

RECLAMATION

Managing Water in the West

Calendar Year 2017 Report to the Rio Grande Compact Commission

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Albuquerque, New Mexico

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Cover photo – Eric Gonzales (Reclamation) and Eileen Henry (USFWS) seine for silvery minnows while Josh Grant (USFWS) takes notes, during Reclamation's annual fall fish surveys in the San Marcial Delta Water Conveyance Channel, within the boundaries of Elephant Butte Reservoir. (Liza Yazzie, Reclamation)

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List of Acronyms and Abbreviations

AAO	Albuquerque Area Office
ABCWUA.....	Albuquerque Bernalillo County Water Utility Authority
ac-ft	acre-feet
AIS	Aquatic Invasive Species
AM	adaptive management
ANWR	Alamosa National Wildlife Refuge
AOP.....	Annual Operations Plan
ARRC.....	Aquatic Resources and Recovery Center
ASR.....	Aquifer Storage and Recovery
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
CERRO	Concentrate Enhanced Recovery Reverse Osmosis
cfs.....	Cubic Feet per Second
CMIP5.....	Coupled Model Intercomparison Project Phase 5
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
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
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
MRCOG.....	Mid-Region Council of Governments
MRG	Middle Rio Grande
MRGCD.....	Middle Rio Grande Conservancy District
MRMPO.....	Mid-Region Metropolitan Planning Organization
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
P & P.....	Prior and Paramount
P.L.....	Public Law
PSR.....	Periodic Security Review
RDLES.....	Reclamation Detection Laboratory for Exotic Species
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
SJ-C.....	San-Juan Chama
SL.....	standard length
SLL.....	San Luis Lake
SLVWCD.....	San Luis Valley Water Conservation District
SOD.....	Safety of Dams
TCEQ.....	Texas Commission on Environmental Quality
TDS.....	Total Dissolved Solids
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
WCFSF.....	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 Authority. Reclamation transferred title to the canal and drainage facilities to the districts in a 1996 quit claim deed.

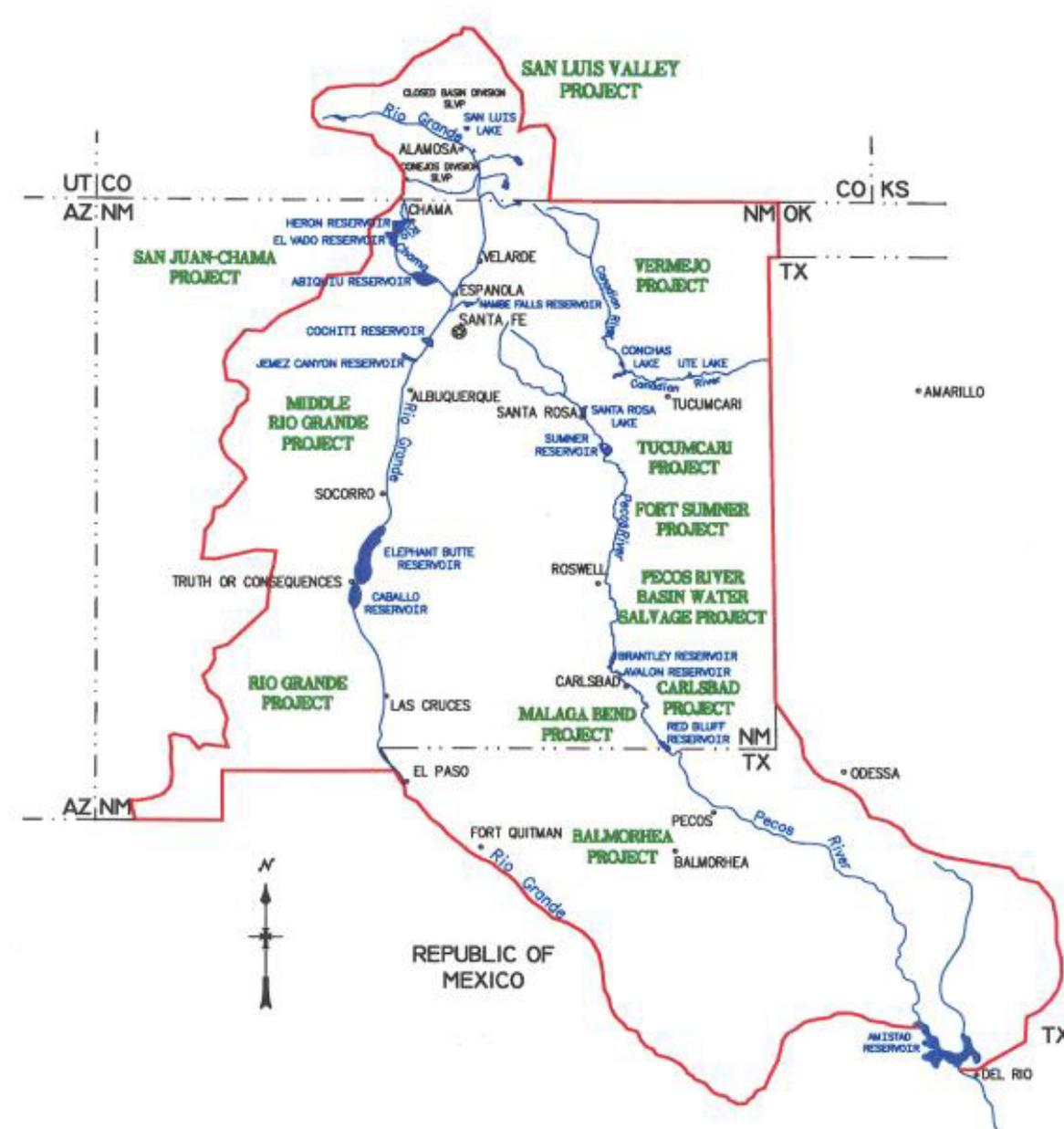


Figure 1: Project Map of Reclamation's Albuquerque Area Office

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 located in Manassa, Colorado.

Platoro Reservoir started the year on January 1, 2017, with a water surface elevation of 9,974.46 feet and a storage volume of 15,371 acre-feet (ac-ft). The December 31, 2017, reservoir elevation was 9,988.48 feet, with a storage volume of 23,304 ac-ft. The minimum storage during calendar year 2017 occurred on April 2, 2017, at 15,275 ac-ft (9,974.17 feet). Maximum storage was on June 25, 2017, when the reservoir peaked at 39,993 ac-ft (10,011.90 feet).

Article VII restrictions were in place from January 1 to April 8, 2017, with storage of native water allowed from April 9 to August 9. Article VII restrictions came back into effect on August 10, and remained in place to December 6, 2017. Restrictions were lifted from December 7 to 31, 2017.

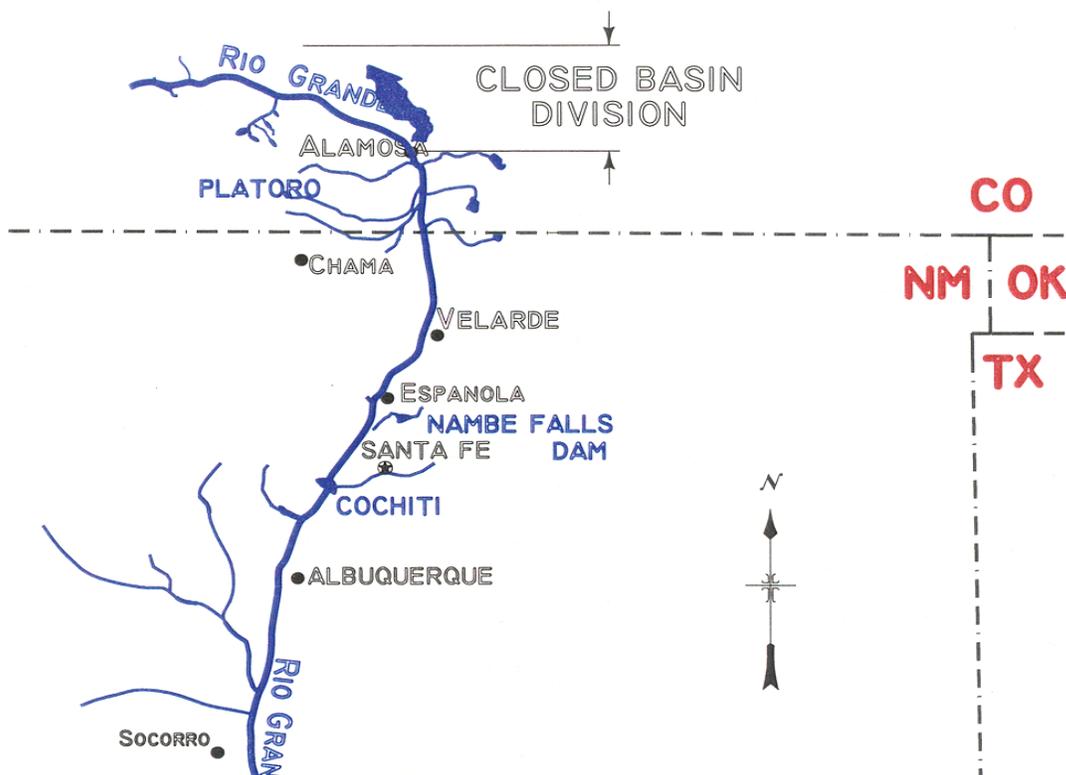


Figure 2: Area Map of San Luis Valley Project

Platoro Dam Facility Review and Safety of Dams Programs

Outside of aging infrastructure, there are no significant dam safety-related Operations and Maintenance (O&M) issues associated with Platoro Dam and Dike. At the end of Fiscal Year (FY) 2017, there was one incomplete Category 2 O&M recommendation for Platoro Dam.

A scheduled Periodic Facility Review (PFR) was completed in 2017. No recommendations were initiated from the PFR exam. A Functional Exercise is scheduled for 2018.

The Facility Review Rating was updated in October 2017. The rating for Platoro increased from a total score of 90 in 2016 to a score of 95. Platoro currently has an overall rating of “Good.”

Closed Basin Division

The Closed Basin Project 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 and Blanca Wildlife Habitat Area. Reclamation continues to work under the guidance of the Closed Basin Project Operating Committee in management of Closed Basin 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) 2017 included deliveries to the Rio Grande, Blanca Wildlife Habitat Area (BWHA), and Alamosa National Wildlife Refuge (ANWR). A total of 11,789 ac-ft of Project water was delivered in CY2017.

Total deliveries of Compact water to the Rio Grande for CY2017 were 8,003 ac-ft. Table 1 compares Project total production and Compact deliveries in 2017, to quantities in the five preceding calendar years. The Rio Grande Compact also specifies that water delivered to the river cannot exceed, based on a ten-day average, 350 parts per million total dissolved solids (TDS).

Total water deliveries to the Bureau of Land Management’s (BLM) BWHA were 1,274 ac-ft. This included 800 ac-ft for annual mitigation, 250 ac-ft from a water exchange between BLM and Colorado Parks and Wildlife (CPW), and 128 ac-ft from a water exchange between BLM and the San Luis Valley Water Conservancy District (SLVWCD). In addition, ANWR transferred 96 ac-ft of mitigation water to the BWHA.

Total water deliveries to the ANWR for project mitigation were 2,512 ac-ft. This total accounts for their 2017 mitigation amount of 2,608 ac-ft, less the 96 ac-ft transfer to the BWHA.

Table 1: Closed Basin Project Deliveries 2012-2017

Year	Total Production (ac-ft)	Delivered to Rio Grande (ac-ft)
2017	11,789	8,003
2016	12,095	8,469
2015	11,684	8,059
2014	11,213	7,598
2013	11,401	7,979
2012	12,877	9,409

Natural inflows to San Luis Lake (SLL) are measured at the SLL inlet flume and culverts. Inflow to SLL during CY2017 totaled 2,370 ac-ft. Closed Basin Division water accounting for the 2017 calendar year is summarized in Table 2.

Table 2: San Luis Valley Project - Closed Basin Division Water Accounting (units are acre-feet)

MONTH	BLANCA WILDLIFE HABITAT AREA, ac-ft			PARSHALL FLUME, ac-ft		ALAMOSA NATIONAL WILDLIFE REFUGE, ac-ft (ANWR)				DELIVERY TO THE RIO GRANDE			PROJECT TOTALS
	CH03 STA. 730+00	CH04 STA. 798+60	MONTH TOTALS	TOTAL PASSING FLUME	CREDITABLE AMOUNT AT FLUME	CH01 CHICAGO TURN-OUT	CH02 MUM TURN-OUT	PUMPING PLANT	MONTH TOTALS	Total at Flume Minus Del. to ANWR	Creditable Amt. to RG and not used by ANWR	NON-CREDITABLE @ LOBATOS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
JAN	0	0	0	924	924	0	0	0	0	924	924	0	924
FEB	0	0	0	780	780	62	65	9	136	644	644	0	780
MAR	48	48	96	1202	1202	316	217	365	898	304	304	0	1298
APR	28	28	56	942	942	0	0	0	0	942	942	0	998
MAY	20	20	40	916	916	0	0	0	0	916	916	0	956
JUN	51	49	100	849	849	0	0	0	0	849	849	0	949
JUL	183	141	324	680	680	0	0	0	0	680	680	0	1004
AUG	202	143	345	710	710	173	174	0	347	363	363	0	1055
SEP	131	103	234	724	724	255	243	0	498	226	226	0	958
OCT	79	0	79	896	896	301	296	0	597	299	299	0	975
NOV	0	0	0	908	908	10	26	0	36	872	872	0	908
DEC	0	0	0	984	984	0	0	0	0	984	984	0	984
ANNUA	742	532	1274	10515	10515	1117	1021	374	2512	8003	8003	0	11789

Notes: 1. Delivery to BWAH includes: 250 ac-ft exchange from Colorado Parks and Wildlife (CPW)
127.5 ac-ft exchange from SLV Water Conservancy District (SLVWCD)
96 ac-ft transfer of mitigation water from ANWR

2. Total creditable to Rio Grande from delivery and exchange = 8,003 + 250 + 128 = 8,381 ac-ft.

The project continues to provide Priority 1 (Compact) and Priority 2 (mitigation) water deliveries. The San Luis Valley is in the midst of 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.

Reclamation has been meeting with the U.S. Fish and Wildlife Service (USFWS), CPW, RGWCD, and Colorado Division of Water Resources on the operation of San Luis Lake and

surrounding wetlands in an effort to provide wildlife habitat and help make the San Luis Lake Wildlife Area a viable recreation area. The goal is to coordinate Project deliveries with natural inflows to improve surrounding habitat while reducing TDS concentrations in San Luis Lake and wetlands.

The U.S. Geological Survey (USGS) continues to provide quality assurance/quality control of the observation well data for Reclamation. Reclamation continues to work in partnership with the USGS, National Park Service (NPS), BLM, USFWS, and the RGWCD to monitor several observation well networks in and around the Project.

Maintenance

Routine preventive maintenance and repair activities continue at observation and salvage well sites and vaults, project lateral line valves, canal structures, pumping plants, and shelterbelts. Several miles of lateral roadways were graded and reformed. Avian protection nesting platforms were also installed throughout the project. All heavy equipment was serviced and grader doors were replaced with updated ones.

Re-drilling and rehabilitation of salvage wells is an ongoing process. Five salvage wells were re-drilled, 24 wells were rehabilitated, and 18 new pumps were installed in 2017.

The new well rehabilitation technique using stainless steel casing and putting new gravel pack into the existing borehole is still being tested and appears to be a promising alternative to drilling a new well, as it does not require a drill permit, and the existing pipeline and electrical service can be utilized. This well replacement program will continue in 2018 and the effectiveness and costs will be closely evaluated to determine if and when it may be a preferred alternative to drilling a new well.

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 1,367 samples collected in 2017.

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 Fall USGS Evaluation Program for Standard Reference Water Samples. The Laboratory continues to perform well on these audits.

Rio Grande Water Conservation District

RGWCD continues to perform civil maintenance on the Project through a cooperative agreement with Reclamation. Task were previously divided between the two agencies. A new agreement was recently reached, and RGWCD and Reclamation crews will be working closer than they have previously.

The RGWCD has been given new assignments associated with rehabilitation and drilling activities. Canal berms, lateral access roads, and right-of-ways were maintained by blading and

mowing in 2017. Other work included removal of aquatic weeds and sediment from structures and the canal, repair of fences, repair of berms eroded because of large precipitation events, and assisting Reclamation in maintaining equipment. RGWCD continued its involvement in the groundwater monitoring program and continues maintenance of the irrigation systems for shelterbelt areas.

San Juan – Chama Project, Colorado – New Mexico

An area map of the San Juan – Chama (SJ-C) Project is provided below in Figure 3.

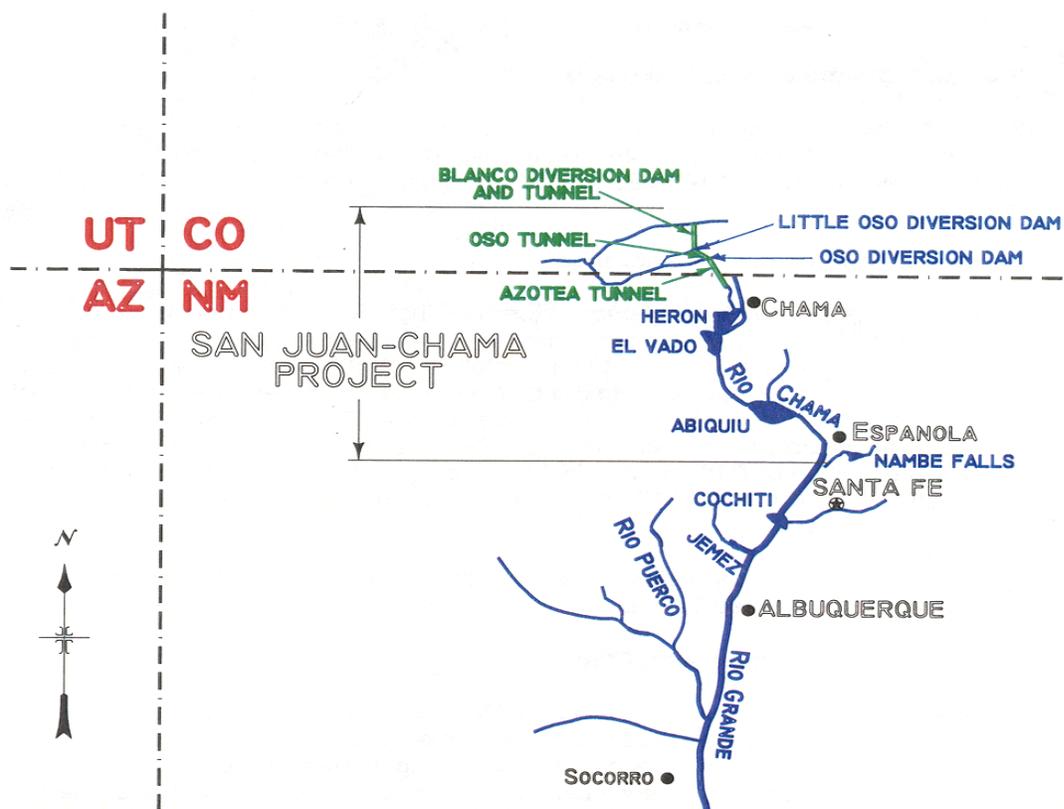


Figure 3: Area Map of the San Juan-Chama Project

San Juan - Chama Project Accounting

Water diverted from the San Juan Basin in Colorado through the SJ-C Project, 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.

