Appendix B
Support for In-Stream Flow Study on San Simeon and Santa Rosa Creeks

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Cambria Community Services District

US Army Corps of Engineers

TM Support for In-Stream Flow Study on San Simeon and Santa Rosa Creeks

CAMBRIA DESALINATION AND OTHER WATER SUPPLY FACILITIES

Water Supply Alternative Concepts

September 11, 2012

CDM Smith

The information contained in the document titled Cambria Desalination and Other Water Supply Facilities Water Supply Alternative Concepts TM Support for In-Stream Flow Study on San Simeon and Santa Rosa Creek, dated September 11, 2012, has received appropriate technical review and approval. The conclusions and recommendations presented represent professional judgments and are based upon findings from the investigations and sampling identified in the report and the interpretation of such data based on our experience and background. This acknowledgement is made in lieu of all warranties, either expressed or implied. The activities outlined in this report were performed under the supervision of a California Registered Professional Engineer.

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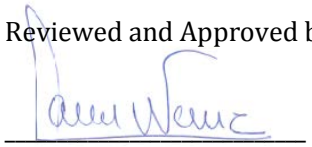

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AF	acre-feet
ASR	Aquifer Storage and Recovery
CCSD	Cambria Community Services District
cfs	cubic feet per second
gpm	gallons per minute
MSL	mean sea level
SLO	San Luis Obispo

Section 1
Existing Conditions

This technical memorandum presents an analysis of water budgets for San Simeon and Santa Rosa Creeks to be used for evaluating potential impacts of various supplemental water supply projects considered for implementation by Cambria Community Services District (CCSD). The analysis presented below is not intended to replace the need for an in-stream flow study on these creeks, but rather will aid in the scoping of such studies to be implemented in the future by multiple agencies that utilize water from the underlying groundwater basins in coordination with governing bodies charged with the protection of natural resources that rely on these waters.

1.1 Hydrology

This assessment of flow is based on limited historical stream flow data for San Simeon and Santa Rosa Creeks and their tributaries. US Geological Survey gauges constructed and operated on lower San Simeon Creek in 1987 through 1989 have since been operated by San Luis Obispo (SLO) County Department of Public Works (Station 22); however data is only published up to February of 2003. SLO County is in the process of updating the streams rating curve prior to publishing data post 2003. On Santa Rosa Creek, SLO County constructed a flow gauge at the Main Street (Station 16), just downstream of the confluence with Perry Creek. Published data from this gauge exists for the period of 1988 through 2004. Similar to San Simeon Creek, SLO County is in the process of updating the streams rating curve prior to publishing data post 2004.

Figure 1-1 presents a flow duration curve for each of these gauges for the period of published data. These curves show a similar wet weather response in each watershed, but the presence of more flow during dry weather conditions in Santa Rosa Creek (dry 18 percent of days) than in San Simeon Creek (dry 58 percent of days). Yates and Konyenberg (1998) found a similar trend when evaluating flow gauge data for the upper portions of the San Simeon Creek (1971-1989 at Palmar Flats) and Santa Rosa Creek (1959-1989 upstream of Curti Creek). Rainfall and associated runoff occurs almost exclusively during the wet season, when weather patterns are favorable for precipitation to occur. The wet season, as defined in CCSD diversion permits, can vary for the San Simeon aquifer depending upon the time flow ceases at a historic, Palmer Flats gaging location. The San Simeon permit defines the dry season pumping window maximum as being between the time flow ceases at Palmer flats until November 1st. The Santa Rosa diversion permit fixes the dry season as being May 1st to October 31st, which results in the wet season being November 21st through June 30th in San Simeon Creek and November 1st through April 30th in the Santa Rosa Creek.

