



— BUREAU OF —
RECLAMATION

2025 Management Agency Agreement Annual Report

Interior Region 10 – California-Great Basin



Mission Statements

The U.S. Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; honors its trust responsibilities or special commitments to American Indians, Alaska Natives, Native Hawaiians, and affiliated Island Communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Cover Photo: Delta-Mendota Canal/California Aqueduct Intertie Canal with brilliant blue water winding through valley. (Reclamation)

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Abbreviations and Acronyms

Action Plan	Actions to Address the Salinity and Boron TMDL Issues for the Lower San Joaquin River November 2008
AI/ML	Artificial Intelligence / Machine Learning
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin River Basins, 5th Edition
BO	Biological Opinion
CALFED	California Bay-Delta Authority
CVO	Central Valley Operations
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CV Water Board	Central Valley Regional Water Quality Control Board
CV-SALTS	Central Valley Salinity Alternatives for Long Term Sustainability Stakeholder Group
CV-SWAT	Central Valley Soil & Water Assessment Tool
D-1641	State Water Resources Control Board Water Right Decision 1641
DF	Base Design Flow
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
EC	Electrical Conductivity
FY	Fiscal Year
GBP	Grassland Bypass Project
GDA	Grassland Drainage Area
GDF	Goodwin Dam Flow
GUI	Graphical User Interface

GWD	Grassland Water District
LSJR	Lower San Joaquin River
MAA	Management Agency Agreement
MID	Modesto Irrigation District
MOU	Memorandum of Understanding
NOAA	National Oceanic and Atmospheric Administration
mg/L	milligram(s) per liter (parts per million)
μS/cm	micro-Siemens per centimeter
PTMS	Program to Meet Standards
Reclamation	United States Department of the Interior Bureau of Reclamation
RFC	California-Nevada River Forecast Center
RTMP	Real Time Management Program
SJR	San Joaquin River
SJRIP	San Joaquin River Water Quality Improvement Project
SJVDA	San Joaquin Valley Drainage Authority
SLDMWA	San Luis & Delta Mendota Water Authority
State Water Board	State Water Resources Control Board
TAF	Thousand Acre-Feet
TDS	Total Dissolved Solids
TID	Turlock Irrigation District
TMDL	Total Maximum Daily Load
VAMP	Vernalis Adaptive Management Plan
USGS	United States Geological Survey
WARMF	Watershed Analysis Risk Management Framework

WQO	Water Quality Objective
WRDP	Westside Regional Drainage Plan

2025 MAA Summary of Reclamation Activities

Purpose

The Central Valley Regional Water Quality Control Board's (CV Water Board) Control Program for Salt and Boron Discharges into the Lower San Joaquin River (LSJR), also known as the Salt and Boron Total Maximum Daily Load (TMDL), was approved and placed into effect on September 10, 2004. In response to the Salt and Boron TMDL, the U.S. Bureau of Reclamation (Reclamation) developed the salinity management plan titled "Actions to Address the Salinity and Boron TMDL Issues for the Lower San Joaquin River" (Action Plan) and entered into a Management Agency Agreement (MAA) with the CV Water Board on December 22, 2008. The MAA described Reclamation's actions to meet the obligations allocated to it by the Salt and Boron TMDL for the LSJR. In the MAA, Reclamation agreed to implement the Action Plan. Figure 1 shows seven TMDL subareas for salt load management in the LSJR Basin.

Reclamation and the CV Water Board revised the MAA on December 4, 2014. The revised MAA does not reference the Action Plan. However, Section 2.3d of the revised MAA states that "Reclamation actions will be detailed in an Annual Work Plan and submitted along with a Status of Activities to Date from the previous year."

This report summarizes activities conducted by Reclamation in fiscal year (FY) 2025 in conjunction with the related elements outlined in the revised MAA. The original Action Plan described Reclamation's past practices and procedures to mitigate and manage adverse impacts of salt and boron imported into the San Joaquin Basin via the Delta-Mendota Canal (DMC) to help achieve compliance with the objectives contained in the CV Water Board's *Water Quality Control Plan for the Sacramento River and the San Joaquin River Basins – 5th Edition* (Basin Plan). Reclamation reported the activities in quarterly reports as agreed to in the 2008 MAA. In the 2015 revised MAA (referred to as the MAA from here forward), Reclamation activities are now reported at the end of each calendar year in the Annual Report and activities planned for the next fiscal year are proposed in the Annual Work Plan.

Organization of the Annual Report

The Annual Report provides a synopsis of the various activities performed by Reclamation in accordance with the MAA. Action categories include providing flows to the system, salt load reductions, and phased program activities. For each action a brief description and list of activities are provided. The Annual Report includes calculations of salt loads based on DMC deliveries and calculations of assimilative capacity provided through dilution flows. The Compliance Monitoring and Evaluation Plan (Reclamation 2010) outlines the criteria and methodology for determining DMC loads and credits.

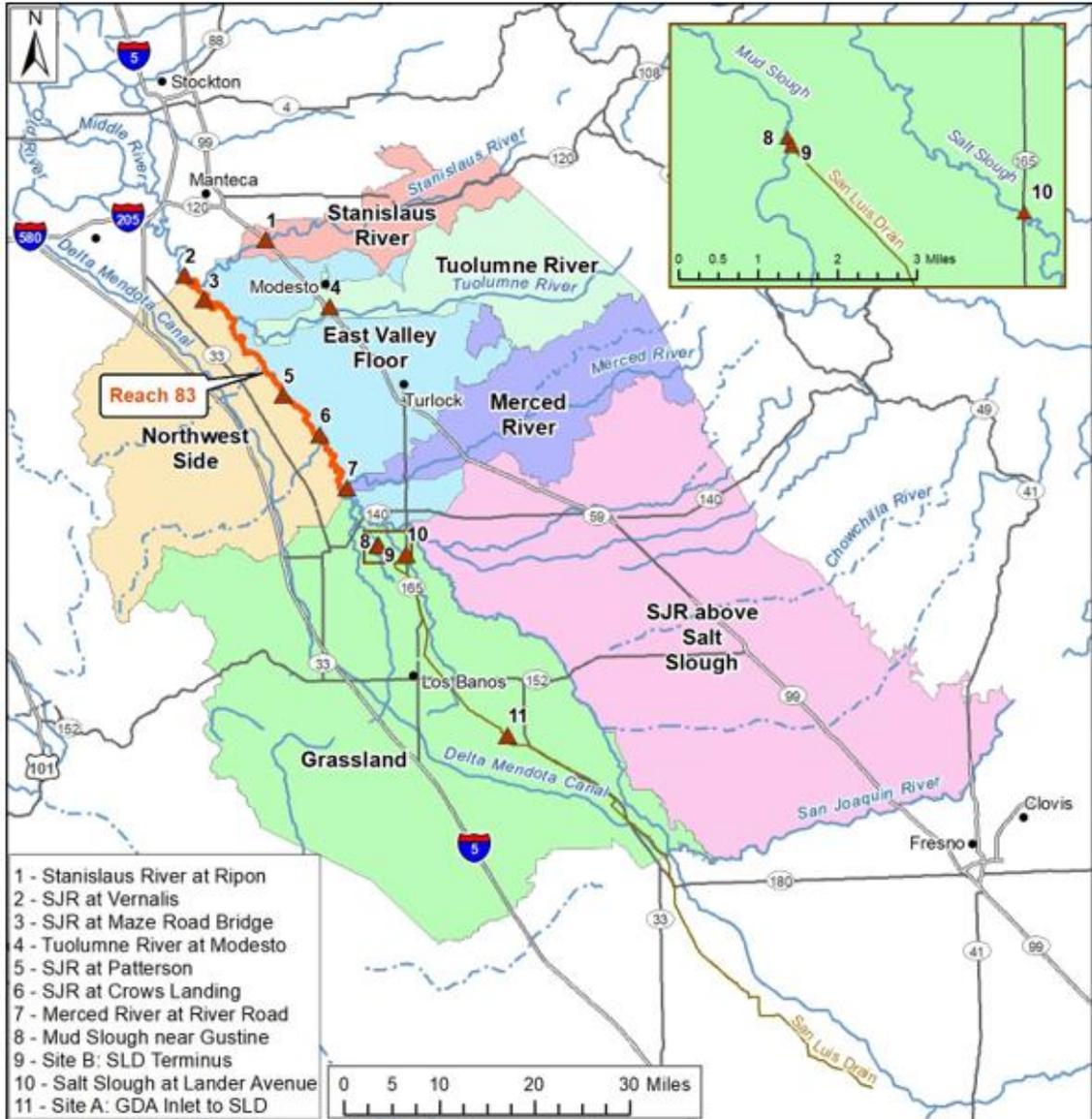


Figure 1. TMDL Subareas for Salt Load Management in the LSJR Basin

Providing Flow Releases to the San Joaquin River to Help Meet Salinity Objectives

