drought shortfalls in supply at higher levels of demand in the future.
12. The potential effects of climate change on GWD's water supplies have been integrated into future State Water delivery calculations. The effect on local supplies is less-well understood, with studies suggesting less than a 10% swing in precipitation either way in the future.

As the result of this WSMP, policy issues for the GWD Board of Directors to consider include:

a. <u>Assumptions for Future Planning</u> – should GWD plan for average conditions or worst-case conditions? Should there be a planned shortfall in supplies for the worst year of a drought because any shortfalls should be offset by customers conserving water during such times?
b. <u>New supplies</u> – should GWD focus on increasing and enhancing recycled water use, given that it is one of the most available options for future supply?
c. <u>Groundwater Management</u> – should GWD manage its groundwater pumping such that groundwater elevations generally remain well above or only slightly above 1972 levels (except during a drought)? The WSMP model used the SAFE requirements that groundwater can be pumped anytime groundwater elevations were above 1972 levels. Maintaining elevations well above 1972 levels would enhance the existing Drought Buffer and drought protection for customers. In addition, the District's Annual Storage Commitment to the Drought Buffer is currently 2,378 acre feet per year, which means that the District will be required to not pump wells *and* inject a small amount of water from another source to meet the requirements of SAFE, if groundwater elevations were to drop below the 1972 levels (except during a drought). At the same time, maintaining a buffer well above the 1972 levels means that more costly State Water would be used in lieu of groundwater to serve customers.

d. Conservation – what future conservation methods are appropriate for GWD and how will they be implemented?

e. SAFE Calculation for Additional Service Connections – how should the 1% of potable supplies for future development be calculated and allocated?

This WSMP is based on knowledge of the water supply sources as they are now understood (including the projection to 2030 of State Water conditions). There are several factors that could affect the conclusions in this study:

a. If there was an emergency within the State Water project – failure of Delta levees, damage to aqueducts from earthquakes or other natural disasters – deliveries could be reduced or curtailed for a period of time.

b. A local earthquake could disable the Tecolote Tunnel for a period of time, leaving groundwater pumping and recycled water as the remaining sources of water.

c. Issues with endangered species could further affect either State Water or Cachuma deliveries.

d. Seawater intrusion or a contaminant release could reduce the ability to pump a portion of the groundwater basin.

e. Climate change produces future conditions that are dramatically different than past conditions.

8 Recommendations

Recommendations developed from this WSMP are divided into segments based on the potential timing of implementation of the recommendations.

8.1 Immediate Actions

1. Implement the hybrid strategy for use of GWD's various sources of water supply, as discussed in Section 12.2.2 and Chapter 9. This strategy includes using groundwater and State Water in a manner that balances drought storage against supply costs and optimizes GWD's groundwater well capacity during drought periods.
2. Encourage CCWA to formalize their current San Luis Reservoir water bank with DWR.
3. Use the findings in this Plan as input to appropriate portions of the upcoming Urban Water Management Plan and in any assessments of GWD's water supplies.
4. Calculate average spring groundwater elevations each year using wells designated in Groundwater Management Plan. Plot this average on Index wells chart to determine where current groundwater conditions are relative to 1972 groundwater elevation.

8.2 Actions for Next Year

1. Develop conservation measures to reduce water supply demand as per State-mandated guidelines to be developed in GWD's upcoming Urban Water Management Plan.
2. Develop Water Supply Management Plan Implementation Guidelines as discussed in Section 6.
3. Continue to fund the semi-annual collection of groundwater elevation data so that average groundwater elevations in the basin can be calculated to assist in determining water supply priorities.

8.3 Actions for the Following Four Years

1. Update the WSMP to reflect changes in the Santa Ynez River Model and State Water availability calculations. It is recommended that these updates are implemented every five years, or more often if the input information changes significantly.
2. At intervals of every five years, determine whether GWD's groundwater pumping capacity is adequate for drought protection. This can be accomplished using the updated WSMP and water supply demand projections. Consideration should also be given to recalibrating the Groundwater Model if basin conditions differ from historical.
3. Continue to fund the semi-annual collection of groundwater elevation data so that average groundwater elevations in the basin can be calculated to assist in determining water supply priorities

4. Modify the WSMP every five years, preferably in the year prior to the Urban Water Management Plan being prepared.
5. As part of the regular update of the WSMP, evaluate whether the pumping restrictions under the SAFE Ordinance would cause an "artificial" water supply shortage as discussed in Section 13.4.1. This shortage could occur in the years when Cachuma deliveries are not reduced, but State Water deliveries are significantly curtailed. The WSMP modeling suggests that the probability of this occurrence is relatively low at current demand levels. However, the modeling suggests that this could occur more frequently at higher levels of demand (when the groundwater basin is operated more-frequently below 1972 groundwater elevations).

9 Management Plan

The recommendation is that the groundwater-State Water hybrid management strategy be used by GWD to manage its various water sources. This hybrid strategy is charted in the flow diagram in Figure 9-1, and described below in priority order:

1. Cachuma water sources are used first until their entitlement is exhausted for the year, in the following order: Carry-over Water, spill Water, and Cachuma Entitlement.
2. However, if there is a local drought such that Cachuma deliveries are reduced below 100% in any month, then groundwater is pumped at its capacity as a supplement to Cachuma water. This extends the availability of Cachuma water later into the water year and allows longer pumping of the limited-capacity groundwater wells.
3. Any CCWA banked water is then used. CCWA considers that the first State Water used is banked water, so this accounting is done automatically as State Water is used.
4. Determine the average spring groundwater elevations from the Index Wells. Use the following logic sequence:
    a. If groundwater elevations are higher than -26.2 ft msl (1972 groundwater elevation), pump groundwater at its capacity of 300 acre-feet per month. Then supplement State Water as needed to fully meet demand.
    b. If groundwater elevations are lower than -84.6 ft msl (historical low elevation), use State Water to meet demand.
    c. If groundwater elevations are between -26.2 ft and -84.6 ft msl, use the following logic sequence:
        i. If Cachuma deliveries are at 100%, use State Water to meet demand.
        ii. If Cachuma deliveries have been reduced, use groundwater first at its capacity, supplemented by State Water to meet demand.

Examples of how supplies would be used on a monthly basis in different conditions are shown below. The critical nine months are shown through the summer and into the fall – the following year's Cachuma entitlement starts in October, which allows return to Cachuma supplies.

Average Year Above 1972	Jan	Feb	March	April	May	June	July	August	Sept
Cachuma Potable & GWC	634	614	690	971	1,324	1,427	910		
Groundwater							300	300	300
State Water							351	1,207	1,122
Total	634	614	690	971	1,324	1,427	1,561	1,507	1,422

Table 9-1. Example of an average year (groundwater elevations above 1972 levels) monthly mix of sources of water supply. Cachuma supplies are used first when Cachuma deliveries are at full entitlement.

Average Year Below 1972	Jan	Feb	March	April	May	June	July	August	Sept
Cachuma Potable & GWC	634	614	690	971	1,324	1,427	910		
Groundwater									
State Water							651	1,507	1,422
Total	634	614	690	971	1,324	1,427	1,561	1,507	1,422

Table 9-2. Example of an average year (groundwater elevations below 1972 levels) monthly mix of sources of water supply. Cachuma supplies are used first when Cachuma deliveries are at full entitlement. The Annual Storage Commitment as per SAFE is met by not pumping any groundwater and by injecting a small amount of water from another source.

Dry Year Example	Jan	Feb	March	April	May	June	July	August	Sept
Cachuma Potable & GWC	521	395	620	883	1,183	1,132	783		
Groundwater	300	300	300	300	300	300	300	300	300
State Water							492	1,290	1,092
Total	821	695	920	1,183	1,483	1,432	1,575	1,590	1,392

Table 9-3. Example of a dry year (reduced Cachuma deliveries) monthly mix of sources of water supply. Groundwater is pumped at capacity to supplement Cachuma supplies. This strategy makes maximum use of GWD's groundwater pumping capabilities in a dry year.

Spill Year Below 1972	Jan	Feb	March	April	May	June	July	August	Sept
Cachuma Potable & GWC	530	507	634	1,009	1,308	1,444	1,635	1,579	602
Groundwater									
State Water									830
Total	530	507	634	1,009	1,308	1,444	1,635	1,579	1,432

Table 9-4. Example of a Cachuma spill year (groundwater elevations below 1972 levels) monthly mix of sources of water supply. Cachuma supplies extend farther into the year because the use of spill water during the winter months does not debit GWD's Cachuma allocation. The Annual Storage Commitment as per SAFE is met by not pumping any groundwater and by injecting a small amount of water from another source. If groundwater elevations were above 1972 levels, groundwater would be pumped in September to offset some of the State Water use.

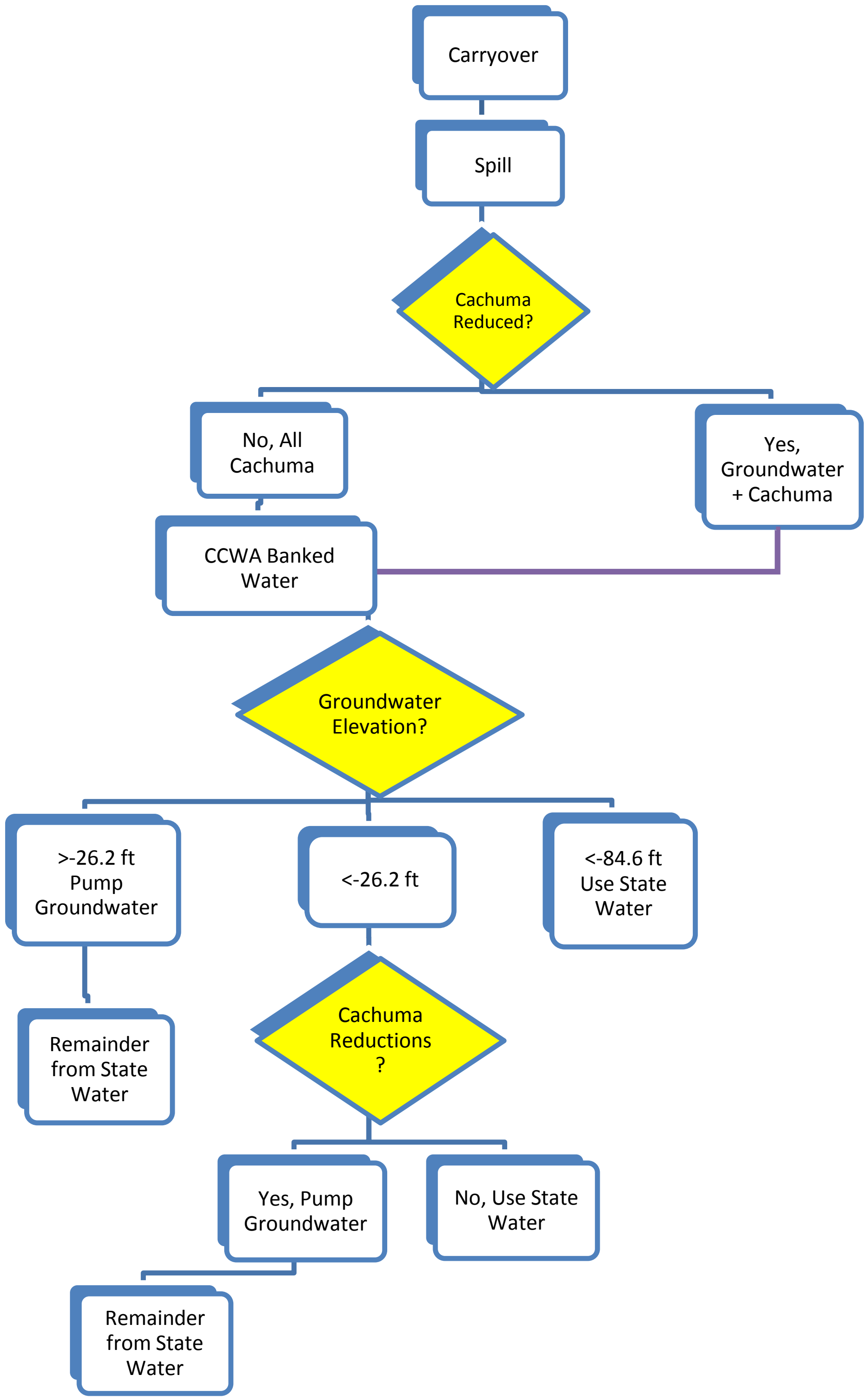

Figure 9-1. Hierarchy of water supply use in the recommended hybrid groundwater-State Water strategy. All water supplies are used progressively down from the top of the diagram until they are depleted or until capacities are equaled. Decision points where groundwater elevations or Cachuma deliveries need to be assessed are marked with yellow diamond shapes. Groundwater elevations are the average Spring elevations in the Index Wells in the Goleta groundwater basin (GWD, 2010).

10 References

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Technical Appendices

11 Technical Appendix – Historical Supply Strategies

The strategy of how to interactively use GWD's water supplies is as important as the reliability of each of those supplies. For instance, if groundwater supplies have been pumped down prior to a drought, then the usually-reliable groundwater supplies may not be available in that drought. In this chapter, the individual supply sources are discussed and evaluated for reliability, critical supply components are identified, and the reliability of the current supply strategies are evaluated.

11.1 Sources of Supply

GWD has a variety of local and supplemental water supplies available to meet customers' needs. Water supplies include local surface water supplies from Lake Cachuma, groundwater from the Goleta Groundwater Basin, recycled water from the Goleta Sanitation District, and importation of State Water. The proportion of each of these supplies has varied considerably over time, with State Water replacing groundwater use over the past 15 or so years so that the groundwater basin could recharge (Figure 11-1). In the last ten years, GWD has obtained approximately 76% of its water supplies from Lake Cachuma, 16% from State Water (direct delivery and exchange water), 6% from recycled, and 2% from groundwater. Of those supplies, about 11% were for non-potable uses though recycled water and Goleta West Conduit deliveries.

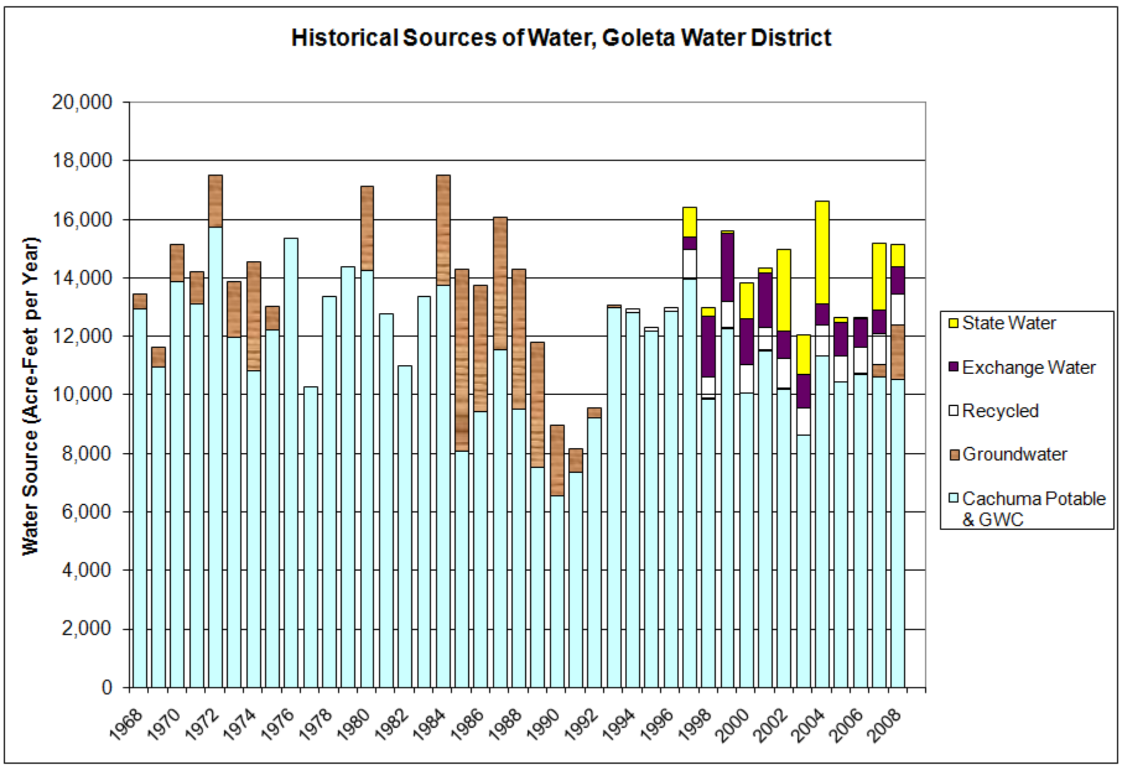

Figure 11-1. Historical sources of GWD water. Of these supplies, about 11% were for non-potable uses (recycled water, Goleta West Conduit).

Monthly use is highest during August of most years (Figure 11-2), with Cachuma supplying an increasing amount of supply during the summer months.

