2016

Calendar Year 2016 Report to the Rio Grande Compact Commission

Dick Wolfe
Colorado

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New Mexico

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Texas

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Federal Chairman

RECLAMATION

Managing Water in the West

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U. S. Department of the Interior
Bureau of Reclamation
Albuquerque Area Office
Albuquerque, New Mexico

March 2017

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Cover photo – Overbank flow at habitat restoration site on the Sevilleta NWR during 2016 spring pulse (Dustin Armstrong, 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
AOP.....Annual Operations Plan
ARRC.....Aquatic Resources and Recovery Center
AWARDS .....Agricultural Water Resources Decision Support
BA .....Biological Assessment
BDANWR.....Bosque del Apache National Wildlife Refuge
BIA.....Bureau of Indian Affairs
BiOp.....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
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
CWCD.....Conejos Water Conservancy District
CWMP .....Cooperative Watershed Management Program

CY .....Calendar Year
DOMSAT .....Domestic Communications Satellite
DSAT .....Dam Sector Analysis Tool
DSIS .....Dam System Information System
DSS .....Data Storage System
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
ESA .....Endangered Species Act
ET.....Evapotranspiration
FERC.....Federal Energy Regulatory Commission
flycatcher.....Southwestern willow flycatcher
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
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
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
NPS .....National Park Service
NRCS .....Natural Resources Conservation Service
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
RM.....River Mile
RWS.....Regional Water System
SJ-C.....San-Juan Chama
SL.....standard length
SLL.....San Luis Lake
SOD.....Safety of Dams
TDS.....Total Dissolved Solids
TRT.....Technical Response Team
URGSiM.....Upper Rio Grande Simulation model
URGWOM.....Upper Rio Grande Water Operations Model
USACE.....U.S. Army Corps of Engineers
USFWS.....U.S. Fish and Wildlife Service
USGS.....U.S. Geological Survey
YOY.....young of year

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 for communities and industries in southern New Mexico. Reclamation transferred title to the canal and drainage facilities to the districts in a 1996 quit-claim deed.

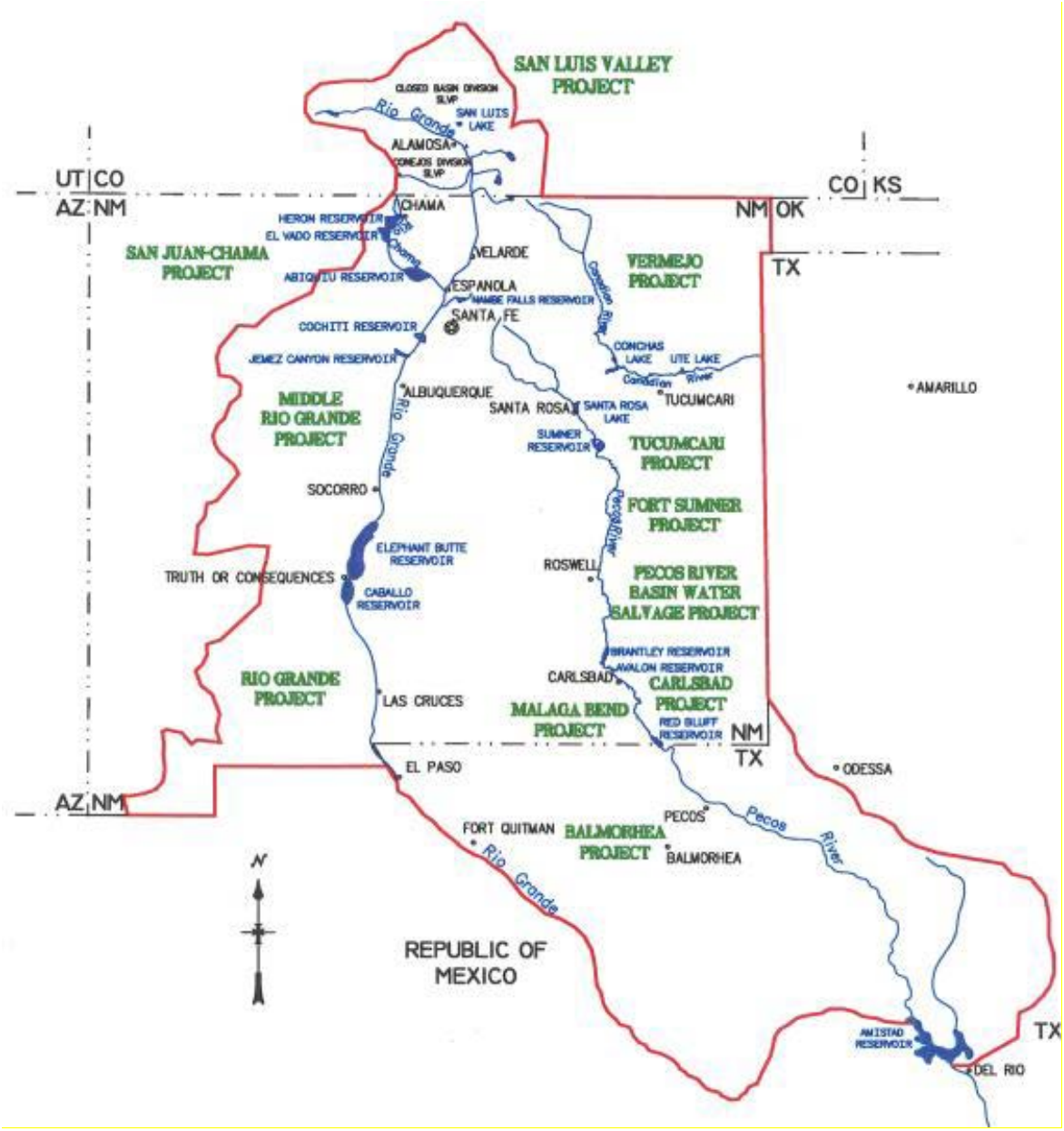

Figure 1: Project Map of Reclamation's Albuquerque Area Office

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, 2016, with a water surface elevation of 9,970.02 feet and a storage volume of 13,238 acre-feet (ac-ft). The December 31, 2016, reservoir elevation was 9,974.46 feet, with a storage volume of 15,371 ac-ft. The minimum storage during calendar year 2016 occurred on January 1, 2016. Maximum storage occurred on June 21, 2016, when the reservoir peaked at elevation 9,997.77 feet (29,298 ac-ft). There was 1,251 ac-ft water stored in Platoro Reservoir while under the Rio Grande Compact's Article VII restrictions during calendar year 2016. All of this water was converted to Conejos Project water, according to a 2013 relinquishment agreement with Texas.

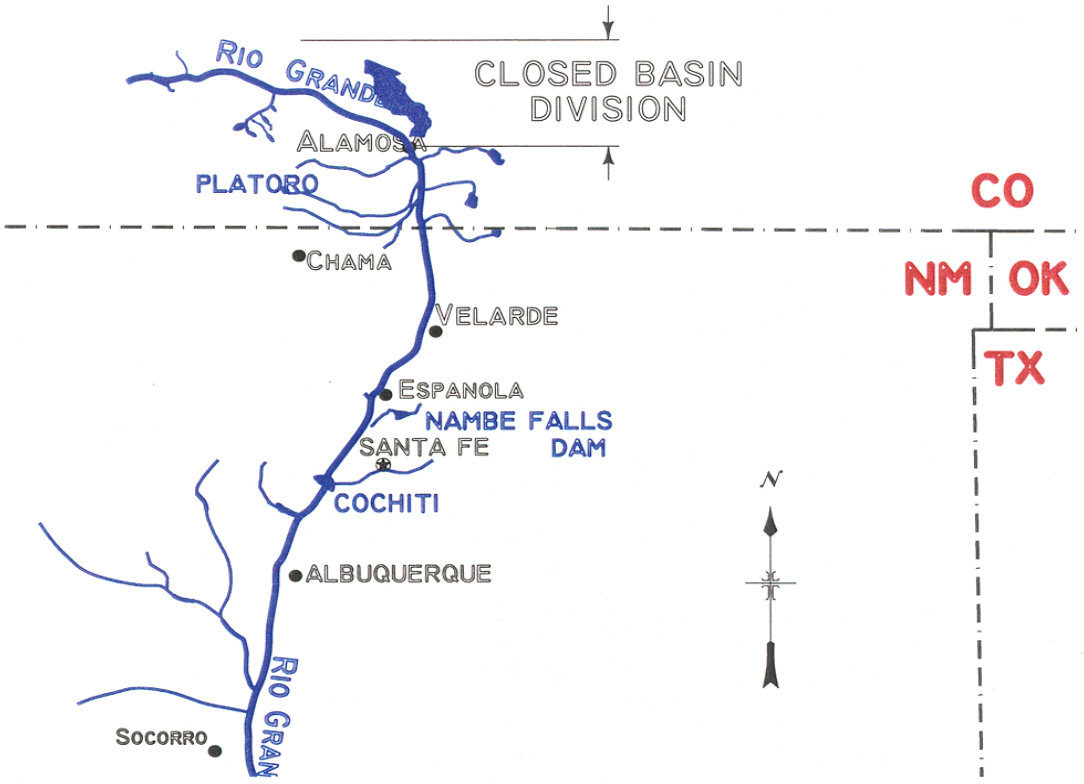

Figure 2: Area Map of San Luis Valley Project

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) 2016, there were two incomplete Category 2 O&M recommendations for Platoro Dam.

A scheduled Annual Site Inspection, Periodic Security Review (PSR) and a Tabletop Exercise were completed in 2016. A Periodic Facility Review (PFR) is scheduled for 2017.

The Facility Review Rating was updated in October 2016. The rating for Platoro increased from a total score of 89 in 2015 to a score of 90. Platoro currently has an overall rating of "Good."

Closed Basin Division

The Closed Basin is a water salvage project constructed in the San Luis Valley within 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) 2016 included deliveries to the Rio Grande, Blanca Wildlife Habitat Area and Alamosa National Wildlife Refuge.

A total of 12,095 ac-ft of Project water was delivered in CY2016. Total deliveries of Compact water to the Rio Grande for CY2016 were 8,469 ac-ft. 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. Table 1 compares Project total production and Compact deliveries in 2016, to quantities in the five preceding calendar years. Total water deliveries to the Bureau of Land Management's (BLM) Blanca Wildlife Habitat Area (BHWA) were 1,027 ac-ft. This included 800 ac-ft for annual mitigation and 227 ac-ft from a water exchange between BLM and Colorado Parks and Wildlife (CPW). Total deliveries to Alamosa National Wildlife Refuge were 2,599 ac-ft, for project mitigation.

Table 1: Closed Basin Project Deliveries 2011-2016

Year	Total Production (ac-ft)	Delivered to Rio Grande (ac-ft)
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
2011	15,167	11,579

Natural inflows to San Luis Lake (SLL) are measured at the SLL inlet flume and culverts. Inflow to SLL during CY2016 totaled 2,630 ac-ft. Closed Basin Division water accounting for the 2016 calendar year is summarized in Table 2.

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

	BLANCA WILDLIFE HABITAT AREA (BWHA)			PARSHALL FLUME		ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR)				DELIVERY TO THE RIO GRANDE			
MONTH	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	PROJECT TOTALS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
JAN				1,000	1,000					1,000	1,000	0	1,000
FEB				1,000	1,000					1,000	1,000	0	1,000
MAR				1,178	1,178	492	369		861	317	317	0	1,178
APR	58	89	147	899	899					899	899	0	1,046
MAY		78	78	910	910					910	910	0	988
JUN		56	56	932	932					932	932	0	988
JUL	98	150	248	803	803	85	92		177	626	626	0	1,051
AUG	115	194	309	776	776	142	252		394	382	382	0	1,085
SEP	79	110	189	769	769	218	247		465	304	304	0	958
OCT				1,006	1,006	330	325		655	351	351	0	1,006
NOV				873	873	33	14		47	826	826	0	873
DEC				922	922					922	922	0	922
ANNUAL	350	677	1,027	11,068	11,068	1,300	1,299	0	2,599	8,469	8,469	0	12,095

Notes: 1. Delivery to BWHA includes 227 ac-ft exchange from Colorado Parks and Wildlife (CPW)
2. Project Total does not include 15 ac-ft delivery through Head Lake Turnout via exchange with CPW

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.

The Alamosa Field Division has been meeting with interested parties (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 to help make the San Luis Lake State Park a viable recreation area. The goal is to coordinate Project

deliveries with natural inflows to improve surrounding habitat while reducing total dissolved solids (TDS) concentrations in San Luis Lake and wetlands. In 2016, 15 ac-ft of Project water was delivered through the Head Lake turnout to the wetlands above Head Lake. This was a water exchange by Colorado Parks and Wildlife.

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 salvage and observation well sites, canal structures, pumping plants, and shelterbelts. Salvage well preventive maintenance tasks were completed for the year. Re-drilling and rehabilitation of salvage wells is an ongoing process. Three salvage wells were re-drilled, 22 wells were rehabilitated and 20 new pumps were installed in 2016.

Two of the re-drilled wells were constructed using glass beads for the filter pack. Although glass beads are much more expensive than a gravel pack, the intent is to inhibit growth of iron bacteria. The filter pack will be easier to rehabilitate due to the uniformity and roundness of the beads which will allow them to move and reposition during redevelopment. The productivity of these wells will be closely monitored to evaluate performance of the filter pack over time.

A new technique of rehabilitation was tested on two wells. This involved the total removal of the old well casing and gravel pack and replacement with new stainless steel casing and new gravel pack into the existing borehole. This appears to be a very 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 without relocating. This well replacement program will continue in 2017 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.

In an effort to extend the productive life of salvage wells, a timer program has been installed in the control of each well. Currently all wells are timed to be off from 2-12 hours per day depending on the location and size of the well, size of the pump, and TDS concentration of the well. With the timer program the wells are being designed with slightly larger capacity pumps. The combination of pumping at a higher output for shorter duration of time is proving to be more energy efficient while extending the productive life of the wells.

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 1,354 samples collected in 2016.

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

The Water Quality Laboratory participated in the Spring USGS Evaluation Program for Standard

Reference Water Samples. The Laboratory continues to perform commendably on these audits.

Rio Grande Water Conservation District

RGWCD continues to perform civil maintenance on the Project through a cooperative agreement with Reclamation. Canal berms, lateral access roads, and right-of-ways were maintained by blading and mowing. Other work included removal of aquatic weeds and sediment from structures and the canal, repair of fences, repair of erosion to berms from large precipitation events, and assisting Reclamation personnel in maintaining equipment. RGWCD continued its involvement in the groundwater monitoring program and continues maintenance of the irrigation systems for shelterbelt areas. RGWCD continues to assist Reclamation in the re-drill and rehabilitation of salvage wells.

San Juan – Chama Project, Colorado – New Mexico

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

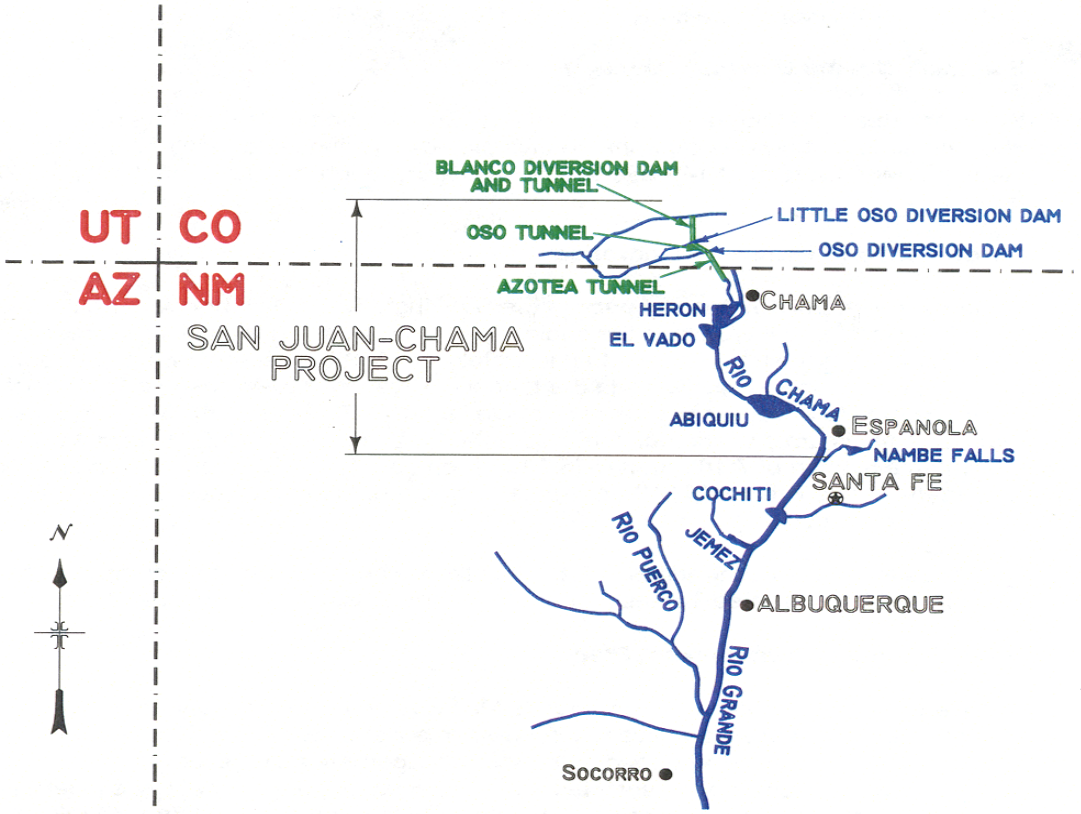

Figure 3: Area Map of the San Juan-Chama Project

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 2016 is provided in the separate 2016 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 January 1, 2016, and continued until October 28. The total volume diverted through the tunnel was 94,309 ac-ft. The running 10-year average of Azotea Tunnel diversions increased slightly this year, from 86,051 ac-ft for the period 2006 through 2015, to 87,602 ac-ft for the period 2007 through 2016 (Table 3).

