BUREAU OF RECLAMATION

Calendar Year 2019 Report to the Rio Grande Compact Commission

Interior Region 7: Upper Colorado Basin

U.S. Department of the Interior

March 2020

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 Rio Grande Compact Commission

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Cover Photo: Looking upstream at the Rio Grande adjacent to the Bosque del Apache National Wildlife Refuge on May 31, 2019. Extended high flows in 2019 caused widespread overbanking throughout the Middle Rio Grande. (Reclamation/Carolyn Donnelly)

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List of Acronyms and Abbreviations

AAO....Albuquerque Area Office
ABCWUA....Albuquerque Bernalillo County Water Utility Authority
ac....acres
ac-ft....acre-feet
AIS....Aquatic Invasive Species
AM....adaptive management
ANWR....Alamosa National Wildlife Refuge
AOP....Annual Operating Plan
ARRC....Aquatic Resources and Recovery Center
ASR....Aquifer Storage and Recovery
ASI....Annual Site Inspection (Safety of Dams)
AWARDS....Agricultural Water Resources Decision Support
BA....Biological Assessment
BDANWR....Bosque del Apache National Wildlife Refuge
BIA....Bureau of Indian Affairs
BO....Biological Opinion
BLM....Bureau of Land Management
BWHA....Blanca Wildlife Habitat Area
CADSWES....Center for Advanced Decision Support for Water and Environmental Systems
CAS....Corrective Action Study

CBP	Closed Basin Project
CERRO	Concentrate Enhanced Recovery Reverse Osmosis
cfs	cubic feet per second
CMIP5	Coupled Model Intercomparison Project Phase 5
Coalition	Coalition of the Six Middle Rio Grande Basin Pueblos
CPUE	catch per unit effort
CPW	Colorado Parks and Wildlife
CR	Comprehensive Review
Cuckoo	Western Yellow-billed Cuckoo
CWCD	Conejos Water Conservancy District
CWMP	Cooperative Watershed Management Program
CY	Calendar Year
DCP	Drought Contingency Plan
DOMSAT	Domestic Communications Satellite
DSAT	Dam Sector Analysis Tool
DSIS	Dam System Information System
DSS	Data Storage System
EAP	Emergency Action Plan
EBID	Elephant Butte Irrigation District
EDW	Emergency Drought Water
EIS	Environmental Impact Statement
EOM	End of Month
EPCWID	El Paso County Water Improvement District No. 1
EPWU	El Paso Water Utilities
ESA	Endangered Species Act
ET	Evapotranspiration
FERC	Federal Energy Regulatory Commission
flycatcher	Southwestern willow flycatcher
FR	Federal Register
FRR	Facility Review Rating
FY	Fiscal Year
FW	Floodway
ha	hectares
HCCRD	Hudspeth County Conservation and Reclamation District No. 1
HDB	Bureau of Reclamation's Hydrologic Database
IBWC	International Boundary and Water Commission
ITS	Incidental Take Statement
JPL	NASA's Jet Propulsion Laboratory
km	kilometers
kWhr	kilowatt-hour
LACPP	Los Alamos County Power Plant
LCC	Landscape Conservation Cooperative
LFCC	Low Flow Conveyance Channel
LFSTP	Longitudinal Fill Stone Toe Protection
LOPP	Lease of Power Privilege
MAT	Minnow Action Team
mi	miles

MODIS ..... Moderate Resolution Imaging Spectroradiometer
MRCOG ..... Mid-Region Council of Governments
MRG ..... Middle Rio Grande
MRGCD ..... Middle Rio Grande Conservancy District
MRMPO ..... Mid-Region Metropolitan Planning Organization
MR&R ..... Maintenance Rehabilitation and Repair
NEPA ..... National Environmental Policy Act
NMDGF ..... New Mexico Department of Game and Fish
NMISC ..... New Mexico Interstate Stream Commission
NMOSE ..... New Mexico Office of the State Engineer
NMSP ..... New Mexico State Parks
NPS ..... National Park Service
NRCS ..... Natural Resources Conservation Service
OA ..... Rio Grande Project Operating Agreement
O&M ..... Operations and Maintenance
OVIC ..... Observation Visual Inspection Checklist
PAO ..... Provo Area Office
PCR ..... Polymerase Chain Reaction
PFR ..... Periodic Facility Review
PIT ..... Passive Integrated Transponder
P&P ..... Prior and Paramount
P.L. ..... Public Law
PSR ..... Periodic Security Review
RDLES ..... Reclamation Detection Laboratory for Exotic Species
Reclamation ..... Bureau of Reclamation
RGCC ..... Rio Grande Compact Commission
RGP ..... Rio Grande Project
RGWCD ..... Rio Grande Water Conservation District
RIO ..... River Integrated Operations
RM ..... River Mile
RWS ..... Regional Water System
SADD ..... San Acacia Diversion Dam
S&T ..... Science and Technology Program
SJ-C ..... San-Juan Chama
SL ..... standard length
SLL ..... San Luis Lake
SLVWCD ..... San Luis Valley Water Conservation District
SOD ..... Safety of Dams
SWFL ..... Southwestern willow flycatcher
TCEQ ..... Texas Commission on Environmental Quality
TDS ..... Total Dissolved Solids
Title XVI ..... Title XVI of Public Law 102-575
TRT ..... Technical Response Team
UC ..... Upper Colorado
URGSiM ..... Upper Rio Grande Simulation model
URGWOM ..... Upper Rio Grande Water Operations Model
USACE ..... U.S. Army Corps of Engineers
USDS ..... U.S. District Court

USFWS ..... U.S. Fish and Wildlife Service
USGS..... U.S. Geological Survey
VIE..... Visible Implant Elastomer
WCFSP ..... Water Conservation Field Services Program
WEEG ..... WaterSMART Water and Energy Efficiency Grant
YOY ..... young of year
ZQM ..... quagga and zebra mussels

Introduction

The Albuquerque Area Office (AAO) of the Bureau of Reclamation (Reclamation) is responsible for operation, maintenance, and oversight of four projects on the mainstem of the Rio Grande and its upper basin tributaries. These projects are: the San Luis Valley Project, the San Juan – Chama Project, the Middle Rio Grande Project, and the Rio Grande Project (Figure 1).

The San Luis Valley Project consists of the Conejos and Closed Basin Divisions. The Conejos Division, which includes Platoro Dam and Reservoir, provides water for approximately 86,000 acres within the Conejos Water Conservancy District. The Closed Basin Division is a groundwater salvage project located near Alamosa, Colorado, which pumps water from the shallow unconfined aquifer primarily to assist Colorado in meeting its commitment under the Rio Grande Compact.

The San Juan – Chama (SJ-C) Project consists of a system of storage dams, diversion structures, tunnels, and channels for transbasin movement of water from the San Juan River Basin to the Rio Grande Basin as a component of the Colorado River Storage Project. The SJ-C Project provides water for municipal, domestic, industrial, recreation, fish and wildlife purposes, and supplemental water for irrigation. Another component of the project is the Pojoaque Irrigation Unit including Nambé Falls Dam. The Pojoaque Irrigation Unit provides water for approximately 2,800 acres in the Pojoaque Valley.

The Middle Rio Grande Project consists of El Vado Dam and Reservoir and irrigation and drainage facilities in the Middle Rio Grande Valley. The project also includes river channel maintenance from Velarde, New Mexico southward to Caballo Reservoir, and the Low Flow Conveyance Channel (LFCC) south of San Acacia, New Mexico. Irrigation water is provided to the Middle Rio Grande Conservancy District (MRGCD) which supplies water to 50,000 to 70,000 acres of land.

The Rio Grande Project includes Elephant Butte and Caballo Reservoirs and Percha, Leasburg, and Mesilla Diversion Dams. The Project stretches from the lower Rio Grande Valley of southern New Mexico to just south of El Paso, Texas. The Rio Grande Project provides an agricultural water supply for approximately 178,000 acres of land within the Elephant Butte Irrigation District (EBID) in New Mexico and the El Paso County Water Improvement District No. 1 (EPCWID) in Texas. Water is also provided for diversion to Mexico by the International Boundary and Water Commission (IBWC) - United States Section according to the terms of the Convention of 1906 between the United States and Mexico. Drainage waters from the Rio Grande Project lands provide a supplemental supply for approximately 18,000 acres of land within the Hudspeth County Conservation and Reclamation District No. 1 in Texas. Elephant Butte Dam also generates electrical power that is marketed by the Western Area Power Administration. Reclamation transferred title to the canal and drainage facilities to the districts in a 1996 quit claim deed.

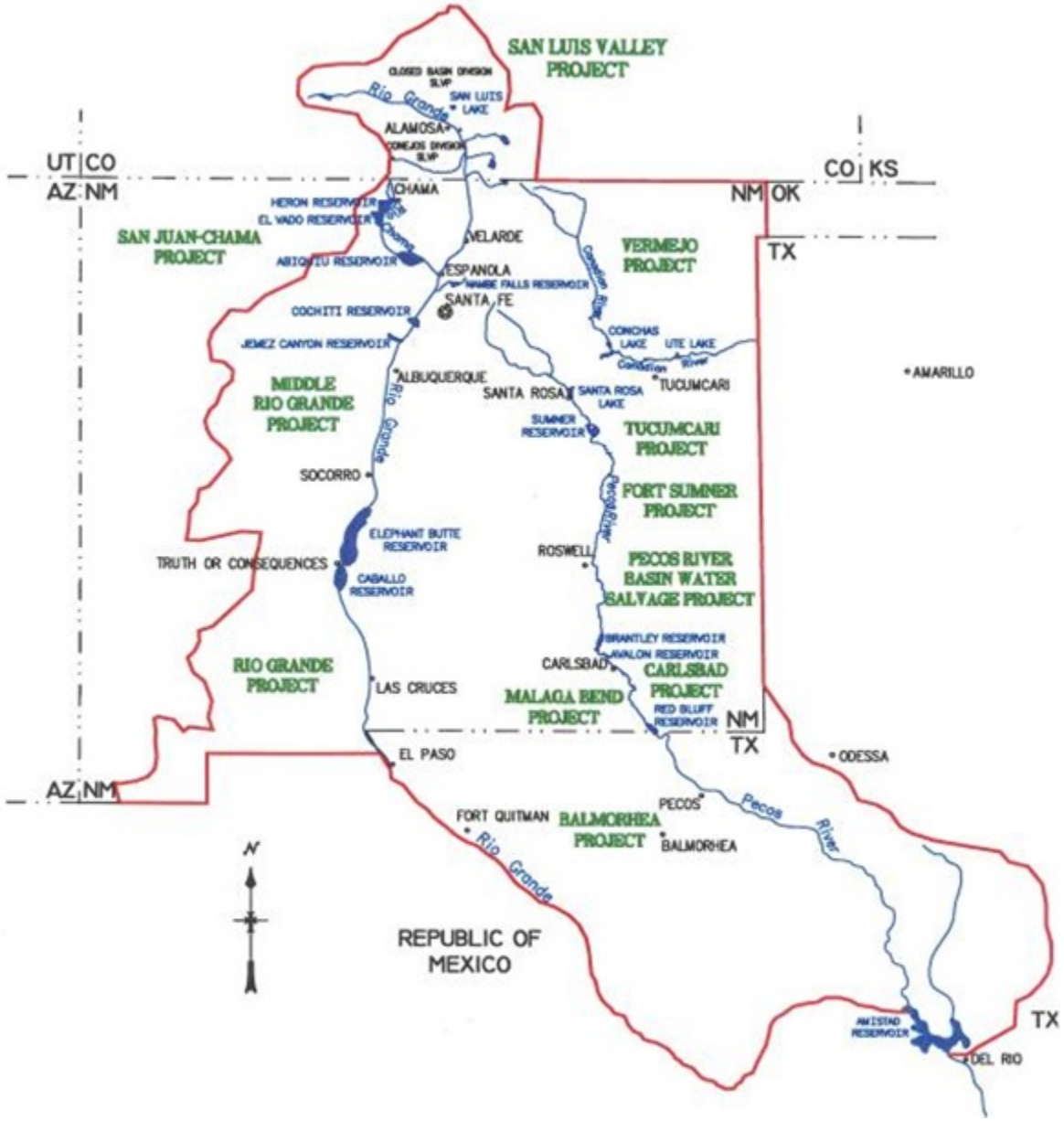


Figure 1: Map of Reclamation's Albuquerque Area Office Projects

San Luis Valley Project, Colorado

Conejos Division, Platoro Reservoir

The Conejos Water Conservancy District (CWCD) operates Platoro Reservoir, which provides storage for approximately 86,000 acres associated with the San Luis Valley Project (Figure 2). The CWCD's office is in Manassa, Colorado.

Platoro Reservoir started 2019 with a midnight water surface elevation of 9,981.32 feet, and a storage volume of 19,080 acre-feet (ac-ft), on January 1. The December 31, 2019, reservoir elevation was 9,980.46 feet, with a storage volume of 18,601 ac-ft. This was also the minimum storage during calendar year 2019. Maximum storage was on July 4, 2019, when the reservoir peaked at 51,039 ac-ft (10,024.79 feet).

Article VII restrictions were in effect between January 1 and May 12, 2019. Restrictions were lifted on May 12 and remained so through the end of 2019.

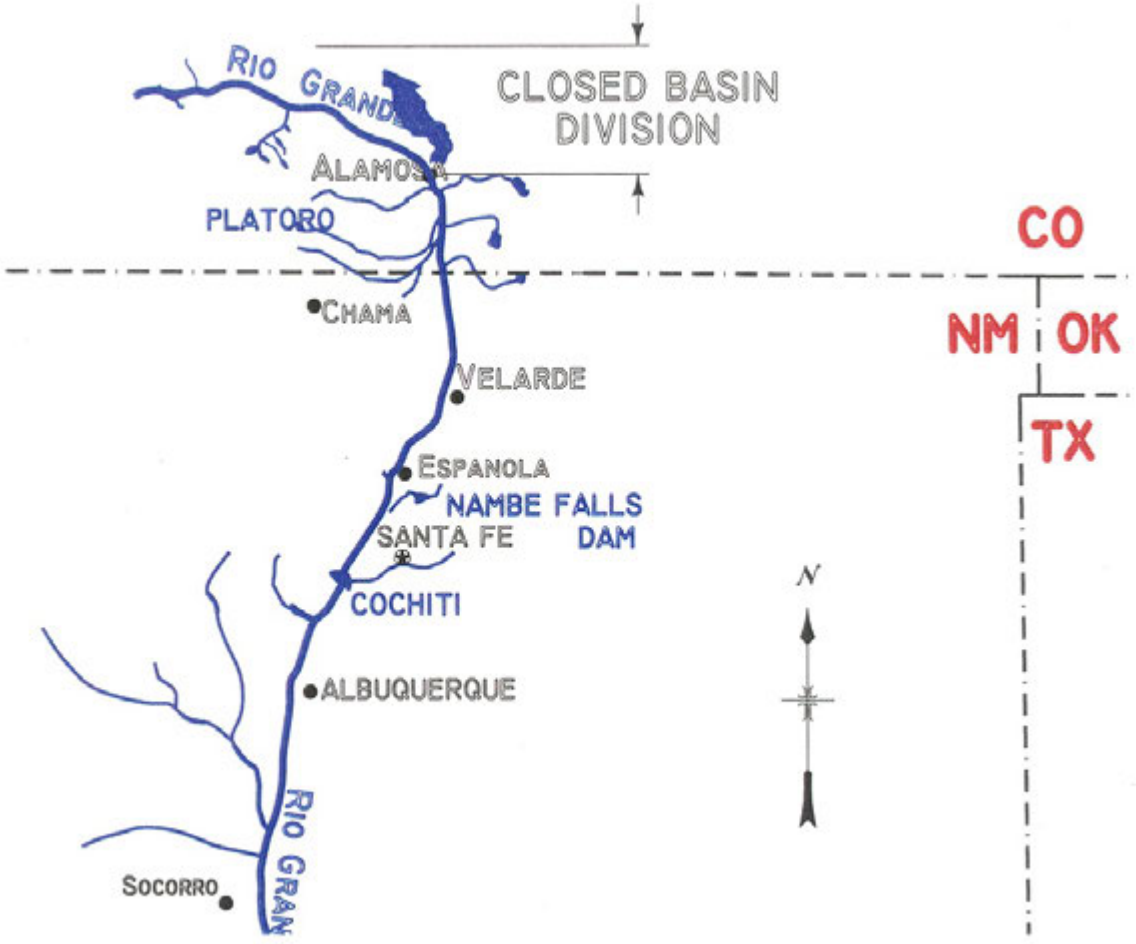


Figure 2: Area Map of San Luis Valley Project

Platoro Dam Facility Review and Safety of Dam Programs

Other than aging infrastructure, there are no significant dam safety-related Operations and Maintenance (O&M) issues associated with Platoro Dam and Dike. Currently there is one incomplete Category 2 O&M recommendation for Platoro Dam.

The Annual Site Inspection (ASI) was completed on July 3, 2019. The Facility Review Rating (FRR) was completed in October 2019. The rating for Platoro Dam was 97 meaning the Dam is in "good condition."

In the spring of 2019 after an above normal snowpack, releases through the jet flow gates were increased to make room for inflows. During the release operations the dam tender noticed that the conduit and jet flow gates were vibrating more than normal. Reclamation dam safety personnel inspected the conduit pipe and decided the conduit and jet flow gates warranted further inspection and testing. In August 2019, a team of inspectors installed instrumentation on the conduit and operated the jet flow gates from 10% to 100% fully open.

The team found that the pipe shell vibrations are well within the acceptable range and no modifications or operational limitations are required. They determined that cavitation was the likely cause of the vibration and noise at the 56-inch outlet pipe. While the specific locations could not be determined, cavitation may form near the manholes, bifurcation, or some other offset in the pipe. Therefore, they recommended inspecting the outlet pipe and bifurcation. They also recommended developing an updated rating curve for both jet flow gates and avoiding operations at 90% of full gate opening for prolonged periods.

The interior of the conduit pipe was inspected on November 5, 2019. The overall condition of the pipe and coating was good. Minor abrasion along the length of the main 56-inch pipe and transition to the bifurcation was apparent but still in good condition. Previously observed in 2017, two areas next to the bifurcation are exhibiting peeled off coating stemming from high velocity and should be repaired before the next peak discharge season to prevent further damage.

Closed Basin Division

The Closed Basin Project (CBP) is a water salvage project constructed in the San Luis Valley of Colorado (Figure 2). The purpose of the Project is to salvage unconfined groundwater from the Closed Basin that would otherwise be lost to evaporation and evapotranspiration. The salvaged water is pumped from up to 170 salvage wells and delivered through a conveyance channel to the Rio Grande to assist Colorado in meeting its commitment under the Rio Grande Compact. The project also delivers mitigation water to the Alamosa National Wildlife Refuge (ANWR) and Blanca Wildlife Habitat Area (BWHA). Reclamation continues to work under the guidance of the Closed Basin Project Operating Committee in management of Project operations and water deliveries. The Rio Grande Water Conservation District (RGWCD) provides civil maintenance on the Project, while Reclamation operates and maintains the Project.

Operations

Deliveries by the Closed Basin Project in Calendar Year (CY) 2019 included deliveries to the Rio Grande, BWHA, and ANWR. A total of 12,334 ac-ft of Project water was delivered in CY 2019.

Total delivery of Compact water to the Rio Grande for CY 2019 was 8,967 ac-ft. This included 8,567 ac-ft delivered at the CBP canal outlet, in addition to 400 ac-ft delivered to the BWHA in exchanges with Colorado Parks and Wildlife (CPW) and the ANWR. The Rio Grande Compact specifies that water delivered to the river cannot exceed 350 parts per million total dissolved solids, based on a ten-day average. All water deliveries to the Rio Grande met these water quality standards again in 2019. Table 1 compares total production and Compact deliveries in 2019 to quantities in the five preceding calendar years.

Table 1: Closed Basin Project Deliveries 2014-2019[1]

Year	Total CBP Production	Delivered to RG @ CBP Canal Outlet	Delivered to RG by Exchange[2]	Total Creditable Delivery to RG
2019	12,334	8,567	400	8,967
2018	10,209	6,558	250	6,808
2017	11,789	8,003	378	8,381
2016	12,095	8,469	242	8,711
2015	11,684	8,059	237	8,296
2014	11,213	7,598	228	7,826

Total water deliveries to the Bureau of Land Management's (BLM) BWHA were 1,546 ac-ft. This was composed of 800 ac-ft for annual mitigation, 350 ac-ft from an exchange between BLM and CPW, a 50 ac-ft exchange with ANWR, and a 346 ac-ft transfer from the ANWR.

Total water deliveries to the ANWR were 2,221 ac-ft for project mitigation. This total consists of their 2019 mitigation amount of 2,567 ac-ft minus the 346 ac-ft transfer to the BWHA.

Natural inflows to San Luis Lake (SLL) are measured at the SLL inlet flume and culverts. Inflow to SLL during CY 2019 totaled 4,450 ac-ft. Closed Basin Division water accounting for the 2019 calendar year is summarized in Table 2.

[1] Units are acre-feet

[2] CBP water delivered to BWHA or San Luis Lakes State Wildlife Area (SWA) in exchange for other water sources delivered upstream to the RG.

Table 2: San Luis Valley Project - Closed Basin Division Water Accounting[1]

SAN LUIS VALLEY - CLOSED BASIN DIVISION	BLANCA WILDLIFE HABITAT AREA CH03 STA. 730 + 00	BLANCA WILDLIFE HABITAT AREA CH04 STA. 798 + 60	BLANCA WILDLIFE HABITAT AREA MONTH TOTALS[2]	PARSHALL FLUME TOTAL PASSING FLUME	PARSHALL FLUME CREDITABLE AMOUNT AT FLUME	ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR) CH01 CHICAGO TURN-OUT	ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR) CH02 MUM. TURN-OUT	ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR) PUMPING PLANT	ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR) MONTH TOTALS	DELIVERY TO THE RIO GRANDE TOTAL AT FLUME MINUS DEL. @ ANWR	DELIVERY TO THE RIO GRANDE Credit Amt. Del. To R.G. & not used by ANWR[3]	DELIVERY TO THE RIO GRANDE NON-CREDITABLE AT LOBATOS	PROJECT TOTALS
JANUARY	0	0	0	921	921	0	0	0	0	921	921	0	921
FEBRUARY	2	2	4	904	904	0	0	0	0	904	904	0	908
MARCH	122	122	244	1,061	1,061	249	228	0	477	584	584	0	1,305
APRIL	36	36	72	910	910	62	55	0	117	793	793	0	982
MAY	0	0	0	1,024	1,024	0	0	0	0	1,024	1,024	0	1,024
JUNE	75	75	150	809	809	0	0	0	0	809	809	0	959
JULY	223	232	455	526	526	0	0	0	0	526	526	0	981
AUGUST	230	273	503	479	479	35	11	0	46	433	433	0	982
SEPTEMBER	63	55	118	1,008	1,008	177	254	0	431	577	577	0	1,126
OCTOBER	0	0	0	1,113	1,113	355	301	0	656	457	457	0	1,113
NOVEMBER	0	0	0	1,077	1,077	232	262	0	494	583	583	0	1,077
DECEMBER	0	0	0	956	956	0	0	0	0	956	956	0	956
ANNUAL	751	795	1,546	10,788	10,788	1,110	1,111	0	2,221	8,567	8,567	0	12,334

[1] Units are acre-feet

[2] Delivery to BWHA includes: 350 ac-ft exchange from Colorado Parks and Wildlife (CPW), a 50 ac-ft exchange from the ANWR and a 346 ac-ft transfer of mitigation water from ANWR.

