

TECHNICAL MEMORANDUM

DATE: March 2, 2026 **PROJECT #:** 9100.78

TO: Salinas Valley Basin Groundwater Sustainability Agency

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PROJECT: Castroville & Eastside Canals and Alternatives Preliminary Feasibility Study

SUBJECT: Projected Salinas River Flows Analysis

INTRODUCTION

This appendix documents the methods and assumptions used to develop projected Salinas River flows and associated diversion estimates for project scenarios evaluated as part of the Castroville and Eastside Canals and Alternatives Preliminary Feasibility Study (C&E Study). This analysis builds on the Salinas River Historical Flows Analysis that was completed based on observed historical flows. The analysis supports a comparative, planning-level evaluation of how proposed Salinas River diversion, recharge, and in-lieu use concepts could affect groundwater sustainability in the Eastside, Langley, and 180/400 Subbasins. Project goals, project concepts, and the overall study context are described in the main body of the report.

The sections that follow describe the analytical approach used to estimate future potential diversions under Permit 11043, including preparation and bias correction of modeled streamflow, application of operational constraints, and computation of projected diversion volumes at the Castroville Canal Intake location (or Castroville Intake for short). The analysis is intended to evaluate relative differences in diversion availability across diversion capacities and future conditions, rather than to predict precise daily or annual flows.

METHODS

Determining Diversions for Project Scenarios

A multi-step process was undertaken to estimate diversions that could be made in accordance with Permit 11043. These used the Salinas Valley Operational Model (SVOM) future baseline climate sequence (M&A, 2026). This projected analysis followed the analytical approach as the historical Salinas River flows analysis; however, it relied on modeled weekly flows that required

a correction for consistency between simulated and observed data. Diversion at the Castroville Intake location was evaluated rather than at the Soledad or Chualar stream gages. Additional flow-past constraints were applied, intended to approximately align with MCWRA's proposed Salinas River Operations Habitat Conservation Plan (HCP) and ensure diversions would not constrain Salinas River Diversion Facility (SRDF) operations.

Model outputs and daily series preparation

SVOM future baseline results were extracted for reservoir releases, flow at the Chualar and Soledad gages, flow at SRDF (and required flow at SRDF when available), and flow at the Castroville Intake location. Because SVOM results are provided on a weekly time step, the series were converted to a daily time step to apply the same daily diversion logic used in the historical flows analysis, including running-average conditions and daily diversion-rate limits. For this screening-level evaluation, weekly values were carried through to daily values across the corresponding week to enable daily accounting.

Bias correction to align modeled and historical magnitudes

The historical flows analysis was repeated at Chualar using historical (1977–2018) and modeled flows to (1) estimate average annual diversion availability for 50, 100, and 200 cubic feet per second (cfs) diversion capacities and (2) evaluate the degree of bias in the modeled flows relative to the historical record. SVOM was found to overestimate streamflow at this location in these years, so a simple linear transformation was applied, via trial by error, to better align modeled and historical flow magnitudes for the purposes of estimating diversion volume:

$$Q_{corr} = \max(0, 0.36 \cdot Q_{svom} - 70)$$

where Q_{corr} is corrected flow, and Q_{svom} is modeled flow from the SVOM.

This correction is not intended to reproduce day-to-day hydrograph behavior or event timing.

The correction could increase the number of zero-flow days; however, it was selected to support a reasonable estimate of total annual diversion volume, which is the key quantity used to compare diversion capacities and evaluate potential groundwater benefit in subsequent analyses.

The same transformation was then applied to modeled flows at the Castroville Canal Intake location. Modeled flows at Chualar and the Castroville Intake were nearly identical during the primary diversion season (December–April; regression slope 0.99, intercept 2 cfs, $R^2 = 0.75$), and observed intake flow data were not available to develop an independent bias correction. Given this agreement between modeled locations during the months when diversion would primarily occur, applying the Chualar-based correction at the intake was considered reasonable for this study.

