



— BUREAU OF —
RECLAMATION

Calendar Year 2019 Report to the Pecos River Commission

Interior Region 7: Upper Colorado Basin



Mission Statements

The Department of the Interior (DOI) conserves and manages the Nation's natural resources and cultural heritage for the benefit and enjoyment of the American people, provides scientific and other information about natural resources and natural hazards to address societal challenges and create opportunities for the American people, and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities to help them prosper.

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.

Calendar Year 2019 Report to the Pecos River Commission

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List of Acronyms and Abbreviations

AAM.....	Annual Accounting Method
AAO	Albuquerque Area Office
ac-ft.....	acre-feet
ACAP	Area-Capacity
ADVM.....	acoustic doppler velocity meter
ASEI.....	Annual Security Equipment Inventory
ASI.....	Annual Site Inspection
BO	Biological Opinion

BLM	Bureau of Land Management
BLNWR.....	Bitter Lakes National Wildlife Refuge
cfs.....	cubic feet per second
CID.....	Carlsbad Irrigation District
CPWA	Carlsbad Project Water Acquisition
CWMP	Cooperative Watershed Management Program
DOI.....	Department of the Interior
EA.....	Environmental Assessment
ESA	Endangered Species Act
FCP.....	Fish Conservation Pool
FEIS	Final Environmental Impact Statement
FSID.....	Fort Sumner Irrigation District
FY	Fiscal Year
GSWCD.....	Guadalupe Soil and Water Conservation District
NAVD	North American Vertical Datum
NCAR	National Center for Atmospheric Research
NGVD	National Geodetic Vertical Datum
NMISC.....	New Mexico Interstate Stream Commission
NMOSE.....	New Mexico Office of the State Engineer
NRCS	Natural Resources Conservation Service
NREL.....	National Renewable Energy Laboratory
O&M.....	Operation and Maintenance
PCR	Polymerase Chain Reaction
PROM.....	Pecos River Operations Model
PVACD	Pecos Valley Artesian Conservancy District
RO&M.....	Review of Operations and Maintenance
ROD.....	Record of Decision
S&T	Science and Technology
SOP	Standing Operating Procedures
STAR.....	Security Tailored Assessment Report
SWEP	Small-scale water efficiency projects
USFWS	United States Fish and Wildlife Service
USGS.....	United States Geological Survey
VCP	Vaughan Conservation Pipeline
WCFSP	Water Conservation Field Services Program
WEEG	WaterSMART Water and Energy Efficiency Grants
WWRA.....	West-Wide Risk Assessment

Introduction

The Albuquerque Area Office (AAO) of the Bureau of Reclamation (Reclamation) has oversight responsibilities for three projects on the Pecos River (Pecos). These projects are the Carlsbad Project, which includes Sumner, Brantley, and Avalon Dams; the Pecos River Basin Water Salvage Project; and the Fort Sumner Project, which includes the Fort Sumner Diversion Dam. Figure 1 depicts the general location of the Projects on the Pecos.

Reclamation's Annual Report to the Pecos River Compact Commissioners conveys all required reporting information on the three projects mentioned above. It also informs the Commission of proposed changes in programs, management activities, and strategies that may affect operations, operating conditions, and/or the Compact, including Endangered Species Act (ESA) issues.

An agreement between Reclamation and Carlsbad Irrigation District (CID), finalized on October 2, 1989, provides for CID to operate and maintain Sumner, Brantley, and Avalon Dams, and the Pecos River Water Salvage Project. Reclamation continues to be responsible for assuring that this work is accomplished in compliance with all applicable agreements, contracts, regulations, compacts, and related laws.

The Pecos River Water Salvage Project has not been funded since Fiscal Year (FY) 2012. Funding is not anticipated in the near future. It will not be discussed further in this report.

The gage data used within this report were downloaded from the United States Geological Survey's (USGS) web page at: <https://waterdata.usgs.gov/nm/nwis/current/?type=flow>. All 2019 data presented or used in this report has been approved. Reclamation receives provisional reservoir elevation and weather data from CID on a monthly basis.

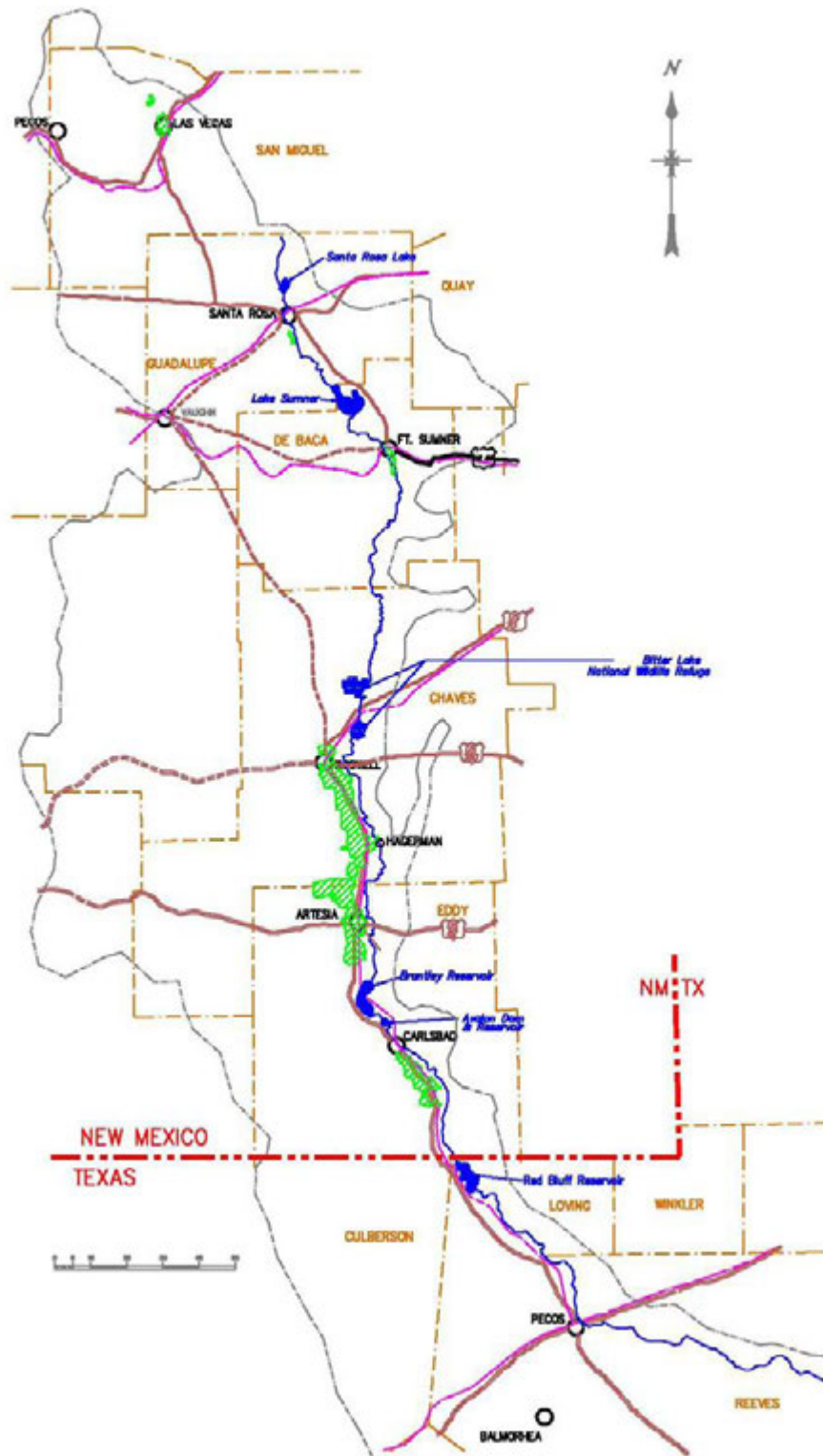


Figure 1: Map of Reclamation Projects on the Pecos

Carlsbad Project Operations

Reservoir Storage Entitlements

All Carlsbad Project reservoirs are operated in accordance with the requirements of the Pecos River Compact and U.S. Army Corps of Engineers’ (USACE) flood control criteria. Figure 1 on page 6 depicts the location of the Carlsbad Project storage dams on the Pecos River. Operation of the dams on the Pecos is a joint effort between Reclamation, the Carlsbad Irrigation District (CID), and USACE, in coordination with the Fort Sumner Irrigation District (FSID) and the State of New Mexico.

Reclamation calculated annual total conservation storage entitlements for the four Pecos River reservoirs within New Mexico (Santa Rosa, Sumner, Brantley, and Avalon). Table 1 presents the calendar year 2019 storage entitlements for these Reservoirs. Note that the Avalon elevation references a project datum.

Carlsbad Project conservation storage in the Pecos reservoirs began the year on January 1, 2019, at 61 percent of entitlement. Santa Rosa, Sumner¹, Brantley, and Avalon Reservoirs were at approximately 53, 51, 70, and 0 percent, respectively. On December 31, 2019, the total storage in the reservoirs was 49 percent of entitlement. Santa Rosa, Sumner, Brantley, and Avalon Reservoirs were at approximately 26, 39, 99, and 0 percent, respectively.

Table 1: Pecos River Reservoir Storage Entitlements for 2019

Reservoir	Entitlement Storage (ac-ft)	Minimum Pool (ac-ft)	Total Estimated Sediment Accumulation (ac-ft)	Total Conservation Storage (ac-ft)	Conservation Elevation (feet)
Santa Rosa	100,020	0	559	100,579	4,749.55 (NAVD88)
Sumner	32,614	2,500	803	35,917	4,260.88 (NAVD88)
Brantley	40,000	2,000	513	42,513	3,256.27 (NAVD88)
Avalon	3,866	600	0	4,466	3,117.40 (USBR)
TOTAL	176,500		1,875	183,475	

The Natural Resources Conservation Service’s (NRCS) May 1, 2019, most probable streamflow forecast for March through July, predicted 80,000 acre-feet (ac-ft) of inflow into Santa Rosa Reservoir, or 143 percent of the 30-year median kept by the NRCS. Observed March through July inflow to Santa Rosa Reservoir was 62,676 ac-ft as measured at the USGS’ Above Santa Rosa gage, or 112 percent of the 30-year average of 56,000 ac-ft.

Surveys at Avalon Reservoir have shown there has been little to no loss of volume since 1979. Brantley Dam is immediately upstream and has an estimated trap efficiency of 90%. Therefore,

¹ During the winter months, Sumner is permitted to store an additional 20,000 ac-ft above the entitlement storage as long as the total entitlement storage is not exceeded in all four reservoirs.

unless a future survey shows volume lost in Avalon due to sediment, Avalon’s conservation storage will remain the same and is not discussed further in this section.