[3] Total creditable to Rio Grande from delivery and exchange = 8,567+400 = 8,967 ac-ft.

The project continues to provide Priority 1 (Compact) and Priority 2 (mitigation) water deliveries. The San Luis Valley remains in a long-term drought. Since 2002, the water table in the unconfined aquifer has dropped significantly in some areas. Project salvage wells are operated to minimize aquifer impacts outside the Project and to insure sustainability of the Closed Basin aquifer. Salvage wells turned off at the recommendation of the Project Operating Committee remain off while monitoring nearby water levels.

Maintenance

Routine preventive maintenance and repair activities continue at all observation and salvage wells, lateral line valves, canal structures, pumping plants, and canal and lateral access roads. Several miles of lateral roadways were upgraded and rehabilitated with additional road base material. All vehicles and heavy equipment were serviced according to their recommended maintenance interval.

Redrilling and rehabilitation of salvage wells is ongoing. In 2019, four salvage wells were redrilled, 18 wells were rehabilitated, and 10 new pumps were installed. In two of the rehabilitations, a PVC liner was installed inside the existing steel well casing because it had lost structural integrity due to corrosion.

All four redrilled wells were constructed using a glass bead filter pack with stainless steel casing. Although this is an expensive design, stainless steel casing will greatly increase the life of the well while the glass beads are intended to increase long term well productivity and reduce the need for frequent well rehabilitation. The performance of these wells will be closely monitored.

Water Quality

Water quality monitoring of Closed Basin Division salvage wells, the Rio Grande, San Luis Lake, Head Lake, and the conveyance channel continued with 1,351 samples collected in 2019.

The Water Quality Laboratory continues to support the Operations and Maintenance groups with their salvage well rehabilitation and bio-fouling mitigation efforts. Currently all salvage wells are monitored for the presence of iron-related bacteria.

The Water Quality Laboratory participated in the spring and fall U.S. Geological Survey (USGS) Evaluation Program for Standard Reference Water Samples. The Laboratory continues to perform commendably on these audits.

Rio Grande Water Conservation District

RGWCD continues to perform civil maintenance on the Project through a cooperative agreement with Reclamation. The task divisions between RGWCD and Reclamation have been officially lifted and both crews are working closer than ever before.

RGWCD continues to assist with salvage well maintenance, rehabilitation, and drilling activities. Other work completed includes blading and mowing of all canal berms and lateral access roads, removal of aquatic weeds and sediment from the canal and associated structures, repair and maintenance of right-of-way fences, and repair of erosion along the canal berms. RGWCD also assisted in vehicle and heavy equipment maintenance.

San Juan – Chama Project, Colorado – New Mexico

Water diverted from the San Juan Basin in Colorado through the San Juan – Chama (SJ-C) Project (Figure 3) authorized by Congress in 1962 through Public Law (P.L.) 87-483, introduced special circumstances for water use and management in the Middle Rio Grande Valley. Imported SJ-C Project water must be accounted for separately from native Rio Grande flow.

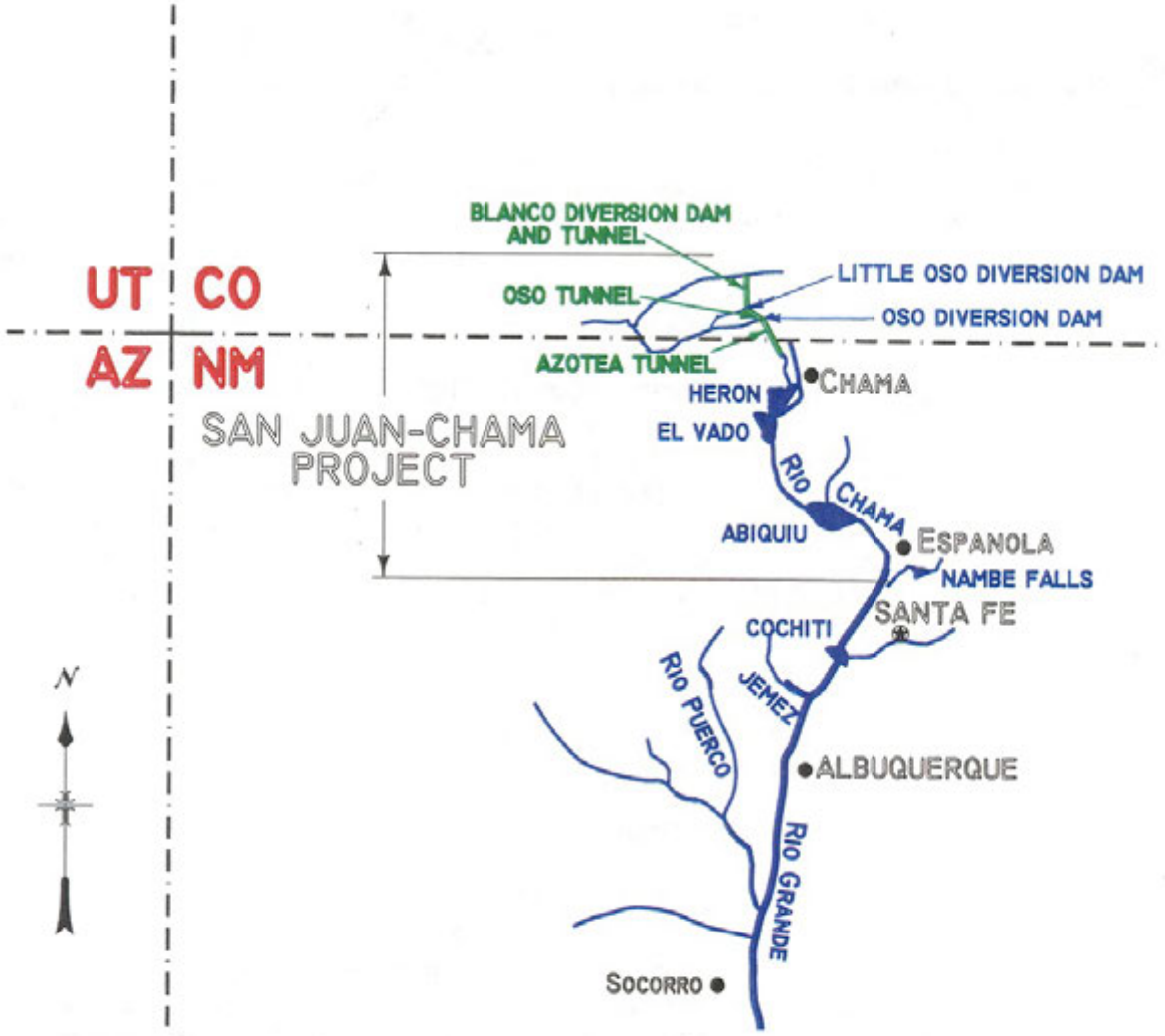


Figure 3: Area Map of the San Juan-Chama Project

San Juan – Chama Project Accounting

Reclamation is responsible for water contracts and accounting for the SJ-C Project. Accounting reports are generated with Crystal Reports®, which mines accounting data from Reclamation's hydrologic database (HDB). HDB is Reclamation's database of record. The data are computed in RiverWare® and sent to HDB via a Data Management Interface. Crystal Reports® has been used since 2013 to generate the SJ-C Project accounting report. SJ-C Project accounting for 2019 is provided in the separate *2019 Water Accounting Report*.

Heron Dam and Reservoir Operations

Diversions into the Azotea Tunnel began on March 13 and continued until September 18, 2019. The total volume diverted through the tunnel was 148,270 ac-ft. The running ten-year average of Azotea Tunnel diversions increased slightly this year, from 82,786 ac-ft for the period 2009 through 2018, to 87,078 ac-ft for the period 2010 through 2019 (Table 3).

Table 3: SJ-C Project - Diversions through Azotea Tunnel[1]

AZOTEA	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	10 YEAR TOTAL
JANUARY	0	0	0	0	0	28	109	0	0	0	137
FEBRUARY	0	0	0	0	227	974	1,917	1,488	0	0	4,606
MARCH	546	2,008	7,014	1,036	1,984	6,890	6,489	16,839	1,598	1,036	45,440
APRIL	21,908	13,570	18,133	7,068	13,808	8,163	13,687	32,628	12,869	24,049	165,883
MAY	35,368	22,315	17,032	16,844	20,251	24,470	27,940	45,326	15,616	33,926	259,088
JUNE	27,249	42,779	4,037	8,387	18,851	38,438	35,427	46,227	2,636	56,925	280,956
JULY	1,815	8,404	670	511	1,550	8,581	3,535	10,617	152	26,285	62,120
AUGUST	1,501	1,594	260	3,115	788	889	3,681	4,809	7	5,841	22,485
SEPTEMBER	712	1,852	76	4,930	902	126	1,271	1,806	0	208	11,883
OCTOBER	251	4,452	0	2,761	1,334	811	253	2,413	1,216	0	13,491
NOVEMBER	53	1,295	0	1,049	335	862	0	279	283	0	4,156
DECEMBER	0	52	0	59	0	334	0	90	0	0	535
ANNUAL	89,404	98,321	47,222	45,760	60,030	90,566	94,309	162,522	34,377	148,270	870,780

[1] Units are acre-feet

Heron Reservoir began the year at elevation 7,090.61 feet (56,308 ac-ft), which was also its lowest elevation of the year. The reservoir reached a maximum elevation of 7,143.8 feet on August 1 (193,157 ac-ft). It ended the year at 7,116.69 feet (106,197 ac-ft).

No initial allocation to the SJ-C Project contractors was made in January 2019. Subsequent allocations were made in April, May, June, and July until a full allocation was achieved.

The SJ-C Project contractors' 2019 and waivered 2018 annual allocations were delivered as shown in Table 4, for a total delivery of 88,935 ac-ft. The remaining 2019 allocations are being held in Heron according to waivers, which grant an extension of the delivery date into 2020. Table 5 presents actual monthly Heron water operations for calendar year 2019.

Table 4: SJ-C Project – Water Releases from Heron Reservoir[1]

SJ-C HERON RELEASE	ALLOCATION	2019 CY TOTAL	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MRGCD	20,900	21,113	0	0	0	0	0	0	0	0	0	0	0	21,113
SANTA FE	5,230	5,876	0	0	0	0	0	0	0	4,676	1,171	29	0	0
SANTA FE COUNTY	375	548	173	0	0	0	0	0	0	0	0	0	0	375
COCHITI	4,290	4,290	0	0	0	0	0	0	0	0	0	0	0	4,290
CITY OF ALBUQUERQUE	48,200	43,090	0	0	0	0	0	0	0	17,801	25,289	0	0	0
POJOAQUE UNIT	1,030	950	0	0	0	0	0	0	0	0	0	0	561	389
TAOS	766	0	0	0	0	0	0	0	0	0	0	0	0	0
COUNTY OF LOS ALAMOS	1,200	0	0	0	0	0	0	0	0	0	0	0	0	0
CITY OF ESPANOLA	1,000	82	0	0	0	0	0	0	0	82	0	0	0	0
TAOS SKI VALLEY	15	0	0	0	0	0	0	0	0	0	0	0	0	0
VILLAGE OF LOS LUNAS	400	183	100	0	0	0	0	0	0	0	0	0	83	0
TOWN OF BERNALILLO	400	37	0	0	0	0	0	0	0	37	0	0	0	0
BELEN	500	144	93	0	0	0	0	0	0	0	0	0	51	0
RED RIVER	60	0	0	0	0	0	0	0	0	0	0	0	0	0
JICARILLA APACHE	6,500	0	0	0	0	0	0	0	0	0	0	0	0	0
OHKAY OWINGEH	2,000	0	0	0	0	0	0	0	0	0	0	0	0	0
RECLAMATION	0	12,622	0	0	0	0	0	10	0	5,210	2,563	2,791	2,042	7
EL PRADO	40	0	0	0	0	0	0	0	0	0	0	0	0	0
TAOS PUEBLO	2,215	0	0	0	0	0	0	0	0	0	0	0	0	0
AAMODT SETTLEMENT	1,079	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**96,200**	**88,935**	**366**	**0**	**0**	**0**	**0**	**10**	**0**	**27,806**	**29,023**	**2,820**	**2,737**	**26,174**

[1] Units are acre-feet

Table 5: SJ-C Project – Monthly Water Storage in Heron Reservoir[1]

HERON STORAGE[2]	RIO GRANDE INFLOW	SAN JUAN CHAMA INFLOW	RIO GRANDE OUTFLOW	SAN JUAN CHAMA OUTFLOW	SAN JUAN CHAMA LOSS	RIO GRANDE END-OF-MONTH CONTENT	SAN JUAN CHAMA END-OF-MONTH CONTENT	TOTAL	ELEVATION (FEET)
DEC. 2018	0	0	0	0	0	350	55958	56308	7090.61
JANUARY	229	0	48	366	0	182	55942	56124	7090.48
FEBRUARY	676	0	51	0	0	807	55942	56749	7090.92
MARCH	11080	1036	9690	0	0	2197	56978	59175	7092.59
APRIL	3414	24001	5439	0	0	172	80979	81151	7105.48
MAY	2036	33858	1312	0	0	896	114837	115733	7120.34
JUNE	83	56811	630	10	2363	348	169276	169624	7137.50
JULY	102	26232	102	0	2777	348	192731	193079	7143.78
AUGUST	1856	5829	1864	27806	2363	340	168391	168731	7137.25
SEPTEMBER	86	208	86	29022	1027	340	138550	138890	7128.30
OCTOBER	83	0	83	2820	1480	340	134250	134590	7126.90
NOVEMBER	79	0	79	2737	35	340	131478	131818	7125.98
DECEMBER	639	0	86	26174	0	893	105304	106197	7116.69
SUB-TOTAL	20,363	147,975	19,470	88,935	0	0	0	0	0
ADJUSTMENT	0	0	0	0	0	-350	0	0	0
ANNUAL	0	168,338	0	108,405	10,045	543	105,654	106,197	0

Heron Dam Facility Review and Safety of Dams Programs

There are no significant dam safety-related O&M issues associated with Heron Dam and Dike. Currently, there are four incomplete Category 2 O&M recommendations for Heron Dam. In 2019, recommendation 2016-2-A was completed by installing a carport to cover the exposed bulkhead.

The Annual Site Inspection was completed in July 2019. The annual elevator inspection was completed in December.

No O&M recommendations were added in 2019. The 2019 FRR was updated in September. The total score for Heron is 83, resulting in an overall rating of "Good."

A dive team inspected the intake structure in September 2019, in anticipation of the upcoming Comprehensive Review (CR) scheduled for the spring of 2020. The mechanical inspection was scheduled for fall of 2019; however, budget issues prevented completion that year.

[1] Units are acre-feet except as noted

[2] Note that 350 ac-ft of native Rio Grande water is annually retained in Heron to cover water use by New Mexico State Parks' facilities under a water right they hold by exchange.

Pojoaque Tributary Unit - Nambé Falls Dam and Reservoir

Nambé Falls Reservoir began 2019 with an elevation of 6,821.25 feet (1,447 ac-ft). The maximum elevation for the year was 6,826.93 feet (1,748 ac-ft) from June 8 to 10. Releases ended on October 1. The reservoir also reached a minimum elevation at 6,806.09 feet (808 ac-ft) on that date. It ended 2019 at elevation 6,820.91 feet (1,430 ac-ft). The reservoir filled and spilled during the year. The reservoir initially filled in mid-March and remained full until late July when irrigation releases began, and reservoir storage and elevation started falling.

Cyclical operations of Nambé Falls Reservoir consist of non-irrigation and irrigation season operations. During non-irrigation season (November through April), all inflow in excess of the bypass requirement of 0.5 cfs is stored until an elevation of 6,825.60 feet is reached. Once that elevation is attained, the outlet gates are regulated weekly to stabilize the reservoir at 6,825.60 feet, or an elevation determined by 100 percent ice cover. An uncontrolled spill begins at elevation 6,826.60 feet, which is the top of the spillway crest. During irrigation season (May through October), water is stored and released on demand to meet downstream requirements.

In 2015, there was an error in the calculation for the net effect of Nambé Falls Reservoir on the Rio Grande. This resulted in a release from Heron Reservoir that was 703 ac-ft less than the depletion. Over the next three years releases were made from Heron to make up for this under-delivery. In some years there was just enough water available to meet that year's depletion. In 2019 there was finally enough water available in Heron to make up for the 2015 error, bringing the balance owed to zero.

Table 6 includes a summary of Nambé Falls use above Otowi and the Pojoaque Unit return flow credit used to calculate depletions during 2019 (columns 7 and 8). A summary of 2019 Nambé Falls Reservoir operations is provided in Table 7.

Table 6: SJ-C Project – Water at Otowi[1]

SJ-C AT OTOWI	RELEASE FROM HERON	HERON RELEASE STORED IN EL VADO	RELEASE FROM EL VADO	TOTAL BELOW EL VADO	RELEASE FROM OR STORAGE IN ABIQUIU	TRANS. LOSSES	NAMBÉ FALLS USE ABOVE OTOWI	RETURN FLOW CREDIT - POJOAQUE UNIT	SAN JUAN WATER AT OTOWI
JANUARY	366	0	1,018	1,384	5,818	80	148	21	6,995
FEBRUARY	0	0	1,500	1,500	1,757	46	69	35	3,177
MARCH	0	0	1,764	1,764	6,943	98	102	29	8,536
APRIL	0	0	0	0	4,900	44	30	17	4,843
MAY	0	0	0	0	0	0	18	16	-1
JUNE	10	0	3,065	3,075	-3,041	34	23	16	-7
JULY	0	0	4,271	4,271	73	86	20	16	4,254
AUGUST	27,806	5,525	0	22,281	-14,574	314	33	14	7,374
SEPTEMBER	29,022	2,084	0	26,938	-16,218	393	35	55	10,347
OCTOBER	2,820	2,332	0	489	4,890	54	196	74	5,203
NOVEMBER	2,737	2,042	0	695	2,813	39	231	26	3,264
DECEMBER	26,174	18,398	0	7,775	-2,984	129	207	22	4,477
ANNUAL	88,935	30,381	11,618	70,172	-9,623	1,317	1,112	341	58,462

Table 7: SJ-C Project – Monthly Water Storage in Nambé Falls Reservoir[1]

NAMBÉ FALLS	INFLOW	OUTFLOW BYPASSED	OUTFLOW STORAGE RELEASE OPERATIONAL	OUTFLOW STORAGE RELEASE IRRIGATION	RESERVOIR LOSSES	TOTAL OUTFLOW + LOSSES	END OF MONTH CONTENT	END OF MONTH ELEVATION
DEC. 2018	0	0	0	0	0	0	1,447	6,821.25
JANUARY	222	74	0	0	0	74	1,595	6,824.13
FEBRUARY	196	127	15	0	-2	140	1,651	6,825.18
MARCH	1,013	908	10	0	9	927	1,737	6,826.75
APRIL	1,860	1,825	0	9	19	1,853	1,744	6,826.87
MAY	2,030	2,011	0	7	16	2,033	1,741	6,826.82
JUNE	2,348	2,317	0	14	21	2,352	1,737	6,826.74
JULY	853	825	0	78	11	914	1,676	6,825.65
AUGUST	398	359	0	412	12	783	1,291	6,818.04
SEPTEMBER	191	148	0	500	9	657	825	6,806.60
OCTOBER	303	107	0	17	5	129	999	6,811.31
NOVEMBER	283	52	0	0	6	58	1,224	6,816.59
DECEMBER	258	51	0	0	1	52	1,430	6,820.91
ANNUAL	9,955	8,804	25	1,037	107	9,972	0	0

[1] Units are acre-feet

Nambé Falls Dam Facility Review and Safety of Dams Programs

There are no significant dam safety-related issues associated with Nambé Falls Dam. There are currently one incomplete SOD recommendation and three incomplete Category 2 O&M recommendations. In 2019, recommendation 2017-2-B was completed by installing a new buoy line over the reservoir. Work on O&M recommendation 2007-2-A, to update the dam break analysis and resulting inundation mapping, is in progress.

The Annual Site Inspection was completed in July 2019. No O&M recommendations were added during 2019. The 2019 FRR was updated in September. The total score decreased to an 84 due to older O&M Recommendations, but still results in an overall rating of "Good."

The 2018 – 2019 snowpack was above normal resulting in flow over the uncontrolled spillway until early July.

2020 San Juan – Chama Project Outlook

On December 31, 2019, Heron Reservoir had 43,594 ac-ft of SJ-C Project storage. This amount is just under half of the calculated firm yield of 96,200 ac-ft. Heron Reservoir's dead pool, which is water that cannot be drained by gravity through the outlet works, is 1,218 ac-ft. Allocations must leave sufficient water in SJ-C Project storage to cover both the dead pool and anticipated reservoir evaporation from January 1 until runoff begins in the spring, usually during March. Therefore, contractors were notified on January 15, 2020, that the initial allocation would be 40,000 ac-ft, 41.6% of the firm yield.

Water scarcity was contemplated in the SJ-C Project authorization, and all SJ-C Project water contracts state that "when the actual available water supply may be less than the estimated firm yield, [contractors] shall share in the available water supply in the ratio that the above allocation bears to the firm yield." Subsequent allocations will be made monthly beginning in April. They will continue until December 15, unless a full allocation is made earlier. Median annual Project inflow for the period of 1971 to 2019 is 89,403 ac-ft, so a full allocation is likely in 2020.

Middle Rio Grande Project, New Mexico

The Middle Rio Grande Project (Figure 4) is operated out of the AAO, with support provided by the Chama Field Division for operations and maintenance of northern facilities. The Socorro Field Division performs construction throughout the project area.