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

AZOTEA	YEAR										10 YEAR TOTAL
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
JANUARY	0	0	0	0	0	0	0	0	28	109	137
FEBRUARY	179	0	272	0	0	0	0	227	974	1,917	3,569
MARCH	12,976	4,745	5,938	546	2,008	7,014	1,036	1,984	6,890	6,489	49,626
APRIL	17,745	25,816	19,111	21,908	13,570	18,133	7,068	13,808	8,163	13,687	159,009
MAY	33,837	44,461	51,766	35,368	22,315	17,032	16,844	20,251	24,470	27,940	294,284
JUNE	26,679	47,463	23,544	27,249	42,779	4,037	8,387	18,851	38,438	35,427	272,854
JULY	4,302	13,428	4,392	1,815	8,404	670	511	1,550	8,581	3,535	47,188
AUGUST	7,375	2,606	232	1,501	1,594	260	3,115	788	889	3,681	22,041
SEPTEMBER	1,948	1,465	99	712	1,852	76	4,930	902	126	1,271	13,381
OCTOBER	33	0	0	251	4,452	0	2,761	1,334	811	253	9,895
NOVEMBER	0	0	0	53	1,295	0	1,049	335	862	0	3,594
DECEMBER	0	0	0	0	52	0	59	0	334	0	445
ANNUAL	105,074	139,984	105,354	89,404	98,321	47,222	45,760	60,030	90,566	94,309	876,023

Heron Reservoir began the year at an elevation of 7,098.53 feet (68,555 ac-ft), and finished the year at an elevation of 7,096.53 feet (65,748 ac-ft). The low point of the year was reached on December 29, 2016, at an elevation of 7,096.79 feet (65,684 ac-ft). The reservoir peaked at an elevation of 7,128.16 feet (138,456 ac-ft) on July 6, 2016.

Unlike calendar year 2015, an initial allocation was able to be made in January, albeit only 7,000 ac-ft out of the full allocation of 96,200 ac-ft. This also marked the third year where the full allocation was not delivered to the SJ-C Project contractors. Approximately 96% of the allocation was made throughout the year as water became available, an increase from 94% the previous year.

The SJ-C Project contractors' 2016 and waivered 2015 annual allocations were delivered as shown in Table 4, for a total delivery of 88,400 ac-ft. The remaining 2016 allocations are being held in Heron according to waivers. The waivers grant an extension for the delivery date for several contractors into 2017.

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

SJ-C HERON RELEASE / MONTH	MRGCD	SANTA FE	SANTA FE COUNTY	COCHITI	CITY OF ALBUQUERQUE	POJOAQUE UNIT	TAOS	COUNTY OF LOS ALAMOS	CITY OF ESPAÑOLA	TWINING SANITATION	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	2,080	0	0	0	2,080
APRIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,278	0	0	0	5,278
MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUNE	0	3,313	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,261	0	0	0	4,574
JULY	1,882	1,501	0	673	321	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,378
AUGUST	0	0	0	16,967	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,330
SEPTEMBER	0	302	0	25,410	0	0	0	0	149	0	0	55	0	0	0	0	198	0	0	0	26,114
OCTOBER	0	298	2,049	0	0	0	0	0	0	0	0	0	0	0	0	0	3,856	0	0	0	6,203
NOVEMBER	5,245	0	788	0	0	0	0	0	0	11	140	0	0	0	0	0	0	0	0	0	6,184
DECEMBER	14,851	0	824	0	541	0	0	0	0	0	0	0	45	0	0	0	0	0	0	0	16,260
2016 CY TOTAL	21,978	5,414	3,661	43,050	1,225	0	0	0	149	11	140	55	45	0	0	0	12,673	0	0	0	88,400

Table 5 presents actual monthly Heron water operations for the 2016 calendar year.

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

HERON STORAGE / MONTH	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)	(5)	(6)	(7)	(8)	(9)
DEC. 2015						350	68205	68555	7098.53
JANUARY	386	109	45	0	-5	702	68308	69010	7098.80
FEBRUARY	736	1917	43	0	0	1395	70225	71620	7100.32
MARCH	1595	6476	2121	2080	668	869	73953	74822	7100.12
APRIL	722	13660	734	5278	440	857	81894	82751	7106.29
MAY	62	27884	345	0	346	573	109432	110005	7118.18
JUNE	77	35356	1761	4574	1852	-1110	138361	137251	7127.77
JULY	802	3528	83	4378	1952	-391	135559	135168	7127.09
AUGUST	729	3674	348	17330	1199	-11	120705	120694	7122.14
SEPTEMBER	399	1271	66	26114	1113	322	94748	95070	7112.05
OCTOBER	61	253	61	6202	735	321	88064	88385	7109.02
NOVEMBER	55	0	55	6184	205	321	81675	81996	7105.91
DECEMBER	534	0	522	16260	0	342	65414	65748	7096.83
SUB-TOTAL	6,158	94,128	6,184	88,400					
ADJUSTMENT						-350			
ANNUAL		100,286		94,584	8,505	-8	65,756	65,748	

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.

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.

Category 2 O&M recommendation 2013-2-B from the 2013 Comprehensive Review (CR) calls for abandoning the hydraulic piezometer system at Heron, which is no longer functional. The original plan was to backfill the piezometer well with sand, but a thorough review of the O&M Guidelines discouraged this route. In 2016 after the Technical Response Team (TRT) preparation meeting for the Periodic Facility Review (PFR), it was decided to modify the Observation Visual Inspection Checklist (OVIC) and add that the Dam Operator should visit the piezometer well monthly and observe for any leakage or abnormalities. This recommendation will be deleted in the Dam System Information System (DSIS).

The Annual Site Inspection for 2016 only included the Security section due to the scheduled Periodic Facility Review (PFR), which was completed on June 2016. Two Category 2 O&M recommendations were initiated during the PFR, 2016-2-A and 2016-2-B.

The required elevator and weight test inspections were completed in 2016.

The Facility Review Rating (FRR) was updated in September 2016. 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 2016 with a reservoir elevation of 6,822.16 feet (1,493 ac-ft). The reservoir filled and spilled during the year. The maximum elevation for the year was 6,826.92 feet (1,747 ac-ft) on May 13. The reservoir initially filled in early March and remained full until July 7, when irrigation releases began and reservoir storage and elevation started falling. Releases continued through November 1 with no irrigation release happening for most of August due to monsoon activity. The reservoir reached a low point of elevation at 6,808.34 feet (886 ac-ft) on August 2 and ended 2016 at elevation 6,823.75 feet (1,575 ac-ft).

Cyclical operations of Nambé Falls Reservoir consist of non-irrigation season operations 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 6826.6 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.

Last year, there was an error in the calculation for the net effect of Nambe Falls Reservoir to the Rio Grande. The depletion amount to be replaced was 703 ac-ft greater than what was released from Heron Reservoir. A portion of that 703 ac-ft was made up in 2016. The calculated depletion for 2016 was 1,010 ac-ft, but 1,310 ac-ft was released from Heron. With losses factored in, 278 ac-ft was released in 2016 to make up for some of the 703 ac-ft deficit from 2015. More of the deficit will be reduced or eliminated in 2017.

Table 6 includes a summary of Nambé Falls use above Otowi and the Pojoaque Unit return flow

credit used to calculate depletions during 2016 (columns 7 and 8). A summary of 2016 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 MONTH	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
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
JANUARY	0	0	4,146	4,146	-1,443	70	128	19	2,524
FEBRUARY	0	0	4,072	4,072	-1,144	71	98	51	2,810
MARCH	2,080	0	2,403	4,483	-1,400	77	70	24	2,959
APRIL	5,278	1,523	0	3,755	-62	75	42	14	3,591
MAY	0	0	1,584	1,584	1,955	49	35	16	3,472
JUNE	4,574	2,817	0	1,758	2,697	59	25	15	4,385
JULY	4,378	1,885	0	2,493	10,181	141	13	14	12,533
AUGUST	17,330	0	1,275	18,605	-10,270	280	418	108	7,744
SEPTEMBER	26,114	17,030	0	9,084	-2,859	156	36	35	6,069
OCTOBER	6,202	0	2,310	8,512	591	176	33	38	8,932
NOVEMBER	6,184	5,245	0	939	2,087	38	275	40	2,754
DECEMBER	16,268	14,851	0	1,417	1,957	46	236	25	3,117
ANNUAL	88,408	43,351	15,790	60,848	2,290	1,238	1,409	399	60,890

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

NAMBÉ FALLS MONTHLY MONTH	INFLOW	OUTFLOW			RESERVOIR LOSSES	TOTAL OUTFLOW + LOSSES	END OF MONTH	
		BYPASSED	STORAGE RELEASE				CONTENT	ELEVATION
			OPERATIONAL	IRRIGATION				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEC. 2015							1,493	6,822.16
JANUARY	398	270	0	0	0	270	1,621	6,824.61
FEBRUARY	724	626	34	0	1	661	1,684	6,825.79
MARCH	798	724	9	0	15	748	1,734	6,826.70
APRIL	1,076	1,032	0	27	15	1,074	1,736	6,826.73
MAY	1,719	1,677	0	21	20	1,718	1,737	6,826.75
JUNE	1,487	1,450	0	16	21	1,487	1,737	6,826.74
JULY	541	512	0	809	19	1,340	938	6,809.74
AUGUST	672	254	0	52	-1	305	1,305	6,818.33
SEPTEMBER	530	490	0	150	7	647	1,188	6,815.80
OCTOBER	349	310	0	147	8	465	1,072	6,813.09
NOVEMBER	327	50	0	3	6	59	1,340	6,819.06
DECEMBER	287	51	0	0	1	52	1,575	6,823.75
ANNUAL	8,908	7,446	43	1,225	112	8,826	1,575	6,823.75

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 Nambé Falls Dam.

No O&M recommendations were completed during FY 2016.

High sediment inflow from the Pacheco Canyon Fire of 2011 burn scars continues to be a significant O&M concern, but does not currently present any known SOD issues. All three of the O&M recommendations developed during the FY 2013 Comprehensive Review are intended to improve management of the increased inflow of sediment and woody debris. No work on these recommendations has been accomplished. In 2016, Nambé Pueblo completed some work to install debris barricades upstream of the dam on the inflow river of Nambe.

The Facility Review Rating was updated in October 2016. The rating for Nambé Falls Dam decreased from a total score of 93 in 2015 to a score of 85, which gives the facility an overall rating of "Good".

2017 San Juan - Chama Project Outlook

On December 31, 2016, Heron Reservoir had 2,972 ac-ft of SJ-C Project storage. This amount is well below the calculated firm yield of 96,200 ac-ft, and is insufficient for a full annual or even a partial allocation for all contractors prior to the 2017 runoff season. 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."

Heron Reservoir's dead pool, which is water that cannot be drained by gravity through the outlet works, is 1,218 ac-ft. Available Project storage must also cover reservoir evaporation from January 1 until runoff begins in the spring, usually during March. Therefore, contractors were notified on January 15, 2017, that there would be no initial allocation in 2017. Subsequent allocations will be made monthly, beginning in April. They will continue until either a full allocation is received or by December 15.

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.

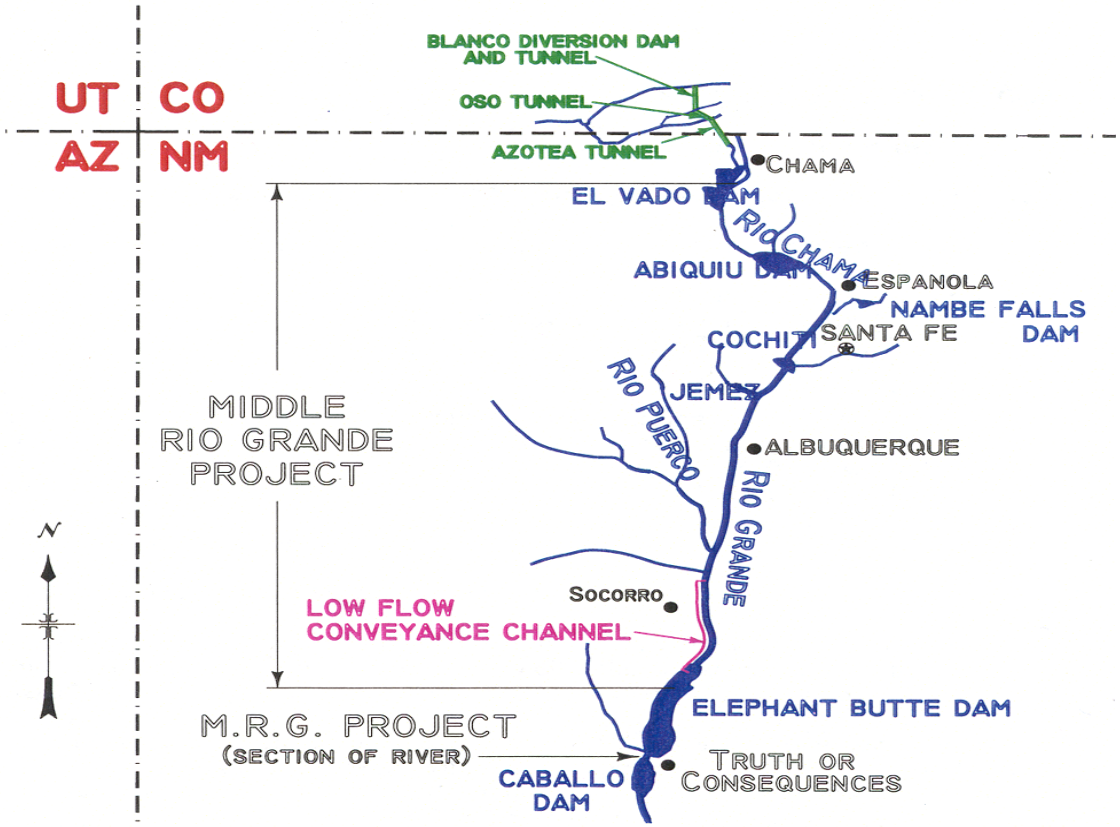

Figure 4: Area Map of the Middle Rio Grande Project

Article VII

Since 2011, the three Rio Grande Compact states have not finalized Compact accounting because they have been unable to reach a consensus on the appropriate accounting method. The Commission has, therefore, maintained multiple accounting sheets since that time. While the Commission determines final Compact accounting, 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.

Per the Rio Grande Compact Article I definition and method 1 accounting, the usable water in Rio Grande Project (RGP) storage (Elephant Butte and Caballo Reservoirs combined) rose above 400,000 ac-ft on February 20, 2016. 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 stored there 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, 2016.

A total of 4,959 ac-ft were stored in El Vado Reservoir for P&P from January 1 to February 20, when Article VII restrictions were lifted. On February 21, 2016, Reclamation began storing native water in El Vado Reservoir for use by the MRGCD. From February 21 to April 15, 34,701 ac-ft of native water were stored for MRGCD.

On April 16, 2016, per accounting method 1, usable water in RGP storage fell below 400,000 ac-ft, and Article VII restrictions came back into effect. Reclamation continued storing native water for use on P&P lands, and stored an additional 7,980 ac-ft from April 16 to 21. The final P&P storage volume determined by the Bureau of Indian Affairs (BIA) was 14,473 ac-ft. This left a deficit of 1,534 ac-ft, so this volume was deducted from MRGCD's native storage. P&P water stored outside of Article VII restrictions reverts to MRGCD after irrigation season. This year, however, the water was released to Elephant Butte, as New Mexico expects to end the year in a Compact debit. From April 22 to May 5, Reclamation stored 23,489 ac-ft of relinquishment credit water (also referred to as Emergency Drought Water (EDW)) on behalf of MRGCD.

On May 6, 2016, storage for release to the Middle Rio Grande Valley under the March 31, 2016 Rio Grande Compact Commission (RGCC) Resolution *Regarding Temporary Modification of Operations at El Vado Reservoir in New Mexico During May and June 2016* began. A volume of 31,593 ac-ft were stored to May 20. Note that a change in the USGS' Rio Chama below El Vado gage data resulted in an increase of 417 ac-ft as compared to the 31,417 ac-ft reported by email to the EAs in June. Because El Vado inflow was high, releases to the Middle Rio Grande began several days earlier, but on May 21 outflow exceeded inflow and all native inflow to El Vado was bypassed beginning on that date. Note that the channel capacity below the downstream Abiquiu Reservoir limits the release from Abiquiu to 1,800 cfs.

All native water stored for MRGCD was released during irrigation season. All native water stored for use on P&P lands was released by December 17, 2016. As of December 31, 2016, no native water was in storage in El Vado.

All daily operations decisions were made using provisional data available at the time of the decision. Because of that, reservoir storage in the final accounting model, which uses final 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 2016 data.

New Mexico Relinquishment of Rio Grande Compact Credit

Reclamation started 2016 with 0 ac-ft of EDW stored in El Vado Reservoir, but there was 1,206 ac-ft of EDW water set aside for the New Mexico Interstate Stream Commission (NMISC). No additional EDW was captured in El Vado Reservoir for the benefit of Reclamation under the 2003 Emergency Drought Water Agreement. Storage for MRGCD was 23,489 ac-ft, all of which was consumed during the year (22,924 ac-ft released, 565 ac-ft evaporative loss).

During the year, 1,138 ac-ft was released for Endangered Species Act (ESA) purposes. This was all of the water set aside for ESA use by the NMISC. At the end of the year, 0 ac-ft of NMISC's EDW remained in storage.

A new Emergency Drought Water Agreement was established in 2016. The balance of EDW available for capture and storage by Reclamation during 2017 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 manage the Emergency Drought Water 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 2016 at an elevation of 6,829.32 feet (36,503 ac-ft), with a low point for the year on February 13, 2016, at 6,827.39 feet (34,255 ac-ft). The reservoir peaked on May 20, 2016, at an elevation of 6,880.62 feet (128,160 ac-ft). The reservoir ended the year at 6,841.38 feet (52,230 ac-ft).