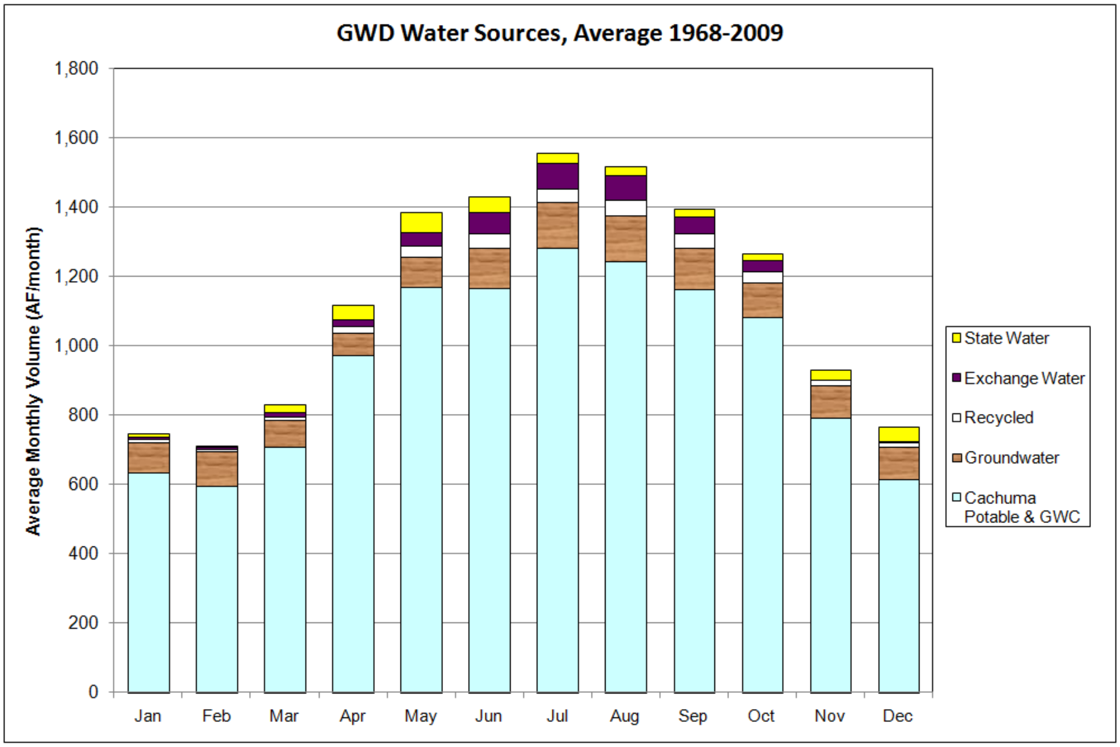

Figure 11-2. Sources of water supply by month for period 1968 to 2009. Note that State Water was not available for the entire period and groundwater was not pumped for over a decade as the basin was allowed to refill.

11.1.1 Cachuma Reservoir

Cachuma Reservoir was constructed by the Bureau of Reclamation and is operated by the Cachuma Operations Management Board (COMB) under contract to the Bureau. Entitlements, costs, constraints, and reliability are summarized in Table 11-1.

11.1.1.1 Cachuma Supply

Entitlement – GWD's share of the Cachuma yield is 9,322 AFY; with the addition of spill water, the average of Cachuma deliveries for the period 1997 to 2008 has been 10,675 AFY (Figure 11-6). Current Cachuma operations have been optimized by COMB based on modeling using the Santa Ynez River Model.

Carryover Water – Entitlement that is not used in any Cachuma water year (October through September) is carried over to the following years. When Cachuma spills (on the average of once every three years), all carryover water is considered to have been spilled and the accounting for carryover water is returned to zero. Thus, it is important to use carryover water as soon as possible, giving it the highest priority of use.

Spill Water – When Cachuma spills, GWD can take as much water as it can use, without debiting its entitlement for that year. The amount of spill water that GWD can actually use for customer demand and for groundwater injection is largely limited by GWD's treatment and injection capacity. Once the spill ceases, further use of Cachuma water by GWD is debited against its annual entitlement as if the spill had not occurred. The WSMP modeling calculated the additional Cachuma yield from spill water by allocating spill water to customer demand in each month that Cachuma spilled. The average amount of spill water allocated to customer demand over the 86-year model period was 870 acre-feet per year. An additional 280 acre-feet per month of spill water was allocated to injection in each month that Cachuma spilled. The average amount of spill water allocated to injection over the 86-year model period was 295 acre-feet per year of water (it is a coincidence that this number is close to the 280 acre-foot per month treatment/injection capacity). The occurrence of spills during the 86 years of the Santa Ynez River Model is indicated in Figure 11-3. Spills generally occur during the months of January through May (Figure 11-4) and usually occur over one to four months in duration (Figure 11-5).

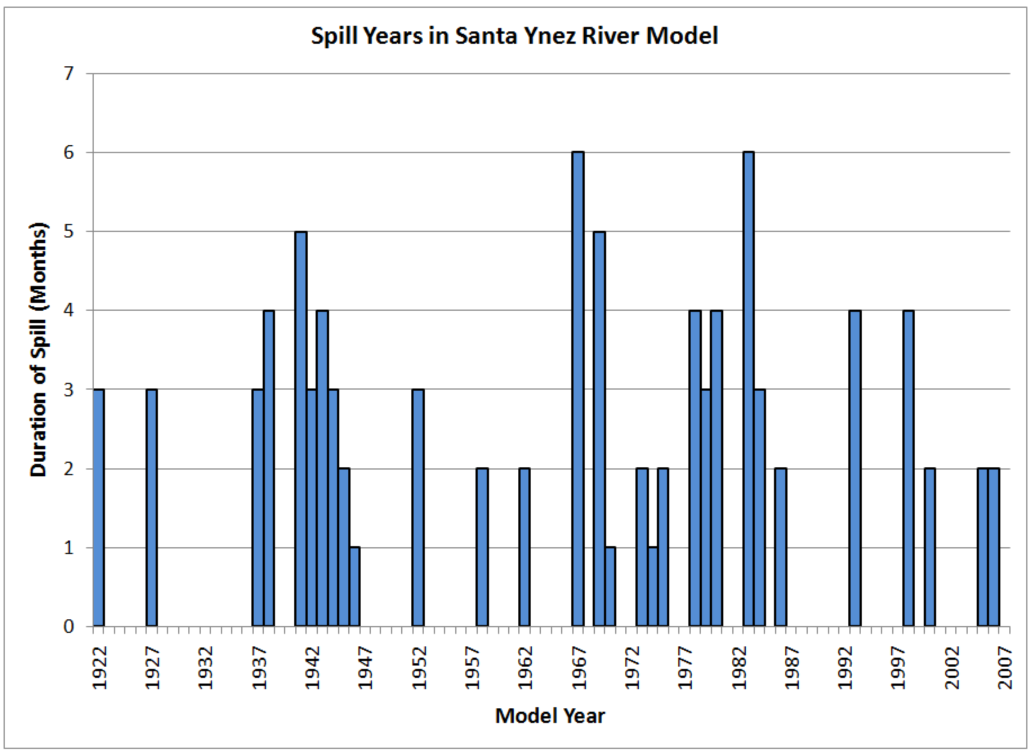

Figure 11-3. Years in which there is a Cachuma spill in the Santa Ynez River model.

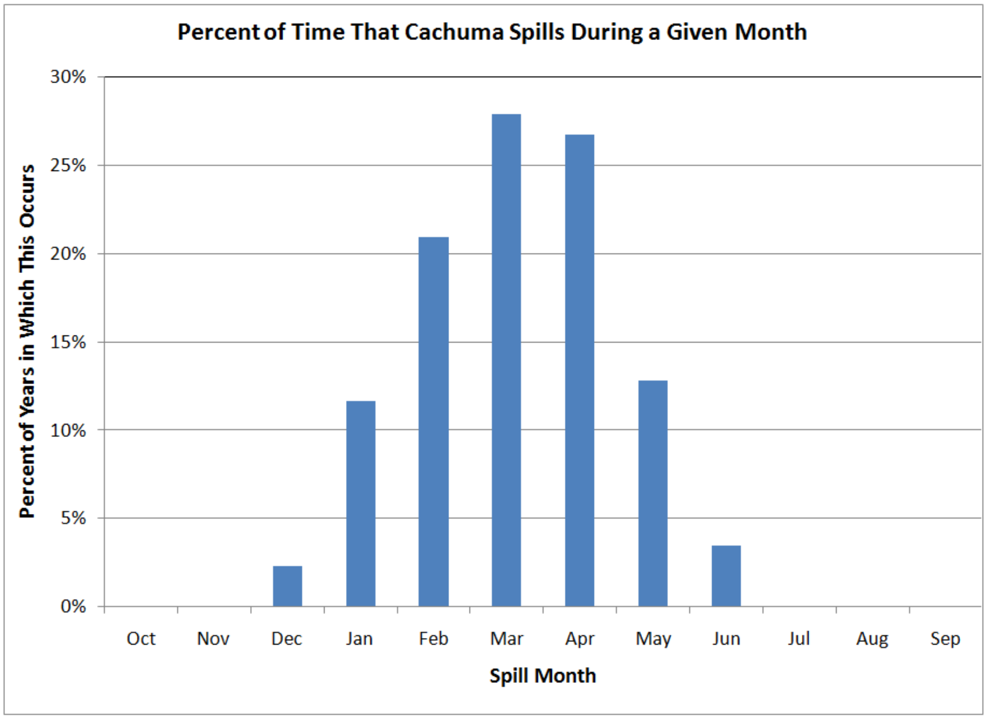

Figure 11-4. Months during which Cachuma spills, based on 86 years of Santa Ynez River Model.

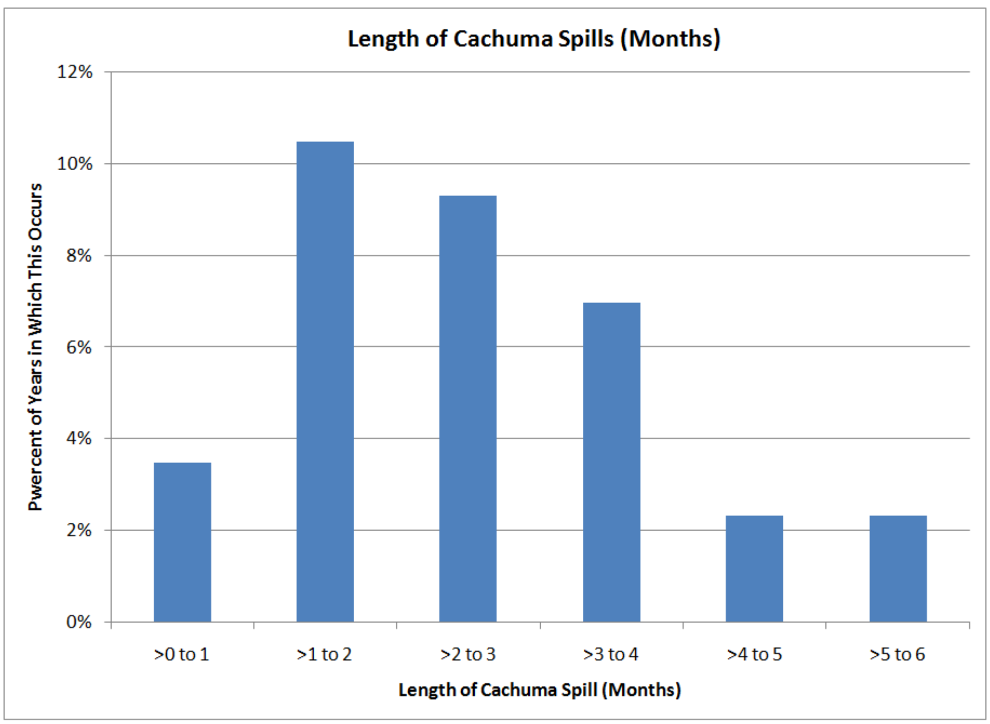

Figure 11-5. Length of Cachuma spills, based on 86 years of Santa Ynez River Model.

11.1.1.2 Cachuma Reliability

Water is diverted from the reservoir at a fixed rate that is somewhat higher than the yield of the reservoir, with deliveries cut back by 20% during drought periods. The adjustments for the water supply from Lake Cachuma are mutually agreed to by the Cachuma member agencies. For example, the Cachuma entitlements for all water purveyors were reduced by 40% in 1991, during the 1987-92 drought. If the "March miracle" of 1991 hadn't filled Cachuma Reservoir, there was the possibility of more severe reductions in deliveries. Scenarios #1b-drght, #2c, and #4 of the WSMP modeling depict such a possibility.

Over the 86-year period of the WSMP, 97% of its Cachuma entitlement was available to GWD. Carryover water is generated only in a few years when Cachuma spills and GWD's entitlement is not used during those spill months. The WSMP evaluates whether, and how often, carryover water is lost in the various management scenarios.

Whenever there is a large storm event or following a fire in the Cachuma watershed, material is washed down the river and is caught behind Bradbury Dam. This "siltation" slowly fills the reservoir and decreases the yield of the Cachuma Project. River models take this into account for current conditions; some predict future siltation. The Santa Ynez River Model uses current conditions, so the Cachuma yield in the future (such as in the 2030 model runs) is likely overstated.

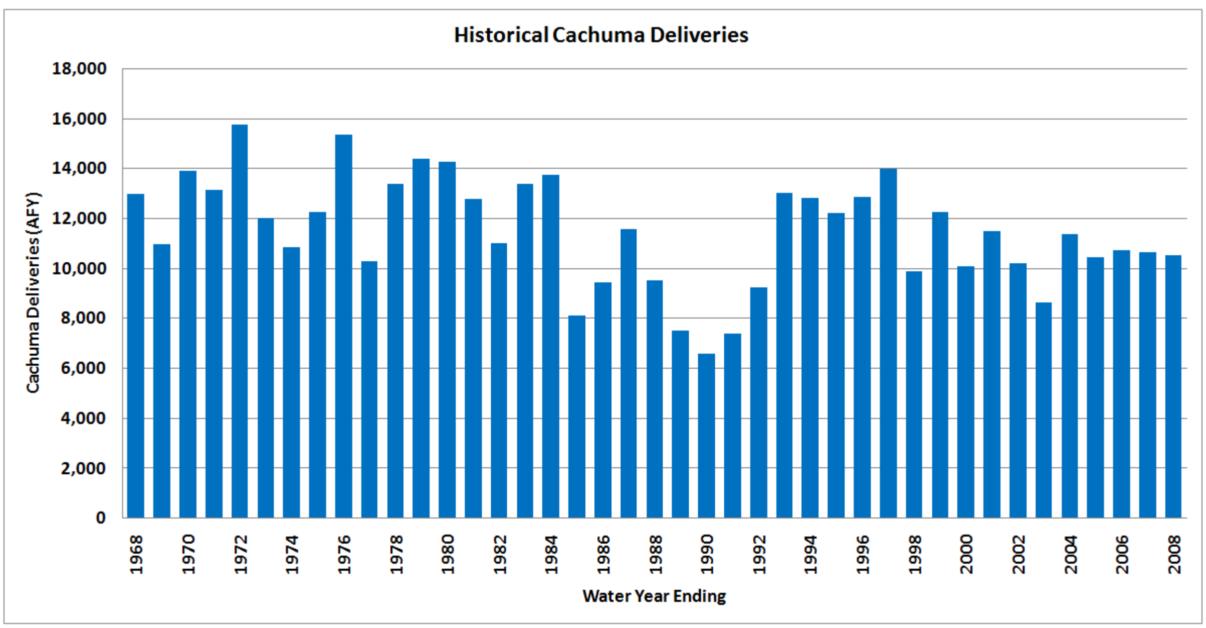

Figure 11-6. Historical Cachuma potable and Goleta West Conduit deliveries to GWD.

11.1.1.3 Cachuma Costs

GWD pays an annual fixed cost of $2,574,000 to COMB and $450,000 to the Cachuma Conservation Release Board (CCRB) for its share for operating Cachuma Reservoir. The cost for GWD to treat the water delivered from Cachuma is an additional $67 per acre foot. However, since 1997 an average of 700 AFY of the untreated water is routed to the Goleta West pipeline, where treatment costs are only $22 per acre foot. Fixed and variable costs are illustrated in Figure 11-7 through Figure 11-9. The Goleta West Conduit deliveries from Cachuma have a slightly reduced Agency fee of $320 (instead of $324 for potable deliveries), based on the amount of water that is estimated to be used.

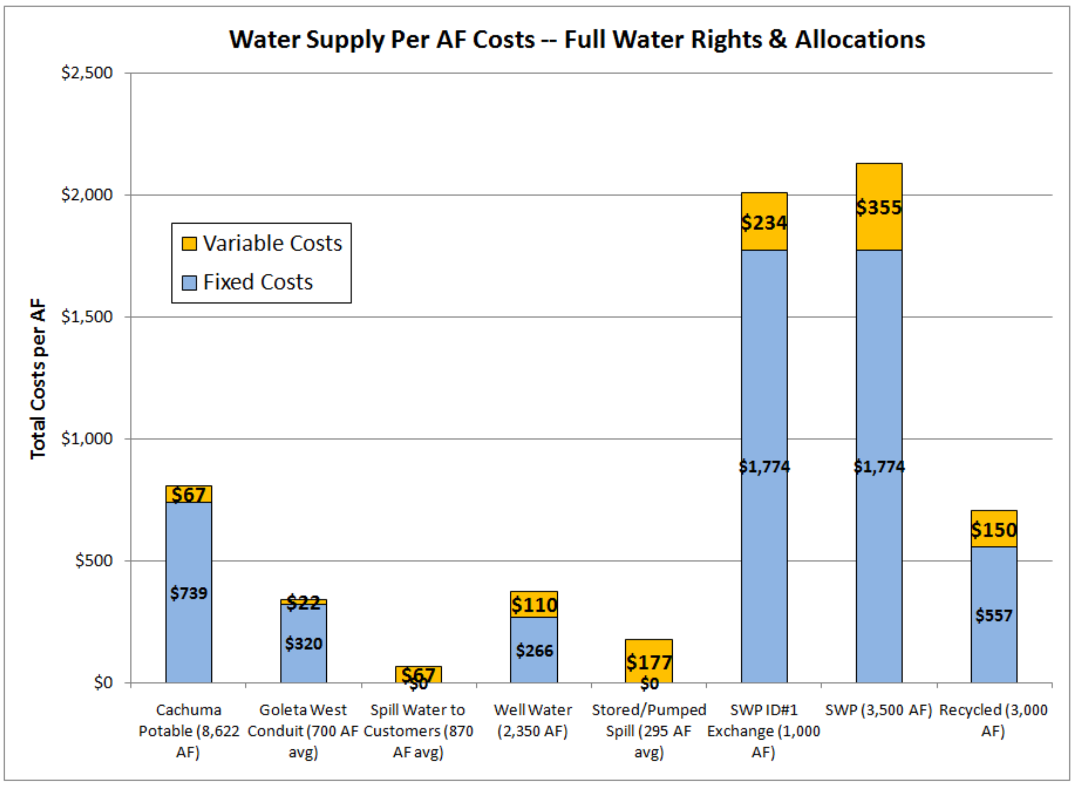

Figure 11-7. Cost per acre-foot of GWD's water supplies. Fixed costs for recycled water are based on capacity of 3,000 acre-feet per year, although there are currently customers for only about 1,000 acre-feet per year of recycled water.

