Middle Rio Grande Flood Protection

Bernalillo to Belen, New Mexico

Mountain View, Isleta, and Belen Units

Appendix C

Cultural Resources

December 2019

US Army Corps
of Engineers ®
Albuquerque District

Summary of Appendix Contents

This appendix contains documentation relevant to compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended. Actions completed to comply with the NHPA included the completion of archaeological surveys to assess the potential for construction of the project to impact archaeological sites; conducting tribal consultation to determine if the project would impact and historic properties to which Tribes attach religious or cultural significance; and obtaining concurrence from the New Mexico State Historic Preservation Officer and Isleta Pueblo Tribal Historic Preservation Officer that this project would result in No Adverse Effect to Historic Properties. Through completion of these tasks, USACE is in compliance with the National Historic Preservation Act of 1966, as amended [54 U.S.C. § 300101 et seq.].

Specific items contained in this appendix include:

- 1998 archaeological survey report for the survey of the levees from Isleta Pueblo to Belen

Bargman, Byrd A.
1998 *A Cultural Resources Survey of Middle Rio Grande Conservancy District Levees: Isleta to Belen Reach*. OCA/UNM Report No. OCA-185-605. NMCRIS Activity No. 59915. Office of Contract Archaeology, University of New Mexico, Albuquerque.

- 2001 archaeological survey report for the survey of the levees from Mountain View to Isleta Pueblo

McEnany, Timothy G.
1998 *A Cultural Resources Inventory of the Mountain View Reach Levee Alignments in and Adjacent to Isleta Pueblo, Bernalillo County, New Mexico*. OCA/UNM Report No. OCA-185-666. NMCRIS Activity No. 75870. Office of Contract Archaeology, University of New Mexico, Albuquerque.

- 2015 archaeological survey report for the survey of newly proposed levee alignments on Pueblo of Isleta land

Decker, Jeremy T.

2015 *A 63.4-Acre Cultural Resources Inventory of Proposed Levee Alignments for the Bernalillo to Belen Flood Protection Project on Isleta Pueblo, Bernalillo and Valencia Counties, New Mexico*. USACE Report No. USACE-ABQ-2013-012. NMCRIS Activity No. 128666. US Army Corps of Engineers, Albuquerque District.

- 1997 historical documentation of MRG flood protection projects

Berry, K. Lynn and Karen Lewis
1997 *Historical Documentation of Middle Rio Grande Flood Protection Projects*. OCA/UNM Report No. OCA-185-555. NMCRIS Activity No. 59879. Office of Contract Archaeology, University of New Mexico, Albuquerque.

- Historical overview of Corps projects in the Middle Rio Grande

Dodge, William A. and Abraham Santillanes
2007 *Controlling the Floods: The Role of the U.S. Army Corps of Engineers in the History of the Middle Rio Grande Conservancy District*. Van Citters: Historic Preservation, LLC, Albuquerque.

- New Mexico State Historic Preservation Officer concurrence letter dated January 21, 2014

- Isleta Pueblo Tribal Historic Preservation Officer concurrence letter dated September 28, 2015

- 1997 programmatic agreement between USACE, Albuquerque District and the New Mexico SHPO for mitigation of adverse effects to historic Rio Grande flood protection works

- Tribal consultation letter dated October 1, 2010

- Tribal responses from the Hopi Tribe, the Pueblo of Laguna, White Mountain Apache Tribe and Ysleta del Sur Pueblo

- Memorandum for Record detailing consultation between USACE and the Pueblo of Isleta.

A Cultural Resources Survey of Middle Rio Grande Conservancy District Levees: Isleta to Belen Reach

Byrd A. Bargman
March 2, 1998

Executive Summary

This report presents the results of a Class III cultural inventory survey on the Isleta to Belen Middle Rio Grande Conservancy District levee alignments in Bernalillo and Valencia Counties, New Mexico. The study was conducted by the Office of Contract Archeology, University of New Mexico, for the U.S. Army Corps of Engineers, Albuquerque District under Contract No. DACW47-94-D-0019, Delivery Order 13 (OCA/UNM Project No. 185-605). The field work for the cultural resource survey was carried out in January and February of 1998. The linear survey covered 40 mi of levee alignments, and resulted in relocation of three previously documented sites. Laboratory of Anthropology (NMCRIS) site update forms were prepared for LA 50255, LA 111616 and LA 111617. Only minor updates were made for the latter two sites; a description and site map addendum were prepared for LA 50255.

Acknowledgments

The efforts and cooperation of many individuals have contributed to the success and completion of the Isleta to Belen alignment survey. The project development and administration was handled by Ron Kneebone, Archeologist for the U. S. Army Corps of Engineers, Albuquerque District, Richard Chapman, Principal Investigator (OCA/UNM), and William Doleman, Project Director (OCA/UNM).

We wish to thank Ron Kneebone for not only handling the bureaucracy in his usual adept fashion, but tolerating the numerous communications regarding the project. We salute the Albuquerque District Corps of Engineers for their commitment to quality cultural resource management.

Our thanks to Randy Lujan, Range Patrol Supervisor for the Pueblo of Isleta for his cooperation. His knowledge of the area and repeated efforts to help, turned difficult into simple.

The staff at the Middle Rio Grande Conservancy District provided us with a key for the gates in their district. Their information of the levees, gates and the "trick" to using the key was invaluable. Thank you for sharing your knowledge.

We thank Clarence Valdez, the Ranger at the Senator Willie Chavez State Park in Belen for access to the levees and current up dates of their conditions.

An appreciative thanks goes to Scott Geister at the Archeological Records Management Section (ARMS) in Santa Fe. Not only were our requests handled promptly, but additional information was there if needed. Your proficiency in "fielding" my barrage of phone calls was awesome.

I thank our crew members; Bob Estes, Kathy Pierce, and Colleen Shaffrey, for a job well done. They were the necessary elements in transforming the "long walk" into " great days on the levee".

Without the support of Ron Stauber, our cartographer, and Donna Lasusky, our administrative assistant, we would flounder. Thank you for quality graphics and report production.

Most of all I thank Richard Chapman and William Doleman for their repeated support, knowledge, unending patience, and casting light into the shadows.

Introduction

This report provides a description of a cultural resources survey of Middle Rio Grande Conservancy District levees along the east and west sides of the Rio Grande as it flows from Isleta Pueblo to the town of Belen , New Mexico. The survey was conducted by the University of New Mexico Office of Contract Archeology (OCA) in January and February, 1998, pursuant to Corps of Engineers Solicitation DACW47-94-D-0019, Delivery Order 13 (UNM/OCA Project no. 185-605). The present project is the second of two cultural resource surveys to be conducted under Delivery Order 13. The previous survey involved the levee alignments from San Acacia to San Marcial and potential access to 10 habitat improvement areas (Doleman 1997).

Attached are the deliverables specified in the Revised Scope of Services: (a) the daily field logs (1 copy), the remainder data compendium, consisting of updated Laboratory Of Anthropology (ARMS/NMCRIS) site forms and related items (3 copies), a photographic notebook, and a DOS-compatible disk with relevant project files certified to be virus-free.

Three sets of maps, comprising the first part of the data compendium are also enclosed. One set consists of the "blueline" orthophoto maps (scale 1 inch:400 feet) provided by your office (COE maps, sheet numbers 29-39). These maps are annotated with the location of known archeological sites and areas of disturbance. The other sets of maps consist of 15 copies of portions of ARMS/NMCRIS 7.5 min USGS maps, which show known site locations and actual 7.5 min USGS maps. The ARMS/NMCRIS Project/activity number for the present project is 59915.

Project Activities

Between January 21 and February 7, 1998, the University of New Mexico Office of Contract Archeology (OCA) conducted an archeological survey of approximately 45 miles of levee along the east and west banks of the Rio Grande in Bernalillo and Valencia Counties for the U.S. Army Corps of Engineers, Albuquerque District (COE). The eastern corridor ran from .15 mi north of Hwy 47 bridge at Isleta to the railroad bridge 1.75 mi south of Belen. The western portion ran from the Belen Highline Canal, south of Hwy 314 approximately 3.75 mi north of Los Lunas to the intersection of the Upper Sabinal Riverside Drain and the Old Jarales Ditch, 4 mi south of Belen (Figure 1).

Survey Results

Survey of the levees located seven isolated lithic and ceramic artifacts. These could not be associated with any existing site. As covered in the scope of services, these were neither recorded or collected. Historic or prehistoric sites were not encountered. Three previously recorded sites (LA 111616 and LA 111617, historic irrigation canals and LA 50255 (a large PIII-PIV site), were encountered during survey (Figure 1).

Data from ARMS/NMCRIS were used to locate previously documented archeological sites within the project area. Using coordinates and ARMS/NMCRIS site numbers supplied by the Corps of Engineers, computer generated project maps were created (Figure 1). These maps were used in combination with faxed copies of portions of the master ARMS/NMCRIS USGS maps to plot known site locations on the COE maps and our USGS maps. It was then determined if sites would fall in the project corridor. ARMS/NMCRIS site forms were then requested for possibly sensitive sites. It appeared two sites fell on and one adjacent to the survey corridor.

LA 50255

The prehistoric component of LA 50255 consists of a large scatter of late Pueblo III- early Pueblo IV artifacts that extend for approximately 150 m north-south and 50-90 m east-west. The western part of the site, which appears to have included most of the pueblo, was destroyed by the construction of the San Juan feeder canal. No obvious house mound is present in the undisturbed area east of the canal, but the rather extensive scatter of artifacts in the area suggests that buried features are present.

A historic road which may be the Camino Real Trail, bisects the site area. This road is a conspicuous linear depression approximately 12 m in width and 50 cm in depth. No historic artifacts were observed. The width, reduction, and stabilization of this road resembles sections of the Camino Real (Marshall 1991), and is located on the east bank of the Rio Grande, which was part of the historic road (Marshall,1992).

A site update was completed for LA 50255, using Laboratory of Anthropology (ARMS/NMCRIS) forms. The original boundaries and artifact concentrations were not evident, as eolian sediments and large stands of alkali sacaton covered the area. An artifact concentration covering a mounded area was recorded northeast of the original site extending the site boundaries . The artifacts noted in the survey corridor, appear to be redeposited on the levee by dredging activities in the canal located below the site. The site itself will not be impacted by proposed construction. The two historic irrigation canals (LA 111616 and LA 111617) will not be impacted by levee construction.

Recommendations

The previously recorded sites will not be impacted by proposed construction if the restraints and guidelines set forth are followed.

Contract DACW47-94-D-0019, Delivery Order 0013 (OCA/UNM Project No. 185-605)

COE LEVEE SURVEY--ISLETA-BELEN: DAILY LOG

1-21-98 (Wed.)

Met Dr. Chapman and Dr. Doleman at OCA and drove to the Isleta/Belen area. We had previously arranged to meet with Randy Lujan, the Isleta Pueblo Range Patrol Supervisor at the Isleta substation. His duties prevented meeting with us, but phone communication was established. We will coordinate with him on the location and time of the Isleta portion of the survey. This is to insure observance of any culturally sensitive areas or activities we might encounter on the pueblo.

We then drive to Belen to the Middle Rio Grande Conservency District. After introductions and a brief description of the project, a key is obtained which will fit the locked gates overseen by the MRGCD. A trial run of the gates in the immediate area, locate another type of lock. This key is obtained from Clarence Valdez, the resident ranger at Senator Willie Chavez State Park. The rest of the day was spent in reconnaissance of the survey area. This encompassed locating access roads, gates, starting points on the north end of the corridor, and community facilities. Also a general assessment was done of topography and land forms.

1-22/23-98 (Thur.,Fri.)

Pre-field gear-up activities, including organization of equipment and field help, map acquisition ect. The boundaries of the COE aerial photos were drawn and numbered on the USGS quads. Copies from the master map of various USGS quads in the project area were requested from ARMS/NMCRIS. The known site locations were transferee to the COE maps and our USGS maps. Site forms of possibly associated sites were also obtained and reviewed. It appears three sites will fall on or near the corridor: LA 111616, LA 111617, and LA 50255.

1-25-98 (Wed.)

First day of field work. Pick up rental vehicle at 7:00 am. Load vehicle at OCA and depart with Bob Estes at 7:30 am. We meet with Randy Lujan at Isleta substation. After discussion and review of the project maps, it is apparat we will not encounter any culturally sensitive areas. We also give Randy a timetable listing when we will be on the reservation. Drive to north end of east levee alignment at HWY 147 bridge in Isleta.
We continue south on levee and start survey where dense bosque begins (station 661 L) at 8:30 am. We have questions regarding width of survey corridor around base of hill and through the disturbed area, both at the beginning of survey. Will survey after clarification. Began survey "leap-frog" style with BE walking one mile and I drove to a point 1 mi south to continue.
The levee in this area of the survey, is partially overgrown with minimal visibility. The west side drops off to the bosque. This has dense vegetation and no ground visibility. The top has a narrow two-track and a moderate to heavy cover of cottonwood leaves and dead weeds. Approximately 30% ground visibility. The east side is an eroded steep slope which levels out to a two-track running parallel with the Upper Peralta Riverside Drain. This slope is the only area where potentially undisturbed deposits may be seen. We will "zig-zag" from upper to lower road and walk at base of slope in this segment. The method used will hinge on the amount of ground visibility. This does not adhere to the "centerline" statements in the scope, but appears more effective in this situation. This area does pertain to the "previously disturbed construction zone".

A locked gate is encountered at 2.6 mi, just south of station 688 L. We drive back down ditch and take State Road 47 to HWY 6 at Los Lunas. Resume survey heading north on the east levee, back to the locked gate covering 5 mi. A good portion of this stretch had been graded. Once at gate we drive back to HWY 6 and take lunch at 1:00 pm.

Start afternoon survey traveling south on the east levee from the bridge at HWY 6 in Los Lunas. We end this day at station 781 L, 4 mi down levee at 3:45 pm.

Many factors played a part in today's coverage of 11.7 mi. First, we were most fortunate to have the previous experience of Dr. Doleman's San Acacia-San Marcial survey. Second, the conditions were prime. The level road surfaces, excellent weather, easy access, minimal visibility, dense understory, and seasoned field personnel facilitated great day of survey in pleasant surroundings.

1-26-98 (Thur.)

Left office at 7:00 am with Bob Estes. We start at 8:00 am at station 781 L south of Los Lunas bridge. The "leap-frog" and "zig-zag" methods are used again. This produces 6.25 mi (BE: 3mi; BB: 3.25mi). Survey is hindered by a blanket of cottonwood leaves, dead weeds and grasses, and low forbs. The surface of the slope between two-track and the lower canal road is visible in some areas. The lower half of this stretch has been recently graded. This leg is terminated south of station 848 L as drawn on the COE map. We relocate site LA 111616, a historic irrigation canal south of station 858 L found north of the Belen bridge. This is not in our survey zone.

After lunch at 1:00 pm, survey is resumed south from the Belen bridge. BE does .7 mi to designated end south of station 865 L. From station 860 L to 862 L, in an area of recent trash dumping and road grading, three IOs (one gray indented corrugated and three Glaze A sherds) were located. The end of this area, from 864 L to south of 865 L contained lithics and ceramics. These are possibly redeposited from dredging activities below LA 50255, located 90 m east across the Lower Peralta Riverside Drain.

The next portion of survey (.6 mi), resumed south of 869 L and ends at 871 L. The area was very overgrown with dense tamarisk and willow making it almost impassable. This is the end of the east levee alignment. 7.6 mi covered.

An investigation of LA 50255 takes us back to HWY 47 in an effort to locate the site boundaries. The site is in a field between a Yucca Self Storage and a mobile home park. The original artifact concentrations and boundaries are not visible as eolian deposits and large areas of alkali sacatone blanket the site. The prominence of the possible historic road swale has also diminished. We do locate a large artifact scatter (glazewares and lithics) and mounded area northeast of the original site. South of the mounded area, two looters pits (An update with new areas mapped seems to be the course of action. Will ask Dick C.

Phone calls are made to arrange a meeting with Randy Lujan regarding a key for the impassable gate. This gate was located near the southern reservation boundary. We will rendezvous at the sub-station at 8:00 am tomorrow. A call to D. Chapman at the office was unsuccessful. Head for home 3:30 pm.

1-30-98 (Friday)

Kathy Pierce and I depart office at 7:30 am. Randy Lujan meets us at the substation at 8:00 am. After relating the locked gate incident, Randy calls Buddy at the MRGCD office. It appears he did have a key, but was unaware of its usage for the particular gate in question. We discuss today's survey corridor which will include the west levee alignment across Isleta land.

Drive south down west levee to Los Lunas bridge. Even though you have the key, it does not guarantee entrance. We tried this MRGCD lock during recon and found it difficult. This leg will be surveyed north up the levee.

KP starts the first segment of a mile, while I drive one mi to start the leapfrog. The understory was dominated again by cottonwood leaves and dead weeds. The bosque is not as dense but ground visibility still poor. As there are various patches of open ground, zigzagging was necessary. We do encounter a gate at the reservation boundary. Our first key from the MRGCD fits the lock. Four miles are covered ending at HWY 314. A vesicular basalt groundstone fragment was noted in mile 4. The beginning of the west levee survey at the High Line canal, across HWY 314, will be done another day.

Lunch is taken at the Los Lunas bridge. At 12:30 pm we start the Los Lunas to Los Chavez segment. Small freshwater clamshells are found covering the steep slope of the levee. Clear evidence of dredging activities for ditch maintenance. Afternoon coverage is 4.5 mi (KP:2.5mi; BB:2mi). An obsidian core was noted in mile 4. We exit at the Los Chavez bridge at 3:30 pm. Get gas on way in. Total mileage for day 8.5.

1-30-98 (Sat.)

Colleen Shaffrey and I leave OCA at 7:30 am. We arrive at 8:00 am at Los Chavez bridge and survey south, starting at station 787 L. The ground visibility on top of the levee is higher. The edge on the bosque side overgrown, but side dropping off to lower road much clearer. We are seeing primarily river cobbles and some "grizzly" material dropped in high traffic and muddy areas. Encounter a lot of civilian activity on Saturday. Morning mileage: 5 mi (CS:3 mi, BB:2 mi). We lunch on the banks of the Rio Grande entertained by the snow geese, mallard pairs, and sandhill cranes.

The afternoon begins at 12:30 pm heading south at station 840 L. Another locked gate is found but the local access road around it works great. The levee top is much wider and very well-traveled. This was only a two mile segment ending at the Belen bridge. LA 111617, a historic irrigation canal was relocated. It appears the canal will not be impacted by construction.

At 2:00 went in search of access to end of west levee survey. Found access roads and traveled to railroad bridge labeled as "too low" for access. It certainly was! Total daily mileage: 7mi. Leave for office at 3:00 pm.

2-1-98 (Sun.)

Colleen Shaffrey and I leave for Belen at 7:00 am. We start this survey south of the Belen bridge adjacent to the Sen. Willie Chavez State Park. The presence of tamarisk and willow are prevalent in this area of the bosque. The roads are not used as much but ground visibility is fairly good. When we arrive at the railroad bridge, Colleen continues to survey. I drive around to Jarales and find her. A small portion farther and we end the west levee survey where the Upper Sabinal Riverside drain and the Old Jarales ditch meet, between stations 900 L and 910 L.

After lunch, the rest of the afternoon is spent taking photos of this end of the corridor. Total daily mileage: 4.1 mi. We leave at 3:00 pm. We leave the key given to us by Randy Lujan, in the predetermined spot.

2-6-98 (Fri.)

Bob Estes and I leave OCA at 7:00 am. We will survey the upper ends of both the east and west levee alignments, purposely left for last. These areas have not been affected by previous levee construction and have greater potential for locating cultural material. After consulting with Dr. Kneebone, Dr. Chapman has answered my questions regarding the width of the survey through the disturbed area in the east end.

We survey north from station 661 L, through the disturbed area. Various episodes of dumping and grading activity are visible. It appears gridding or a series of parallel roads were created for flood control. It is then more bosque, the new and replacement structures, a graded lot and HWY 147. After crossing the highway, survey continues on the west side of the canal and the west side of the hill to the gravel pit. The ground visibility on the hill was hindered by dead grasses, weeds and hay. This is an area where hay has been repeatedly stacked. An obsidian flake was noted.

The beginning of the west levee alignment is the next destination. The survey ran from the levee access road between stations 696 L and 697 L across the road to the Belen Highline canal. Only eolian sand and various desert forbs were seen. Fresh water clamshells were present on the lower canal banks.

It was discovered the camera being used for photos was not operating properly. We will re-shoot photos representative of the west levee alignment today.

After lunch we map our observations of LA 50255. This takes the rest of the afternoon. We leave at 3:30 pm.

2-7-98 (Sat.)

I leave OCA at 7:00 en route to Isleta Pueblo. I spend the entire morning re-shooting photos of the east levee alignments. Update photo logs with stations from the bluelines. Stop at Sen. Willie Chavez State Park to return key. No one home and pitbull is doing his duty. Leave key in mailbox. Spend more time at LA 50255. Gas up the rental vehicle. Clean interior and wash. Return to airport.

A CULTURAL RESOURCES INVENTORY OF THE MOUNTAIN VIEW REACH LEVEE ALIGNMENTS IN AND ADJACENT TO ISLETA PUEBLO, BERNALILLO COUNTY, NEW MEXICO

by

Timothy G. McEnany

Prepared for

The US Army Corps of Engineers
Albuquerque District

Contract No. W81G6993375403
OCA/UNM Project No. 185-666
NMCRIS Activity No. 75870

Submitted by

Dr. Richard C. Chapman
Principal Investigator
OCA/UNM

August, 2001

Abstract

This following report describes the results of a Class III cultural resources survey of the Mountain View Reach Levee Alignments conducted for the US Army Corps of Engineers, Albuquerque District by the Office of Contract Archeology, University of New Mexico pursuant to Contract No. W81G6993375403 (UNM/OCA Project No. 185-666). The project area included a 7.4 km (4.6 mile) long segment of the Albuquerque Riverside Drain levee north of Isleta Pueblo and another 1.6 km (1.0 mile) long portion of the same levee on Isleta Pueblo property. A third 1.9 km (1.2 mile) long levee segment adjacent to the Atrisco Riverside Drain west of the Rio Grande was also surveyed during the project.

The need to upgrade or rehabilitate many of the water control facilities in the Middle Rio Grande Conservancy District has been recognized for some time. No previously unidentified cultural resources were encountered in the survey area. A portion of the Atrisco Riverside Drain has been recorded as a site (LA 100483). The Albuquerque Riverside Drain has not been given a site number, although the levee or at least portions of it were in-use in the 1920s and perhaps earlier. Since no previously unidentified cultural resources were discovered within the project area, any proposed rehabilitation activities involving the levee segments should not impact any previously unknown cultural properties. The historical significance of MRGCD construction of flood control facilities along the Rio Grande has been summarized elsewhere.

Acknowledgements

Our efforts toward completing the present project and previous cultural resource inventories of flood control facilities in the Middle Rio Grande Conservancy District have been aided by a numbers of agencies an individuals. University of New Mexico involvement in project development and implementation has been primarily through contact with Dr. Ronald Kneebone, Archeologist from the US Army Corps of Engineers, Albuquerque District. His assistance has been invaluable. Dr. Richard C. Chapman has served as Principal Investigator for OCA/UNM.

Thanks are due also to Subhas Shah, Chief Engineer for MRGCD, and members of the staff. On a number of occasions the MRCDG provided OCA with gate keys and information concerning access to the project areas. Randy Lujan, Range Patrol Supervisor for the Pueblo of Isleta provided much appreciated assistance for surveys involving Isleta Pueblo property. Similarly, the rangers and staff at the Bosque del Apache Wildlife Refuge and Clarence Valdez at Senator Willie Chavez State Park facilitated access to these areas during previous surveys. Tim Seaman and the staff of the Archeological Records Management Section (ARMS) of the State Historic Preservation Division have shown remarkable patience and cooperation in facilitating our requests concerning previously recorded cultural properties.

Introduction

This report describes the results of an archeological survey of the Mountain View Reach Levee Alignments conducted for the US Army Corps of Engineers, Albuquerque District by the Office of Contract Archeology, University of New Mexico pursuant to Contract No. W81G6993375403 (UNM/OCA Project No. 185-666). The Class III cultural resources inventory included 6.5 miles of flood control facilities (levees) in the Middle Rio Grande Conservancy District north of Isleta Pueblo.

The project area included a 7.4 km (4.6 mile) long segment of the Albuquerque Riverside Drain Levee north of the Isleta Pueblo boundary and another 1.6 km (1.0 mile) long portion of the same levee on Isleta Pueblo property. Including another 1.9 km (1.2mile) long levee segment along the Atrisco Riverside Drain west of the Rio Grande was also survey (Figure 1). The first segment of the Albuquerque Riverside Drain Levee was surveyed on January 18, 2000. When OCA received permission to conduct the survey on Isleta Pueblo property, the remaining segment was examined for cultural resources on June 2, 2000 in conjunction with the Isleta Drain Alignments survey (see Previous Research below). The Atrisco levee segment was also surveyed at that time.

The Albuquerque Riverside Drain levee segment is located in Section 18 of Township 9 North, Range 3 East, in Section 13 of Township 9 North, Range 2 East on the Albuquerque West USGS quadrangle, and in Sections 24, 25, and 36 of Township 9 North, Range 2 East and Sections 1 and 12 of Township 8 North, Range 2 East on the Isleta, NM quadrangle. A portion of Section 1 and all of Section 12 of Township 8 North are within the Isleta Pueblo boundary. The project area lies at an elevation of approximately 1493 m (4900 ft). Occupied homes are common near the project areas, especially north of Interstate 25.

The purpose of the pedestrian survey was to locate any previously unrecorded cultural resources in the project area. In addition, consultation with Isleta Pueblo officials concerning the location of possible traditional cultural properties within the present project area as well as within the Isleta Drains project area (see Previous Research below) were completed prior to the survey. No such properties were identified in the surveyed areas. Richard C. Chapman served as Principal Investigator. Jeanne A. Schutt served as Project Director, while Tim McEnany and John Mark Sheppard served as crew chiefs. Tod Dikeman served as crew member.

Previous Research

In accordance with the Isleta Drain Survey Scope of Services, the Office of Contract Archeology completed a search of the New Mexico Cultural Properties Information System (NMCRIS) records at the Archeological Records Management Section/Historic Preservation Division at the Laboratory of Anthropology in Santa Fe. The search area defined by UTM Coordinates was expanded to include the Mountain View Reach Levees. All previously recorded sites located below an elevation of 1554 m (5100 ft) were plotted on the USGS maps for use in the field. A copy of the maps showing the locations of previously recorded sites in the project area was included in the data compendium.

A total of 49 previously recorded archeological sites containing 55 cultural/temporal components were identified in the records search. At the time of the survey, a segment of the Atrisco Riverside Drain (LA 100485) was the only previously recorded site in or near the Mountain View Reach. Except for LA 100485 and similar segments of the Arenal Main Canal and Isleta Indian Drain, the only other previously recorded site in either project area was Isleta Pueblo. Consultations concerning the possible presence of Traditional Cultural Properties within the Isleta Drains and Mountain View Reach project areas were conducted prior to the survey. No were identified in the Mountain View Reach project area.

Including the Isleta Drains survey, the Office of Contract Archeology has completed and reported three previous archeological surveys of flood control and irrigation facilities in the Middle Rio Grande Conservancy District (MRGCD). The need to upgrade or rehabilitate many of the water control facilities constructed initially by individual communities and, later, by the MRGCD has been recognized for some time (Berry and Lewis 1997). The proposed rehabilitation effort may affect cultural properties located in the project areas.

A survey of 72.4 km (45 miles) of levees in the San Marcial to San Acacia Reach was completed in September of 1997 (Doleman 1997). In addition, ten potential access routes to Habitat Improvement Areas (HIAs) were surveyed during this phase of the project. An attempt was made to survey a proposed realignment of the Rio Grande railroad bridge near San Marcial, but the area was overgrown with vegetation. Two archeological sites (LA 119574 and LA 119575) were located and recorded on one of the access routes.

An archeological survey of 64.4 km (40 miles) of levee segments in the Isleta to Belen Reach was completed in February in 1998 (Bargman 1998). Survey personnel relocated three previously recorded sites in the project area (LA 111616, LA 111617, and LA 50255). Updated Laboratory of Anthropology site forms were completed for each site and submitted with the final report. The Isleta Drain Alignments survey included 24.1 km (15.0 miles) of flood control and drainage facilities located within or adjacent to Isleta Pueblo property (McEnany, 2000). Three previously unrecorded archeological sites were located and recorded during the project (LA 130584-130586).

The Atrisco segment was recorded by the Museum of New Mexico during an archeological survey along Interstate 25 (Willmer 1993). Historic records suggested initial construction of the drain may have occurred prior to 1896. The Atrisco drain empties into the river near the Atchison Topeka and Santa Fe (now Burlington Northern and Santa Fe) Railroad bridge north of Isleta Pueblo. The Albuquerque Riverside Drain empties into the Rio Grande near the same area. Segments of the Arenal Main Canal (LA 100483) and Isleta Indian Drain (LA100484) had also been recorded during the 1993 survey. The Isleta Drain, Isleta Indian Drain, Indian Lateral, Butte Lateral, and Atrisco Riverside Drain are all shown in the 1920s Report of the Chief Engineer (Burkholder

1928).

Segments of the Arenal Main Canal and Isleta Indian Lateral have also been recorded as historic properties (LA 100483 and 100484, respectively). The Arenal Main Canal and Isleta Indian Lateral were not included in the scope of work, however, the Arenal Main intersected the Isleta Drain near Black Mesa. Over the years, different site numbers have often been assigned to different segments of the same facility. In part, this situation led the State Historic Preservation Office on Santa Fe to issue guidelines regarding functioning irrigation drains or acequias. Functioning systems or segments are no longer assigned site numbers. The Albuquerque Riverside Drain-or at least a large portion of it including the surveyed segment-is also shown in the 1928 MRGCD Report of the Chief Engineer.