Stream flow in San Simeon and Santa Rosa Creeks is highly variable with rainfall as the predominant controlling factor. Yates and Konyenberg (1998) identified a close correlation between annual streamflow and annual rainfall depth ($r = 0.96$ and 0.91 for San Simeon and Santa Rosa Creeks, respectively). Highly permeable surficial soils and limited groundwater storage capacity in the underlying basins minimize the impact of long-term trends in hydrologic conditions. Consequently, flow in these creeks is largely a function of rainfall. Table 1-1 summarizes annual rainfall for Cambria and annual runoff volume from San Simeon and Santa Rosa Creeks based on data from the more recently monitored downstream SLO County stations (Stations 22 and 16).

The close correlation between stream flow and watershed rainfall translates to groundwater levels as well because the San Simeon and Santa Rosa groundwater basins have limited storage capacity and high transmissivity. Accordingly, groundwater levels generally are high during the wet season with infiltration of rainfall induced runoff in creek bottoms being the greatest inflow, followed by decline during the dry season when creek flow is significantly diminished or eliminated and groundwater pumping is increased to meet higher seasonal municipal and agricultural water demand. The lack of long-term storage is a significant concern to CCSD and agricultural pumpers, because during droughts, groundwater basins may not be completely filled during the wet season, and as a result, water level drawdown from dry season pumping poses a greater risk of causing seawater intrusion in San Simeon Creek or land subsidence in the Santa Rosa Creek watershed.

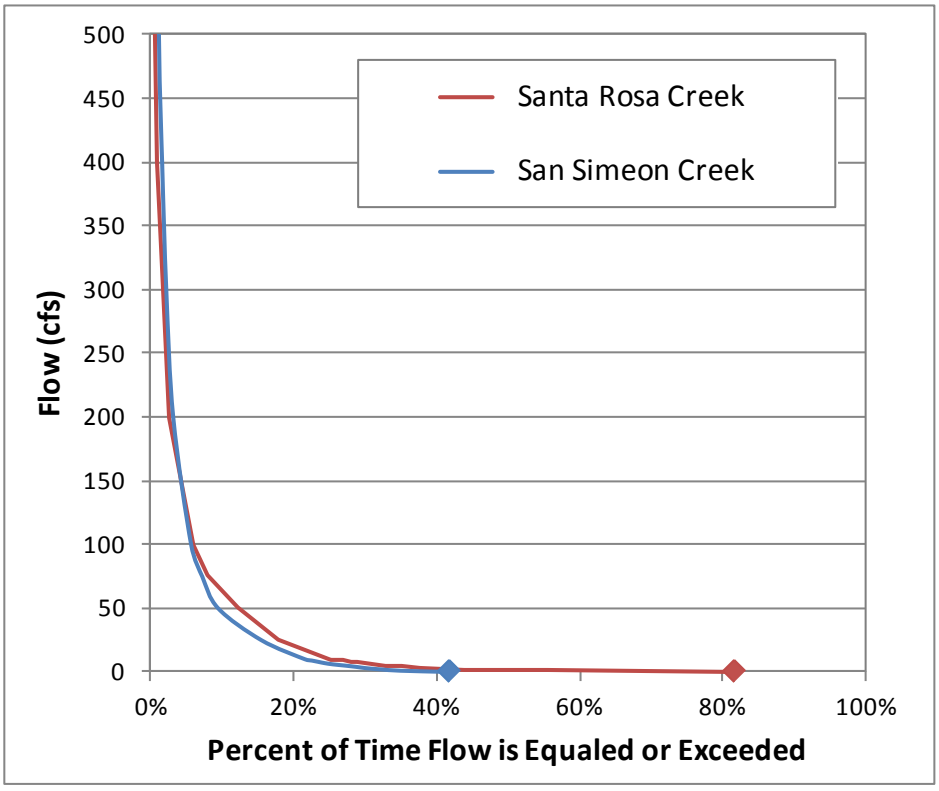

Figure 1-1 Flow Duration Curves for San Simeon (SLO County Station 22) and Santa Rosa Creek (SLO County Station 21)