MRGCD began the year with 10,260 ac-ft of native Rio Grande water in storage in El Vado for Middle Valley irrigation, all of which was stored outside of Article VII restrictions in 2015. In 2016, there was also a window of time between February and April during which Article VII restrictions were not in effect. Please refer to the *Article VII* section for more details about Article VII timing. During this time, 33,167 ac-ft was stored for MRGCD.

MRGCD also started 2016 with 17,653 ac-ft of SJ-C Project water in El Vado from the previous year's allocation. There was insufficient project storage in Heron Reservoir to make a full allocation on January 1, 2016, but there was an initial allocation of 1,521 ac-ft. MRGCD's 2016 SJ-C allocation in Heron was 20,096 ac-ft by the end of the year, about 96% of their full allocation of 20,900 ac-ft.

At the end of the year in El Vado, MRGCD had no EDW or general Rio Grande storage, but had 36,899 ac-ft of SJ-C Project storage. In 2016, 23,489 ac-ft of EDW was stored for MRGCD, which was depleted by July 25. (Note: MRGCD had no SJ-C Project water stored in Abiquiu as of December 31, 2016.)

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 moved its 2015 SJ-C allocation out of Heron and into El Vado late in that year. That water was used to maintain winter flows between El Vado and Abiquiu, while allowing native inflows to be captured for P&P storage.

An operation for the benefit of the endangered Rio Grande silvery minnow (silvery minnow) was undertaken in May. A March 2016 resolution signed by the RGCC allowed temporary storage of water in El Vado while under Article VII restrictions. The water had to be released by June 15, and was intended to augment natural flow on the mainstem of the Rio Grande to aid in creating a spawning flow for the benefit of the silvery minnow.

Peak flows at the Embudo gage happened around May 18. Peak storage at El Vado for the operation happened on May 20 when there was 31,593 ac-ft of water in storage available for release. This water was then released over a period of 26 days to maintain flows on the Rio Grande.

During this time a separate but concurrent operation was undertaken to improve overall ecological health on the Rio Chama. A large spike flow of just under 4,000 cfs was released on May 25 for a period of 24 hours. Releases of this magnitude had not been made since 2009. Flows were then dropped dramatically for another 24-hour period, before being increased to normal operating levels. This was done to cause maximum geomorphic work due to sudden changes in bank soil pore pressure.

A total of 14,473 ac-ft was captured and stored for P&P irrigation, with 12,939 ac-ft stored under Article VII restrictions and 1,534 ac-ft stored outside of Article VII restrictions. From July 22 through August 1, 545 ac-ft was released to meet P&P needs during the irrigation season. From November 5 to December 4, 2016, 13,106 ac-ft of unused P&P water was released to Elephant Butte. Loss to evaporation from El Vado Reservoir was 821 ac-ft in 2016. The 1,534 ac-ft stored outside of Article VII restrictions would have reverted to MRGCD's Rio Grande storage at the end of irrigation season, but was instead released with the rest of the P&P water for delivery to Elephant Butte.

El Vado total storage at the end of the year was 52,230 ac-ft, comprised of 1,239 ac-ft of the City of Santa Fe's SJ-C water, 36,899 ac-ft of the MRGCD's SJ-C water, 13,869 ac-ft of the Albuquerque Bernalillo County Water Utility Authority's (ABCWUA) SJ-C water, 132 ac-ft of native Rio Grande, and 91 ac-ft of SJ-C 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		
MONTH	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEC. 2015	5687	4330	42198	1519	101	-4	12098	24405	36503
JANUARY	4902	0	2381	3558	0	0	14031	20891	34922
FEBRUARY	6219	0	1156	4072	0	0	19094	16819	35913
MARCH	15673	2080	159	4483	59	35	34549	14381	48930
APRIL	42316	5278	1739	3755	290	24	74836	15880	90716
MAY	73373	0	58289	1584	432	68	89488	14228	103716
JUNE	24772	4574	32703	1758	492	108	81065	16936	98001
JULY	-2517	4378	29382	2493	387	126	48779	18694	67473
AUGUST	-9254	17330	6530	18605	126	12	32869	17407	50276
SEPTEMBER	-12179	26114	6003	9084	37	103	14650	34335	48985
OCTOBER	2861	6202	4355	8512	24	156	13132	31869	45001
NOVEMBER	2974	6184	10763	939	171	20	5172	37094	42266
DECEMBER	3282	16268	8012	1417	310	-153	132	52098	52230
ANNUAL	152422	88408	161472	60260	2328	499			

El Vado Dam Facility Review and Safety of Dams Programs

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

The hydrologic portion of the CAS is near the end of the feasibility design process. The CAS report was finalized in late October prior to the development of the Dam Sector Analysis Tool (DSAT), which was completed November 2016. In April 2016, a decision by the Upper Colorado Regional Director was made to assign the Provo Area Office (PAO) a project management role in the El Vado Safety of Dams project due to increased AAO workload associated with the Pojoaque Basin Regional Water System project and PAO's experience with Dam Safety Projects.

The environmental and cultural compliance is moving forward and work between PAO and AAO continues. The spillway and embankment need to be recorded by an architectural historian. A Statement of Work is being prepared for a contract to be awarded in 2017.

A physical model of the dam was completed in 2016 and is available to view in Building 56 of the Denver Federal Center.

Recommendation 2013-SOD-A, from the August 2013 CR Report, requires completion of a Risk Analysis to examine static failure modes, particularly due to faceplate defects. This recommendation had been considered to be in the Issue Evaluation stage in previous years, but it will now be reported as a CAS since all work is being funded under the Initiate Safety of Dams

Corrective Action program. Data gathering and analysis for a risk analysis was completed in 2016. A static risk analysis was completed in August 2016 and risks are two orders of magnitude above guidelines. A DSAT is scheduled for January 2017 and will exclude the recommendation to proceed to Corrective Action to address internal erosion through the embankment as a potential failure mode.

In the spring of 2015, the Los Alamos Power Plant (LAPP) started a major project to remove the generator and have it shipped for repairs. They requested to cut the slope on the right side looking upstream of the power plant to allow them to safely load and haul the generator off site. Reclamation granted permission, and in late summer the dam tender noticed that there was a small area on the recently cut slope where the seepage had settled and an area of material sloughed. The dam tender monitors this area on his daily visits to the seepage collection weirs. The LAPP completed the generator rewind and turbine rehabilitation project in November and December of 2015 and requested that Reclamation operate the reservoir to meet certain reservoir elevations needed to test the turbine. In the spring of 2016 the LAPP in coordination with Reclamation conducted testing to recommission their unit.

The required elevator weight test and inspections were completed in the spring of 2016.

A Periodic Security Review was completed on the 1st quarter of FY 2016; no major issues were identified.

The scheduled Periodic Facility Review (PFR) was completed in June of 2016. Two category 2 O&M recommendations were initiated 2016-2-A and 2016-2-B.

In October of 2016 a special inspection of the upstream faceplate was completed; each vertical seam of the plates was inspected; no major cracks were identified; but there was a series of smaller cracks throughout the plates that will need to be repaired.

There are currently two incomplete SOD recommendations and eleven incomplete Category 2 O&M recommendations for El Vado Dam.

The FRR was updated in September 2016. The rating for El Vado remained the same as 2015'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 water in storage in Abiquiu Reservoir peaked on March 31 at 132,701 ac-ft. Abiquiu ended 2016 with 117,722 ac-ft of SJ-C water in storage. Table 9 provides a summary of monthly operations and water accounting for Abiquiu Reservoir.

During 2016, 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, 21,020 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). This does not include water released from El Vado under the EDW Agreement nor water released on behalf of Audubon New Mexico.

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

ABIQUIU RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT			
MONTH	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	SEDIMENT	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DEC. 2015	45981	1359	45663	6593	0	-7	295	266	129972	130533
JANUARY	2144	4052	1814	2609	1	74	295	595	131335	132225
FEBRUARY	4429	3981	5020	2836	4	349	296	-1	132130	132425
MARCH	2089	4588	1663	3189	1	828	296	425	132701	133422
APRIL	6845	3638	7267	3576	3	868	297	0	131895	132192
MAY	63108	1643	44900	3598	90	1389	411	18118	128550	147079
JUNE	39406	1738	57336	4435	131	1743	452	57	124110	124619
JULY	39204	2377	39074	12558	17	2042	486	170	111888	112544
AUGUST	28037	17689	28209	7418	0	470	523	-2	121689	122210
SEPTEMBER	22972	9084	22973	6225	0	955	541	-3	123592	124130
OCTOBER	4828	8667	4827	9258	0	1139	543	0	121862	122405
NOVEMBER	11081	1030	11083	3117	0	149	544	0	119627	120171
DECEMBER	9208	1540	9180	3497	0	-52	545	100	117722	118367
ANNUAL	233,351	60,027	233,346	62,316	247	9,954				

Cooperative Programs with the State of New Mexico

In September 2012, a new 5-year Cooperative Agreement (R13CF40001) was executed between the NMISC and Reclamation (State Co-op). The Agreement provides funding for joint benefit: water salvage work on the Middle Rio Grande Project. This work currently includes Delta Channel maintenance and other 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. In December 2014, Reclamation finalized consultation with the USFWS and issued a Biological Opinion for Delta Channel maintenance activities. The Delta Channel maintenance is covered under the December 2, 2016 Biological Opinion and therefore the December 2014 Biological Opinion is superseded.

The maintenance work performed along the Delta Channel in 2016 extended from River Mile (RM) 47.5 upstream to approximately RM 52. Maintenance of the Delta Channel was conducted by NMISC’s contractor beginning January 15, 2016 through March 16, 2016. Maintenance work included: in-channel excavation, sandbar devegetation, and road grading.

Photo 1: Nogal Canyon berm maintenance

Lower San Juan Riverside Drain Vegetation Removal

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

Irrigation Drain Improvements

The following work was accomplished in 2016 by the Reclamation Socorro Field Division.

LFCC Vegetation Removal: The purpose of the work on the LFCC is to improve wasteway flow conveyance and water salvage capabilities, improve maintenance access, and reduce potential safety risks to the general public and maintenance crews. Maintenance consisted of removing large vegetation and normal mowing operations. Photo 2 depicts LFCC channel cleaning and/or vegetation removal. The main section of focus was between Ft Craig and RM60.

Photo 2: LFCC Vegetation removal at Ft Craig powerlines crossing (April 2016)

Drain Unit 7 Extension (DU7X): The purpose of the wok on the DU7X is the same as LFCC. Maintenance consisted of removing large vegetation and normal mowing activities. Photo 3 shows DU7X channel cleaning and/or vegetation removal. The work was completed between San Acacia Diversion Dam and extended 10 miles to the north to the private property boundary.

Photo 3: Drain Unit 7 Extension vegetation removal near Rio Salado

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. The realized 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 cycles of each of the project's intended design life.

River Maintenance Sites

Reclamation is pursuing work at 16 sites and/or reaches along the Middle Rio Grande Project area. Of the active sites, six require an annual review of channel capacity and possible maintenance due to sediment accumulation. In 2016, Reclamation completed work at Truchas Arroyo, Santa Ana River Mile (RM) 205.8, and pre-emergency repair at the Corrales Siphon crossing. During the 2016 spring runoff, eastern bankline erosion occurred at the completed 2008 Sandia Pueblo Priority site located about 2-miles downstream of U.S. Hwy. 550 crossing near Bernalillo, New Mexico. Plans for repair work at this location before the 2017 spring

runoff are underway. Work at the exposed Corrales Siphon involved temporary river bed and bankline protection to reduce the vulnerability of the siphon to damages by river flows. Technical staff worked with MRGCD to resolve this matter for the short-term. Repair work was also performed in 2016 at Santa Ana Pueblo to safeguard the levee system at the RM 205.8 site. In collaboration with NMISC, work continues through the Delta Channel to maintain a 20-mile temporary channel into the reservoir pool for effective water delivery. Recent regional drought conditions have lowered reservoir pool elevations to historic lows. 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 evaluation, 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 narrative, the terms "new", "existing", and "adaptive" are used to describe the various river maintenance sites 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.

Truchas Arroyo (Existing Maintenance Site)

A project was initiated for Truchas Arroyo confluence that involved two phases. The first phase was excavation of the sediment deposit at the arroyo confluence to restore the channel capacity. The second phase involves repairing a gap in the dike system and the replacement of a culvert that was used for cross drainage for agricultural lands.

The first phase of the project was completed in April 2015 with 4,000 cubic yards of sediment removed from the arroyo confluence. The second phase of the project occurred in February 2016. The components of the second phase included backfilling the gap in the dike with 45 cubic yards of materials delivered to the site from a contractor and placing a 2-foot diameter culvert with a flap gate as cross drainage.

Photos 4 & 5: Dike backfill and placement of a culvert with a flap gate in the dike (Bui, February 2016)

Estaca Arroyo (New Maintenance Site)

In September 2016, two landowners in the Estaca area contacted Reclamation to report some damage to a riverside dike along the Rio Grande of the Española reach. The breach in the west riverside dike was thought to be the result of a monsoonal event that occurred in August 2016 involving a localized thunderstorm event of 3-inch rainfall in 3-hours. The location of the riverside dike breach is approximately 2 miles downstream of the El Guique Diversion Dam.

The Estaca Arroyo historically was connected and discharged directly into the Rio Grande prior to the 1950s. Between 1955 and 1957, channelization work occurred in the Velarde Reach involving the riverside dikes along the Rio Grande. There are three arroyos in the vicinity of the Estaca area including the Estaca Arroyo, the Lopez Arroyo, and the Borrego Arroyo. They all experienced arroyo drainage problems due to the presence of the riverside dikes after strong monsoonal events on the arroyos.

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

Following the September 2016 call, the River Analysis Group visited the site to assess the breach. From this site visit, it was concluded that the breach was man-made to release water ponding caused by the 3-inch, 3-hour, monsoonal event in August 2016.

In response to flooding concerns in the Estaca community, Reclamation is currently working with the local landowners, the Upper Rio Grande Watershed District, and the County of Rio Arriba to cooperate on addressing the river maintenance needs and arroyo drainage problems.

San Ildefonso Pond (Adaptive Maintenance Site)

This river maintenance site is located at RM 259. In spring 2007, Reclamation's Socorro Field Division constructed a river maintenance project to provide protection for the San Ildefonso fishing pond. During the spring runoff of 2009, the channel eroded through a line of dense vegetation planted as part of the project. A longer-term solution that provided protection through the bend was completed in 2014. The long-term project also 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 occurred to replace the cottonwood trees that did not survive re-vegetation efforts during the 2014 construction. Revegetation efforts are planned for 2017 as well, since the 2016 survival rate, while higher than in 2014, was still only slightly above 30%.

Peralta Arroyo (Adaptive Maintenance Site)

The confluence of the Peralta Arroyo and the Rio Grande is located about 2.7 miles downstream of Cochiti Dam, within the Pueblo de Cochiti. The Peralta Arroyo watershed burned in the 2011 Las Conchas fire, affecting the stability of the slopes on the upper watershed, which has led to an increase in soil erosion. An intense rainfall-runoff event in 2013 occurred on the Peralta Arroyo that completely blocked the main river channel with sediment. Reclamation, USACE, and the Pueblo de Cochiti worked to develop a project to rectify the limited channel capacity in the Rio Grande caused by the sediment block. The project involved excavation of a pilot channel through the sediment block and augmentation of natural flow paths on the eastern terrace. The goals of the project were to reduce the time needed for the river to respond naturally to the

sediment block and to provide a minimum channel capacity of 5,000 cfs. The pilot channel was completed in fall of 2013. The augmentation of natural flow paths on the eastern terrace was completed in the spring of 2014. Reclamation is currently waiting on the Pueblo de Cochiti to pursue a Public Law 93 - 638 Native American Self-Determination Act grant (PL 93-638) to facilitate planting, monitoring, and maintenance of vegetation on the eastern terrace. The site was visited during the 2016 spring snow-melt runoff season and is still functioning as designed.

Photo 6: Peralta Arroyo flow augmentation paths on the eastern terrace (AuBuchon, June 2016)

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 currently in or at the construction phase of planning. The remaining three sites are RM 211.3, RM 212.8, and RM 214.4. Construction at RM 211.3 began in the fall of 2015 and was partially completed by March 2016. The work at this site involved a longitudinal fill stone toe protection (LFSTP). Work was put on hold by the Pueblo of San Felipe in March 2016 to facilitate a review of impacts to vegetation of traditional or medicinal value. Work is currently pending permission by the Pueblo of San Felipe to resume construction work.

Photo 7: Installation of LFSTP at RM 211.3 (AuBuchon, February 2016)

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. A project consisting of nine bendway weirs and the creation of a low elevation floodplain was completed 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 occurred at the site that threatened the integrity of the project. An interim, adaptive management solution was completed in January 2016 to provide protection while a longer-term solution was investigated. The longer-term investigation includes looking at the specific hydraulic and geomorphic conditions leading to the unexpected bank erosion. This investigation may result in the recommendation of additional adaptive management steps as part of a permanent repair project. Reclamation, the Pueblo of Santa Ana, and the University of New Mexico are in the second 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 endangered Rio Grande silvery minnow.

Photo 8: Santa Ana RM 205.8, looking upstream at exposed bendway weirs (AuBuchon, October 2016)

River Mile 201 to Montaño Reach Planning (New Maintenance Site)

In 2014, Reclamation identified the stretch of the Rio Grande from RM 201 to Montaño Breach for hydraulic and geomorphic assessment. The objective of this reach planning was to analyze the current geomorphic and hydraulic trends and then identify potential river projects that minimize the need for river maintenance action and/or have habitat creation/rehabilitation value. A hydraulic model for this reach was updated with 2015 hydrographic data. During the 2016 spring runoff, the total load measurement at the entrance and exit cross sections of the reach were collected. Analyses of total loads are underway by Reclamation's hydrographic data collection contractor. The hydraulic and geomorphic report have a due date in September 2017.