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 accounting report. SJ-C Project accounting for 2017 is provided in the separate *2017 Water Accounting Report*.

Heron Dam and Reservoir Operations

(All elevations are 1929 NGVD, storage reference is 2010 ACAP survey)

Diversions into the Azotea Tunnel began on February 7, 2017, and continued until December 7. The total volume diverted through the tunnel was 162,522 ac-ft. The running 10-year average of Azotea Tunnel diversions increased significantly this year, from 87,602 ac-ft for the period 2007 through 2016, to 93,347 ac-ft for the period 2008 through 2017 (Table 3).

Table 3: SJ-C Project - Diversions through Azotea Tunnel (units are acre-feet)

AZOTEA MONTH	YEAR										10 YEAR TOTAL
	2008 (1)	2009 (2)	2010 (3)	2011 (4)	2012 (5)	2013 (6)	2014 (7)	2015 (8)	2016 (9)	2017 (10)	
JANUARY	0	0	0	0	0	0	0	28	109	0	137
FEBRUARY	0	272	0	0	0	0	227	974	1,917	1,488	4,878
MARCH	4,745	5,938	546	2,008	7,014	1,036	1,984	6,890	6,489	16,839	53,489
APRIL	25,816	19,111	21,908	13,570	18,133	7,068	13,808	8,163	13,687	32,628	173,892
MAY	44,461	51,766	35,368	22,315	17,032	16,844	20,251	24,470	27,940	45,326	305,773
JUNE	47,463	23,544	27,249	42,779	4,037	8,387	18,851	38,438	35,427	46,227	292,402
JULY	13,428	4,392	1,815	8,404	670	511	1,550	8,581	3,535	10,617	53,503
AUGUST	2,606	232	1,501	1,594	260	3,115	788	889	3,681	4,809	19,475
SEPTEMBER	1,465	99	712	1,852	76	4,930	902	126	1,271	1,806	13,239
OCTOBER	0	0	251	4,452	0	2,761	1,334	811	253	2,413	12,275
NOVEMBER	0	0	53	1,295	0	1,049	335	862	0	279	3,873
DECEMBER	0	0	0	52	0	59	0	334	0	90	535
ANNUAL	139,984	105,354	89,404	98,321	47,222	45,760	60,030	90,566	94,309	162,522	933,471

Heron Reservoir began the year at the lowest elevation of 2017, 7,096.83 feet (65,748 ac-ft), and finished the year at an elevation of 7,130.75 feet (146,650 ac-ft). It peaked at an elevation of 7,144.67 feet (196,556 ac-ft) on June 30, 2017.

An initial allocation to the SJ-C Project contractors was not able to be made in January 2017, but a full allocation was made on June 15, 2017. This was the first year since 2013 that a full allocation was delivered to the SJ-C Project contractors. In 2016, the allocation was approximately 96% of full.

The SJ-C Project contractors' 2017 and waived 2016 annual allocations were delivered as shown in Table 4, for a total delivery of 70,871 ac-ft. The remaining 2017 allocations are being held in Heron according to waivers, which grant an extension of the delivery date into 2018.

Table 4: SJ-C Project – Water Releases from Heron Reservoir (units are acre-feet)

SJ-C HERON RELEASE	MIRGCD	SANTA FE	SANTA FE COUNTY	COCHITI	CITY OF ALBUQUERQUE	POUQUOE UNIT	TAOS	COUNTY OF LOS ALAMOS	CITY OF ESPAÑOLA	TAOS SKI VALLEY	VILLAGE OF LOS LUNAS	TOWN OF BERNALILLO	BELEN	RED RIVER	JICARILLA APACHE	SAN JUAN PUEBLO	RECLAMATION	EL PRADO	TAOS PUEBLO	TOWN OF TAOS SETTLEMENT	TOTAL
ALLOCATION	19,900	5,230	375	5,000	48,190	1,030	400	1,190	1,000	15	400	400	500	60	6,500	1,900	2,990	40	2,215	366	96,190
JANUARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FEBRUARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APRIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,452	0	0	0	7,452
JULY	0	4,979	0	2,356	0	0	0	0	0	0	0	0	0	0	0	0	3,951	0	0	0	11,286
AUGUST	0	0	0	0	14,871	0	0	0	0	0	0	0	0	0	0	0	7,107	0	0	0	21,978
SEPTEMBER	0	175	0	0	28,360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,535
OCTOBER	0	425	0	0	0	525	0	0	0	0	0	0	0	0	0	0	0	0	0	0	950
NOVEMBER	0	0	0	0	0	505	0	0	0	12	116	0	37	0	0	0	0	0	0	0	670
DECEMBER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016 CY TOTAL	0	5,579	0	2,356	43,231	1,030	0	0	0	12	116	0	37	0	0	0	18,510	0	0	0	70,871

Table 5 presents actual monthly Heron water operations for calendar year 2017.

Table 5: SJ-C Project – Monthly Water Storage in Heron Reservoir (units are acre-feet)

HERON STORAGE	INFLOW		OUTFLOW		SAN JUAN CHAMA LOSS	END-OF-MONTH CONTENT			ELEVATION (FEET)
	RIO GRANDE	SAN JUAN CHAMA	RIO GRANDE	SAN JUAN CHAMA		RIO GRANDE	SAN JUAN CHAMA	TOTAL	
	(1)	(2)	(3)	(4)		(6)	(7)	(8)	
DEC. 2016						342	65406	65748	7096.83
JANUARY	1220	0	43	0	0	1169	65756	66925	7097.55
FEBRUARY	3181	1488	2904	0	0	1446	67244	68690	7098.61
MARCH	9959	16805	8737	0	0	2668	84049	86717	7108.23
APRIL	5033	32563	5153	0	0	2548	116612	119160	7121.59
MAY	84	45235	2275	0	1913	356	159935	160291	7134.84
JUNE	98	46135	98	7452	2418	356	196200	196556	7144.67
JULY	1011	10596	1017	11286	1418	350	194091	194441	7144.13
AUGUST	898	4799	898	21979	1299	350	175613	175963	7139.25
SEPTEMBER	160	1806	89	28534	937	420	147948	148368	7131.28
OCTOBER	738	2413	88	950	1101	1070	148310	149380	7131.59
NOVEMBER	85	279	519	670	966	636	146952	147588	7131.04
DECEMBER	87	90	369	0	716	354	146296	146650	7130.75
SUB-TOTAL	22,554	162,209	22,190	70,871					
ADJUSTMENT						-350			
ANNUAL		184,763		93,061	10,768	4	146,646	146,650	

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

Heron Dam Facility Review and Safety of Dams Programs

There are no significant dam safety-related operations and maintenance issues associated with Heron Dam and Dike other than aging infrastructure. Currently, there are five incomplete Category 2 Operations and Maintenance (O&M) recommendations for Heron Dam.

The Annual Site Inspection was completed in 2017. A Tabletop Exercise was also completed in 2017. The required annual elevator inspections were completed in the summer of 2017.

The Facility Review Rating (FRR) was updated in September 2017. The total score for Heron is 90. Heron currently has an overall rating of “Good.”

Pojoaque Tributary Unit - Nambé Falls Dam and Reservoir

(All elevations are 1929 NGVD, storage reference is 2004 ACAP survey)

Nambé Falls began 2017 with a reservoir elevation of 6,823.75 feet (1,575 ac-ft). The reservoir filled and spilled during the year. The maximum elevation for the year was 6,827.02 feet (1,753 ac-ft) on May 15 and 16. The reservoir initially filled in mid-February and remained full until June 28, when irrigation releases began and reservoir storage and elevation started falling. Releases continued through September 22. The reservoir reached a low point of elevation at 6,808.14 feet (713 ac-ft) on that date. The reservoir ended 2017 at elevation 6,825.14 feet (1,649 ac-ft).

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. A portion of that 703 ac-ft was made up in 2016. The calculated depletion in 2016 was 1,010 ac-ft, but 1,310 ac-ft was released from Heron. With losses factored in, the 2016 release was 278 ac-ft greater than what was needed, reducing 2015's 703 ac-ft deficit to 425 ac-ft.

In 2017, the Otowi depletion was 1,025 ac-ft. The release from Heron was 1,030 ac-ft. With losses, 1,019 ac-ft reached Otowi for a net deficit of six ac-ft. Therefore the current running deficit at Otowi is 431 ac-ft, which will be released as water is available.

Table 6 includes a summary of Nambé Falls use above Otowi and the Pojoaque Unit return flow credit used to calculate depletions during 2017 (columns 7 and 8). A summary of 2017 Nambé Falls Reservoir operations is provided in Table 7.

Table 6: San Juan-Chama Project – SJ-C Water at Otowi (units are acre-feet)

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	NAMBE FALLS USE ABOVE OTOWI	RETURN FLOW CREDIT - POJOAQUE UNIT	SAN JUAN WATER AT OTOWI
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
JANUARY	0	0	6,147	6,147	-2,313	102	121	52	3,664
FEBRUARY	0	0	6,167	6,167	-3,349	93	80	28	2,671
MARCH	0	0	2,826	2,826	6,091	111	32	31	8,804
APRIL	0	0	5,056	5,056	-3,521	69	31	17	1,451
MAY	0	0	30,340	30,340	-26,325	370	31	18	3,633
JUNE	7,452	1,095	0	6,357	-4,049	91	17	17	2,217
JULY	11,286	0	679	11,965	1,538	253	109	25	13,166
AUGUST	21,979	14,954	0	7,025	116	142	71	62	6,990
SEPTEMBER	28,534	18,844	0	9,690	-971	185	174	51	8,411
OCTOBER	950	306	0	644	2,677	37	715	68	2,637
NOVEMBER	640	0	0	670	9,661	100	88	32	10,175
DECEMBER	0	0	1,812	1,812	10,514	131	17	59	12,237
ANNUAL	70,841	35,199	53,027	88,699	-9,931	1,684	1,486	460	76,056

Table 7: SJ-C Project – Monthly Water Storage in Nambé Falls Reservoir (units are acre-feet)

NAMBÉ FALLS MONTHLY	INFLOW	OUTFLOW		RESERVOIR LOSSES	TOTAL OUTFLOW + LOSSES	END OF MONTH		
		BYPASSED	STORAGE RELEASE			CONTENT	ELEVATION	
MONTH	(1)	(2)	OPERATIONAL	IRRIGATION	(5)	(6)	(7)	(8)
DEC. 2016							1,649	6,825.14
JANUARY	266	144	31	0	0	176	1,665	6,825.45
FEBRUARY	373	292	8	0	5	304	1,734	6,826.70
MARCH	809	773	12	0	13	798	1,745	6,826.89
APRIL	1,663	1,627	0	21	15	1,663	1,745	6,826.88
MAY	2,166	2,127	0	14	19	2,160	1,751	6,826.99
JUNE	1,548	1,515	0	85	27	1,627	1,672	6,825.57
JULY	663	546	0	462	8	1,017	1,318	6,818.60
AUGUST	579	505	0	276	5	785	1,112	6,814.05
SEPTEMBER	451	263	0	399	12	674	889	6,808.41
OCTOBER	944	229	0	6	8	243	1,590	6,824.04
NOVEMBER	405	316	3	0	8	327	4,668	6,825.50
DECEMBER	251	233	34	0	4	270	1,649	6,825.14
ANNUAL	10,118	8,570	88	1,263	124	10,044	1,649	6,825.14

Nambé Falls Dam Facility Review and Safety of Dams Programs

There are no significant dam safety-related O&M issues associated with Nambé Falls Dam other than aging infrastructure. Currently, there is one incomplete Safety of Dams (SOD) recommendation and four incomplete Category 2 O&M recommendations for the Dam. Two O&M recommendations were completed during FY2017.

A Periodic Facility Review (PFR) was completed in 2017. As result of the PFR, two new

Category 2 O&M recommendations were added, and two current recommendations – 2013-2-A and 2013-2-C – were considered completed.

High sediment inflow from the 2011 Pacheco Canyon Fire burn scars continues to be a significant O&M concern, but does not currently present any known SOD issues. The O&M recommendations developed during the FY2013 Comprehensive Review (CR) were intended to improve management of the increased inflow of sediment and woody debris. No work on these recommendations has been accomplished.

The Facility Review Rating was updated in October 2017. The rating for Nambé Falls Dam decreased from a total score of 85 in 2016 to a score of 80, which gives the facility an overall rating of “Good”.

2018 San Juan - Chama Project Outlook

On December 31, 2017, Heron Reservoir had 58,546 ac-ft of SJ-C Project storage. This is due to the volume of the 2017 runoff, which – at 162,522 ac-ft – was the second highest in the Project’s history. Therefore, contractors were notified on January 15, 2018, that the initial allocation would be 55,000 ac-ft, 57% of a full allocation. After the allocation is made, there must be sufficient water in SJ-C Project storage to cover both Heron Reservoir’s dead pool and anticipated reservoir evaporation from January 1 until the start of runoff. The dead pool, 1,218 ac-ft, is water that cannot be drained by gravity through the outlet works.

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.

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.

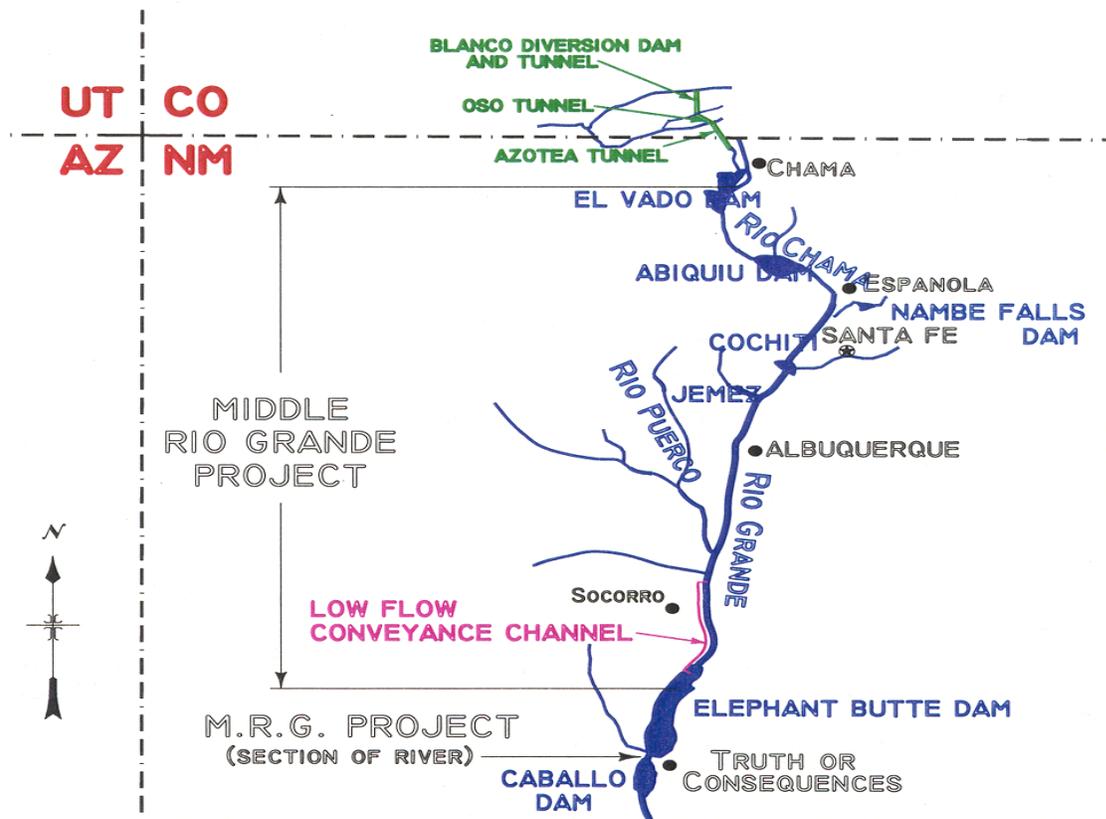


Figure 4: Area Map of the Middle Rio Grande Project

Article VII

Since 2011, the three Rio Grande Compact states have not been able to reach consensus on the appropriate Compact accounting method. Because of that, Compact accounting has not been finalized since that year, and multiple accounting sheets are maintained. For a time, each state maintained its own accounting sheets, but in 2016 only two methods were published: method 1, advocated by Texas, and method 2, advocated by New Mexico and supported by Colorado.

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

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 both accounting methods 1 and 2, New Mexico began 2017 with an accrued debit, although the amount of the debit differed. In the URGWOM model, an account with any non-zero value continues to be assessed gains and losses. An account with a negative value could therefore end the year with a greater negative value than it began the year with. This means an account with no wet water would be incorrectly assessed a portion of actual reservoir evaporation.

Because of that, New Mexico's account in Elephant Butte Reservoir was given a value of zero, rather than a negative value, in the 2017 model. Hence the only credit water accounted for in Elephant Butte was the 7,400 ac-ft of accrued credit with which Colorado began 2017. This modest amount of credit water was not enough to result in different Article VII timing under the two accounting methods.

Per the Rio Grande Compact Article I definition, the usable water in Rio Grande Project (RGP) storage (Elephant Butte and Caballo Reservoirs combined) rose above 400,000 ac-ft on April 9, 2017. It fell below 400,000 ac-ft on August 10, 2017, and again rose above it on December 6, 2017.

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. Storage of native water for relinquishment credit and irrigation of P&P lands began on January 1, 2017, while under Article VII restrictions.

From January 1 until Article VII restrictions were lifted on April 9, 17,846 ac-ft was stored in El Vado Reservoir. Because of the high snowpack at that time, it was clear that no relinquishment credit water would be stored in 2017. On April 10 and 11, 2,832 ac-ft stored under Article VII restrictions were released and 14 ac-ft lost to evaporation, bringing the quantity in storage for P&P use to 15,000 ac-ft. The final call for P&P storage from the Bureau of Indian Affairs (BIA) is made after the May 1 streamflow forecast is released by the Natural Resources Conservation Service (NRCS).

Reclamation received the final call for storage of 14,473 ac-ft from BIA on May 5, 2017. To reduce the volume in storage to the requested volume, Reclamation released 402 ac-ft on that day. In addition, 125 ac-ft were lost to evaporation between April 12 and May 5.