The historical period used to develop the streamflow bias correction (1977–2018) differs from the historical periods summarized in the main body of the report and the historical flows analysis appendix (2010–2024 and 2020–2024). The 1977–2018 period also spans multiple reservoir operation regimes that no longer fully align with current conditions. This choice reflects, in part, modeling decisions made earlier in the study, as well as a deliberate tradeoff between using more recent years that reflect current operational practices and using a longer period that better captures climate variability and is less dominated by the 2012–2016 drought. The appropriate balance between these competing considerations introduces some inherent uncertainty. Nonetheless, the resulting projected diversion estimates align closely with those derived from the historical analysis (Table 1).

Additionally, the bias correction was developed to align historical and modeled diversion volumes for 50, 100, and 200 cfs capacities, but not the 400 cfs capacity. While the linear transformation could closely align historical and modeled average annual diversion volumes for the 50, 100, and 200 cfs capacities, achieving a similar fit for the 400 cfs case would have reduced performance for the other capacities, which were used more extensively in this study. As a result, diversion volume estimates for the 400 cfs scenario are slightly conservative, with the bias-corrected volumes averaging approximately 90% of historical estimates.

Table 1. Projected Average Annual Diversions Compared to Historical Annual Diversions at Chualar

| | 50 cfs capacity | 100 cfs capacity | 200 cfs capacity | 400 cfs capacity |
|---|-----------------|------------------|------------------|------------------|
| Historical Recent Period (WY 2020-2024) | 5,300 | 10,000 | 18,200 | 31,700 |
| Historical (WY 2010-2024) | 4,400 | 8,600 | 16,200 | 29,300 |
| Projected | 5,100 | 9,700 | 17,200 | 26,800 |

Values in acre-feet per year

Additional flow-past constraints (HCP and SRDF protection)

After preparing the bias-corrected intake flow series, additional constraints were applied beyond the historical flows analysis diversion bypass approach to better reflect likely future operating requirements. To approximate the proposed HCP, the projected flow at Chualar and the date were used to identify which fish passage release rule(s) could be in effect at each time, and the most restrictive flow-past requirement was enforced. In most cases this resulted in a minimum of 80 cfs flowing past Chualar, while higher requirements were applied during “block flow” periods when indicated by the HCP logic.

A second, intentionally conservative constraint was applied during periods when model results indicated SRDF was operating. During these times, a 200 cfs requirement was enforced to ensure diversion under Permit 11043 would not reduce water availability for SRDF (i.e., would not occur at the expense of CSIP operations). This threshold was derived by identifying the highest

simulated streamflow loss between the Castroville intake and SRDF during April operating periods and adding the SRDF diversion rate. While this approach is expected to be conservative in many cases, it provides a protective assumption for this screening-level assessment.

Calculate each diversion capacity

Finally, potential diversion amounts were computed at the Castroville Intake using the bias-corrected flows and the flow-past constraints described above, for diversion capacities of 50, 100, 200, and 400 cfs. Diversions were assumed to begin in Water Year (WY) 2036 (after October 2035).

Figure 1 illustrates how these calculations were applied for an example projected diversion season of WY 2053. The total area under the curves represents simulated streamflow in the Salinas River at the Castroville Intake. Each colored band corresponds to a different allocation of flow. The lowest band (light blue) represents the flow required to remain past the diversion point to satisfy the HCP and SRDF constraints described above. The next band (orange) shows the volume that could be diverted with a 50 cfs capacity. The subsequent band (gray) represents the additional flow that could be diverted to reach a total diversion capacity of 100 cfs. Diversion capacities of 200 and 400 cfs are shown similarly by the yellow and blue bands, respectively. The green area represents flow in excess of the 400 cfs diversion capacity.

