RECLAMATION

Managing Water in the West

Calendar Year 2008 Report to the Rio Grande Compact Commission

Colorado	New Mexico	Texas
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Federal Chairman
Vacant

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

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Cover photo – Site of Bosque del Apache sediment plug taken December 2008. Photo looking north (upstream).

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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 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, Mesilla, and Riverside 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 1996.

This general background does not usually change from year to year.

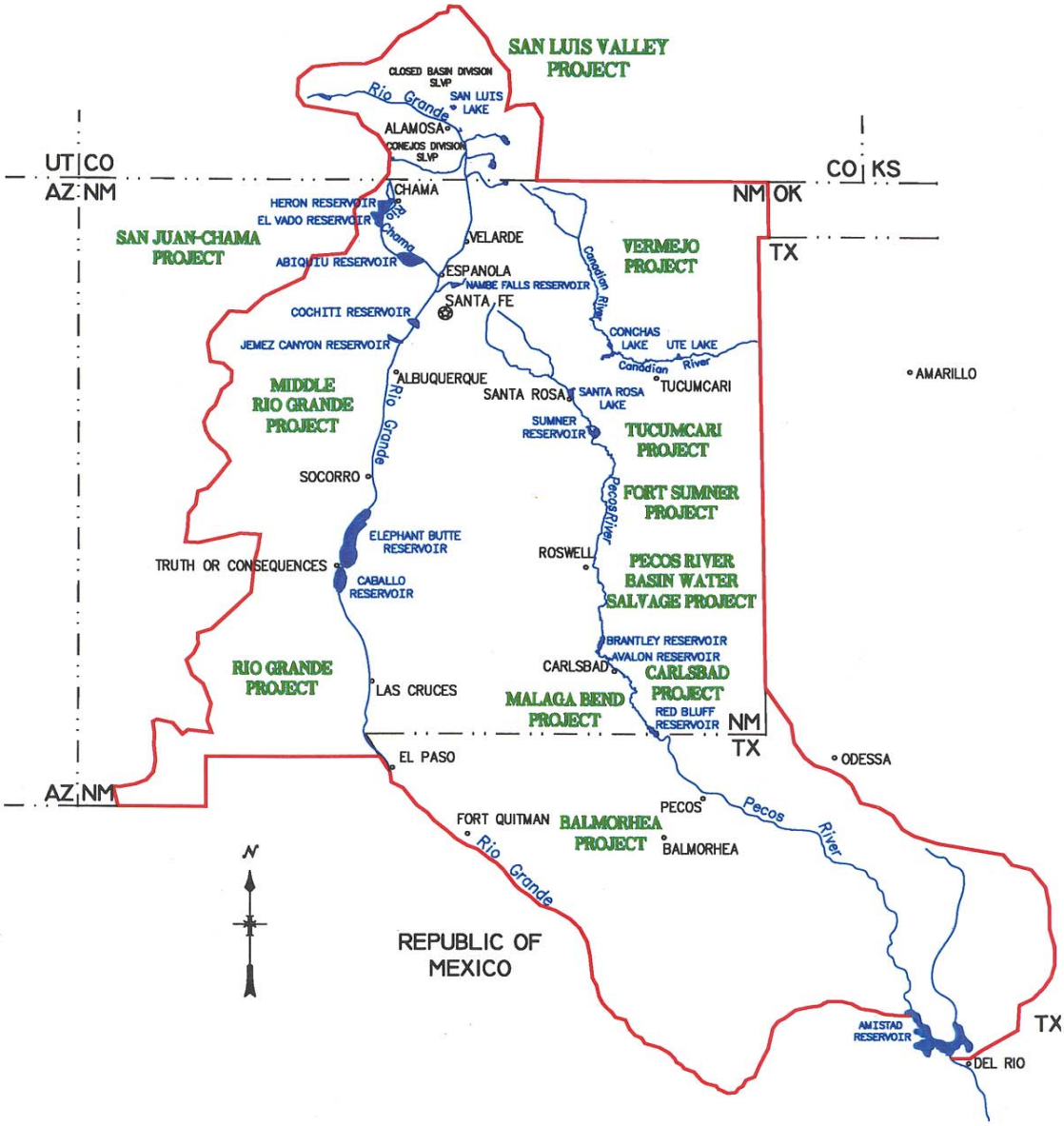

Figure 1: Project Map of Reclamation's Albuquerque Area Office

San Luis Valley Project, Colorado

Conejos Division, Platoro Reservoir

The Conejos Water Conservancy District operates Platoro Reservoir which provides storage for the San Luis Valley Project (Figure 2). Conejos Water Conservancy District's office is located in Manassa, Colorado, at 318 Main Street.

Platoro Reservoir began January 1, 2008, at elevation 9968.78 feet AMSL, with a content of 12,648 af. The September 30, 2008, elevation was 9,992.26 feet, with a content of 19,611.5 af – of that content 3,164 af was direct-flow storage (re-regulated water that was evacuated by the end of October, 2008), and 1,617af of Compact water. December 31, 2008, data were: elevation 9,977.9 feet, with a storage content of 17,227.5 af – no Compact water remained in storage.

Reclamation and CWCD formalized a Memorandum of Understanding to clarify O&M responsibilities at Platoro Dam in mid-2008.

Platoro Dam Facility Review and Safety of Dams Programs

In 2008, the following activities were implemented for Platoro Dam:

- O&M recommendation 1998-2-B 2001-2-C recommending (recoating of the butterfly values and 400 feet of penstock downstream outlet works (guard-gate). Has been either scheduled or completed. The penstock was recoated and the butterfly values are scheduled for replacement in the fall of 2009.
- The Water District is now seeking assistance from Reclamation for inspecting the upper conduit and upstream side of the guard-gate and filler-line. This will require designing and fabricating a stop-log system.
- The Water District would like to replace the temporary bypass system with a permanent system which would also serve as a filler-line, eradicating safety concerns.

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 of the project is to salvage unconfined ground water from the Closed Basin that would otherwise be lost to evaporation and transpiration. 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 2005. The next RO&M examination is scheduled for 2011.

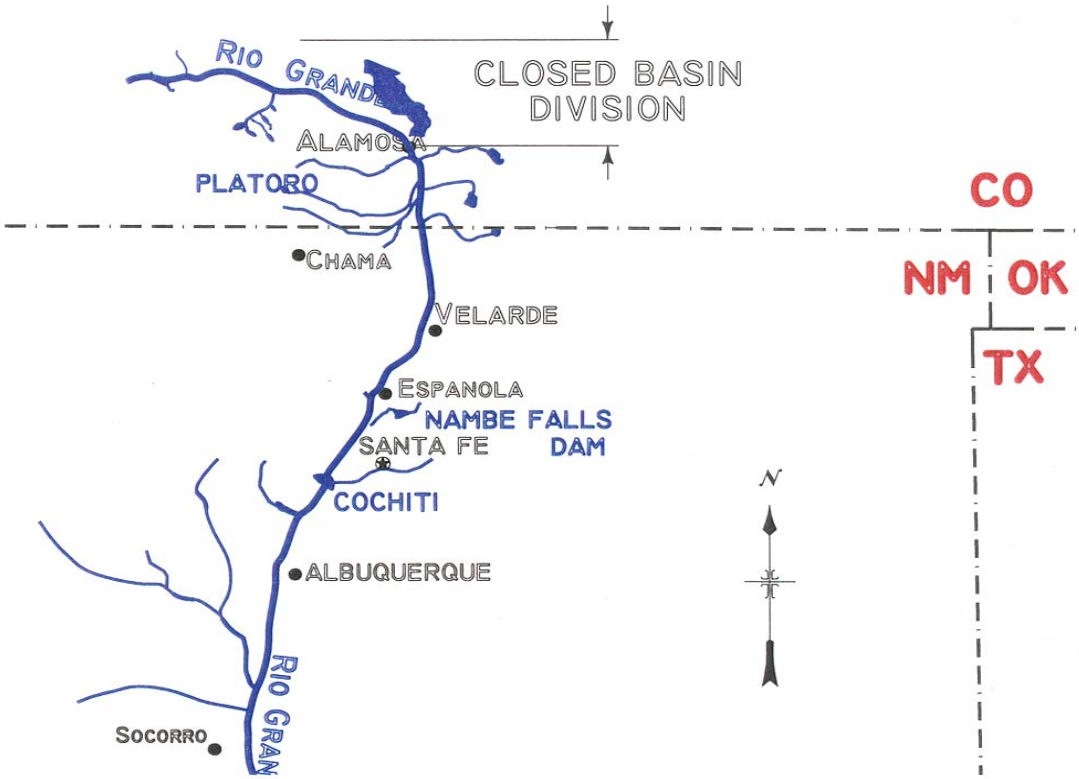

Figure 2: Area Map of San Luis Valley Project

Closed Basin – Operations and Maintenance

Operations

Closed Basin water deliveries in CY2008 included deliveries to the Rio Grande, Blanca Wildlife Habitat Area, Alamosa National Wildlife Refuge, and to provide for stabilization of San Luis Lake.

A total of 17,079 AF of project water was delivered in Calendar Year (CY) 2008. Total deliveries of Compact water to the Rio Grande for CY2008 were 13,044 AF.

Total water deliveries to the BLM Blanca Wildlife Habitat Area for CY2008 were 800 AF annual mitigation and 500 AF Division of Wildlife exchange.

Total water deliveries to the Alamosa National Wildlife Refuge for CY2008 were 2,735 AF 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 CY2008 totaled 2,154 AF. 1,000 AF was delivered to SLL via the feeder canal per an exchange with the Colorado Division of Wildlife.

This exchange was Weminuche Trans-mountain water from the Rio Grande Reservoir. The Closed Basin Project is storing this 1,000 AF for CDOW.

Closed Basin Division water accounting for the 2008 calendar year is summarized in Table 1.

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

SLV CBD	BLANCA WILDLIFE HABITAT AREA			PARSHALL FLUME		ALAMOSA NAT'L WILDLIFE REFUGE (ANWR)				DELIVERY TO THE RIO GRANDE			
MONTH	CH03 STA. 730+00	CH04 STA. 798+60	MONTH TOTALS	TOTAL PASSING FLUME	CREDIT-ABLE AMOUNT AT FLUME	CH01 CHICAGO TURN-OUT	CH02 MUM TURN-OUT	PUMPING PLANT	MONTH TOTALS	TOTAL AT FLUME MINUS DEL. @ ANWR	Credit. Amt. del. to RGrande & not used by ANWR	NON-CREDIT-ABLE @ LOBATOS	PROJECT TOTALS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
JAN	0	0	0	1745	1745	0	0	0	0	1745	1745	0	1745
FEB	0	0	0	1698	1698	0	0	0	0	1698	1698	0	1698
MAR	60	55	115	1684	1684	353	357	383	1093	591	591	0	1799
APR	0	0	0	1726	1726	40	176	0	216	1510	1510	0	1726
MAY	0	0	0	1728	1728	0	0	0	0	1728	1728	0	1728
JUN	2	4	6	1623	1623	0	0	54	54	1569	1569	0	1629
JUL	170	239	409	628	628	0	0	0	0	628	628	0	1037
AUG	195	245	440	816	816	0	0	0	0	816	816	0	1256
SEP	143	187	330	1198	1198	78	95	11	184	1014	1014	0	1528
OCT	0	0	0	946	946	248	295	203	746	200	200	0	946
NOV	0	0	0	902	902	231	211	0	442	460	460	0	902
DEC	0	0	0	1085	1085	0	0	0	0	1085	1085	0	1085
ANNUAL	570	730	1,300	15,779	15,779	950	1,134	651	2,735	13,044	13,044	0	17,079

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.

The 2007 annual report on vegetation monitoring within the project boundary summarized that an average of 736 acres within the project boundary indicated a significant decrease in vegetation from the pre-project baseline. Much of this amount is known to be attributed to factors other than project pumping. This amount is far less than the 8,460 acres that were predicted in the Final Environmental Impact Statement, and subsequently mitigated. An average of 1,010 acres within the project boundary indicated significant increase in vegetation from the pre-project baseline.

The United States Geological Survey's (USGS) Pueblo Colorado Office continues to provide quality assurance/quality control (QA/QC) of the observation wells' network data for Reclamation. Reclamation received an excellent rating through the QA/QC program in 2008.

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 5 replacement wells were drilled in 2008. These replacement salvage wells range from 100 gallons per minute (gpm) to 500 gpm. With the different well screen design and change in the gravel pack style; these wells continue to prove that the re-drills have been very successful to the project and commitment to the Rio Grande Compact, the Alamosa National Wildlife Refuge,

and the Blanca Wildlife Habitat Area. A total of 50 salvage wells have been re-drilled from 2002 through 2008.

Repair and replacement of pumps and motors in the Salvage Wells vaults is an on going process. The maintenance crew will continue to chemically treat salvage wells in our rehabilitation efforts in 2008. Annual preventive maintenance of salvage wells is ongoing as well as maintenance on the lateral valves.

Over the last 18 months, 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. The decreased rate of pumping slows down the processes of bio-fouling and plugging of the gravel pack with fine sand particles.

2. Rehabilitation of existing wells. A combination of acid treatment with brushing and surge blocking is used to maintain or improve salvage well yield.

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.

Energy savings realized so far has been approximately $100,000.00.

The Project office equipment has been updated with a cab and chassis to mount the drill rig on, John Deere motor grader, 18’ equipment/utility trailer and a Ranco bellydump.

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 2008.
In addition to the standard water quality parameters, dissolved oxygen, nitrogen, and carbon dioxide continue to be monitored to assist canal grass carp survival studies and dissolved nitrogen reduction endeavors. This work is conducted in cooperation with Reclamation’s Denver Technical Service Center personnel.

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.

The laboratory has the capability to culture and identify “iron related bacteria” to support salvage well rehabilitation and bio-fouling mitigation efforts. All salvage wells are currently monitored for the presence of these bacteria.

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 ground water 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. Five wells have been replaced during 2008, and numerous others were treated and rehabilitated.

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 2008. 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.

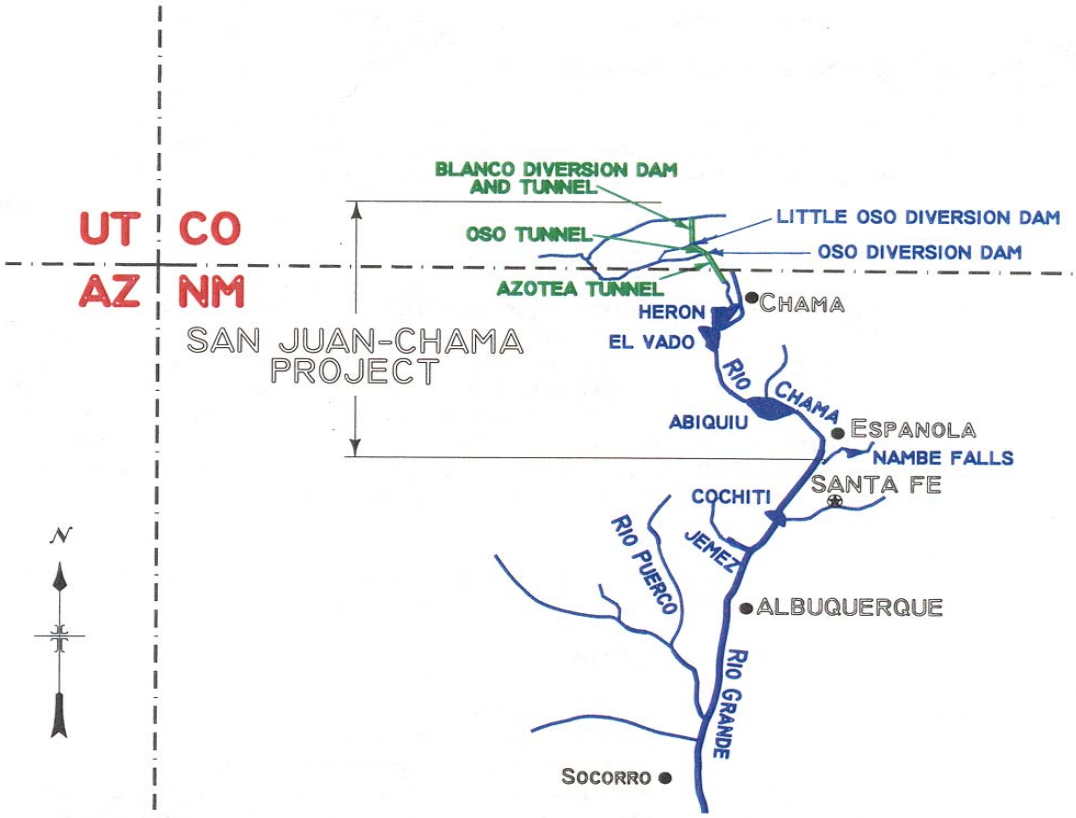

Figure 3: Area Map of the San Juan-Chama Project

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, accounting was accomplished with Fortran code models. Fortran code based models were replaced with a Lotus® electronic file spreadsheet around 1993. A Microsoft

Excel® version of the Lotus® spreadsheet was developed around 2004, at about the time a RiverWare® accounting model was constructed. The Fortran models and Lotus® spreadsheet were the approved methods of accounting until 2008 when the Excel® spreadsheet was 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 each method with favorable results. Reclamation intends to use the RiverWare® accounting model/HDB/ Crystal Reports® method in the future. San Juan Chama Project accounting for 2008 is provided in the separate report *2008 Water Accounting Report*.

San Juan-Chama Diversion Dams and Tunnels

Initial diversions for the San Juan Chama Project begin in Colorado at the Blanco, Oso and Little Oso diversion dams depicted on 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.

As a requirement of the Corps of Engineers 404 program, permits for maintenance at the Blanco and Oso Diversion Dams were acquired and are available at the Albuquerque Area Office and Chama Field Division Office. The permits expire December 1, 2011, and require an 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.

Over time, rocks and sand diverted with high velocity spring flows cause abrasion and impact damage to the tunnel inverts. An Azotea Tunnel repair contract was awarded in September, 19, 2007 for the Phase II repair work. Notice to proceed was issued for the contract on October 17, 2007. The Contract was award to DLM Enterprises of Albuquerque New Mexico. The Contract consisted of repairing a total of 16,000 feet of tunnel invert from Stations 920+00 to 1080+00. Work consists of placing 400 cubic yards of concrete for tunnel invert repair. Work was completed on February 21, 2008. Budget and quantity estimates by the government engineer were within 2% of the actual expense and volume of concrete placed.

Photo 1. Azotea Tunnel prior to repair

Photo 2. Azotea Tunnel after repair

Heron Dam and Reservoir Operations

Diversions into the Azotea Tunnel began on March 5, and ended on September 18 during 2008. The total volume diverted through the tunnel was 139,984 ac-ft, The running 10-year average Azotea Tunnel diversion increased slightly this year, from 86,189 ac-ft for the period 1998 through 2007 to 90,518 ac-ft for the period of 1999 through 2008 (Table 2). Heron Reservoir began the year at an elevation of 7144.33' (196,689 ac-ft) and finished the year at an elevation of 7155.52' (243,441 ac-ft). Heron's lowest pool elevation and storage occurred on January 4 at an elevation of 7144.26' (196,413 ac-ft). Storage peaked on July 28 at an elevation of 7171.64' (321,115 ac-ft).

Table 2: SJ-C Project - Diversions through Azotea Tunnel (units are acre-feet)

Azotea	Year										10 Year Total
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
Month	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
January	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	93	0	179	0	272
March	4,152	536	1,512	743	1,170	11,505	1,931	706	12,976	4,745	39,976
April	12,516	15,864	19,284	4,499	11,366	15,427	31,721	17,799	17,745	25,816	172,037
May	32,806	20,987	51,092	865	26,613	30,164	45,146	25,674	33,838	44,461	311,646
June	39,659	5,019	29,283	204	18,816	20,390	50,210	7,600	26,679	47,463	245,323
July	12,734	106	4,643	0	669	2,139	13,347	3,785	4,302	13,428	55,153
August	13,019	229	4,455	0	487	237	3,779	4,868	7,375	2,606	37,055
September	4,015	0	313	0	3,340	1,973	3,360	5,567	1,948	1,465	21,981
October	0	0	0	0	246	1,821	4,873	12,795	33	0	19,768
November	0	0	0	0	0	1,218	735	0	0	0	1,953
December	0	0	0	0	0	12	0	0	0	0	12
Annual	118,901	42,741	110,582	6,311	62,707	84,886	155,195	78,794	105,075	139,984	905,176

The SJ-C contractors' 2008 and waivered 2007 annual allocations were delivered as shown in Table 3, for a total delivery in 2008 of 88,351 ac-ft. The remaining 2008 allocations are being held in Heron according to waivers which grant an extension for the delivery date for several contractors into 2009. Table 4 presents actual monthly Heron water operations for the 2008 calendar year.