Table 1-1 Summary of Rainfall and Runoff Data from 1987 through 2004

Variable	Minimum (Water Year)	Maximum (Water Year)	Average
Rainfall (in/yr)[1]	9.98 (1989-90)	44.31 (1994-95)	20.15
San Simeon Runoff Discharge (afy)	595 (1989-90)	22,879 (1994-95)	8,850
Santa Rosa Creek Runoff Discharge (afy)	515 (1989-90)	50,142 (1994-95)	15,420

1) Rainfall data was obtained from Cambria CFD Station, except for WY 1994-95 when this station was inoperable. Data from the Cal Poly SLO station was used for rainfall depth in WY 1994-95

1.2 CCSD Water Supply

Diversion permits issued by the SWRCB to the CCSD allow a maximum of 1230 acre-feet (af) annually from the San Simeon aquifer, while limiting dry season pumping to 370 af maximum. The Santa Rosa Creek SWRCB appropriations permit limits the Santa Rosa aquifer pumping to 518 af annually, with a dry season pumping limit of 260 af. However, the combined pumping form the both Santa Rosa Creek and San Simeon Creek cannot exceed 1,230 AF per year. Based on these permits, CCSD could meet existing and future demand from the groundwater basins underlying San Simeon and Santa Rosa creeks (Table 1-2). The maximum pumping rates allowed are 2.5 cubic feet per second (cfs), or 4.97 AF per day) for the San Simeon aquifer; and, 2.67 cfs (5.31 AF per day) for the Santa Rosa aquifer. Based on historical pumping data, Table 1- 2 shows these daily diversion limits are in excess of peak seasonal water demand for CCSD, which is approximately 1.5 cfs (2.98 AF per day).

Table 1-2 Summary of Diversion Permits for San Simeon and Santa Rosa Creeks in Relation to CCSD Water Demand

Groundwater Basin	Annual Volume	Dry Season Volume	Daily Pumping Rate	
	afy	Af	af per Day	cfs
San Simeon Creek	1,230 (712[3])	370[1]	4.97	2.5
Santa Rosa Creek	518	260[2]	5.31	2.67
Total	1,230[3]	630	10.28	5.17
CCSD Potable Demand	812	420	1.75 – 2.88	0.88 - 1.45

1) Based on information provided by CCSD
2) Basis for dry season demand estimate from Santa Rosa Creek diversion permit (May 1 – Oct 31)
3) Total annual maximum as combined supply from both San Simeon Creek and Sana Rosa Creek. In years when 518 AF of water is pumped from Santa Rosa Creek, only 712 AF of water can be pumped from San Simeon Creek

Table1-2 shows that SWRCB issued diversion permits limits do not constrain the ability for CCSD to meet existing and future water demands. However, there are several other factors caused by drought conditions that impact the availability of water from the groundwater basins underlying San Simeon and Santa Rosa Creeks, including:

- Subsidence caused by groundwater level decline – Yates and Konyenberg (1998) estimated that dry season pumping of 260 af or more would result in water level drawdown close to the threshold (14 to 20 feet below MSL) that would result in land subsidence in the Santa Rosa groundwater basin. The groundwater model showed water level declines necessary for subsidence in long dry seasons and in dry seasons following a wet season with incomplete basin recharge. However, in 2001 the CCSD completed a new well (SR-4) approximately 1 mile further up gradient from the wells cited in the 1998 US GS study after shutting down its older Santa Rosa wells (SR-1 & SR-3) in response to an MtBE contamination plume. To date, SR3-4 is the only CCSD production well operating in the Santa Rosa basin.

- Seawater intrusion caused by negative gradient of water table – In San Simeon basin, percolation of treated wastewater between the CCSD well field and the Ocean creates an important seawater intrusion barrier. Groundwater basin model scenarios evaluated by Yates and Konyenberg (1998) predicted seawater intrusion in San Simeon Basin in dry seasons following a wet season with incomplete basin recharge.

