Rio Grande Project

Robert Autobee
Bureau of Reclamation
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At the twentieth century's first light, just as the Rio Grande Project reached completion, the mythic legend of the American West was beginning to wrap its two fists around the collective national conscious. Over the succeeding decades, the words "Rio Grande" still inspires images to most Americans of badlands, badmen, and the last stand of the law before crossing the United States-Mexico border. The reality of the Rio Grande Project demonstrated federal involvement in the development of the modern Western United States. Claiming and controlling this storm-water stream was a dream of engineers and settlers before the Bureau of Reclamation was ever imagined. A little more than a decade into the twentieth century, the recently minted U.S. Reclamation Service built the Rio Grande Project and succeeded in capturing spring runoff and summer rains, created one of the world's largest man-made lakes, and led the first international civil engineering effort to allocate water between the United States and Mexico.

Unfortunately, the people living along the river still wait for the harmony planners saw as the ultimate benefit of the Rio Grande Project. For people living on both sides of the border, the Rio Grande is a portal. It can be a path to employment, or it can lead down a road to oblivion, or death. Historically, the river is a turnstile, as Indian planters, Spanish conquistadors, Mexican tenant farmers and migrants, and Anglo homesteaders all have contributed and taken away during each of their intervals of control. In a place where there has been four centuries of confrontation, Reclamation wrote the first page of the Rio Grande's modern chapter. The Bureau's mission along the Rio Grande was not to erect paradise, but to introduce a measure of productivity where turmoil has often been the norm.

Project Location

Never a peaceful crossroads, the valleys of the Rio Grande, stand as islands of green growth bracketed by the stony soil, sagebrush, and rattlesnakes of the surrounding desert. Running linear to the Rio Grande River in New Mexico and Texas with a maximum width of 4.5

miles, the Project extends 165 miles north and forty miles southeast of El Paso, Texas. The water system for this narrow oasis features Elephant Butte and Caballo Dams, six diversion dams, 141 miles of canals, 462 miles of laterals, 457 miles of drains, and a hydroelectric plant. The Rio Grande flows through narrow gorges requiring diversion and canal systems for three valleys, the Rincon, Mesilla, and El Paso. This necklace of fertility blankets 178,000 acres in Dona Ana, Sierra and Socorro Counties in south-central New Mexico and the City and County of El Paso in west Texas. Sixty percent of Project lands are in New Mexico and the remaining 40 percent are in Texas. Supplemental drainage provides water for 18,000 acres in the Hudspeth County (Texas) Conservation and Reclamation District. An international treaty between Mexico and the United States guarantees an annual allowance of 60,000 acre-feet of water for diversion to Mexico at the city of Juarez.[1]

Over millennia, mud, silt and alluvial soils gathered and recessed along the banks of the Rio Grande. This alluvium supported sagebrush and mesquite for centuries before modern comprehensive irrigation designs introduced alfalfa, cotton, and grazing cattle. The source of modern irrigation in the project is Elephant Butte Dam and Reservoir some 124 miles north of El Paso, four miles east of Truth of Consequences, New Mexico, and a half mile from a lava capped hill for which it is named. Elephant Butte's companion structure, the Caballo Dam and Reservoir, is 25 miles downstream. The lower Rio Grande offers a 247 day growing season where temperatures can shoot up to 111 degrees Fahrenheit, and plummet to -16 degrees. Two-thirds of the annual precipitation of 7.8 inches is packed into the late summer and early fall when drought years have been sometimes suddenly interrupted by a torrent.[2]

Historic Setting

Spanish *entradas* into the interior of the United States were led by Alvar Núñez Cabeza de Vaca in 1536. He was a shipwreck victim wandering inland in search of a way to Mexico. Cabeza de Vaca's small group did find its way back to Mexico, but in the process the group

1. U.S., Department of Interior, Bureau of Reclamation, *Annual Project History, Rio Grande Project,* Vol. 69, 1980, 2.
2. Barbel Hannelore Schonfeld LaMar, *Water and Land in the Mesilla Valley, New Mexico: Reclamation and its Effects on Property Ownership and Agricultural Land Use,* Ph.d. diss., University of Oregon, Eugene, 1984, 21.

discovered an unexpected surprise. Near the present site of Juarez, Mexico, they found Indians irrigating and cultivating almost 30,000 acres of maize, beans and calabashes. The Spanish arrival instigated a hundred year test of wills between the Europeans and the Pueblos. At the dawn of the seventeenth century, a mission established by fathers at El Paso del Norte, (modern Juarez), began schooling the Indians in more advanced methods of growing crops, aided by water provided by the Acequia Madre (Main Canal). In 1680, an Indian revolt drove the Spanish and Christianized Indians south from New Mexico to present Juarez, Mexico, and Yselta, Texas. Don Diego De Vargas began the reconquest of New Mexico twelve years later, and the Spanish influence over the Rio Grande was cemented into place.

In the following 150 years, up to 40,000 acres of land were tilled along the river, most on what would later become Mexico. Once Mexico achieved its independence from Spain in 1821, Mexican settlers dug modest canal and diversion structures, and built a loose boulder dam. On the left bank of the river, Juan Maria Ponce de Leon in 1827 found modern El Paso. Almost immediately, colonists diverted water from above the boulder dam with no complaint from the residents of Juarez. At the close of the nineteenth century, 25,000 people lived on the U.S. and 25,000 on the Mexican sides of the Rio Grande.[3]

The New Mexican story on the lower Rio Grande began when Don Juan de Oñate led a party of colonizing Christians up the Rio Grande. Oñate's expedition first inhabited northern New Mexico in 1598. The events leading to development along the lower Rio Grande can be traced to 1805, when the Mexican government gave Don Juan Garcia a land grant near modern-day Las Cruces. Garcia's deed contained most of the land where the Rio Grande Project would unfold a century later.[4]

Relations between the United States and Mexico simmered and eventually boiled over in the Mexican War of the late 1840s. The signing of the Treaty of Guadalupe Hidalgo in 1848 ended the fighting between Mexico and the United States, and the U.S. took the northern frontier

3. B. M. Hall, *A Discussion of Past and Present Plans for Irrigation of the Rio Grande Valley*, (United States Reclamation Service: Nov., 1904), 2-4, 6; *El Paso Times*, 2 January 1890, p. 4-5.
4. Willis C. Boegli, "The Miracle of the Rio Grande," in *The Reclamation Era*, (March, 1953), 59-60.