In 2000, Reclamation agreed to the provisions in the State Water Resources Control Board’s (State Water Board) revised Decision 1641 (D-1641), which require the release of flows from New Melones Reservoir (Figure 2) to meet the Vernalis salinity objectives. Historically, Reclamation has provided both fishery and water quality dilution flow to the San Joaquin River (SJR) from New Melones Reservoir and through purchases of water supply to satisfy flow objectives established by the Vernalis Adaptive Management Plan (VAMP) and the Central Valley Project Improvement Act (CVPIA). The SJR Agreement, which included provisions to acquire

spring and fall pulse flows for the VAMP, expired on December 31, 2011. Reclamation continued to provide interim spring pulse flows for the SJR through a two-year agreement with Merced Irrigation District, which expired on December 31, 2013. During this timeframe, interested parties within the watershed, including Reclamation, initiated the San Joaquin Tributary Settlement Process to formulate a collaborative solution to present as an alternative to the State Water Board's new proposed SJR flow standard.

New Melones Reservoir Operations – Provision of Dilution Flow

In the Flood Control Act of October 1962, Congress reauthorized and expanded the function of the Melones Reservoir (P.L. 87-874) to become a multipurpose reservoir constructed by the U.S. Army Corps of Engineers (USACE) and operated by the Secretary of the Interior as part of the Central Valley Project (CVP), thus creating the New Melones Reservoir. Reclamation signed a Memorandum of Understanding (MOU) with the CV Water Board in 1962 to schedule water releases from New Melones Reservoir to maintain a dissolved oxygen level of 5 milligrams per liter (mg/L) in the Stanislaus River at the Ripon monitoring station, downstream of the reservoir. The multipurpose objectives of the reservoir now include flood control, irrigation, municipal and industrial water supply, power generation, fishery enhancement, water quality improvement, and recreation. Since June of 2009, New Melones Reservoir has been operated by Reclamation to meet the National Marine Fisheries Service's Biological Opinion (BO). The BO addresses the effects of the continued operation of the CVP and the California State Water Project on the various runs of Chinook salmon, Central Valley steelhead, and green sturgeon, and their designated critical habitats.



Figure 2. New Melones Reservoir

The Basin Plan was amended in 2004 to include a control program for salt and boron discharges into the LSJR. The control program dictated that through the MAA between Reclamation and the CV Water Board, Reclamation would either (a) meet DMC salinity load allocations, or

(b) provide dilution flows to create additional salt load assimilative capacity in the LSJR equivalent to DMC salt loads in excess of their allocation. Items 12 and 13 in the Salt and Boron TMDL include the following statements:

Item 12. Salt loads in water discharged into the LSJR or its tributaries for the express purpose of providing dilution flow are not subject to load limits described in this control program if the discharge:

- Complies with salinity Water Quality Objectives (WQOs) for the LSJR at the Airport Way Bridge near Vernalis;
- Is not a discharge from irrigated lands; and
- Is not provided as a water supply to be consumptively used upstream of the San Joaquin River at the Airport Way Bridge near Vernalis.

Item 13. Entities providing dilution flows, as described in item 12, will obtain an allocation equal to the salt load assimilative capacity provided by this flow. This dilution flow allocation can be used to 1) offset salt loads discharged by this entity in excess of any allocation, or 2) trade, as described in item 10. The additional dilution flow allocation provided by dilution flows is calculated as described in Table 4-9 (CV Water Board 2019).

Activities

Reclamation continues to operate the New Melones dam and reservoir to comply with State Water Board D-1641, New Melones Interim Plan of Operations, applicable BOs, and the Stanislaus River at Ripon monitoring station dissolved oxygen criteria.

Quantification Methodology: Table IV-4.4 (CV Water Board 2017) states that dilution flow allocations should be calculated as follows:

$$A_{dil} = Q_{dil} \times (C_{dil} - WQO) \times 0.8293$$

Where:

A_{dil} = Monthly assimilative capacity provided by a dilution flow (expressed as salt load) in tons per month

Q_{dil} = Dilution flow rate in thousand acre-feet (TAF) per month [above base flows]

C_{dil} = Electrical conductivity (EC) of the dilution flow in micro-Siemens per centimeter ($\mu\text{S}/\text{cm}$)

WQO = Salinity water quality objective for the LSJR at Airport Way Bridge near Vernalis in $\mu\text{S}/\text{cm}$

Table 1 lists data and monthly calculations for the past water year. Data for flow releases from Goodwin Dam, the Stanislaus River, "design flows" and salinity at Orange Blossom Bridge are

used to calculate the monthly dilution flow allocations. When Goodwin Dam flows are less than base design flows, the flows are adjusted to set assimilative capacity for the month to zero. The water-year type is estimated based on the 75% probability of exceedance found in California Department of Water Resources (DWR) Water Supply Index Forecasts (<https://cdec.water.ca.gov/reportapp/javareports?name=WSI>) for the San Joaquin Valley. The 75% exceedance flow forecast for May 1, 2025, is 2.56, which classifies water year 2025 (October 2024 through September 2025) as a “below normal” year. In 2025 the SJR Valley floor received 73% of the average seasonal rainfall¹.

Water Resources and Water Quality Regulation

The CVPIA, signed into law on October 30, 1992, modified priorities for managing the developed federal water resources in the Basin allocated by the CVP. The CVPIA resulted in modifications to the management of the CVP as a result of the elevation of fish and wildlife protection, restoration, and enhancement as co-equal objectives with the same priority as water supply for agriculture and municipal and industrial purposes while recognizing other associated secondary benefits such as power generation. To meet water acquisition needs under the CVPIA, the U.S. Department of the Interior developed a Water Acquisition Program as a joint effort between Reclamation and the U.S. Fish and Wildlife Service. The program’s purpose is to acquire water supplies to meet the habitat restoration and enhancement goals of the CVPIA and to improve the Department of the Interior’s ability to meet regulatory water quality requirements.

Activities

Reclamation did not acquire any additional water for water quality purposes in 2025.

Salt Load Reductions

Reclamation is under a court order to provide drainage to the San Luis Unit on the west side of the San Joaquin Valley. As part of this effort, Reclamation historically supported the Westside Regional Drainage Plan (WRDP) through grants and in-kind services. Incidental salt load reduction actions have included the Grassland Bypass Project (GBP), implementation of the WRDP, and the following conservation programs: Water Conservation Field Services Program, WaterSMART Water and Energy Efficiency Grants (formerly Water 2025 Grants Program), and the California Bay-Delta Authority Act (CALFED) Bay-Delta Water Use Efficiency Program. Although most of these programs were not initiated originally as salt load reduction efforts, their successful implementation has resulted in measurable reduced salt loading to the LSJR. In December of 2019, a new Waste Discharge Requirement for the GBP was adopted by the CV Water Board (Order R5-2019-0077). This order expanded some of the monitoring requirements

¹ https://www.cnrfc.noaa.gov/monthly_precip_2024.php

Table 1. Monthly estimated salt load assimilative capacity of Goodwin Dam releases to the San Joaquin River, water year 2025. Salt load assimilative capacity is the additional salt load that can be accommodated as a result of the additional release of flow that has a concentration below the Vernalis salinity objective.

