

2011

Calendar Year 2011 Report to the Rio Grande Compact Commission

Dick Wolfe
Colorado

Scott A. Verhines
New Mexico

Patrick R. Gordon
Texas

Hal Simpson
Federal Chairman

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RECLAMATION

Managing Water in the West

Calendar Year 2011 Report to the Rio Grande Compact Commission

Colorado
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Texas
Patrick R. Gordon

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

March 2012

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Cover photo – Elephant Butte as seen through an emergency spillway outlet at the Dam

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Introduction

The Albuquerque Area Office 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 ground water salvage project located near Alamosa, Colorado, which pumps water from the shallow unconfined aquifer.

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 and 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 entails 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 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 resides in 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 in New Mexico and the El Paso County Water Improvement District No. 1 in Texas. Water is also provided for diversion to Mexico by the International Boundary and Water Commission-United States Section according to the terms of the 1906 Treaty 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 provides generation of 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 operating agreement.

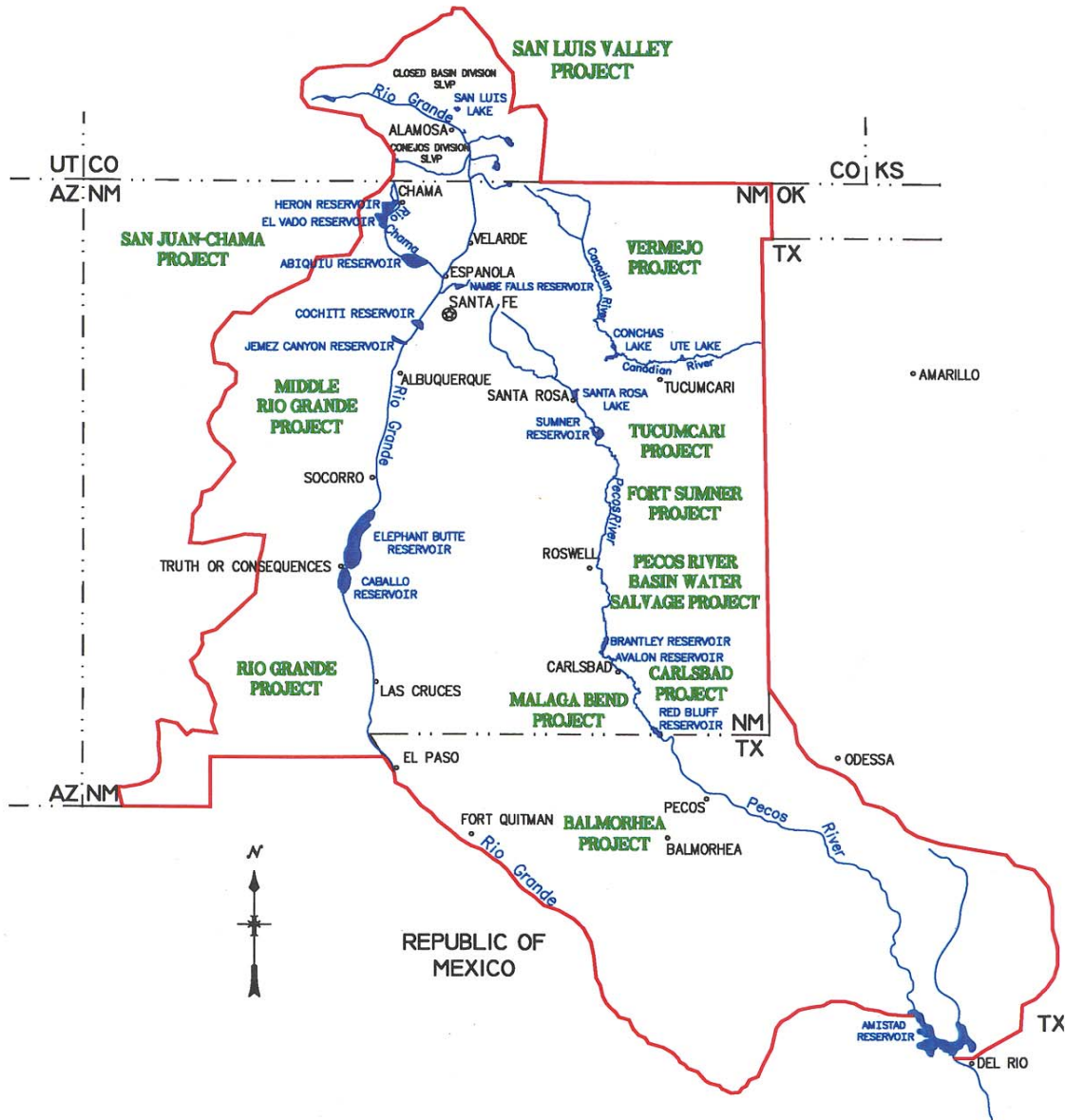


Figure 1: Project Map of Reclamation's Albuquerque Area Office

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 began January 1, 2011, at elevation 9,985.63 feet AMSL, with a content of 21,571 ac-ft. The September 30, 2011, elevation was 9,984.33 feet, with a content of 20,809 ac-ft. Of that content, 708 ac-ft was direct-flow storage and 5,024.2 ac-ft was Compact water. On December 31, 2011, the elevation was 9,973.82 feet, with a storage content of 15,098 ac-ft. A volume of 1,460.4 ac-ft of Compact water remained in storage.

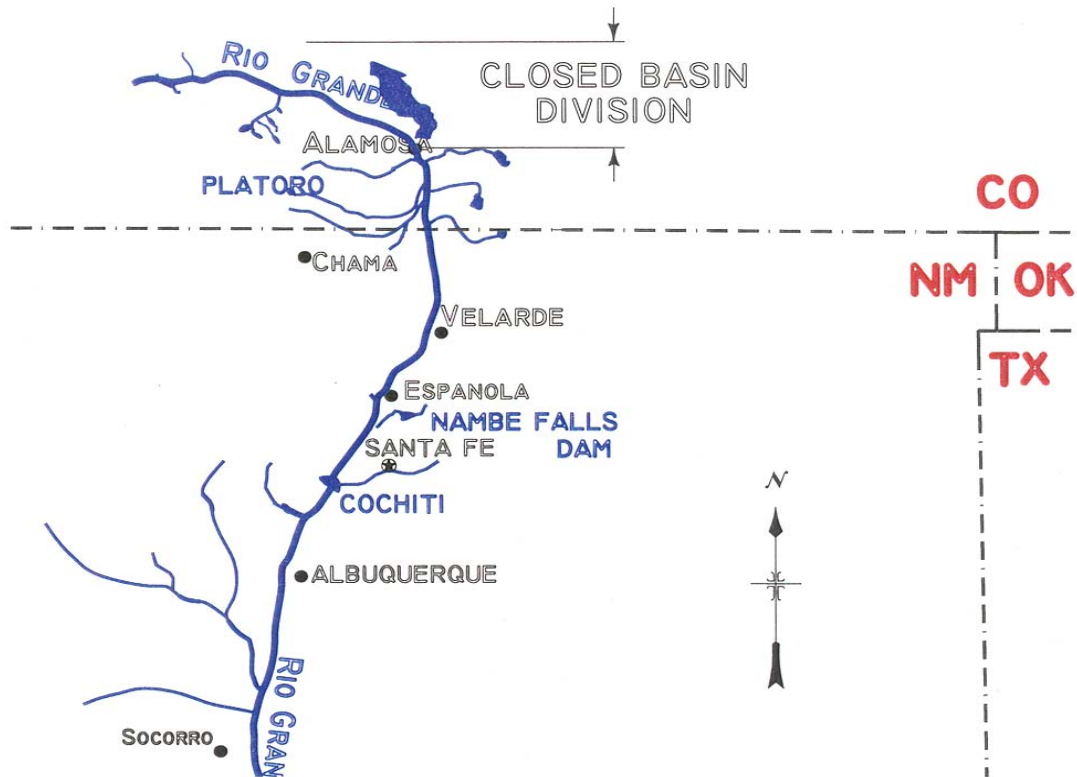


Figure 2: Area Map of San Luis Valley Project

Platoro Dam Facility Review and Safety of Dams Programs

There were no major issues with the operation and maintenance at Platoro Dam, other than aging infrastructure. Accomplishments in 2011 included:

- The Periodic Security Review was completed in September with no significant issues.
- The Annual Site Inspection was completed.
- The Facility Review Rating was updated and Platoro fell in the Good category.
- Installation of new Jet-Flow gates was finalized with replacement of the northwest operator on gate No. 2.
- Dam tender training was completed by the new secondary dam tender.
- The outlet works service gate was inspected for cavitation.
- There are currently four category 2 incomplete O&M recommendations.

Closed Basin Division

The Alamosa Field Division of the Albuquerque Area Office operates and oversees the maintenance of a water salvage project constructed in the Closed Basin area of the San Luis Valley, Colorado (Figure 2). The purpose is to salvage unconfined ground water from the Closed Basin that would otherwise be lost to evaporation and evapotranspiration. The salvaged water is pumped from 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 provides for the delivery of mitigation water to the Alamosa National Wildlife Refuge and Blanca Wildlife Habitat Area, and stabilization of San Luis Lake. Reclamation continues to work under the guidance of the Closed Basin Division Operating Committee in management of Closed Basin operations and water deliveries. A Review of Operations and Maintenance examination (RO&M) was conducted in October of 2011. The next RO&M examination is scheduled for 2016.

Closed Basin – Operations and Maintenance

Operations

Closed Basin water deliveries in Calendar Year (CY) 2011 included deliveries to the Rio Grande, Blanca Wildlife Habitat Area, and Alamosa National Wildlife Refuge.

A total of 15,167 ac-ft of project water was delivered in CY2011. Total deliveries of Compact water to the Rio Grande for CY2011 were 11,579 ac-ft. Total water deliveries to the Bureau of Land Management (BLM) Blanca Wildlife Habitat Area for CY2011 were 800 ac-ft for annual mitigation and 88 ac-ft for a San Luis Valley Conservancy District exchange. Total water deliveries to the Alamosa National Wildlife Refuge for CY2011 were 2,700 ac-ft for annual mitigation.

Natural inflows to San Luis Lake (SLL) are measured by the SLL inlet flume or estimated at the spillway and culverts. Natural inflow to SLL during CY2011 was 282.6 ac-ft.

Closed Basin Division water accounting for the 2011 calendar year is summarized in Table 1.

Table 1: San Luis Valley Project - Closed Basin Division Water Accounting (units are acre-feet)

MONTH	BLANCA WILDLIFE HABITAT AREA (BWHA)			PARSHALL FLUME		ALAMOSA NATIONAL WILDLIFE REFUGE (ANWR)				DELIVERY TO THE RIO GRANDE			PROJECT TOTALS
	CH03 STA. 730+00	CH04 STA. 798+60	MONTH TOTALS	TOTAL PASSING FLUME	CREDITABLE AMOUNT AT FLUME	CH01 CHICAGO TURN-OUT	CH02 MUM TURN-OUT	PUMPING PLANT	MONTH TOTALS	TOTAL AT FLUME MINUS DEL. TO ANWR	CREDITABLE AMOUNT TO RG AND NOT USED BY ANWR	NON- CREDITABLE @ LOBATOS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
JAN	0	0	0	1,428	1,428	0	0	0	0	1,428	1,428	0	1,428
FEB	0	0	0	1,194	1,194	112	0	39	151	1,043	1,043	0	1,194
MAR	0	0	0	1,379	1,379	623	0	343	966	413	413	0	1,379
APR	0	93	93	1,170	1,170	362	320	68	750	420	420	0	1,263
MAY	0	0	0	1,228	1,228	190	35	0	225	1,003	1,003	0	1,228
JUN	25	51	76	1,131	1,131	0	0	0	0	1,131	1,131	0	1,207
JUL	133	202	335	817	817	0	0	0	0	817	817	0	1,152
AUG	107	190	296	964	964	0	0	0	0	964	964	0	1,260
SEP	0	0	0	1,317	1,317	124	115	0	239	1,078	1,078	0	1,317
OCT	0	88	88	1,255	1,255	192	177	0	369	886	886	0	1,343
NOV	0	0	0	1,152	1,152	0	0	0	0	1,152	1,152	0	1,152
DEC	0	0	0	1,244	1,244	0	0	0	0	1,244	1,244	0	1,244
ANNUAL	265	623	888	14,279	14,279	1,603	647	450	2,700	11,579	11,579	0	15,167

The project continues to provide Priority 1 (Compact) and Priority 2 (Mitigation) water deliveries. The San Luis Valley is in the midst of a severe drought and the water table in the unconfined aquifer has dropped significantly in some areas. Pumping levels remain stable to allow the water table to recover while minimizing impacts to the surrounding area and preserving the integrity of existing project wells.

Wells turned off at the recommendation of the Project Hydrologist in 2007 remained off in 2008, 2009, 2010, and 2011. The sixteen wells were turned off to maintain the aquifer within the project at a sustainable level.

The Alamosa Field Division has been meeting with other interested parties (US Fish and Wildlife Service, Colorado Division of Parks and Outdoor Recreation, Colorado Division of Wildlife and Rio Grande Water Conservation District) on the operation of San Luis Lake in an effort to make the Lake a viable recreation area and to provide storage of water for later delivery to the Rio Grande to meet Compact requirements.

The United States Geological Survey's (USGS) Pueblo, Colorado, office provides quality assurance/quality control (QA/QC) of the observation wells' network data for Reclamation. Reclamation received an excellent rating through the 2011 QA/QC program.

Maintenance

Routine preventive maintenance and repair activities continued at salvage and observation well sites, canal structures, pumping plants, and shelterbelts. Other work included aquatic and noxious weed control, rodent control, and ice removal.

A total of eight replacement wells—six for Reclamation and two for the U. S. Fish and Wildlife Service—were drilled, and 27 wells were rehabilitated. Reclamation has requested permits to re-drill three wells in 2012. The intent is to expand Reclamation's much improved salvage well rehabilitation program. With a different well screen design, a change in the gravel pack style, and rehabilitation, these wells continue to prove that the re-drills have been very successful to the

project and the commitment to the Rio Grande Compact, the Alamosa National Wildlife Refuge, and the Blanca Wildlife Habitat Area. A total of 65 salvage wells were re-drilled from 2002 through 2011.

Repair and replacement of pumps and motors in the salvage well vaults is an ongoing process. The maintenance crew will continue to chemically treat salvage wells in our rehabilitation efforts in 2012. We are in the process of testing a new salvage well treatment product which is sodium hydroxide-based. Annual preventive maintenance of salvage wells is ongoing as well as maintenance on the lateral valves.

Over the last two plus years, Reclamation has undertaken a program to improve salvage well efficiency, by increasing salvage well yield while reducing pump energy consumption and cost. The improvement in salvage well efficiency is being achieved by:

1. Designing pumps to maintain a higher pumping water level in re-drilled wells. This requires smaller pumps and energy use, because the water lift requirement is reduced. This will also maintain well efficiency over a longer period of time.
2. Rehabilitation of existing wells. A combination of aggressively brushing and surge blocking is used before doing any chemical treatment. This aggressive rehabilitation is being accomplished with the new and larger workover rig purchased this year.
3. Improvement in monitoring and measurement techniques. Great improvements have been made in the measurement and monitoring of salvage well flow and drawdown, and pipeline pressure. By having good measurement of these parameters the most efficient pump can be selected for each well.

Water Quality

Water quality monitoring of Closed Basin Division salvage wells, the Rio Grande, San Luis Lake, Head Lake, and the conveyance channel continued throughout 2011.

The Water Quality Laboratory continues to support the Operations and Maintenance groups with their salvage well rehabilitation and bio-fouling mitigation efforts. The laboratory has the capability to culture and identify “iron related bacteria,” and all salvage wells are currently monitored for the presence of these bacteria.

The Water Quality Laboratory participated in the spring and fall USGS’ Evaluation Program for Standard Reference Water Samples. The Laboratory continues to perform commendably on these audits.

Rio Grande Water Conservation District

The Rio Grande Water Conservation District (RGWCD) continues to perform civil maintenance

on the Project based on 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 the 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.

The RGWCD continues to assist Reclamation in the re-drill and rehabilitation efforts due to the bio-fouling in numerous wells.

San Juan – Chama Project, Colorado – New Mexico

Reclamation's Albuquerque Area Office Water Management Division continued to maintain its internet web page for Middle Rio Grande Water Operations during 2011. This web site provides the current year's monthly data for the operation and water accounting of the San Juan – Chama Project. To reach the internet web page, type <http://www.usbr.gov/uc/albuq/water/> into a web browser. An area map of the San Juan – Chama Project is provided below in Figure 3.