Storage of native water for MRGCD began on April 10. It peaked at 125,056 ac-ft on June 26. When Article VII restrictions were back in place on August 10, MRGCD had 114,372 ac-ft of native water in storage. Of that amount, 34,001 ac-ft was released for irrigation from August 15 to September 25.

Heavy rain in the Middle Rio Grande in late September re-connected the river. At that time, MRGCD decided to release some of the remaining water for delivery to Elephant Butte to meet New Mexico's Compact obligation. Between October 2 and December 20, 39,366 ac-ft were released for that purpose. On December 31, 2017, MRGCD had 39,843 ac-ft of native water in storage.

There were no releases of P&P water for irrigation in 2017. All water stored for use on P&P lands was released by December 5, 2016. Evaporative losses from May 6 to December 5 totaled 540 ac-ft; a total of 13,933 ac-ft was released to Elephant Butte.

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 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 2017 data.

New Mexico Relinquishment of Rio Grande Compact Credit

On January 1, 2017, Reclamation, New Mexico Interstate Stream Commission (NMISC), and the MRGCD all had no relinquishment credit, or Emergency Drought Water (EDW), in storage in El Vado Reservoir. No EDW was captured in El Vado Reservoir for the benefit of any party in 2017.

A new Emergency Drought Water Agreement was established in 2016. The balance of EDW available for capture and storage by Reclamation during 2018 or later years is 19,000 ac-ft, by NMISC is 13,000 ac-ft, and by MRGCD is 53,767 ac-ft. In this new agreement, MRGCD agreed to jointly manage the EDW allocated to Reclamation for the sole purpose of ESA compliance.

El Vado Dam and Reservoir Operations

(All elevations are Middle Rio Grande Project Datum – add 7.8 feet for 1929 NGVD, storage reference is 2007 ACAP survey)

El Vado Reservoir began 2017 at an elevation of 6,841.38 feet (52,230 ac-ft), and ended the year at 6,854.91 feet (73,693 ac-ft). The low point for 2017 was on February 8 and 9, at 6,839.80 feet (49,997 ac-ft), and the peak was on June 29, 2017, at an elevation of 6,885.72 feet (141,806 ac-ft).

MRGCD began the year with no native Rio Grande water in storage in El Vado for Middle Valley irrigation, with the exception of 132 ac-ft of incidental storage which was released on January 1. In 2017, Article VII restrictions were not in effect between April 9 and August 10. During this time, 114,372 ac-ft was stored for MRGCD. Please refer to the *Article VII* section for more details about Article VII timing.

MRGCD also started 2017 with 36,898 ac-ft of SJ-C Project water in El Vado from previous years' allocations. There was insufficient project storage in Heron Reservoir to make an allocation on January 1, 2017, but by the end of the year they had their full SJ-C Project

allocation of 20,900 ac-ft in Heron. In order to maintain a lower reservoir elevation in the early part of 2018, their allocation was waived, and may be held in Heron until September 2018.

At the end of 2017, MRGCD had no EDW storage in El Vado, but had 39,843 ac-ft of Rio Grande water that had been stored outside of Article VII restrictions, as well as 36,899 ac-ft of SJ-C Project storage. In 2017 no EDW was stored for MRGCD. In addition, MRGCD had no SJ-C Project water stored in Abiquiu as of December 31, 2017.

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 2016 SJ-C Project allocation out of Heron and into El Vado late in that year. That water (1,186 ac-ft and 13,868 ac-ft, respectively) was used to maintain winter flows between El Vado and Abiquiu while allowing native inflows to be captured for P&P storage.

Another spike flow on the Rio Chama was attempted during the spring to maintain the geomorphic health of the system for ecological purposes. A release of just under 3,000 cfs was made on April 27 to move sediment through the system. Flows were brought back to this level again for several days during the last week in May.

Two unique operations took place at El Vado in 2017. The first was an agreement between MRGCD and ABCWUA that allowed MRGCD to temporarily store their SJ-C Project water in Abiquiu. This freed up space in El Vado, allowing storage of more native Rio Grande water. MRGCD's SJ-C Project water was moved to Abiquiu between May 19 and June 1, and helped create the geomorphic flows mentioned above. From mid-August to the end of September, ABCWUA waived 2016 SJ-C Project water was released from Heron to El Vado. On September 30, a one-for-one accounting exchange traded MRGCD's SJ-C Project water in Abiquiu with ABCWUA's water in El Vado.

The second operation was the release of Rio Grande water, stored outside of Article VII restrictions in El Vado, to Elephant Butte between October and December to reduce New Mexico's potential Compact debit. Monsoon rains in early October re-wet the river channel, and it was assumed that water released from El Vado could be efficiently moved to Elephant Butte to increase project storage. Rio Grande releases from El Vado were 16,277 ac-ft in October, 10,697 in November, and 12,392 in December. There was also significant inflow into Elephant Butte during this time from those monsoon rains. The total inflow into Elephant Butte was 80,597 ac-ft in October, 61,625 ac-ft in November, and 73,292 in December.

A total of 14,473 ac-ft was captured and stored for P&P irrigation, with all of that stored under Article VII restrictions. Throughout the irrigation season no releases were made to meet P&P needs during the irrigation season. From November 15 to December 5, 2017, 13,933 ac-ft of unused P&P water was released to Elephant Butte. Evaporation loss was 540 ac-ft while the water was in storage in El Vado Reservoir.

El Vado total storage at the end of the year was 73,693 ac-ft, comprised of 29,733 ac-ft of the MRGCD's SJ-C Project water, 4,028 ac-ft of the Albuquerque Bernalillo County Water Utility

Authority's (ABCWUA) SJ-C Project water, 39,843 ac-ft of native Rio Grande, and 89 ac-ft of SJ-C Project water held for Santo Domingo Pueblo. Table 8 provides a summary of monthly operations and water accounting for El Vado Reservoir.

Table 8: Reservoir Operation for El Vado Dam (units are acre-feet)

EL VADO RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT		
	RIO GRANDE	SAN JUAN - CHAMA	TOTAL						
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEC. 2016	3282	16268	8012	1417	310	-153	132	52098	52230
JANUARY	4777	0	132	6147	326	-148	4451	46007	50458
FEBRUARY	9880	0	-194	6167	71	-7	14455	39847	54302
MARCH	44062	0	36679	2826	139	99	21699	36922	58621
APRIL	98458	0	89020	5056	175	114	30963	31751	62714
MAY	146440	0	63652	30340	413	143	113337	1268	114605
JUNE	56101	7452	29091	6357	1035	7	139311	2356	141667
JULY	11603	11286	22006	11965	544	11	128364	1666	130030
AUGUST	6680	21979	15624	7025	447	32	118973	16587	135560
SEPTEMBER	5649	28534	30556	9690	407	22	93659	35408	129067
OCTOBER	9501	950	25568	644	354	48	77239	35666	112905
NOVEMBER	7275	670	28909	670	156	63	55448	35604	91052
DECEMBER	4518	0	19965	1812	70	30	39931	33762	73693
ANNUAL	404944	70871	361008	88699	4137	414			

El Vado Dam Facility Review and Safety of Dams Programs

The ongoing El Vado Corrective Action Study (CAS) focuses on potential hydrologic failure modes of the service spillway and embankment. The CAS was originally initiated by recommendation 2009-SOD-A, which focused specifically on the service spillway erosion mode. Recommendation 2009-SOD-A was later deleted and replaced by recommendation 2011-SOD-A, which expanded the CAS scope to include all potential hydrologic failure modes.

A new CAS was initiated in July 2017 with the introduction of recommendation 2017-SOD-A, which will develop a preferred alternative to reduce the risks due to internal erosion. Because of this new recommendation, a decision to delay the final design for the spillway CAS has been made until such time when the final internal erosion risk reduction alternative design has been chosen.

In April 2016, Reclamation's UC Regional Director assigned the Provo Area Office (PAO) to lead project management for the El Vado Safety of Dams project. The existing spillway and embankment will be recorded by an architectural historian. A statement of work is being prepared, and the contract is expected to be awarded in 2018.

Economists are analyzing economic losses if the dam is breached or a reservoir elevation restriction is imposed. The economic benefits analysis compares repairing versus replacing the spillway. The lost benefits from a reservoir elevation restriction or dam breach are also being evaluated.

The Hydrologic Failure CAS began in August 2011. The Internal Erosion CAS began in July 2017. The Draft Hydrologic Failure Corrective Action Study Report was delayed until a decision on the Internal Erosion CAS can be made. At this time, it is not known when Congress will approve the Modification Report.

A Project Management Team has been established for the Hydrologic Failure CAS. The draft Scoping and Value Planning Report was released in May 2012. A Value Planning Study for the Internal Erosion CAS was conducted in August 2017. Field explorations were completed in 2012, which included drilling by the PAO. Geology Report No. G-559 was transmitted from the PAO to the Technical Service Center (TSC) in November 2013, with analysis of the field data ongoing.

The CAS, recommended by 2011-SOD-A and 2013-SOD-A to investigate hydrologic and static failure modes at El Vado Dam, continued during FY 2017. A Value Planning Study was completed in August 2017, and a Risk Reduction Analysis was completed in October 2017. Work continues to analyze all the data collected for both hydrologic and static failure modes.

In the spring of 2017, an internal alert under the Emergency Action Plan was issued when the reservoir water surface elevation rose above 6,879 feet. High inflows also triggered an alert per the Standard Operating Plan, as the rate of rise of the reservoir elevation exceeded two feet per day. This required additional instrumentation readings.

Also in the spring of 2017, the first monthly inclinometer readings were taken, and continue on a monthly basis. The increased inflow and a reservoir elevation above 6,875 feet also triggered weekly readings of the recently installed piezometer wells, which are ongoing.

Los Alamos County completed a turbine rehabilitation at their hydroelectric plant during the summer of 2017. Final commissioning was completed on July 19, 2017, with the plant currently in full operation, as releases allow.

The required annual elevator inspections were completed in the summer of 2017. The scheduled Annual Site Inspection was completed in 2017, and a Tabletop Exercise was also completed in 2017.

There are currently three incomplete SOD recommendations and eleven incomplete Category 2 O&M recommendations for El Vado Dam. The Facility Rating Review (FRR) was updated in September 2017. The rating for El Vado remained the same as 2016's score of 59, which gives the facility an overall rating of "Poor".

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 Abiquiu Reservoir in 2017 peaked on June 2 at 148,534 ac-ft. Abiquiu ended 2017 with 116,537 ac-ft of SJ-C Project water in storage. Table 9

provides a summary of monthly operations and water accounting for Abiquiu Reservoir.

During 2017 Reclamation had a storage agreement with the ABCWUA to store up to 10,000 ac-ft of supplemental water in the ABCWUA's storage space in Abiquiu Reservoir. Over the course of the year, 13,413 ac-ft of leased SJ-C water was released from Abiquiu by Reclamation for endangered species purposes, namely the Rio Grande silvery minnow (silvery minnow).

Table 9: Reservoir Operations for Abiquiu Dam (units are acre-feet)

ABIQUIU RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT			
	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	SEDIMENT	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DEC. 2016	9208	1540	9108	3497	0	-52	545	100	117722	118367
JANUARY	2614	5866	2749	3553	0	-304	545	-35	120340	120850
FEBRUARY	1625	6105	1591	2755	-1	399	545	0	123291	123836
MARCH	45768	3003	40504	9094	20	644	606	5244	116555	122405
APRIL	104666	5000	94749	1479	86	841	814	15075	119235	135124
MAY	82916	26601	97911	276	90	1364	1029	-9	144196	145216
JUNE	32926	9050	32385	5001	67	2501	1083	465	145744	147292
JULY	23799	12476	24153	14015	5	1490	1105	105	142716	143926
AUGUST	16964	6948	17065	7064	2	1450	1115	3	141150	142267
SEPTEMBER	33147	8951	32532	7981	-3	1033	1145	621	141087	142853
OCTOBER	28071	1269	28016	3946	8	941	1159	667	137470	139297
NOVEMBER	31585	651	32249	10312	1	468	1176	2	127341	128520
DECEMBER	22992	1590	22996	12104	-1	290	1188	0	116537	117726
ANNUAL	427,073	87,510	426,900	77,580	274	11,117				

Cooperative Programs with the State of New Mexico

In September 2017, a new five-year Cooperative Agreement (17-WC-40-678) was executed between the NMISC and Reclamation (State Coop). The Agreement provides funding for joint benefits: water salvage work within the Middle Rio Grande Project and vegetation management on the Rio Grande Project at Elephant Butte and Caballo. 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, and was 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 2017 extended from River Mile (RM) 47.5 upstream to approximately RM 52. Reclamation conducted maintenance of the Delta Channel from January through March 2017. Maintenance work included: in-channel excavation, sandbar de-vegetation, and road grading. This included the purchase and installation of three tracks for amphibious excavators.

San Acacia Diversion Dam Riprap Supply

NMISC has committed funding from the State Coop agreement to assist with the installation of riprap for the apron stabilization at San Acacia Diversion Dam. This is part of Reclamation and NMISC's commitments towards river connectivity under the 2016 MRG BO. Construction on this project is planned for fiscal year 2018.

Lower San Juan Riverside Drain Vegetation Removal

Work on the Lower San Juan Drain was funded by both Reclamation and State Coop funds, and performed by Reclamation's contractor in 2015 and 2016. The goal of this maintenance is to remove all vegetation from the edge of the Drain channel to the west side of the spoil berm, extending 4.5 miles south from NM Hwy 60 to Salas Arroyo. This work finished in the spring of 2016. Herbicidal treatment on the project was completed in September 2016. Option year 2 of the herbicidal treatment was completed in 2017.

Sediment Plug Removal

A sediment plug formed within the Bosque del Apache National Wildlife Refuge (BDANWR) in April 2017 during runoff. It completely blocked the river channel, forcing flows into both the east and west overbank. NEPA compliance was completed in late August 2017, and plans were prepared to remove the plug. Crews from the Socorro Field Division (SFD) mobilized at the end of August, and began opening a channel through the three mile long plug. Work was confined to the reach without flycatcher and cuckoo habitat through the end of August. After the Labor Day weekend, SFD began channel work in the area with flycatcher and cuckoo habitat. Work progressed quickly, and was completed on September 15, 2017. Equipment was out of the area by September 20, 2017.



Photo 1: Bosque del Apache Sediment Plug Removal (Vollmer, August 2017)

River Maintenance

Reclamation has authorization for maintenance of the Rio Grande from Velarde, New Mexico, south to the headwaters of Caballo Reservoir under the Middle Rio Grande Project. Responsibilities include maintenance of the river channel, floodplain, project drains, and the 55 mile LFCC. Project purposes include improving water delivery and sediment transport, protecting riverside facilities and property, and preventing flooding. River maintenance includes any work done in the channel and floodplain, and includes 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 work is achieved through projects involving planning, construction, and adaptive management. All 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 12 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. River bank erosion continues along two private residences in the Bernalillo area, but because this is private property and outside of Reclamation's authority, the landowners are working with local state, county, and city government agencies. In April 2017, work was completed on the eastern bankline near the levee system on the Pueblo of Sandia in response to erosion observed in 2016.

The 2017 spring runoff was above average, resulting in bank erosion towards the levee in the Corrales reach at River Mile 199. The Middle Rio Grande Conservancy District (MRGCD) performed significant levee maintenance in the Isleta to Belen reach due to overbank flooding during the runoff. A three mile sediment plug developed in the main channel at River Mile (RM) 81 within BDANWR, also during the runoff. The plug was removed in September 2017, and a long-term river realignment project at this location started in January 2018. 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 detail 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 reaches status. "New sites" are sites that developed

following high flow events on the Rio Grande. “Existing sites” are sites in the process of being completed. “Adaptive sites” sites have been substantially completed and are being monitored for function and performance.

Estaca Arroyo (Adaptive Maintenance Site)

In September 2016, two landowners in the Estaca area contacted Reclamation to report damage to a riverside dike along the Rio Grande in the Española reach. The breach in the west riverside dike was reported to be the result of a monsoonal event in August 2016, when a localized thunderstorm resulted in three inches of rainfall in three hours. The location of the riverside dike breach is approximately two miles downstream of the El Guique Diversion Dam.

The Estaca Arroyo historically discharged directly into the Rio Grande. Between 1955 and 1957, channelization work occurred in the Velarde Reach that created riverside dikes along the Rio Grande. There are three arroyos in the vicinity of the Estaca area – Estaca Arroyo, Lopez Arroyo, and Borrego Arroyo. Riverside dikes have resulted in drainage problems on the arroyos after strong monsoonal events.

In 2004, Reclamation designed three cross drainage structures for the three arroyos. However, due to landowner permission and access issues, the structures were only constructed at two of the three arroyos, and not at the Estaca Arroyo.

Following the September 2016 call, Reclamation staff visited the site to assess the breach. The visit determined that the breach was manmade, possibly to release ponded water caused by the August 2016 event.

In response to flooding concerns in the Estaca community, Reclamation is working with the local landowners, the Upper Rio Grande Watershed District, and the Rio Arriba County to cooperate on addressing the river maintenance needs and arroyo drainage problems. A cross drainage culvert design has been provided to the community, but they are also looking at an open channel design with a consultant. Reclamation’s current understanding is that Reclamation will construct the final design, after it is reviewed and approved by Reclamation.

San Ildefonso Pond (Adaptive Maintenance Site)

This river maintenance site is located at RM 259. In spring 2007, Reclamation’s Socorro Field Division (SFD) constructed a project to provide protection for the San Ildefonso fishing pond. During the 2009 runoff, the channel eroded through a line of dense vegetation planted as part of the project.

A long-term solution that provided protection through the bend was completed in 2014. The long-term project included the creation of a floodplain side channel on the west side. The project features continue to function as designed. In early 2016, additional planting replaced cottonwood trees that did not survive re-vegetation efforts during the 2014 construction.

Revegetation efforts were conducted in 2017 as well. There is dynamic channel formation – sand bars and high flow channels – and initial observations indicate that the river processes are suitable for habitat creation and there is less concern of erosion on the outside of the river bend.

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 by the Pueblo of San Felipe in March 2016 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.

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 constructed in 2014. The Pueblo of Santa Ana, through a PL 93-638 contract, planted vegetation at this site in early 2015. During the spring runoff in 2015, erosion at the site threatened the project. An interim adaptive maintenance solution was completed in January 2016 to provide protection while a longer term solution was investigated. The site experienced additional bank erosion during the 2017 runoff, however, the temporary controls placed in 2016 minimized the extent of the lateral bank migration.