Santa Rosa Reservoir Sediment Accumulation

USACE completed a sediment resurvey in 2015 and applied the results on January 1, 2017. Because of the new sediment survey, there was no sediment accumulation in Santa Rosa Reservoir in 2016 (Table 2). Estimated sediment accumulation in 2017 was 449 ac-ft, and in 2018 was 110 ac-ft.

Table 2: Estimated Sediment Accumulation for 2019 Santa Rosa Storage Entitlement

Calendar Year	Sediment Accumulation (ac-ft)
2016	0
2017	449
2018	110
Total	559

Lake Sumner Sediment Accumulation

The basis of the estimated sediment accumulation calculations for Lake Sumner is the ratio of total sediment deposition to total inflow during the period between the May 2001 and April 2013 sediment surveys. Inflow to Sumner is measured at the USGS gage, Pecos River near Puerto de Luna, NM. The total sediment deposition during this period was the difference in the content between the 2001 and 2013 surveys at the top of the conservation pool, elevation 4,262.88 feet (NAVD 88 vertical datum; 4,261.00 feet referencing project vertical datum). In 2012, at the request of CID, Reclamation reduced the maximum conservation pool elevation in Sumner by 2.11 feet to 4,260.88 feet (NAVD 88).

The total sediment deposition divided by the total inflow gives an average ratio of sediment deposition to inflow during this period. To estimate sediment deposition in a given period, calendar year inflow is multiplied by this ratio. Table 3 shows an annual tabulation of the inflow and estimated sediment accumulation since April 2013. The estimated cumulative sediment deposition since the 2013 sediment survey was 803 ac-ft.

Table 3: Estimated Sediment Accumulation for 2019 Sumner Storage Entitlement

Calendar Year	Inflow (ac-ft)	Sediment Accumulation (ac-ft)
4/2013 - 12/2013	74,640	96
2014	121,581	156
2015	108,299	139
2016	128,384	155
2017	102,480	131
2018	98,030	126
Total		803

Brantley Reservoir Sediment Accumulation

The basis of the estimated sediment accumulation calculations for Brantley is the ratio of total sediment deposition to total inflow during the period between the May 2001 and March 2013 sediment surveys. Inflow to Brantley is measured at the USGS gage, Pecos River near Lakewood, NM (Kaiser Channel). The total sediment deposition during this period was the difference in the content between the 2001 and 2013 surveys at the top of the designated conservation pool, elevation 3,272.6 feet (NAVD 88 vertical datum; 3,271.00 feet referencing NGVD 29). Total sediment

deposition divided by the total inflow yields an average ratio of sediment deposition to inflow during this period.

Annual sediment deposition since the 2013 survey is estimated through multiplying this ratio by the calendar year inflow. Table 4 shows estimated inflow and sediment accumulation since April 1, 2013. The estimated sediment deposition since the last sediment survey was 513 ac-ft.

Table 4: Estimated Sediment Accumulation for 2019 Brantley Storage Entitlement

Calendar Year	Inflow (ac-ft)	Sediment Accumulation (ac-ft)
4/2013 - 12/2013	74,801	57
2014	183,316	139
2015	132,404	100
2016	102,309	78
2017	98,605	75
2018	84,345	64
Total		513

Reservoir Data

Prior to 2016, Reclamation used reservoir data – elevation, storage, weather, and evaporation – received from CID. Reclamation stopped using most of the data that CID collects and records manually and now primarily uses data collected and transmitted electronically. Use of data maintained in this advanced and more accurate manner is standard operating procedure at the majority of Federal reservoirs. All storage and flow data used in this report for the three Reclamation-owned reservoirs are from electronic instrumentation maintained by the USGS.

First of the year elevation and storage are the midnight values on December 31 of the previous year. Unless otherwise specified, other elevations are the daily elevation, recorded at midnight of the date listed, and daily storage values correspond to that end-of-day elevation. Reclamation continues to use weather and pan evaporation data collected and recorded by the CID’s dam tenders, typically at about 8 am daily.

Sumner Dam and Lake

Sumner Dam Operations

Note: All elevations reference the North American Vertical Datum of 1988 (NAVD 88).

Operations at Sumner Dam (Sumner) store available natural inflow as long as bypass is not required. Bypass may be required either to meet the 35 cubic feet per second (cfs) target at the USGS’ Pecos River below Taiban Creek near Fort Sumner gage, or to maintain continuous flow in the river. A flow of 5 cfs or greater at the Pecos River near Acme gage is considered an indication of continuous river flow. The targeted flows are required by the *Final Biological Opinion for the Carlsbad Project Water Operations and Water Supply Conservation, 2016-2026* (2017 BO; Consultation Number 02WNNM00-2016-F-0506), implemented in December 2017 for the Pecos Bluntnose Shiner (shiner) and the Interior Least Tern (tern).

Natural inflow may be bypassed at any time outside of irrigation season. During irrigation season, the New Mexico Office of the State Engineer (NMOSE) calculates Fort Sumner Irrigation District's (FSID) two-week allotment from the estimated natural inflow to Sumner Reservoir over the previous two weeks. Bypass is only available during irrigation season when the estimated natural inflow, as calculated by the NMOSE, exceeds FSID's maximum direct diversion water right of 100 cfs.

All other inflow into Sumner is considered Carlsbad Project water. Stored Project water is released as a block at CID's discretion and in consultation with Reclamation. The duration of block releases from Sumner is restricted to a maximum of 15 contiguous days. The cumulative annual duration of all block releases is restricted to a maximum of 65 days, not including flood operations, and scheduled block releases should have a minimum of 14 days between releases. These restrictions are in accordance with the 2017 BO.

When possible, CID schedules block releases in cooperation with Reclamation to alleviate river intermittency. Reclamation directs the CID dam tender on releases from Sumner to maintain compliance with the 2017 BO. CID is responsible for all maintenance activities at the dam. This operating procedure does not alter the normal operations of Avalon and Brantley Dams for delivering water to CID.

From November 1 to April 30, under a water right permit granted by the NMOSE, the Carlsbad Project is permitted to store up to 20,000 ac-ft above its storage entitlement in Sumner, provided that the entitlement storage of all four reservoirs on the Pecos in New Mexico does not exceed 176,500 ac-ft. CID is required to evacuate the winter storage held above its storage entitlement by May 1.

Sumner began 2019 with 28,597 ac-ft (4,257.62 feet) in total storage. Total storage reached a maximum on March 1, 2019, at 33,819 ac-ft (4,260.00 feet). Sumner's minimum storage occurred on October 30 and 31 at 13,710 ac-ft (4,248.51 feet). Figure 2 depicts Sumner's total storage and releases.

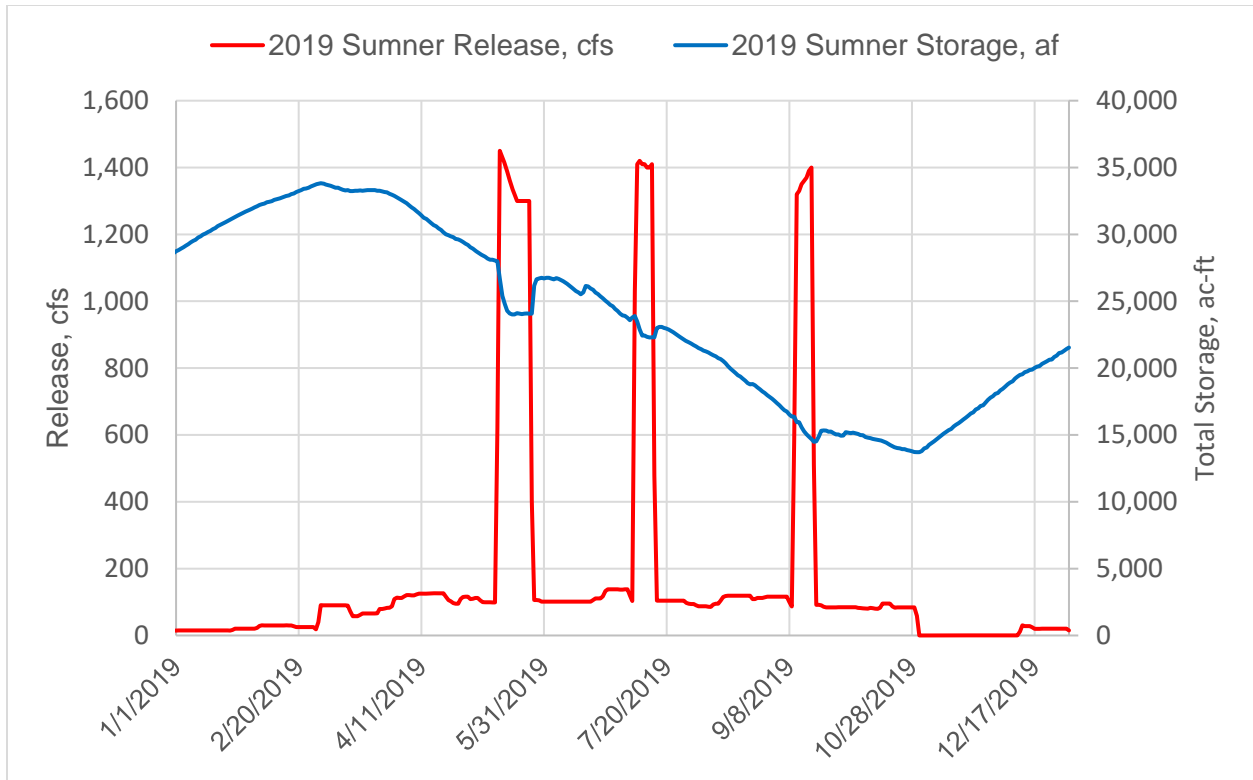


Figure 2: 2019 Storage and Release for Sumner Dam

FSID was in the last year of a forbearance contract with Reclamation under which they may forbear up to 2,500 ac-ft per year. Forbearance storage for 2019 began on February 13. FSID called for their full two-week allotment on February 28, with 561 ac-ft remaining to forbear. By March 25, the full volume of 2,500 ac-ft had been stored. USGS-approved data has since changed the Sumner release slightly, such that it would now show 2,513 ac-ft were forborne.

There were three block releases made this irrigation season (Figure 2). The first block release from Santa Rosa and Sumner began on May 13 and ended on May 27, at average release rates from Santa Rosa of 1,250 cfs, and from Sumner of 1,235 cfs. The total release for CID from Santa Rosa was 37,177 ac-ft and 33,976 ac-ft from Sumner. An additional 2,912 ac-ft was released from Sumner for FSID during this period.