Sandia Priority Site Bendway Weir Repairs (New Maintenance Site)

Reclamation constructed the Sandia Priority Site in 2008 in collaboration with the Pueblo of Sandia as there was a concern that the river approached the eastern levee. Reclamation had previously considered the Sandia Priority Site as a completed river maintenance project and moved to the Adaptive Management and Monitoring phase. Post project geomorphic monitoring such as cross section data collection around the project site, aerial flights along the Rio Grande, longitudinal profile data collection of the Rio Grande have been performed at this project site since 2008 as part of the Adaptive Management activities. During a river reconnaissance float trip in 2012, it was noticed that scalloping between bendway weirs at the Sandia Priority Site had occurred between river cross section rangelines BB-314 and BB-315. It was also observed that the river within this project site appeared to have incised (experienced bed lowering) since the completion of the project in 2008.

In January 2016, the Bosque Project Manager of the Pueblo of Sandia, contacted Reclamation regarding new erosion (scalloping areas) along the east bankline of the Sandia Priority Site. After a site visit with the Pueblo to the erosion area on February 3, 2016, with the Pueblo's permission, the River Analysis Group of Reclamation conducted weekly monitoring of the bankline erosion. This monitoring was performed during the 2016 spring runoff to ensure the bankline erosion did

not progress past the tie-in features (keys) of the 2008 bendway weirs at the erosion site. The 2016 spring runoff monitoring showed that the left and right banklines had eroded approximately 30-40 feet. Reclamation presented the monitoring results to the Pueblo's tribal council in October 2016, and got their approval for the repair of the bendway weirs that will occur in March-April 2017.

The Sandia Pueblo bendway weir temporary repairs require a continuous buried rock protection with two keys and four tie-backs placed behind the eroding left bankline. It is expected that 3,800 cubic yards of riprap of 24-inch nominal size will be used for the repair. Construction of the buried rock protection for the Sandia Pueblo Bendway Weir Repairs occurs only in the dry area on the left floodplain.

The dimensions of the buried rock protection for the interim repairs:

- Length of continuous bankline protection: 660 feet
- Length of the upstream key: 280 feet
- Length of the downstream key: 220 feet
- Length of each tie-back: 70 feet
- Top and bottom width of buried rock: 8 feet
- Height of buried rock: 8 feet
- Top elevation of buried rock: 5,045 feet, approximately at 5,000-cfs WSE
- Side slope of buried rock: 1.5 horizontal: 1.0 vertical (1.5H:1V)
- Riprap loading: 2.5 cubic yards/linear foot
- Riprap size: 24-in diameter nominal

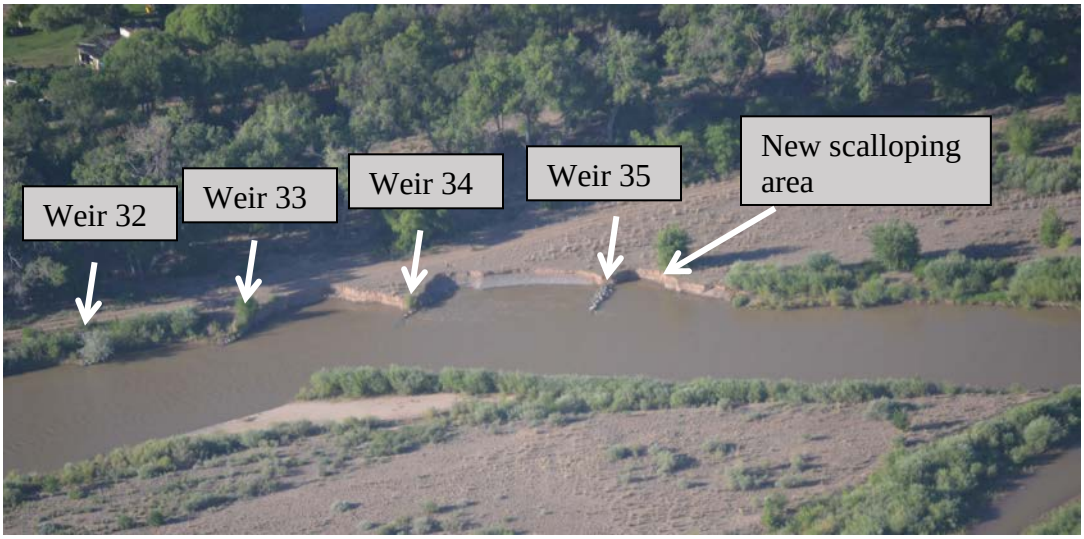

Photo 9: Aerial view of scalloping between Sandia Bendway Weirs (Padilla, July 2016)

Corrales Siphon (New Maintenance Site)

The Corrales Siphon is located in Corrales, New Mexico just north of Albuquerque. It is located within the Rio Grande at River Mile 199.7 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 a prior river reconnaissance float trip in 2012 by Reclamation, it was discovered that degradation was occurring in the area, exposing the siphon and subjecting it to the direct forces of the water. MRGCD raised concerns over the site

and condition assessments were performed to determine a solution. MRGCD requested emergency technical assistance and construction support from Reclamation to temporarily protect the siphon for the 2016 spring runoff high flows.

Reclamation and MRGCD collaborated on a short-term project that would involve the placement of riprap material 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 for a width of about 75 feet across the river channel from the bankline toe. The short-term work also involved the placement of riprap material upstream and downstream of the siphon along the western bankline. This bank protection on the west side of the river involved placing approximately 3 cubic yards per linear foot both upstream and downstream of the siphon for lengths of approximately 100 feet. Riprap key trenches were also placed at the end of the 100 foot bankline protection at a 30-degree angle for a width of 21.5 feet and a depth of 5.8 feet for flanking protection. The volume of riprap placed for the project was approximately 1,800 cubic yards. MRGCD has shared that they are planning a long-term project at this location to repair the wooden stave pipe siphon and address the continued threat to the siphon from future river bed erosion/degradation given the short-term nature of this temporary protection.

Isleta to San Acacia Reach Planning (New Maintenance Site)

In 2014, Reclamation identified the stretch of the Rio Grande from the Isleta Diversion Dam to the San Acacia Diversion Dam for additional investigation work. The objective of this reach planning was to analyze the current geomorphic and hydraulic trends and identify potential river projects that minimize the need for river maintenance action and/or have habitat creation value. The geomorphic and hydraulic analyses are underway, with a summary report anticipated to be completed in 2017.

Arroyo de las Cañas Reach Planning (Existing and New Maintenance Site)

The Arroyo de las Cañas site is located upstream of the Arroyo de las Cañas confluence, between River Mile 96 and 95. The Rio Grande is close to the western 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 at this location. 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 in the event that spring snow-melt monitoring of the bankline indicated a potential failure. In the summer of 2016, the USACE began a levee construction project adjacent to the Arroyo de las Cañas site. Reclamation plans to evaluate the need for additional maintenance work and the exploration of habitat creation potential in 2017. The evaluation area for this work would occur on the Rio Grande between the confluence with Arroyo de la Presilla and about two miles upstream of the U.S. Highway 380 Bridge.

Photo 10: Bank erosion at the Arroyo de las Cañas and Rio Grande confluence (AuBuchon, July 2016)

Bosque del Apache Sediment Plug (Existing Maintenance Site)

During the 2008 spring runoff, a sediment plug formed in the main channel of the Rio Grande at RM 81 located within the Bosque del Apache National Wildlife Refuge (BDANWR). Reclamation and the NMISC partnered to construct a 25-foot-wide pilot channel in October 2008. In 2014, a multi-agency project team consisting of Reclamation, BDANWR, the USFWS State Ecological Services office, and the USACE began to pursue an east realignment strategy for addressing the ecological and engineering concerns affecting the Rio Grande near where the 2008 sediment plug formed. The overall realignment project will involve realignment of two river segments about 4.5 miles and 2.6 miles in length. A 30% design has been developed to date, including sediment transport modeling. Compliance and final designs of a pilot project (termed the BDA Pilot Realignment Project) are being pursued in 2017, with the goal of a 2018 construction start date. The BDA Pilot Realignment Project will focus on the downstream (2.6-mile) section of the overall realignment project, which would address the concerns associated with a sediment plug occurrence at the 2008 location. The BDA Pilot Realignment Project would also provide an opportunity for investigating the channel and habitat development response for an eastern realignment that may help improve the functionality of the upstream portion of the overall realignment project.

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 involves effectively and safely passing the mean annual peak flow – a 2-year flood or 7,700 cfs – through the reach. The maintenance design criteria of the Delta Channel used in the analysis was effectively conveying 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 but was not received until

late in the year. A one dimensional hydraulic model is in the process of being updated with the 2016 data. No results from the 2016 hydraulic model are available at the time of this report.

An air boat inspection of the Delta Channel occurred in early January 2017 with Reclamation and NMISC staff. Maintenance work on the Delta Channel is planned to start in January 2017 or a duration of 2 months. NMISC's contractor is planning to work on the access roads and vegetation mowing at the same time in the vicinity of Nogal Canyon.

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. A temporary solution to the erosion problem at Fort Craig was the design and placement of a rock windrow on the west bank of the river in 2012 where erosion at the toe of the bank occurred. A site visit to the Fort Craig and RM 60 occurred on January 10, 2017. The windrow on the west bank at Fort Craig has not launched into the channel though scour at the toe of the bank has occurred.

A multi-disciplinary project team is being established to develop and evaluate alternatives to reduce maintenance frequency, increase water salvage, and enhance wildlife habitat. The project team decided to combine Fort Craig Bend and RM 60 into one comprehensive project because the two sites are close to each other. Work on the project is pending staffing availability and further scoping with stakeholders.

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 in 2016 involved sediment removal at the mouth of three major tributaries (Mescal, Cuchillo Negro, and Hondo) and minor locations throughout the reach. During periods of non-release, Reclamation installs a dike in the river to check up the water surface elevation to increase the alluvial groundwater levels for the benefit of the artesian hot spring bathhouse owners in Truth or Consequences. A regional permit was obtained to extend Reclamation's Clean Water Act compliance through 2017, facilitating annual maintenance responsibilities in this reach of the Rio Grande. The regional permit will be renewed in 2017 for another 5-year period.


Photo 11: Sediment to be removed at mouth of Mescal Arroyo (AuBuchon, November 2016)

Mescal Arroyo Planning (Adaptive Maintenance)

Mescal Arroyo is a tributary to the Rio Grande within the Truth or Consequences reach. Because of its proximity to Elephant Butte Dam (~ 2 miles downstream) excessive sediment deposition at the confluence can create channel capacity concerns that influence water operations and power generation. Geomorphic and hydraulic modeling analyses of this watershed led to the formation of a multi-disciplinary team within Reclamation to assess potential options at the Mescal and Rio Grande confluence that would minimize the maintenance need. The team formulated potential alternatives in 2016 and is in the process of evaluating those alternatives currently. A final alternative analysis report, along with the selection of a preferred alternative are expected to be completed in 2017.


Photo 12: Rio Grande, looking upstream, at Mescal Arroyo confluence showing effects of a monsoonal event (AuBuchon, November 2016)

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 RM 201 (near Rio Rancho and Corrales) to Montaño Bridge and Isleta downstream to Elephant Butte. This lower reach has been identified as a high priority reach for habitat restoration and meeting ecological goals. A report entitled "Lower Reach Conditions and Strategies" was completed in July 2015 for this reach. This document provides a geomorphic overview, a habitat suitability assessment, and a review of the viable river maintenance and habitat restoration strategies for Isleta Diversion Dam to Elephant Butte Reservoir reach.

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.

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 compliments the approaches in the long-term Plan and Guide and the current 2015/16 Middle Rio Grande Biological Assessment & Opinion for River Maintenance Actions.

Endangered Species

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

On March 17, 2003, the USFWS issued the 2003 Biological Opinion (BiOp) on the effects of actions associated with the Programmatic Biological Assessment (BA) of Bureau of Reclamation's Water and River Maintenance Operations, U.S. Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande, New Mexico for March 10, 2003 through February 28, 2013. The 2003 BiOp contained a Reasonable and Prudent Alternative (RPA) designed to alleviate jeopardy to the silvery minnow, adverse modification to silvery minnow critical habitat, and jeopardy to the Southwestern willow flycatcher (flycatcher) based on the biological needs of the species. The RPA elements address some of the long-term needs of the silvery minnow by incorporating four essential factors during the 10-year scope of the project: 1) water operations, 2) habitat improvement, 3) population management, and 4) water quality. The water operations elements establish flow requirements under different hydrologic scenarios that are needed to alleviate jeopardy to both species.

For the 2016 irrigation season, the USFWS decided that dry year flow requirements would be in effect, with anticipated incidental take calculated to be mortality of 1,109 silvery minnows. Despite early predictions of an El Niño winter, snowfall was limited and the Rio Grande was experiencing a sixth consecutive year of drought with the prospect of limited minnow recruitment in the spring. Reclamation worked with the Collaborative Program's Minnow Action Team (MAT), as in 2013, 2014, and 2015 to develop a water operations plan to best utilize the available water for endangered species purposes and water users' needs. However, some late snows arrived, and water managers stored additional water due to a 2016 Rio Grande Compact Commission resolution and augmented natural flows in May, resulting in a moderate runoff with an estimated 5,800 acres of inundated minnow habitat.

Reclamation remained in compliance with the 2003 BiOp throughout 2016. The summer monsoon did not occur in July; however, the river remained continuous until July 13, well past the June 15 requirement in the 2003 BiOp. The summer monsoons returned in August. River drying occurred in the San Acacia Reach from July 13 through November 1 (when monitoring ceased), with periodic rewetting due to monsoons. River drying occurred in the Isleta Reach from August 31 through October 30, with periodic rewetting due to monsoons. The pumps at the south boundary of the Bosque del Apache National Wildlife Refuge (BDANWR) were used between July 11 and November 2. The pumps at the north boundary of BDANWR were only used July 11-13. Refer to the LFCC pumping section for cumulative volumes for 2016 at each of the sites. Reclamation released a total of 21,020 ac-ft of supplemental water in 2016.

The USFWS provided a draft 2016 Salvage Report on November 30, 2016. Between July 13 and September 21, 2016, the USFWS's New Mexico Fish and Wildlife Conservation Office (with assistance from Reclamation) conducted rescue and salvage activities on 28.6 unique miles of the Rio Grande, as compared to 17.4 miles in 2015. Of this, 19.7 unique miles were salvaged in the San Acacia Reach on 10 days from the south boundary of the BDANWR to about two miles downstream of Brown's Arroyo near Socorro. In the Isleta Reach, rescue and salvage occurred on 10 days within 8.9 unique miles from downstream of the Peralta Wasteway outfall to the Los Lunas bridge.

Of the 29,222 Rio Grande silvery minnow found in isolated pools, 15,282 were found alive. Of these, 13,986 were transported and released alive in continuous segments of the river within the same reach. Of the 15,282 minnows found alive, 15,137 were young of year (YOY) 10,351 of the YOY were greater than 30 millimeters (mm) standard length (SL). There were 742 silvery minnow greater than 30 mm SL found dead after June 15, identified as incidental take under the 2003 BiOp. In addition, an estimated 10,000 to 20,000 RGSM were found dead and counted towards the USFWS permit. Also, an additional 1,294 RGSM died during transport and were counted toward the USFWS permit. These mortalities do not count towards incidental take of silvery minnow greater than 30 mm SL under the 2003 BiOp. Of the 15,282 silvery minnow found alive in 2016, nearly all were naturally spawned, and 63 (0.4%) were marked (VIE), indicating that they were hatchery-released individuals.

Formal ESA Section 7 consultation was reinitiated by the USFWS on February 22, 2013, prior to the end of the term of the 2003 BiOp, providing continued Federal and non-Federal coverage in 2016 in accordance with the terms of the 2003 BiOp. The USFWS issued a new final Biological and Conference Opinion for Reclamation, BIA, and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande on December 2, 2016.

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 2016 was notably higher than October estimates during recent years of monitoring (Dudley and Platania 2016a; Figure 5). During October 2016, a total of 584 silvery minnow were collected. The species was present at 18 of 20 monitoring sites, was the second most common fish species collected, and was collected in 114 of 284 seine hauls that yielded fish (Dudley and Platania 2016a). All silvery minnow collected in October 2016 were unmarked and presumably naturally spawned fish. The results from October 2016 monitoring suggest that spring runoff flows during this year were of sufficient duration and magnitude for successful silvery minnow spawning and recruitment.

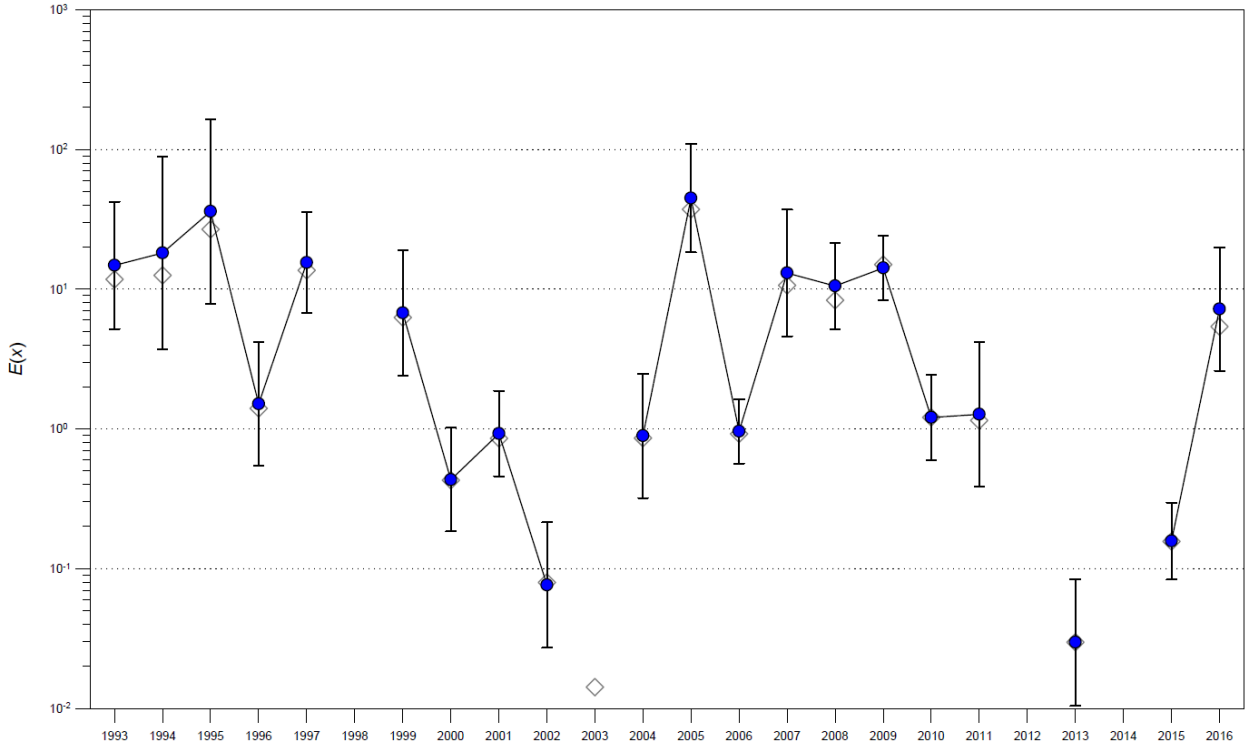

Figure 5: October silvery minnow density estimates (E(x)) for 1993–2016 from American Southwest Ichthyological Researchers. Solid circles indicate estimates, and bars represent 95% confidence intervals.