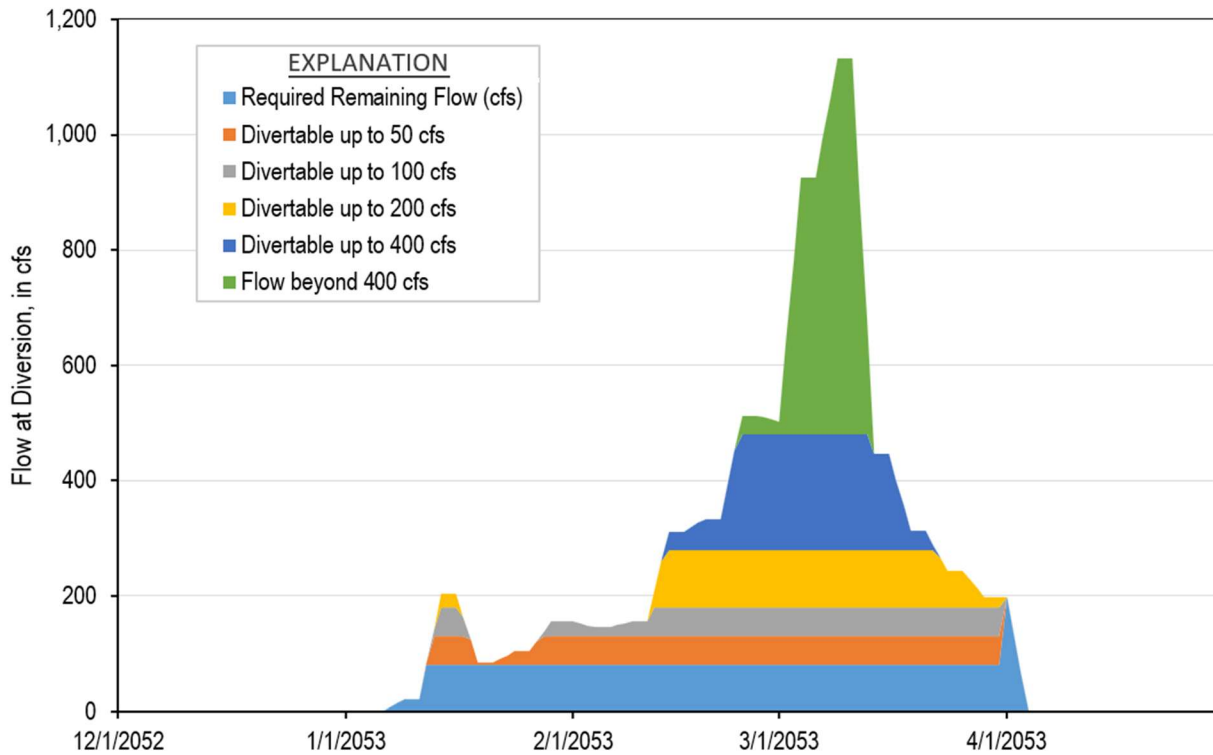


Figure 1. Total Bias Corrected Flow, Required HCP Flows, and Divertable Flows for WY 2053 Diversion Season

RESULTS

Projected average annual diversion volumes for each diversion capacity are summarized alongside historical estimates in Table 1. For all capacities, projected values fall between the estimates from the 2 historical periods shown. This result reflects, in part, differences in the years represented and the substantial interannual variability in divertible flow, as illustrated on Figure 2. The WY 2010–2024 historical period includes the severe 2012–2016 drought, which likely lowers the associated averages. In addition, the streamflow bias correction was calibrated using a different historical period than those summarized in Table 2. That the projected values remain close to these independent historical summaries validates the correction approach. Projected diversions also reflect additional constraints applied to approximate anticipated HCP requirements and protect SRDF diversions. Given the inherent uncertainty of the projected climate, the results are considered sufficiently representative for the purposes of this study.

Table 1 shows that both projected and historical diversion volumes increase less than proportionally with diversion capacity. This increase occurs during periods when streamflow exceeds required flow-past constraints but remains below 1 or more diversion capacity thresholds, limiting the extent to which higher capacities can be used.

Total projected annual diversion volumes for each capacity are shown on Figure 2 and exhibit substantial year-to-year variability. Only 6 years in the 50-year projection period show no diversion, while a similar number of years yield identical diversion volumes across 2 or more capacities, indicating no benefit from additional capacity in those years. Many years show roughly double the diversion volume for the 100 cfs capacity relative to 50 cfs, whereas this pattern is less common for the 200 cfs capacity and does not occur for the 400 cfs capacity. This pattern reflects the limited frequency of flow conditions capable of fully using the highest diversion capacity.