Date	Goodwin Dam Flow (GDF) ^a TAF	Base Design Flow (DF) ^b TAF	(Qdil)Qdil = GDF-DF= TAF	WQO ^c , μS/cm	Monthly Average EC at Orange Blossom Bridge (Cdil) ^d , μS/cm	Monthly Assimilative Capacity, (Adil) tons
October 2024	41	8	33	1,000	26	26,655
November 2024	18	12	6	1,000	11	4,921
December 2024	13	13	0	1,000	8	0
January 2025	13	9	4	1,000	7	3,294
February 2025	17	13	4	1,000	19	3,254
March 2025	19	11	8	1,000	29	6,442
April 2025	45	36	9	700	81	4,620
May 2025	89	46	43	700	88	21,824
June 2025	76	2	74	700	90	37,435
July 2025	17	2	15	700	96	7,513
August 2025	15	2	13	700	97	6,501
September 2025	13	13	0	1000	97	0
Total						122,459

a <https://www.usbr.gov/mp/cvo/reports.html>

b Reclamation 2010 Compliance Monitoring and Evaluation Plan

c State Water Board Decision 1641

d <http://cdec.water.ca.gov/dynamicapp/staSearch>

and implemented a requirement to meet a 5 parts per billion 4-day average selenium WQO at Mud Slough beginning in January 2020.

Grassland Bypass Project

The GBP was a multi-agency stakeholder project originally based upon the 1995 Use Agreement² between Reclamation and the San Luis and Delta-Mendota Water Authority (SLDMWA) to manage and reduce the volume of agricultural drainage water produced within the Grassland Drainage Area (GDA). As stated above, the Waste Discharge Requirement (Order R5-2019-0077) dictates the current and ongoing monitoring requirements for the GBP. The project continued to use a 28-mile section of the San Luis Drain to convey drainage water to Mud Slough, a tributary of the SJR, until December 31, 2020, when all irrigation season subsurface drainage discharges from the selenium-impacted Grasslands Drainage Area are diverted to the 6,000-acre San Joaquin River Improvement Project (SJRIP) reuse facility. Annual and monthly reductions in allowable selenium load discharge to Mud Slough were part of the original negotiated Use Agreement and have been realized over the past 25 years of the project. The new Use Agreement and Waste Discharge Order allow storm-induced drainage from the Grassland Drainage Area to be conveyed by the San Luis Drain during significant storm events to prevent widespread flooding of the GDA watershed. The GBP has been a highly successful example of agency and stakeholder cooperation to slowly phase out the non-point source environmental pollutant selenium from the water quality impaired SJR.

Activities

- Although the GBP was specifically designed to address selenium non-point source loading to the SJR, the GBP also significantly reduced the drainage discharge loading of salt and boron. The SJRIP has slowly expanded its footprint to accommodate all subsurface drainage from the selenium impacted watershed. Over time salinity has increased on some of the SJRIP acreage, impacting alfalfa production. Alfalfa fields have been replaced with Jose tall wheatgrass – a more salt tolerant crop that is in high demand from local livestock producers but has lower economic return than alfalfa.
- Prior to Water Year 1996, more than 191,000 tons of salts, 357 tons of boron, and 8,806 pounds of selenium were discharged annually from the GDA to the LSJR. Figure 3 shows the progressive reduction of salts discharged from the GDA³ due to agricultural flow diversion to the SJRIP.
- During Water Year 2025, 80,400 tons of salts, 113 tons of boron, and 526 pounds of selenium were discharged from the GDA and diverted into the SJRIP. As a result of storm-induced discharges, 17,800 tons of salts, 26 tons of boron, and 25 pounds of selenium bypassed diversion into the SJRIP and were conveyed in the San Luis Drain into Mud Slough and subsequently to the San Joaquin River. Absent the collaboration

² U.S. Bureau of Reclamation and the San Luis and Delta-Mendota Water Authority, December 22, 2009. Agreement for Continued Use of the San Luis Drain for the Period January 1, 2010, through December 31, 2019. Agreement No. 10- WC-20-3975.

³ Data Sources: CV Water Board (pre-project), Reclamation, and Summers Engineering.

between Grassland Area Farmers and Reclamation, the entire salt, boron, and selenium loads produced by subsurface agricultural drainage from the GDA would have been discharged to the SJR. Figures 3, 4, and 5 show the progressive reduction of salt, boron, and selenium loads discharged from the GDA.

Inflows of subsurface agricultural drainage water to the SJRIP can vary substantially from year to year and within the irrigation season. Annual variation in subsurface drainage volume diverted into the SJRIP is indirectly impacted by the water year designation which, in turn, can affect water supply allocation south of the Delta. When water supply allocation is curtailed or reduced to contractors with junior water rights south of the Delta more agricultural land is fallowed in these areas on the west-side of the San Joaquin Basin – less water is applied as irrigation resulting in lower volumes of drainage. Senior water right holders such as the Exchange Contractors and seasonal wetland management entities such as Grassland Water District and the State and Federal refuges rarely experience reductions below a 100% water supply. Hence, during 2023 and 2024 irrigation seasons reduced water allocations led to reduced inflow to the SJRIP requiring the fallowing of some fields within the facility. In 2025 greater water supply allocations have reduced fallowing operations within the SJRIP.

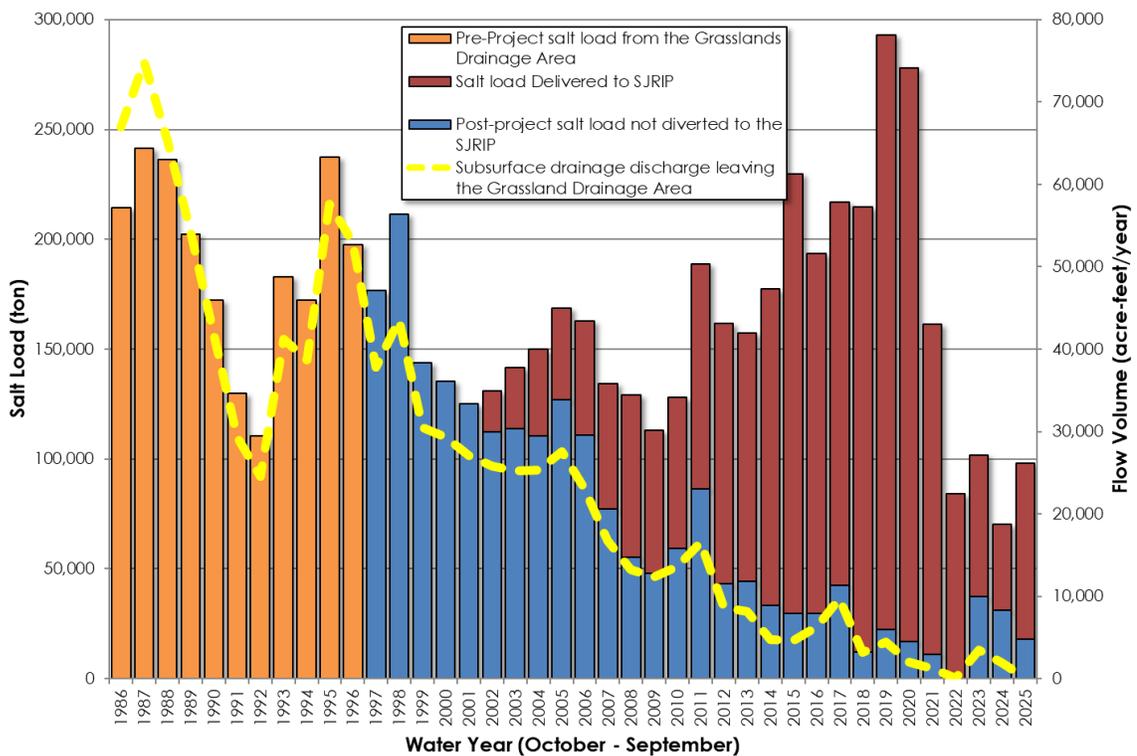


Figure 3. Salts Discharged (tons) and Subsurface Drainage Discharge Leaving the GDA

During years when all subsurface drainage water from the GDA is contained within the SJRIP and there are no emergency stormwater releases into the SLD from the watershed

– groundwater still seeps into the SLD through the weep valves embedded in the Drain’s concrete liner.