Silvery minnow CPUE increased in December 2016 relative to October 2016 and was much higher during this year than in December collections taken during recent years (Dudley and Platania 2016b). During December 2016, silvery minnow was present at 19 of 20 monitoring sites, was the most common species collected, and was present in 170 of 220 seine hauls that yielded fish (Dudley and Platania 2016b). A total of 1,061 silvery minnow were collected in December 2016. Of this total, 1,039 were unmarked naturally spawned fish, while 22 fish were marked and of hatchery origin.

Reclamation conducted two periods of Rio Grande fish monitoring during 2016 associated with Reclamation projects. The winter electrofishing survey was carried out from February 16–22, 2016. Surveys were conducted at sites between Bernalillo and the Delta Channel, below the confluence of the Low Flow Conveyance Channel. A total of 314 silvery minnows were captured during February 2016 monitoring. The majority (268) of these silvery minnow were unmarked and presumably naturally spawned. Reclamation's fall surveys were conducted October 24–26, 2016, using seine nets within the Delta Channel in the Elephant Butte Reservoir pool, from the confluence of the Low Flow Conveyance Channel downstream to just above the reservoir pool near the Monticello Boat Ramp. Seventy-two unmarked silvery minnows were captured in the Delta Channel in 2016. No tagged minnows 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 2016, October CPUE for the species was higher than in recent years, requiring stocking of fewer fish. Middle Rio Grande releases of silvery minnow in 2016 occurred as follows: 1) 20,888 VIE-marked released in the Angostura Reach[1]; 2) 2,000 VIE-marked released in the Isleta Reach[2]; and 3) 43,000 VIE-marked released in the San Acacia Reach[3].

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 2016, 410,931 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.

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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.

[1] Angostura Reach releases in 2016 were comprised of pink left dorsal (n=10,880), and green left dorsal (n=10,000) VIE tags.

[2] Isleta Reach releases in 2016 were comprised of green left dorsal (n=2,000) VIE tags.

[3] San Acacia Reach releases in 2016 were comprised of green left dorsal (n=43,000) VIE tags.

Southwestern Willow Flycatcher

The flycatcher (*Empidonax traillii extimus* – SWFL) was listed as endangered by the USFWS effective March 29, 1995. Critical habitat was designated, effective August 21, 1997, in some areas of New Mexico and other states throughout the species' range. The Rio Grande was not designated as critical habitat for the flycatcher at that time. The 1997 critical habitat proposal was later retracted. On October 13, 2004, under court order, the USFWS reissued a proposed designation for critical habitat for the flycatcher that included portions of the Rio Grande in New Mexico. The USFWS released a new proposal for critical habitat in August 2011 because of a lawsuit by the Center of Biological Diversity over the 2005 critical habitat designation. On January 3, 2013, once again, a final designation was published.

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.

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

During the summer of 2016, Reclamation conducted surveys and nest monitoring of the flycatcher in ten distinct reaches along approximately 400 kilometers (250 miles) of the Rio Grande in New Mexico, mainly between the southern boundary of the Isleta Pueblo and Elephant Butte Reservoir (Table 10). Other areas surveyed include a 6-mile stretch just 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. In 2015, there were 663 resident flycatchers documented in 389 territories and forming 274 breeding pairs. 2016 surveys documented 668 resident SWFLs; these comprised 401 territories of which 267 were pairs and 134 were unpaired or of undetermined breeding status. As in previous years, the San Marcial Reach of the river was by far the most productive, containing 511 resident flycatchers and 302 territories (of which 209 were pairs).

Table 10: Southwestern Willow Flycatcher Territories – Middle Rio Grande Project, 2000 - 2016 Breeding Seasons (N/S = Not Surveyed)

Year/ Location	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Frijoles	0	0	0	1	0	2	N/S	1	1	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Belen	20	17	18	23	14	9	6	3	4	10	1	4	0	N/S	1	N/S	N/S
Sevilleta	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	1	2	0	0	0	0	0	0	0	0
Escondida	5	7	4	8	23	8	4	0	1	0	1	0	0	0	4	0	0
BDANWR	14	11	23	27	51	49	34	20	5	7	4	0	1	3	3	0	0
Tiffany	5	1	8	4	1	4	5	5	8	4	9	3	6	4	3	0	0
San Marcial	302	300	307	266	252	318	298	319	235	197	142	107	113	86	63	25	23
Caballo Reservoir	9	14	15	4	1	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Lower Rio Grande	41	31	26	34	27	3	N/S	5	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Total	401	389	405	371	375	402	360	372	287	232	179	131	150	113	87	37	33

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

In 2016, nest monitoring was conducted at all sites where nesting pairs were detected from the southern boundary of Isleta Pueblo to Elephant Butte Reservoir, and in select sites from Caballo to El Paso, TX. Nests were monitored for success rates, productivity, and brown-headed cowbird (*Molothrus ater*) parasitism. The San Marcial Reach proved most productive, producing 256 nests. Other studies continued in 2016 include: 1) flycatcher nesting hydrology and habitat variable study, 2) river maintenance impact monitoring, 3) photo monitoring of habitat development in the Elephant Butte delta, 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.

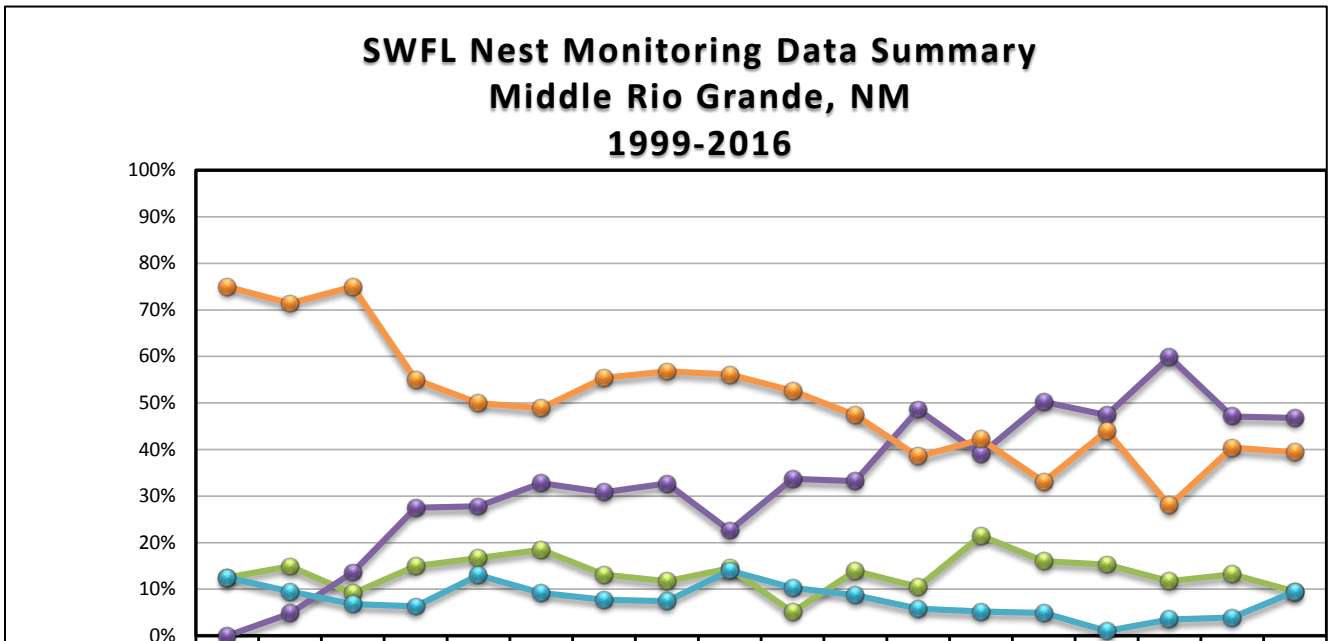
When compared to the results from 2015, in 2016 the flycatcher population showed a small increase overall going from 389 territories to 401 territories. Small decreases were noted in the Sevilleta, Escondida, and Caballo reaches and small increases were documented in the Belen, Bosque del Apache, Tiffany and San Marcial reaches. The largest change was observed in the Lower Rio Grande (primarily sites adjacent to Hatch, NM), where a 32 percent increase in territories was documented.

At Elephant Butte Reservoir, flycatchers have expanded their occupied habitat farther south near River Mile 38. Flycatcher occupied areas in the 'delta' portion of Elephant Butte Reservoir (i.e. River Miles 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 any overbank flooding from the LFCC any longer 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 the natural elements.

Habitat modeling from 2012 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 to this population. The reason that flycatchers do not expand into all areas of suitable habitat is likely a cause of their site fidelity. Habitat mapping was again conducted in 2016 and updated maps are being processed.

Nest success in the Middle Rio Grande rebounded to roughly 40% in 2015 and 2016 from the 2014 nest success of 28%, the lowest it has been since Reclamation has been conducting flycatcher surveys (Figure 6). The decline in nest success over the past few years may represent the decline in habitat suitability and quality in heavily populated areas. The 2014 decline in nest success can be directly attributed to the almost 60% predation rate for flycatchers that year. Predation, the biggest source of nest failure, is typically between 30 and 45%. In 2015 and 2016, it was 47% and consequently nest success was higher. These changes may be attributed to how habitat is influenced by hydrology. In 2014, the drought kept most of the sites relatively dry which reduced plant vigor and canopy cover, reducing concealment from predators, cowbirds and the elements. In 2015 and 2016, the Rio Grande and Low Flow Conveyance Channel both saw better flows compared to the past several years, which translated into more vigorous plant growth and higher concealment from predators.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
# Nests	8	21	44	80	108	174	130	162	221	175	310	257	251	263	209	257	280	231
Parasitism	0.125	0.149	0.091	0.15	0.167	0.185	0.131	0.117	0.145	0.051	0.139	0.105	0.215	0.16	0.153	0.117	0.132	0.095
Predation	0	0.048	0.136	0.275	0.278	0.328	0.308	0.327	0.226	0.337	0.332	0.486	0.39	0.502	0.474	0.599	0.471	0.468
Abandonment	0.125	0.095	0.068	0.063	0.13	0.092	0.077	0.074	0.14	0.103	0.087	0.058	0.052	0.049	0.01	0.035	0.039	0.095
Nest Success	0.75	0.714	0.75	0.55	0.5	0.489	0.554	0.568	0.561	0.526	0.474	0.385	0.422	0.331	0.44	0.28	0.404	0.394

Figure 6: Summary of flycatcher nesting in the Middle Rio Grande from 1999 to 2016.

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 on the Federal Register in August of 2014 includes eight units in New Mexico (Figure 7).

Along the Rio Grande, this proposed area includes:

- a 10 mile long continuous segment of the upper Rio Grande from Ohkay Owingeh to near Alcade in Rio Arriba County (1,830 acres);
- a six mile long continuous 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
- a continuous 170 mile long 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).

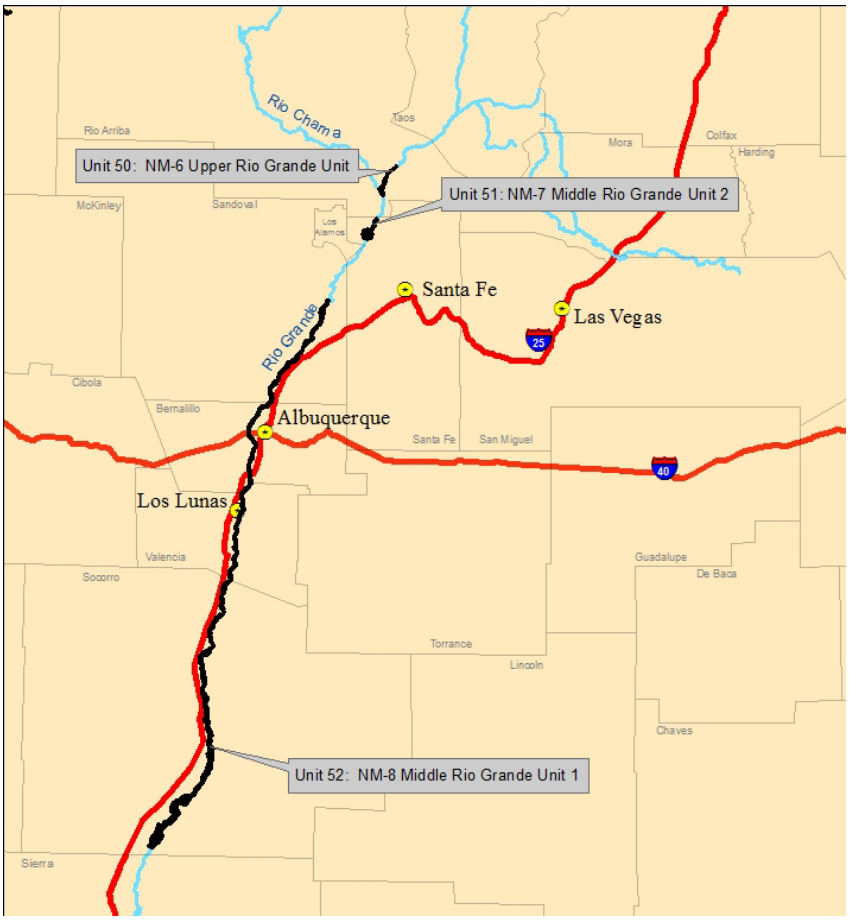


Figure 7. Proposed critical habitat locations along the Rio Grande in New Mexico.

During the summer of 2016, Reclamation conducted surveys in eleven distinct reaches within sites also surveyed for flycatchers from the south boundary of Isleta Pueblo to Radium Springs, New Mexico (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 2016, there were an estimated 140 breeding territories (assumed to be pairs) derived from 515 detections. The estimated territories and documented detections were most concentrated in the southern portion of the San Marcial reach.

Table 11: Yellow-billed Cuckoo Detections/Estimated Territories – Middle Rio Grande Project, 2000 - 2015 Breeding Seasons (N/S = Not Surveyed)

Year/ Location	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
Belen	54/12	39/10	24/5	20/6	44/15	16/4	3/0	1/0	N/S	N/S	N/S
Sevilleta	32/10	18/5	9/2	19/6	36/12	6/2	1/0	4/2	N/S	N/S	N/S
San Acacia	23/8	27/8	15/4	20/5	19/4	6/1	3/0	8/1	N/S	N/S	N/S
Escondida	58/16	62/16	27/7	80/23	68/21	15/3	6/2	29/9	19/10	3/2	N/S
BDANWR	32/11	40/12	34/12	29/8	36/10	17/4	14/3	47/11	35/14	22/13	N/S
Tiffany	9/0	2/0	2/0	4/1	10/2	4/1	2/0	10/3	7/3	12/4	10/6
San Marcial	220/ 59	215/ 59	190/ 61	219/ 70	202/ 57	202/ 58	249/ 58	257/ 69	299/ 60	222/ 52	106/ 38
Caballo	62/15	48/15	29/8	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Percha	3/1	1/0	0/0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Hatch	6/2	4/1	0/0	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Radium Springs	16/6	10/4	8/2	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Total	515/ 140	466/ 130	338/ 99	391/ 119	415/ 121	266/ 73	278/ 75	356/ 95	360/ 87	259/ 71	116/ 44

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

New Mexico Meadow Jumping Mouse

The historical distribution of the New Mexico meadow jumping mouse (jumping mouse; *Zapus hudsonius luteus*) likely included riparian areas and wetlands along streams in the Sangre de Cristo and San Juan Mountains from southern Colorado to central New Mexico, including the Jemez and Sacramento Mountains and the Rio Grande Valley from Española to Bosque del Apache National Wildlife Refuge (BDANWR), and into parts of the White Mountains in eastern Arizona. A final rule was published in the June 10, 2014, Federal Register (effective July 10, 2014) to list the jumping mouse as an endangered species under the Endangered Species Act (ESA) with proposed critical habitat. The final designation for critical habitat for the species is still being determined, but proposed critical habitat units have been identified for Bernalillo, Colfax, Mora, Otero, Rio Arriba, Sandoval, and Socorro Counties, in New Mexico; Las Animas, Archuleta, and La Plata Counties, Colorado; and Greenlee and Apache Counties, Arizona (79 CFR 33119).

In the Middle Rio Grande (MRG) valley, jumping mouse are known to use both natural wetlands and riparian habitats associated with irrigation channels (Frey and Wright 2012). In either case, tall, dense herbaceous riparian vegetation is a key habitat component. Current distribution of jumping mouse within the MRG is uncertain, but the species was confirmed to be present at

Ohkay Owingeh Pueblo and the adjacent Rio Chama (Rio Arriba County), Isleta Pueblo (Bernalillo County), near Casa Colorada Wildlife Area (Valencia County), and BDANWR (Socorro County) as of the late 1980s (Frey 2006). Survey efforts have regularly occurred at BDANWR. Recent surveys in 2014 and 2015 using box traps resulted in the capture of 19 and 6 jumping mice respectively. The 2016 box trap surveys initially resulted in the capture of 3 mice. BDANWR changed to camera trapping part way through the trapping season and recorded an additional 27 mice but it is unclear how many of these were individual mice or photos of the same individual. With the exception of BDANWR, systematic survey efforts for jumping mouse and their habitat have not been conducted throughout the riparian corridor of the MRG. Since its listing, surveys for suitable jumping mouse habitat have occurred in selected areas as part of environmental compliance activities for specific projects, such as the Delta Channel river maintenance project (Reclamation 2014).