Average monthly projected diversions for each capacity are summarized in Table 2. Diversions are concentrated in the December–April period, with the highest and most similar monthly averages occurring in February and March, followed by January and December; April contributes relatively little volume. This seasonal pattern is broadly consistent with the historical analysis (Table 3), although differences are evident in the relative contribution of individual months.

These differences likely reflect several factors, including the use of different year sets, limitations of the modeled streamflows in reproducing short-duration high-flow events, the focus of the bias correction on aligning average annual (rather than monthly) diversion volumes, and the application of additional HCP and SRDF protective constraints. For the purposes of this study, these differences are not considered significant. The historical analysis remains more appropriate for evaluating diversion timing and operational considerations, while the bias-corrected projections are well suited for assessing diversion volumes and recharge impacts at seasonal to annual scales, where total volume and interannual variability are the primary drivers of groundwater response.

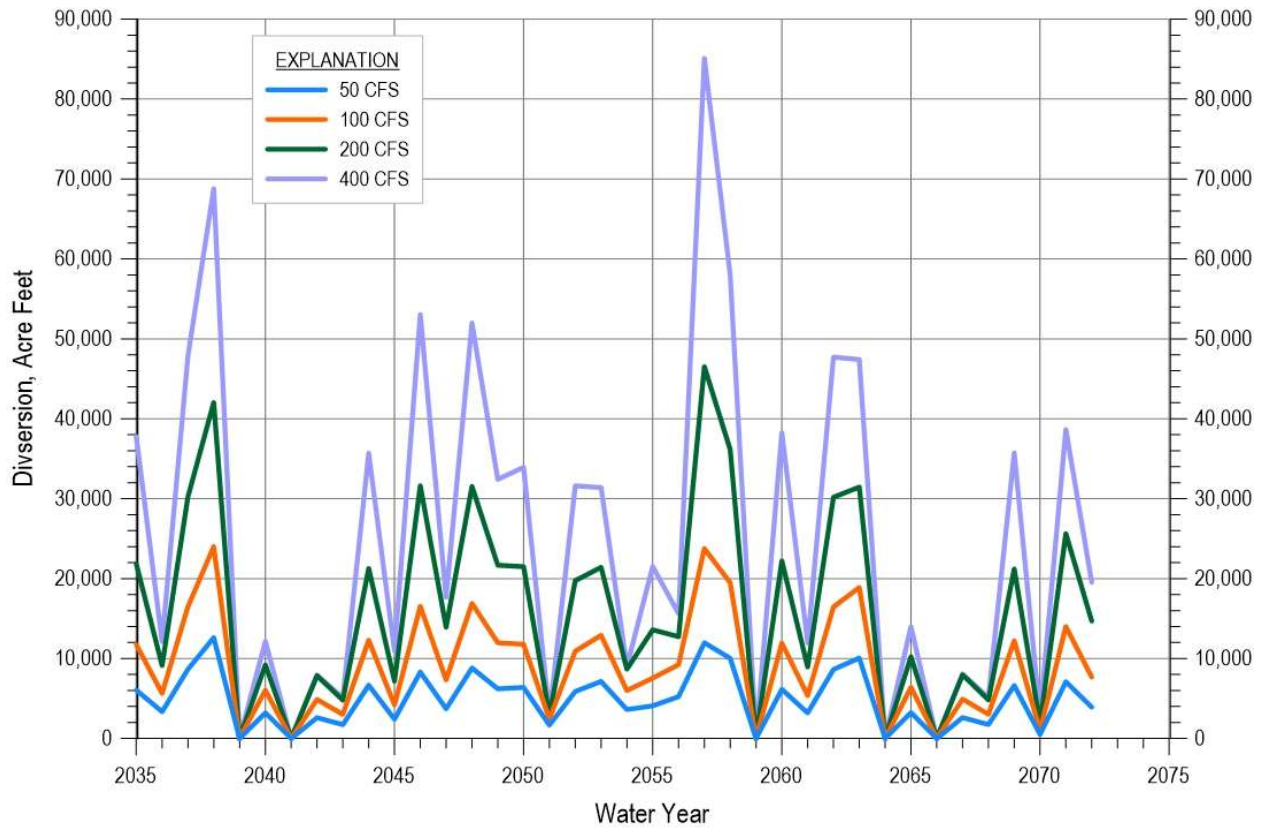


Figure 2. Projected Annual Diversions, in Acre-Feet per Year

Table 2. Average Monthly Projected Diversions, in cfs

| Month | 50 cfs | 100 cfs | 200 cfs | 400 cfs |
|-------|--------|---------|---------|---------|
| Oct | 0 | 0 | 0 | 0 |
| Nov | 0 | 0 | 0 | 0 |
| Dec | 17 | 31 | 54 | 72 |
| Jan | 19 | 35 | 64 | 105 |
| Feb | 21 | 39 | 70 | 117 |
| Mar | 22 | 41 | 71 | 106 |
| Apr | 3 | 5 | 9 | 14 |
| May | 0 | 0 | 0 | 0 |
| Jun | 0 | 0 | 0 | 0 |
| Jul | 0 | 0 | 0 | 0 |
| Aug | 0 | 0 | 0 | 0 |
| Sep | 0 | 0 | 0 | 0 |

Table 3. Average Monthly and Annual Diversions for Historical Flow Analysis and Flood Control Assessment at Soledad, WY 2010–2024

| Month | Historical Flow Analysis | Flood Control Assessment |
|--------------|--------------------------|--------------------------|
| Oct | 74 | 167 |
| Nov | 62 | 91 |
| Dec | 506 | 649 |
| Jan | 3,875 | 3,881 |
| Feb | 6,243 | 6,860 |
| Mar | 8,374 | 7,990 |
| Apr | 4,386 | 4,458 |
| May | 702 | 646 |
| Jun | 2 | 5 |
| Jul | 20 | 43 |
| Aug | 3 | - |
| Sep | 108 | 180 |
| Total | 24,353 | 24,971 |

Values in acre-feet

CONCLUSIONS