Another of the previously recorded cultural properties is Isleta Pueblo (LA 724). Portions of the pueblo were recorded by the Laboratory of Anthropology and by the School of American Research. The site record lists three temporal components - a possible Pueblo IV or glaze period component (AD 1300 to 1600) and two Post-Pueblo Revolt components dating from AD 1700 to 1821 and AD 1700 to present. Features observed include a church, structure foundations, and house middens. The site is listed on the National Register of Historic Places and the State Register. The pueblo is located more than a mile south of the project area.

Survey Methods

Levee segments were examined for cultural resources by walking along the top of levee, usually moving back and forth from one edge to the other in order to observe the slopes of the facilities. The levee surfaces averaged about 5.0 m (16.4 ft) wide for a total survey area of 33.4 ha (13.5 acres). In most places the sides of the levees were overgrown with vegetation and the ground surface was rarely visible. Similarly, portions of the levee surface less affected by vehicular traffic were also overgrown with weedy vegetation (Figure 2). Canals ran along the east side of the Albuquerque Riverside Drain and the west side of the Atrisco Drain. Sides of the levees facing the Rio Grande were bounded by bosque dense enough to obscure the river from view in most areas.

Survey Results

No previously unidentified cultural resources of any kind were encountered in the Mountain View Reach survey area. As noted above, a portion of the Atrisco Riverside Drain has been recorded as a site (LA 100485). The Albuquerque Riverside Drain has not been given a site number, although the levee or at least portions of it were in-use in the 1920s and perhaps earlier.

Recommendations

Since no cultural resources were identified within the project area, any proposed rehabilitation activities involving the levee segments described above should not impact any previously known or unknown cultural properties. The historical significance of MRGCD construction of flood control facilities along the Rio Grande has been summarized by Berry and Lewis (1997).

References

Bargman, Byrd A.
1998 *A Cultural Resources Survey of Middle Rio Grande Conservancy District Levees: Isleta to Belen Reach*. Office of Contract Archeology, University of New Mexico Report No. 185-605. Albuquerque.

Berry, K. Lynn, and Karen Lewis
1997 *Historical Documentation of Middle Rio Grande Flood Protection Projects.* Office of Contract Archeology, University of New Mexico Report No. 185-555. Albuquerque.

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McEnany, Timothy G.
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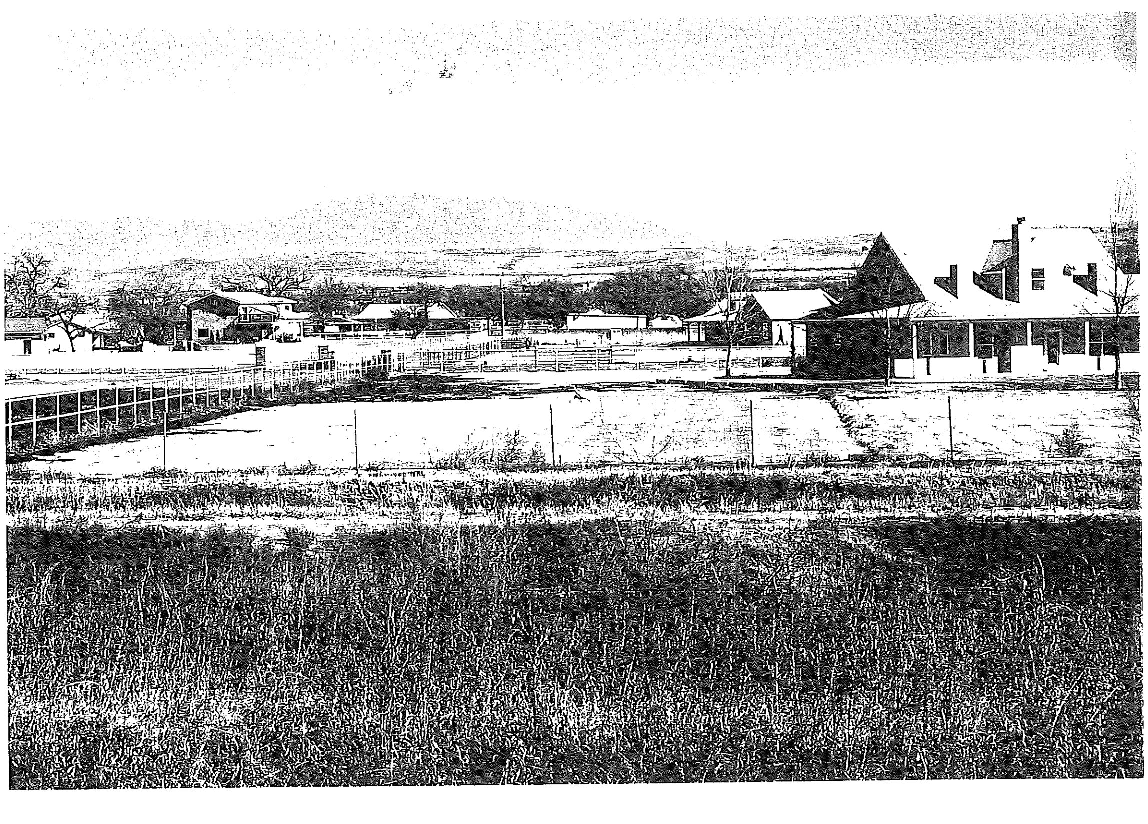

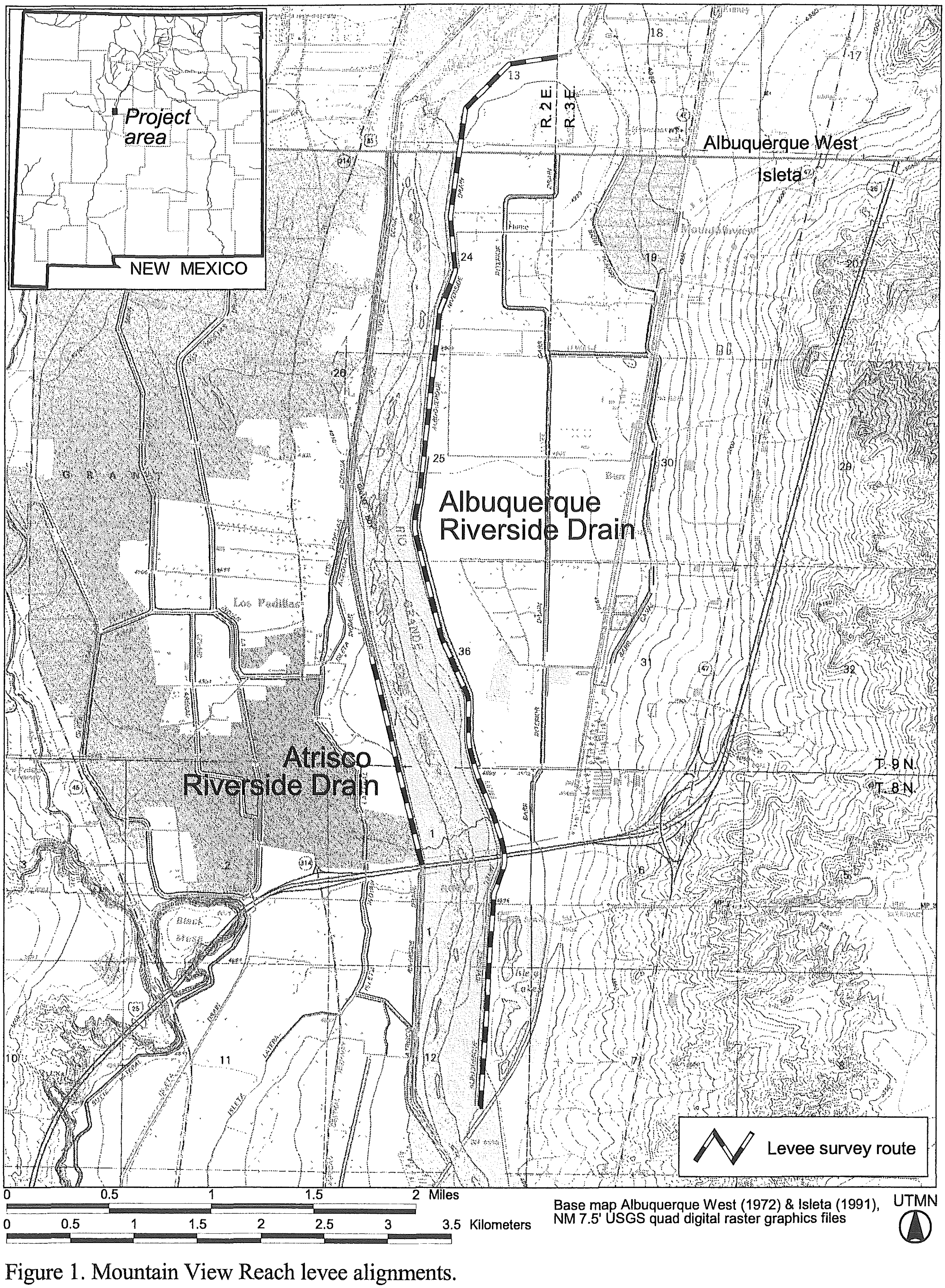

Figure 1. Mountain View Reach levee alignments.

NMCRIS No. 128666

A 63.4-ACRE CULTURAL RESOURCES INVENTORY OF PROPOSED LEVEE ALIGNMENTS FOR THE BERNALILLO TO BELEN FLOOD PROTECTION PROJECT ON ISLETA PUEBLO, BERNALILLO AND VALENCIA COUNTIES, NEW MEXICO

Prepared by

Jeremy T. Decker

U.S. Army Corps of Engineers
Albuquerque District

Prepared for

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Office: (505) 342-3283; Fax: (505) 342-3668

New Mexico Annual State General Permit No. NM-13-193

Report No. USACE-ABQ-2013-012

January 5, 2015

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NMCRIS INVESTIGATION ABSTRACT FORM (NIAF)

1. NMCRIS Activity No.:	2a. Lead (Sponsoring) Agency:	2b. Other Permitting Agency(ies):	3. Lead Agency Report No.:
128666	USACE, Albuquerque District		USACE-ABQ-2013-012

4. Title of Report: A 63.4-ACRE CULTURAL RESOURCES INVENTORY OF PROPOSED LEVEE ALIGNMENTS FOR THE BERNALILLO TO BELEN FLOOD PROTECTION PROJECT ON ISLETA PUEBLO, BERNALILLO AND VALENCIA COUNTIES, NEW MEXICO

Author(s) Jeremy T. Decker

5. Type of Report
☐ Negative ☒ Positive

6. Investigation Type
☐ Research Design ☒ Survey/Inventory ☐ Test Excavation ☐ Excavation ☐ Collections/Non-Field Study
☐ Overview/Lit Review ☐ Monitoring ☐ Ethnographic study ☐ Site specific visit ☐ Other

7. Description of Undertaking (what does the project entail?): Construction of engineered levees to replace the existing spoil banks along the Rio Grande from Mountain View south to Belen.

8. Dates of Investigation: (from: 9/11/2013 to: 12/15/2014)

9. Report Date: 1/5/2015

10. Performing Agency/Consultant: USACE, Albuquerque District
Principal Investigator: Jeremy T. Decker
Field Supervisor: Jeremy T. Decker
Field Personnel Names: Jonathan Van Hoose, Gregory Everhart

11. Performing Agency/Consultant Report No.: USACE-ABQ-2013-012

12. Applicable Cultural Resource Permit No(s): NM-0193-13S

13. Client/Customer (project proponent): MRGCD
Contact: Mike Hamman
Address: 1931 Second St. SW, Albuquerque, NM 87102
Phone: (505) 247-0234

14. Client/Customer Project No.:

15. Land Ownership Status ***(Must be indicated on project map):***

Land Owner	Acres Surveyed	Acres in APE
Pueblo of Isleta	63.4	63.4
TOTALS	63.4	63.4

16 Records Search(es):

Date(s) of ARMS File Review August 2013	Name of Reviewer(s) Jeremy T. Decker	
Date(s) of NR/SR File Review August 2013	Name of Reviewer(s) Jeremy T. Decker	
Date(s) of Other Agency File Review August 2013	Name of Reviewer(s) Jeremy T. Decker	Agency USACE, Albuquerque District

17. Survey Data:

a. Source Graphics ☐ NAD 27 ☒ NAD 83
☒ USGS 7.5' (1:24,000) topo map ☐ Other topo map, Scale:
☒ GPS Unit Accuracy ☒<1.0m ☐ 1-10m ☐ 10-100m ☐>100m

b.

USGS 7.5' Topographic Map Name	USGS Quad Code
Isleta, NM	34106-H6
Los Lunas, NM	34106-G6

c. County(ies): Bernalillo and Valencia

17. Survey Data (continued):
d. Nearest City or Town: Isleta Pueblo
e. Legal Description:

Township (N/S)	Range (E/W)	Section	¼ ¼ ¼
8N	2E	12	, , .
8N	2E	13	, , .
8N	2E	24	, , .
7N	2E	3	, , .

Projected legal description? Yes [ ] , No [X] Unplatted [ ]
f. Other Description (e.g. well pad footages, mile markers, plats, land grant name, etc.):

18. Survey Field Methods:
Intensity: ☒ 100% coverage ☐ <100% coverage

Configuration: ☒ block survey units ☐ linear survey units (l x w): ☐ other survey units (specify):

Scope: ☒ non-selective (all sites recorded) ☐ selective/thematic (selected sites recorded)

Coverage Method: ☒ systematic pedestrian coverage ☐ other method (describe)

Survey Interval (m): 15 Crew Size: 3 Fieldwork Dates: 9/11/2013-9/12/2013; 12/15/2014

Survey Person Hours: 30 Recording Person Hours: 6 Total Hours: 36

Additional Narrative: The survey was conducted using two methods. First, where existing spoil bank levees are present a transect was walked with one person walking the service road between the riverside drain and the toe of the levee, one person on the slope of the levee, and another person on the top of the levee. Surveyors returned by lining up with one person on the river side of the levee near the toe, and the other two spaced at 15-meter intervals toward the river. In areas where no existing levee was present, surveyors walked 15-meter spaced transects centered on the proposed alignment until at least a 75-meter buffer was surveyed. Several areas within the survey area were not surveyed due to the presence of marshy, standing water conditions as well as very dense vegetation.

19. Environmental Setting (NRCS soil designation; vegetative community; elevation; etc.): The study area is located in the northern Mexican Highland Section of the Basin and Range Physiographic Province (Lozinsky et al. 1991). The project is situated on the floor of the Rio Grande Valley adjacent to the active river channel and within the historic and modern river floodplain. Elevations in the surveyed area range from 4,895 to 4,910 feet amsl. Soils in the survey area consist of Torrifluvent floodplain alluvium and Gila Loam and Anapra series soils (NRCS 2013). The survey area falls in the transition zone between bosque woodland and agricultural fields.

20. a. Percent Ground Visibility: 0-75% b. Condition of Survey Area (grazed, bladed, undisturbed, etc.): Ground visibility was variable. In the bosque on the riverside of the spoil banks visibility was near zero where vegetation was thick, but was 30-50% in the northern portion of the survey area. On the spoil banks themselves visibility was 10-50%. Visibility was good in the plowed fields along the westernmost portions of the survey area at 50-75%. During the survey some standing water was present in the fields, but this did not present a significant impediment to surface visibility. The majority of the survey area is heavily disturbed due to construciton of the MRGCD riverside drains/spoilbanks and the use of the area for agricultural fields.

21. CULTURAL RESOURCE FINDINGS ☒ Yes, See Page 3 ☐No, Discuss Why:

22. Required Attachments (check all appropriate boxes):
☒ **USGS 7.5 Topographic Map with sites, isolates, and survey area clearly drawn**
☒ **Copy of NMCRIS Mapserver Map Check**
☒ **LA Site Forms - new sites (*__with sketch map & topographic map__*)**
☐ **LA Site Forms (update) - previously recorded & un-relocated sites (*__first 2 pages minimum__*)**
☐ **Historic Cultural Property Inventory Forms**
☒ **List and Description of isolates, if applicable**
☐**List and Description of Collections, if applicable**

23. Other Attachments:
☒ **Photographs and Log**
☐ **Other Attachments**
***(Describe)*:**

24. I certify the information provided above is correct and accurate and meets all applicable agency standards.

Principal Investigator/Responsible Archaeologist: Jeremy T. Decker

Signature ________________________________ **Date** ____________ **Title (if not PI):**

25. Reviewing Agency: USACE, Albuquerque District
Reviewer's Name/Date

Accepted ( ) Rejected ( )

Tribal Consultation (if applicable): ☒ Yes ☐No

26. SHPO
Reviewer's Name/Date:

HPD Log #:
6. SHPO File Location:
Date sent to ARMS:

CULTURAL RESOURCE FINDINGS

[fill in appropriate section(s)]

1. NMCRIS Activity No.: 128666	2. Lead (Sponsoring) Agency: USACE, Albuquerque District	3. Lead Agency Report No.: USACE-ABQ-2013-012

SURVEY RESULTS:

Sites discovered and registered: 1
Sites discovered and NOT registered: 0
Previously recorded sites revisited (*site update form required*): **0**
Previously recorded sites not relocated *(site update form required):* 0
TOTAL SITES VISITED: 1
Total isolates recorded: 13 **Non-selective isolate recording?** ☒
Total structures recorded (*new and previously recorded, including acequias*): **0**

MANAGEMENT SUMMARY: The present survey included four sections of proposed levee alignments on the east and west side of the Rio Grande on lands owned by Isleta Pueblo for a proposed levee construction project. The total survey acreage is 63.4 acres. The survey identified one new archaeological site, LA 177391, a prehistoric artifact scatter. A total of 13 isolated occurrences were encountered.

The area extends approximately 20 river miles from Albuquerque's South Diversion Channel on the east bank and the I-25 bridge on the west bank, to immediately south of the railroad bridge south of Belen. The Corps, in cooperation with the MRGCD as the project sponsor, proposes to rehabilitate the existing spoil bank levees to produce engineered levees capable of withstanding significant flood events along the Rio Grande.

Proposed project activities include replacing the existing spoil-bank levees with engineered, trapezoidal levees that would provide protection from the one-percent chance exceedence flood event (formerly the 100-year flood) plus an additional three feet of freeboard. In most cases where the proposed levee alignment follows the existing spoil banks, the engineered levees would be constructed within the same footprint of the existing spoil banks, and the spoil banks themselves would be utilized as fill material for the newly constructed levees. The spoil banks were constructed through decades of dumping spoil materials from the riverside drains onto the piles to create an irregularly-shaped alignment paralleling the riverside drain. As such, the footprint of the spoil banks throughout the project area is generally larger than is necessary for the engineered levees. The engineered levees, therefore, will fit within the existing disturbed area created by the spoil banks, and will not increase the footprint of disturbance. Existing access roads are currently maintained along the spoil banks by MRGCD, and these roads will be used to access the project area. A 15-foot buffer from the toe of the engineered levee on both the land and riverside will need to be maintained free of woody vegetation to protect the structural integrity of the levee. The landside buffer will include the access road and riverside drain, while the riverside buffer will need to be periodically maintained by MRGCD.

At this time the Corps considers the status of the eligibility of site LA 177391 for listing in the National Register of Historic Places (NRHP) to be "undetermined". In order to make this determination, additional information regarding the depth and condition of subsurface deposits within the site is required. This is particularly true in the eastern portion of the site outside of the plowed field where undisturbed cultural deposits may be present within the bosque woodland. As such, the site will be treated as eligible for the purposes of project planning and will be afforded the same protection as a site determined eligible for listing until such time that it is determined otherwise. The information potential of all 13 IOs is considered exhausted by recording and documentation in this report, and all IOs are therefore considered ineligible for listing in the NRHP.

During the initial planning for the levee rehabilitation project, the Corps proposed several alternative alignments in addition to those that follow the existing spoil banks. Site LA 177391 falls within one of those proposed alternative alignments. As project planning has progressed, however, several alternatives have been eliminated from consideration, including the alignment within which LA 177391 falls. LA 177391, therefore, is no longer within the project area and will not be affected by project activities. If, in the future, any project may have an effect on LA 177391, it is recommended that further investigation be conducted at the site to determine the full extent of site deposits and to evaluate the depth and condition of subsurface deposits to make a determination of the sites NRHP eligibility. As stated above, all 13 IOs therefore considered ineligible for listing in the NRHP and therefore are not considered historic properties. The current project, as proposed within this 63.4-acre survey area, will result in No Historic Properties Affected and no additional cultural resources work is recommended within this portion of the proposed project area.

IF REPORT IS NEGATIVE YOU ARE DONE AT THIS POINT.

SURVEY LA NUMBER LOG SURVEY LA NUMBER LOG

Sites Discovered:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
LA 177391		Undetermined

Previously recorded revisited sites:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
N/A		

MONITORING LA NUMBER LOG *(site form required)*

Sites Discovered (*site form required*) **:** **Previously recorded sites** ***(Site update form required):***

LA No.	Field/Agency No.	LA No.	Field/Agency No.
N/A			

7. **Areas outside known nearby site boundaries monitored? Yes ☐, No ☐ If no explain why:**

TESTING & EXCAVATION LA NUMBER LOG (*site form required)*

Tested LA number(s)	Excavated LA number(s)
N/A	

CHAPTER 1
INTRODUCTION AND PROJECT DESCRIPTION

Purpose of the Survey and Project Background

The purpose of the survey documented in this report is to identify cultural resources that may be present within the alignments of a levee construction project proposed by the US Army Corps of Engineers (USACE) at the behest of the project sponsor, the Middle Rio Grande Conservancy District (MRGCD). Broadly, this proposed levee construction project is authorized under the Flood Control Act, 18 Aug 1941, Section 4 (Public Law (P.L.) 228, 77th Congress, 1st Session, H.R. 4911), which authorizes the Secretary of the Army, acting through the Chief of Engineers, to study and implement flood control projects along the Rio Grande and its tributaries. Under this authority the USACE prepared a 1979 report feasibility report titled "Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, Interim Feasibility Report" documenting the flooding problems along the middle Rio Grande between Bernalillo and Belen. This report provides the baseline justification for the current project, which was authorized in Section 401 of the 1986 Water Resources Development Act (P.L. 662, 99th Congress, November 17, 1986). At present, the USACE is preparing a general reevaluation report (GRR) to reevaluate the findings of the 1979 feasibility report and to begin planning of the construction of flood control projects, particularly the replacement of the existing spoil bank levees along the east and west banks of the Rio Grande with engineered levees. The majority of the project has previously been surveyed for cultural resources. However, due to the development of several new alternatives for the project this additional survey was necessary.

Project Description and Location

As originally conceived in the 1979 feasibility report, the project included two northern units in Corrales and Bernalillo and five southern units. The Corrales unit was constructed in 1997, and the Bernalillo unit is being considered as a separate project. The study area of the current GRR investigations includes the five southern study units (Mountain View, Isleta East and West and Belen East and West) located in Bernalillo and Valencia Counties, New Mexico. The area extends approximately 20 river miles from Albuquerque's South Diversion Channel on the east bank and the I-25 bridge on the west bank, to immediately south of the railroad bridge south of Belen (Figure 1.1). The study area encompasses approximately 110 square miles of drainage area and includes several small rural communities on both sides of the Rio Grande between Albuquerque and Belen. Most communities are unincorporated: Isleta Pueblo, Los Lentes, Los Lunas, Los Chavez, Belen, Bacaville, Jarales and Pueblitos are located on the west bank of the Rio Grande. The unincorporated communities of Mountain View, Bosque Farms, Peralta, Valencia, Tome, Adelino, La Constancia and Madrone are located on the east bank of the Rio Grande.

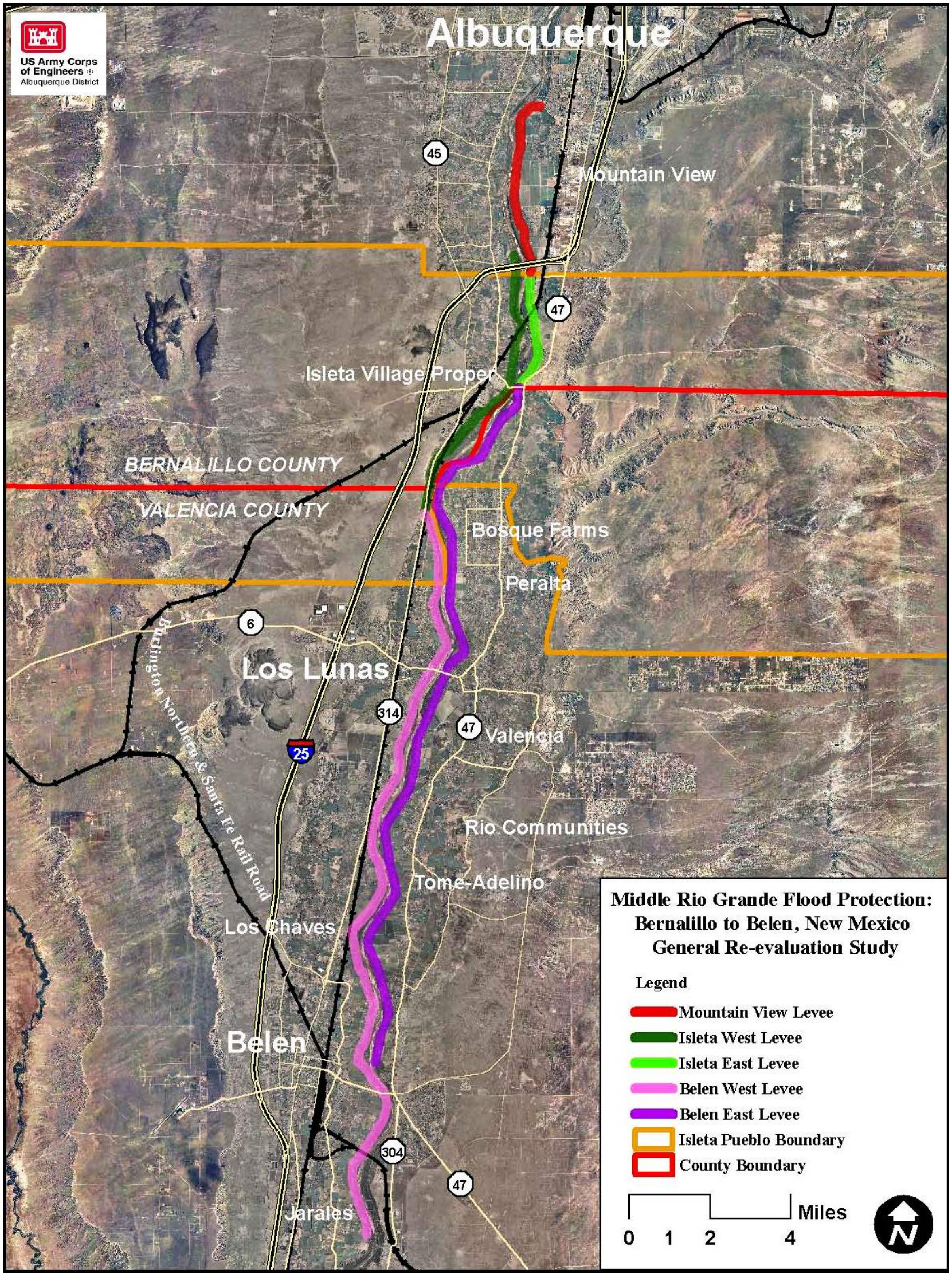

Figure 1.1. Project area map showing all reaches considered during the study (not all will go forward as viable alternatives).

The Mountain View area is mainly suburban with some industrial and small businesses. Agriculture fields of alfalfa or hay and mini-farms still remain along the existing spoil banks. The Isleta Pueblo is almost completely rural with housing generally scattered throughout, the main housing area being the actual pueblo itself and with a few businesses found along the major paved roads. The Belen East and West Units have substantial municipalities along both banks of the Rio Grande with the remainder of the floodplain consisting of agricultural fields of mainly alfalfa or hay, scattered housing developments, mini-farms and businesses. Valencia County, NM had a population of 66,152 as of the 2000 Census. The vast majority of the population and local businesses are located within the 100-year event floodplain.

The need for flood protection along this section of the Rio Grande is great due to the high incidence of flooding coupled with intensive development within the floodplain. Floods on record prior to levee construction include those occurring during the following years: 1828, 1851, 1865, 1874, 1886, 1903, 1905, 1911, 1920, 1928, 1929, 1935, 1941 and 1942. Most flooding resulted from heavy spring runoff caused by either especially heavy winter snows or snowpack melting quickly after warm spring rains. Other flood events were the results of large storms within the Rio Grande and tributary watersheds during the summer and fall. Figure 1.2 through Figure 1.5 show representative historical photographs within the study area.

Newspaper accounts from the winter of 1873 – 1874 tell of unusually large amounts of snow in the western United States, including the watersheds of the Rio Grande and its tributaries. Heavy snowpacks were mentioned to extend as far south as the Sandia Mountains to east of Bernalillo and Albuquerque. In the spring of 1874, rains began to fall upon the mountains of southern Colorado and northern New Mexico's snowpack which resulted in a flood that was estimated at more than 100,000 cfs (cubic feet per second) at times and was reported to cover at least 24 square miles of the middle Rio Grande valley between Bernalillo and Albuquerque for over 3 months. The United States Army was called in to do a survey of the damages and informed the federal government that not only was the area between Bernalillo and Albuquerque standing in water, but that the valley was flooded for miles south of the Isleta Pueblo.

Local newspaper accounts of the flood of 1884 tell that flooding was again caused when isolated spring rains fell upon unprecedented heavy winter snowpacks in southern Colorado and northern New Mexico in mid- to late April. Snow continued to fall in the Rio Grande watershed well into May. By May 1st, Belen, NM and surrounding farms and ranches were already underwater from Rio Grande flooding. River currents and wave action were strong enough to flatten unfinished building construction projects. Buildings made from adobe bricks melted. Two hundred feet of the bridge over the Rio Grande at Los Lunas was swept away.