of Mexico as the war's principal prize. However, settlers from the rest of America did not rush into west Texas and the New Mexico territory for a generation. Sparked by the construction of the Atchison, Topeka and Santa Fe Railroad from Albuquerque to El Paso in 1880, a few individuals populated the land along its line. Concurrently, the Denver and Rio Grande Railroad track expanded through the San Luis Valley in Colorado. By the mid-1890s, at the headwaters of the Rio Grande, settlers in southern Colorado constructed extensive irrigation systems to reclaim thousands of acres of land.[5]

The United States Geological Survey, (USGS), first investigated the Rio Grande in 1888. For the remainder of the nineteenth century, few streams in the West were studied more than was the Rio Grande above El Paso. During the 1890s, a series of official reports confirmed what was common knowledge along the borderlands -- the river was going dry by the time it reached El Paso. Incoming settlers and irrigated farming at the headwaters of the Rio Grande in Colorado, and settlements in central New Mexico, meant more dry summers for southern New Mexico and west Texas. In Colorado, an estimated 925 ditches were drawing water out of the Rio Grande before it left the state. In 1896, an International Boundary Commission report estimated the flow of the Rio Grande had decreased by 200,000 acre-feet a year since 1880. By the time it reached El Paso, one sardonic wit suggested the Rio Grande was the "only river with its bottom side up."[6]

Different types of storage works were proposed and discussed among the citizens, governments, and businesses of New Mexico, Texas, and Mexico. Instead of working together, conflicting interests, notably Mexico's claims for loss of water based on ancient prior right, prevented any of the plans to progress. At the turn of the century, the Rio Grande Dam & Irrigation Co. (RGD&IC) proposed to build a low dam with a limited storage capacity to serve only a few subscribers with no surplus diverted to Mexico. The lack of regard for Mexican water claims was shaping into an international crisis. One New Mexican settler wrote, the

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5. U.S., Department of Interior, Bureau of Reclamation, Record Group 115, (Hereafter RG 115), *Report on Floods and Drainage at San Marcial, New Mexico, Elephant Butte Reservoir*, (October, 1925), Box 718, File 500-25 RG.

6. Hall, *A Discussion of Past and Present Plans for Irrigation of the Rio Grande Valley*, 2-4, 6; Clint G. Smith, "Las Cruces Celebrates – Taming a Wild River," in *Reclamation Era*, (September, 1949): 206; Schonfeld La Mar, *Water and Land in the Mesilla Valley, New Mexico*, 33.

Mexican government's claim to the water was "so insistently urged as to cause some embarrassment to our Department of State." The State Department blocked RGD&IC with lawsuits, before the Supreme Court ruled against the dam promoters. RGD&IC's work halted in April, 1897, because of the burdens of too much litigation, an inability to receive construction permits, and dwindling funds.[7]

As the State Department shut out the RGD&IC in the courts, a door opened for the possibility of a federally built dam. The birth of the United States Reclamation Service (USRS) in June of 1902 propelled construction of a storage system on the Rio Grande to the top of the Federal government's "must do" list. Surveys of the bedrock in south-central New Mexico began in March, 1903, and a year later, the USRS settled on a site near Engle, New Mexico, where it would build a dam accomplishing "much for Mexico, and a great deal more for the United States."[8]

Below the conical peak of Elephant Butte, the Reclamation Service conceived a reservoir 175 feet deep at its lower end, and 40 miles long. With a storage capacity of 2 million acre feet the dam could furnish 600,000 acre feet a year of water for irrigation. Armed with a library of reports and a drafting table piled with designs, Reclamation captured the Rio Grande, but the voices of legislation and diplomacy still had to speak – in both Spanish and English.

Project Authorization

In 1905, it seemed all branches, and every agency of the federal government, wanted a dam to cross the Rio Grande. Congress ratified the construction of the Engle Dam on February 25, 1905. Later that year, both the Elephant Butte Water Users' Association, based in Las Cruces, New Mexico, and the El Paso Valley Water Users' Association, (later the El Paso County Water Improvement District No. 1), headquartered in El Paso, were formed. President of the El Paso association, Felix Martinez, led the drive for a federal storage project. Martinez was a important figure in El Paso's financial and political scenes, and through his newspaper, the *El*

7. U.S., Department of Interior, Bureau of Reclamation, *Annual Project History, Rio Grande Project,* Vol. 1, through 1912, 5; H. B. Holt, *Early History of the Elephant Butte Dam or Rio Grande Project*, (Las Cruces, New Mexico: Bronson Printing Company, 1946), 1; Smith, "Las Cruces–Taming a Wild River," 204.
8. *A Discussion of Past and Present Plans for Irrigation of the Rio Grande Valley*, 6-7.

Paso Daily News, supported a Federal project on the Rio Grande as early as 1899. An active 1905 concluded on December 2, when Interior Secretary Ethan A. Hitchcock authorized the project. Six months later, the authority of the Reclamation Act was extended to Texas on June 12, 1906. Previously, the state of Texas owned all its public land, exempting Reclamation from constructing irrigation projects. Two weeks later, the government signed a contract with the two water users' associations.

The Project would never be a success unless the United States and Mexico found a mutually agreeable water diversion plan. Negotiations over the Rio Grande produced the first civil engineering works to affect international allocation of water between the two nations. Under the terms of the treaty signed on May 21, 1906, Mexico received 60,000 acre-feet of water annually from the Rio Grande. In return, Mexico waived all claims to the river above the town of Fort Quitman, Texas, and all demands for past damages from water shortages. Providing initial seed money, Congress on March 4, 1907 appropriated $1 million under the direction of the Secretary of the Interior toward Project completion. The million dollars provided a start to a proposition estimated to eventually cost $7.2 million.[9]

Construction History

If one man can claim both parentage and mid-wifery of Elephant Butte Dam, it would be the second Director of the Reclamation Service, Arthur Powell Davis. Few men in Reclamation history have personally discovered the location of a future damsite, named the spot, and many years later, spoken at the dam's dedication. Before Reclamation's birth, the USGS sent the forty-one-year-old bespectacled and studious-looking Davis to lead a reconnaissance party in to the wilds of the territory of New Mexico to survey potential damsites. Davis's inspiration for the dam's eventual name came soon after his arrival at Engle, New Mexico. Recalling that day in April 1902, Davis said, "I had never seen this portion of the river, but as soon as I came in sight of the mountain there I at once said that that was Elephant Butte, as it looks so much like an

9. U.S., Department of Interior, Bureau of Reclamation, *Annual Project History, Rio Grande Project,* through 1912, Vol. 1, 10; "Elephant Butte Dam," in *Dams and Control Works*, (U.S. Government Printing Office, Washington, D.C., 1929), 40; "Felix Martinez, Rio Grande Project, New Mexico, in *Reclamation Record*, (April, 1915): 150-1.

elephant's head."[10]