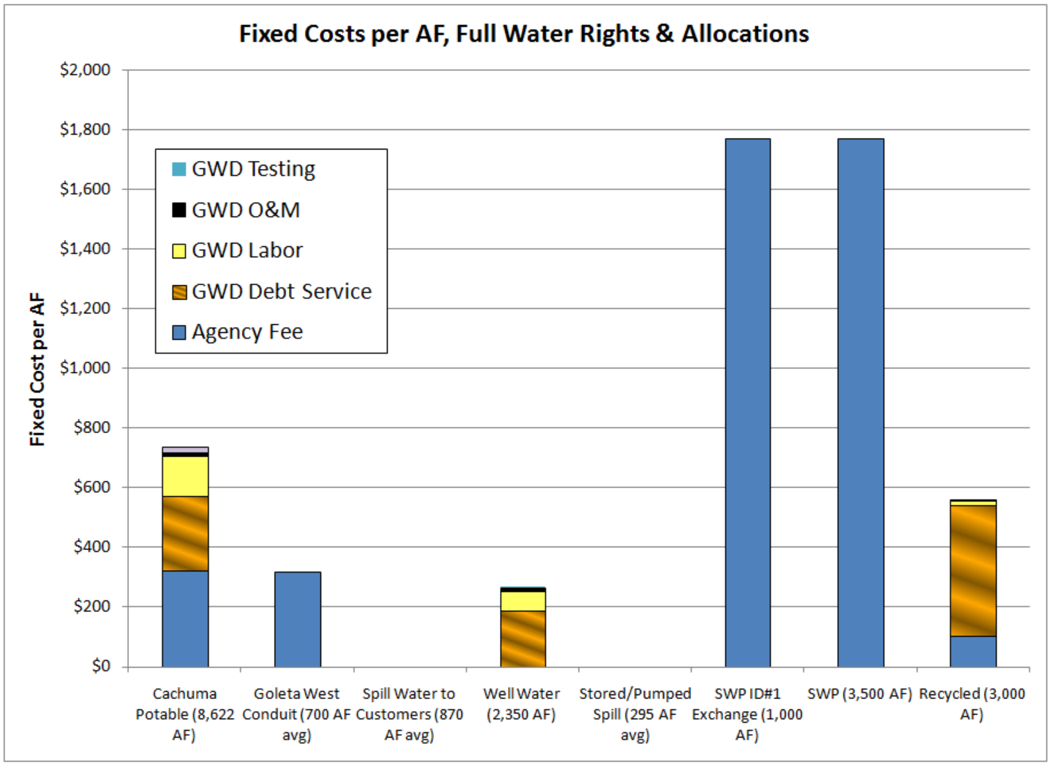

Figure 11-8. Elements in fixed costs per acre-foot for GWD's water supply sources. Fixed costs for Cachuma are not reflected in the cost of spill water because these costs are accrued irrespective of whether there is a spill. Recycled fixed costs are distributed across the full recycled water capacity.

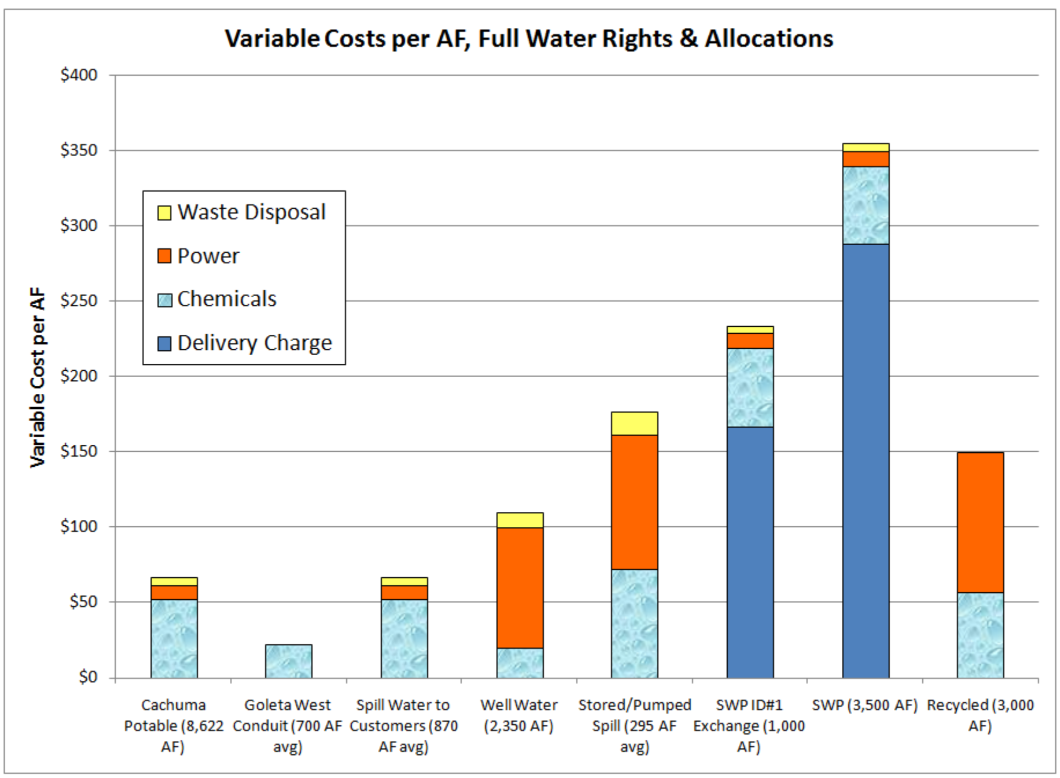

Figure 11-9. Variable costs per acre-foot for GWD's water supply sources.

11.1.2 Groundwater

Groundwater used by GWD is pumped from its own wells within the Goleta Groundwater basin, with both the amount and timing of the pumping determined in part by the Wright Judgment and GWD's SAFE Ordinance. Water rights, costs, constraints, and reliability are summarized in Table 11-1.

11.1.2.1 Groundwater Supply and Constraints

Wright Judgment – GWD has a current water right to 2,350 AFY of groundwater from the Goleta Groundwater basin under the terms of the Wright Judgment. Unexercised groundwater rights at the end of a year revert to a stored water right in the basin. GWD can also store water by injecting water in the basin for later extraction. The amount of water stored in the basin is reported annually by GWD; as of 2009, GWD storage in the basin was 43,253 acre-feet (GWD, 2010). The details of how both the Wright Judgment and the SAFE Ordinance affect groundwater use by GWD are contained in GWD's and La Cumbre Mutual Water Company's Groundwater Management Plan for the Goleta Groundwater basin (GWD, 2010).

SAFE Ordinance – How this groundwater is used is regulated by GWD's SAFE Ordinance, which specifies conditions under which groundwater is either pumped or stored. The key determining factors are groundwater elevations in the basin and the availability of Cachuma water in any year. When groundwater elevations are below those measured in 1972, groundwater cannot be pumped and a pre-determined amount of water must be stored annually in the basin as a drought buffer. The exception to this rule is when there are reduced deliveries of Cachuma water – SAFE allows for pumping of groundwater during these "drought" conditions. The Groundwater Management Plan specifies which wells to use in determining groundwater elevations in 1972 and in subsequent years (GWD, 2010) (Figure 11-10).

Groundwater Elevations Below 1972 Levels – When groundwater elevations are below 1972 levels, SAFE requires some actions to be taken. As discussed above, groundwater cannot be pumped unless Cachuma supplies have been reduced. In addition, an "Annual Storage Commitment" of at least 2,000 acre-feet per year is required under the SAFE Ordinance for replenishment to 1972 levels (this has risen to 2,378 acre-feet per year in 2010 as new customers have been connected – see section 14.2.3). Any excess State Water actually delivered over 3,800 acre-feet per year shall be stored in the Central subbasin until the basin is replenished to its 1972 level. There can be no new service connections unless all the obligations for water service and the Annual Storage Commitment are met.

Physical Facilities – GWD currently has five fully operational groundwater production wells, with accompanying treatment facilities. Well extraction and treatment capacity is about 300 acre-feet per month. The wells are located in the North and Central subbasins of the Goleta Groundwater basin.

The same wells used for extracting groundwater can also be used for injection. Historically, the source water for injection has been spill water from Cachuma. This injection of Cachuma spill water occurs in both GWD's well and in La Cumbre Mutual Water Company's wells. The injection capacity during spill events is controlled by the capacity of treatment facilities (raw water can't be introduced in the distribution system) and well injection capacity. GWD's injection capacity is currently about 280 acre-feet per month (3 mgd). Injection of Cachuma entitlement water or State Water could also be accomplished during periods when the wells are not used for extraction. This possibility is investigated in this WSMP.

Groundwater in Storage Above 1972 Groundwater Elevations – Because much of the groundwater in the Goleta basin is stored in confined aquifers, there cannot be a simple calculation of water in storage from groundwater elevations. However, the groundwater modeling (CH2MHill, 2010) gives an estimate of how much water can be pumped from above 1972 groundwater elevations – it takes roughly 10,000 acre-feet of cumulative GWD pumping to drop from high groundwater elevations (10+ ft msl) to the 1972 elevation (-26 ft msl).

Pumping from the Drought Buffer – The Drought Buffer can only be used for delivery to existing customers when a drought on the South Coast causes a reduction in GWD's annual deliveries from Lake Cachuma, and cannot be used as a supplemental supply for new or additional water demands. The amount of water that can be pumped from the Drought Buffer has been calculated in the Groundwater Model (CH2MHill, 2010), the results of which have incorporated into the WSMP (see Section 14.4). For instance, in the current-demand scenario with an extended drought (Scenario #2c that has two drought years added to the 1986-1991 drought), an average of 2,900 acre-feet per year was pumped from the basin for six consecutive years, resulting in a drop in groundwater elevations of 46 feet (well within the Drought Buffer). In the future-demand scenario with an extended drought (Scenario #4), an average of 4,500 acre-feet per year was pumped for six years, resulting in a drop in groundwater elevations of 70 feet (which is most of the Drought Buffer if beginning groundwater elevations are near 1972 elevations).

In the Groundwater Management Plan (GWD, 2010), it was calculated that during the drought of 1986-1991 groundwater elevations dropped about 8 feet per year when GWD pumped about 4,500 acre-feet per year (rather than a little more than 10 feet per year calculated here). This suggests that the Groundwater Model (and subsequently, the WSMP) may somewhat overestimate the effect of drought pumping on the basin.

11.1.2.2 Groundwater Reliability

Prior to the Wright Judgment and SAFE Ordinance, GWD used groundwater as an important source of its water supply, with groundwater elevations dropping to historical lows during the drought of 1986-1991 (left portion of Figure 11-10). Since the drought, GWD has largely foregone pumping the basin to any extent, which allowed the basin to rise to near-historical high groundwater elevations (right side of Figure 11-10). As the result, there is a significant amount of groundwater in the basin that GWD has the right to pump (over 43,000 acre-feet as of 2009). Thus, the reliability of groundwater is currently very good. Groundwater is a less expensive source of water than State Water, but its use must be balanced by the need to maintain a drought buffer of groundwater to ensure a reliable supply when Cachuma and/or State Water supplies are reduced in a drought. Determining this balance is one of the primary purposes of this WSMP.

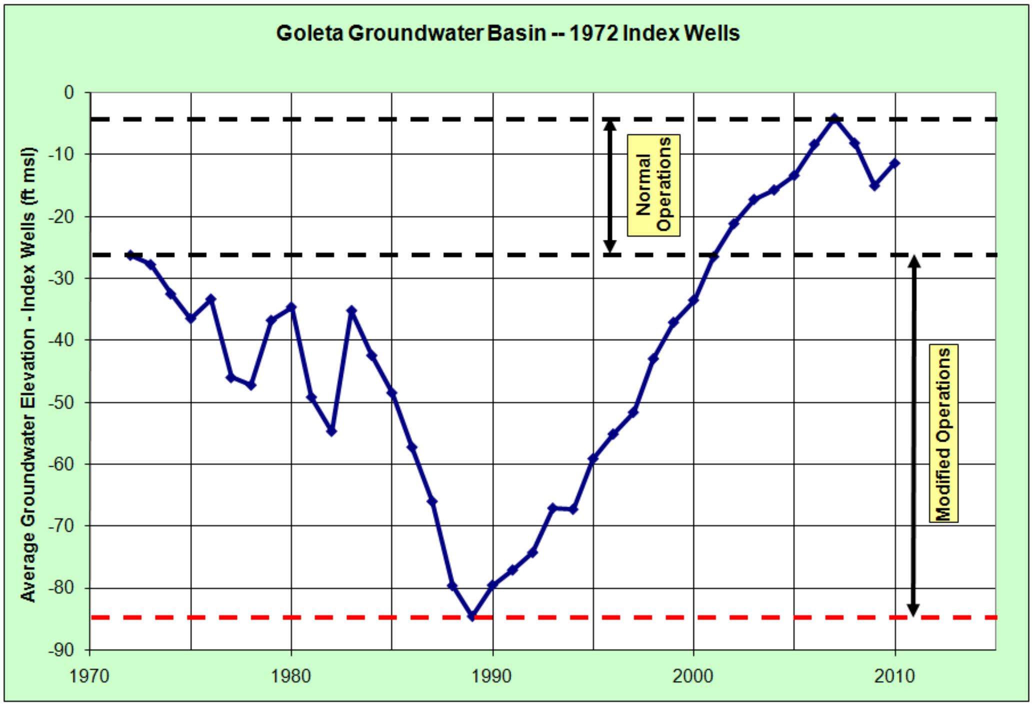

Figure 11-10. Groundwater elevations in the Goleta Groundwater basin, as indicated by the seven-well 1972 Index Wells average (GWD, 2010). The 1972 groundwater elevation used in the SAFE Ordinance is indicated at -27 ft elevation.

11.1.2.3 Groundwater Costs

Extraction of Groundwater – The cost to extract and treat groundwater is about $110 per acre-foot. The fixed costs of groundwater production are about $266 per acre-foot per year, spread across GWD's 2,350 acre-feet annual water right in the basin.

Groundwater Injection – The cost for groundwater injection of spill water is the treatment cost for the source water. These treatment costs are about $67 per acre-foot. When the water is pumped back out for use, the $110 for groundwater extraction must be added, resulting in an overall variable cost of $177 per acre-foot.

Fixed and variable costs are illustrated in Figure 11-7 through Figure 11-9.

11.1.3 State Water

In 1991, voters within the service area of GWD chose to purchase an allocation of State Water. In 1994, voters increased the amount of State Water purchased (but not the pipeline capacity) so that the reliability of State Water could be increased. Treated State Water is delivered to GWD by the Central Coast Water Authority (CCWA) using the Coastal Branch of the California Aqueduct. The terminus of the Coastal Branch is Lake Cachuma, where State Water is de-chlorinated and mixed with untreated Cachuma water. The physical mixture of State and Cachuma water must be re-treated before delivery to customers. Allocations, costs, constraints, and reliability are summarized in Table 11-1.

11.1.3.1 State Water Supply and Constraints

Allocation – GWD has a State Water allocation of 7,000 acre-feet per year, plus an additional allocation of 450 acre-feet per year through the CCWA Drought Buffer. However, GWD only purchased 4,500 acre-feet per year of capacity in the Coastal Branch of the California Aqueduct. The higher allocation than carrying capacity reflects the reality that the State Project cannot on average deliver the full amount of its customers' allocations.

Storage – GWD currently uses two means of storing State Water –Cachuma Reservoir and CCWA storage in San Luis Reservoir. Long-term storage of State Water (such as for drought protection) in Cachuma Reservoir is problematic because Cachuma spills on average every three years, with State Water considered the first water over the spillway.

CCWA stores State Water that has been ordered by its member agencies but is unused at the end of the year. This relatively new program uses San Luis Reservoir (an off-aqueduct reservoir along the California Aqueduct) as the storage site. Stored water can also be "spilled" from San Luis when DWR moves a large amount of water into the reservoir for temporary storage and displaces the CCWA stored water. This is likely to happen in 2011. Although no upper limits for storage have been set, CCWA considers that 4,000 acre-feet of storage for GWD is likely a reasonable number. The WSMP modeling suggests that the Bank can be re-filled in a year or two after it has been depleted. During a serious drought, the Bank is very helpful in the early stages of the drought; when it is depleted, it is not likely to be re-filled until the drought is over.

Exchange Water – From 1997 to 2008, about 52% of GWD's State Water delivery was involved in an exchange with Santa Ynez River Water Conservation District-Improvement District No. 1.

11.1.3.2 State Water Reliability

Delivery of water from the State Water Project varies with climatic conditions in northern California and environmental/regulatory issues in the Sacramento Delta. The allocation is based each year on reservoir levels, the amount of snow runoff expected, and constraints on pumping from the Delta into the California Aqueduct. The California Department of Water Resources (DWR) has calculated probabilities of water delivery over a range of climatic conditions and environmental constraints, both for current conditions and those projected for 2029. DWR has been updating the reliability studies every two years or so. The latest reliability study for 2009 (DWR, 2010) was used in the WSMP modeling for both current demand and projected 2030 demand. Overall, the reliability of State Water is now considered to be 60% of Table A allocation, with a low of 7% during the driest year to a high of 81% during the wettest year.

11.1.3.3 State Water Costs

State Water costs are divided into fixed (capital) and variable (operational) costs. GWD currently pays $7,051,000 a year to CCWA for its share of the fixed costs for State Water. The variable rate is considered below.

Table A Water Delivered to Cachuma – The variable cost of State Water delivered to Cachuma Reservoir and subsequently treated for GWD customers is $355 per acre-foot.

The fixed cost per acre-foot is $1,774 when it is proportioned across the total of 4,500 acre-feet per year of average yield/aqueduct capacity.