In early June, 1884 a massive thunderstorm in northern portion of the Rio Grande watershed extending from Bernalillo, NM to southern Colorado dumped heavy rains upon what winter snowpack was still existing. Within 24 hours of the storm, the western portion of Albuquerque's only bridge across the Rio Grande was gone. The river had already jumped its banks south of Albuquerque and the backwaters were moving north. The railroad bridge at Isleta was under a foot of water and Belen, most of which was still under water, was hit with its second flood event of the year. On June 2, the territorial governor made an appeal over the telegraph to the citizens of the New Mexico to aid the people of the middle Rio Grande Valley from the Isleta Pueblo south. The worst of the damage from the June storm event were the communities of Peralta, Valencia, Tome and Los Pinos (which no longer exists). The villages and towns were completely underwater and their citizens camped out in the nearby foothills. This same area was hit with another thunderstorm in late June which caused the receding waters of the Rio Grande to again rise to spread out across the valley.

In 1889, streamflow gaging began and future flood events could more accurately be measured: 1903 (18,900 cfs), 1904 (33,000 cfs), 1920 (22,500 cfs), 1929 (24,000 cfs), 1935 (15,000 cfs), 1941 (24,600 cfs) and 1942 (18,400 cfs).

The flood of 1929 again flooded much of the low lying land outside the banks of the Rio Grande within the study area and prompted levee construction for the next decade. From 1930 to 1935, the MRGCD constructed 190 miles of non-engineered (sometimes called spoil-banks) levees in the middle Rio Grande Valley as part of their district-wide plan to drain the valley farmlands and to provide flood protection. The levees from Bernalillo to San Acacia, New Mexico date to this time.

Figure 1.2. Aerial photos of flooding at Los Lunas, NM, May 5, 1935 (15,000 cfs)

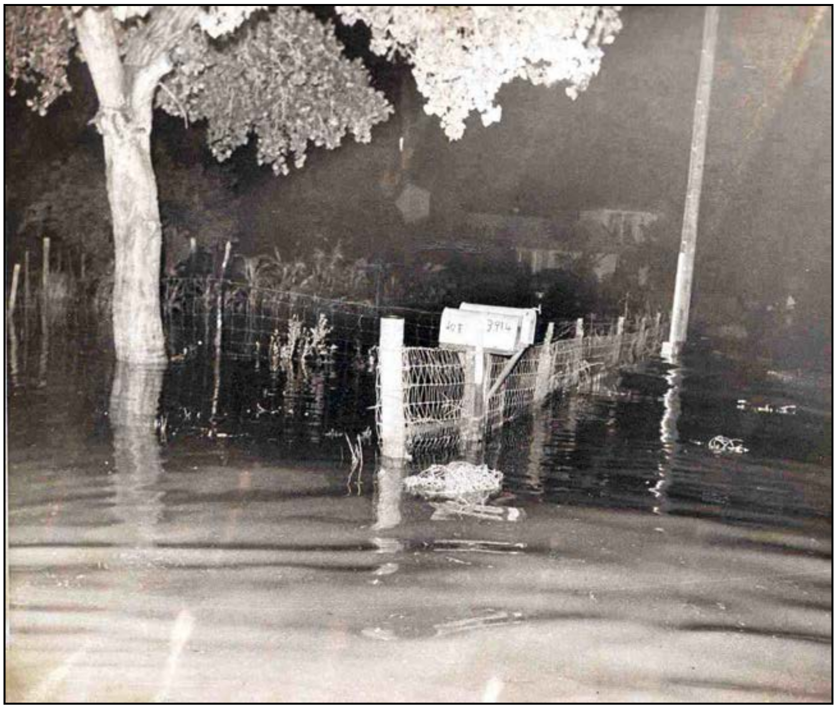

Figure 1.3. House in floodplain after flooding within the study area circa 1941 (24,600 cfs)

Figure 1.4. Aerial photos of Belen, NM bridge washed out, July 13, 1941 (24,600 cfs)

Figure 1.5. House in study area standing in drying floodwaters in 1942 (18,400 cfs)

The Rio Grande in the study area is currently characterized by setback non-engineered levees that contain the floodway. The setback levees have been in place for more than 50 years, and in that period of time sediment has deposited between them. As a result of these sediment deposits, the floodway has become elevated above the surrounding floodplain (Figure 1.6, Figure 1.7), decreasing the effectiveness of the existing spoil bank levees.

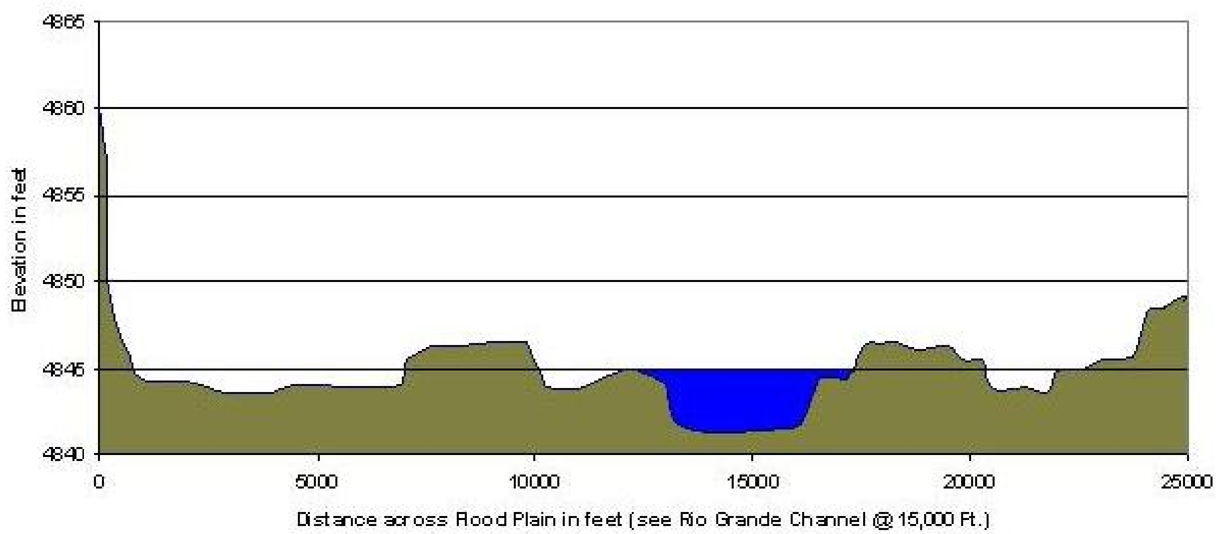

Figure 1.6. Conceptualized Historic Rio Grande Cross Section (pre-levees)

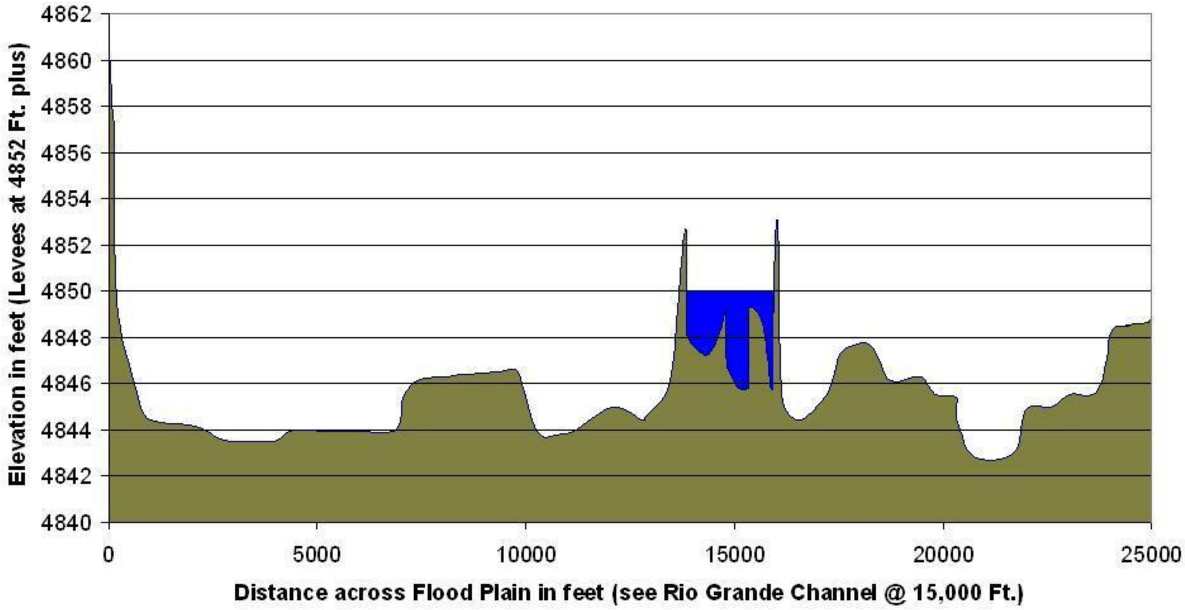

Figure 1.7. Typical Rio Grande Cross Section post-levee construction

In the years following the construction of Cochiti Dam & Reservoir in the early 1970s, flows downstream through the MRG project reach have been regulated. However, this has not entirely protected the reach against all problems associated with Rio Grande spring snowmelt flows. Spring snowmelt releases typically vary in duration from one month to three months depending on the snowpack. Large releases come from both Cochiti Dam and Jemez Canyon Dam with the goal to limit the combined discharge rate to approximately 7,000 cfs measured at the Albuquerque gage near Central Avenue. For example, in 1992, the maximum release from Cochiti Dam was 5,853 cfs on May 11 and the maximum release from Jemez Canyon Dam was 1,279 cfs on May 8. In the years of 1979, 1984, 1985, 1987, 1992, 1993, 1994, 1995 and 2005 the spoil levees required either monitoring (i.e.: sand boils, seepage, levee saturation & overtopping) or flood fighting (i.e.: spreading plastic lining, reinforcing and raising levees with sand bags & constructing ring dikes) to prevent failure in some reaches.

In reviewing the reservoir operations records, it becomes clear that concerns over the levee system have played a role in the ability to manage reservoir releases. The 1979 record states in part, "Two reaches of major concern, one above and the other below Albuquerque have a channel capacity of 5,000 cfs. Major fluctuations of releases were kept to a minimum to prevent sloughing along the inside of the levee system throughout the Albuquerque area. Throughout the flood operation when the Jemez Canyon and Cochiti projects were discharging at channel capacity, the levee system downstream had to be monitored daily. Sand boils and sloughing on the back side of the levees were occurring in numerous locations and levee raising was required in localized areas." The record was not more specific in describing exact locations. However, more recently problems of this nature have been observed in the Mountain View, Isleta East, Isleta West, Belen East and Belen West Units.

The levee system has deteriorated to the point that in 2005 the regulated release to Albuquerque could not be made to the 7,000 cfs peak flow as planned. As flow was approaching 6,000 cfs it became apparent that at least one reach of spoil levee in the vicinity of the Isleta Pueblo and Bosque Farms on the east side of the Rio Grande would be in jeopardy of failure if flow was maintained or increased as planned. This was a general seepage failure through and under the spoil levee for an extensive reach approaching a length of a mile or more. Releases were reduced with a peak flow of approximately 6,300 cfs being passed through the system before the flow rate drastically dropped off through this reach. These flow rates are based on the USGS gage data for the Rio Grande at Central Avenue.

The spoil levees are currently not capable of holding prolonged flows in the floodway. The channel capacity prior to over banking is only 3,000 cfs to 4,000 cfs in many locations through the project area. The evidence indicates that many reaches continue to aggrade (particularly from the Isleta Diversion to Los Chavez) and the river channel is experiencing reduced conveyance capacity at many locations. This condition results in more frequent overbanking with water standing against weakened spoil levees for a longer duration, greatly increasing the risk for catastrophic failure.

Proposed project activities include replacing the existing spoil-bank levees with engineered, trapezoidal levees that would provide protection from the one-percent chance exceedence flood event (formerly the 100-year flood) plus an additional three feet of freeboard. In most cases where the proposed levee alignment follows the existing spoil banks, the engineered levees would be constructed within the same footprint of the existing spoil banks, and the spoil banks themselves would be utilized as fill material for the newly constructed levees. The spoil banks were constructed through decades of dumping spoil materials from the riverside drains onto the piles to create an irregularly-shaped alignment paralleling the riverside drain. As such, the footprint of the spoil banks throughout the project area is generally larger than is necessary for the engineered levees. The engineered levees, therefore, will fit within the existing disturbed area created by the spoil banks, and will not increase the footprint of disturbance. Existing access roads are currently maintained along the spoil banks by MRGCD, and these roads will be used to access the project area. A 15-foot buffer from the toe of the engineered levee on both the land and riverside will need to be maintained free of woody vegetation to protect the structural integrity of the levee. The landside buffer will include the access road and riverside drain, while the riverside buffer will need to be periodically maintained by MRGCD.

Land Ownership

All portions of the current project were conducted on the Isleta Pueblo Indian Reservation.

Project Personnel and Schedule

USACE archaeologists Jeremy Decker, Gregory Everhart and Jonathan Van Hoose conducted a cultural resources survey on September 11 and 12, 2013. Jeremy Decker and Gregory Everhart conducted additional survey December 15, 2014. Jeremy Decker prepared this report. Corps archaeologist Jonathan Van Hoose reviewed this document. At this time no date has been scheduled for project construction.

CHAPTER 2
ENVIRONMENTAL SETTING

Natural Environment

Physiography and Geology

The study area is located in the northern Mexican Highland Section of the Basin and Range Physiographic Province (Lozinsky et al. 1991). The Albuquerque-Belen Basin is within the Rio Grande Rift, and at Isleta is bounded by the Manzano Mountains on the east and the West Mesa to the west (Kelley 1977). The project is situated on the floor of the Rio Grande Valley adjacent to the active river channel and within the historic and modern river floodplain. Elevations in the surveyed area range from 4,895 to 4,910 feet above sea level.

The Albuquerque Basin consists of a series of complex graben and fault structures, and is flanked on the east by the Sandia-Manzano Mountain uplift. The basin is filled with a complex set of sediments known as the Santa Fe Formation which extends to a maximum depth of 12,000 feet and consists of sandstone, mudstone and gravel deposits of Miocene and Pliocene age. Widespread sedimentation in the Pleistocene produced a relatively thin (20 to 200 feet) surface known as the Ortiz Formation, which is preserved on the mesa to the west of the project area. The Rio Grande Valley has cut into the upper basin fill sediments. Locally, the floor of the Rio Grande valley has an average annual rainfall of 10 inches and averages 180 frost-free days (Tuan et. al. 1973:18 and 80).

Soils

Soils in the survey area consist of Torrifluvent floodplain alluvium and Gila Loam and Anapra series soils (Natural Resources Conservation Service 2013). Torrifluvent most common and consists of frequently flooded, slightly to moderately saline floodplain alluvium. The Gila series consists of very deep, well drained soils formed in stratified alluvium. Gila soils are on alluvial fans and flood plains and have slopes of 0 to 5 percent. The Anapra series consists of deep, well drained, moderately slowly permeable soils on bottomlands. These nearly level soils formed in stratified loamy material underlain by sandy material.

Climate

The study area has a semiarid climate. The project area has a mid-latitude desert climate, with an annual average precipitation amount of 7.59 inches (recorded for Belen, NM, Western Regional Climate Center 2013). Precipitation is irregular, but there is typically a pattern of monsoonal rains in July and August as Gulf air masses penetrate into the region. Cyclonic precipitation occurs during winter months, with average annual snowfall of 4.8 inches. Average diurnal temperature fluctuations of 30° F to 40° F are characteristic of the project area. Summer temperatures are warm and winters are mild.

Vegetation and Wildlife

The survey area falls in the transition zone between bosque woodland and agricultural fields. The eastern portion of the survey area is bosque woodland composed primarily of cottonwood, salt cedar, Russian olive, Siberian elm and varieties of willow with lesser growths of ailanthus (tree of heaven), and white mulberry. New Mexico olive (privet) is one of the important shrubby plants. The bosque under-story includes a variety of grasses, annual herbs, and riparian plants such as yerba mansa. The western portion of the survey area consists of plowed agricultural fields flanked by brushy fence lines.

Results of Records Check

An online records check of the New Mexico Office of Cultural Affairs, Historic Preservation Division, Archaeological Records Management Section's (ARMS) database was conducted by Jeremy Decker in August of 2013. Table 2-1 lists archaeological surveys that have been conducted within 0.5 miles of the current project area. According to the ARMS database and Corps records, 27 surveys have been conducted within 0.5 miles of the project area; ARMS data for these sites are presented in Table 2-1. These surveys total more than 1100 acres. A screen capture of the ARMS map server search is shown in Appendix A, Figure A.1 and A.2.

Two additional surveys not found in the NMCRIS GIS database were conducted in order to cover the entire spoil-bank alignment within the proposed project area. The surveys of the spoil-bank alignments were conducted by the Office of Contract Archeology, University of New Mexico (OCA); one in 1998 for the reach from Isleta Pueblo southward to Belen (Bargman 1998, NMCRIS No. 59915), and the other in 2000 for the Mountain View Unit (McEnany 2001, NMCRIS No. 75870). Each of these surveys covered the existing spoil-bank alignment including the spoil bank itself, as well as the toe of the levee on either side to encompass the entire proposed construction area. The current survey was conducted with the intent of covering those areas that were not surveyed by OCA during these two projects.

Table 2-1. Surveys conducted within 0.5 miles of project area.

NMCRIS Number	Performing Agency	Project End Date	Acres	Number of Sites	Survey Type
20295	Indian Health Service Albuquerque Area Office	8/18/1980	Unknown	Unknown	Unknown
20474	NM State Highway & Transportation Dept	2/29/1988	72.00	1	Intensive
25166	US Bureau of Indian Affairs Albuquerque Area Office	7/10/1984	0.50	0	Intensive
42053	US Bureau of Indian Affairs Albuquerque Area Office	3/13/1979	Unknown	Unknown	Unknown
42429	Indian Health Service Albuquerque Area Office	2/1/1993	0.23	0	Intensive
42431	Indian Health Service Albuquerque Area Office	8/9/1979	Unknown	0	Unknown
42437	Indian Health Service Albuquerque Area Office	5/19/1980	Unknown	Unknown	Unknown
46996	TRC, Inc.	5/31/1994	Unknown	0	Intensive
48580	US Bureau of Indian Affairs Albuquerque Area Office	5/24/1995	456.40	8	Intensive
51426	US Bureau of Indian Affairs Albuquerque Area Office	10/7/1997	3.80	2	Intensive
52308	TRC, Inc.	9/20/1996	126.00	7	Intensive

NMCRIS Number	Performing Agency	Project End Date	Acres	Number of Sites	Survey Type
57561	Lone Mountain Archaeological Services	7/18/1997	2.40	1	Intensive
70995	USDI Bureau of Indian Affairs Southwest Region	6/23/2000	0.29	0	Intensive
71175	University of New Mexico Office of Contract Archaeology	7/19/2000	181.82	3	Intensive
72421	RDM Associates	10/14/2000	2.00	0	Unknown
73003	RDM Associates	12/31/2000	10.30	1	Intensive
75747	Tetra Tech NUS, Inc.	8/24/2001	0.04	0	Intensive
77390	Cibola Research Consultants	2/5/2002	1.00	0	Intensive
93516	Marron and Associates	5/25/2005	6.60	0	Intensive
100494	Cibola Research Consultants	8/1/2006	220.00	4	Intensive
107048	Marron and Associates	9/10/2007	8.80	1	Intensive
110039	Hammerstone Archaeological Services	4/26/2008	2.00	0	Intensive
110154	NM Department of Transportation	5/9/2008	1.60	0	Intensive
110601	Marron and Associates	6/27/2008	1.00	0	Intensive
112260	Hammerstone Archaeological Services	11/30/2008	5.73	0	Intensive
115085	Hammerstone Archaeological Services	8/20/2009	1.00	0	Intensive
118758	Hammerstone Archaeological Services	8/6/2010	4.66	0	Intensive

There are 15 known archaeological sites within 0.5 mile of the project area; ARMS data for these sites are presented in Table 2-2. Of these sites, eight are historic, three are prehistoric, three have both a prehistoric and historic component, and one property has an unknown temporal affiliation. Generally speaking, prehistoric sites and the large multi-component sites of Isleta Pueblo (LA 724) and the Nineteenth Hole Site (LA 725) are located on terraces above the floodplain, while historic sites, mostly related to flood control and agricultural activities, are located directly within the floodplain of the Rio Grande. Given that this survey was conducted entirely within the floodplain, it was expected at the outset of the survey that any new sites encountered would be historic sites related to these activities. In addition to these sites, several historic water delivery systems are located within the project area including the Atrisco, Isleta and Upper Belen Riverside Drains. These drains were not recorded as part of this survey, but parallel the project area throughout. The survey area does not overlap with any other known historic properties. A single state and National Register-listed property, Isleta Pueblo (SR#247, listed on the National Register on 9/5/75) is located within 0.5 miles of the project area, but did not fall within the surveyed area and will not be impacted by project activities.

Results of Tribal Consultation

Consistent with the Department of Defense's American Indian and Alaska Native Policy of 1998, and pursuant to 36 CFR 800.2(c)(2)(i), tribal consultation on this project was conducted in 2010 with all Native American tribes that indicated they have concerns in Bernalillo and Valencia Counties. Responses were received from The Hopi Tribe, Laguna Pueblo, White Mountain Apache and Ysleta del Sur Pueblo; all indicated that there were no cultural resources concerns with the project. In addition to these consultation letters, the Corps has worked closely with Isleta Pueblo to identify potential cultural resources concerns on Isleta Pueblo lands. Consultation with Isleta Pueblo is ongoing, and the Corps will conduct formal consultation with the Isleta

Table 2-2. Known archaeological sites within 0.5 miles of project area.

LA Number	Site Type	Occupation Type	Description	Site Size (m²)
724	Structural	Multi-Component	Isleta Pueblo	30000
725	Structural	Multi-Component	Nineteenth Hole Site, Roomblock with artifact scatter	3370
65961	Structural	Historic	House structure	300
108648	Structural	Historic	Residential complex	32725
108652	Structural	Unknown	Lithic scatter, thermal feature	615
108653	Structural	Prehistoric	Lithic scatter, thermal feature	6325
108654	Structural	Historic	Agricultural field	200000
108655	Structural	Prehistoric	Ceramic scatter, thermal feature	20
114984	Nonstructural	Prehistoric	Artifact scatter	1387
118119	Structural	Historic	Isleta Lateral	2000
136323	Nonstructural	Multi-Component	Unknown	Unknown
153622	Structural	Historic	Bridge/dike feature	225
153623	Structural	Historic	Railroad bridge	2000
153624	Structural	Historic	Flood control dike	6000
153625	Structural	Historic	Foot bridge	40

Pueblo THPO for the portions of the project that will be constructed on Isleta Pueblo lands. This report covers the survey for archaeological sites; however, tribal consultation may reveal information regarding other cultural resources not identifiable on survey. The Tribal Council at Isleta Pueblo has expressed their formal support of the project.

Culture History and Literature Review

In 2006 Cibola Research Consultants conducted an archaeological survey on Isleta Pueblo lands for the Corps. The resulting report provided and excellent overview of cultural resources on Isleta Pueblo (Marshall and Walt 2006). The following culture history section is taken directly from that report (Marshall and Walt 2006: 23-26).

> *"Isleta Pueblo is located 13 miles (21km) south of present-day Albuquerque, New Mexico, on the west bank of the Rio Grande. It has a resident population of almost 5,000 persons. It is one of the three largest pueblos in New Mexico, and has usually been the largest Rio Grande pueblo since before the beginning of the American regime (1846). Since the early 18th century, Isleta has been the southernmost Pueblo in New Mexico, with large areas of land to the south and the east that are completely removed from the territory of any of the other pueblos.*
>
> *The Isleta Reservation has a land area of 211,002 acres. The name Isleta (Spanish for islet) refers to the fact that the Rio Grande has changed its course over many years; and at one time it almost encircled the village. While today the village is on the west bank, there are both ancient and modern settlements on both sides of the river with affiliation to Isleta. Some of these settlements date from the Pueblo III period (ca. 1200 A.D.). The Isleta name for the village is Shiehwiíb-ag,*

referring to a 'hwib' stick, which is used in a game. The name is said to refer to the knife-like shape of the game stick that resembles the higher ground upon which the central village is built (Lummis in Harrington 1916:528).

The people of Isleta belong to the Tigua Nation as the Spanish called them, and they speak a language known as Southern Tiwa. They also speak English and some older people speak Spanish as well. Southern Tiwa is also spoken at the Pueblo of Sandia, although it is a different dialect.

Prehistoric Settlement at Isleta

Some of the earliest evidence of people in the New World is found in the American Southwest within or near Isleta (Judge 1973:63). The Pleistocene-era Clovis Tradition and later Folsom and Plano complexes date to 10,000 B.C. or earlier. From that time on, a continual cultural presence can be traced in the Isleta area, up to and including the present occupation of Isleta Pueblo.

From the late Archaic period, beginning about 1805 B.C. (Elyea 1999:147), peoples in the middle Rio Grande region employed a mixed economy of maize agriculture with hunting and gathering. This period marks the beginning of an agriculturally-based Puebloan tradition that emerged during the early centuries of the Christian era. One of the oldest known agricultural villages identified in the general area has been dated to the first millennium B.C. (O'Leary and Biella 1987:199; Gossett and Gossett 1988). The fact that this early occupation is found in stratigraphic deposits directly beneath a later Tiwan pueblo is of interest, and it is likely that other ancestral Tiwan villages are superimposed over earlier village occupations.

Pottery was first used in the Isleta area about A.D. 500. Settlements dating to the early part of the early Developmental Puebloan period (ca. A.D. 500–900) are scattered over Isleta lands and consist of small villages of circular pithouses. Settlements in the subsequent Pueblo II and III periods (ca. A.D. 900–1300) continued as small hamlets and pueblitos, with the addition of rectangular surface roomblocks and subterranean kivas. The ruins of these early Puebloan villages at Isleta are found along the upper margins of the Rio Grande and Rio Puerco valleys where small garden plots were cultivated. During these eras, population density was low and settlement was dispersed in order to take advantage of local resources and small, cultivated plots.

During the Pueblo IV period (ca. A.D. 1300–1540), the small settlements of the earlier period were replaced by larger adobe roomblocks constructed adjacent to or within the floodplain of the Rio Grande. These early adobe pueblos coincided with the emergence of the Rio Grande Glazeware ceramic tradition, ca. A.D. 1300, and mark the beginning of a cultural florescence in the region. Populations in the Isleta area may have increased tenfold from A.D. 1200 to 1500. This increase resulted from both in-situ growth and immigration into the valley, primarily from the south and southeast (Brandt and Walt 2000:82).

It is during this period of early coalition that a cultural complex of direct Isletan ancestry can be positively identified, although a much earlier Tiwan occupation is likely. Fifty to seventy-five Pueblo villages of Southern Tiwan affinity, both great and small, were built in the middle Rio Grande valley at this time (Marshall and Walt 1985). The largest of these contained multiple plazas and multistoried adobe apartments containing more than 1,000 rooms.

A pattern of aggregation into confined geographic areas with fewer, but much larger, villages is a pan-Puebloan phenomenon in the 1300s, evident across the entire Southwest. The nucleation and growth of villages coincided with an increase in the regionalization of traits that led to the identification of the Puebloan ethnic groups recognized by the Spanish in 1540-1580.

Southern Tiwan settlements extended from Bernalillo on the north to Abo Wash on the south along a 60-mile segment of the central Rio Grande. Additional Tiwan settlements were also found along the eastern slopes of the Manzano Mountains and in the western canyons of the Sandia and Manzano Mountains. Prior to European contact in 1540, a substantial community of ancestral Isleta peoples occupied a number of villages in the region immediately surrounding the present pueblo within the middle Rio Grande, eastern Manzano, and Tijeras Canyon areas. Eventually all inhabitants of the ancestral Isleta cluster were absorbed into Isleta Pueblo of today. The emergence of Isleta Pueblo as the regional center or "mother village" is the pattern rather than the exception in the Pueblo world.

The archaeological data, historical records, and oral historical accounts indicate that Isleta Pueblo as a regional center evolved from a larger ancestral Isleta community cluster. Evidence also suggests that a concentration of ancestral Isleta villages existed in the general area of the present pueblo from Astrisco south to Los Lunas during the period from A.D. 1350 to 1540 (Fisher 1931; Mera 1940; Marshall and Marshall 1990, 1992; Marshall and Walt 1985). This constellation of villages appears to have formed a sociopolitical nucleus to which the ancestral Isleta community cluster eventually congregated. These villages included Isleta (LA 724), Rainbow Village (LA 81), Shipman Pueblo (LA 720), Amalia Pueblo (LA 719), Pajarito Pueblo (LA 723), Los Lentes Pueblo (LA 951), Valencia Pueblo (LA 953), and Yellow Earth Village, among others.

Isleta in the Historic Period

The first contact of Tiwan peoples with Europeans occurred on September 7, 1540, when a detachment of Spanish conquistadors from the Coronado expedition arrived in the area. Conflict with the Spaniards during their two-year stay reduced many of the pueblos to ruins. Many Tiwan refugees fled to other pueblos and to retreats in the Sandia and Manzano mountains. Following the Coronado expedition, the Spanish did not return until 1580 and did not attempt colonization until 1590 and 1598. In the interim, there was a considerable decline in Tiwan *and other Puebloan populations, perhaps because of the introduction of European diseases.*

There were 22 Southern Tiwa pueblos in the Rio Grande Valley and the eastern Manzano area named in the early Spanish records of the 1580s (Barrett 1997:8). By 1630, the number of Southern Tiwa pueblos recognized by the Spanish had dropped to eight (Ayer 1965:23). The number of Southern Tiwa villages was reduced to four by the time of the Pueblo Revolt of 1680 including Sandia, Alameda, Puaray, and Isleta. Following the Pueblo Revolt, Isleta Pueblo was reoccupied by 1706. In 1748, refugees returning from Hopi Pueblo reestablished the other Southern Tiwa pueblo of Sandia.

