Conveyance Capacity

I. Introduction

Water management activities by SWP subcontractors in San Luis Obispo and Santa Barbara Counties (Central Coast Contractors) will frequently require use of conveyance capacity in the California Aqueduct and the Coastal Branch Aqueduct (Figure 1). These facilities are operated by different agencies, with different patterns of availability and different rules. The California Aqueduct and Coastal Branch reaches upstream of Polonio Pass, are operated by DWR as part of the overall SWP. The downstream portion of the Coastal Branch (below Polonio Pass) is operated by CCWA. The two operators – DWR and CCWA – have different operating rules, which affect use of their facilities by subcontractors and other agencies.

Following the initial discussion of operations for both the California Aqueduct and Coastal Branch, descriptions of the facilities involved are presented along with information related to physical and operational capacities. This conveyance capability discussion touches on constraints upstream and downstream of San Luis Reservoir, analyses of CALSIM-2 and historical capacities for the California Aqueduct, and comparison of design capacity and historical deliveries for the Coastal Branch. Finally, a high-level summary of available capacity in various reaches is presented.

Overall, the summary identified major constraints in available capacity in summer months (generally June through September) in years of above average deliveries along the California Aqueduct east of Coalinga, due to historic subsidence. There are also lesser, but still often significant, limitations in capacity along most Coastal Branch reaches during the summer. Alternatively, there is plentiful available capacity in the October through May period in nearly all years in the conveyance facilities serving the Coastal Branch Contractors.

II. Conveyance Facility Operation and Access by Outside Entities

DWR constructed and operates the California Aqueduct and Coastal Branch reaches through Polonio Pass for the SWP and their primary purpose is to deliver SWP water to its contracting water agencies. Although SWP contractors are assigned a share of capacity (and associated costs) in the reaches of the facility providing their water supply, the SWP water supply projects do not give SWP contractors direct rights to use that capacity. The Department of Water Resources (DWR) operates the SWP as a whole and does not instantaneously constrain contractor water supplies to their allocated share of capacity. Contractors submit annual water delivery request schedules to DWR and DWR strives to meet contractor water supply needs to the extent possible by optimizing available capacity. DWR only limits contractor use of conveyance for SWP water to their assigned capacities under extreme circumstances. SWP contractors, including CCWA and SLOCFCWCD, have rights to move non-SWP water through available capacity under Article 55 of the water supply projects. Additionally, any entity has a right to use unused conveyance capacity with the payment of fair compensation under Water Code Section 1810.

The Coastal Branch downstream of Polonio Pass is operated by CCWA. CCWA's prime purpose in operating its portion of the Coastal Branch is also to deliver SWP water to its subcontractors on their

requested schedule. CCWA does not have any defined provisions for allowing use of its facilities by member agencies or outside entities. As with any public agency conveyance facilities, Water Code Section 1810 provides for the use of unused conveyance capacity for an outside entity.

III. State Water Project Operational Features of the California Aqueduct and a Portion of the Coastal Branch Aqueduct

As described above, DWR operates the SWP, including California Aqueduct and a portion of the Coastal Branch Aqueduct. The configuration of SWP California Aqueduct and Coastal Branch Aqueduct is shown in Figure 1.

Figure 1: Placeholder for Figure of California Aqueduct

SWP contractors, including Santa Barbara County Flood Control and Water Conservation District (SBCFCWCD, administered by Central Coast Water Authority) and San Luis Obispo County Flood Control and Water Conservation District (SLOCFCWCD), are provided water by the SWP and are responsible for payment of assigned costs for their portion of the SWP. Table 1 shows the allocation of Central Coast Contractors' capacity in the State Water Project for upstream reaches of the California Aqueduct and the Coastal Branch. These capacities are used by DWR primarily for cost allocation purposes, but under extreme circumstances they could also be constraining in the event of continuing shortage in conveyance capacity.

Table 1
California Aqueduct: Capacity Provided for SWP Contractors, by Reach*

	SBCFCWCD Share	**SLOCFCWCD Share**	**Design Total**	**Current Estimated Total**
Reach	Capacity (cfs)	Capacity (cfs)	Capacity (cfs)	Capacity (cfs)
1	72.03691	39.0471	10,300	10,300
2A	72.02638	39.04134	10,000	10,000
2B	71.61539	38.81848	10,000	10,000
3	71.48536	38.74804	13,100	13,100
4	71.34908	38.67414	13,100	13,100
5	71.17955	38.58213	11,800	11,800
6	70.9241	38.4437	8,350	6,900
7	70.84246	38.39943	8,100	6,900
8C	70.73959	38.34363	8,100	8,100
8D	70.73761	38.34264	8,100	8,100
31A	70.60034	38.26825	450	450
33A	70.06459	37.9774	71	71

*(Includes Consideration of Scheduled Outages and Operational Losses)

In addition to SWP project deliveries (including Table A amounts, Turnback Pool, Carryover Water and Article 21 Water), the California Aqueduct system is also commonly used for conveyance of other supplies on behalf of SWP contractors (and potentially outside agencies). While DWR attempts to meet all SWP contractor conveyance needs, in situations with extended periods of limited capacity, a SWP

contractor may be limited to their proportional share of remaining capacity after SWP project needs have been met.

Generally, limitations to conveyance availability are likely to occur in the summer months of high-delivery (wet) years. SWP facilities for SWP agricultural contractors were designed to meet water demands on an irrigation demand schedule, which has high peaks during summer months. Additional conveyance constrictions can occur in Aqueduct reaches where SWP contractors purchased additional Table A amounts or where outside factors (such as groundwater subsidence or facility outages) have limited operational capacity.

As an example, if the SWP is using 80 percent of the capacity in a reach for SWP purposes, Article 55 provides that the remaining 20 percent could be allocated among contractors proportional to each contractor's assigned capacity of that reach. Central Coast Contractors access to conveyance facilities for non-SWP purposes will normally be on an "as available" basis, subject to primary use by the SWP or by other project participants.

To address the potential for limited conveyance access on an "as available" basis, this discussion quantifies both the physical capacity of conveyance facilities and the primary facility use for purposes of delivering SWP water. The primary facilities described here are the California Aqueduct and the Coastal Branch Aqueduct. The overall approach used was to compare historical or projected Aqueduct use for representative Aqueduct reaches with physical capacities, and quantify the amounts of available, or unused, capacity. For purposes of this study, analysis is limited to available conveyance probabilities on a monthly basis, with totals indicated for annual potential conveyance. The approach to defining available conveyance capacity is different for each facility, as described below.