1.3 Steelhead Trout Migration Requirements

In both Santa Rosa and San Simeon Creeks, Alley and Associates (1992, 1993) determined minimum surface flow thresholds to allow for Steelhead Trout migration patterns from January through May based on hydraulic modeling of critical riffles (i.e. creek segments where flow is quicker and shallower, which may constrain passage by Steelhead). Table 1-3 shows that CCSD water demands are minimal relative to these seasonal minimum flow thresholds and therefore pumping would not be expected to have a significant impact of Steelhead migration. Even in late May when Steelhead migration is still active and water supply demand is increasing, CCSD demand of 1.2 cfs is small relative to the smolting flow requirement of 11 cfs. Accordingly, as long as flow is greater than 12.2 cfs in San Simeon Creek, or greater than 9.2 cfs in Santa Rosa Creek, pumping would not prevent Steelhead from smolting.

Table 1-3 CCSD Monthly Water Demand in Relation to Surface Runoff in San Simeon and Santa Rosa Creeks

Month	San Simeon Creek				Santa Rosa Creek			
	Minimum Passage Flow for Steelhead (cfs) [2]	CCSD Demand[1] (cfs)	Mean Daily Flow (cfs)	Mean Daily Flow, Diversion Days (cfs)	Minimum Passage Flow for Steelhead (cfs)	CCSD Demand[1] (cfs)	Mean Daily Flow (cfs)	Mean Daily Flow, Diversion Days[2] (cfs)
October	n/a	1.3	0.2	n/a	n/a	0	1	n/a
November	n/a	0.4	10	n/a	n/a	0.6	4	n/a
December	n/a	0.3	23	n/a	n/a	0.6	23	n/a
January	67.5	0.3	84	206	35	0.6	63	212
February	67.5	0.3	116	215	35	0.6	95	195
March	67.5	0.3	72	150	35	0.6	67	162
April	19	0.5	17	47	15	0.6	17	64
May	11	1.2	4	42	8	0	11	48
June	n/a	1.3	1	n/a	n/a	0	7	n/a
July	n/a	1.4	0.1	n/a	n/a	0	3	n/a
August	n/a	1.5	0	n/a	n/a	0	2	n/a
September	n/a	1.3	0	n/a	n/a	0	1	n/a

1) CCSD demand divided between San Simeon and Santa Rosa groundwater basins based on assumed Santa Rosa pumping of 35 af/mo in November – April, with remainder of demand from San Simeon well pumping. Other operational scenarios were not evaluated, but are not expected to significantly impact fish passage
2) Based on 1988 – 2003 assessment of flow gauge data in relation to minimum passage flow at critical riffles as determined by Alley and Associates (1992, 1993) for San Simeon Creek at Palmer Flat and Santa Rosa Creek at Main Street.

Minimum flow thresholds are not typically sustained throughout the entire migration season in Santa Rosa and San Simeon Creeks. Figure 1-2 shows the number of days with sufficient flow to allow for Steelhead Trout migration based on historical flow gauge data from 1987 to 2003 on both creeks. CCSD currently uses only one well in the Santa Rosa Creek groundwater basin and is limited in its use by conditions within the CCSD's SWRCB-issued diversion permit. Based on the aforementioned data and assuming pumping were limited to the wet season, this production represents only one percent of runoff that would otherwise be discharged to the Pacific Ocean. The impact of a daily flow reduction of 0.6 cfs (~35 af/mo) on Steelhead migration frequency is minimal, suggesting there could be only 4 more migration days over the 1988-2004 period if Santa Rosa Creek diversions were not utilized during the wet season.

The North Coast Area Plan (NCAP) includes standards and findings required for any new public water supply project that will assure CCSD water withdrawals are limited to protect adequate in-stream flows to support sensitive species and riparian/wetland habitat within the reach of streams effected by CCSD pumping. This leads to an in-stream flow management study objective to determine the sustainable amount of withdrawals for new development that may be accommodated, which will not adversely affect riparian and wetland habitat or agricultural activities. In addition, the CCSD has implemented a rigorous demand offset conservation program, which avoids such impacts from any new or future connections. Based on this assessment of flows in San Simeon and Santa Rosa Creeks, additional demand from new development would not be expected to significantly impact Steelhead migration. One caveat to this conclusion is that the minimum flow requirements for Steelhead Trout migration are based on studies from 1992 and 1993. Changes to the creek morphology in the past 20 years to modify the location and minimum passage flow rates at critical riffles for Steelhead Trout migration are unknown.