The second block release began on July 7 from Santa Rosa Dam, and July 8 from Lake Sumner, at an average release rate from Sumner of 1,263 cfs for a total CID release of 21,653 ac-ft. The volume of the Santa Rosa release retained in Sumner was 1,817 ac-ft. An additional 986 ac-ft were released from Sumner for FSID.

The third block release began on September 10 from Santa Rosa and September 11 from Sumner, with an average release rate from Sumner of 1,180 cfs. The release from Santa Rosa was stopped on September 18 and from Sumner on September 19, which was earlier than planned due to abundant precipitation in the Pecos Basin. The CID release was 19,466 ac-ft, with an additional 1,737 ac-ft released for FSID. The volume of the Santa Rosa release retained in Sumner was 655 ac-ft.

As stated above, Reclamation acquired 2,500 ac-ft of forbearance water in 2019 through a contract between the United States and FSID (Contract No. 08-WC-40-292; *Forbearance of Exercising Priority Water Rights*), which expired at the end of 2019. On December 23, 2019, Reclamation and FSID signed a new contract (Contract No. 19-WC-40-756; *Forbearance of Exercising Priority Water Rights and Making Water Available to Reclamation for ESA Storage*) for yearly forbearance of up to 3,500 ac-ft. The forbearance is stored in Sumner to provide releases for target flows at the Taiban gage and to avoid river intermittency. This water was stored and released under the Carlsbad Project Water Supply Management Agreement between the United States and CID. Reclamation also pumped 469 ac-ft of water into Brantley Reservoir from April 3 through May 24 to acquire the 626 ac-ft Fish Conservation Pool (FCP) in Sumner.

Releases of forbearance water began on August 8 with the last release on December 12, 2019. Forbearance releases were needed intermittently during the irrigation season between August and December at an average rate of 20 cfs. During calendar year 2019, 1,580 ac-ft were released and 933 ac-ft reverted to Project Storage.

During the non-irrigation season, 1,635 ac-ft was bypassed to meet target flows and to avoid river intermittency. Flow was bypassed between January 1 and February 12 at an average rate of 19 cfs. FSID's allotment reached the maximum of 100 cfs for 112 days in 2019, which allowed bypass of 2,145 ac-ft during irrigation season. The forbearance and FCP water that remained in storage in Sumner at the end of the irrigation season on October 31 provided flow below Sumner from that date to the end of 2019, and no water was bypassed during that time. Reclamation released 23 ac-ft of FCP, and 794 ac-ft of forbearance between December 12 and December 31. The remaining 933 ac-ft of forbearance reverted to Project storage on December 31, 2019, which was the total supplemental water returned to Project storage in 2019.

Sumner Dam Facility Review and Safety of Dams Programs

At the beginning of 2019 there was one incomplete Category 1 Operation and Maintenance (O&M) recommendation, which is related to rehabilitation of the three radial gates. Category 1 O&M recommendations are intended to correct severe deficiencies where immediate action is required to ensure structural safety and operational integrity of a facility. Also, at the beginning of 2019, there were 20 incomplete Category 2 O&M recommendations. Category 2 O&M recommendations indicate that action is needed to prevent or reduce further damage or preclude possible operational failure of a facility.

In 2019, the Carlsbad Irrigation District (CID) completed five Category 2 O&M recommendations. Of the 15 remaining incomplete Category 2 O&M recommendations, two are scheduled to be completed by CID in 2020, five are related to the replacement or repair of the radial gates and associated concrete and are scheduled for completion in FY 2022, and the remaining eight are related to updating the Standing Operating Procedures (SOP), which is scheduled to be completed in FY 2021. There were no new Category 1 or Category 2 O&M recommendations in 2019.

The radial gates at Sumner Dam need repair and rehabilitation. CID and Reclamation are working together to plan the repairs and will be cost sharing the work. Reclamation is evaluating options for repair or replacement of the gates and may contract out repairs to expedite the work. The plan for completion, costs, and repayment of the radial gate rehabilitation will be submitted to the CID board in 2020, with construction planned to start in 2022.

The last Comprehensive Review was completed on February 6, 2018, with the next scheduled for FY 2026. The last Periodic Facility Review for Sumner Dam was completed on April 1, 2014, with the next one scheduled for FY 2022. The last Annual Site Inspection (ASI) was completed on July 30, 2019, with no significant O&M issues reported. The next ASI is scheduled for FY 2020.

The last security reviews for Sumner Dam were an Annual Security Review completed on February 6, 2019; an Annual Security Equipment Inventory (ASEI) checklist completed on August 13, 2019; and a Security Tailored Assessment Report (STAR) completed on September 8, 2019. No significant security issues were reported from any of those reviews. The next security reviews will be an ASEI and a STAR scheduled for 2020.

Brantley Dam and Reservoir

Brantley Dam Operations

Note: All elevations reference the North American Vertical Datum of 1988 (NAVD 88).

During periods without irrigation releases, approximately 20 cfs is bypassed from Brantley Dam to mitigate reservoir impacts to Major Johnson Springs. However, in 2018 an exception was allowed for maintenance and inspections at the downstream Avalon Reservoir and it was drained at the end of the 2018 irrigation season. The Brantley bypass would have refilled Avalon, preventing or delaying the work. The bypass was thereafter shut off beginning in November 2018, except for small releases to keep a wet area immediately downstream from the dam. This process was repeated at the end of the 2019 irrigation season when Avalon was again drained to facilitate a LIDAR drone flight to develop a new Avalon ACAP.

During the irrigation season, releases were made from Brantley to Avalon Reservoir at a rate necessary to support diversion into CID's Main Canal, generally between 150 and 250 cfs as required by irrigation demand. The highest average daily release of 2019 was 357 cfs on June 26 to refill Avalon, which had been drawn down due to high irrigation demand. Figure 3 depicts Brantley's total storage and release.

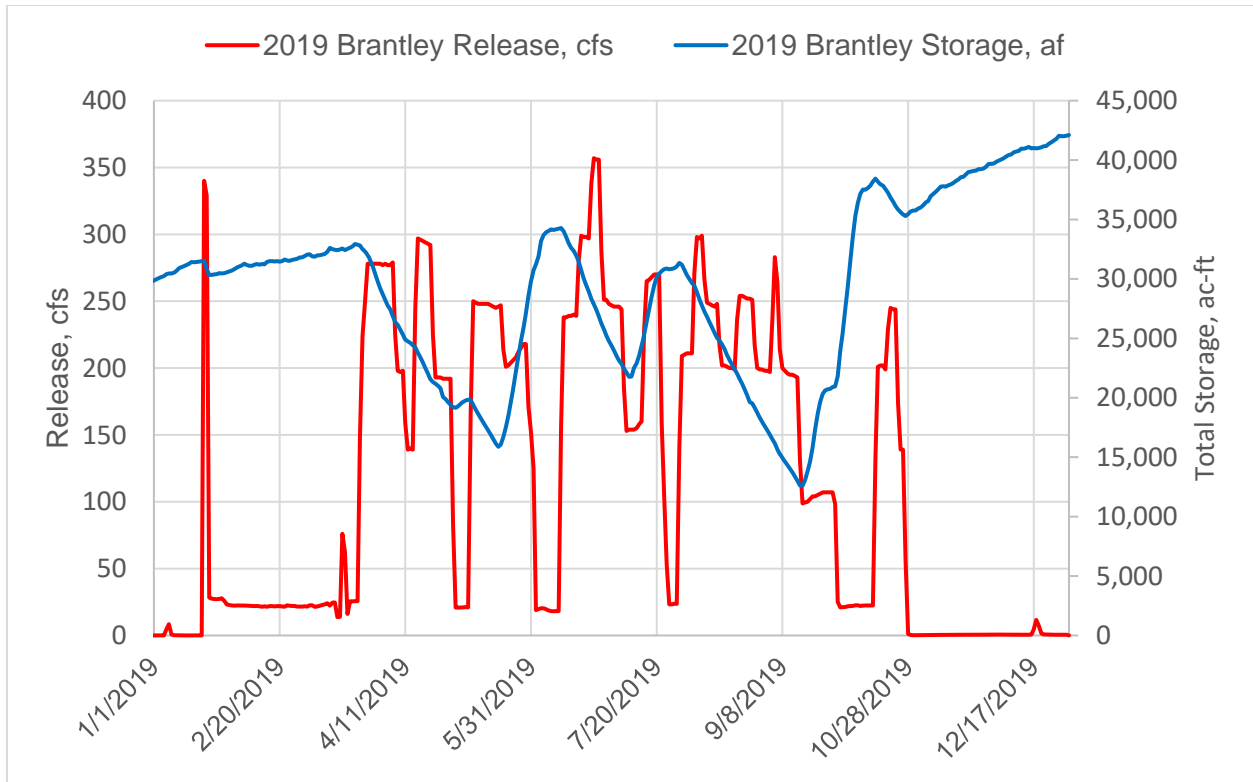


Figure 3: Storage and Release for Brantley Dam

Brantley began the year with a total storage of 29,776 ac-ft (3,251.58 feet). On December 31, Brantley reached its maximum storage for 2019, 42,110 ac-ft (3,256.14 feet). The lowest total storage in 2019 was 12,595 ac-ft (3,242.41 feet) on September 16.

After refilling Avalon on January 21 and 22, irrigation releases from Brantley began on March 24. Subsequently, water releases varied to meet demand and conserve water. The final irrigation release from Brantley occurred on October 27. The total released from Brantley in 2019 was 83,989 ac-ft, with 79,715 ac-ft released for irrigation, and 4,274 ac-ft for mitigation flows.

As stated above, Avalon was emptied at the end of the 2019 irrigation season. Releases from Brantley from January 28 through February 1, 2020, refilled Avalon in preparation for the irrigation season.

Brantley Dam Facility Review and Safety of Dams Programs

At the beginning of 2019, there were eight incomplete Category 2 O&M recommendations. Category 2 O&M recommendations indicate that action is needed to prevent or reduce further damage or preclude possible operational failure of a facility. In 2019, CID completed five Category 2 O&M recommendations. Of the three remaining incomplete Category 2 O&M recommendations, all are related to updating the Standing Operating Procedures, which was completed in 2019 and will be transmitted in FY 2020. There were no new Category 2 O&M recommendations during 2019.

There are sinkholes upstream and downstream on the left (southeast) side of Brantley Dam. The sinkholes are monitored visually on a regular basis and are documented via photographic surveys

every eight years. The last sinkhole survey was conducted in August 2015. The sinkholes appear to be filling in naturally and are more difficult to locate during each subsequent survey.