IV. SWP Conveyance Constraints Upstream of San Luis Reservoir

The California Aqueduct begins at Clifton Court Forebay in the Sacramento-San Joaquin Delta and terminates in Southern California. For Reaches 1 through 4 (from Clifton Court Forebay to San Luis Reservoir), DWR has designated the California Aqueduct as having two purposes – conveyance (labelled "transportation"), for delivering water to meet SWP contractor demands, and storage (labelled "conservation"), for delivering water to San Luis Reservoir for storage during wet periods for later use to meet SWP contractor demand.

While Aqueduct Reaches 1-4 were designed with capacities of up to 10,300 cubic feet per second to provide for both direct SWP deliveries and storage of water at San Luis Reservoir, in actual operations that apparent high capacity is not usable to the SWP for a variety of reasons:

- A U.S. Army Corps of Engineers permit for Banks Pumping Plant (Reach 1) limits its use to 6,680 cfs, with provision for somewhat higher capacities under limited circumstances for limited periods, for reasons relating to levee protection.
- Fisheries and water rights permits for Banks Pumping Plant and Sacramento-San Joaquin Delta operations generally restrict allowable exports at Banks Pumping Plant for extended periods from November through June.

- Upstream California Department of Fish and Wildlife flow regulations limit the ability to increase Oroville Reservoir releases at times when permitted Banks Pumping Plant capacity is available.

As a result of these various regulatory and physical constraints at Banks Pumping Plant, constraints from water supply availability and upstream flow management limitations, there is essentially a four-month period (July through October) when unused capacity in Reaches 1-4 is available. While the physical capacity in Banks Pumping Plant and the California Aqueduct is 10,300 cfs, the capacity that is actually allowable considering applicable regulations is usually 6,680 cfs or less. In most wetter-than-average runoff years, the SWP normally uses all available permitting pumping capacity at Banks Pumping Plant (and Aqueduct Reaches 1-4) for filling San Luis Reservoir with available high Delta outflows and for conveying Oroville Reservoir releases to SWP contractors. It is only in below-average runoff years that there is unused available capacity in Aqueduct Reaches 1-4. Even in those below-average runoff years, capacity can be limited and its availability is frequently difficult to predict.

As described in the earlier water supply discussion, DWR allocates Table A amounts to SWP contractors based on a combination of availability of water in the Delta (either from natural flows or from Oroville Reservoir releases), permitted pumping capacity at Banks Pumping Plant and water stored over the winter in San Luis Reservoir. The SWP's annual Table A allocation is the amount available for SWP contractors after adjusting for the most limiting of available unregulated Delta flows, Oroville and San Luis Reservoir storage and ability to convey water to SWP contractors on requested delivery patterns.

Considering the purpose of this discussion is to describe the potential for capacity use by Central Coast Contractors, unused capacity on the California Aqueduct upstream of San Luis Reservoir has not been quantified. While transfers of North of Delta water supplies are theoretically an option, their availability is uncertain as is the ability to deliver them through Aqueduct facilities south of the Sacramento-San Joaquin Delta. The underlying assumption for Central Coast water management is that water management measures would be limited to water that is already south of the Delta. The water available for Central Coast Contractor water management has been assumed to be limited to SWP Table A allocations (which are effectively made available to contractors by DWR at San Luis Reservoir) and other potential South of Delta water supply sources and management measures such as SWP Table A Transfers, exchanges with SWP or other water agencies and South of the Delta groundwater banking programs.

V. Analysis of SWP Conveyance Capacity Availability Downstream of San Luis Reservoir

To evaluate the impacts of California Aqueduct capacity constraints, a comparison of two analyses were conducted at Reach 7 (Check 21), Reach 31A (Badger Hill Pumping Plant), Reach 33A (Polonio Pass Pumping Plant). The first analysis reviews historical SWP deliveries compared to physical capacity. Where CALSIM-2 data is available, a second analysis relies on data extracted from CALSIM-2 model simulations of the California Aqueduct. The historical and CALSIM-2 projection analyses provide different types of information. While the historical analysis is a likely indication of actual operational practices for SWP and Central Coast Contractors, it does not account for factors that may change in the future. Factors such as Delta regulatory requirements, changes in upstream SWP facility operations and

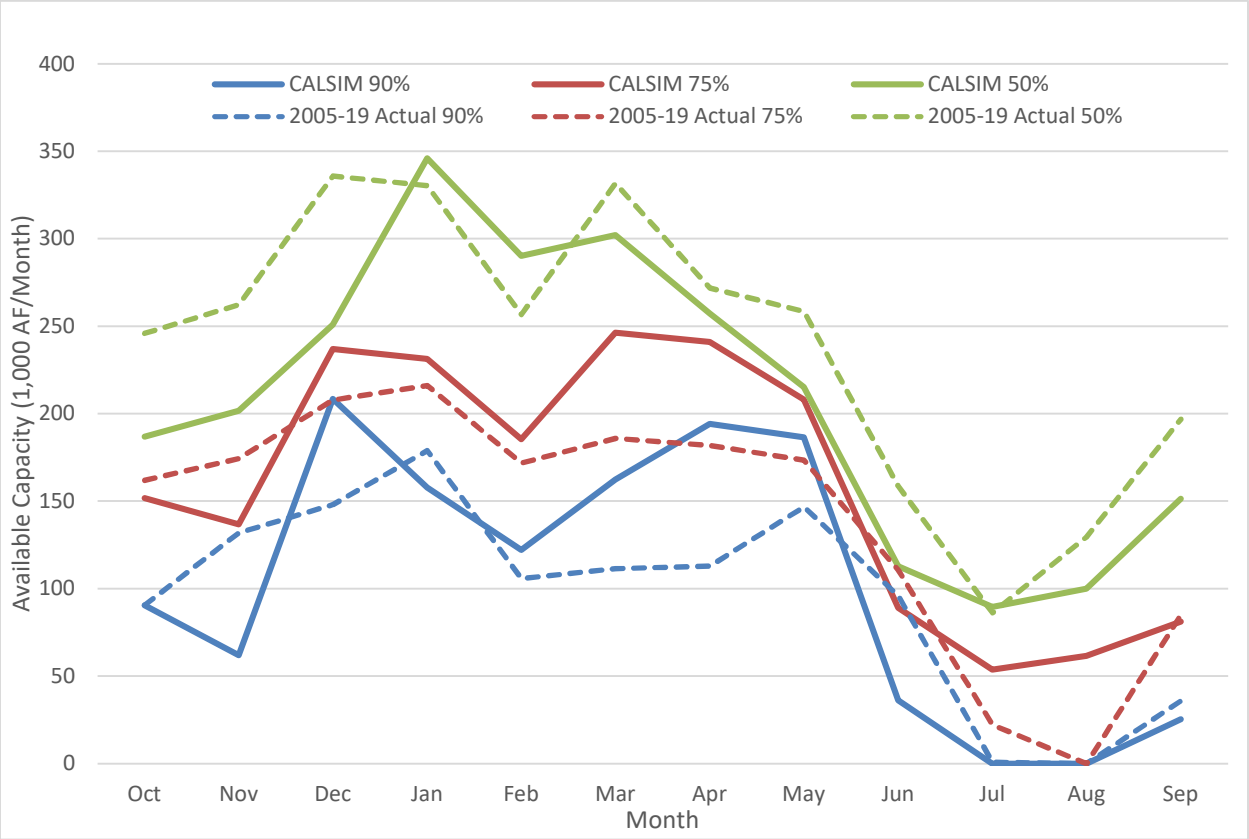
increased future use of contracted water supplies by downstream SWP contractors are not represented in historical operations but are included in CALSIM-2 simulations. While CALSIM-2 operations studies are generally not as accurate in indicating the nuances of SWP contractor actual operations, they have the advantage of considering known factors that can affect future availability of conveyance capacity. Next the two analysis are compared. Where historical and CALSIM-2 estimates of available capacity are similar, there can be strong confidence in the accuracy of their results. Where they differ, this summary offers an interpretation of which is more likely and provides a recommended outcome.