The Spanish, over their tenure, were successful in consolidating the Southern Tiwa into two major pueblos–Isleta and Sandia. These are what remained of the Southern Tiwa at the time of the American occupation in 1846. The Spanish issued grants, by which Pueblo and non-Indian lands were defined.

As a leading town in the region and the southernmost pueblo in New Mexico since post–Pueblo Revolt times (1706), Isleta has absorbed migrants from other communities throughout its existence. It has served as a regional capital for smaller farming settlements and residential areas. Despite smallpox epidemics, droughts, and raiding by nomadic Indians, Isleta has maintained a population close to the largest of the New Mexico pueblos.

The second half of the nineteenth century saw an end to Mexican rule and the entry of the United States. In 1846, New Mexico became a territory of the United States. Accounts of Isleta during the later half of the 19th century describe a thriving agrarian community.

Isleta became a popular destination for a wide variety of American explorers and visitors. Among these was Charles Lummis, who published and publicized Isleta traditional stories and cultural practices in many articles and books. They are housed at the Southwest Museum in Los Angeles, founded by Lummis in 1910. Isleta's Spanish grant was recognized by the United States in 1864, although it excluded what became known as the "Isleta Tract", the northeastern corner of Isleta lands in the Manzano Mountains. These lands were eventually returned to Isleta in 1933.

During the late 1870s, Isleta accepted an influx of religious refugees from Laguna Pueblo who settled in an area south of the main village known as Oraibi. Today there are residential suburbs of Isleta known as Oraibi, Ranchitos (T'aykabede), and Chical (Shi'a).

Throughout the historic occupation of Isleta Pueblo and the ancestral occupation of various Tiwan pueblos, the Rio Grande and its bosque were, no doubt, extensively utilized as part of the subsistence system and were places of traditional and *sacred use. Excavations in ancestral Tiwan sites from as early as the 1200s indicate a considerable reliance on faunal and flora resources from both riparian and adjacent desert habitats (Marshall and Marshall 1994). Indeed, most of the ancestral Tiwan settlements are situated on the edge of the river valley in positions which allowed accessibility to both the riverside and desert grassland-scrubland ecozones. Interviews with Isleta elders and the Isleta Pueblo Cultural Affairs Committee indicate a continued Isleta Pueblo reliance on plant and animal resources in the bosque riverside environment, and substantiate traditional land use and sacred site locations in the area."*

CHAPTER 3
FIELD METHODS

Introduction

Areas surveyed included four sections of the proposed levee alignments on the east and west side of the Rio Grande on lands owned by Isleta Pueblo (Figure 3.1 and Figure 3.2). Where existing spoil banks were present the survey followed those alignments. In other areas proposed for new levee construction surveyors followed a center line for the proposed alignment using a GPS unit. The following methods were used for the survey.

Size of the Survey Crew, Transect Interval(s) and Transect Method

The survey took place in two phases, the first on September 11 and 12, 2013 and the second on December 15, 2014 with Corps archaeologists Jeremy Decker, Jonathan Van Hoose and Gregory Everhart contacting Steve Abeita (2013) and Cody Walker (2014) of Isleta Pueblo to gain access to the survey area. During survey, photographs were taken of the proposed project area to document the condition of the survey area. The survey was conducted using two methods. First, where existing spoil bank levees are present a transect was walked with one person walking the service road between the riverside drain and the toe of the levee, one person on the slope of the levee, and another person on the top of the levee. After walking the length of the survey segment on the land side of the levee, surveyors returned by lining up with one person on the river side of the levee near the toe, and the other two spaced at 15-meter intervals toward the river. The second method was utilized where no existing levee was present. In these areas surveyors walked 15-meter spaced transects centered on the proposed alignment until at least a 75-meter buffer was surveyed. Several areas within the survey area were not surveyed due to the presence of marshy, standing water conditions as well as very dense vegetation (willow, Russian olive, tamarisk). In these areas surveyors attempted to survey any nearby open ground or adjacent roads. The total survey acreage is 63.4 acres, all on Isleta Pueblo lands.

One prehistoric archaeological site, LA 177391, was recorded during survey, and 13 isolated finds were documented. All locational information, including staging area, site and feature boundaries, was recorded with a Trimble Geo-XH GPS sub-meter unit.

Field Conditions

During the survey, temperatures were cool, with overcast skies. Ground visibility was variable. In the bosque on the riverside of the spoil banks visibility was near zero where vegetation was thick, but was 30-50% in the northern portion of the survey area where cottonwoods were the dominant vegetation. On the spoil banks themselves visibility was 10-50% depending upon vegetation cover. Visibility was good in the plowed fields along the westernmost portions of the survey area at 50-75%. During the survey some standing water was present in the fields, but this did not present a significant impediment to surface visibility. The majority of the survey area is heavily disturbed. The area was heavily modified during the construction and subsequent maintenance of the MRGCD riverside drains and spoil banks. Repeated plowing of the agricultural fields has resulted in disturbance to the upper 30-50 centimeters of sediment within the fields.

Methods of Site Location and Site Recording

A pre-field check of the New Mexico Office of Cultural Affairs Archaeological Records Management Section's (ARMS) database in September of 2013 by Jeremy Decker indicated the presence of several archaeological sites within 0.5 miles of the project area. Other than the riverside drains and spoil banks, no archaeological sites are known to intersect the survey area. See Appendix A, Figures A.1-A.2 for the results of this ARMS search.

Standard survey methods, such as presence of features and artifacts, were used to identify historic properties. The locations of individual artifacts and features were mapped using a hand-held Trimble Geo-XH sub-meter GPS unit. Site recording at LA177391 consisted of GPS mapping and collection of attribute data for all artifacts, as well as photography at the site. No datum stake was placed at the site. Site information was recorded on an LA site form.

Photography and Documentation Methods

Digital photographs were taken at different points during the survey. Some of these photos have been incorporated into this document. Notes, photographs, and copies of the report are stored at the Corps' Albuquerque District office.

Strategies Employed for Collection or Limited Tests

No artifact collection or testing was conducted as part of this project.

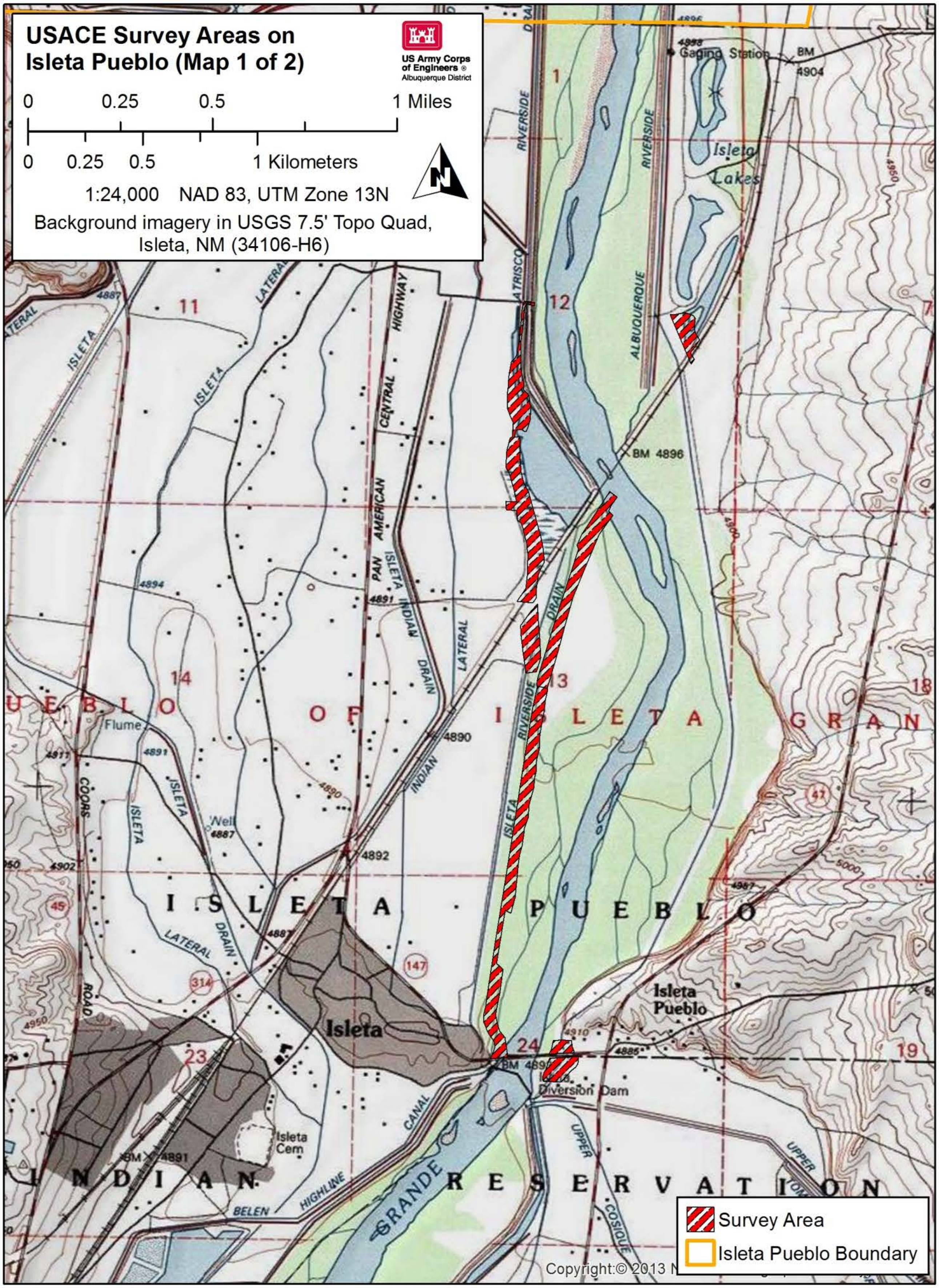

Figure 3.1. Northern USACE survey blocks.

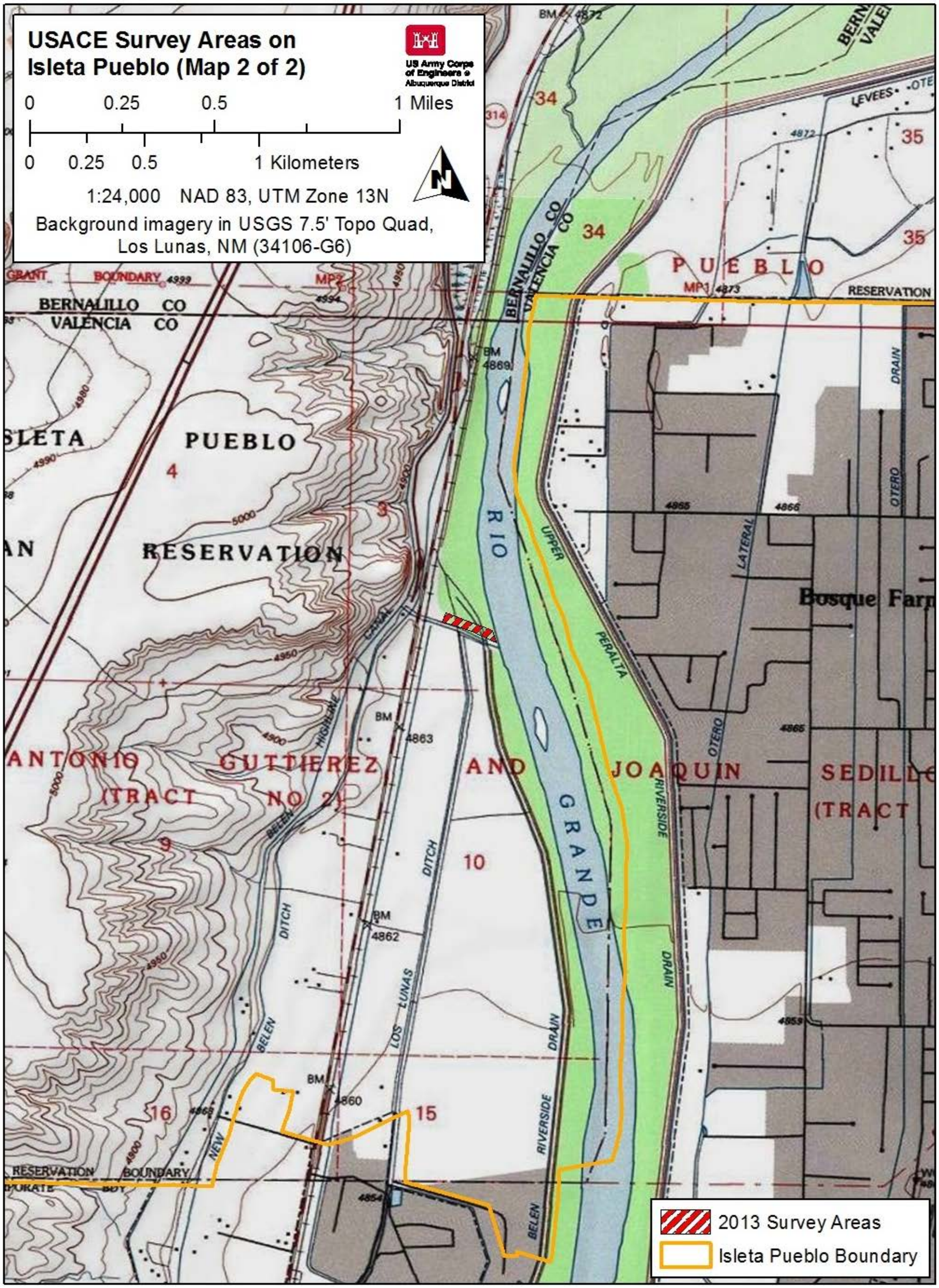

Figure 3.2. Southern USACE survey block.

CHAPTER 4
RESULTS OF SURVEY

Location of Cultural Properties

The survey resulted in the discovery of one new archaeological site and 13 isolated occurrences. A map of the site and isolated occurrence locations is provided in Appendix A, Figure A.3. The public disclosure of the location of archaeological sites on state and private lands is prohibited by Section 18-6-11.1 NMSA 1978. Public disclosure of archaeological site locations is federally prohibited by 16 USC 470hh (36 CFR 296.18). Confidential site location information is provided in Appendix A. Appendix A should be removed prior to public disclosure of this report.

LA 177391 (Prehistoric Site)

LA 177391 is a newly recorded prehistoric artifact scatter containing lithic debitage and tools, ceramics and ground stone artifacts. The site measures 89 meters N/S x 60 meters E/W (3831 m^2). The site is located on the west side of the Rio Grande along a dirt road that provides access to numerous agricultural fields on the Isleta Pueblo Reservation (Figure 4.1). The site is located at an elevation of 4,895 feet AMSL. The site extends into two agricultural fields on the west side of the road, and may extend to the east into the Rio Grande bosque, however surface visibility is zero in this area and no artifacts were observed east of the road during the current recording. The Rio Grande is approximately 500 meters east of the site, and the site is within the historic floodplain. Vegetation on the east side of the road is typical of the Rio Grande bosque with cottonwood, willow, tamarisk and Russian olive trees with other riparian grasses and forbs present. Vegetation on the west side of the road consists of agricultural crops such as hay and alfalfa. A site location map for LA 177391 is included in Appendix A, Figure A.4.

Figure 4.1. Overview of the site showing the agricultural fields on the west side of the road.

A total of 26 artifacts were observed on the site. Though the total number of artifacts is small, the assemblage is diverse. Artifacts observed included ten flakes, one chalcedony core, one obsidian projectile point fragment, ten ceramic sherds, two ground stone manos, and two historic artifacts. Eight of the eleven pieces of lithic debitage, including the small, globular core, were chalcedony. Two quartzite flakes and an obsidian flake were also observed. Attributes for these flakes are provided in Table 4-1. The single lithic tool is an obsidian projectile point fragment (Figure 4.2). The fragment is the tip of a very small point with an impact fracture. Even though the point is not diagnostic, its small size indicated that it comes from a post-Archaic, late prehistoric to historic context. The two other lithic artifacts are quartzite mano fragments. Both fragments are too small to assess whether or not they are one or two-handed implements. Table 4-2 provides attributes for the ground stone artifacts.

Ceramics on the site include one Rio Grande Glazeware (Figure 4.3), five plainware utility, one corrugated, two black-on-whites (Figure 4.4), and a single whiteware sherd with heavily oxidized paint (Figure 4.5). Table 4-3 provides attributes for all sherds located within LA 177391. Date ranges for ceramic artifacts on the site span from as early as A.D. 450 to the historic period; however, the assemblage as a whole appears most likely to date to sometime after A.D. 1200 based on the presence of Santa Fe Black-on-white and a single Rio Grande Glazeware sherd consistent with Glaze E types. The range of dates suggested by the ceramic assemblage may be indicative of multiple occupations of the site, or may be a product of intense mixing related to the use of the site as an agricultural field.

Table 4-1. Attributes for lithic artifacts from LA 177391.

Material	Size (cm)	Condition	Platform Type	Cortex	Edge Modification
Chalcedony	3-4	Complete	Plain	Absent	No
Obsidian	1-2	Broken	Plain	Present	Yes
Quartzite	3-4	Debris	None	Present	No
Chalcedony	3-4	Complete	Cortical	Present	No
Chalcedony	4-5	Flake Fragment	None	Present	No
Chalcedony	3-4	Flake Fragment	None	Absent	Yes
Chalcedony	2-3	Debris	None	Absent	No
Chalcedony	2-3	Complete	Crushed	Absent	No
Quartzite	6-7	Complete	Plain	Present	No
Chalcedony	2-3	Broken	Plain	Present	No

Table 4-2. Attributes for ground stone artifacts from LA 177391.

Type	Material	Complete (%)	Length (cm)	Width (cm)	Thick (cm)	Mano Planview	Mano Cross Section	Grind Surface Shape	Pecking
Mano	Quartzite	1-25	4	4	2	Ovate	Parallel Faces	Flat	Yes
Mano	Quartzite	26-50	10	6	5	Irregular	Uniface	Uniaxial	No

Figure 4.2. Obsidian projectile point fragment with impact fracture on the tip.

Figure 4.3. Rio Grande Glazeware sherd.

Figure 4.4. Santa Fe Black-on-white sherd.

Figure 4.5. Black-on-white sherd with heavily oxidized pigment that appears red.

Table 4-3. Attributes for ceramics at LA 177391.

General Category	Size (cm)	Thick (mm)	Portion	Form	Comment	Type	Date Range
Glazeware	1-2	5	Body	Bowl	Redware with polished interior and exterior, fine rounded sand temper with small dark flecks; paste red throughout; interior painted line, slightly runny glaze	Rio Grande Glaze E (possibly Puaray Glaze Polychrome)	AD 1515-1650 or AD 1600-1700/1750
Plainware	3-4	6	Body	Jar	Gray surfaces and paste, slightly darker core, no coils visible, subangular quartzite and sand temper with single larger dark igneous inclusion	Plain grayware	AD 450-1600
Plainware	3-4	5	Body	Jar	Rough interior and exterior surfaces, with light exterior polish; no coils visible; small rounded sand temper	Plain grayware	AD 450-1600
Plainware	1-2	4	Body	Indet.	Spall	Plain grayware	AD 450-1600
Plainware	1-2	n/a	Body	Indet.	Spall, thickness incomplete	Plain grayware	AD 450-1600
Plainware utility	3-4	n/a	Body	Indet.	Spalled exterior fragment; rough gray exterior; rounded sand temper; same as others above	Plain grayware	AD 450-1600
Black on white	5-6	5	Body	Bowl	carbon paint int 3 parallel lines; polished int, rough exterior	Consistent with Santa Fe B/W	AD 1200-1350
Black on white; decorated rim with oxidized paint	2-3	5	Rim	Bowl	Painted rim sherd with thick paint which appears red, but is most likely oxidized black	Unidentified B/W	Late Prehistoric
Gray/whiteware sherd; no decoration	3-4	5	Body	Bowl	Polished interior rough exterior; like the b/w sherd but without paint	Similar to Santa Fe B/W	AD 1200-1350
Corrugated	3-4	5	Body	Jar	Flattened coils, small indentations	Indented Corrugated	AD 1150-1450

Two historic artifacts were also observed on the site. One is a fragment from the base of a white ceramic plate and the other is the base of a clear glass wine bottle. The wine bottle does not have a maker's mark, but does have the numbers "22 069" printed on it which may suggest a bottling date of 1969 (Figure 4.6). These domestic objects are either related to the historic occupation of the farmland on which the site rests, or to the use of the road that runs through the site, and they are considered isolated occurrences within the prehistoric site.

LA 177391 is in poor condition. The site has been worked as an agricultural field for decades and the upper 30-50 centimeters of soil has been heavily disturbed by plowing. The site also has a road cutting through its eastern edge and a fence line bisecting it. In addition, the site falls within the historic floodplain of the Rio Grande and has likely been inundated by flood waters numerous times in the past. Though surface deposits within the site have been heavily impacted, given the site's location within a floodplain it is possible that buried deposits are present that have not been disturbed by agricultural activities. It is also possible that the site extends eastward into the bosque. This area is heavily vegetated and surface visibility is zero so no artifacts were observed during site recording, however it has never been cultivated and may contain relatively undisturbed deposits.

Figure 4.6. Historic wine bottle base.

Isolated Occurrences

A total of 13 isolated occurrences (IOs) were located on Isleta Pueblo lands. Table 4-4 provides a description of the IOs, and Figure A.3 in Appendix A shows the location of each IO. UTM coordinates for each IO are provided in Appendix A, Table A.1. Of the 13 IOs, five are prehistoric and eight are historic. Prehistoric IOs include three ceramic sherds and two pieces of lithic debitage. Historic IOs included both features and scatters of historic trash. Four historic feature isolates were recorded, three of which are pipes likely related to agricultural activities in the area, and the fourth is a railroad tie fencepost that is part of a barbed wire fence strung amongst the trees along the river side of the spoil bank. The age of the fence is unknown, and most of it is laying on the ground. Historic artifact isolates white ceramic plate fragments, a white glass cosmetics jar, a blue glass insulator cap and a small scatter of multiple artifacts. The scatter (IO10) is concentrated in an area approximately two meters by two meters and contains the remains of perhaps 10-15 artifacts including remnants of several church key-opened metal cans, clear and brown bottle glass fragments, two glass cooking vessels and a rubber shoe sole. One of the cooking vessels is a piece of Fire King Oven Ware, a highly popular Pyrex-like brand utilized heavily in the middle part of the 20^{th} century (Figure 4.7). The markings on the base of this artifact indicate a date between 1951 and 1960 (Wiggins 2013; Fire-King-Mug.com 2013).

Table 4-4. Summary of isolated occurrences observed in the survey area.

IO #	Occupation Type	Description
1	Prehistoric	Plainware utility rim sherd, rough exterior and polished interior, 2-3 cm, 9 mm thick
2	Prehistoric	Undecorated redware sherd, no visible temper, 0-1 cm
3	Historic	Aluminum pipe, 2-inch diameter, pipe is straight and coming out of ground 26 inches
4	Prehistoric	Undecorated, polished redware sherd, bowl body, sand temper, 3-4 cm, 5 mm thick
5	Historic	Aluminum pipe, mostly buried. Pipe has a 90-degree bend but diameter could not be determined
6	Prehistoric	Chalcedony flake fragment, cortex present, 3-4 cm
7	Historic	Aluminum pipe, 2-inch diameter with reducer to 1 ½ inches, pipe has a 90-degree elbow and is coming out of ground 22 inches
8	Prehistoric	Complete quartzite flake, plain platform, cortex absent, 4-5 cm
9	Historic	3 white ceramic plate sherds, non-diagnostic (no maker's marks)
10	Historic	Historic trash scatter, likely dates to the 1950's
11	Historic	Blue glass insulator cap fragment. Likely first half of 20^{th} century but no diagnostic markings
12	Historic	White glass jar for cosmetics, likely facial cream
13	Historic	Railroad tie fence post. Part of a barbed wire fence. Age unknown

Figure 4.7. Base of a Fire King Ware mug likely dating to the 1950s or early 1960s.

CHAPTER 5
SUMMARY AND RECOMMENDATIONS

Evaluation and Statement of Significance

The present survey included four sections of proposed levee alignments on the east and west side of the Rio Grande on lands owned by Isleta Pueblo for a proposed levee construction project. The total survey acreage is 63.4 acres. The survey identified one new archaeological site, LA 177391, a prehistoric artifact scatter. A total of 13 isolated occurrences were encountered.

The area extends approximately 20 river miles from Albuquerque's South Diversion Channel on the east bank and the I-25 bridge on the west bank, to immediately south of the railroad bridge south of Belen. The Corps, in cooperation with the MRGCD as the project sponsor, proposes to rehabilitate the existing spoil bank levees to produce engineered levees capable of withstanding significant flood events along the Rio Grande.

Proposed project activities include replacing the existing spoil-bank levees with engineered, trapezoidal levees that would provide protection from the one-percent chance exceedence flood event (formerly the 100-year flood) plus an additional three feet of freeboard. In most cases where the proposed levee alignment follows the existing spoil banks, the engineered levees would be constructed within the same footprint of the existing spoil banks, and the spoil banks themselves would be utilized as fill material for the newly constructed levees. The spoil banks were constructed through decades of dumping spoil materials from the riverside drains onto the piles to create an irregularly-shaped alignment paralleling the riverside drain. As such, the footprint of the spoil banks throughout the project area is generally larger than is necessary for the engineered levees. The engineered levees, therefore, will fit within the existing disturbed area created by the spoil banks, and will not increase the footprint of disturbance. Existing access roads are currently maintained along the spoil banks by MRGCD, and these roads will be used to access the project area. A 15-foot buffer from the toe of the engineered levee on both the land and riverside will need to be maintained free of woody vegetation to protect the structural integrity of the levee. The landside buffer will include the access road and riverside drain, while the riverside buffer will need to be periodically maintained by MRGCD.

At this time the Corps considers the status of the eligibility of site LA 177391 for listing in the National Register of Historic Places (NRHP) to be "undetermined". In order to make this determination, additional information regarding the depth and condition of subsurface deposits within the site is required. This is particularly true in the eastern portion of the site outside of the plowed field where undisturbed cultural deposits may be present within the bosque woodland. As such, the site will be treated as eligible for the purposes of project planning and will be afforded the same protection as a site determined eligible for listing until such time that it is determined otherwise. The information potential of all 13 IOs is considered exhausted by recording and documentation in this report, and all IOs are therefore considered ineligible for listing in the NRHP.

Effect Determination

During the initial planning for the levee rehabilitation project, the Corps proposed several alternative alignments in addition to those that follow the existing spoil banks. Site LA 177391 falls within one of those proposed alternative alignments. As project planning has progressed, however, several alternatives have been eliminated from consideration, including the alignment within which LA 177391 falls. LA 177391, therefore, is no longer within the project area and will not be affected by project activities. If, in the future, any project may have an effect on LA 177391, it is recommended that further investigation be conducted at the site to determine the full extent of site deposits and to evaluate the depth and condition of subsurface deposits to make a determination of the sites NRHP eligibility.

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HISTORICAL DOCUMENTATION OF MIDDLE RIO GRANDE FLOOD PROTECTION PROJECTS
Corrales to San Marcial

K. Lynn Berry and Karen Lewis

Office of Contract Archeology
University of New Mexico

HISTORICAL DOCUMENTATION

OF

MIDDLE RIO GRANDE FLOOD PROTECTION PROJECTS
Corrales to San Marcial

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Submitted by
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Principal Investigator

Office of Contract Archeology
The University of New Mexico

OCA/UNM Report No. 185-555

July 15, 1997

NMCRIS No. 59879

ABSTRACT

This document provides an historical summary of flooding and the need for flood control in the middle Rio Grande valley. History of the former, of course, stretches deep in to geologic time, but here we are concerned only with the late 19th and early 20th centuries, when communities in the floodplain experienced ruinous and repeated flooding which resulted in a public clamor for assistance in flood protection. Numerous projects were eventually undertaken by individual communities and, later, the Middle Rio Grande Conservancy District (MRGCD) so that, by the 1930s, a majority of the communities were protected in some way. Nevertheless, more than twenty years ago it was determined that flood protection in the middle valley was inadequate, given the nature and extent of development in the area. A series of studies and plans have been developed in the ensuing years to upgrade the levees within the MRGCD. Documents such as the 1979 *Middle Rio Grande Flood Protection Bernalillo to Belen, New Mexico. Interim Feasibility Report* set the stage for the current project (proposed action) which includes levee rehabilitation in three of the four Divisions of the MRGCD. These are: the Albuquerque Division, Corrales Unit; the Belen Division; and the Socorro Division, San Acacia to Bosque del Apache Unit (San Acacia). The proposed action will include the removal of the old levee alignments followed by construction of new (better engineered) levees in the same location, which are capable of providing greater flood protection.

The agency primarily responsible for the design and implementation of the proposed action is the U.S. Army Corps of Engineers (COE), Albuquerque District. Preparation of this report was undertaken by the Office of Contract Archeology, University of New Mexico and Karen Lewis: Historic Preservation as Contract No. DACW47-94-D-0019, Delivery Order No. 0006.