A month later in his report to Washington, Davis stated that due to upstream diversions, the Rio Grande's yearly flow was impossible to predict. Further, the river conveyed so much silt, a large, deep reservoir was necessary to minimize evaporation. Also, a structure would have to provide ample capacity for holding surplus water over from wet to dry years. Like an illness, silt could shorten the life of any storage project. In spite of all the problems of getting the Rio Grande Project off the ground, control of the sediment flowing in the water quickly became the "most difficult and serious obstacle" in designing a reservoir. Despite whatever troubles lay ahead, one wishful thinker predicted this operation would be "more than a reclamation project. It is a great opportunity for constructive statesmanship and empire building." Consulting Engineer Louis C. Hill supervised the team responsible for the engineering and political success of the Project. Hill served from the commencement of operations until March 1, 1915. Homer J. Gault was the original construction engineer, succeed by E. H. Baldwin in October, 1912. Designing Engineer Fred Teichman oversaw the execution of the dam and outlet works.[11]

In the Reclamation Service's original plans, the storage dam stood 185 feet. However, following Davis' report, the height of the dam and capacity of the reservoir were both increased. Raising the dam's height meant the construction of a secondary earth and rock-fill embankment, and a more expensive spillway. First crews dug down a hundred feet below the riverbed to remove debris and ensure the stability of the foundation. During that excavation, crews dealt with cramped spaces and the danger of falling rock. At the time of the dam's completion, the dam rose 306 feet above the foundation.[12]

The Leasburg Diversion Dam was the first structure completed on the Project. It was built 62 miles north of El Paso at Leasburg, New Mexico, to replace the previous diversion dam which was "an obstruction built of poles, interwoven with twigs with stones for ballast." For

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10. "Address of Arthur P. Davis, Director and Chief Engineer of the Reclamation Service, at the Dedication of the Elephant Butte Dam, New Mexico, October 19, 1916," in *Reclamation Record*, (December, 1916): 554.
11. *Dams and Control Works*, 40, 43; RG 115, *Proposal for the Completion of the Rio Grande Project*, Box 71; *Annual Project History, Rio Grande Project*, Vol. 1, through 1912, 7.
12. *Dams and Control Works*, 40.

years a community ditch at the head of the upper Mesilla Valley had served Spaniards, Mexicans, and Americans. Work commenced on the new diversion November 20, 1906. Designed as a 10 foot high, 600 foot long rubble concrete weir, with a 1,500 foot earthen dike extension at the dam's west end, Reclamation built the weir is built on piling driven 20 to 25 feet into the silt of the riverbed. A reinforced concrete apron, 23 feet wide and two feet thick, directs water flowing over the weir away from the dam. The Leasburg Diversion Dam, built at a construction cost of $210,000, diverted its first water in 1908. The 13.7 mile long canal with an initial capacity of 625 cubic feet per second (cfs) provided water to 31,600 acres. The Picacho Flume, nine miles south of Leasburg Diversion Dam, is a 502 foot long steel truss structure carrying water on the Leasburg Canal over the Rio Grande. Two support structures, the Picacho North Dam and Picacho South Dam, were both added to the system in the early 1950s. The two zoned earthfill dams are on the north and south branches of the Picacho Arroyo, five miles northwest of Las Cruces.[13]

The rapid mobilization of the Leasburg system was soon overshadowed by a showdown over the Elephant Butte Dam. Haggling over money threatened to halt Reclamation from proceeding with the dam and reservoir. In the spring of 1909, the Reclamation Service and the Victorio Land & Cattle Co. of Bakersfield, Calif., could not agree on the value of 33,640 acres of land composing three-quarters of the proposed Elephant Butte Dam, Reservoir, and allocated railroad right-of-way. Victorio Land & Cattle asked $600,000, while Reclamation offered $65,000. The standoff between both parties halted work on May 1, 1909. A series of prolonged condemnation hearings over the next three years in a New Mexico court resulted in the land company receiving $200,000 for 30,000 acres.[14]

In the three years while lawyers and landowners argued, Reclamation built the Elephant Butte workers camp, and 12.8 miles of railroad to connect with the Santa Fe Railroad at Engle.

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13. "The Engle Dam and Reservoir, Rio Grande Project, U.S. Reclamation Service," in *Engineering News*, (August 18, 1910): 168; *Annual Project History, Rio Grande Project*, Vol. 69, 1980, 2; "Las Cruces Celebrates – Taming a Wild River," 203; Arthur Powell Davis, *Irrigation Works Constructed by the United States Government*, (New York: John Wiley and Sons, 1917): 236.
14. *Annual Project History, Rio Grande Project*, Vol. 1, through 1912, 15-7.

Surveys for the railroad began in 1908, with track first laid in December 1910 and the final spike driven in early 1911. The train carried supplies to the camp from Engle three times a week. The rolling stock included two sight-seeing cars for visitors interested in watching progress on the dam. Workers also built 19 miles of roads and a 300 foot highway bridge across the Rio Grande.[15]

Rubble concrete with a smooth concrete face, better known as Masonry, served as the surface of the Elephant Butte Dam. The dam's first concrete was poured on June 3, 1913. From that day forward all operations were timed to produce the greatest possible pouring of concrete in the shortest amount of time. Due to the wild fluctuations of temperatures, engineers believed the seams would open over time in the dam's foundation. The Reclamation Service decided to conduct masonry operations paralleling the foundation excavation. Trying to avoid cracks in the dam's upstream face, a coat of commercial mortar known as "Gunite" was first shot out of a cement gun in March 1914. A team of six men sprayed the oatmeal-thick material through a 1.25 inch rubber hose. A mixture of 48 per cent pulverized sandstone obtained from three nearby quarries was blended with 52 per cent commercial Portland cement combined to form the 611,000 cubic yards finishing the completed dam.[16]

Fixed 350 feet above the heads of those clearing the foundation and pouring concrete in the riverbed, a three cable system carried concrete to the steadily rising dam. The cableway spanned 1,400 feet, and delivered an average of 125 1.75 cubic foot buckets of concrete during an eight-hour shift. Power was provided by a 300 horsepower electric motor.[17]

The dam's original height was 306 feet with its crest spanning 1,674 feet, a base width of 228 feet narrowing to a top width of 18 feet. Concrete lampposts stand watch over the dam's downstream side along the 16 foot wide road at the dam's crest. The straight gravity, thick concrete design did not initiate any radical departures in engineering practices common in the

15. *Dams and Control Works*, 40; L. J. Charles, "The Elephant Butte Railroad," in *Reclamation Record*, (July, 1916): 323.
16. E. H. Baldwin, "Placing Masonry for the Elephant Butte Dam, New Mexico," in *Engineering News*, (September 30, 1915): 645, 648; RG 115, *Reports on Cement Gun and Grouting Operations, Elephant Butte Dam, June 30, 1916*, Box 720; Joseph E. Sater, "Interesting Comparisons of Elephant Butte and Arrowrock Dams," in *Reclamation Record*, (October, 1917): 474.
17. *Dams and Control Works*, 41.

early twentieth century. During construction, the Rio Grande was diverted through a lumber flume built on a bench excavated on the right bank. Concrete replaced timber once the flume crossed the dam site and was incorporated into the dam.