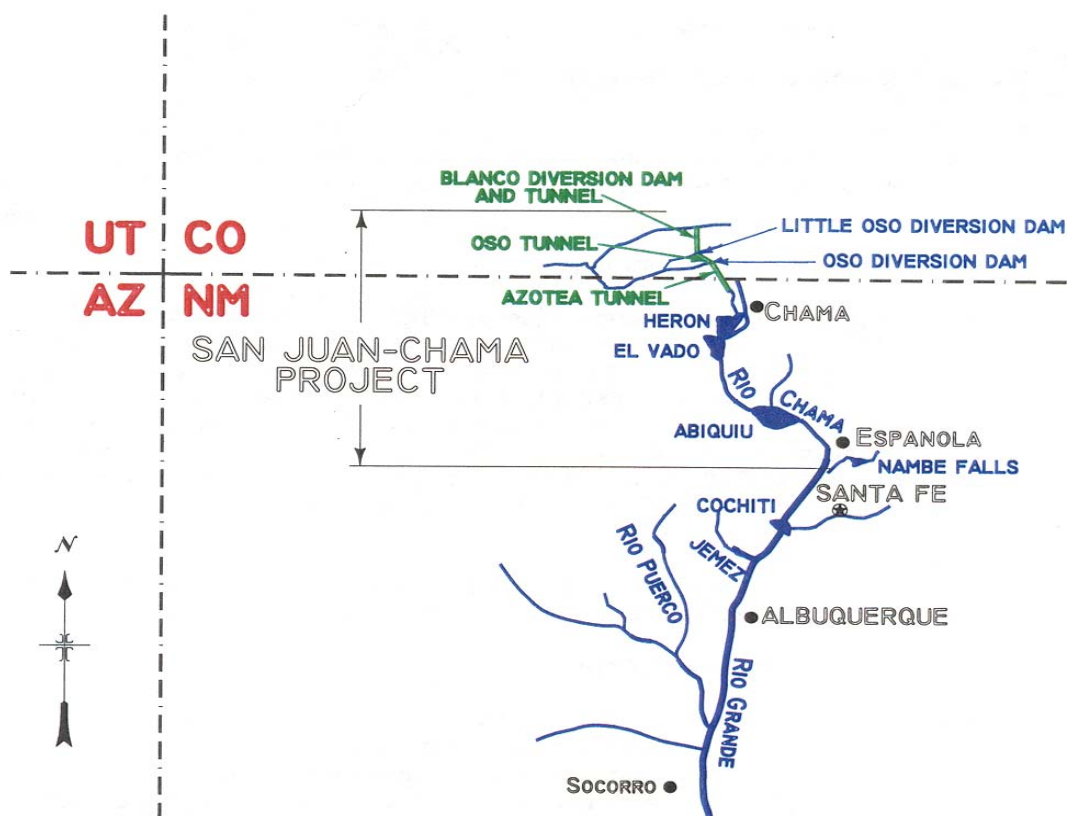


Figure 3: Area Map of the San Juan-Chama Project

San Juan-Chama Project Accounting

Water diverted from the San Juan Basin in Colorado through the San Juan – Chama Project authorized by Congress in 1962 through P.L. 87-483, introduced special circumstances for water use and management in the Middle Rio Grande Valley. Imported San Juan Chama Project water must be accounted for separately from native Rio Grande flow, and fully consumed in New Mexico.

Reclamation is responsible for water contracts and accounting for the San Juan – Chama Project.

Historically, Fortran models and a Lotus® spreadsheet captured and implemented approved Compact accounting methods until 2008, when an Excel® spreadsheet was developed and used to produce the final accounting document. Improvements to the RiverWare® accounting model using the hydrologic database (HDB) for data storage and Crystal Reports® for report generation allowed side-by-side comparison of accounting tables produced independently by Excel® and the RiverWare® accounting model/HDB/ Crystal Reports® method with favorable results. This practice continued in 2010. In 2011 and into the future, Reclamation will use the RiverWare® accounting model/HDB/ Crystal Reports® method exclusively. San Juan – Chama Project accounting for 2011 is provided in the separate report *2011 Water Accounting Report*.

Response to Compact Commission Request

In 2010, the Engineer Advisors asked Reclamation to develop set loss rates for movement of San Juan – Chama Project water from Cochiti Reservoir to Elephant Butte Reservoir. On January 18, 2012, Reclamation presented results and backup data from an analysis of these loss rates to the Engineer Advisors. Modeling results set loss rates based on the month in which the movement took place, the length of the San Juan – Chama release, the native flow at the time, and the amount of San Juan – Chama water moved. Tables were developed for three ranges of native flow: 500 – 1200 cfs, 1200 – 2000 cfs, and greater than 2000 cfs. Portions of tables for the lowest and highest native flow ranges are presented below.

Table 2: Example Loss Rate Tables for Movement of San Juan – Chama Water from Cochiti to Elephant Butte

SJC Loss from Cochiti to Elephant Butte						SJC Loss from Cochiti to Elephant Butte					
Native Flow at Cochiti 500-1200 cfs						Native Flow at Cochiti >2000 cfs					
	SJC Release Length (days)	SJC Release Rate (cfs)					SJC Release Length (days)	SJC Release Rate (cfs)			
		5	10	15	20			5	10	15	20
January	0-300	13%	12%	12%	11%	April	0-300	9%	8%	8%	8%
	300-600	12%	12%	11%	10%		300-600	9%	8%	8%	8%
	600-900	12%	11%	10%	10%		600-900	9%	8%	8%	8%
	900-1500	11%	10%	10%	9%		900-1500	8%	8%	8%	8%
February	0-300	13%	12%	12%	11%	May	0-300	9%	8%	8%	8%
	300-600	12%	12%	11%	10%		300-600	9%	8%	8%	8%
	600-900	12%	11%	11%	10%		600-900	9%	8%	8%	8%
	900-1500	11%	11%	10%	9%		900-1500	8%	7%	8%	8%
March	0-300	15%	14%	13%	13%	June	0-300	10%	10%	8%	7%
	300-600	14%	13%	12%	12%		300-600	9%	9%	7%	7%
	600-900	13%	13%	12%	11%		600-900	9%	9%	7%	7%
	900-1500	13%	12%	11%	10%		900-1500	8%	9%	7%	6%

Reclamation recommends that San Juan – Chama water not be moved if native flow is less than 500 cfs, and not be moved in December. These loss rates are being reviewed by the Engineer

Advisors.

San Juan-Chama Diversion Dams and Tunnels

Diversions for the San Juan – Chama Project begin in Colorado at the Blanco, Oso, and Little Oso diversion dams, depicted in Figure 3. Operation begins with the spring runoff, and maintenance occurs in the fall, when the intake forebay areas and associated structures are dredged and cleaned to allow unobstructed access to the associated tunnels. The Azotea Tunnel collects diversion flows for transport to the outfall at Willow Creek above Heron Reservoir.

To maintain compliance with Section 404 of the Clean Water Act, permits for maintenance at the Blanco and Oso Diversion Dams were acquired from the U.S. Army Corps of Engineers (USACE). The permits, initially scheduled to expire December 1, 2011, have been extended through December 1, 2016. They require annual reporting of any maintenance that was accomplished for that year, including sediment removal, bank stabilization, and maintenance of the diversion dams and associated infrastructure.

In 2009, a sluice gate malfunctioned at the Oso Diversion and allowed about 700 cubic yards of sediment to discharge downstream. Reclamation received a Notice of Violation of the Clean Water Act from the USACE. Reclamation has corrected the sluice gate programming error that caused the accidental discharge of sediment. Reclamation also worked with downstream property owners to remove sediment deposited on their property. As a result of this violation, Reclamation agreed to conduct a three year survey of fish and macro-invertebrates to ascertain the health of the Navajo River. Reclamation submitted interim reports of findings to the USACE annually from 2009 to 2011. Reclamation will submit the final report to the USACE in December 2012. Several tort claims concerning the 2009 release of sediment were filed in 2011 by landowners adjacent to the river. These claims are currently being processed by Reclamation.

Heron Dam and Reservoir Operations

(All elevations are 1929 NGVD, storage reference is 1987 ACAP survey)

Diversions into the Azotea Tunnel began on March 14 and ended on December 4, 2011. The total volume diverted through the tunnel was 98,321 ac-ft. The running 10-year average Azotea Tunnel diversion decreased slightly this year, from 93,829 ac-ft for the period 2001 through 2010 to 92,603 ac-ft for the period 2002 through 2011 (Table 3). Heron Reservoir began the year at an elevation of 7,151.66 feet (226,639 ac-ft) and finished the year at an elevation of 7,152.39 feet (229,761 ac-ft). Heron's lowest pool elevation and storage occurred on February 28, at elevation 7,150.88 feet (223,328 ac-ft). Storage peaked on August 2 at an elevation of 7,168.41 feet (304,607 ac-ft).

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

AZOTEA	YEAR										10 YEAR TOTAL
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
JANUARY	0	0	0	0	0	0	0	0	0	0	0
FEBRUARY	0	0	0	93	0	179	0	272	0	0	544
MARCH	743	1170	11505	1931	706	12976	4745	5938	546	2,008	42268
APRIL	4499	11366	15427	31721	17799	17745	25816	19111	21908	13,570	178962
MAY	865	26613	30164	45146	25674	33837	44461	51766	35368	22,315	316209
JUNE	204	18816	20390	50210	7600	26679	47463	23544	27249	42,779	264934
JULY	0	669	2139	13347	3785	4302	13428	4392	1815	8,404	52281
AUGUST	0	487	237	3779	4868	7375	2606	232	1501	1,594	22679
SEPTEMBER	0	3340	1973	3360	5567	1948	1465	99	712	1,852	20316
OCTOBER	0	246	1821	4873	12795	33	0	0	251	4,452	24471
NOVEMBER	0	0	1218	735	0	0	0	0	53	1,295	3301
DECEMBER	0	0	12	0	0	0	0	0	0	52	64
ANNUAL	6311	62707	84886	155195	78794	105074	139984	105354	89403	98,321	926029

TEN YEAR AVERAGE = 92603

The SJ-C contractors' 2011 and waived 2010 annual allocations were delivered as shown in Table 4, for a total delivery in 2011 of 80,588 ac-ft. The remaining 2011 allocations are being held in Heron according to waivers which grant an extension for the delivery date for several contractors into 2012. Table 5 presents actual monthly Heron water operations for the 2011 calendar year.

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

SJ-CHERON RELEASE	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	UNCONTRACTED	RECLAMATION	TOTAL	
																				MONTH
ALLOCATION	20,900	5,230	375	5,000	48,200	1,030	400	1,200	1,000	15	400	400	500	60	6,500	2,000	2,990		96,200	
JANUARY	565	0	0	956	0	244	0	0	0	0	0	0	0	0	0	0	0	0	0	1,765
FEBRUARY	0	0	0	0	651	109	2	0	93	6	122	0	47	0	0	0	0	0	0	1,030
MARCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APRIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	0	0	0	0	144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	144
JUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JULY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AUGUST	0	0	44	357	27,081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27,482
SEPTEMBER	0	0	156	650	20,324	0	14	0	57	2	76	0	16	0	0	0	0	12,078	33,374	
OCTOBER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NOVEMBER	8,900	3,264	0	1,605	0	0	27	0	74	4	149	0	31	0	0	0	0	0	0	14,055
DECEMBER	0	2,210	0	0	0	529	0	0	0	0	0	0	0	0	0	0	0	0	0	2,739
2011 CY TOTAL	9,465	5,474	200	3,569	48,200	881	43	0	224	12	347	0	94	0	0	0	0	0	0	80,588

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)	
DEC. 2010						28	226,652	226,680	7,151.67
JANUARY	114	0	142	1,765	457	0	224,430	224,430	7,151.14
FEBRUARY	103	0	102	1,030	73	1	223,327	223,328	7,150.88
MARCH	935	2,008	114	0	497	822	224,838	225,660	7,151.43
APRIL	2,391	13,543	2,169	0	2,160	1,043	236,221	237,265	7,154.12
MAY	1,118	22,270	1,702	144	2,410	459	255,938	256,398	7,158.39
JUNE	126	42,693	126	0	1,443	459	297,189	297,648	7,167.02
JULY	1,373	8,387	136	0	2,718	1,696	302,857	304,554	7,168.40
AUGUST	768	1,594	1,610	27,482	1,818	854	275,152	276,005	7,162.58
SEPTEMBER	522	1,852	860	33,374	1,102	516	242,527	243,043	7,155.43
OCTOBER	545	4,443	120	0	852	940	246,118	247,058	7,156.33
NOVEMBER	115	1,295	177	14,055	851	879	232,507	233,386	7,153.23
DECEMBER	116	52	666	2,739	388	329	229,432	229,761	7,152.39
SUB-TOTAL	8,224	98,137	7,923	80,588					
ADJUSTMENT						-350	(M)		
ANNUAL		106,361		88,511	14,769	-21	229,782	229,761	

Heron Dam Facility Review and Safety of Dams Programs

There were no major issues with the operation and maintenance at Heron Dam, other than aging infrastructure. Accomplishments in 2011 include:

- The Periodic Security Review was completed in September with no significant issues.
- The Annual Site Inspection was completed.
- The Facility Review Rating was updated and Heron fell in the Good category.
- The Sutron Data Control Panel was replaced.
- Minor updates to the security plan were completed.
- The 2010 area-capacity (ACAP) tables were delivered.
- Work continued on Quagga/Zebra mussel prevention.
- O&M recommendation 2007-2-D, updates to the SOP, was completed.
- There are currently three category 2 incomplete O&M recommendations.

Pojoaque Tributary Unit - Nambé Falls Dam and Reservoir

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

Nambé Falls began 2011 with the reservoir at elevation 6,820.73 feet, providing a storage volume of 1,602 ac-ft. During the winter, releases averaged around 1 cubic foot per second (cfs) to maximize conservation storage as agreed to by the Pojoaque Valley Irrigation District and Indian water users. The reservoir filled and spilled in 2011. The maximum elevation for the

year was 6,826.61 feet (1,920 ac-ft) on March 23. The reservoir filled on that date and remained full until April 24 when irrigation releases began and reservoir storage and elevation began to fall. Nambé Falls Reservoir ended 2011 at an elevation of 6,812.57 feet (1,221 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 an elevation of 6,825.60 feet 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 an elevation of 6,826.6 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.

A net depletion of 764 ac-ft was calculated for Nambé Falls operations for the entire year. The depletion amount (plus transportation loss) was released from Heron and Abiquiu Reservoirs throughout 2011. Table 6 provides a summary of Nambé Falls use above Otowi and the Pojoaque Unit return flow credit used to calculate depletions during 2011. A summary of 2011 Nambé Falls reservoir operations is provided in Table 7.

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

SJ-C AT OTOWI	RELEASE FROM HERON	HERON RELEASE STORED IN EL VADO	RELEASE FROM EL VADO	TOTAL BELOW EL VADO	RELEASE FROM OR STORAGE IN ABQUIU	TRANS. LOSSES	NAMBE FALLS USE ABOVE OTOWI	RETURN FLOW CREDIT - POJOAQUE UNIT	SAN JUAN WATER AT OTOWI
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
JANUARY	1,765	358	0	1,407	848	36	186	27	2,060
FEBRUARY	1,030	702	0	328	2,428	28	119	25	2,633
MARCH	0	0	0	0	2,875	26	26	22	2,846
APRIL	0	0	0	0	9,105	82	13	21	9,031
MAY	144	0	241	384	4,140	45	37	33	4,475
JUNE	0	0	924	924	4,198	56	26	101	5,141
JULY	0	0	7,194	7,194	233	146	143	76	7,214
AUGUST	27,482	6,660	0	20,822	-15,437	278	223	47	4,931
SEPTEMBER	33,374	1,196	0	32,178	-17,968	482	31	58	13,756
OCTOBER	0	0	5,326	5,326	-1,602	92	79	49	3,601
NOVEMBER	14,055	8,831	0	5,224	-1,555	90	216	31	3,393
DECEMBER	2,739	0	111	2,850	326	60	184	27	2,959
ANNUAL	80,588	17,747	13,795	76,636	-12,410	1,421	1,282	517	62,040

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

NAMBÉ FALLS MONTHLY	INFLOW	OUTFLOW			RESERVOIR LOSSES	TOTAL OUTFLOW + LOSSES	END OF MONTH			
		BYPA SSED	STORAGE RELEA SE				CONTENT	ELEVA TION		
MONTH	(1)		(2)	OPERATIONAL	IRRIGATION	(3)			(4)	(5)
DEC. 2010							1,599	6,820.67		
JANUARY	238	52	0	0	0	52	1,784	6,824.19		
FEBRUARY	201	82	0	0	-1	81	1,904	6,826.33		
MARCH	270	245	0	2	8	255	1,920	6,826.60		
APRIL	357	340	0	118	22	480	1,797	6,824.42		
MAY	467	415	0	675	17	1,108	1,156	6,811.00		
JUNE	389	352	0	345	17	715	830	6,802.07		
JULY	402	254	0	97	4	355	877	6,803.50		
AUGUST	526	298	0	212	4	515	888	6,803.83		
SEPTEMBER	324	290	0	160	4	454	758	6,799.79		
OCTOBER	355	275	0	10	3	287	825	6,801.94		
NOVEMBER	244	29	0	0	4	33	1,037	6,807.98		
DECEMBER	212	28	0	0	0	28	1,221	6,812.57		
ANNUAL	3,985	2,660	0	1,619	82	4,362	1,221	6,812.57		

Nambé Falls Dam Facility Review and Safety of Dams Programs

There were no major issues with the operation and maintenance at Nambé Falls Dam, other than a fire in the watershed in June and an earthquake near the dam in October. These incidents are covered in more detail below. Accomplishments in 2011 include:

- The Comprehensive Security Review was completed in September, and five new security recommendations were added.
- The Annual Site Inspection was completed
- The Facility Review Rating was updated, and Nambé fell in the Fair category.
- In response to the June fire, a sediment/debris trap/dam was constructed.
- A collimation and level point survey on the embankment points was completed.
- There are currently five incomplete category 2 O&M recommendations.

In June 2011, the Pacheco Canyon Fire burned approximately 10,000 acres in the Nambé Falls Dam drainage basin. The Bureau of Reclamation coordinated with the Bureau of Indian Affairs, the Native American Pueblos, and the Pojoaque Valley Irrigation District to construct a sediment trap on the Rio Nambé at the upstream end of the reservoir. The fire started June 18, 2011, and the Socorro Field Division began work July 11, 2011, completing the sediment trap on September 30, 2011. Dredging operations to remove sediment that entered the reservoir as a result of storms after the fire were completed on November 10, 2011.

An earthquake occurred near the dam on October 17, 2012 at 10:38 am. The epicenter was 2.8 miles from the dam, and the magnitude was 3.8. Standard Operating Procedures and the

Emergency Action Plan were followed. After a complete internal and external walk through, no offsets and/or displacement to the concrete and abutments or the earthfill dike were observed.

Middle Rio Grande Project, New Mexico

The *Middle Rio Grande Project* (Figure 4) is operated out of the Albuquerque Area Office, 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.