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Our efforts in producing this document were greatly aided by a number of people and institutions. For a list of sources (libraries, archives) searched, please see the administrative summary below. Specifically, we would like to thank Dr. Ron Kneebone of the U.S. Army Corps of Engineers, Albuquerque District, and Middle Rio Grande Conservancy District staff: Subhas K. Shah, Chief Engineer; Johnny Mounyo, Socorro Division Manager; Anabel Gallegos; and Leonard Utter, Assistant Engineer. Dr. Richard Melzer provided valuable clues in locating information on the Belen area, as well as generously offering a copy of his published article on San Marcial. Laurie Schuller kindly loaned us a copy of her master's thesis, which provided an overview of middle valley floods and irrigation. Mary Davis and Ernest Alary, both of Corrales, are appreciated for their insights into that village's history. Benny Barreras, who should be made an official goodwill ambassador of the City of Socorro, was very conscientious in his efforts to provide us with introductions to the city's officials, as well as information about the 1995 reunion of former San Marcial residents. John and (especially) Phyllis Reiche, of Socorro, were also kind to take time out of their day to lead us in the right direction for historical resources. Spencer Wilson, of Albuquerque, has done considerable research on the Socorro area and was quite valuable in identifying potential references. For anyone interested in historic photos of the Socorro area, we recommend that you contact Holm Bursom, president of First State Bank, for a tour of his collection; you will recognize that he has made a significant contribution to local efforts of historic preservation. Finally, we would like to thank Monique Durham, of the Robb Archive of Southwestern Music at UNM's Center for Southwest Research, for her success in tracking down not only the words, music, and audio recording of "El Corrido de San Marcial," but also the name of the individual we have to thank for that recording. Mr. Vicente Saucedo, of Albuquerque, is the sole surviving member of a musical trio named Los Conquistadores. Mike Cardenas and Eddie Gallegos, who actually sings on this recording, have passed away, but Mr. Saucedo kindly gave us permission to use it on their behalf.

I. INTRODUCTION

The Middle Rio Grande Flood Protection Project has been designed and will be implemented by the U.S. Army Corps of Engineers, Albuquerque District. The project consists primarily of replacing spoil embankments with engineered levees. This report was prepared under contract with the Office of Contract Archeology and Karen Lewis Historic Preservation. The historic documentation presented in this report has been undertaken to meet the COE's requirement to comply with section 106 of the National Historic Preservation Act of 1966.

COE policy for all civil works construction projects requires a local sponsor. A sponsor may be any non-federal government or governmental entity having the legal authority to perform the terms of a project cooperation agreement and the financial ability to share in the cost of a study or project. Local sponsorship for this project is provided by the MRGCD.

LOCATION: The Corrales Unit is part of the Albuquerque Division of the MRGCD. The area of the proposed action runs parallel to the Rio Grande on the west side. It begins north of the Village of Corrales where the main Corrales ditch siphon crosses the river and extends for approximately 11.6 miles (mi) downstream to Montaño Boulevard in Albuquerque, New Mexico.

The MRGCD Belen Division runs on both the east and west sides of the Rio Grande. On the east side of the river the levee begins 400 ft north of Highway 147 (the Isleta Bridge) and continues to the railroad bridge in Belen. On the west side of the river the levee begins just south of the Isleta marsh and continues to 2 mi south of the Belen railroad bridge.

The San Acacia unit of the MRGCD Socorro Division, runs parallel to the river on the west side. It begins at the San Acacia dam and extends approximately 46 mi downstream. (Figure 1).

USGS QUADRANGLE MAPS (1:100,000 SCALE):

Corrales Unit:	Alameda, Bernalillo, and Los Griegos
Belen Division:	Belen
Socorro Division:	Truth or Consequences, Oscura Mountains, Socorro, and San Mateo Mountains

DATE OF CONSTRUCTION: From 1930 to 1935 the MRGCD constructed 190 mi of levees in the middle Rio Grande valley as a part of their district-wide plan to adequately drain the valley farmlands and provide flood protection. The levees present in Corrales, Belen, and San Acacia date to this period. However, documents at the MRGCD archives and other sources from the 1920s refer to existing levees, dikes, irrigation canals, etc. throughout the middle Rio Grande valley.

In Corrales, most of the historically documented flood protection structures were located on the east side of the river protecting Albuquerque, but it may be likely that there was flood protection for Corrales as well. Some of the east side structures include the 1884, 5,000 foot (ft) long dike that was constructed north of Alameda and the railroad grade elevations which served as informal levees.[1] In the Belen area there were probably flood protection structures and there is a reference in the July 1955 *New Mexico Historical Review* to "*burros*" or levees being constructed in Tomé to protect the plaza.[2] Within the Socorro Division there were also flood protection structures prior to the work of the MRGCD. Although many references to these are oblique or general, there is a plan of the San Marcial area, produced by the MRGCD in the 1920s prior to the initiation of construction, which shows existing and proposed levees.

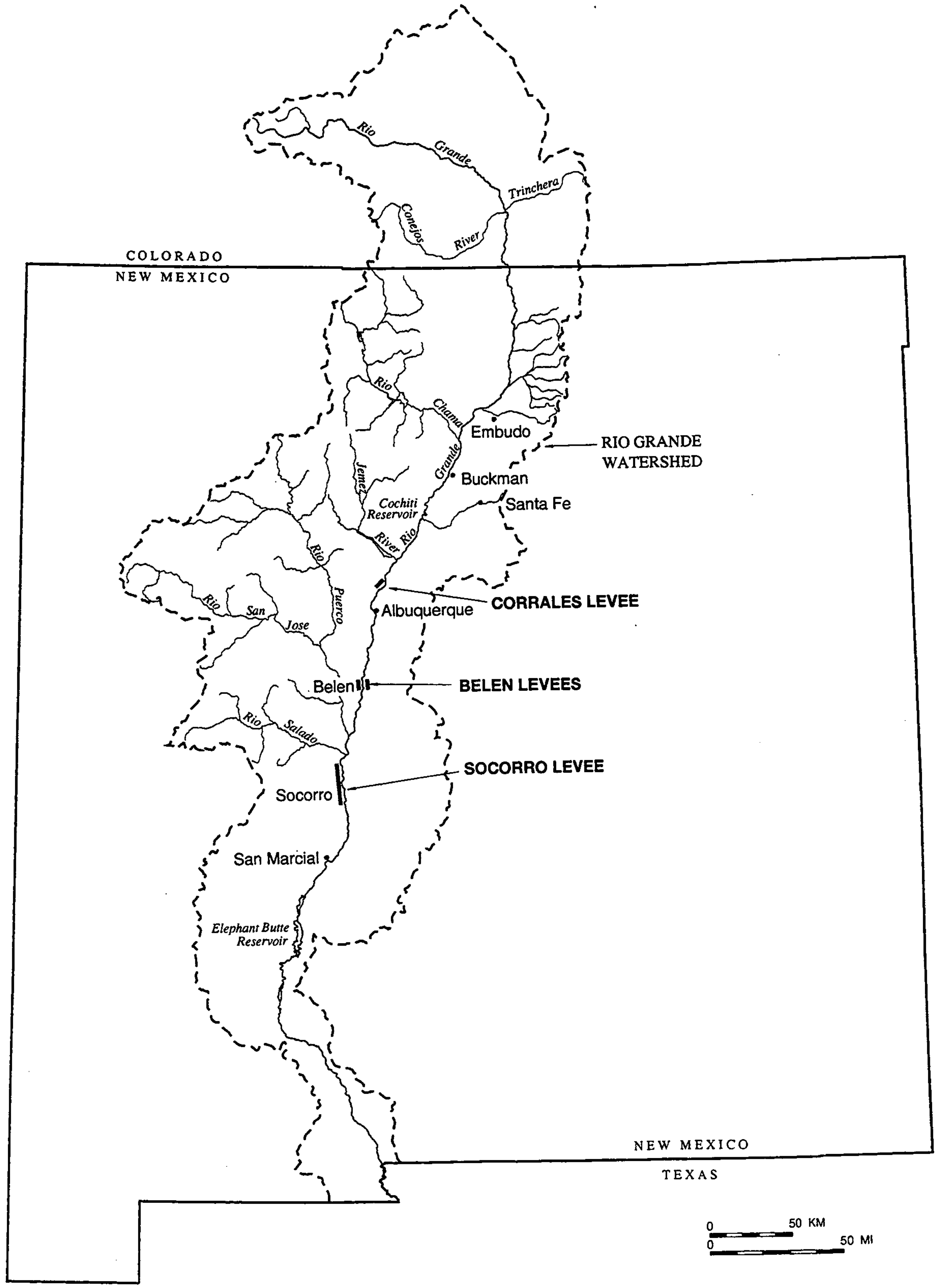

Figure 1 Location Map for Middle Grande Flood Protection Projects: Corrales, Belen, and Socorro Levees.
Source: 1928 MRGCD Official Plan

Although there were informal and site-specific irrigation and flood protection structures throughout the middle Rio Grande valley, there were not any successful attempts at organized flood control in this area until the formation of the MRGCD in 1925.

PRESENT OWNER: Middle Rio Grande Conservancy District

PRESENT USE: The existing levees within the MRGCD Albuquerque, Belen, and Socorro Divisions provide some measure of security for valley communities from the threat of flood from the Rio Grande. Flood protection provided by the Corrales levee is currently at the 19-year frequency, or a discharge of approximately 7,500 cubic feet per second (cfs). Levees in the Belen Division currently provide protection up to the 7-year frequency, or approximately 7,000 cfs. The current level of flood protection in the Socorro Division is at the 7-year frequency level, which is equivalent to a discharge ranging from 12,200 cfs at San Acacia to 6,500 cfs at San Marcial. At these discharges, soil at the base of the spoilbank levees becomes saturated, threatened their structural integrity.

SIGNIFICANCE: The works of the MRGCD have had a dramatic impact on the welfare of populations along the Rio Grande. The flood control, irrigation, and drainage systems constructed and employed by the MRGCD have enabled communities to thrive where once the threat of flood was eminent and the high water table made living on the land nearly impossible.

The major floods that occurred in the the late 19th and early 20th centuries destroyed crops and, indeed, whole communities. The floods were the most dramatic and awesome demonstrations of the need to control the Rio Grande. Perhaps more mundane, but equally significant, was the status of land use along the valley during this time of increasing settlement. Daily farming operations were made nearly impossible in the late 1800s due to the swampy, alkaline conditions of riverside land. Unable to drain itself, the valley became waterlogged, making the land virtually useless. By 1912, the water table rose to an average of 23 inches below ground surface over 90 percent of the valley.[3] The 1930s work of the MRGCD to drain the valley, control the channel, and provide flood control, resulted in revitalizing a waning agricultural community. Changes in the vegetation of the valley between 1935 and 1989 (see Appendix A) are in part the result of this MRGCD construction.

II. ADMINISTRATIVE SUMMARY

HISTORIANS: Karen Lewis, Karen Lewis: Historic Preservation
K. Lynn Berry, Consultant

DATES OF RESEARCH: Fall of 1995 and Spring of 1996

SOURCES SEARCHED:

Center for Southwest Research, John Donald Robb Archive of Southwestern Music
City of Albuquerque Planning Library
City of Socorro Library
City of Socorro Offices
MRGCD Archives
New Mexico Institute of Mining and Technology Library
Valencia County Historical Society
Village of Corrales Historic Preservation Committee
Village of Corrales Library
Village of Corrales Offices

State of New Mexico, Office of Cultural Affairs, Historic Preservation Division
U.S. Army Corps of Engineers, Albuquerque District
University of New Mexico Center for Southwest Research
University of New Mexico Fine Arts Library
University of New Mexico Valencia Campus Library
University of New Mexico Zimmerman Library

METHODOLOGY:

Karen Lewis: Historic Preservation (Lewis Preservation) was contracted in August 1995 to conduct historical documentation of the MRGCD levees prior to proposed improvements to the system. The levee system currently in place is a spoil embankment capable of containing only the 19-year flood frequency level (7,500 cfs) in Corrales, the 7-year frequency level in Belen (ca. 7,000 cfs), and the 7-year frequency (12,200 cfs) in San Acacia. Proposed enhancements to the levees are designed to withstand the 270-year flood frequency level. Documentation of the existing levees follows the guidelines and standards of the Historic American Engineering Record (HAER), Level II. On-site graphic documentation of the levees in each unit were completed by the U.S. Army Corps of Engineers (COE) during 1995. Three separate drawing sets produced by the COE and incorporated as part of the graphic documentation each include:

1. a vicinity map;
2. site location map;
3. a key map for the drawing set;
4. photographs along the levee showing existing conditions and the location of the proposed baseline for the new levee;
5. a key plan for these photographs;
6. aerial photographs which show the Rio Grande and levees;
7. levee profiles (both longitudinal and cross section);
8. proposed construction details, and;
9. field data.

Archival research was completed by Lewis Preservation to provide an historical narrative and background information on the construction of the levees, the formation of the MRGCD, and its effect on the communities along the middle Rio Grande who depend on the management of its waters.

III. HISTORICAL INFORMATION

DATE OF ERECTION: 1930–35

ENGINEERS: Middle Rio Grande Conservancy District
Joseph L. Burkholder, Chief Engineer

HISTORICAL NARRATIVE:

MRGCD Water System Overview

The MRGCD includes 150 mi along the Rio Grande and varies in width from 1 to 5 mi. The MRGCD runs through 6 pueblos and four New Mexico counties. There are four divisions within the MRGCD, the Cochiti Division, Albuquerque Division, Belen Division, and the Socorro Division. Three of the four divisions are affected by the proposed action: Albuquerque Division, Belen Division, and Socorro Division. Within the MRGCD there are approximately 85 drains, 15 canals, 79 acequias, 117 laterals, 24 feeders, and 27 wasteways. Structures associated with the water management system include levees, dikes, jetty jacks, culverts, fences, bridges, and roads.

Unit/Division-Specific Histories

The Rio Grande channel has been roughly in its present location for the last one to two thousand years[4], but the lack of significant channel migration belies the active and powerful forces which have been so destructive in the past. Flooding along the Rio Grande has been frequent and devastating. Records of floods prior to the 1800s are scant, but early mission records reflect that churches and their associated settlements often suffered from the proximity to the river during deluges.[5] In the following narrative we will briefly summarize available information on past flooding for each of the levee units in the flood protection project.

CORRALES UNIT: Systematic stream gaging did not begin in the middle Rio Grande valley until the late 1890s (and not in Albuquerque until 1941), but despite a lack of official records, one early flood in particular stands out. In the spring of 1874 a flood hit the valley and was talked about for decades. Heavy snowmelt followed by excessive rainfall produced a flow that was estimated to be 100,000 cfs at its peak. This is an enormous flow. Remember, the Corrales levee as it stands today can only withstand 7,500 cfs and with improvements will be able to withstand 42,000 cfs. Needless to say, the 1874 flood made a vivid impression on those who were in its path. R.G. Hosea, with the MRGCD circa 1920–30s, reported that valley inhabitants even composed a song commemorating the event. It began:

> Año de mil ochocientos setenta cuatro Dia veinte uno de Mayo, vimos el rio correr
> (In the year 1874, the 21st day of May, we saw the river run)[6]

Diaries of the Jesuits at San Felipe de Neri in Old Albuquerque recorded their observations of the flood. A translation of part of the diaries appears in R. G. Hosea's report, "The Flood Menace to Albuquerque and the Middle Rio Grande Valley." The following is a portion of those diaries:

1874

May 20th.	In these days, the river enters by Rinconada (the bend above Alameda) and threatens Alameda.
May 22nd.	The river floods Alameda and goes by way of Los Lomas and threatens Los Griegos.
May 23rd.	The river approaches Albuquerque; many seek refuge on the hills. Great fear during the night. At two o'clock in the morning the bells of the church rang to call the people together to save the plaza from the onrush of the river. Early in the morning, the river turning towards the hills opens its way through Los Barelas and the two arms, and the new and the old unite. Fathers Gasparri, Persone and D'Aponte went to help the people in staying the river.
May 25th.	The printing press and other appurtenances of the church are carried to the hills for fear of the river.
May 26th.	New consternation on account of the river.
May 29th.	The river began to fall.[7]

1904 brought another disastrous flood resulting in the typical loss of homes and property, but also resulted in the loss of a community's traditional name. Lurlie Silva, of Corrales, described the aftermath of the flood, reporting that the walls of adobe houses "melted like sugar," and she told the story of how Corrales temporarily lost its identity. According to Silva, men working in the fields at the time of the flood were able to partially divert the water via ditches into one or two large fields which served as holding basins. The sacrifice of one of these fields, she says, was the cause of a significant dispute.

> Mr. Alejandro Sandoval was the rich man of Corrales and Bernalillo. He owned everything and always took his irrigation water first. But he treated his workmen like coyotes, and lots of people didn't like him. That time after the flood in 1904 he came riding down the ditchbank in his fancy buggy from his fancy home in Bernalillo, and demanded that the workmen open the ditch and drain his property, even if it meant the water would run onto someone else's field.
>
> The men refused to obey him, and stood their ground. He turned red in the face and waved his whip in the air. His horses got scared and jumped, and turned the buggy over, spilling Mr. Alejandro Sandoval right into the ditch. He looked just like a big red, wet turkey, and none of the men offered to help him out of the ditch.[8]

Some weeks later Sandoval returned and asked the farmers of Corrales to sign a petition for government aid in the aftermath of the flood. Not reading or speaking much English, the farmers signed, unknowingly agreeing to a village name change from Corrales, to Sandoval. And so it remained for almost seventy years until the powers that be reversed the decision.[9]

On October 1, 1904, the Albuquerque Journal reported the flood as follows:

> **Rio Grande Goes on Rip-Roaring Wild Rampage**
>
> The swollen Rio Grande has found its way around both ends of the Alameda Dike . . . Alameda, Los Corrales, and Barelas are as usual the heaviest sufferers. In Barelas yesterday the water stood 2 feet deep in many of the houses and the people moved out all their belongings that could be taken at short notice. The same condition prevailed at Alameda and Corrales . . . Looking down from the mesa, it looked as if the entire valley from foothill to foothill, was under water. Just west of the city (Albuquerque) the Rio Grande was fully four miles wide and yesterday the water found its way up to the grandstand in the fairgrounds . . . [10]

The 1929 flood is still within reach of Ernest Alary's memories. Alary's great grandparents settled in Corrales in 1879 and the family farm is still a village landmark. Ernest was six years old in 1929 and vividly remembers trying to save a bunch squawking chickens when he suddenly felt something crawl up his pants leg. A young, frightened gopher had temporarily found refuge there before Ernest could remove him.[11] Since the MRGCD works of the thirties, the levees have protected the village of Corrales, but according to Ernest, the levees have come close to failing many times. There are particularly weak spots, he says, north of his farm where a calm Rio Grande takes a bend, but where raging floodwaters would rather keep heading south. He remembers seeing workers piling up old cars and fallen cottonwoods along the slopes of the levees to shore them up during the 1941 flood.[12]

BELEN DIVISION: At first glance, flooding in the Belen area appears to have been slightly less of a problem than in other parts of the valley. Local history hasn't entirely centered around the lore of catastrophic flooding as it has in the areas surrounding San Marcial, for example (see below). But the Rio Grande roared more than once in that part of the valley and communities there certainly were not immune to the hazards of heavy rain or snowmelt. In fact, the area that is now Bosque Farms got its start from such an event. In 1769 a major flood actually caused the river to change its course south of Isleta. A new channel, approximately 2 mi west of the old one, was formed and the area between the old and new channels came to be known as Bosque de Los Pinos.[13]

Despite the hazards of proximity to such a potentially violent force, most communities along the Rio Grande have relied for centuries on the rich farm land adjacent to the river. Belen was no exception. Fray Francisco A. Dominguez wrote in 1776, "About a league downstream (from Pajarito) to the south, some widely separated ranches began, located all over the river meadow downstream. They belonged to a settlement of ranchos called Belen which is opposite Tome, six leagues from the mission. It lies on the river meadow mentioned so many times. It has good farmlands, which are irrigated from the said river, and they yield very good and copious crops of everything."[14] In 1843, Lieutenant Emory described the area this way, "Below Tomé, for a few miles, the valley widens, the soil improves and the cultivation is superior to any other part, particularly that of the rancherias around the pleasant little village of Belén."[15] The 1790 census records for Belen further authenticate the story of Belen as a farming community. The number of farmers and ranchers is nearly 3/4 of the total occupations listed (Table 1).

Table 1 Occupation of Belen Residents Listed by Ethnic Background circa 1790. *Source:* Horvath 1980

OCCUPATIONS	GENIZARO	INDIO	COYOTE	MESTIZO	ESPANOL	MULATO	TOTALS
Farmer*	8	4	-	16	30	1	59
Rancher**	-	-	-	-	17	-	17
Weaver	-	-	1	1	6	-	8
Shepherd	1	1	-	1	2	-	5
Laborer	1	1	2	1	-	-	5
Wool Carder	2	1	1	-	-	-	4
Blacksmith	-	-	-	3	-	-	3
Carpenter	-	-	-	1	1	-	2
Silversmith	-	-	-	-	2	-	2
Tailor	-	-	-	-	1	-	1
Shoemaker	-	-	-	1	-	-	1
Musician	-	-	-	-	1	-	1
Blind Beggar	-	-	-	-	1	-	1
Unemployed	-	-	1	-	-	-	1
Disabled	-	-	1	-	-	-	1
Absent	-	-	-	1	-	-	1
Vagabond	2	-	-	-	-	-	2
TOTALS	14	7	6	26	61	1	114

* One of the Español farmers was given the title "Don."
** Three of the Español ranchers were given the title "Don."

This thriving community was proud to build its first church in 1793, having previously travelled to the Franciscan mission of San Agustin de Isleta for its weddings, baptisms and funerals. Flooding was something of a concern to Belen residents at the time; F. Stanley writes that two towers, a rock base and flat rocks on the roof protected the church "against Indians, ***floods***, rain, snow and flaming arrows usually shot on roofs in the hopes of penetrating to the twigs, branches and vigas that were combustible."[16] Unfortunately, efforts to protect the church were inadequate. Parish records report that "stringent measures like facing the adobe church with flat rocks and raising the land of the church did not solve the problem."[17] The church was destroyed in 1855 "due to repeated inundation of the river [and] it was deemed advisable by the pastor to have the church located in [the] new town, away from the river. A letter under date of April 15, 1856 states that he (the Bishop) had been deceived by some of the parishioners of Belen and that the Vicar General (afterwards first Bishop of Denver) having been upon the ground had selected a much better place to locate the new church, and in accordance with the wishes of the local pastor."[18] Belen did, in fact, opt for a new church in the new part of town (though considerable opposition was raised by old town loyalists who preferred to rebuild in the same spot), and by 1860 it was completed.[19] Still, that didn't stop Father P. Luis Benavidez from dubbing the community "Ciudad Charcos" — or City of Stagnant Pools — when he was temporarily on assignment there in 1869.[20]

According to Fray Dominguez, there were numerous floods that threatened to destroy the low-lying houses and the church at nearby Tomé in the eighteenth and nineteenth centuries,[21] but the flood that most stands out in local history is the one of 1884. After breaking its banks near Chical (south of Isleta), the river inundated the east bank, flooding the valley for approximately 18 miles down to La Constancia. Water was "five feet deep from Los Pinos to Tome,"[22] or "to the tops of the trees" by some accounts.[23] Local residents fled for high ground. Fr. Ralliere, pastor at Tomé from June 1858 to July 1913,[24] is said to have "set up his altar beside a tamarisk tree and assemble his large household nearby. Then, on horseback, he travelled up and down to the various groups, bringing cheer and distributing provisions to the people."[25] The provisions came by way of Catholic churches in Santa Fe, Las Vegas, and Bernalillo, as well as merchants and residents of other valley communities such as Peralta. The following song was composed by a man whose claim to local fame, according to Ellis,[26] "rests equally upon this lyric and the fact that he still could crack nuts with his baby teeth (he never acquired a second set) at the age of 97."

Indita del '84

I

Año de mil ochocientos — ochenta y cuatro allegado
Año de mil ochocientos — ochenta y cuatro allegado
Una creciente varaz — que no la hemos sopartado.
Una creciente varaz — que no la hemos sopartado.

CHORUS

¡AY! Indita del Rio Grande — ¡Ay! Que ingrata te estas mostrando
¡AY! Mira esas pobres mujeres — ¡AY! Con sus colchones rodando.

II

El Rio se nos rompio — viniendo la luz del dia —
El Rio se nos rompio — viniendo la luz del dia —
Dios me lo perdonara — lo rompio Jesus Garcia
Dios me lo perdonara — lo rompio Jesus Garcia

III

Salgan todos los correos — los de a'caballo y de a'pie
Salgan todos los correos — los de a'caballo y de a'pie
Lleven pronto la noticia — que el rio va pá Tomé.
Lleven pronto la noticia — que el rio va pá Tomé.

IV

El señor don Jesus Baca — no ha dijado confuso —
El señor don Jesus Baca — no ha dijado confuso —
Si se quedan en Valencia — alli no se encuentro Refugio.
Si se quedan en Valencia — alli no se encuentro Refugio.

V

Toda la genta se fue — de Valencia para el cerro —
Toda la genta se fue — de Valencia para el cerro —
No se han quedado en la casa — mas que el gatito y el perro.
No se han quedado en la casa — mas que el gatito y el perro.

VI

Sale el padre Ralliere — con toda su compatriota
Sale el padre Ralliere — con toda su compatriota
Todos los dias preguntan: — "¿No se ha caido la parroquia?"
Todos los dias preguntan: — "¿No se ha caido la parroquia?"

VII

A la gente de Peralta — arrisenle desde aquí —
A la gente de Peralta — arrisenle desde aquí —
Salgan todos de la casa — corriendo hasta Picuri.
Salgan todos de la casa — corriendo hasta Picuri.

The translation of the chorus is as follows:

Ay! My love of the Rio Grande Ay! How ungrateful you show yourself
Ay! Look at the poor women — Ay! With beds and everything pell-mell.

1884 may have been "the big one," but it unfortunately was not the first or last. Other floods on record include those of 1828, 1851, 1865, 1874, 1884, 1886, 1903, 1904, 1905, 1911, 1920, 1929, 1935, 1941, and 1942. Most of these floods occurred during the spring and were a result of snowmelt or warm rain on top of an existing snowpack."[27]

SAN ACACIA UNIT: No place stands out in the history of Rio Grande floods like San Marcial. Tales abound of the tragic deluge which destroyed a once thriving town. Other area floods are noted, to be sure. Phyllis Reiche wrote that "In the early 1900s a flood destroyed vineyards, farms and homes in the Polvedera area, including those of Paul Jean Frassinet whose family had emigrated from France in 1876.[28] And, "On Tuesday afternoon, July 30, 1895, the city of Socorro was visited by the greatest flood ever known in the history of the city since the time of the first settlement here," according to a report in *The Socorro Chieftain*.[29] Several townspeople were killed, damages were estimated to be as high as $200,000, and truly horrific scenes were witnessed. One resident recalled, "While the Wickhams and the Armijos watched the water rolling down the arroyo, they saw all manner of things pass: animals, wagons, furniture and, most pitiful of all, a cradle with a baby's hand sticking out of the water above it."[30] Yet San Marcial has remained, to a great extent, *the* flood story of the Rio Grande (Appendix B). Undoubtedly, the fact that not one, but two major floods hit the community within weeks of each other, and finally the beleaguered town was unable to recoup or rebuild, must account for the staying power of the drama. Perhaps, also, it is the undying affection former residents still have for their once promising and flourishing town. In a 1992 video produced for the city of Soccoro, Connie Martinez, who lived in San Marcial as a little girl, wept before the camera as she spoke of her childhood memories and the loss of her home — and this, 63 years after the fact.[31]

A reunion was held in August of 1995 for residents and descendants of San Marcial at which 300–400 people were in attendance. Organizers of this event collected photos and various documents, and sketched a map of the town as they remembered it (Figure 2).[32] The San Marcial story has become something of a legend.