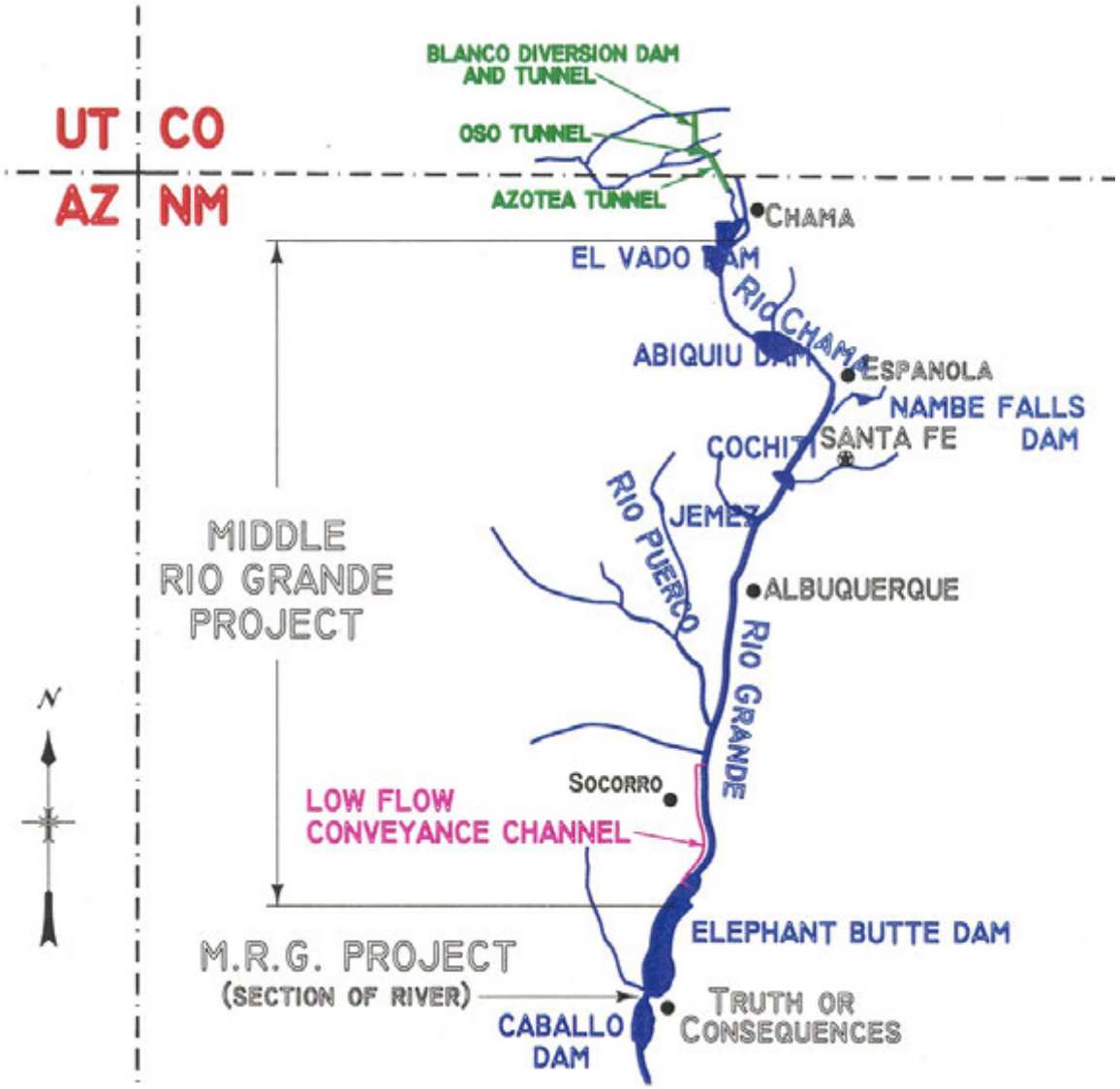


Figure 4: Area Map of the Middle Rio Grande Project

Article VII

Since 2011, the three Rio Grande Compact states have not reached consensus on the appropriate Compact accounting method. Because of that, Compact accounting has not been finalized since that year, and two sets of accounting sheets are currently maintained. Accounting method 1 is advocated by Texas, and accounting method 2 is advocated by New Mexico and supported by Colorado.

The Commission determines final Compact accounting, while Reclamation performs daily accounting of SJ-C Project and native Rio Grande water on the Rio Grande in New Mexico, including the composition of water in reservoirs from Heron to Caballo. This accounting is needed to make day-to-day water operations decisions.

To perform this accounting, Reclamation utilizes the interagency Upper Rio Grande Water Operations Model (URGWOM). Methods in URGWOM are consistent with accounting method 1 presented in various addendums to the Commission Reports since 2011.

Under accounting method 1, New Mexico began 2019 with a 10,900 ac-ft credit. Per method 2, the credit was 5,400 ac-ft. Colorado began 2019 with a 3,200 ac-ft credit under method 1, and a 3,100 ac-ft credit per accounting method 2.

Elephant Butte Reservoir, therefore, began 2019 with a total of 14,100 ac-ft of credit water in storage, per accounting method 1. All of the numbers that follow reference accounting method 1.

Per the Rio Grande Compact Article I definition, the usable water in Rio Grande Project (RGP) storage (Elephant Butte and Caballo Reservoirs combined) was 128,816 ac-ft on January 1, 2019, and 579,377 ac-ft on December 31, 2019. Usable storage rose above 400,000 ac-ft on May 12, and reached a high for the year on July 14 at 607,303 ac-ft. After Article VII restrictions were lifted on May 12, usable water in RGP storage did not fall below 400,000 ac-ft, and it remained above that limit for the rest of 2019.

Article VII of the Rio Grande Compact stipulates that when usable water in RGP storage is below 400,000 ac-ft, no native Rio Grande water will be stored in post-1929 reservoirs upstream of Elephant Butte Reservoir unless accrued credit has been relinquished. Reclamation also stores native water for use on Prior and Paramount (P&P) lands while under Article VII restrictions. Storage of native water for irrigation of P&P lands began on January 1, 2019, while under Article VII restrictions.

Between January 1 and May 12, when Article VII restrictions were lifted, native Rio Grande inflow to El Vado Reservoir was 150,106 ac-ft. The majority of that water was bypassed, but 14,345 ac-ft were stored for P&P use while under Article VII restrictions. No P&P water was released for irrigation in 2019. The water stored for use on P&P lands was released between November 1 and 11. Evaporative losses to November 11 were 638 ac-ft and 13,707 ac-ft were released.

In addition, the State of New Mexico requested that 400 ac-ft of relinquishment credit be stored on their behalf for commitments under the 2016 Biological Opinion (BO). This water was stored on May 5 while under Article VII restrictions and was not released during 2019.

Storage of native water for MRGCD began on May 12, when Article VII restrictions were lifted. It peaked at 94,520 ac-ft on June 20, 2019. Of that amount, 20,692 ac-ft were released for irrigation between June 27 and October 6. On October 6, rainstorm runoff reconnected portions of the Rio Grande that had been disconnected due to drying during the irrigation season. Anticipating that New Mexico would fall short of its Compact delivery obligation for 2019, MRGCD took advantage of the river connectivity to deliver the water to Elephant Butte Reservoir and maintained high releases from El Vado even as irrigation demand decreased.

From October 7 to 31, 28,161 ac-ft of MRGCD's native storage was released from El Vado. After the water stored for P&P use was released from November 1 to 11, release of MRGCD's native water stored in 2019 resumed on November 11. An additional 44,623 ac-ft were released between November 11 and December 7, emptying native storage in El Vado.

All daily operations decisions were made using provisional data available at the time of the decision. Because of that, reservoir storage in the final accounting model, which uses final Compact approved data, may differ from reservoir storage used to make a daily operational decision. Hence, the dates mentioned above may differ from those determined using final 2019 data.

New Mexico Relinquishment of Rio Grande Compact Credit

On January 1, 2019, neither Reclamation, the New Mexico Interstate Stream Commission (NMISC), nor the MRGCD had any relinquishment credit water, or Emergency Drought Water (EDW), in storage in El Vado Reservoir. NMISC requested that 400 ac-ft of EDW be captured in El Vado in 2019. This volume was stored on May 5, and none was released in 2019. By the end of the year that amount had been reduced to 390 ac-ft by evaporation.

The New Mexico State Engineer allocated 19,000 ac-ft of EDW to Reclamation. Reclamation subsequently reached an agreement with the Albuquerque Bernalillo County Water Utility Authority (ABCWUA), granting them 5,000 ac-ft as repayment for water released during the early 2000s under an Agreed Order. A new multi-party Emergency Drought Water Agreement was established in 2016. In this agreement, MRGCD agreed to jointly manage the relinquishment credit water allocated to Reclamation for the sole purpose of Endangered Species Act (ESA) compliance. The balance available for capture and storage during 2020 or future years is 14,000 ac-ft by Reclamation, 5,000 ac-ft by ABCWUA, 12,600 ac-ft by NMISC, and 53,767 ac-ft by MRGCD.

El Vado Dam and Reservoir Operations

El Vado Reservoir began 2019 at an elevation of 6,805.45 feet (13,957 ac-ft), which was also the low point of the year, and ended the year at 6,825.47 feet (32,109 ac-ft). The highest elevation occurred on June 20 at 6,876.32 feet (117,372 ac-ft).

MRGCD began the year with no native Rio Grande water in storage in El Vado for Middle Valley irrigation. At the beginning of 2019, Article VII restrictions were in effect. On May 12, Article VII restrictions were lifted and remained so for the rest of the year. Please refer to the *Article VII* section for more details about Article VII timing. Between January 1 and May 12, 2019, 14,345 ac-ft was stored while under Article VII restrictions.

Storage of native water for MRGCD began on May 12, 2019. A total of 96,800 ac-ft were stored on various dates from May 12 to August 20. At the end of 2019, MRGCD had no native storage in El Vado.

In 2019, no EDW was stored for MRGCD. On May 5, 2019, 400 ac-ft was stored for the State of New Mexico. On December 31, 390 ac-ft remained in storage. Evaporative losses were 10 ac-ft.

MRGCD started 2019 with 1,263 ac-ft of SJ-C Project water in El Vado from their 2018 allocation. There was not enough Project storage in Heron Reservoir to make a January allocation, but by the end of 2019 the full allocation of 20,900 ac-ft was delivered. MRGCD ended 2019 with 22,326 ac-ft of SJ-C Project storage. MRGCD had no SJ-C Project water stored in Abiquiu as of December 31.

El Vado was once again used as a re-regulating reservoir for water moving between Heron and Abiquiu in order to simplify operations and have water available for multiple purposes. The City of Santa Fe and the ABCWUA moved some of their waivered 2017 SJ-C Project allocation out of Heron and into El Vado prior to September 30, 2018, the end of the waiver period (5,077 ac-ft and 5,249 ac-ft, respectively, remained at the end of 2018). That water was used to maintain winter flows between El Vado and Abiquiu in 2019 while allowing native inflows to be captured for P&P storage. It also allowed for weekend recreation releases in July and August when the release of stored water there was not needed for irrigation.

A request to store 14,345 ac-ft for P&P irrigation was made by the Bureau of Indian Affairs (BIA) in May. No release of P&P was necessary during the 2019 irrigation season. The unused 13,707 ac-ft was released to Elephant Butte between November 1 and 11, 2019. Evaporative losses in 2019 were 638 ac-ft.

Runoff was extremely high in 2019. In such high runoff years, New Mexico's Compact delivery requirement is also high. Estimates made during the year showed that New Mexico might end 2019 with a large Compact deficit. To reduce the potential deficit, MRGCD chose to release all of the native water stored out of Article VII restrictions to Elephant Butte Reservoir before December 31, 2019. All non-EDW native storage was released from El Vado. Total storage in the reservoir at the end of the year was 32,109 ac-ft. It was comprised mostly of SJ-C Project water: 22,326 ac-ft held by the MRGCD, 2,826 ac-ft held by ABCWUA, 6,490 ac-ft held by Reclamation, and 75 ac-ft held for Santo Domingo Pueblo. It also included 390 ac-ft of EDW stored for the NMISC. Table 8 provides a summary of monthly operations and water accounting for El Vado Reservoir.

Table 8: Reservoir Operation for El Vado Dam[1]

EL VADO RESERVOIR OPERATION	RIO GRANDE INFLOW	SAN JUAN - CHAMA INFLOW	RIO GRANDE OUTFLOW	SAN JUAN - CHAMA OUTFLOW	RIO GRANDE LOSSES	SAN JUAN - CHAMA LOSSES	RIO GRANDE EOM CONTENT	SAN JUAN - CHAMA EOM CONTENT	TOTAL EOM CONTENT
DEC. 2018	2713	2259	2651	133	80	119	160	13797	13957
JANUARY	2736	366	191	1140	0	0	2705	12779	15484
FEBRUARY	3481	0	36	1500	0	0	6150	11279	17429
MARCH	23163	0	11465	1764	149	-8	17699	9522	27221
APRIL	70910	0	65855	0	159	41	22595	9481	32076
MAY	128266	0	97859	0	182	16	52819	9466	62285
JUNE	120039	10	63757	3075	508	57	108594	6344	114938
JULY	20412	0	26409	4271	485	32	102112	2041	104153
AUGUST	9393	27806	8550	22281	486	56	102470	7510	109980
SEPTEMBER	4015	29022	14751	26938	394	45	91340	9550	100890
OCTOBER	4045	2820	36150	489	396	81	58839	11801	70640
NOVEMBER	3570	2737	55644	695	107	561	6657	13283	19940
DECEMBER	3083	26174	9185	7775	164	-37	391	31718	32109
ANNUAL	393113	88935	389852	69928	3030	844	0	0	0

El Vado Dam Facility Review and Safety of Dams Programs

There are currently three incomplete SOD recommendations and 10 incomplete Category 2 O&M recommendations for El Vado Dam. A majority of these recommendations are tied to the ongoing Corrective Action Study (CAS) of the spillway. When the CAS and resulting modifications are complete, most of the outstanding incomplete recommendations will be either reevaluated, completed, or deleted.

The CAS, recommended by 2011-SOD-A and 2013-SOD-A to investigate hydrologic and static failure modes at El Vado Dam, continued throughout FY 2019. Analyses of data collected for both failure modes are ongoing. A new recommendation, 2019-SOD-B, was issued last year to restrict El Vado Reservoir to elevation of 6,875 feet to reduce overall risk.

The 2019 FRR was completed in September. The score decreased from the prior year rating of 59 to 56, or "poor" condition. This is due to the new recommendation described above as well as the 2019 Dam Safety Priority Rating (DSPR) of 2, representing an "Urgent Priority."

In March 2019, a small sinkhole was observed on the left abutment. Baseline measurements were taken, and no further changes have been observed.

The annual elevator inspection was completed in December.

[1] Units are acre-feet

A dive team inspected both the Reclamation and powerplant intake structures in September 2019. The final reports had not been completed as of February 2020. A CR is scheduled for spring 2020. The mechanical inspection, previously scheduled for the fall of 2019, is being rescheduled.

U.S. Army Corps of Engineers' Related Reservoir Operations

Abiquiu Dam and Reservoir is a U.S. Army Corps of Engineers' (USACE) facility. P.L. 97-140 authorizes storage of up to 200,000 ac-ft of SJ-C Project water in Abiquiu Reservoir. The volume of SJ-C Project water in storage in 2019 peaked on September 30 at 85,224 ac-ft after the last of the ABCWUA's waivered 2018 water was delivered from Heron Reservoir. Total storage in the reservoir peaked on May 13 at 106,256 ac-ft (6,197.29 feet), which included flood storage due to Article VII restrictions being in place until May 12, precluding storage of native water in El Vado until after that date. Abiquiu ended 2019 with 79,441 ac-ft of SJ-C Project water in storage. Table 9 provides a summary of monthly operations and water accounting for Abiquiu Reservoir.

Table 9: Reservoir Operations for Abiquiu Dam[1]

ABIQUIU RESERVOIR OPERATION	RIO GRANDE INFLOW	SAN JUAN - CHAMA INFLOW	RIO GRANDE OUTFLOW	SAN JUAN - CHAMA OUTFLOW	RIO GRANDE LOSSES	SAN JUAN - CHAMA LOSSES	EOM CONTENT SEDIMENT	EOM CONTENT RIO GRANDE	EOM CONTENT SAN JUAN - CHAMA	EOM CONTENT TOTAL
DEC. 2018	2993	733	3568	3247	1	574	1342	1	76735	78078
JANUARY	595	1300	578	7138	0	102	1342	18	70816	72176
FEBRUARY	6722	1474	5870	3231	-1	273	1347	871	68786	71004
MARCH	21371	1804	21823	8747	0	316	1361	420	61527	63308
APRIL	83480	0	66100	4900	38	650	1495	17762	55976	75233
MAY	115581	0	105461	0	511	533	1733	27371	55443	84547
JUNE	71259	3041	95802	0	396	1104	1837	2433	57381	61650
JULY	26742	4224	29341	4297	5	889	1857	-172	56419	58104
AUGUST	8126	21260	7942	6686	12	926	1873	0	70067	71940
SEPTEMBER	12888	27104	12890	10885	-3	1061	1900	0	85224	87124
OCTOBER	33547	679	33684	5569	-3	916	1920	-134	79418	81204
NOVEMBER	55715	687	55828	3500	2	258	1979	-249	76348	78078
DECEMBER	10388	7594	9647	4610	-2	-110	1985	494	79441	81921
ANNUAL	446,414	69,167	444,966	59,563	955	6,918				

[1] Units are acre-feet

Cochiti Dam and Reservoir is another USACE facility. It is located downstream of the confluence of the Rio Chama and the Rio Grande. Congress authorized a permanent pool of 1,200 surface acres for recreational purposes and for fish and wildlife (Rec Pool). This pool is composed of SJ-C Project water; evaporation losses are replaced with additional SJ-C Project water to maintain 1,200 surface acres.

The Rec Pool water may be released from Heron Reservoir and temporarily stored in Abiquiu, where it is then released over the winter to provide flows in the Rio Chama between Abiquiu and the confluence with the Rio Grande. In 2019, 4,430 ac-ft was released from Abiquiu Reservoir to maintain flows on the Rio Chama and fill the Rec Pool. In December 2019, 4,290 ac-ft was released from Heron and stored in Abiquiu in support of 2020 winter flows. The year ended with a deficit of 2,793 ac-ft in the Cochiti Rec Pool, meaning that volume was needed to reach 1,200 surface acres. Table 10 provides a summary of monthly operations and water accounting for Cochiti Reservoir.

Table 10: Reservoir Operations for Cochiti Dam

MONTH	EOM SJ-C POOL (AC-FT)	AREA SJ-C POOL (ACRES)	EOM SJ-C POOL LOSSES (AC-FT)	HOLD POOL (SJ-C + SED.) (AC-FT)	EOM WETLANDS ELEVATION (FEET)	EOM WETLANDS AREA (ACRES)	ALLOC. SJ-C POOL AREA (ACRES)	ALLOC. SJ-C POOL CAPACITY (AC-FT)	DEMAND FOR SJ-C POOL (AC-FT)	MONTHLY SJ-C DELIVERY (AC-FT)
DEC. 2018	42523	1030	12	44704	5354	0	1200	46860	4337	185
JANUARY	42679	1037	-37	44864	5354	0	1200	46860	4181	119
FEBRUARY	43216	1055	141	45406	5354	0	1200	46860	3644	677
MARCH	43029	1050	187	45250	5354	0	1200	46860	3831	0
APRIL	43566	1064	357	45954	5354	0	1200	46860	3294	894
MAY	43217	1055	349	46080	5354	0	1200	46860	3643	0
JUNE	42779	1041	438	45924	5354	0	1200	46860	4081	0
JULY	42411	1025	369	45744	5354	0	1200	46860	4449	0
AUGUST	42027	1007	384	45399	5354	0	1200	46860	4833	0
SEPTEMBER	42661	994	366	45057	5354	0	1200	46860	5199	0
OCTOBER	42560	1032	240	45969	5354	0	1200	46860	4300	1139
NOVEMBER	42507	1029	53	45942	5354	0	1200	46860	4353	0
DECEMBER	44067	1076	43	47515	5354	0	1200	46860	2793	1603
ANNUAL			2890							4432

Cooperative Programs with the State of New Mexico

In 2017, a five-year Cooperative Agreement (17-WC-40-678; State Coop) was executed between the NMISC and Reclamation. The Agreement provides funding for joint benefits; water salvage work within the Middle Rio Grande Project and vegetation management on the Rio Grande Project within Elephant Butte and Caballo Reservoirs. This work currently includes Delta Channel maintenance, river maintenance projects, and riverside irrigation drain improvements with water salvage potential.

Delta Channel Maintenance

The term "Delta Channel" refers to the Rio Grande channel that flows into the delta of Elephant Butte Reservoir, previously called the temporary channel. The Delta Channel maintenance is now covered under the 2016 MRG Biological Opinion.

The maintenance work performed along the Delta Channel in 2019 extended from River Mile (RM) 47.5 upstream to approximately RM 52. NMISC's contractor, Wilco, conducted maintenance of the Delta Channel from February through April 2019, and removed a sediment plug in the Delta Channel with Reclamation support. Maintenance work included in-channel excavation and sandbar de-vegetation. Reclamation provided all necessary engineering and environmental compliance support for the continued maintenance of the Delta Channel through this Cooperative Agreement.

In addition, NMISC provided funding to replace Reclamation's amphibious excavator tracks at a cost of approximately $175,000.

Caballo Vegetation Control

Previously cleared sites within the Caballo Reservoir pool floodplain are maintained free of selected vegetation to reduce the non-beneficial consumption of groundwater. This vegetation clearing was conducted in the spring of 2019. Please refer to the Rio Grande Project section of this report for more details on work performed under this part of the agreement.

River Maintenance

Under the Middle Rio Grande Project (Project), Reclamation has authorization for maintenance of the Rio Grande from Velarde, New Mexico, south to the headwaters of Caballo Reservoir. Responsibilities include maintenance of the river channel, floodplain, project drains, and the 55-mile Low Flow Conveyance Channel (LFCC). Project purposes include improving water delivery and sediment transport, protecting riverside facilities and property, and preventing flooding. River maintenance consists of any work done in the channel and floodplain, including habitat restoration. Reclamation conducts annual river reviews of conditions of sites and reaches after the spring snowmelt runoff and summer monsoon events.

Maintenance needs are prioritized based on these reviews and assessment of geomorphic trends and conditions, public and infrastructure risk, and water delivery effects for the 260-mile reach of the Middle Rio Grande. Project needs listed above are joined by newer considerations to enhance ecological function of the system within the Project's authorization. Maintenance projects involve planning, construction, and adaptive management. Most maintenance projects require adaptive and recurring maintenance over the life cycle of each of the project's intended design life.

River Maintenance Sites

Reclamation is pursuing work at 16 sites and/or reaches along the Middle Rio Grande Project area. Of the active sites, six require an annual review of channel capacity and possible maintenance due to sediment accumulation.

The 2019 spring runoff was extremely high (160% of average at the Otowi gage). During the spring runoff, two sediment plugs developed along the river. One was immediately upstream of the Elephant Butte "Narrows" along the Delta Channel. Another was at RM 81 within the Bosque del Apache National Wildlife Refuge (BDANWR) in the same area where plugs formed during the 2008 and 2017 spring runoff.

Since the plug at RM 81 was removed in 2009, planning for a river realignment project in that area has been ongoing. Although Reclamation and NMISC initially disagreed on the projected results of the realigned channel, the 2019 BDANWR sediment plug made implementation of the realignment crucial. Environmental compliance for the project, called the BDANWR Pilot Realignment, was completed in time to allow construction to begin in August, precluding the need to excavate the plug. At the time of this report, work continues with the river flows going down the Pilot Realignment channel. Some excavation work is also occurring in the new alignment, and excavated materials are being placed in the old channel.

In collaboration with NMISC, work continues through the Delta Channel to maintain a 20-mile temporary channel into the Elephant Butte Reservoir pool for effective water delivery. See the *Cooperative Programs with the State of New Mexico* section of this report for more details on the Delta Channel maintenance.

Reclamation's efforts at all maintenance sites include data collection, geomorphic and sediment investigations, design studies, alternative evaluations, design and development of construction drawings, material supply and development, lands access, environmental compliance, project and construction management, construction maintenance, and adaptive maintenance/monitoring.

In the following sections, the terms "new," "existing," and "adaptive" are used to describe the various river maintenance sites and reach status. "New" sites are those developed following high flow events on the Rio Grande in the previous year. "Existing" sites are those in the process of being completed. "Adaptive" sites have been substantially completed and are being monitored for function and performance.

San Felipe (Existing Maintenance Site)

A total of 10 river maintenance sites have been identified on the Pueblo of San Felipe. Seven sites have been completed and three are ready for construction. The remaining three sites are RM 211.3, RM 212.8, and RM 214.4. Construction on longitudinal fill stone toe protection at RM 211.3 began in the fall of 2015 and was partially completed by March 2016. The work was put on hold at that time by the Pueblo of San Felipe for a review of impacts to vegetation of traditional or medicinal value. All construction work at the remaining sites is currently pending permission by the Pueblo of San Felipe. During the 2019 spring runoff, bank erosion towards the levee was observed at the two eastern bends located at RM(s) 212.8 and 214.4. Again, work at these locations is currently on hold. A letter was sent to the Pueblo of San Felipe on October 31, 2019, informing the Pueblo of the potential risk to riverside facilities presented by conditions at these locations.