i. California Aqueduct Reach 7 (Check 21)

Conveyance capacity south of the San Luis Reservoir has been reduced from design amounts by subsidence. High groundwater pumping in the westside of the San Joaquin Valley along the California Aqueduct alignment has resulted in subsidence that has lowered local ground surface elevations. The decline in the ground surface has been uneven and has reduced gradients in many parts of the California Aqueduct, with corresponding reductions in conveyance capacity. A 2019 DWR analysis of ground surface declines to date and their impacts on the California Aqueduct, identified reductions in capacity that varied by reach of the Aqueduct. The analysis showed that California Aqueduct capacities remained at design levels through Pool 19 (generally, north of Huron). Aqueduct Pools 20 through 29 were identified as having some level of capacity reductions. The largest reduction in Aqueduct capacity was identified in Pool 20 of Reach 7, which lost 1,450 cfs of its design capacity of 8,350 cfs, leaving a reduced operational capacity of 6,900 cfs.

This historical analysis of SWP deliveries from 2005 to 2019 compared actual Aqueduct flows with the reduced 6,900 cfs capacity available in Aqueduct Reach 7, near Kettleman City.

Figure 2: California Aqueduct Reach 7 (Check 21) Capacity Availability



The analyses for Reach 7 (Check 21) capacity show similar results based on both CALSIM-2 projections and actual historical operations. In both analyses, severe limitations on capacity are projected in wetter years (90-percentile usage) for the months of July and August, and lesser limitations are projected in the months of June and September. There is significant available capacity for the remainder of the months, October through May. For the 75-percentile usage, actual historical operations show significant constraints during the months of June through September, which are consistent with CALSIM-2 projections. For the 50-percentile and lesser use conditions, both historical and CALSIM-2 analysis indicates minimal capacity constraints year-round.

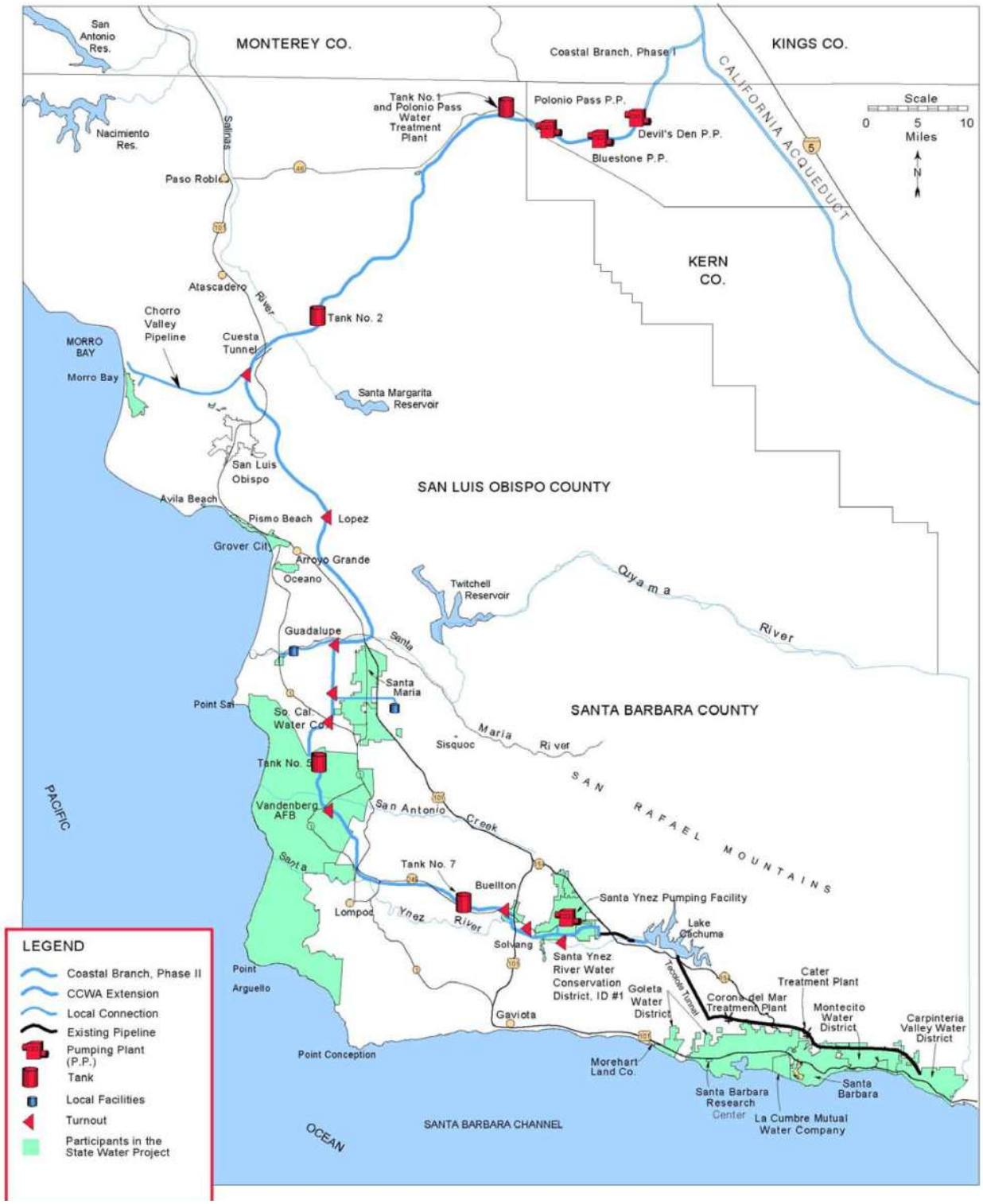
Overall, the actual historical operations are consistent with CALSIM-2 projections, with both showing significant constraints in available capacity during the June through September period for high use (90-percentile and 75-percentile) periods. There is significant available capacity in all year types October through May.