Exchange Water with ID #1 – The variable cost of State Water delivered and treated through the exchange agreement with ID#1 is $234. The fixed cost per acre-foot is $1,774 when it is proportioned across the total of 4,500 acre-feet per year of average yield/aqueduct capacity.

Storage – There is currently no supplemental charge for storing State Water in either Cachuma Reservoir or San Luis Reservoir.

Fixed and variable costs are illustrated in Figure 11-7 through Figure 11-9.

11.1.4 Recycled Water

Through an agreement with the Goleta Sanitation District, recycled water is delivered within GWD for non-potable uses such as landscape irrigation. This water would otherwise have been discharged into the ocean. Capacities, costs, constraints, and reliability are summarized in Table 11-1.

11.1.4.1 Supply and Constraints

Current Capacity – The recycled water project (treatment and distribution) currently has a seasonal treatment and distribution capacity of approximately 3,000 AFY. The recycled water plant has a design capacity of 3 million gallons per day (mgd), which is about 9 acre-feet per day (GSD, 2006). GWD is currently delivering approximately 1,000 AFY to the University of California Santa Barbara campus, several golf courses, and other irrigation users, most of whom were previously using the District potable water for irrigation.

Future Capacity – There is currently about 2,000 acre-feet per year of unused recycled water capacity. GWD plans on expanding use of recycled water, but that expansion is linked to further public acceptance of using recycled water. Any expansion beyond the current capacity would most likely require an expanded distribution system. If current infrastructure could deliver additional recycled water, then recycled water is one of the least expensive options for increasing GWD supplies. If additional infrastructure and capital costs were required, the cost of delivering additional recycled water would be increased.

11.1.4.2 Recycled Water Reliability

Recycled water has very good delivery reliability because the amount of wastewater flowing into the Goleta Sanitary District even in severe drought conditions exceeds the recycled water demand.

11.1.4.3 Recycled Water Costs

Recycled water currently costs $707 per acre-foot when fixed costs are distributed across the 3,000 acre-feet per year of capacity. If the fixed costs are distributed across the current deliveries of about 1,000 AFY, the variable and fixed costs are $1,821 per acre-foot. Fixed and variable costs are illustrated in Figure 11-7 through Figure 11-9. It is important to note, however, that the variable cost of $150 per acre-foot makes it one of the least expensive sources of additional supply because most of the fixed costs for treating another 2,000 acre-feet per year are already being paid.

Supply Source	Annual Allocation, Entitlement, or Water Right (AFY)	Fixed Costs (per AF)	Variable Costs (per AF)	Constraints	Reliability (% of Full Supply)
Cachuma Potable[5]	8,622	$739	$67	None	97%
Cachuma – Goleta West Conduit	700	$320	$22	None	97%
Cachuma – Spill Water to Customers[6]	875	$0	$67	None; Irregular Reliability	N/A
Cachuma – Spill Water to Injection, Later Extraction[7]	296	$0	$177	280 AF/month	N/A
Groundwater[8]	2,350	$266	$110	300 AF/month SAFE	100%/92%
State Water – Table A[9]	3,500	$1,774	$355	4,500 AFY Pipeline	60%
State Water – ID#1 Exchange[10]	1,000	$1,774	$234	Included above	60%
Recycled Water[11]	3,000	$557	$150	Only 1,000 AFY demand	100%

Table 11-1. Summary of all sources of GWD water supply, including costs, constraints, and reliability. Availability of these sources varies annually, and is regularly assessed by the District throughout any given year. Additionally, the table does not reflect total system losses, which are approximately 6%. Costs were developed by T. Bunosky, GWD.

11.2 Critical Supply Components

There are several critical supply components that affect the reliability of GWD's water supplies. These include: 1) Cachuma supplies in a severe drought; 2) State Water availability during droughts or emergencies; 3) GWD capacity in the Coastal Aqueduct of the State Water Project; 4) restrictions on timing of use of groundwater; and 5) treatment/pumping limitations.

[5] Reliability is percent of full entitlement available over 86 years of WSMP Model.
[6] Annual amount is average over 86 years of WSMP Model. If demand increases, this number will also increase.
[7] Amount is average over 86 years of WSMP Model. Constraint is treatment capacity for spill water.
[8] Reliability reflects that groundwater right is always available over 86 years of WSMP Model, but SAFE requires storage but no pumping in some years.
[9] 4,500 AFY is GWD's portion of the Coastal Aqueduct. Fixed costs spread over 4,500 AFY of reliable supply and aqueduct capacity.
[10] Amount is average since State Water was first delivered.
[11] Amount is current capacity. Only 1,000 AFY of current customers. Fixed cost calculated on 3,000 AFY of capacity.

11.2.1 Cachuma Reliability

Historically, Cachuma Reservoir has been a reliable source of water for GWD. In the 1986-92 drought, Cachuma water deliveries were only reduced by 40% during the last year of the drought. However, another year of drought would have significantly stressed the Cachuma supply, with plans to pump water from the reservoir because reservoir levels would likely have dropped below the intakes for normal gravity flow from the reservoir. This would have had a large impact on GWD's water supplies. To determine the potential impact to GWD's supplies of such an occurrence, the WSMP modeling included two scenarios (current and future demand) in which the 1986-92 drought was extended for two extra years and Cachuma deliveries were reduced by as much as 80% at the end of this extended period (scenarios #2c and #4).

11.2.2 State Water Reliability

State Water reliability, discussed in Section 6.1.3.2, is a concern for all State Water customers. To determine the effect on GWD from the highly-variable annual deliveries, all scenarios in the WSMP modeling used the year-by-year current reliability modeling by the State Water project. In addition, future demand scenarios used the State Project's year-by-year future reliability modeling results.

11.2.3 CCWA Storage Bank

The CCWA Bank in San Luis Reservoir is subject to a "spill" when DWR displaces the storage with its own water. This is likely to happen in 2011, when early-winter rains and snowmelt caused DWR to move water out of its Sierra reservoirs to ensure that there was adequate space for flood control and to maximize runoff capture if the Sierra reservoirs spilled. Thus, the CCWA Bank, which has a very positive effect on GWD reliability, has uncertain reliability.

11.2.4 GWD Capacity in Coastal Aqueduct

GWD purposely acquired capacity in the Coastal Aqueduct (4,500 acre-feet per year) that was less than its full State Water allocation (7,450 acre-feet per year). This was done because the average reliability of the State Project is significantly less than 100% of allocation (and is continuing to decline). The WSMP modeling used the aqueduct capacity as the limiting amount of State Water that GWD could receive in any year. The effect of this limitation was evaluated in the modeling and is discussed in Chapters 7 and 8.

11.2.5 Groundwater Reliability

The SAFE Ordinance was enacted to ensure that there would be adequate groundwater supplies during a drought to supplement reduced Cachuma and State Water deliveries. SAFE requires that pumping of groundwater below 1972 levels only occurs when Cachuma supplies are reduced – if State Water supplies are reduced but Cachuma supplies are not, groundwater pumping of the Drought Buffer is not allowed. The WSMP modeling examined the effects of the SAFE Ordinance over the modeling period, with the perspective both from building an adequate drought buffer and from subsequent pumping of that drought buffer. The results of the modeling are discussed in Chapters 7 and 8.

11.2.6 Facilities Limitations

There are necessary limitations on water production and treatment facilities within GWD – overbuilding of facilities is a waste of money. However, it is also important to ensure that these limitations do not adversely impact water supply reliability. Facilities limitations that could affect reliability include: 1) groundwater well capacity during drought periods of increased pumping; 2) groundwater well capacity when large amounts of water are available during a Cachuma spill event; 3) capacity to treat the available Cachuma spill water prior to injection; and 4) GWD's share of Coastal Aqueduct capacity.

The WSMP modeling uses current facility capacities to determine if they are limiting factors in optimizing the use of the various water supplies. Many of the modeling scenarios also increase those capacities to determine the effect on water availability and on cost.

11.3 Historical Priorities for Use of Supplies

GWD has varied its priorities in the use of its various supplies over time, partly related to drought conditions and partly related to the purchase of State Water in the 1990s. This history of water use is discussed briefly in Section 11.1 and illustrated in Figure 11-1. Prior to the importation of State Water, groundwater was relied on heavily during drought periods, resulting in historical low groundwater elevations in the basin. Following the importation of State Water, the Wright Judgment, and the passage of the SAFE Ordinance, groundwater pumping was reduced or eliminated in many years. This allowed the groundwater basin to refill to well above 1972 groundwater elevations. Now that refilling of the basin has been achieved, previous management strategies are no longer workable – groundwater should largely be preserved for drought protection, but if groundwater is allowed to rise too high, flooding and other adverse effects could occur. Thus, a new, balanced approach for using State Water and groundwater is necessary.

11.4 Reliability of Historical Supply Strategies

The reliability of GWD's current water supplies under historical methods of operation was evaluated using the WSMP (see Section 5.3 for description of model and model scenarios). In these model runs, GWD's monthly surface water supplies were predicted using Santa Ynez River historic hydrology and California Department of Water Resources' year-by-year analysis of State Water availability.

The model scenarios that evaluated historical methods of operation all have one strategy as their lynchpin – Cachuma water sources are used first because they are the cheapest sources of water and unused Cachuma entitlement is subject to spillage an average of once every three years. At today's level of water supply demand, all the scenarios below maintain average groundwater elevations above 1972 levels. The results of the model runs include:

Scenario #1a – Similar to operations since State Water arrived, with preferential use of State Water before using groundwater; no CCWA bank: In this scenario, demand exceeds supply in 30 of the 86 model years, although shortages don't exceed 20% of demand except in two years (Table 11-2). These annual shortages are caused by varying combinations of shortage of supply in any year (primarily State Water), restrictions on pumping groundwater by SAFE, and insufficient groundwater pumping capacity to meet demand. Melded costs of supply (variable costs only) over the 86-year model period are $114 per acre-foot, one of the least expensive options.

Scenario #1 – Same as #1a, but with CCWA Bank: This scenario is identical to scenario #1a, except the unused State Water that CCWA banks in San Luis Reservoir is also part of the supply. The CCWA Bank improves the reliability of GWD's supplies, but overall supply costs (variable costs) rise to $127 per acre-foot (Table 11-2).

Scenario #1c – Similar to operations prior to arrival of State Water, with groundwater playing an important role in average precipitation/demand-year supplies. The obvious exception to historical operations is that State Water is now available as a back-up supply; no CCWA bank: The reliability of the supply improves by using groundwater preferentially before State Water (Table 11-2). Although this appears at first to be counter-intuitive, groundwater is used in more months of the year so that pumping capacity doesn't play as big a role in supply shortages; State Water is in reserve and its delivery limitations are not as restrictive. Because groundwater is not as expensive as State Water, overall variable costs of supply are reduced by a small amount.

Scenario #1b – Same as #1c, but with CCWA Bank: The CCWA Bank improves reliability over scenario #1c, but the costs of the extra State Water used through the bank raises the variable costs of supply somewhat (Table 11-2).

Scenario	A. Number of Years of Any Shortage (86 Model Years)	B. Years When Shortage>20% (86 Model Years)	C. Max Shortage (% of Supply)	D. Deepest Groundwater Elevation	E. Variable Cost Per Acre-Foot (All Supplies)
#1a (GW last, no CCWA Bank)	30	2	22%	-13 ft	$114
#1 (GW last, CCWA Bank)	19	1	22%	-11 ft	$127
#1c (SWP last, no CCWA Bank)	20	1	20%	-18 ft	$111
#1b (SWP last, CCWA Bank)	12	0	17%	-19 ft	$124

Table 11-2. WSMP results for scenarios that two historical modes of using groundwater – using groundwater as part of the regular supply (#1c and #1b) or using it only when there is insufficient supply from all other sources (#1a and #1). Column A lists the number of hydrologic years within the 86-year period of the model when supplies do not meet demand. Column B lists the number of years when shortages exceed 20% of average demand. Column C lists the percentage of supply shortfall (from average demand) in the worse drought year in the model. Column D is the deepest average groundwater elevation reached in the basin during pumping of the Drought Buffer. Column E is the variable cost per acre-foot of all supplies during the 86 years of the Model.

11.5 Reliability in Extreme Drought

The WSMP, which uses historical hydrology from 1922 to 2007, includes the largest droughts of the last century. This period is also used y the California Department of Water Resources in evaluating the response of the State Water Project to drought conditions. It is implicit in such evaluations that this period does not replicate the worse drought conditions that have ever occurred. However, it is not possible to reliably model the interplay of GWD's diverse set of water sources for weather conditions that may have occurred prior to historical records of hydrology.

However, the last drought (1986-1991) on the South Coast does give some guidance to what could happen in a longer drought. If not for the 1991 "March miracle" rains, there would likely have been at least another year of drought with Cachuma Reservoir levels low enough to cause significant cutbacks in water deliveries. Therefore, Scenario #1d-drght extends this drought for another two years, reducing Cachuma deliveries progressively to only 20% of entitlement. The results of this analysis indicate that with current capacities and water sources, there would be up to a 26% shortfall in supplies in the last year of this hypothetical extended drought. For perspective, GWD customers actually conserved as much as 50% of water demand during the 1986-1991 drought.

12 Technical Appendix – Optimizing GWD Water Supplies

Optimizing water supplies involves finding the appropriate balance of cost and reliability. Usually the tradeoff is that more reliability costs more. For this WSMP, both individual water sources and combinations of sources were analyzed. The combinations always prescribed using Cachuma sources first because of their vulnerability to reservoir spillage. Thus, the analysis of the optimum combination of water sources varied priorities of State Water and groundwater use, increased treatment and well capacities, and formulated operating rules.

12.1 Cachuma Supplies

Cachuma Reservoir is currently being operated using a rule curve that was optimized using the existing Santa Ynez River Model. In this study, this rule curve was used with the addition of modeled use of spill water and carry-over water.

Cachuma spill water (water that is delivered to GWD during the time that Cachuma is spilling) is essentially “free” water – that is, it is not debited from GWD’s annual allocation. However, spills occur during very wet months, when GWD demand is low. Currently, GWD uses spill water to meet all customer demand plus injects a portion of it in the groundwater basin. The amount of water that can be injected in the short times that Cachuma spills (see Figure 11-3 and Figure 11-4) is limited by treatment capacity for the water before injection (the secondary constraint) and the capacity of wells to inject water (the primary constraint). Although this spill water is “free”, the water incurs treatment costs on the way to injection and extraction/treatment costs when it is subsequently pumped and delivered to customers. Its variable cost of $177 per acre-foot makes it the most expensive source of water besides State Water. Section 12.1.2 discusses the results of increasing treatment capacity so that additional spill water can be injected.

GWD accrues carry-over water when GWD’s Cachuma entitlement is not completely used in any Cachuma water year, most likely when there is a spill during which the spill water used is not debited against GWD’s entitlement. Carry-over water is at risk if left in the reservoir – carry-over water is the first to spill in a subsequent spill event. Thus, it is imperative to use carry-over water as soon as it is accrued.

12.1.1 Priority of Use

Cachuma water in general should have the highest priority of use because of its lower variable costs and because of the danger of spilling unused water on average every three years. Thus, Cachuma sources should be used first each year to satisfy all customer demand until the annual entitlement plus any carry-over water is exhausted (recycled water has its own customer base and should always be delivered on a regular schedule). If there is carry-over water from the previous year, COMB considers that the first water used in the new water year is carry-over. WSMP modeling indicates that carry-over water will not be lost to a spill if the strategy of exhausting Cachuma supplies first is followed.

However, there is an unintended consequence of using Cachuma water first during the periods when Cachuma deliveries have been reduced because of drought. When the reduced Cachuma deliveries are exhausted part way through the year, groundwater must be pumped instead. The amount of groundwater that can be supplied is dependent upon well capacity – at current pumping capacity, groundwater cannot make up for the Cachuma water that is no longer available. Increasing pumping capacity is an option evaluated in this WSMP.

An alternative to increasing well capacity is to pump the wells for a longer period of time during a year when groundwater is needed. The only way to do this is to modify the “Cachuma always first” strategy. This alternative strategy is discussed in detail in section 12.2.2.

Another exception to the “Cachuma always first” strategy may be made for unusual circumstances. For instance, runoff from the area burned by the large Zaca fire in the Cachuma watershed brought high-TOC water into the Reservoir, requiring GWD to pump significant amounts of groundwater in 2008 to maintain acceptable water quality.

12.1.2 Spill Water

Spill water from Cachuma is GWD’s highest priority supply. Among the Cachuma supplies, spill water does not have an allocation and does not count against GWD’s annual Cachuma entitlement. The effective limit on how much spill water that GWD can use is GWD treatment capacity – Cachuma water must be treated prior to either delivery to customers or injected into the groundwater basin. Although this water is “free,” as discussed above, it is not inexpensive water. As part of the WSMP modeling, treatment/injection capacity was increased to determine the cost and effectiveness of such a strategy. Results are shown below.

Scenario #2b-treat –Scenario #2b (optimized groundwater/State Water priority, CCWA bank) modified by increasing GWD pumping capacity from 300 to 450 acre-feet per month and treatment capacity for treating spill water is increased (Table 12-1): By increasing pumping and treatment capacity, reliability is improved, with the shortfall during the worst year of drought not exceeding 3% of supply. However, per acre-foot costs of supply increases $227.

Scenario	Years with Any Shortage (86 Model Years)	Years When Shortage>20% (86 Model Years)	Maximum Shortage (% of Supply)	Deepest Groundwater Elevation	Variable Cost Per Acre-Foot (All Supplies)
#2b-treat (GW/SWP optimized, CCWA Bank, 450 AF/mo treatment/well capac)	11	0	3%	-57 ft	$227

Table 12-1. WSMP results for a scenario that increases GWD’s treatment/well capacity, thus allowing increased injection of Cachuma spill water. See Table 11-2 for explanation of columns.

12.1.3 Carry-over Water

As discussed above, carry-over water should be the first non-spill water used. Because COMB counts carry-over as the first water used in a new water year, carry-over water will be effectively used if the overall priority of using Cachuma water before any other source is maintained.