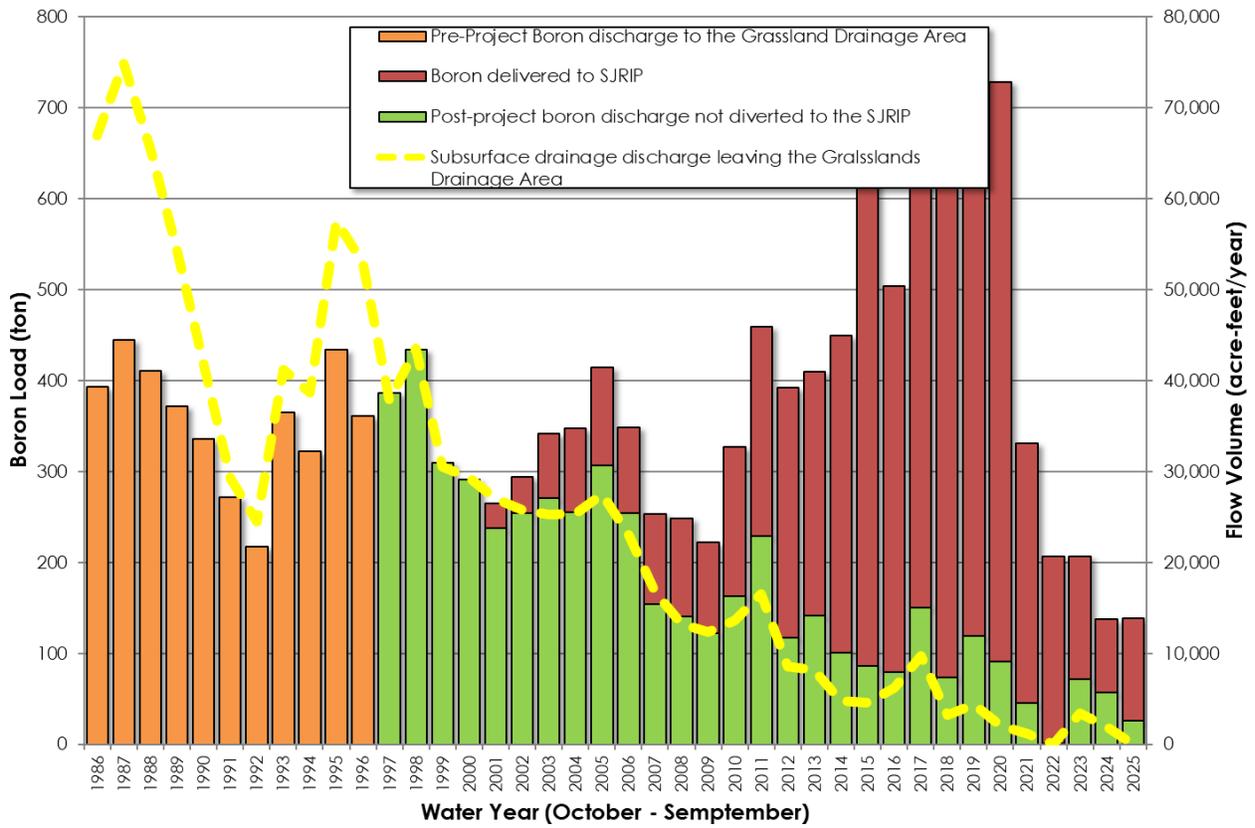


Figure 4. Boron Discharged (tons) and Subsurface Drainage Discharge Leaving the GDA

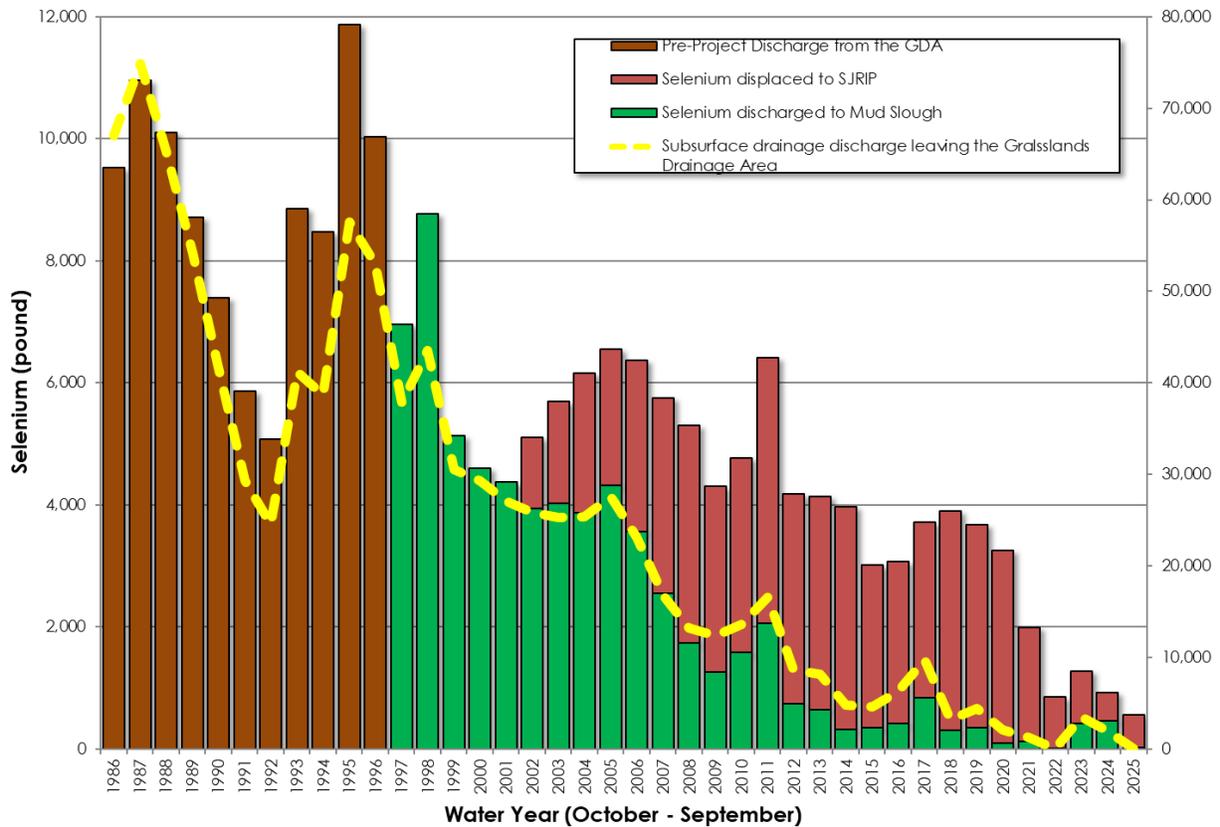


Figure 5 Selenium Discharged (pounds) and Subsurface Drainage Discharge Leaving the GDA

Westside Regional Drainage Plan

The WRDP was a cooperative drainage management plan developed by stakeholders in conjunction with government and local agencies and private partnerships. The original efforts of the WRDP focused on reducing selenium discharges to the SJR. The initial goals of the WRDP were met, while real-time monitoring and management of salt load discharge to the San Joaquin River has continued as part of the Salt and Boron TMDL in the San Joaquin Basin Water Quality Control Plan.

Activities

- The GDA continues to implement activities associated with the WRDP and the SJRIP. The SJRIP reuses subsurface agricultural drain water from the GDA to irrigate salt-tolerant crops such as Jose tall wheatgrass and pistachio trees. Income from the sale of forage hay and pistachios has been used to offset costs associated with irrigation and drainage management within the SJRIP facility. Elevated soil salinity levels in certain fields within the SJRIP have forced a transition from alfalfa to Jose tall wheatgrass owing to the high salinity tolerance levels of the wheatgrass forage crop with subsequent loss of income at harvest given the market premium for alfalfa. Although the funding levels applied to

SJRIP activities have diminished in recent years, Reclamation continues to partner with California State University, Fresno and other entities to improve and enhance field data collection activities toward improving salinity management and resource sustainability within the SJRIP.