The Delta Channel is located on the southern fringe of the geographic area where jumping mouse could potentially occur. However, during the habitat assessment it was determined that the Delta Channel area does not represent suitable habitat based on the herbaceous vegetation composition and structure, lack of soil moisture, high frequency and long history of disturbance, and lack of regular inundation necessary to support jumping mouse habitat. Based on the habitat assessments within the Delta Channel, it is unlikely that occupied or suitable jumping mouse habitat exists south of BDANWR.

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New Middle Rio Grande Water Management and River Maintenance ESA, Section 7 Consultation

Formal ESA Section 7 consultation between the USFWS and Reclamation was reinitiated on February 22, 2013, prior to expiration of the 2003 BiOp, providing continued federal and non-federal coverage in accordance with the terms of the 2003 BiOp. Consultation goals include achieving and maintaining comprehensive ESA compliance through a hydrologically viable BiOp that maintains and improves the status of listed species.

For these reasons, Reclamation submitted a BA for Middle Rio Grande water operations and river maintenance to the USFWS on July 31, 2012 addressing Reclamation, MRGCD, and State of New Mexico water management-related actions taken in the Middle Rio Grande, and State actions in the Upper Rio Grande followed by a series of supplements and revisions. The final BA, submitted August 31, 2015, was updated with information on the yellow-billed cuckoo and New Mexico meadow jumping mouse, and descriptions of specific measures to offset adverse effects and provide conservation benefits for listed species.

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 BiOp, the USFWS concluded that the Proposed Action will not jeopardize the continued existence of the silvery minnow, flycatcher, and 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 USFWS provided an Incidental Take Statement for silvery minnow, flycatcher, and cuckoo, with eleven Reasonable and Prudent Measures and accompanying non-discretionary Terms and Conditions.

Supplemental Water Program

The Supplemental Water Program is utilized to comply with elements of the Reasonable and Prudent Alternative of the 2003 BiOp. The Program consists of water acquisition and storage, concurrence with waiver requests, and the continued conveyance of water from the LFCC to the Rio Grande. The Program supports ESA coverage under Section 7(a)(2).

Water Acquisition and Management

In 2016, a BiOp "dry" year, 21,020 ac-ft of supplemental water was released by Reclamation for endangered species purposes. The volume was entirely composed of leased SJ-C water. Just over 4,000 ac-ft was water leased in 2016, and about 13,230 was leased in 2015. The remaining 3,781 ac-ft was leased from ABCWUA out of Abiquiu under a 2013 agreement.

Reclamation ended the year with 10,763 ac-ft of 2016 leased SJ-C water in storage in Heron Reservoir. In 2017, Reclamation will likely have potential leases of approximately 12,000 to 13,000 ac-ft from 2017 SJ-C allocations. Because of the SJ-C Project shortage, however, available leased water could be much less.

Other Sources of Supplemental Water

In addition to the water released by Reclamation, there were three other sources of water used to minimize river drying in 2016 from September 1 and October 31. As shown in Table 12, all of this water was released to the river by MRGCD at four wasteway outfalls in the Isleta reach: Alejandro, Los Chavez, Lower Peralta Drain #2, and Sabinal.

First, Audubon New Mexico acquired and received contributions of SJ-C water totaling 799 ac-ft: 399 ac-ft from The Club at Las Campanas and 100 ac-ft each from the Pueblos of Sandia, Isleta, Santa Ana, and Cochiti (a total of 400 ac-ft). Evaporation losses while the 799 ac-ft of water was in storage for Audubon were 15 ac-ft. This resulted in a release of 784 ac-ft from Abiquiu between August 28 and September 21, with subsequent delivery to the Isleta reach from September 1 and 24, 2016.

Second, 154 ac-ft of native water rights owned by Reclamation and permitted to be used for offset via the NMISC's Strategic Water Reserve were released from the outfalls from September 25 to 29.

Third, the remainder of the relinquishment credit water stored in 2015 by Reclamation on behalf of the NMISC, 1,138 ac-ft, was released from El Vado between September 25 and October 31, for delivery in the Isleta Reach between September 30 and October 31. Several federal and non-federal agencies and organizations coordinated to make these releases possible: Reclamation, New Mexico Interstate Stream Commission, MRGCD, ABCWUA, and Audubon New Mexico. Note that there may be some overlap of dates due to travel time from different reservoirs and simultaneous release from more than one source.

Table 12: 2016 Isleta Reach Outfall Deliveries

Isleta Reach Outfall Delivery Dates, 2016	Delivered Water Volume, ac-ft	Water Source
September 1 – September 24	784	SJ-C (Audubon New Mexico)
September 25 – September 29	154	Native water acquired, permitted, and used for offset
September 30 – October 31	1,138	New Mexico Interstate Stream Commission Compact relinquishment credits

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 a level that may result in adverse impacts to the silvery minnow and flycatcher. Reasonable and Prudent Alternatives D, G, K, and O of the 2003 BiOp require the use of pumps to manage river recession, maintain river connectivity, and supply water for nesting flycatchers. The LFCC Pumping Program also helps Reclamation comply with the continuous river requirements stipulated by Reasonable and Prudent Alternatives E, H, and L, and has been effective in allowing Reclamation to maximize the effectiveness of supplemental water releases made for ESA purposes.

Reclamation installed, maintains and operates portable pumps, with flow meters, at strategic locations along the LFCC. The pumps are used to move water from the LFCC into the Rio Grande. Meter data for the pumping sites is now posted in orange boxes on the MRGCD Gage Schematic page within the Reclamation ET Toolbox web site. The web address for the ET Toolbox is:
http://www.usbr.gov/tsc/rivers/awards/Nm2/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 2003 permit granted by the New Mexico Office of the State Engineer.

Due to the low flows in the Rio Grande and the need to manage recession through BDANWR, pumps located at the North Boundary pump site were started on July 11. To maintain connectivity from the south boundary of BDANWR to Elephant Butte Reservoir, pumps at the South Boundary site were turned on July 11. At the North Boundary, pumps were used only for 3 days then turned off and not used again during the season. The pumps at the South Boundary ran for entire season and were shut off on November 2 once the river flow reached 40 cfs.
In Table 13 below, the yearly volume accrual at each site is summarized in ac-ft.

Table 13: 2016 LFCC Pumping Volume by Site

Total Per Pumping Site For The Year	Neil Cupp	North Boundary	South Boundary	Ft. Craig
	0 ac-ft	1,363 ac-ft	5,837 ac-ft	0 ac-ft

As seen in Table 13, pumps at the North Boundary and South Boundary sites were used, while pumps at the Ft. Craig and Neil Cupp sites were not used for pumping supplemental water during the 2016 season. The total volume of supplemental flow provided by the pumping effort in the 2016 season was 7,200 ac-ft.

Isleta Settlement

Reclamation, Isleta Pueblo, and the MRGCD signed a global settlement on October 21, 2016, resolving trespass issues associated with Isleta Diversion Dam.

Isleta Diversion Dam was built by the MRGCD on Isleta Pueblo land in 1934. Reclamation rehabilitated the dam in 1954. Isleta Pueblo 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 Isleta Pueblo to work on reaching agreement that could lead to a settlement.

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.

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

This project has been funded by the Collaborative Program since Fiscal Year 2002. The USGS operates and maintains a network of streamflow gages within the MRG, including 15 on the mainstem and numerous others on tributaries or distribution features. Four streamflow gages are funded by the Collaborative Program: the Rio Grande near Bosque Farms (08331160), the Rio Grande at State Hwy 346 (08331510), the Rio Grande near Escondida (08355050), and the Rio Grande above US Hwy 380 (08355490).

Data from the river gages helps the various Middle Rio Grande water management agencies in many ways. The monitoring system assists agencies in meeting the needs of water users, fulfilling the requirements of the Rio Grande Compact, maintaining sufficient water in storage for future needs, 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

In the 2003 Biological Opinion, Element C of the Reasonable and Prudent Alternative states that monitoring must be performed when flows are less than 300 cubic feet per second (cfs) at San Acacia. RiverEyes is a program that provides current information on river flows and river drying and allows action agencies to react quickly to changing conditions on the river. RiverEyes also facilitates coordination among agencies to prevent unexpected drying, to prepare for silvery minnow salvage and to initiate rescue actions.

For the 2016 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 the end of irrigation season on October 31. The total maximum river miles that experienced drying during the 2016 RiverEyes monitoring period was 22.5 miles on September 25; 8.5 miles in the Isleta Reach and 22 miles in the San Acacia Reach. The first occurrence of channel drying was recorded on July 13, and the last occurrence of channel drying was observed on October 31.

Large sections of the Isleta Reach were kept wet this year by small releases made by the MRGCD at various wasteways to the river. There were 3 segments of river which dried during

the year. The first was a section above the Los Chaves Wasteway which released water throughout the summer. The maximum amount of drying was 5 miles in this section. The Los Chavez Wasteway kept a 0.5 mile stretch wet before drying resumed. There was a 5.5-mile section that dried down to the Peralta Wasteway. The river remained continuous below the Peralta Wasteway.
The San Acacia Reach experienced drying on July 13 from the South Boundary pumps almost to the North Boundary pumps. The maximum drying in this reach occurred on August 1 with the river drying starting at Brown Arroyo, for just over 20 miles. Flows from monsoon rains then reconnected the river until early September. Re-drying then sporadically continued from September 6 until the end of irrigation season on October 31.

Middle Rio Grande Endangered Species Collaborative Program

In 1994, the USFWS listed the silvery minnow as endangered, issued a recovery plan in 1999, and released a revised critical habitat designation in 2003[4]. The silvery minnow recovery plan[5] was updated in 2010. The flycatcher was added to the endangered species list in 1995 and a final recovery plan[6] was issued in 2002. The designation for flycatcher critical habitat was revised in January 2013[7]. Consultation was reinitiated on the 2003 BiOp prior to its expiration on March 1, 2013. The 2003 BiOp thus remained in effect in 2016 and required delivery of supplemental (leased) water and other measures to reduce impacts to the listed species and alleviate jeopardy on the MRG Project for water, river maintenance, and flood control operations.

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) brings diverse groups together to support ESA compliance 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.

Currently, Reclamation manages and serves as the fiscal agency for the Collaborative Program as authorized by the Omnibus Appropriations Act of 2009 (P.L. 111-8). In FY 2016, total appropriations were $5,000,000, of which $3,000,000 was utilized for Collaborative Program activities and $2,000,000 was utilized for water leasing, pumping, and Program administration activities. Related FY2016 accomplishments include:

- Conducting the silvery minnow Genetics Project Peer Review and fish population

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

monitoring workshop and reviewing both panelists' recommendations for implementation;
- Supporting four USGS streamflow gages;
- Captive propagation of silvery minnow at the Southwestern Native Aquatic Resources & Recovery Center[8],the City of Albuquerque's BioPark Aquatic Conservation Facility[9] and the New Mexico Interstate Stream Commission's Los Lunas Silvery Minnow Refugium[10];
- Silvery minnow rescue efforts during river drying and reproductive monitoring;
- Annual monitoring of silvery minnow populations and flycatcher nests;
- Leasing of 4,000 ac-ft of supplemental water from SJ-C Project contractors in FY2015;
- Pumping from the LFCC into the Rio Grande;
- Program management, assessment, reporting, and outreach activities.

[8] http://www.fws.gov/southwest/fisheries/dexter/
[9] http://www.cabq.gov/culturalservices/biopark/news/success-for-abq-bioparks-silvery-minnow-program
[10] 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 8). Elephant Butte Field Division operates and maintains Elephant Butte and Caballo Dams and Elephant Butte Powerplant. The El Paso Office is responsible for scheduling releases from Elephant Butte and Caballo Reservoirs to meet irrigation demand and the delivery of Rio Grande Project water to the canal headings of EBID, 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 Coffer Dam, both in Texas. Riverside Diversion Dam had been inoperable since 1987, when flooding on the Rio Grande caused the structure to fail.

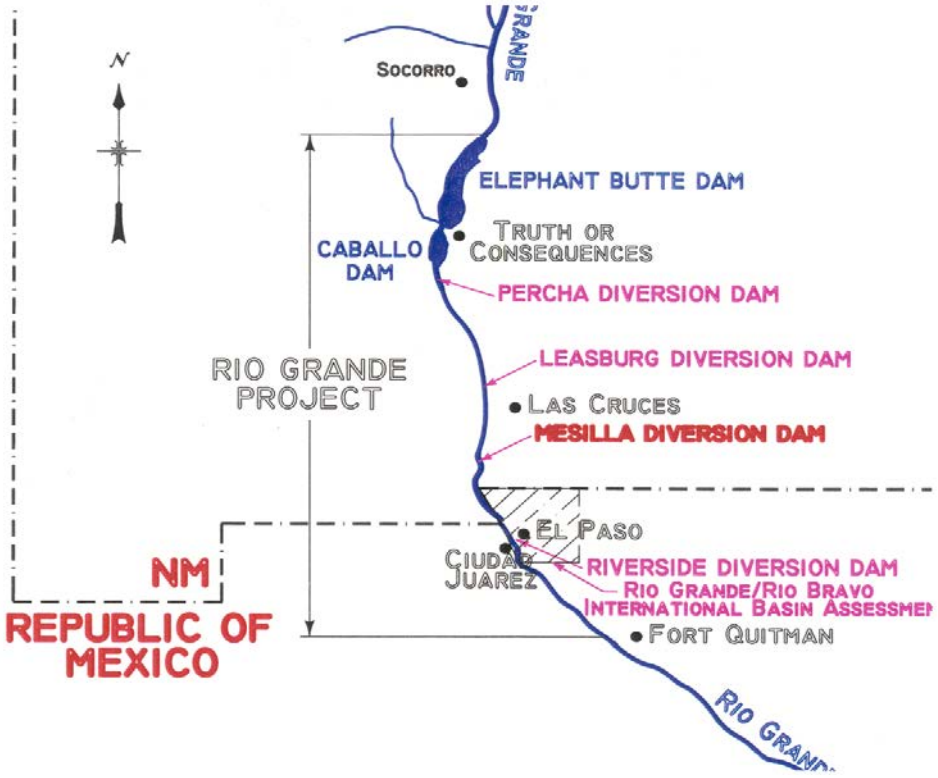

Figure 8: Area Map of the Rio Grande Project

Water Supply Conditions

Preliminary inflow data into Elephant Butte Reservoir during 2016, measured as the sum of the Rio Grande floodway and the Low Flow Conveyance Channel at San Marcial, was 471,722 ac-ft. The provisional flow record for the 2016 spring runoff (March - July), measured at San Marcial, was 275,911 ac-ft, or approximately 54% of the 30-year average.

During the period from 1998 to 2016, the spring runoff at the San Marcial gauging station continues to be below the 30-year average. From 1998 to 2016, average inflow was 265,607 ac-ft, and only two years, 2005 and 2008, exceeded the 30-year average of 510,000 ac-ft.

Releases from Elephant Butte Reservoir began on March 21, 2016, and continued through September 8, 2016. During this period, a total release of 522,919 ac-ft was recorded by the USGS. October through December daily flow data remains provisional; all other data has been approved by the USGS. A release of 9,304 ac-ft was also made from October 14, 2016, to October 21, 2016, in order to raise the Caballo Reservoir storage levels after a reservoir draining operation was done for maintenance on the Caballo Reservoir intake.

During the 2016 irrigation season (March 26 to October 1), 544,167 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 223,489 ac-ft on December 31, 2016, or 10% 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) was below 400,000 ac-ft through February 20, 2016; it was above 400,000 ac-ft through April 16, 2016. The usable water in Project storage remained under 400,000 ac-ft through the end of the year.

Since 2011, the average March through July runoff was 151,802 ac-ft. In 2016, the spring runoff was estimated at 275,911 ac-ft. With the combined Project storage and minimal runoff, Reclamation allotted 69% of 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 26, 2016, and the irrigation season continued through October 1, 2016.

An initial allocation for 2017 was made in February. On January 15, 2017, combined storage in Elephant Butte and Caballo Reservoirs was 246,965 ac-ft; water available to the Project water users was 233,627 ac-ft. Based on the January 1, 2017, 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 2017 for the Rio Grande Project.

Project Irrigation and Drainage Systems

Following title transfer, which was completed in 1996, the irrigation and drainage system of the Rio Grande Project, is owned, operated, and maintained by EBID in New Mexico and by EPCWID in Texas. Reclamation owns and administers the lands and rights-of-way activities of the reservoirs and diversion dam areas. 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 2016. Reclamation also performed flow measurements at canal headings and river stations, 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 2016. 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 2016, 25,950 ac-ft was diverted.

Elephant Butte Reservoir and Powerplant

In 2016, Elephant Butte Reservoir reached a daily minimum storage of 125,963 ac-ft (elevation 4300.17 feet) on September 07, 2016, and a daily maximum storage of 430,441 ac-ft (elevation 4,335.12 feet) on March 20, 2016.

The total gross power generation for 2016 was 43,419,930 kilowatt-hours (KWhr). Net power generation for 2016 was 42,833,098 KWhr, which is 111 percent of the 8-year average (2009 through 2016) of 39,094,894 KWhr. The power plant releases were utilized to meet downstream irrigation demand and manage Caballo Reservoir storage levels. Balance valve releases, which bypass power production, of 22,211 AF were used to meet demands for the 2016 irrigation season. Balance valve releases had to be made due to the oil cooler failure on Generating Unit

No. 1. The balance valves will be available for any required release beyond the Elephant Butte Powerplant capabilities in 2017.

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. No O&M recommendations were completed during FY 2016.