The longer term investigation includes evaluating the specific geomorphic and hydraulic conditions that led to the unexpected bank erosion in 2015. The geomorphic assessment was completed in 2017. The hydraulic analysis is expected to be completed in 2018. This investigation may result in the recommendation of additional adaptive maintenance steps as part of a permanent repair project. Reclamation, the Pueblo of Santa Ana, and the University of New Mexico are in the third year of a 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.



Photo 2: Santa Ana RM 205.8, looking upstream at flow over bendway weir field during the 2017 spring runoff (Herrington, May 2017)

Highway 550 to Montañito Reach Planning (Existing Maintenance Reach)

In 2014, Reclamation identified the reach of the Rio Grande from RM 201 to Montañito Bridge for hydraulic and geomorphic assessment and project planning. This reach is transitioning, with river bed incision and migrating bends that have caused problematic erosion, such as in the area of the Sandia Priority Site (described below), the Bernalillo Priority Site, the Corrales Siphon (described in a following section), 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 work and improve habitat value. Two hydraulic models for this reach were created using 2015 and 2017 hydrographic data. The hydraulic and geomorphic report will be complete in April 2018.

Sandia Priority Site Bendway Weir Repairs (Adaptive Maintenance Site)

Reclamation constructed the Sandia Priority Site in 2008, in collaboration with the Pueblo of Sandia, because the river was approaching the east levee. After completion of the project, Reclamation considered the Sandia Priority Site to be a completed river maintenance project, and moved to the adaptive maintenance and monitoring phase. Post project geomorphic monitoring, such as cross section data collection at the project site, aerial flights along the Rio Grande, and longitudinal profile data collection on the Rio Grande, have been performed since 2008 as part of the adaptive maintenance activities.

During a river reconnaissance float trip in 2012, bank erosion between bendway weirs at the Sandia Priority Site was noted. The river within the project site appeared to have incised (bed lowering) since completion in 2008.

In January 2016, the Pueblo of Sandia contacted Reclamation regarding new erosion along the

east bankline at the site. Reclamation monitored during the 2016 spring runoff, and saw 30 to 40 feet of erosion. As a result, Reclamation sought and received approval from Pueblo's tribal council to repair the bendway weirs.

Reclamation crews performed repair work at this location in March and April 2017. The temporary repairs included a continuous buried rock protection, with two keys and four tie-backs placed behind the eroding left bankline. Approximately 2,510 cubic yards of 24-inch riprap was used. Construction occurred only in the dry area on the east floodplain.

Some changes were made to design dimensions to accommodate the Pueblo's requests to preserve habitat features. Due to the early start to the 2017 runoff and the increase in water surface elevation this caused, the bankline riprap protection had to be moved several feet closer to the levee.

Bankline monitoring continued after construction during the spring and summer of 2017. The bankline eroded significantly downstream of weir 35, but the erosion was stopped by the buried riprap bankline protection.

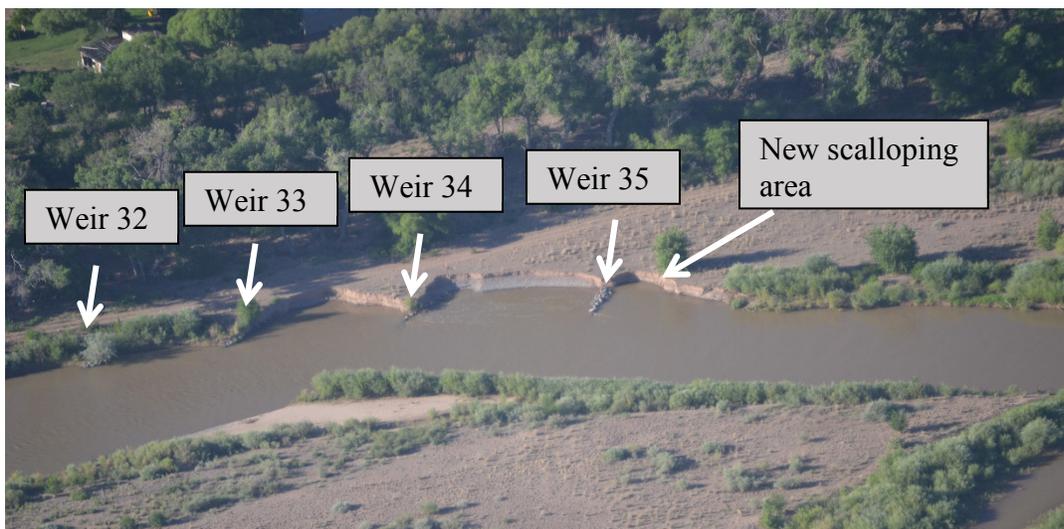


Photo 3: Aerial view of scalloping between Sandia Bendway Weirs (Padilla, July 2016)

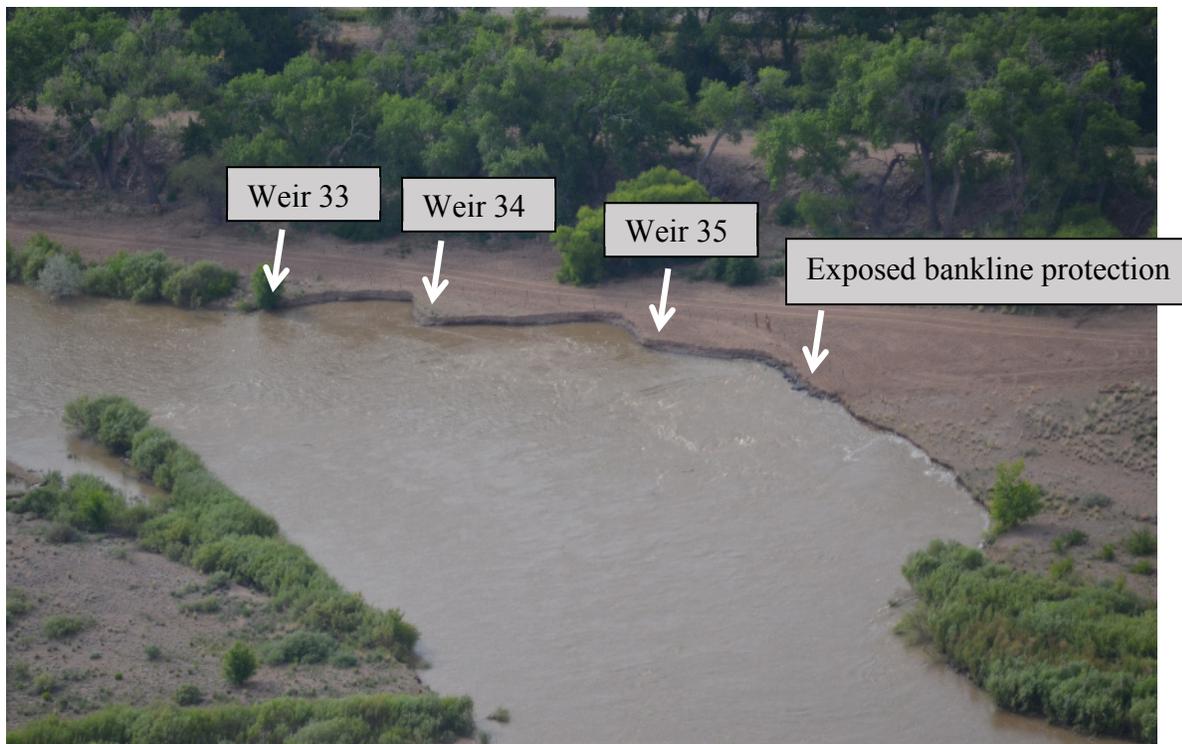


Photo 4: Aerial view of post-construction Sandia site (Padilla, May 2017)

Corrales Siphon (Adaptive Maintenance Site)

The Corrales Siphon is located in Corrales, New Mexico, just north of Albuquerque, at RM 199.7 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, exposing it to the current. MRGCD requested emergency technical assistance and construction support from Reclamation to temporarily protect the siphon 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 from the western bankline. This riprap material was placed on the river bed to a depth of approximately 6 feet for a length of about 50 feet downstream of the siphon and a width of about 75 feet across the river channel from the bankline toe. Riprap was also placed upstream and downstream of the siphon along the west bankline. Approximately 1,800 cubic yards of riprap were placed for the project. MRGCD is planning to repair the wood stave siphon, and address the continued threat from erosion and degradation.

Annual monitoring on the ground and from the air continues. The scour hole and exposed part of the siphon have moved away from the western bank, toward center of the river channel. New developments caused by geomorphic responses to the temporary repair will continue to be monitored by Reclamation.



Photo 5: Aerial view of Corrales Siphon (Padilla, May 2017)

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. There are no river cross sections in the vicinity. Brushing and surveying to establish a new rangeline at this location is planned for 2018. This site's bankline had not been surveyed before, so the amount of erosion resulting from the 2017 runoff cannot be quantified. The reach planning effort between Highway 550 Bridge to Montañño Bridge will provide a detailed geomorphic and hydraulic study of the reach and sub-reaches that will help evaluate erosion at RM 199 in context of the overall reach needs.



Photo 6: Bank erosion at River Mile 199 (Padilla, May 2017)

Isleta to San Acacia Reach Planning (Existing Maintenance Reach)

In 2014, Reclamation identified the stretch of the Rio Grande from the Isleta Diversion Dam to the San Acacia Diversion Dam for additional investigation to analyze the current 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 runoff. Geomorphic and hydraulic analyses for this reach are expected to be completed by early summer 2018. These analyses will be used to identify potential projects that minimize the need for river maintenance action and/or have habitat value.

Escondida Burn Scar Habitat Restoration

In June 2016, a wildfire burned approximately 524 acres in the bosque near Escondida, New Mexico. Restoration designs for two aquatic habitat restoration sites were completed in 2017, and construction is scheduled for spring 2018. This work helps Reclamation and its partners meet the commitments of the 2016 BO.

The habitat restoration sites in the Escondida burn scar include lowering the Arroyo de la Parida delta and an abandoned side channel. Approximately 1.8 acres of the arroyo delta will be lowered to the 300 cfs inundation design level. Cut banks will also be sloped to encourage growth of riparian vegetation.

The side channel work is intended to create a flow-through channel at 2,000 cfs. An additional three outlets will be added along the side channel, which along with the original inlet and outlet,

will function as backwaters at the 300 cfs inundation design level.



Photo 7: Burned trees and cut bank on Arroyo de la Parida, looking up arroyo from confluence with Rio Grande (Bui, February 2017)

Rhodes Property Habitat Restoration

A multi-disciplinary design team worked together to assess this site, which is south of Socorro, NM, for opportunities to create aquatic habitat. This work helps Reclamation and its partners meet the commitments of the 2016 Middle Rio Grande Biological Opinion. Preliminary designs were shared with the property owner and other stakeholders in January 2018. Reclamation obtained additional information about depletions should the lowered floodplain extend beyond 300 feet of the centerline of the main Rio Grande channel, and the possibility of spoiling excavated material on a nearby county road.

Reclamation is working with county planners and other stakeholders on detailed aspects of the design, as well as finding appropriate locations for spoiled material and maximizing habitat creation. Stakeholders and Reclamation agree on the general design, target elevations, and need for pre- and post-monitoring of flora and fauna at the site. The final design is scheduled to be completed in the fall of 2018, with work starting at the site shortly thereafter.

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, NM. The Rio Grande is close to the west spoil levee for the LFCC through this reach, with a potential for damage to the spoil levee from lateral erosion of the river. In 2005, significant bank erosion was observed at this site and plans were initiated for constructing a river maintenance project. The project was ready for construction when the 2008 spring snowmelt runoff moved the river's alignment away from the spoil levee. This reduced the probability of damage to the spoil levee and a decision was made to monitor the area to see if future work would be warranted.

Reclamation completed a geomorphic assessment of this area in 2016. A contingency response

plan was also developed in 2016, had spring monitoring observed signs of a potential failure. In 2017, the USACE completed a levee construction project adjacent to the Arroyo de las Cañas site. Reclamation reviewed the USACE levee design and found that the design riprap size, quantity, and protection length was more than adequate to also address Reclamation's river maintenance concerns there. Reclamation will conduct a reach evaluation in the area in 2018. It should help identify potential river projects that minimize the need for river maintenance action and/or improve habitat value.



Photo 8: Bank erosion and deposition at Arroyo de las Cañas and Rio Grande confluence (AuBuchon, August 2017)

Bosque del Apache River Realignment (Existing Maintenance Site)

During the 2008 and 2017 spring runoffs, a sediment plug 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 to the east of the current channel that would address river maintenance concerns near the 2008 and 2017 sediment plugs. The overall realignment project will involve two river segments, about 4.5 miles and 2.5 miles in length, that reconnect with the current channel. In 2016, Reclamation decided to construct the southern portion first to learn lessons 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. Environmental approvals allowed mowing to begin in January 2018. NEPA and Clean Water Act compliance for the entire project is underway and is expected to be received by summer 2018. Construction is contingent on field conditions, but should be completed in 2018 or 2019.



Photo 9: Looking south along northern portion of the BDA pilot realignment project. Flagging is on proposed centerline (Holste, December 2017)

2017 Bosque del Apache Sediment Plug Pilot Channel Work (Existing Maintenance Site)

During the 2017 spring runoff, a sediment plug formed in the main channel of the Rio Grande at RM 81 within the BDANWR. Reclamation initiated work on a pilot channel through the plugged area in August 2017. It was completed in September 2017. The 2017 pilot channel had a similar 25 foot bottom width as the previous pilot channel constructed after the 2008 sediment plug. Observations of the pilot channel in fall 2017 indicated that the river was removing spoil material adjacent to it.



Photo 10: Looking east at spoil berm from 2017 pilot channel through the sediment plug. Spoil piles are actively eroding (Holste, December 2017).

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 the levee systems is to effectively and safely pass the mean annual peak flow – a 2-year flow, which is 7,700 cfs – through the reach. The maintenance design criteria of the Delta Channel used in the analysis was to effectively convey a normal spring runoff peak flow of 5,000 and 4,000 cfs to the reservoir pool.

As part of continued analysis, hydrographic data was collected in 2016 and 2017. The hydraulic model for this river reach has been updated with the 2016 cross section survey data. Updated hydraulic model results were reported in an annual summary report on levee and channel monitoring released in March 2017 (with 2016 data). The model results with the 2017 data should be completed in February 2018. The 2017 report found that there were four cross sections where the levee freeboard elevation would be exceeded within the Bosque del Apache levee system, 15 levee freeboard incursions at cross sections within the Tiffany levee system, and a single levee freeboard incursion within the San Marcial levee system. Preliminary findings from the 2018 hydraulic analysis report indicate an increase in freeboard incursions for the Bosque del Apache levee system and a reduction in incursions within the Tiffany and San Marcial systems.

The BDA Pilot Realignment Project is expected to begin in spring of 2018, and will likely have a significant impact on the channel's hydraulic characteristics through the Bosque del Apache levee system. Reclamation expects that the realignment project will reduce the occurrence of 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 2019 annual report should contain results from both the revised channel alignment and channel profiles in the updated hydraulic model.

An air boat inspection of the Delta Channel is planned in early 2018 with Reclamation and NMISC staff. Maintenance work on the Delta Channel by Reclamation will be planned thereafter. NMISC is not planning on utilizing 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 has been 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 has 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 outside of these bends is near the western 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, access road, and the Fort Craig pump site. 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. Reclamation has begun designing a new outfall from the LFCC to the main Rio Grande channel at RM 60 to provide drainage of ponded water. This outfall will be closed using a gated control during the fall and winter months to promote wetland habitat for migratory bird species. Design of this project is currently underway, and construction of the RM 60 outfall is expected to begin in late 2018.

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 Reservoir. Maintenance activities are conducted after releases are shut off from Elephant Butte Dam each fall. The primary activity consists of sediment removal 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 the 2017/2018 season involves sediment removal at the mouth of three major tributaries (Mescal, Cuchillo Negro, and Hondo) and minor locations throughout the reach. 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 is being pursued for another 5-year period.

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 power generation. Geomorphic and hydraulic modeling analyses of this tributary led to the formation of a multi-disciplinary team to assess potential options at the Mescal Arroyo and Rio Grande confluence that would minimize the future maintenance. The team formulated potential alternatives in 2016, and completed a final alternative analysis report in 2017.

The preferred alternative seeks to change past sediment spoil management practices that exacerbated the deposition problem at the confluence. The spoil within the active channel of the Mescal Arroyo will be moved (this work was started in 2017), resulting in a wider channel confluence that will allow deposition to occur above the Rio Grande confluence. A new location has been identified for the excavated spoil material that would cause less impinging flow conditions on the sediment piles from the arroyo. A grade control structure is also proposed to help stabilize the arroyo bed and prevent future head-cutting up the arroyo that would generate additional sediment. Design for this alternative is expected in 2018.



Photo 11: Relocation of previously stockpiled sediment (foreground) away from active arroyo (background), looking up Mescal Arroyo near Rio Grande confluence (Harris, December 2017)

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 Project authorization. A final report is posted at the following web address:

<http://www.usbr.gov/uc/albuq/envdocs/reports/mrgRivMaint/index.html>

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, upstream and downstream.

Work is also being pursued with respect to reach-based planning and developing ecological criteria for endangered species suitable habitat to compliment current water delivery and public health and safety factors. Reach-based planning is underway to evaluate the geomorphic reaches from Hwy 550 Bridge to Montañño 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” will be 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 Elephant Butte Reservoir pool.

Determination of River Maintenance Need 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 newly 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 new methodology and criteria developed. A total of 86 sites and 11 reaches were evaluated. Monitoring during the spring runoff and monsoon season in 2017 and work progress was considered in the recently completed 2018 site and reach ratings. These ratings help prioritize project development and implementation.

The technical rating system integrates information involving technical factors for channel instability, bank erosion, and loss of channel capacity with 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 new maintenance class designations are:

- Maintenance Class 1 – Maintenance is required in the short-term (typically before the next high flow event or could be required immediately) because there is a 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 potential 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 the 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 Middle Rio Grande Biological Opinion for River Maintenance Actions.

Endangered Species

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

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) on December 2, 2016. In the Biological Opinion (BO), the USFWS concluded that the Proposed Action will not jeopardize the continued existence of the silvery minnow, flycatcher, or cuckoo, and will not destroy or adversely modify designated or proposed critical habitat, based on full implementation of the Conservation Measures. Also, the USFWS concurred with Reclamation’s determination that the Proposed Action is not likely to adversely affect the jumping mouse and its designated critical habitat, and is not likely to adversely affect the Pecos sunflower. 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 flycatcher will be considered exceeded if more than 26 flycatcher territories are displaced in any year as a result of the Proposed Action, or if more than 2,071 acres of suitable flycatcher habitat are impacted as a result 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 as a result 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 silvery minnows is authorized for the Proposed Action if:

- October density is greater than or equal to 1.0 fish per 100 m² for 10 of 15 years; and
- October density is less than 1.0 per 100 m² for no more than 5 of 15 years; and
- October density is less than 0.3 fish per 100 m² for no more than 2 of the 15 years.