The March 2009 most probable streamflow forecasts at both Blanco Diversion on the Rio Blanco and Oso Diversion on the Navajo River are 104% and 104% of the 30 year average respectively. Heron inflow during the snowmelt runoff is projected to be 99,290 ac-ft based on preliminary model runs using the Natural Resources Conservation Service's February 1 streamflow forecast. Based on this same model run and forecast, Heron Reservoir is projected to achieve a maximum storage of 260,000 ac-ft during 2009. Reclamation will maximize diversions as water becomes available.

Table 3: SJ-C Project – Water Deliveries from Heron Reservoir (units are acre-feet)

SJ-C HERON RELEASE / MONTH	MRGCD	SANTA FE	SANTA FE COUNTY	COCHITI	CITY OF ALBUQUERQUE	POJOAQUE UNIT	TAOS	COUNTY OF LOS ALAMOS	CITY OF ESPAÑOLA	TWINING SANITATION	VILLAGE OF LOS LUNAS	TOWN OF BERNALILLO	BELEN	RED RIVER	JICARILLA APACHE	SAN JUAN PUEBLO	UNCON-TRACTED	TOTAL
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	
JANUARY	0	0	0	664	0	0	0	0	0	0	0	0	0	0	0	0	0	664
FEBRUARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
APRIL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JUNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JULY	0	0	0	1,595	6,832	0	0	0	0	0	0	0	0	0	0	0	0	8,427
AUGUST	0	0	0	0	4,921	0	0	0	0	0	0	0	0	0	0	0	0	4,921
SEPTEMBER	0	0	0	0	13,025	0	0	0	0	0	0	0	0	0	0	0	0	13,025
OCTOBER	0	0	0	309	15,431	0	0	0	0	0	0	0	0	0	0	0	0	15,741
NOVEMBER	9,616	0	0	1,307	3,597	714	0	0	0	0	0	0	0	0	0	0	0	15,233
DECEMBER	11,284	5,229	375	0	812	198	400	1,200	951	17	362	400	488	60	5,948	0	2,990	30,715
2008 CY TOTAL	20,900	5,229	375	3,875	44,619	912	400	1,200	951	17	362	400	488	60	5,948	0	2,990	88,726

Table 4: SJ-C Project – Monthly Water Storage in Heron Reservoir (units are acre-feet)

HERON STORAGE	INFLOW		OUTFLOW		SAN JUAN CHAMA LOSS	END-OF-MONTH CONTENT			ELEVATION (FEET)
MONTH	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. 2007						-167	196,856	196,689	7,144.33
JANUARY	885	0	105	664	0	613	196,192	196,804	7,144.36
FEBRUARY	1,922	0	1,138	0	0	1,397	196,192	197,589	7,144.56
MARCH	11,970	4,736	9,287	0	0	4,080	200,927	205,008	7,146.43
APRIL	4,491	25,764	7,945	0	0	626	226,692	227,318	7,151.82
MAY	121	44,372	121	0	1,429	626	269,635	270,262	7,161.37
JUNE	130	47,368	130	0	1,424	626	315,579	316,206	7,170.69
JULY	1,335	13,401	1,607	8,427	0	354	320,553	320,907	7,171.60
AUGUST	140	2,601	140	4,921	681	354	317,552	317,906	7,171.02
SEPTEMBER	134	1,465	134	13,025	936	354	305,056	305,410	7,168.57
OCTOBER	134	0	134	15,741	755	354	288,560	288,914	7,165.25
NOVEMBER	126	0	126	15,233	203	354	273,124	273,478	7,162.05
DECEMBER	823	0	146	30,715	0	1,032	242,409	243,441	7,155.52
SUB-TOTAL	22,212	139,707	21,013	88,726					
ADJUSTMENT						-350	(A)		
ANNUAL		161,919		109,739	5,428	682	242,759	243,441	

Acknowledgment

Reclamation acknowledges a release determination issue in 2008 at Heron Dam. The following text describes the issue and its lack of effect on annual accounting.

Release Determination Issue

On July 3, 2008 a release was started from Heron Reservoir to Abiquiu Reservoir, with a corresponding increase in release from El Vado Reservoir (which is between Heron and

Abiquiu). Water from Heron should have been passed through El Vado Reservoir with no change in storage occurring at El Vado. Storage at El Vado did begin to drop, suggesting that not enough water was being released from Heron to make up for the increased release at El Vado. A similar situation occurred on the following weekend indicating something was definitely wrong with the release requested from Heron. A calculated change in storage at Heron showed that flows were just about one-half of what they should have been. On the 3rd weekend of releases, an amount double of what was needed was called for. That time an adequate amount of water was released. It was determined that while the cause of the error was being investigated, it would be better to simply call for a release that was double the amount required.

It was found that the errors were two-fold. First, the dam tender failed to follow basic SOP procedures in reporting releases. According to dam tender records incorrect releases had been going on since the beginning of 2008 due to dam tender mistakes and failure to follow procedure. Secondly, the RTU system was reporting the wrong release values. It was documented that the RTU system crashed on March 18, 2008, which is suspected to be the date that the RTU/SCADA system started reporting incorrect values. Appropriate action was taken to remedy both issues, and currently Heron Reservoir releases are as requested.

Reclamation Albuquerque Area Office performed a number of checks in order to determine the cause of under releases. These checks included:

- Review of dam tender records with the SOP discharge curves to determine RTU/SCADA system malfunction.
- Stream Gauging efforts on 8/5/2008, 11/5/2008, and a collaborative stream gauging effort with MRGCD, USGS, and Reclamation on 11/24/2008. This was performed to check the RTU as well as the SOP discharge curves.
- On site investigation led to the conclusion that the issue was not mechanical but instead related to RTU or personnel issues.
- Actual flows, based on gate openings and reservoir elevations in dam tender records, were correct

As a result of this issue there have been several updates to the SOP that will ensure this type of mistake can be identified and resolved in a time efficient matter. These updates are as follows:

1. The dam tender must check all gate changes with the SOP to ensure that the release is correct and that the RTU/SCADA system is reporting properly.
2. When there is a discrepancy between the RTU and the SOP the AAO shall be notified. Until contact is made the SOP shall be trusted not the RTU system.
3. In the event of an RTU crash the AAO shall be notified before the system is put back into operation.
4. Dam tender will be trained to use all methods of gate operation.

To further avoid similar problems in the future, several outstanding actions will be completed in the beginning of 2009, including:

- New gate opening displays at the Dam facility to read tenth decimal place for greater accuracy in reporting and operating.
- Continuing review of RTU/SCADA system software and code to ensure proper calculations and reporting.
- Rating of the new USGS stream gauging station just downstream of Heron Reservoir.

Accounting

Due to the issues in operating Heron releases for 2008, the releases from the beginning of 2008 were recalculated using dam tender records for gate openings and elevation, and SOP discharge curves to determine the actual release. These release values were then input into the Riverware Accounting Model and used for the final accounting for 2008. The accounting process for 2008 was disturbed during 2 distinct periods; a period from mid-February to Mid-April when only Rio Grande water was being released, and early July until September when only San Juan-Chama water was being released. In the first period the Rio Grande native account was greatly exaggerated, as the model tried to reconcile the inflows, elevation and outflow (which was actually half of what was input in the model). The model had to 'create' additional native inflow to account for the storage (which was accurate) because the actual release rate was only one-half of what was being input into the model. A total release of 34,590 ac-ft of native water was originally entered into the model based solely on the inaccurate RTU-based reports from the dam tender, but the correct value (determined later) was 18,060 ac-ft (34,590 – 18,060 = 16530). The model calculated slot inflow from the original data (based on incorrect outflow information) was 21,164 ac-ft, but the corrected values (with actual outflow reconstructed from dam tender records) resulted in native inflows of only 4,796 ac-ft (21,164 - 4,796 = 16,368). The difference, between the input total release and the actual total release, and the model calculated (with bad data) slot inflow and the actual native inflow (16,530 vs 16,368), is due to both a late change in weather data, and different surface areas used to calculate evaporation on the two native volumes (model projected with bad data smaller volume resulting from larger release and actual larger volume in storage due to smaller release). The model had to create inflow that didn't exist to reconcile with the other data available in the model. Because the inflow and the release were both equivalently overestimated in the initial model, subsequent use of actual lower inflow and release data resulted in no actual extra water being stored or released in the model.

During the second period (early July until September) there should have been little to no accrual of Rio Grande water because the runoff season around the reservoir itself was mostly over. With the incorrect release data in the model, over 4,400 ac-ft of Rio Grande was shown to have entered the reservoir (the model again had to 'create' water to reconcile storage values). With the correct values in the model, that native inflow drops to under 1,400 ac-ft. Since <u>less</u> water came out than expected, the only effect on the accounting was more of the contractor's water (the ABCWUA in this case) remained in storage in Heron, which was subsequently released as pay back MRGCD in El Vado at a later date. There was no effect in El Vado, since a "borrow/payback" RiverWare® method was used – all San Juan-Chama water released from El Vado from the MRGCD account (that was supposed to have been ABCWUA water passing through) was deposited into the ABCWUA account in Abiquiu, then the volume that was released from El Vado was then paid back from the ABCWUA account in Heron to the MRGCD account in El Vado. In the end, both accounts were made whole.

Heron Dam Facility Review and Safety of Dams Programs

The following work was completed for Heron Dam during 2008:

- Facility Reliability Rating.
- Annual Emergency Action Plan Review, Drill, and Communication Directory Update.
- Two O&M recommendations were completed in 2008.
- 2008 Heron Dam Comprehensive Security Review (CSR).
- USGS installed a gage station downstream of the stilling basin.

Pojoaque Tributary Unit - Nambé Falls Dam and Reservoir

Nambé Falls began 2008 with the reservoir at elevation 6,816.95' providing a storage volume of 1,417 ac-ft. During the winter, releases averaged around 1 ft^3/s to maximize conservation storage as agreed to by the Pojoaque Valley Irrigation District and Indian water users. The reservoir filled and spilled in 2008. The maximum elevation for the year was 6,826.81' (1,932 ac-ft) on May 29. The reservoir filled on March 31 and remained full until July 27 when irrigation releases began and reservoir storage and elevation started falling. Nambé Falls Reservoir ended 2008 at elevation 6,822.75' (1,707 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 ft^3 is stored until an elevation of 6,825.60 ft is reached. Once an elevation of 6,825.60 ft is attained, the outlet gates are regulated weekly to stabilize the reservoir at 6,825.60 ft, or an elevation determined by 100 percent ice cover. An uncontrolled spill begins at elevation 6826.6 ft, 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 1,020 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 during December 2008. Table 5 provides a summary of Nambé Falls use above Otowi and the Pojoaque Unit return flow credit used to calculate depletions during 2008. A summary of 2008 Nambé Falls reservoir operations is provided in Table 6.

Table 5: SJ-C Project – San Juan-Chama Water at Otowi (units are acre-feet)

SJ-C AT OTOWI MONTH	RELEASE FROM HERON	HERON RELEASE STORED IN EL VADO	RELEASE FROM EL VADO	TOTAL BELOW EL VADO	RELEASE FROM OR STORAGE IN ABIQUIU	TRANS. LOSSES	NAMBE FALLS USE ABOVE OTOWI	RETURN FLOW CREDIT - POJOAQUE UNIT	SAN JUAN WATER AT OTOWI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
JANUARY	664	0	255	920	-683	12	194	23	53
FEBRUARY	0	0	5,581	5,581	-718	105	219	20	4,559
MARCH	0	0	17,740	17,740	600	360	138	19	17,860
APRIL	0	0	0	0	52	0	22	22	52
MAY	0	0	0	0	0	0	101	17	-84
JUNE	0	0	2,061	2,061	334	44	18	26	2,358
JULY	8,427	0	3,030	11,457	-5,057	184	-8	18	6,242
AUGUST	4,921	0	6,717	11,638	1,020	242	4	19	12,431
SEPTEMBER	13,025	1,346	0	11,680	-297	231	31	74	11,194
OCTOBER	15,741	5,323	0	10,417	-2,941	182	201	42	7,136
NOVEMBER	15,233	13,212	0	2,021	42	41	236	25	1,810
DECEMBER	30,715	15,205	0	15,510	-7,738	241	186	20	7,366
ANNUAL	88,726	35,086	35,384	89,024	-15,384	1,642	1,344	324	70,978

Table 6: SJ-C Project – Monthly Water Storage in Nambe Falls Reservoir (units are acre-feet)

NAMBÉ FALLS MONTHLY MONTH	INFLOW	OUTFLOW			RESERVOIR LOSSES	TOTAL OUTFLOW + LOSSES	END OF MONTH	
		BYPASSED	STORAGE RELEASE				CONTENT	ELEVATION
			OPERATIONAL	IRRIGATION				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DEC. 2007							1,417	6,816.95
JANUARY	225	30	0	0	0	30	1,612	6,820.93
FEBRUARY	251	32	0	0	0	33	1,831	6,825.04
MARCH	542	399	0	39	11	450	1,923	6,826.66
APRIL	843	820	0	0	21	841	1,925	6,826.69
MAY	1,364	1,256	0	84	19	1,358	1,931	6,826.79
JUNE	1,475	1,457	0	0	24	1,481	1,925	6,826.69
JULY	650	656	0	57	5	717	1,858	6,825.52
AUGUST	609	597	0	558	7	1,162	1,304	6,814.47
SEPTEMBER	556	519	0	205	7	731	1,129	6,810.34
OCTOBER	460	258	0	37	2	297	1,292	6,814.20
NOVEMBER	295	59	0	0	7	66	1,521	6,819.12
DECEMBER	281	95	0	0	0	96	1,707	6,822.75
ANNUAL	7,551	6,180	0	979	103	7,262	1,707	6,822.75

Nambé Falls Dam Facility Review and Safety of Dams Programs

During 2008, Nambé Falls Dam had the following activities implemented or completed:

- The New Mexico Office of the State Engineer has installed new data loggers and flumes within the Nambe Falls irrigation system. Live data should be available this irrigation season 2009.
- The trash-rack Operations and Maintenance recommendation has been scheduled for February 22, 2009. The work will be performed by the Unite States Army Dive Team, which is the first of its kind within Reclamation.
- Nambe Falls surveying monitoring is now on a 6 year interval.
- TSC is also looking into instrumentation monitoring concerning access, safety and funding.
- The foundation drains were videoed in March it was discovered there was a slight offset between the contact area (bedrock and concrete).
- The toe drains are scheduled for videoing mid summer 2009.
- The Flat-Jacks are scheduled for grouting early April 2009.

M&I Water Use - National Environmental Policy Act Compliance

Reclamation is involved in City and County of Santa Fe water supply projects. The City, County, and a private developer (Las Campanas) are working with the U.S. Forest Service and the Bureau of Land Management on an EIS to address effects of the proposed Buckman Direct Water Diversion Project. Reclamation is serving as a cooperating agency on the Buckman EIS. U.S. Fish and Wildlife Service issued a Biological Opinion on the Buckman project in June 2007. The Buckman FEIS and Record of Decision (ROD) are completed. The Notice of Availability for the ROD was published in February, 2008, and construction began in September of 2008. The anticipated completion date is in 2010.

Reclamation is assisting the Cities of Española and Chimayo, New Mexico, with drinking water projects that include the conveyance of San Juan-Chama Project water from a point of diversion on the Rio Grande and new municipal wells. A new Public Law (PL 108-354) was enacted that provides 25% federal funding for construction of a filtration facility for Espanola and 75% funding for Chimayo infrastucture. The Corps of Engineers, New Mexico Interstate Stream Commission, and the New Mexico Environment Department have additional funding from EPA and other federal sources for the Cities to construct their water projects. Chimayo has expended approximately one-half of their funding. Espanola has not yet determined the scope and design of their project. Additional NEPA compliance will be required for the Espanola project.

The Albuquerque – Bernalillo County Water Users Authority (ABCWUA) brought their direct surface diversion Drinking Water Project online at the end of 2008. They are diverting both San Juan Chama and native Rio Grande water (50/50) under permit by the NM Office of the State Engineer. NEPA for the project was completed in 2006.

Middle Rio Grande Project, New Mexico

The *Middle Rio Grande Project* (Figure 4) consists of El Vado Dam and Reservoir and irrigation and drainage facilities in the Middle Rio Grande valley. The project also includes river channel maintenance from Velarde, New Mexico, southward to Caballo Reservoir, and the Low Flow Conveyance Channel (LFCC) south of San Acacia, New Mexico. Irrigation water is provided to the Middle Rio Grande Conservancy District, which can supply water to approximately 50,000 to 70,000 acres of land.

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 af on January 1, 2008. On February 01, 2008, the State of New Mexico relinquished 125,000 af of its Compact credit waters, and Compact usable water in Project storage went above 400,000 af removing the Compact's Article VII restriction on upstream storage in post-1929 reservoirs. The State of Texas accepted New Mexico's relinquishment, and that relinquishment was then allocated to the Rio Grande Project water users for the 2008 irrigation season.

During 2008 no Emergency Drought Water was captured by Reclamation for the benefit of the Middle Rio Grande Conservancy District under the Emergency Drought Water Agreement (EDWA) nor was any of Reclamation's remaining Emergency Drought Water balance captured during the year. The balance of Emergency Drought Water available for capture and storage by Reclamation and MRGCD during 2008 or later years is 79,036 ac-ft. Reclamation's balance for use as supplemental water for endangered species is 30,451 ac-ft, and 48,585 ac-ft remains to be captured for the benefit of MRGCD. These amounts may increase as further relinquishment of credit water in Elephant Butte Reservoir by the State of New Mexico occurs.

Reclamation started 2008 with 0 ac-ft of Emergency Drought Water stored in El Vado Reservoir for use on behalf of listed endangered species. MRGCD started 2008 with 10,578 ac-ft of Emergency Drought Water in El Vado Storage, and ended the year with a total of 10,116 ac-ft in storage.

El Vado Dam and Reservoir Operations

El Vado reservoir began 2008 at an elevation of 6,887.54' (142,759 ac-ft). The reservoir peaked on July 17 at an elevation of 6900.44' (181,247 ac-ft) after coming off of the low of the year, 6865.58' (91,010 ac-ft) which occurred on April 20. Due to the reservoir starting off the year at such a high level and a snowpack that was well above average, a pre-release of water to create storage space was started in late February. The pre-release reduced the runoff peak that was released to just over 2,000 cfs. The reservoir finished the year at elevation 6893.42 (159,619 ac-ft).