12.2 Groundwater Supplies

Groundwater is important to GWD both as a source of average-year supply and as a drought buffer. As discussed in Section 11.4 and summarized in Table 11-2, the reliability of GWD's water supply is highest and the costs the least when groundwater is used first before State Water. The WSMP scenarios that gave these results used current pumping capacity and current water demand. This caveat is important, because groundwater levels remained above 1972 levels even when groundwater pumping was prioritized above State Water use. At higher pumping rates and water demand, this might not continue to be true.

The modeling discussed previously used only end-members in a spectrum of combinations of water supply priorities. To examine optimum priorities, additional WSMP modeling scenarios were developed. These included varying both water supply priorities and groundwater pumping capacities.

12.2.1 Additional Well Capacity

To determine the effect of increasing GWD's groundwater pumping capacity, two previous WSMP scenarios were modified only by adding pumping capability. Increasing pumping capacity has a fixed cost of approximately $266 per acre-foot of groundwater produced, which is integrated into the overall costs in the model scenarios.

Scenario #2-450 –Scenario #1 (preferential use of State Water before using groundwater, CCWA bank) modified by increasing GWD pumping capacity from 300 to 450 acre-feet per month (Table 12-2): By increasing pumping capacity, reliability is improved. There is a slight decrease in the number of years that have a supply shortfall, with the shortfall never exceeding 19% of supply. Per acre-foot costs of supply increase from $127 to $157.

Scenario #2-900 –Scenario #1 (preferential use of State Water before using groundwater, CCWA bank) modified by increasing GWD pumping capacity from 300 to 900 acre-feet per month (Table 12-2): By increasing pumping capacity even more, reliability is also improved. There is a slight decrease in the number of years that have a supply shortfall, with the shortfall never exceeding 10% of supply. Per acre-foot costs of supply increase substantially from $127 to $255.

Scenario #2a-450 –Scenario #1b (preferential use of groundwater before using State Water, CCWA bank) modified by increasing GWD pumping capacity from 300 to 450 acre-feet per month (Table 12-2): By increasing pumping capacity, reliability is also improved in this scenario. The number of years with a supply shortfall decreases from 13 to 7 years, with the shortfall never exceeding 13% of supply. During droughts, the Drought Buffer of groundwater is barely tapped into. Per acre-foot costs of supply increase from $124 to $153.

Scenario #2a-900 –Scenario #1b (preferential use of groundwater before using State Water, CCWA bank) modified by increasing GWD pumping capacity from 300 to 900 acre-feet per month (Table 12-2): By increasing pumping capacity, reliability is improved in this scenario. The number of years with a supply shortfall decreases from 13 to 3 years, with the shortfall never exceeding 7% of supply. During droughts, about one-half of the

Drought Buffer of groundwater is used. Per acre-foot costs of supply increase substantially from $124 to $246.

Scenario	Years with Any Shortage (86 Model Years)	Years When Shortage>20% (86 Model Years)	Maximum Shortage (% of Supply)	Deepest Groundwater Elevation	Variable Cost Per Acre-Foot (All Supplies)
#2-450 (GW last, CCWA Bank, 450 AF/mo well capac)	18	0	19%	-10 ft	$157
#2-900 (GW last, CCWA Bank, 900 AF/mo well capac)	18	0	10%	-24 ft	$255
#2a-450 (SWP last, CCWA Bank, 450 AF/mo well capac)	6	0	13%	-32 ft	$153
#2a-900 (SWP last, CCWA Bank, 900 AF/mo well capac)	3	0	7%	-52 ft	$246

Table 12-2. WSMP results for scenarios that increase GWD's groundwater pumping capacity. See Table 11-2 for explanation of columns.

The tradeoff between increased reliability and increased cost is very clear in these scenarios. If GWD's target for reliability is to limit shortfalls of supply during droughts to 20%or less, then additional pumping capacity may not be needed at current levels of water demand. For potential increased levels of demand in the future, further evaluation of pumping capacity is discussed in Section 13.4.

12.2.2 Priority of Use

WSMP modeling results discussed earlier suggest that the strategy of using groundwater before State Water (within the rules of SAFE) enhances reliability and is less expensive than prioritizing State Water above groundwater (e.g., Table 11-2 and Table 12-2). It is clear why using groundwater before State Water is less expensive – it is the least expensive source of water for GWD besides Cachuma water. It takes a careful examination of the monthly results from the WSMP to understand why reliability is also enhanced by using groundwater before State Water. There are two factors that emerge from the modeling that favor groundwater use first:

1) **Pumping Capacity**: When State Water is used first and is exhausted (this occurs during periods of curtailed delivery of State Water), groundwater can only fill in at the rate of about 300 acre-feet per month. This rate is insufficient to make up the monthly supply shortfall. However, when groundwater is used first, groundwater pumping is spread across a longer period during the year and pumping capacity doesn't play as big a role in supply shortfalls. As pumping capacity is increased, the difference between the two strategies narrows (Table 12-2).

2) **CCWA Bank**: When groundwater is used before State Water, there is an accrual of unused State Water in the CCWA Bank. This water provides a readily-available cushion during drier years and can be delivered at higher monthly rates than groundwater can.

There are a couple of potential disadvantages to using groundwater before State Water. With that priority, the Drought Buffer is partially depleted during dry years; however, that is what it is designed to do. The Drought Buffer is quickly refilled with either strategy. Groundwater is also generally of lesser water quality than State Water – not for health-related issues but for taste and odor considerations.

As discussed briefly in Section 12.1.1, the strategy of always using Cachuma water first limits the quantity of groundwater that can be pumped in any year – pumps are only turned on after GWD's Cachuma entitlement is depleted for the year. Thus, expensive expansion of pumping capacity is required. However, if the "Cachuma first" strategy is modified slightly, the pumping capacity bottleneck can be by-passed. This by-pass can be accomplished by changing the "Cachuma first" strategy to a shared priority with groundwater during droughts.

In the modified "hybrid" priority strategy, during any month when Cachuma deliveries have been scaled back because of drought conditions, groundwater is pumped at capacity to partially offset some of the Cachuma deliveries. In this manner, Cachuma supplies last somewhat longer during these drought years and the amount of groundwater pumped during a year can be more than doubled.

Another portion of the hybrid water supply strategy deals with the priority of use of groundwater and State Water. In the hybrid strategy, State Water is used first when groundwater elevations are below 1972 levels (to preserve the Drought Buffer) and groundwater is used first when groundwater elevations are above 1972 levels (to keep costs lower and to prevent the groundwater basin from over-filling). There are two exceptions to this general rule: 1) if Cachuma deliveries are reduced, groundwater has a priority equal to Cachuma water (and higher than State Water); and 2) if there is water in the CCWA Bank, it is used before pumping groundwater (so that it isn't lost).

This overall hybrid strategy was simulated in the WSMP using both current pumping capacity (Scenario #1d) and increased pumping capacity (Scenarios #2b), with results compared to the strategy previously evaluated of using groundwater before State Water (Scenario #1b)(Table 12-3). The hybrid strategy reduces the magnitude of supply shortfalls by using more groundwater; additional pumping capacity reduces the magnitude of supply shortfalls further but is a more expensive option. If GWD's target for reliability is to limit shortfalls of supply during droughts to 20% or less, then additional pumping capacity would not be needed at current levels of water demand.

Scenario	Years with Any Shortage (86 Model Years)	Years When Shortage>20% (86 Model Years)	Maximum Shortage (% of Supply)	Deepest Groundwater Elevation	Variable Cost Per Acre-Foot (All Supplies)
#1b (GW before State Water)	12	0	17%	-19 ft	$124
#1d (Hybrid Strategy)	12	0	7%	-46 ft	$126
#2b-450 (Hybrid Strategy, 450 AF/mo well capac)	11	0	3%	-61 ft	$156

Table 12-3. WSMP results for the hybrid water supply strategy. Scenario #1d uses GWD's current pumping capacity and Scenario #2b uses increased pumping capacity. Scenario #1b results shown for comparison. See Table 11-2 for explanation of columns.

12.2.3 Drought Buffer

At current levels of water demand, the Drought Buffer (groundwater levels between historical low elevations and 1972 elevation) is only partially utilized during drought periods. Two examples of groundwater levels calculated in the WSMP are indicated in Figure 12-1 and Figure 12-2. The beginning groundwater elevation for each run is arbitrarily set at the historical low groundwater elevation to determine how the Drought Buffer is renewed. In the two examples illustrated, if groundwater elevations had been set above 1972 levels, then they would have largely remained there through the 86 years of the model. Even when the 1986-1991 drought is extended by two years in Scenario #1b-drght (discussed in Section 11.5), the Drought Buffer is only partially used. However, the Drought Buffer is utilized considerably at higher levels of water demand (e.g., Section 13.5).

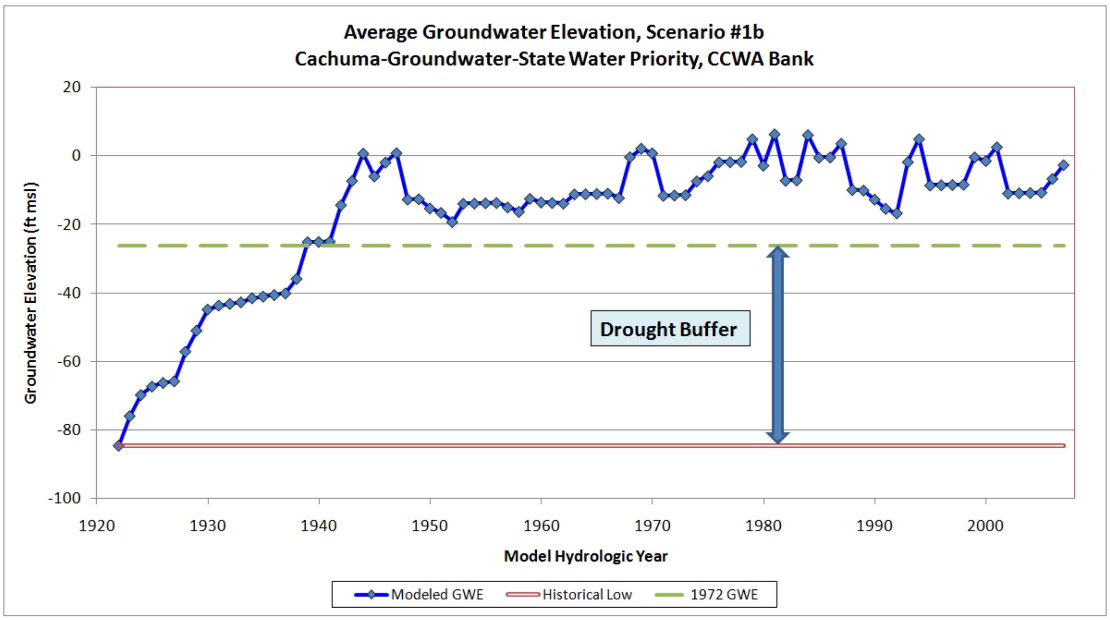

Figure 12-1. Groundwater elevations during the 86 years of hydrology in the WSMP for Scenario #1b (groundwater used before State Water). Year 1 of the model runs is always assigned the historical low groundwater elevation to see how the basin recovers from a depleted Drought Buffer.

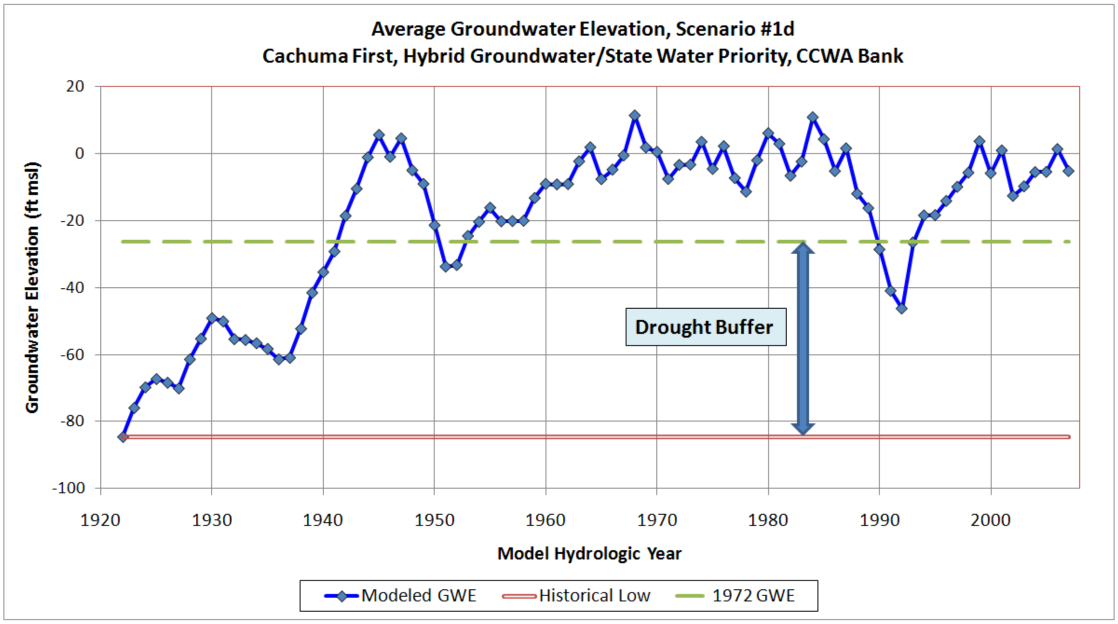

Figure 12-2. Groundwater elevations during the 86 years of hydrology in the WSMP for Scenario #1d (hybrid groundwater/State Water use). Year 1 of the model runs is always assigned the historical low groundwater elevation to see how the basin recovers from a depleted Drought Buffer.

12.3 State Water

State Water is GWD's most expensive source of water, but is key in the reliability of GWD's water sources. Without it in the last drought (1986-1991), groundwater was pumped down to historical low elevations. How to prioritize the use of State Water is discussed below. The CCWA Bank in San Luis Reservoir is very important to GWD during periods of water shortages; it is also discussed below.

12.3.1 Priority of Use

The relative priority of use of State Water and groundwater is discussed in Section 12.2.2. The hybrid groundwater/State Water operational scenario appears to be the best compromise of cost and reliability.

12.3.2 Banking

The current CCWA Bank of unused State Water in San Luis Reservoir is very important to GWD's water supply reliability (see Table 11-2 for illustration). The limit of storage in the Bank for GWD was set at 4,000 acre-feet for the WSMP. The Bank is currently operated in an informal mode – no formal agreements with DWR have yet been made. It is recommended that GWD share the results of the WSMP that indicate the importance of the Bank and work with CCWA to both formalize agreements on the Bank and increase the size of potential storage if possible.

12.4 Recycled Water

Currently, there is more recycled water treatment capacity than customers to take the water. Thus, for any increase in customers within the current delivery system, the cost of the water is only the variable cost of $150 per acre-foot. This makes recycled water an attractive alternative for any expansion of service within the current delivery system – not only for cost but also for reliability (recycled water has less supply variable during dry periods). It is recommended that GWD keep the recycled option near the top of its list for both new and existing customers.

To deliver recycled water to the entire GWD service area, however, would require new capital outlay for transmission infrastructure – the feasibility of such an expansion would have to be looked at on its own merits.

12.5 Conjunctive Use of Surface Water and Groundwater

GWD's main opportunity for conjunctive use is injecting Cachuma spill water into the groundwater basin. GWD already injects spill water up to the limits of its injection capacity for Cachuma water. The option to expand this conjunctive use of spill water involves upgrading the capacity of current treatment/injection facilities. The problem with upgrading treatment facilities is that this extra capacity is only used during periods of spill (9% of all the months in the WSMP are spill months) and sits idle the rest of the time. Thus, new capital costs are spread over a relatively small amount of new water. This option is evaluated in Section 12.1.2 – it adds some reliability, but raises the melded variable costs of all supplies by 50%.

12.6 Reliability with Optimized Use of GWD's Water Supplies

The hybrid priority strategy was simulated by the WSMP using both the historical hydrology and the extended drought method discussed in Section 11.5. The results are shown in Table 12-4. Maximum supply shortages of 7% would be expected if weather patterns are similar to the 86-year hydrology period of the WSMP. Although supply shortages of up to 25% are expected in an extended drought with current pumping capacity, this is within the range of historical conservation by customers of GWD. If shortages are to be kept at or below 20% of supply in an extended drought, pumping capacity must be increased to 350 acre-feet per month at a relatively small cost increase (Table 12-4).

Scenario	Years with Any Shortage (86 Model Years)	Years When Shortage>20% (86 Model Years)	Maximum Shortage (% of Supply)	Deepest Groundwater Elevation	Variable Cost Per Acre-Foot (All Supplies)
Historical Hydrology					
#1d (Hybrid Strategy)	12	0	7%	-46 ft	$126
Extended Drought					
#1d-drght (Hybrid Strategy with extended drought)	14	1	25%	-46 ft	$127
#2c (Hybrid Strategy, 350 AF/mo well capac, extended drought)	12	0	14%	-47 ft	$137

Table 12-4. WSMP results for the hybrid strategy for use of groundwater and State Water with an extended drought. Scenario #1d uses GWD's current pumping capacity and Scenario #2c uses increased pumping capacity. See Table 11-2 for explanation of columns.

13 Technical Appendix – Future Reliability of Water Supplies

Although GWD's water supplies are sufficient to protect against drought conditions at current demand levels, both the SAFE Ordinance and regional planning agencies foresee a potential growth in population and water demand in the coming decades. Thus, it is imperative to determine whether water supplies also provide reliability at higher water demand levels.

13.1 Growth in Demand

The potential growth in population and perhaps water supply demand was analyzed using the following approaches:

1) Santa Barbara County Association of Governments (SBCAG, 2007) forecast the population of the City of Goleta to be 37,300 in 2030. This would be an 18% increase over the 2010 population, and a similar rate of growth is forecasted for the entire Santa Barbara County south coast. This assumed growth would result in a proportional rise in population and water demand across the District's entire service area would mean that GWD would potentially have a water demand of as much as 17,200 acre-feet per year in 2030 (within the restrictions of the SAFE Ordinance). However State-mandated conservation means that per capita water use and associated demand will be lower in the future. The guidelines currently available for calculating State-mandated water conservation targets allow several methods for determining the amount of conservation required by 2020[12]. One of these methods prescribes a specific target for potable water use per capita per day.