Incidental take will be considered exceeded if these densities are not met as a result of the Proposed Action.

Specific flow requirements are not included in the 2016 BO, providing flexibility for Reclamation and its BO Partners to achieve the best results for threatened and endangered species, while meeting other legal requirements, including Compact deliveries. A key part of the BO is the application of adaptive management (AM) principles, including River Integrated Operations (RIO). RIO includes hypothesis testing to improve understanding of how MRG hydrology can meet the conservation needs of the silvery minnow and other listed species in a sustainable manner over time. The intent of the RIO approach is to guide the continual refinement of hydrologic management for listed species and their habitat in the MRG through the steps of a formal AM cycle.

Another key element of the BO is restoration of river connectivity, with requirements to implement fish passage at San Acacia Diversion Dam within five years, at Isleta Diversion Dam within six years, and at Angostura Diversion Dam within 10 years. Reclamation also committed to implementing the Bosque del Apache Realignment Project, pending completion of NEPA, as well as habitat restoration in the Isleta and San Acacia Reaches.

The Bosque del Apache Realignment Project is a river maintenance project realigning the river channel to promote long-term effective conveyance of water and sediment through the reach, while minimizing potential for spoil levee and LFCC failure. The project will also have habitat restoration benefits by creating and improving aquatic, wetland, and native riparian habitat to benefit the minnow, flycatcher, and cuckoo.

Projects in the Isleta and San Acacia Reaches will be summarized, including anticipated schedules, in the Lower Reach Plan, a conceptual planning document due to the USFWS within 18 months of the BO (June 2018). In 2017, Reclamation and the BO Partners began successfully implementing these elements, as well as the other requirements of the BO. The 2nd Annual Report, due to the Service on March 1, 2018, provides specific information on the implementation of BO requirements and the Proposed Action.

While persistent drought in the region and degraded baseline conditions had a negative impact on the Rio Grande silvery minnow in past years, the region experienced a good spring runoff in 2017 with flows at the Central gage over 4,000 cfs for 14 days and above 3,000 cfs for 36 days. The runoff resulted in much better silvery minnow population numbers, with an October density of 21.56 fish per 100 m² at the standard 20 monitoring sites. Thus, Reclamation met the 2016 BO's incidental take (IT) requirements in 2017.

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 when no monitoring for the species

occurred. Survey methods are standardized and the same sites have been consistently monitored since the project began.

CPUE of silvery minnow during October 2017 was higher than October estimates during recent years of monitoring (Dudley and Platania 2017; Figure 5). During October 2017, a total of 2,192 silvery minnow were collected from the 20 standard long term monitoring sites. The species was present at 19 of 20 monitoring sites, was the most common fish species collected, and was collected in 213 of 309 seine hauls that yielded fish (Dudley and Platania 2017). All silvery minnow collected in October 2017 were unmarked and presumably naturally spawned fish. The results from October 2017 monitoring suggest that spring runoff flows during this year were of sufficient duration and magnitude for successful silvery minnow spawning and recruitment.

In October 2017, 10 additional sites were sampled and added to the 20 long term monitoring sites to assess how the addition of sites influences silvery minnow CPUE. The addition of the 10 monitoring sites resulted in the capture of 675 additional silvery minnow, for a 30 site total of 2,867 silvery minnow. Silvery minnow CPUE for the 20 standard long term monitoring sites was 21.56 fish/100m². CPUE for the 20 standard long term monitoring sites plus the 10 additional sites (30 sites total) was 18.90 fish/100m², which is slightly lower than the estimated CPUE for the 20 long term monitoring sites alone.

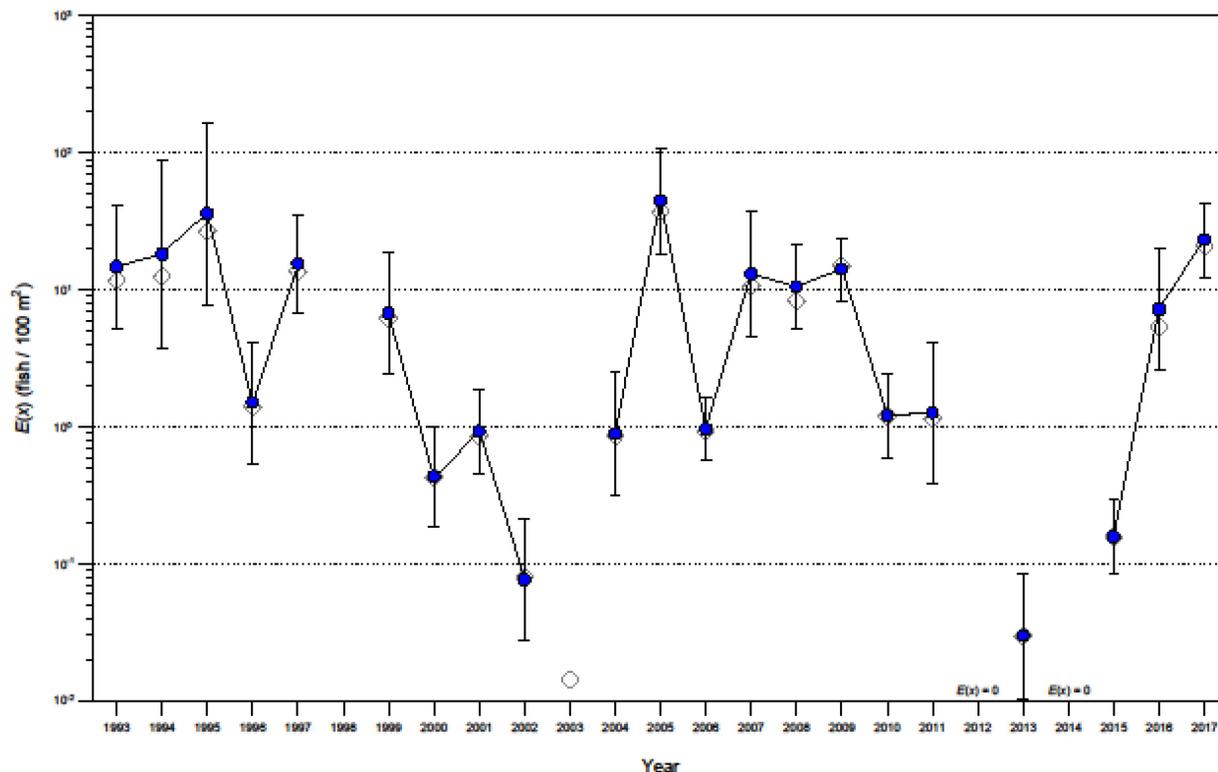


Figure 5: October silvery minnow density estimates ($E(x)$) for 1993–2017 from American Southwest Ichthyological Researchers. Solid circles indicate estimates, hollow circles represent simple estimates using methods of moments, and bars represent 95% confidence intervals.

Reclamation conducted two periods of Rio Grande fish monitoring during 2017 associated with

Reclamation projects. The winter electrofishing survey was carried out from February 14 to 21, 2017. Surveys were conducted at sites between Bernalillo and the Delta Channel, below the confluence of the Low Flow Conveyance Channel with the Rio Grande. A total of 280 silvery minnows were captured during that monitoring. Only one of these silvery minnow was marked and the rest presumably were all naturally spawned.

Reclamation's fall surveys were conducted from October 23 to 25, 2017, using seine nets within the Delta Channel in the Elephant Butte Reservoir pool, from the Rio Grande confluence with the Low Flow Conveyance Channel downstream to the current reservoir pool level near the Monticello Boat Ramp. Three hundred and sixty eight silvery minnows were captured in the Delta Channel in fall 2017. No marked silvery minnow were detected, and the majority were young-of-year fish.

Captive silvery minnows 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 Interstate Stream Commission's Los Lunas Silvery Minnow Refugium. In 2017, 60,360 hatchery silvery minnow were released into the San Acacia Reach of the Middle Rio Grande. No silvery minnow were released into other reaches of the Middle Rio Grande.

The USFWS also annually stocks captively propagated silvery minnows from these facilities into Big Bend National Park, Texas, to maintain the experimental population there. In fall of 2017, 278,815 silvery minnow from both SNARRC at Dexter, New Mexico, and the Uvalde National Fish Hatchery, Texas, were stocked at Big Bend National Park. Stocking of silvery minnow at Big Bend National Park was coordinated by the Texas Fish & Wildlife Conservation Office.

Literature Cited

- Dudley, R.K. and S.P. Platania. 2017. Summary of the Rio Grande Silvery Minnow Population Monitoring Program Results from October 2017. Report to the Middle Rio Grande Endangered Species Collaborative Program and the U.S. Bureau of Reclamation, Albuquerque, N.M. 29 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 the state of 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.
- 2 km (1.2 miles) 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 2017, Reclamation conducted surveys and nest monitoring of the flycatcher in 10 distinct reaches along approximately 400 kilometers (250 miles) of the Rio Grande in New Mexico, mainly between the southern boundary of the Pueblo of Isleta and Elephant Butte Reservoir (Table 10). Other areas surveyed include a 6 mile stretch north of Cochiti Reservoir, as well as select locations from Caballo Reservoir to El Paso, TX. Surveys were performed to contribute to current baseline population data of the flycatcher along the Rio Grande, and to meet Reclamation's ESA compliance commitments.

A total of 677 resident SWFLs were documented in 2017. These SWFLs established 370 territories, of which 307 were pairs. As in previous years, the San Marcial Reach was by far the most productive, containing 480 resident flycatchers and 257 territories, of which 223 were pairs. These totals represent an 8% decline in overall territory numbers from 2016. The decline within the San Marcial Reach, which includes Elephant Butte Reservoir, was 15% from 2016 to 2017. However, from 2016 to 2017, SWFL territories within the Lower Rio Grande Reach increased 36% from 50 territories to 68 territories, respectively. The 2017 increase follows an 11% increase in territories from 2015 to 2016.

Table 10: Southwestern Willow Flycatcher Territories; 2000 – 2017 Breeding Seasons (N/S = Not Surveyed)

Year/ Location	2 0 1 7	2 0 1 6	2 0 1 5	2 0 1 4	2 0 1 3	2 0 1 2	2 0 1 1	2 0 1 0	2 0 0 9	2 0 0 8	2 0 0 7	2 0 0 6	2 0 0 5	2 0 0 4	2 0 0 3	2 0 0 2	2 0 0 1	2 0 0 0
Frijoles	0	0	0	0	1	0	2	N/S	1	1	N/S							
Belen	17	20	17	18	23	14	9	6	3	4	10	1	4	0	N/S	1	N/S	N/S
Sevilleita	4	5	8	4	4	6	9	13	18	31	14	21	17	19	17	13	11	8
San Acacia	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0
Escondida	8	5	7	4	8	23	8	4	0	1	0	1	0	0	0	4	0	0
BDANWR	16	14	11	23	27	51	49	34	20	5	7	4	0	1	3	3	0	0
Tiffany	0	5	1	8	4	1	4	5	5	8	4	9	3	6	4	3	0	0
San Marcial	257	302	300	307	266	252	318	298	319	235	197	142	107	113	86	63	25	23
MRG SUBTOTALS	302	351	344	364	333	347	399	360	367	287	232	178	131	139	110	87	36	31
Caballo Reservoir	8	9	14	15	4	1	N/S											
Caballo to El Paso, TX	60	41	31	26	34	27	3	N/S	5	N/S								
LRG SUBTOTALS	68	50	45	41	38	28	3	N/S	5	N/S								
TOTAL	370	401	389	405	371	375	402	360	372	287	232	178	131	139	110	87	36	31

(This table does not include detections outside of the active floodplain at Bosque del Apache NWR)

In 2017, nest monitoring was conducted at all sites where nesting pairs were detected from the southern boundary of the Pueblo of Isleta to Elephant Butte Reservoir, and in select sites from Caballo to El Paso, TX. A total of 419 nests were discovered and monitored to determine success rates, productivity, and brown-headed cowbird (*Molothrus ater*) parasitism. The San Marcial Reach proved most productive, producing 298 nests. Other studies which continued in 2017 included: 1) flycatcher nesting hydrology and habitat variable study, 2) river maintenance impact monitoring, 3) photo monitoring of habitat development in the Elephant Butte delta, and 4) saltcedar leaf beetle (*Diorhabda spp.*) impact monitoring. These studies are designed to provide further insight into potential threats to and habitat requirements of flycatcher populations.

At Elephant Butte Reservoir, flycatchers have expanded their occupied habitat farther south, to near RM 38. Flycatcher occupied areas in the Elephant Butte Reservoir delta – RM 60 to 54 – used to consist of mainly dense Goodding's and coyote willow of various age classes, with water provided by the LFCC outfall. However, with the drought the last few years, this area rarely receives water from the LFCC, and invasive saltcedar is encroaching and taking dominance. Although this provides refuge habitat for flycatchers, the arrival of the saltcedar leaf beetle is an issue because they would likely defoliate saltcedar during flycatcher nesting times – providing less foliage cover and making nests more vulnerable to predation, parasitism, and natural

elements.

Habitat modeling from 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. The reason that flycatchers do not expand into all areas of suitable habitat is likely because of their site fidelity and overall population size.

Nest success in the Middle Rio Grande decreased to 25% in 2017 – the lowest level since Reclamation has been conducting flycatcher surveys (Figure 6).

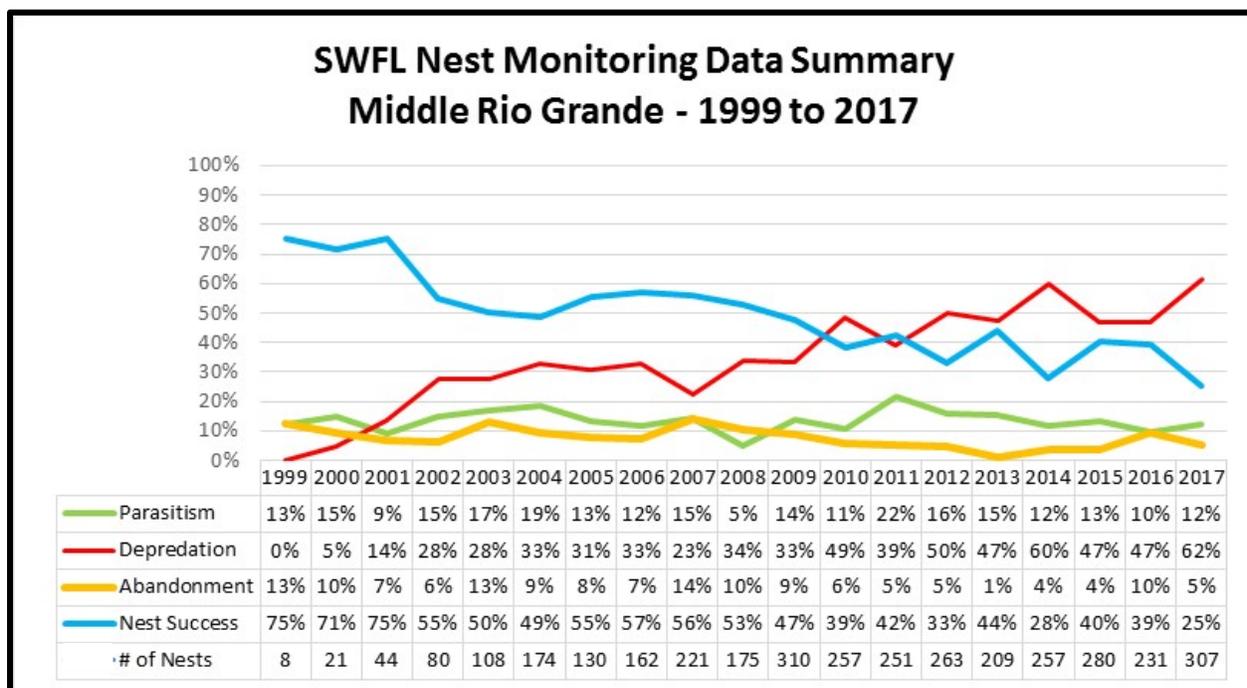


Figure 6: Summary of flycatcher nesting in the Middle Rio Grande from 1999 to 2017

The decline in nest success over the past few years may be related to the decline in habitat suitability and quality in heavily populated areas. Depredation, the biggest source of nest failure, averaged 27% from 1999-2011. Since 2012, the predation rate has nearly doubled, averaging 52%. The predation rate in 2017 was 62%, the highest recorded since 1999. These changes may be attributed to how habitat quality is influenced by hydrology. Drought conditions, which typically result in reduced discharge and groundwater levels, reduce plant vigor and canopy cover. A reduction in plant vigor and canopy cover reduces nest concealment, which exposes the nest to predators and the elements. The defoliation of saltcedar by *Diorhabda spp.* has similar affects, and will likely be of greater concern in the near future. Nest success in the Lower Rio Grande was much higher, at 60% within the Caballo Reservoir and 62% from Caballo to Leasburg (Figure 7 and 8).