CCSD is evaluating several water supply alternative concepts that would sustain or potentially improve current riparian and wetland habitat and agricultural water uses by providing alternative sources of water to meet demands.

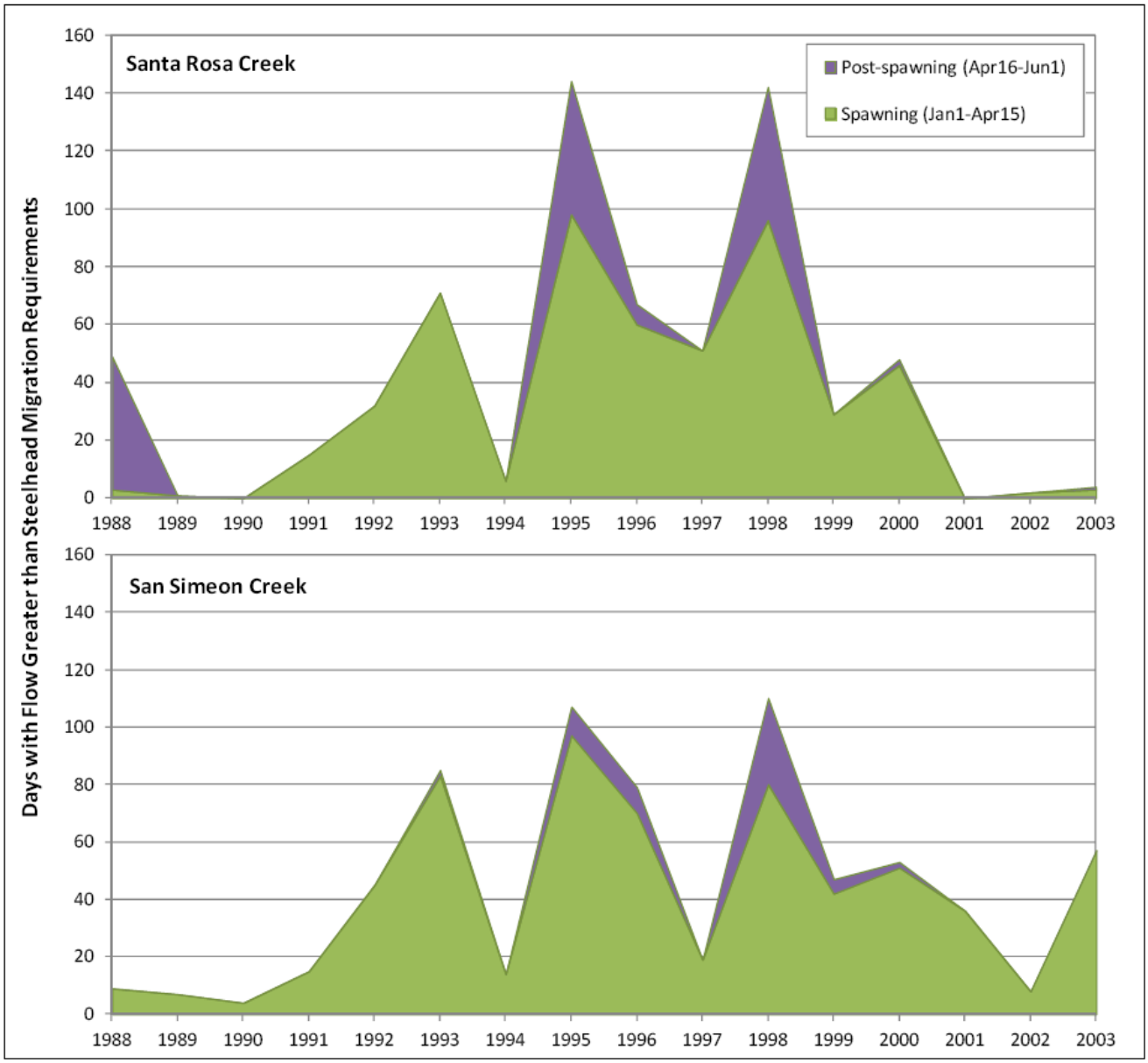

Figure 1-2 **Number of Days with Flow Equal to or Greater than Minimum Flow Requirements for Steelhead Migration during Spawning (Jan 1 – Apr 15) and Post-Spawning / Smolting (Apr 16 – Jun 15) Life Stages**

Section 2
Water Supply Alternative Concept Impacts

The water supply for Cambria is vulnerable to drought because of the limited amount of groundwater storage capacity in the Santa Rosa and San Simeon basins. Storage is small relative to average annual groundwater pumping, and storage is consequently incapable of sustaining current pumping rates through one or more years of substantially decreased recharge. Because local groundwater aquifers are the only supply of water, CCSD is investigating means to further augment and diversify its existing potable supplies including seawater desalinization, enhanced wet season storage, and indirect potable reuse. The following sections describe the impact of proposed projects on in-stream flow conditions.

2.1 Enhanced Wet Basin Storage

Three of the proposed projects involve capture of additional wet season groundwater for storage and subsequent use during the dry season. For most of the wet season, this would reduce the volume of runoff lost to the Ocean as surface runoff from both San Simeon and Santa Rosa Creeks. The projects are briefly described below:

- The Hard Rock Aquifer Storage and Recovery (ASR) Project would extract additional wet season groundwater from existing and new wells in the Santa Rosa Creek groundwater basins for recharge into a nearby geologic formation that may be capable of holding water. Further geotechnical investigation of the proposed site is needed to determine the feasibility of this project.

- The Whale Rock Reservoir project would extract additional groundwater from existing and new wells in both San Simeon and Santa Rosa Creek groundwater basins for transmission through the existing CCSD water system to a new pump station and 16 mile of new pipeline to Whale Rock Reservoir. In the dry season, water from Whale Rock reservoir would be sent back in the same pipeline to meet CCSD water demands.