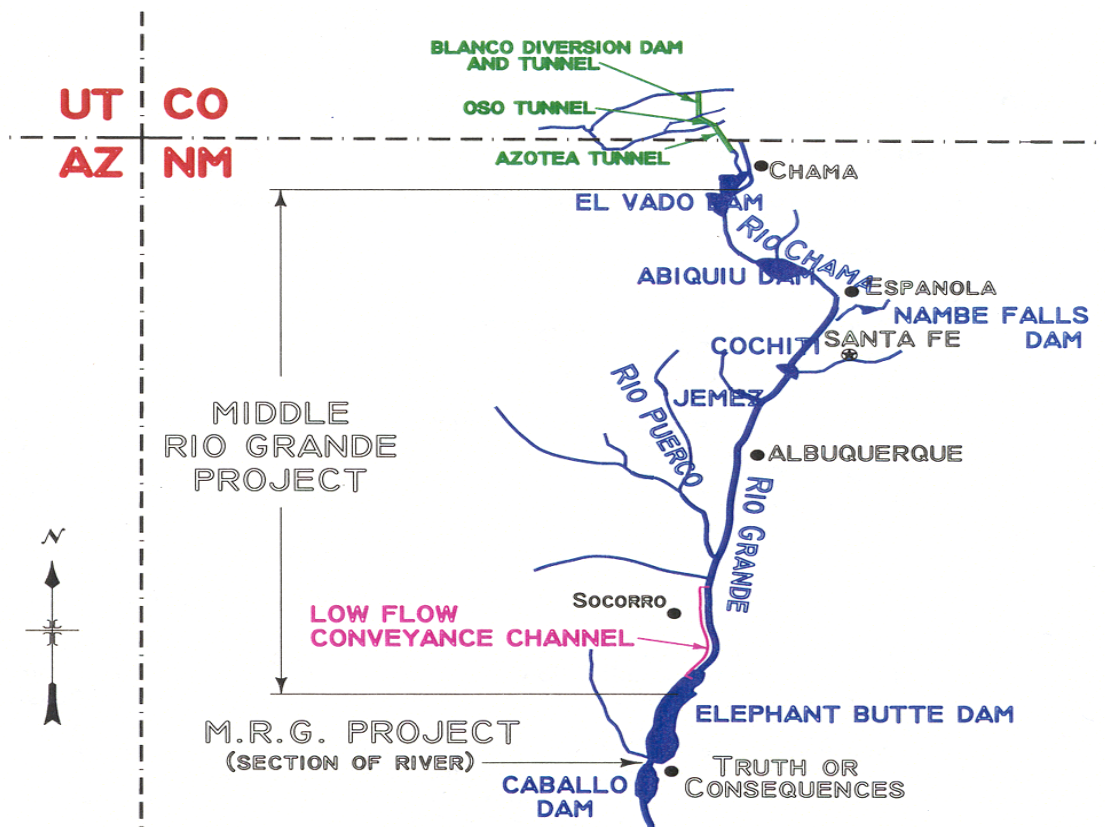


Figure 4: Area Map of the Middle Rio Grande Project

New Mexico Relinquishment of Rio Grande Compact Credit

Per the Rio Grande Compact Article I definition, the usable water in Project storage (Elephant Butte and Caballo Reservoirs together) was below 400,000 ac-ft for all of 2011. Article VII of the Rio Grande Compact stipulates that when usable water in Project storage is below 400,000 ac-ft, no “native Rio Grande flows” will be stored in post-1929 reservoirs upstream of Elephant Butte Reservoir in New Mexico and Colorado unless relinquishment of credit waters in Elephant Butte Reservoir occurs.

During 2011, 18,500 ac-ft of Emergency Drought Water, available after previous years’ relinquishments made by New Mexico, was captured by Reclamation for the benefit of the Middle Rio Grande Conservancy District (MRGCD) under the Emergency Drought Water Agreement (EDWA), and 20,000 ac-ft was captured for Reclamation. The balance of

Emergency Drought Water available for capture and storage by Reclamation and MRGCD during 2012 or later years is 40,536 ac-ft. Reclamation's balance for use as supplemental water for endangered species is 10,451 ac-ft, and 30,085 ac-ft remains to be captured for the benefit of MRGCD.

Reclamation started 2011 with 0 ac-ft of Emergency Drought Water stored in El Vado Reservoir for use on behalf of listed endangered species. MRGCD started 2011 with 9,200 ac-ft of Emergency Drought Water in El Vado Storage, and by the end of the irrigation season had exhausted all of that water as well as the water captured during the year. Of, MRGCD released all of the Emergency Drought Water captured in 2011, while Reclamation did not release any, and had 19,196 ac-ft in storage at the end of 2011.

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 2011 at an elevation of 6,872.56 feet (108,543 ac-ft). The reservoir peaked on May 30 at an elevation of 6,893.03 feet (163,009 ac-ft), and hit a low point of 6,861.98 feet (86,560 ac-ft) on December 20. The reservoir finished the year at elevation 6,862.03 (86,655 ac-ft).

MRGCD began the year with 9,200 ac-ft of Emergency Drought Water, 33,762 ac-ft of general Rio Grande storage, and 65,598 ac-ft of SJ-C water in El Vado for Middle Valley irrigation. This was in addition to MRGCD's 20,900 ac-ft of 2011 SJ-C allocation in Heron, and a beginning year balance of 576 ac-ft of SJ-C stored in Abiquiu Reservoir. At the end of the year, MRGCD had 0 ac-ft of Emergency Drought Water, 0 ac-ft of general Rio Grande storage, and 67,332 ac-ft of SJ-C storage in El Vado reservoir. El Vado ended the year with 127 ac-ft of Rio Grande water in storage which was inadvertently stored due to end-of-year operations. This water will be released as soon as possible.

MRGCD also had 2,193 ac-ft of SJ-C stored in Abiquiu as of December 31, 2011. The amount in Abiquiu exceeded the MRGCD storage allocation of 2,000 ac-ft due to a transfer request for 655 ac-ft from the New Mexico State Engineers Office to make up for depletions caused by the Albuquerque Bernalillo County Water Utility Authority.

Reclamation stored a total of 16,500 ac-ft for the Prior and Paramount needs of the six Middle Rio Grande Pueblos during 2011. All of this water was captured and stored while New Mexico was under storage restrictions required by Article VII of the Rio Grande Compact. A total of 15,757 ac-ft of water captured and stored for Prior and Paramount irrigation while under Article VII restrictions was released to Elephant Butte between November 15 and December 19, as none was needed to meet Prior and Paramount needs during the irrigation season.

The total SJ-C water in El Vado storage at the end of the year was 67,332 ac-ft, all of which belonged to the MRGCD. Table 8 provides a summary of monthly operations and water accounting for El Vado Reservoir.

A crack in the metal face plate of the dam was noticed in October. Staff from the Chama Field

Office performed repairs on the crack down to the water line. The release of MRGCD's SJ-C water from Heron was delayed so that the reservoir level could be reduced another couple of feet. It appeared that the crack continued well below the water line, which was confirmed by an underwater camera. In addition, a dye test will be performed in February 2012 to try to determine where seepage from the crack may be emerging downstream. If the crack is not deemed a safety concern, the release from Heron will continue in early 2012, and the MRGCD's remaining 12,000 ac-ft of 2011 SJ-C water will be delivered to El Vado.

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

EL VADO RESERVOIR OPERATION MONTH	INFLOW		OUTFLOW		LOSSES		EOM CONTENT		
	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. 2010	4,327	19,882	3,349	10,688	183	-77	42,962	65,649	108,611
JANUARY	2,654	1,765	3,397	1,407	34	34	42,185	65,973	108,158
FEBRUARY	3,696	1,030	3,099	328	25	1	42,756	66,674	109,430
MARCH	7,699	0	8,144	0	166	163	42,144	66,511	108,656
APRIL	37,507	0	25,698	0	354	192	53,600	66,320	119,920
MAY	82,578	144	38,607	384	440	411	97,131	65,668	162,799
JUNE	39,811	0	45,098	924	790	616	91,054	64,128	155,182
JULY	5,951	0	32,345	7,194	339	345	64,321	56,589	120,910
AUGUST	3,616	27,482	31,360	20,822	245	387	36,332	62,863	99,195
SEPTEMBER	4,160	33,374	5,252	32,178	233	60	35,008	63,998	99,006
OCTOBER	5,033	0	4,887	5,326	177	40	34,976	58,633	93,609
NOVEMBER	4,601	14,055	10,618	5,224	161	23	28,798	67,441	96,239
DECEMBER	4,352	2,739	13,734	2,850	93	-2	19,323	67,332	86,655
ANNUAL	201,658	80,588	222,240	76,636	3,058	2,269			

El Vado Dam Facility Review and Safety of Dams Programs

In June 2011, a site visit was completed by staff from Albuquerque, Reclamation's Technical Service Center (TSC) in Denver, and Chama to discuss issues with the cathodic protection system. A work service agreement was initiated. The designs and specifications for repair are moving forward. Anticipated schedule:

- May 2012 Investigations, drill anode beds
- Nov. 2013 Finish investigations and specs
- Feb. 2013 Award Contract
- Sept. 2013 Notice to proceed
- One to Two months for installation

Concerns continued regarding cracking of the steel face plate. Below is a summary of activities in 2011:

- In early spring the dam tender noticed that seepage was again increasing. TSC was notified and recommended daily inspections of seepage areas through the summer. The seepage pond and the white milky substance were not noticed this year as they were in 2010.

- In March 2011 a closer visual inspection of the upstream faceplate was completed. The inspection team noticed more activity on the left abutment, including more cracks on the seams. The Chama Field Division repaired these cracks soon after.
- In October 2011, the dam tender noticed a crack at the same distance from the left abutment, but lower in elevation, than the crack discovered in the spring of 2010. The new crack is also much longer than the 2010 crack (estimated at 25 feet) and is located on a panel seam. At the time of identification it was at the water surface elevation, 6866 feet, and minimal work could be accomplished. The reservoir elevation was lowered, and the crack was repaired to the extent possible.
- In December 2011, an underwater camera was used to inspect that crack. This revealed that the crack continues 18 to 20 feet below the current water level (6862 feet). Additional tests and discussions within Reclamation continue to determine the appropriate course of action.

El Vado Dam accomplishments in 2011 include:

- The Annual Site Inspection was completed.
- The Facility Review Rating was updated and El Vado fell in the Fair category.
- Minor updates to the security plan were completed.
- The Sutron Data Control Panel was replaced.
- In July 2011 the Chama Field Division removed the excess shale material that had accumulated on the right embankment of the spillway floor by releasing 250 cfs through the spillway radial gate.
- The second survey of the crest survey points was completed. One more survey is required before the 2013 Comprehensive Facility Review.
- Work continued on Quagga/Zebra mussel prevention.
- There are currently eight incomplete category 2 O&M recommendations. Log booms should be installed in FY2012 for 2007-2-E; 2007-2-C is also moving forward with design and specifications for the cathodic protection system scheduled for completion in FY-2012.

Status of Corrective Action Study:

- Risk Analysis was updated to include static and hydrologic failure modes, and to include both the service and emergency spillways;
- Result was that the overall risk is above Reclamation guidelines and justifies taking action to reduce the risk;
- To determine if federal funding was warranted, the cause of the condition of the service spillway had to be determined;
- Finding was that the deficiencies were the result of changes to the state-of-the-art criteria and therefore a Corrective Action Study qualifies for up to 85% federal funding assistance;
- The Corrective Action Study is scheduled to begin in 2012, with data collection efforts beginning in early 2012.

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

Abiquiu Dam and Reservoir is a Corps of Engineers' facility. Public Law 97-140 authorizes storage of up to 200,000 ac-ft of San Juan-Chama (SJ-C) water in Abiquiu Reservoir.

Adjustments for sediment reduced the sum of the available storage allocations to 180,338 ac-ft at the start of 2011, which is calculated as the total capacity at the top of the SJ-C storage pool (elevation 6,220.00 feet) less the total accumulated sediment in the reservoir at the end of 2010.

The volume of SJ-C water in storage in Abiquiu Reservoir peaked on January 1, 2011, at 179,010 ac-ft. Abiquiu ended 2011 with 177,011 ac-ft of SJ-C water in storage. Table 9 provides a summary of monthly operations and water accounting for Abiquiu Reservoir.

During 2011, Reclamation had a storage agreement with the Albuquerque Bernalillo County Water Utility Authority 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, 20,415 ac-ft of leased SJ-C water was released by Reclamation for silvery minnow purposes.

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

ABIQUIU RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT			
	RIO GRANDE	SAN JUAN CHAMA	RIO GRANDE	SAN JUAN CHAMA	RIO GRANDE	SAN JUAN CHAMA	SEDIMENT	RIO GRANDE	SAN JUAN CHAMA	TOTAL
MONTH	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DEC. 2010	3,717	10,680	1,385	11,712	0	379	3,543	1,407	179,012	183,962
JANUARY	4,045	1,391	5,166	2,239	1	315	3,543	285	177,849	181,677
FEBRUARY	4,014	295	3,909	2,723	3	266	3,543	390	175,155	179,088
MARCH	8,678	29	8,817	2,904	-1	1,004	3,544	251	171,276	175,071
APRIL	26,170	0	26,271	9,105	4	1,398	3,555	150	160,773	164,478
MAY	40,980	380	40,145	4,520	20	2,117	3,585	985	154,516	159,086
JUNE	48,474	914	49,227	5,112	38	3,072	3,635	231	147,245	151,112
JULY	35,243	7,114	35,473	7,348	-3	1,978	3,665	1	145,034	148,700
AUGUST	34,482	19,462	34,483	4,026	-4	1,628	3,719	0	158,843	162,561
SEPTEMBER	5,015	32,699	5,053	14,731	-1	953	3,745	-39	175,858	179,565
OCTOBER	5,421	5,501	5,266	3,899	-2	765	3,747	116	176,695	180,558
NOVEMBER	11,046	4,965	10,648	3,410	0	758	3,751	514	177,492	181,757
DECEMBER	15,392	3,048	15,076	3,374	2	156	3,757	829	177,011	181,597
ANNUAL	239,015	75,801	239,537	63,391	57	14,410				

Cooperative Programs with the State of New Mexico

In February 2007, a new Cooperative Agreement was executed between the New Mexico Interstate Stream Commission (NMISC) and Reclamation. The Agreement provides funding for water salvage work on the Middle Rio Grande Project, including Elephant Butte Temporary Channel maintenance and other river maintenance projects and irrigation drain improvements with water salvage potential.

The 2007 Agreement provided \$1,140,900. An additional \$2,184,000 has been added by modification, bringing the total funding provided as of December 31, 2011, to \$3,324,900. A modification was executed at the end of the federal fiscal year 2011 for carryover of funds to fiscal year 2012. As of December 31, 2011, \$2,497,024 has been obligated to task orders leaving a balance of \$827,876 for future task orders. Total expenditures under the agreement as of December 31, 2011, are \$1,715,670.

Elephant Butte Temporary Channel History

River disconnection has been an issue at the headwaters of Elephant Butte Reservoir since the early 1950s. The contributing factors for the disconnection are many: the valley slope is very slight, the incoming sediment load is high, the clay deposits are highly cohesive, and vegetation growth is extremely aggressive. During drought periods when the reservoir pool decreases rapidly, all of these factors make it difficult for the river channel to maintain a connection with the reservoir pool (Photo 1). The latest incidence of disconnection began in the late 1990s, and construction of the Temporary Channel began in 2000. The channel was constructed in three phases:

- **Temporary Channel 2000:** This reach was constructed from 2000 to 2004 and is seven miles in length, beginning at River Mile (RM) 58 and ending at Nogal Canyon (RM 51.5). This reach has a high flow channel with an average width of 250 feet and a smaller channel within the larger channel to carry low flows. The low flow channel width is approximately 75 feet.
- **Temporary Channel 2002:** Constructed from 2003 to 2004, it is 11 miles long, beginning at Nogal Canyon (RM 51.5) and ending just downstream of the Elephant Butte Narrows (RM 41). The average width for this reach is 150 feet.
- **Temporary Channel 2004:** Construction began in 2004, and approximately three miles has been constructed to date. This channel begins at RM 41 and will be extended downstream as needed in response to future retreat of the reservoir. The average width for this reach is 75 feet.



Photo 1: Headwaters of Elephant Butte Reservoir, prior to construction of the Temporary Channel (1998)

Elephant Butte Temporary Channel — 2011 Maintenance

The majority of work performed in 2011 was on the Temporary Channel 2002 reach in the vicinity of the Red Rock Staging Area. The channel breached at five sites, in approximately the same locations as in previous years.

The repaired berms have not proven stable, as they are composed of fine cohesionless sand. The Socorro Field Division monitors and repairs the berms, as they are continually eroding. Maintenance of these berms continued until April 15, 2011.

Reclamation will be re-consulting with the U.S. Fish and Wild Life Service (Service) on the Temporary Channel maintenance activities during the 2012. The Biological Assessment is expected to be submitted to the Service in early May of 2012.



Photo 2: Amphibious excavator working on breach south of the Red Rock Staging Area (November 2010, Holste)

Irrigation Drain Improvements

The following work was accomplished in 2011 under the Cooperative Agreement.

- MRGCD uses Drain Unit 7 Extension but does not pay to maintain it. Reclamation, in conjunction with NMISC, has made an official request to MRGCD for further discussion on

this issue, but no conclusions have been reached.

- The La Joya Drain needs extensive maintenance. State and federal wildlife refuges in the area have noted the maintenance need.
- NMISC has expressed interest in funding maintenance on the Lower San Juan Drain, between Salas Arroyo and the drain's downstream terminus (Photo 3). Reclamation is in the process of performing analysis necessary to obtain environmental compliance for this work.



Photo 3: Vegetation growing in Lower San Juan Drain downstream of Salas Arroyo (June 2011, Nemeth)

- In February 2011, the Bureau of Reclamation, using funds from the NMISC, initiated maintenance activities in the Low Flow Conveyance Channel (LFCC) south of Ft. Craig. Maintenance activities were intended to restore an amount of flow in the LFCC sufficient to remediate channel overtopping immediately upstream of the “tumbleweed plug” (Photo 4) and relieve groundwater swelling in the Reclamation-owned Valverde Borrow Pit. Underlying sediment deposition in the LFCC has created shallow surface flow over time. High wind events in the Ft. Craig area during the winter of 2010-2011 dislodged and deposited debris in the LFCC, the majority of which migrated to the low velocity and highly vegetated area south of Ft. Craig. This migration created a “plug” which resulted in overbanking flow or flooding upstream of the plug. Significant issues with environmental compliance restricted Reclamation to removing only the newly deposited debris, which restored flows to pre-plug conditions and alleviated flooding upstream. Work was completed

by March 7, 2011.