The last Comprehensive Review was completed on February 7, 2018, with the next one scheduled for FY 2026. The last Periodic Facility Review was completed on April 2, 2014, with the next one scheduled for FY 2022. The last Annual Site Inspection (ASI) was completed on July 9, 2019, with no significant O&M issues reported. The next ASI is scheduled for FY 2020.

The last security reviews for Brantley Dam were an Annual Security Review completed on February 7, 2019; an Annual Security Equipment Inventory (ASEI) checklist completed on August 14, 2019; and a Security Tailored Assessment Report (STAR) completed on September 9, 2019. No significant security issues were reported from any of those reviews. The next security reviews will be an ASEI and a STAR scheduled for FY 2020.

Avalon Dam and Reservoir

Avalon Dam Operations

Note: All elevations reference Project Datum. (Subtract 16.49 feet to obtain NGVD29 elevation.)

Due to the small reservoir capacity and the location of Brantley Dam 10 miles upstream, Avalon Dam is used primarily as a diversion dam to meet irrigation demand for CID. Water released from Brantley Dam is re-regulated at Avalon, which releases into the CID Main Canal. Avalon Reservoir began the year empty to allow for required maintenance and inspections with zero ac-ft (3,164 feet). It also ended 2019 empty, at 0.0 ac-ft (3,164 feet), again drained for a possible LIDAR drone flight to develop a new Area-Capacity (ACAP) table. It reached a maximum storage of 3,282 ac-ft (3,176.01 feet) on June 4. Diversions into the CID Main Canal began on March 24 and ended on November 2. The total release for irrigation was 72,612 ac-ft. Figure 4 depicts Avalon's total storage and release. There were no releases to the Pecos River in 2019.

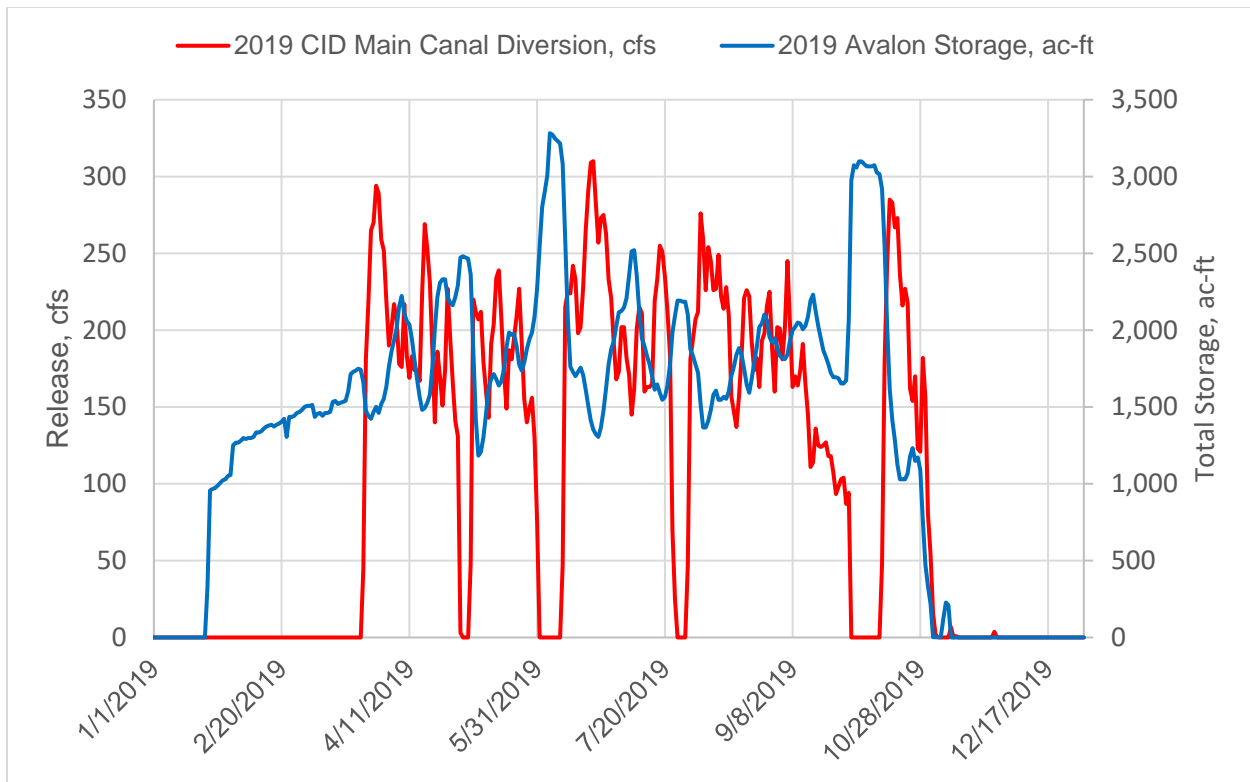


Figure 4: Storage and Release for Avalon Dam

As stated in the Brantley section above, the reservoir was completely drained at the end of the 2019 irrigation season for a possible LIDAR drone flight to develop a new ACAP table. By November 8, the reservoir was empty and remained so through the end of 2019. Avalon was refilled between January 28 and February 1, 2020.

Avalon Dam Facility Review and Safety of Dams Programs

At the beginning of 2019, there were 15 incomplete Category 2 O&M recommendations. Category 2 O&M recommendations indicate that action is needed to prevent or reduce further damage or preclude possible operational failure of a facility. In 2019, CID completed three Category 2 O&M recommendations. Of the 12 remaining incomplete Category 2 O&M recommendations, eight are related to the replacement or repair of the river outlet works, scheduled for completion in FY 2023. The remaining four are related to updating the Standing Operating Procedures, also scheduled to be completed in FY 2023. There were no new Category 2 O&M recommendations during 2019.

The cylinder gates that comprise the river outlet works, hoist platform, and walkway are currently in poor structural condition and need repair or replacement. CID would like to decommission the cylinder gates and find another way to release to the Pecos River, such as converting the cylinder gates to glory holes. Reclamation is working with CID to complete the cylinder gate rehabilitation and can assist with planning and design. CID will be responsible for all construction costs.

The last Comprehensive Review was completed on February 8, 2018. The next one is scheduled for FY 2026. The last Periodic Facility Review for Avalon Dam was completed on April 3, 2014, and

the next one is scheduled for FY 2022. The last Annual Site Inspection (ASI) was completed on July 10, 2019, with no significant O&M issues reported. The next ASI is scheduled for FY 2020.

The last security reviews for Avalon Dam were an Annual Security Review completed on February 8, 2019; an Annual Security Equipment Inventory (ASEI) checklist completed on August 15, 2019; and a Security Tailored Assessment Report (STAR) completed on September 10, 2019. None reported any significant security issues. The next security reviews will be an ASEI and a STAR scheduled for FY 2020.

Carlsbad Project Environmental Compliance

Current ESA and NEPA Compliance

In support of Carlsbad Project water operations for irrigation, Reclamation accepted the *Final Biological Opinion for the Carlsbad Project Water Operations and Water Supply Conservation, 2016-2026* (2017 BO; Consultation Number 02WNNM00-2016-F-0506) in 2017. The hydrologic analysis for the 2017 BO considered new conditions such as severe drought, additional supplemental water acquisitions and measures, and updated water user roles and responsibilities. In addition, the 2017 BO provides compliance under ESA for Reclamation's Carlsbad Project actions, and affects to ESA-listed species including the Pecos Bluntnose Shiner and the Interior Least Tern. Reclamation's proposed action includes offsetting any losses to the Project by acquiring and delivering offset water to Brantley Reservoir for delivery to CID farmers. The Fort Sumner Irrigation District (FSID) has elected to renew their ESA compliance under Section 10; therefore, their actions are not covered under Reclamation's 2017 BO.

In July 2019, Reclamation finalized the Carlsbad Project Water Operations and Water Supply Addendum Environmental Assessment (EA) to assess the potential consequences of proposed changes in Carlsbad Project operations, and the implementation of an expanded water acquisition program in the Pecos River basin of New Mexico. This EA includes description of a new alternative to be implemented under the 2017 BO, and supplements the alternatives proposed in the Carlsbad Project Water Operations and Water Supply Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) of 2006. The EA proposes a new means of implementing the proposed Federal action, and presents an evaluation of the potential environmental, economic, and social consequences that could result from implementation. The new alternative addresses historically *Critically Dry* conditions such as those experienced within the Pecos basin in the years 2011 to 2013.

This new alternative modifies the 2006 FEIS' preferred 'Taiban Constant' Alternative by eliminating the requirement to maintain a 35 cfs flow at the USGS' Pecos River below Taiban Creek (Taiban) gage during critically dry years. Another part of the proposal includes a new conservation storage pool for up to 30,000 ac-ft in USACE's Santa Rosa Reservoir to provide storage to maintain a continuous river during extreme drought conditions. It is unlikely that this pool would exceed approximately 10,000 ac-ft due to years with high supplemental water demand. These proposed changes in water operations are designed to conserve the Pecos Bluntnose Shiner and its designated critical habitat, while conserving the Carlsbad Project water supply.

Reclamation's Direct Flow Operations

Reclamation has a lease agreement with the New Mexico Interstate Stream Commission (NMISC) for groundwater from two water rights, Vaughan and VP Bar, to be pumped into the Pecos River annually. The Vaughan Conservation Pipeline (VCP) supplements flow on the Pecos and helps minimize the chance of intermittency between Sumner and Brantley Reservoirs. The outfall structure of the VCP is located upstream of the USGS' Taiban gage. Maximum output during 2019 was 10.0 cfs. The VCP provided 1,618 ac-ft of the 1,649 ac-ft available for 2019. After irrigation

season, CID performed maintenance on the Sumner Dam penstocks. Releases from the Dam could not be made during this period, and 698 ac-ft were instead pumped from the VCP between November 5 and December 10, 2019, to assist with ESA targets.

In addition to the lease agreement described above, Reclamation establishes a 1,000 ac-ft fish conservation pool (FCP) in Sumner through an exchange of 750 ac-ft of water rights it owns at Seven Rivers Wildlife Management Area (Seven Rivers). Water under this water right is pumped into Brantley from wells at Seven Rivers and exchanged for the water stored in Sumner Lake. Due to the availability of bypass water in 2019, Seven Rivers pumping was stopped at 469 ac-ft for an exchange in Sumner of 626 ac-ft.