ii. Coastal Branch Aqueduct (Reach 31A)

The Coastal Branch breaks off from the California Aqueduct at Avenal Gap, just south of Kettleman City. Aqueduct Reach 31A (shown as Coastal Branch Phase 1 and including Las Perillas and Badger Hill Pumping Plants, provides deliveries for CCWA, SLCFCWCD, Santa Clarita Valley Water District (for the former Devils Den Water District), Kern County Water Agency (for their member agency Berrenda Mesa

178 Water District), and a potential future SWP water contractor. Figure 2 shows the alignment and major
179 features of the Coastal Branch Aqueduct.

180 *Figure 3: Diagram of Coastal Branch Aqueduct*



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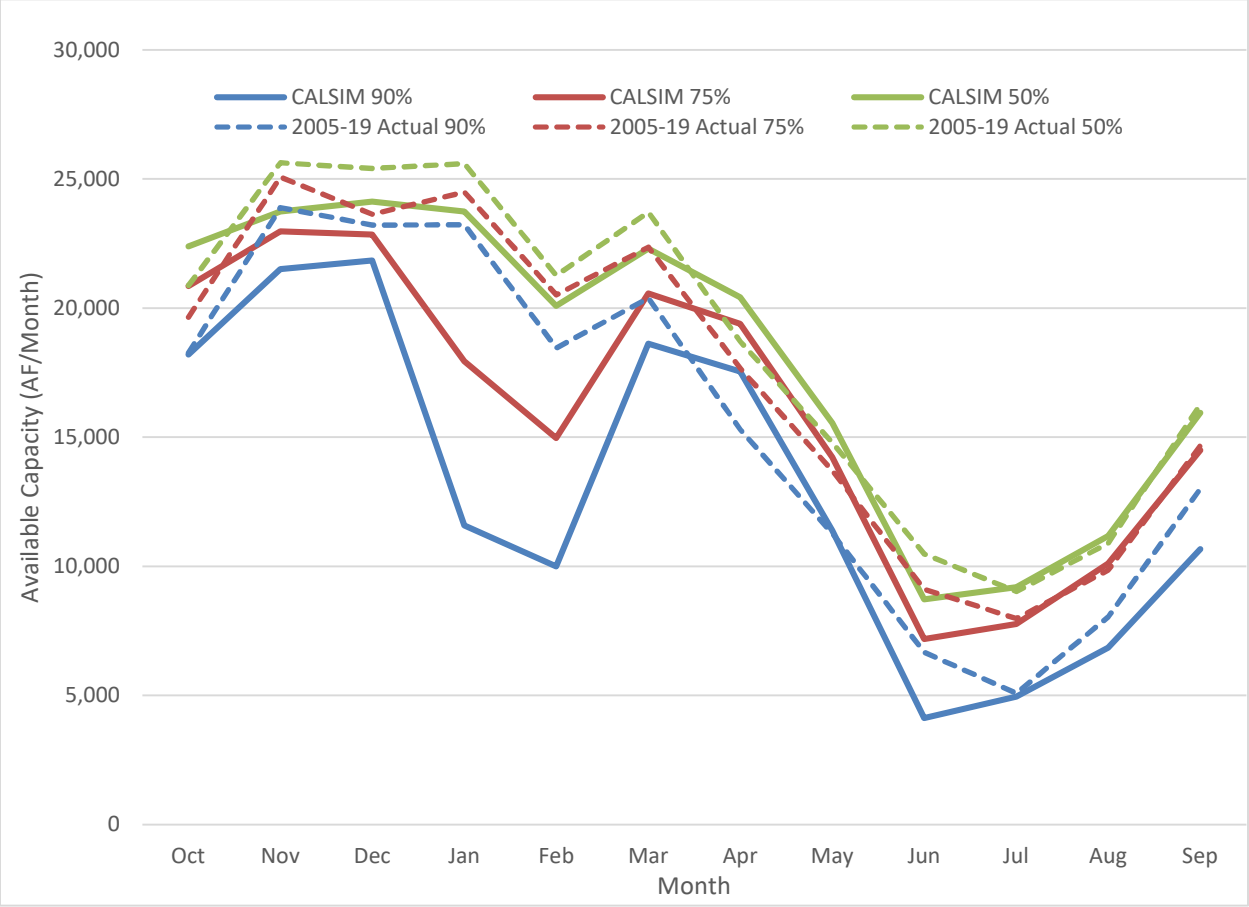
As with the California Aqueduct, 2005-2019 historical water flows for Badger Hill Pumping Plant were reviewed along with CALSIM-2 projections of a 1922-2003 long term period. As there are minimal SWP delivery turnouts until the end of Reach 31A, the Badger Hill Pumping Plant analysis is considered representative of Reach 31A. The design capacity for Badger Hill Pumping Plant is 454 cfs, which is equivalent to a monthly capacity of 27,000 to 29,000 acre-feet.