Photo 4: Tumbleweed plug within the LFCC (February 2011)

River Maintenance

Reclamation has authorization for river channel maintenance of the Rio Grande from Velarde, New Mexico, south to the headwaters of Caballo Reservoir, as specified by the Flood Control Acts of 1948 and 1950. Project purposes include ensuring effective water delivery, transporting sediment, protecting riverside facilities and property, and preventing flooding. Reclamation prioritizes river maintenance based on public safety, property damage risk, and potential for reduction of water delivery.

River Maintenance Priority Sites

Reclamation is actively pursuing work at 19 priority sites along the Middle Rio Grande Project reach where bank erosion or reduced channel capacity could cause levee failure resulting in shallow overland flooding, reduction of water delivery, or destruction of canals and drains. Reclamation's efforts at these 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, and construction maintenance.

Work has involved completion of 15 sites since 2004. Two of the 15 completed sites were finished in 2011. Of the current 19 active priority sites, five require an annual review of channel

capacity and possible maintenance due to sediment accumulation. These five are the Bosque del Apache sediment plug, the Bosque del Apache levee, the Tiffany and San Marcial levees, the Truth or Consequences reach, and the Temporary Channel. Although the Temporary Channel is discussed in the State of New Mexico Cooperative Programs section, it is also a priority site.

San Ildefonso Pond

This priority site is located at River Mile (RM) 259. In spring 2007, a river maintenance project was constructed by Reclamation's Socorro Field Division to provide protection for the San Ildefonso fishing pond. During the normal spring runoff of 2009, however, the channel eroded through a line of dense vegetation planted as part of the project, resulting in the loss of up to 75 feet of bankline upstream of the previous project area. Approximately 50 feet of erosion occurred in portions of the previously constructed project area where the vanes and vegetation were installed.

This bank erosion exposed and threatened to flank three of the buried rock vanes. Reclamation worked with the Pueblo de San Ildefonso to construct a temporary solution prior to the 2010 spring runoff. The project consisted of a buried trench riprap revetment and a riprap windrow (Photo 5). This temporary protection allows time for the development and permitting of a longer term solution.

The kickoff meeting and site visit for the long term project was held at the Pueblo de San Ildefonso on November 17, 2011. The project team hopes to select a preferred alternative by the end of March 2012. Detailed designs, construction drawings, a project description, and environmental compliance would then be completed during the remainder of 2012. Construction of the long term project is planned for early 2013.



Photo 5: San Ildefonso bankline erosion, riprap windrow, and exposed rock vanes (June 2011, Benoit)

Santo Domingo

There are currently three priority sites on the reach of the Rio Grande passing through Santo Domingo Tribe lands (RM 225.1, RM 224.6, and RM 223.9). Bankline erosion on the west side of the river is cause for concern because of the close proximity to the levee and riverside drain. RM 224.6, which is across from the confluence of the Rio Galisteo, is shown in Photo 6. A Data Collection and Confidentiality Agreement was executed between the Santo Domingo Tribe and Reclamation in August 2007 to allow collection of design data for the three priority sites. Reclamation has reached preferred alternatives for the three priority sites in cooperation with the Pueblo of Santo Domingo, and construction may begin in late 2012.



Photo 6: Santo Domingo Pueblo RM 224.6 (Galisteo Creek) Priority Site (June 2011, Benoit)

San Felipe

There are currently 10 river maintenance priority sites on the Pueblo of San Felipe. Current conditions at these sites could lead to damage of levees, irrigation infrastructure, roads, and a residential area of the Pueblo. In late 2006, Reclamation obtained permission from the Pueblo to collect cross-section and bed material data for use in designs to address these sites. Construction was completed on two sites, RM 213.4 and RM 213.7, in 2011. Construction at RM 212 is expected to be finished in early 2012. Photo 7 shows the site at RM 213.4. Seven sites have yet to be completed.



Photo 7: Rock toe and Bio-D blocks at Priority Site RM 213.4, San Felipe (February 2011, Benoit)

Santa Ana River Mile 208.4

Reclamation's river maintenance work associated with a large scale project at the Pueblo of Santa Ana is complete. The work at this site extended from RM 208.4 to 207.2, with major features including river realignment and construction of a gradient restoration facility (GRF) completed in 2002 by Reclamation's Socorro Field Division. In the spring of 2007, riprap was buried to extend a key at the western upstream end of the gradient restoration facility, and a reinforced bankline at the Jemez River confluence was extended to protect against flanking caused by bank erosion. This construction was performed by Reclamation's Socorro Field Division.

In October 2009, Reclamation's Socorro Field Division installed thirteen bendway weirs in an eroding bend upstream of the gradient restoration facility. At the same time the remaining sediment spoil piles (from earlier terrace lowering work) were lowered to allow increased inundation of the floodplain. The removed sediment was placed over the bendway weirs and the ground sloped to create variability in the terrain during high flow inundation. Planting of native vegetation on the redistributed sediment was accomplished through an existing PL 93-638 contract in place with the Pueblo of Santa Ana.

The 2010 spring runoff saw increased inundation in the project area and lowered floodplain.

Erosion also occurred on the upstream eastern bank of the gradient restoration facility, threatening to flank a wing wall (Photo 8). A solution has been designed to protect the bank and prevent flanking of the gradient restoration facility and is expected to be constructed in 2012.



Photo 8: Bank erosion upstream of the GRF wingwall (2011, AuBuchon)

Santa Ana River Mile 205.8

This site was upgraded to river maintenance priority site status following the 2008 spring runoff. The site is within the Pueblo of Santa Ana, on the east bank of the Rio Grande across from the Tamaya Resort special events tent. An island and bar lowering project, undertaken by the Corps of Engineers through their Section 1135 project authority, has helped reduce the active bank erosion at this site by increasing the conveyance capacity at high flows (Photo 9). Reclamation is working with the Pueblo of Santa Ana to implement an Information Sharing Agreement and to develop a preferred alternative to provide protection at this site. A Public Law 93-638 contract was initiated with the Pueblo of Santa Ana in 2010 and amended in 2011 to pursue the geomorphic and hydraulic analyses at this site, develop suitable alternatives, and produce final designs. Designs are expected in June 2012, with maintenance construction in January 2013.



Photo 9: Increased wetted width at higher flows (approximately 1310 cfs) from the Corps of Engineers' bar lowering at the Pueblo of Santa Ana, looking at the RM 205.8 priority site (June 2011, Benoit)

Bosque del Apache Sediment Plug

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 NMISC partnered to construct a 25 foot wide pilot channel, and that work was completed in October 2008. Reclamation monitored this site closely after completion of the 2008 pilot channel. While the pilot channel area remained open, the river channel remained partially plugged upstream of the pilot channel area, extending several miles.

As part of the 2008 Biological Opinion, Reclamation continues to monitor the river in the vicinity of the sediment plug by gathering cross-section data and performing field observations during the spring runoff. The yearly monitoring report was delivered to the U.S. Fish and Wildlife Service (Service) in September of 2011. Spring runoff observations were done in June 2011, and no overbanking was observed.

Reclamation continues to monitor the 2008 sediment plug area, and has analyzed sediment plug potential in the general reach of river from RM 89 (2 miles upstream of the U.S. Highway 380 Bridge) to RM 80. A geomorphic assessment and hydraulic and sediment-continuity analyses report for this reach was completed in February 2010. In addition to assessing sediment plug potential, the report identified specific areas most vulnerable to plug formation and measures that may prevent plug formation.

Reclamation completed and submitted the *Bosque del Apache Sediment Plug Management: Alternatives Analysis* to the Service in September 2011, in accordance with Service's 2008 Biological Opinion, for the 1.5 mile pilot channel work. The analysis included 13 alternatives to address the recurring sediment plug formation between RM 87.1 and RM 68.6. The alternatives list was developed through interagency coordination between Reclamation, the Service (BDANWR, NMESFO, and Fisheries Branches), NMISC, USACE, and NMDGF. The area thought to currently have the greatest potential for sediment plug formation is shown in Photo 10.



Photo 10: A portion of the reach of river currently considered most prone to sediment plug formation, looking south (May 2011, Lopez)

Bosque del Apache Levee

The Bosque del Apache Levee is located on the west side of the Rio Grande from approximately RM 87 to 74, and is a spoil levee that was formed during excavation of Reclamation's Low Flow Conveyance Channel (LFCC) in the 1950's. The portion of the levee from approximately RM 85 to 80 has become an area of concern in recent years due to the amount of sediment deposition in the river and floodplain areas. Future plug formation in the river channel in the vicinity of RM 81 also causes concern for the levee stability. The 2008 sediment plug caused a rise in water surface against the levee and prompted emergency work on a portion of the levee during the runoff.

In 2009, Reclamation requested American Recovery and Reinvestment Act (ARRA) funds for improvements to the levee, and received \$2 million. The improvements included raising low areas and widening narrow areas within a three mile stretch of levee where conditions were of greatest concern. Work will resume in spring 2012 to widen the base of the levee.

Fort Craig Bend

This site is located on the west bank of the Rio Grande, approximately 4.5 miles downstream from the San Marcial railroad bridge. It is also about 0.25 miles upstream of the Fort Craig Pump Site, where water can be pumped from the LFCC to the river during the dry summer months. The active bankline is currently 30 feet from the toe of the San Marcial Levee, which protects the LFCC from the river. The levee road also provides the only access to 9.5 miles of the river downstream of this site, including the upper 3.5 miles of the Elephant Butte Temporary Channel.

The river bend at this site has been fairly stable in past years, but became active during the 2008 runoff, with even more erosion during the 2009 runoff. The upper portion of the bend was stable during the 2010 runoff, although the erosion continued to progress downstream and almost 50 feet of bank was lost at one location. The amount of potential erosion in a given year is greater than the distance between the river and levee, so a riprap windrow was constructed in March and April 2011 (Photo 11). Approximately 3,900 cubic yards of rock was placed at the site with a nominal diameter of 16 inches. The windrow is 630 feet long and provides a short term countermeasure against erosion continuing to the west and breaching the levee.



Photo 11: Fort Craig Bend riprap windrow, looking downstream (April 2011, Holste)

Truth or Consequences

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. During periods of non-release, Reclamation installs a dike in the river to raise the stage for the benefit of hot spring bathhouse owners in Truth or Consequences. Owing to the interaction between the river and the hot spring aquifer, the increased stage within the river floodway increases water temperatures and the flow of water at hot spring sites.

Sediment excavation was performed in 2011 at arroyo mouths (Photo 12) and various reaches of the river channel, with a total volume of approximately 13,900 cubic yards removed.



Photo 12: Rio Grande and Mescal Arroyo confluence before sediment excavation (September 2011, AuBuchon)

Middle Rio Grande River Maintenance Plan

The Middle Rio Grande River Maintenance program is undertaking an effort to develop 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. The Plan's main objective is to provide a technical guide for Reclamation's future river maintenance activities, to meet the original project authorization (core mission) purposes and environmental compliance needs.

Part 1 of the Plan provides documentation of the authority and necessary maintenance actions, including legal requirements, water delivery needs, endangered species needs, current river and LFCC conditions, historical changes in these conditions, and potential river and LFCC realignment strategies downstream of the San Marcial railroad bridge. This Part 1 report was completed in May 2007 and is available for download at the following website:

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

Part 2 of the report addresses future maintenance strategies, conditions, and needs. Part 2 was completed in December 2011. Final technical writing and editing is in progress. A final report will be posted on Reclamation's internet site in January 2012.

This maintenance plan is envisioned to be 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.

Preparation for 2012 Spring Runoff

As of January 2012, it appears that the spring runoff will be near normal on the Rio Grande, with some potential for erosion damage to riverside facilities. In preparation, Reclamation is assessing riprap availability for potential emergency placement and analyzing levee capacity and the need for levee work prior to the runoff. Specific attention will be given to the Bosque del Apache Levee, the Ft. Craig Priority Site, and the new bank erosion observed at the Santa Ana RM 208.4. Attention is given to the Bosque del Apache Levee due to the potential for sediment plug formation and the other two sites will be watched because of the high risk of additional bank erosion. Additionally, periodic monitoring by aerial flights and levee patrols will occur during high flow periods, and rates of bankline erosion will be monitored at selected sites as necessary. Discharge reported by gages on the Rio Grande and its tributaries will be monitored daily. If flow predictions increase to above normal as the spring runoff period approaches, Reclamation will coordinate with other flood control agencies to facilitate efficient reporting of river maintenance needs and issues.

Middle Rio Grande Endangered Species Act Collaborative Program

The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) brings diverse groups together to support Endangered Species Act (ESA) compliance and address serious environmental issues along the Middle Rio Grande (MRG). The Collaborative Program consists of 16 stakeholders including federal, state, and local governmental entities, tribes and pueblos, and non-governmental organizations who participate in the Executive Committee (EC). The Collaborative Program works to protect existing and future regional water uses, while complying with state and federal laws, including Rio Grande Compact delivery obligations.

The Collaborative Program implements activities required by the March 2003 Biological Opinion (2003 BiOp), as amended, and additional activities that contribute to recovery of the Rio Grande silvery minnow (silvery minnow) and the Southwestern willow flycatcher (flycatcher). Signatories believe the Program is the best mechanism to conserve and contribute to recovery of the endangered species, attain and maintain ESA compliance, and provide support for continuing and future water management activities, and reduce the likelihood of litigation.

In 2011, the EC directed that the Collaborative Program transition to a Recovery Implementation Program (RIP) based on a Long Term Plan and an Action Plan linked to silvery minnow and flycatcher endangered species recovery plans. As the 2003 BiOp expires in early 2013, new ESA Section 7 consultation is underway and a new Program document, action plan, and cooperative agreement are being developed to formalize a RIP for incorporation into a new hydrologically sustainable biological opinion. An initial adaptive management plan was completed in October 2011 to assist the Collaborative Program and decision makers in evaluating and altering actions into the future.

Reclamation manages and serves as the fiscal agency for the Collaborative Program as authorized by P.L 111-8, Omnibus Appropriations Act, 2009, March 11, 2009. During FY2011, on behalf of the Collaborative Program, Reclamation awarded approximately \$11.3M to: acquire and manage water; captively propagate and rear silvery minnow; plan, construct, and monitor habitat restoration (HR) projects; monitor the status of the silvery minnow and the flycatcher; conduct biological and hydrological studies; and rescue silvery minnow during river drying. These and other beneficial activities serve to meet 2003 BiOp requirements or address species recovery goals.

Habitat Restoration Projects

Collaborative Program-funded HR projects improve and enhance habitat in the MRG by increasing backwaters, oxbows, and overbank flooding to support native vegetation and regenerate stands of cottonwoods and willows for the flycatcher. Projects are also designed to produce shallow, low velocity habitats over a wide range of instream flows to increase habitat available for the silvery minnow. The following briefly describes HR work accomplished during

FY2011:

- Sandia Pueblo Habitat Restoration – The Pueblo of Sandia constructed 35.5 acres of riverine habitat features between November 2010 and February 2011. A variety of restoration techniques were implemented including island vegetation removal, bankline lowering, backwater and embayment creation, low flow pool creation, placement of large woody debris, and jetty jack removal. The 17 completed features increase riverine habitat complexity and floodplain connectivity.
- Santo Domingo Endangered Species Habitat Improvement Project, Phase IV – The Santo Domingo Tribe completed Phase IV of their Endangered Species Habitat Improvement Project during February and March 2011. A total of 39 acres was restored consisting of two backwater features, a high flow (1,000 cfs) side channel, a perennial (500 cfs) side channel, and planting of native willow and cottonwood poles at all sites. Backwater areas were fenced off to prevent disturbance from wild horses and livestock.
- Ohkay Owingeh Two Rivers Flycatcher Habitat Expansion – Ohkay Owingeh completed the 20-acre Two Rivers Flycatcher Habitat Expansion Restoration Project. Work in the field was completed in March 2011, and the final report was submitted in December 2011. The project consisted of construction of secondary channels, replacement of non-native vegetation with native vegetation, and subsequent treatment of non-native vegetation resprouts.
- Ohkay Owingeh Three Falls Flycatcher Habitat Restoration Project – The final report for the Three Falls Flycatcher Habitat Restoration Project was submitted by Ohkay Owingeh in March 2011; work in the field was completed in late 2010. The project consisted of rerouting the downstream end of Arroyo Chinguague and replacing non-native vegetation with native vegetation. The area of the project was 28.3 acres.

Fish Passage at San Acacia Diversion Dam

This Reclamation project, a required activity per the 2003 BiOp, is in the planning stage. An external peer review process was completed in February 2011 to evaluate the science behind the requirement to implement fish passage at San Acacia Diversion Dam (SADD). The peer review panel found much uncertainty surrounding what the goals for fish passage are, and how many silvery minnow would need to use it to accomplish these goals. The peer review panel recommended that more research into the relationship between genetic diversity and dam fragmentation as well as the influence of habitat mitigation within reaches on movement, growth, survival, and reproductive success of the silvery minnow be conducted before fish passage at SADD is attempted.

The Collaborative Program is considering options for implementing the peer review panel's recommendations. The Science workgroup is developing a statement of work for synthesizing the results of previous silvery minnow studies. The Science and Habitat Restoration workgroups are developing a targeted silvery minnow fish passage study to better understand silvery minnow longitudinal movement, including research of silvery minnow movement below SADD and other

diversion structures during the critical low flow summer months.

One additional recommended action from the 2009 independent oversight review of designs and cost estimates (DEC review) was completed in 2011, a geomorphic assessment of the likely future degradation downstream of the diversion dam. The report concluded that the most likely future trends in the 1-mile long reach below the SADD are bed material coarsening, localized bank erosion where the banks are not protected, and possibly some channel widening because of the coarse, armored nature of the subreach immediately downstream of SADD. The report authors believe it is likely that there will be very little adjustment of the currently straight and single channel river planform, and that future degradation is unlikely.

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, the continued conveyance of water from the Low Flow Conveyance Channel (LFCC) to the Rio Grande, and the implementation of water conservation practices by water contractors. The Program supports Endangered Species Act coverage under Section 7(a)(2).