Under a forbearance agreement with FSID, 2,500 ac-ft were stored for Reclamation under the Carlsbad Project's storage right at Sumner Lake. The forbearance and FCP water was released as needed to maintain flow in the Pecos River below Sumner at the Taiban and Acme gages. Reclamation utilized 632 ac-ft of the 625.64 ac-ft of FCP. Reclamation also utilized 1,607 ac-ft of the 2,500 ac-ft of forbearance water. The remaining 893 ac-ft of forbearance was returned to Project storage, described further in the Sumner Operations section.

Pecos Basin Water Accounting

Reclamation, the NMISC, and CID developed a 20-year Depletions Agreement for ESA water use (2014-2033). The accounting related to this agreement determines the reduction in Carlsbad Project water supply due to modification of Reclamation's Sumner operations to meet BO obligations, and the amount by which any reductions in Project water supply are offset by Reclamation's water acquisitions.

Historically, a Microsoft Excel® spreadsheet, the Annual Accounting Method (AAM), was used to determine the amount of water depleted from the Pecos River. An accounting model that utilizes RiverWare® software, called the Pecos River Operations Model (PROM), was later developed and beginning in 2015, its results were compared to those from the AAM. Both the AAM and PROM were jointly developed by Reclamation and the NMISC, with review by CID. As stated, for several years the two methodologies were compared. PROM_2016 was the first version of the RiverWare® model. Accounting in 2019 was performed using the PROM_2019 version.

Reclamation believes that the RiverWare® model is a better representation of physical conditions on the river than the AAM. This is because RiverWare® more accurately models physical hydrologic processes using current data, whereas the AAM typically uses historical averages to represent processes such as channel losses.

The PROM has now replaced the AAM spreadsheet to account for depletions. From 2017 forward, the most current version of PROM will be used exclusively to determine depletions. As modeling technology advances and changes to the PROM are made, such adjustments will be presented to the interagency Pecos Hydrology Workgroup for review.

Reclamation’s Water Offset Program

Reclamation leases water rights from willing owners within the Pecos Basin to offset the additional depletions caused by ESA-related operations. Reclamation is entirely dependent on the availability of water rights by willing holders, and limited by budget constraints to meet the instream flow requirements of the 2017 BO.

During the 2019 water accounting year, which extends from November 1, 2018, through October 31, 2019, Reclamation had water lease agreements with three Pecos river-pumpers to lease 760.83 ac-ft of surface water rights and 507 ac-ft of Hagerman Canal water rights. Both volumes are the consumptive use portion of the right. The land associated with the leased water was fallowed. The Hagerman Canal water was pumped directly into the Pecos River.

In water accounting year 2019, Reclamation bypassed 3,801 ac-ft and released 3,058 ac-ft of forbearance water. Note that both include water released in 2018 and 2019. This caused 259 ac-ft of depletions in the 2019 accounting year.

Carlsbad Project Water Acquisition (CPWA or Offset) amounts of 5,600 ac-ft, adjusted for consumptive use, transmission loss, and Brantley evaporation, were provided at Brantley for the accounting year to make up for these additional depletions. This resulted in a Reclamation credit of 4,228 ac-ft for the 2019 accounting year.

The accounting calculations were made using the PROM_2019 Two Stream Model. For the 2019 accounting year, output from the model indicates Reclamation’s CPWA Program put 3,969 ac-ft more into the Pecos River than were depleted, a result of modified operations at Sumner in support of the 2017 BO.

Table 5 shows the output of the Two-Stream Accounting Model since 2016.

Table 5: 2016 – 2019 Net Depletions (+ equals depletion / - equals credit)

Depletions ¹	Normalized ² Net Depletions	Normalized Difference without Storage
2016	582	-2,186 ³
2017	288	-4,988
2018	415	-3,130
2019	259	-4,228

Figure 5 below shows the cumulative effects of the added supplemental water Reclamation contributes to the Pecos River as directed by the 2017 BO. While the bypass release depletes the Carlsbad Project supply in Sumner, Reclamation’s nearly continuous release of purchased water stored in Sumner (leased water through the VCP), and compensation to farmers who forgo pumping from the Pecos River both serve to replenish the Project supply in Brantley.

¹ Units are acre feet

² “Normalized” means storage in all reservoirs is reduced to Brantley Reservoir.

³ A negative value in the right-hand column means water was added to the river.

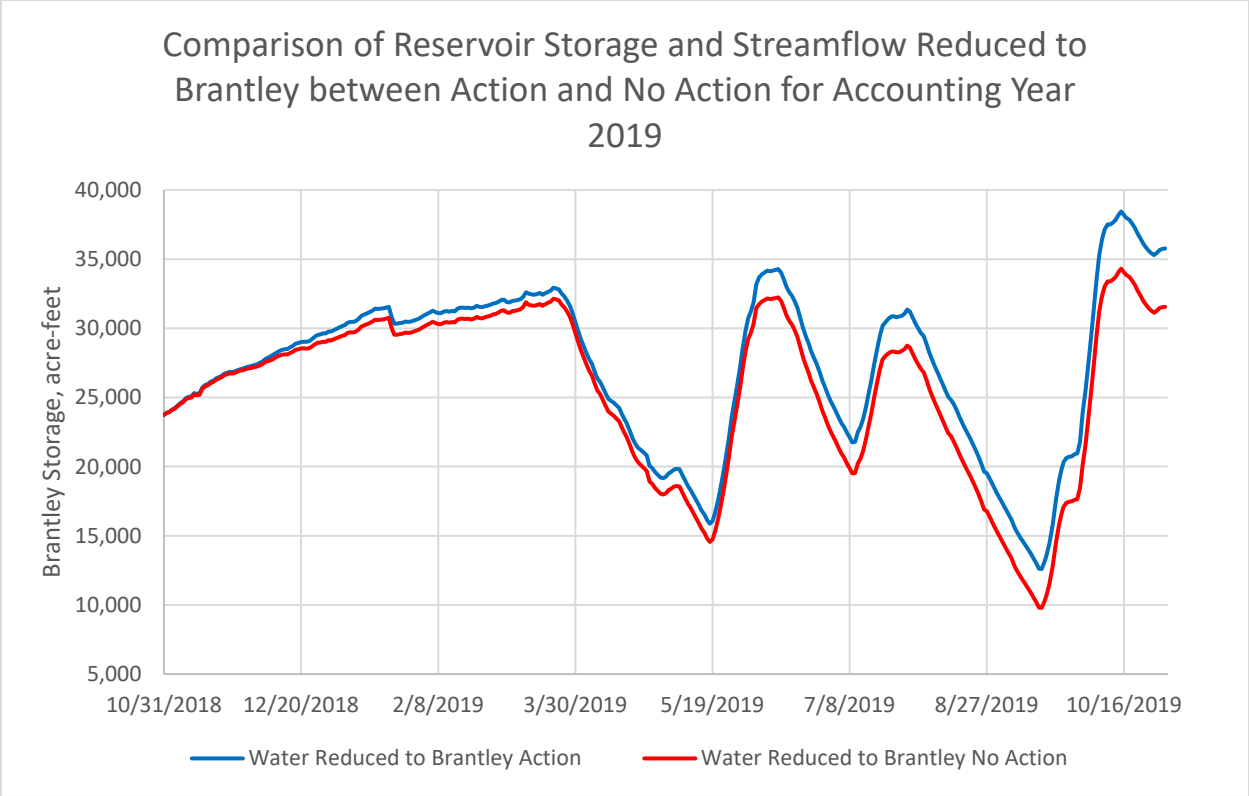


Figure 5: Reservoir Storage and Flows Reduced to Brantley Action and No Actions Storage

The red “no action” line represents total Carlsbad Project storage reduced to Brantley without any operations in support of the 2017 BO, while the blue “action” line represents Project storage reduced to Brantley with current operations in support of the BO.

Endangered Species Program

Pecos Bluntnose Shiner

The threatened Pecos Bluntnose Shiner (*Notropis simus pecosensis*, shiner) is monitored annually to assess population status and determine incidental take for Reclamation's Carlsbad Project. During normal flow conditions, the 2017 BO established take for shiner using the mean 3rd trimester density of 12 fish per 100m² as a surrogate for determining if take has been exceeded during a given water year. The BO states that under normal flow conditions, shiner density would either increase from the previous year's 3rd trimester density or stay above the prescribed mean 3rd trimester density of 12 fish/100m². Decreasing densities and a density below 12 fish per 100m² as a result of the Proposed Action requires further consultation with the USFWS.

The 2017 BO also defines a *Critically Dry* condition, which has various measures. Some are designated in the percent of the basin classified as Extreme or Exceptional Drought per the U.S. Drought Monitor; the proportion of the 30-year average of the Natural Resources Conservation Service's forecast for inflow to Santa Rosa Reservoir; and the percent of time in which bypass is available. Reclamation assesses these factors monthly from January to June. A designation of *Critically Dry* is an indication that Reclamation may not be able to cover the deficit in the hydrologic system with its available resources. In that case, the Taiban gage target of 35 cfs is removed, and Reclamation focuses on maintaining 5 cfs at the Acme gage, which should ensure that the reach is continuous. In addition, under *Critically Dry* conditions, no take from the proposed action occurs, provided that all water resources at Reclamation's disposal are utilized to minimize drying (USFWS, 2017).

Reclamation funds and receives trip reports from the USFWS for fish sampling from April to October. These data are compiled into an annual report on the status of the shiner. The following shiner data summarize information provided to Reclamation under the USFWS interagency agreement¹.

In 2019, 12 sites were monitored on six separate sampling trips. A total of 14,704 fish were collected from 23 different species. Fewer fish were collected in 2019 than in 2018. The most abundant fish species was Red Shiner (*Cyprinella lutrensis*). Pecos Bluntnose Shiner was second most abundant fish species, with a total of 3,090 collected during 2019 site visits. Small bodied minnows dominated fish collections: Red Shiner; Plains Minnow (*Hybognathus placitus*); Speckled Chub (*Macrhybopsis aestivalis*); Rio Grande Shiner (*Notropis jemezianus*); and Pecos Bluntnose Shiner accounted for nearly 94% of all fish collected.

During the 3rd trimester of 2019 (August through December), 1,313 Pecos Bluntnose Shiner were collected from the Pecos River, comprising a mean percent of total that was $17.1 \pm 1.0\%$ of all species collected. The 2019 mean Pecos Bluntnose Shiner 3rd trimester density was 14.1 ± 1.8 fish per 100m², which was lower than the 2018 3rd trimester density of 34.3 ± 4.6 fish per 100m² (Table 6). The 2019 3rd trimester density was above the prescribed mean 3rd trimester density of 12 fish per 100m², therefore take was not exceeded in 2019. Overall, the species 2019 abundance was higher than the average abundance for the species for years 2000 – 2018 (Table 6).