- San Simeon Off-channel Storage is an alternative concept that involves construction of dams and reservoirs in minor tributaries to San Simeon Creek. During the wet season, additional pumping from San Simeon groundwater basin would fill the reservoirs behind each dam to replace the volume of water used during the preceding dry season. Runoff from the small (<500 acre) watersheds above each tributary is not included in the stored water calculations.

Daily runoff data from 1987-2004 was evaluated to determine the potential for these projects to capture and store adequate supply of water during the wet season to provide a minimum of 250 afy of groundwater during the wet season for use in the dry season, as further discussed and directed by the CCSD Board during its regular April 26, 2012 meeting (agenda Item 9.C) (Figure 2-1). Historical flow data from the SLO County gauges on San Simeon and Santa Rosa Creeks were evaluated to determine the volume of wet season runoff that is in excess of minimum flow requirements for Steelhead Trout and immediate consumptive demand. This analysis showed that for each creek, an annual average volume 10,000 -15,000 afy is in excess of flow required to maintain the baseline frequency of Steelhead Trout migration days (see Figure 2-1). Table 2-1 summarizes the potential average annual runoff capture for addition to long-term storage based on an assumed storage capacity of 1200 af and runoff diversion up to the permitted rates. Combining the permitted diversion pumping limits from

both the Santa Rosa and San Simeon Creeks, it is possible to divert up to 5.17 cfs of wet weather flow into long term storage, as envisioned by the San Simeon Off-channel Storage, Hard Rock ASR, and Whale Rock Reservoir water supply concepts. Potential runoff capture with the considered water supply concepts was estimated using a daily water balance analysis of historical hydrology, minimum Steelhead Trout flow requirements, consumptive demand, and diversion permit limits. If constrained to the currently permitted diversions of 5.17 cfs, the estimated long term average annual runoff capture and storage potential is 470 afy.