Water Acquisition and Management

In 2011, a BiOp “dry” year, 20,415 ac-ft of supplemental water was released for endangered species purposes. Reclamation ended the year with 49,303 ac-ft in storage—19,197 ac-ft of Emergency Drought Water in El Vado, 6,295 ac-ft in Abiquiu, and 23,811 leased and waived in Heron. In addition, there are approximately 11,500 ac-ft in potential leases from 2012 SJC allocations.

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 and maintains portable pumps with flow measurement devices at strategic locations to move water from the LFCC into the Rio Grande. Discharge data for the pumping sites is now posted in orange boxes on the MRGCD Rio Grande Silvery Minnow Operations schematic pages within the Reclamation ET Toolbox web site. The URL of the referenced site is:

<http://www.usbr.gov/pmts/rivers/awards/Nm2/rg/riog/schematic/SCHEMATICsocorrodiv.html>

The total available pumping capacity for all pump locations is approximately 200 cfs, although the maximum total combined 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, pumps located at the North and South Boundary pumping sites were started on March 31, 2011. Pumps were turned off between June 6 and June 18, 2011, as a result of higher flows during runoff in the Rio Grande. Similarly, monsoonal rain resulted in Rio Grande flows high enough to turn the pumps off between August 22 and August 31, 2011. In response to the conclusion of irrigation season, all pumps were turned off on November 1, 2011. Table 10 below summarizes the volume, in acre-feet, pumped at each site for the year.

Table 10: 2011 Pumping Volume by Site

Total Per Pumping Site For The Year	Neil Cupp	North Boundary	South Boundary	Ft. Craig
	0 ac-ft	935 ac-ft	13,540 ac-ft	0 ac-ft

As Table 10 illustrates, the South Boundary pump site was used almost exclusively, while pumps located at the Ft. Craig and Neil Cupp pumping sites were not used at all during the 2011. The total volume of supplemental flow provided by the pumping effort for the 2011 season was 14,475 ac-ft.

Other Ongoing Water Management and Water Quality Related Projects

Upper Rio Grande Water Operations Model (URGWOM)

Funding has been provided to support collaborative URGWOM modeling efforts since FY 2006. In 2011, enhancements to the URGWOM planning model continued to be made to support the new ESA Section 7 consultation for MRG water operations, river maintenance activities, and USACE flood operations. The planning model has been further updated to reflect current water operations practices and calibrated to be consistent with observed conditions during low flow periods. Using the five synthetic 10-year hydrologic sequences representing a range of conditions from very wet to very dry, developed for use as URGWOM inputs, draft and final water management scenarios were developed and run through the planning model for all five hydrologic sequences. The results of the model runs will be utilized to evaluate and further refine current water management operations for the upper Rio Grande.

U.S. Geological Survey (USGS) Groundwater/Surface Water Interaction in the MRG Valley

The monitoring network presently consists of 252 groundwater piezometers on both sides of the Rio Grande, from I-25 to the Alameda bridge crossing, and 27 surface water staff gages. The majority of these components are equipped with data loggers, which monitor water level and temperature at regular intervals. FY2011 was the eighth year of funding by the Collaborative Program. This project has been successful in the collection of continuous data sets and the posting of data on the USGS website, <http://nm.water.usgs.gov/projects/riograndesections/>.

A draft report, titled *Groundwater Hydrology and Variability of Groundwater Gradients and*

Fluxes from the Rio Grande at Selected Locations in Albuquerque, New Mexico, 2009-10, was issued during 2011. A final report should be issued during 2012. Data were collected from all of the sites in September and October. During this round of data collection Reclamation personnel accompanied the USGS into the field to document all of the well locations, as well as inventory the instrumentation and evaluate the condition of the instruments. It will be determined in 2012 whether future data will be collected by the USGS, Reclamation, or a contractor.

USGS MRG River Gage Operation and Maintenance

This project has been funded by the Collaborative Program since FY2002. The USGS operates and maintains a network of 24 streamflow gages in the MRG, including 12 in the mainstem and 12 in tributaries or distribution features. Four of these gages are funded by the Collaborative Program. In 2012, the Program will also fund sediment data collection at a fifth gage. Data from the river gages help MRG water management agencies meet the needs of water users, fulfill the requirements of the Rio Grande Compact, maintain sufficient water in storage for future needs, maintain adequate water in the river to support the silvery minnow, and provide 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 the web address: <http://waterdata.usgs.gov/nm/nwis/current/?type=flow>.

Endangered Species

Programmatic Water Operations and River Maintenance ESA, Section 7, Consultation

On March 17, 2003, the Service issued the 2003 BiOp on the effects of actions associated with the Programmatic Biological Assessment of Bureau of Reclamation's Water and River Maintenance Operations, 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 flycatcher based on the biological needs of the species. The RPA elements address some of the long-term recovery 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.

The Service made a determination that dry year flow requirements would be in effect for the 2011 irrigation season. Reclamation remains in compliance with the 2003 BiOp, however, there was one incident in 2011 when Reclamation was not able to meet the 2003 BiOp requirements. Drying was noted on April 22, prior to the June 15 date for first allowable drying. Approximately eight miles of drying were reported within the Bosque del Apache National Wildlife Refuge (BDANWR). Continuous flow was re-established on April 25. A total of 527 dead adult silvery minnow were noted due to this drying.

In compliance with the 2003 BiOp, the Rio Grande was allowed to dry in isolated locations

within the Isleta Reach, and within the San Acacia Reach downstream to the south boundary of BDANWR. Water pumped from the LFCC helped slow river drying in the river channel starting on March 31. The southernmost pumps at the south boundary of the BDANWR generally remained on all season. Native flow reconnected the river at the end of the irrigation season, and all LFCC pumping for the year ceased on November 1, 2011.

As of November 15, 2011, the Service's New Mexico Fish and Wildlife Conservation Office conducted rescue and salvage activities on 39.8 unique miles of the Rio Grande. Of this, 27.3 miles were salvaged in the San Acacia Reach on 27 days from the south boundary of BDANWR to Socorro between June 25 and October 26, 2011. In the Isleta Reach, 12.5 unique miles of the Rio Grande were salvaged between the Peralta wasteway to near Bosque Farms on 28 days between July 9 and October 26, 2011.

Draft data reports a total of 7,831 (4,852 San Acacia, 2,979 Isleta) silvery minnow > 30 mm SL were salvaged, transported, and released alive to a continuously flowing site of the Rio Grande within each reach salvaged. There were 112 (111 San Acacia, 1 Isleta) silvery minnow > 30 mm SL identified as incidental take for water operations. In addition, a total of 663 (294 San Acacia, 369 Isleta) died during transport, were too small or sick to salvage, or were found dead during secondary drying events. These mortalities do not count towards incidental take of silvery minnow > 30 mm SL for the 2003 BiOp. Of the 8,606 RGSM observed so far in 2011, 419 (4.9%) have been VIE marked, indicating that they are hatchery-released individuals.

Efforts to develop silvery minnow population viability models by the Conservation Breeding Specialist Group and the Service, and separately by Montana State University and the Middle Rio Grande Conservancy District, continued in 2011. The Collaborative Program's ad hoc Population Viability Analysis Work Group is moving forward in a coordinated process to develop both models and is working to address science matters cooperatively.

The current BiOp expires in March 2013. Reconsultation is underway. Reclamation expects to submit a joint Biological Assessment to the service in coordination with Collaborative Program partners in spring 2012.

Rio Grande Silvery Minnow

The silvery minnow was formerly one of the most widespread and abundant species in the Rio Grande basin of New Mexico, Texas, and Mexico, but is now endangered (Fish and Wildlife Service, 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 to indicate trends of silvery minnow abundance have generally used October catch per unit effort (CPUE) from the population monitoring project that have used similar survey methods since 1993. Catch rates were highest in 2005, and were similar in 2004, 2006, 2010, and 2011 (figure 5). Population estimation studies have also been conducted for the last five years; consistent assessment methods have been used since 2008. Though 2011 data is not compiled yet, there was strong correlation between the trends of the population estimation and population monitoring data from 2008 through 2010.

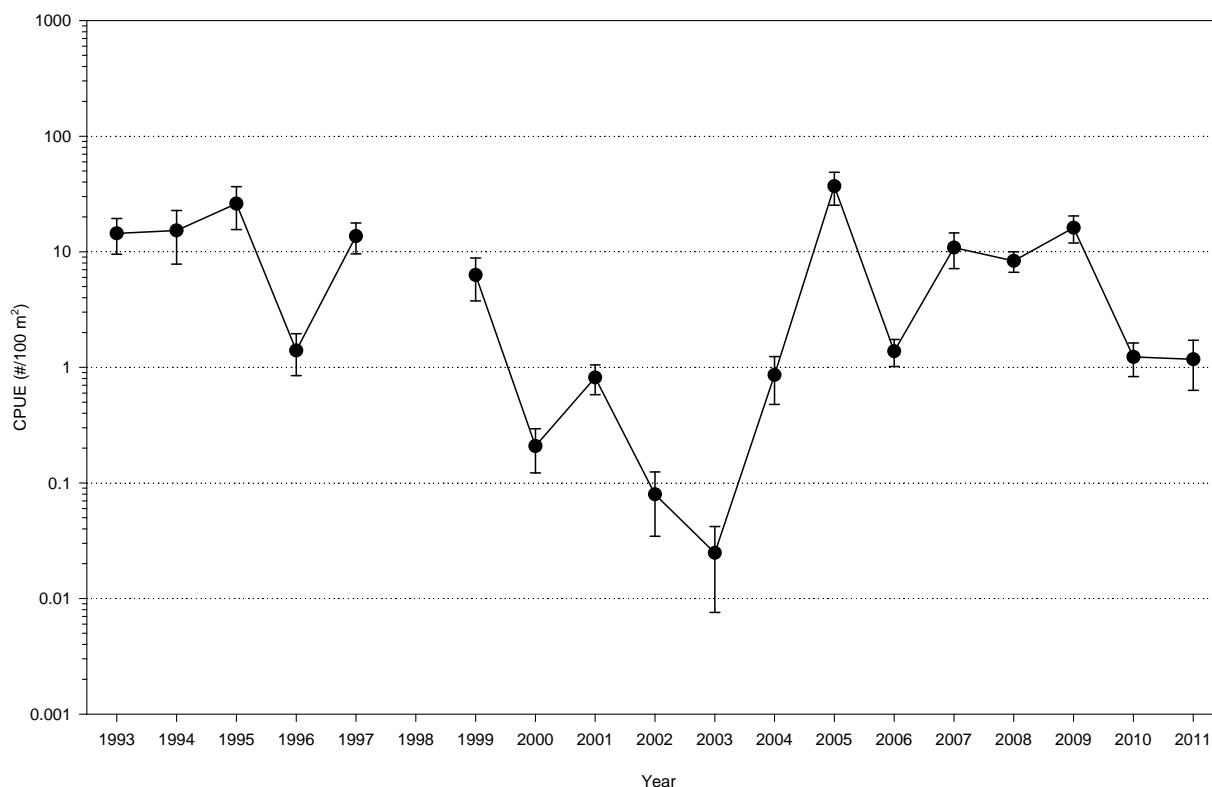


Figure 5: Rio Grande silvery minnow catch rates during October (1993-2011) from American Southwest Ichthyological Researchers

Reclamation conducted two periods of Rio Grande fish monitoring during 2011 to gain knowledge associated with Reclamation projects. The winter electrofishing survey was carried out from February 21 through February 24, 2011. Surveys were conducted at four sites between Bernalillo and Bosque del Apache. Species frequently caught included common carp, channel catfish, flathead chub, river carpsucker, longnose dace, white sucker, and silvery minnow. Surveys were also conducted in the spring to monitor silvery minnow near the Isleta Phase II habitat restoration site and other Collaborative Program habitat restoration sites. Flows were not at a level high enough to inundate the restored areas in 2011. No silvery minnow were detected near the newly constructed Isleta Phase II sites, but they were detected near older restoration sites located within the Albuquerque Reach. For the second year, fall surveys were conducted in the Temporary Channel within the reservoir pool of Elephant Butte. Abundance of silvery minnow within the Temporary Channel was lower in 2011 than 2010.

Captive silvery minnow populations include Albuquerque BioPark, Dexter National Fish Hatchery, and the Interstate Stream Commission’s Los Lunas Silvery Minnow Refugium. In 2011, a total of 47,318 (Yellow Right Dorsal) VIE marked silvery minnow were released in the Isleta Reach, and a total of 143,517 (Red Right Dorsal) were released in San Acacia Reach. Of the total (190,835), 3,000 were from Los Lunas, 52,000 were from the BioPark, and 135,835 were from Dexter.

The Service’s Minnow Sanctuary in Albuquerque’s south valley conducted test operations in

summer 2011. There continue to be technical issues at the facility, which Reclamation, the Service, and others are coordinating to resolve. Testing will continue in 2012 to try to work out pending issues.

The Service also stocked captively propagated silvery minnow from these facilities into Big Bend National Park, Texas, in 2008, 2009, 2010, and 2011. Monitoring for survival is conducted quarterly. Establishment of sustainable populations outside the Middle Rio Grande is essential for downlisting the species to threatened status, as well as ultimately delisting the species. In 2010, scientists detected successful silvery minnow breeding in Big Bend, including presence of eggs, larval fish, and juvenile fish. In June 2011, the Service and multi-agency crews documented that silvery minnows have dispersed 15 miles upstream and almost 70 miles downstream from release sites.

Southwestern Willow Flycatcher

The flycatcher was listed as endangered by the Service 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 Service reissued a proposed designation for critical habitat for the flycatcher that now includes portions of the Rio Grande in New Mexico. The final rule designating critical habitat was issued October 19, 2005, and includes four sections of riparian forest in the Middle Rio Grande Valley: from the Taos Junction bridge to the north boundary of Ohkay Owingeh Pueblo, from the south boundary of the Pueblo of Isleta to the north boundary of Sevilleta National Wildlife Refuge (NWR), from the south boundary of Sevilleta NWR to the north boundary of Bosque del Apache NWR, and from the south boundary of Bosque del Apache NWR to the powerline crossing of the Rio Grande near Milligan Gulch.

The Service released a new proposal for critical habitat in August 2011. Along the Rio Grande in New Mexico, the proposed revision would include all areas historically listed as critical habitat with the addition of:

- The Rio Fernando area (0.25 mi) in the Upper Rio Grande Management Unit (just upstream from the Rio Lucero confluence) near Taos and an extended area from the north boundary of Ohkay Owingeh Pueblo downstream to Otowi Bridge.
- The Lower Rio Grande Management Unit (from Caballo Dam to Leasburg Dam).
- An extended area within the Middle Rio Grande Unit. Previously, the three segments of the Middle Rio Grande Unit extended from the southern boundary of Isleta Pueblo to the overhead powerlines near Milligan Gulch (near Elephant Butte Reservoir full pool elevation or River Mile 62 approximately). With the new proposed rule, the southern boundary of the Middle Rio Grande Unit would extend farther south into Elephant Butte Reservoir to approximately just south of River Mile 36 (or about 9 river miles north of the dam). The previously designated habitat within this Unit also excluded the Bosque del Apache NWR and the Sevilleta NWR because they have specific flycatcher management plans that outline actions they undertake to benefit the species. Both refuges are proposed for critical habitat designation at this time.

Several areas within the Upper and Middle Rio Grande Units will be considered for exclusion from the final designation of flycatcher critical habitat under section 4(b)(2) of the Endangered Species Act (ESA). Those areas include:

- Tribal lands within San Ildefonso, Santa Clara, and Ohkay Owingeh Pueblos. These will be considered for exclusion due to their tribal management plans and partnerships.
- The water storage area of Elephant Butte Reservoir. This area will be considered due to the development of plans for the operation of the reservoir as well as a flycatcher management plan. This area is also being considered for exclusion based on initial evaluation of potential impacts of water operations of the dam and reservoir.

In December 2011, Reclamation submitted a draft of its voluntary ESA Section 7(a)1 Flycatcher Management Plan for the Rio Grande Project for consideration by the Service in excluding Elephant Butte Reservoir from the final designation.

During the summer 2011, Reclamation conducted surveys and nest monitoring of the flycatcher in eight distinct reaches along approximately 200 kilometers (124 miles) of the Rio Grande in New Mexico, mainly between the south boundary of the Isleta Pueblo and Elephant Butte Reservoir. One of the eight reaches was located just north of Cochiti Reservoir. Surveys were performed to contribute to current baseline population data of the flycatcher along the Middle Rio Grande, and also to meet Reclamation's ESA compliance commitments. In 2010, there were 632 resident flycatchers documented in 360 territories and forming 272 breeding pairs. In 2011, there were 686 resident flycatchers documented in 402 territories and forming 284 breeding pairs. As in previous years, the San Marcial reach of the river was by far the most productive, containing 298 territories (of which 235 were pairs) in 2010, and 318 territories (of which 237 were pairs) in 2011. In 2011, the flycatcher population grew in the Bosque del Apache NWR and remained steady to the south.

In 2011, nest monitoring was conducted at all sites where nesting pairs were detected. Nests were monitored for success rates, productivity, and Brown-headed cowbird (*Molothrus ater*) parasitism. The San Marcial reach proved most productive, producing 240 nests, including renesting. Other studies continued in 2011 include: (1) vegetation and avian monitoring, (2) Elephant Butte Reservoir photo station documentation and summary report, and (3) a flycatcher nesting vegetation and hydrology study. These studies are designed to provide further insight into potential threats to and habitat requirements of flycatcher populations.