Santa Ana River Mile 205.8 (Adaptive Maintenance Site)

This site is within the Pueblo of Santa Ana, on the east bank of the Rio Grande across from the Tamaya Resort special events tent. Nine bendway weirs and a low elevation floodplain were designed by a contractor hired by the Pueblo and were constructed by Reclamation in 2014. The Pueblo of Santa Ana, through a P.L. 93-638 contract, planted vegetation at this site in early 2015. During the spring runoff in 2015, erosion at the site washed away the newly planted vegetation and caused bankline scalloping between some of the weirs immediately upon completion. An interim adaptive maintenance project was completed in January 2016 to provide additional protection of the levee system while a longer-term solution could be investigated. The site experienced additional bank erosion during the 2016 and 2017 runoff, but the existing weir field and temporary controls placed in 2016 minimized the extent of the lateral bank migration.

An investigation to evaluate the specific geomorphic and hydraulic conditions that led to the unexpected bank erosion during the 2015 runoff was completed in October 2018. In the past year, the scalloped sections of this weir field experienced significant infill and formed a shelf that has started to support new vegetation. Reclamation is currently planning adaptive maintenance work at the site as part of a permanent repair project. These repairs will include the placement of longitudinal stone toe protection between the existing bendway weirs for toe strength, the construction of a new side channel on the opposing bankline to relieve hydraulic pressure on the bendway, and the installation of vegetated, mechanically stabilized earth along the hillslope above the stone toe to promote further bank stability. Additional P.L. 93-638 funds have been awarded to the Pueblo to acquire more recent channel data in and around the bendway weir field to inform this design work, and it is expected that this data collection will take place sometime in January of 2020. Reclamation, the Pueblo of Santa Ana, and the University of New Mexico are also in the process of granting a one-year extension on the original five-year collaborative research effort at this project site. The research is investigating the effects of bendway weirs on primary producer organisms, specifically targeting those known to be food sources for the silvery minnow.

Angostura to Montaño Reach Planning (Existing Maintenance Reach)

In 2014, Reclamation identified the reach of the Rio Grande from RM 201 to Montaño Bridge for hydraulic and geomorphic assessment and project planning. This reach is transitioning, with riverbed incision and migrating bends that have caused problematic erosion, such as at the Sandia Priority Site, the Bernalillo Priority Site, the Corrales Siphon, Corrales River Mile 199, and at private land below the Highway 550 Bridge. The objective of this reach planning is to analyze the current geomorphic and hydraulic trends and identify potential river projects that both minimize the need for river maintenance and improve habitat value. Two hydraulic models of this reach were created using 2015 and 2017 hydrographic data. The hydraulic and geomorphic report is complete and located at the following website: https://www.usbr.gov/uc/envdocs/reports/AngosturaDamtoMontanoBridge-GeomorphicandHydraulicAnalysis.pdf. Reclamation continues to assess river maintenance needs and/or opportunities for habitat restoration in support of the 2016 Biological Opinion (BO).

Sandia Priority Site Bendway Weir Repairs (Adaptive Maintenance Site)

In collaboration with the Pueblo of Sandia, Reclamation constructed the Sandia Priority Site in 2008 as the river was approaching the east levee. Upon completion, Reclamation transitioned oversight of the Sandia Priority Site to the adaptive maintenance and monitoring phase. Post-project geomorphic monitoring, such as cross section data collection at the project site, aerial flights, and longitudinal profile data collection on the Rio Grande, have been performed since 2008 as part of the adaptive maintenance activities.

In 2016, there was new erosion along the east bankline at the site. With the approval of the Pueblo's tribal council, Reclamation strengthened the bankline at the bendway weirs in March and April 2017.

An investigation to evaluate the specific geomorphic and hydraulic conditions that led to the 2016 spring runoff bank erosion was completed in August 2018. As a result of this investigation, Reclamation has planned adaptive maintenance work at the site as part of a longer-term repair project. The adaptive maintenance work will include rehabilitating the side channels constructed on the western floodplain as part of the original 2008 project, and include additional features such as bank lowering immediately across from the eroding bendway weir site, a new side channel to facilitate water and sediment transport from an arroyo on the western floodplain, and two new side channels immediately downstream of the project in an area that is also eroding. Construction is anticipated to begin in early 2020.

Photo 1: Aerial view of the Sandia Priority Site (flow direction from bottom to top of photo). The eroding bend apex has moved downstream roughly 400 feet in four years and point bar deposition now protects the bankline at the bendway weirs at low flows. (7/18/2019)

Corrales Siphon (Adaptive Maintenance Site)

The Corrales Siphon, at RM 199.7, is in Corrales, New Mexico, just north of Albuquerque, and about 700 feet downstream of the Arroyo de la Barranca confluence. The siphon was constructed in the early 1930s by the MRGCD to provide irrigation water to the Corrales Main Canal. During river reconnaissance in 2012, Reclamation discovered that degradation in the area had exposed the siphon. MRGCD requested emergency technical assistance and construction support from Reclamation to temporarily protect it during the 2016 runoff.

Reclamation and MRGCD collaborated on a short-term project that placed riprap in the scour hole downstream of the exposed siphon. Approximately 1,800 cubic yards of riprap were placed upstream and downstream of the siphon along the west bankline.

The scour hole and exposed part of the siphon have moved away from the west bank toward the center of the river channel. New developments caused by geomorphic responses to the temporary repair will continue to be monitored by Reclamation. MRGCD is working on a longer-term solution, and Reclamation is awaiting further information about their proposed project.

Photo 2: Looking upstream at the Corrales Siphon and the 2016 riprap protection placed downstream of the siphon. The river upstream of the riprap protection has filled in with sediment. (9/11/2019)

River Mile 199 (New Maintenance Site)

In spring 2017, Reclamation identified a new erosion site near RM 199 in the Corrales area. This site is on the west side of the river, and the active bankline is approximately 120 feet from the west levee toe. The Angostura to Montaño reach plan provides a detailed geomorphic and hydraulic study of the reach and sub-reaches and has helped evaluate erosion at RM 199 in the context of the overall reach needs.

In 2019, Reclamation began alternative formulation and analysis to address bank erosion near the Corrales levee system. Project goals include dissipating energy in the surrounding two-mile reach between the Corrales Siphon and RM 198 and improving ecological function at this site. In 2020, an alternative will be selected and designed.

Photo 3: New erosion in the RM 199 project area. Photo is looking downstream immediately below Corrales Siphon. (9/11/2019)

Isleta to San Acacia Reach Planning (Existing Maintenance Reach)

In 2014, Reclamation identified the stretch of the Rio Grande from the Isleta to the San Acacia Diversion Dams for additional investigation to analyze the geomorphic and hydraulic trends within this reach. This investigation is especially relevant given the observed overbank flooding in portions of the reach during the 2017 and 2019 runoffs. Geomorphic and hydraulic analysis reports for this reach were completed in March and December 2018, respectively. These analyses will be used to identify potential projects that have river maintenance and/or habitat value.

In 2019, Reclamation began to identify sites that may need river maintenance and/or offer opportunities to perform habitat restoration in support of the 2016 BO. Site identification is anticipated to be completed in 2020.

Escondida Burn Scar Habitat Restoration

In June 2016, a wildfire burned approximately 524 acres in the bosque near Escondida, New Mexico. Two aquatic habitat restoration sites were designed and construction was completed in July 2018. The two sites include floodplain lowering at the Arroyo de la Parida delta and a side channel network just upstream of Nogal Arroyo. This work helps Reclamation and its partners meet 2016 BO commitments.

In 2019, six monitoring visits were made to the sites. The monitoring included surveying sedimentation changes, collecting inundation extents, flow velocity and depth, water temperature, isolated pool monitoring, and noxious weed mapping. This monitoring data will inform future adaptive management decisions.

Photo 4: Escondida side channel project during 2019 spring runoff. (4/22/2019)

Rhodes Property Habitat Restoration

A multi-disciplinary design team assessed this site, which is south of Socorro, New Mexico, for opportunities to create aquatic habitat. Again, this work supports Reclamation and its partners in meeting the commitments of the 2016 BO. Project designs and environmental permitting were completed in December 2018. Construction of the project was completed in mid-February 2019, with as-built surveys collected at the end of February 2019. Monitoring will continue for the next five years.

Arroyo de las Cañas Reach Planning (Existing Maintenance Reach)

The Arroyo de las Cañas site is located upstream of the Arroyo de las Cañas confluence, between RM 96 and 95, south of Socorro, New Mexico. It extends downstream to the U.S. Hwy 380 Bridge (RM 87) at San Antonio, New Mexico.

Reclamation completed a geomorphic assessment of this area in 2016. Due to current staffing levels and other priority activities, Reclamation did not complete further work on this reach planning effort in 2019. Work to identify potential river projects that minimize the need for river maintenance action and/or improve habitat value will likely be reinitiated in 2020.

Bosque del Apache River Realignment (Existing Maintenance Site)

During the 2008 and 2017 spring runoffs, sediment plugs formed in the main channel of the Rio Grande at RM 81, located within the BDANWR. In 2014, a multi-agency project team began to pursue a realignment of the current channel to the east to address river maintenance concerns in the area. The project will move two river segments to the east, about 4.5 miles and 2.5 miles in length, and then reconnect them with the current channel.

In 2016, Reclamation decided to first construct the southern portion to learn from the observed channel response of the smaller realignment section before beginning work on the longer northern realignment. The southern realignment portion was termed the BDA Pilot Realignment Project.

Designs were completed on the BDA Pilot Realignment Project in 2017. Mowing began in January 2018. During the extended 2019 spring runoff, a plug again formed in the main river channel at the same location as in 2017. This plug completely blocked flow from the main channel, and water was forced into the area mowed for the Pilot Realignment Project. The necessary Clean Water Act compliance was obtained from USACE that summer and Reclamation's Socorro Field Division began excavating the pilot realignment channel at the beginning of September 2019, immediately following the end of migratory bird season. By October, a pilot channel had been established along the planned realignment, restoring river conveyance. In early 2020, excavated spoil material was being redistributed within the old channel. In addition, sections of the 300-foot realignment corridor will be root ripped during lower winter flows and prior to the 2020 spring runoff.

Monitoring of the pilot realignment section of the channel will begin with an as-built LiDAR survey in February 2020 and will be followed by fieldwork measurements of the physical channel in March 2020. Additional field measurements are planned for late summer of 2020, immediately following the monsoon season.

Bosque del Apache, Tiffany, and San Marcial Levee and Delta Channel Capacity Analyses (Adaptive Maintenance Sites)

The hydraulic channel capacity criteria used in the analysis of levee systems is to effectively and safely pass the two-year flow of 7,700 cfs. The maintenance design criteria of the Delta Channel used in the analysis was to effectively convey a normal spring runoff peak flow of 4,000 to 5,000 cfs to the Elephant Butte Reservoir pool.

As part of continued analysis, hydrographic data was collected in 2018 and 2019, although 2019 data are not yet available. The hydraulic model for this river reach has been updated with the 2018 cross section survey data. Updated hydraulic model results were reported in an annual summary report on levee and channel monitoring released in November 2019. The report found 11 cross sections within the Bosque del Apache levee system where the levee freeboard elevation would be exceeded, 15 cross sections within the Tiffany levee system, and no levee freeboard incursion within the San Marcial levee system. The spring runoff volume in 2019 was very high, and this section of the river system most likely had significant physical changes that will be summarized in next year's analysis.

The BDA section has experienced considerable changes over the last year. In June, a sediment plug again formed in the river between RM 79 and RM 82 (same location as the 2017 plug) and forced river flows into the cleared section of the Pilot Realignment Project. Reclamation expects that the realignment project will reduce levee freeboard incursions along this portion of the levee system. Channel cross sections within this reach will continue to be surveyed post-construction, and the 2020 river maintenance report should contain both the revised channel alignment and channel profiles in the updated hydraulic model.

Reclamation and NMISC inspected the Delta Channel in December 2019. Reclamation began maintenance work on the Delta Channel in January 2020 which is expected to continue until bird nesting season begins in April. NMISC is not planning to utilize a contractor for maintenance work this year.

Fort Craig Bend and River Mile 60 (Existing Maintenance Site)

Historically, the Rio Grande between Fort Craig and RM 60 was a wide, braided, and relatively straight river channel. During recent years, the degree of meandering has increased in several areas as a more sinuous planform developed. This has caused the formation of multiple bends, including Fort Craig Bend near RM 64 and the S-curve bend at RM 60. The outsides of these bends are near the west edge of the confined floodplain and adjacent to the spoil levee and the LFCC. Continued bank erosion and lateral migration at these locations threatens to breach the spoil levee and cause damage to the LFCC and access road. Downstream water delivery and habitat for endangered species are likely to be negatively impacted by a breach. In 2012, a rock windrow on the west bank of the river was placed as a temporary solution to erosion at the toe of the bank near the Fort Craig pump site. Recent observations show that the windrow has not launched into the channel, but the toe of the bank has had additional scour.

A multi-disciplinary project team will develop and evaluate alternatives to reduce maintenance frequency, increase water salvage, and enhance habitat. More than likely, additional repair work will be required at the RM 60 bend in 2020. Currently the Fort Craig bend appears to be stable. A new project team will evaluate the feasibility of reconnecting the LFCC with the main river channel from San Acacia south to RM 60, and one option includes an outfall to the river at RM 60.

Truth or Consequences (Existing Maintenance Site)

Reclamation annually excavates sediment from the river channel to maintain the authorized 5,000 cfs capacity in the reach of the Rio Grande between Elephant Butte Dam and Caballo Reservoirs. Maintenance activities are conducted each fall after releases are shut off from Elephant Butte Dam. Primarily, sediment is removed at arroyo mouths. Secondary activities include sediment removal in other areas throughout the reach and bank stabilization with riprap at selected sites. Work identified for 2020 involves sediment removal at the mouths of three major tributaries (Mescal, Cuchillo Negro, and Hondo) and one smaller tributary near the Feykus property.

In addition, during periods of non-release, Reclamation installs a dike in the river to increase the alluvial groundwater levels for the benefit of the artesian hot spring bathhouse owners in Truth or Consequences. A new regional 404 permit associated with this work for another 5-year period was issued in 2018.

Mescal Arroyo Planning (Adaptive Maintenance)

Mescal Arroyo is a tributary to the Rio Grande within the Truth or Consequences reach. Because it is only two miles downstream from Elephant Butte Dam, sediment deposition at the confluence can create channel capacity concerns and influence water operations and hydropower generation. Geomorphic and hydraulic modeling analyses of this tributary led to the formation of a multi-disciplinary team to assess options to minimize maintenance at the Mescal Arroyo and Rio Grande confluence. The preferred alternative is to change sediment management practices that exacerbated the deposition problem.

Some of the spoil within the active channel of the Mescal Arroyo was moved beginning in 2017, resulting in a wider channel that will allow deposition to occur above the Rio Grande confluence. Widening the confluence of the arroyo and relocating the spoil piles left from previous maintenance to offsite locations was undertaken in 2019. The project was completed in October 2019; however, it is expected that annual maintenance will still be required on this channel confluence in any year that has an active monsoon season.

San Acacia Diversion Dam 10-4 Pilot Study

The riprap-covered ramp downstream of the San Acacia Diversion Dam (SADD) just north of Socorro, New Mexico, was rehabilitated by Reclamation in the late 1980s. A multitude of high flow events have progressively displaced much of the ramp downstream. This has exposed some of the dam's apron and presents challenges to upstream fish movement at the dam when it is left unchecked. At the request of Reclamation's partner MRGCD, Reclamation provided design and construction support to rehabilitate the ramp to facilitate future fish passage. This project's goal is to renovate the ramp by providing a 10% design slope comprised of 3- to 4-foot nominal riprap, to determine if fish can traverse the ramp to the dam's apron while also providing protection to the exposed apron toe. The Socorro Field Division completed work on the SADD ramp in March 2019.

Middle Rio Grande River Maintenance Plan

The Middle Rio Grande River Maintenance program has developed a long-term River Maintenance Plan that will assist in accomplishing project purposes in an environmentally and economically sound manner that is consistent with the Middle Rio Grande Project's authorization. A final report is posted at the following web address:
https://www.usbr.gov/uc/albuq/envdocs/reports/mrgRivMaint/CompPlan/start.pdf.

This maintenance plan is an engineering and geomorphic review that can be used to readily implement the most cost effective and environmentally sound strategies that reduce Reclamation's long-term commitment of resources. Ongoing work on the "living" long-term comprehensive plan and guide involves evaluating reach-based strategies for feasibility, prioritizing reaches, and evaluating effects of strategy implementation between reaches, including both upstream and downstream.

Work is also being pursued with respect to reach-based planning and developing ecological criteria for endangered species suitable habitat restoration to complement current water delivery as well as public health and safety factors. Reach-based planning is underway to evaluate the geomorphic reaches from Angostura to Montaño Bridge, and Isleta downstream to Elephant Butte. This lower reach has been identified as a high priority reach for habitat restoration and meeting ecological goals. A report entitled "Lower Reach Plan" was completed in 2018. This document provides a strategic overview of reach projects and efforts underway for the river and LFCC from Isleta Diversion Dam to the Elephant Butte Reservoir pool.

Determination of River Maintenance Needs at Individual Sites and Reaches

In 2014, Reclamation completed its "Determination of River Maintenance Needs" process, which involved a joint workshop between Reclamation's Technical Services Center and the AAO River Analysis Group. The workshop followed a developed rating system for sites and reaches along the river channel that considers geomorphic trends and conditions, public and infrastructure risk, and water delivery effects for the 260-mile reach of the Middle Rio Grande. All monitored, existing, and completed sites were rated utilizing the methodology and criteria. A total of 86 sites and 11 reaches were evaluated. Monitoring during the spring runoff and monsoon season in 2018 and work progress were considered in the recently completed 2019 site and reach ratings. These ratings help prioritize project development and implementation.

The technical rating system integrates technical factors for channel instability, bank erosion, and loss of channel capacity with the potential for impacts to riverside infrastructure, public health and safety, and water delivery. In addition, five distinct maintenance classes are identified by the assessment. The maintenance class designation helps define the apparent urgency related to addressing any need. The maintenance class designations are as follows:

- Maintenance Class 1 – Maintenance is required in the short-term (typically before the next high flow event or could be required immediately). High likelihood of substantial consequences if no action is taken.
- Maintenance Class 2 – Maintenance can be planned, but the consequences of no action could be substantial in the near-term (the next normal spring runoff or within the next few years). This class includes the majority of ongoing or normal river work at existing and new sites.
- Maintenance Class 3a – Maintenance can be planned, and the consequences of no action are less likely to be substantial in the near-term (the next normal spring runoff or within the next few years). Work can be described as preventative maintenance and includes habitat enhancement.
- Maintenance Class 3b – Maintenance can be planned, and the consequences of no action are less likely to be substantial in the near-term (the next normal spring runoff or within the next few years). Data collection and/or analysis are required to determine if preventative or normal maintenance (including habitat enhancement) is needed.
- Maintenance Class 4 – Maintenance is not anticipated to be needed in the near-term (the next normal spring runoff or within the next few years) because changes appear to be occurring at a slow rate. Work can be described as monitoring for changes that could accelerate the need for maintenance to the near-term.

- Maintenance Class 5 – Maintenance may be needed but is not within Reclamation's authority. Responsible parties will be notified if it appears that consequences of no action could be substantial in the near-term.

This approach for the ratings and maintenance class designation complements what is in the long-term River Maintenance Plan and Guide and the 2016 BO for River Maintenance Actions.

Endangered Species

Programmatic Water Operations and River Maintenance Endangered Species Act (ESA), Section 7, Compliance

The U.S. Fish and Wildlife Service (USFWS) issued a final *Biological and Conference Opinion for Reclamation, BIA, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande* (Consultation Number 02ENNM00-2013-F-0033) on December 2, 2016. The non-jeopardy determination in the BO is based on the mandatory accomplishment of numerous commitments by Reclamation and the BO partners (86 Conservation Measures, 11 Reasonable and Prudent Measures, and 50 Terms and Conditions). The USFWS provided an Incidental Take Statement for the silvery minnow, flycatcher, and cuckoo.

Incidental take of silvery minnows is authorized for the Proposed Action if: October density is greater than or equal to 1.0 fish per 100 m^2 for ten of the 15 years; October density is less than 1.0 fish per 100 m^2 for no more than five of the 15 years; and October density is less than 0.3 fish per 100 m^2 for no more than two of the 15 years. Incidental take for the silvery minnow will be considered exceeded if these densities and time limits are not met as a result of the Proposed Action.

Silvery minnow density increased from 0.1 fish per 100 m^2 in October 2018 to 3.4 fish per 100 m^2 in October 2019. High spring runoff years, such as 2019, typically result in higher October density estimates. It is also likely that the October 2019 density was influenced by low density and extremely low runoff in 2018. Due to the silvery minnow's reproductive capacity and population augmentation by the BO partners, the minnow was able to survive and reproduce during good conditions in 2019 and incidental take was not exceeded.

Incidental take of flycatcher will be considered exceeded if more than 26 flycatcher territories are displaced in any year because of the Proposed Action, or if more than 2,071 acres of suitable flycatcher habitat are impacted because of the Proposed Action over the 15-year BO duration. Incidental take of cuckoos will be considered exceeded if more than 11 cuckoo territories are displaced in any year because of the Proposed Action, or if more than 2,071 acres of suitable cuckoo habitat are impacted as a result of the Proposed Action over the 15-year BO duration. Incidental take of flycatcher or cuckoos was also not exceeded in 2019.

There was no incidental take of flycatcher or cuckoo nests/territories in 2019. However, approximately 20 acres of suitable flycatcher habitat and 20 acres of suitable cuckoo habitat was disturbed in 2019 due to the pilot river realignment project at the BDANWR.

In 2019, Reclamation and the BO Partners continued implementing the commitments set forth in the BO. The Minnow Action Team, including Reclamation, the NMISC, MRGCD, and the USFWS, met on February 20, 2019, to determine the best use of available water. Additional water management actions were not needed in 2019 because of the high runoff. During 2019, 9,669 ac-ft of supplemental water was released by Reclamation for endangered species purposes.

Planning and work on the following projects began in 2019:

- Fish passage at San Acacia and Isleta Diversion Dams (planning & design phase)
- Bosque del Apache Pilot River Realignment/Sediment Plug Circumvention (underway)
- Escondida Fire Habitat Restoration (complete)
- Rhodes Property Habitat Restoration (complete)

The 2019 annual report, due to the USFWS on April 1, 2020, will provide more information on the implementation of BO requirements and the Proposed Action.

Rio Grande Silvery Minnow

The silvery minnow (*Hybognathus amarus*) was formerly one of the most widespread and abundant species in the Rio Grande Basin of New Mexico, Texas, and Mexico, but is now listed as endangered (USFWS, 1994). Currently, the silvery minnow occupies less than 10 percent of its historic range and is restricted to the reach of the Rio Grande in central New Mexico from Cochiti Dam to the headwaters of Elephant Butte Reservoir.

Studies of long-term trends of silvery minnow abundance have generally used October catch per unit effort (CPUE) data from the species population monitoring project. Monitoring has occurred annually since 1993, with the exception of 1998. Survey methods are standardized, and the same sites are consistently monitored since the project began.

The October 2019 silvery minnow CPUE was higher than the October 2018 estimate (Dudley et al., 2019; Figure 5). During October 2019, a total of 209 silvery minnow were collected from the 20 standard long-term monitoring sites. The species was present at 19 of 20 sites and was collected in 92 of 333 seine hauls that yielded fish (Dudley et al, 2019). All silvery minnow collected in October 2019 were unmarked and presumably naturally spawned fish. In addition, two age classes of silvery minnow were present with the majority being young-of-year fish. The results from October 2019 monitoring show that spring runoff flows in 2019 resulted in successful silvery minnow spawning and recruitment.