¹ Davenport, S.R. 2020. 2019 Pecos River Basin Fisheries Update Summary Report. DRAFT report submitted to US Bureau of Reclamation, Albuquerque Area Office, New Mexico.

Table 6: Presence and abundance of Pecos Bluntnose Shiner (*Notropis simus pecosensis*) in trimester 3 only, Pecos River, New Mexico, for calendar years 2000–2019. Take metric catch rate is in bold for 2019. Total Shiner is the number of Pecos Bluntnose Shiner collected during trimester 3. Total fish is the number of fish, without regard to species, collected during trimester 3.

Calendar Year	Presence: Total Site Visits	Presence: Occupied Sites	Presence: Percent Occupied	Abundance: Total Shiner	Abundance: Total Fish	Abundance: Percent (%)	Abundance: Total Area (m ²)	Abundance: Shiner/100 m ²
2000	23	23	100.0	1,510	8,907	15.50	9,879	16.78
2001	14	12	85.7	1,141	8,521	13.55	3,339	33.57
2002	13	13	100.0	585	8,923	7.45	3,780	17.64
2003	9	9	100	151	8,425	2.13	1,483	13.95
2004	23	19	82.6	118	10,676	1.56	5,628	2.50
2005	21	19	90.4	174	6,138	3.52	4,271	4.35
2006	25	21	84	358	4,757	7.76	5,661	6.56
2007	25	25	100	803	6,581	12.45	6,241	13.72
2008	30	29	96.6	781	11,511	7.78	7,389	16.96
2009	38	38	100	1,345	16,316	10.91	7,925	19.68
2010	41	41	100	2,217	20,387	15.04	10,058	23.26
2011	32	29	90.6	1,778	20,298	8.24	8,125	23.23
2012	24	14	58.3	509	24,484	1.93	5,598	7.35
2013	18	13	72.2	164	11,901	1.32	5,533	3.10
2014	33	26	73.3	385	7,106	5.27	12,496	3.04
2015	24	23	95.8	567	4,484	13.27	8,026	7.66
2016	30	27	90	780	9,257	7.5	11,113.5	7.3
2017	31	31	100	749	6,250	14.1	10,788.5	7.1
2018	33	33	100	2,419	10,499	22.0	7,659	33.3
2019	36	36	100	1,313	8,091	17.1	9,247.5	14.1
Total/Avg.			91.0	17,847	213,512	9.4	144,241	13.7

Literature Cited

Davenport, S.R. 2019. 2019 Pecos River Basin Fisheries Update Summary Report. DRAFT report submitted to US Bureau of Reclamation, Albuquerque Area Office, New Mexico.

U.S. Fish and Wildlife Service. 2016 Biological Opinion for the Bureau of Reclamation's Proposed Carlsbad Project Water Operations and Water Supply Conservation, 2016–2026. New Mexico Ecological Services Field Office, Albuquerque, New Mexico.

Interior Least Tern

When the elevation of Brantley Reservoir is at or above the full pool elevation of 3,256 feet (all elevations are North American Vertical Datum 1988), the surface area is 3,034 acres or greater and no suitable nesting shoreline habitat is available to Interior Least Terns (*Sterna antillarum athalassos*, tern). Even when the reservoir elevation is at the normal elevation as defined by New Mexico State Parks (3,250 feet) and the surface area of Brantley Reservoir is approximately 2,219 acres, very little nesting shoreline is typically available to terns.

During the 2019 breeding season, reservoir elevations reached a seasonal low of approximately 3,244.6 feet on May 18 (Figure 6), prior to the representative onset of Least Tern breeding at Brantley Reservoir. The reservoir then rose to a seasonal high of 3,253.4 feet on June 12, and subsequently fell to 3,247.9 feet on July 10. Within the June 12 to July 10 span, more than 600 acres of shoreline became exposed.

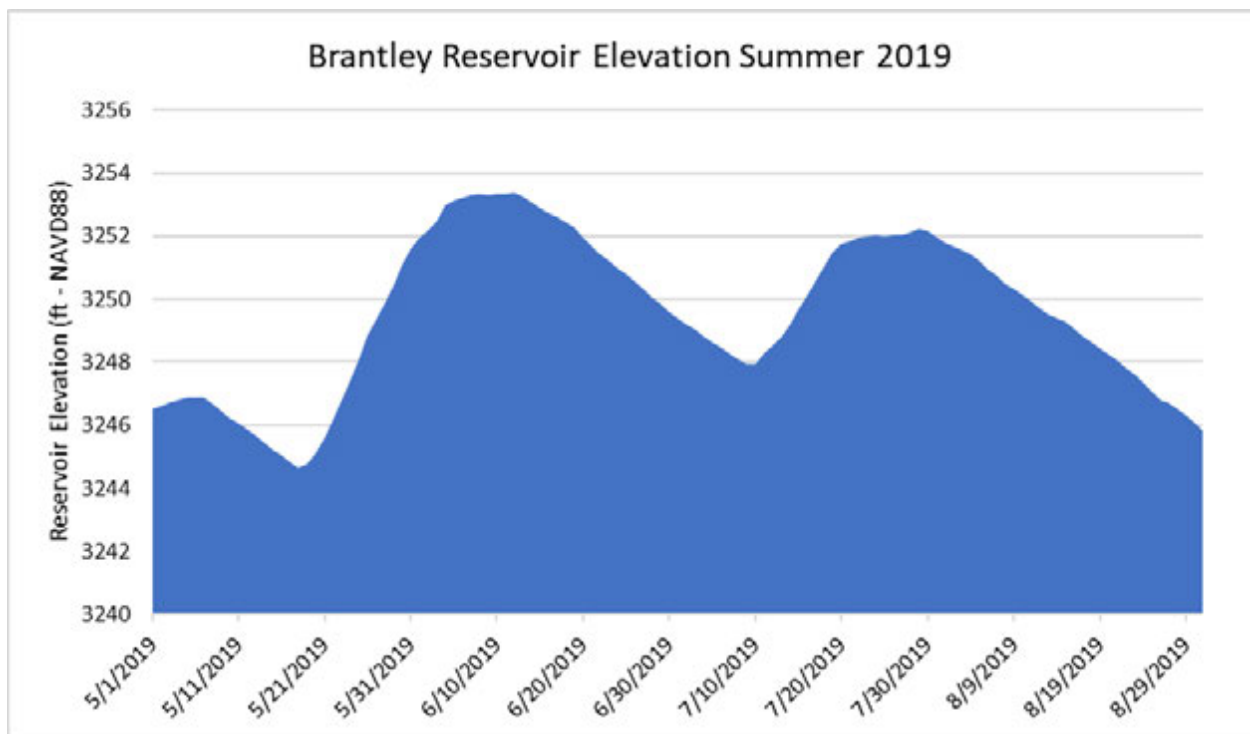


Figure 6: Brantley Reservoir Elevations during the 2019 Interior Least Tern Breeding Season

Survey dates and observation results for Least Terns at Brantley Reservoir during the spring and summer of 2019 are presented in Table 7. Two terns were observed flying together and exhibiting brief mating displays during the evening of June 12. With concurrence from the USFWS, tern surveys were discontinued after August 1 as it extended beyond the close of the typical tern nesting season and limited shoreline habitat was available due to reservoir elevation. The June 12 tern sighting was the only sighting in 2019.

Table 7: Summary of 2019 Interior Least Tern Observations at Brantley, New Mexico

Date	Adult	Sub-Adult	Immature	Nests
May 29/30	0	0	0	0
June 6/7	0	0	0	0
June 12/13	2	0	0	0
June 19/20	0	0	0	0
June 25/26	0	0	0	0
July 3/4	0	0	0	0
July 9/10	0	0	0	0
July 15/16	0	0	0	0
July 23/24	0	0	0	0
July 31/Aug 1	0	0	0	0
2019 Totals¹	2	0	0	0

As stated, the two terns observed on June 12 were seen flying together during the evening survey. One bird was carrying a small fish and appeared to show courtship behavior toward the other tern. For approximately ten minutes, the pair was observed flying around the Seven Rivers area of the reservoir, then flew off and were not seen again. Similar to previous years, Brantley Reservoir levels fluctuated drastically over the course of the breeding season as a result of block releases from upstream reservoirs and releases for irrigation from Brantley. The arrival of the block release in late May essentially removed all potential tern nesting habitat. By the time the reservoir had receded to expose shoreline habitat in late June, it was likely inopportune for initiation of nesting efforts.

Pecos River Restoration

Under the 2006 BO, Reclamation agreed to “assist in the completion of ongoing habitat improvement projects on the Pecos, and to restore 1 to 1.5 miles of quality habitat within the Farmlands reach by 2009 with another 1 to 1.5 miles by 2014.” In 2009, Reclamation funded and completed a channel restoration project that reconnected Oxbow 4 at Bitter Lakes National Wildlife Refuge (BLNWR) to the mainstem of the Pecos. Reclamation has completed the required monitoring for this restoration.

A second habitat improvement project, located at the Bureau of Land Management (BLM) Overflow Wetlands Area of Critical Environmental Concern (south of the BLNWR restoration project), was completed in 2014. Lands in the project area are managed by BLM, New Mexico State Land Office, and private landowners. Monitoring of this habitat restoration project was initially planned to extend to the end of 2019, but Clean Water Section 404 permit requirements were completed in 2018.

According to the 2006 BO, activities that restore and optimize the interaction of river channel and floodplain habitats with available flows will be most successful in mitigating the observed displacement of the shiner eggs, and in providing a variety of channel conditions favorable to the

¹ M. Bullard and D. Moore. 2020. Interior Least Tern Monitoring Results 2019. Brantley Reservoir, New Mexico. Bureau of Reclamation, Albuquerque Area Office, New Mexico.

different life stages of the shiner. This project included removal of non-native vegetation, lowering and contouring riverbanks, and excavating smaller bank sites. Prior to construction, the Pecos River in this reach was a deep channel with very little diversity. The cross sectional data collected since 2014 shows areas of varying depth, and flows that have improved the habitat for the shiner in this reach. Although all commitments under the 2006 BO have been fulfilled, Reclamation does periodically monitor the restoration sites.

Fort Sumner Project

Operations

The irrigation season for FSID typically begins March 1 and ends October 31. FSID is also permitted to divert for two, eight-day periods during the winter. Historically, this winter allotment is taken just prior to March 1.