In the summer of 1914, on the upstream side of the dam, blocks of masonry about 100 feet long of different heights grew up from the riverbed. Contraction joints between the blocks provided frequent vertical off-sets to discourage the passage of water. A block grew to a height of 20 feet before the contraction joints were coated with heavy oil to prevent adhesion, then a new block started against it. This confined expansion and contraction from changes in temperature, avoiding cracks in the dam's face. Teams of four and five men spaded the concrete against the forms and sides of imbedded large rocks, known as plumstones. When a layer of concrete reached sufficient thickness, plumstones were embedded in the material with the aid of a derrick. Eventually, plumstones accounted for 15 percent of the dam's volume. While construction on the main dam proceeded, work continued a mile to the west on the Elephant Butte Dike. The Dike plugs a saddle in the spur of hills running northwesterly across from the main structure. The earth and rock fill dike is 59 feet high and 2,000 feet long and cost $266,086 to complete.[18]

The dam's spillway evolved rather than soared in one rapid movement. The crest and gate outlets were finished in 1916, but construction on the transition channel and downstream chute concluded six years later. The delay occurred, in part, when engineers discovered better foundation rock, and a potential savings, if the chute was rerouted.[19]

As Elephant Butte went into service, other important diversion works on the Project formed arteries moving water irrigate to lands. Reconstruction of the Franklin Canal led the way, followed by the construction of the Mesilla Diversion Dam, the East and West Side Canals, the Percha Diversion Dam, and the Rincon Valley Canal.

The oldest feature in service, the Franklin Canal, was originally constructed by the El Paso Irrigation Company, a private firm, in 1889. Reclamation acquired the canal in 1912, and it

18. *Ibid.*, 42-3; Baldwin, "The Construction of Elephant Butte Dam," 264.
19. *Dams and Control Works*, 40.

presently extends 31 miles with an initial capacity of 325 cfs to cover 18,500 acres of the upper El Paso Valley. Twenty-five miles below Elephant Butte, the reinforced concrete Percha Diversion Dam is 350 feet long, required 15 months of work before its completion in 1918, and cost approximately $139,000. The dam's base is set six feet below the riverbed, and when raised, eight radial or "Taintor" gates lift the level of the river six feet above its normal elevation. Rincon Valley Canal travels twenty-seven miles southeast from Percha Diversion Dam with a capacity of 350 feet to water 16,260 acres in the Rincon Valley. The canal was completed in 1919.[20]

Although more than a year's work remained before completion of the Elephant Butte Dam, by January 1915 farmers on the Project received their first deliveries of water. The visually intriguing Mesilla Diversion Dam diverted water into the East and West Side Canals for 54,000 acres in the central and southern Mesilla Valley. Mesilla Diversion Dam is a low concrete weir, twenty-two feet high and 303 feet long carrying a highway bridge. The striking feature of this dam are the thirteen Taintor gates installed on the concrete crest, extending the full length of the dam. The bridge is buttressed by 13 concrete spans giving the entire structure a clean, linear design. The East Side Canal runs for 13.5 miles with an initial capacity of 300 cubic feet per second (cfs), and was completed to its current specifications in 1919. Brought into service a year later, the West Side Canal, reached its present length of 27.9 miles in 1920, and boasts of a capacity of 650 cfs. Almost 33 miles southeast of Las Cruces, the West Side Canal crosses under the river in the Montoya Siphon. The siphon travels an additional 468 feet.[21]

The first fifteen years of the twentieth century were the lowest point in relations between the United States and Mexico since the Mexican War. The Mexican Revolution erupted in 1910, just as Reclamation was progressing on construction of the Elephant Butte campsite. Events for six years were contained within the borders of Mexico, until March 9, 1916, when only 60 miles southwest of El Paso, a band led by Pancho Villa crossed the border and killed 16 American

20. L. M. Lawson, "Percha Diversion Dam," in *Reclamation Record*, (May, 1918): 234; "Diversion Dams on the Rio Grande," in *Dams and Control Works*, 6.
21. *Annual Project History, Rio Grande Project*, Vol. 69, 1980, 2; *Dams and Control Works*, 6-7.

citizens in Columbus, New Mexico. Nine days later, on March 18, a letter from Acting Chief of Construction L. J. Charles, to Construction Engineer E. H. Baldwin, detected a ripple of tension in camp resulting from Villa's activities. Charles wrote, "Conditions on the border are beginning to be felt in the labor here. There is no danger of trouble unless some drunken specimen of either race should start it; then it is difficult to tell just where it would end." Fortunately, much of the work on the dam concluded by the time of Villa's raid.[22]

Anxiety between the Rio Grande's Mexican-Americans, Mexicans, and Anglo-Americans existed before the Project was imagined, but the opportunity for steady work exacerbated relations between all groups. Reclamation decided Elephant Butte would be completed by force account to prevent delays common with contractors. The secretary of El Paso's Central Labor Union, E. D. Skinner, feared a large number of American citizens would be "begging for food on our streets" while the contractors would hire "cheap, imported, foreign paupers" from across the border. Skinner, and his membership, were in frequent contact with the state's Senators and the Secretary of Labor, William B. Wilson throughout 1914. The growing dissatisfaction among Anglo workers prompted Director Frederick H. Newell to look into the matter. Newell wrote to Texas Senator Morris Sheppard, advocating any man, "claiming American citizenship, whether speaking English or not, is eligible for employment, as it is obviously impossible to discriminate between the different classes of Americans. The only discrimination exercised has been to employ local labor and teams of water users as much as possible."[23]

Reclamation staffers met with the Central Labor Union in El Paso to clear up the "misconception of our operations and methods," but resentment against Mexican labor continued throughout construction. The jobs workers of both nationalities wanted paid $1.25 to $1.50 a day for concrete, mixing, placing and finishing jobs. Skilled laborers made from $2.00 to $2.50. Jobs on the damsite's periphery, like blacksmith, plow driver, teamster, and carpenter, averaged from $1.25 to $4.00 per day. An aggregate of twelve hundred men were employed at Elephant

22. U.S., Department of Interior, Bureau of Reclamation, *Rio Grande Project*, RG 115, General Correspondence, Box 1178, File 251; *Dams and Control Works*, 40.
23. RG 115, *Rio Grande Project*, General Correspondence, Box 1178, File 251.