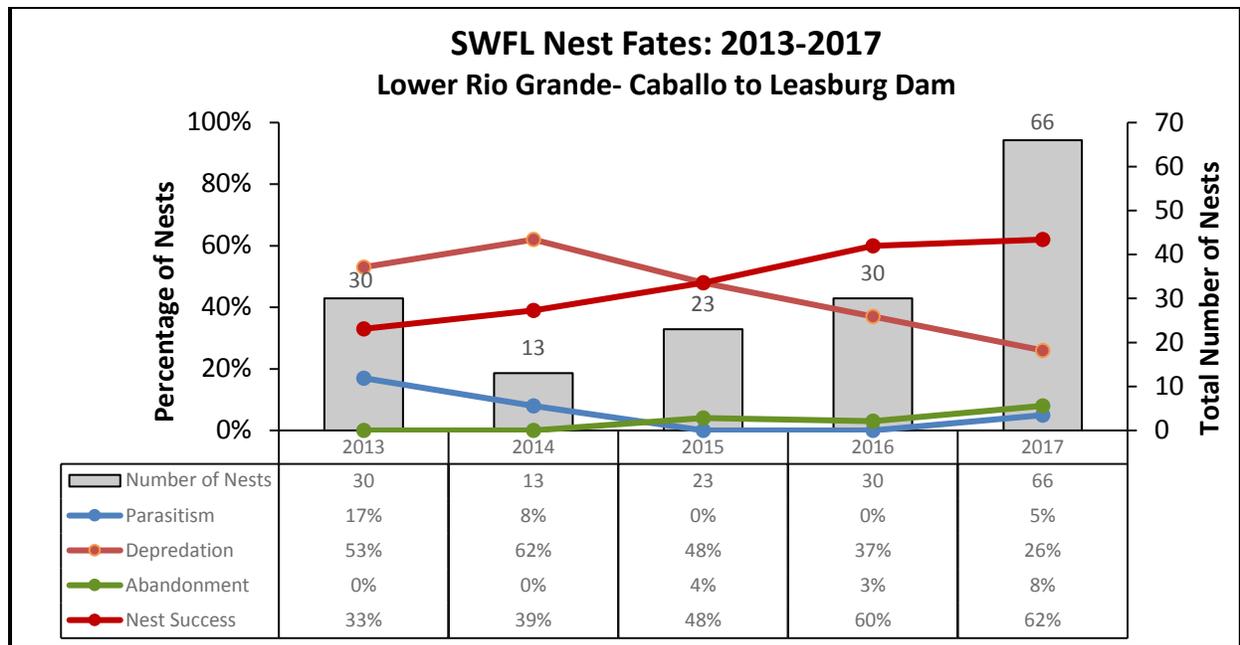


Figure 7: SWFL nest variables, Lower Rio Grande from Hatch to Leasburg Dam, 2013 to 2017

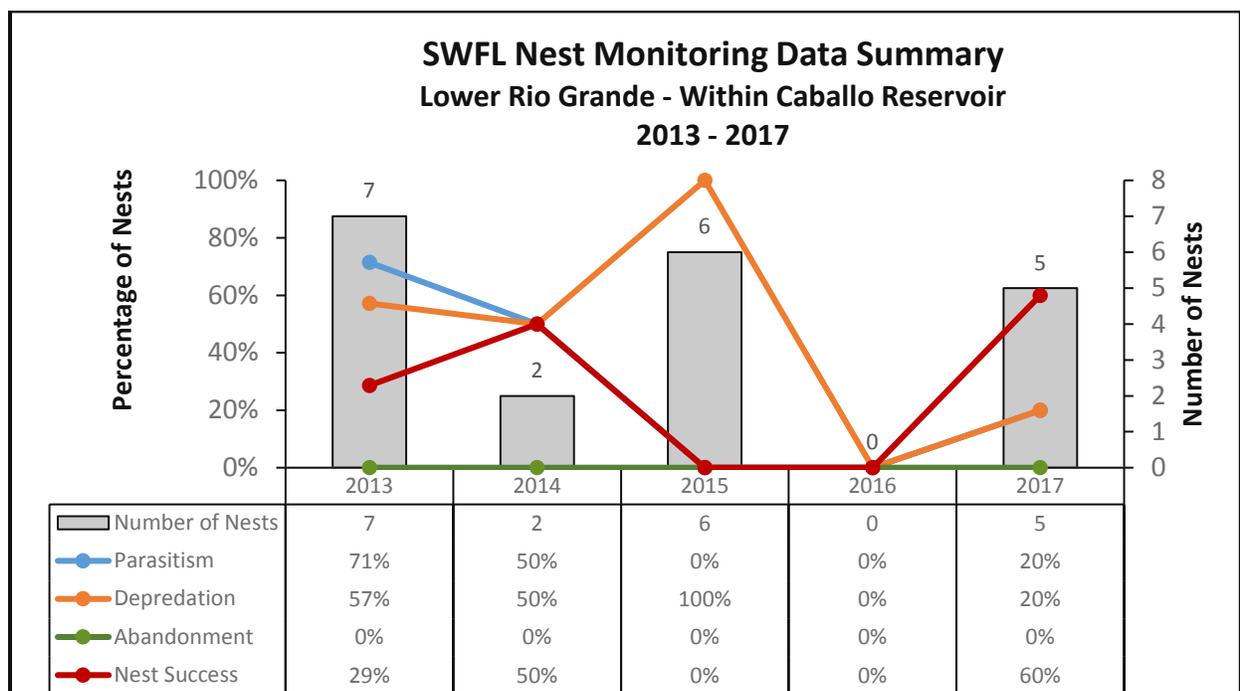


Figure 8: SWFL nest variables, Lower Rio Grande, Caballo Reservoir delta, 2013 to 2017

From 2015 to 2017, the Rio Grande and Low Flow Conveyance Channel both saw higher flows compared to the past several years. As a result, some areas within the Middle Rio Grande and Lower Rio Grande experienced overbank flooding and higher groundwater levels, improving plant vigor, structure, density and overall habitat quality. Also, during the summer of 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, seven that were nesting at that time.

Western Yellow-billed Cuckoo

The western distinct vertebrate population segment of the Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) (cuckoo) was listed as a threatened species by the USFWS in October of 2014. The proposed critical habitat posted in the Federal Register in August of 2014 includes eight units in New Mexico.

Along the Rio Grande, this proposed area includes:

- Unit 50, Upper Rio Grande 1, Rio Arriba County: a continuous 10 mile segment of the upper Rio Grande from Ohkay Owingeh to near Alcade 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 San Ildefonso Pueblo 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 at Elephant Butte Reservoir upstream to just below Cochiti Dam. Within this reach is the largest breeding population of western yellow-billed cuckoos north of Mexico (61,959 acres).

During the summer of 2017, Reclamation conducted surveys in eleven distinct reaches within sites also surveyed for flycatchers, from the south boundary of the Pueblo of Isleta to El Paso, TX (Table 11). Surveys were performed to contribute to current baseline population data of the cuckoo along the Rio Grande, and to meet Reclamation's ESA compliance commitments. In 2017, there were an estimated 121 breeding territories (assumed to be pairs) derived from 505 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 11: Yellow-billed Cuckoo Detections/Estimated Territories – Middle Rio Grande Project, 2006 - 2017 Breeding Seasons (N/S = Not Surveyed)

Year/ Location	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
Belen	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	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	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	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	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	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	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	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	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	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	11/1	6/2	4/1	0/0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Radium Springs	10/4	16/6	10/4	8/2	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
LRG SUBTOTAL	93/23	87/24	63/20	36/10	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
TOTALS	505/ 121	515/ 140	466/ 130	337/ 101	391/ 119	415/ 121	266/ 73	278/ 75	356/ 95	360/ 87	259/ 71	116/ 44

Table does not include detections outside of the active floodplain at Bosque del Apache NWR.

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 also has 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) and the 2016 BO.

Water Acquisition and Management

In 2017, 13,413 ac-ft of supplemental water was released by Reclamation for endangered species purposes. The volume was entirely composed of leased SJ-C water. Of the water released in 2017, 10,793 ac-ft was leased in 2016 and the remaining 2,620 was leased in 2017.

Reclamation ended the year with 4,933 ac-ft of 2017 leased SJ-C water, acquired via short term leases or other water contracts, in storage in Abiquiu Reservoir and 7,729 ac-ft of water in Heron. In 2018, Reclamation will likely have potential leases of approximately 12,000 to 13,000 ac-ft from 2018 SJ-C allocations. If there is a SJ-C Project shortage, however, available leased

water might only be 50% of that amount.

Low Flow Conveyance Channel (LFCC) Pumping Program – San Acacia to Fort Craig Reach

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 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 maintain silvery minnow density requirements in the Incidental Take Statement (ITS). As an optional tool in support of meeting the ITS, Reclamation used the south boundary pumps in 2017 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.

To maintain river connectivity from the south boundary of BDANWR to Elephant Butte Reservoir, pumps at the South Boundary site were turned on July 7. The pumps at the South Boundary ran for the entire season and were shut off on October 2, after rain storms brought river flow at the San Marcial gage above 40 cfs.

Table 12 below summarizes the yearly volume pumped at each site.

Table 12: 2016 LFCC Pumping Volume by Site

Total Per Pumping Site For The Year	Neil Cupp	North Boundary	South Boundary	Ft. Craig
	0 ac-ft	0 ac-ft	4,481 ac-ft	0 ac-ft

The pumps at the South Boundary sites were the only ones used for pumping supplemental water during the 2017 season. The total volume of supplemental flow provided by the pumping effort in the 2017 season was 4,481 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 Middle Rio Grande Conservancy District were formed in May 2015, in response to a letter from Pueblo of Isleta to work on reaching 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 grants 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. The Pueblo will receive full support from Reclamation and MRGCD in continued sediment management, riparian and bosque restoration, and other environmental benefits.

Past milestones facilitated by the technical team include ratification of standard operating procedures for Isleta Diversion Dam and completion of a cross-section data collection plan, a dam operations record keeping plan, and a legacy sediment disposal plan. The technical team also developed a routine dam maintenance schedule and a preliminary feasibility scope of work for sediment management and fish passage studies.

In FY17, major milestones included final settlement payment to the Pueblo, completion of Reclamation's responsibilities for sediment disposal, and awarding a PL93-638 contracts to the Pueblo of Isleta to fund the design and environmental analyses to support diversion dam modifications, and to plan and permit bosque and riverine habitat restoration projects. In addition, administrative support of the settlement has included agreement on administrative processes, such as in-kind services commitments and monitoring and reporting.

Over the next 10 years, the technical team will be responsible for further development, review, and implementation of projects and activities agreed to in the settlement for data collection, diversion dam improvements, and habitat restoration.

Other Ongoing Water Management and Water Quality Related Projects

USGS MRG River Gage Operation and Maintenance

The need for additional gages along the river and in MRGCD facilities was 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 gages on diversions, wasteways, and important canals. MRGCD subsequently took over operation and maintenance (O&M) of the gages.

Other funding allowed the USGS to install four new river gages, and Reclamation continues to fund the O&M of these gages. All these new gages were a result of the ongoing ESA discussions with the Service, and became a requirement in the 2003 BiOp, to increase the

availability of accurate flow data in the Middle Rio Grande. 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).

Data from the river gages helps the various Middle Rio Grande water management agencies in many ways. The gages assist agencies in meeting the needs of water users, fulfilling the requirements of the Rio Grande Compact, maintaining adequate water in the river to support the silvery minnow, and providing the information needed to improve the daily management of the river system from Cochiti Dam to Elephant Butte Reservoir. The 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 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 include specific flow targets and maximum rates of drying, but instead focuses on using adaptive management to maintain silvery minnow density requirements in the Incidental Take Statement. Because of the valuable information provided by RiverEyes' observations of flows and drying, it continues to be utilized. The information is an integral part of the interagency coordination that informs Middle Rio Grande water operations.

For the 2017 irrigation season, RiverEyes monitored river conditions along the Rio Grande from Isleta Diversion Dam to the full pool elevation of Elephant Butte Reservoir. Monitoring occurred from early July through early October, after the river had reconnected due to large rainstorms. The total maximum extent of river drying during the 2017 RiverEyes monitoring period was 25 miles on September 12 – 2.5 miles in the Isleta Reach and 22.5 miles in the San Acacia Reach. The first occurrence of channel drying was on July 9, and the last occurrence was on September 28, both in the San Acacia reach.

The first occurrence of channel drying in Isleta reach was on September 4, and that reach reconnected on September 22. Large sections of the Isleta reach were kept wet this year by small releases made by the MRGCD to the river at various wasteways. There was only one section of the Isleta reach which dried this year. That was a three mile section above the Peralta Wasteway. The river remained continuous below the Peralta Wasteway.

The San Acacia Reach experienced drying on July 9 in the middle of the Bosque del Apache Wildlife Refuge. The maximum drying in this reach occurred on September 12 with the river dry from about two miles above Brown Arroyo to the South Boundary pumps, a distance of just over 22.5 miles. Flows from monsoon rains then reconnected the river on September 28, and it remained connected for the rest of the year.

Middle Rio Grande Endangered Species Collaborative Program

In 1994, the USFWS listed the Rio Grande silvery minnow as endangered, issued a recovery plan in 1999, and released a revised critical habitat designation in 2003¹. The silvery minnow recovery plan² was updated in 2010. The southwestern willow flycatcher was added to the endangered species list in 1995 and a final recovery plan³ was issued in 2002. The designation for flycatcher critical habitat was revised in January 2013⁴.

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

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 Middle Rio Grande Conservancy District), specifying requirements for ESA compliance for water management and river maintenance activities on the MRG. Reclamation is responsible for implementing the 2016 BO (86 Conservation Measures, 11 Reasonable and Prudent measures, and 50 Terms and Conditions) with its partners.

The Collaborative Program is not included in the 2016 BO, and does not have responsibility or authority for meeting the BO requirements. However, Reclamation works with the Collaborative Program on science recommendations in support of adaptive management studies related to species' needs. The Collaborative Program is working to develop a science and adaptive management program and a new organizational framework that will meet signatories' requirements, and help to support implementation of Reclamation's and other signatories' BOs (e.g., United States Army Corps of Engineers and Albuquerque Bernalillo County Water Utility Authority).

Currently, Reclamation provides some of the funding for the Collaborative Program in support of 3rd party management and studies related to species' needs, as authorized by the Omnibus

¹http://www.fws.gov/southwest/es/Documents/R2ES/FINAL_CH_EIS_Rio_Grande_Silvery_Minnow_no_appendices_Feb_2003.pdf

²http://www.fws.gov/southwest/es/Documents/R2ES/Rio_Grande_Silvery_Minnow_Recovery_Plan_First_Revision.pdf

³http://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>

Appropriations Act of 2009 (P.L. 111-8). In FY2017, Reclamation provided \$3,326,138 for Collaborative Program activities. Related FY2017 accomplishments include:

- Collaborative Program Executive Committee Retreat in April 2017;
- Captive propagation of silvery minnow at the Southwestern Native Aquatic Resources and Recovery Center⁵, the City of Albuquerque's BioPark Aquatic Conservation Facility⁶, and the New Mexico Interstate Stream Commission's Los Lunas Silvery Minnow Refugium⁷;
- Annual monitoring of silvery minnow population;
- Genetics study of the silvery minnow;
- Silvery minnow rescue and salvage efforts during river drying, and reproductive monitoring;
- Annual monitoring of southwestern willow flycatcher population and their nests;
- Program management, assessment, reporting, and outreach activities.

⁵ <http://www.fws.gov/southwest/fisheries/dexter/>

⁶ <http://www.cabq.gov/culturalservices/biopark/news/success-for-abq-bioparks-silvery-minnow-program>

⁷ <http://www.ose.state.nm.us/LLSMR/index.php>

Rio Grande Project (New Mexico - Texas)

Reclamation’s El Paso 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 Diversion Dam, Leasburg Diversion Dam, and Mesilla Diversion Dam in New Mexico, under a contract with Reclamation. In September 2003, Reclamation completed work to remove Riverside Diversion Dam and the adjacent Coffey Dam, both in Texas. Riverside Diversion Dam had been inoperable since 1987, when flooding on the Rio Grande caused the structure to fail.

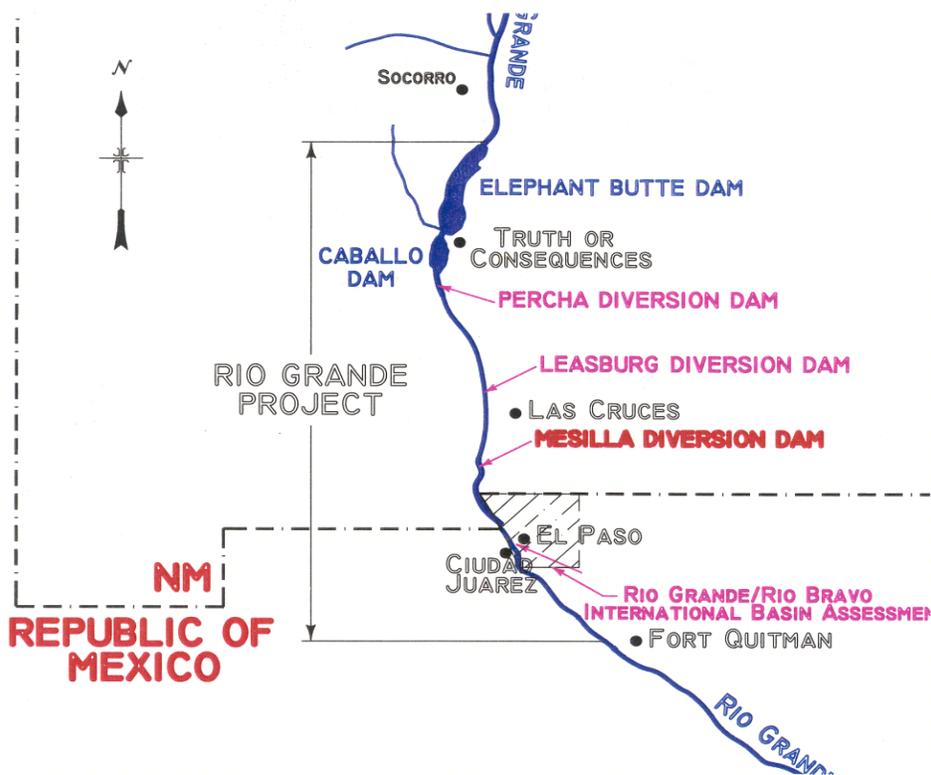


Figure 9: Area Map of the Rio Grande Project

Water Supply Conditions

Preliminary inflow data into Elephant Butte Reservoir during 2017, measured as the sum of the Rio Grande floodway and the Low Flow Conveyance Channel at San Marcial, was 945,012 ac-ft. The provisional flow record for the 2017 spring runoff (March - July), measured at San Marcial, was 580,452 ac-ft, or approximately 114% of the 30-year average.

From 1998 to 2017, average spring runoff at the San Marcial gauging station was below the 30-year average used by the NRCS, which is from 1981 to 2010. From 1998 to 2017, average inflow was 284,504 ac-ft, and only three years – 2005, 2008, and 2017 – exceeded the 30-year average of 510,000 ac-ft.

Releases from Elephant Butte Reservoir began on March 6, 2017, and continued through October 2, 2017. During this period, a total release of 648,381 ac-ft was recorded by the USGS. This flow data has been approved by the USGS.

During the 2017 irrigation season (March 31 to October 11), 622,467 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 water users.

Combined total storage for Elephant Butte and Caballo Reservoirs was 462,144 ac-ft on December 31, 2017, or 20% of their total capacity. The available storage for both reservoirs during the winter months, October 1 to March 31, is equal to the capacity of Elephant Butte Reservoir, 2,024,586 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, 324,934 ac-ft, minus 100,000 ac-ft for flood control space, for a total of 2,224,520 ac-ft during the winter and 2,199,520 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) rose above 400,000 ac-ft on April 9, 2017. It remained above 400,000 ac-ft from April 9 to August 10, 2017. The usable water in Project storage remained under 400,000 ac-ft from August 10 to December 6, 2017. Usable water in Project storage remained above 400,000 ac-ft into 2018.

With the combined Project storage and runoff, Reclamation allotted 769,120 ac-ft, a full supply, to Rio Grande Project water users. The available storage was not sufficient to release in late February, as has frequently occurred in the past. Reclamation coordinated with the IBWC, Mexico, EBID, and EPCWID to schedule a timely and organized irrigation release. Release from Caballo Reservoir began on March 31, 2017, and the irrigation season continued through October 11, 2017.