2015-2-C O&M recommendation was completed. The erosion gullies along the downstream crest of the Elephant Butte Dike were repaired. We have worked to direct the water to the drains to prevent erosion gullies from forming.

An Annual Examination was completed in September 2016. The inspection did not produce any new issues that were not previously identified.

The Facility Review Rating was updated in October 2016. The rating for Elephant Butte remained the same as in 2015, which was a total score of 94, giving the facility an overall rating of "Good".

Caballo Dam and Reservoir

During the 2016 water year, October 1, 2015 to September 30, 2016, Caballo Reservoir reached a minimum storage of 4,293 ac-ft (elevation 4,126.95 feet) on October 3, 2016, and a maximum storage of 78,426 ac-ft (elevation 4,152.53 feet) on May 25, 2016.

Reclamation operated Caballo Reservoir during the irrigation release period, March 26 through October 1, 2016, by maintaining adequate storage levels in response to irrigation calls. Toward the end of the irrigation season, however, the intake structure became clogged with sediment and debris. The release rate dropped without a corresponding gate change during irrigation releases. This occurred without the influence of any significant inflow from summer monsoons.

The following are the observations and the tasks completed to maintain and clean the intake:

- August 13, 2016 – Releases from Caballo dam decreased noticeably.
- August 16 – August 25, 2016 – Reclamation crews worked daily to keep debris away from intake structure and maintain outflow, while working with irrigators to reduce demand and maintain appropriate discharge.
- September 1, 2016 – Reclamation determined a solution to the clogged intake and contracted a crane with clamshell to clean around the intake structure.
- September 14, 2016 – Contract awarded to Crane Services Inc. for emergency operation and maintenance.
- September 27, 2016 – Crane with clamshell arrived and began removing silt and

sediment around intake.
- October 1, 2016 – Cleaning of intake was completed.
- October 18, 2016 – A functional test of the gates was performed to clean out the sediment that had built up in the outlet tunnel and to see if the gate setting/outflow relationship had been re-established. The test was successful, and release rates at a given gate opening were as expected.

Reclamation communicated with stakeholders during this time to provide information and weekly projections of reservoir elevations through the remainder of the irrigation season. Overall, 545,473 ac-ft was recorded at the Caballo gage from January 1 to December 31, 2016.

Discussion is ongoing between EBID, EPCWID, and Mexico about the start date for the 2017 irrigation season. The parties are coordinating release schedules to avoid isolated releases. Reclamation will finalize a reservoir operating plan in the spring of 2017.

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. Two O&M recommendations were completed during FY 2016.

2015-2-D O&M recommendation was completed. An expansion seal was placed in the contraction joint and is operating well. It was installed in October of 2015 and was inspected this year after irrigation season ended and is still in place.

2015-2-A O&M recommendation was completed. The woody vegetation on the upstream face of the dam was treated with herbicide. However, this will always be an issue. A more comprehensive herbicide plan has been established to treat woody vegetation before it becomes too large and poses a dam safety issue.

An Annual Examination was completed in September 2016 and only addressed the clogged intake. This problem was addressed and a final cleaning of the intake structure took place at the end of September. This cleaning was successful and the intake structure is clear of sediment and debris and operating as originally designed.

The Facility Review Rating was updated in October 2016. The rating for Caballo decreased from a total score of 98 to 94, giving the facility an overall rating of “Good”.

Rio Grande Project Adjudications

The United States filed the case United States of America v. Elephant Butte Irrigation District, 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 quiet legal title to the waters of the Rio Grande Project in its name. The United States District Court (USDC) for the District of New Mexico dismissed the

case in August 2000. On May 7, 2002, the United States 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.

The Lower Rio Grande Basin Adjudication (New Mexico), State of New Mexico, ex rel, Office of the State Engineer v. EBID, et al, CV-96-888 "stream adjudication" case was originally filed by EBID against the State Engineer in 1986. Negotiation meetings on the Offers of Judgment on Lower Rio Grande Basin Adjudication (New Mexico) have been held between the Office of the State Engineer and the United States. In 2011, as part of Stream System Issue No. 101, the Court issued a final judgment approving a settlement agreement whereby the State of New Mexico and the farmers in the Rio Grande Project agreed to a farm delivery requirement of 4.5 ac-ft per acre per year. The total may be increased to a maximum of 5.5 ac-ft if a farmer can prove beneficial use in excess of 4.5 ac-ft per acre per year.

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.

Under the latest courts schedule, the parties shall file proposed findings of facts and trial briefs on January 26, 2017. The discovery process is scheduled to begin on June 1, 2017.

In January 2013, Texas filed a motion in the United States 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; plus award damages and other relief for the injury suffered by the State of Texas. On December 10, 2013, the United States filed a brief stating that Texas' motion for leave to file a complaint should be granted, and New Mexico should be invited to file a motion to dismiss the complaint. 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 Supreme Court of the United States appointed Gregory Grimsal of New Orleans as the Lower Rio Grande Adjudication Special Master. The Special Master held hearings on August 19-20, 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 9, 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. Thus, the Special Master recommends to the court that the Texas complaint be maintained under the 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 be denied. Exceptions (appeals) may now be taken from the Special Master's report to the Supreme Court.

The Texas Commission on Environmental Quality (TCEQ) posted public notice of adjudication of all claims of water rights in the Upper Rio Grande (above Ft. Quitman) segment of the Rio Grande Basin and the requirement to file sworn claims pursuant to section 11.307 of the Texas Water Code on or before April 22, 1996. Threshold issues were briefed, and on July 31, 2003, the Administrative Law Judge ruled as follows: (1) the TCEQ has jurisdiction over the proceeding, (2) the river segment subject to the adjudication does not need to be revised or expanded, and (3) the proceeding qualifies as an adjudication of water rights under the McCarran Amendment. An evidentiary hearing was held on December 11, 2003, and Reclamation presented expert testimony about the Rio Grande Project. Notice was given under Texas Administrative Code §86.18 (c) that on April 13, 2006, the TCEQ issued a Final Determination of all claims of water rights under adjudication in the Upper Rio Grande Segment of the Rio Grande Basin (above Fort Quitman) located within the State of Texas which includes all portions of Hudspeth and El Paso Counties, Texas. The effective date of the Final Determination is May 15, 2006.

Rio Grande Project Operating Agreement

In 2016, 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. A record of decision (ROD) for the final environmental impact statement was signed on January 4, 2017. This ROD allows the 2008 OA to remain in effect through 2050.

The 2016 irrigation season for the Rio Grande Project began in March for EPCWID and Mexico, and April for EBID. The Project released 544,181 ac-ft from Rio Grande Project storage for irrigation. EBID, EPCWID, and Mexico were charged for 435,295 ac-ft of delivered water. The calculated diversion ratio, a quantitative measure of delivery performance, for 2016 was 0.8. EBID ended the season with 3,226 ac-ft in their allocation carryover account and EPCWID ended the 2016 irrigation season with 50,179 ac-ft in their allocation carryover account. Table 14 summarizes the Rio Grande Project Accounting for 2016.

Table 14: Summary of Rio Grande Project Accounting Charges, 2016

	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	Calculated Carryover, ac-ft	Transfer due to Carryover Cap, ac-ft	Final Carryover, ac-ft
EBID	180,912	175,199				5,713		-2,487	3,226	0	3,226
EP1	268,381	216,309				52,072		-1,893	50,179	0	50,179
Mexico	46,497	43,787			39,407	-4,380					
Total	495,790	435,295	544,181	0.80							

Based on current storage in Elephant Butte and Caballo along with the forecast, it is expected that 2017 will have a less than full allocation to the water users. 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. The technical team for the OA, which consists of representatives from EBID, EPCWID, and Reclamation, will meet in early 2017 to discuss potential updates and amendments to the Manual.

Elephant Butte and Caballo Reservoir Vegetation Management Cooperative Agreement

Under the Vegetation Management Cooperative Agreement, Reclamation performs maintenance of previously managed vegetation, primarily by mowing to limit the non-beneficial consumption of water by woody phreatophytes such as saltcedar (Tamarix). Herbicide treatments to saltcedar and tornillo (screwbean mesquite) are also made to limit the amount of mowing necessary to complete the task. Approximately 7,041 acres have been sprayed at both reservoirs over the past eleven years with varying amounts of success. With assistance from New Mexico State University, scientific investigations are currently being done to monitor the effects of saltcedar leaf beetles that have arrived and are active within the management area. During FY 2016, Reclamation managed 4,046 acres of phreatophytic vegetation at Caballo reservoir utilizing mowers and mulchers.

Other Reclamation Programs

The Secure Water Act

The SECURE Water Act became law on March 30, 2009, as a component of the Omnibus Land Management Act of 2009. It provides authority for Federal water and science agencies to work both independently, and in partnership with States and local water managers to plan for climate change and other threats to our water supplies, and to take action to secure water resources for the communities, economies, and ecosystems they support. The SECURE Water Act authorizes and funds several programs under the Department of the Interior's WaterSMART Program (https://www.usbr.gov/watersmart/) to evaluate the risk that climate change and other threats pose to water supply, and to initiate local actions to adapt to projected future conditions, and provide for resilient social and ecological systems. These programs, funded and managed by Reclamation's Office of Policy and Administration in Denver, CO, and administered by the AAO, include:

- WaterSMART Grants
  - Water and Energy Efficiency Grants
  - Small-Scale Water Efficiency Grants
  - 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
- Title XVI Water Reclamation and Re-use Program
- Basin Study Program
  - West-Wide Climate Risk Assessment activities
    - 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

Annual WaterSMART funding opportunities may be found at: https://www.usbr.gov/watersmart/calendar.html.

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 CERRO units at existing wellheads). This award was made in 2014 and has a completion date of September 2017.

The 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. This award was made in 2014 with completion scheduled for September 2017.

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 2016. Reclamation entered into agreements with the Village of Los Lunas to compose a 40-year water conservation plan, and the City of Rio Rancho to perform water loss audits. The Town of Bernalillo completed its water conservation plan and the City of Española is working on their plan. Bernalillo County Public Works is providing support for new meters for various unincorporated water systems as part of a larger plan to improve water accounting and develop effective and reasonable rate structures. The Village of Tijeras used funding to replace antiquated meters with more accurate meters, a project which is nearing completion. The Madrid Mutual Domestic Water Association continues to use its funding to complete a 40-Year water conservation plan.

WCFSP personnel provided technical support for water conservation activities to the Pueblos of San Felipe, Santo Domingo and Cochiti in the form of laser levelling design, drafting and inspection. The work included the conversion of traditional earthen ditches into pressurized underground pipes, construction of check valves, and installation of measuring devices. The WCFSP also supported an emergency drought project by providing technical assistance to the Regina Mutual Domestic Water Association's exploratory drought well. And, WCFSP staff were able to support outreach to hundreds of children in Rio Rancho, McKinley County, Santa Rosa, and Cochiti and Taos Pueblos by demonstrating water conservation principles through the Water Jeopardy game at their respective Water Festivals, and participate in the New Mexico Water Conservation Alliance.

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 2015, Reclamation provided cost-share funding to Rio Grande Restoration, Inc. (RGR) to formalize the Rio Chama Watershed Partnership. In December 2016, RGR completed their watershed restoration plan which proposes to broaden the membership, expand its geographic scope to the entire lower Rio Chama Basin, and rename it the 'Rio Chama Watershed Partnership.'

Reclamation also entered into a two-year agreement with the Upper Rio Grande Watershed District to form a task force and watershed group. 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 new Drought Response Program supports a proactive approach to drought. It provides assistance for two sub-programs: Drought Contingency Planning, which provides assistance to water users for drought contingency planning, including consideration of climate change information; and Drought Resiliency, which supports actions that will build long-term resiliency to drought.

Drought Contingency Planning

In June of 2016, the MRGCD was awarded funding to implement a Drought Contingency Planning Project. This project requires a 50/50 cost match from the MRGCD and its partners. The Drought Contingency Plan 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. The process is being initiated with an assessment of vulnerabilities of the District to drought. It will then evaluate several potential mitigation actions intended to increase the District'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 Drought Contingency Plan will define direct actions to be taken by the District under various stages of drought conditions. The Plan identifies key responsibilities of the District, as well as required

interaction and communication with other agencies, which will be implemented during drought conditions.

Establishment of a Drought Planning Task Force at the outset of the planning process is a requirement of the Drought Contingency Planning Program. The MRGCD has established a Drought Contingency Planning Task Force made up of interested stakeholders within the planning area that want to actively participate in developing the Drought Contingency Plan.

The DCP will be updated every 7 years to reflect current District infrastructure, management obligations, and evolving understanding of basin and climatic conditions.

Resiliency Projects

In June of 2016, MRGCD was awarded funding to implement a Drought Resiliency Project R16AP00145 for the Socorro Main Canal South Distribution Hub dedicated pumping station. This project requires a 50/50 cost match from the MRGCD.

Due to return flow collection and re-use, the southern end of the MRGCD's Socorro Division generally has adequate water supply; however, water is commonly in the wrong channel for efficient use, being in the LFCC instead of the Socorro Main Canal. At present, the Neil Cupp check structure in the LFCC provides gravity flow of collected tail-water into the MRGCD's Socorro Riverside Drain. This water remains at an elevation below that required for delivery to irrigated lands in the area.

To provide greater efficiency and better control of water delivery, the Middle Rio Grande Conservancy District (MRGCD) will install the "Socorro Main Canal South Distribution Hub," which includes the construction of a dedicated pumping facility, check structure, and installation of 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 to the Rio Grande, using existing infrastructure through the spoil levee, to augment river channel flows for endangered species. This Distribution Hub will replace the function of Reclamation's temporary Neil Cupp pump station, allowing water to be returned to the river channel for greater periods of time, with much less cost and nuisance. Construction is expected to begin in late 2017.

Title XVI Water Reclamation and Re-use Projects

Under the authority of P.L. 102-575 and P.L. 104-266, Reclamation participates with the cities of Albuquerque and 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.

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, and EPWU began construction, with cost-share funding from Reclamation, of the Wastewater Diversion from Haskell Street Wastewater Plant to Fred Hervey Water Reclamation Plant (aka Fred Hervey Purple Pipe Project) in 2016. The new collection system reconfiguration will deliver flows to the Fred Hervey Water Reclamation Plant for treatment and re-use in northeast El Paso. When fully implemented, this project will recycle an additional 365 million gallons (~ 1,100 ac-ft per year) of water per year, and is scheduled to be completed in December 2018.

EPWU also 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.

In 2016, EPWU was also 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 with a completion date in 2019.

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, provided to Reclamation in September 2016, is undergoing review and the two-year project is in the closeout phase.

Basin Study Program

Reclamation's Basin Study Program, a component of the WaterSMART 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) and basin-specific WWCRA Impacts 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.

West-Wide Climate Risk Assessments

WWCRA implementation activities focus on development of consistent climate projections for Western river basins, and evaluation of impacts of the projected changes to water supply, water demand, water/reservoir operations, water quality, hydropower generation, endangered species, fish and wildlife, flow- and water-dependent ecological resiliency, and recreation. WWCRA activities include development and refinement of climate projections, water supply analyses, water demand analyses, WWCRA impact assessments, and development of guidance for analysis of potential impacts of climate change on Reclamation projects.

WWCRA Impacts Assessments are Reclamation-only projects, which focus on the development of baseline projections of the impacts of climate change alone, isolated from other human-induced changes to our water supply and ecological resources, so that the magnitude of the impacts of climate change can be understood. A WWCRA Impact Assessment for the Upper Rio Grande was completed in 2013 (Llewellyn, et. al., 2013). The work performed for this Impact Assessment has formed the basis for several studies, environmental compliance, and planning efforts, both within Reclamation and among Reclamation's partners in the Middle Rio Grande. These studies include a 100-year water plan for the ABCWUA (http://www.abcwua.org/uploads/files/Water%202120%20PPT%20Presentation%20Summary%20for%20Web.pdf). Within Reclamation, the projections have been used to support the Middle Rio Grande Endangered Species Biological Opinion, the Pojoaque Basin Regional Water System Environmental Impact Statement (EIS), and the Rio Grande Project Operating Agreement EIS.

The WWCRA team also submits reports to Congress on the achievements of the Basin Study Program every five years, and in 2016, finalized its 2016 SECURE Report to Congress. This report includes the projections developed from the most recent set of hydroclimate projections for the Western US, and a summary for each of the major Reclamation river basins, of the work on projection of the impacts of climate change and development of adaptations and resilience-building strategies over the past five years. This report was released as a paper report and an interactive website with data visualization (https://www.usbr.gov/climate/secure/).

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), which was performed as a component of the WWCRA. The projects are managed out of the Upper Colorado Region, AAO, 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 are scheduled to complete the Pecos Basin Study in 2017 (please see the Pecos Compact Report for more information on the Pecos Basin Study). Letters of interest for 2017 Basin Studies were due from potential project partners to Reclamation in

January 2017. Reclamation will select qualified partners who have submitted letters of interest to submit a full Basin Study proposal. Reclamation expects to select the final 2017 Basin Studies by May 2017.

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 is currently undergoing final revision after a Reclamation review. The completed feasibility study enables Santa Fe to apply and compete for funding from Reclamation to support implementation of its water reuse project.