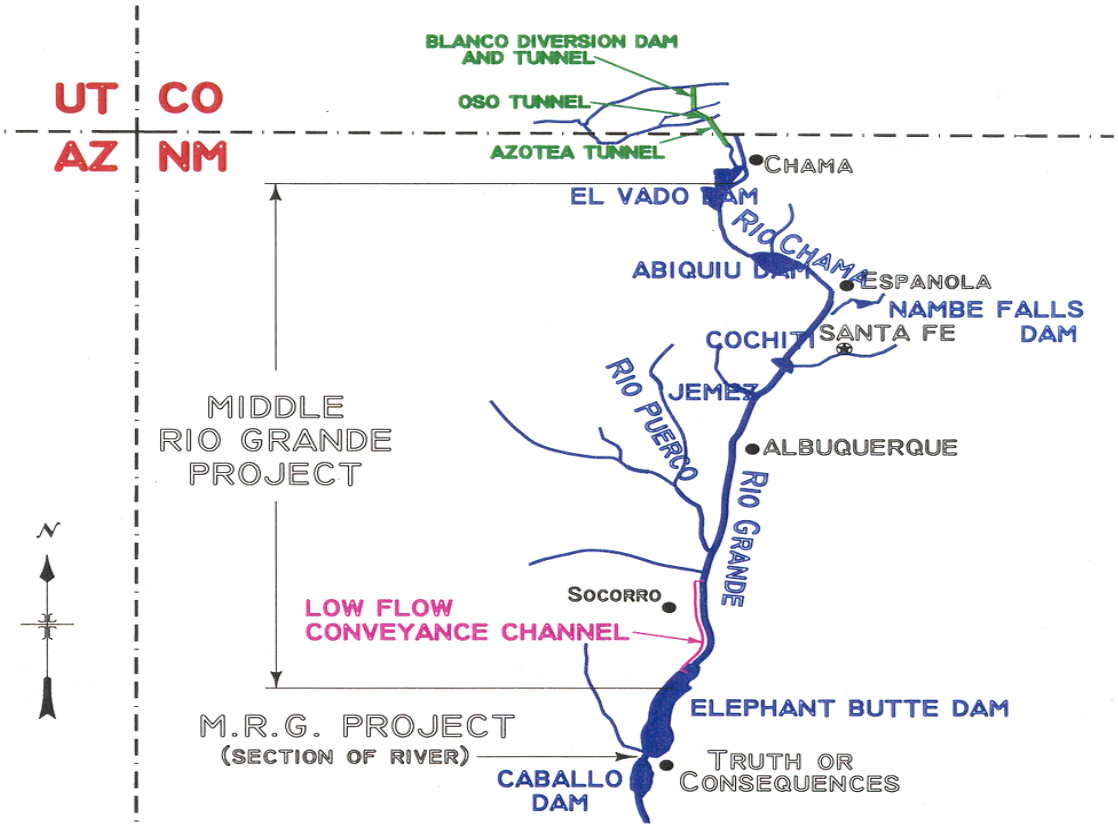

Figure 4: Area Map of the Middle Rio Grande Project

MRGCD began the year with 10,578 ac-ft of Emergency Drought Water, 88,805 ac-ft of general Rio Grande storage, and 40,680 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 2008 SJ-C allocation in Heron, and a beginning year balance of 1,099 ac-ft of SJ-C stored in Abiquiu Reservoir. At the end of the year, MRGCD had 10,116 ac-ft of Emergency Drought Water, 106,782 ac-ft of general El Vado Rio Grande storage, and 39,451 ac-ft of SJ-C storage in El Vado reservoir. MRGCD also had 1,532 ac-ft of SJ-C stored in Abiquiu as of December 31, 2008.

Reclamation stored a total of 16,500 ac-ft for the Prior and Paramount needs of the six Middle Rio Grande Pueblos during 2008. All Prior and Paramount storage was captured outside of Article VII storage restrictions. Water that was earmarked for P&P use was returned to the Rio Grande pool in November

The total SJ-C water in El Vado storage at the end of the year was 42,721 ac-ft. Table 7 provides a summary of 2008 monthly operations and water accounting for El Vado Reservoir.

Table 7: Reservoir Operation for El Vado Dam (units are acre-feet)

EL VADO RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT		
MONTH	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DEC. 2007	5,062	27,732	8,176	3,342	69	-49	99,383	43,376	142,759
JANUARY	5,891	664	5,741	920	36	-29	99,498	43,150	142,648
FEBRUARY	6,217	0	6,465	5,581	0	0	99,250	37,569	136,819
MARCH	29,625	0	43,956	17,740	25	6	84,894	19,824	104,717
APRIL	71,464	0	75,037	0	471	118	80,850	19,705	100,555
MAY	151,771	0	72,399	0	786	113	159,435	19,593	179,028
JUNE	59,750	0	57,542	2,061	1,160	93	160,483	17,439	177,921
JULY	14,529	8,427	10,593	11,457	585	38	163,834	14,371	178,205
AUGUST	3,920	4,921	22,664	11,638	712	50	144,377	7,604	151,981
SEPTEMBER	1,512	13,025	20,520	11,680	547	26	124,823	8,924	133,747
OCTOBER	1,934	15,741	8,983	10,417	340	25	117,433	14,222	131,655
NOVEMBER	3,166	15,233	2,405	2,021	186	21	118,008	27,414	145,422
DECEMBER	2,003	30,715	3,125	15,510	-10	-103	116,897	42,722	159,619
ANNUAL	351,782	88,726	329,429	89,024	4,839	357			

El Vado Dam Facility Review and Safety of Dams Programs

The following work was completed for El Vado Dam during 2008:

- Facility Reliability Rating.
- Annual Emergency Action Plan Review, Drill, and Communication Directory Update.
- Completed the 2008 Periodic Security Review (PSR).
- Completed a Standing Operating Procedures (SOP) revision in 2008.
- A spillway test was completed in 2008; a maximum of 2,500 ft^3/s was released for about ten minutes. Instrumentation was installed to monitor structural vibration response during the testing. The results of the testing indicate that it is not reasonable to rely on the spillway, in its existing condition. A Dam Safety Advisory Team (DSAT) meeting is scheduled for February 2009, to evaluate repair or replacement recommendations.
- The 2,500 cfs spillway restriction remains in place, and velocities above 20 ft/s with depths for more than two days are .
- The wet spot that was identified a few years ago continues to be monitored on a monthly basis, with no apparent changes.
- General Maintenance was done and completed some O&M recommendations.
- The area capacity tables were completed and delivered in 2008.
- The Cathodic Protective System is currently still functioning, but has a life span of 20 years and began operation more than 20 years ago. Additional funding will be needed to replace the whole system with deeper anode beds. Monthly rectifier readings are sent to Reclamation's Denver Technical Service Center (TSC) for analysis.
- Denver TSC is working on preparing specifications for repairing the exposed rebar on the stilling basin. Core samples were taken in December 2008.

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 SJ-C water in Abiquiu Reservoir. Adjustments for sediment reduced the sum of the available storage allocations to 181,833 ac-ft at the start of 2008, which is calculated as the total capacity at the top of the SJ-C storage pool (elevation 6,220.00') less the total accumulated sediment in the reservoir at the end of 2007. The volume of SJ-C water in storage in Abiquiu Reservoir peaked on March 9, 2008, at 182,656 ac-ft. Abiquiu ended 2008 with 181,888 ac-ft of SJ-C water in storage. Table 8 provides a summary of monthly operations and water accounting for Abiquiu Reservoir.

During 2008 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, **33,441** ac-ft of leased SJ-C water was released via this agreement by Reclamation for silvery minnow purposes.

Table 8: Reservoir Operations for Abiquiu Dam (units are acre-feet)

ABIQUIU RESERVOIR OPERATION	INFLOW		OUTFLOW		LOSSES		EOM CONTENT			
MONTH	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	RIO GRANDE	SAN JUAN - CHAMA	SEDIMENT	RIO GRANDE	SAN JUAN - CHAMA	TOTAL
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DEC. 2007	10,029	3,089	9,708	2,707	-5	-172	2,048	321	180,346	182,715
JANUARY	7,088	1,071	7,326	388	1	123	2,049	83	180,906	183,037
FEBRUARY	14,655	4,489	13,259	3,771	0	26	2,060	1,478	181,597	185,135
MARCH	58,348	18,629	56,711	19,230	18	902	2,169	3,115	180,094	185,378
APRIL	96,697	0	99,855	52	55	1,810	2,331	-43	178,232	180,520
MAY	84,512	0	72,746	0	50	1,832	2,463	11,722	176,400	190,586
JUNE	68,547	2,038	80,274	2,372	241	2,530	2,562	-5	173,537	176,093
JULY	13,897	10,932	13,540	5,875	8	1,518	2,573	352	177,075	180,000
AUGUST	25,769	10,881	25,781	11,901	2	1,915	2,597	340	174,140	177,076
SEPTEMBER	25,999	12,198	26,006	11,901	4	1,495	2,624	333	172,942	175,899
OCTOBER	10,992	10,685	10,914	7,744	0	1,102	2,634	411	174,780	177,825
NOVEMBER	1,746	1,920	2,154	1,962	0	493	2,634	2	174,245	176,881
DECEMBER	4,775	14,959	4,675	7,221	0	196	2,640	102	181,786	184,529
ANNUAL	413,400	87,801	413,243	72,418	376	13,943				

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 to provide funding for water salvage work on the Middle Rio Grande Project. Work funded under this Agreement included Elephant Butte Temporary Channel maintenance, other river maintenance projects with water salvage potential, and irrigation drain improvements.

The new Agreement provided funding in the amount of $1,140,900 and a balance of $33,340 was also carried over from the previous 2004 Agreement. Additional funds in the amount of $1,240,000 have been added by modification to the Agreement for a new total of $2,380,900. A modification was executed at the end of fiscal year 2008 for carryover of funds to fiscal year 2009. As of December 31, 2008, the balance of unspent funds was $1,563,000.

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 occurrence of 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 7 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, a length of 11 miles, 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 3 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.

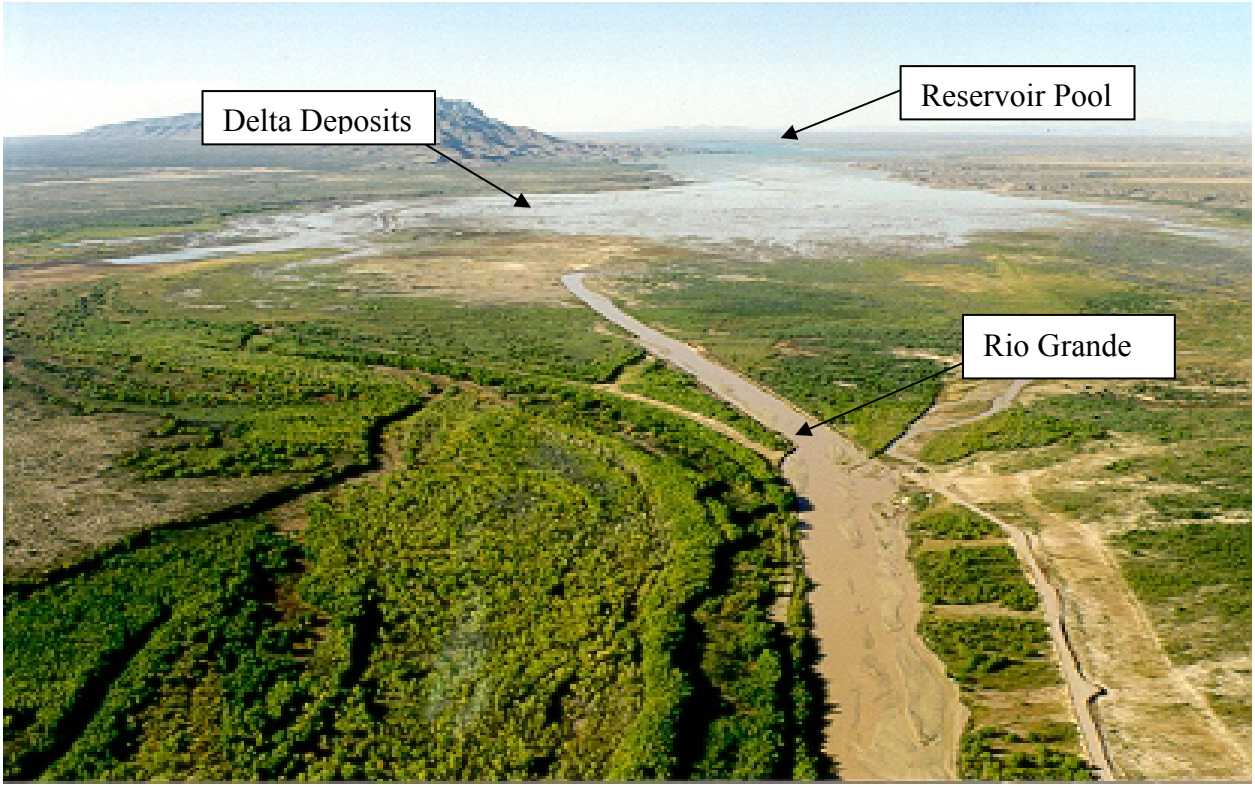

Photo 3. Headwaters of Elephant Butte Reservoir, prior to construction of the Temporary Channel (1998).

Elephant Butte Temporary Channel—2008 Maintenance

The majority of work performed in 2008 was on the Temporary Channel 2002 reach, as a sediment plug formed just downstream of the Red Rock Staging Area during the 2008 spring runoff. The plug was discovered in early July during an airboat review of the Temporary Channel. Photo 2 shows the plug area from the air, and Photo 3 from the ground. The plug was approximately 1 mile in length, and the Temporary Channel berms were breached in numerous places on the east and west side of the channel. Reclamation began excavation of a pilot channel through the plug mid-August and completed the pilot channel mid-September. Photo 4 shows an amphibious excavator working on the pilot channel. Reclamation crews also repaired the most critical damage to berms at that time but then returned to the area in November to repair areas that breached again after the initial repair. An NMISC contractor took over the berm repairs in December, and that work is still in progress.

Reclamation crews also performed access road repairs and mowing of vegetation along the shoulders. Equipment maintenance and repairs, by the Socorro Field Division maintenance shop, also continued in 2008. The most significant repairs involved replacement of the wear plates and guides that secure the excavator tracks to the pontoons, completed in 2008.

Photo 4. Temporary Channel sediment plug, looking downstream. Red Rock Staging Area is in the foreground (July 2008, Gonzales).

Photo 5. Temporary Channel sediment plug, looking upstream (July 2008, Rolland).

Photo 6. Amphibious excavator working on pilot channel through Temporary Channel sediment plug (September 2008, Weems).

Irrigation Drain Improvements

The following work was accomplished in 2008 under the Cooperative Agreement:

- Escondida Drain: In 2008 data collection, designs, and preparation of environmental compliance documents were completed for the Phase II work, which provides for vegetation control, and for reestablishing the outfall to the Rio Grande. Phase II work began in early January 2009, with mowing of the road shoulders and drain prism (Photo 5), and is scheduled for completion by September 2009. These drain improvements are funded on a cost share basis by NMISC and Reclamation.

- Elmendorf Drain. Reclamation completed designs and began preparation of environmental compliance documents for replacement of a collapsed culvert at an arroyo crossing of the drain, within the Bosque del Apache National Wildlife Refuge. Photo 6 shows the culvert shortly after the collapse began. The culvert continued to collapse and was eventually removed. The new culvert will be a 7-foot diameter reinforced concrete pipe (RCP), 200 lineal feet in length, and work is scheduled to begin in June 2009. The work will be accomplished cooperatively by NMISC, Reclamation, MRGESACP, and Bosque del Apache.

Photo 7. Recently mowed Escondida Drain, looking south (January 2009, Everetts).

Photo 8. Collapsed culvert on Elmendorf Drain, looking east (July 2008, Gonzales).

Other Projects—Cooperative Agreement Funding

Agreement funding was also used for the projects listed below. More detail for each project is provided in the River Maintenance section below.

- Tiffany Levee Improvements: Approximately 2 miles of levee was raised and widened in April 2008, in preparation for the 2008 spring runoff.
- Bosque del Apache Sediment Plug Pilot Channel: Excavation of a pilot channel through a sediment plug that formed in the main channel of the river during the 2008 spring runoff.

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 24 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, and destruction of canals and drains. Reclamation's efforts on addressing river maintenance work 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. A 2008 Post-Runoff Field Review of the Project reach conducted by Reclamation indentified two additional priority sites located on Santa Ana Pueblo and in the northern portion of the Bosque Del Apache National Wildlife Refuge (sediment plug). Work to address the backlog of river maintenance priority sites along the project reach has involved completion of a total of 11 sites since 2004. There are 6 active priority sites that require continual annual maintenance due to sediment accumulation.

San Ildefonso Pond

The primary concern at the San Ildefonso Pond priority site is that the east bank of the Rio Grande is very close to the berm surrounding the pond; the distance between the edge of the river channel and the toe of the berm is as little as 50 feet in some areas. Furthermore, the bend upstream of the pond has been observed to be eroding very actively during the spring runoff's of 2005, 2007, and 2008. Reclamation completed the construction of rock vanes to provide protection to the pond in 2007. In January of 2008 150 native cottonwood and black willow poles were delivered by Reclamation to the Pueblo of San Ildefonso. Under an agreement with Reclamation, the Pueblo planted these poles in the area disturbed by the construction project. A site visit in July 2008 found the majority of the planted poles doing well (Photo 7). While there is still a block of dense vegetation that provides substantial protection against flanking of the buried rock vanes, an optional plan is being developed to provide the necessary protection in the event the bend destabilizes the vegetation. This design plan would only be implemented if ongoing monitoring of the site reveals that the bend has moved to such a degree that additional flanking protection is necessary. Work on this design plan is in progress.

Photo 9. Poles planted around the buried rock vanes at San Ildefonso, viewed looking upstream. The active bend is upstream of the group of mature trees (July 2008, AuBuchon)

Cochiti Priority Sites

There are two priority sites on the Pueblo of Cochiti: one (at RM 231.3) is on the west side of the Rio Grande about 1 mile downstream of Cochiti Dam, and the other (at RM 228.9) is on the east side, about 3 miles downstream of the dam. At RM 231.3 (Photo 8), the west bank of the channel has migrated beyond the jetty jack line and is very close to a road and some agricultural fields. At RM 228.9 (Photo 9), the main channel is on the west side of a large island, and the secondary channel is on the east side. The secondary channel carries water year-round. The concern at this site is that the secondary channel was slowly, but steadily, migrating eastward toward the levee and riverside drain. Construction at both sites was completed during the summer of 2008. While poles were planted as part of the bioengineered bankline, additional planting is still required in the areas disturbed by construction activities. Sites reviews during and after the spring runoff, revealed that native vegetation was already returning to the site, so revegetation efforts at this site were postponed. Native species vegetation recruitment will be monitored during the 2009 growing season. In coordination with the Pueblo of Cochiti plans to restore native species vegetation will be prepared as necessary during the 2009 growing season.

Photo 10. Bankline protection on the Pueblo of Cochiti at RM 231.3 (July 2008, Baird)

Photo 11. Bankline protection on the Pueblo of Cochiti at RM 228.9 (July 2008, AuBuchon)

Santo Domingo

There are currently three priority sites on the reach of the Rio Grande passing through the Pueblo of Santo Domingo (RM 225.1, RM 224.6, and RM 223.9). At these sites, bankline erosion on the west side of the river is cause for concern because of the close proximity to the levee and riverside drain. Priority Site No. 2 (RM 224.6), which is across from the confluence of the Rio Galisteo, is shown in Photo 10. 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. Design data collection was completed in December 2007, and a geomorphic analysis was completed in May 2008. An evaluation of design alternatives for each of the sites was completed in December 2008 and selection of a preferred alternative for each of the sites is anticipated early in 2009.

Photo 12. Santo Domingo Priority Site No. 2 (RM 224.6), looking west (June 2008, Gonzales).

San Felipe

There are currently nine 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. Hydrographic data was collected in spring 2007. A geomorphic analysis was completed in June 2008, and four sites were selected for initial consideration. Designs for these sites should be completed by March 2009, and construction is expected to begin in late 2009 or early 2010. Photo 11 shows the site at RM 213.4R.

Photo 13. Upstream view of eroding terrace at Priority Site 213.4R, San Felipe. Note the location of the levee about 60 feet west of the bank edge. (February 2008, Mussetter Engineering, Inc.)

Santa Ana

A large scale river maintenance project at Santa Ana Pueblo is nearly complete. The major features, river realignment and construction of a gradient restoration facility, are complete. The primary activity during 2005 was redistributing piles of excess sediment to facilitate their removal during the high spring flows; approximately 60,000 cubic yards of sediment was removed. In spring 2007, a line of riprap was installed at the upstream end of the gradient restoration facility, and a reinforced bankline at the Jemez River confluence was extended to protect against erosion. A willow trench was constructed by the Pueblo of Santa Ana in January 2008 according to a Reclamation design that would allow natural vegetation to provide ongoing protection of the east bank once the sediment spoil piles have been removed (Photo 12). Reclamation has developed designs to redistribute the remaining sediment spoil piles to best accomplish the project's goals. The sediment redistribution plan has permit approval, but due to the project construction load and water level restrictions the project is expected to be constructed in the summer of 2009. The overall project design requires average or higher spring runoff flows to develop features to their final configurations. Therefore, the duration of ongoing activities is dependent on hydrologic conditions.