An initial allocation for 2018 was made in February. On January 26, 2018, combined storage in Elephant Butte and Caballo Reservoirs was 486,441 ac-ft; water available to the Project water users was 480,521 ac-ft. Based on the January 1, 2018, Natural Resources Conservation Service and National Weather Service spring runoff forecast at the San Marcial gauging station, and uncertain El Niño Southern Oscillation activity and present hydrologic conditions, Reclamation

anticipates a less than full supply for irrigation during 2018 for the Rio Grande Project.

Project Irrigation and Drainage Systems

Upon 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 lands and rights-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 Elephant Butte Powerplant.

The districts performed flow measurements at canal headings, river stations, and lateral headings during 2017. 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 2017. 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 gauging 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. In 2017, 35,439 ac-ft was diverted.

Elephant Butte Reservoir and Powerplant

In 2017, Elephant Butte Reservoir reached a daily minimum storage of 203,956 ac-ft (elevation 4311.99 feet) on January 1, 2017 and a daily maximum storage of 516,226 ac-ft (elevation 4,341.89 feet) on June 14, 2017.

The total gross power generation for 2017 was 45,817,560 kilowatt-hours (KWhr). Net power generation was 45,371,956 KWhr, which is 114 percent of the 8-year average (2010 through 2017) of 39,935,227 KWhr. The Elephant Butte powerplant record showed releases of 388,131 ac-ft to meet downstream irrigation demand and manage Caballo Reservoir storage levels. According to the Elephant Butte powerplant record, the balance valves, which bypass power production, released 195,469 ac-ft to meet irrigation demand during the 2017 season. Note that Elephant Butte operators consistently record a lower flow than the USGS. Balance valve releases had to be made due to the penstock head gate replacement contract on Unit 3.

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 three incomplete Category 2 O&M recommendations for Elephant Butte Dam. The outstanding Category 1 recommendation to replace the generating unit penstock operating system is substantially complete, with work on penstocks 2 and 3 completed. Work on penstock 1 is scheduled for completion in May 2018.

An Annual Examination was completed in September 2017. The inspection did not produce any new issues that were not previously identified.

The Facility Review Rating was also updated in September 2017. The rating for Elephant Butte decreased from a total score of 94 to 82, giving the facility an overall rating of “Good”.

Caballo Dam and Reservoir

During 2017, Caballo Reservoir’s maximum storage was 78,426 ac-ft (elevation 4,152.53 feet) on March 30. The minimum storage occurred on January 1, at 21,124 ac-ft (elevation 4,136.83 feet).

The irrigation release period extended from March 31 through October 11, 2017. During that period, Reclamation operated Caballo Reservoir to maintain storage levels adequate to respond to irrigation calls.

Reclamation communicated with stakeholders to provide information and projections of reservoir elevations throughout the irrigation season. Overall, 622,489 ac-ft was recorded at the Caballo gage from January 1 to December 31, 2017.

Discussion is ongoing between EBID, EPCWID, and Mexico about the start date for the 2018 irrigation season. The parties are coordinating release schedules to avoid isolated releases. Reclamation will finalize a reservoir operating plan in the spring of 2018.

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 five incomplete Category 2 O&M recommendations for Caballo Dam. No O&M recommendations were completed during FY 2017.

An Annual Examination was completed in September 2017, and the Facility Review Rating was also updated. The rating for Caballo increased slightly from a total score of 94 to 97, giving the facility an overall rating of “Good”.

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, requesting the Court to grant quiet legal title to the waters of the Rio Grande Project in its name. The U.S. District Court (USDC) for the District of New Mexico dismissed the case in August 2000. On May 7, 2002, the U.S. Court of Appeals (10th Circuit) vacated the USDC's August 2000 decision and remanded the case back to District Court for further proceedings. Chief Judge James A. Parker issued an order to stay the case and close for administrative purposes on August 15, 2002. He further ordered that, if it becomes necessary or desirable during the pendency of the 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 would mean the United States still has a right to such inflows once they become surface water again.

On September 06, 2017, the Court found that good cause exists to continue suspension of proceedings in SS-97-104 and SS-97-107, which involve pre-Project interests for the purpose of allowing the parties to continue to make progress in their negotiations. By March 2, 2018, the parties shall report on the status of their negotiations and shall propose new scheduling orders for SS-97-107 and SS-97-104, if appropriate.

State of New Mexico v. United States

On August 8, 2011 the New Mexico Attorney General filed a lawsuit against the United States Bureau of Reclamation (*State of New Mexico v. United States*, et al. U.S. Dist. Ct. 11-cv-691) regarding the Rio Grande Project 2008 Operating Agreement 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 U.S. Supreme 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 much of the same claims as Texas. On November 3, 2014, the U.S. Supreme Court appointed Gregory Grimsal of New Orleans, LA, as the Lower Rio Grande Adjudication Special Master. The Special Master held hearings on August 19 and 20, 2015, on New Mexico's motion to dismiss, and the motions filed by EBID in New Mexico and EPCWID

in Texas for leave to intervene, but did not rule from the bench.

On February 13, 2017, the parties received the final report of the Special Master regarding the motions of New Mexico to dismiss the complaints of Texas and the United States as well as the motions of the two districts to intervene. The Special Master recommended to the court that the Texas complaint be maintained under the U.S. Supreme Court's jurisdiction as a matter of right, that the United States' complaint in intervention be retained as a matter of the Court's discretionary authority, and that the motions to intervene by EBID and EPCWID be denied. Exceptions (appeals) to the Special Master's report were taken to the U.S. Supreme Court. On January 8, 2018, the U.S. Supreme Court heard oral argument on the exception to the Special Master's report by the United States and Colorado. The arguments were related to the United States' motion to intervene to protect unique sovereign interests in the Reclamation Rio Grande Project, where the Special Master had argued that the claims of the United States under the Rio Grande Compact be dismissed, but that jurisdiction be extended for the other claims made under the federal government's treaty powers and under Reclamation law.

Rio Grande Project Operating Agreement

In 2017, the Rio Grande Project continued to be operated under the 2008 Rio Grande Project Operating Agreement (OA) and Manual. The OA and its Manual provide detailed procedures for operating the Rio Grande Project, allocating the water supply to EBID, EPCWID, and Mexico, and accounting for use by the parties while recognizing and fulfilling the terms of the 1906 Convention with Mexico.

The 2017 irrigation season for the Rio Grande Project began on March 31 for EPCWID, with their initial diversion beginning on April 3. Mexico began diverting a week later, on April 10. EBID began the irrigation season in two phases, with the Rincon Valley beginning irrigation mid April and the Mesilla Valley in May. The Project released 622,467 ac-ft from Rio Grande Project storage for irrigation. EBID, EPCWID, and Mexico were charged for 563,935 ac-ft of delivered water. The calculated diversion ratio, a quantitative measure of delivery performance, was 0.91 for 2017. EBID ended the 2017 irrigation season with 11,239 ac-ft in their allocation carryover account, and EPCWID ended with 202,102 ac-ft in their allocation carryover account. Table 13 summarizes the 2017 Rio Grande Project Accounting.

Table 13: Summary of Rio 2017 Grande Project Accounting Charges

	Final Allocation, ac-ft	Total Allocation Charges, ac-ft	Release from Caballo Dam, ac-ft	Calculated Diversion Ratio	Allocation based on Release, ac-ft	Account Balance, ac-ft	Conservation Credit, ac-ft	Mexico Allocation Adjustment, ac-ft	Final Carryover, ac-ft
EBID	270,749	259,510				11,239			11,239
EP1	438,371	249,919				188,452	13,650		202,102
Mexico	60,000	54,506			N/A				
Total	769,120	563,935	622,467	0.91					

Based on current storage in Elephant Butte and Caballo and the current forecast, water users will likely receive less than full allocation in 2018. Since 2008, the calculated diversion ratios have been less than one, demonstrating that the Project has been operating in an extreme drought scenario.

Reclamation continues to work with water users to accurately account for water released from Caballo and water delivered at each diversion point. Additionally, Reclamation will have its first annual accounting report for the Rio Grande Project available in spring 2018 to provide detailed accounting of the allocations, diversion records, and charges for the irrigation season. The technical team for the OA, which consists of representatives from EBID, EPCWID, and Reclamation, will meet in early 2018 to discuss potential updates and amendments to the Manual.

Elephant Butte and Caballo Reservoir Vegetation Management Cooperative Agreement

Under the Vegetation Management Cooperative Agreement between NMISC and Reclamation, Reclamation performs maintenance of areas where vegetation has been previously managed, primarily by mowing to limit the non-beneficial consumption of water by woody phreatophytes such as saltcedar (Tamarix).

During FY2017, no agreement was in place for this work. Reclamation and NMISC created a new Service Agreement for FY2018. Some maintenance of Caballo reservoir was, however, done solely at the expense of Reclamation during FY2017. Approximately 876 acres of phreatophytic vegetation was managed utilizing mowers and mulchers.

Other Reclamation Programs

The WaterSMART Program

Water is our most precious natural resource and is increasingly stressed by the demands society places on it. Adequate water supplies are an essential element in human survival, ecosystem health, energy production, and economic sustainability. Significant climate change-related impacts on water supplies are well documented in the scientific literature and scientists are forecasting changes in hydrologic cycles.

Congress recognized these issues with the passage of the SECURE Water Act. The law authorizes federal water and science agencies to work together with state and local water managers to plan for climate change and other threats to water supplies, and take action to secure water resources for the communities, economies, and the ecosystems they support.

To implement the SECURE Water Act, and ensure that the Department of the Interior is positioned to meet these challenges, Secretary Salazar established the WaterSMART Program in February 2010. WaterSMART 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 sustainable use of all natural resources, and coordinating the water conservation activities of the various Interior offices.

As the Department's main water management agency, Reclamation plays a key role in the WaterSMART Program. Reclamation's portion of the WaterSMART Program is focused on improving water conservation, and helping water and resource managers make wise decisions about water use. Goals are achieved through administration of grants, scientific studies, technical assistance, and scientific expertise.

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 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 Re-use Program
- Basin Study Program

- Baseline Water Assessments
 - Impact Assessments
 - Data, tools, and guidance
 - SECURE Reports to Congress
 - Reservoir Operations Pilots
- Basin Studies
- Landscape Conservation Cooperatives
 - Southern Rockies Landscape Conservation Cooperative
 - Desert Landscape Conservation Cooperative

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

A new WaterSMART Data Visualization Tool and Progress Report (2010-2016) can be found at: <https://usbr.maps.arcgis.com/apps/MapJournal/index.html?appid=043fe91887ac4ddc92a4c0f427e38ab0>.

Specific information on projects awarded to recipients within the jurisdiction of the Albuquerque Area Office (AAO), and therefore administered by the AAO, can be found below.

WaterSMART Grants

Water and Energy Efficiency Grants

WaterSMART Water and Energy Efficiency Grants (WEEG) provide cost-shared funding for projects that save water, increase energy efficiency and the use of renewable energy in water management, and support environmental benefits.

El Paso Water Utilities (EPWU) continues to implement an ongoing WEEG for *Potable Water and Energy Conservation and Savings from Secondary Membrane Treatment of Reverse Osmosis Concentrate* (via installation of Concentrate Enhanced Recovery Reverse Osmosis (CERRO) units at existing wellheads). This award was made in 2014. The completion date has been extended to September 2018.

Elephant Butte Irrigation District (EBID) continues to implement an ongoing WEEG entitled *EBID Rincon Water Habitat Energy Nexus (WHEN)* for irrigation, energy, efficiency and habitat improvements. All piping has been installed. Remaining work includes planting trees in the habitat area, and enlarging, installing solar-powered pump at, and diverting arroyo flows into the tail end pond. This award was made in 2014. The completion date has been extended to September 2018.

Small-Scale Water Efficiency Projects

Six small-scale water efficiency projects were awarded for AAO administration in FY2017. Environmental compliance is progressing and recipients are awaiting the issuance of notices to proceed.

Water Conservation Field Services Program

Through the Water Conservation Field Services Program (WCFSP), Reclamation provides funding and technical assistance to several water management entities in New Mexico and west Texas. The WCFSP seeks to promote water use efficiency through support of outreach efforts, research projects, and technical assistance to water users.

Reclamation continued to support conservation outreach aimed at increasing public and industrial awareness of water issues during 2017. A summary of the work completed, grants closed and new grants awarded follows:

Work Completed

The following work was completed by grantees under the WCFSP:

- City of Espanola: Water Conservation Plan (in close-out phase)
- Bernalillo County: Provide outreach to small community water systems to test, calibrate, and replace water meters (in close-out phase)
- Madrid Water Cooperative: Water Conservation Plan (completion date March 2018)
- Village of Tijeras: Water meter analysis and replacements/upgrades (in close-out phase)
- Village of Los Lunas: Water Conservation Plan (ahead of schedule, entering close-out phase)
- City of Rio Rancho: Finished year one of conducting water audits; 15.67 acre-feet of water was saved through these audits.

Grants Closed

The City of Bernalillo completed and submitted its water conservation plan in 2017.

New Grants Awarded

A grant was awarded to the MRGCD to demonstrate project technologies aimed at improving irrigation efficiencies.

Cooperative Watershed Management Program

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

In 2016, Reclamation entered into a two-year agreement with the Upper Rio Grande Watershed District to form a task force and watershed group (Phase I). This effort will expand local involvement in addition to creating an action plan to mitigate damages to the watershed as a result of wildfires. Currently, members are from various jurisdictions that have been unable to independently accomplish watershed restoration goals. This work is scheduled to be completed in September 2018.

Drought Response Program

The Bureau of Reclamation's Drought Response Program supports a proactive approach to drought. It provides assistance for three sub-programs: Drought Contingency Planning, which provides assistance to water users for drought contingency planning, including consideration of climate change information; Drought Resiliency, which supports actions that will build long-term resiliency to drought; and Emergency Response Actions, to minimize losses and damages resulting from drought, relying on the authorities in Title I of the Drought Act.

Drought Contingency Planning

In 2016, the MRGCD was awarded funding to implement a Drought Contingency Planning Project. The Drought Contingency Plan (DCP) is being developed to guide management and protection of the District's water supplies and its ability to deliver water to agricultural users, to assist New Mexico in meeting Rio Grande Compact obligations, and to assist the Middle Rio Grande community in meeting commitments for endangered species. In 2017, contracts were initiated for assessment of vulnerabilities of the MRGCD to drought, as well as of the suitability of the MRGCD's infrastructure for drought mitigation. The MRGCD plans to use the resulting information to evaluate several potential mitigation actions intended to increase the MRGCD's resilience to drought, and pre-emptively limit those vulnerabilities.

Drought contingency planning establishes a process for evaluating conditions, water supply, and needs. Should that process determine drought conditions are in effect, the DCP will define direct actions to be taken by the MRGCD under various stages of drought conditions. The DCP identifies key responsibilities of the MRGCD, as well as required interaction and communication with other agencies, which will be implemented during drought conditions.

As required by the program, MRGCD has established a Drought Contingency Planning Task Force made up of interested stakeholders within the planning area who want to actively participate in developing the Drought Contingency Plan.

The DCP will be updated every seven years to reflect current MRGCD infrastructure, management obligations, and understanding of basin and climatic conditions.

Resiliency Projects

In 2016, MRGCD was awarded funding to provide greater efficiency and better control of water delivery. MRGCD will install the "Socorro Main Canal South Distribution Hub," which will include construction of a dedicated pumping facility, check structure, and pipelines to direct water to three discharge points. The project will use the existing Neil Cupp check structure along with a new check structure to be built in the Socorro Riverside Drain "A" to supply water to a new pump station. The pump station will lift water to three discharge points. The first two are the MRGCD's Socorro Main South Canal and the Mosely Lateral. The third discharge point will be the Rio Grande, using existing infrastructure through the spoil levee to augment river channel flows for endangered species. This distribution hub will replace Reclamation's Neil Cupp pump station, allowing water to be returned to the river channel for greater periods of time and at a lower cost. Construction is expected to begin in late 2018.

Emergency Response Actions

AAO staff provided emergency drought assistance to the Regina Mutual Domestic Water Association on the exploratory drought well drilled for them under the Drought Program. A new inter-agency agreement with the US Geological Survey to accomplish the work was signed and executed in 2017. Work on the well is planned for the spring/summer of 2018.

Title XVI Water Reclamation and Re-use Projects

In 2017, under the authority of P.L. 102-575, Reclamation participated with the cities of Santa Fe, New Mexico, and El Paso, Texas, in the feasibility, research and construction of water reclamation and reuse projects.

City of El Paso

The City of El Paso has been using recycled water since 1961. Reclamation has contributed to El Paso Water Utilities' (EPWU) efforts since 1996 through the Title XVI Program. EPWU recycles nearly 2 billion gallons of water per year (~ 6,000 ac-ft per year) through 50 miles of purple pipe.

Fred Hervey Reclaimed Water Project

EPWU prepared a Title XVI feasibility study for rerouting collection system flows currently delivered to the Haskell R. Street Wastewater Treatment Plant. Reclamation approved the feasibility study. In 2016, EPWU was awarded funding for construction of the Wastewater Diversion from Haskell Street Wastewater Plant to Fred Hervey Water Reclamation Plant (aka Fred Hervey Purple Pipe Project). The new collection system reconfiguration will deliver flows to the Fred Hervey Water Reclamation Plant for treatment and re-use in northeast El Paso. EPWU intends to propose a new project alignment which will require additional environmental review and an extension to the completion date. When fully implemented, this project will recycle an additional 365 million gallons of water per year (~ 1,100 ac-ft per year).

Collection, Storage, Recharge, and Recovery of Conserved Source Waters for Advanced Purified Treatment of Reclaimed Water

In September 2017, EPWU developed, and Reclamation approved, a Title XVI feasibility study for *Collection, Storage, Recharge and Recovery of Conserved Source Waters for Advanced Purified Treatment of Reclaimed Water*, to reuse wastewater as a possible component of potable supply for the area. EPWU implemented an advanced pilot study facility to test various treatment technologies with varying progressions using actual wastewater, the results of which contributed to the feasibility study. This study was finalized and closed out in November 2017.

Feasibility of Water Recovery from Filter Backwashing and Rewashing Operations

In 2016, EPWU was awarded funding for a Title XVI research study for Feasibility of Water Recovery from Filter Backwashing and Rewashing Operation. This is a two-year agreement, and Reclamation will enter the closeout phase in 2018.

Aquifer Storage and Recovery using Reclaimed Wastewater Feasibility Study

In September 2017, EPWU was awarded funding for a Title XVI research study to evaluate the feasibility of a comprehensive Aquifer Storage and Recovery (ASR) program. The ASR program would use reclaimed wastewater, combined with available supplies of conserved reclaimed water from electrical generation, to preserve and recharge the Hueco Bolson, and contribute to future drinking water supplies. The study is scheduled to be completed in December 2018.