FSID began diverting water for irrigation on March 2, 2019, and ended irrigation for the year on October 31. During the irrigation season, 0 to 100 cfs was bypassed through Sumner for FSID diversion based on the available water right, and in accordance with their call. FSID diverted 44,024 ac-ft into the FSID main canal as recorded by the USGS Fort Sumner Main Canal gage near Fort Sumner, NM (USGS gage number 08385000:

https://waterdata.usgs.gov/nm/nwis/uv/?site_no=08385000&PARAMeter_cd=00065,00060), shown in Figure 7. The total allotment for FSID in 2019 was 48,669 ac-ft, including the winter allotment. Of that, 90% was called for and diverted, 6% was forborne, and 4% was left in Sumner storage.

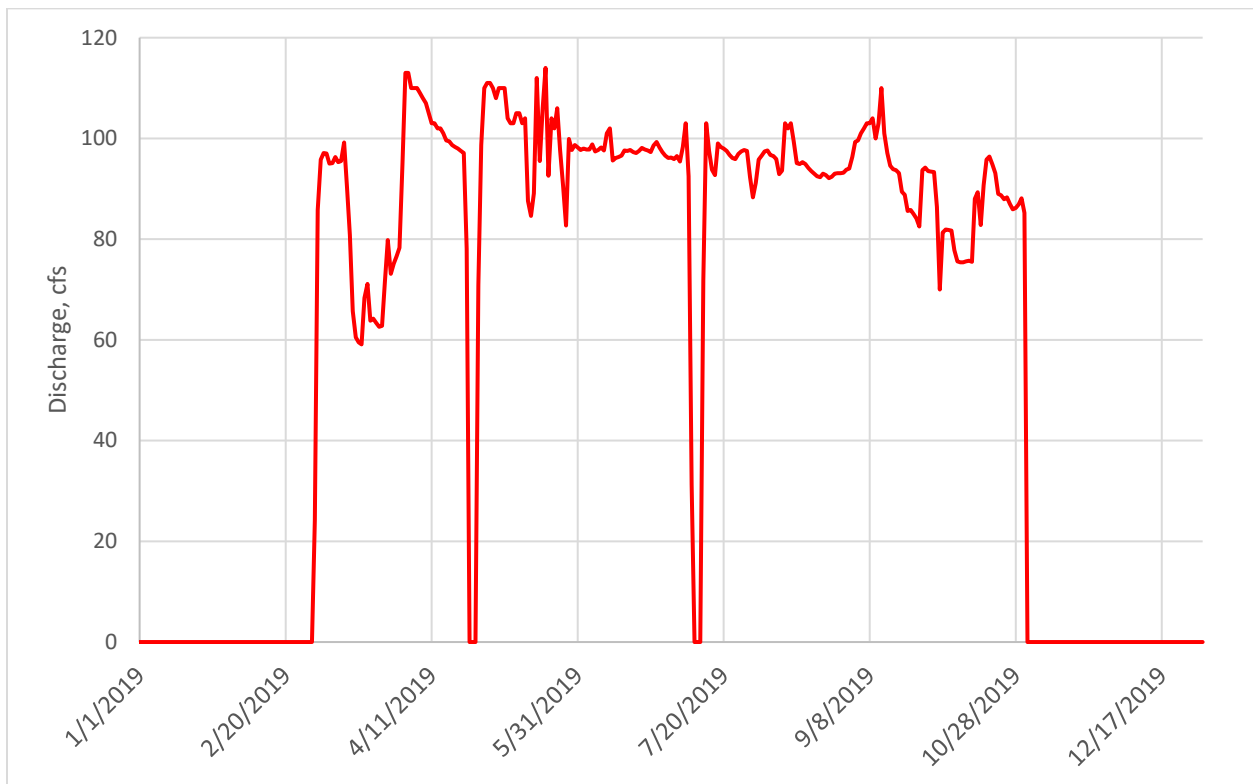


Figure 7: FSID Main Canal Diversion

This year, FSID diverted flows less than 115 cfs arriving at their dam, and released Reclamation's supplemental water call back to the river at the Sand Gate Diversion (USGS gage number 08385503, https://waterdata.usgs.gov/nm/nwis/uv/?site_no=08385503&PARAMeter_cd=00065,00060). The total ESA release back to the river at the Sand Gate was 2,279 ac-ft.

In 2019, the USGS replaced the Sand Gate gaging station, moving it to a location with better hydraulic control approximately 250 feet downstream from the diversion inlet. Because the new location and gaging station are further away from the inlet structure, the turbulent flow at that location should no longer impact the gage reading.

As of 2018, the FSID Main Canal Gage was often discovered not actively reporting or performing reporting functions incorrectly. In September 2018, the acoustic doppler velocity meter (ADVM) gaging system was replaced with a water stage recorder and has since continued to send reliable data.

Fort Sumner Irrigation District Review of Operation and Maintenance

At the beginning of 2019, there were six incomplete Category 2 O&M recommendations. Category 2 O&M recommendations indicate that action is needed to prevent or reduce further damage or preclude possible operational failure of a facility. In 2019, FSID completed three Category 2 O&M recommendations. The remaining three Category 2 O&M recommendations are scheduled to be completed by FSID in FY 2020.

The last Review of Operations and Maintenance (RO&M) examination of the FSID Canal System and Diversion Dam was completed on April 21, 2015, identifying six Category 2 O&M recommendations, including vegetation control and gate repairs.

Reclamation personnel conducted an unscheduled site visit of the FSID diversion dam radial gates on September 23, 2018, to assist FSID in determining current condition of the gates. FSID finished maintenance on the radial gates in March 2019, which completed three of the six Category 2 O&M recommendations.

There are no other RO&M issues of concern for the FSID system other than vegetation control along the canals and ongoing RO&M maintenance. The next RO&M examination is scheduled for FY 2021.

Other Pecos River Activities and Operations

Pecos River Settlement Implementation

The State of New Mexico, the Pecos Valley Artesian Conservancy District (PVACD), CID, and the United States Government signed the water rights Settlement Agreement (Settlement) on March 25, 2003. The Settlement and its implementation were vital to ensure delivery to Texas under the Pecos River Compact, to provide additional water supply to CID, and to protect PVACD from a priority call on its junior groundwater rights. The Settlement provides additional water from two sources acquired by the NMISC: surface water from CID farmers, and groundwater from PVACD farmers pumped from augmentation well fields operated by the NMISC.

The NMISC has not pumped water for CID under the Settlement since September 13, 2013. Climatic conditions since 2013 have kept the Carlsbad Project Supply above the Settlement's maximum Target Supply.

WaterSMART Program

Congress recognized the increasing stresses on water supplies in the Western U.S. with the passage of the SECURE Water Act in 2009. The law authorizes federal water and science agencies to work together with state and local water managers to plan for threats to water supplies, as well as take action to secure water resources for the communities, economies, and ecosystems they support.

To implement the SECURE Water Act and ensure that the Department of the Interior is positioned to meet these challenges, the WaterSMART Program was established in February 2010. The Program's framework allows all bureaus of the Department to work with States, Tribes, local governments, and non-governmental organizations to pursue a sustainable water supply for the Nation by establishing a framework to provide federal leadership and assistance on the efficient use of water, integrating water and energy policies to support the maintainable use of all natural resources, and coordinating the water conservation activities of the various Interior offices.

As the Department's main water management agency, Reclamation plays a key role in the WaterSMART Program. Reclamation's portion of the WaterSMART Program is focused on improving water conservation and helping water resource managers make wise decisions about water use. Goals are achieved through administration of grants, scientific studies, technical assistance, and sharing scientific expertise. Reclamation will continue to work cooperatively with States, Tribes, and local entities as they plan for and implement actions to increase water supply through investments to modernize existing infrastructure and give attention to local water conflicts.

These programs, funded and managed by Reclamation's Office of Policy and Administration in Denver, CO, include:

- WaterSMART Grants
 - Water and Energy Efficiency Grants
 - Small-Scale Water Efficiency Projects
 - Water Marketing Strategy Grants
- Water Conservation Field Services Program
- Cooperative Watershed Management Program (Phases I and II)
- Drought Response Program
 - Drought Contingency Planning
 - Drought Resiliency Projects
 - Emergency Response Actions
- Title XVI Water Reclamation and Reuse Program
- Basin Study Program
 - Baseline Assessments
 - Reservoir Operations Pilots
 - Basin Studies
 - Applied Science Grants

More information about all of these programs, completed project reports, and funding opportunity announcements can be found at: <https://www.usbr.gov/watersmart/>.

A WaterSMART Data Visualization Tool showing project locations can be found at:

<https://usbr.maps.arcgis.com/apps/MapJournal/index.html?appid=043fe91887ac4ddc92a4c0f427e38ab0>.

General information about Reclamation's WaterSMART Program is provided below. Ongoing or newly funded projects within the jurisdiction of the AAO in the Pecos River Basin are also summarized below.

WaterSMART Grants

Water and Energy Efficiency Grants

WaterSMART Water and Energy Efficiency Grants (WEEG) provide funding to irrigation and water districts, Tribes, States, and other entities with water or power delivery authority. These projects conserve and use water more efficiently, increase the production of hydropower, mitigate conflict risk in areas at a high risk of future water conflict, and accomplish other benefits that contribute to water supply reliability in the western United States.

Small-Scale Water Efficiency Projects

Small-scale water efficiency projects (SWEP) provide funding to irrigation and water districts, Tribes, States, and other entities with water or power delivery authority for small water efficiency improvements that have been identified through previous planning efforts. Projects eligible for funding include installation of flow measurement or automation devices in a specific part of a water

delivery system; lining of a section of a canal to address seepage; or other similar projects that are limited in scope.

SWEPs underway in the Pecos Basin include:

- Guadalupe Soil and Water Conservation District (GSWCD) was awarded \$67,500 for their “Acequia Restoration & Conservation Project,” which is a cost-shared effort to begin actively assisting landowners with irrigation efficiency infrastructure projects. The funding will assist with implementation of an ongoing small-scale conservation program to restore compromised acequias and minimize their degradation, and improve irrigation efficiency. GSWCD will install acequia lining and piping in open dirt ditches for interested water users within District boundaries. The improvements will reduce seepage and stretch existing water supplies. A notice to proceed was issued in August 2019 and the project is expected to be completed by March 31, 2021.
- Carlsbad Irrigation District was awarded \$75,000 for their “Main Canal Lining for Water Savings & Efficiency” cost-shared project to line a portion of the canal with polyuria material to conserve and use water more efficiently. The district repaired approximately 1,900 feet of their damaged Main Canal by cleaning and sandblasting problematic areas and sealing cracks with Aqualastic® polyuria coating prior to the start of irrigation season in March 2019. The final performance letter was submitted to Reclamation in January 2020.
- Fort Sumner Irrigation District (FSID) was awarded \$24,972 for their “Canal Flow Telemetry and Automatic Head Gate” cost-shared project, intended to provide near real-time measurements of water flows at key points in their canal and lateral system to ditch riders and water managers to help decrease response times and allow better decision making. A new automatic head gate controller and telemetry system will work to adjust flows in the Wilson Lateral and give a warning if the automatic gate fails. The project was reviewed for environmental concerns and a categorical exclusion was issued in December 2019. Implementation of the project will take approximately four months, to begin in 2020.