- Reclamation continues to fund activities in the western San Joaquin Valley through the WaterSMART Program. The competitive grant program has been expanded beyond the drought resiliency and water and energy efficiency themes to include watershed management, which now better aligns with the goals and cyberinfrastructure themes of real-time water quality management.

Water Conservation Efforts Benefiting Salt Management

The water use efficiency program oversees several grant programs, most of which fund actions to assure efficient use of existing and new water supplies. Activities to improve water use efficiency can alter the magnitude and scheduling of water diversions from Reclamation canals potentially resulting in reduced discharge of agricultural drainage and associated pollutants, improving water quality in receiving waters such as the SJR. Although Reclamation is not always able to quantify the benefits of the various funded projects with respect to salt load reduction, these projects all contribute to the agency’s water conservation efforts in the basin. Funding for approximately 100 projects in the San Joaquin Valley has been provided through programs such as WaterSMART, the Reclamation/Natural Resources Conservation Service partnership, and the various state bond measures. The funding Reclamation provided in FY 2025 is listed in Table 2.

Table 2. Fiscal Year 2025 Reclamation Funding

Funding Program	FY 2025 Allocation
<p>Program to Meet Standards</p> <ul style="list-style-type: none"> • The Program provided financial assistance to Grassland Water District for the real-time management program to provide public access to their sensor network and wetland drainage data critical to calibrating Reclamation’s Watershed Analysis Risk Management Framework (WARMF) forecasting model. • Systech Water Resources Inc. released several new versions of the WARMF model to simulate and forecast flow, EC, and salt load in the lower SJR. The newest version of WARMF (version 7.2.3) includes the following updates: (1) A volume balance error in the diffusion wave hydrology simulation was identified and corrected; and (2) Enhanced, more user-friendly graphics—such as displaying the date and y-value when hovering over any point on the Time Series Output graph—have been implemented for improved usability. • Systech Water Resources Inc. discontinued work on the following two WARMF forecasting improvement tasks after the contract was canceled in February 2025: (1) enhancing groundwater simulation to improve predictions of riverbed seepage loss, and (2) performing real-time QA/QC of monitored flow and EC data at the Crows Landing, Maze Road Bridge, and Vernalis stations. 	<p>\$750,000</p>

Funding Program	FY 2025 Allocation
<ul style="list-style-type: none"> Monitoring system technical support that was previously provided through a cooperative agreement with UC Merced was extended via a multi-year agreement through Grassland Water District. This new arrangement will better support stakeholder communication and coordination with interested parties. Reclamation staff continues to provide technical support for WARMF model based SJR water quality forecasting and salt load assimilative capacity and data dissemination. 	
<p>Delta-Mendota Canal (DMC) Subsidence Correction Project: Simulations of future land subsidence through 2073 for the DMC Subsidence Correction Project were performed using the USGS CVHM2 model to assist design staff involved in canal repairs and maintenance. The simulations tested the sensitivity of future land subsidence to groundwater pumping demands, uncertainty in hydrology due to climate change, and management actions such as Managed Aquifer Recharge (MAR). A journal paper was published on the results of this project in <i>Water</i>.</p>	\$38,949
<p>S&T Project 23041 - Climate Change Impact Analysis on Groundwater Availability and Managed Aquifer Recharge (MAR) in California: This project has analyzed climate impacts in cooperation with DWR using an integrated suite of models including CalLite, CVHM2, and BCM to estimate the climate impacts on groundwater and the feasibility of management actions such as MAR. This study aims to provide an analytical framework that may be applicable to other regions throughout Reclamation and provides a tool that is assisting the Delta-Mendota subbasin with implementation of their Groundwater Sustainability Plans.</p>	\$97,000

Phased Program Activities

The MAA lists several actions that are intended to improve management of salt and boron loads in the SJR. These actions were initially phased in coordination with interested parties in the SJR Basin and associated with primary goals. These phases and goals were recognized in Annual Work Plans that were developed jointly with the San Joaquin Real-Time Management Program (RTMP) Steering Committee (Reclamation 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025). The summary of the phases is shown in the following table.

Table 3. Real-time salinity management program phase history

PHASE	YEAR	GOAL	ACTIVITIES
Phase 1	Dec-2014 to Mar-2015	Initiation	Goal setting Conceptual framework Model selection
Phase 2	Mar-2015 to Mar-2016	Monitoring	Monitoring station design Sensor networks WARMF model customization
Phase 3	Mar-2016 to Mar-2018	Early Implementation Forecast Model Development	Weekly forecasting WARMF Manager Module Data processing improvements WARMF model bug fixes
Phase 4	Mar-2018 to Dec-2025	Full Implementation Model Simplification	Daily salinity forecasting Stakeholder data expansion Regression model development
Maintenance Phase	Dec-2025 onward	Optimization Stakeholder Engagement	Engagement with CVSALTS Real-time data access Forecast model optimization

As previously described, Phases 1 and 2 of the RTMP were focused on initiation (Phase 1) and early development (Phase 2) that tackled the following goals: (Goal 1) monitoring station design, installation, and operation; (Goal 2) engaging participation from interested parties; (Goal 3) multi-organizational cooperation to seek grants and other external funding; and (Goal 4) initial development of a watershed-level water quality simulation and forecasting tool that would provide essential decision support for salt load assimilative capacity determination and salt load management. Phase 2 of the San Joaquin RTMP occurred from March 31, 2015, to March 31, 2016. Phase 3 of the RTMP was the early implementation phase, which concluded in March 2018. Goals under this phase included: Programmatic weekly forecasting of assimilative capacity in the SJR by one or more cooperating RTMP parties; Initiation of data-sharing activities between and among RTMP parties and information technology innovations to facilitate secure reliable data flows; (periodic analysis of additional infrastructure and funding needs through feedback from the MOU Steering Committee; development and recommendation of specific additional management practices needed to better coordinate the real-time operation of discharges to the SJR; and proactive outreach to current and prospective interested parties in the basin, specifically those who have not participated in the RTMP to date. Phase 4 of the RTMP is the implementation phase where RTMP participants continue to implement and upgrade monitoring sites, improve real-time data access and dissemination, and encourage innovative salt management practices. Other

implementation phase activities have included provision of the WARMF model database to CV-SALTS consultants developing the CV-SWAT model – the model of choice for future salinity management in the Central Valley. Ongoing interaction with the CV-SALTS technical team and involvement through the CV-SALTS Executive Committee has contributed greatly to progress of the modeling effort. Phase 4 marked the completion of the implementation phases. The post implementation phase, or Maintenance Phase, continues from December 2025 and onward. Tasks in this phase include stakeholder engagement and optimization. Interaction and involvement with the CV-SALTS teams will follow through. Optimization of forecast models will be focused on enhancing real-time data access capabilities and Artificial Intelligence / Machine Learning (AI/ML) enabled modeling technologies.

Summary of ongoing implementation phase activities

Implementation activities include actions that are aimed at more widespread adoption of RTMP practices and better cooperation and coordination among interested parties. These activities include an institutional component to secure long-term funding and technical expertise to ensure continued success of the RTMP.

Goal 1: Continue to implement/upgrade monitoring and data networks and to support real-time management practices. Use salt load assimilative capacity forecasting to coordinate the timing of discharges to the river.

An effective RTMP requires timely telemetry of real-time data to allow forecasting of flow and EC and the estimation of salt load assimilative capacity. This has been accomplished with networks of flow and salinity sensors along the main stem of the SJR and at diversion points, drains and small streams discharging to the SJR. These sensor networks should allow easy access to data, promote data sharing through features such as web-based data dashboards, and provide a mechanism for automated retrieval for use in forecasting models. Ancillary information of scheduled releases from reservoirs that discharge into tributaries to the SJR. Real-time quality assurance is essential to avoid posting erroneous data and to encourage data sharing.