City and County of Santa Fe

The 2015 Santa Fe Basin Study found that climate change and population growth will drive future water shortages, and that increasing water reuse could help mitigate those shortages. The City and County of Santa Fe subsequently developed a Title XVI feasibility study to optimize the use of regional reclaimed wastewater as a component of the water supply by evaluating several augmentation alternatives. The City and County assessed which alternative could optimize the use of reclaimed water in terms of environmental and economic sustainability, regional water needs, administrative and legal limitations, and compatibility with existing infrastructure and infrastructure planning efforts. The City and County of Santa Fe Title XVI feasibility study was finalized in April 2017. The agreement was closed in November 2017.

Basin Study Program

Reclamation's Basin Study Program represents a comprehensive approach to identifying and incorporating the best available science into climate-change adaptation planning. 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 Act. The Program includes the West-Wide Climate Risk Assessment (WWCRA) Program, now referred to as Baseline Water Assessments, as well as the Basin Studies themselves. The Basin Study Program is also closely affiliated with the Landscape Conservation Cooperatives (LCCs). The Southern Rockies and Desert LCCs encompass the Middle Rio Grande and are jointly managed by Reclamation and the USFWS. Further information about each of these sub-programs is provided below.

Baseline Water Assessments

Baseline Water Assessment activities focus on development of projections of future water supply and demand for Western river basins, and evaluation of impacts of the projected changes to water/reservoir operations, water quality, hydropower generation, endangered species, fish and wildlife, flow- and water-dependent ecological resiliency, and recreation. WWCRA activities include development of guidance for analysis of potential impacts of changes to water supply and demand on Reclamation projects.

The Baseline Water Assessment Program includes the Reservoir Operations Pilot Projects. Reclamation has initiated an analysis of water operations on the Rio Chama, in northwestern New Mexico, under this program. This project seeks to evaluate the legal constraints on river and reservoir operations on the Rio Chama, evaluate the economic implications of reservoir

operations and potential changes to reservoir operations, and compile existing data and information on the impact of reservoir operations on the ecology, geomorphology, hydropower generation, and recreation potential of the Wild and Scenic designated reach of the Rio Chama.

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 projects are managed out of the Upper Colorado Region, and seek to develop adaptation and mitigation strategies for watersheds affected by climate change. Basin studies require a 50% cost share from Reclamation's local water-management partners, and involve considerable cooperation with other members of the water community in a basin.

Reclamation and its partners completed the Santa Fe Basin Study in 2015, and were funded in 2017 to perform an update to that study.

Reclamation and the New Mexico Interstate Stream Commission are scheduled to complete a Pecos Basin Study in 2018 (please see Reclamation's Report to the Pecos River Commission for more information). In addition, Reclamation is now in partnership with the Middle Rio Grande Conservancy District along with 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 will follow from the Middle Rio Grande Basin Study – Plan of Study, and will be called the Rio Grande – New Mexico Basin Study.

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 evaluates projected impacts of climate change, population growth, and other stressors on the Santa Fe watershed, and on water supplies for the combined municipal water system of the City and County.

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

In 2016, Santa Fe was also awarded funding from Reclamation for a Basin Study Update. In this ongoing project, Reclamation and Santa Fe are working together to determine the likely timeline for projected impacts of climate change on Santa Fe's water supply over the coming century, so that the Santa Fe water utility can plan for implementation of the remainder of its adaptation portfolio.

Middle Rio Grande Basin Study: Plan of Study and Rio Grande – New Mexico Basin Study

In 2015, Reclamation entered into a partnership with the MRGCD, Audubon, The Nature Conservancy, Sandia Pueblo, and the Middle Rio Grande Water Assembly to develop a Plan of Study for a comprehensive Middle Rio Grande Basin Study. This Plan of Study was completed

in 2017, and provided the basis for a successful proposal to Reclamation for a comprehensive, multi-stakeholder Basin Study. The scope of the Basin Study has been expanded to include the entire portion of the Rio Grande Basin under New Mexico's jurisdiction per the Rio Grande Compact. The new project, which will be initiated in 2018, will be called the Rio Grande – New Mexico Basin Study. The Basin Study, like the Plan of Study, will be funded as a 50/50 cost split between Reclamation and all the other partners combined.

Landscape Conservation Cooperatives

Reclamation is partnering with the USFWS to manage the Desert and Southern Rockies LCCs. LCCs are designed to be links between science and conservation actions, which address climate change and other stressors within and across landscapes. The Upper Rio Grande straddles the Southern Rockies LCC and the Desert LCC. Reclamation invites all federal, state, tribal, local government, and non-governmental management organizations to become partners in the development of these cooperatives.

Southern Rockies Landscape Conservation Cooperative

The following project of the Southern Rockies LCC in the Upper Rio Grande Basin was completed in 2017:

Collaboration between the USDA Forest Service, Rocky Mountain Research Station, and the SRLCC to complete vulnerability assessments and analysis work for the Upper Rio Grande geographic focus area.

- Awarded to U.S. Forest Service, Rocky Mountain Research Station, Albuquerque
- Funding: Bureau of Reclamation \$65,000 and USFWS \$65,000
- Timeline: August 2015 to February 2017
- Status: Project complete
- More information about the project can be obtained from: John Rice (jrice@usbr.gov)

Desert Landscape Conservation Cooperative

The following are the active projects of the Desert LCC in the Upper Rio Grande Basin:

Rio Grande Forum

The Desert LCC, along with World Wildlife Fund, the Coca-Cola Company, the South Central Climate Science Center, Rio Grande Joint Venture, the Instituto Mexicano de Tecnología del Agua, and the Tecnológico de Monterrey, hosted the first Rio Grande / Río Bravo Basin Binational Water Forum in El Paso, Texas, on November 7 and 8, 2017.

This effort brought together over 150 people from Mexico and the United States to share creative strategies that promote water balance among people and ecosystems to foster a healthy, resilient river. Participants included city officials, business leaders, university researchers, farmers and ranchers, and conservationists. Attendees participated in solution-focused discussions on innovative water management and access for all, water quality, watershed restoration, water conservation, and basin and natural resources conservation.

Participants heard from nearly three dozen speakers, who shared the issues they face and the work they do to overcome them. Speakers represented a diversity of organizations working in the basin, such as Río Bravo Basin Council, Texas Comptroller Office, U.S. Forest Service, University of New Mexico, EPWU, Hidalgo County Irrigation District No. 2, and the MRGCD, among others.

Participants also prioritized next steps. The highest priority was creating more partnerships across the basin. Next were additional research on groundwater and water quality, a single location to house basin research and projects, and scheduling regular conference calls and meetings to improve collaboration and communication throughout the Basin.

Fire-smart Southwestern Riparian Landscape Management and Restoration of Native Biodiversity in View of Species of Conservation Concern and the Impacts of Tamarisk Beetles
In regulated rivers of the southwest, reduced flooding and the invasion of tamarisk contributes to accumulation of greater fuel loads and increased riparian fire frequency. As a result, some desert riparian areas, historically considered barriers to wildfire, have been converted into pathways for wildfire spread. Fire-smart management strategies are needed to protect sensitive riparian species and reduce fire risk. This study completed fire niche simulations to project impacts of fire frequency where flycatcher, cuckoo, and northern Mexican gartersnake may be the most and least susceptible to habitat. Maps were produced to inform restoration priorities and mitigate potential habitat loss. Results indicate that under future scenarios, a significant increase in suitability for flycatchers was seen in the southern portion of the breeding range along southern Arizona, New Mexico, and far west Texas. A restoration simulation scenario of planting willows along excavated side channel pools could help restore lost flycatcher habitat. Simulations indicate that the potential hazard from wildfire to flycatcher habitat can be exacerbated by tamarisk beetle defoliation activity, which can also delay habitat recovery. Surveys along the Gila River near Fort Thomas revealed good populations of flycatchers at planned restoration sites, but no cuckoo were found.

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Upper Rio Grande Water Operations Model

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 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 water accounting of SJ-C Project water contracts, and forecasting to simulate daily storage and delivery operations in the Rio Grande Basin. The model is used to simulate operations for Annual Operations Plans (AOP) that forecast the remainder of the year, and for long-term forecasts for planning studies.

The Technical Team meets approximately monthly, while the Executive and Advisory Committees meet less frequently but at least annually. The URGWOM website (<http://www.spa.usace.army.mil/Missions/CivilWorks/URGWOM.aspx>) is updated with details on recent activities, postings of the latest documentation, and meeting notes.

In 2017, work to improve the Lower Rio Grande segment of URGWOM continued. This included release and diversion rules, and considerable changes to the rules governing Elephant Butte and Caballo operations. Testing of the URGWOM salinity model also continued. The team also investigated using ET Toolbox to compute reference evapotranspiration (ET) and crop ET to replace the previous method, which used a spreadsheet outside of the model. The tech team continues to review and test a monthly time step model.

In 2018, ET calculations will be a particular focus, as the team looks to take these data from ET Toolbox. The tech team will also continue work on the monthly time step model.

Water Accounting Reports Projects

2017 San Juan – Chama Project Water Accounting

The 2017 San Juan – Chama Project water accounting was accomplished using version 7.1.5 of the RiverWare modeling system software and version 7.1 of the URGWOM accounting module. All accounting data and information is stored directly in the final version of the 2017 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 year-end data quality and accounting concerns.

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 Reclamation use with RiverWare® models. HDB is an Oracle® relational database application, and includes connections to data sources such as Reclamation's Hydromet, DOMSAT, DSS, and models such as RiverWare. HDB was originally developed at the University of Colorado's CADSWES. The HDB instance housing URGWOM data is located in the Upper Colorado Regional office, and is maintained by Reclamation's Upper Colorado Regional 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 Office depend on HDB installations for data storage and retrieval.

Development of water accounting and reporting functionalities for the Upper Colorado HDB installation continued during 2017. Water accounting data is directly transferred from the RiverWare URGWOM Accounting Model to HDB, and from HDB to URGWOM, via an HDB/RiverWare Data Management Interface (DMI). OpenDCS 6.3 and HDB POET 3.4 were also released in 2017. OpenDCS is an application that allows automated computations and data manipulation. HDB POET is an interface for data viewing and analyses.

Planned work for 2018 includes continued maintenance of HDB and continuing to back-populate historical data for both the Middle Rio Grande and Rio Grande Projects to HDB. Reclamation is also working on moving HDB to a new server using Linux version 7 and Oracle version 12. Additional Crystal Reports (version 2011) accounting table reports for internal use and external reporting may be developed, as well as work to ensure that data posted to the internet are current and correct.

RiverWare®

Numerous improvements to RiverWare® were accomplished during 2017 through multiple contracts (Reclamation and USACE) with CADSWES at the University of Colorado. Work included completing enhancements to the plotting utility and the Output Canvas, continued development of the Scenario Manager (previously called the Scenario Explorer) for use by stakeholders, and displaying certain types of metadata on series slots. An annual report produced by CADSWES summarizes the 2017 improvements to URGWOM and RiverWare. The report is distributed to the user community at their annual meeting.

Evapotranspiration (ET) Toolbox

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 (estimates of daily riparian and crop water use, open water evaporation, and rainfall).

The 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. Its coverage extends from Cochiti Dam to Elephant Butte Reservoir. ET currently accounts for an estimated 67 percent of the water depletions over this reach of the Rio Grande, including riparian vegetation, irrigated crops, and open water/wet sand evaporation.

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

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

In 2017, the ET Toolbox support contract was extended through Fiscal Year 2018. In 2017, the following general tasks were performed on the ET Toolbox: general development and maintenance, updates to cropping patterns, improvements and simplifications to the data acquisition workflow, evaluation of new MRGCD weather stations, and updating ET Toolbox documentation.

The URGWOM technical team decided that it will begin using ET Toolbox as the source for ET data in the model. In order to transition to ET Toolbox, historical reference ET values were compared to those used in URGWOM and to the reference calculated by ET Toolbox. The team also asked Reclamation to begin using URGWOM's crop curves in ET Toolbox.

In 2018, Reclamation plans to continue to update cropping pattern information; develop data connections between URGWOM, HDB, and ET Toolbox; update documentation to include all ET Toolbox features; and remove unused components. ET Toolbox will transition to using MRGCD weather data if it is deemed appropriate. The area covered by ET Toolbox may also expand. Work to allow ET Toolbox to be used as the source for ET data in URGWOM will continue. This will focus on adding a different effective precipitation component.

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 and purchases included concrete lining of farm ditches, terracing, laser leveling, check structures, pipes, culverts, and turnouts. Reclamation completed an irrigation improvement project at Taos Pueblo, which was aided by the Natural Resources Conservation Service (NRCS) funding and construction management support. Reclamation is also working with the BIA on irrigation system improvements for Middle Rio Grande Conservancy District facilities on lands of 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. Study appropriations in FY17 provided funding for surveying within the Pueblos of Nambe, Santa Clara, and Taos. In addition, the Study Report was completed and is progressing through the necessary approvals prior to submittal to Congress.

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 the 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. The Secretary's statement of finding that all conditions precedent have been fulfilled was published in the Federal Register on October 7, 2016, and the Settlement Agreement is final and enforceable.

Under the terms of the Settlement, Taos Pueblo has a recognized right to 11,827.71 ac-ft per year of depletions, 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 reacquire the forborne water rights through purchase of surface water rights from willing sellers. Reclamation entered into contracts to lease San Juan – Chama Project water from the Pueblo (2,215 ac-ft per year), the Town of Taos (366 ac-ft per year), and El Prado Water and Sanitation District (40 ac-ft per year).

Implementation of the settlement is currently in the final, on-the-ground phase, and Reclamation is in the process of completing environmental compliance and awarding grants to entities as they apply for financial assistance for their projects. The mutual benefit projects will minimize adverse effects on Taos Pueblo's water resources by moving future non-Indian ground water pumping away from the Pueblo's Buffalo Pasture, a culturally sensitive wetland.

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; the County of Santa Fe; 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), and established several deadlines, including completion of all "conditions precedent" by September 15, 2017, and completion of the RWS by June 30, 2024. The "conditions precedent" milestone was accomplished in 2017 in compliance with the act.

The RWS will 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. It may also include conjunctive use wells that would supply up to 4,000 ac-ft of water annually to Pueblo and non-Pueblo customers within the Pojoaque Basin. Permits from the New Mexico Office of the State Engineer (NMOSE) will be obtained to divert and consume the water supply for the RWS. The Pueblo water supply includes 1,079 ac-ft of SJ-C Project water, 1,141 ac-ft of "Top of the World" water rights that BIA acquired from the County of Santa Fe, and 302 ac-ft of Nambé reserved water rights that BIA acquired from the Pueblo of Nambé.

The SJ-C Project repayment contract with the four Pueblos was executed on January 21, 2016. There was one public negotiating meeting regarding this contract on November 4, 2015. Three separate applications to divert these water rights were filed with the NMOSE in January 2015. Reclamation completed its 30 percent design and related cost estimates for the RWS in December 2017. Reclamation and the 11 cooperating agencies have developed five alternatives that were analyzed in the Final EIS, published in the Federal Register (FR) on January 12, 2019, with the notice of filing published by the EPA in the FR on January 19, 2018. The 30-day no federal decision on the proposed action ends on February 20, 2018, with a Record of Decision tentatively set for the end of April 2018. Completion of final design is tentatively scheduled for mid-2018, and construction may start in late 2018.

Quagga and Zebra Mussel Update

Quagga and zebra 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 by via standing water in or adult mussel attachment on 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 will continue to grow into reproducing adults. Clumped onto these hard surfaces, ZQM clog infrastructure and restricting operation and maintenance of water storage, water delivery, and hydropower structures and systems. They also impairing recreational use and aquatic ecosystems (<http://www.usbr.gov/research/docs/ks/ks-2015-04.pdf>).

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

Outreach: Reclamation has engaged in public outreach efforts since 2009, printing 41,000 ‘Zap the Zebra’ brochures and 1,000 mussel posters. These brochures and posters have been dispersed throughout New Mexico at the New Mexico State Parks (NMSP) facilities, convenience and sporting good shops, 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 quagga or zebra mussel 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 that are distributed.

Watercraft Inspections and Decontamination: Reclamation does not have a direct role in conducting watercraft inspections and decontamination 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 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 shall 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 locations that watercraft inspections occur. The number of watercraft inspections statewide has increased from 9,346 in 2013 to 39,124 in 2017 (J. Dominguez, Personal Communication, see Table 14). 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: 2017 AIS Inspection Data (compiled by NMDGF and Reclamation). Inspections totals include incoming and outgoing vessels.

Location	Inspections	Decontaminations
Abiquiu Lake	1	0
Clayton Lake	2	0
Navajo Reservoir	14,422	58
Eagle Nest Lake	3	1
Elephant Butte Reservoir	16,528	46
Ute Lake	3,960	31
Farmington Lake	1,737	0
Conchas Reservoir	2,284	9
Blue Water Lake	0	0
Santa Rosa Reservoir	0	0
Sumner Reservoir	70	0
Caballo Reservoir	0	0
Bill Evans Lake	0	0
Brantley Reservoir	85	0
Other Locations	9	6
Cochiti Lake	0	0
NMDGF Headquarters	10	8
NMDGF Albuquerque Office	11	2
Las Cruces Office	2	0
Roswell Office	0	0
Raton Office	0	0
Totals	39,124	161

Reclamation has a contract for AIS monitoring for up to 5 years for the following:

- Inspections for watercraft entering Navajo and Elephant Butte Reservoirs,

- Decontamination of watercraft considered “high risk,” as defined by NMDGF,
- As needed, coordination with NMDGF or other law enforcement for issuance and removal of red warning tags.

There were over 16,000 inspections at Elephant Butte Reservoir, and over 14,000 inspections at Navajo Reservoir in 2017 (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 or RDLES) in Denver, CO. 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.

State Aquatic Invasive Species 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 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 water body 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 and that data is 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. The table below shows the reservoir, total number of tests sites, the total number of months over which the tests were conducted, associated PCR test results and microscopy test results for 2017 (D. Hosler, personal Communication, Table 15).

Table 15: 2017 AIS sampling results for seven Reclamation reservoirs in New Mexico.

Water body	Number sites sampled	Microscopy Results	PCR Results
Navajo Reservoir	33	Negative for all	Negative for all
Heron Reservoir	15	Negative for all	Negative for 11 tested
El Vado Reservoir	17	Negative for all	Negative for all
Elephant Butte Reservoir	17	Negative for all	Negative for all
Caballo Reservoir	16	Negative for all	Not tested
Sumner Reservoir	17	Negative for all	Negative for all
Brantley Reservoir	12	Negative for all	Not tested

In 2017, none of the seven Reclamation reservoirs sampled in New Mexico tested positive for zebra or quagga mussels via either microscopy or 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 conditions more suitable to AIS establishment may occur in the future.

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