Butte from 1914 to 1916. The overall population of the camps fluctuated between 2,500 to 3,000. The arena of chaos that is the border between Mexico and the United States, Reclamation safely claimed almost two-thirds of the population of the Elephant Butte camp were of "Mexican stock." Work went on day and night, with Sundays reserved for rest, except the unfortunate few assigned to repair machinery. After sunset, a lighting system cast the laborers' long shadows against the canyon and concrete.[24]

In a time and a place divided by a border, culture and language, it followed the laborers' camps were segregated. The "Upper Town" was home to the engineering and office force, featuring two churches and a movie theater. The "Lower Town" housed the foremen, mechanics, laborers. Within the Lower Town existed a further division between the American and Mexican quarters. A Mexican family ran their own boarding house, furnishing meals at a price lower than the 25 cents charged at the Reclamation Service mess. A Service commentator noted the family provided food "more agreeable to the Mexican laborers." The Upper Town's main office, mess hall, chemical laboratory, and management cottages were of adobe. A one-room school housed ten or twelve children, taught by Chief Engineer Baldwin's daughter, Mabel. Housing, other structures in the Lower camp were of canvas, wood, adobe, or a combination of the three. Mexican workers and their families in the Lower Town were described as "illy (sic) clothed, and a high percent illy (sic) fed." Water for the camps and construction was even-handedly distributed from wells sunk in the sands of the river bottom.[25]

A detailed record of survival in the federal bivouac is found in the reports and articles written by the camp doctor, J. Dale Graham. From 1914, until the dam's completion two years later, he dealt with and chronicled his attempts to fight disease in a land where communal living

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24. RG 115, *Rio Grande Project*, General Correspondence, Box 1178, File 251; *Dams and Control Works*, 40-1; U.S., Department of Interior, United States Reclamation Service, *History of Elephant Butte Storage Unit, Jan. 1 to Dec. 31, 1914*, 19; E. H. Baldwin, "The Construction of Elephant Butte Dam," in *Reclamation Record*, (July-August, 1914): 264.

25. J. Dale Graham, "Construction Camp, Elephant Butte, New Mexico," in *Engineering News*, (Dec. 31, 1914): 1300; *History of Elephant Butte Storage Unit, Jan. 1 to Dec. 31, 1914*, 70; Baldwin, "The Construction of Elephant Butte Dam," 264; Sophie M. Hedrick, "Memories of Life at Elephant Butte, 1911-6," Bureau of Reclamation, Southwest Region Office, Amarillo, Texas: no date, 1; U.S., Department of Interior, United States Reclamation Service, *Report on Construction of Embankment, Elephant Butte Reservoir, Rio Grande Project*, (April 30, 1916), 15.

was a risky prospect. As measles and diphtheria reached epidemic levels, fourteen people died from a variety of illnesses during Elephant Butte's construction. Measles, with complications killed many children in the Mexican quarter. Dr. Graham regarded the Mexican population as "well-housed," but he felt "their method of living. . . did not tend to promote good health." Drinking the water from a nearby hot springs was discouraged, so a character named "Burro Jim" sold water he gathered from a spring near the town of Williamsburg at a nickle a bucket. The moral and physical well-being of the worker's town was kept on a tight rein. Exercise was encouraged, and excessive drinking by an employee would result in dismissal. Another continual battle was the removal of stable, human, and kitchen wastes and the flies they would bring. A sanitary officer responsible to Dr. Graham policed the camp daily. Graham defined his role in military terms, "The price of good sanitation is an eternal fight -- a continuous campaign."[26]

After four years of non-stop work from 1912 to 1916, the cost of the dam and reservoir came to a little over $5.2 million. Reclamation's Statistician, C. J. Blanchard, characterized the Rio Grande Project as "The Peacemaker," upon its completion. He prophesied the dam would end international and interstate bickering over water shortages which "often resulted in personal violence." Blanchard was correct in so far as the new dam cooled a good deal of friction from any possible international incidents, but the immediate result of the dam's opening irritated a wound between two groups trying to abide together in this country.[27]

Post-Construction History

Two surprises typify the trial-and-error nature of both the early reclamation efforts and the Rio Grande Project in its first decade of service. In the first two delivery seasons, farmers, not used to plentiful water, flooded their acreage, requiring the digging of an extensive drain system. Some over-irrigated their fields with as much as six to eight acre-feet of water per acre, believing the greater the applications of water, the greater the yields. Additionally, the lands

26. RG 115, *Hospital Operation and Camp Sanitation*, (June 30, 1916), Box 728; Graham, "Construction Camp, Elephant Butte, New Mexico," 1303-4.
27. *Reclamation Record*, (June, 1916): 245.

along the river were also cursed by a high water table. In the Mesilla Valley, croplands rose nearly nine feet between 1905 and 1917. Reclamation's plans for a drainage system was initially met by angry farmers unwilling to pay for construction out of their own pockets. Authorities, like the local Farm Bureaus and county agents, persuaded a stubborn few there was no other way to regain and maintain their acreage. Digging began in 1917, and three years later, there was noticeably less standing water in the Project's fields. A 457-mile network of open drains, covering all of the valleys, was completed in 1925.[28]

As soon as the drainage situation was under control, a massive flood called upon the people along the Rio Grande, and the federal government, to further modernize their water and power gathering capabilities. In arid lands, rain brings welcome surprises. However, in the late summer of 1925, floods arrived like unwanted guests. In August and September 1925, flash flooding west of the river submerged residential southeastern El Paso and crop land in the Mesilla and El Paso valleys. Texans and New Mexicans realized it was time to build a second storage dam to catch the runoff from the nearby Black Range. They also wanted to supply year-round electric power from Elephant Butte Dam, and provide extra storage to replace any capacity of Elephant Butte Reservoir lost to silt. A decade would pass before an allotment from the State Department through the Public Works Administration (PWA) furnished Reclamation with the funding for a flood control unit. In October, 1935, Reclamation brought $1.5 million back to the Rio Grande.[29]

Previous to construction of a second dam on the lower Rio Grande, additional features were completed between the 1920s and the 1940s. Finished in 1928, the Riverside Diversion Dam, the southernmost Project diversion point, is 15 miles southeast of El Paso, and diverts water into the Riverside Canal. The dam stands 17.5 feet high, and is a radial-gate concrete structure flanked by river levees. The accompanying canal is 17.1 miles long, serves 39,000 acres in the lower portion of the valley, and delivers surplus to the Hudspeth County

28. *Water and Land in the Mesilla Valley, New Mexico,* 102, 104.
29. "The Rio Grande Floods of 1925," in *New Reclamation Era*, (November, 1925): 173-4; Ruth Ellen Ballmer, "Caballo Dam, New Mexico," in *The Reclamation Era*, (December, 1936): 284-5.