As with Reach 7 (Check 21) capacity analyses, Badger Hill Pumping Plant available capacity was consistent for both actual historical flows and CALSIM-2 projected flows. In both analyses, available capacity at Badger Hill Pumping Plant is limited during the months of June through September for the 90-percentile use level particularly, and, to a lesser extent, for the 75-precentile use level. Capacity is likely to be available for the remainder of the months, October through May, at the 90-percentile use level. Additionally, considerable capacity is available in essentially all months for the 50-percentile use level and drier conditions.

Figure 4: Coastal Aqueduct Badger Hill Pumping Plant Capacity Availability



iii. Coastal Branch Aqueduct (Reach 33A)

The Coastal Branch has reduced capacity in Reach 33A with CCWA and SLOCFCWCD being the only participant SWP contractors. There are three pumping plants in Reach 33A: Devils Den, Bluestone and

Polonio Pass. These three plants each have design capacities of 134 cfs (roughly 8,000 to 8,200 acre-feet per month), which were intentionally designed with higher capacities than needed for CCWA and SLOCFCWCD. The purpose of the higher capacity is to allow for more energy efficient off-peak pumping operation. The higher capacity would enable the SWP to pump water to Polonio Pass Water Treatment Plant during evenings and low power cost periods as a means to reduce overall SWP power costs.

Figure 5: Coastal Aqueduct Polonio Pass Pumping Plant Capacity Availability

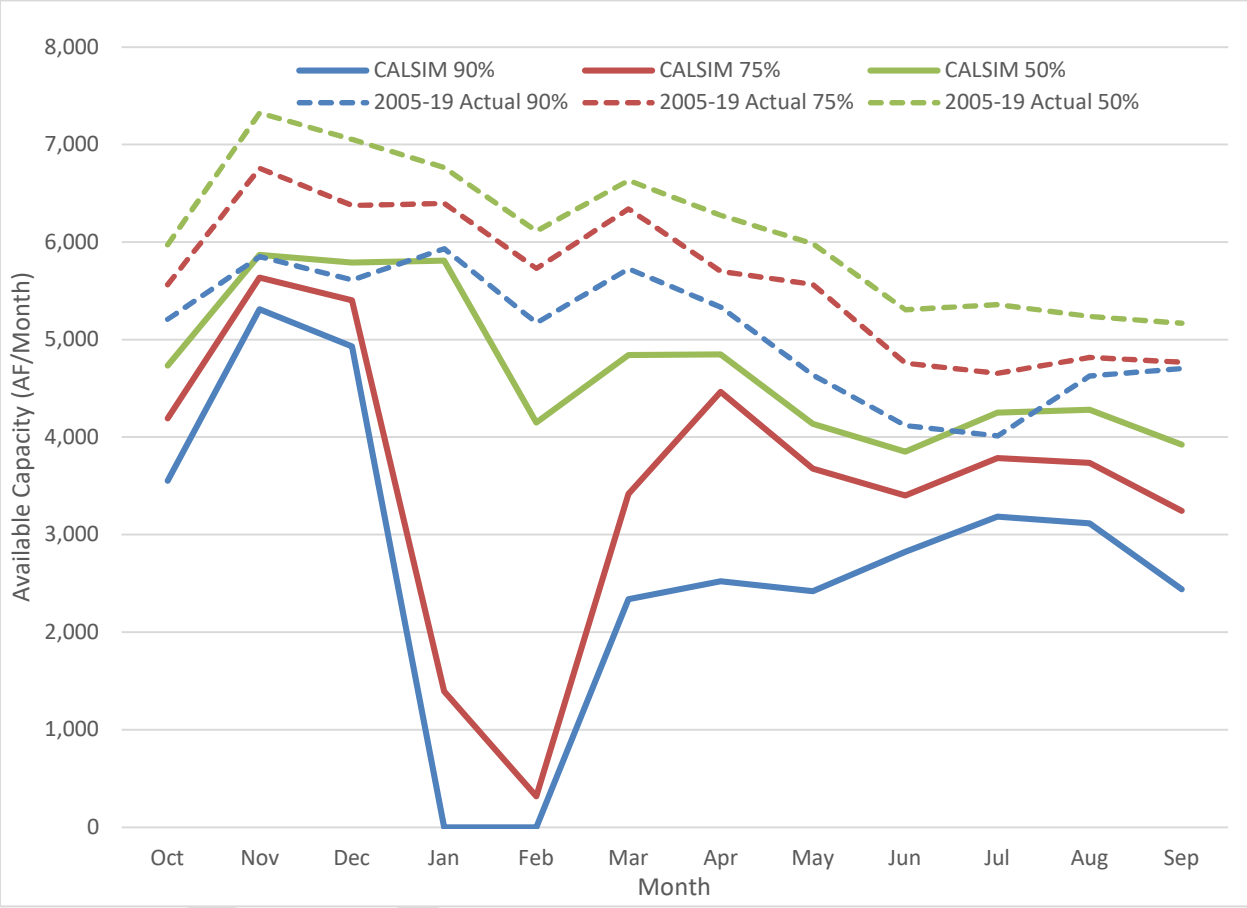


Figure 5 shows available capacity for Polonio Pass Pumping Plant using both actual historical operations data for 2005-2020 and CALSIM-2 projections. Unlike similar comparisons for Check 21 and Badger Hill Pumping Plant, the review of Polonio Pass Pumping Plant data shows significant differences between the CALSIM-2 projections and actual historical operations. The actual operations data shows essentially no periods of restricted capacity for any of the evaluated exceedances. There is essentially 50% available capacity (about 4,000 acre-feet per month) in even driest conditions. The CALSIM-2 projections included what are likely questionable assumptions about the delivery patterns for CCWA and SLOCFCWCD that have high delivery amounts in the months of January and February in some of the higher delivery years (90-percentile and 75-percentile.) These delivery patterns resulted in low-capacity availability in high delivery years, which do not match historical experience and appears to be an unrealistic modeling artifact. The poor representation of Polonio Pass flows by CALSIM-2 is likely due to modeler's focusing

on operational issues on the main California Aqueduct and minimal attention to operations on the Coastal Branch. For purposes of the current water management study, the CALSIM-2 data for Polonio Pass is being ignored and the capacity available in actual historical operations will be used instead. As noted, the actual historical data show essentially no limitations on available unused conveyance capacity based on likely potential use.

Based on the actual historical use data for Badger Hill and Polonio Pass Pumping Plants, there is limited available capacity in upstream reaches of the Coastal Branch in the summers (June through September) in most high delivery years (any years above 50-percentile). In dry years and in non-summer months, there is good availability of capacity.