   Calculations using the SBCAG (2007) population growth rates and this per capita target result in a water demand of approximately 14,900 acre-feet per year in 2020 and 15,833 acre-feet per year in 2030 (see section 14.2 for explanation). These demand calculations will be further refined when the State finalizes its guidelines for the development of 2010 Urban Water Management Plans.

2) SAFE Ordinance – For each year that all other obligations for water delivery have been met, GWD may authorize new service connections equal to a maximum of 1% of the total potable water supply[13]. The requirements for new service connections have been met over the last decade, with authorized new service connections adding 567.80 acre-feet per year of demand since 1997. If authorization of new service connections were provided at the maximum rate of 1% per year of potable water supply, GWD water supply demand would be approximately 17,510 acre-feet per year in 2030[14]. Notably, this exceeds current estimates of State required demand levels; therefore, SAFE provides a theoretical upper limit for newly authorized demand.

3) In addition to newly authorized connections that are subject SAFE, approximately 850 acre feet of additional future water demand has already been authorized under District Permits, Water Service Agreements, Reclaimable Meters, and Measure T allotments,

[12] See Section 14.2 for more detail on demand calculations.
[13] GWD Ordinances No. 91-01 and 94-03.
[14] GWD water supply demand has averaged 14,600 acre-feet per year over the past 5 years.

which were primarily executed prior to the adoption of SAFE. These are commitments and entitlements that the District is required to serve, and are worth noting for long range resource planning purposes. This 850 acre-feet of demand is included in all 2030 WSMP model runs. See Section 14.2 for more detail.

Because the availability of GWD's water supply varies considerably by climatic conditions (see Figure 11-1 for annual variability), two conditions of water supply (average-year and drought) are evaluated in this section.

13.1.1 Average Conditions

During average years, there is a slight excess of water supply at current water demand levels (Figure 13-1). When water demand increases to projected 2030 levels (including the 850 acre-feet per year of previously-authorized new service connections), water demand and water supply are about the same (Figure 13-1). A similar analysis for drought conditions follows.

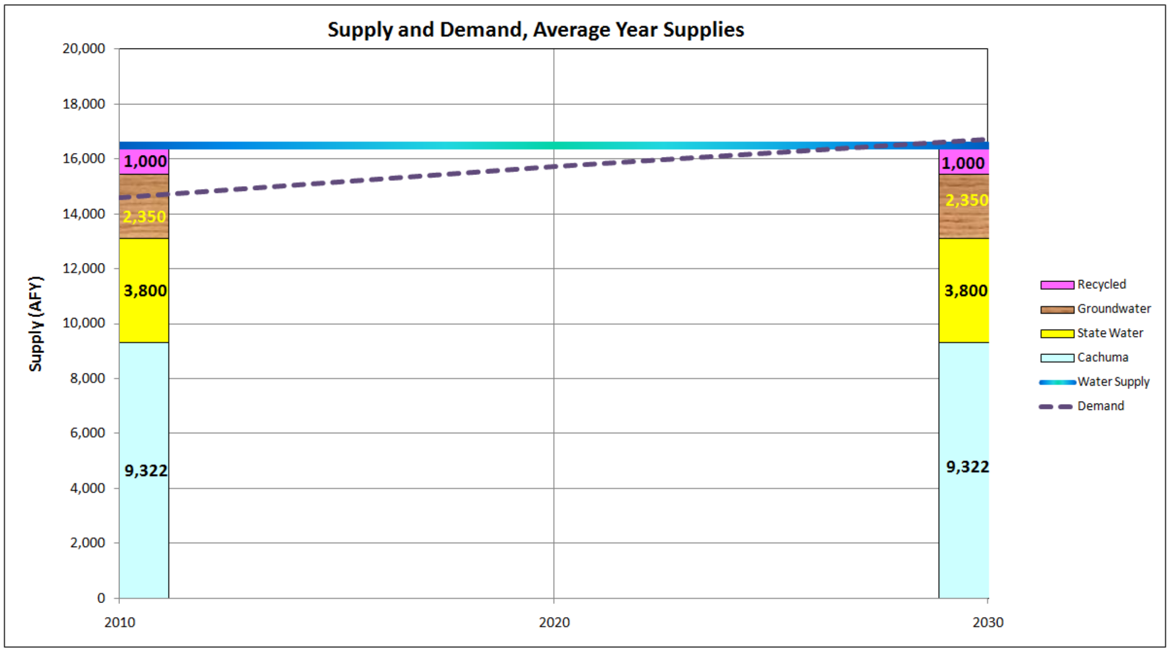

Figure 13-1. Water supplies in average years are indicated by supply sources for 2010 and 2030[15]. The SAFE Ordinance requires that for planning purposes the State Water supply must be considered to be 3,800 acre-feet per year; the WSMP Model calculates that 4,025 acre-feet per year would be available at 2010 demand levels and 3,680 acre-feet per year would be available at 2030 demand levels. Groundwater supply is the Wright Judgment water right. Dashed line represents GWD projected demand including the conservation required in the future by the State.

13.1.2 Drought Conditions

For the analysis of GWD water supplies in a drought, the worst five-years of the late 1980s to early 1990s were used. The supplies indicated in Figure 13-2 are the average of the five years from the WSMP scenarios for water demand levels in 2010 (actual) and 2030 (projected). Figure 13-2 indicates that there is about the same amount of drought supply as there is demand at

[15] Recycled water supply is kept constant in the calculations. However, there is an additional 2,000 acre-feet per year of unused recycled capacity if additional customers are identified and additional pipelines are constructed.

current water demand, but that at 2030 projected water demand there is a drought shortfall of about 2,600 acre-feet per year of supply.

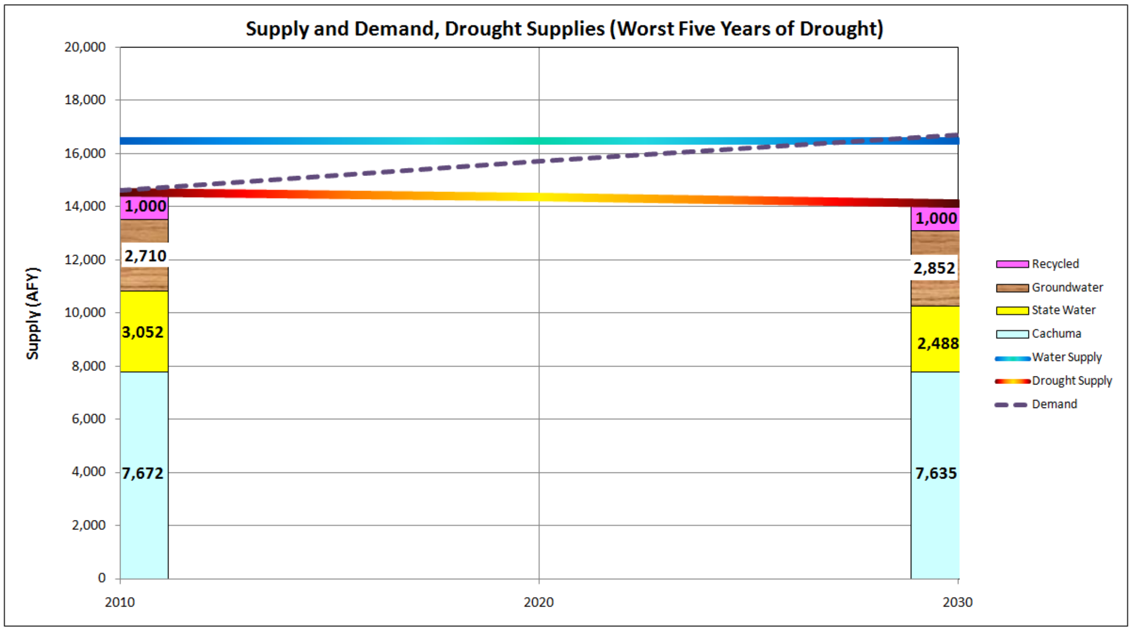

Figure 13-2. Drought water supplies calculated from the WSMP Model are indicated by individual supply sources for 2010 and 2030[16]. Supplies are based on average availability during the five worst years in the last drought (late 1980s to early 1990s) from the WSMP models for 2010 and 2030 water demand. State Water supply includes water from the CCWA Bank. Groundwater supply assumes no increase in current pumping capacity. Dashed line represents GWD projected demand including the conservation required in the future by the State.

13.2 Future State Water Reliability

As discussed in Section 11.1.3, delivery of water from the State Water Project varies with climatic conditions in northern California and environmental/regulatory issues in the Sacramento Delta. The California Department of Water Resources (DWR) has calculated probabilities of water delivery over a range of climatic conditions and environmental constraints for the year 2029. DWR has been updating the reliability studies every two years or so, the last being in 2009. The WSMP modeling used these supply projections. DWR considers that the average reliability of State Water in 2029 would be 60% of Table A allocation, with a low of 11% during the driest year to a high of 97% during the wettest year (DWR, 2010). The DWR modeling suggests that between 60% and 70% of Table A water can be delivered about half (50%) of the time (Figure 5-3).

Projecting future conditions of the water supply is difficult, particularly in the Sacramento Delta where State Water is currently pumped. DWR considered a number of issues in its reliability study: 1) climate change and sea level rise; 2) Delta levee failure; 3) disruptions caused by earthquakes; 4) disruptions caused by floods; and 5) environmental-judicial concerns. Although DWR took its best estimate of the effects of these concerns given what is known at

[16] Recycled water supply is kept constant in the calculations. However, there is an additional 2,000 acre-feet per year of unused recycled capacity if additional customers are identified and additional pipelines are constructed.

present, it is likely that as these issues develop further, projections of State Water reliability are also likely to change.

13.3 Effects of Climate Change

Climate change may have differing effects on water supplies derived from winter snow pack (State Water), local winter rain storms (Cachuma), or groundwater. Modeling of long-term climate change is problematic at best. There is general agreement that California will be warmer, which has several potential impacts. The effect on precipitation patterns is not entirely clear. The U.S. Global Change Research Program (2009) predicts lower rainfall and longer droughts in the southwestern United States.

DWR (2009) believes that changes have already been observed in California's climate over the past 100 years. According to DWR, air temperatures have risen about 1 degree Fahrenheit with the greatest changes occurring at night and at higher elevations. Early spring snowpack in the Sierra Nevada has decreased about 10% resulting in a significant loss of water storage, and sea levels along the California coast have risen by about 7 inches. DWR believes that the climate is expected to continue changing in the future, with mean temperatures predicted to increase by 1.5 degrees to 5.0 degrees Fahrenheit by mid-century and 3.5 degrees to 11 degrees by the end of the century, and future sea level rise estimated to range from 4 to 16 inches by mid-century and 7 to 55 inches by the end of the century (DWR, 2009).

Climate factors that could affect GWD's water supply reliability include:

State Water – More of the winter precipitation in the Sierra Nevada will fall as rain instead of snow. Because Sierran dams are partially operated as flood control facilities, some of the winter rain runoff will have to be released from the dams to preserve storage space for later storm events, effectively reducing winter storm capture and water available for the State Water Project. Higher sea levels could threaten the existing levee system in the Delta. Salinity intrusion into the Delta could also require increased releases of freshwater from upstream reservoirs to maintain compliance with water quality standards.

Cachuma Reservoir – Ongoing studies by the California Department of Water Resources (e.g., DWR, 2006) indicate that rainfall in southern California will not change significantly, with climate modeling indicating that precipitation will increase in wet years in the Sierra, but decrease in dry years. This modeling suggests that these effects will likely be less than a 10% swing in precipitation in either direction. However, periodic drought periods may be longer in duration affecting runoff into Cachuma Reservoir.

Groundwater – Periodic drought periods may be longer in duration, affecting recharge to the groundwater basin. The projected sea level rise discussed above would potentially allow the sea to encroach farther up the Goleta Slough and extend the estuary over portions of the West and Central subbasins. This encroachment would likely occur over the portions of the basin that are under confined conditions – that is, there are low-permeability sediments that separate the estuary at the surface from the drinking water aquifers at depth. Thus, it is unlikely that this encroachment would allow saline water into the aquifers. However, such encroachment would require additional monitoring wells to be installed to ensure that downward percolation of saline waters does not occur.

Preventing the encroachment of the ocean onto coastal plains around the world will be a major effort – it will be expensive and disruptive. It is not known at this time if the Goleta Slough area would be protected from encroachment in the future as part of this global effort.

Infrastructure – If seawater was to encroach on the Goleta Slough, distribution pipes such as the recycled water line at the slough would potentially have to be relocated.

Demand – Higher temperatures could increase evapotranspiration (temperature is one of the factors in evapotranspiration), causing an increase in outside water use and crop irrigation.

13.4 Enhancements for Greater Reliability

There are some actions that GWD could take to improve its future water supply reliability. These actions are primarily infrastructure capacity increases. Because these actions are relatively expensive, costs must be balanced against the improvement in reliability; this analysis is presented in the following sections.

13.4.1 Groundwater Pumping Capacity

The current groundwater pumping capacity of 300 acre-feet per month caused supply shortages in some years with current water supply demand. As demand potentially increases in the future, this pumping capacity limitation becomes a larger factor in shortfalls of supply.

A series of WSMP runs were conducted with progressive steps of increasing demand by another 500 acre-feet per year in each run, starting at 500 acre-feet per year higher than current average demand (Table 13-1). For each step in increasing demand, the Model was run first using current pumping capacity and then again with increased pumping capacity if the supply shortfall exceeded 20% of supply.

As indicated in Table 13-1, additional pumping capacity is not required until there is an additional 2,000 acre-feet of increased demand. At that demand level, no more than an additional 100 acre-feet per month of capacity is needed – the maximum supply shortage cannot be reduced further because the SAFE Ordinance does not allow groundwater pumping in the situation where Cachuma is at full deliveries when State Water deliveries are significantly reduced. The variable costs of all supplies with and without the added capacity are also shown in the table. At the higher pumping capacity and demand, the Drought Buffer is only partially utilized (Figure 13-3). An increase in demand of 2,000 acre-feet per year does not reach the full projected 2030 demand. The 2030 demand analysis is included in sections 13.5 and 14.2.

Scenario	Years with Any Shortage (86 Model Years)	Years When Shortage >20% (86 Model Years)	Maximum Shortage (% of Supply)	Deepest Groundwater Elevation	Variable Cost Per Acre-Foot (All Supplies)
Add 500 AFY of Demand					
Current pumping capacity	33	0	12%	-40 ft	$130
Add 1,000 AFY of Demand					
Current pumping capacity	51	0	15%	-40 ft	$130
Add 1,500 AFY of Demand					
Current pumping capacity	49	0	19%	-43 ft	$129
Add 2,000 AFY of Demand					
Current pumping capacity	57	4	27%	-44 ft	$128
Add 100 AF/mo of pumping capacity (400 total)	53	2	23%	-52 ft	$148

Table 13-1. WSMP results for the hybrid strategy (Scenario #1d) in increasing steps of potential additional water supply demand within GWD in the future. Each increment of 500 acre-feet per year of demand is analyzed using current well capacity and additional well capacity if supply shortfalls exceed 20% in any year. See Table 11-2 for explanation of columns.

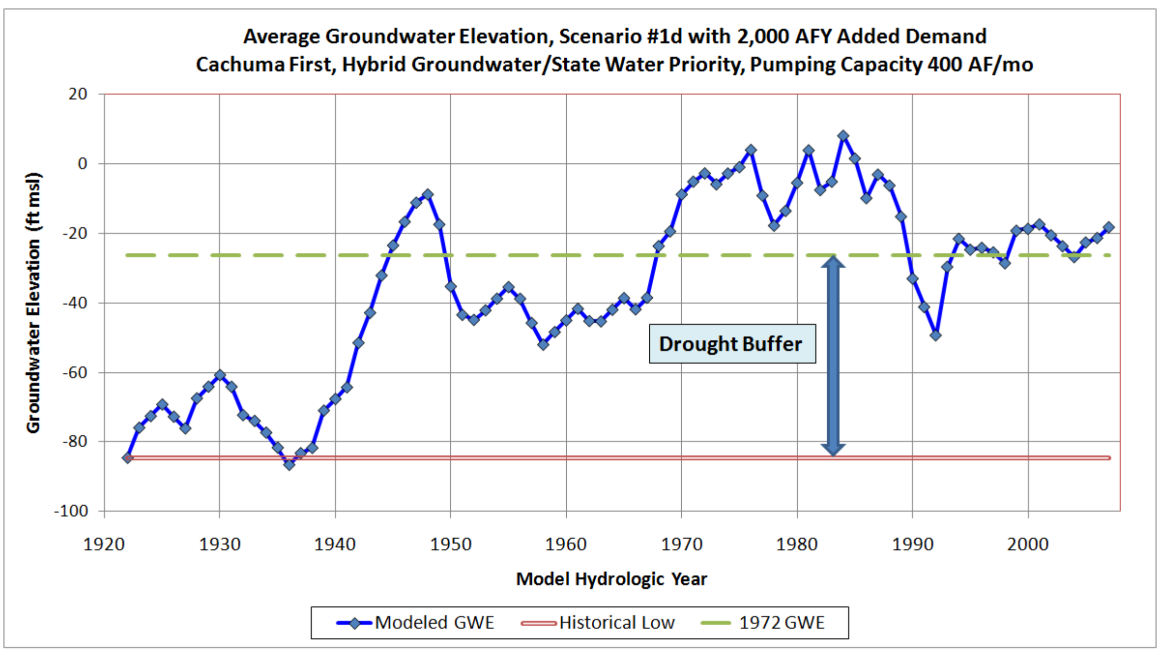

Figure 13-3. Groundwater elevations from WSMP for model run with 2,000 acre-feet of additional demand and increased groundwater pumping capacity to 400 acre-feet per month. Starting groundwater elevations in the Model are set to historical low elevation in all model runs; the drought in the 1930s delayed recovery of modeled water levels in the basin.