- Reclamation has continued to provide funding and technical support to GWD for the continued development of its RTMP. GWD operates approximately 25 real-time web-based flow and water quality monitoring stations. With the help of additional grant funding through Proposition 84 (that concluded in December 2024), GWD has maintained and in some cases being able to upgrade their sensor network with state-of-the-art instrumentation. GWD and SJVDA both use HydroMetCloud Data Services for data telemetry and real-time data access available through OTT HydroMet. Real-time data access has proven useful to both entities for checking sensor readings prior to regular data quality assurance site visits and efficiently scheduling site troubleshooting.
- Real-time data for the GWD and SJVDA projects can be publicly accessed on the HydroMetCloud web portals as follows:

- For GWD: <http://hydrometcloud.com/>
User: RTWQ@gwdwater
Password: Grassland
- For SJVDA: <http://hydrometcloud.com/>
User: sjvda-RTM
Password: Realtime-2020
- Reclamation continues to support web access to San Joaquin River flow and EC at the three compliance monitoring sites – Crows Landing, Maze Road Bridge and Vernalis. This web portal for flow and EC forecasts was upgraded to allow easy access from smartphones by entering “Reclamation PTMS” in a web search command. A reminder about this web application is provided during ongoing quarterly MAA oversight meetings.

Goal 2: Continue to address long-term funding and project needs.

Reclamation and the SJVDA have continued to seek grant opportunities during 2024/2025 to support the Real-Time program and support participation in CV-SALTS stakeholder-led modeling- activities. A Reclamation proposal to the internal Reclamation Applied Science Program entitled “Determining Salt Accumulation in the San Joaquin River Improvement Project (SJRIIP) using HYDRUS 1D” has been awarded funding. This project applies HYDRUS 1D, a well-established vadose zone solute transport model, to provide a physics-based characterization of the salt accumulation within the agricultural stakeholder-owned SJRIIP facility. The project is aimed to characterize salt accumulation and flow within the soil to understand the long-term sustainability of the salt disposal facility. This project is expected to provide major benefits to the current regional salinity modeling effort within CV-SALTS that is using the SJRIIP facility as an archetype for subsurface drainage reuse within the Central Valley. The current CV-SWAT model provides a very crude simulation of salinity dynamics within the crop vadose zone. The more physics-based simulations possible using the HYDRUS-1D (and possibly HYDRUS-3D) model will provide an important validation check on the CV-SALTS modeling approach.

Reclamation has submitted an additional grant application for 2026 with the Reclamation Applied Science Program for the development of a prototype flow and EC forecasting model using readily accessible AI/ML tools and toolboxes. The WARMF model for the San Joaquin River was developed in 2004/2005 as a means of simulating phytoplankton growth and decay in the lower San Joaquin River and exploring options for elimination of low dissolved oxygen episodes as the River transitioned to the Delta via the Stockton Deep Water Ship Channel. The San Joaquin WARMF model took advantage of the State Board’s San Joaquin River Input-Output (SJRIO) model to optimize the timeliness of model development. For the current task of flow and EC forecasting at the three compliance monitoring stations of the SJR the current WARMF model is more complex than is needed – the WARMF model is a comprehensive watershed water quality simulation tool requiring significant watershed data and is computationally time consuming. A more transparent, simpler model that can take advantage of the more readily available data resources assimilated during the past 20 years, is the main goal of this new San Joaquin model initiative.

Reclamation intends to continue to seek other grants and funding opportunities together with partners in the GWD and the SJVDA.

Goal 3: Expand real-time management program membership to include all regulated parties, including both direct and indirect dischargers of salt to the San Joaquin River.

The RTMP has been successful in obtaining data from most entities in the SJR Basin that directly discharge salt loads to the SJR. Grant funding over the past decade has supported flow and salinity load monitoring from several agricultural drainage monitoring stations on the west side of the basin and from seasonally managed wetlands. Reclamation has provided resources to support the development of the real-time monitoring networks in GWD.

- Reclamation continues to support the network of real-time flow and water quality monitoring stations that provide flow and EC data at major GWD inlets and outlets as well as along the water distribution network.
- Reclamation funding for the GBP was \$970,000 in FY 2025,⁴ including \$246,250 to the U.S. Geological Survey (USGS) to monitor five stations on the SJR and tributary sloughs.
- Reclamation has provided funding for flow monitoring upgrades to the Mud and Salt Slough stations with the installation of SONTEK acoustic doppler sensors. The use of these instruments will help to eliminate flow estimation errors associated with occasional backwater conditions where a high river stage impedes tributary inflow and leads to unrealistic elevated flows. Reclamation has worked with DWR (Fresno) to improve flow and water quality monitoring at the Maze Road Bridge site. Prior monitoring issues have been largely resolved and the Maze Road Bridge site was substantially upgraded during 2025.

Goal 4: Continue technical improvements to data processing, quality assurance, and the SJR assimilative capacity forecast modeling.

Reclamation has continued to investigate further automation of data acquisition to reduce the data processing steps needed for WARMF model forecasts and simplifying the WARMF GUI to encourage wider use of the model. The WARMF model relies on a very large array of both publicly accessible and more restricted data to reliably perform weekly forecasts of flow and EC. The PTMS has been effective at helping to coordinate real-time monitoring of west-side flow and EC drainage monitoring stations together with major river diversions into Patterson and West Stanislaus Irrigation Districts and monitoring of eastside operational spills and drainage from Turlock and Modesto Irrigation Districts. Reclamation's PTMS modelers have affirmed the critical need for these data to produce accurate forecasts of EC at the three compliance monitoring stations along the San Joaquin River and estimate river salt load assimilative capacity at Crows Landing, Maze

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Road Bridge and Vernalis. Estimates of salt load assimilative capacity provide stakeholders with the decision support information they need to manage salinity in the contributing watersheds to the San Joaquin River and meet salinity objectives.

During 2025 the CV-SALTS salinity modeling team that has chosen to use the CV-SWAT model to identify salinity management zones and best management practices in the San Joaquin Basin (and the rest of the Central Valley) was provided access to the WARMF model database. Final reports and associated data from both the SJVDA and GWD Proposition 84 projects were supplied to the CV-SALTS modeling team. Although the WARMF model is a more comprehensive model of the San Joaquin River Basin and has a much larger, quality controlled database the CV-SALTS modeling team's purview is the entire Central Valley and the consultants already had familiarity and experience with the SWAT model. Reclamation continues to attend meetings of the CV-SALTS Executive Committee and technical sub-groups which has provided an opportunity to validate CV-SWAT modeling results. This activity will continue into 2026.

Real-time data quality assurance for forecasting

Data quality assurance has always been a major constraint to implementation of the RTMP. Participants are reluctant to share erroneous data for potential liability reasons. Poor data quality assurance also has potential to diminish public trust in the data and participants' willingness to utilize the data and the forecast model results for decision support. In 2023 the USACE HEC-DSSVue platform was used in the development of a linked software product to perform real-time data quality assurance of imported data from GWD and SJVDA sites. The HEC-DSSVue software package is well documented and accommodates customized Python scripts developed to screen and process raw data and perform routines such as correcting errors, and filling data gaps to produce reliable daily mean flow and EC data files for direct import to the WARMF model.

Central Valley Project Deliveries Load Calculation

The CVP delivers water to both the Grassland and Northwest subareas, as described in the Basin Plan, through the DMC, the San Luis Canal, and the San Joaquin River/Mendota Pool. Most CVP water is pumped from the Delta into the DMC through the Jones Pumping Plant located near Tracy, California. CVP water is conveyed south to DMC Check 13 near Santa Nella, California, where water is either mixed with the State Water Project in O'Neill Forebay and then either pumped into San Luis Reservoir for later delivery, or conveyed further south to the DMC terminus at the Mendota Pool. During periods of drought, groundwater and river water are pumped into the DMC at several locations. The calculation methods used in this report are provisional, and some elements in this report do not include estimations of benefits at this time. Reclamation submitted the *Compliance Monitoring and Evaluation Plan* (Reclamation 2010), which outlines the criteria and methodology for determining DMC loads and credits, to the CV Water Board.

Quantification Methodology: The monthly amount of CVP water supply delivered to each district is prorated according to the area of each district within either the Grassland subarea, Northwest subarea, or outside of these subareas. The monthly mean salinity of CVP water is calculated from average daily measurements taken at three locations along the DMC. The salinity of CVP water delivered to each district is associated with the salinity monitoring site closest to the district's turnout along the DMC.