Table 11: Southwestern Willow Flycatcher Territories – Middle Rio Grande Project, 2000 - 2011 Breeding Seasons (N/S = Not Surveyed)

	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Velarde	N/S	N/S	0	0	0	1	0	1	0	0	1	2
Frijoles	2	N/S	1	1	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Belen	9	6	3	4	10	1	4	0	N/S	1	N/S	N/S
Sevilleta	9	13	18	31	14	21	17	19	17	13	11	8
San Acacia	0	0	1	2	0	0	0	0	0	0	0	0
Escondida	8	4	0	1	0	1	0	0	0	4	0	0
BDANWR	49	34	20	5	7	4	0	1	3	3	0	0
Tiffany	4	5	5	8	4	9	3	6	4	3	0	0
San Marcial	318	298	319	235	197	142	107	113	86	63	25	23
Lower Rio Grande	3	N/S	5	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S	N/S
Total	402	360	372	287	232	179	131	150	113	87	37	33

Habitat modeling throughout the Middle Rio Grande has shown that there is 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 more a cause of their site fidelity. Predation and parasitism rates during summer 2011 were higher than average and nest success (42%) was lower than historic values. Though nest success was higher than that in 2010 (39%), this decline in nest success over the past couple of years could be an indicator that vegetation in the northern end of the full reservoir pool elevation may be over-mature, eventually causing the population to shift their territories to other areas of suitable habitat. This shifting in territories may be what is currently occurring, particularly with the large population increase in the Bosque del Apache NWR and into other areas of suitable previously unoccupied habitat.

Elephant Butte Reservoir

At Elephant Butte Reservoir, flycatchers occupied habitat to the south end of the Narrows section, just at the north end of the current reservoir pool. As reservoir levels decreased during the late 1990s and early 2000s, vast expanses of primarily native habitat have developed on the western side of the floodplain, and by 2011 have developed as far south as the north end of the current reservoir pool. This habitat consists of dense Goodding's and coyote willow of various age classes, with water provided in part by the LFCC outfall. During this same period, habitat

upstream of the full pool elevation in the San Marcial reach declined in quality. Due to these factors, the vast majority of flycatcher territories within this reach, and the study area as a whole, are located within the full reservoir pool area.

The LFCC provides water to much of the high quality flycatcher habitat on the western side of the reservoir. Historically large portions of the western area of the Elephant Butte Reservoir pool are continuously flooded, even with low flows in the LFCC. This has prevented seedling establishment in the past. Lower flows this past summer, however, allowed this area outside of the channel to dry, which may have stimulated new growth. As it is likely that currently occupied habitat will become over-mature within the next several years, this surface water drying event may have been a positive occurrence. In other areas of the Reservoir pool, particularly closer to the main channel, the drought combined with the freezing event in February 2011, as well as grazing activity, caused tremendous stress to currently existing and historically occupied vegetation.

Flycatcher habitat has historically been a dynamic system that is created and destroyed in relatively short periods of time. Flycatchers depend on this type of dynamic successional system for breeding habitat. Habitat may be gained and lost from year to year, but as a whole this population within the Reservoir pool should persist and be a valuable source population for the surrounding areas over the next several years.

Flycatcher ESA Compliance Issues at Elephant Butte Reservoir

Due to the ongoing drought, Elephant Butte Reservoir has receded and remained low. Reclamation has allowed temporary habitat to develop as the reservoir recedes as part of Reclamation's ESA Section 7(a)1 authority to help in the conservation of threatened and endangered species. Under ESA Section 9, Reclamation would still need to address incidental take of flycatchers if the reservoir were to fill up and impact flycatchers or their habitat. Reclamation is also developing a voluntary ESA Section 7(a)1 'Flycatcher Management Plan' to develop flycatcher habitat as part of the Rio Grande Project. Reclamation will initiate ESA Section 7 consultation in 2012 to address the incidental take issue and identify the flycatcher management plan as a conservation measure.

RiverEyes

Reasonable and Prudent Alternative Element C of the 2003 BiOp states that monitoring must be performed when flows are less than 300 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 and prepare for silvery minnow salvage and rescue actions.

For the 2011 irrigation season, RiverEyes monitored river conditions along the Rio Grande from Isleta Diversion Dam to the full pool elevation of Elephant Butte Reservoir from April 5, 2011, through October 31, 2011. The total maximum river miles dried during the 2011 RiverEyes monitoring period was 41 miles which included 13 miles in the Isleta Reach and 28 miles in the San Acacia Reach. The first occurrence of channel drying was recorded on April 22, 2011; the

last occurrence of channel drying was observed on October 22. River drying was restricted to two river segments; from 3.5 miles above the Los Lunas Bridge to 0.8 miles below the Peralta Wasteway in the Isleta Reach, and from Escondida Drain Outfall to the South Boundary pumping station in the San Acacia Reach. There were four main periods of drying punctuated by re-wetting events that were caused by flooding during the summer monsoons.

New Middle Rio Grande Water Management and River Maintenance Consultation

Reclamation has been successful in meeting the requirements of the 2003 BiOp, in part, through supplemental water acquisition and management with willing lessors, including San Juan-Chama Project (SJCP) contractors. In the future, both imported and native water supplies will be limited, making the 2003 BiOp hydrologically unsustainable. In addition, the term of the 2003 BiOp expires at the start of the 2013 irrigation season, and new ESA Section 7 consultation is needed to provide future federal and non-federal coverage. For these reasons, in 2011, Reclamation worked to draft a biological assessment (BA) on the effects of discretionary Middle Rio Grande water management and river maintenance actions on the silvery minnow, flycatcher, Pecos sunflower, and Interior least tern. The BA will include an action-by-action analysis of discretionary Reclamation and non-federal activities. Reclamation is scheduled to provide the BA to the Service in spring 2012. Consultation goals include achieving and maintaining comprehensive ESA compliance through a hydrologically viable BiOp that maintains and improves the status of listed species. A water management strategy must be developed that optimizes management of native water and allows for carryover of leased SJCP supplemental water for dry years.

Reclamation presented a draft BA to the Collaborative Program in August 2011 for review, and is evaluating all comments received. The Collaborative Program recently committed to becoming a “Recovery Implementation Program” (RIP) and is in the process of developing key associated documents including, a RIP Program Document, a RIP Action Plan, and continued work on the Long Term and Adaptive Management Plans. An adaptive management framework will allow more flexibility to test and implement different water management tools and strategies under the new BiOp. With this commitment from the Collaborative Program, Reclamation is working to develop Conservation Measures that will incorporate the RIP and associated actions into the BA. The resultant BiOp would remain in effect as long as sufficient progress is being made toward recovery and re-initiation criteria are not triggered. The path to success includes (1) working through the Collaborative Program to develop the aforementioned plans, and (2) negotiating, in partnership with the Service, with stakeholders for water and non-water conservation measures. Reclamation continues to conduct government-to-government consultation with the pueblos and tribes based on this approach.

Rio Grande Project (New Mexico - Texas)

Reclamation's El Paso and Elephant Butte Field Divisions are jointly responsible for the operations of the Rio Grande Project (figure 6). Elephant Butte Field Division operates and maintains Elephant Butte and Caballo Dams. El Paso Field Division 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 Elephant Butte Irrigation District (EBID), El Paso County Water Improvement District No. 1 (EPCWID), and Mexico (under the 1906 International Treaty). EBID operates and maintains Reclamation's diversion dams on the Rio Grande, including Percha Diversion Dam, Leasburg Diversion Dam, and Mesilla Diversion Dam in New Mexico. EBID operates and maintains the three diversion dams in New Mexico under a contract with Reclamation. In September 2003, Reclamation completed work to remove Riverside Diversion Dam and the adjacent Coffey Dam, both in Texas. Riverside Diversion Dam had been inoperable since 1987, when flooding on the Rio Grande caused the structure to fail.

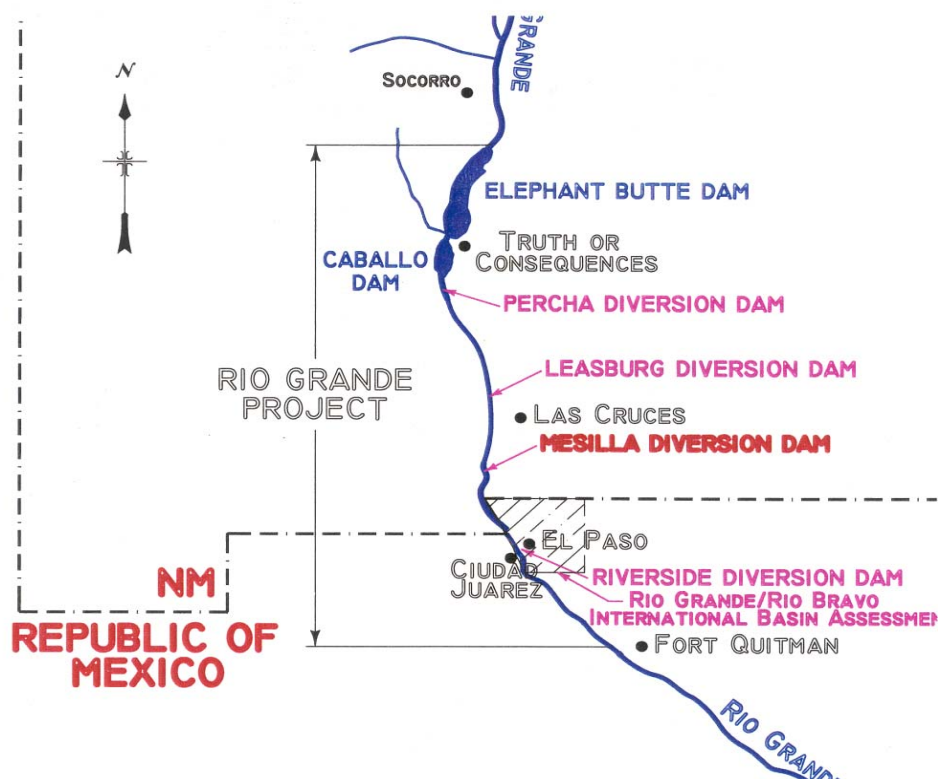


Figure 6: Area Map of the Rio Grande Project

Water Supply Conditions

Inflow into Elephant Butte Reservoir during 2011 as measured at the Rio Grande Floodway (FW) plus the Low Flow Conveyance Channel (LFCC) at San Marcial (FW+LFCC) was 307,474 ac-ft, or 36 % of the 97-year average annual flow at the San Marcial stations (FW+LFCC). The estimated 2011 March through July runoff, measured at San Marcial (FW+LFCC), was 87,321 ac-ft which was 15.24% of the 30-year average. During the period from 1996 to 2011, spring runoff (March-July) at the San Marcial gaging station has consistently been below average. During the 2011 irrigation season (March 1-Sept. 9), 405,919 ac-ft of water was released from Elephant Butte Reservoir. As of February 23, 2012, 2011 daily streamflow data for the FW and LFCC remain provisional. These stations are maintained and operated by the United States Geological Survey (USGS).

There was a release of 396,444 ac-ft to meet the irrigation requirements of Project water users from Caballo Reservoir.

The most probable January through June Natural Resources Conservation Service and National Weather Service (NRCS and NWS) coordinated forecasts received for the 2011 March through July runoff season are presented in Table 12.

Table 12: Summary of 2011 Rio Grande Coordinated Spring Runoff Forecasts

Month	Forecasted Otowi Runoff (ac-ft)	Percent of 30-Year Average	Forecasted San Marcial Runoff (ac-ft)	Percent of 30-Year Average
Jan 1	685,000	90	505,000	88
Feb 1	575,000	76	405,000	71
Mar 1	480,000	63	300,000	52
Apr 1	370,000	49	190,000	33
May 1	380,000	50	190,000	33
June 1	315,000	41	123,000	22
Actual Runoff	394,446	52	87,321	15

Combined total storage for Elephant Butte and Caballo Reservoirs was 308,122 ac-ft on December 31, 2011. This combined storage was 13.9% of their total capacity. In 2011, 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, or 2,224,520 ac-ft during the winter (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 together) was below 400,000 ac-ft throughout 2011. In March 2011, Compact Credit and San Juan – Chama (SJ-C) water was 231,450 ac-ft or 46.24% of project storage.

A final allocation to the Rio Grande Project water users of 42.75% of a full supply was declared

by Reclamation in October 2011 for the irrigation season. The initial allocation to the Rio Grande Project water users (declared in January 2011) started at only 19.85% of a full supply. The January 2011 forecast seemed promising because of the projected snowmelt, but fell short of an average year.

For the 2012 irrigation season initial allocation, a less than full allocation was declared as of December 2011. On January 1, 2012, Project storage was 309,998 ac-ft. Compact Credit water and San Juan – Chama water totaled 174,209 ac-ft or 56% of Project Storage. Based on the January 1, 2012, NRCS/NWS spring runoff forecast at the San Marcial gaging stations and present hydrologic conditions, Reclamation anticipates a less than full supply for irrigation during 2012 for the Rio Grande Project.

The 2012 coordinated forecasts from the NRCS and NWS for the 2011 March through July runoff season is presented in Table 13.

Table 13: 2012 Rio Grande Coordinated Spring Runoff Forecasts

Month	Otowi Runoff (ac-ft) (Mar-Jul)	Percent of 30-Year Average	San Marcial Runoff (ac-ft) (Mar-Jul)	Percent of 30-Year Average
Jan 1	665,000	88	490,000	86
Feb 1	600,000	79	400,000	70

Project Irrigation and Drainage Systems

Following title transfer, which was completed in 1996, the irrigation and drainage system is owned, operated, and maintained by Elephant Butte Irrigation District in the New Mexico portion of the Rio Grande Project and by El Paso County Water Improvement District No. 1 in the Texas portion of the Project. Reclamation owns and administers the lands and rights-of-way activities of the reservoirs and diversion dam areas, and also retains title and operation and maintenance responsibilities for Elephant Butte and Caballo Dams and Reservoirs.

The Districts performed flow measurements at canal headings, river stations, and lateral headings during 2011. Reclamation 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 2011. The International Boundary and Water Commission (IBWC) continued to own, operate, and maintain the American Diversion Dam and the American Canal during 2011 in accordance with the International Treaties with Mexico (1906 and 1933). In addition, the IBWC operated the International Diversion Dam, which diverts irrigation waters into the Acequia Madre headgates operated by Mexico.

Drainage waters from the Rio Grande Project lands provide supplemental irrigation water for

approximately 18,342 acres of the Hudspeth County Conservation and Reclamation District No. 1 (HCCRD). Total flows out of the Project to HCCRD are measured at three gaging stations near the Hudspeth County line: the Hudspeth Feeder Canal, the Tornillo Canal at Alamo Alto, and the Tornillo Drain. Under the Warren Act contracts, HCCRD was charged for drainage water from the Project between March 1 and September 30 which amounted to 59,999 ac-ft in 2010. The 2011 total will be available late February.

Water flows measured by IBWC on the Rio Grande at Fort Quitman Station, downstream of the Project and HCCRD boundaries, amounted to 31,260 ac-ft during 2011.

Elephant Butte Reservoir and Powerplant

Elephant Butte Reservoir reached a minimum storage of 189,257 ac-ft (elevation 4,309.98 feet) on September 8, 2011. A maximum storage of 504,808 ac-ft (elevation 4,341.03 feet) was reached on March 1, 2011.

Net power generation for 2011 was 34,616,379 kilowatt-hours, which was 47 percent of the 69-year average (1940 through 2008) of 73,397,441 kilowatt-hours. The power plant releases were utilized to meet downstream irrigation demand and manage Caballo Reservoir storage levels. The balanced valves were not needed to meet peak releases during 2011. Reclamation anticipates that all three turbines will be available for generation and discharge by the spring of 2012.

The 2011 summer monsoon season was relatively mild, and did not produce any flood events or sediment discharges into the Rio Grande below Elephant Butte Dam.

Elephant Butte Dam Facility Review and Safety of Dams Program

There were no major issues with the operation and maintenance at Elephant Butte Dam, other than aging infrastructure. Accomplishments in 2011 include:

- The Comprehensive Facility Review was completed in July.
- The Annual Site Inspection was completed.
- The Facility Review Rating was updated and Elephant Butte fell in the Good category.
- O&M recommendations completed in 2011:
 - EB-2005-2-M, completed in 2011: Pressure relief valves testing/calibration procedures,
 - EB-2005-2-B, completed (not updated in DSIS yet): Acquire large drain covers for foundation drains,
 - EB-2009-3-A, completed: Install cap for piezometer holes at two locations on the crest of dam.

In addition, the following maintenance was completed:

- Exciter Frame: The frame will support new equipment on the mezzanine floor of the power plant related to power generation. The frames are each designed to support an approximate

weight of 15,000 pounds including floor live loading. This load was determined so that a wide facet of available equipment could be considered during the procurement process. The configuration of the frame design will allow replacement of equipment located on the generator floor for future upgrades.

- **Lateral Connection for Emergency Penstock Building and Water Lines Discovered:** During a water line repair, a lateral water line connection was uncovered. This connection enabled maintenance to be performed on separate water lines without compromising the shutdown of the emergency penstocks operation and continuing to supply water to the facility.
- **Mussel Support:** During FY 2011, Elephant Butte Field Division continued its support of AIS (Quagga/Zebra mussels) prevention. Reclamation has a mobile decontamination unit at Elephant Butte State Park. Elephant Butte Field Division also assisted Reclamation's Technical Service Center (TSC) with collection of samples for testing for mussels.
- **Inspection of EB Intakes and Trash Rack:** In January of 2011, remotely operated vehicle (ROV) teams from the Pacific Northwest (PN) region came to document and evaluate the underwater condition of the upstream sides of the penstock, sluice, and service gates. While many areas had silt deposits and organic growth, no visible damage or deterioration was found.
- **Enhanced Security Systems:** Elephant Butte Field Division has increased the number of video monitoring locations. One segment of the video security has been installed with the power plant portion soon to follow.
- **Lower 1 Balance Valve Repaired:** During the 2011 mechanical Comprehensive Facility Review, the lower no. 1 balance valve (BV) would not close. Testing and further inspection showed no obvious problems, so new gaskets and seals were installed. After two tests, the BV operated correctly.

Caballo Dam and Reservoir

Caballo Reservoir reached a minimum storage of 6,284 ac-ft (4,128.53 feet) on September 10, 2011. A maximum storage of 66,013 ac-ft (4,150.09 feet) was reached on May 6, 2011.

According to Court Order No. CIV-90-95 HB/WWD of October 17, 1996, which resulted from a negotiated settlement with the Irrigation Districts, the Caballo Reservoir storage level is targeted not to exceed 50,000 ac-ft (4,146.44 feet) from October 1 to January 31 of each year, unless flood control operations, storage of water for conservation purposes, re-regulation of releases from Elephant Butte Dam, safety of dams purposes, emergency operations, or any other purpose authorized by Federal law, except non-emergency power generation, dictate otherwise. Significant variation above 50,000 ac-ft during the winter months of October through January requires collaboration and consultation between the Districts and Reclamation.