In the early part of this century, the citizens of San Marcial knew they were living with a great risk. By the late 1920s, the MRGCD had completed numerous studies regarding the need for drainage and flood control along the middle valley, including "The Situation at San Marcial" which warned of the grave danger of potential overflow.[33] Indeed, it was widely acknowledged that as the town grew (closer and closer to the river and the railroad tracks), it was precariously dependent on the meager protection offered by the railroad grade and associated dikes. Residents were "ever mindful" of the flood threat.[34]

Heavy rains in August of 1929 eventually resulted in the worst case scenario for the railroad town.[35] Huge volumes of water surpassed the capacity of the Elephant Butte reservoir, and the river continued to rise. Many residents fled, expecting the worst, and others stayed behind to attempt to strengthen the dikes. All the sandbags in the county would not likely have saved the town, though, as the water crashed through and reached the second stories of many

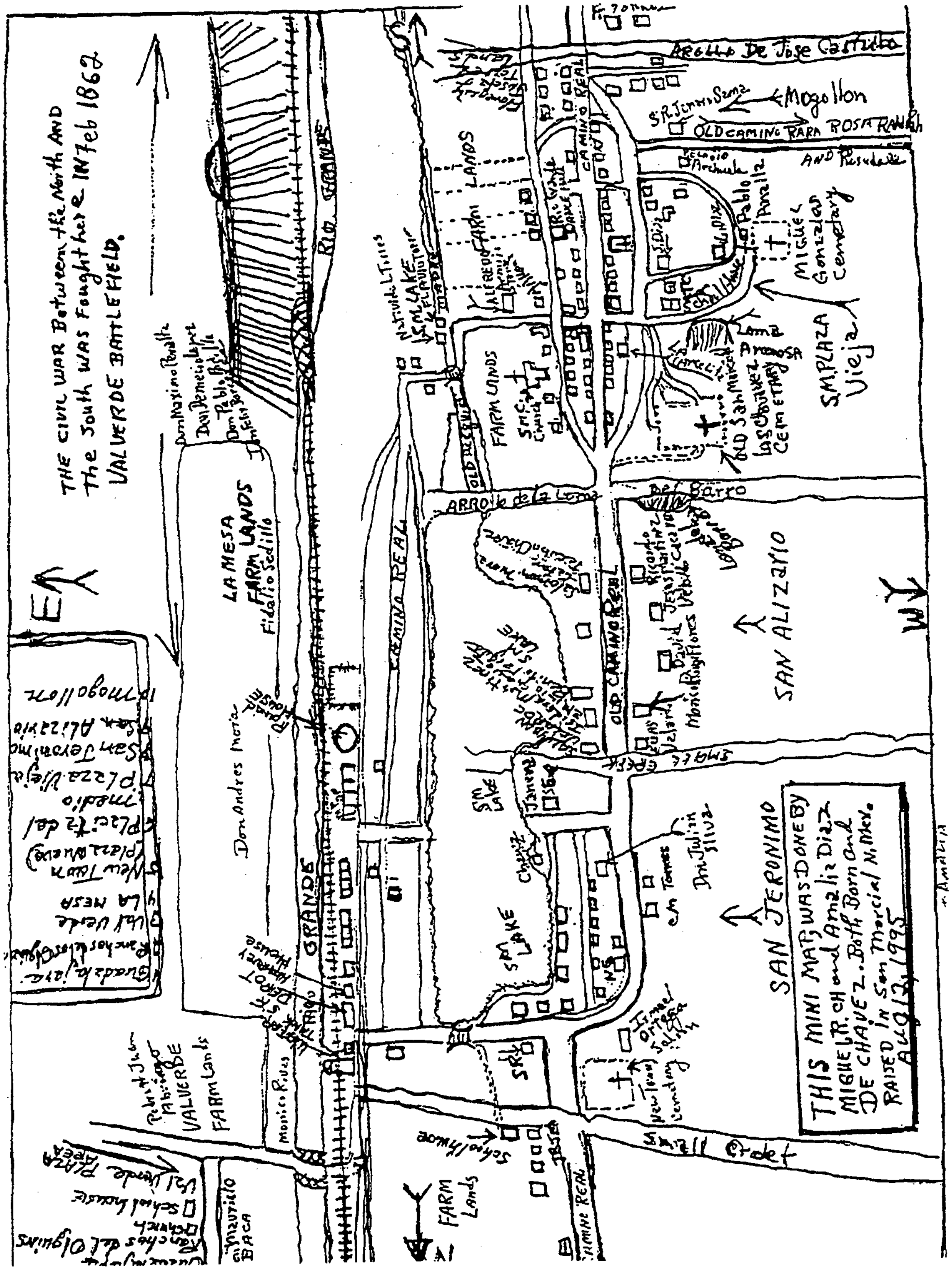

Figure 2 Map of San Marcial drawn by former residents at August 1995 reunion

buildings. Surprisingly, there was no loss of human life in the flood. Entire buildings and numerous possessions, and certainly a host of domestic animals, did not fare so well. The disaster was great enough to warrant emergency assistance from Governor Richard Dillon via the Red Cross, as well as a dispatch of National Guardsmen, and state health officials providing typhoid fever vaccinations.[36]

"El Corrido de San Marcial" commemorates the tragedy (Appendix C):

I

El dia venite de agosto[37]
no me quisiera acordar,
que se llevo el Rio Grande
la plaza de San Marcial.

II

La gente andaba excitada
pues no hallaba que pensar
si marcharse para El Paso
o quedarse en San Marcial.

III

Pobrecita de mi gente,
ah, que suerte les toco!
Todos sus casas perdieron,
no mas el Harvey quedo.

IV

Ah, que lastima de Pueblo!
como quedo destrozado!
Por el medio de las calles
lomas de arena quėdaron.

V

Les compuse este corrido
a los paisanos de alli.
Quiero decirles mu nombre
pá que se acuerden de mi.

VI

Pues mi nombre es Ramon Luna,
yo so nativo de alli,
pues por cierto es que me duele
el pueblo donde naci.

VII

Pobrecita de mi gente!
Todos debemos rogar
que Dios les mande consuelo
a todos: perdieron su hogar.

VIII

Pobrecita de mi gente!
Todos debemos rogar.
Aqui se acaba el corrido
del final de San Marcial.

I

The twentieth day of August
I would rather not recall
For on that day the Rio Grande
Flooded the town of San Marcial.

II

The people were all upset
Because they couldn't decide
Whether to go to El Paso
Or to remain in San Marcial.

III

My poor people,
What a sad plight has touched them!
They all lost their houses;
Only the Harvey House remained.

IV

How sad that the town
Was destroyed so completely!
In the middle of the streets
Mounds of sand remained.

V

This corrido was composed
For the natives of that region.
I want to tell them my name
So that they may remember me.

VI

Well, my name is Ramon Luna,
I was born there,
And I am certainly sorry
For the town where I was born.

VII

My poor people!
We all ought to pray
For God to send consolation
To all who lost their homes.

VIII

My poor people!
We all ought to pray.
This is the end of the Corrido
Of the destruction of San Marcial.

If that had been the last of the bad news, San Marcial might have been able to rebuild. Several weeks later, however, barely emerging from the gloom of the first flood, another hit. A memorandum within the MRGCD described it this way:

> It appears that the river came down in a rush, flowed over the tracks of the A.T.& S.F Ry. near the ranch of Mr. Simmons and flowed on down and began to seriously erode about the location where the road crossed from the west side to the east side and then followed along between the track and the old ditch . . . A marooned passenger train and twenty-five or thirty cars . . . were noted near San Acacia station. These cars were all standing vertically on that date . . . Part of the track was on edge instead of lying horizontally . . . It is believed that the river has abandoned the channel of two weeks ago from a section about a mile below San Acacia to a section about a mile above the Escondido bridge . . . The breaks in the dikes at San Marcial occurred about two o'clock in the afternoon on Tuesday, at a section about a mile and a half above the depot. About four-thirty in the afternoon a break occurred near the Harvey House and it is said that another break occurred about eight o'clock near the coal chutes. The height of the water at San Marcial is said to have been about five feet in the Harvey House, or higher than the lunch counter in the lunch room."[38]

MRGCD Response to Floods

These and other floods throughout the late 1800s and early 1900s caused great concern throughout the middle Rio Grande valley. Certainly by the 1880s, there were increasing calls for action by the residents of the valley. In 1883 a Board of River Commissioners was formed and soon they were in a position to levy an assessment for potential works along the river. In March of 1884, the commission toured and inspected the river upstream from Albuquerque from a point about two miles north of Alameda. The commission determined that a levee should be built and by May of the same year the "Alameda Dike" was constructed. It was approximately 5,000 ft long, 4 ft high and 6 ft wide at the top. In 1891, despite a scuffle over who should pay for improvements, the dike was enlarged and lengthened. The improvements resulted in a levee 5,350 ft long, 32 ft wide at the base, 8 ft high and 12 ft wide on top, and lined with terrone (sod) blocks and willow trees to stabilize the slopes. Similar structures were constructed throughout the 1890s, and by the turn of the century there were piecemeal, non-engineered systems of bank protection from Alameda to Albuquerque.[39] The same can be generally said for the rest of the middle Rio Grande valley, though documentation of these structures is scant. It is reasonable to assume, nevertheless, that the residents of many communities along the river made efforts to protect themselves in some way.

As for official, well-planned, and engineered control of the river, that was slower in coming (Appendix D). According to Rodey and Burkholder[40], as early as the late 1890s, plans were being discussed by various organizations and individuals for improvements to the system of canals and ditches. Fifteen years later a small drainage district was attempted south of Albuquerque. In 1917, Joseph Burkholder (later Chief Engineer of the MRGCD) appeared before a meeting of the Albuquerque Chamber of Commerce to discuss the city's drainage needs. Soon the Chamber formed and fostered a voluntary association called the Middle Rio Grande Reclamation Association. By 1921 the Rio Grande Valley Survey Commission was created. This organization entered into a contract with the U.S. Reclamation Service (now the U.S. Bureau of Reclamation) to prepare a report on the Middle Rio Grande project. The report was published in 1923. In 1925, the MRGCD was organized as a political subdivision of the State of New Mexico. Its objective was to provide irrigation, drainage, and flood control for about 128,000 acres from White Rock Canyon near Cochiti to San Marcial.

The organization of the MRGCD was, as previously illustrated, a long-awaited and much-needed development. In addition to flooding, irrigation and drainage were primary concerns. The total acres of middle Rio Grande farmland documented in 1880 was 124,800 and by 1927 it had been reduced to 45,000 through waterlogging and alkali conditions (Figure 3). There were two primary reasons for the waterlogging, alkali, and flood conditions along the middle Rio Grande:

1) Increased use upstream caused less water to flow into middle Rio Grande, thus increasing the silt and raising the water stream elevation.

2) The unregulated construction of ditches and use of water since colonial times effected raising the water table of the agricultural lands along the valley.[41]

The 1928 MRGCD *Report of the Chief Engineer: Submitting a Plan for Flood Control, Drainage, and Irritation of the Middle Rio Grande Conservancy Project* (*Official Plan*) stated that the channelization of the Rio Grande through bank stabilization, bridges, and railroads had caused the riverbed to rise, which in turn raised the water surface elevation and exacerbated the waterlogging and alkali problems. These changes also increased the risk of floods as the river could not carry as much water in its bed. Percolating water[42] from the Rio Grande exacerbated the problem. Waterlogging was described in an early MRGCD report as:

> the natural consequence of irrigation. It is the result of an oversupply of water for given soil conditions and existing topographic features. The rise of alkali which usually accompanies water-logging greatly increases and complicates the seriousness of the problem . . . The condition thus wrought is a menace to irrigation farming and the combating and prevention of the damage caused thereby is the problem of drainage.[43]

The Chief Engineer of the MRGCD backed up this statement asserting that the use of *acequias* throughout the valley without coordination or organization had resulted in exacerbating the waterlogging problems. These problems were so great when the MRGCD plan was being created that the Chief Engineer stated, "The need for drainage in the middle Rio Grande valley is so self evident and so well known that little need be said in regard to it."[44]

In 1928, the MRGCD's *Official Plan* included sections on "Seeped Areas" and "Causes in Decrease of Cultivated Areas." It was reported that there were 50,000 acres of valley land which was waterlogged and affected by alkalinity (Figure 4), only 2,000 acres which were unaffected. Of the 50,000 acres of valley land approximately 45,000 acres were intended for agricultural use. Table 2 shows the 1926–27 classification of land in the middle Rio Grande valley. Throughout the valley approximately 72% of the agricultural lands had a water table which occurred from 0 to 4 ft below the surface. According to the *Official Plan*, once the water table rises to less than 4 ft from the surface, it is almost impossible to farm the land. During 1926–27, the MRGCD considered 3,038 acres in Corrales as agricultural valley lands. Of the 3,038 acres, 2,227 were considered non-farmable.[45]

Because the irrigation *acequias* were built locally and not designed as a comprehensive system, there was duplication of effort, a large loss of water, and the development of waterlogging throughout the valley. River diversion dams built by *acequia* associations with trees and brush were often washed out. Also, where a diversion ditch crossed an arroyo the ditch was usually destroyed during a flood event. Continuous upkeep by individual *acequia* associations were required to maintain water flow to fields. A considerable amount of effort was spent diverting water from the Rio Grande.

> They (*acequia* associations) had to divert the water in the river by means of dams made of trees and brush to make the water rise and divert it so that it would go into the ditches at the main gate. Some of the people would be assigned to cut branches, logs in the woods, and haul rocks to divert the water. They had to take off their clothes to enter the water and place these reeds and trees and poplar branches so that the water could pass into the designated *acequias* that flowed into the valley. Then when the river flooded it would take the diversion away, and they would have to start all over again.[46]

Figure 3 Waterlogging. Original MRGCD caption reads, "View showing seep swamp land in the Corrales District. Property of Francisco Garcia." *Source:* Middle Rio Grande Conservancy District, No. 813, Plate 1

Figure 4 Alkali conditions. Original MRGCD caption reads. "Showing airplane view of Belen Riverside Drain and levee. Scene of the 'Battle of Los Chavez' Note Alkali land. May 26, 1930". *Source:* Middle Rio Grande Conservancy District, No. 202

Table 2 1926–27 Classification of Middle Rio Grande valley. *Source:* Middle Rio Grande Conservancy District Official Plan (1928)

CLASSIFICATION 1926–27	ACRES	TOTAL ACRES	PER CENT	PER CENT
Orchard and Garden	3,408		2.28	
Alfalfa and Grain	40,001		26.69	
Pasture and Hay	1,355		.90	
Homesites	820		.55	
Total Irrigated		45,584		30.42
Salt Grass	48,603		32.43	
Bosque	37,821		25.24	
Swamp and Lake	3,324		2.21	
River Wash and Arroyo Wash	1,290		.86	
Barren Alkali	275		.18	
Sand Dunes and Gravel	4,400		2.94	
Fallow Land	4,980		3.32	
Homesites	3,588		2.40	
Total Non-Irrigated		104,281		69.58
TOTAL	149,865	149,865	100.00	100.00

Note: Above areas include about 28,500 acres of Indian lands located in 6 different pueblos.

The MRGCD Chief Engineer called for a consolidated ditch system that would control waterlogging, provide water to farmers, and reduce flood damage. In effect it would revitalize the farmland and allow the farmers to expend their effort on farming rather than diverting water from the Rio Grande. The engineering issues involved in reclaiming and maintaining the farmland were drainage, irrigation, and flood protection. In discussing the MRGCD levees, it must be clear that the levee flood protection was intertwined with drainage and irrigation. "The drain ditches not only drain the land, but they also develop water for irrigation, and the excavated material partly builds the levees which protect against floods (Figure 5)."[47]

MRGCD official construction of the riverside drains, laterals, and levees began in 1930 and continued to 1935. It included four diversion dams, three diversion headings (Figure 6), 630 miles of irrigation canals and laterals, 340 miles of interior and riverside drainage ditches (Figure 7), and 190 miles of riverside levees (Figure 8) — all at a cost of nine million dollars.[48]

IV. ENGINEERING INFORMATION

SITE:

The middle Rio Grande valley is in a synclinal fold, rock strata which slope inward to meet at a central point. The syncline is filled in with gravel and sand. Throughout most the valley water flows through the gravelly infill; this is the underground aquifer which provides Albuquerque with its water supply. Emergent vegetation around the levee and riverside drain consists of cattail, sedge, rush, watercress, and bulrush. This vegetation is usually trimmed and maintained by the MRGCD. Other vegetation in the area includes forbs, coyote willow, and Russian olive. A variety of fish and wildlife inhabit the riverside drain.[49]

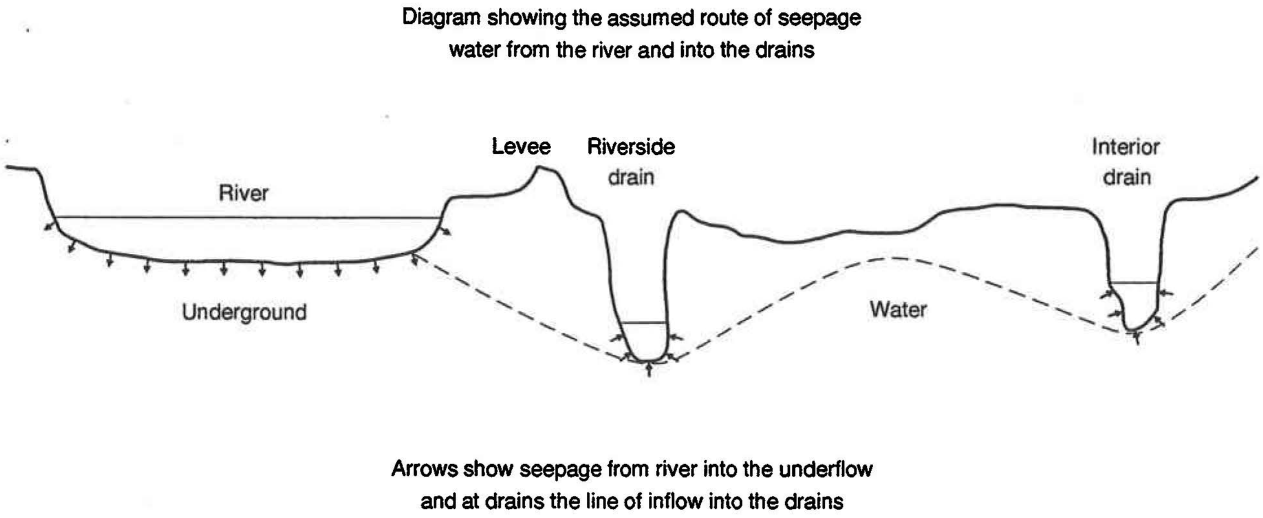

Figure 5 Diagram showing how the leeves and drains work together. *Source:* "Developing Water by Drainage Canals in the Middle Rio Grande Valley," by H.F. Robinson

Figure 6 Construction of a diversion channel on the middle Rio Grande. *Source:* Middle Rio Grande Conservancy District, No. 495, Plate 33

CHARACTER:

Maintenance roads run along the tops of the levees and are approximately 10 to 12 feet (ft) wide. From the edge of the maintenance road the levee angles outward and down, so that at the base it is approximately 20 to 25 ft wide. On the riverside of the levees, between the levee and the river, is a riparian environment consisting of cottonwood and the vegetation noted above (Figure 9). On the inland side of the levee there is a flat piece of land, the width of

Figure 7 Interior drain. Original MRGCD caption reads, "View showing portion of the Bosque Interior Drain looking North from (Station 86)." *Source:* Middle Rio Grande Conservancy District, No. 706, Plate 1

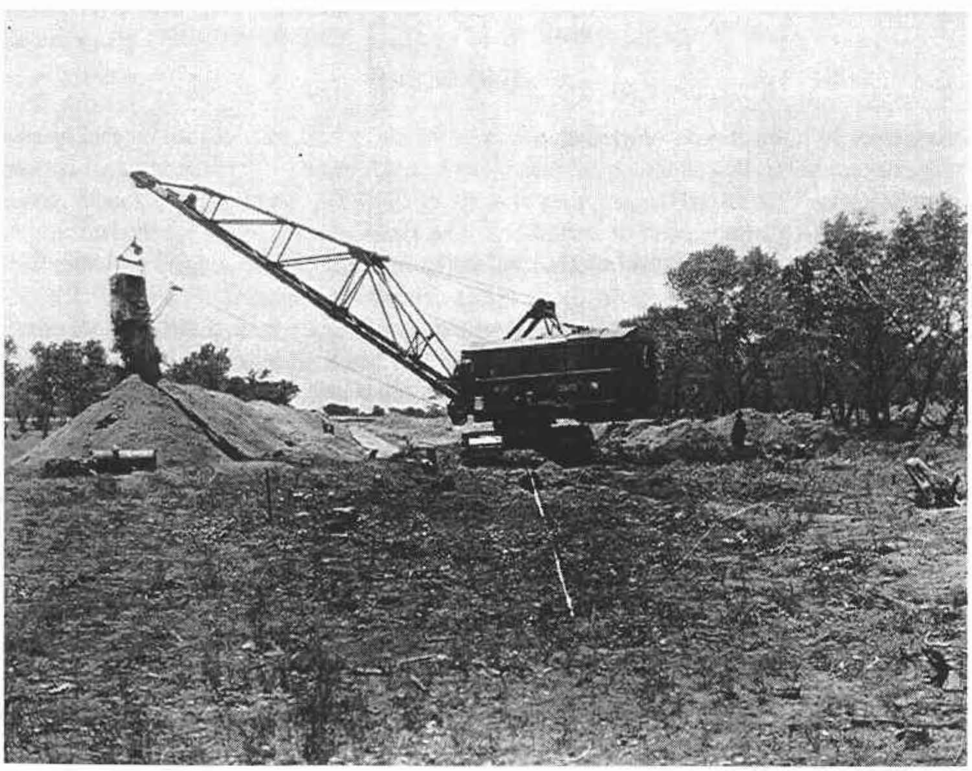

Figure 8 Construction of a riverside drain and spoil embankment. Original MRGCD caption reads, "View showing nature of material excavated. June 12, 1930. Belen Division - Bosque District." *Source:* Middle Rio Grande Conservancy District, No. 114, Plate 2

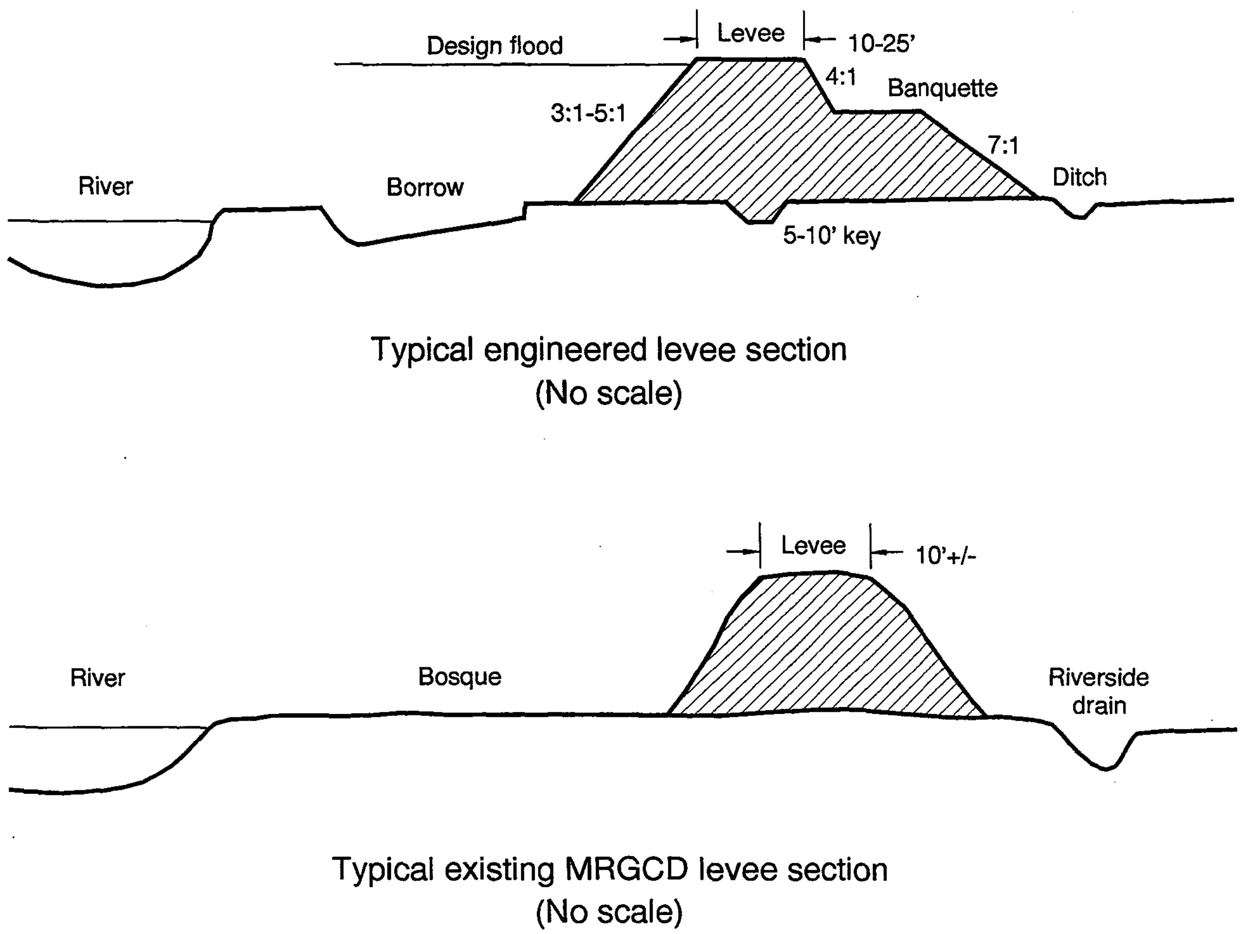

Figure 9 Comparison of typical engineered levee and the MRGCD spoil embankments

this varies from approximately 3 ft to 15 ft along the length of the levee. The riverside drains, on the landside of the levees, are adjacent to this flat strip, which also varies in depth and width (Figure 10).

The Corrales Unit levee runs between the Rio Grande and the Corrales Drain and is parallel to the river. The levee crosses the Calabacillas Arroyo and all access to the levee is by locked gates. In Corrales the drain is generally about 3 ft wide and 3 ft deep. On the west side of the Corrales Drain is residential property, often including fences, agricultural land, and farm animals. Land values along the levee have risen substantially in recent years. Access to the levees is through a series of locked gates.

The Belen Division levees are located on both the east and west sides of the river and run roughly parallel to the river. The riverside drains are much wider than in Corrales, and along most of the levee they run about 15 to 20 ft wide. On the east side of the river the drain is called the Tome Drain and on the west side of the river it is called the Los Chavez Drain. The landside of the levee consists of lumber yards, low to middle income housing (trailer parks, older homes, and new subdivisions), a sewage treatment plant, a general aviation landing strip, and some agricultural land. There is more agricultural land on the east side of the river than the west. Hunting and fishing are allowed by permit and access to the levees is through a series of locked gates.

Figure 10 Riverside drain and spoil embankment. Original MRGCD caption reads, "View showing section of floodway with riverside drain near outlet. March 17, 1931." *Source:* Middle Rio Grande Conservancy District

The San Acacia levee is located on the west side of the river and runs between the Bureau of Reclamation (BOR) low flow channel and the Lemitar Riverside Drain. At the San Acacia Dam, water is diverted into the Socorro Main Canal and the Atchison, Topeka, & Santa Fe (AT&SF) grade acts as a levee. The AT&SF grade works as a levee from the dam to the point where the levee stops heading west and begins to head south. At this point the BOR low flow canal and associated levee begins; on the landside of the BOR levee is the low flow channel and to the west of that is the old MRGCD levee and the Lemitar Riverside Drain. Both levees begin near the San Lorenzo Settling Basin, which was used to collect silt from the low flow drain before water headed south to Elephant Butte. The old MRGCD levee begins just south of the settling basin and weaves its way south along the river. Virtually the entire length of this unit within the proposed action lies within an agricultural area.

CONDITION:

The vegetation on the riverside of the levee, is natural and appears unmaintained. As a result, in many locations, the vegetation has encroached upon the levee and in some cases new trees have sprouted on the maintenance road. Encroachment of vegetation on the road occurs primarily in the Corrales Unit, vegetation reduces in density as the levees move southward. In Corrales there are areas of the levee which have deteriorated leaving large ruts in the maintenance road and slumping of the slope. In areas along the Socorro Division the levee is virtually flat in some locations and in other locations the levee was used as fill for the BOR low flow channel spoil embankment.

There are also conditions which affect the stability of the levee, but which are not visible. The levees are described as "highly erodible." They also have no seepage control features and as a result experience piping and "severe backside sloughing" at flows much less than the rated capacity.[50] Basically, because the levees are spoil embankments, they lack the design features which promote stability, and as a result are beginning to deteriorate.

ENGINEERING DATA:

Description of Levees

Levees are basically longitudinal dams. Dams are constructed perpendicularly to a river in order to retain water and levees are constructed parallel to a river in order to mitigate a flood. Dams continuously retain water along a river and levees are designed to trap water in the flood plain when a river rises above its normal capacity. Without the levee or if the levee were to fail, communities would be flooded, resulting in damage and destruction of improved properties.

Levees are usually constructed of earthen material and are required to meet the same structural stability and criteria that are used for earthen dams. The construction of modern earthen dams began in the late 18th century in England.[51] The development of design elements became fairly standardized by the late 1800s. In fact, "the design principles . . . evolved leading to safe and fairly reasonably economic large earth dams."[52] The elements which became standard details to reduce the hydrostatic pressure within dams, include variation of material, impervious cores, seepage collars, and puddling of clayey materials.

As both levees and dams are designed to retain water, the standard design details for earthen dams apply to the construction of earthen levees. Concrete seepage collars are used around pipes or other structures which penetrate dams or levees. These collars run perpendicular to the pipe and stop water from travelling along the pipe through the embankment. The variation of earthen material is commonly used to slow the movement of water through these earthen structures. In levees, the riverside portion is constructed using small particle fill, such as silt and clay, which is packed to achieve high density and the landside portion is constructed using larger fill, consisting of sand and gravel. Earthen dams have a constant line of saturation, while levees develop a line of saturation during a flood event. In both cases, to ensure stability, the line of saturation should exist in relative equilibrium. Varying the material to create a relatively impervious upstream slope and a pervious downstream slope aids in protecting these earthen structures from failure through saturation.

In some cases concrete flood walls are constructed along rivers to retain water in the event of a flood, but levees are more often used for flood mitigation because of their low cost. They are usually constructed of material taken from borrow pits on the riverside of the levee. These borrow pits run parallel to the levee. A bermed area is left between the borrow pit and the toe of the levee to provide stability for the ditch bank.[53] The tops of levees are usually a minimum of 10 ft wide to provide room for maintenance equipment. Often the slope of the sides is relatively flat to avoid erosion. In addition, the sides can be stabilized with vegetation or riprap.

MRGCD Work Along the Rio Grande

In the 1928 *Official Plan* the MRGCD Chief Engineer stated that the construction was planned to cause the least amount of disturbance as possible and that most of the existing ditches would be reused by adapting them to the engineered design and augmenting them with headgates. The MRGCD canals and laterals were designed to take water within a half mile of every farm, and from that point private ditches would deliver the water to individual farms. The recommendations for levee construction included the following:

1) 8–10 ft heights;
2) 8–10 ft crowns;
3) slope of 1½ to 1 on the land side and;
4) slope of 2½ to 1 on the river side.