The Basin Plan allocates a salt load to Reclamation for water delivered to the Grassland and Northwest subareas. This background load allocation is calculated according to Table IV-8 as shown in the following equation:

$$LA_{DMC} = Q_{DMC} \times 52 \text{ mg/L} \times 0.00136$$

Where:

LA_{DMC} = load allocation of salts, in tons

Q_{DMC} = monthly amount of CVP water delivered to Grassland and Northwest subareas, in acre-feet

52 mg/L = "background" salinity of water in the San Joaquin River released at Friant Dam (per the Basin Plan) measured as total dissolved solids (TDS)

0.00136 = factor for converting units into tons

Actual DMC salt loads are calculated by the following equation:

$$L_{DMC} = Q_{DMC} \times C_{DMC} \times 0.00136$$

Where:

L_{DMC} = actual DMC load, in tons

Q_{DMC} = monthly amount of water delivered to Grassland and Northwest Subareas, in acre-feet

C_{DMC} = monthly average of salinity of the water delivered to Grassland and Northwest subareas, in mg/L TDS

0.00136 = factor for converting units into tons

Each subarea's Q_{DMC} is calculated and then paired with the associated monthly average TDS for that reach, so the equation becomes:

$$L_{DMC} = 0.00136 * \sum (Q_{DMC} * C_{DMC}) \text{ Subareas}$$

This equation is then broken into calculations for each subarea based on the source of CVP water. Table 4 lists the salt loads of CVP water delivered to the Grassland and Northwest subareas and an estimate of the salts delivered in excess of the monthly load allocation.

Table 4. Calculation of DMC Allocations and Loads

Water Year	Water Year Type	Grasslands Subarea – SJR and Mendota Pool Salt Load from CVP (Thousand Tons)	Grasslands Subarea – DMC Salt Load from CVP (Thousand Tons)	Grasslands Subarea – San Luis and Cross Valley Canal Salt Load from CVP (Thousand Tons)	Grasslands Subarea – Total Flow (Thousand Acre-Feet)	Grasslands Subarea – Load Allocation (Thousand Tons)	Grasslands Subarea – Actual Load – Load Allocation (Thousand Tons)	Northwest Subarea – SJR and Mendota Pool Salt Load from CVP (Thousand Tons)	Northwest Subarea – DMC Salt Load from CVP (Thousand Tons)	Northwest Subarea - Total Flow (Thousand Acre-Feet)	Northwest Subarea – Load Allocation (Thousand Tons)	Northwest Subarea – Actual Load - Load Allocation (Thousand Tons)	Total – Total Excess Load from CVP Deliveries (Thousand Tons)
2018	Below Normal	220	118	42	1112	79	300	17	19	115	8	27	328
2019	Wet	167	76	28	1023	72	198	12	12	110	8	16	215
2020	Dry	225	100	40	1006	71	294	18	20	111	7	30	324
2021	Critical	266	105	44	778	55	361	20	29	96	7	42	403
2022	Critical	269	90	45	892	63	343	22	20	97	7	34	377
2023	Wet	145	70	21	909	64	173	11	58	306	22	48	221
2024	Above Normal	164	73	25	952	67	196	13	20	139	10	24	219
2025	Below Normal	179	83	29	1017	72	220	13	25	145	10	28	248

Report of Annual Work Plan Activity Performance

Reclamation has met schedule milestones for the MAA and performance of actions for assisting interested parties in managing salt loads and offsetting the DMC salt load into the SJR. New Melones Reservoir continues to be operated in accordance with D-1641.

During 2025, Reclamation continued to support the development and use of the WARMF-based 14-day forecasts for EC and discharge. The following tasks were planned for FY 2025 and FY 2026:

1. **Automated Data Quality Control and Seepage Loss Simulation**

Real-time data quality assurance is critical for the collected data's credibility to stakeholders and the proper function of the WARMF model, but most of the data is not subjected to quality assessment and must often be corrected by hand to prevent model errors. The California Data Exchange Center in particular has issues with quality control: missing data is sometimes entered as a zero value and sometimes reported values are nonzero but do not make sense.

Seepage loss is a key component in the water and salt balance of the San Joaquin River. The amount of seepage loss is highly variable and is currently estimated for the recent past in the self-calibration step of forecasting. The seepage loss for the two-week forecast period is currently extrapolated from past seepage loss.

Systech Water Resources Inc. discontinued work on the following two WARMF forecasting improvement tasks after the contract was canceled in February 2025: (1) performing real-time QA/QC of monitored flow and EC data at the Crows Landing, Maze Road Bridge, and Vernalis stations, and (2) enhancing groundwater simulation to improve predictions of riverbed seepage loss, and

2. **Automated retrieval of GWD data and input to WARMF**

There are eight boundary inflow points along the San Joaquin River for which the flow and EC must be specified: Stanislaus River at Ripon, Tuolumne River at Modesto, Merced River near Stevinson, San Joaquin River near Stevinson, Salt Slough at Highway 165, Mud Slough near Gustine, Los Banos Creek at Highway 140, and Del Puerto Creek at Vineyard. USGS and DWR operate and maintain all of these sites, and real-time (preliminary) data is supplied from all of these sites to the California Data Exchange (CDEC). The Mud Slough (Gustine) station operated by USGS is upstream of the Los Banos Creek confluence with Mud Slough. The Los Banos Creek monitoring station at Highway 140, operated by GWD, occasionally records flows in excess of 100cfs and this tributary can be an important source of salt load to the River. The Los Banos Creek flow and EC data can be downloaded manually from the Hydromet Cloud web portal. However, the time required for routine processing of these data makes use of this interface for real-time forecasting impractical. Using daily or monthly average flow and EC estimates for Los Banos Creek introduces potential error to the forecasting process, especially during the winter and spring months when flow is greatest. Reclamation made arrangements with HydroMet, the vendor responsible for the HydroMetCloud web portal, to have data files posted hourly to a special HydroMetCloud directory from which the data could be automatically downloaded. The utility which automatically downloads and processes data for WARMF forecasting was then expanded to

collect and process GWD’s real-time flow and EC data from 2024 for Los Banos Creek at Highway 140 for import into WARMF.

Figures 6 and 7 illustrate the impact of incorporating real-time data into WARMF forecasts. The dark red line shows the average measured salt load from Los Banos Creek for 2005–2024. The black dashed line represents the measured salt load for 2024 (Figure 6) and 2025 (Figure 7). Deviations from the historical average, previously used in WARMF forecasts, vary by year. In spring 2024, the salt load was substantially higher than the average. In contrast, 2025 began with below-average salt loads prior to March, followed by significantly above-average values in March, October, and November. An added benefit of using stakeholder-provided data is increased confidence in WARMF model forecasts of salinity and salt load assimilative capacity in the SJR.

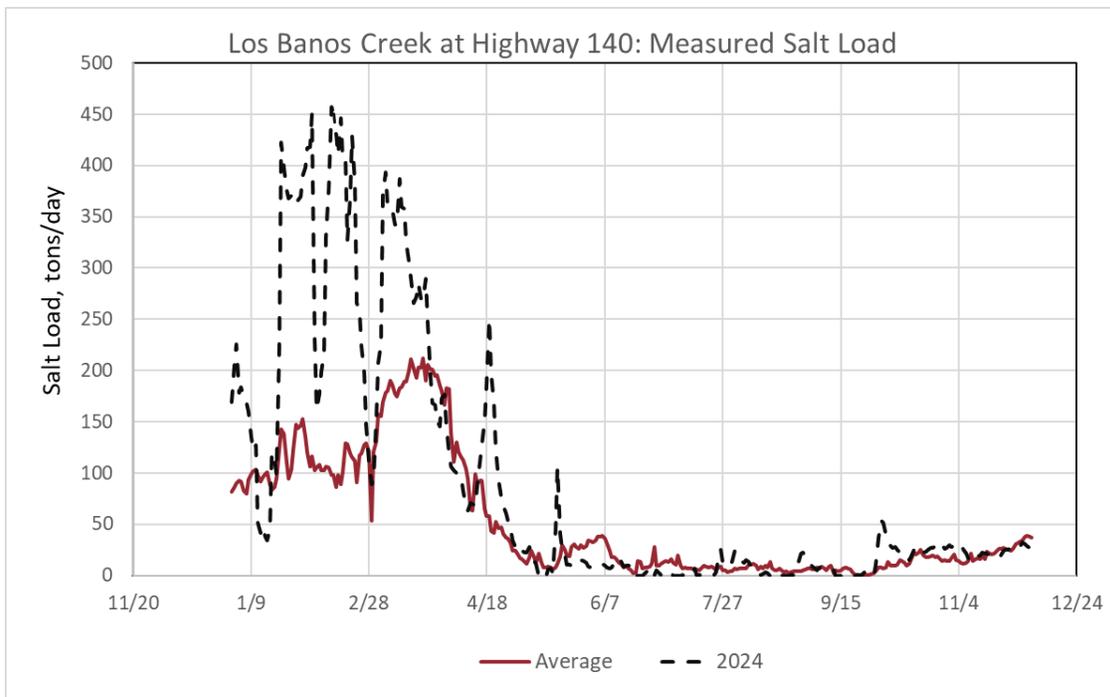


Figure 6. The measured salt load from Los Banos Creek in 2024 vs. averaged salt load over 2005-2024