Photo 14. Willow trench constructed by the Pueblo of Santa Ana in January 2008 (October 2008, AuBuchon)

Tamaya

An additional priority site was added on the Pueblo of Santa Ana on the east bank of the Rio Grande, across from the Tamaya Resort special events tent, following the 2008 spring runoff (Photos 13 and 14). For many years, the bankline had been stable and had followed the jetty jack line. Prior to the 2008 runoff, the bankline had migrated beyond the jetty jack line; further erosion occurred during the 2008 runoff. The Pueblo of Santa Ana has repeatedly stated concern about conditions at the site. The Corps of Engineers is planning an island and bar lowering project in the area and project design work will be integrated with the Corps' plans. Due to the close proximity of the spoil levee and the amount of bankline erosion observed during 2008 this site was elevated to the status of a priority site. Reclamation is currently working with the Pueblo to of Santa Ana to develop a preferred protection strategy.

Photo 15. Aerial view looking upstream toward the bend erosion at the Santa Ana Tamaya site (June 2008, Padilla)

Photo 16. Looking downstream at the bend erosion at the Santa Ana Tamaya site (July 2008, AuBuchon)

Sandia

At the Sandia priority site, there was a 3,300-foot-long section of the river where the eastern bankline was only about 50 to 70 feet from the toe of the levee. Earthwork at this site began in December 2006. The project consisted of realigning the channel further away from the east levee, increasing sinuosity to improve habitat, and installing bendway weirs to make the east bankline more resistant to erosion. Construction was completed in March 2008. To increase erosion resistance and also improve habitat, native trees and shrubs were planted in late 2008. Work at this site is complete, except for reseeding disturbed areas.

Corrales Siphon

The Corrales Siphon river maintenance site is located about 600 feet downstream of the Arroyo de la Barranca confluence (which is also the site of the Rio Rancho wastewater treatment outfall). At this site, an inverted siphon operated by MRGCD conveys irrigation water to the Corrales Main Canal by passing under the Rio Grande channel. During the high flows of the 2005 spring runoff, the bank experienced erosion primarily associated with undercutting. In late 2006, a preferred alternative for the project, consisting of installation of a bio-engineered bankline with a rock toe and coir fabric encapsulated soil, was selected. Preliminary designs were completed in 2007.

However, in early 2008, Reclamation became aware that the inverted siphon consists mostly of a wood pipeline that was constructed in the 1930s. Because of concerns about the stability of the wood pipeline when subjected to the loading and vibration of construction equipment, vibration testing and video examination of the pipe were performed. While the video was inconclusive, the vibration testing indicated that equipment should stay approximately 50 feet from the pipe to avoid damaging it. In addition, conditions at the site have changed, as deposited sediment now directs most flows away from the previously undercut bank.

Reclamation is currently considering design modifications intended to reduce the likelihood that the pipeline could be damaged, and also to reflect the reduced risk due to changed site conditions. This has delayed the planned construction date.

Drain Unit 7 Extension

This priority site is located approximately 500 feet upstream of San Acacia Diversion Dam, on the west bank of the Rio Grande (Photo 15). The river is actively eroding the embankment of a spoil levee that protects the Drain Unit 7 Extension irrigation structure. Pre-emergency maintenance work was performed in May, 2005 to stabilize the eroding bankline. Riprap was placed along 200 feet of bankline at that time, but some of the riprap was displaced during the high flows of the 2006 monsoon season, and additional riprap was added prior to the 2007 spring runoff. A complete analysis of potential alternatives was completed in 2008, and placement of large gradation riprap for protection of the levee was determined to be the most appropriate solution for this site. Designs were completed in 2008 and construction is scheduled to begin in January 2009.

Photo 17. Drain Unit 7 Extension priority site, looking downstream toward San Acacia Diversion Dam (November 2008, Gonzales).

San Acacia River Miles 114 and 113

Reclamation completed earthwork at the River Mile 114 and 113 priority sites, approximately 2 miles downstream of San Acacia Diversion Dam. Channel incision, lateral channel migration, and bank erosion previously threatened the integrity of the levee system in this area. This project involved moving the levee and LFCC approximately 1,500 feet to the west, away from the river (Photo 16).

Major items of work included clearing and grubbing vegetation, excavating a new LFCC channel (approximately 10,800 feet), constructing a spoil levee adjacent to new LFCC channel, constructing a sheetpile grade control structure and a pipe crossing at San Lorenzo Arroyo, filing the existing LFCC channel, creating new potential floodplain between the new levee position and the channel, and planting cottonwood poles and other native species within the project area. The project is currently being monitored to document the amount of reseeding and weed control that is needed.

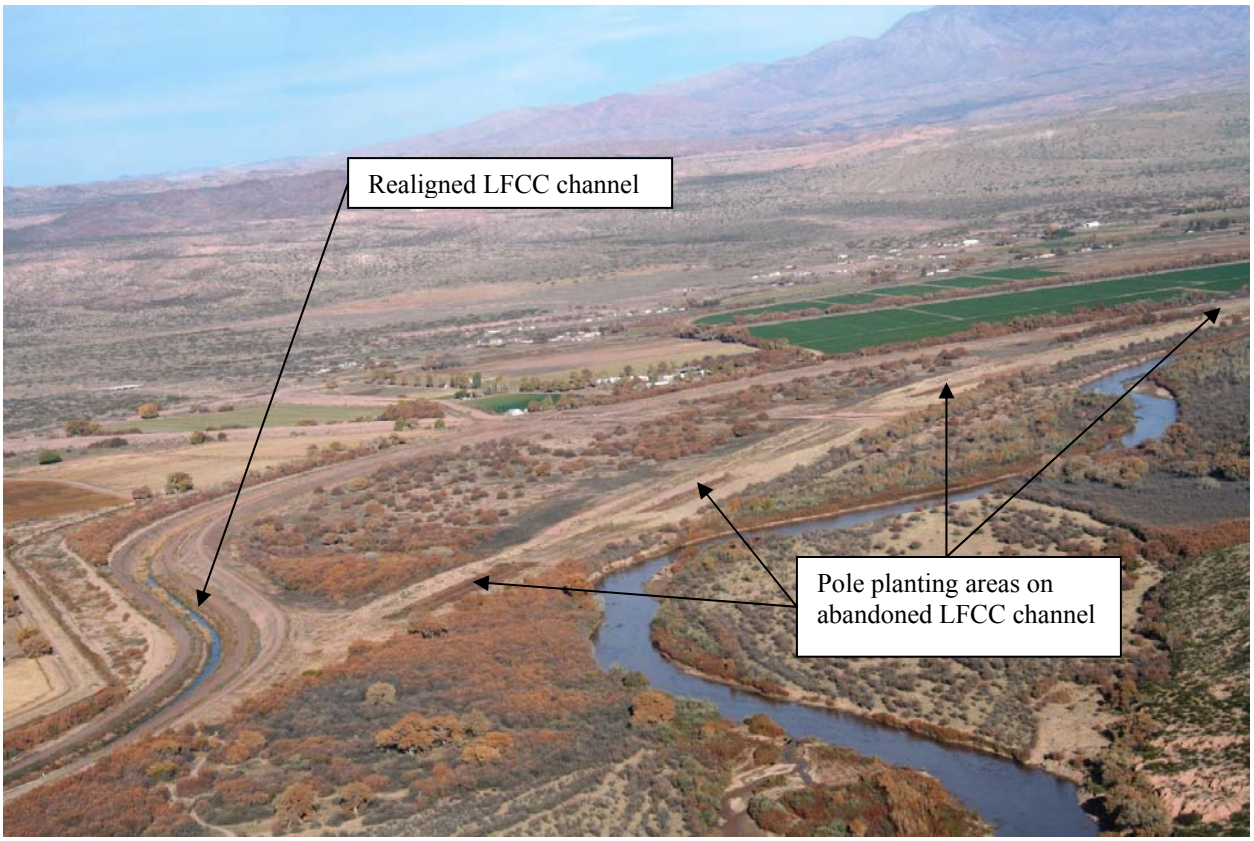

Photo 18. Looking upstream at the completed RM 114/113 construction (November 2008, Gonzales)

San Acacia River Mile 111

The San Acacia River Mile 111 priority site is located on the west side of the Rio Grande, approximately 5.5 miles downstream of the San Acacia Diversion Dam (Photo 17). The concern at this site is river channel migration and the fast rate of the bank erosion towards the levee which protects the Low Flow Conveyance Channel (LFCC). The construction of a levee setback project, similar in scope to the work performed at RM 114/113, was delayed for several years to allow a research project in the area to be completed. A self launching riprap windrow was placed in 2006 to provide temporary protection while awaiting the completion of the research project. Construction on the long term project began in April 2008. Construction is expected to be completed by the summer of 2009.

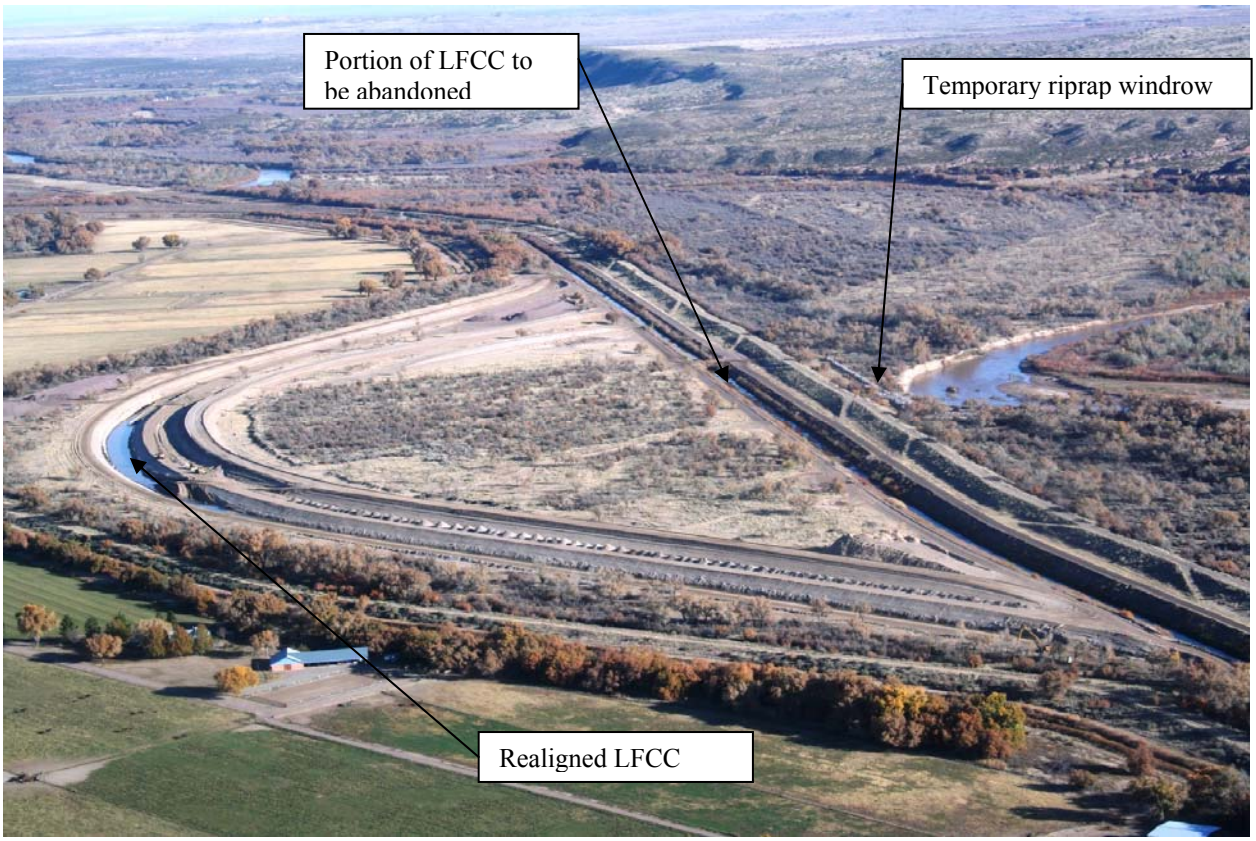

Photo 19. Looking upstream at the RM 111 construction (November 2008, Gonzales)

Arroyo de las Cañas

This site is located on the west bank of the Rio Grande, near the confluence of an unnamed arroyo upstream of Arroyo de las Cañas. When the site was identified in 2005, the bankline was less than 100 feet from the levee toe, and the thalweg was along the outside of the bend nearest the levee. While the bankline was eroded during the 2005 runoff, subsequent years have seen deposition near the bankline.

The active channel shifted eastward, so that the bankline is more than 200 feet away from the levee everywhere except at a short section near the bend in the levee at the downstream end of the site. These changes are most evident in the aerial photography taken in the fall of 2007 (Photo 18). Preliminary observations indicate that the main channel shifted significantly between fall 2007 and the 2008 runoff.

The recent changes in planform greatly reduce the probability of damage to the levee at the Arroyo de las Cañas site. In October 2008, the project team decided to downgrade the site from a priority site to a monitored site and to suspend the environmental compliance process. No construction activities at the site will occur unless conditions change in the future. Preventative work involving bioengineering treatment may be implemented at a future time as well.

Photo 20. Aerial photographs showing recent changes in river channel at the Arroyo de las Cañas site.

Bosque del Apache Sediment Plug (2008)

During the 2008 spring runoff a sediment plug formed in the main channel of the Rio Grande at River Mile 81, within the Bosque del Apache National Wildlife Refuge (BDANWR), forcing flows in the river to the floodplains. The plug was first identified during a river flight on May 17, and growth of the plug continued during the remainder of the runoff, to a length of approximately 1.5 miles (Photo 19).

The plugged river channel caused a rise in water surface against the levee, and a portion of the levee was raised and widened during the runoff to alleviate concerns of levee failure due to overtopping and/or excessive seepage. After the runoff, Reclamation obtained environmental clearances for excavation of a pilot channel through the sediment plug, and NMISC funded the construction work. The pilot channel excavation began the end of September and was completed on October 21 (Photo 20). Reclamation has been closely monitoring the river since that time, including collection of several sets of survey data and aerial photography. So far the pilot channel is remaining open and the majority of river flows are confined to the main channel. However, due to sediment deposition in the channel over this general reach of the river, concerns remain regarding formation of future sediment plugs and Reclamation will continue to monitor the area closely, particularly as the spring runoff begins. Photo 21 shows how much the river has widened following the pilot channel excavation, leaving only two small sections of spoil berm.

Photo 21. Bosque del Apache sediment plug, facing downstream (July 2008, Gonzales).

Photo 22. Bosque del Apache pilot channel excavation, looking downstream (October 2008, Rolland).

Reclamation has also began data collection for a thorough analysis of a reach of river extending from the San Antonio Bridge to the South Boundary of the BDANWR, to determine the risk for future sediment plug formation and, if applicable, to evaluate alternatives for a long-term solution.

Photo 23. Recent photo of Bosque del Apache sediment plug area showing widening of the river since completion of pilot channel excavation. Taken from just south of the downstream end of the 2008 plug, looking upstream. (January 2009, Rolland)

Tiffany Sediment Plug

During the 2005 spring runoff, a sediment plug formed in the Tiffany area and completely blocked the main channel of the Rio Grande. The plug first formed about 1.5 miles upstream of the San Marcial railroad bridge, in the vicinity of River Mile 70, and eventually extended about 3 miles upstream. The plug caused the entire active river channel to completely fill with sediment and resulted in an alarming rise in water surface against the Tiffany Levee. In a joint effort between NMISC and Reclamation, the plug was removed in 2005. However, concerns remain that another spring runoff with sustained overbanking flows, similar to the 2005 spring runoff, could result in formation of another plug, and Reclamation is actively monitoring this reach of the river and investigating potential river maintenance work which could reduce the frequency of sediment plugs.

In February 2008 NMISC and Reclamation partnered to contract modeling work with Dr Craig Boroughs to examine the risk for formation of a sediment plug during the 2008 runoff. Results of the modeling indicated that a sediment plug would form during the spring runoff, based on the March and April forecasts and URGWOM hydrographs. These modeling results caused concerns that a portion of the levee could fail during the runoff and resulted in another NMISC/Reclamation cost-share project to provide for improvements to the Tiffany Levee prior to the runoff . In April a total

of 10,000 cubic yards of material was hauled and placed on approximately 2 miles of the levee to raise and widen critical areas.

A sediment plug did not form during the 2008 spring runoff, and subsequent surveys of the area indicate that recent channel degradation has made this reach of the river less susceptible to sediment plugs. Reclamation still plans to implement a project for channel work to reduce the probability of future plugs in this area, but it has become a lower priority due to the recent degradation. Nonetheless, Reclamation will analyze potential for sediment plug formation prior to the 2009 runoff, utilizing the Boroughs model and URGWOM predicted hydrographs, and will monitor the area closely for initiation of a plug during the runoff. Environmental permits are in place which will allow for the excavation of a pilot in the event that a sediment plug does form.

Bosque del Apache, Tiffany, and San Marcial Levees

These three levee segments are located along the western edge of the Rio Grande floodplain, from San Antonio (RM 87) to the Ft. Craig area (RM 60). They are non-engineered spoil levees, created during excavation of Low Flow Conveyance Channel (LFCC), and serve to protect that structure. Previous capacity analysis reviews for these levees have been limited to an area starting approximately 5 miles upstream of the South Boundary BDANWR (RM 79) and extending downstream to RM 60. However, in 2008 it was discovered that there has been a significant amount of deposition in the reach between San Antonio and RM 79 in recent years, in both the river channel and floodplain. Accordingly, Reclamation is currently in the process of collecting data to allow a capacity analysis for this reach of levee, and may perform levee improvements prior to the 2009 runoff at critical locations, if the analysis indicates such a need. Emergency work was performed during the 2008 runoff on a portion of this levee adjacent to the sediment plug that formed during the runoff, and that work is covered above (Bosque del Apache Sediment Plug).

The conveyance capacity for the Tiffany and San Marcial Levees has increased in the last few years, due to degradation in that reach, and those levees currently have the target conveyance capacity, provided that a sediment plug does not form in the river channel. Work performed on the Tiffany Levee prior to the 2008 runoff is covered above (Tiffany Sediment Plug). The target conveyance capacities for the levees are: 10,000 cfs with a 3-foot freeboard allowance for the Bosque del Apache levee, and 8,500 cfs with a 2-foot freeboard allowance for the Tiffany and San Marcial levees.

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 approximately 0.25 miles upstream of the Fort Craig Pump Site, where water is pumped from the LFCC to the river during the dry summer months. The active bankline is currently less than 100 feet from the San Marcial Levee (Photo 22), 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, and was monitored very closely. There is considerable potential for more bankline erosion during the 2009 runoff, and the site will be monitored closely. Hydrographic data was collected for the site in 2007, and the alternative analysis process will begin in 2009.

Photo 24. Fort Craig Bend priority site, looking west (January 2009, Rolland).

River Mile 60

This site is located at River Mile 60, on the west bank of the Rio Grande, approximately 8.5 miles downstream from the San Marcial Railroad Bridge. The river makes a sharp bend to the west just upstream of the site, and then is forced to make another very abrupt bend to the south when it encounters a maintenance road embankment (Photo 23). The river then flows parallel to this road for a length of approximately 1,500 feet, with the right bank of the channel and left slope of the road embankment being one and the same. The road provides access to 5.5 miles of river downstream of the site, including the upper 3.5 miles of the Elephant Butte Temporary Channel.