13.4.2 Treatment Capacity

The capacity of GWD treatment facilities can be a limiting factor in how much Cachuma water can be injected during a spill event (high turbidity in the storm water can reduce treatment capacity). Raw Cachuma water must be treated prior to injection to meet health requirements and to ensure that the wells used for injection do not get plugged with sediment and organic material. This additional treatment capacity is expensive because it is not needed except during the 9% of the months that Cachuma spills in the Santa Ynez River and WSMP models. This option is evaluated in Section 12.1.2 – it adds some reliability, but raises the melded variable costs of all supplies by 50%.

13.4.3 Cooperation with Other Agencies

GWD is a member agency of both COMB (for Cachuma water) and CCWA (for State Water). The joint agency strategy that is likely to provide the most reliability for GWD's water supply in the future is storage of unused State Water by CCWA somewhere south of the Sacramento Delta. As discussed in Section 6, the current CCWA Bank has increased GWD's supply reliability – a further expansion of this bank in San Luis Reservoir or a possible CCWA groundwater bank along the Coastal Aqueduct would further GWD's supply reliability.

13.5 Evaluation of Future Supply Reliability

The projected 2030 demand (including authorized future demand) discussed in Section 13.1 is 16,705 acre-feet per year. This is over 2,000 acre-feet per year higher than current deliveries. The WSMP Model was used to evaluate GWD's supply reliability at this higher rate of demand (Table 13-2). The model was run for current and increased well capacity for historical hydrology and for increased well capacity for the extended drought hydrology discussed in Section 11.5. As pumping capacity was increased with increasing demand, the cost of water also increased (Table 13-2).

At current well capacity, there were two model years where there was a shortage of more than 20% of supply, with almost three-quarters of the years having some amount of supply shortfall. At the increased well capacity of 425 acre-feet per month, there was a slight improvement in water supply reliability (one year over 20% shortfall), but increasing pumping capacity beyond 425 acre-feet per month did not improve reliability. This anomaly was caused because the shortage occurred in years when Cachuma deliveries were not reduced (thus pumping wasn't allowed by SAFE when groundwater elevations were below 1972 levels as well), but State Water deliveries were significantly reduced. This potential interaction with SAFE was discussed in GWD's Groundwater Management Plan (GWD, 2010), but apparently is not a problem until demand is higher than current levels. A similar anomaly occurred when the extended drought scenario was run – there was no amount of added pumping capacity that allowed supply shortage to remain at 20% or below because of the interaction with SAFE.

Scenario	Years with Any Shortage (86 Model Years)	Years When Shortage>20% (86 Model Years)	Maximum Shortage (% of Supply)	Deepest Groundwater Elevation	Variable Cost Per Acre-Foot (All Supplies)
Historical Hydrology					
#3a (Hybrid Strategy, current well capac)	61	3	22%	-43 ft	$134
#3 (Hybrid Strategy, 425 AF/mo well capac)	52	1	21%	-53 ft	$158
Extended Drought					
#4 (Hybrid Strategy, 425 AF/mo well capac, extended drought)	51	2	29%	-54 ft	$158

Table 13-2. WSMP results for the hybrid water supply strategy at projected water supply demand levels in 2030. Additional pumping capacity is added in Scenarios #3 and #4. Adding capacity beyond 425 acre-feet per month did not provide incremental benefit at this demand level. See Table 11-2 for explanation of columns.

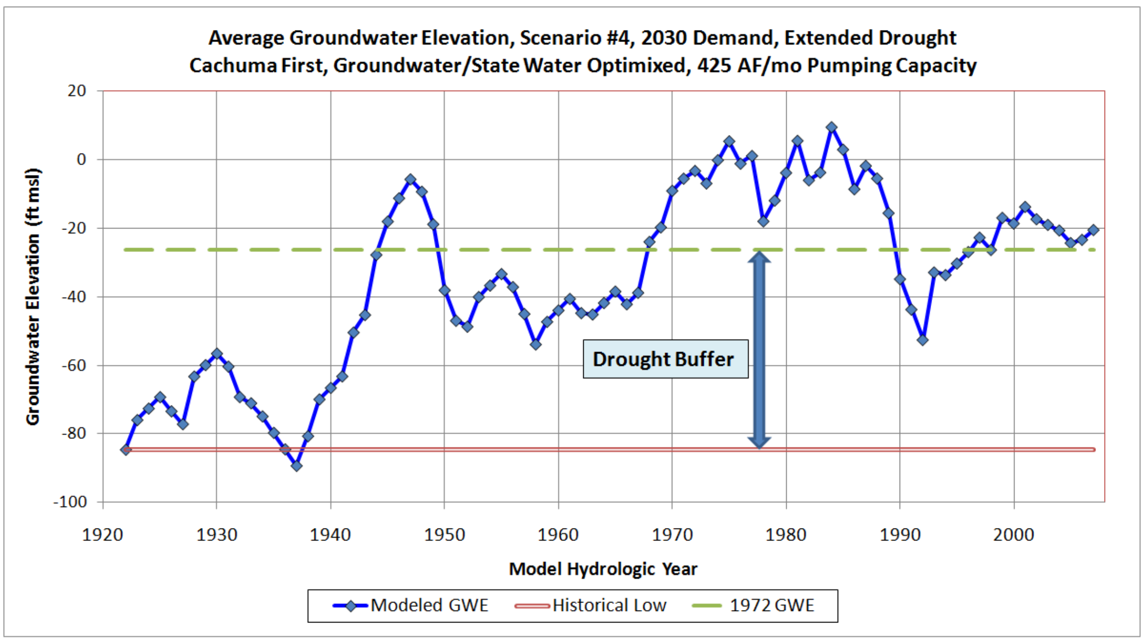

Figure 13-4. Modeled groundwater elevations for 2030 demand and 425 acre-feet per month of groundwater pumping capacity. Although the modeling indicates that the drought of the 1930s results in groundwater elevations below historical lows, this is an artifact of setting the initial groundwater elevation at historical low levels followed very soon by a drought.

14 Technical Appendix – Model Input

14.1 WSMP Input

This section contains information on water supply assumptions, cost of supplies, and model organization.

14.1.1 Water Supply and Other Assumptions

Cachuma water right: 9,322 AFY

Minimum Cachuma drought deliveries: 80% (by COMB policy). In the severe drought simulation (two more dry years following the 1986-1991 drought), Cachuma deliveries were reduced to 20% by the end of the additional two years of drought.

State Water allocation: 7,000 AFY

CCWA Drought Buffer: up to 4,000 AF at any time.

Annual State Water Delivery %: Based on 2009 DWR State Water Reliability Study (which integrates current judicial/environmental constraints; 2030 reliability based on same document, using their most likely future scenario).

CCWA Carryover Storage in San Luis Reservoir: Limited to 4,000 AF at any time (upper limit not yet certain)

GWD share of Coastal Aqueduct capacity: 4,500 AFY

Average % of State Water delivered as Exchange Water: 52%

Current groundwater pumping/treatment capacity: 300 AF/mo

Current capacity for treatment/injection of Cachuma spill water: 280 AF/mo (3 mgd)

Recycled water delivery: 1,000 AFY

GWD groundwater rights, SAFE Ordinance requirements, Annual Storage Commitment: From GWD 2010 Groundwater Management Plan.

Climate Change: The potential effects of climate change on GWD's water supplies have been integrated in the WSMP as much as is possible. Climate change considerations have been integrated into DWR's calculations of future State Water deliveries. The effect on local supplies is less-well understood, with studies suggesting less than a 10% swing in precipitation either way in the future. However, several of the scenarios addressed in this document model severe drought conditions that have not been experienced in recent history. In this way, the potential impacts of severe reductions in supply may be understood, whether these reductions are caused by climate change or other factors.

14.1.2 Supply Costs

Variable Water Supply Costs ($/AF)	Delivery Charge	Treatment: Chemicals	Treatment: Electrical	Waste Disposal	Variable Cost
Cachuma Potable	-	$52	$10	$5	**$67**
Goleta West Conduit	-	$22	-	-	**$22**
State Water (Table A)	$288	$52	$10	$5	**$355**
State Water (Exchange)	$167	$52	$10	$5	**$234**
Groundwater	-	$20	$80	$10	**$110**
Recycled Water	-	$57	$93	-	**$150**

Table 14-1. Cost per acre-foot for the variable cost for each source of GWD water supply.

Fixed Water Supply Costs ($/AF)	Agency Fee	Debt Service	Labor	Oper & Maint	Testing	Fixed Cost
Cachuma Potable	$324	$250	$134	$11	$20	**$739**
Goleta West Conduit	$320	-	-	-	-	**$320**
State Water (Table A)	$1,774	-	-	-	-	**$1,774**
State Water (Exchange)	$1,774	-	-	-	-	**$1,774**
Groundwater	-	$188	$66	$10	$3	**$266**
Recycled Water[17]	$312	$1,309	$47	$3	-	**$1,671**

Table 14-2. Cost per acre-foot for the fixed cost for each source of GWD water supply.

14.2 Water Supply Management Plan Demand Projections

14.2.1 Assumptions for Base Forecasted Demand in 2030

With the adoption of Senate Bill X7-7, the State of California set water demand targets for urban water retailers, such as the Goleta Water District. In alignment with this State mandate, these targets have been used to forecast water demand in 2030, as described below.

1) Per Capita Demand – Potable Water

Potable water demand was forecasted using the per capita water target of 117 gallons per capita per day (gpcd) for the Central Coast established by the Guidebook Urban Water Management Plan, finalized in March 2011 by the California Department of Water Resources (DWR). This per capita water target has been reduced by an additional increment to 114.50 gpcd, pursuant to the Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use published by DWR (DWR Technical Methodologies).

[17] Fixed costs calculated on 1,000 AFY of current delivery. At full capacity of 3,000 AFY, fixed costs per AF would be reduced to one-third of costs in table.

2) Population Growth

The Santa Barbara County Regional Growth Forecast, which was published by the Santa Barbara County Association of Governments (SBCAG) in 2007, forecasts an annual growth rate of 0.8% for the South Coast, including the Goleta Valley. Given an existing population base of approximately 80,000 in 2010, the local population is forecasted to grow to 93,821 by 2030.

Multiplying the forecasted 2030 population of 93,821 by the per capita water demand of 114.50 gpcd produces a total potable water demand of 12,033 acre feet per year in 2030.

3) Demand for Recycled and Agricultural Water

DWR Technical Methodologies enable per capita water demand to be calculated based on "Gross Water Use," which excludes recycled water and water delivered for agricultural use (California Water Code Section 10608.12(g)). This Water Supply Management Plan assumes that demand for recycled water (approximately 1,000 AFY) and demand for agricultural water (approximately 2,800 AFY) will remain steady through 2030.

4) Summary

In summary, the components of the District's base forecasted water demand in 2030 include:

- Potable Demand: 12,033 AFY
- Recycled Water Demand: 1,000 AFY
- Agricultural Demand: 2,800 AFY

Total: **15,833 AFY**

14.2.2 Authorized Future Demand

Future growth in potable water demand is subject to the SAFE Ordinance, which limits new annual service connections to 1% of available potable water supplies. In addition to connections that are subject SAFE, approximately 850 acre feet of future water demand has already been authorized under a variety of entitlements including District Permits, Water Service Agreements, Reclaimable Meters, Measure T allotments, and Can & Will Serve Letters. Many of these entitlements were executed prior to the adoption of SAFE or are for projects that have not yet been built. These are commitments and entitlements that the District is required to serve, due to contractual or other legal obligations, and are worth noting for long range supply and demand planning purposes.

Table 14-3 provides a listing of the agreements and obligations that are used to estimate the District's authorized future demand of 850 acre feet. Notably, this illustrates an additional increment of demand that may be served, above and beyond forecasted base demand in 2030, which would be subject to the new water distribution provisions of SAFE.

Entitlement Type	Entitled Acre Feet Per Year (AFY)	Notes and Analytical Assumptions
1. Water Agreements		
1a. Los Carneros	54	This is the portion of the Los Carneros Agreement not subject to the SAFE Ordinance. Total water demand for the project was estimated to be 119 AFY.
1b. Levison/Koral	61	Remaining portion of water entitlement.
1c. Univ. Exchange Corp (UEC)	250	A portion of this entitlement is forecasted to be served in the near future for several UCSB projects, separate from the projects on the main campus, which are covered under Permit 14 (see below).
2. Reclaimable Meters	133	Reclaimable meters are considered active service connections under GWD Code Section 5.04.010. A conservative analysis has been performed to determine the potential water use associated with the 75 reclaimable meters not yet put in service.
3. Permits	250	Prior to issuing Can & Will Serve Letters, District water entitlements were granted through Permits. One of the most significant is Permit 14, enabling UCSB to use 948 AFY of potable water on its main campus. As of 2009, UCSB had usage of just under 700 AFY, leaving approximately 250 AFY.
4. Measure T Parcels	30.10	Measure T (passed by voters in 1987), enabled District customers to reserve water entitlements for specified parcels. District records indicate that 301.52 acre feet were reserved; however, the exact unserved portion of this total reservation is currently unknown. An assumption is made that 10% (30 AFY) of the total water reservation has not been served.
5. Outstanding Can & Will Serve (CAWS) Letters	76.40	The District began providing CAWS Letters to projects in 1997 for new connections. Since that time, some projects have not yet been built and served. This includes a CAWS Letter to the Haskell's Landing project for approximately 21 AFY, as well as CAWS Letters for projects where construction is currently in progress.
Total (1)	**854.50**	

Table 14-3. Authorized future demand. Note (1): This represents a conservative estimate of the District's Authorized Future Demand for potable water. Intended for long range planning purposes, the extent to which this forecasted demand will be served over a 20-year planning horizon depends on numerous factors, including landowner preferences, economic trends, and market dynamics.

14.2.3 Annual Storage Commitment to the Drought Buffer

Between 1997 and 2010, authorized new service connections have added a total of 567.80 acre-feet per year of demand. Section II.5 of SAFE requires that two-thirds of potable water use resulting from new or additional service connections be permanently added to the Annual Storage Commitment to the Drought Buffer. Accordingly, the Annual Storage Commitment has grown from 2,000 acre feet, as originally identified in Section I.1 of SAFE, to 2,378.50 acre feet (Table 14-4).

Year	Annual Allocation (Acre Feet per Year)	Total Annual New Service Authorized	Additional Annual Storage Commitment (Acre Feet)	Total Storage Commitment to the Drought Buffer (Acre Feet)
		Pursuant to SAFE		2,000.00
1997	164.6	164.60	109.73	2,109.73
1998	164.6	96.26	64.17	2,173.91
1999	164.6	13.19	8.79	2,182.70
2000	164.6	21.38	14.25	2,196.95
2001	176.6	33.40	22.27	2,219.22
2002	176.6	31.05	20.70	2,239.92
2003	175	11.37	7.58	2,247.50
2004	175	23.95	15.97	2,263.47
2005	175	45.23	30.15	2,293.62
2006	175	25.71	17.14	2,310.76
2007	160	77.01	51.34	2,362.10
2008	154	9.41	6.27	2,368.37
2009	142	6.75	4.50	2,372.87
2010	146	8.46	5.64	2,378.51
1997 - 2010 AFY of New Service		567.80		

Table 14-4. Water allocation summary.

14.3 Model Organization

The following list of columns in the model spreadsheet gives an explanation of how the spreadsheet works ("Main" tab in spreadsheet). All calculations are in acre-feet.

Year: The hydrologic year of the model.

Column B: Month in the year.

Type: Climatic type year in Goleta based on rainfall records for that hydrologic year. The type year controls customer demand for GWD, based on the patterns of the last 15 years of demand records.

GWD Demand: Monthly demand adjusted for climatic type. There is a lookup table under "GWD Demand" tab in spreadsheet.

% Monthly Median: Percent of Cachuma water available to Cachuma users for that month, based on Santa Ynez River Model.

GWD Base Cachuma Available: Monthly Cachuma water available to GWD, based on historical deliveries.

Recycled Use: Fixed monthly delivery based on current deliveries.

GWD Base Cachuma Used: Amount of available Cachuma water used to meet monthly demand.

GWD Spill Water In-Lieu: Spill months are based on Santa Ynez River Model. Cachuma spill water replaces use of any other water source to meet GWD demand.

GWD Spill Water Inject: Amount of spill water injected by GWD, limited by injection capacity listed in cell "J2".

GWD Carryover: Amount of Cachuma carryover from previous year, calculated on Cachuma water year.

GWD Carryover Water Delivered: Monthly delivery of carryover water, which subtracts each month from **GWD Carryover** column.

GWD Total Cachuma Deliveries: Total of base Cachuma and carryover water.

Spill Month?: Spill month according to Santa Ynez River Model.

Unmet Demand after Cach-Recy: Unmet demand after delivery of recycled water and Cachuma deliveries (not including injected water from Cachuma).

SWP Delivery (2009 Availability): Percent of State Water availability for that hydrologic year, based on DWR 2009 reliability study using current regulatory/environmental restrictions.

Annual SWP Available: Amount of State Water available to GWD based on availability percentage and GWD allocation. Resets at the beginning of each year, then monthly deliveries are subtracted from annual total.

CCWA Bank: Amount of unused State Water stored in San Luis Reservoir at the end of the year by CCWA for use by GWD. It is limited to amount in cell "Y2". This limit will likely change as the program matures – it is the best estimate of current operations. The limit can be set to "0" if the bank is not operated. This water is used before the regular SWP allocation, with monthly deliveries subtracted from the total.

CCWA Bank Used for Unmet Demand: Monthly amount of banked water used to supply any unmet demand after Cachuma deliveries.

SWP Allocation to Unmet Demand: Monthly amount of State Water used to supply unmet demand after Cachuma and CCWA Bank deliveries.

SWP Available for SAFE: State Water available to recharge basin according to SAFE Ordinance protocol, if injection of spill water and deferred use of groundwater are insufficient. This situation has not yet occurred for GWD.