Conservation and Reclamation District, southeast of El Paso. The Tornillo Canal extends 12 miles from the Riverside Canal with a 325 cfs capacity. Riverside Canal took from 1927 to 1940 to complete, while construction on the Tornillo Canal was a comparatively brief two year period from 1923-24.[30]

Beginning in the summer of 1936, giant diesel shovels, carryalls, and caterpillars pushed at and dug in the foothills of the Caballo, "Horse" Mountains. Mittry Bros. Construction Co. of Los Angeles received the contract for construction of Caballo Dam on May 2, 1936, and work began a month later. The 96 feet high earth and rockfill dam is composed of clay, sand, and gravel compacted in layers six inches thick. The 4,558 feet long upstream face is protected with riprap and the downstream face with rockfill. The dam's right abutment rises so gradually that it has the appearance of being on level ground. Reclamation placed Caballo Reservoir downstream from Elephant Butte Dam and planned for water released for winter power generation at Elephant Butte Powerplant to be stored in the 343,990 acre-feet capacity Caballo Reservoir for irrigation in the summer.

The dam's spillway is located on the left abutment and features a concrete-lined inlet channel. Flow is controlled by two 50-by-21 foot automatic radial gates. The channel provides overflow capacity for flood waters if a large flood occurs at a time when the reservoir is at capacity. An outlet tunnel provides irrigation water to flow down to the canals and laterals below the dam. The tunnel is 13 feet, six inches in diameter and 18 inches thick. The spillway is 108 feet wide and 21 feet deep at its gates. On the north slope of a small hill between Hatch and Hot Springs, New Mexico, the Caballo camp town was less wild and wooly, but a lot more hygienic, than its Elephant Butte predecessor. Twelve residences of various sizes housed the engineers, and a dormitory held bunks for 200 laborers. Work concluded in September 1938 with the final cost of the Caballo Dam and Reservoir totaling a little over $2.1 million.[31]

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30. U.S., Department of Interior, Water and Power Resources Service, *Project Data*, (Denver: United States Government Printing Office: 1981), 1051, 1057.
31. RG 115, Rio Grande Project, General Correspondence, Box 1177, File 251; "Caballo Dam on Rio Grande to Store 350,000 ac. ft.," in *Western Construction News*, (September, 1936): 294; U.S., Department of Interior, Bureau of Reclamation, *Annual Project History, Rio Grande Project*, Vol. 27, 1938, 43.

Completion of Caballo Reservoir also resulted in the construction of a full-time power plant at the Elephant Butte damsite. During Elephant Butte's construction, gates and six penstock openings were built into the dam for hydroelectric power. However, demand among rural consumers was non-existent, so hydroelectric plans were shelved. As irrigation lured new landowners, interest in electrical power grew, and plans for a powerplant located next to the downstream face of the dam were approved. Funding for Elephant Butte power development came twenty-one years after completion of the dam in the Interior Department Appropriation Act of 1937. The modern power system consists of a 24,300-kilowatt hydroelectric plant, and service is provided over 490 miles through 115-kilovolt transmission lines assisted by 11 substations. Final cost of the Elephant Butte powerplant totaled $1.5 million. The government operated the system from 1940, until its sale to the Plains Electric Generation and Transmission Cooperative, Inc., in 1979.[32]

A mile-and-a-half downstream from the Caballo Dam is the rock-faced, earthfill Percha Arroyo Diversion Dam, named for a stream joining the Rio Grande from the west. Usually dry, but potentially dangerous in rainy years, the Percha Arroyo's flow is diverted by the dam through an open channel which flows into the Caballo Reservoir about 3/4 miles upstream from the dam.[33]

Constructed in 1938 to satisfy a Rio Grande treaty between the U.S. and Mexico, the American Diversion Dam sits two miles northwest of the city of El Paso and diverts water to the El Paso Valley. It is operated by the American Section of the International Boundary and Water Commission (IBWC) to regulate delivery of water to Mexico in accordance with treaty provisions. The radial gate structure is 18 feet high and 286 feet long with earth fill dikes. The American Canal carries a maximum 1,200 cfs for 2.1 miles from the dam to the head of the Franklin Canal.[34]

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32. "Elephant Butte Power," in *The Reclamation Era*, (April, 1940): 109; *Project Data*, 1049; "Las Cruces Celebrates – Taming a Wild River," 204, 206.
33. U.S., Department of Interior, Bureau of Reclamation, *SEED Report on Caballo Dam*, (Denver: 1982), 1-2, 4; "Caballo Dam to Store 350,000 ac. ft," 295; Ballmer, "Caballo Dam, New Mexico," 284-5.
34. *Annual Project History, Rio Grande Project*, Vol. 69, 1980, 2; U.S., Department of Interior, Bureau of Reclamation, *Repayment of Reclamation Projects*, (United States Government Printing Office: Washington, D.C., (continued...)

The value of Elephant Butte and Caballo Reservoirs revealed themselves in the turbulent 1940s. The decade began on a high note, as water splashed for the first time over the Elephant Butte spillway in late June 1941, twenty-five years after the pouring of the last barrel of concrete. In a period of six months, from December 1940 to June 1941, the Elephant Butte Reservoir went from a near record low to record high storage. El Paso newspapers made the run-off big news, as the story competed with Nazi Germany's invasion of the Soviet Union on the city's front pages during the last week of June, 1941. The surplus did not last long, since a lingering drought lasted from 1943 to 1952. Little snow in the Rocky Mountains meant minuscule run-off, and only a remaining trickle by the time the river entered southern New Mexico. During nine straight years of drought there was a shortage of over a million acre-feet. Farmers responded by planting crops requiring little water, drilled 700 wells, and practiced through strict conservation. Using only 50 percent of the usual water supply, members of both water districts raised $45 million worth of crops in 1951 -- $3 million more than the previous year.[35]

In spite of the drought, work was channeled into maintenance activities during the 1940s and 1950s. A few years before excess water gushed over the spillway, engineers identified that it could not withstand a flood. Reclamation built a redesigned spillway between 1947 and 1949, featuring permanent training walls and channel covers to force the flow to change its direction and not pile against the walls. Patching of the cracks in the spillway structure and tunnels, and an elaborate foundation grouting were all completed during the same period. Operating at low water conditions for most of its life has kept Elephant Butte Dam in satisfactory condition despite almost 80 years of use. The only visible signs of age are gaps left by thin broken chips of concrete, known as spalling, marring the dam's downstream face.[36]

Settlement of the Project

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34. (...continued)
1972), 393.
35. *El Paso Times*, 30 June 1941, p. 1; 1 July 1941, p. 5; Ralph Bristol, "Defeating the Rio Grande Drought," in *The Reclamation Era*, (June, 1952): 139-40.
36. U.S., Department of Interior, Bureau of Reclamation, *SEED Report on Elephant Butte Dam*, (Denver: 1981), 5, 8, 34.