The site has been an area of concern, but fairly stable, for many years but erosion has become more aggressive in the last few years due to river channel degradation through this reach. The upstream end of the site has been monitored closely in recent years because of a deep scour hole caused by the abrupt bend, and the possibility for undercutting of the riprap that protects the road embankment. However during the 2008 runoff the downstream end of the bend became an area of even greater concern, as the river is now eroding bankline in that area that is not protected with riprap. That erosion advanced to within 5 feet of the road embankment toward the end of the 2008 runoff, and the road was closed as a safety precaution for rest of the runoff. There is a high probability that at least a portion of the road will be destroyed during the 2009 runoff. The site will be monitored closely and the road will likely be closed again. Hydrographic data for this site was updated in 2007 and the alternative analysis process is currently in progress.

Photo 25. River Mile 60 priority site, looking southwest (January 2009, Rolland)

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 at arroyo mouths and various reaches of the river channel occurred during fall 2008. The total volume of sediment removed in 2008 was approximately 34,000 cubic yards.

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. The first Part 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. The Part 2 report addresses future maintenance strategies, conditions, and needs and is scheduled for completion in April 2009. The combined two phases of this maintenance plan are 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 2009 Spring Runoff

As of March, 2009, it appears that the spring runoff of 2009 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, due to the potential for sediment plug formation in that reach of the river. 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 become 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

Public Law 110-161, the Consolidated Appropriations Act of 2008, established the Executive Committee of the Collaborative Program consistent with the bylaws of the Collaborative Program which were adopted on October 2, 2006. Current priorities for the Collaborative Program include providing spawning and recruitment flows for the silvery minnow; propagation of captive silvery minnow for survival, augmentation, and reintroduction; habitat restoration; and funding sound scientific research to expand understanding of the species and its habitat. The Program is working with the Congressional delegation to pursue authorizing legislation in 2009.

The Middle Rio Grande Endangered Species Collaborative Program (Program) brings diverse groups together, as an alternative to litigation, to address serious environmental issues along the Middle Rio Grande. The Program is comprised of Federal, State, local, and tribal governments, nonprofit institutions, and other nongovernmental entities working collaboratively to protect and improve the status of endangered listed species along the Middle Rio Grande and to simultaneously protect existing and future regional water uses while complying with state and federal laws, including Rio Grande Compact delivery obligations. The Program implements activities required by the March 2003 Biological Opinion (BiOp), as amended, and additional activities that contribute to recovery of the Rio Grande silvery minnow (silvery minnow) and the Southwestern willow flycatcher (flycatcher).

During FY2008 on behalf of the Collaborative Program, Reclamation awarded $16,010,000 to acquire and manage water, to plan, construct and monitor habitat restoration projects, to monitor the status of the minnow and the flycatcher, to conduct biological and hydrological studies, and to rescue silvery minnow during river drying. All of these activities meet BiOp requirements or address long-term recovery needs.

I. Habitat Restoration Projects:

Program-funded habitat restoration projects restore and enhance habitat in the Middle Rio Grande by increasing backwaters, oxbows, and overbank flooding to enhance native vegetation and regenerate stands of cottonwoods and willows for the flycatcher; producing shallow, low velocity habitats over a wide range of instream flows to increase habitat available for the silvery minnow; and providing for fish passage upstream of diversion dams. The following briefly describes habitat restoration work accomplished during FY 2008.

Albuquerque and Isleta Reach Riverine Restoration Projects

ISC embarked upon Phase II of habitat restoration work in the Albuquerque Reach during the spring of 2007, which totaled about 87 acres in four different areas. Restoration techniques included vegetated island modification, bar habitat modification, placement of large woody debris, bank scouring, bank lowering, and the establishment of ephemeral channels. In 2008, monitoring was performed at these sites and island modification techniques were evaluated to determine whether project goals were achieved. Environmental compliance was initiated for the first phase of work to be performed in the Isleta Reach. Similar techniques that were utilized in the Albuquerque Reach will be undertaken in early 2009.

Santo Domingo Pueblo Habitat Restoration Project

Construction of Phase II of the Santo Domingo Pueblo habitat restoration project began in the fall of 2007 and was completed in early 2008. Phase II involved the creation of approximately 4.5 acres of embayments and side channels to increase silvery minnow habitat. Phase III environmental compliance was obtained in early 2008 and construction of projects at three sites similar to those completed in Phase II was initiated in the summer of 2008.

Pueblo of San Felipe Bosque Restoration Project

The Pueblo removed non-native vegetation from 10 acres of tribal land in the bosque on the east bank of the Rio Grande and replanted it with various riparian native species during 2008. The Pueblo community would also benefit from the restoration of these plants which are viewed as having cultural importance.

Upper Rio Grande Water Operations Model (URGWOM)

Funding has been provided to support collaborative URGWOM modeling efforts since FY 2006. In 2008 the model was enhanced to allow evaluation of various water management scenarios, with different target flows, to support the development of the new Biological Assessment for MRG water operations, river maintenance activities, and Corps of Engineers flood operations. The results of the model runs will be utilized to evaluate and further refine water management options for a new Biological Assessment.

Fish Passage at San Acacia Diversion Dam

This Reclamation project, a required activity per the 2003 BiOp, is presently in the planning stage. The environmental and biological assessments are being developed. Studies continue to gather information about silvery minnow longitudinal and seasonal movement. Public meetings will be held after the public draft Environmental Assessment is completed. Feasibility level designs (30% design) were prepared in 2008 for the preferred alternative, a baffled roughened channel fishway.

City of Albuquerque (City) Habitat Restoration Project

This project includes the clearing of non-native vegetation, planting of native vegetation, excavation of ephemeral side channels and embayments, jetty jack removal, and the development of a moist soil area. This project has sites that are both north and south of Rio Bravo bridge, on the east side of the river. The goal of the project is to provide refuge for aquatic organisms, including silvery minnow, and restoration of native riparian vegetation. Construction at the north site was undertaken during 2008 as well as monitoring of both project areas.

Rio Grande Silvery Minnow Sanctuary

Reclamation, the U.S. Fish and Wildlife Service (Service), MRGCD, and the City are cooperating in the development of an off-channel sanctuary for the silvery minnow at a site in Albuquerque. The sanctuary will serve as one of the two additional refugia required by the 2003 BiOp. Construction of the sanctuary has now been completed and the Service will be operating the facility. Initial test operations are scheduled to begin in early 2009. The MRGCD has obtained a permit from the New Mexico Office of the State Engineer for use of ground water required to operate the sanctuary.

Additional Habitat Restoration Projects Funded in 2008

In addition to those projects mentioned above, the Collaborative Program provided funding for:

- Santo Domingo Pueblo Habitat Restoration Project, Phase IV (Construction)
- Pueblo of Sandia Habitat Restoration Monitoring
- Ohkay Owingeh, Southwestern Willow Flycatcher Habitat Restoration Monitoring, Habitat Restoration Monitoring and Habitat Restoration Construction (Two Rivers and Three Falls)
- NMISC, Isleta Reach Habitat Restoration Improvements, Phase II
- Isleta Pueblo Habitat Restoration Planning
- Santa Clara Pueblo Habitat Restoration Planning

II. Other Ongoing Water Management and Water Quality Related Projects:

USGS Groundwater/Surface Water Interaction in the Middle Rio Grande Valley

The monitoring network presently consists of 162 groundwater piezometers on both sides of the Rio Grande, from I-25 to the Paseo del Norte bridge crossings, and 14 surface water staff gages. The majority of these components are equipped with data loggers which monitor water level and temperature at regular intervals. The project, which is currently in the fifth year of funding by the Program, has been successful in the collection of continuous data sets and the posting of data on the USGS website, http://nm.water.usgs.gov/bosque.html. A report is expected in 2009 which will summarize the data collection program, include calculations of river leakage based on water elevation measurements, and evaluate the effect that water temperature has on ground water viscosity and flow.

USGS MRG River Gage O & M

This project has been funded by the Program since FY 2002. 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. 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, and ensure the BiOp flow targets are being met. The data from these gages are available to the public at the web address:

http://waterdata.usgs.gov/nm/nwis/current/?type=flow.

Decision Support System (DSS) for the Middle Rio Grande Conservancy District (MRGCD)

This project is an on-going cooperative effort since FY 2003 to support the implementation of efficient rotational water delivery in the MRG irrigation system. The DSS will allow irrigation demands to be met with reduced diversions from the Rio Grande, which could extend the irrigation season in water-short years. The DSS is a network of interlinked models that compute demand information at the farm and lateral level and then use that information to recommend water delivery schedules. During 2008 the DSS was expanded to include the Albuquerque division in addition to the previously completed models for the Belen and Socorro divisions. MRGCD has reduced diversions by about 40%, using limited scheduling and infrastructure

modernizations. Future plans include expansion of the DSS to cover the Cochiti division, integration of the DSS with the existing MRGCD SCADA system, and additional public outreach and education.

New Mexico Environment Department Water Quality Monitoring

This study, in its third year of funding by the Program, performed by New Mexico Environment Department – Surface Water Quality Bureau (NMED), will provide a comprehensive water quality monitoring and assessment program in the MRG to assess potential water quality relationships that may affect silvery minnow population and recovery. The integration of water column and sediment chemistry, with fish tissue contaminant concentrations, will complement on-going work on fish/silvery minnow health monitoring by the Service.

Endangered Species

Middle Rio Grande - Endangered Species Act Compliance

The following summarizes Reclamation's compliance with the Endangered Species Act (ESA) in the Middle Rio Grande.

- Compliance with 2003 Biological Opinion (BiOp): Reclamation remains in compliance with the 2003 BiOp. A Freedom of Information Act request from the Defenders of Wildlife and WildEarth Guardians, seeking information on how Reclamation and the U.S. Army Corps of Engineers (Corps) are complying with the 2003BiOp, has been received by Reclamation. The middle Rio Grande in New Mexico remained wet during the 2008 irrigation season due to a good spring runoff and monsoon period. Habitat restoration and recruitment flows in 2007 contributed to higher silvery minnow densities in the Angostura Reach, and high runoff in 2008 allowed for extensive overbank flooding.

- Supplemental water program: The Rio Grande had continuous flow from the termination of the irrigation season on November 1, 2007, through the end of the 2008 irrigation season – no drying occurred. Reclamation ended the year with 20,687 acre-feet (ac-ft) of supplemental water in storage with the prospect of up to 15,000 ac-ft more in potential leases for 2009. In 2008, a BiOp "wet" year, 33,441 ac-ft of supplemental was released for endangered species purposes.

- Future Compliance: The MRG Endangered Species Collaborative Program (Program) has embraced the need for the federal action agencies to initiate a new Section 7 consultation in 2009-2010. The Program's Executive Committee is supporting hydrologic and biologic modeling efforts to answer key questions in order to prepare a new Biological Assessment (BA). Signatories are expected to make significant contributions and commitments towards the goal of obtaining a sustainable BiOp by March 2010.

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.

Reclamation conducted two periods of Rio Grande fish monitoring during 2008. The winter survey was carried out from February 21 through February 28, 2008. Surveys were done at Los Lunas, Bridge Street, Below San Acacia Dam, Escondida, Rio Puerco, and Sandia sites. Species caught included common carp, red shiner, channel catfish, flathead chub, river carpsucker, longnose dace, white sucker, smallmouth buffalo, and Rio Grande silvery minnow (minnow).

Minnows were most commonly found at the Bridge, Rio Puerco, Escondida, and Los Lunas sites comprising 40, 57, 68, and 91 percent of species composition respectively. The Below San Acacia Dam and Sandia sites were 2 and 12 percent respectively.

The summer sampling was conducted in late August, from August 25 through August 28, 2008. The species composition was slightly different, comprised of common carp, red shiner, smallmouth buffalo, flathead chub, river carpsucker, longnose dace, channel catfish, white sucker, Rainbow Trout, Brown Trout, White Bass and minnow. Survey sites included Above Calabacillas, Below San Acacia Dam, Sandia Pueblo, and Santa Clara. Minnows were most commonly found at Above Calabacillas and Sandia Pueblo sites, comprising 84 and 28 percent of species composition respectively. Minnows were only 2 percent of species composition at the Below San Acacia Dam site and were not found at the Santa Clara site.

Captive silvery minnow populations include Albuquerque Biopark, Dexter National Fish Hatchery, and New Mexico State University. Two additional silvery minnow propagation facilities are expected to initiate operations in 2008. The Service re-introduced the silvery minnow into Big Bend National Park, Texas, in December 2008. A sustainable population outside the Middle Rio Grande is essential for downlisting the species to threatened status.

Southwestern Willow Flycatcher

The Southwestern Willow Flycatcher was listed endangered by the USFWS effective March 29, 1995. Critical habitat was designated, effective August 21, 1997 in some areas of New Mexico and other states throughout the species' range. The Rio Grande was not designated as critical habitat for the Southwestern Willow Flycatcher at that time and the 1997 critical habitat proposal was later retracted. On October 13, 2004, under court order, the USFWS reissued a proposed designation for critical habitat for the Southwestern Willow 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 San Juan 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. Though critical habitat is not proposed for every location where Southwestern Willow Flycatchers exist on the Rio Grande, Section 7 of the ESA requires all Federal agencies to consult with the USFWS on any action that "may affect" a listed species, regardless of whether critical habitat has been designated or not. Since 1995, Reclamation has been in consultation with the USFWS, pursuant to Section 7 of the ESA, over numerous actions, mainly operations and river maintenance activities along the Rio Grande.

Six primary breeding sites for Southwestern Willow Flycatchers have been documented during various survey efforts in the Middle Rio Grande between 1993 and 2008 and include the following: Okay Owingeh Pueblo, Isleta Pueblo, Sevilleta NWR and La Joya State Wildlife Management Area (WMA), the San Marcial area, and the Elephant Butte Reservoir delta. Table 9 displays the results of surveys for Southwestern Willow Flycatchers at these and other sites from 2002 through 2008.

Reclamation continues to conduct Southwestern Willow Flycatcher surveys and nest monitoring along the Middle Rio Grande between the south boundary of Isleta Pueblo and into the dry pool of Elephant Butte Reservoir. Between 2002 and 2008, the number of Southwestern Willow Flycatcher territories in the San Marcial reach has expanded from 63 to a maximum of 244. A majority of these territories (229) are located in the recently-developed riparian vegetation within the uppermost levels of the conservation pool of Elephant Butte Reservoir. This area holds the largest breeding population of Southwestern Willow Flycatchers on the Middle Rio Grande to date, and the largest population of flycatchers in New Mexico. Flycatcher surveys and nest monitoring in this region of the Middle Rio Grande will continue in 2009.

Because the Southwestern Willow Flycatcher population has expanded throughout the Elephant Butte Reservoir pool and flycatchers now occur to the south end of the “Narrows” area, Reclamation is pursuing a formal Endangered Species Act Section 7 consultation with the USFWS in the event that rising water levels may cause a “take” of flycatchers. This consultation is over a five-year annual operating plan for Elephant Butte Reservoir, the federal action for which Reclamation has determined that it has a modicum of discretion. In February 2008 Reclamation submitted a Biological Assessment to the USFWS that evaluates the effects to flycatchers of three reservoir inflow operating scenarios—dry, average, and wet. Under these situations, it is estimated that the “wet” inflow conditions for the next five years could negatively impact a small number of flycatchers through displacement, loss of habitat, or even submergence of nests. Because of this potential to adversely affect the species, Reclamation has requested incidental take in its consultation. The resulting Biological Opinion from the USFWS is expected in May or June of 2009.

Table 9. Estimate of Southwestern Willow Flycatcher Territories – Middle Rio Grande Project, 2002 - 2008 Breeding Seasons

River Reach	Number of Territories 2002	Number of Territories 2003	Number of Territories 2004	Number of Territories 2005	Number of Territories 2006	Number of Territories 2007	Number of Territories 2008[a]
Velarde area	0	not surveyed	1	0	1	0	0
Okay Owingeh Pueblo	not surveyed	Unknown[b]	Unknown[b]	Unknown[b]	Unknown[b]	Unknown[b]	Unknown[b]
Isleta Pueblo	not surveyed	5	7	9	9	9	12[c]
Belen reach	not surveyed	not surveyed	0	1	1	2	4
Sevilleta NWR/La Joya State WMA	13	17	19	20	21	22	31
Bosque del Apache NWR	4	3	1	0	4	7	5
San Marcial/Tiffany areas	12	34	16	3	16	7	15
Elephant Butte Reservoir delta	51	52	113	107	135	194	229
Total	80	111	149	131	186	241	296

(Ahlers and Moore 2003; Moore and Ahlers 2004, 2005, 2006a, 2006b, 2007; Smith and Johnson 2006, 2007)
[a] Reclamation unpublished data, except as noted.
[b] Surveys conducted by pueblo; results currently unavailable.
[c] Data preliminary.

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

During the Minnow v. Keys litigation, the District Court ordered Reclamation to reinitiate Endangered Species Act consultation for 2003 water operations. This consultation was initiated by Reclamation in October 2002. On March 17, 2003, U.S. Fish and Wildlife Service issued the 2003 Biological Opinion (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." In the 2003 BiOp, U.S. Fish and Wildlife Service analyzed the full spectrum of water management options described in the February 19, 2003, final biological assessment for March 10, 2003, through February 28, 2013, water operations and river maintenance proposed by Reclamation and the Corps of Engineers.

The U.S. Fish and Wildlife Service issued the 2003 BiOp with a Reasonable and Prudent Alternative (RPA) designed to alleviate jeopardy to the Rio Grande silvery minnow, adverse modification to Rio Grande silvery minnow critical habitat, and jeopardy to the southwestern willow flycatcher based on the biological needs of the species. The RPA elements address some of the long-term recovery needs of the Rio Grande 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 minimum water flows under different hydrologic scenarios that are needed to alleviate jeopardy to both species.

Reclamation remains in compliance with the 2003 BiOp. Information was provided in 2008 in response to A Freedom of Information Act request from the Defenders of Wildlife and WildEarth Guardians seeking information on how Reclamation and the U.S. Army Corps of Engineers (Corps) are complying with the 2003BiOp. The 2008 irrigation season for the Middle Rio Grande Conservancy District is complete with a good spring runoff and monsoon period kept the river wet. An important ongoing project by the Conservation Breeding Specialist Group and the U.S. Fish and Wildlife Service (Service) is a silvery minnow population viability model which will be used in upcoming 2009-2010 consultation to replace the 2003 BiOp. 2007 habitat restoration with recruitment flows contributed to higher silvery minnow densities in the Angostura Reach, and 2008 high runoff allowed for extensive overbank flooding.

On April 18, 2008, the Service provided an Incidental Take Statement for take due to channel drying from April 1, 2008, through March 30, 2009, based on the October 2007 fish surveys and projected peak runoff flow. Take will be considered exceeded if observed mortality exceeds 155,851 silvery minnows. Take may be amended if the actual flows during the spring peak are less than projected. The Service also made a determination that wet year flow targets would be in effect for the 2008 irrigation season. There was no take in 2008.

Rio Grande Silvery Minnow v. Keys Litigation

In November 1999, environmental groups collectively filed suit against Reclamation and the Corps for alleged Endangered Species Act (ESA) and National Environmental Policy Act (NEPA) violations. The Middle Rio Grande Conservancy District (MRGCD), State of New Mexico, City of Albuquerque, and Rio Chama Acequia Association subsequently intervened. The plaintiffs identified the central issue to be the scope of discretionary authority that Reclamation and the Corps have over the Middle Rio Grande and San Juan-Chama Projects' water deliveries and river operations.

The District Court of New Mexico (District Court) issued a final judgment and memorandum opinion in this case on November 22, 2005, and dismissed portions of the case. Judge Parker denied all motions to vacate his 2002 rulings regarding Reclamation's discretion over water operations. The judge ruled that in future consultations under the ESA, Reclamation must consult with the U.S. Fish and Wildlife Service over the full scope of Reclamation's discretion concerning Middle Rio Grande Project operations. The San Juan-Chama Project water-related claims were dismissed as moot with prejudice. Judge Parker's reasoning included the fact that the December 2004 "minnow rider" enacted by Congress removed Reclamation's discretion to use San Juan-Chama Project water to meet ESA requirements. Federal defendants, the State of New Mexico, and MRGCD have appealed Judge Parker's November rulings to the 10th Circuit Court of Appeals. Reply briefs were filed by all parties in 2006 for this continuing litigation.