This analysis extends the historical diversion assessment by estimating diversion availability under a projected future baseline, using bias-corrected modeled flows and additional operational constraints. Results are intended to support screening-level evaluation of diversion capacity and recharge benefits, rather than detailed operational forecasting.

Key findings include:

Diversion timing and variability

As in the historical analysis, diversion opportunities are concentrated in the wet season and vary substantially from year to year. The projected record includes years with no diversion as well as years where higher diversion capacities provide little or no incremental benefit, reflecting the limited frequency of flow conditions that exceed flow-past requirements.

Average annual diversion volumes

Projected average annual diversion volumes fall between estimates from the 2 historical periods evaluated and are considered reasonably consistent given the uncertainty in future hydrology. This agreement provides additional confidence that the bias-correction approach yields plausible estimates of annual divertible volume, even though monthly patterns differ modestly.

Diminishing returns with increasing capacity

Increases in diversion capacity yield less-than-proportional increases in diversion volume. While a 100 cfs capacity often provides a meaningful increase relative to 50 cfs, incremental gains from 200 cfs occur less consistently, and the 400 cfs capacity is constrained by the rarity of conditions that allow full utilization under flow-past requirements.

Implications for groundwater benefits

Interannual variability in projected diversion volumes is an important input to groundwater modeling. Years with limited diversion help identify conditions under which recharge benefits may be minimal, while wetter years illustrate how recharge opportunities can accumulate over time to improve groundwater levels and storage. For this purpose, annual and seasonal diversion volumes are more important than the exact intra-seasonal distribution, making the projected analysis appropriate for evaluating recharge impacts, while the historical analysis remains the preferred reference for diversion operations and facility design.

REFERENCE

M&A. 2026. Salinas Valley Operational Model Update and Projected Baseline Simulation. Prepared for: Salinas Valley Basin Groundwater Sustainability Agency.