Water reclaimed from the riverside drains became an important asset for water supply to the MRGCD lands (Figure 5). In 1928 it was determined that the amount of water reclaimed by the drains provided a surplus of water, even though the result would be increased water use for irrigation of the reclaimed agricultural lands.[54] The drains were also important to the development of flood protection. The *Official Plan* states that "The riverside drains will supply the major portion of the material for the construction of levees without materially adding to the cost of these drains."[55] It also states that the spoil banks for the interior drains would provide a second line of defense against floods and that draining the land would also provide added protection in that the land would have the capacity to allow infiltration of water. The MRGCD also included jetty jacks or retards in their designs. These were intended to aid in depositing silt in predetermined locations[56], thereby channelizing the Rio Grande (Figure 11). Channelization keeps water from dispersing across the land; when confined, water tends to move faster and deposit less silt. In 1928 it was determined that a combination of levees and jetty jacks provided the best level of flood protection for the money expended. There are basically 3 types of jetty jacks or retards which have been used in the MRGCD: felled trees (Figure 12), vertical logs with wire mesh (Figure 13), and steel jacks with wire mesh.

The Corrales, Belen, and Socorro Division levees were constructed during the 1930s middle Rio Grande project. Spoil embankments resulted from the creation of the drainage ditches constructed to alleviate the adjacent agricultural lands of waterlogging and alkali conditions. A spoil embankment is a levee constructed of material transferred from an adjacent borrow pit, which is mounded to create the embankment (Figure 9 shows relationship of borrow to levee). In the MRGCD, earth was taken from the riverside drains (Corrales, Los Chavez, Tome, Lemitar, and Luis Lopez) and piled between the drain and the river to serve as flood protection (Figure 14). Spoil embankments are not engineered, thus they do not have keys at grade, seepage relief at the landside toe, variation of earthen material, or the proper slope (Figure 9). As a result, spoil embankments have low resistance to emergency flows (as compared to higher resistance of engineered embankments). It is believed that the existing Corrales and Belen levees can withstand a 7,500 to 10,000 cubic ft per second (cfs) flow, while the new levee, to be constructed during 1996, is designed to withstand the 270-year flood, a 42,000 cfs flow.[57] The existing Socorro Division levee can withstand a seven year flood, approximately 12,200 cfs[58] and the designed dam would withstand the 100-year flood with a 51,000 cfs at the diversion dam decreasing to 39,000 cfs at the lower end.[59]

The levees are one part of a system which was created to provide flood protection and alleviate the waterlogging of agricultural lands. The other elements include siphons, drains, laterals, canals, and *acequias.* Water which is diverted from the Rio Grande for use in Corrales and Albuquerque is taken at the Angostura Diversion near Algodones, New Mexico, about 20 mi north of Albuquerque. The water is moved through the Albuquerque Main Canal on the east side of the river, then diverted into the Corrales Main Canal north of Albuquerque and brought underneath the river with the Corrales Siphon at the north end of Corrales. The Corrales Siphon, an inverted siphon, was constructed with a 40 inch diameter concrete pipe and is 1200 ft long.[60] Water is brought into Corrales through the Corrales Main Canal. This canal is the westernmost water supply ditch in Corrales and is uphill from the others. Water is gravity fed into the Corrales and Sandoval laterals; the Sandoval Lateral is closest to the river. Between the two laterals is the Corrales Drain. East of, and below, the Sandoval Lateral is the Corrales Riverside Drain (Figure 15). This riverside drain is the drain whose spoil resulted in the embankment levee. The levee is intended to provide flood protection, the drains keep land from becoming waterlogged, while the canals and laterals supply water for irrigation. Leading from the canals and laterals are *acequias.* The *acequias* are the ditches that supply water to individual farms and properties.[61]

Water is diverted from the Rio Grande for use in Belen at the Isleta Diversion Dam. Water is diverted into the Belen High Line on the west side of the river and the Peralta Main Canal (Chical Lateral) on the east side of the river. The Belen High Line canal has the highest capacity in the MRGCD system and was designed with a base width of 30 ft and a depth of 8 ft and was intended to carry 1,000 cfs.[62] This canal terminates at mile post 943 on the AT&SF. The Peralta Main Canal has a maximum width of 12 ft and depth of 4.8 ft and terminates below Cerro Tome (Figure 16).[63] As with the Corrales Unit, the high line and laterals in Belen supply irrigation water through laterals and *acequias.*

Water diverted from the Rio Grande for use along the Socorro Division is diverted at the San Acacia Dam. The dam is a "low weir or a barrage of gates with headworks for regulating flow into canals and sliceways for clearing the control gates."[64] The water is gravity fed into the Socorro Main Canal and laterals (Figures 17 and 18). From these larger supply sources, the water is then fed into *acequias.*

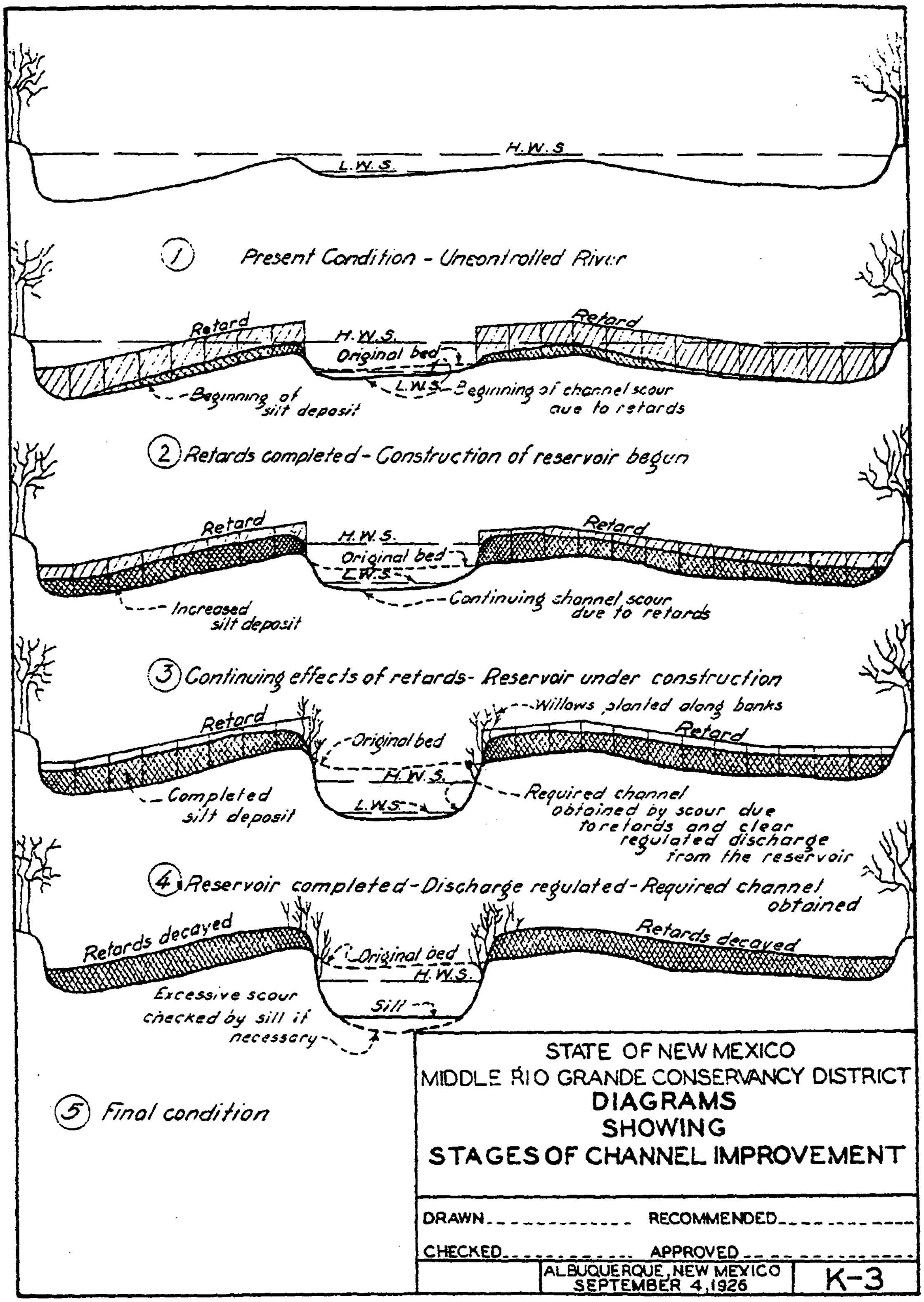

Figure 11 Diagram showing how the river could scour its own channel once retards and jetty jacks were in place. Channelizing the river was meant to increase the flow thereby reducing silt and resulting in less change of flooding. *Source:* "Rio Grande Channel Improvement," C.H. Howell

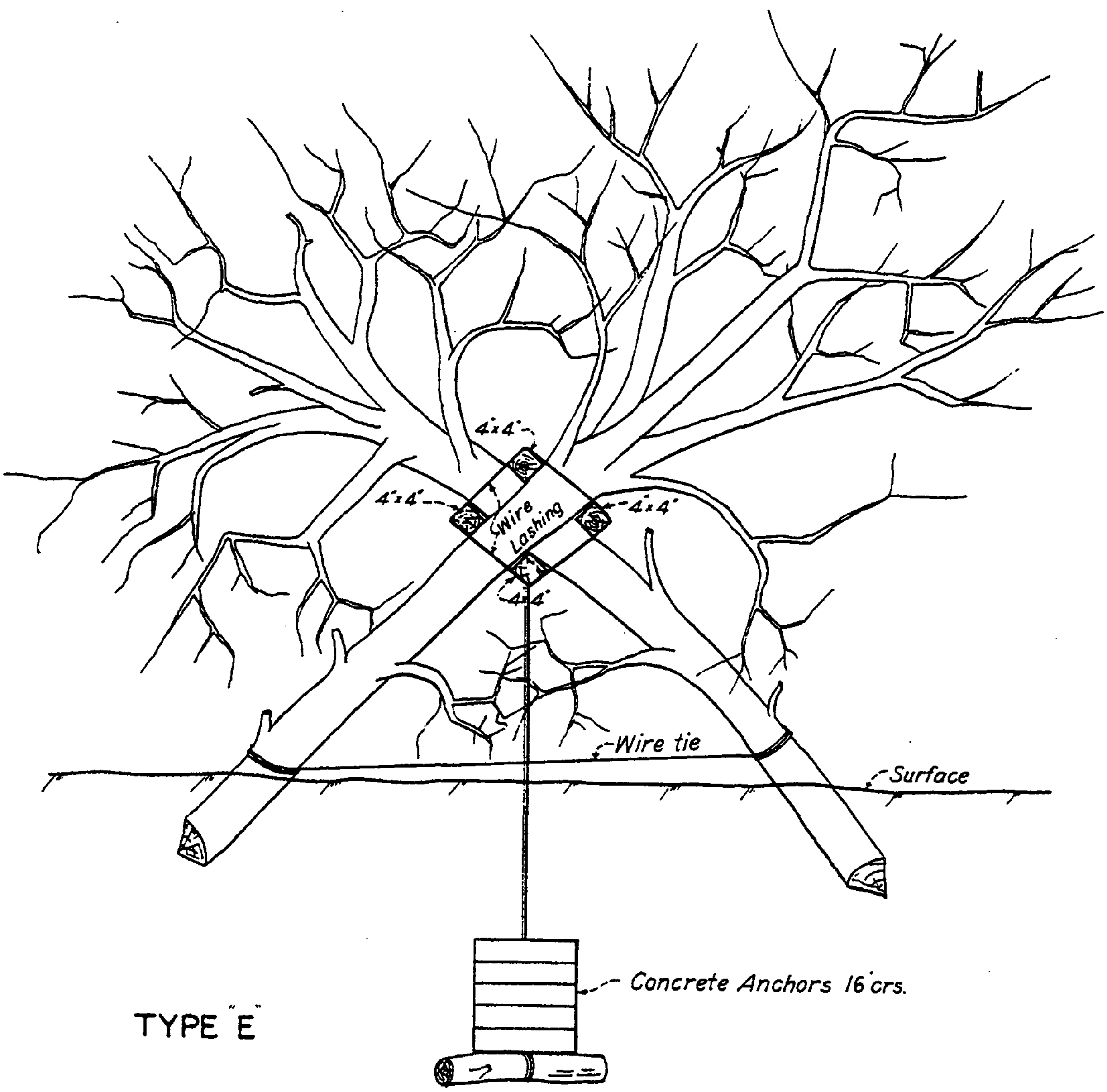

Figure 12 Felled trees with a concrete anchor. *Source:* "Rio Grande Channel Improvement," by C.H. Howell

Corrales Unit

In the *Official Plan*, Burkholder states that the dikes above Alameda (on the east side of the river) and the banks of the irrigation ditches provide protection from the flooding of Albuquerque, but that an exceptional flood would not be held by these structures. This area around the Corrales Drain (west side of the river) and the Alameda Lateral (east side of the river) is the location of a large bend in the Rio Grande. If water was to flow at a high rate, it would leave the banks of the river and flow into Albuquerque. It also had the potential to back up and flood Corrales, as it did many times. It would seem from the *Official Plan* reference to dikes and existing structures, that there may have been some sort of levee or flood protection on the Corrales side of the river before the engineered construction of the drains.

If there were flood protection structures in Corrales, the work of the MRGCD would have been the organized continuation of what the community had begun. The construction of the levee may have paralleled the irrigation work of the MRGCD, in that a traditional, less organized approach to provide flood protection and irrigation was

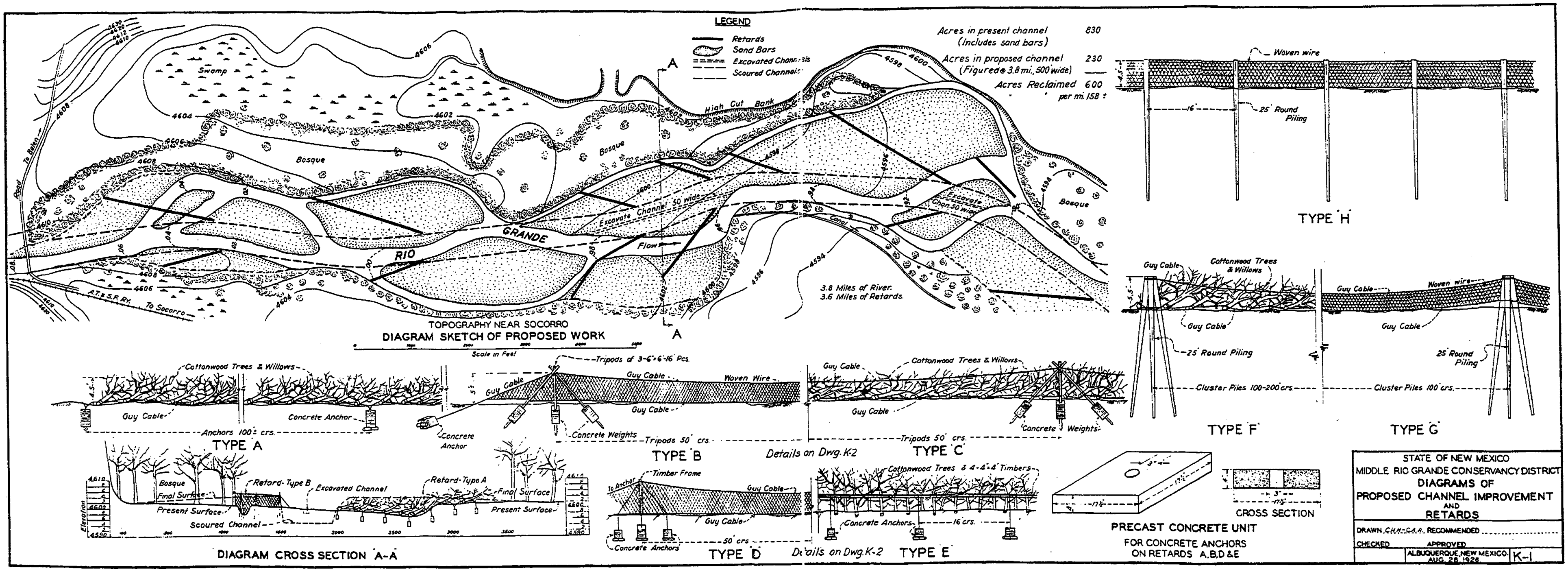

Figure 13 Various methods of channel improvements proposed by the MRGCD during the 1920s. *Source:* "Rio Grande Channel Improvement," by C.H. Howell

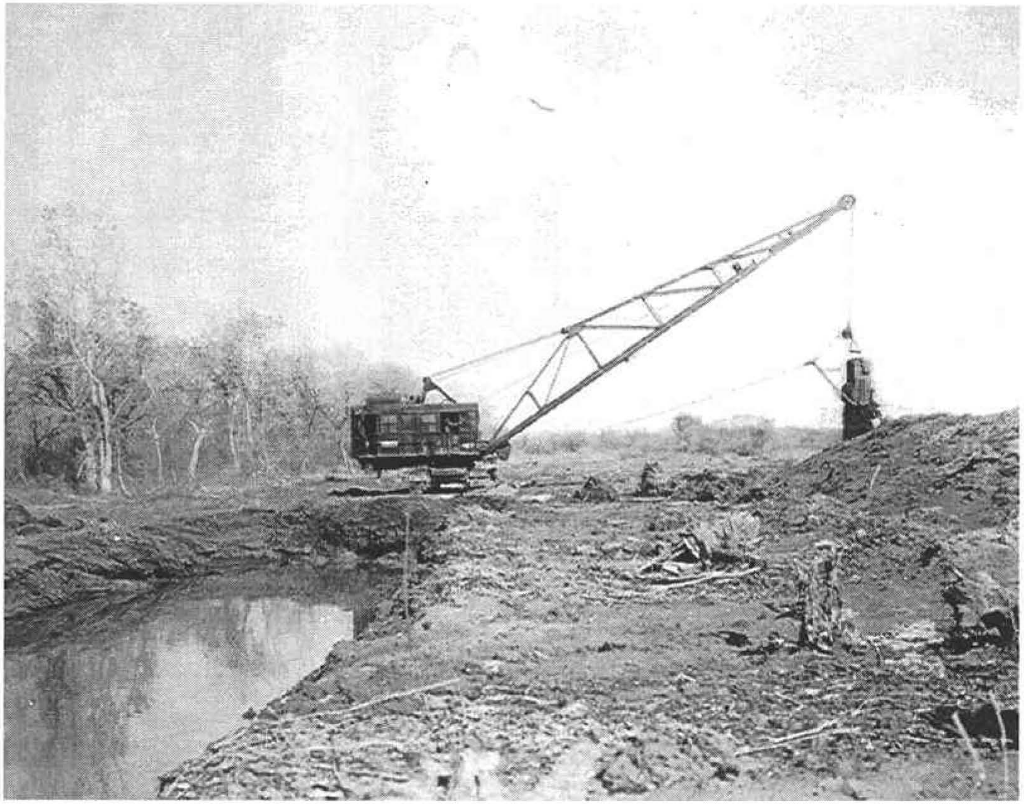

Figure 14 Construction of the Corrales Riverside Drain and Levee. *Source:* Middle Rio Grande Conservancy District, No. 118, Plate 4

incorporated into a large, regulated project. Drainage would have been the one portion of the project that was an entirely new development in Corrales. Unfortunately, we can only surmise about an earlier origin of Corrales flood protection, as written records and oral histories focus around waterlogging and damage caused by floods, rather than the existence of flood protection in Corrales prior to the MRGCD.

Belen Division

High line canals are water supply structures located on hills above a valley and are constructed to increase the amount of irrigable land in the valley. The construction of these canals are usually more costly than developing low line canals on the valley floor. In most cases in the MRGCD it was decided that high line canals would be expensive and difficult to construct because of the arroyos they would have to cross. In Belen, on the west side of the Rio Grande, little cross drainage was noted and it was determined that the area could benefit from a high line canal. Burkholder states that by incorporating a high line canal in the Belen District, "Some very fine land above the present ditches will . . . be brought under the new irrigation system"

The high line canal in Belen was investigated as a potential location for hydraulic power in the 1928 *Official Plan*. The plan states that there were two locations where a drop could be designed into the canal. At the base of these drops a power plant could be located. Through the combination of providing a wasteway and extra head in the canal to the power drop, both electricity and irrigation could be provided. The two locations identified in the *Official Plan* were: 2 mi west of Los Chavez and 16 mi below the head of the canal and 3 mi south of Belen. The first location required a 400 cfs flow and would result in 1220 horse power and the second location required a 400–500 cfs flow and would result in 1490–1990 kilowatts of power.[65]

Although both irrigation and power could have been provided from the Belen High Line Canal, it was decided to omit the power plants from the plan. It was decided to not include these as they would require continuous operation of the canal, making maintenance difficult and requiring water flow year-round rather than only during the 8 months

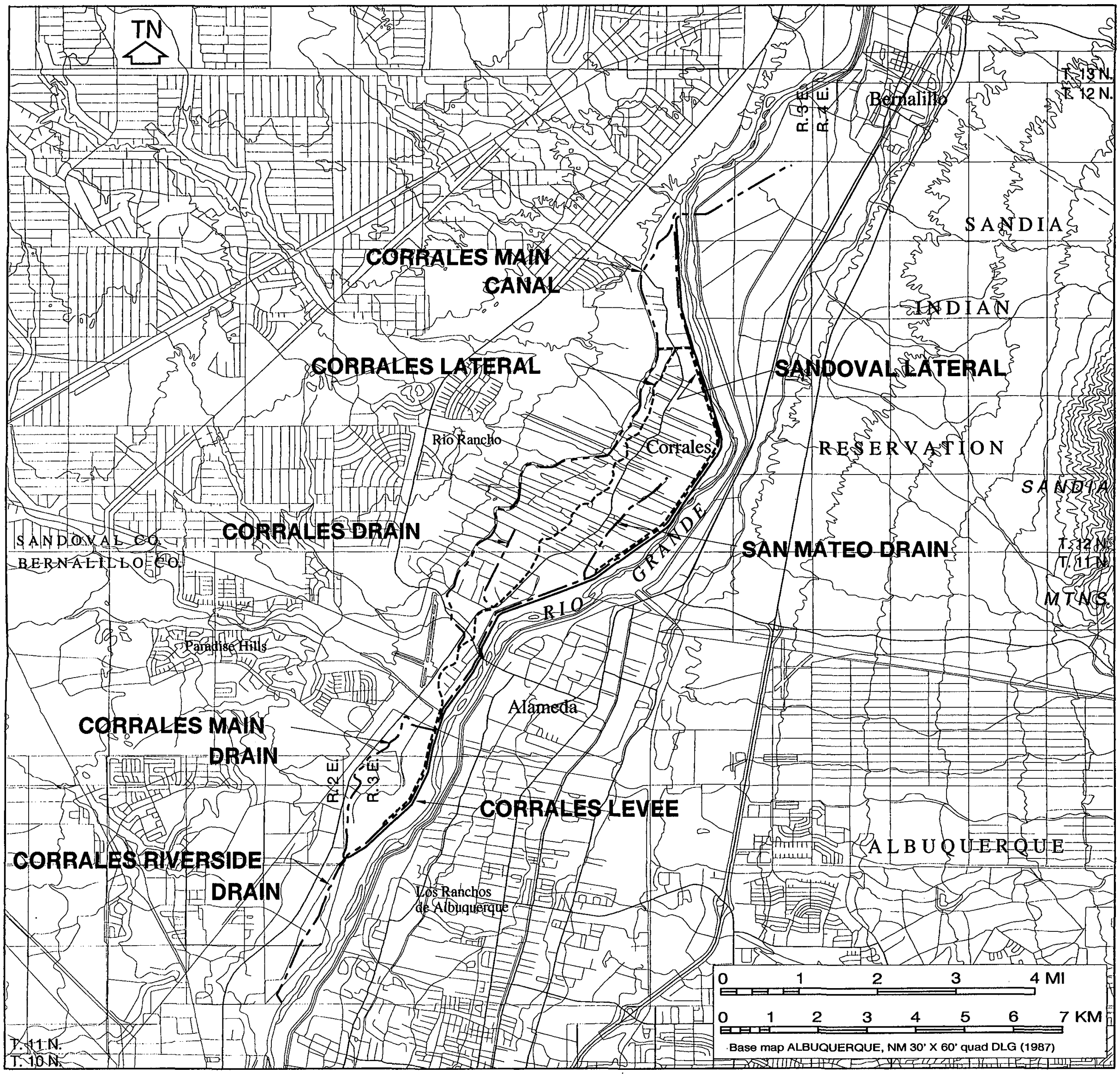

Figure 15 Map of irrigation, drainage, and flood protection, Corrales Unit (USGS 1:100,000 scale)

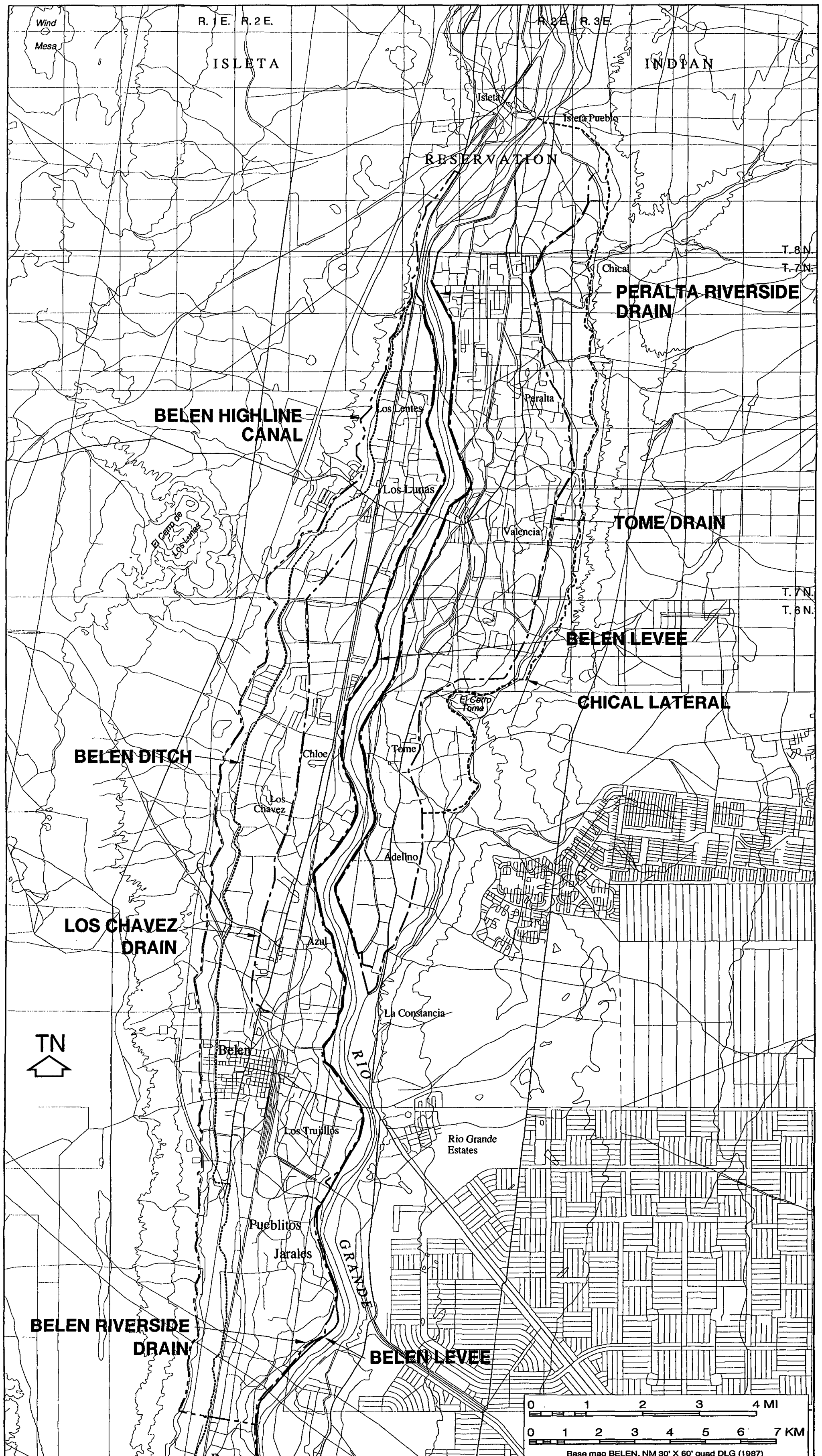

Figure 16 Map of irrigation, drainage, and flood protection, Belen Division (USGS 1:100,000 scale)