Reclamation's plan for operation of Caballo Reservoir during February 1 through September 30, 2011, was to maintain storage levels such that they would not exceed 30,000 ac-ft in February, not exceed 65,000 ac-ft in June, and not be less than 20,000 ac-ft by the end of September. Operating Caballo Reservoir at these storage levels during the 2011 irrigation season allowed Reclamation to:

- Reduce evaporative losses between Elephant Butte and Caballo Reservoirs,
- Provide sufficient operational hydraulic head at Caballo Reservoir for irrigation demand releases,
- Have Caballo serve as a reserve pool should releases from Elephant Butte Dam be interrupted, and minimize changes to release rates from Elephant Butte Dam,
- Allow for data collection and maintenance of OPEC and 3D-sec (ET) systems at Caballo through cooperative research with New Mexico State University.

Caballo Reservoir's operating plan for October 1, 2011, through September 30, 2012, has not yet been finalized. Due to drought, all possible release scenarios are being considered including block releases. Storage in Caballo Reservoir at the end of the 2011 irrigation season did not exceed 50,000 ac-ft. Reclamation will finalize its reservoir operating plan in the spring of 2012. The 2012 operations plan will reflect accommodations to minimize evaporation differences between Elephant Butte and Caballo Reservoirs. Initial measurements of open water evaporation at both reservoirs using OPEC and 3D-sec (ET) systems indicate that losses at Caballo reservoir were less than predicted, depth-dependent, and in some cases less than Elephant Butte. Minimizing surface area fluctuations at Caballo reservoir during irrigation season may reduce losses.

Caballo Dam Facility Review and Safety of Dams Program

There were no major issues with the operation and maintenance at Caballo Dam other than aging infrastructure. Accomplishments in 2011 include:

- The Comprehensive Facility Review was completed in July.
- The Annual Site Inspection was completed.
- The Facility Review Rating was updated and Caballo fell in the Good category.
- O&M recommendation 2005-2-C, concrete repair on spillway, was completed.

In addition, the following maintenance was completed:

- Caballo Dam Spillway Repairs: Work on Caballo Dam spillway was completed in 2011. Preparation of the repair area followed the Guide to Concrete Repair (GCR) published by TSC on April of 1997. The repair preparation followed guidelines that indicated that all bonding surfaces be clean and free of loose material.
- Caballo Detent Repairs: During annual inspection of the outlet tunnel and energy dissipation (detent) devices, the coatings protection of the angle armor for the detents showed signs of undercutting. The old coating was removed, and most of the detents were coated with a zinc wasser coating. The coating will provide protection from rust for the next operational season.

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, but further ordered that should it become 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.

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: This "stream adjudication" was originally filed by Elephant Butte Irrigation District (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. Since August 2011, interested parties have been proceeding with Stream System Issue No. 104 in state court in New Mexico.

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. The Investigation Report was completed under Phase 1. Phase 2 calls for evidentiary hearings in which claimants present evidence to support the validity of their claims. 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 Texas Commission on Environmental Quality 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 and which includes all portions of Hudspeth and El Paso Counties, Texas. The effective date of the Final Determination is May 15, 2006.

In 2011, the State of New Mexico made an offer to the farmers in the Rio Grande Project for a total of 4.5 ac-ft per acre per year, consisting of up to 3.024 ac-ft of surface water and the remainder from groundwater. 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. On August 25, 2011, District Judge Jerald Valentine issued a final judgment approving the settlement.

Rio Grande Project Operating Agreement

On February 14, 2008, Reclamation, Elephant Butte Irrigation District (EBID), and El Paso County Water Improvement District No. 1 (EP#1) agreed to, finalized, and signed a new operating agreement for the Rio Grande Project. This is very significant in that the first negotiations of a draft operating agreement started almost 30 years ago. This historic document,

and its accompanying operations manual finalized in August 2008, provides detailed procedures for operating the Rio Grande Project between Reclamation, EBID, and EP#1 while recognizing and fulfilling the terms of the 1906 Convention Treaty with Mexico to supply up to 60,000 ac-ft of irrigation water from the Rio Grande Project.

The most important items in the operating agreement are: (1) procedures for allocation of Rio Grande Project water supply to the three Project water users, (2) recognition of groundwater pumping in the Rincon and Mesilla valleys affecting the water supply available to EP#1 and adjusting the allocation procedures to mitigate the allotment for EP#1, and (3) an incentive for EBID and EP#1 to carry over their respective unused allotments each year with a maximum carry over provision for each District of 60% of their respective historical full allocation. This carry over incentive encourages each District to conserve and effectively utilize irrigation water, particularly during drought periods on the Rio Grande Project. The Rio Grande Project has completed four irrigation seasons under the 2008 Operating Agreement and will begin the fifth irrigation season in late March or early April 2012 due to extremely low available water supplies.

EP#1 ended the 2011 irrigation season with 9,042 ac-ft on their allocation account and EBID ended the season with 17,333 ac-ft on their allocation account.

The technical team for the Rio Grande Project, which consists of representatives from EBID, EP#1, and Reclamation, will meet in early 2012 to discuss amendments to the operations manual. At this time, none have been proposed.

During the 2011 irrigation season, the Project released 396,440 ac-ft of from Caballo Dam. The project water users (EBID, EP#1, and Mexico) were charged for 344,193 ac-ft of delivered water. The release to delivery ratio of 0.87 shall be used in the calculation of the allocation at the start of the 2012 irrigation season.

The release to delivery ratios for the four years that the operating agreement has been in effect show that we are still operating in an extreme drought scenario. Reclamation continues to work with each district to account accurately for water released from Caballo and water delivered at each diversion point. Snow pack conditions presently are below normal, therefore reservoir levels are expected to fall during the 2012 irrigation season.

Response to Compact Commission Requests

In the 2010 Report of the Rio Grande Compact Commission, the Engineer Advisors made a number of specific requests related to the stream gages below Elephant Butte and Caballo Reservoirs, and the apparent shift of the reach between the two Reservoirs from gaining to losing. Below are actions Reclamation has taken relative to these specific requests.

In addition, Reclamation's Technical Service Center performed discharge measurements at three locations downstream from Elephant Butte Dam in an attempt understand conveyance losses in this reach. The study was inconclusive, as flows were inadequate to make a sufficient number of measurements.

Rio Grande below Caballo Gage Record for 2010

The Bureau of Reclamation has met with staff from the USGS office in Las Cruces to review Reclamation's record for Caballo reservoir discharges. A process for documentation was discussed and outlined in order to comply with USGS procedures. The methods will be included in the quality assurance plan for the Rio Grande Project.

Reclamation has contracted with USGS Austin office to provide training and to review the 2010 record to resolve to the best methods possible any issues remaining. The discharge record will be independently calculated and a comparison of each result will be made with assistance from the USGS Las Cruces office. Results will be provided prior to the February 2012 Engineer Advisor's meeting.

Gaging Station Review

- Request: That the USGS and Reclamation cooperate to conduct discharge measurements at the Rio Grande below Elephant Butte gage this spring and fall for the normal range of stages experienced at the gage;

Action: The USGS performed 42 measurements during 2011 at the station downstream of Elephant Butte Dam at various discharge levels. They were made at various discharge levels to try and establish a rating table that would be applicable at all flows. The USGS will report their results. Reclamation has coordinated with the USGS to establish a secondary metering site that will not be as susceptible to aquatic weed growth.
- Request: That the State of New Mexico and Reclamation continue to cooperate to verify reservoir stage at Caballo Reservoir during 2011 and 2012;

Action: The State of New Mexico has jointly reviewed the stage at Caballo Reservoir with Reclamation. The USGS contractor with the El Paso office will provide training and assistance to Reclamation to reestablish and maintain the stage record. The process will continue in 2012. The process will also be documented in the Rio Grande Project quality assurance plan.
- Request: That Reclamation thoroughly document the procedures used to develop the gage record at the Rio Grande below Caballo gage including quality assurance, quality control, and data accessibility and provide a report to the Engineer Advisers for review by September 30, 2011;

Action: A plan documenting procedures used to develop the gage record at the Rio Grande below Caballo gage has been drafted with assistance from USGS and has been provided to the Engineer Advisers.
- Request: That Reclamation replace the F type chart recorder at the Rio Grande below Caballo gage with an A type chart recorder or a second digital device such as a digital data recorder, and use the F type recorder only as a second back-up if needed. In addition, Reclamation should use the ADVDM data to work out the final gage record;

Action: The USGS ABQ in November of 2011 suggested we use the current electronic encoder and electric tape gage as the primary stage data. The data is currently stored in 15-min intervals on the data collection platform and each minute on the electronic encoder. Reclamation will use the A-Type recorder as a backup for daily operations. Reclamation will reinstall the ADVDM prior to the start of irrigation season with equipment that will allow for placement in the flow stream depth which will provide the optimum flow record. The solar panel will also be move to a location which will provide

more reliable a sustained charging of the batteries. This will be done in order to provide a more reliable power source.

5. Request: That Reclamation use the measurement data being collected during the current (March 2011) stable release from Caballo Reservoir and evaluate the measured data with the Caballo gage data. The comparison should be reported to the Engineer Advisers by May 1, 2011;

Action: Reclamation is working with the irrigation districts to finalize a report using the data from the 2011 stable release from Caballo Reservoir.

Elephant Butte and Caballo Reservoir Vegetation Management Cooperative Agreement

Under this 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 6,931 acres have been sprayed at both reservoirs over the past eight years with varying amounts of success. With assistance from New Mexico State University, scientific investigations are being done concurrently to estimate reductions in evapotranspiration after various treatments.

During FY2011, Reclamation managed 4,038 acres of phreatophytic vegetation at Caballo reservoir utilizing mowers, mulchers, grubbers and extraction equipment.

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 together with States and with 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 a number of programs under the Department of the Interior's WaterSMART Program to evaluate the risk that climate change and other threats pose to water supply, and to initiate local actions to mitigate these threats. These programs include:

- **WaterSMART Grants**
 - Water and Energy Efficiency Grants
 - System Optimization reviews
 - Advanced Water Treatment Pilot and Demonstration Projects
 - Grants to Develop Climate Analysis Tools
- **Basin Study Program**
 - West-Wide Climate Risk Assessments
 - Basin Studies
 - Landscape Conservation Cooperatives
- **Adaptations to Climate Change through the Water Conservation Initiative**
 - Water Conservation Challenge Grant Program (previously Water for America Challenge Grant Program)
 - Title XVI Water Reclamation and Reuse Program

WaterSMART Grants (Formerly the Water for America Initiative)

In 2009, the WaterSMART Initiative replaced the Water for America Initiative, which had replaced the Water 2025 Initiative. The Department of the Interior's WaterSMART Initiative is a plan for working with communities, irrigation districts, and states to help resolve and avert water supply crises in the West. The Rio Grande has been identified as among the most likely areas in the West to experience the kinds of water-related conflicts that the WaterSMART Initiative is addressing. The WaterSMART Initiative's goals are being accomplished primarily through competitive award of challenge grants to irrigation districts, communities, and states. Through the Challenge Grant Program, Reclamation provides 50/50 cost-share funding for projects focused on water conservation, efficiency, and water marketing. The focus is on projects that can be completed within 24 months.

The following projects are currently being funded under the WaterSMART Initiative. In FY 2010 and FY 2011, Arch Hurley Conservancy District was awarded grants to apply sodium bentonite to areas along the main canal to reduce water loss due to poor soil conditions. Construction will continue throughout the year due to insignificant water allocations.

Basin Study Program

West-Wide Climate Risk Assessments

In 2011, Reclamation was authorized to initiate a climate risk assessment for the Upper Rio Grande, which for purposes of this project includes the headwaters of the Rio Grande and the Rio Chama in Colorado and New Mexico, and the Rio Grande and its tributaries as far downstream as Elephant Butte Reservoir. Under this project, Reclamation has used a suite of 112 General Circulation Model (GCM, which are global climate models) simulations to develop projections of future climatic conditions in the basin. These forecasts have been downscaled and corrected for bias, and used as input to hydrologic models, which use forecasted temperature and precipitation to provide projections of future snowpack, evapotranspiration rates, and river flow rates. These parameters, after additional calibration and correction for bias, are then used in local routing models which incorporate river and reservoir operations within the basin to provide projections of future river flow and water availability. This project also includes a general assessment of ecological resilience or vulnerability to the predicted climatic and hydrologic changes.

Basin Studies

Reclamation has been seeking partnerships with local water management agencies to perform Basin Studies. In the Upper Rio Grande, these studies build on the hydrologic projections developed by Reclamation as part of the Rio Grande Climate Risk Assessment, 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 partner, and involve considerable cooperation with other members of the water community in a basin.

In 2011, Reclamation initiated a partnership with the City and County of Santa Fe for a Basin Study covering the Santa Fe River watershed, the headwaters of the Rio Grande as far downstream as Otowi gage, and the San Juan Basin tributaries that contribute to Reclamation's San Juan-Chama Project. Reclamation and its partners have developed a Memorandum of Agreement for this project and agreed on a scope of work. A contractor has been selected and planning has begun for a preliminary assessment workshop, which will focus on assessment of the myriad of potential impacts of climate change in the basin, including impacts on such things as human systems, wildlife, and forest health, and evaluation of human and ecosystem resiliency to the projected changes. The project will include a detailed assessment of the implications of the predicted hydrologic changes on the City and County's ability to provide water supply to its constituents, as well as the development of adaptation and mitigation measures for predicted shortages.

Reclamation has solicited letters of interest for 2012 Basin Studies in the Rio Grande and Pecos watersheds in New Mexico, and has received the letters and selected three partners to work with the Albuquerque Area Office on the development of proposals, which are to be submitted for review by February 10, 2012.

Landscape Conservation Cooperatives

Reclamation is partnering with the U. S. Fish & Wildlife Service to establish Landscape Conservation Cooperatives (LCCs). LCCs are designed to be links between science and conservation actions, which address climate change and other stressors within and across

landscapes. The Middle 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.

Under the Southern Rockies Landscape Conservation Cooperative, the Albuquerque Area Office has received funding for enhancements to the Upper Rio Grande Water Operations Model (URGWOM) to allow it to perform runs of 50 to 100 years, sufficient length to allow evaluation of water operations under conditions predicted in climate change projections.

Title XVI Water Reclamation and Reuse Projects

Under the authority of Public Laws 102-575 and 104-266, Reclamation is/was participating with the cities of Albuquerque, New Mexico, and El Paso, Texas, in the construction of water reclamation and reuse projects. Reclamation has also participated in a Title XVI feasibility study with the City of Espanola.

Albuquerque Bernalillo County Water Utility Authority (ABCWUA)

In 1999 Reclamation entered into agreements with ABCWUA that provide the framework for participation and cost sharing in their \$67 million non-potable water reclamation and reuse project. Up to 25 percent federal cost share was authorized for construction of the project, not to exceed \$20 million.

- **North I-25 Industrial and Non-Potable Surface Water Project (Northside Project):** The Northside Project diverts San Juan-Chama project water directly from the Rio Grande using horizontal wells, then blends it with reclaimed water from industrial recycling, and delivers this water to turf irrigation customers in the northern portions of Albuquerque. The combined consumptive use in 2011 for this project was 2,646 acre-feet of San Juan-Chama project water, and the ABCWUA projects consumptive use in 2012 of 3,000 acre-feet.
- **Southside Municipal Effluent Reuse Project (Southside Project):** The Southside Project will design and construct an expanded treatment system at the Southside Water Reclamation plant to include a clearwell/chlorine contact tank, two pump stations, a 1.9 million gallon storage reservoir, and associated distribution pipelines. Construction began in December 2009, and the project will be operational in March of 2012. The project will provide about 2,500 acre-feet per year of polished municipal effluent, which will be used primarily for turf irrigation by various municipal, industrial, and commercial customers along the pipeline route. The storage reservoir and facilities at Puerto Del Sol golf course were completed in 2011.
- **Arsenic Pilot Demonstration Project:** The Arsenic Pilot Demonstration Project started operating in 2008. The project removes arsenic from two wells on the west side of Albuquerque (College No. 1 and No. 2), and provides about five million gallons per day of drinking water that meets or exceeds the EPA drinking water maximum contaminant level (MCL) for arsenic.
- **Alameda Trunk Arsenic Project:** The feasibility study for this project began in 2008 to evaluate a new treatment system for existing wells where water quality is impaired due to naturally-occurring arsenic. The project will pipe water from the wells to a central treatment

facility to remove arsenic from the groundwater prior to distribution to service area customers. NEPA compliance began in 2011 and is ongoing. Design and construction of the project are contingent upon receiving federal matching funding. Facilities construction is currently estimated at an additional \$15 million.

Town of Chimayo

In October 2004, P.L. 108-354 was enacted, which authorized up to \$3 million for emergency water supply development assistance for the Town of Chimayo. In Fiscal Year 2010, Congress provided a \$233,000 earmark for the construction of storage tanks, extension of domestic water lines, and development of additional ground water supplies for the Town. The Greater Chimayo Mutual Water Users Association is the project sponsor. The project was completed on December 14, 2011.

City of El Paso

The City of El Paso has been using recycled water since 1961. Reclamation has contributed to El Paso's efforts since 1996 through Title XVI. El Paso currently recycles nearly 2 billion gallons (~6,000 AFPY) of water per year through 50 miles of purple pipe. This recycle program has cost the City \$56 million dollars, with Reclamation's contribution of \$14.4 million

The recycled water has been applied to some sites not suited for this water, resulting in damage to vegetation. The City of El Paso, in conjunction with Texas A&M, has proactively implemented a best management program to help water users better prepare their sites and select vegetation better suited for recycled water. Reclamation has contributed more than \$50,000 to aid El Paso's best management practices program.

Reclamation was working with the El Paso Water Utilities-Public Service Board (EPWU-PSB) to conduct a pilot plant study for utilizing the Montoya Drain flows during the non-irrigation season (October – March). This work has been on hold while the EPWU-PSB has concentrated on repair and upgrades to their infrastructure since the flooding in 2006.