CCWA Bank Available for SAFE: Same as above. Banked water has priority of use over SWP allocation for that year.

Bank Used for SAFE: Water used from column CCWA Bank Available for SAFE.

SWP to SAFE: Water used from column SWP Available for SAFE.

Total SWP Delivery: Total deliveries of SWP allocation and CCWA Bank.

Annual SAFE ASC: Annual Storage Commitment as per SAFE Ordinance, based on SAFE protocols.

GWD Unmet Demand after SWP: Unmet GWD monthly demand after delivery of Cachuma, SWP, and CCWA Bank water.

GWD Groundwater Pumping: Amount of water pumped to satisfy unmet demand, within restrictions of SAFE Ordinance and GWD pumping capacity (capacity in cell "E1" in AF/Mo). In the scenarios where groundwater and State Water are shared in priority, there is a trigger based on State Water availability for that year – when the availability is below the trigger percentage (cell "C1"), then the ratio of pumping to State Water increases to conserve more State Water for use later in the year. This allows most or all of GWD's well capacity to be used across a dry year, rather than sharing State Water in winter months and then running out of State Water before the end of the year.

Annual Defer Pumping: Amount of groundwater pumping deferred from Wright Judgment water right. It is the difference between Wright water right and actual pumping – if there is unused water right, the deferred pumping is counted as helping to satisfy the SAFE ASC.

GWD Injection: Amount of Cachuma spill water injected (AF), within injection capacity limitation in cell "J1" (which is in mgd).

GWD Net Pump(+)/Inject(-): Net monthly pumping and/or injection. Number can be positive (pumping dominates) or negative (injection dominates).

Net Annual Pump/Inject: Annual calculation of sum of previous column.

Change Groundwater Elev: Annual change in average groundwater elevation in the basin, based on a set of mathematical equations derived from results of Groundwater Model. The equations take into account both net annual pumping/injection and the average groundwater elevation of the previous year.

Groundwater Elev: Average groundwater elevation in basin, calculated by combining previous year's elevation and annual change in groundwater elevation.

SAFE Status: Status of basin according to SAFE Ordinance protocols.

ASC Annual Requirement: Annual Storage Commitment, as per SAFE protocols.

ASC Balance: Remainder of ASC not yet satisfied.

Flag Meet Demand: Flag indicates when annual GWD is not met by sources of supply (no conservation applied).

Cachuma to Goleta West: Cost of treating Cachuma water and treating it for Goleta West system.

Cachuma Remainder: Cost of treating Cachuma water that does not go to Goleta West system.

SWP Alloc less Exchange: Variable cost of State Water delivery, less Exchange water.

Santa Ynez Exchange: Cost of Santa Ynez Exchange water.

CCWA Bank: Variable cost of State Water that has been stored in San Luis Reservoir by CCWA.

Total State Water: Total variable cost of sources of State Water delivery.

Groundwater: Cost of pumping and treating groundwater.

Total: Total costs of all supplies.

14.4 Interaction with Groundwater Model

A Groundwater Model was constructed by for the Goleta Groundwater basin as a separate project from this WSMP (CH2MHill, 2010). Because groundwater elevations are a critical factor in determining how groundwater can be used under the SAFE Ordinance, results of the Groundwater Model were integrated into the WSMP. The following process was used in this integration:

1) The pumping/injection amounts from Scenarios #1, 2, 3, and 4 were used as input to the Groundwater Model.

2) Resultant groundwater elevations from the Groundwater Model were then put back into the scenarios, where pumping/injection were recalculated given the new data (the Groundwater Model does not have of the SAFE Ordinance operating rules, whereas the WSMP does, so pumping changes as groundwater elevations change).

3) In an iterative approach, the recalculated pumping/injection were put back into the Groundwater Model again, with the resultant groundwater elevations calculated.

4) The iterative process was continued until pumping amounts and groundwater elevations agreed in both the Groundwater Model and the WSMP for a particular scenario. It took between five and fourteen iterations for this convergence to occur.

5) The results of the four Groundwater Model runs were combined to determine whether there was a consistent relationship between annual pumping and annual changes in groundwater elevations. When all the data were taken together, there was not a good correlation. However, when data were separated into groups depending upon the absolute groundwater elevations in the model (e.g., for groundwater elevations from -30 to 0 ft, 0 to 20 ft, etc.), the correlations improved.

6) A set of four equations was derived for the relationship, each equation representing a certain groundwater elevation depth range.

7) These equations were then put into the WSMP so that other scenarios can be run without having to rerun the Groundwater Model for each new scenario. An example of the results of groundwater elevations derived from these equations is shown in Figure 12-2.

15 SAFE Ordinance

APPENDIX B

SAFE Water Supplies Ordinance

Adopted by the electorate in November, 1994
Ordinance No. 94-03

and

Adopted by the electorate in June, 1991
Ordinance No. 91-01

FULL TEXT OF MEASURE J94
GOLETA WATER DISTRICT

AN AMENDMENT TO THE SAFE WATER SUPPLIES ORDINANCE

THE PEOPLE OF THE GOLETA WATER DISTRICT, COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA, DO ORDAIN AND ENACT THE FOLLOWING ORDINANCE WHICH SHALL BE AN AMENDMENT TO THE SAFE WATER SUPPLIES ORDINANCE:

RECITALS:
WHEREAS, the voters of the Goleta Water District ("District") enacted the SAFE Water Supplies Ordinance ("SAFE") in June 1991 authorizing the participation by the District in the State Water Project and providing for the bond financing to develop the Project Facilities necessary for delivery of that water to the District; and

WHEREAS, the District is now a member of the Central Coast Water Authority, the members of which are cooperating collectively to develop the Project Facilities which are now under construction; and

WHEREAS, SAFE provides for the creation of a Drought Buffer of water stored in the Goleta groundwater basin to protect against future drought emergencies and a Water Supply Distribution Plan to protect the District's water supplies against new demands until deliveries from the State Water Project are available; and

WHEREAS, this proposed amendment to SAFE maintains all the provisions regarding the protection of water supplies provided by the Drought Buffer and the Water Supply Distribution Plan; and

WHEREAS, pursuant to provisions of the judgment in the lawsuit known as Wright v. Goleta Water District, the District is required to develop a Water Plan to provide the necessary water supplies to achieve a balance between supply and demand for water within the District. The District's Water Plan is based on continuing to use the maximum amount of water available from the Cachuma Project; prudent management of the Goleta groundwater basin; use of the newly constructed wastewater reclamation project to replace existing use of potable water for turf irrigation; a continuing water conservation planning effort; participation in the State Water Project; and the necessary level of commitment to a desalinated seawater project. As a result of the long-term water supply deficit in the District, the District has been operating under a water connection moratorium for over twenty years. Once fully implemented the District's Water Plan should provide adequate supplies to meet long-term water demand in the District; and

WHEREAS, the forty year water service contract with the United States Bureau of Reclamation for delivery of water from the Cachuma Project will expire in May 1995. Negotiations are currently under way to renew that contract. The Bureau of Reclamation has required that the Cachuma Project be subjected to an environmental review process which is now being undertaken. It appears likely that the District's yield from the Cachuma Project after contract renewal will be less than the current yield as a result of the dedication of water for environmental enhancement purposes on the lower Santa Ynez River; and

WHEREAS, the Southern California Water Company is a Santa Barbara County water purveyor which currently holds rights to an entitlement to 3,000 acre feet per year of water from the State Water Project and has given notice of its intent to sell 2,500 acre feet of that entitlement. The Goleta Water District has identified itself as a potential purchaser of the entitlement. It is the intent of this Ordinance to authorize the acquisition and use of that entitlement; and

WHEREAS, the District estimates the annual cost of the Southern California Water Company entitlement to be $500 per acre foot of water delivered to the District. The entitlement acquisition is intended to reduce the long-term costs of water to the District and its customers in that alternative supplies that would be available, and necessary to meet the District's long-term demand would be more expensive than the water available from Southern California Water Company. The District's cost analysis of the acquisition is available at the District office.

NOW, THEREFORE, THE FOLLOWING ORDINANCE IS ENACTED INTO LAW:

1. The District is authorized to acquire an additional entitlement to the State Water Project in an amount of up to 2,500 acre feet per year, which is currently available from the Southern California Water Company. This entitlement will supplement the 4,500 acre feet per year authorized by the voters in originally adopting the SAFE Water Supplies Ordinance. This authorization shall provide for the payment of all costs of the acquisition and use of any additional entitlement acquired. Due to the controversy concerning the physical ability of the State Water Project to deliver its full contractual commitments, the District shall plan for the delivery of 3,800 acre feet per year of water as the amount of firm average long-term yield. The District's total State Water Project entitlement includes the basic entitlement of 4,500 acre feet per year, the District's share of the drought buffer held by the Central Coast Water Authority and the entitlement acquired pursuant to this authorization. Any excess water actually delivered over 3,800 acre feet per year

shall be stored in the Goleta groundwater Central basin until the basin is replenished to its 1972 level, for use during drought conditions.

2. Enactment of this Ordinance shall comply with all applicable law, including the California Environmental Quality Act.

3. If adopted, this Ordinance shall be an amendment to the SAFE Water Supplies Ordinance adopted by the electorate in June, 1991, which amended and superseded the Responsible Water Policy Ordinance, originally adopted by the electorate in 1973. Paragraph 1 of this Ordinance shall amend and fully supersede paragraph 6 of the SAFE Water Supplies Ordinance. All other provisions of the SAFE Ordinance shall remain in full force and effect. If adopted, this Ordinance may not be modified except pursuant to a vote of the electorate of the District.

4. This Ordinance shall be liberally construed and applied in order to fully promote its underlying purposes. If any word, sentence, paragraph or section of this Ordinance is determined to be unenforceable by a court of law, it is the intention of the District that the remainder of the Ordinance shall be enforced.

FULL TEXT OF MEASURE H91
GOLETA WATER DISTRICT
Ordinance 91-01
SAFE WATER SUPPLIES ORDINANCE

THE PEOPLE OF THE GOLETA WATER DISTRICT, COUNTY OF SANTA BARBARA, STATE OF CALIFORNIA, DO ORDAIN AND ENACT THE FOLLOWING ORDINANCE WHICH SHALL BE KNOWN AS THE *SAFE WATER SUPPLIES ORDINANCE*:

RECITALS:
Whereas, the Goleta Water District ("District") faces a significant shortage of water to meet current long-term water demands of its customers as determined by the State Department of Water Resources and the Santa Barbara County Flood Control and Water Conservation District in their 1985 Santa Barbara County Water Project Alternatives study; and

Whereas, a drought emergency was declared in Santa Barbara County in 1990 following four years of below normal precipitation within Santa Barbara County and, in the future, the District will continue to be subject to recurring drought cycles which will threaten the ability of the District to meet the health and safety needs of its customers unless new and diversified, long term water projects are developed; and

Whereas, the District relies exclusively on local water supplies to meet its current water demand, which supplies originate entirely within Santa Barbara County and which supplies are all subject to the same climatic conditions; and

Whereas, in the absence of a system limiting the District's authority to provide new and/or additional water service connections without first mandating groundwater storage of water in wet years for use in dry years (a "drought buffer program") District customers may face severe water shortage in the future; and

Whereas on October 1, 1990 the Board of Directors of the Goleta Water District adopted a Water Supply Management Plan which includes use of water supplies from both a desalting plant and the State of Water Project; and;

Whereas, the District is a party to an agreement with the Santa Barbara County Flood Control and Water Conservation District entitled "Water Supply Retention Agreement" dated December 11, 1984 which it executed on June 28, 1986 (the "WSRA") entitling the District to 4,500 acre feet per year from the State Water Project, and has executed amendments thereto; and

Whereas, the District is also a party to a "Contract for Preliminary Studies for Financial Feasibility, Preliminary Design and Environmental Review Under State Water Supply Contract" (the "Design and EIR Agreement") dated June 2, 1986 but did not identify itself as a proposed participant in the preliminary studies in response to the "Notice of Intent to Request Preliminary Studies" for the Coastal Branch and the Mission Hills Extension of the California Aqueduct given by the city of Santa Maria on or about May 24, 1986; and

Whereas, the WSRA and its amendments and the Design and EIR Agreement contain the ways and means to provide for a long term solution to the existing drought emergency and to the ongoing water shortage within the County of Santa Barbara; and

Whereas, the District has a duty to provide a permanent, reliable water supply to its residents.

NOW, THEREFORE, THE FOLLOWING ORDINANCE IS ENACTED INTO LAW:

I Drought Buffer

1. In each year, commencing in the first year the State Water Project makes deliveries to the District, the District shall, after providing service to its existing customers, commit at least 2,000 acre feet of its water supply (the "Annual Storage Contribution") to the Goleta Central Basin either by direct injection or by reduction in groundwater pumping. The water so stored in the Central Basin shall constitute the District's "Drought Buffer".

2. The Drought Buffer may be pumped and distributed by the District only to existing customers and only in the event that a drought on the South Coast causes a reduction in the District's annual deliveries from Lake Cachuma. The Drought Buffer cannot, under any circumstances, be used by the District as a supplemental water supply to serve new or additional demands for water within the District.

3. Unless and until the Central Basin water level rises to 100% of its 1972 levels, the District shall be required to make its Annual Buffer Commitment. Thereafter, for so long as the District maintains the Central Basin at or above 1972 levels, the District may utilize the yield of the Central Basin to lower the cost of water service to existing customers.

II Water Supply Distribution Plan

4. The District shall be forbidden from providing new or additional potable water service connections to any property not previously served by the District until all of the following conditions are met:

a. District is receiving 100% of its deliveries normally allowed from the Cachuma Project;

b. The District has met its legal obligations required by the judgment in Wright v Goleta Water District;

c. Water rationing by the District is eliminated;

d. The District has met its obligation to make its Annual Storage Commitment to the Drought Buffer.

5. For each year in which the conditions of paragraph 4, have been met, the District shall be authorized to release 1% of its total potable water supply to new or additional service connections and if such new releases are authorized, the District shall permanently increase the size of the Annual Storage Commitment made to the Drought Buffer by 2/3 of the amount of any release for new or additional uses so that safe water supplies in times of drought shall not be endangered by any new or additional demands.

III State Water Supply

6. Due to controversy concerning the physical ability of the State Water Project to deliver its full contractual commitments, District shall plan for delivery of only 2,500 acre feet per year as the amount of the firm new yield from the State Water Project. Any excess water actually delivered shall be stored in the Goleta Groundwater basin for use in drought.

7. The District shall immediately either (a) give Notice of its Intention to Request Construction of Described Project Facilities under the State Water Contract, as provided for in Section 5(a)(1) of the WSRA or (b) respond to any such notice previously given by any other Contractor as provided for in Section 5(a)(2) of the WSRA that it wishes to participate in the described project.

8. The Project Facilities to be constructed pursuant to the Notice of Intention shall be the Mission Hills and Santa Ynez Extensions of the Coastal Branch of the California Aqueduct and required water treatment facilities and other appurtenant facilities (herein the "Project Facilities").

9. The District agrees, pursuant to section Section 5(a)(2) of the WSRA, that the time for determination of participation and sizing of the Project Facilities may be any date on or after September 1, 1992 agreeable to the other participants.

10. The District shall, in the shortest time lawfully possible, exercise all of its rights and fulfill all of its obligations under the WSRA, including the payment of any monies required thereunder.

11. The District shall file a Late Request to Amend, pursuant to Secton 3(f) of the Design and EIR Agreement, and agrees to pay its proportionate share of all costs required by said Section 3(f) and any amounts required under Section 3(g) of said Design and EIR Agreement.

12. The District, or the Santa Barbara Water Purveyors Agency, or any other joint powers agency of which the District is a member or may become a member for such purposes, may issue revenue bonds ("bonds") from time to time in an amount not to exceed Forty-Two Million Dollars ($42,000,000.00) to provide funds to finance the District's pro rata share of the costs and expenses under the WSRA and the Design and EIR Agreement. Said bonds shall be used for the purposes of constructing the Project Facilities, including without limitation, any and all necessary facilities required for the delivery of State Project Water pursuant to the WSRA to the District through the Coastal Branch of the California Aqueduct, including any and all expenses incidental thereto or connected therewith, and shall include, without limitation, the cost of acquiring rights of way, the cost of constructing and/or acquiring all buildings, equipment and related personal and real property required to complete the Project Facilities, and the engineering, environmental review, inspection, legal and fiscal agent's fees, costs incurred by the District or joint powers agency in connection with the issuance and sale of such bonds, and reserve fund and bond interest estimated to accrue during the construction period and for a period of not to exceed twelve (12) months after completion of construction, such bonds to be payable from the District's water revenues, to bear interest at a rate or rates not to exceed the legal maximum from time to time, and to mature in not more than forty (40) years from the date of issuance.

13. This Ordinance shall be submitted to a vote of the people of the District in compliance with the requirements of Section 5(a)(4)(1) of the WSRA and pursuant to Elections Code Section 5201.

14. All actions taken pursuant to this Ordinance shall be in compliance with all local, state and federal environmental protection laws. Nothing in the Ordinance shall be construed to require such compliance prior to the election provided for herein.

15. This Ordinance shall be liberally construed and applied in order to fully promote its underlying purposes. If any word, sentence, paragraph or section of this Ordinance is determined to be unenforceable by a court law, it is the intention of the District that the remainder of the Ordinance shall be enforced.

16. If adopted, this ordinance shall be an amendment to the Responsible Water Policy Ordinance adopted by the people in May, 1973, and may not be modified except pursuant to the vote of the electorate of the District. To the extent that the provisions of this ordinance conflict with that ordinance or any prior ordinance or measure previously enacted by the District or the voters of the District, the provisions of this ordinance shall control. To the extent that the provisions of this Ordinance conflict with any other ordinance or measure adopted at the same election, the ordinance or measure receiving the highest number of affirmative votes shall control.

17. Nothing herein is intended to affect the rights of any parties nor the obligations of the District pursuant to the judgment in the action know as Wright v Goleta Water District, Santa Barbara Superior Court Case No. SM57969.

18. This ordinance shall take effect immediately upon being approved by a majority vote of the votes cast at the election.