To assess how the addition of sites influences silvery minnow CPUE, 10 additional sites were sampled in October 2019 and added to the 20 long-term monitoring sites. The addition of the 10 monitoring sites resulted in the capture of 308 additional silvery minnow, for a 30-site total of 517 silvery minnow. Silvery minnow CPUE for the 20 standard long-term monitoring sites was 2.11 fish/100m^2. CPUE for the 20 standard long-term monitoring sites plus the 10 additional sites (30 sites total) was 3.41 fish/100m^2.

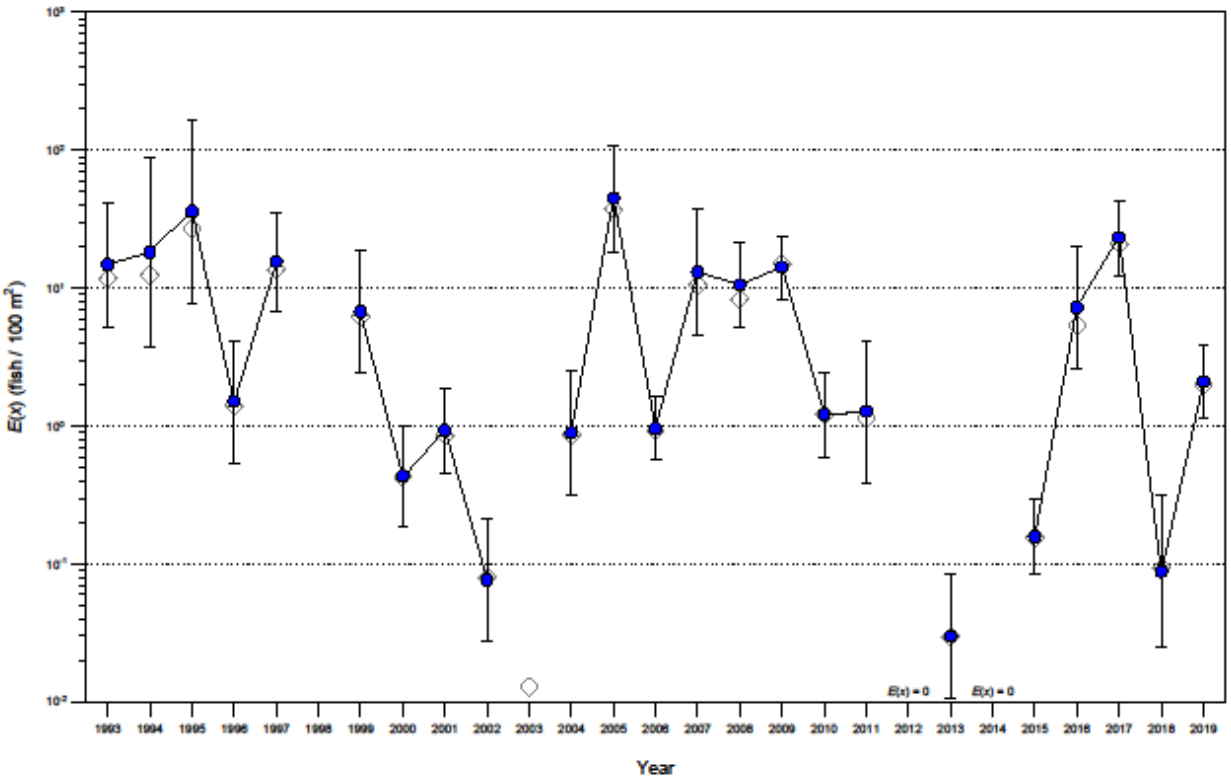


Figure 5: October silvery minnow density estimates (E(x)) for 1993–2019 from American Southwest Ichthyological Researchers. Solid circles indicate estimates, hollow circles represent simple estimates using methods of moments, and bars represent 95% confidence intervals.

Reclamation conducted two periods of Rio Grande fish monitoring during 2019 associated with applicable projects. The winter electrofishing survey was carried out from February 19 to March 1. Surveys were conducted at sites between Bernalillo and the Delta Channel, and below the confluence of the Low Flow Conveyance Channel with the Rio Grande. A total of 74 silvery minnow were captured during that monitoring. Thirteen of these silvery minnow were marked with a visible implant elastomer (VIE), meaning they were hatchery spawned and subsequently released to the river; the remaining were presumably naturally spawned.

Reclamation's 2019 fall surveys were conducted from October 21 to October 24, using seine nets and electrofishing to sample the San Acacia Reach at sites between River Mile 112, near Lemitar, NM, and the current upper extent of the Elephant Butte Reservoir pool near Pete Well Road. During these surveys, 205 silvery minnow were collected. Three of these were marked and the rest were presumably naturally spawned.

Captive silvery minnow are maintained at the following permitted facilities in New Mexico: City of Albuquerque BioPark; Southwestern Native Aquatic Resources and Recovery Center (SNARRC, formerly the Dexter National Fish Hatchery); and the NMISC's Los Lunas Silvery Minnow Refugium. In 2019, 94,455 hatchery silvery minnow were released into the Middle Rio Grande. Of those fish, 11,830 were implanted with Passive Integrated Transponder (PIT) tags to support a silvery minnow movement study. The USFWS did not stock captively propagated silvery minnow into Big Bend National Park, Texas, during 2019.

Literature Cited

Dudley, R.K., S.P. Platania, and G.C. White. 2019. Summary of the Rio Grande Silvery Minnow Population Monitoring Program Results from October 2019. Report to the Middle Rio Grande Endangered Species Collaborative Program and the U.S. Bureau of Reclamation, Albuquerque, N.M. 43 pp.

U.S. Fish and Wildlife Service. 1994. Endangered and threatened wildlife and plants; Final rule to list the Rio Grande silvery minnow as an endangered species. Federal Register 59: 36988-36995.

Southwestern Willow Flycatcher

The flycatcher (*Empidonax traillii extimus*; SWFL) was listed as endangered by the USFWS effective March 29, 1995. The 2013 final designation of critical habitat defines two units located along the Rio Grande in New Mexico: the Upper Rio Grande Management Unit and the Middle Rio Grande Management Unit. No Critical Habitat was designated for the Lower Rio Grande Management Unit (Elephant Butte Dam to El Paso, TX).

The Upper Rio Grande Management Unit includes the following segments:

- Taos Junction Bridge to the upstream boundary of Ohkay Owingeh Pueblo, as well as a segment between the southern boundary of Ohkay Owingeh Pueblo to the northern boundary of Santa Clara Pueblo.
- Sarco Canyon downstream to the Arroyo Miranda confluence.
- A 2 km segment above Coyote Creek State Park to the second bridge on State Route 518, upstream from Los Cocas.
- A 0.2 mile segment located approximately 2 miles upstream from the Rio Lucero confluence.

The Middle Rio Grande Management Unit includes the following segment:

- The southern boundary of the Pueblo of Isleta to approximately 2 miles north of the Sierra County line.

During the summer of 2019, Reclamation conducted surveys and nest monitoring of flycatchers in 12 distinct reaches along approximately 350 kilometers (220 miles) of the Rio Grande in New Mexico, mainly between San Acacia Diversion Dam and Elephant Butte Reservoir (Table 11). Other areas surveyed include portions of reaches between the Caballo Reservoir delta and the international boundary in El Paso, TX. Surveys were performed to contribute to the baseline population data of the flycatcher along the Rio Grande, and to meet Reclamation's ESA compliance commitments.

A total of 771 resident flycatchers were documented in 2019. These flycatchers established 426 territories, of which 345 had pairs. This represents a one percent increase in territory numbers from 2018. As in previous years, the San Marcial Reach was by far the most productive, containing 536 resident flycatchers and 293 territories, of which 243 were pairs – a six percent increase in territories from 2018.

The biggest increase, however, was documented within the Percha Reach of the Lower Rio Grande, which grew from one territory in 2018 to 18 in 2019 due to the addition of three new survey sites.

Table 11: Southwestern Willow Flycatcher territories 2006-2019[1]

Location[2]	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
Frijoles	N/S[3]	0	0	0	0	0	1	0	2	N/S	1	1	N/S	N/S
Belen	N/S	20	17	20	17	18	23	14	9	6	3	4	10	1
Sevilleta	N/S	12	4	5	8	4	4	6	9	13	18	31	14	21
San Acacia	0	0	0	0	0	0	0	0	0	0	1	2	0	0
Escondida	9	4	8	5	7	4	8	23	8	4	0	1	0	1
BDANWR	24	24	16	14	11	23	27	51	49	34	20	5	7	4
Tiffany	0	0	0	5	1	8	4	1	4	5	5	8	4	9
San Marcial	293	277	257	302	300	307	266	252	318	298	319	235	197	142
MRG Subtotals	326	337	302	351	344	364	333	347	399	360	367	287	232	178
Caballo Reservoir	9	7	8	9	14	15	4	1	N/S	N/S	N/S	N/S	N/S	N/S
Caballo to El Paso, TX	91	77	60	41	31	26	34	27	3	N/S	5	N/S	N/S	N/S
LRG Subtotals	100	84	68	50	45	41	38	28	3	N/S	5	N/S	N/S	N/S
Total	426	421	370	401	389	405	371	375	402	360	372	287	232	178

[1] Breeding seasons only
[2] This table does not include detections outside of the active floodplain at BDANWR.
[3] N/S = Not Surveyed

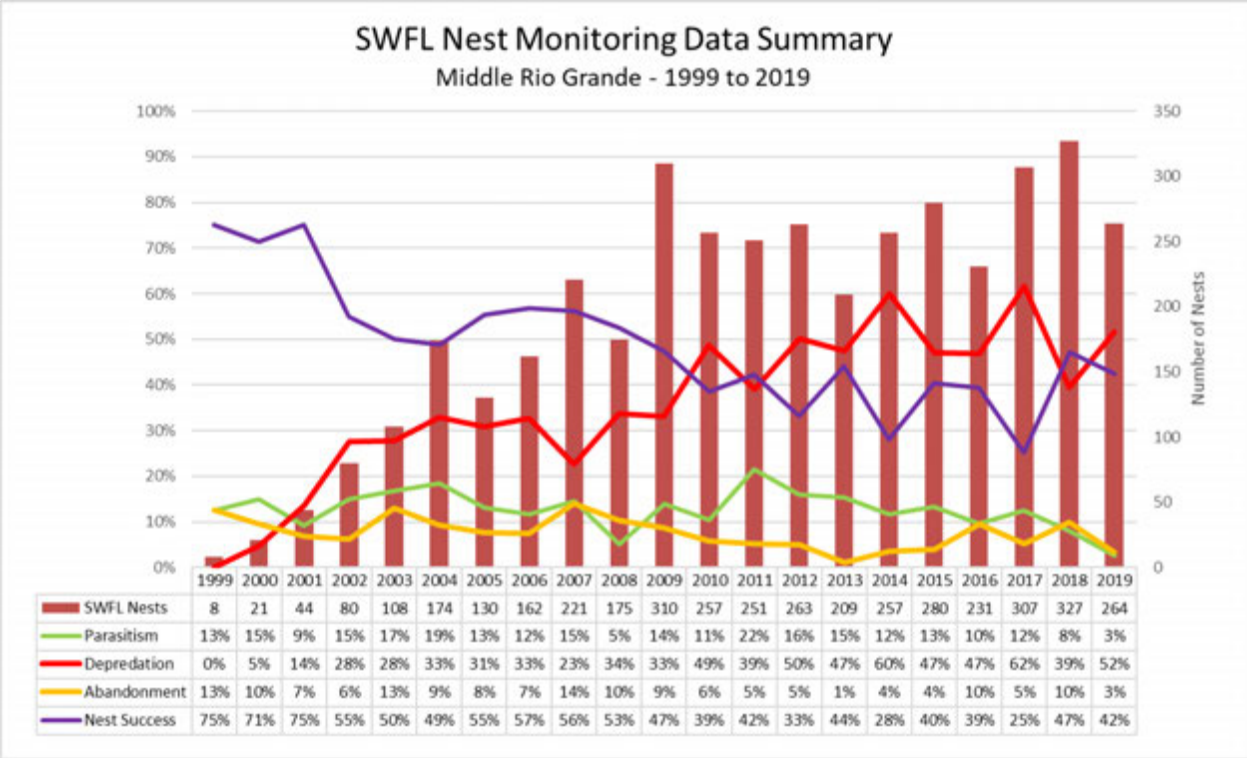
In 2019, nest monitoring was conducted at all sites where nesting pairs were detected from San Acacia Diversion Dam to Elephant Butte Reservoir, and in select sites from Elephant Butte Dam to El Paso, TX. A total of 393 nests was discovered and monitored to determine success rates, productivity, and brown-headed cowbird (*Molothrus ater*) parasitism. The San Marcial Reach was most productive at 280 nests.

Other studies continued in 2019 include: 1) flycatcher nesting hydrology and habitat variable study; 2) river maintenance impact monitoring; 3) photo monitoring of habitat development in the Elephant Butte delta; 4) saltcedar leaf beetle (*Diorhabda* spp.) impact monitoring; and 5) Elephant Butte delta hydrology monitoring. These studies are designed to provide insight into potential threats and habitat requirements of flycatcher populations.

At Elephant Butte Reservoir, flycatchers have expanded their occupied habitat south, to near Mitchell Point at RM 38. Flycatcher-occupied areas in the Elephant Butte Reservoir delta – RM 60 to 54 – were previously mostly dense Goodding's and coyote willow of various age classes, with water provided by the LFCC outfall. However, drought conditions during the past 10 years reduced flow from the LFCC, and invasive saltcedar is encroaching and becoming dominant. Although this provides refuge habitat for flycatchers, breeding flycatchers are not as successful or productive in saltcedar-dominated habitats. Additionally, the arrival of the saltcedar leaf beetle may be an issue as it will likely defoliate saltcedar during nesting periods, reducing foliage cover and making nests more vulnerable to predation, parasitism, and natural elements.

Habitat modeling since 2016 throughout the Middle Rio Grande has shown that there is still suitable habitat that is not occupied, thus indicating that habitat is not a limiting factor for this population. However, the overall quality of the habitat is likely reducing success and productivity. It is likely that flycatchers do not expand into all areas of suitable habitat due to their site fidelity and overall population size.

Nest success in the Middle Rio Grande rebounded to 47 percent in 2018 following a study period low of 25 percent in 2017 (Figure 6).

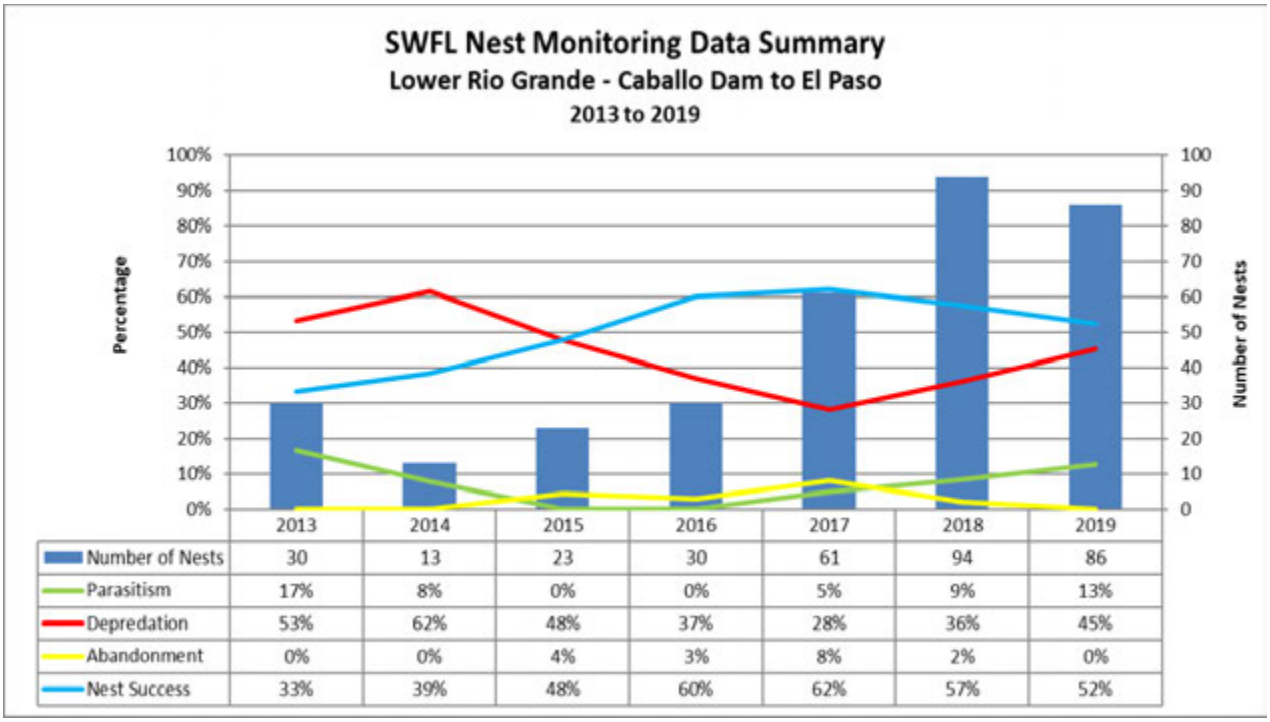


	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SWFL Nests	8	21	44	80	108	174	130	162	221	175	310	257	251	263	209	257	280	231	307	327	264
Parasitism	13%	15%	9%	15%	17%	19%	13%	12%	15%	5%	14%	11%	22%	16%	15%	12%	13%	10%	12%	8%	3%
Depredation	0%	5%	14%	28%	28%	33%	31%	33%	23%	34%	33%	49%	39%	50%	47%	60%	47%	47%	62%	39%	52%
Abandonment	13%	10%	7%	6%	13%	9%	8%	7%	14%	10%	9%	6%	5%	5%	1%	4%	4%	10%	5%	10%	3%
Nest Success	75%	71%	75%	55%	50%	49%	55%	57%	56%	53%	47%	39%	42%	33%	44%	28%	40%	39%	25%	47%	42%

Figure 6: Summary of flycatcher nesting in the Middle Rio Grande from 1999 to 2019

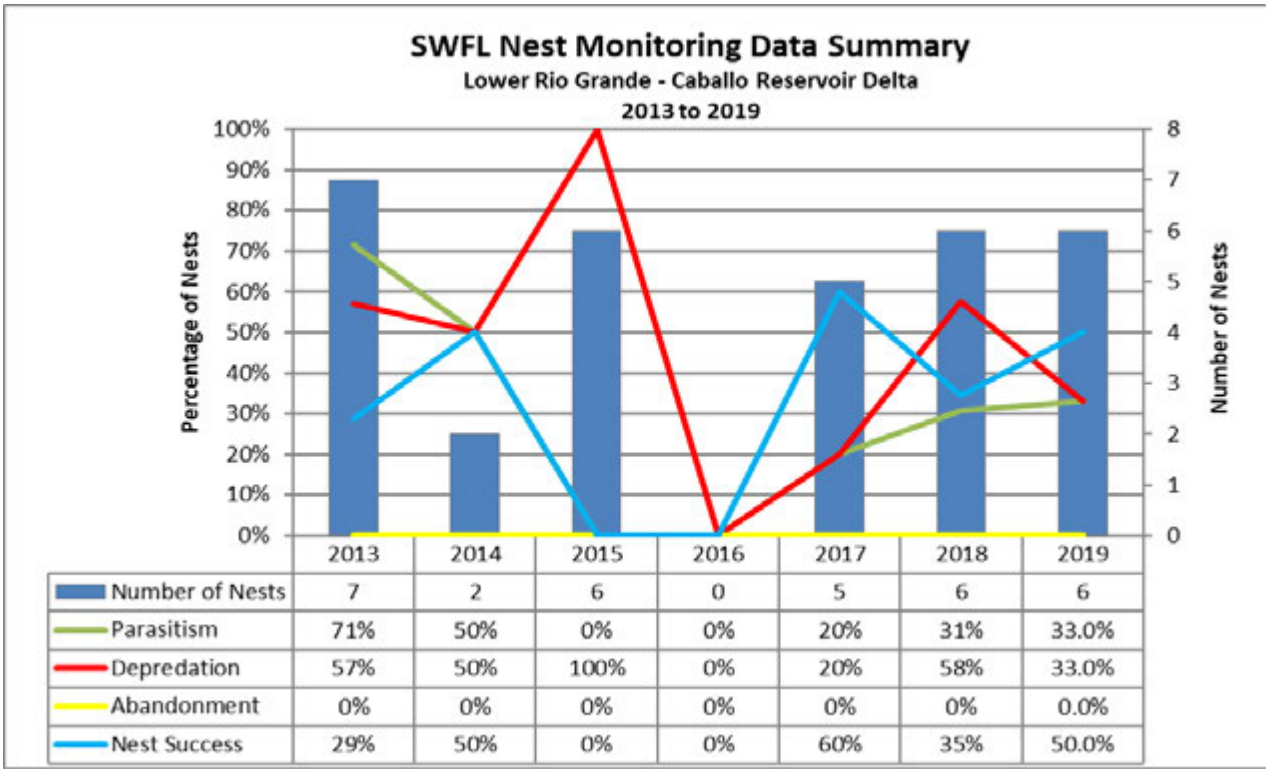
The decline in nest success from 2009 to 2017 may be related to the decline in habitat suitability and quality in heavily populated areas. Depredation, the biggest source of nest failure, averaged 27 percent from 1999 to 2011. Since 2012, the depredation rate has nearly doubled, averaging 51 percent. The depredation rate in 2017 was 62 percent, the highest recorded since 1999, but dropped back to 39 percent in 2018.

These changes may be a result of reduced habitat quality as a result of lower flows. Drought conditions, which typically result in reduced discharge and groundwater levels, reduce plant vigor and canopy cover. This reduces nest concealment, exposing the nest to predators and the elements. The defoliation of saltcedar by *Diorhabda* spp. has similar effects and may be of greater concern in the future. Nest success in the Lower Rio Grande has been much higher the past four years, averaging 58 percent for territories downstream of Caballo Dam, primarily in the Hatch Reach, and 48 percent within the Caballo Reservoir Delta (Figures 7 and 8).



	2013	2014	2015	2016	2017	2018	2019
Number of Nests	30	13	23	30	61	94	86
Parasitism	17%	8%	0%	0%	5%	9%	13%
Depredation	53%	62%	48%	37%	28%	36%	45%
Abandonment	0%	0%	4%	3%	8%	2%	0%
Nest Success	33%	39%	48%	60%	62%	57%	52%

Figure 7: SWFL nest variables, Lower Rio Grande, Caballo Dam to El Paso, 2013 to 2019



	2013	2014	2015	2016	2017	2018	2019
Number of Nests	7	2	6	0	5	6	6
Parasitism	71%	50%	0%	0%	20%	31%	33.0%
Depredation	57%	50%	100%	0%	20%	58%	33.0%
Abandonment	0%	0%	0%	0%	0%	0%	0.0%
Nest Success	29%	50%	0%	0%	60%	35%	50.0%

Figure 8: SWFL nest variables, Lower Rio Grande, Caballo Reservoir delta, 2013 to 2019

During 2017 and 2019, the Rio Grande and Low Flow Conveyance Channel both saw higher flows compared to the past several years, resulting in extensive overbank flooding and higher groundwater levels in some areas. This improved plant vigor, structure, density, and overall habitat quality. Also, during 2017, the Tiffany Fire burned 9,200 acres between RM 74 and RM 62. Of that, about 700 acres had vegetation that could accommodate breeding activity for the flycatcher. Despite an extensive effort to save native vegetation by various agencies, 16 flycatcher territories were impacted by the fire, including seven with nesting birds.