Struggling to keep himself and his ship from burning up during re-entry into Earth's atmosphere, the first American to orbit the Earth, John Glenn, allowed himself a moment for an observation. As his capsule passed over the North American continent, he noted "a green ribbon" separate from the white-brown barrenness of the U.S.-Mexican border. Glenn's comment in 1962, certified the development of the Rio Grande had made an impact on the earth's surface.[37]

However, within that green ribbon, few beneficial milestones touched many of the people who tilled the valley before space travel was ever contemplated. Elephant Butte's completion signaled a wave of land speculation that shoved Mexican-Americans to second class status. In 1905, the largest valley on project -- the Mesilla -- was almost totally in private ownership with a third of the land under irrigation. In the valley, approximately 80 percent of the population were former Mexican-Americans, and the remaining 20 percent were Americans of European descent. Within a decade, however, claims to the land were changed by an influx of twentieth century promoters with different values. The Secretary of Immigration for the Elephant Butte Water Users Association, H. B. Link, captured the mood of the time and place when he stated, "We are not here to 'sell land to suckers,'" but many of his fellow Anglo landowners, "have tired of renting to Mexicans, and these are listing occasional tracts for leasing to good American farmers."[38]

A number of Hispanics found themselves as "tenant farmers, farm laborers, or menial urban workers." A few years after Elephant Butte's completion, many former Hispanic landholders were paid $1 to $1.50 for a day in the field. Old attitudes caused one source to sniff, "Mexican laborers when handled right are as good as any common labor that has been available in other parts of the United States." The unexpected popularity of growing cotton on Project lands in the 1920s, introduced sharecropping on farms of several hundred acres. In addition to victimization by cultural prejudices, most picking cotton had faced foreclosure, tax sale, or

37. "Elephant Butte Dam," in *Reclamation Era,* Vol. 64, nos. 1 and 2, 22.
38. H. B. Link, "Helping the Farmers to Help Themselves," in *Reclamation Record*, (November, 1915): 512; H. B. Link, "Cooperation Under the Elephant Butte Project," in *Reclamation Record*, (October, 1915): 462; *Water and Land in the Mesilla Valley, New Mexico*, 268.

recently escaped the poverty of Mexico. Occasionally, some fortunate Hispanic landowners made the switch from growing alfalfa and beans to cotton with great success, and from the 1920s forward, planted most of their acreage in cotton. Unfortunately, for most Mexican-Americans during the decades when cotton was king of the Rio Grande, it was if the Old South found a home in the New Southwest.[39]

The first wave of Anglo landowners were for the most part lured by advertisements and feature stories in publications as diverse as the *Farmers' Mail and Breeze* of Topeka, Kansas, the *St. Louis Globe Democrat*, and *Scientific American*. However, interest across the rest of the nation was slow to build. Speaking in El Paso in 1923, David W. Davis, a few months away from becoming the Commissioner of Reclamation, chastised locals for a decade's failure of colonization efforts stemming from land prices "unduly inflated" and settlers not receiving "fair treatment" from developers. The economic mastery of Rio Grande's white landowners would become noticeable only after the completion of Caballo Dam. By the 1940s, many Anglo farmers were able to afford farm machinery to clear and cultivate larger pieces of land. Another sign of cultural transformation and prosperity was fewer new dwellings built of plastered adobe, as modern houses of wood, pre-fabricated brick, and double insulated building board sprang up -- materials not readily available in the local biosphere.[40]

After World War I, the Las Cruces headquarters of the Elephant Butte Irrigation District, got the promotional jump on other areas of the Project. Calling the surrounding farmland the "Temple of Agriculture," some outsiders made the pilgrimage to southern New Mexico. Promoters in and around El Paso took longer to form their own booster group, the Gateway Club. One observer of the Gateway Club's efforts groused that among the people of El Paso there was as much interest in the Rio Grande Project as "in the addition of a wing to the local post office." El Paso's nonchalant attitude changed by the 1920s, as the city's political and economic masters realized the importance to the city's development of sound cattle and

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39. *Water and Land in the Mesilla Valley, New Mexico,* 227, 282.
40. *Ibid*., 259; R.E. Bassett, "Advertising and Immigration Work," in *Reclamation Record,* (October, 1914): 374; "The Valleys of Elephant Butte," in *Reclamation Record,* (September, 1921): 419-20.

agricultural industries in outlying areas. At the start of World War II, an influx of war jobs, and the growth of Fort Bliss, made it necessary for the city to purchase Project lands in order to obtain water rights for its increasing domestic needs. The two largest cities on the Project, Las Cruces and El Paso, were sucked into the suburban maelstrom of post-World War II America, and some original Project lands are now part of subdivisions.[41]

The fractious life of the Rio Grande continued to ebb and flow into recent times. The migration of undocumented Mexicans into the United States captured America's attention in the 1970s and has not let go since. An increase in illegal crossings forced Reclamation in 1980, to warn employees of "possible danger" as they worked along the Rio Grande border, due to "several angry confrontations" between refugees from Mexico and border patrol agents.[42]

After almost a hundred years of migration from other parts of the United States, the demographic scales in the Project's four counties were altered in the late twentieth century. In three rural New Mexican counties of Dona Ana, Socorro, and Sierra, whites outnumber those of Hispanic origin by 144,111 to 85,884. In El Paso County, Texas, the figures are much closer (452,512 White to 411,619 Hispanic), but this reflects more the makeup of the city of El Paso than who is farming the valley.[43]

Uses of Project Water

Centuries of sediment provided the Rio Grande's fertile soil. Unfortunately, the river's flow carries so much fine brownish-gray silt, that over time, islands of mud have piled against the Project's dams. A 1925 Reclamation study determined that the river carries 1.65 per cent silt in its annual flow. Over Elephant Butte Reservoir's first 25 years, the lake lost 16 percent of its total capacity to silt, or enough water to irrigate 5,000 to 7,000 additional acres of land each year. Ignoring the potential damage of mounting sediment, supporters boasted the water in the completed reservoir could cover "Massachusetts to a depth of six inches." However, by 1980,