Continuing downstream of the California Aqueduct to the Coastal Branch Aqueduct, the remainder of this discussion focuses on the Coastal Branch design capacities, making a conservative estimate of actual operational capacity that could be available on a consistent basis.

VI. Analysis of CCWA Conveyance Capacity Availability

At Polonio Pass, CCWA treats water at its Polonio Pass Water Treatment Plant (WTP). Downstream of the Polonio Pass WTP, CCWA operates remaining reaches of the Coastal Aqueduct. The capacity of Polonio Pass WTP is 43 million gallons per day (66.5 cubic feet per second), which can be a limiting factor for use of the Coastal Branch.

To evaluate the impacts of Coastal Branch capacity constraints, available Coastal Branch capacity on selected downstream reaches of the Coastal Branch was reviewed comparing historic delivery data for 1997-2020 provided by CCWA with the design capacities shown in Table 2. Note that no analysis of CALSIM-2 results was prepared, as CALSIM-2 does not include operation of the Coastal Branch downstream of Polonio Pass.

i. Coastal Branch Reach 33B

Design capacities for the Coastal Branch reaches are shown in Table 2. A 2011 hydraulic analysis conducted for CCWA identified modeled flow capacities for the Coastal Branch that were higher than design estimates. In Reach 33B, modeling indicated potential short term flow rates of up to 84.5 cfs. In Reaches 34, modeled flow capacity of up to 77 cfs was identified. While the hydraulic flow modeling indicates higher capacities than used for design, the higher capacities are considered a short-term peaking capability and it is uncertain that they could be maintained on a consistent basis. For the analysis here, the design rates are being used as representative of sustained flows that can be maintained under normal operations.

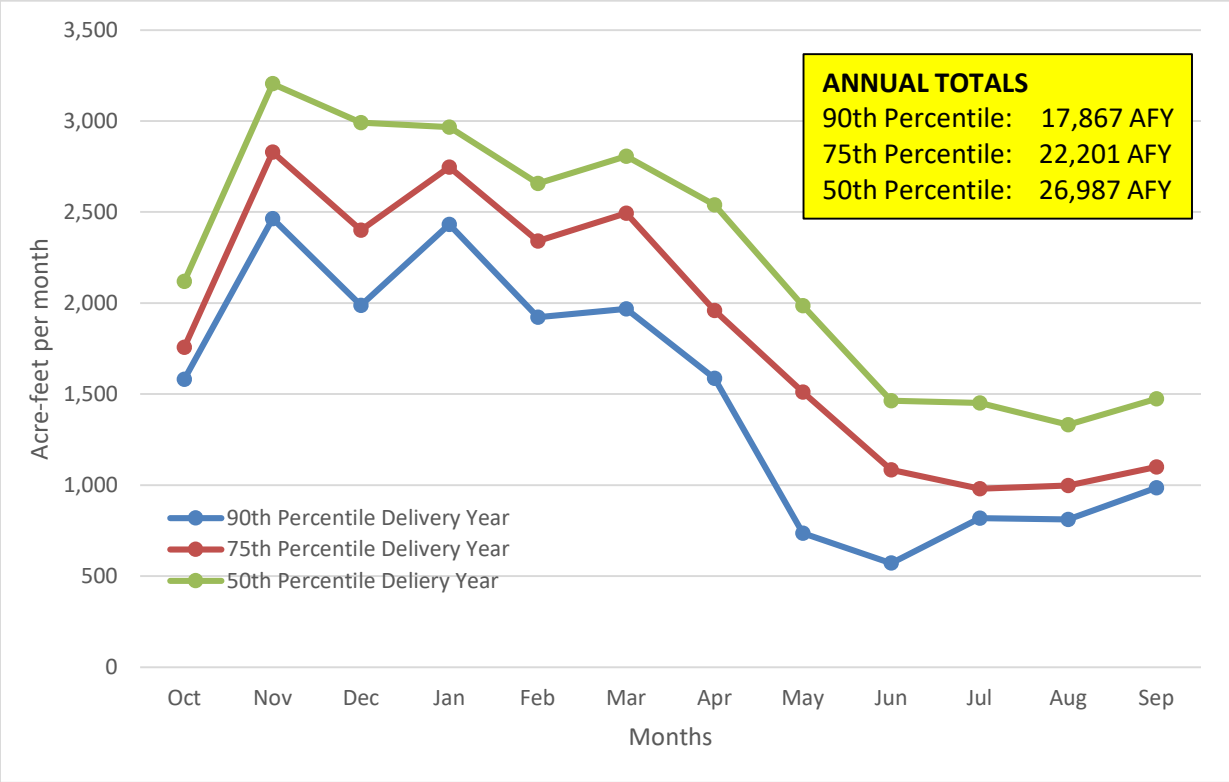
Table 2
Coastal Branch Design Capacity

Reach(s)	Upstream	Downstream	Design Capacity (cfs)
33B	Polonio Pass WTP	Chorro Valley TO	71
34	Chorro Valley TO	Lopez TO	68
35	Lopez TO	Guadalupe TO	64

37	Guadelupe TO	Southern Pacific RR	64
38	Southern Pacific RR	Tank 5	33
MH II	Tank 5	McLaughlin Rd	35/26
SY I	McLaughlin Rd	Santa Ynez PP	26
SY II	Santa Ynez PP	Cachuma Reservoir	22

During actual historical 1997-2020 CCWA delivery operations, the upstream reaches of the Coastal Branch (Reaches 1-4), with a design capacity of 71 cfs, had monthly availability as shown in Figure 6. This figure indicates the potential for limited availability capacity for the months of May through September. Available monthly capacity during this May through September period was limited to less than 1,000 AF for the 90th-percentile high delivery year. Available capacity is also near 1,000 AF for the months of Jun through September at the 75-th percentile. Conversely, available conveyance capacity of 1,500 AF or higher is regularly available for the months of October through April.