Western Yellow-billed Cuckoo

The western distinct population segment of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*; cuckoo) was listed as a threatened species by the USFWS in October of 2014. Critical habitat for the cuckoo was proposed in the Federal Register (79 FR 48548) in August 2014 and included eight units in New Mexico.

Along the Rio Grande, three critical habitat units were proposed:

- Unit 50, Upper Rio Grande 1, Rio Arriba County: a continuous 10-mile segment of the Upper Rio Grande from Ohkay Owingeh Pueblo to near Alcalde in Rio Arriba County (1,830 acres);
- Unit 51, Middle Rio Grande 2, Santa Fe and Rio Arriba Counties: a continuous six-mile segment of the Middle Rio Grande starting from the Highway 502 Bridge at the south end of the Pueblo of San Ildefonso upstream to a point on the river in Rio Arriba County south of La Mesilla (1,173 acres); and
- Unit 52, Middle Rio Grande 1, Sierra, Socorro, Valencia, Bernalillo, and Sandoval Counties: a continuous 170-mile segment, from river mile 54 within the Elephant Butte Reservoir pool upstream to just below Cochiti Dam. The largest breeding population of western yellow-billed cuckoos north of Mexico is within this reach (61,959 acres).

During the summer of 2019, Reclamation conducted cuckoo surveys in 12 distinct reaches of the Rio Grande within sites also surveyed for SWFL from the south boundary of the Pueblo of Isleta to El Paso, TX (Table 12). Surveys were conducted to contribute to baseline population data of the cuckoo along the Rio Grande and to meet Reclamation's ESA compliance commitments. In 2019, there were an estimated 96 breeding territories, all assumed to be pairs, derived from 429 cuckoo detections. The estimated territories and documented detections were most concentrated in the southern portion of the San Marcial reach, i.e., Elephant Butte Reservoir pool.

Table 12: Yellow-billed Cuckoo Detections/Estimated Territories 2006 - 2019[1]

Location[2]	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
Belen	N/S[3]	41/10	34/4	54/12	39/10	24/5	20/6	44/15	16/4	3/0	1/0	N/S	N/S	N/S
Sevilleta	N/S	41/10	12/4	32/10	18/5	9/2	19/6	36/12	6/2	1/0	4/2	N/S	N/S	N/S
San Acacia	28/8	47/14	50/13	23/8	27/8	15/4	20/5	19/4	6/1	3/0	8/1	N/S	N/S	N/S
Escondida	51/11	55/10	44/11	58/16	62/16	27/7	80/23	68/21	15/3	6/2	29/9	19/10	3/2	N/S
BDANWR	59/14	46/13	43/10	32/11	40/12	34/12	29/8	36/10	17/4	14/3	47/11	35/14	22/13	N/S
Tiffany	0	0	2/0	9/0	2/0	2/0	4/1	10/2	4/1	2/0	10/3	7/3	12/4	10/6
San Marcial	190/ 42	193/ 49	227/ 56	220/ 59	215/ 59	190/ 61	219/ 70	202/ 57	202/ 58	249/ 58	257/ 69	299/ 60	222/ 52	106/ 38
MRG Subtotal	**328/ 75**	**423/ 106**	**412/ 98**	**428/ 116**	**403/ 110**	**301/ 91**	**391/ 119**	**415/ 121**	**266/ 73**	**278/ 75**	**356/ 95**	**360/ 87**	**259/ 71**	**116/ 44**
Caballo	47/11	58/13	64/16	62/15	48/15	28/8	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Percha	13/2	7/1	8/2	3/1	1/0	0/0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Hatch	11/2	17/6	11/1	6/2	4/1	0/0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Radium Springs	9/3	25/7	10/4	16/6	10/4	8/2	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Las Cruces	12/2	10/3	9/3	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Mesilla	5/1	9/2	0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
LRG Subtotal	**101/ 21**	**126/ 32**	**93/23**	**87/24**	**63/20**	**36/10**	**N/S**	**N/S**	**N/S**	**N/S**	**N/S**	**N/S**	**N/S**	**N/S**
TOTAL	**429/ 96**	**549/ 138**	**505/ 121**	**515/ 140**	**466/ 130**	**337/ 101**	**391/ 119**	**415/ 121**	**266/ 73**	**278/ 75**	**356/ 95**	**360/ 87**	**259/ 71**	**116/ 44**

[1] Breeding seasons only
[2] Table does not include detections outside of the active floodplain at BDANWR.
[3] N/S = Not Surveyed

New Mexico Meadow Jumping Mouse

The historical distribution of the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*; jumping mouse) was likely riparian areas and wetlands along streams in the Sangre de Cristo and San Juan Mountains from southern Colorado to central New Mexico, including the Jemez and Sacramento Mountains, the Rio Grande Valley from Española to BDANWR, and into parts of the White Mountains in eastern Arizona. A final rule was published in the June 10, 2014, Federal Register to list the jumping mouse as an endangered species under the ESA, with final critical habitat designation following in March 2016. While designated critical habitat units for the species occur in Colorado, New Mexico, and Arizona, only Unit 6 – BDANWR is in close proximity to the Rio Grande. Unit 6 consists of 403 ha (995 ac) along 21.1 km (13.1 mi) of ditches and canals associated with managed irrigation on the BDANWR in Socorro County, New Mexico. This unit begins in the northern part of the refuge and generally follows the Riverside Canal to the southern end. Jumping mice have not been found on the Rio Grande in this area.

In the Middle Rio Grande (MRG) Valley, jumping mice are known to use both natural wetlands and riparian habitats associated with irrigation channels (Frey and Wright, 2012). In either case, tall, dense, herbaceous, riparian vegetation is a key habitat component. Historic distribution of the jumping mouse within the MRG is uncertain, but as of the late 1980s, the species was confirmed to be present at Ohkay Owingeh Pueblo and the adjacent Rio Chama (Rio Arriba County), Isleta Pueblo (Bernalillo County), near Casa Colorada Wildlife Area (Valencia County), and BDANWR (Socorro County) (Frey, 2006). The BDANWR is the only locality within the Middle Rio Grande where the population is considered still in existence (Frey and Wright 2012; USFWS 2014a).

Surveys have regularly occurred at BDANWR. Surveys in 2014 and 2015 using box traps resulted in the capture of 19 and six jumping mice, respectively. The 2016 box trap surveys initially resulted in the capture of three mice before BDANWR changed to camera trapping midway through the trapping season and recorded an additional 27 mice. However, it is unclear how many photos were of unique or individual mice. BDANWR has continued camera trapping efforts in 2017, 2018, and 2019. According to BDANWR, in 2019 additional restoration efforts were implemented during a good water year and habitat was extremely favorable for the mouse. While there were fewer detections, they reasoned it was because the mice had spread out in response to an increase in available suitable habitat. This was supported by discovery of a jumping mouse in a newly created habitat site further south than documented in recent years (email correspondence, Jeff Sanchez, BDANWR).

With the exception of BDANWR, systematic surveys for jumping mice and their habitat have not been conducted throughout the riparian corridor of the MRG. However, since its listing, surveys for suitable jumping mouse habitat have occurred in selected areas as part of environmental compliance activities for specific projects, such as the Delta Channel river maintenance project (Reclamation, 2014). The Delta Channel is located on the southern fringe of the geographic area where the jumping mouse could potentially inhabit. During the habitat assessment it was determined that the Delta Channel area does not represent a suitable natural environment based on the herbaceous vegetation composition and structure, lack of soil moisture, high frequency and long history of disturbance, and lack of regular inundation necessary to support jumping mouse habitat. Based on the habitat assessments within the Delta Channel, it is unlikely that suitable or occupied jumping mouse habitat exists south of BDANWR and no additional populations have been identified along the MRG.

Literature cited:
Frey, J.K., 2006. Status of the New Mexico meadow jumping mouse (Zapus hudsonius luteus) in the Sangre de Christo Mountains, New Mexico. Final Report submitted to New Mexico Department of Game and Fish, Santa Fe, 14 December 2006, 78 pp.
Frey, J.K., and D.A. Kopp. 2014. Final Report: Preliminary Assessment of jumping mouse habitat associated with Middle Rio Grande Project U.S. Department of the Interior, Bureau of Reclamation, Albuquerque Area Office, 18 pp.
Frey, J.K., and G.D. Wright. 2012. Multiple scale habitat selection by a small mammal habitat specialist (Zapus hudsonius luteus) in a managed floodplain landscape. Final Report submitted to U.S. Fish and Wildlife Service, Cooperative Agreement 201819J806, 16 March 2012, 109 pp.
Reclamation. 2014. River Maintenance Program: San Marcial Delta Water Conveyance Channel Maintenance Project Biological Assessment. Bureau of Reclamation, Albuquerque Area Office, September 2014, 80 pp.
U.S. Fish and Wildlife Service. 2014. Endangered and Threatened Wildlife and Plants; Determination of Endangered Status for the New Mexico Jumping Mouse Through Its Range; Final Rule. Federal Register 79: 33119-33137.
U.S. Fish and Wildlife Service. 2013. Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the New Mexico Meadow Jumping Mouse: Listing Determination for the New Mexico Meadow Jumping Mouse; Proposed Rules. Federal Register 78: 37328-37363.
U.S. Fish and Wildlife Service. 2014. New Mexico meadow jumping mouse (Zapus hudsonius luteus) Survey Results at Bosque del Apache National Wildlife Refuge, United States Government Memorandum. 12 pp.

Supplemental Water Program

Reclamation initiated its Supplemental Water Program in 1996 to support water needs of the ESA-listed species in the Middle Rio Grande. The program originally included water acquisition, reservoir storage, and release of water to support river flows. Since 2001, it has also included operation of a pumping network in the San Acacia Reach to pump water from the LFCC to the river. The Program supports ESA coverage under Section 7(a)(2) of the 2016 BO.

Water Acquisition and Management

In 2019, 9,669 ac-ft of supplemental water was released by Reclamation for endangered species purposes. All of that volume was leased SJ-C Project water. The release of supplemental water began on August 23 as flow decreased in reaches prone to drying. The last release was on October 4.

Widespread rain on October 4 re-connected dry parts of the Rio Grande and led the MRGCD to release native water stored in 2019 in El Vado Reservoir for delivery to Elephant Butte Reservoir. This water was released to help make up for the Rio Grande Compact debit that New Mexico anticipated at the end of 2019. With the river re-connected, the supplemental water releases ended on October 4.

Reclamation ended 2019 with a total of 13,460 ac-ft of SJ-C Project water. This was comprised of 6,491 ac-ft of 2018 leased SJ-C Project water in storage in El Vado Reservoir, and 6,969 ac-ft of water in Heron, all acquired via short term leases or other water contracts.

In 2020, Reclamation will have potential leases of approximately 12,000 ac-ft from 2020 SJ-C Project allocations. However, available leased water could be less than half of that amount, dependent on a SJ-C Project shortage.

Other Sources of Supplemental Water

In addition to the water released by Reclamation, there was another source of water used to support the needs of the ESA-listed species in 2019. As shown in Table 13, this water was released to the river by MRGCD at four wasteway outfalls in the Isleta Reach: Alejandro, Los Chavez, Lower Peralta Drain #2, and Sabinal.

A total of 293.61 ac-ft of pre-1907 native water rights owned by Reclamation and permitted to be used for offsetting via the NMISC's Strategic Water Reserve were released from the outfalls from September 20 to 22, and from October 4 to 5.

Table 13: 2019 Isleta Reach Outfall Deliveries

Isleta Reach Outfall Delivery Dates, 2019	Delivered Water Volume, ac-ft	Water Source
September 20 – 22	139.61	Native water acquired, permitted, and used for offset
October 4 – 5	154	Native water acquired, permitted, and used for offset

Low Flow Conveyance Channel (LFCC) Pumping Program

During the irrigation season, flows in the Rio Grande between San Acacia Diversion Dam and the full pool elevation of Elephant Butte Reservoir can drop to low levels that may impact the success of the silvery minnow and flycatcher. The LFCC Pumping Program helps maintain longer sections of continuous river and helps Reclamation maximize the effectiveness of supplemental water releases made for ESA purposes.

The 2003 BO required the use of pumps to manage river recession, maintain river connectivity, and supply water for nesting flycatchers. Requirements under the 2016 BO do not stipulate pumping, and instead focus on using adaptive management and a variety of tools to meet or exceed silvery minnow density thresholds in the Incidental Take Statement (ITS). As an optional tool in support of meeting these thresholds, Reclamation used the south boundary pumps in 2019 to maintain river connectivity from that location to the Elephant Butte Reservoir pool.

Reclamation maintains and operates portable pumps with flow meters at strategic locations along the LFCC. The pumps are used to return water from the LFCC to the Rio Grande. Data for the pumping sites is posted in orange boxes on the MRGCD Gage Schematic page on Reclamation's ET Toolbox web site at:

https://www.usbr.gov/uc/albuq/water/ETtoolbox/rg/riog/schematic/SCHEMATICsocorrodiv.html.

The total available pumping capacity for all pump locations is approximately 200 cubic feet per second (cfs). The maximum total pumping rate is limited to 150 cfs by the 2004 permit granted by the New Mexico Office of the State Engineer.

Flow arriving at the south boundary pump site began to decline in early August, and observations showed that it fell below 20 cfs in late August. To maintain river connectivity from the south boundary of BDANWR to Elephant Butte Reservoir, pumps at the south boundary site were turned on August 25, 2019, at 3 pm.

The south boundary pumps were shut off for the season on October 5, 2019, at 8pm, after upstream releases brought flow at the San Marcial floodway gage above 40 cfs.

The pumps at the south boundary site were the only ones used for pumping supplemental water during the 2019 season. The total volume of supplemental flow provided by the pumping effort in the 2019 season was 1,817 ac-ft.

Isleta Settlement

Isleta Diversion Dam was built by the MRGCD on Pueblo of Isleta land in 1934 and rehabilitated by Reclamation in 1954. The Pueblo of Isleta has maintained that proper easement was never fully granted to the MRGCD or Reclamation. Technical and legal teams comprised of representatives of the Pueblo, Reclamation, and the MRGCD were formed in May 2015 in response to a request from the Pueblo of Isleta to work on an agreement that could lead to a settlement.

Reclamation, the Pueblo of Isleta, and the MRGCD signed a global settlement on October 21, 2016, resolving trespass issues associated with Isleta Diversion Dam. This global settlement granted the United States easement for the next 100 years. The Pueblo was paid a lump sum of $5 million for this easement and to redress past and present trespass issues. Additional commitments encompass diversion dam modifications to better manage sediment transport into irrigation canals and provide fish passage through the dam, as well as bosque and riverine restoration.

In FY 2019, the settlement team achieved major milestones including completion of the preliminary engineering and analysis report on diversion dam modifications, completion of sediment sampling during high flow events to aid in quantification of the sediment issues at the dam and associated sluiceways, completion of the bosque and riverine restoration plan, and completion of a new P.L. 93-638 contract with the Pueblo, which funds environmental compliance and implementation of the first stages of bosque and riverine restoration.

The technical team will continue development, review, and implementation of projects to meet the settlement commitments. The commitments are scheduled to be completed by 2026.

Other Ongoing Water Management Related Projects

USGS MRG River Gage Operation and Maintenance

Additional gages along the river and in MRGCD facilities were a high priority in FY 2002 and 2003. Two sets of gages were funded by the Collaborative Program through Reclamation. To assess how much water was being diverted from and returned to the river, funding allowed MRGCD to establish the first set of gages. These were on diversions, waste ways, and important canals. MRGCD subsequently took over operation and maintenance (O&M) of those gages.

Other funding allowed the USGS to install four new river gages, which Reclamation continues to fund. The four gages are the Rio Grande near Bosque Farms, NM (08331160); Rio Grande at State Hwy 346 near Bosque, NM (08331510); Rio Grande at bridge near Escondida, NM (08355050); and the Rio Grande above US Hwy 380 near San Antonio, NM (08355490). All of these new gages were a result of the ongoing ESA discussions with the USFWS, and became a requirement in the 2003 BO, to increase the availability of accurate flow data in the Middle Rio Grande.

Data from the river gages helps Middle Rio Grande water management agencies meet the needs of water users, fulfill the requirements of the Rio Grande Compact, maintain adequate water in the river to support the silvery minnow, and provide information needed to improve the daily management of the river system from Cochiti Dam to Elephant Butte Reservoir. Data from these gages are available to the public at: http://waterdata.usgs.gov/nm/nwis/current/?type=flow.

RiverEyes

The RiverEyes program was developed under the 2003 BO to provide current information on river flows and river drying, allowing action agencies to react quickly to changing river conditions to meet 2003 BO flow and intermittency requirements. RiverEyes also facilitates coordination among agencies, helping to prevent unexpected drying, and prepare for and initiate silvery minnow salvage.

The 2016 BO does not set specific flow targets or maximum rates of drying but instead focuses on thresholds of silvery minnow density in October. It is left up to the BO Partners to do what they can to maintain adequate densities and avoid exceeding established thresholds. One of the critical efforts to maintain densities is the coordination of Middle Rio Grande water operations; the RiverEyes' observations of flows and drying remain an integral part of that coordination.

For the 2019 irrigation season, RiverEyes monitored river conditions along the Rio Grande from Isleta Diversion Dam to the S-curve at RM 60. Monitoring occurred from August through October. The total maximum extent of river drying during the 2019 RiverEyes monitoring period was 17.4 miles on September 13, 2019, all of which was in the San Acacia Reach.

Channel drying was detected a total of 25 days in 2019. The first occurrence was on September 2, and the last occurrence was on October 5, both in the San Acacia Reach. No drying occurred in the Isleta Reach during the 2019 irrigation season. As in previous years, the reach was kept continuous by small releases to the river at various MRGCD wasteways.

Middle Rio Grande Endangered Species Collaborative Program

The USFWS listed the Rio Grande Silvery Minnow as endangered in 1994 and issued a recovery plan in 1999. Thereafter, a revised critical habitat designation was released in 2003[1]. The silvery minnow recovery plan[2] was updated in 2010. The southwestern willow flycatcher was added to the endangered species list in 1995 and a final recovery plan[3] was issued in 2002. The designation for flycatcher critical habitat was further revised in January 2013[4].

In response to ESA species listings in the Middle Rio Grande (MRG), ESA-related litigation, and the 2003 BO, the Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) was formed, bringing various groups together to support ESA compliance for the silvery minnow and flycatcher, and address environmental issues along the MRG. The Collaborative Program consists of stakeholders representing diverse interests including federal, state, and local government entities; Tribes and Pueblos; as well as non-governmental organizations working to protect and improve the status of listed species along the MRG while protecting existing and future regional water uses and in compliance with applicable state and federal laws, including Rio Grande Compact delivery obligations. The Collaborative Program was a partner in implementing the 2003 Biological Opinion.

On December 2, 2016, the USFWS issued a final *Biological and Conference Opinion for Reclamation, BIA, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande* (Consultation Number 02ENNM00-2013-F-0033) to Reclamation and its BO partners (Bureau of Indian Affairs [BIA], State of New Mexico, and MRGCD), specifying ESA compliance requirements for water management and river maintenance activities on the MRG. Reclamation and partners are responsible for implementing the 2016 Biological Opinion (86 Conservation Measures, 11 Reasonable and Prudent measures, and 50 Terms and Conditions).

The Collaborative Program is not included in the 2016 BO and does not have responsibility or authority for meeting requirements. However, Reclamation and the partners work with the Collaborative Program to provide an annual symposium for entities conducting science within the basin to share information, maintain a common database management system for data to be housed, and science recommendations in support of adaptive management.

[1] http://www.fws.gov/southwest/es/Documents/R2ES/FINAL_CH_EIS_Rio_Grande_Silvery_Minnow_no_appendices_Feb_2003.pdf
[2] http://www.fws.gov/southwest/es/Documents/R2ES/Rio_Grande_Silvery_Minnow_Recovery_Plan_First_Revision.pdf
[3] http://www.fws.gov/southwest/es/arizona/Documents/SpeciesDocs/SWWF/Final%20Recovery%20Plan/ExecSummary_Contents.pdf
[4] http://www.gpo.gov/fdsys/pkg/FR-2013-01-03/pdf/2012-30634.pdf

Currently, Reclamation provides some of the funding for the Collaborative Program in support of third-party management and studies related to species' needs, as authorized by the Omnibus Appropriations Act of 2009 (P.L. 111-8). In FY 2019, Reclamation provided $3,651,193 for Collaborative Program-related activities. FY 2019 accomplishments include:

- Captive propagation of silvery minnow at the Southwestern Native Aquatic Resources and Recovery Center; the City of Albuquerque's BioPark Aquatic Conservation Facility; and the NMISC's Los Lunas Silvery Minnow Refugium;
- Annual monitoring of silvery minnow population;
- Genetics study of silvery minnow;
- Development of high throughput markers to allow for an enhanced and rapid assessment of silvery minnow genetic diversity;
- Silvery minnow rescue and salvage efforts during river drying;
- Reproductive monitoring of silvery minnow;
- Annual monitoring of southwestern willow flycatcher and yellow-billed cuckoo populations;
- Program management, assessment, reporting, and outreach activities.

Rio Grande Project, New Mexico - Texas

Reclamation's El Paso Field Office and Elephant Butte Field Division are jointly responsible for the operations of the Rio Grande Project (Figure 9). Elephant Butte Field Division operates and maintains Elephant Butte and Caballo Dams and Elephant Butte powerplant. Releases from Elephant Butte and Caballo Reservoirs are scheduled to meet irrigation demand, with concomitant power production, at the canal headings of the Elephant Butte Irrigation District (EBID), El Paso County Water Improvement District No. 1 (EPCWID), and Mexico (under the 1906 International Treaty). EBID operates and maintains Reclamation's diversion dams on the Rio Grande, including Percha, Leasburg, and Mesilla in New Mexico, under a contract with Reclamation. In September 2003, Reclamation completed work to remove Riverside Diversion Dam and the adjacent Coffer Dam, both in Texas. Prior to removal, Riverside Diversion Dam had been inoperable since 1987 when flooding on the Rio Grande caused the structure to fail.