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41. F. E. Schmitt, "Through the Reclamation Country," in *Engineering News-Record*, (December 6, 1923): 919.
42. *Annual Project History, Rio Grande Project*, Vol. 69, 1980, 8.
43. U.S., Department of Commerce, Bureau of Census, *1990 Census of Population and Housing, Mountain Division*, Summary Tape File 1A, (Washington, D.C.: 1991); *1990 Census of Population and Housing, Texas*, Summary Tape File 1A, (Washington, D.C.: 1991).

the reservoir's surface area had shrunk from 42,000 acres to 36,987 acres and its capacity dipped from 2,638,000 acre-feet to 2,110,298 acre-feet. The situation was first traced to flash flooding along untimbered tributaries in central New Mexico after Elephant Butte's completion, and later advanced mechanized farming methods breaking up larger areas of soil previously tilled by stone hoes. The Reclamation estimate from the mid-1920s predicted the world's then largest man-made reservoir to last 233 years. In making good that forecast, the Bureau will have to implement innovative methods of regulating silt and mud brought by the river in the future.[44]

Concurrent with the rise of the Elephant Butte Dam, prices for unimproved land shot up. At the beginning of construction in 1906, land averaged $17.50 an acre. Seven years later, the value of the same unimproved ground was $50 to $75 an acre. A few years later, developed orchard and garden tracts within 10 miles of El Paso sold for $650 to $1,200 an acre. In the early days of the Rio Grande Project, nearly three-fifths of the land was in large tracts held by a few owners, necessitating excess acreage to be sold under the 160-acre limit of the Reclamation Act. All the descriptions and advertisements in mid-western publications could not avoid the stories reaching back east of over-inflated prices for Project property. Prospective landowners faced amortization, interest on land purchases, and irrigation construction costs. Eventually, the government purchased land and under a system of organized aid and direction offered low interest rates with long-term credit. Repayment for all construction totaled $6.4 million for the Elephant Butte Irrigation District, while El Paso County Water Improvement District No. 1 was billed $7.3 million.[45]

Forage covered 77,880 acres during the early 1920s. Easily grown, an overabundance of alfalfa, corn, and wheat pushed Reclamation to suggest that Project farmers grow new crops for the good of both local producers and consumers. Before 1915, most people associated with agriculture felt the soil along the Rio Grande would not support cotton, but a successful 600 acre

44. Victor A. Koelzer, and Luna B. Leopold, "Science Against Silt," in *The Reclamation Era*, (February, 1947): 40; U.S., Department of Interior, Bureau of Reclamation, *Elephant Butte Reservoir: 1980 Sedimentation Survey*, (Denver: July, 1983), 1, 6; Frederick Simpich, "Along Our Side of the Mexican Border," in *The National Geographic Magazine*, (July, 1920): 65.

45. "Report of the Central Board of Review on the Rio Grande Project, New Mexico-Texas," in *Reclamation Record*, (February, 1917): 82-6; "The Valleys of Elephant Butte," in *Reclamation Record*, (September, 1921): 421; U.S., Department of Interior, Bureau of Reclamation, *Repayment of Reclamation Projects*, 393.

experiment in the El Paso Valley proved otherwise. In the spring of 1918, 600 acres of cotton were in the ground, and forage swiftly fell out of favor. Within a few years, every Rio Grande farmer knew good money could be made from cultivating cotton. Ninety percent of irrigators in the Mesilla Valley grew the crop, despite the cash required for labor and the unreliability of its price in the commodities market. Ten years after its introduction, nearly 110,000 acres of project land were in cotton which returned almost $90 an acre.

Down river after the armistice, ninety-thousand people called El Paso home. Despite its proximity to fields capable of supporting livestock and almost any variety of plant, three-fourths of its fresh vegetables, fruit, poultry, and dairy products came from California or East Texas, a distance of 600 to 1,000 miles away. Only 4,200 dairy cows serviced El Paso and nearby farms provided only an average of a little more than a half-pint a person a day. Beginning in the late 1920s, enough fruits and vegetables were grown in the area to support the residents of El Paso, and now the city is a shipping crossroads for fruits and vegetables sent to the rest of the United States and Mexico.[46]

In the last decade of the century, a little more than 145,000 acres were irrigated out of a potential 196,557 acres tied to the Project. Irrigated acreage contained a total of 4,349 farms, some 27,000 farmers, and an overall number of 66,000 people. The gross value of the 28 different varieties of crops harvested on the project totaled $204 million. As cultural change progressed on the Project, crops also evolved. Where alfalfa and cotton once ruled, pecans are valued more than any other crop. In 1991, nearly 22,000 acres of pecans brought $62.2 million to project growers. Cotton still reigns, covering some 57,000 acres bringing in $32.8 million to its growers. After pecans and cotton, green onions, peppers, and alfalfa bring the greatest return to Rio Grande producers.[47]

Sadly, one of North America's most fabled rivers is now a running cesspool. In 1993, a conservation group listed the Rio Grande as the country's most imperiled river, fouled by

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46. "The Valleys of Elephant Butte," 419-20; U.S., Department of Interior, Bureau of Reclamation, *Annual Project History, Rio Grande Project*, Vol. 3, 1915, 149.
47. U.S., Department of Interior, Bureau of Reclamation, *1991 Summary Statistics: Water, Land and Related Data*, (Denver: 1991), 233.

nitrates, phosphates, and human and animal wastes that "make any skin contact with the river dangerous." City officials in Juarez estimate 55 million gallons of raw sewage and industrial pollutants leave the city of 2 million each day. While most of the treatment nightmare is on the Mexican side of the border, the organisms that carry hepatitis, dysentery, typhoid and cholera, presents a problem that should bring both the United States and Mexico together in the same way they solved the water rights dispute ninety years previous.[48]

Conclusion

After four hundred years of harvests along the Rio Grande, the Rio Grande Project accelerated developments in both agriculture and population. However, the conflicts along the borderlands have overshadowed the technical and agricultural accomplishments brought by the Project. History tries not to estimate possibilities, but it is fair to say the border between the United States and Mexico would have been much more tense if someone had not stepped in and built a water storage facility providing an equable distribution of the Rio Grande's flow. In a land where the river, the weather, and even the shifting of the earth has conspired against man, Reclamation could only offer balance.

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About the Author

Robert Autobee holds a Masters degree in History from the University of Northern Colorado. The Colorado Historical Society published his thesis, *If You Stick With Barnum: A History of a Denver Neighborhood*, as part of their *Essays and Monographs in Colorado History* series in 1993. He has worked as a reporter for several different Colorado newspapers, and for a national environmental newsletter, *Western Resources Wrap-Up*, based in Washington,

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