In MRGCD's cross-claim against the United States in the *Minnow v. Keys* lawsuit, MRGCD seeks to quiet title to certain Middle Rio Grande Project properties. The United States' position in this cross-claim is that MRGCD conveyed these Middle Rio Grande Project properties to the United States and that these properties remain in the name of the United States until, among other things, Congress authorizes title transfer. The repayment contract also stays in effect until such time.

Judge Parker ruled in favor of the United States on July 25, 2005. Ownership of all properties necessary for MRG project operations, including El Vado Dam and San Acacia and Angostura diversion dams, was declared to be in the United States. In September 2005, MRGCD and the City of Albuquerque appealed Judge Parker's decision in the quiet title cross-claim. The Federal defendants' motion to dismiss or abate MRGCD's appeal was denied. MRGCD's appeal of the quiet title decision has been consolidated with the Minnow v. Keys appeals described above. A hearing was conducted on May 22, 2007, in Oklahoma City for both the combined cases.

There is nothing new to report in 2008.

Temporary Pumping Program – San Acacia to Fort Craig Reach

During the irrigation season, flows in the Rio Grande between San Acacia Diversion Dam and the headwaters of Elephant Butte Reservoir can drop to a level that may potentially result in adverse impacts to the Rio Grande silvery minnow and southwestern willow 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 southwestern willow flycatchers. The Temporary Pumping Program also helps Reclamation comply with the continuous river requirements stipulated by Reasonable and Prudent Alternatives E, H, and L.

In an effort to help maintain a minimum flow within this reach of the Rio Grande and comply with the Reasonable and Prudent Alternatives of the 2003 BiOp and prior biological opinions, Reclamation has installed portable pumps with flow measurement devices at strategic locations to move water from the LFCC into the Rio Grande floodway. Discharge data for the pumping sites is now posted in orange boxes on the Reclamation ET Toolbox web site within the MRGCD Rio Grande Silvery Minnow Operations schematic pages. The URL of the referenced site is:

www.usbr.gov/pmts/rivers/awards/Nm2/rg/riog/schematic/SCHEMATICsouth.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.

The portable pumps have been effectively used in previous years to augment river flows, allowing Reclamation to maximize the effectiveness of supplemental water releases made for Endangered Species Act purposes. Owing to the high water levels in the Rio Grande, the portable pumps located at the South Boundary pumping site were only used once during the 2008 irrigation season. Two pumps at the South Boundary of Bosque del Apache NWR were turned on October 04, 2008 at 3:45pm and operated for 22.7 hours. The two pumps delivered 30.01 acre-ft from the Low Flow Conveyance Channel to the Rio Grande to assist in Silvery Minnow continuous flow operations. No other pumping operations occurred in FY2008.

A weir located in the South Boundary pump channel, used to measure the discharge from the pumps, was washed out by high flows during the 2008 runoff. Because of the overbanking caused by the sediment plug formation at River Mile 81, rebuilding the weir and rehabilitating the South Boundary pump channel was not an option at the time. Flow meters located inside the discharge pipes were used to measure the flows from the pumps in 2008.

New Biological Opinion

Reclamation is seeking a new Biological Opinion from the U.S. Fish and Wildlife Service, in recognition of the fact that many sources of water for lease for the minnow will not be available in the near future. To date supplemental water supplies have primarily been made up of water leases from San Juan-Chama Project (SCJP) contractors. Those sources are dwindling as SJCP contractors put their supplies to use.

Reclamation's goals for this ESA consultation are to establish comprehensive and stable ESA compliance through a hydrologically viable BiOp that maintains the biologic integrity of the listed species. To achieve the desired hydrologic viability, a water management strategy must be developed that optimizes management of native water and allows for the carryover of SJCP supplemental water for use as a reserve in average and dry years. Through adaptive management, the consultation should provide more flexible and dynamic operations and help streamline future ESA compliance.

The BA will include an appendix that presents a recommended water management scenario to meet the stated consultation goals. Additional water contributions from federal and non-federal stakeholders will be necessary and will also be included in the appendix to the BA. A next step of the BA development is negotiations with stakeholders to understand their potential contributions.

The Corps of Engineers (Corps) has been a joint action agency with Reclamation in past ESA consultations but recently decided to complete their own separate Section 7 consultation. The Corps has committed to continue working with Reclamation in developing a common environmental baseline. It is expected that both Reclamation and the Corps will submit their separate biological assessments (BAs) simultaneously to allow the Service to complete the two consultations in concert. While each action agency will have their own biological opinion (BiOp), associated water management actions will need to occur in an integrated manner.

An administrative draft of Reclamation's BA is due by mid-May 2009. Government-to-government consultation with Pueblos and Tribes should also begin in May. The final BA is scheduled to be submitted to the Service to initiate formal Section 7 consultation on July 31, 2009 with the goal of having a final BiOp in place prior to the 2010 irrigation season.

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 8). 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 Coffer Dam, both in Texas. Riverside Diversion Dam had been inoperable since 1987, when flooding on the Rio Grande caused the structure to fail.

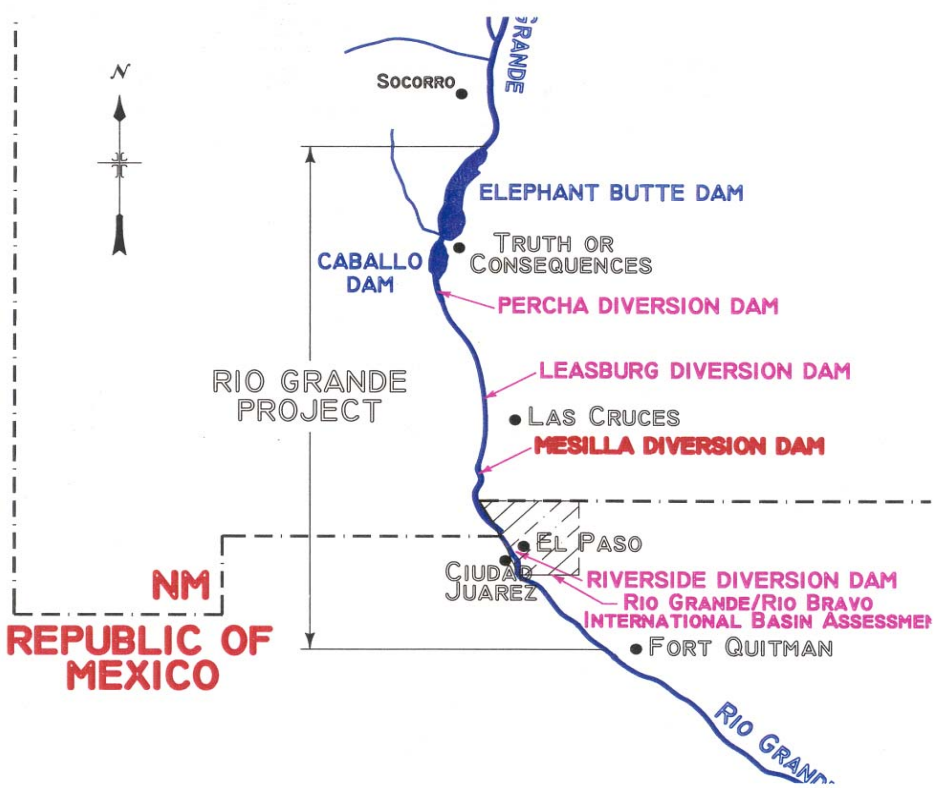

Figure 5: Area Map of the Rio Grande Project

Water Supply Conditions

Inflow into Elephant Butte Reservoir during 2008 as measured at the Rio Grande Floodway (FW) plus the Low Flow Conveyance Channel (LFCC) at San Marcial (FW+LFCC) was 949,662 af which is 111.0% of the 97-year average annual flow at the San Marcial stations (FW+LFCC). The 97-year average annual flow at San Marcial (FW+LFCC) is 855,604 af. The actual 2008 March through July runoff, measured at San Marcial (FW+LFCC), was 679,816 af, which was 118.6% of the 30-year average of 573,000 af. Of the period 1996-2008, the spring runoffs (March-July) at the San Marcial gauging stations have consistently been below average, with the exception of 1997, 2005, and 2008 which were 120%, 129%, and 119% of average respectively. The 1996, 2000, 2002, 2003, and 2006 spring runoffs have been near-record low volumes, with the 2003 spring runoff volume being the ninth lowest on record at the San Marcial gauging stations. During 2008, 671,182 af of water was released from Elephant Butte Reservoir. There was a release of 675,479 af to meet the irrigation requirements of Project water users from Caballo Reservoir.

The January through June Natural Resources Conservation Service and National Weather Service (NRCS & NWS) coordinated forecasts received for the 2008 March through July runoff season are presented in Table 10.

Table 10: Summary of 2008 Rio Grande Coordinated Spring Runoff Forecasts

Month	Forecasted Otowi Runoff (af)	Percent of 30-Year Average	Forecasted San Marcial Runoff (af)	Percent of 30-Year Average
Jan 1	940,000	124	750,000	131
Feb 1	1,300,000	172	1,050,000	183
Mar 1	1,380,000	182	1,150,000	201
Apr 1	1,170,000	155	980,000	171
May 1	1,040,000	137	695,000	121
June 1	965,000	127	665,000	116
Actual Runoff	944,955	125	679,816	119

Combined total storage for Elephant Butte and Caballo Reservoirs was 652,103 af on December 31, 2008. This combined storage was 27.7% of the total capacity of both reservoirs, and 29.3% of the available storage. In 2008, the available storage for both reservoirs during the winter months (October 1 to March 31) is equal to the capacity of Elephant Butte Reservoir, 2,023,358 af minus 25,000 af that Reclamation reserves for winter operational flood control space (50,000 af during the summer), plus the capacity of Caballo Reservoir, 326,672 af minus 100,000 af for flood control space, or 2,225,030 af during the winter (2,200,030 af during the summer).

On January 1, 2009, Reclamation began using new area-capacity tables for Elephant Butte and Caballo Reservoirs based on sediment surveys conducted in 2007. Elephant Butte Reservoir gained 1,228 af of total storage, and Caballo Reservoir lost 1,738 af of total storage. The combined total storage of both reservoirs lost 510 af since the last sediment surveys conducted in 1999. Therefore, in 2009, 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 af minus 25,000 af that Reclamation reserves for winter operational flood control space (50,000 af during the summer), plus the capacity of Caballo Reservoir, 324,934 af minus 100,000 af for flood control space, or 2,224,520 af during the winter (2,199,520 af 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 af on January 1, 2008. On February 01, 2008, the State of New Mexico relinquished 125,000 af of its Compact credit waters, and Compact usable water in Project storage went above 400,000 af removing the Compact's Article VII restriction on upstream storage in post-1929 reservoirs. The State of Texas accepted New Mexico's relinquishment, and that relinquishment was then allocated to the Rio Grande Project water users for the 2008 irrigation season.

However, Article VII of the Rio Grande Compact stipulates that when usable water in Project storage is below 400,000 af that 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. Due to waters stored in Platoro Reservoir by Colorado from November 2007 to January 2008, Colorado relinquished 1,200 af of its Compact credit waters on February 29, 2008 to Texas, and Texas accepted the relinquishment. The 1,200 af relinquished credit waters was then allocated to the Rio Grande Project water users for the 2008 irrigation season.

The Compact usable water in Project storage stayed above 400,000 af for the remainder of 2008. On January 1, 2009, total Compact credit waters in Elephant Butte Reservoir for both Colorado and New Mexico increased based on available data concerning deliveries in 2008. However, Compact usable water in Project storage remained above 400,000 af.

A final allocation to the Rio Grande Project water users of 96.26% of a full supply was declared by Reclamation on December 12, 2008 for the 2008 irrigation season. The initial allocation to the Rio Grande Project water users (declared on January 18, 2008) started at only 24.20% of a full supply. 2008 proved to be a very generous irrigation water supply for the Project water users.

Elephant Butte ended 2008 with 31,938 af of San Juan Chama (SJC) water in storage for Albuquerque-Bernalillo County Water Users Authority and the City of Santa Fe. In addition, Reclamation leased SJC minnow water was also in storage.

For the 2009 irrigation season initial allocation, a less than full allocation (54.73% of a full supply) was declared on February 05, 2009. Based on the February 1st NRCS/NWS spring runoff forecast at the San Marcial gauging stations and present hydrologic conditions, Reclamation anticipates a full supply for irrigation during 2009 for the Rio Grande Project.

The 2009 coordinated forecasts from the NRCS & NWS for the 2009 March through July runoff season is presented in Table 11.

Table 11: 2009 Rio Grande Coordinated Spring Runoff Forecasts

Month	Otowi Runoff (af) (Mar-Jul)	Percent of 30-Year Average	San Marcial Runoff (af) (Mar-Jul)	Percent of 30-Year Average
Jan 1	915,000	121	730,000	127
Feb 1	890,000	118	710,000	124
Mar 1	760,000	100	590,000	103

Project Irrigation and Drainage Systems and Title Transfer

In 1992, Congress authorized the transfer of title to certain irrigation facilities to the Districts. The official transfer of the irrigation and drainage rights-of-way and facilities to the Districts was completed on January 22, 1996. In 2008, the irrigation and drainage system continued to be 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 continues to own and administer the lands and rights-of-way activities of the reservoirs and diversion dam areas.

Reclamation retains title and operation and maintenance responsibilities for Elephant Butte and Caballo Dams and Reservoirs. Operation and maintenance of the diversion dams are performed by the Districts under contracts with Reclamation. Reclamation retains the rights-of-way and title of the diversion dams and their associated reserved works. The Districts performed flow measurements at canal headings, river stations, and lateral headings during 2008. Reclamation coordinated and maintained central control of releases, river operations, and water accounting. To accomplish the water allotment accounting, the Districts collected field flow measurements and coordinated 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 2008. The International Boundary and Water Commission (IBWC) continued to own, operate, and maintain the American Diversion Dam and the American Canal during 2008 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 a supplemental irrigation water supply for approximately 18,342 acres of the Hudspeth County Conservation and Reclamation District No. 1 (HCCRD). Total flows out of the Project to HCCRD are measured at three gauging stations near the Hudspeth County line: the Hudspeth Feeder Canal; the Tornillo Canal at Alamo Alto; and, the Tornillo Drain. Under the Warren Act contracts, HCCRD was charged for drainage water from the Project between March 1 and September 30 which amounted to 89,678 af in 2008.

Water flows measured by IBWC on the Rio Grande at Fort Quitman Station, downstream of the Project and HCCRD boundaries, amounted to 138,544 af during 2008.

Elephant Butte Reservoir and Powerplant

Elephant Butte Reservoir reached a minimum storage of 409,700 af (elevation 4,332.30 ft) on January 01, 2008. A maximum storage of 646,410 af (elevation 4,350.18 ft) was reached on June 17-18, 2008. Storage levels in Elephant Butte Reservoir did not enter into the 50,000 af prudent flood control space in 2008.

Net power generation for 2008 was 63,282,427 kilowatt-hours which was 86.2 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 balance valves were utilized to help meet peak releases during 2008 (March 27 - April 07, April 10 – May 17, May 31 – June 13, June 18 – July 09, and August 14 - 25). Reclamation completed repair work on the power plant's lower No. 1 penstock guard gate in 2008. Repair and replacement of the lower No. 1 penstock guard gate hydraulic control system continues. Reclamation anticipates that all three turbines will be available for generation and discharge by the spring of 2009.

In 2008, monsoon rainstorms at Elephant Butte Reservoir and between Elephant Butte Dam and Caballo Reservoir produced significant rainfall runoff flows into the Rio Grande and Elephant Butte Reservoir. Consequently, a number of sediment plugs formed in the river channel between Elephant Butte Dam and Caballo Reservoir. Reclamation worked over the fall and winter of 2008 to remove over 28,700 cubic yards of sediment material in this reach of the river to maintain the safe channel capacity of 5,000 cubic feet per second for flood control purposes. Because of excess rainfall runoff into Caballo Reservoir, Elephant Butte Dam's releases were shut off from September 1 – 30 to allow irrigation demand to draw Caballo Reservoir down to its winter operating level by October 1, 2008.

Elephant Butte Dam Facility Review and Safety of Dams Programs

During the FY2008, Elephant Butte Field Division implemented and completed the following recommendations:

- **Triathlon Event**:
  This event took place September 27, 2008. Coordination for approval of this event went through the Albuquerque Area Office and the Regional Safety Security and Law Enforcement office. Event security was provided by the New Mexico State Parks, local police and state police.
- **Updates to unit annunciation, excitation, protection, control:**
  The wiring schematics and diagrams for the powerplant were outdated and not in an "As Built" condition. This made it very difficult to trouble shoot problems. With the assistance of the Denver Technical Service Center the drawings were "As Built" and are now nearing completion. This process has taken many man hours of wire tracing and many drawing revisions.
- **Purchased new total station survey equipment:**

A new TopCon total station was purchased to replace the outdated Sokkia total station. This new equipment has increased productivity and made all surveying more accurate. All surveying for dam movement has been coordinated with Dan Goins at the Denver office.

- **Caballo control house redesign:**

  The Caballo control house electronics are being redesigned and upgrades. The old system was very complicated and not user friendly. The physical layout was very messy and the wiring was easily grounded. This actually occurred on a routine inspection when the terminal block grounded all the equipment and the PLC was surged with power and has not been functional since. Part of the new system is a new PLC which is user friendly with a graphical user interface.

- **Rock scaling to prevent large event:**

  Mark Niellie from the Salt Lake City office came down to remove some rocks that were identified as being potentially dangerous. These rocks were quite large, ranging from 2ft to 6 ft in diameter. The rocks were located over the entry road into the facility. The increased rain fall cause the exposure of these rocks and for safety reasons they were removed.

- **Building of two new equipment buildings:**

  New equipment buildings were constructed one at Elephant Butte Dam and one at Caballo Dam. The hardware and design of the building was contracted to F&S Environmental. The parts were then delivered to the sites and left for the staff at Elephant Butte Field Division to complete. Foundation footings were designed by Lorenzo Arriaga and the site preparation and survey was done in house. The building was then built per the contract blue prints. The building had no side walls but did have a sloped roof to protect equipment from the hard summer months.

Photo 26 - New equipment cover at the Caballo Dam yard.

Photo 27 - New equipment cover at Elephant Butte Dam yard.

- **<u>Aerial application of herbicide to kill Tornillo:</u>**

  Brent Tanzy working with Sierra SWCD contracted an aerial applicator to spray within the Caballo Reservoir flood plain to control the growth of screwbean mesquite (Tornillo). 604 acres were treated during the month of September. This application will greatly improve vegetation maintenance within the area. Additionally 140 acres of saltcedar were treated with herbicides using the carpet roller applicator. During FY ’08 a total of 2, 941 acres were maintained by mowing and herbicide treatments.

- **Moved computer servers to secure room:**

  Elephant Butte Field Division's server was located in the copy room just encased in a cabinet with a lock on it. This took up a lot of area in the copy room and was not the most secure. A room for the server was constructed. New cooling system for that room and a security lock and server racks were all built into the room. The server now resides in this space and has been working well.

Photo 28 - Pictures showing old server location, new door access to server room, and the new servers on the racks up and running.

- **Upgraded LAN wiring:**

  The administration office here at Elephant Butte Dam was re-wired with new CAT-6 communication lines into each office. This replaced the old CAT-5 Ethernet cable and new drop down connection points were installed to accommodate the growing number of workstations and networked printers. Also the need for connection points in the conference room was necessary and the area is now capable for having multiple computers and is a training center if necessary.

- **Re-Roofed and replaced roof sections on water tank:**
  The water tank at Elephant Butte Field Division was recently lined with a fiberglass surface and this cleaned out the years of sediment and allowed the renovations needed. Valves were replaced and security lids for the valves were replaced as well. A closer look at the roof reviled that the shingles and siding needed rehab work. Even more investigation into the roof reviled that some of the trusses had major cracks and had deflected / sagged to the point that the structural integrity was compromised. The decision was made to replace the trusses that needed to be rather than repairing them. Then new plywood was applied and the entire roof re-shingled. The copula at the peak of the roof was repainted and repaired as necessary. The siding was also repainted. This project will extend the operating life of the water tank well into the future.