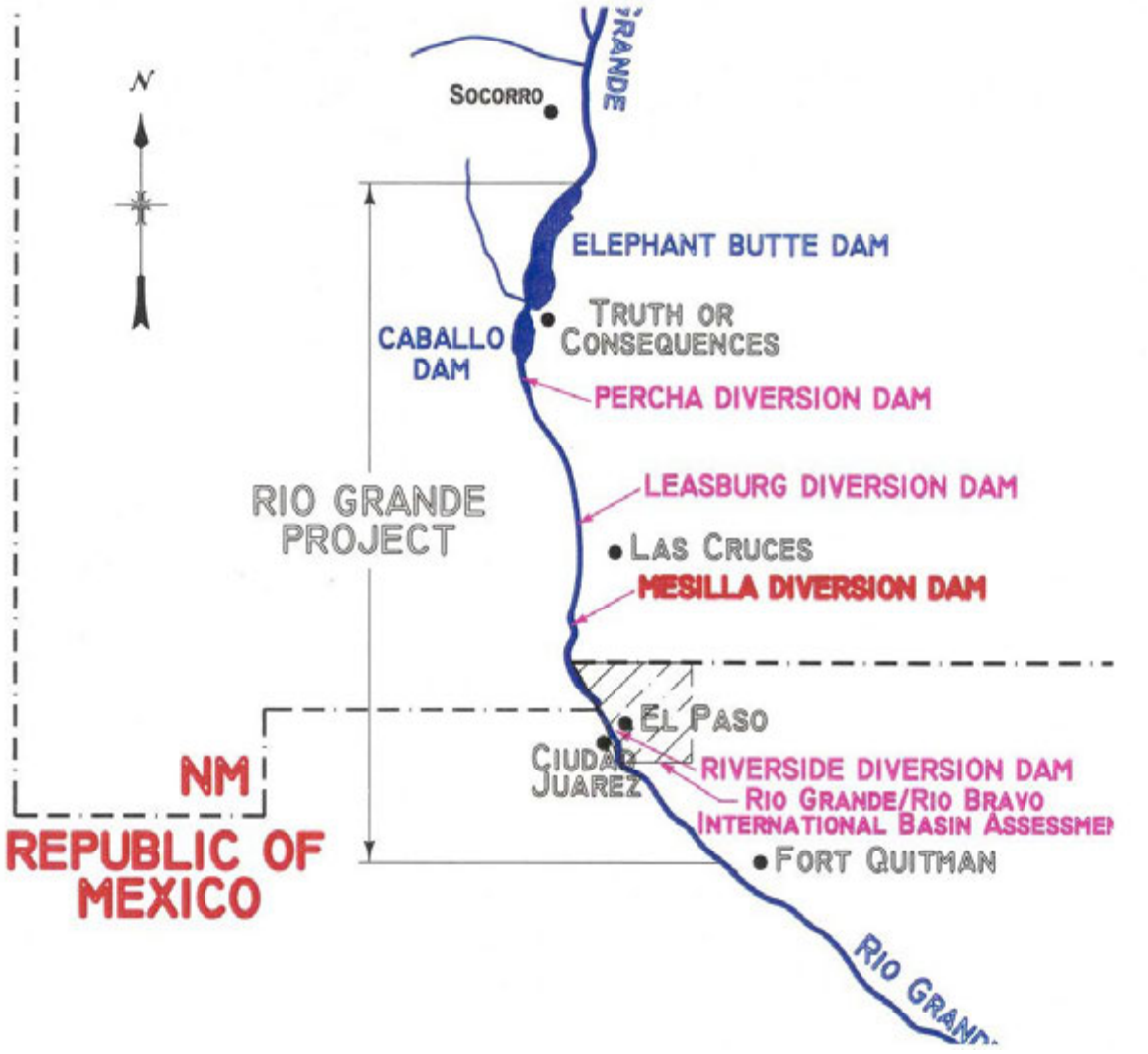


Figure 9: Area Map of the Rio Grande Project

Rio Grande Project Supply

Preliminary inflow data into Elephant Butte Reservoir during 2019, measured as the sum of the Rio Grande floodway and the Low Flow Conveyance Channel at San Marcial, was 977,399 ac-ft. The provisional flow record for the 2019 spring runoff (March - July), measured at San Marcial, was 715,399 ac-ft, or approximately 140% of the 30-year average.

For the period of 1998 to 2019, average spring runoff at the San Marcial gaging station is below the 30-year average used by the Natural Resources Conservation Service (NRCS), which is for the period of 1981 to 2010. From 1998 to 2019, average inflow was 293,634 ac-ft, and only four years – 2005, 2008, 2017, and 2019 – exceeded the 30-year average of 510,000 ac-ft.

Releases from Elephant Butte Reservoir began on May 2 and continued through October 7, 2019. During this period, a total release of 468,896 ac-ft was recorded by the USGS. This flow data has been approved by the USGS and reviewed by Reclamation.

During the 2019 irrigation season (May 24 to October 12), 453,580 ac-ft of water was released from Caballo Reservoir for delivery to Rio Grande Project water users. The water released is combined with drain and arroyo inflows downstream of Caballo Dam for use by the Project beneficiaries.

Combined total storage for Elephant Butte and Caballo Reservoirs was 591,163 ac-ft on December 31, 2019, or 25% of their total capacity. However, due to implementation of new area - capacity (ACAP) tables on January 1, 2020, combined total storage was reduced to 579,801 ac-ft. The available storage for both reservoirs during the winter months, October 1 to March 31, is equal to the capacity of Elephant Butte Reservoir, 2,010,900 ac-ft, minus 25,000 ac-ft that Reclamation reserves for winter operational flood control space (50,000 ac-ft during the summer), plus the capacity of Caballo Reservoir, 324,509 ac-ft, minus 100,000 ac-ft for flood control space, for a total of 2,210,409 ac-ft during the winter, and 2,185,409 ac-ft during the summer.

Per the Rio Grande Compact Article I definition, the usable water in Project storage (Elephant Butte and Caballo Reservoirs combined) was below 400,000 ac-ft from January 1 to May 12, 2019. It rose above 400,000 ac-ft on that date and remained above that quantity for the remainder of 2019.

With the combined Project storage, runoff, and return flows, Reclamation allocated 705,496 ac-ft to Rio Grande Project water users by July for the 2019 irrigation season. The initial available storage, however, was not sufficient to start releases in late February, as has occurred in the past with similar allocations. Reclamation coordinated with the IBWC, Mexico, EBID, and EPCWID to schedule a timely and organized irrigation release. Releases from Caballo Reservoir began on May 24, 2019, and continued through October 12, 2019.

On January 31, 2020, combined total storage in Elephant Butte and Caballo Reservoirs was 603,095 ac-ft. Water available to the Project water users was 611,691 ac-ft. Based on the January 2020 NRCS's spring runoff forecast for the Rio Grande at San Marcial, the National Weather Service's prediction for neutral El Niño Southern Oscillation activity, and present hydrologic conditions, Reclamation anticipates a near-full supply for irrigation during 2020 for the Rio Grande Project.

Project Irrigation and Drainage Systems

Since completion of title transfer in 1996, the irrigation and drainage system of the Rio Grande Project has been owned, operated, and maintained by EBID in New Mexico and EPCWID in Texas. Reclamation owns and administers the land and right-of-way activities of the reservoirs and diversion dam areas, including Percha, Leasburg, and Mesilla. Reclamation also retains the title and O&M responsibilities for Elephant Butte and Caballo Dams and Reservoirs, and the Elephant Butte Powerplant.

The districts performed flow measurements at canal headings, river stations, and lateral headings during 2019. Reclamation performed flow measurements at the Rio Grande below Caballo gaging station, and coordinated and maintained central control of releases, river operations, and water accounting. To accomplish the water allotment accounting, the districts collect field flow measurements and coordinate data from all water user entities. Utilizing the summarized flow data submitted by the districts for their areas of responsibility, Reclamation calculated and summarized the monthly and end-of-year Project water supply use and accounting for 2019.

The IBWC owns, operates, and maintains the American Diversion Dam and the American Canal in accordance with the International Treaties with Mexico (1906 and 1933). In addition, the IBWC operates the International Diversion Dam, which diverts irrigation waters into the Acequia Madre head gates operated by Mexico.

Drainage waters from the Rio Grande Project lands provide supplemental irrigation water for approximately 18,342 acres of the Hudspeth County Conservation and Reclamation District No. 1 (HCCRD). Total flows out of the Project to HCCRD are measured at three gaging stations near the Hudspeth County line: the Hudspeth Feeder Canal; the Tornillo Canal at Alamo Alto; and the Tornillo Drain. Under the Warren Act contracts, HCCRD is charged for drainage water from the Project between March 1 and September 30. At the time of this report in 2018, only provisional data were available to calculate the 2018 diversion. That quantity, 39,603 ac-ft, has since been finalized. The 2019 diversion was 29,341 ac-ft.

Elephant Butte Reservoir and Powerplant

In 2019, the daily minimum storage at Elephant Butte Reservoir was 115,976 ac-ft (elevation 4,298.41 feet) on January 1. The daily maximum storage was 577,261 ac-ft (elevation 4,346.32 feet) on July 14.

The total gross power generation for 2019 was 48,316,960 kilowatt-hours (kWhr). Net power generation was 47,711,262 kWhr, which is 122 percent of the ten-year average (2010 through 2019) of 39,492,032.40 kWhr. The Elephant Butte powerplant record showed releases of 380,092 ac-ft to meet downstream irrigation demand and manage Caballo Reservoir storage levels. Note that Elephant Butte operators consistently record a lower flow than the USGS.

Elephant Butte Dam Facility Review and Safety of Dams Program

There are no significant dam safety-related O&M issues associated with Elephant Butte Dam other than aging infrastructure. There are currently two incomplete Safety of Dams recommendations and five incomplete Category 2 O&M recommendations for Elephant Butte Dam.

A rehabilitation of the balance valve gate system began in September 2018 and was completed in February of 2019.

CR mechanical and civil examinations for Elephant Butte Dam were completed on October 29, 2018, and April 16, 2019, respectively. The examinations resulted in three new O&M recommendations. A report discussing both was finalized in September 2019.

Caballo Dam and Reservoir

Caballo Reservoir started 2019 at 26,939 ac-ft (4,139.26 feet) and ended the year at 33,872 ac-ft (4,141.77 feet). During 2019, the maximum storage was 55,947 ac-ft (4,147.88 feet) on May 30. The minimum storage occurred on January 2 at 26,786 ac-ft (elevation 4,139.20 feet).

The irrigation release period extended from May 24 through October 12, 2019. During that period, Reclamation operated Caballo Reservoir to maintain adequate storage levels to respond to irrigation calls while managing water elevation levels to conserve and protect water, biological, and cultural resources. Reclamation operated Caballo and Elephant Butte Reservoirs to maximize hydropower generation at Elephant Butte while maintaining sufficient storage in Caballo to respond to irrigation demand.

Reclamation communicated with stakeholders to provide information and projections of reservoir elevations throughout the irrigation season. Overall, 453,971 ac-ft was recorded at the Caballo gage from January 1 to December 31, 2019.

Discussion is ongoing between EBID, EPCWID, and Mexico about the start date for the 2020 irrigation season, tentatively scheduled to begin on March 13. The parties are coordinating release schedules to avoid isolated releases. Reclamation will finalize a reservoir operating plan in the spring of 2020.

Reclamation conducted a bathymetric sediment survey of Caballo Reservoir in April 2017, and a report was published in 2019. The 2017 area-capacity table was implemented on January 1, 2020. The results of the 2017 sediment survey show that Caballo Reservoir lost about 425 ac-ft of capacity since the previous survey in 2007, and 22,227 ac-ft since the dam was closed in 1938.

Caballo Dam Facility Review and Safety of Dams Program

There are no significant dam safety-related O&M issues associated with Caballo Dam other than aging infrastructure. There are currently thirteen incomplete Category 2 O&M recommendations for Caballo Dam. No O&M recommendations were completed during FY 2019.

CR mechanical and civil examinations for Caballo Dam were completed on October 30, 2018, and April 18, 2019, respectively. The examinations resulted in 12 new O&M recommendations. A report discussing both was finalized in September 2019.

Active Rio Grande Project Litigation

United States of America v. Elephant Butte Irrigation District

The United States filed the case United States of America v. Elephant Butte Irrigation District (EBID) et al., Civ. No. 97-0803 JP/RLP/WWD (Quiet Title to the Waters for the Rio Grande Project) on June 12, 1997, in the U.S. District Court of NM (D.N.M.) petitioning for quiet legal title to the waters of the Rio Grande Project in its name. The court dismissed the case in August 2000. On May 7, 2002, the U.S. Court of Appeals (10th Circuit) vacated the lower court's August 2000 decision and remanded the case for further proceedings. On remand, the court issued an order to stay the case and close for administrative purposes on August 15, 2002. The court further ordered that, if it becomes necessary or desirable during the pendency of water adjudications in New Mexico and Texas, any party may initiate proceedings as though the case had not been closed for administrative purposes.

Since 2010, interested parties have been proceeding with Stream System Issue No. 104, which involves the United States' water interests in the Lower Rio Grande in New Mexico. In 2012, the court determined that the United States did not have a groundwater right associated with the Rio Grande Project. However, the court did not rule on whether the various groundwater inflows into the Rio Grande are considered "project water", which – if so determined by the court – would mean the United States has a right to such inflows once they become surface water again. This proceeding is suspended while the parties negotiate. The suspension was continued on October 26, 2018, with the court citing progress in the negotiations.

State of New Mexico v. United States

On August 8, 2011, the State of New Mexico filed a lawsuit against the United States Bureau of Reclamation (State of New Mexico v. United States et al., D.N.M. Civ. No. 11-0691) regarding the Rio Grande Project 2008 Operating Agreement (OA) and a purported change in accounting of the water to be delivered to Texas from the Rio Grande. The case is stayed pending ruling by the Supreme Court on Texas v. New Mexico.

Texas v. New Mexico

In January 2013, Texas filed a motion in the U.S. Supreme Court to: receive a declaration of the rights of the State of Texas to the waters of the Rio Grande pursuant to, and consistent with, the Rio Grande Compact and the Rio Grande Project Act; issue its decree commanding the State of New Mexico to deliver the waters of the Rio Grande in accordance with the provisions of the Rio Grande Compact and the Rio Grande Project Act; and award damages and other relief for the injury suffered by the State of Texas.

On January 27, 2014, the Court ruled that Texas can proceed to the next step in its lawsuit against New Mexico, and invited New Mexico to file a motion to dismiss the action. On February 27, 2014, the United States filed a motion to intervene as a plaintiff, asserting many of the same claims as Texas.

In May 2019, Texas and the United States disclosed expert witnesses and expert reports. New Mexico disclosed responsive expert witnesses and expert reports in October 2019. In December 2019, Texas and the United States submitted rebuttal reports. Production of documents and other discovery is ongoing with a deadline for completion of May 1, 2020.

Rio Grande Project Water Accounting

In 2019, the Rio Grande Project continued to operate under the 2008 Rio Grande Project OA and Manual. The OA and its Manual provide detailed procedures for operating the Rio Grande Project, allocating the water supply to EBID and EPCWID, and accounting for use by the Districts while recognizing and fulfilling the terms of the 1906 Convention with Mexico.

Reclamation delayed the initial 2019 allocation to Mexico, EBID, and EPCWID until April to maximize reservoir storage while allowing for releases to begin that month. Even with the late allocation, the provision of the 1906 Convention for extraordinary drought was applied and Reclamation determined 18% of a full allocation to Mexico. By July, enough water was in storage in Elephant Butte and Caballo Reservoirs to remove the extraordinary drought provision and allow a full allocation of 60,000 ac-ft to Mexico. The July allocation was the final in-season allocation to EBID and EPCWID as it was determined that the expected inflows would not be enough to extend the irrigation season for EBID.

Releases from Caballo for Rio Grande Project irrigation deliveries began on May 24 and ended on October 12, 2019. EBID began surface water diversions in two phases, with the Rincon Valley beginning irrigation May 24, and the Mesilla Valley on June 2. EPCWID's initial diversions were also phased due to water travel time. The El Paso Valley began diverting on June 8, and the diversion to Mexico began on June 5 and ended on September 30. EBID ended their surface water diversions in the Rincon Valley on August 24 and in the Mesilla Valley on August 31, 2019. EPCWID ended all diversions on October 13, 2019.

The total Caballo release for Rio Grande Project water accounting was 453,564 ac-ft, which was used to calculate the diversion ratio. This is 15 ac-ft less than the volume reported for Compact water accounting, and is attributed to seepage when the dam's gates were closed. This volume was not charged to the Districts. For 2019, the calculated diversion ratio, a quantitative measure of delivery performance, will be between 0.85 and 0.86.

Due to the late start of releases and the full allocation delayed until July, Mexico was unable to divert all of their 2019 water. The calculated delivery to Mexico was 39,938 ac-ft. There is no provision under the 1906 Convention for Mexico to use their allocation in a following year.

The calculated charges to EBID were 191,462 ac-ft. EPCWID's charges have not finalized as they depend on calculated credits and Canutillo wellfield charges. EPCWID's unused allocation balance will, however, exceed the maximum of 292,915 ac-ft. OA 1.11 dictates that anything in excess of that be transferred to EBID. Expectations are that about 75,000 ac-ft will be transferred to EBID.

Based on early 2020 storage in Elephant Butte and Caballo and the current runoff forecast, the Project is expected to have sufficient water for a full allocation to Mexico in 2020. With its 2019 unused allocation maximized and the current 2020 allocation, EPCWID will also have a full allocation. EBID is anticipated to have a higher allocation in 2020 than 2019 with an estimated diversion ratio adjustment of 0.90.

Elephant Butte and Caballo Reservoir Vegetation Management Cooperative Agreement

Under the previous Vegetation Management Agreement with the State of New Mexico, Reclamation performed maintenance of vegetation at Caballo Reservoir primarily through mowing, which limits non-beneficial consumption of water by woody phreatophytes like saltcedar (Tamarix).

During FY 2019, Reclamation performed work under the new Agreement to maintain areas previously cleared at Caballo Reservoir. Approximately 891 acres of phreatophytic vegetation at Caballo was managed utilizing mowers and mulchers during FY 2019.

Other Reclamation Programs

Native American Affairs Programs

Reclamation has numerous projects underway with Pueblos and Tribes. These projects fall under several categories including the Native American Affairs Program, planning, water rights settlements, cooperative ventures with other federal agencies, and special projects funded through Congressional legislation.

As part of Reclamation's Native American and other programs, assistance was given to various Pueblos to evaluate and improve irrigation system efficiency. Some of the projects included planning and design services for future upgrades and construction, including concrete lining of farm ditches, land leveling, and replacement of check structures, pipes, culverts, and turnouts. Reclamation is working with BIA on irrigation system improvements for MRGCD facilities on lands within the six Middle Rio Grande Pueblos.

The Omnibus Public Land Management Act of 2009, P.L. 111-11, authorized up to $4 million in federal appropriations to conduct a study of the 18 Rio Grande Pueblos' irrigation infrastructure, and up to $6 million per year for construction through 2019. With FY 2019 funding, contracts were initiated, or existing contracts modified with additional scope, to perform design and construction of irrigation improvements at nine of the 18 Pueblos. Irrigation repairs at two additional Pueblos were undertaken through internal Reclamation field division resources.

In addition, the Secretary's Indian Water Rights Office funded water well installation projects at two Pueblos in support of ongoing water rights discussions. The Office of Management and Budget returned the Study Report to Reclamation in July 2019 with comments. Reclamation expects to complete consultation and finalize the report for submittal to Congress in 2020.

Indian Water Rights Settlements

The Claims Resolution Act of 2010 was signed into law on December 8, 2010, authorizing the settlement of two long-running New Mexico Indian water rights cases. Title V, the Taos Pueblo Indian Water Rights Settlement Act, authorizes implementation of the Abeyta (Taos Pueblo) settlement. Title VI, the Aamodt Litigation Settlement Act, authorizes implementation of the Aamodt (Pojoaque, Nambé, Tesuque, and San Ildefonso Pueblos) settlement. Reclamation is working with BIA, the Pueblos, the State of New Mexico, and other involved parties to implement the provisions of these settlements.

Taos Pueblo Indian Water Rights Settlement

Pursuant to Title V of the Claims Resolution Act, Reclamation is working on implementing their responsibilities under the Taos Pueblo Indian Water Rights Settlement. Under the terms of the Settlement, Taos Pueblo has a recognized right to 11,927.71 ac-ft per year of depletion, of which 7,249.05 ac-ft per year would be available for immediate use. The Pueblo has agreed to forbear using 4,678.66 ac-ft per year in order to allow non-Indian water uses to continue. Over time, the Pueblo would reduce the amount of the forborne water rights through purchase of surface water

rights from willing sellers. Reclamation entered into contracts for SJ-C Project water with the Pueblo for 2,200 ac-ft per year; the Town of Taos for up to 366 ac-ft per year (in addition, Reclamation typically leases the Town of Taos' non-Settlement allocation of 400 ac-ft); and El Prado Water and Sanitation District for 40 ac-ft per year.

The Settlement Act authorizes and directs Reclamation to provide financial assistance in the form of grants on a non-reimbursable basis to plan, permit, design, engineer, and construct Mutual-Benefit Projects. These efforts will minimize adverse effects on the Pueblo's water resources by moving future non-Indian ground water pumping away from the Pueblo's Buffalo Pasture, a culturally sensitive wetland. Implementation of the Settlement is currently in the final, on-the-ground phase, and Reclamation is awarding grants to project entities as they move forward with their Mutual-Benefit Projects.

Aamodt Settlement

The Aamodt Settlement Agreement provides for settlement of water rights claims in the Pojoaque Basin including claims of the Pueblos of Nambé, Pojoaque, San Ildefonso, and Tesuque; Santa Fe County; and the City of Santa Fe. The Secretary and all other governmental parties signed the Settlement Agreement and Cost Sharing and System Integration Agreement on March 14, 2013.

The Aamodt Litigation Settlement Act authorized Reclamation to plan, design, and construct a Regional Water System (RWS). The RWS would consist of a water diversion, raw water transmission pipeline, and water treatment facility at San Ildefonso Pueblo on the Rio Grande, as well as storage tanks and transmission and distribution pipelines that would supply up to 4,000 ac-ft of water annually to Pueblo and non-Pueblo customers within the Pojoaque Basin.

The Final Environmental Impact Statement (EIS) was published in the Federal Register (FR) in January 2018. The Record of Decision was signed on September 11, 2019. Reclamation completed designs at the 100 percent level on Phase 1 in August 2019 that included intake, water treatment plant, storage tanks, and pipelines on the northern end of the project area in San Ildefonso and northern Pojoaque Pueblos. Phase 2 designs at the 60 percent level are also complete, and include conveyance of treated water to existing and proposed distribution tanks within the Nambé, southern Pojoaque, and Tesuque Pueblos, and Bishops Lodge in Santa Fe County. Designs at the 30 percent level for Phase 3 are complete and include distribution piping for the Pueblos of San Ildefonso, Pojoaque, Nambé, and Tesuque, and Santa Fe County. Associated cost estimates are well above the amount authorized for the project. In accordance with the Act, the Secretary has initiated negotiations with the parties for an agreement regarding non-federal contributions to ensure the RWS can be constructed.

An agreement pursuant to Section 611(g) of Title VI of the Claims Resolution Act of 2010 was signed by settlement parties on September 17, 2019, addressing the scope, funding shortfall, and extension of the project construction completion from June 2024 to June 2028.

Federal funding was obligated to the design-build contractor for a limited construction contract at the intake area on the Pueblo de San Ildefonso in September 2019. The notice to proceed was issued on November 7, 2019, and construction is planned to begin in early 2020.

No diversions, river sampling, or water quality analysis of Rio Grande water occurred in 2019.

Upper Rio Grande Water Operations Model (URGWOM)

URGWOM is a computational model developed through an interagency effort. It is used to simulate processes and operations in the Rio Grande Basin from the headwaters in Colorado to Fort Quitman, Texas, as well as track the delivery of water allocated to specific users within New Mexico. URGWOM operates on a RiverWare® software platform. RiverWare® was developed at the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES).

The primary purpose of URGWOM is to facilitate more efficient and effective accounting, forecasting, flood risk management operations, and management of water in the Upper Rio Grande Basin. URGWOM is used for accounting of SJ-C Project water and forecasting of daily storage and delivery operations in the Rio Grande Basin. The model is used to simulate processes for Annual Operating Plans (AOP) that forecast the remainder of the year, and for long-term forecasts for planning studies. It is currently being set up for use in the Rio Grande New Mexico Basin Study.

The URGWOM Technical Team meets approximately monthly, while the Executive Committee meets no less than annually. An Advisory Committee initially strengthened URGWOM's interagency nature, but this committee no longer meets because attendees were generally the same as those at the Technical Team meetings. The URGWOM website is updated with details on recent activities, postings of the latest documentation, and meeting notes. It can be accessed at: http://www.spa.usace.army.mil/Missions/CivilWorks/URGWOM.aspx.