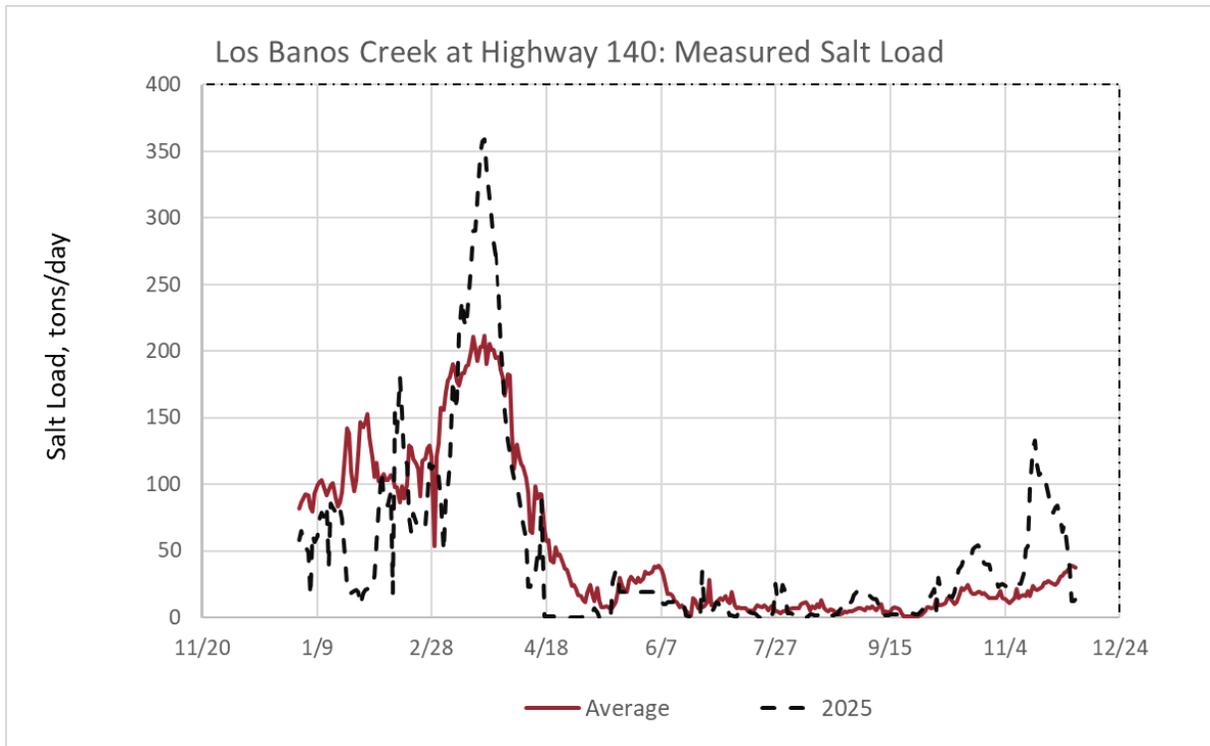


Figure 7. The measured salt load from Los Banos Creek in 2025 vs. averaged salt load over 2005-2024

The Salt and Boron Control Program states that “Participation in a Regional Water Board approved real-time management program and attainment of salinity and boron water quality objectives will constitute compliance with this control program.” Figure 8 shows that Reclamation has maintained annual compliance with the salinity WQO at Vernalis during Water Year 2025.

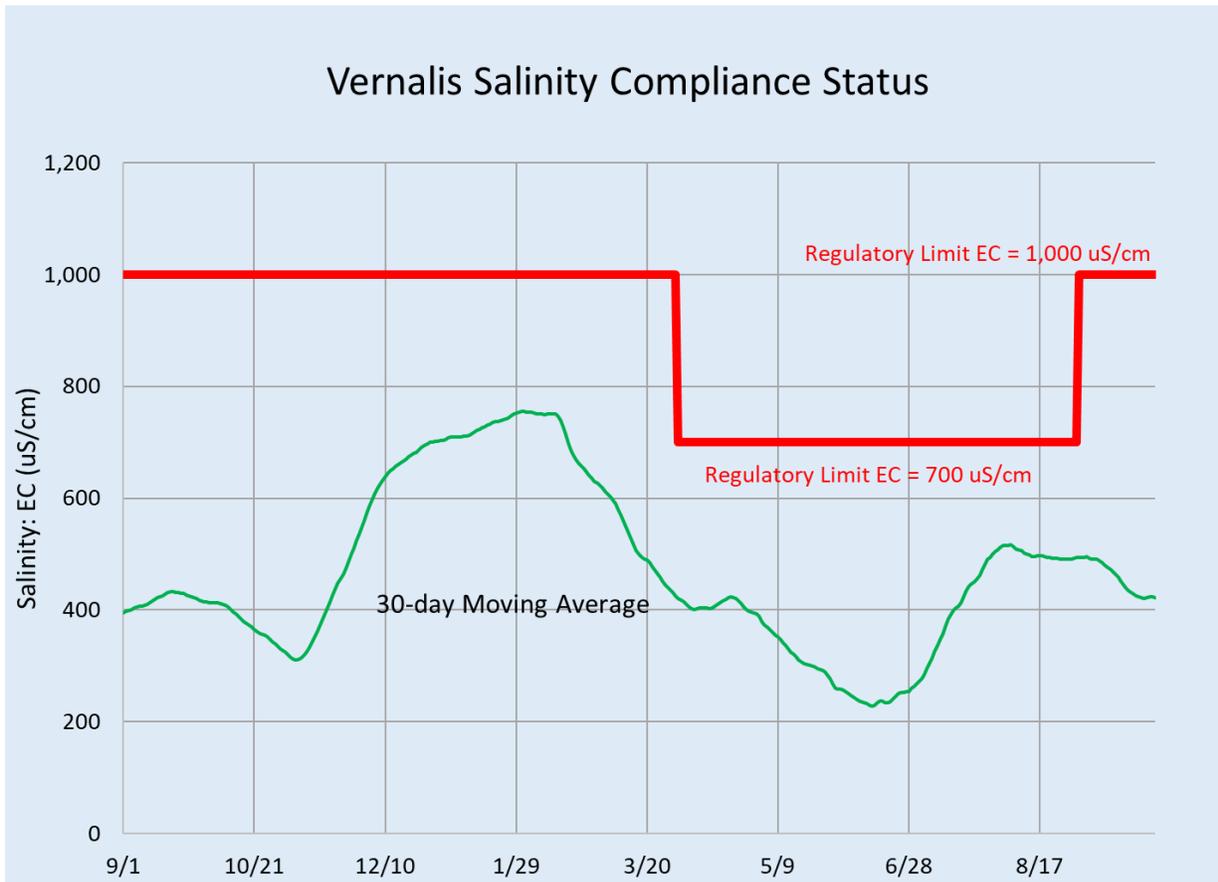


Figure 8. Water Year 2025 Compliance with the Salinity WQO at Vernalis

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