The City of El Paso is moving forward with an upgrade to the Kay Bailey Hutchison Desalination Plant. The City will install solar photovoltaic panels to generate power for their operations. Reclamation declined an initial request to transfer purple pipe funds to this project. In the event that this decision is overturned, the scope of future Title XVI projects could be expanded by tying water and energy needs together. The pumping and processing of water and sewage is the City's largest use of electricity.

Reclamation's Water Conservation Field Services Program

Through the Water Conservation Field Services Program, Reclamation provides cost-share funding and technical assistance to a number of water management entities in New Mexico and Texas. The Water Conservation Field Services Program 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 2011, and also completed a water conservation plan for the Village of Tijeras, New Mexico. Funding was used to promote the nation's largest xeriscape conference, as well as for irrigation water management workshops that were co-sponsored by Reclamation, the New Mexico Office of the State Engineer, and the New Mexico Water Conservation Alliance. The New Mexico Association of Conservation Districts provided funding to support the Rolling Rivers Educational Trailers throughout New Mexico. Outreach demonstrations are generally held at State and County Fairs, public and private schools, teacher workshops, water conferences, and other outreach activities. Funding was provided for children's water festivals in Albuquerque, Santa Fe, Artesia, Carlsbad, Lovington, and Las Cruces.

In 2011 Reclamation provided funding to the Arch Hurley Conservancy District through the Water Conservation Field Services Program, as well as the 2010 Water Smart Initiative, to apply sodium bentonite to areas along the main canal to reduce water loss due to poor soil conditions. Construction will continue throughout the year due to no water allocations.

Other grantee's include: 1) the Office of the State Engineer to develop a Regional Water Conservation Planning Guidebook, 2) the Chama Valley Association to rehabilitate their diversion structure, 3) the City of Clovis to write a Water Conservation Plan, and 4) the County of Santa Fe to inventory water resources in the Espanola Basin.

Upper Rio Grande Water Operations Model

The Upper Rio Grande Water Operations Model (URGWOM) is a set of daily time step, river-reservoir models for the Upper Rio Grande basin that utilize a numerical computer modeling software (RiverWare) developed by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at the University of Colorado at Boulder. URGWOM is capable of simulating the river and reservoir hydrology, water accounting, and operational policy on the Rio Grande from the Colorado-New Mexico state line to Elephant Butte Reservoir in New Mexico. URGWOM also models flood control operations from Elephant Butte Dam to American Dam, which is located in El Paso, Texas. The URGWOM models are used in flood control operations, water accounting, and for the evaluation of short- and long-term water operation alternatives.

Since 2002, the URGWOM accounting model has been the primary tool used by Reclamation for San Juan-Chama and Rio Grande Compact accounting. The Nambé Falls Accounting Model was added to the Accounting Model workspace in 2008, but was not linked to the rest of the model, and continued to be operated as a separate model independent of the main URGWOM Accounting Model through 2011. URGWOM's water operations module was used to develop the 2011 Middle Rio Grande Annual Operating Plan, and to compute operational scenarios for the Middle Rio Grande Biological Assessment.

URGWOM development during 2011 continued to concentrate on the connectivity of RiverWare to other applications for preparation of reports and data transfer to other applications, application of new methods for modeling the groundwater and surface water interactions within the Middle

Valley, continued improvement, documentation and clean-up of the water operations ruleset, and improvements to the Accounting Model and Hydrologic Database (HDB) interface. Functionality in Riverware that was developed in 2010 to present information similar to the Reclamation “Greenbook” was improved in 2011 by CADSWES for use in the Accounting Model.

The URGWOM Technical Team and Sandia National Laboratory continued to work cooperatively during 2011 on refinements of a monthly time step model (URGSiM) using the Sandia Powersim simulation software. In the process of performing validation work on URGSiM, potential deficiencies in the ET Toolbox computations used by URGWOM that were discovered in 2010 were further analyzed, and are currently being studied rigorously by the Technical Team for acceptance and improvement.

Planned work for 2012 will concentrate on continuing the development and application of the many new improvements and capabilities of RiverWare in URGWOM. These include improvements to the user interface and model run setup, the shallow groundwater/surface water interaction simulation capability and river evaporation methods, and improvements to the Daily Water Operations Model to better simulate daily water operations, including meeting in-stream flow targets and functionality for daily use. Forecast modeling work is also scheduled for use of the new Middle Rio Grande Combined Forecast and Annual Operating Plan Model to test the application of a full range of forecast probabilities. The operations forecasts will use each year of the currently available historical flow records (1975 to near-current) scaled to the five May-July volume forecasts (10, 30, 50, 70, and 90%) provided by the NRCS each month prior to spring snowmelt.

The Accounting Model improvements and documentation that were completed in 2007 have improved reporting efficiency and accuracy in 2008 through 2011. Continued work to improve data storage, security, and reporting efficiency are also anticipated to complement work done in 2011 and previously.

It continues to be notable that there is currently no policy dependency between the Nambé Falls Accounting Model and the main URGWOM Accounting Model. Linking the two portions of the model may not be practical and has the potential to be detrimental. The Nambé Falls network is now contained within the main URGWOM Accounting Model, which is sufficient until a confirmed need arises for such linkage. Due to the lack of data in the Nambé Falls portion of the model, a linkage could stop or limit running of the main URGWOM Accounting Model; therefore, such linkage is not advisable at this time.

Additional information about URGWOM and the RiverWare modeling software can be found at the Corps of Engineers’ web site: <http://www.spa.usace.army.mil/urgwom/default.asp>, which was updated in 2011.

Water Accounting Reports Projects

2011 San Juan – Chama Project Water Accounting

The 2011 San Juan – Chama Project water accounting was accomplished using version 6.1.1 of the RiverWare modeling system software and the URGWOM accounting module. All accounting data and information is stored directly in the final version of the 2011 accounting model. Reclamation held periodic meetings with representatives of the New Mexico Interstate Stream Commission and the U. S. Army Corp of Engineers, Albuquerque District, to verify accounting data entered for the previous months. This minimized year-end data quality and accounting concerns.

Oracle® Hydrologic Database (HDB)

The Hydrologic Database (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, Center for Advanced Decision Support for Water and Environmental Systems (CU-CADSWES). Reclamation's Albuquerque Area Office (AAO) HDB instance is now maintained by Reclamation's Upper Colorado Regional Office as well as through contract with Sutron Corporation. HDB has been customized by independent Reclamation consultants and Reclamation offices for specific office and model requirements. HDB is currently used by Reclamation's Upper and Lower Colorado Regional Offices for joint management of the Colorado River. The AAO and the El Paso Field Division (EPFD) depend on HDB installations for the purposes of data storage and retrieval. The AAO instance of HDB is located in the Salt Lake City Regional Office.

Development of water accounting and reporting functionalities for the AAO's HDB installation continued during 2011. Water accounting data is now directly transferred from the RiverWare URGWOM Accounting Model to HDB via an HDB/RiverWare Direction Data Connection interface. Further improvements to DECODES, the Computation Processor, the Calculation Application, Compedit, and the MetaData Application were accomplished to improve data storage and availability in 2011.

Planned work for 2012 includes continued work on DECODES, the Computation Processor, the Calculation Application, Compedit, and the MetaData Application. Historical data at most sites will also be back-populated to HDB as needed. Automated functionality to notify the AAO of EPFO entry or editing of MRG Accounting Model-dependent data will also be examined and potentially developed. Additional Crystal Reports (Version 2008) accounting table reports for internal use and external reporting may be developed, as well as work to automatically update certain accounting tables posted to the internet.

RiverWare®

The use of the new RiverWare® URGWOM Accounting Module Data Objects allow for all accounting and accounting report table data to be derived within and acquired directly from the RiverWare® based URGWOM Accounting Module. The URGWOM Accounting Module Data

Objects easily allow Reclamation, the USACE, and the NMISC to check the current status of individual or multiple accounts, transfers, and storage.

Numerous improvements to RiverWare® were accomplished during 2011 through multiple contracts (Reclamation and USACE) with the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at Colorado University-Boulder, Colorado. The improvements are documented in the annual report produced by CADSWES and distributed to the user community at the February 2012 annual meeting.

Evapotranspiration (ET) Toolbox Decision Support System

Reclamation and others have determined a need for rapid improvement in measuring and predicting both daily open water evaporation, and daily riparian and crop water use in the Rio Grande Basin. Reclamation developed the ET Toolbox for estimating these daily water use requirements at a resolution useful for implementation in URGWOM.

The primary purpose of the ET Toolbox project is to supply water managers within and outside of Reclamation with accurate, real-time ET predictions via a dedicated website, while making the real-time ET dataset (daily riparian and crop water use estimates, open water evaporation estimates, and rainfall estimates) available to URGWOM for daily water operations model runs. 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. The initial development work focused on the Middle Rio Grande area from Cochiti Dam to San Marcial, which is just south of the Bosque del Apache National Wildlife Refuge in New Mexico. ET Toolbox coverage has now been extended 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.

The ET Toolbox daily rainfall and water depletion predictions for the Rio Grande are available to users and water managers via the Internet at the URL <http://www.usbr.gov/pmts/rivers/awards/Nm2/riogrande.html>.

During 2011, the ET Toolbox switched to the FAO-56 Penman-Montieth method for calculating Reference ET. Beginning on January 1, 2011, all ET values are based on this method. The delineation between river Reaches 5 and 6 was changed from the Bernardo Rio Grande USGS stream flow measurement gage to the State Highway 346 near Bosque, NM, measurement gage due to the discontinuation of the Bernardo gage. A new stream flow schematic for the Middle Rio Grande Conservancy District's Socorro Division was implemented, while the old Belen, North, and South schematics were removed. The termination date for all agricultural crops was

uniformly set at October 31. Previously, corn and sorghum had earlier termination dates. This termination date does not exclude termination due to growing degree days and crop curves. There was also improvement in the retrieval timing of the USGS streamflow data.

During 2012, Reclamation will continue to maintain and update the ET Toolbox to meet needs and improve ET estimates.

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, water rights settlements, WaterSMART Program, 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 improve irrigation system efficiency. Some of the items funded or purchased included concrete lining of farm ditches, terracing, laser leveling, check structures, pipes, and turnouts. Reclamation is working with the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), on additional irrigation improvements at several Pueblos. Reclamation is also working with the Bureau of Indian Affairs (BIA) on irrigation system improvements for the Middle Rio Grande Conservancy District facilities on lands of the six Middle Rio Grande Pueblos. The BIA is providing funding which is being passed through to these six pueblos via Reclamation contracts.

The Omnibus Public Land Management Act of 2009, Public Law 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. Construction is authorized up to \$6 million per year through Fiscal Year 2019, not to exceed \$60 million. In Fiscal Year 2010, Congress did not appropriate any funding to accomplish either the study or construction. The study cannot begin until Congress appropriates funds. However, Reclamation is providing technical assistance to the eighteen Pueblos with funding provided by the Native American Affairs Program, and has entered into contracts with the Pueblos to do some project identification and prioritization. A limited amount of land surveying has begun.

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 the Bureau of Indian Affairs (BIA), the Pueblos, the State of New Mexico, and other involved parties to implement the provisions of these settlements.

As specified by the settlement legislation, Reclamation has contracted with Taos Pueblo for 2,215 acre-feet per annum of San Juan-Chama Project water. Work continues to implement the remaining provisions of the 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 Aamodt Settlement Agreement is anticipated to be executed in the summer of 2012. The Aamodt Litigation Settlement Act authorizes Reclamation to plan, design, and construct a Regional Water System (RWS). The RWS will consist of a surface water diversion and water treatment facilities at San Ildefonso Pueblo on the Rio Grande and storage tanks, transmission and distribution pipelines, and aquifer storage and recovery well fields that will supply up to 4,000 acre-feet of water annually to Pueblo and non-Pueblo customers within the Pojoaque Basin. The Pueblo water supply includes 1,079 acre-feet of San Juan Chama Project water, 1,141 acre-feet of “Top of the World” water rights the BIA will acquire from the County of Santa Fe, and 302 acre-feet of Nambé reserved water rights. A Pojoaque Basin Regional Water Authority will be formed to operate and maintain the RWS. Permits from the New Mexico Office of the State Engineer will be obtained to divert and consume the water supply for the RWS.

Work proceeded on a negotiated settlement of the Abouselman adjudication on the Rio Jemez involving Jemez, Zia, and Santa Ana Pueblos.

Emergency Drought Program

Congress provided appropriations for emergency drought relief in the Reclamation states. In the Rio Grande basin, Reclamation, through an interagency agreement with the U.S. Indian Health Service, is providing drought relief by providing drinking water wells for the Pueblos of Acoma, Nambé, Isleta, and San Felipe. Acoma Well #8 was completed in May 2009. Wells for Nambé and San Felipe Pueblos will be constructed under contract.

Wells for Eunice, Hagerman, and Brazos in New Mexico were completed in 2009. Wells for Carlsbad, Wildlife West, Colonias, and Cannon were completed in 2010. The Cannon Well was abandoned due to insufficient water bearing strata.

The Regina and Blue Water Wells are currently under construction, both wells should be completed by February 2012. The well for the Village of Capitan is a “re-drill” due to the poor quality of water and other issues at the previous well. Construction of the Capitan Well is pending a new Easement Permit from Bureau of Land Management.

Quagga and Zebra Mussel Update

In January 2007, an employee with the National Park Service at Lake Mead, NV, discovered the first quagga mussel in the western United States. The mussels were likely transported to the

west via a contaminated boat from an eastern state. Since that time, mussels have expanded their range throughout many western states. Since 2009, Reclamation has been sampling its seven 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 in Denver. At this time, New Mexico has three reservoirs considered "suspect" for having quagga mussels: Sumner, El Vado and Navajo. Further testing and confirmation is necessary before these waterways meet the State of New Mexico's criteria for being deemed "contaminated."

In 2011, the American Recovery and Reinvestment Act (ARRA), along with funding obtained from the Upper Colorado Regional Office, paid for monthly sampling at the six reservoirs. In 2012, funding for the monthly sampling and other related mussel work will come from Reclamation's budget.

Because Reclamation strongly believes that preventing the spread of mussels is the least costly option for protecting the state's water bodies, it is pursuing the following ongoing activities:

- Reclamation's Albuquerque Area Office has made a serious effort in public outreach activities since 2009, printing some 21,000 'Zap the Zebra' brochures and 1,000 mussel posters. These brochures and posters that have been dispersed throughout New Mexico: at the state parks, convenience and sporting good shops, libraries, etc.
- Permanent signs, with the "Stop Aquatic Hitchhikers!" message have been installed at boating docks and other key park locations that are under Reclamation's jurisdiction.
- Reclamation funded the hiring and training of temporary staff to assist New Mexico State Parks with inspections at key boating reservoirs within the state for 2011.
- Reclamation purchased three mobile decontamination units; one is permanently assigned to Elephant Butte Reservoir, one is available for the Chama River area, and the third unit is in the Pecos River basin area. However, these units, being mobile, can be moved where needed.
- State and Federal employees continue to be trained to perform watercraft inspections (Level 1) and decontamination procedures (Level 2).

To protect Reclamation's facilities, the following work has been completed:

- Reclamation developed a Technical Memorandum, *Inspection and Cleaning Manual for Equipment and Vehicles to Prevent the Spread of Invasive Species*, (2010, No. 86-68220-07-05).
- An action plan for Elephant Butte entitled, *Elephant Butte Field Division Action Plan for Prevention and Rapid Response of Dreissenid Mussels*, was developed.
- Facility Vulnerability Assessments have been developed for seven Reclamation reservoirs within New Mexico (Heron, El Vado, Elephant Butte, Caballo, Sumner, Brantley, and Avalon).

Non-Federal Hydroelectric Power Development

The Administration would like to increase America's renewable energy resources. The Town Sites and Power Development Act of 1906 and the Reclamation Project Act of 1939 (1939 Act)

authorize Reclamation to enter into lease of power privilege contracts with non-Federal entities to use Reclamation facilities for electric power generation consistent with Reclamation project purposes. Reclamation recently made available to the public the *Hydropower Resource Assessment at Existing Reclamation Facilities Draft Report*. The draft report indicates that it may be economically feasible to develop the hydropower potential at Caballo Dam. Title to Reclamation Project facilities, and any modifications to those facilities, remains with the United States. Title to any installed powerplant facilities is with the lessee, unless legislated or contracted otherwise.

On September 22, 2011, the Bureau of Reclamation (Reclamation) published a Notice of Intent to Accept Proposals, Select Lessee, and Contract for Hydroelectric Power Development at Caballo Dam in the Federal Register. The Notice stated that Reclamation, in consultation with the Department of Energy, Western Area Power Administration (WAPA), would consider proposals for non-Federal development of hydroelectric power at Caballo Dam, a feature of the Rio Grande Project.

Reclamation is considering such hydroelectric power development under a lease of power privilege, which is a contractual right given to a non-Federal entity to use a Reclamation facility for electric power generation consistent with Reclamation project purposes. No Federal funds will be available for such hydroelectric power development. WAPA would have the first opportunity to purchase and/or market the power that would be generated by such development under a lease of power privilege.

Reclamation will be the lead Federal agency for ensuring compliance with the National Environmental Policy Act (NEPA) and all other relevant Federal environmental compliance laws, such as the Endangered Species Act and Clean Water Act, for any lease of power privilege considered in response to this notice. Leases of power privilege may be issued only when Reclamation, upon completion of the NEPA process, determines that the proposed hydropower development is environmentally acceptable. Any lease of power privilege at Caballo Dam must accommodate existing contractual and environmental commitments related to operation and maintenance of existing Rio Grande Project facilities, including water delivery contracts, flood control operations, and compliance with the Rio Grande Compact and the convention between the United States and Mexico concluded on May 21, 1906. Caballo Reservoir storage levels must comply with the Court Order CIV-90-95/HB/WWD, dated October 17, 1996.

Written proposals are due to Reclamation by January 20, 2012. Any⁷ selected potential lessee will have two years from the date of notification to complete NEPA compliance, and enter into a lease of power privilege for the proposed development of hydropower at Caballo Dam. The lessee will then have up to two years from the date of execution of the lease to complete designs and specifications, and an additional year to begin construction.