In 2019, work continued to improve the Lower Rio Grande segment of URGWOM. The newly developed deep groundwater aquifer objects are being added to the Middle and Lower Rio Grande portions of URGWOM so that URGWOM's shallow groundwater aquifer objects no longer depend on input from MODFLOW. Updated documentation for URGWOM and its components is nearly complete. The Technical Team continues to review and test both monthly time step and unregulated flow functionality. In consultation with the Team, Reclamation is studying how to incorporate the National Weather Service's ensemble forecast – in conjunction with the currently utilized NRCS forecast – into forecast runs. Reclamation is enhancing the representation of Elephant Butte Reservoir in URGWOM, which is intended to maximize power generation while meeting downstream targets.

Water Accounting Reports Projects

2019 San Juan – Chama Project Water Accounting

The 2019 SJ-C Project water accounting was accomplished using version 7.5.2 of the RiverWare® modeling system software, and version 7.5 of the URGWOM accounting module. All accounting data and information is stored directly in the final version of the 2019 accounting model. Data are also sent to Reclamation's HDB via a data management interface (DMI). Reclamation consulted with representatives of the NMISC and the USACE, Albuquerque District, to verify accounting data throughout the year. This ongoing discussion minimized concerns regarding year-end data quality and accounting methods.

Oracle® Hydrologic Database (HDB)

HDB is a specialized relational database for storing and recovering hydrologic data used by Reclamation in the management of river and reservoir systems. A generalized version of HDB was

specifically developed for use by Reclamation with RiverWare® models. HDB is an Oracle® relational database application and includes connections to data sources such as Reclamation's Hydromet, DOMSAT, DSS, and modeling software, as in the aforementioned RiverWare®. HDB was originally developed at the University of Colorado's CADSWES. The HDB instance housing URGWOM data is located in the Upper Colorado Basin Regional Office and is maintained by that office, as well as through contract with Precision Water Resources Engineering. HDB has been customized by Reclamation consultants and offices for specific office and model requirements. The AAO and the El Paso Field Office depend on HDB installations for data storage and retrieval.

Development of water accounting and reporting functionalities for the Upper Colorado Basin HDB installation continued during 2019. The Upper Colorado Basin HDB installation was successfully migrated to a new server with Red Hat Linux 7 and Oracle® 12c R2. Water accounting data is directly transferred from the RiverWare® URGWOM accounting model to HDB, and thereafter from HDB to URGWOM via an HDB/RiverWare® Data Management Interface (DMI). OpenDCS 6.6 and HDB-POET 3.6.10 were also released in 2019. OpenDCS is an application that allows automated computations and data manipulation. HDB-POET is an interface for data viewing and analyses.

Planned work for 2020 includes continued maintenance of HDB, as well as back-population of historical data for both the Middle Rio Grande and Rio Grande Projects into HDB. Reclamation is also working on moving historical and current MRGCD gage data from ET Toolbox to HDB. Reclamation will also begin accessing, recording, and back-populating Colorado Division of Water Resources' published gage data which will eventually overwrite preliminary data, similar to the process used for USGS gage data.

RiverWare®

Numerous improvements to RiverWare® were accomplished during 2019 through contracts that Reclamation and USACE have with CADSWES at the University of Colorado. Work included completing enhancements to the RiverWare® window and workspace, as well as improvements to groundwater modeling, RPL functionality, salinity modeling, and the geospatial view. An annual report produced by CADSWES summarizes the 2019 changes to URGWOM and RiverWare®. The report is distributed to the user community at CADSWES' annual meeting.

Evapotranspiration (ET) Toolbox

ET Toolbox is an extension of Reclamation's Agricultural Water Resources Decision Support (AWARDS) system that provides internet access to high-resolution rainfall and daily crop water use estimates for improving the efficiency of water management and irrigation scheduling. Rainfall coverage extends from the headwaters of the Rio Grande in Colorado to El Paso, Texas. ET coverage extends from Abiquiu Dam on the Rio Chama in New Mexico, and from Embudo on the Rio Grande in New Mexico to El Paso, Texas.

ET Toolbox was intended to make accurate, real-time ET predictions available to URGWOM for daily water operations model runs. This connection was not initially developed, but ET Toolbox has nonetheless proven to be a useful tool for water managers within and outside of Reclamation, supplying accurate, real-time ET predictions via a dedicated website, and providing a real-time ET dataset, e.g., estimates of daily riparian and crop water use, open water evaporation, and rainfall.

Initially, the ET Toolbox model processes and predictions primarily used local weather station data feeds. However, many of these stations are no longer functional and other remote forms of data acquisition currently feed hourly weather data to ET Toolbox. Weather forecasts are now used for all Toolbox calculations.

ET Toolbox can be accessed at:
https://www.usbr.gov/uc/albuq/water/ETtoolbox/riogrande.html.

In 2019, general development and maintenance tasks were performed on ET Toolbox and an update process was initiated in collaboration with NASA's Jet Propulsion Laboratory (JPL) to create a satellite-based ET product that will eventually replace the calculated evapotranspiration displayed on ET Toolbox. Through this collaboration, daily 30-meter ET data are being developed, along with corresponding updates to the forecast system and web interface.

In 2020, Reclamation plans to complete the updates identified above in collaboration with JPL. Reclamation and JPL will also continue software review and updates, integrate the ET product with URGWOM, consolidate data, and expand the initial spatial coverage. Reclamation will also begin improvements to the access and display of the various water operations tools currently provided on the ET Toolbox.

Zebra and Quagga Mussel Update

Zebra and quagga mussels (*Dreissena rostriformis bugensis* and *Dreissena polymorpha*; ZQM) 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 called 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

Reclamation is confident that preventing the spread of mussels is the least costly option for protecting water bodies and Reclamation infrastructure. Therefore, it is assisting with, providing resources for, and/or directly engaged in the following activities:

Outreach: Reclamation has engaged in public outreach efforts since 2009, distributing 41,000 "Zap the Zebra" brochures and 1,000 mussel posters. These brochures and posters have been dispersed throughout New Mexico at New Mexico State Parks (NMSP) facilities, convenience and sporting goods shops, and community libraries. Permanent signs with the "Stop Aquatic Hitchhikers!" message have been installed at boating docks and other key locations at both Elephant Butte and Navajo Reservoirs. Information is distributed to the public at New Mexico reservoirs where ZQM inspections occur. Western States Boat Inspection Information rack cards, New Mexico Department of Game and Fish (NMDGF) Aquatic Invasive Species (AIS) post cards, NMDGF AIS alien stickers, and "Zap the Zebra" rack cards are just a few of the items circulated.

Watercraft Inspections and Decontamination: Reclamation does not have a direct role in inspecting and decontaminating watercraft in New Mexico. However, Reclamation supports these activities primarily by providing equipment and contractual support. Reclamation utilizes up to five mobile decontamination units for AIS inspections. Two are permanently assigned to Elephant Butte Reservoir (generally stationed near Marina del Sur and Rock Canyon). At Navajo Reservoir, there are two mobile units on the Colorado side (large and small), and one mobile unit on the New Mexico side. There is one permanent decontamination station at Navajo State Park, Colorado, and one unimproved decontamination station at Navajo Lake State Park, New Mexico (Pine River Recreation Area). Seven additional mussel decontamination station locations have been designated at the following reservoir locations: Heron; El Vado; Elephant Butte Main Entry; Elephant Butte Hot Springs; Sumner; and two sites at Brantley. Funding will determine if any of these facilities are built.

In general, AIS watercraft inspection efforts have increased in New Mexico since 2013. NMDGF, Reclamation, and other partners have increased the number of watercraft inspection locations. The number of watercraft inspections statewide has increased from 9,346 in 2013 to 42,525 in 2019 (J. Dominguez, Personal communication; Table 16). NMDGF, Pyramid Enterprises (a contractor working with Reclamation, see below), and the City of Farmington are the agencies currently conducting inspections. At many locations, NMSP is providing law enforcement support, location support, and other logistics when needed.

Table 14: 2019 AIS Inspection Data (compiled by NMDGF and Reclamation)

Location	Inspections	Decontaminations
Bill Evans Lake	1	0
Brantley Reservoir	3	0
Conchas Reservoir	2,049	0
Eagle Nest Lake	17	0
Elephant Butte Reservoir	16,854	57
Farmington Lake	1,538	1
Navajo Reservoir	17,117	142
NMDGF ABQ Office	5	1
NMDGF Santa Fe Office	5	3
Other Locations	113	0
Santa Rosa Reservoir	8	0
Ute Lake	4,816	5
Total[1]	42,525	209

Reclamation has contracted Pyramid Enterprises to perform AIS monitoring for up to five years for the following:

- Inspections for watercraft entering Navajo and Elephant Butte Reservoirs;
- Decontamination of watercraft considered "high risk" as defined by NMDGF;
- Coordination with NMDGF or other law enforcement for issuance and removal of red warning tags as needed.

In 2019, there were 16,854 inspections at Elephant Butte Reservoir, and 17,117 inspections at Navajo Reservoir (Table 14).

Reclamation Reservoir Monitoring: Since 2008, Reclamation has been sampling seven of its New Mexico reservoir bodies (Navajo, Heron, El Vado, Elephant Butte, Caballo, Sumner, and Brantley) for mussels, and processing these water samples through Reclamation's research lab, Reclamation Detection Laboratory for Exotic Species (RDLES) in Denver, Colorado. RDLES performs microscopy on all water samples to visually identify the presence of these mussel species.

Polymerase Chain Reaction (PCR) testing (Johnson 1995; Reclamation 2013) is performed on samples from all water bodies that have had positive microscopy. All positive PCR results are sent for gene sequencing to verify species (quagga or zebra) using deoxyribonucleic acid (DNA). RDLES provides remaining bulk water samples for independent lab testing, which most states (including New Mexico) require prior to water body re-classification. RDLES positive results may be confirmed by:

- Microscopic photos (using high resolution fluorescent or scanning electron microscopes) taken and verified by dreissenid mussel experts in independent labs;
- Positive microscopic results verified with positive PCR results; and/or
- Positive microscopic results with positive PCR results verified with gene sequencing.

[1] Inspection totals include incoming and outgoing vessels.

State AIS coordinators routinely request independent lab verification of RDLES test results, which may or may not confirm Reclamation test results, as follows:

- Microscopy results agreed upon/not agreed upon;
- PCR results replicated/not replicated;
- If PCR results are replicated, then gene sequencing replicated/not replicated.

Each state has its own definition of what constitutes a positive water body, and the action it takes to manage the water body is dependent upon its definition. In New Mexico, the NMDGF is responsible for designating a water body's status for invasive mussels using waterbody designations created by western states' AIS coordinators including: status unknown, undetected/negative, inconclusive, suspect, and positive (USFWS 2013).

Reclamation does not make waterbody designations. However, it does make notifications of all positive test results for a water body. All of RDLES confirmed test results are posted to the Reclamation Mussel SharePoint Database; these data are available to designated State and Reclamation employees. Reclamation follows standard operating procedures and quality control and assurance practices, which are documented and available on the Reclamation Mussel internet site at: http://www.usbr.gov/mussels/index.html.

Reclamation continues to sample seven of its New Mexico reservoirs under RDLES' direction. Table 15 shows the reservoir, total number of samples, and associated microscopy and PCR test results for 2019 (S. Pucherelli, Personal communication).

Table 15: AIS sampling of several Reclamation reservoirs in NM 2019

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

In 2019, none of the seven Reclamation reservoirs sampled in New Mexico tested positive for ZQM, neither by microscopy nor 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, as future conditions may be more suitable to AIS establishment.

Literature Cited

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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 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 Department's many 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 Rio Grande Basin are listed in Table 16 at the end of this section.

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 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.

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 carry out financial assistance as part of the WCFSP. 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 and encourages 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 as they 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 will 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 the 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.

Reservoir Operations Pilots

Reclamation is completing an analysis of water operations on the Rio Chama, located in northwestern New Mexico as a Reservoir Operations Pilot project. This project seeks to evaluate the legal constraints to river and reservoir operations on the Rio Chama; evaluate the economic implications of reservoir operations and potential changes to them; and compile existing data and information on the impact of reservoir operations on the ecology, geomorphology, hydropower generation, and recreation potential of the designated Wild and Scenic reach of the Rio Chama. The Rio Chama Reservoir Operations Pilot Report is anticipated to be released to the public in 2020.

Basin Studies

Reclamation has entered partnerships with local water management agencies to perform basin studies. Basin studies in the Upper Rio Grande Basin build on the hydrologic projections developed

by Reclamation as part of the Upper Rio Grande Impact Assessment (Llewellyn et al., 2013). 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.

Santa Fe Basin Study

In 2015, Reclamation's AAO, in partnership with the City of Santa Fe and Santa Fe County, released the *Santa Fe Basin Study: Adaptations to Projected Changes in Water Supply and Demand* (Llewellyn et al., 2015). This study evaluated projected impacts of climate change, population growth, and other stressors on the Santa Fe watershed and water supplies for the combined municipal water system of the City and County.

Based on the conclusions of this Basin Study, the City of Santa Fe proposed and received funding from Reclamation for a Title XVI Feasibility Study, which was completed in 2017. The completed study describes alternatives for implementation of a water reuse project for the City.

In 2016, the City of Santa Fe was also awarded funding from Reclamation for a Basin Study Update. In this project, which is currently being finalized, Reclamation and Santa Fe collaborated to determine the likely timeline for projected impacts of climate change on Santa Fe's water supply over the coming century, empowering the Santa Fe water utility to plan for implementation of the remainder of its adaptation portfolio. In 2018, the City was awarded a Water Management Options Pilot Project to redevelop the system dynamics model used to simulate its water supply sources and distribution. Again, this project is currently underway.

Rio Grande Basin Study: Lobatos to Elephant Butte

Reclamation is now in partnership with the MRGCD and a large number of basin stakeholders to perform a Basin Study for the portion of the Rio Grande under New Mexico's jurisdiction per the Rio Grande Compact. This study follows from the Middle Rio Grande Basin Study – Plan of Study and seeks to include a broad and diverse consortium of basin stakeholders, including State and municipal government entities, Tribes, irrigation districts, acequias, and non-governmental and community organizations. The study is being funded as a 50/50 cost split between Reclamation and all other partners combined.

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 United States 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 into Reclamation's annual water supply planning.
- FY 2018 Award; ongoing: Collison Floating Evaporation Pan (AAO Partnership with University of New Mexico). This project aims to improve reservoir evaporation monitoring through the development and calibration of an in situ floating evaporation pan. Through this project, a floating evaporation pan was deployed on Cochiti Reservoir where it was used to monitor reservoir evaporation for a year and a half. Pans are currently being deployed at Elephant Butte and Caballo Reservoirs, and evaporation monitoring results are being integrated and compared with those generated by New Mexico State University in the project below.
- FY 2019 Award; ongoing: Using Remote Sensing and Ground Measurement to Improve Evaporation Estimation and Reservoir Management (AAO and Elephant Butte Field Office partnership with New Mexico State University). This project aims to improve reservoir evaporation monitoring and reservoir management through the comparison of evaporation estimates from in situ and remotely sensed measurements. In situ evaporation estimates for this project are being measured through eddy covariance towers at Elephant Butte and Caballo Reservoirs and compared with those generated from the Collison Floating Evaporation Pans described above. Remotely sensed evaporation estimates are being developed from LandSat-8 images.

- FY 2019 Award; ongoing: Software Tool Development to Generate Stochastic Hydraulic Simulations using HEC-RAS (AAO partnership with the USACE and the Hydrologic Research Center of San Diego, CA). Statistical analysis will be performed using the results of the developed software and the available flow and sediment measurements for a single reach of the Middle Rio Grande with the purpose of estimating the uncertainty of the simulations.
- FY 2020 Award; ongoing: Utilizing Acoustic Sensors to Detect Streambed Mobilization (Internal to AAO). This project seeks to assess the viability of utilizing acoustic sensors to determine when streambed mobilization begins on the Rio Chama. The goal of this project is to improve management of high flow pulses by correlating the moment of mobilization to a flow rate.

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.

Likewise, through Reclamation's Upper Colorado Basin Regional Office, AAO is partnering with NASA's Jet Propulsion Laboratory (JPL) on a project to update the technology used to produce evapotranspiration (ET) estimates in the Rio Grande Basin. This is described in more detail in the *ET Toolbox* subsection above. The project will provide daily ET estimates at 30-meter spatial resolution derived from the Moderate Resolution Imaging SpectroRadiometer (MODIS) on the Terra and Aqua satellites and Landsat imagery, and forecast ET estimates.

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Table 16: Active WaterSMART Projects in the Rio Grande Basin Managed by the Albuquerque Area Office[1]

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount	GOTR[3]
R18AP00116	CWMP	09/30/2020	Save our Bosque Task Force	Updating and Expanding the Restoration Plan for New Mexico's Middle Rio Grande through Socorro County	$100,000	$0	Dagmar Llewellyn
R18AP00117	CWMP	03/31/2020	Colorado Rio Grande Restoration Foundation	Rio Grande, Conejos River, and Saguache Creek Stream Management Plan	$35,000	$145,172	Dave Park
R18AP00119	CWMP	09/30/2021	National Audubon Society, Inc.	Isleta Reach Watershed Restoration Group, Middle Rio Grande Basin Watershed Group Development and Restoration Plan	$99,964	$0	Dagmar Llewellyn
R18AP00120	CWMP	06/30/2021	Northern Arizona University	Developing a Watershed Restoration Strategy for the Eastern Jemez	$97,673	$0	Dave Park

[1] As of February 11, 2020
[2] CWMP = Cooperative Watershed Management Program
DROUGHT = Contingency Planning, Resiliency Projects, or Emergency Response Actions
WEEG = Water and Energy Efficiency Grant
SWEP = Small-Scale Water Efficiency Project
WCFSP = Water Conservation Field Services Program
Title XVI = Water Reclamation and Reuse Program
WIIN Act = Water Infrastructure Improvements for the Nation
Water Marketing = Strategy Grants yet to be awarded
Applied Science Grants = Part of Basin Study Program yet to be awarded
[3] GOTR = Grant Officers Technical Representative (local AAO point of contact)

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount	GOTR[3]
R16AC00108	DROUGHT PLANNING	09/30/2019	Middle Rio Grande Conservancy District	MRGCD Drought Contingency Plan	$200,000	$229,886	Dagmar Llewellyn
R16AP00145	DROUGHT PROJECT	09/30/2019 Closeout Phase	Middle Rio Grande Conservancy District	Socorro Main Canal South Distribution Hub	$299,000	$676,101	Ann Demint
R18AC00122	DROUGHT PROJECT	*To be determined*	Elephant Butte Irrigation District	Watershed Scale Stormwater Monitoring and Capture	$180,670	$181,784	Michelle Estrada-Lopez
R19AV00009	DROUGHT PROJECT	09/30/2021	Pueblo of Zia	P.L. 93-638 Zia Flume Reconstruction	$750,000	$1,113,391	Tracey Heller
R19AP00115	DROUGHT PROJECT	*To be determined*	Santa Fe County	Aquifer Storage and Recovery in Rancho Viejo	$291,520	$1,790,763	Dave Park
R19AP00105	DROUGHT PROJECT	*To be determined*	City of Las Cruces	Better Managing Water Supplies with Neutral Output Discharge Elimination System (NO-DES)	$262,453	$262,454	John Irizarry
R14AP00086	WEEG	03/31/2019 Closeout Phase	El Paso Water	Potable Water and Energy Conservation and Savings from Secondary Membrane Treatment of Reverse Osmosis (CERRO)	$299,533	$1,340,491	John Irizarry
R18AP00193	WEEG	06/30/2021	El Paso County Water Improvement District No. 1	Riverside Canal Lining Project	$999,000	$1,302,500	Woody Irving

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount	GOTR[3]
R18AP00197	WEEG	06/30/2022	Elephant Butte Irrigation District	Picacho W-H-E-N Project	$997,182	$1,152,288	Woody Irving
R19AP00150	WEEG	*To be determined*	El Paso County Water Improvement District No. 1	La Union East Canal Concrete Lining Project	$300,000	$625,298	Woody Irving
R17AP00215	SWEP	9/30/2020	City of Rio Rancho, NM	Water Efficiency Rebates	$29,300	$47,110	David Park
R17AP00220	SWEP	03/31/2019	City of Elephant Butte, NM	Water Meter Upgrades	$73,945	$93,367	Woody Irving
R17AP00222	SWEP	12/31/2020	Village of Los Lunas	Effluent Reuse for Construction Water	$70,181	$77,090	David Park
R17AP00223	SWEP	09/30/2022	City of El Paso, TX	Water Conservation in the City of El Paso Parks	$70,500	$75,000	Woody Irving
R18AP00255	SWEP	08/30/2020	City of Rio Rancho	Ultrasonic Water Meter Replacement	$69,237	$92,470	David Park
R18AP00258	SWEP	09/30/2020	City of Las Cruces	Smart Irrigation Technology Water Supply Reliability Project	$73,920	$74,420	John Irizarry
R18AP00261	SWEP	03/31/2020	El Paso County Water Improvement District No. 1	Ysla Lateral Concrete Lining Project	$74,000	$119,576	Woody Irving

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount	GOTR[3]
R19AP00207	SWEP	09/30/2021	El Paso County Water Improvement District No. 1	Advanced Metering Infrastructure Upgrades to Irrigation Wells	$74,000	$82,922	Woody Irving
R19AP00223	SWEP	*To be determined*	Pueblo of Zia	P.L. 93-638 Residential Metering Project	$70,320	$91,578	Tracey Heller
R19AP00208	SWEP	*To be determined*	El Paso County Water Improvement District No. 1	Montoya Main and Montoya A Laterals Concrete Lining Project	$75,000	$122,143	Woody Irving
R19 pending	SWEP	*To be determined*	Ponderosa Mutual Domestic Water Consumers Association	Meter Upgrade Project	$25,000	$25,000	Dave Park
R16AP00069	WCFSP	12/31/2018 Closed	City of Rio Rancho	Water Use Audits	$44,421	$78,960	David Park
R17AP00022	WCFSP	06/30/2020	Middle Rio Grande Conservancy District	Demonstrating Conservation Project Technologies	$49,989	$95,558	David Park
R18AP00142	WCFSP	09/30/2020	El Paso County Water Improvement District No. 1	Designing Improvements to Franklin Canal and Franklin Feeder Canal	$75,000	$75,000	Woody Irving
R19 pending	WCFSP	*To be determined*	City of Rio Rancho	Water Resources Management Plan Update	$16,925	$0	Dave Park

Agreement No.	Program[2]	Completion Date	Recipient Name	Project Title	Federal Total Obligation Amount	Non-Federal Total Est Amount	GOTR[3]
R19 pending	WCFSP	*To be determined*	El Paso County Water Improvement District No. 1	La Union Canal Concrete Lining Project	$75,000	$75,317	Woody Irving
R16AP00217	Title XVI	12/31/2020	El Paso Water Utilities Public Service Board	Fred Hervey Reclaimed Water Project	$1,221,692	$3,665,076	John Irizarry
R17AP00323	Title XVI	12/31/2018 Closeout Phase	El Paso Water Utilities Public Service Board	Feasibility Study for Aquifer Storage and Recovery Using Reclaimed Water	$150,000	$180,082	John Irizarry
Selected	Title XVI	*To be determined*	El Paso Water Utilities Public Service Board	El Paso Water Reclamation and Reuse Project	$3,500,000	$0	John Irizarry
Selected	WIIN Act Desalination Program	*To be determined*	El Paso Water Utilities Public Service Board	Kay Bailey Hutchison (KBH) Desalination Plant, Phase I Part A Expansion	$2,050,000	$0	John Irizarry