Water Marketing Strategy Grants

Through these grants and in compliance with state and Federal laws, Reclamation aids States, Tribes, and local governments to conduct planning activities to develop water marketing strategies that establish or expand water markets or water marketing activities between willing participants.

Water Conservation Field Services Program

Reclamation is in the process of updating the Water Conservation Field Services Program (WCFSP) to ensure consistency and efficiency in the method that Reclamation uses to award financial assistance under this program. Currently, financial assistance will be available under the WCFSP for water conservation planning, development of system optimization reviews, designing water management improvements, and demonstration projects.

Cooperative Watershed Management Program

The Cooperative Watershed Management Program (CWMP) contributes to the WaterSMART Program strategy by providing funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. The purpose of the CWMP is to improve water quality and ecological resilience, conserve water, and reduce conflicts over water through collaborative conservation efforts in the management of local watersheds.

In 2012, Reclamation began providing funding for watershed group development, watershed restoration planning, and watershed management project design (Phase I). As part of Phase I activities, applicants may use funding to develop bylaws, a mission statement, complete stakeholder outreach, develop a watershed restoration plan, and design a watershed management project. In 2017, Reclamation started to provide cost-shared financial assistance to watershed groups for implementation of watershed management projects (Phase II). These on-the-ground projects, collaboratively developed by members of a watershed group, address critical water supply needs and water quality concerns, to help water users meet competing demands and avoid conflicts over water.

Drought Response Program

Reclamation's Drought Response Program supports a proactive approach to drought by aiding water managers to develop and update comprehensive drought plans and implement projects that will build long-term resiliency to drought.

Drought Contingency Planning

Reclamation provides financial assistance on a competitive basis for applicants to develop a drought contingency plan or to update an existing plan to meet the required elements described in the drought response framework. Most drought contingency planning processes are structured to address the following questions:

- How will we recognize the next drought in its early stages?
- How will drought affect us?
- How can we protect ourselves from the next drought?

The process is structured to help planners identify solutions and encourages an open and inclusive planning effort that employs a proactive approach to building long-term resiliency to drought.

Drought Resiliency Projects

“Drought Resiliency” is defined as the capacity of a community to prepare for, cope with, and respond to drought. Under this element of the program, Reclamation will fund drought resiliency projects that will help support communities within these parameters. Typically, these types of projects are referred to as "mitigation actions" in a drought contingency plan. Reclamation will fund projects that build resiliency to drought by:

- Increasing the reliability of water supplies;
- Improving water management;
- Providing benefits for fish and wildlife and the environment.

Emergency Response Actions

Reclamation will continue to undertake emergency response actions under the Drought Response Program to minimize losses and damages resulting from drought, relying on the authorities in Title I of the Drought Act. Emergency response actions are crisis-driven actions to mitigate unanticipated circumstances. Eligible emergency response actions are limited to temporary construction activities and other actions authorized under Title I, excluding construction of permanent facilities, water purchases, and use of Reclamation facilities to convey and store water.

Title XVI Water Reclamation and Reuse Projects

Title XVI of P.L. 102-575, as amended (Title XVI), provides authority for Reclamation's water recycling and reuse program. Through the Title XVI Program, Reclamation identifies and investigates opportunities to reclaim and reuse wastewaters and impaired ground and surface water in the 17 Western States and Hawaii. Title XVI includes funding for the planning, design, and construction of water recycling and reuse projects in partnership with local government entities.

Basin Study Program

Reclamation's Basin Study Program represents a comprehensive approach to identifying and incorporating the best available science into adaptation planning for a growing gap between water supply and demand, due to climate change and other factors. Within the Basin Study Program, Reclamation and its partners seek to identify strategies for addressing imbalances in water supply and demand, as authorized in the SECURE Water Act. The Program includes: the West-Wide Risk Assessment (WWRA) Program (now referred to as Baseline Water Assessments), as well as the Basin Studies themselves, Basin Study updates, Water Management Option Pilots, and Applied Science Tools. Further information about each of these sub-programs is provided below.

Baseline Assessments

Reclamation conducts Baseline Water Assessments to develop water supply and demand information, guidance, and tools needed to conduct planning activities across Reclamation's mission areas. Baseline Water Assessments support reservoir operations planning, appraisal and feasibility studies, basin studies, drought contingency planning, and environmental analyses.

Basin Studies

Reclamation has entered partnerships with local water management agencies to perform basin studies. The studies seek to develop adaptation and mitigation strategies for watersheds affected by climate change. Basin studies require a 50% cost share by Reclamation's local water-management partners and involve considerable cooperation with other members of the water community in a basin.

Pecos Basin Study

In 2012, Reclamation entered into a partnership with the NMISC for a Basin Study focusing on the Pecos watershed in eastern New Mexico. This project is evaluating projected changes in water supply and demand in the New Mexico portion of the Pecos Basin, with emphasis on agricultural

impacts and adaptation in the three major irrigation districts in the Pecos Basin: FSID, PVACD, and CID.

Reclamation has developed projections of the hydrologic impacts of climate change for this basin, with assistance from USACE. These projections provide the basis for simulations of the river system using the PROM RiverWare® model, which simulates groundwater/surface water interaction in the Fort Sumner area, and the Roswell Artesian Basin groundwater model, which simulates the artesian aquifer that underlies the Roswell basin and its interaction with the Pecos River.

Initial delays resulted from changes in the Department of the Interior requirements for Basin Studies and the need for additional modeling analyses to support this study. Following the completion of the last draft report, internal and external reviews identified substantive issues in need of additional clarification or expansion, prompting the NMISC to request a six-month extension to collaborate with Reclamation and basin stakeholders. Reclamation is currently working with the NMISC to address concerns as well as clarify and refine parts of the final report. The time extension request was granted and the adjusted completion date for the Basin Study is July 31, 2020.

Applied Science Grants

Through Applied Science Grants, Reclamation provides funding to external non-Federal entities and internal project teams for the development of tools and information to support water management for multiple uses. Eligible projects include the development of modeling and forecasting tools, hydrologic data platforms, and new data sets.

Science & Technology Program and Other Research Projects

Reclamation's Science and Technology (S&T) Program is a Reclamation-wide, competitive, merit-based applied research and development program. The program focuses on innovative solutions for water and power challenges in the Western U.S. for Reclamation water and facility managers and the stakeholders they serve. The program has contributed many of the tools and capabilities Reclamation and western water managers use today.

The AAO is an active participant in Reclamation's S&T Program, and initiates and participates in research to improve the services that Reclamation provides to its stakeholders. S&T Program projects underway in 2019 include:

- FY 2017 Award; completed in 2019: Detecting, Interpreting, and Modeling Hydrologic Extremes to Support Flexible Water Management and Planning (AAO partnership with NCAR, Boulder, CO). This project developed statistical methodologies to characterize changing extreme precipitation events in the Rio Grande and Pecos Basins, with the goal of improving our ability to take advantage of extreme events for water supply. A project summary and the final project report can be found on Reclamation's S&T website at: <https://www.usbr.gov/research/projects/detail.cfm?id=1782>. A follow-on project has been recommended for funding in 2020. This new project will focus on how to use seasonal forecasting improvements for the summer monsoons.
- FY 2018 Award; ongoing: Improving the Robustness of Southwestern US Water Supply Forecasting in the Face of Climate Trends and Variability (AAO partnership with NCAR,

Boulder, CO). This project seeks to develop improved seasonal water supply forecasting tools for the Rio Grande Basin, and incorporate those improvements in Reclamation’s annual water supply planning.

In addition, through Reclamation’s Power Resources Office, AAO is partnering with the Department of Energy’s National Renewable Energy Laboratory (NREL) on a project to evaluate the feasibility of, and obstacles to, the installation of floating solar panels, or “floatovoltaics,” on federal reservoirs to generate electricity and reduce reservoir evaporation losses.

Zebra and Quagga Mussels

Zebra and quagga mussels (*Dreissena rostriformis bugensis* and *Dreissena polymorpha*) are invasive, freshwater, bivalve mollusks. Originally from Eurasia, zebra mussels were first introduced in the Great Lakes in the mid-1980s and have spread to the Western United States. A single female mussel can produce hundreds of thousands of eggs a year, which produce microscopic, swimming larvae (veligers). Veligers spread within a waterbody in numerous ways, mainly by floating within the water column. Transport to neighboring waterbodies occurs via standing water by, or adult mussel attachment to, a water vessel that was used in infested water and then transported to another water body. Eventually, veligers mature and begin to attach to hard surfaces and continue to grow into reproducing adults. Clumped onto these hard surfaces, ZQM clog infrastructure, restricting operation and maintenance of water storage, water delivery, and hydropower structures and systems. They also impair recreational use and aquatic ecosystems: (<http://www.usbr.gov/research/docs/ks/ks-2015-04.pdf>).

In 2019, none of the seven Reclamation reservoirs sampled in New Mexico tested positive for zebra or quagga mussels via either microscopy or Polymerase Chain Reaction (PCR). Factors that may contribute to a lack of mussel occupation in New Mexico reservoirs include a fast spring runoff coupled with high levels of suspended solids, rapid drawdown of reservoir waters and canals, and ongoing drought (D. Hosler, personal communication). Continued vigilance is important, however, as conditions more suitable to mussels may occur in the future (Table 8).

Table 8: 2019 Sampling Results for Reclamation Reservoirs in New Mexico

Water body	Number of samples	Microscopy results	PCR results
Navajo Reservoir	21	Negative for all	Negative for all
Heron Reservoir	8	Negative for all	Negative for all
El Vado Reservoir	6	Negative for all	Negative for all
Elephant Butte Reservoir	9	Negative for all	Not tested
Caballo Reservoir	10	Negative for all	Not tested
Sumner Reservoir	11	Negative for all	Negative for all
Brantley Reservoir	11	Negative for all	Not tested

Literature Cited

Hosler, D. Bureau of Reclamation. Personal communication. January 4, 2017.
Pucherelli, S. Bureau of Reclamation. Personal communication. December 31, 2019.