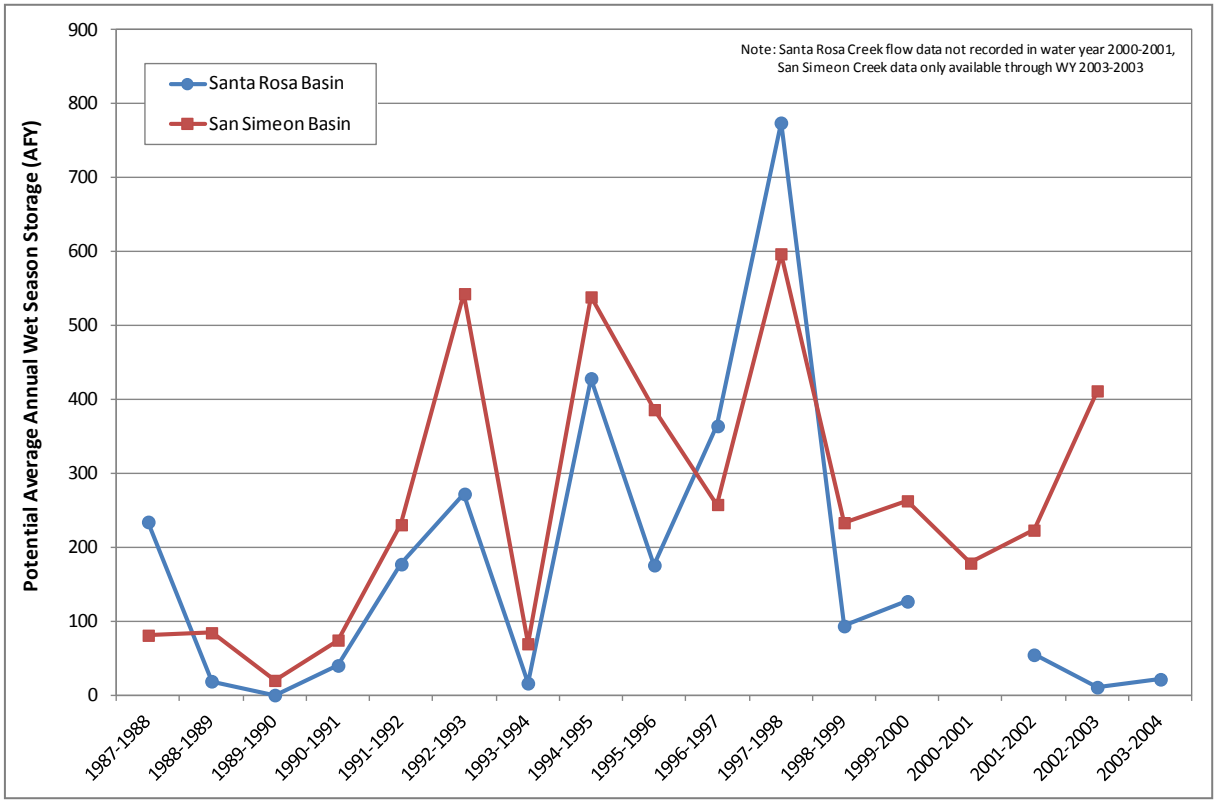

Figure 2-1 Hydrologic Variability in Estimated Wet Season Diversion from Santa Rosa Creek to the Proposed Hard Rock ASR Project

Table 2-1 Storage and Capacity Requirements to Allow for Long-Term Average Annual Wet Season Storage of 250 afy for San Simeon and Santa Rosa Creeks

Groundwater Basin	Pumping/Conveyance/, Recharge Capacity of Project (cfs)	Storage Capacity of Project (af)	Average Annual Wet Season Storage (afy)
San Simeon Creek	2.5	1,200	268
Santa Rosa Creek	2.67		202
Total	5.17	1,200	470