Photo 29 - Showing repainted vent box and redone roof as well as new access hatch.

Photo 30 - Old penstock gate operator – water operated.

Photo 31 - New penstock gate operator - hydraulically operated.

Photo 32 - Hydraulic Pump manifold.

Photo 33 - Penstock control cabinet.

- **CARMA implementation:**
  The next generation of MAXIMO is the CARMA initiative. The development work has been worked on by James Powell and Marian Thornton. This process is very complicated and will all be integrated into the production version of MAXIMO. The training is scheduled for October 14th thru the 17th. Then the Denver office will be down for more training October 20th thru the 24th. The go live date is October 29, 2008.
- **Service agreement for HWL for powerplant:**
  The Hard Wired Logic (HWL) controls for the powerplant have been in use since the mid 1980's and at the time were somewhat outdated. The full functionality of the HWL was never fully utilized and to this day is very difficult to trouble shoot. The service agreement with the Denver TSC was made for the preliminary work for the replacement of the HWL with a new Programmable Logic Control (PLC) system. The Denver TSC has worked well to bring all the current systems such as the Control, Protection, Annunciation, and Excitation schematics and wiring diagrams up to date. This in its self is a great improvement. The next step in the replacement of the HWL will occur as James Powell facility manager permits.
- **Excessing property:**
  Elephant Butte Field Division has accumulated a lot of property over the years. Much of this property has been stored at either the Elephant Butte Dam or Caballo Dam yards. This was ok for storage but when it came time to identify what was available for projects it became very difficult. The process of excessing all the unused property was initiated. A lot of unused property is now on GSA site and being transferred or waiting for the next step in the excess process.
- **Cleaned up lower yard:**
  The lower yard at the Elephant Butte Dam Facility was cleaned up in preparation of excessing equipment and materials. The organization of the yard makes it easy to find needed supplies and know what we have on hand to reduce purchasing of supplies.
- **Powerplant PFR:**
  The Powerplant underwent a Periodic Facility Review in July of 2008. This inspection overall revealed some areas of concern and as a result there was a one category 1 item listed. This was the grounding system for around the transformers. This was completed immediately after the review was completed.
- **Transfer of Garfield quarry:**
  The Garfield Quarry has been under the management of the Bureau of Reclamation for many years and was used often in many of Reclamation Projects for material needs. However the quarry is no going to be transferred to International Boundary and Water Commission as soon as the encroaching road is blocked and BLM approves.
- **Bridge inspections:**
  The inspection of both the Elephant Butte spillway bridge and the Caballo spillway bridge was completed this year. Gary Davis and David Yates did the inspection and Elephant Butte Bridge is in great condition the concrete has held up well and the arches are in good condition no new cracks were identified and no movement in any of the joints was observed. The loading restriction of the

spillway bridge is still in effect. The final report for the inspection is still being created. The Caballo spillway bridge is in overall good condition no new cracks or unusual movement in joints. The one observation was that the supporting beams did have a bow in them this was due to overloading over the past years. This occurred when the dam accommodated traffic and the public would take anything they could. There was no concern for the bridge at this time but the load restriction on the bridge should be upheld. The final report is still being created.

- **River work:**

  During the rainy season of this year (July, August and early September) Mescal Canyon and Cuchillo creek ran substantial amounts of sediment into the Rio Grande river channel. This in conjunction with the shut down of released from Elephant Butte dam (early September) created large plugs in the river channel. This material had to be removed before releases from Elephant Butte dam could resume. The releases were to supply Caballo reservoir with adequate supply of water to release down to the irrigation districts. The plugs were removed to the point that the releases could easily pass through the channel. Numerous other smaller gravel and sediment plugs were removed in the reach below Cuchillo Creek and Hondo Arroyo at Williamsburg Bend were also removed. Total estimated material removed exceeded 15,000 cubic yards.

Photo 34 - River work and the Mescal Creek area.

Photo 35 - River work near the tailbay to the Elephant Butte Dam.

Caballo Dam and Reservoir

Caballo Reservoir (Caballo) reached a minimum storage of 16,394 af (4,134.36 ft) on October 23, 2008. A maximum storage of 65,676 af (4,149.69 ft) was reached on July 15, 2008.

According to Court Order No. CIV-90-95 HB/WWD of October 17, 1996, which resulted from a negotiated settlement with the Districts, the Caballo Reservoir storage level is targeted not to exceed 50,000 af (4,146.11 ft in 2008; starting in 2009, 4,146.44 ft) 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 af during the winter months of October through January requires collaboration and consultation between the Districts and Reclamation.

Reclamation's plan for operation of Caballo during February 1 through September 30, 2008, was to maintain storage levels such that they would not exceed 50,000 af in February, not exceed 55,000 af in June, and not be less than 10,000 af by the end of September. Operating Caballo at these storage levels during the 2008 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
- Serve as a reserve pool in case releases were interrupted from Elephant Butte Dam and minimize changes to release rates from Elephant Butte Dam
- Compensate for loss in discharge capacity from Elephant Butte Dam power plant due to the penstock guard gate repair work.

Caballo Reservoir's operating plan for October 1, 2008 through September 30, 2009 has not yet been finalized. However, Reclamation projects that Caballo Reservoir should not exceed 40,000 af during February, 2009, not exceed 55,000 af during June, 2009, and not be less than 20,000 af in September, 2009. Reclamation will finalize its operating plan in the spring of 2009. The plan will reflect accommodations for the minimization of evaporation differences between Elephant Butte and Caballo Reservoirs, and maintenance of some reserve water in Caballo Reservoir for emergency purposes.

In 2008, monsoon rainstorms at Caballo Reservoir and in the Rio Grande downstream of Caballo Dam produced significant rainfall runoff flows. Reclamation's target level to peak at Caballo Reservoir was 55,000 af in June 2008. However, because of significant rainfall runoff to the reservoir, it peaked at 65,676 af on July 15, 2008. Due to significantly high rainfall runoff flows in the Rio Grande downstream of Caballo Dam to El Paso, TX, Reclamation reduced and/or shut off releases out of Caballo Dam due to mainstem flooding and the lack of irrigation orders from July 9 -15, July 26 – August 2, and August 29 – September 19.

Significant sediment plugs formed in the Rio Grande below Caballo Dam and as far south as the I-25 bridge. Reclamation worked in the fall and winter of 2008 to remove about 3,200 cubic yards of sediment material to maintain the river channel for delivery of irrigation water and flood control purposes.

During the winter of 2008, Reclamation performed repair work to the east regulating gate of Caballo Dam's outlet works. The gate is now ready for operation to release irrigation orders beginning tentatively on February 18, 2009 – the start of the 2009 irrigation season on the Rio Grande Project.

Caballo Dam Facility Review and Safety of Dams Programs

During the FY2008, Elephant Butte Field Division implemented and completed the following recommendations.

- **Modified manholes for Caballo:**
  The toe drains a Caballo Dam have manhole access points throughout the downstream toe of the dam. These manholes are 5ft in diameter and ¼" thick. They are secured with 8 bolts and to access the toe drains for maintenance the entire lid had to be removed. This was very awkward the lid was heavy and presented pinches and potentially crushing of ones hands when handling the lid. The lid was redesigned with just a square lid that was cut into the existing 5ft cover. This lid is square and hinged and locked. This will allow maintenance of the drain system and reduce the possibility of injury to personnel.

Photo 36 - Modified manhole showing new access hatch.

Data Automation and Instrumentation and Flow Monitoring System

Reclamation's El Paso Field Division continued to maintain its internet web page for the Rio Grande Project during 2008. The current year's daily, weekly, and monthly data of the operations of Elephant Butte & Caballo Reservoirs, and the delivery of water to the two United States Rio Grande Project water users (Elephant Butte Irrigation District and El Paso County Water Improvement District No. 1), are available via the internet. To reach the web page, type the following URL into a web browser:

http://www.usbr.gov/uc/elpaso/water/index.html

Modifications and improvements to Reclamation's El Paso Field Division's internet web page continued in 2008. Improvements completed in 2008 included: addition of a table to show adjustments to the NRCS/NWS spring runoff forecasts at San Marcial to compute apparent inflow to Elephant Butte Reservoir; addition of a table showing the status of the Rio Grande Compact credit waters and San Juan-Chama water in Elephant Butte Reservoir; and, addition of tables to show the monthly allocation to the Rio Grande Project water users.

In February, 2008, Reclamation purchased an acoustical doppler velocity meter which was installed at the gauging station on the Rio Grande downstream of Caballo Dam between February 2 to February 18, 2009. The new meter will give Reclamation the ability to develop a rating curve of average velocity and gauge height, and improve the accuracy of calculating daily flows for the record at this station.

A new rating table of gauge height versus flow for the Rio Grande below Caballo Dam gauging station utilizing Reclamation flow measurement records from 2005 to 2008 is being developed in coordination with Elephant Butte Irrigation District and El Paso County Water Improvement District No. 1. Reclamation anticipates using the new rating table at the start of the 2009 irrigation season (tentatively February 18). The USGS performed safety work at the Caballo gauging station cableway on January 22, 2009. They re-positioned and plumbed the west A-frame and replaced the turnbuckle at the supports. On January 30, Reclamation in conjunction with Elephant Butte Irrigation District repainted the five-foot hash marks on the Caballo gauging station cableway utilizing GPS/RTK and total station survey equipment.

Diversion Dam Facility Review and Safety of Dams Programs

Reclamation conducted a field examination of the Rio Grande Project reserved works structures - Percha, Leasburg, Mesilla, and Riverside Diversion Dams, on January 23-24, 2003. The next scheduled operation and maintenance field examination of the diversion dams is tentatively set for the fall of 2009, following the end of the irrigation 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. The most recent meetings were held on January 7, 2008 and February 19, 2008.

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.

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 af of irrigation water from the Rio Grande Project. The most important items of 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.

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 nonbeneficial consumption of water by woody phreatophytes such as saltcedar (Tamarix). Herbicide treatments to both saltcedar and tornillo (screwbean mesquite) are also made to limit the amount of mowing necessary to complete the task. Approximately 4,594 acres have been sprayed at both reservoirs over the past 5 years with varying amounts of success. Scientific Investigations are being done concurrently with assistance from New Mexico State University with funding through Reclamation's Science & Technology programs.

2008 Summary

During FY' 08 Reclamation completed mowing on 2,197 acres of phreatophytic vegetation occurring at Caballo and Elephant Butte reservoirs. Additionally 604 acres of tornillo and 140 acres of saltcedar were treated with herbicides at Caballo reservoir

Under a separate study for measuring water use by riparian vegetation at Caballo reservoir, Reclamation and NMSU College of Civil Engineering measured temporary reductions in evapotranspiration (ET) from saltcedar after mowing. The reductions were significant (30%), and it is estimated that ET may be reduced as much as 50% by either increases in mowing frequency or through the use of herbicides. A similar study at Elephant Butte showed saltcedar treated with herbicides had 57% less ET than untreated saltcedar

(http://wrri.nmsu.edu/publish/techrpt/abstracts/abs328.html).

These investigations will continue and results will be presented in technical reports and appropriate scientific journals.

EL PASO FIELD DIVISION PLANNING STUDIES AND INTERACTION WITH THE NEW MEXICO - TEXAS WATER COMMISSION

The New Mexico-Texas Water Commission (Commission) was created as a result of the voluntary court settlement in the El Paso vs. Reynolds (563 F. Supp. 379 D.N.M. 1983) ground water appropriation case. The Commission seeks to implement the best management practices for the water resources of the west Texas and southern New Mexico area (Figure 6). The following sections summarize studies that are being performed through the cooperation of Reclamation and the Commission.

Elephant Butte and Caballo Reservoir Water Quality Assessments

Reclamation and the USGS are partners in the reservoir water quality assessments of Elephant Butte and Caballo Reservoirs. These assessments consist of monitoring temperature, dissolved oxygen, and pH profiles throughout the year, in addition to investigations into the generation and potential mitigation of hydrogen sulfide gas (H_2S) releases at the Elephant Butte power production facility. The release of H_2S poses a potential health risk to the employees in the power plant, and falls under the purview of Occupational Safety and Health Act (OSHA) regulations. Dissolved H_2S below Elephant Butte is also detrimental to the cold water trout population present in the tailwaters. This effort is being managed by Reclamation's Upper Colorado Regional Office. The actual measurements are being conducted by personnel from New Mexico State University. Continued in 2008.

Rio Grande/Rio Bravo International Basin Assessment / Border Regional Environmental Workgroup

In July 2000, the Department of the Interior and Mexico's Secretariat of Environment and Natural Resources (SeMARNAT) agreed to conduct a binational water and natural resources assessment of a portion of the International reach of the Rio Grande / Rio Bravo. A Memorandum of Understanding was signed whereby an information exchange program was initiated. Data on cultural and natural resources was inventoried and exchanged with SeMARNAT under the leadership of the International Boundary & Water Commission. The focus is on data and reports for the Lower Rio Grande/Rio Bravo Basin.

Various groups have designated the subsections of the river differently. For the purposes of this assessment, the Lower Rio Grande / Rio Bravo is the Reach between El Paso, Texas and Amistad Reservoir. Major U.S. cities located along the Lower Rio Grande include El Paso, Laredo, Brownsville, and McAllen, Texas. Major Mexican cities along the Rio Grande are Juarez, Chihuahua, and Nuevo Laredo and Matamoros, Tamaulipas.

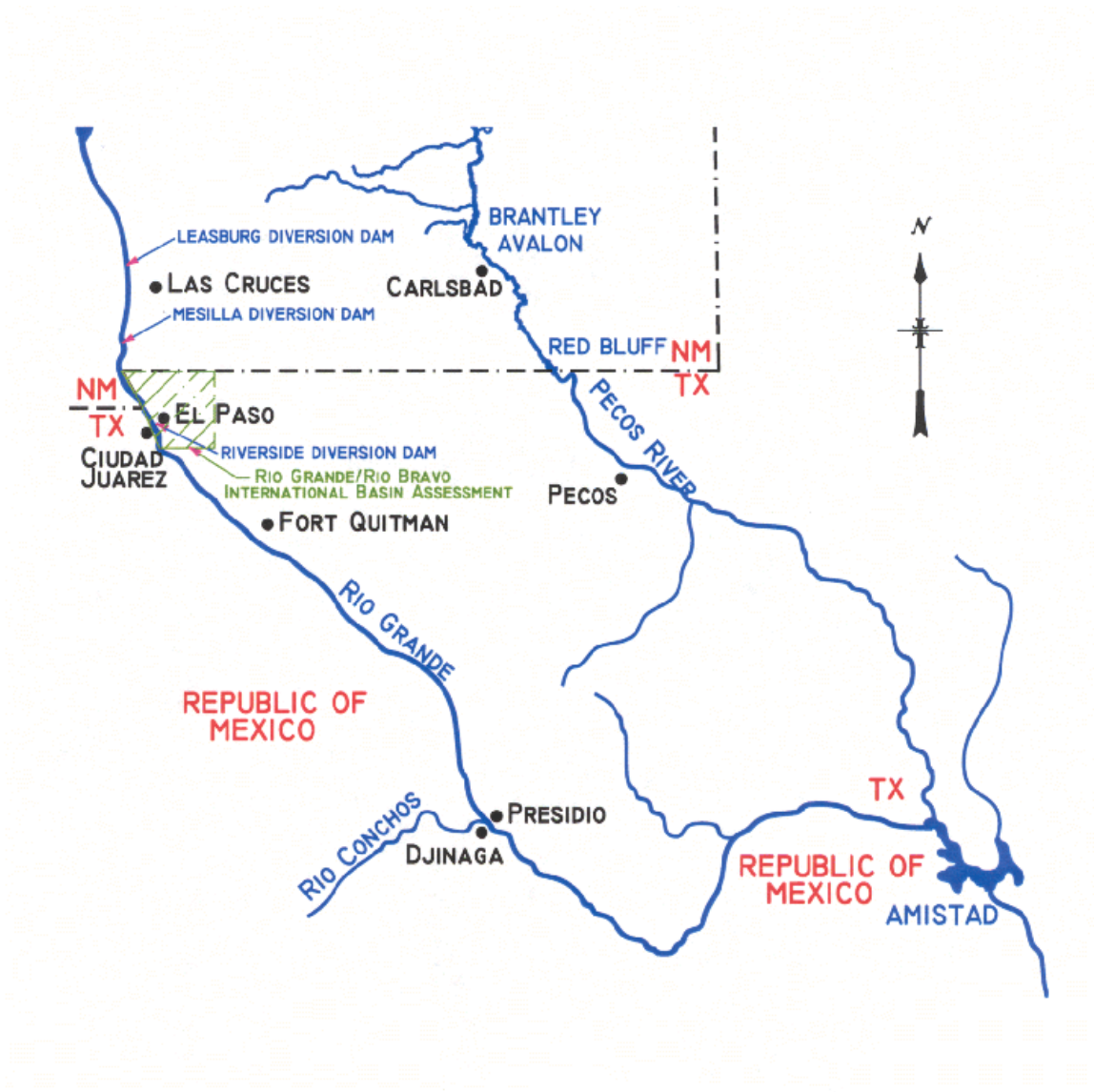

Figure 6: Area Map of the Rio Grande/Rio Bravo International Basin Assessment

The Joint Resolution signed at the Binational Rio Grande / Rio Bravo Symposium on June 14, 2000 listed eight objectives to be accomplished to protect the ecological integrity of the Rio Grande / Rio Bravo in the reach between Fort Quitman and Amistad Dam. Subsequently, meetings have been held between federal and state agency representatives (the organizing committee) to develop a strategy to move forward with initiatives to satisfy the intent of the Joint Declaration. Under a phased completion, Phase 1 enabled implementation of four of the eight objectives listed in the Joint Declaration, (1: Form a binational task force; 6: Undertake research on biological and hydrologic conditions of the region; 7: Develop and exchange compatible information systems; 8: Facilitate public participation in developing strategies for environmental sustainability). Continued in 2008.

Current Activities

Under the leadership of the International Boundary & Water Commission, partnerships for funding are being formulated to focus on a common border riparian problem of saltcedar control. A partnership with the International Boundary & Water Commission, Bureau of Reclamation, National Park Service, U.S. Department of Agriculture – Agricultural Research Service, and the Texas Department of Agriculture exists to identify two pilot project sites for biological control of saltcedar. Continued in 2008.

Environmental Health in the US-Mexico Border Region

Rapid population growth, economic development, and land-use changes are pushing the limits of environmental sustainability and quality in the US-Mexico border region. To allow for continued economic growth while protecting the area's natural resources and fostering a high quality of life, the United States and Mexico need an improved understanding of the threats posed by these anthropogenic changes. The USGS has initiated a project to provide an earth and biological resources database within a geographic framework using an Internet map service (IMS) to further our understanding of the condition of the physical environment in the border region. Although the project is planned to ultimately encompass the entire US-Mexico border, initial efforts have focused on the lower Rio Grande basin from Falcon Reservoir to the Gulf of Mexico. An IMS for that study area is now available via the internet at

http://borderhealth.cr.usgs.gov/.

Continued in 2008.

Databases

The report and database entitled *Standardized Watersheds Database for the Lower Rio Grande/Rio Bravo, Texas USGS Open-File Report 00-065* describes the creation of a large-scale watershed database for the lower Rio Grande/Rio Bravo Basin in Texas. The watershed database includes watersheds delineated to all 1:24,000-scale mapped stream confluences and other hydrologically significant points, selected watershed characteristics, and hydrologic derivative data sets.

Caballo Mercury Study

Reclamation, in conjunction with the New Mexico State University's Department of Fishery and Wildlife Sciences and the USGS Biological Resources Division, has established the only mercury deposition network site in the southwestern United States. Unique to this site is the measurement of both dry and wet deposition of atmospheric mercury.