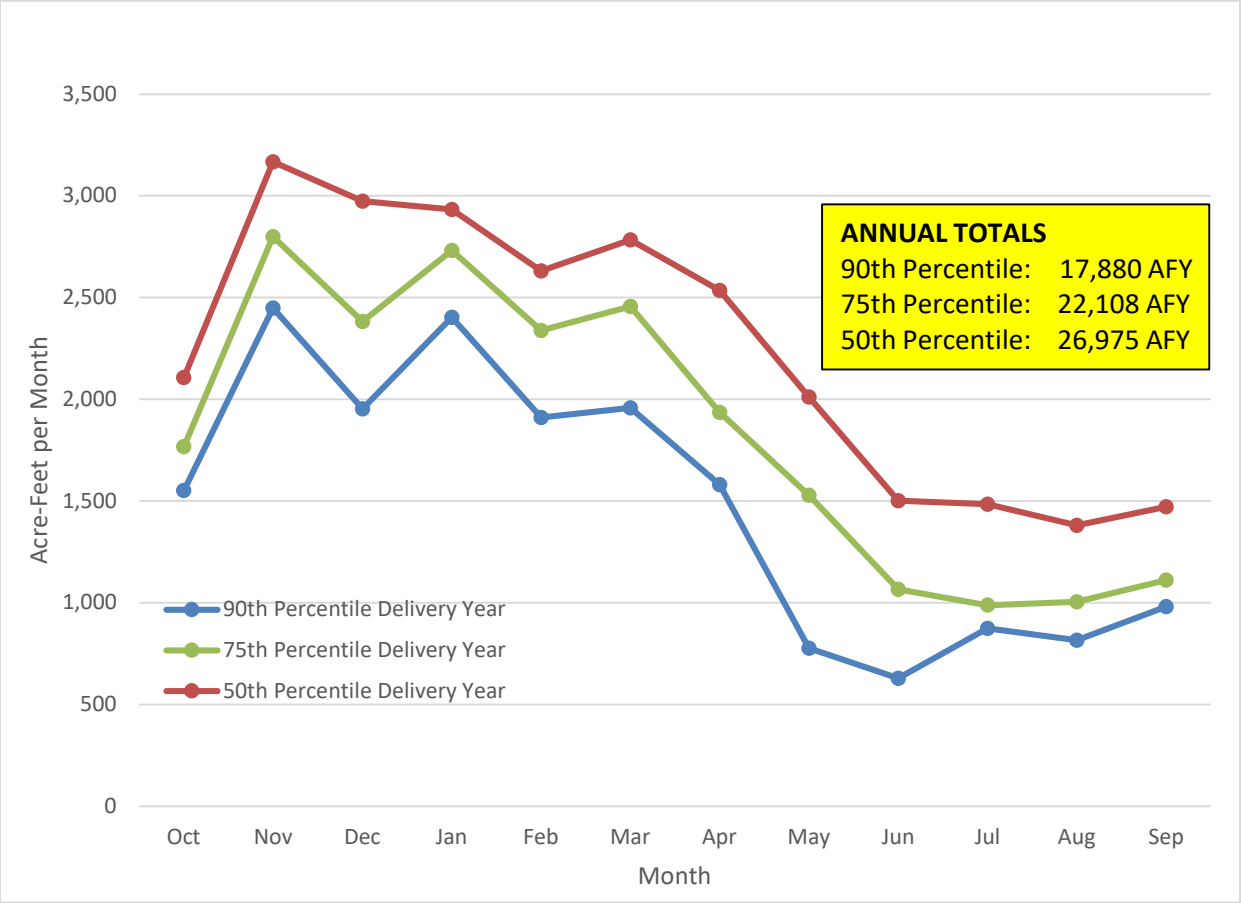
Figure 6: Coastal Branch 33B Historic (1998-2020) Capacity Availability



ii. Coastal Branch Reach 34

Available capacity for Reach 34 of the Coastal Branch was computed based on the design capacity of 68 cfs. These reaches cover the Coastal Branch Aqueduct roughly from Santa Margarita to the San Luis Obispo County line. This review identified the available capacities shown in Figure 7, which are generally similar to those shown for Reaches 1-4. Available capacity is regularly limited during the months of May through September and is relatively open for the months of October through April.

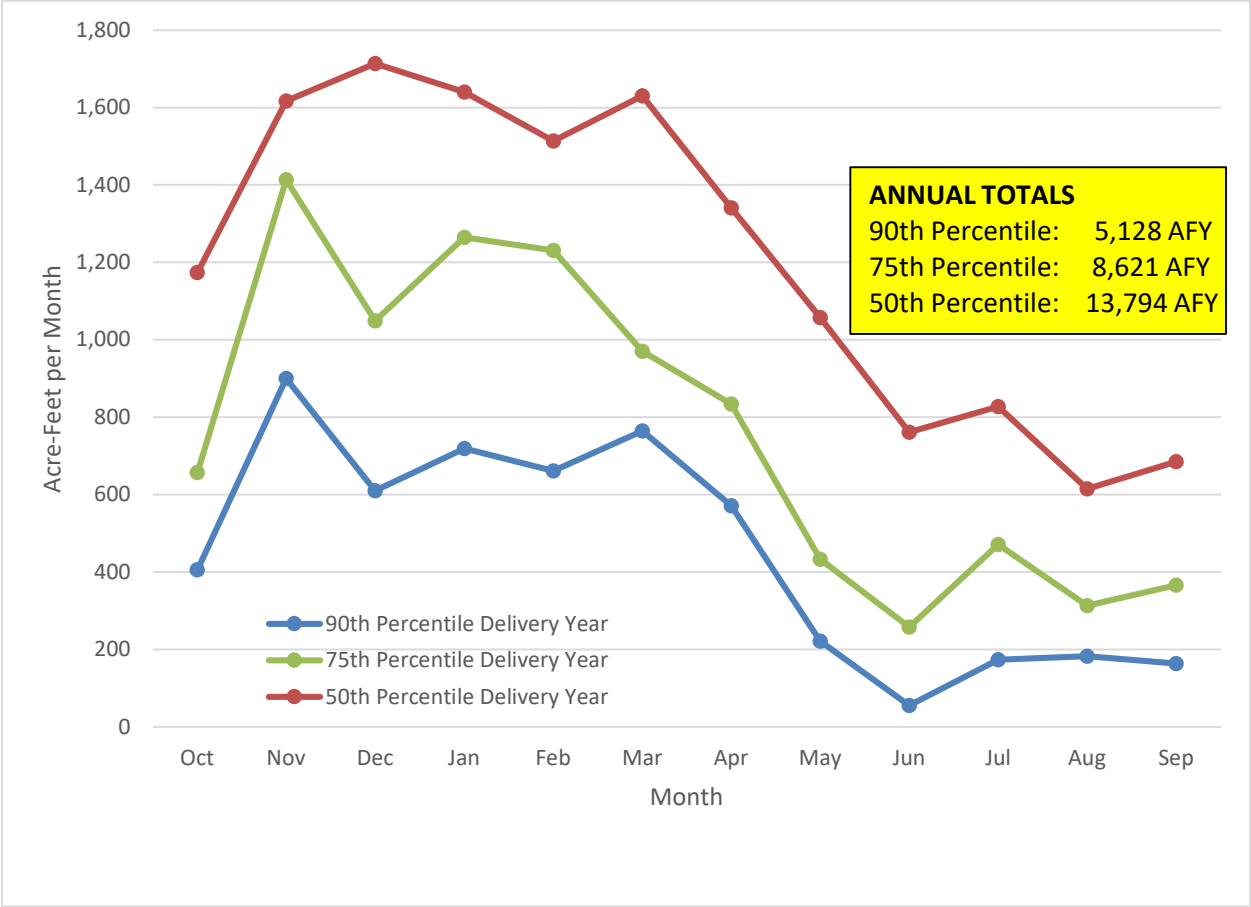
Figure 7: Reach 34 Historic (1998-2020) Capacity Availability