In 2016, Santa Fe was also awarded funding from Reclamation for a Basin Study Update. In this project, Reclamation and Santa Fe will work 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

In 2015, Reclamation's AAO 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. The Plan of Study team partners plan to engage the full suite of water management partners in the Basin Study process. The team's plan is to submit a proposal for the comprehensive Middle Rio Grande Basin Study in Reclamation's 2017 Basin Study proposal process. 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 are the projects of the Southern Rockies LCC in the Upper Rio Grande Basin that are ongoing or were completed in 2016:

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 Underway
- More information about the project can be obtained from: John Rice (SRLCC Science Coordinator) jrice@usbr.gov; or Kevin Johnson (SRLCC Coordinator) kevin_m_johnson@fws.gov

Identifying Refuge Streams and Lakes for Rio Grande Cutthroat Trout in a Changing Climate

- Awarded to U.S. Geological Survey, Fort Collins Science Center
- Funding USFWS $75,000
- Timeline: January 2015 to December 2015
- Status: Final report in development
- More information about the project can be found at: http://southernrockieslcc.org/project/identifying-refuge-streams-and-lakes-for-rio-grande-cutthroat-trout-in-a-changing-climate/

Watershed Disturbance and Restoration Impacts on Hydrologic Function Relative to Increased Snowmelt Water Yields, Stream Water Quality, and Species Conservation in the Jemez Mountains, New Mexico: *Model Calibration and Validation on a Landscape Scale*

- Awarded to U. S. Department of Agriculture Valles Caldera Trust.
- Funding: Bureau of Reclamation $92,160, in kind/other funding: $197,347.
- Timeline: December 2013 to December 2016
- Status: Project underway – project was modified to extend the completion date due to insufficient snow in the second year of data collection
- More information about the project can be found at: http://southernrockieslcc.org/project/watershed-disturbance-and-restoration-impacts-on-hydrologic-function/

Improving Seasonal Water Supply Predictions and Water Management in the Upper Rio Grande River Basin through use of Enhanced Observations of Snowfall, Snowpack and Physics-Based Modeling Systems

- Awarded to National Center for Atmospheric Research
- Funding: Bureau of Reclamation: $89,982, Colorado Water Conservation Board: $215,000; National Science Foundation: $12,856
- Timeline: December 2013 to December 2015
- Status: Final report submitted in 2016; available on our website
- More information about the project can be found at: http://southernrockieslcc.org/project/modeling-systems-to-inform-water-management/

Stream-gage Database Development and Network Analysis

- Awarded to U. S. Geological Survey Colorado Water Science Center
- Funding: $150,000

- Timeline: August 27, 2015 to September 30, 2016 – agreement modified to extend completion date to December 31, 2016
- Status: in progress
- More information about the project can be found at: https://southernrockieslcc.org/sites/all/modules/custom/rockies_pts/pts/GNLCC_PTS4_SRLCC/prj_report.html?PRJ_ID=32

Desert Landscape Conservation Cooperative

The Rio Grande Forum that is being planned by the Desert Landscape Conservation Cooperative has been postponed indefinitely.

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

Tribal Climate Adaptation Workshop

- Timeline: July 20, 2015 – July 19, 2016
- Purpose: The aim of this project is to provide a framework for a partnership with leverages previously existing and newly developing tribal engagement capacity within the Center for Climate Adaptation Science and Solutions and identifies emergent opportunities now possible with enhanced investment.
- Project Status: Completed
- Project Category: Informing Conservation Delivery
- Main Deliverable Type: Training, Outreach, or Workshop
- Project link: https://www.sciencebase.gov/catalog/item/5797c178e4b0589fa1c618af

Desert LCC Land Cover Map Pilot Project

- Timeline: October 1, 2014 – September 30, 2016
- Purpose: The goal of this vegetation mapping project is to deliver 30-meter resolution, binational-integrated seamless dataset for one to three test sites. The final products delivered by this project – a pilot database for a test area, documented methods and accuracy assessments, a classification scheme, and a proposal for future work – will be applied to expand the pilot database to the entire Desert LCC with US-Mexico border coverage.
- Project status: In progress
- Project category: Data acquisition and development
- Main deliverable type: Map, methodology, or protocol
- Keywords: Grasslands, remote sensing, land use, land cover, shrublands, GIS.
- Ecoregion: US-Mexico Border
- Project link: https://www.sciencebase.gov/catalog/item/5498745ce4b07df8de5489fa

Desert LCC Data Management and Delivery

- Timeline: October 1, 2014 – September 30, 2018
- Purpose: To develop an information management and delivery system for the Desert LCC to coordinate science communication platforms and build a catalog of Desert LCC projects inside of the USGS ScienceBase data and information management platform

- Project Status: In Progress
- Project category: Data management and integration
- Main delivery type: Datasets or database, website
- Project link: https://www.sciencebase.gov/catalog/item/54987123e4b07df8de5489dc

Desert LCC Environmental Flows Database

- Timeline: October 1, 2014 –January 30, 2016
- Purpose: The purpose of this project is to 1) Develop a tool that will enable more resilient and effective management of riparian and aquatic ecosystems, 2) Understand the critical data gaps in flow need and flow response data in the Desert LCC (especially related to base-flow-dependent streams), 3 Develop a user-friendly, one-stop-shop for managers and researchers on existing data on flow needs and responses in Desert LCC, and 4) Provide recommendations for next steps to create a guidebook that can be used by managers to evaluate and implement environmental flow methodologies.
- Project Status: Completed
- Project category: Data management and integration; Informing Conservation Delivery; Decision Support
- Main delivery type: Datasets or database, applications and tools, map
- Project link: https://www.sciencebase.gov/catalog/item/5494ce05e4b0a2b9adad8efc

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Llewellyn, Dagmar (Bureau of Reclamation), William Schneider, P. Andrew Erdmann, and Rick Carpenter (City of Santa Fe), Claudia Borchert (Santa Fe County), Kelly Collins and Lauren Starosta (CDM Smith), and Jesse Roach (Sandia National Laboratories), Santa Fe Basin Study: Adaptations to Projected Changes in Water Supply and Demand, August 2015.

Reclamation, 2015, Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections website: http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/dcpInterface.html#Welcome

Upper Rio Grande Water Operations Model

URGWOM is a computational model developed through an interagency effort and is used to simulate processes and operations in the Rio Grande Basin in New Mexico as well track the delivery of water allocated to specific users. 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 on multiple SJ-C Project water contracts and forecasting to simulate daily storage and delivery operations in the Rio Grande Basin. The model is used to complete forecasting of operations for

an upcoming year for an Annual Operations Plan (AOP) and for long-term 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 2016, full implementation of the merged URGWOM model took place, with the official model now extending from the headwaters to Hudspeth County, Texas. Work to improve all segments of URGWOM with some emphasis on the Lower Rio Grande continued in 2016. Specifically, in the Lower Rio Grande, work was done to improve simulated return flows and head gate demands by improving the skill of the model to estimate groundwater fluxes and employing the use of soil moisture to meet crop demands. In the Middle Valley, a new method was developed and employed to allow for the use of soil moisture to meet crop demands while continuing to estimate salinity contents in and fluxes between the ground and surface water. In 2016, various ruleset modifications were done to improve the overall skill of the model to estimate reservoir releases.

In 2016, the tech team continued work on a URGWOM monthly timestep model, which can be used to more efficiently complete runs for scenarios that extend over longer periods of time. Work continued to improve the skill of the monthly model and to develop scripts to convert between the official daily model and the monthly. Ruleset management continues to be a focal point and challenge when developing the monthly and daily model as the two simulations can require different syntax for the same logic, requiring a duplication of effort or added complexity when writing model code.

Water Accounting Reports Projects

2016 San Juan – Chama Project Water Accounting

The 2016 San Juan – Chama Project water accounting was accomplished using version 7.0 of the RiverWare modeling system software and version 7.0 of the URGWOM accounting module. All accounting data and information is stored directly in the final version of the 2016 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 2016. 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).

Planned work for 2017 includes continued maintenance of HDB, continuing to back-populate historical data for both the Middle Rio Grande and Rio Grande Projects to HDB, and possibly implementing a new version of HDB. 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 2016 through multiple contracts (Reclamation and USACE) with CADSWES at the University of Colorado. Work included updating the Soil Moisture Method used to drive crop demand for the lower Rio Grande portion of the model during planning runs, continued work on the Scenario Explorer for use by stakeholders, enhancements to plotting utility, and work to improve the search mechanism within RiverWare's help menu. An annual report produced by CADSWES summarizes the 2016 improvements to URGWOM and RiverWare. The report is distributed to the user community at their annual meeting.

Evapotranspiration (ET) Toolbox Decision Support System

ET Toolbox was intended to make accurate, real-time ET predictions available to URGWOM for daily water operations model runs. This connection was never 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 (daily riparian and crop water use estimates, open water evaporation estimates, and rainfall estimates). 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. ET Toolbox 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.

The ET Toolbox model processes and predictions are highly dependent on local farm weather station data feeds. Other remote forms of data acquisition are under study, but for the near term significant resources are necessary to update and maintain the data collection and telemetry platforms that feed critical hourly weather data to the Toolbox. In 2016, the last weather station

telemetry feed went offline and the toolbox calculations now rely solely on weather forecasts.

The ET Toolbox daily rainfall and water depletion predictions for the Rio Grande are available to users and water managers at https://www.usbr.gov/uc/albuq/water/ETtoolbox/riogrande.html

In 2016, the option year for the current ET Toolbox support contract was exercised, extending the period of performance through Fiscal Year 2017. In 2016, the following tasks were performed on the ET Toolbox: general development and maintenance, updates to cropping patterns, improvements and simplifications to the data acquisition workflow, and updating ET Toolbox documentation. In addition to the general overhead of the Toolbox maintenance, new security requirements being enforced by the Department and Bureau in 2016 created significant rework of web site coding and data server workflows to keep the ET Toolbox online.

In 2017, Reclamation plans to continue to update cropping pattern information, develop data connections between URGWOM, HDB and ET Toolbox, update documentation to represent all ET Toolbox features, and remove unused components. Some effort will also be spent encouraging MRGCD to update and maintain their weather station network and explore other weather station data as required for the standardized reference ET method.

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 is working with the U.S. Department of Agriculture, NRCS, on additional irrigation improvements at Taos Pueblo. 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 eighteen Rio Grande Pueblos' irrigation infrastructure. The focus will be to obtain increased water efficiency through infrastructure improvements. Upon approval of the study Report by Congress, construction is authorized up to $6 million per year through FY 2019, not to exceed $60 million. In FY2016, Congress continued appropriations in the amount of $300,000 toward the study efforts. An additional $250,000 was made available through a fund transfer. These funds were spent on land surveying at various Pueblos to collect data to be used in the study. The anticipated date of the draft study Report is May 2017, after which it will go for review to Reclamation and other Federal agencies before being submitted to Congress.

Additional funding was also provided to Acoma Pueblo for work on water modeling of the Rio San Jose Basin by a consultant. This is a separate model than the U.S. Geological Survey model, which still has three years left until completion.

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, Nambe, 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's AAO is working on implementing Reclamation's responsibilities under the Taos Pueblo Indian Water Rights Settlement. Under the terms of the Settlement, Taos Pueblo has a recognized right to 11,827.71 ac-ft per year of depletion, of which 7,249.05 ac-ft per year would be available for immediate use. The Pueblo has agreed to forbear using 4,678.66 ac-ft per year in order to allow non-Indian water uses to continue. Over time, the Pueblo would reacquire the forborne water rights through purchase of surface water rights from willing sellers. Reclamation entered into contracts for San Juan –Chama Project water with the Pueblo for 2,215 ac-ft per year, the Town of Taos for 366 ac-ft per year, and El Prado Water and Sanitation District for 40 ac-ft per year.

For the Settlement Agreement to become final and effective, several conditions precedent needed to be fulfilled by March 31, 2017. 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 now final and enforceable.

Implementation of the settlement is currently in the final, on-the-ground phase, and Reclamation's AAO will provide financial assistance to eligible non-Indian entities so they can plan, design, and construct mutual-benefit projects. The mutual-benefit projects will minimize adverse effects on the Pueblo's water resources by moving future non-Indian ground water pumping away from the Pueblo's Buffalo Pasture, a culturally sensitive wetland.

During 2017, Reclamation will be working with the mutual benefit projects' parties to award the financial assistance agreements and begin preliminary design work in support of pending NEPA compliance.

Aamodt Settlement

The Aamodt Settlement Agreement provides for settlement of water rights claims in the Pojoaque Basin including claims of the Pueblos of Nambe, 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 authorizes Reclamation to plan, design, and construct a Regional Water System (RWS), and establishes several deadlines, including completion of all "conditions precedent" by September 15, 2017, and completion of the RWS by June 30, 2024. The RWS would consist of a water diversion and water treatment facilities at San Ildefonso Pueblo on the Rio Grande, and storage tanks, transmission and distribution pipelines, and may 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 Nambe.

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 feasibility design and related cost estimates for the RWS in December 2015. Reclamation and the 11 cooperating agencies have developed five alternatives to be analyzed in the EIS and the draft is scheduled for release in January 2017.

Quagga and Zebra Mussel Update

Quagga and zebra mussels (*Dreissena rostriformis bugensis* and *Dreissena polymorpha*) (ZQM) are invasive, freshwater, bivalve mollusks (Figure 9). 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 watercolumn. Transport to neighboring waterbodies occurs by hitching a ride on a boat or other water vessels that were used in infested water and then transported to another water body via standing water or adult mussel attachment. Eventually, veligers mature and began to attach to hard surfaces and will continue to grow into reproducing adults. Clumped onto these hard surfaces, ZQM clog infrastructure and restrict operation and maintenance for water storage, water delivery, and hydropower structures and systems; recreational use; and aquatic ecosystems (Source: http://www.usbr.gov/research/docs/ks/ks-2015-04.pdf).

Figure 9. Adult zebra and quagga mussels. Source: U.S. Geological Survey, http://nas.er.usgs.gov/taxgroup/mollusks/zebramussel/zebra_gallery.aspx

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

Outreach: Reclamation's AAO has engaged in public outreach effort since 2009, printing some 41,000 'Zap the Zebra' brochures and 1,000 mussel posters. These brochures and posters that have been dispersed throughout New Mexico at the New Mexico State Parks (NMSP), convenience and sporting good shops, libraries, etc. Permanent signs with the "Stop Aquatic Hitchhikers!" message have been installed at boating docks and other key locations at both Elephant Butte and Navajo Reservoir. Currently, information and outreach activities are being distributed to the public at any New Mexico reservoir 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. In 2016, the mobile unit on the New Mexico side at Navajo Reservoir was stolen. In the interim (until a new unit can be purchased), a mobile unit from Elephant Butte has been relocated to Navajo Reservoir. 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 and partners have increased the number of locations that watercraft inspections are being conducted from two (2) to eleven (11) waterbodies. The number of watercraft inspections statewide has increased from 9,346 in 2013 to 30,972 in 2016 (J. Dominguez, Personal Communication, see Table 15). NMDGF, Pyramid Enterprises (a contractor working with Reclamation, see below) and the City of Farmington are the agencies currently handling inspections. At many locations, NMSP is providing law enforcement support, location support and other logistics when needed.

Table 15: 2016 AIS Inspection Data (compiled by NMDGF and Reclamation). Inspections totals include incoming and outgoing vessels.

Location	**Number of Inspections**	**Number of Decontaminations**
Navajo Reservoir	12,926	93
Elephant Butte Reservoir	10,379	51
Ute Lake	3,355	17
Farmington Lake	2,707	0
Conchas Reservoir	942	6
Blue Water Lake	312	0
Santa Rosa Reservoir	157	2
Caballo Reservoir	115	0
Bill Evans Lake	6	0
Brantley Reservoir	5	1
Other Locations	4	0
Cochiti Lake	1	0
Headquarters	40	20
Albuquerque Office	16	2
Las Cruces Office	8	0
Roswell Office	2	0
Raton Office	0	0

In May 2016, Reclamation awarded an AIS monitoring contract to Pyramid Enterprises, Inc. (doing business as Rocky Mountain Recreation). The contract (#R16PC00054) could provide AIS watercraft inspections at Elephant Butte and Navajo Reservoirs for up to 5 years for the following:

- Watercraft 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, etc.

There have been over 10,000 inspections at Elephant Butte Reservoir, and over 12,000 inspections at Navajo Reservoir since the contract was awarded in May 2016 (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. Microscopy techniques use a compound microscope equipped with cross-polarized filters that create a black background and causes the calcium carbonate of the veliger shell to glow as light passes through the filters (Johnson 1995, Reclamation 2013). Some portion of the shell will fall in line with the axis of the cross polarizing filters creating a distinctive Maltese cross pattern on the shell. The Maltese cross pattern is the main identifying feature for veliger identification. A polarized filter is utilized to view the distinctive "cross" that confirms the specimen is either a zebra or quagga mussel.

Polymerase Chain Reaction (PCR) testing (Johnson 1995, Reclamation 2013) is performed on samples from all water bodies that have ever 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 reservoir bodies under RDLES' direction. Represented below is the respective 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 2016 (D. Hosler, personal Communication, Table 16).

Table 16: 2016 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	13	Negative for all	Negative (4 tested)
El Vado Reservoir	11	Negative for all	Negative for all
Elephant Butte Reservoir	7	Negative for all	Negative for all
Caballo Reservoir	5	Negative for all	Not tested
Sumner Reservoir	12	Negative for all	Negative for all
Brantley Reservoir	12	Negative for all	Not tested
Farmington Lake	15	Negative for all	Negative (5 tested)

In 2015, RDLES had positive microscopy and PCR for samples taken at Navajo Reservoir, in the vicinity of Simms Marina. Monitoring samples collected by NMDGF throughout the 2015 monitoring season near Simms Marina and other locations within Navajo Reservoir did not result in a positive result for zebra or quagga mussels. Subsequent scuba dive surveys of the anchored structures in and around Simms Marina (facilitated with Dive Teams) by NMDGF and Colorado Parks and Wildlife did not reveal adult mussel presence.

In 2016, a sample collected by NMDGF (Navajo Reservoir-Negro Andy Canyon-(7/15/16) and Navajo Reservoir-Pine Ramp (8/4/16) were reported positive for quagga mussel using PCR technology. Split samples were sent to additional labs (microscopy and PCR) and neither of the samples could be confirmed positive. NMDGF has designated Navajo Reservoir as inconclusive for quagga mussels (using waterbody designations created by the Western Regional Panel and the Navajo Reservoir Incident Rapid Response Plan for Dreissenid Mussels, Dominguez and Patten 2014). Increased monitoring from NMDGF is expected in 2017.

Navajo Reservoir, with its proximity to Lake Powell and other positive ZQM waters, remains a high risk for invasive mussel introduction (J. Dominguez, Personal Communication). Factors that may contribute to a lack of mussel occupation in New Mexico reservoirs include a fast spring run-off 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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