Mercury is deposited on both a regional and global scale, and the inorganic mercury which lands in the watershed of the Rio Grande eventually washes into the river and reservoir areas. Under anaerobic conditions, bacteria may transform inorganic mercury into the toxic organic form, methylmercury (MMHg). MMHg has profound ecological effects because it is one of the few metals that is known to bioconcentrate, bioaccumulate, and biomagnify in aquatic food chains.

The biomagnification is predominantly responsible for the elevated levels of mercury present in the fish populations at Elephant Butte and Caballo Reservoirs. The primary route of MMHg accumulation in wildlife and humans is through the ingestion of fish. The State of New Mexico has issued an advisory concerning the consumption of fish from these reservoirs. The long-term prognosis of mercury accumulation in our reservoirs is unknown, which is the primary reason for undertaking this project.

The goals of this study are to identify the transport, fate, and effects of mercury in an arid environment. Ultimately, the results of this investigation may lead to a better understanding of the potential for mercury contamination in lakes and reservoirs in both arid and wetter climates across the globe. The direct results of this research may expand this investigation to cover other Reclamation reservoirs throughout the Southwest, including Lake Powell, Lake Mead, Lake Havasu, and Roosevelt Lake. Continued in 2008.

Snow-Melt Runoff Modeling

Monitoring snow-melt runoff within the Rio Grande Basin is critical to the management and operation of the Rio Grande Project. The Rio Grande Project system of dams and reservoirs is designed for flood control and for the storage and delivery of irrigation and municipal waters. The crucial factors for determining Rio Grande Project storages, diversions, and releases are the flows within the river, and expected flows from runoff predictions. Currently, this runoff assessment is made from specific NRCS Snowpack Telemetry (SNOTEL) sites coupled with information from the National Weather Service. A Snow-Melt Runoff (SMR) model, utilizing satellite imagery and data from SNOTEL points, could greatly enhance predictive capabilities for runoff forecasts. Implementation of this SMR model is an important step towards more effectively predicting the amount of runoff expected to drain into the Rio Grande Basin. Reclamation is partnering with the Center for Applied Remote Sensing in Agriculture, Meteorology, and Environment, a cooperative effort of the New Mexico State University, College of Agriculture and Home Economics and the U. S. Army Research Laboratory at White Sands Missile Range. Continued in 2008.

Rio Grande Basin Salinity Assessment with the USGS, IBWC, NMED and USBR

Helicopter Electro-Magnetic (HEM) data collected by the IBWC to investigate the density of their river levees was applied to the underlying groundwaters at the bottom of the Mesilla Valley. This data was ground-truthed with existing and newly placed monitoring wells to determine the extent of saline aquifers beneath the Rio Grande. These saline waters are a source of salt intrusion into the Rio Grande Project and are an area of concern for the States of New Mexico and Texas. The HEM portion of the Rio Grande Salinity Assessment is funded on a year-to-year basis and continued funding for FY09 is anticipated. The initial modeling results have proven to be extremely promising and expansion of this method is recommended for other sections of the Rio Grande.

OTHER RECLAMATION PROGRAMS

Department of the Interior's Water 2025 Initiative

The Department of the Interior's Water 2025 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 Water 2025 is addressing. Water 2025 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 Water 2025 program.

Reclamation has awarded a total of $3.6 million to MRGCD for system automation, water measurement, and canal lining. In addition, Reclamation provides technical assistance to MRGCD in support of the program. MRGCD has requested and obtained a one year extension of the grant. The grant shall expire on December, 2009. Work scheduled in 2009 shall include 19 small projects within MRGCD's Cochiti, Albuquerque, Belen, and Socorro Divisions.

MRGCD has completed 8,700 feet of concrete lining of the Cochiti East Main Canal from Cochiti Dam to the Santa Fe River. The concrete lining will reduce seepage losses from the canal and help reduce operation and maintenance costs. Reclamation is working with MRGCD on designs and drawings to replace radial gate lifting drum assemblies, supports, and hoists at San Acacia and Isleta Diversion Dams.

Reclamation is also cooperating with MRGCD on NEPA compliance for a cross river siphon proposed for the La Joya area. The proposed siphon would convey water directly from the Lower San Juan Riverside Drain to Drain Unit 7 which connects directly with the Socorro Main Canal North at San Acacia.

Reclamation's Water Conservation Field Service 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 2008, implementation activities such as domestic well metering in Santa Fe, New Mexico and using GPS surveys to inventory the acequias in the San Luis Valley of Southern Colorado. The County of Santa Fe is writing a water conservation plan. Funding was provided to the New Mexico Association of Conservation Districts to support

the Rolling Rivers Educational Trailers throughout New Mexico. Outreach demonstrations are generally held at the State and County Fairs, public and private schools, teacher workshops, water conferences, and other outreach activities. Funding has also been provided for children's water festivals in Albuquerque, Rio Rancho, Artesia, Carlsbad, and Lovington, and is being expanded to the Anthony, New Mexico area.

Funding and technical assistance is being provided to the city of Las Cruces to promote and demonstrate a "Lush and Lean" garden. Las Cruces hopes this showcase activity will lead through example.

Title XVI Water Reclamation and Reuse Projects

Under the authority of Public Laws 102-575 and 104-266, Reclamation is/was participating in water reclamation and reuse projects with the cities of Española, and Albuquerque in New Mexico, and El Paso, Texas.

City of Española

The City of Española completed its Title XVI projects in 2006. Many of those activities associated with Title XVI were scheduled to be transferred to project activities authorized under P.L. 108-354. The City continued to investigate and consider its water supply options during 2008. The diversion project needed to supply the filtration facility authorized in P.L. 108-354 is still on hold pending a final decision by the City on how to best divert and utilize its current San Juan-Chama Project contract allocation of 1,000 acre-feet.

City of Albuquerque

In 1999 Reclamation entered into agreements with the City of Albuquerque that provide the framework for participation and cost sharing in their 67 million dollar arsenic demonstration project and non-potable water reclamation and reuse program.

<u>North I-25 Industrial and Non-Potable Surface Water Project</u>
The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) has completed the construction of this project and all users are connected. In 2008, these two projects beneficially consumptively used approximately 2,100 af of the 3,000 af permitted for the facilities during 2006. In 2008, ABCWUA also used about 500 AF during a pilot aquifer storage and recovery project on Bear Canyon arroyo. The combined consumptive use for these projects in 2008 was about 2,680 af of SJ-C water and all of the industrial reuse from the Sumitomo manufacturing plant.

<u>Southside Municipal Effluent Reuse Project</u>
The project design is undergoing a value engineering review to identify potential cost-savings that reflect changed field conditions. Once the value engineering review is complete, construction will commence. Construction is expected to begin in the summer of 2009.

<u>Arsenic Pilot Demonstration Project</u>
The Arsenic Pilot Demonstration Project was completed and began operations during 2008. The

project purifies and removes arsenic from two wells on the west side of Albuquerque (College No. 1 and No. 2), polishing about 5 million gallons per day of drinking water that meets or exceeds the EPA drinking water MCL for arsenic.

Alameda Arsenic Project

The engineering and financial feasibility study and NEPA compliance work began in 2008. The feasibility study and environmental assessment are expected to be completed in the summer of 2009. Reclamation review and approval will be required prior to proceeding with design and construction of the project. Design and construction are also contingent on receiving further federal matching funding. Request for this funding was submitted by ABCWUA to their Congressional Delegation.

City of El Paso

The City of El Paso has been using recycled water since 1963. Reclamation has contributed to El Paso's efforts since 1996 through Title XVI. El Paso currently recycles 700 million gallons of water per year through 40 miles of purple pipe. This recycle program has cost the City $36 million dollars with Reclamation's contribution of $8 million. Future plans are to extend the recycled water program to Fort Bliss, which would add an additional 10 million gallons of water per day and require an additional 5 miles of pipe. There was no progress on the Fort Bliss extension during 2007.

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 to 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). Plans are to use reverse osmosis and nano-filtration technology to reduce total dissolved solids levels (up to 2000 ppm) from the Montoya Drain to augment potable supplies. Consequently, the removal of sodium from the brine may render what has normally been a reverse osmosis waste product into a viable soil amendment that is rich in calcium and magnesium. This would eliminate the disposal costs associated with brine production as the "useful" salts would be discharged directly into the existing irrigation works of the Rio Grande Project. If this pilot study proves successful, a full sized production plant may be installed at the existing Canal Street surface Water Treatment Plant. This work has been on hold while the EPWU-PSB has concentrated on repair and upgrades to their infrastructure since the flooding in 2006. There is nothing new to report in 2008.

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). 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. URGWOM was developed by the Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) at the University of Colorado at Boulder

The continued development of URGWOM is overseen by the URGWOM Steering Committee, a collection of interested federal agencies and other signatories to a Memorandum of Understanding. Daily development is performed by the URGWOM Technical Team composed of modelers from Reclamation, the Army Corp of Engineers, USGS, ISC and consultant contractors to the aforementioned agencies, with contracted assistance from CADSWES.

The URGWOM accounting model has now completed its seventh year as the primary tool used by Reclamation for SJ-C and Rio Grande Compact accounting. The Nambé Falls Accounting Model was coded into the main Accounting Model, and was linked into the main URGWOM Accounting Model during 2008. URGWOM's water operations module was used to develop the 2008 Middle Rio Grande Annual Operating Plan, and to evaluate short-term operational scenarios for the ESA Collaborative Program.

URGWOM development during 2008 primarily concentrated on completing development of a groundwater-surface component in the Planning Model to achieve improve model performance related to achieving in-stream target flows, completion of documentation, clean-up of the water operations ruleset, and improvements to the Accounting Model and HDB interface. The primary use of URGWOM in 2008 was providing support to the development of a new Biological Assessment (new BA) using the Planning Model. One hundred and ten model runs were performed and run output analysis tools were developed. The URGWOM Technical Team and Sandia National Laboratory worked cooperatively during 2008 on refinements of a monthly time step model using the Sandia Powersim simulation software, and the development of stochastic hydrology for the new BO model runs.

Planned work for 2009 will concentrate on implementing the many new improvements and capabilities in RiverWare in URGWOM, including improvements to the user interface and model run setup, the shallow groundwater - surface water interaction simulation capability and construction of a Daily Water Operations Model, to better simulate daily water operations, including meeting in-stream flow targets, and functionality for daily use. Additional modeling work is also anticipated for the ESA Collaborative Program and the new BA, with a new Biological Opinion (BO) being sought for March 2010. 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/.

Water Accounting Reports Projects

2008 Rio Grande Compact Water Accounting

Reclamation attempted to use the current approved Compact Accounting process (RiverWare URGWOM Accounting Model→DSS→Lotus® spreadsheet) for all official water accounting during 2008. The Lotus spreadsheet is no longer stable or reliable, due to the size of the file and the lack of patches and version updates (Reclamation no longer supports Lotus). The new RiverWare URGWOM Accounting Model→Excel spreadsheet method is still under technical review by the ISC. The Excel® version of the Lotus® spreadsheet was used for 2008.

Excel Based Water Accounting Spreadsheet

Reclamation completed the development and testing of a fully functional Excel Spreadsheet/DSS version of the current Lotus spreadsheet/DSS Annual Water Accounting Report. The two spreadsheets were operated in parallel all year to test the logic and import/export functions of the Excel spreadsheet in comparison to results generated using the current Lotus spreadsheet. The Excel version uses the same DSS generated text files that are used as input for the Lotus spreadsheet. Improved documentation in the form of internal notes were incorporated within the Excel spreadsheet as it was developed. This project helped achieve Reclamation's policy directive to make Microsoft® Excel the standard spreadsheet software.

While the new Excel version of the Lotus spreadsheet was comparable to the Lotus spreadsheet, additional development in the RiverWare URGWOM Accounting Model itself has yielded data objects which now allow all accounting to occur and be saved directly in the RiverWare URGWOM Accounting model. Excel is only used to format the data tables – no calculations are performed in Excel. An extensive written technical review of this new method was performed and is available as a separate document. The review documents the sources of minor discrepancies between the accounting model and the Lotus/Excel spreadsheets, mostly due to rounding in the spreadsheets

This new RiverWare URGWOM Accounting Model→Excel® reporting method is viewed by Reclamation as an interim step in a process to achieve a RiverWare URGWOM Accounting Model→HDB→Crystal Reports® reporting method where accounting model data is stored in HDB, and Crystal Reports is used to query HDB for the data, and format data tables for annual reports.

During 2008, Reclamation sought approval from the Engineer Advisors to switch to the latest RiverWare URGWOM Accounting Model→Excel® report production method for 2008. RiverWare URGWOM Accounting Model→Excel® report production will compared directly with RiverWare URGWOM Accounting Model→HDB→Crystal Reports® reporting during 2009.

Water Accounting Documentation

Reclamation completed the documentation of the water accounting data sources and information used by both the RiverWare URGWOM Accounting Model →DSS→Lotus® Spreadsheet process as well as the RiverWare URGWOM Accounting Model →DSS→ Excel® Spreadsheet process during 2007. A copy of this documentation was provided to the Engineer Advisers to the

Rio Grande Compact Commission at the annual meeting on February 26, 2007. A copy of the research and documentation for the new RiverWare URGWOM Accounting Model→Excel® report production method was provided to the Engineer Advisors at the annual meeting on February 25-26, 2008. The Lotus® spreadsheet Reclamation has used for years is no longer supported or up-to-date with recent Accounting Model changes. The new RiverWare URGWOM Accounting Model→Excel® report production method needs review (and modification if required) and approval.

URGWOM Accounting Module enhancements in 2008 included implementation of RiverWare expression slots used to calculate and summarize monthly accounting for annual reports and conversion of RiverWare data management interfaces (DMIs) to use the Hydrologic Engineering Center's Data Storage System (HEC-DSS) file format (.dss) for direct input and output of model data from/to the URGWOM database, along with a direct connection to HDB from RiverWare. The expression slots improved the transparency of the accounting calculations since all the calculations used for annual reports are now located in the model. The conversions to HEC-DSS database data management interfaces (DBDMIs) facilitated moving the RiverWare modeling platform from a Solaris computer (UNIX based) to a PC (Windows based). The PC version of RiverWare is more efficient (decreased run time) and allows direct cut and paste of data from or to other Windows based applications for reporting and review. Conversion to DBDMI's also eliminated the use of ASCII RiverWare "control files", which are cumbersome to update and maintain.

Other changes made to the Accounting Module included adding a Santa Fe County account to Heron Reservoir in the model and adding a Santa Fe account at Elephant Butte to the model. In addition, the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) diversion along with related pass through accounts from Heron, El Vado, and Abiquiu, were added to the model. The addition of the ABCWUA diversion enables tracking of ABCWUA water from Heron Reservoir to the diversion point, allows application and tracking of San Juan – Chama loss rates on the water released for the diversion, and enables real-time release, diversion, and return flow data to be archived in the model for later report production.

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, DSS and models such as RiverWare. HDB was developed at the University of Colorado Center for Advanced Decision Support for Water and Environmental Systems (CU-CADSWES). HDB is now maintained by contract with Sutron /Ilex Engineering. 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. Several other Reclamation offices, including the Albuquerque Area Office (AAO), depend on HDB installations for the purposes of data storage and retrieval. The AAO instance of HDB was moved to the Salt Lake City Regional Office in 2008 for better administrative and operations support.

Development of water accounting and reporting functionalities for the Albuquerque Area Office's HDB installation continued during 2008. Water accounting data is now directly transferred from the RiverWare URGWOM Accounting Model to HDB via a new HDB/RiverWare Direction Data Connection interface. The intricacies of SJ-C water accounting such as contractor leases, transfers, borrow/payback, and deliveries are documented by annotating these transactions within HDB. The hand written "Green Book" and HDB water accounting annotations will be maintained in parallel while development and evaluation of the HDB water accounting functionalities continue. Other HDB developments completed during 2008 include completion of all water accounting report tables using the RiverWare URGWOM Accounting Model→HDB→Crystal Reports® (version XI) process to duplicate tables now generated using the RiverWare URGWOM Accounting Model→ Excel® Spreadsheet process. Improvements to DECODES, the Computation Processor, the Calculation Application, Compedit and the MetaData Application were accomplished to improve data storage and availability in 2008. Reclamation hopes to provide side-by-side comparisons of 2009 accounting tables generated with Excel® and Crystal Reports® as evidence of equivalent performance and acceptability. Reclamation hopes to use the URGWOM Accounting Model→HDB→Crystal Reports® method exclusively for 2010.

Reclamation's contractors have provided detailed documentation of all calculations as well as the mapping of URGWOM and Nambé Falls Accounting Model data slots to the annual report tables to the NMISC. The generation of water accounting report tables using the RiverWare URGWOM Accounting Model→HDB→Crystal Reports® method will allow data to be stored securely outside the model, and will open many potential new data distribution options for Reclamation, such as daily/weekly/monthly automated email/pdf and/or internet-based html-coded reports. All accounting data remains visible and transparent in the new Accounting Model report tables so HDB access is not required to review the data throughout the year.

Additional historic information about Reclamation's HDB development efforts can be found at this CU-CADSWES HDB web site: http://cadswes.colorado.edu/hydrodb.com/.

Planned work for 2009 includes continued work on DECODES, the Computation Processor, the Calculation Application, Compedit and the MetaData Application. Additional Crystal Reports (Version XI) accounting table reports for internal use and external reporting will also be developed. CADWES will also be developing Green Book annotation functionality in RiverWare® in 2009.

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 has developed an 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

The cumulative and river reach ET estimates are available daily for the URGWOM RiverWare models. RiverWare currently contains water accounting and ownership tools (objects) and peripheral water budget and flood routing tools (methods) that are configured for URGWOM. The ET Toolbox data, provided early every day for direct import into URGWOM, allows the model to more accurately reflect the physical conditions in the basin, and will allow daily water operation managers to make better water release decisions from upstream control structures when the daily water operations URGWOM model goes online.

Write-in funding for URGWOM improvements resulted in ET research and development (open-water / wet-sand data collection) on river channel evaporation during the summer of 2006. Unfortunately, the extreme monsoonal activity provided above average flow and humidity conditions during the field research. Data analysis and interpretation may result in new models for incorporation in the ET Toolbox for open-water / wet-sand evaporation in 2009. Improvements in and extensions of National Weather Service prediction products in 2007 now allow 7-day ET predictions (for use in URGWOM hypothetical simulation) at 1-kilometer resolution under the QPESUMS model, which replaced the 4x4 kilometer HRAP model grid cells in 2008. The hardware platform and operating system software that supports the ET toolbox was upgraded, and security measure challenges were overcome, while maintaining the Toolbox availability during 2008.

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, the Water 2025 Program, water right settlements, and special projects funded through Congressional write-ins.

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. A joint project between the Middle Rio Grande Conservancy District through the Reclamation Water 2025 Program and the Pueblo de Cochiti through the Native American Program is underway. It includes realigning, rebuilding, and concrete lining the Baca Lateral, a Middle Rio Grande Conservancy District facility which is being turned over to the Pueblo de Cochiti to become a pueblo ditch. A second Middle Rio Grande Conservancy District Facility, the Pena Blanca Lateral No. 2, is being replaced by pipe systems which will provide water to the same service area. The new pipe systems will also be tribal facilities. After laser leveling is completed on the lands served by the newly built facilities, irrigation delivery efficiency will be greatly improved.

Work is proceeding on negotiated settlements of the Abouselman adjudication on the Rio Jemez involving Jemez, Zia, and Santa Ana Pueblos, the Abeyta adjudication on tributaries of the Rio Grande which includes Taos Pueblo, and the Aamodt adjudication on tributaries of the Rio Grande which includes Pojoaque, Tesuque, Nambe, and San Ildefonso Pueblos. Aamodt Settlement legislation has been drafted, and if passed as currently written, would assign the un-contracted 2,990 acre-feet of San Juan Chama Project water to the Settlement, further increasing the cost and reducing the availability of minnow water.

Emergency Drought Program

Congress provided supplemental appropriations in Fiscal Year 2007 for emergency drought relief in the Reclamation states. In the Rio Grande basin, Reclamation is working through an interagency agreement with the U.S. Indian Health Service to relieve drought impacts by providing drinking water wells for the Pueblos of Acoma, Nambe, Isleta, and San Felipe. Wells will also be provided for community water systems in Regina and Brazos.