iii. Coastal Branch Reach 38

Reach 38 is located south of the City of Santa Maria. This reach has a design capacity of 33 cfs, which is significantly lower than upstream reaches and reflects the high turnout capacity at the City of Santa Maria. Figure 8 shows very limited available capacity in the peak delivery season for high delivery years (greater than 75th percentile), with available capacities less than 500 AF for the months of May through September. During the remainder of the year (October through April), monthly capacities of 1,500 AF and greater are available.

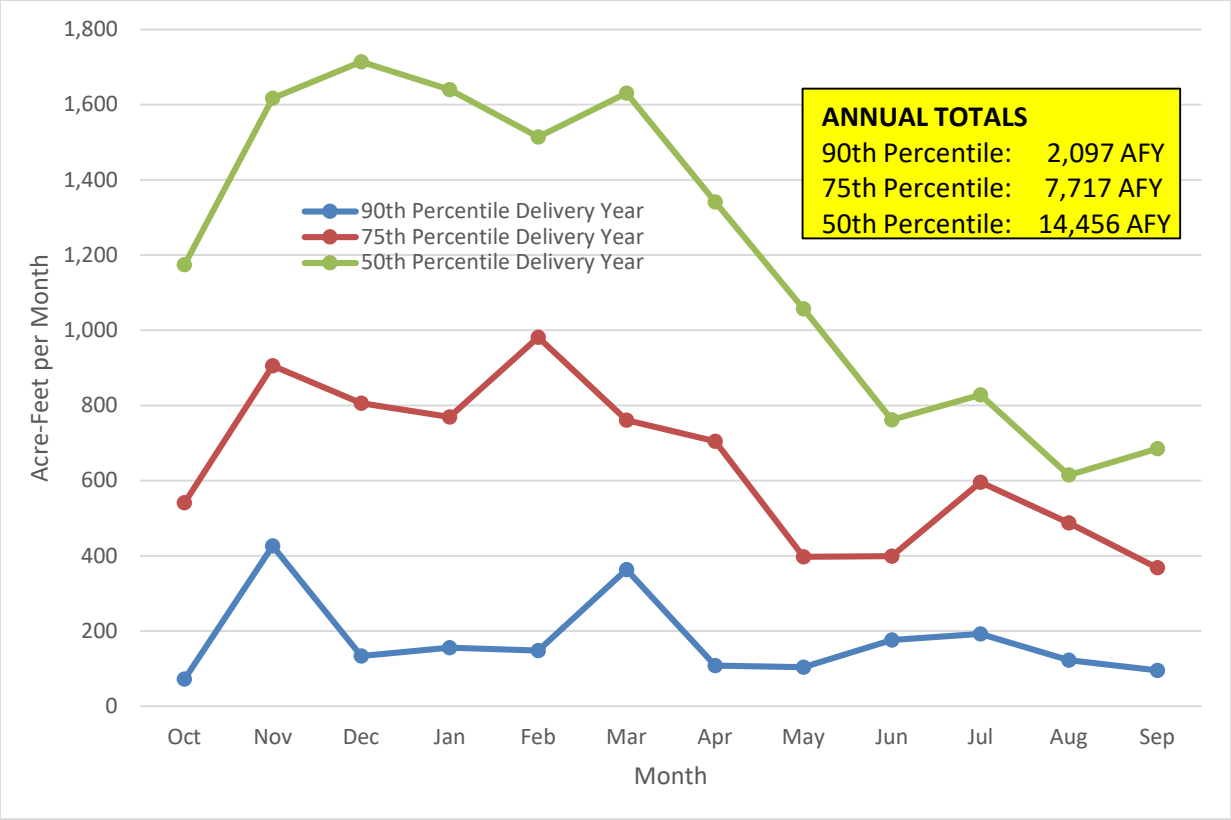
Figure 8: Reach 38 Historic (1998-2020) Capacity Availability



iv. Coastal Branch Reach SY II

The last reach of the Coastal Branch that is analyzed is Reach SY II, located downstream of the Santa Ynez Pump Station. This reach has a design capacity of 22 cfs, which (being the most downstream reach) is the lowest capacity on the Coastal Branch. Figure 9 shows very limited available capacity in the peak delivery season for high delivery years (greater than 90th percentile), with available capacities less than 200 AF for all but two months (November and March). In the 75th percentile delivery year and lower, there is consistent relatively high capacity available for the months of October through April.

Figure 9: Reach SY II Historic (1998-2020) Capacity Availability



VII. Conveyance Constraints Summary

The review of available capacity in the California Aqueduct between the San Luis Reservoir and the CCWA portion of the Coastal Branch indicates good availability of capacity in dry years and in non-summer months. At Reach 7 (Check 21) there is significant available capacity in all year types from October to May. At Reach 31A there is available capacity from October to May in high-use wet years and in all months in drier years (50th percentile and drier). At Reach 33A there are no limitations in available capacity even in the driest conditions. Historical actual data and CALSIM-2 modeling show similar capacity availability results at both Reach 7 and Reach 31A but differ for Reach 33A with historical actual data having more validity.

The review of available capacity in the Coastal Branch indicates that there is limited available capacity from May through September in high-use years for all reaches. Consistently high capacity is available for use by Coastal Branch Contractors in all years in the months of October through April as well as in low delivery years (less than 50th percentile) in all months.