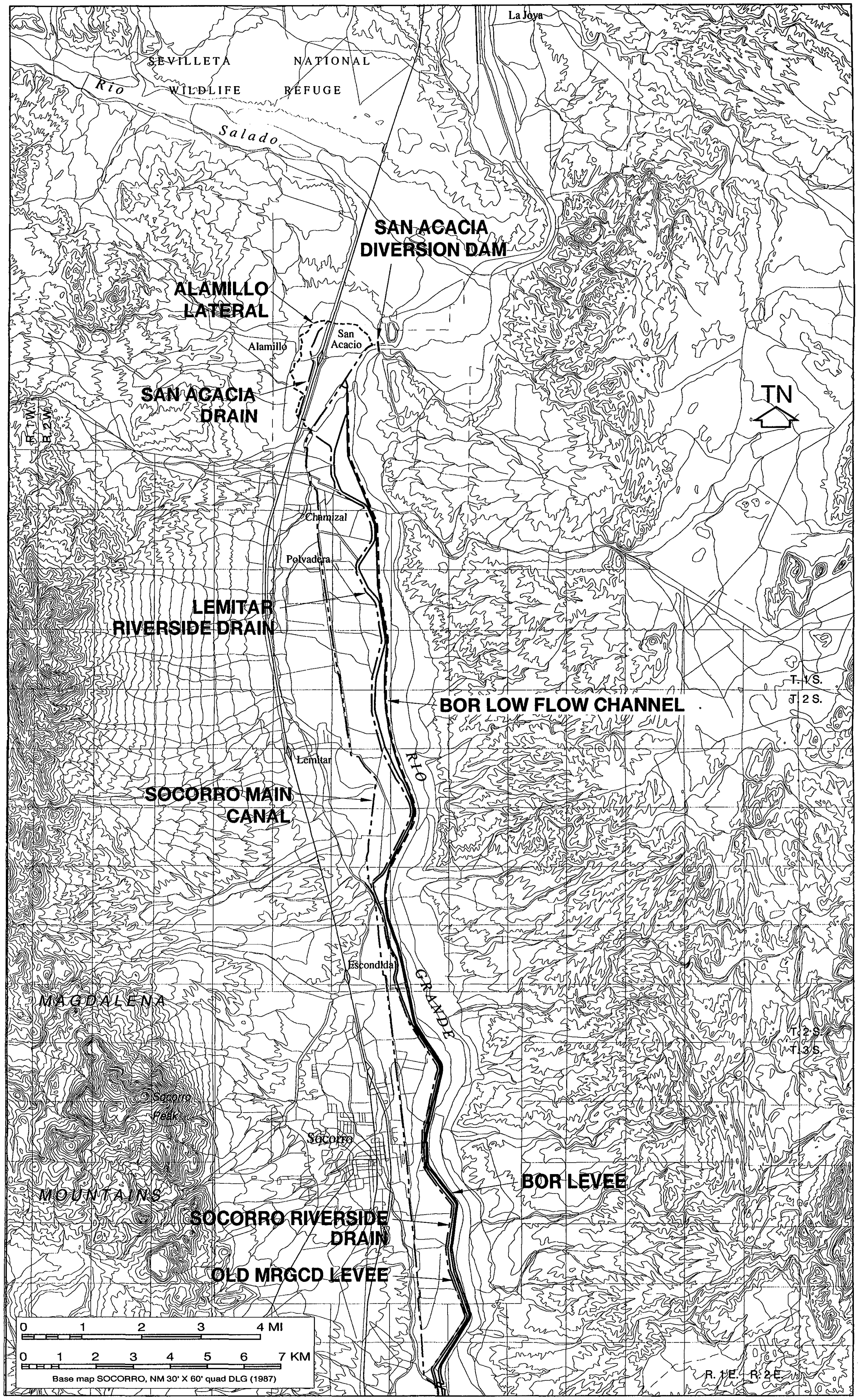

Figure 17 Map of irrigation, drainage, and flood protection, northern Socorro Division (USGS 1:100,000 scale)

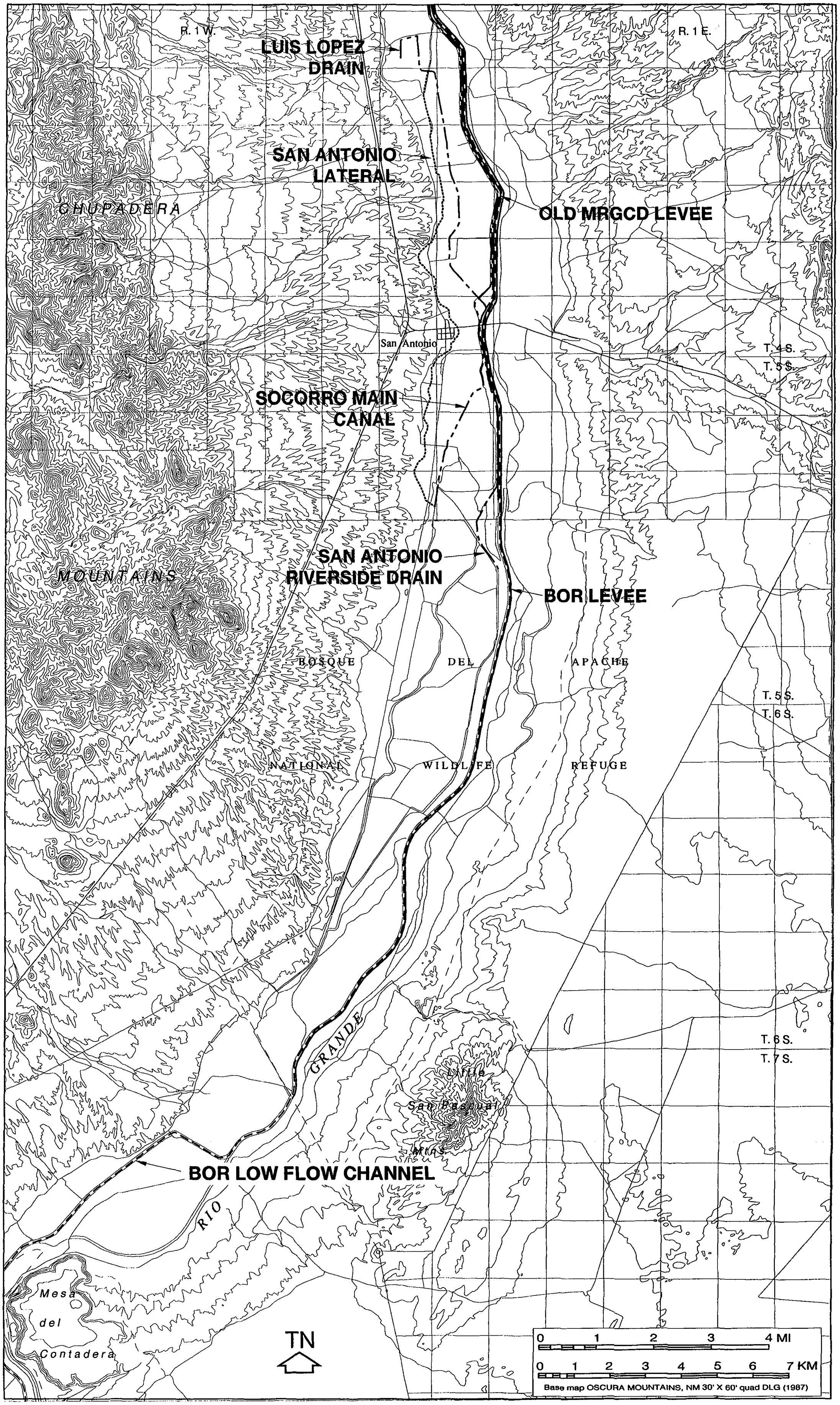

Figure 18 Map of irrigation, drainage, and flood protection, southern Socorro Division (USGS 1:00,000 scale)

of irrigation season. It was also determined that the density of development at that time did not merit the development of the power plants. The *Official Plan* did not recommend the construction of the plants at that time, but encouraged the consideration of such construction when the density of population could support such efforts and noted that they could be easily added with little change to the system as designed.[66]

As with most New Mexican towns, Belen is subject to surface flooding from arroyos, as well as from the Rio Grande. Belen has experienced many floods from the Rio Grande and has had additional problems caused by *arroyo* floods inundating the works of the MRGCD. The Highline Canal offers added flood protection to Belen during small flows, but during large flows it can actually add to the problem. In a 1969 flood, the *arroyo* flows entered the Highline Canal "at several points overloading it with flood water and a large amount of silt; the canal consequently breached at a number of points . . . water ponded in Belen at depths up to . . . 3 feet."[67] Part of the reason Belen is susceptible to flooding is that it is built at an elevation slightly lower than the bed of the Rio Grande.[68] Basically, Belen is the low point between the Highline Canal and the Rio Grande. When there are severe flooding conditions, Belen has the potential to be flooded from the east and west. As noted in the 1982 Federal Emergency Management Agency report, the levees in Belen had never been breached by floods, but the potential for this to occur existed.[69]

Socorro Division

Above Bernalillo, the river is well-defined and falls 8 ft per mi, while below Bernalillo, the channel is wide, fairly undefined, has a 4 ft fall per mi, and before the MRGCD improvements tended to flood at flows of 12,000 cfs. The channel width in 1928 ran from 400 ft above Bernalillo to 2,000 ft at San Marcial.[70] As the channel widens, the flow of the river spreads across the land, the velocity of flow slows, and silt accumulates. Because of this, the riverbed was raised 12 ft between 1880 and 1928 at San Marcial.[71] A 12,000 cfs flow in 1926 caused a flood water level 4.7 ft higher than the 1904 33,000 cfs flow; the 1926 waterline was 6 ft above the railroad tracks.[72]

In order to deal with the meandering flows, the *Official Plan* recommended low flow channels [in the riverbed]. These were intended to provide protection of the levees by defining a narrow channel where the river would increase its velocity and scour the bottom to keep silt from raising the riverbed (Figure 11).[73] These channels would have been most important in the southern ends of the MRGCD, as the silting problems were more extensive there.

In 1928, the railway grades south of Bernalillo were below the top of the proposed levees and were in danger of flooding. In 1927 railway grades near San Acacia were washed out by a flood which originated in the Rio Puerco and flowed at 20,000 cfs.[74] Where there was not room to construct a levee between the tracks and the river, the MRGCD proposed to raise the level of the railroad grade, so that the grade would serve as a levee in the event of a flood. This protection included adding riprap to the grade's riverside and would provide protection for floods of 50,000 cfs. The work of raising the grades was not in the jurisdiction of the MRGCD, but the design was coordinated between the AT&SF and MRGCD engineers.

"At San Marcial the flood menace is ever present and only perpetual vigilance and the expenditure of large sums of money by the A.T. & S.F. Ry., which has a large investment to protect, has averted disaster."[75] The primary flood protection for San Marcial were the levee/railroad grades constructed by the AT&SF and because of the raising of the riverbed the 1928 *Official Plan* stated that raising the railroad grade could not be continued indefinitely and this system must be abandoned. The water table at San Marcial was at the surface of the ground and because the riverbed was higher than the town, the MRGCD proposed that riverside drains be carried far downstream to ensure sufficient fall to adequately lower the water table in town. Another problem at San Marcial was a "silt delta" and the MRGCD proposed many alternative solutions. The preferred solution provided flood protection for flows up to 50,000 cfs with a series of high levees, the raising of railroad bridges and their approaches, a riverside drain whose outlet was near Fort Craig, and the channelizing the river with a series of jetty jacks (Figure 19).[76]

The improvements for San Marcial on the western bank of the Rio Grande and Val Verde on the eastern bank were never made. Protests to the MRGCD improvements were made by J. Fred Schoellkopf "on behalf of 8,300 acres of land at the lower end of the Socorro District."[77] It was determined that the elimination of the portion of the planned design, beginning at the north boundary of the Bosque del Apache Grant, would not affect the MRGCD as a whole.

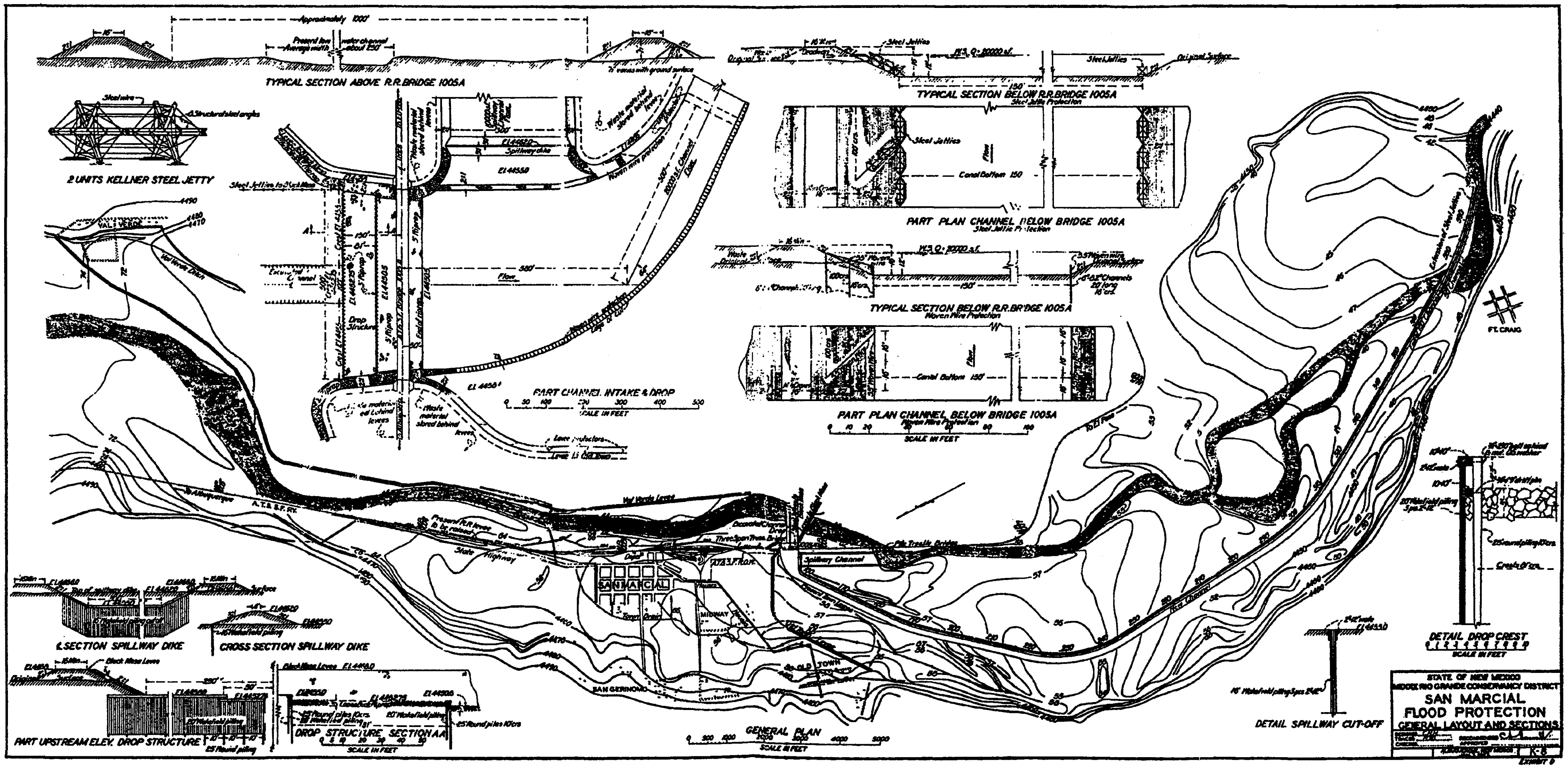

Figure 19 MRGCD flood protection design at San Marcial, 1927. Source: "The Situation at San Marcial", by C.H. Howell

Features which were left intact included jetty jacks to aid in silt control and an outlet for the San Antonio Riverside Drain, which extended 2.5 mi into the Bosque del Apache Grant. In the evaluation of the effects of eliminating this portion of the plan the MRGCD engineers noted benefits and disadvantages, below are two of them:

> *Advantage*
> The Modified Plan eliminates the most difficult engineering problem, the San Marcial silt problem, from the Plan and reduces further uncertainties in regard to maintenance of agriculture in the lower end of the District.
>
> *Disadvantage*
> The Town of San Marcial is now located on land which is lower than the bed of the Rio Grande. Its existence depends upon wholly inadequate dikes. Without the help of a comprehensive plan of improvement, it cannot exist much longer. The citizens of this town have been looking to the District for correction of their problems for many years.

On August 15, 1928, a decree was handed down by the district court of the 2nd Judicial District to accept the modified plan, without improvements below the north boundary of the Bosque del Apache Grant.[78] It seems that this sealed the fate of San Marcial, but in fact the 1929 flood occurred before improvements could have possibly been made in the Socorro District.

From 1951–59 the BOR constructed the low flow channel to transport water to Elephant Butte. The construction began at Elephant Butte in 1951 and proceeded up to Bosque del Apache by 1956. Between 1956 and 1959 the low flow channel continued into the San Acacia Unit.[79] The low flow channel was intended for use during dry seasons when the flow of the river slowed. Rather than let the water spread across the wide riverbed, which results in greater loss through infiltration and evaporation, the BOR channeled the water into a ditch which consolidated the flow and moved it more quickly to the reservoir, resulting in less loss to evaporation.

When the BOR low flow channel was constructed, a spoil embankment was constructed with it and portions of the original MRGCD earthen embankment were incorporated into the new BOR embankment.[80] The BOR spoil embankment is larger than the existing railroad grades and old levee and became the primary flood protection for the San Acacia Unit. When the BOR embankment became the primary flood protection, maintenance efforts were focused on the new levee and the original levee began to fall into disrepair. In some places the levee is quite flat [most likely where fill for the new levee was taken], and in others the form of the levee is distinct. Although the levee has not been the primary flood protection in the San Acacia Unit for many years, it is still distinguishable as a feature in the landscape.

By and large the levees throughout the MRGCD have served the communities well, as damage caused by floods has been kept to a minimum. Throughout their existence the levees have been repaired and maintained on a regular basis, though some repairs (as noted by Mr. Alary) may have been unorthodox. Vegetation has been removed, earth has been infilled, and gravel may have been added to the maintenance road surface.[81] The character of the levees, as with most exposed earthen structures, is of natural deterioration, which requires upkeep to maintain their stability. The material of the current levees will be included in the construction of the new levees and augmented with borrow from nearby, previously disturbed areas. In a sense, the improvement of the levee will be a continuum of its life, the adaptation and reuse of the earth which was used to create it, as has been completed throughout maintenance programs since its inception. The levees will change in size and shape, but will continue to provide the middle Rio Grande with flood protection.

GLOSSARY

***Acequia*:**	an small irrigation ditch.
Alkali:	a soluble mineral present in some soils, especially in arid regions, which is detrimental to agricultural vegetation.
Canal:	an artificial waterway used for irrigation. In Corrales this is the main water supply from which all other irrigation branches.
Dike:	an embankment for holding back water from a sea or river.
Ditch:	a long narrow excavation made in the ground used to transport water for irrigation.
Drain:	a ditch used to slowly and continuously withdraw water from land near the river.
High Line Canal:	a canal located on hills bordering a valley which uses gravity flow and small percentages of grade to move water. Their location above the valley and grade configuration can increase the amount of irrigable valley land.
Low Line Canal:	a canal located on the valley floor requiring drop structures to promote flow.
Lateral:	a canal which runs parallel to the river and distributes water from a main canal.
Levee:	an earthen embankment designed to prevent flooding.
Piping:	the removal of finer particles due to rate of pressure drop resulting from seepage. Usually occurs just downstream of the embankment.
Riparian:	vegetation situated on the bank of a river.
Siphon:	a conduit that uses atmospheric pressure to draw liquid from one container to another. In the Corrales case, a change in conduit height from one side of the river to the other is used to siphon water from the Albuquerque Main Canal into the Corrales Main Canal.
Terrones:	blocks of earth cut from the riverbank, including roots, to serve as bricks in construction.
Waterlog:	to soak, fill, or saturate so as to make soggy or useless.

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34. Richard Melzer, "Floods Haven't Washed Away Memories of Town," p. 87.

35. La Mesa de San Marcial was originally founded in the early 1850s on the east bank of the Rio Grande, but was also obliterated by a flood in 1866. The community reestablished itself on the west bank of the river on the Pedro Armendaris land grant. San Marcial was a fairly sleepy community until 1880 when the Atchison, Topeka, and Santa Fe Railroad established a division headquarters there. A roundhouse, freight depot, telegraph building, a Harvey House and numerous other enterprises were present when a fire nearly destroyed the town in 1881. Yet again the town bounced back. By 1929, when the floods hit, the population had grown to over 1400 and the town boasted a skating rink, a weekly paper, several churches of different denominations, and even such diversified businesses as a bicycle repair shop. (From "San Marcial," no date, author unknown, Socorro Library vertical files.)

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APPENDIX A

1935–1989 Vegetation Maps

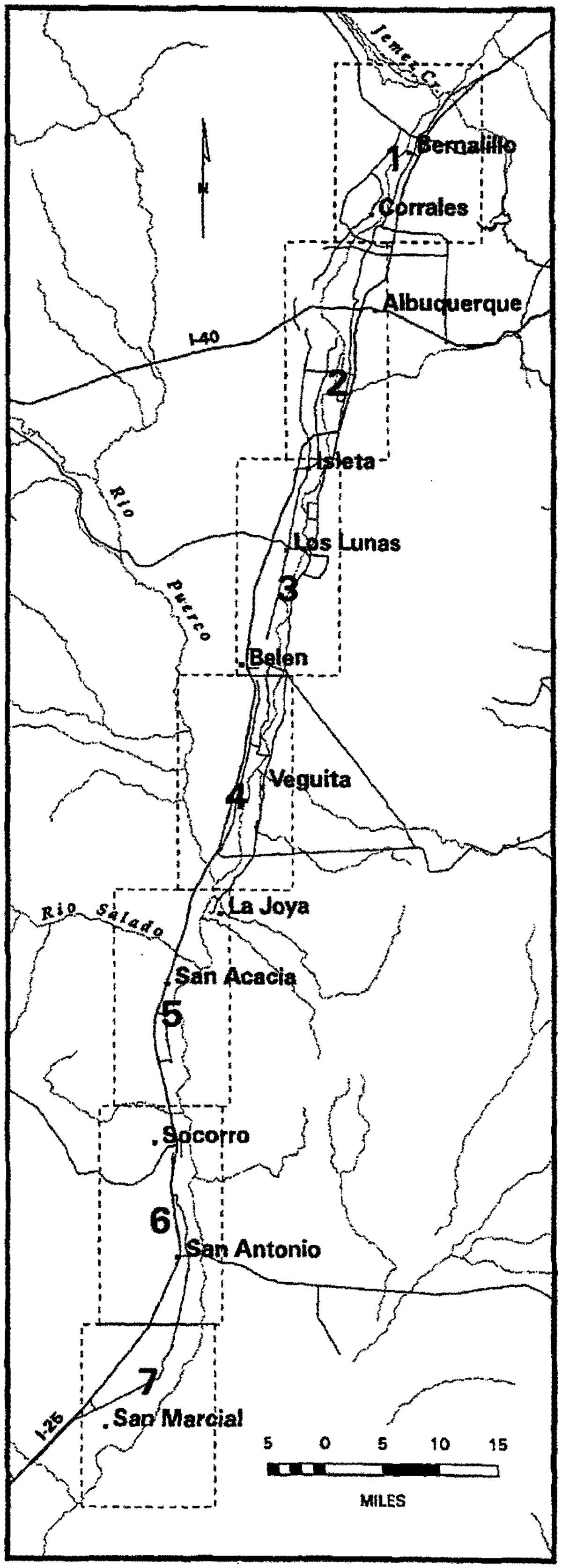
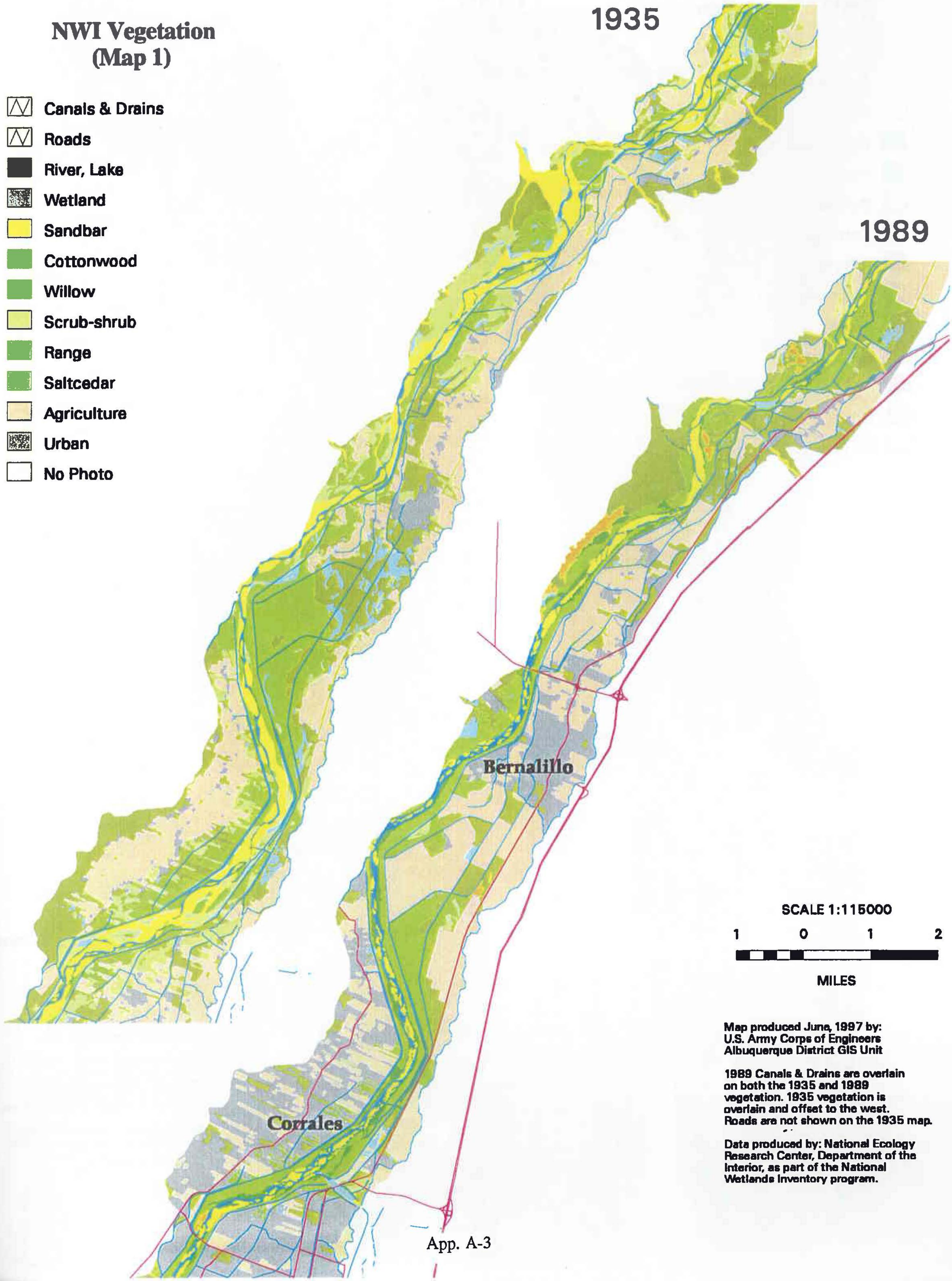
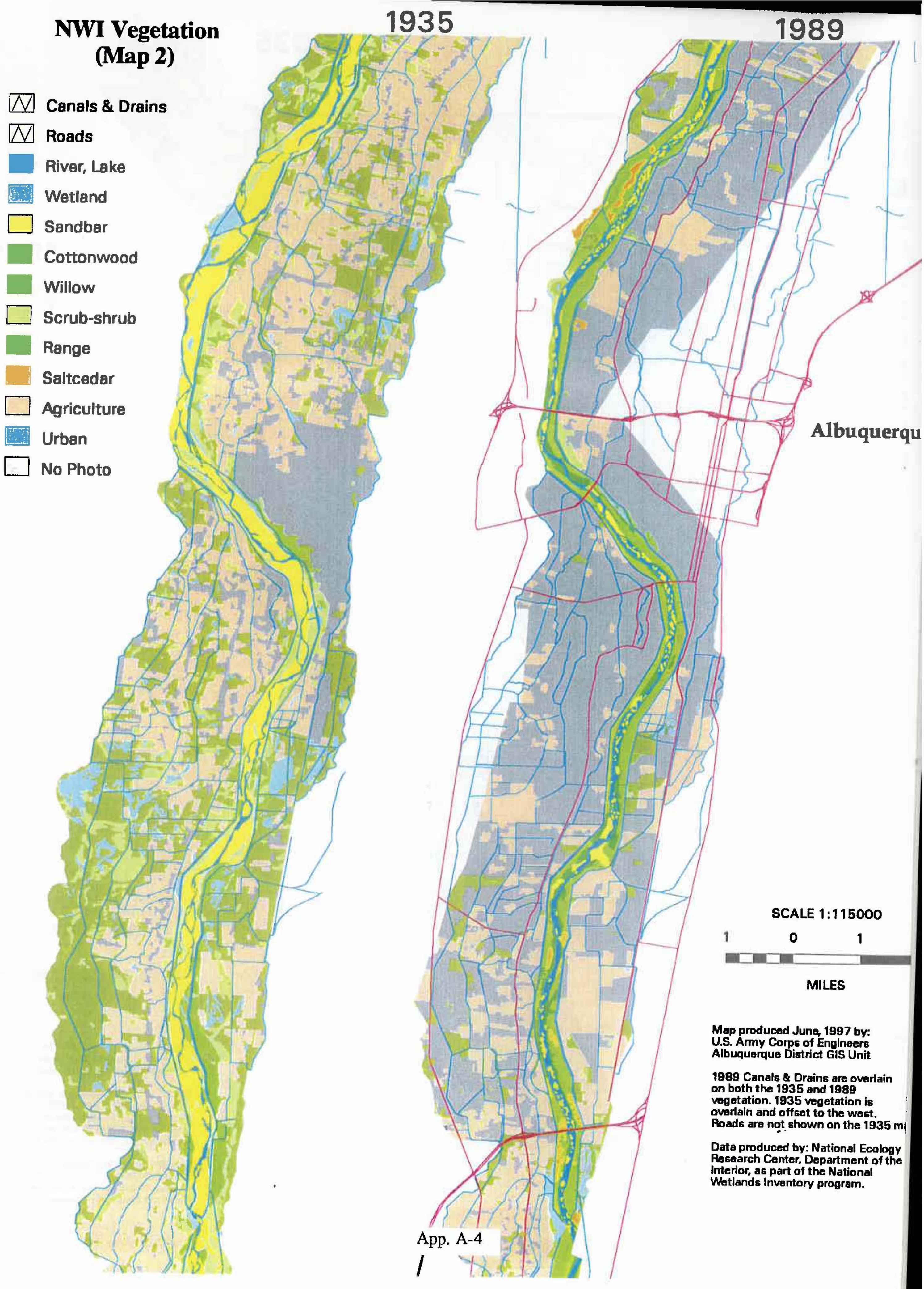
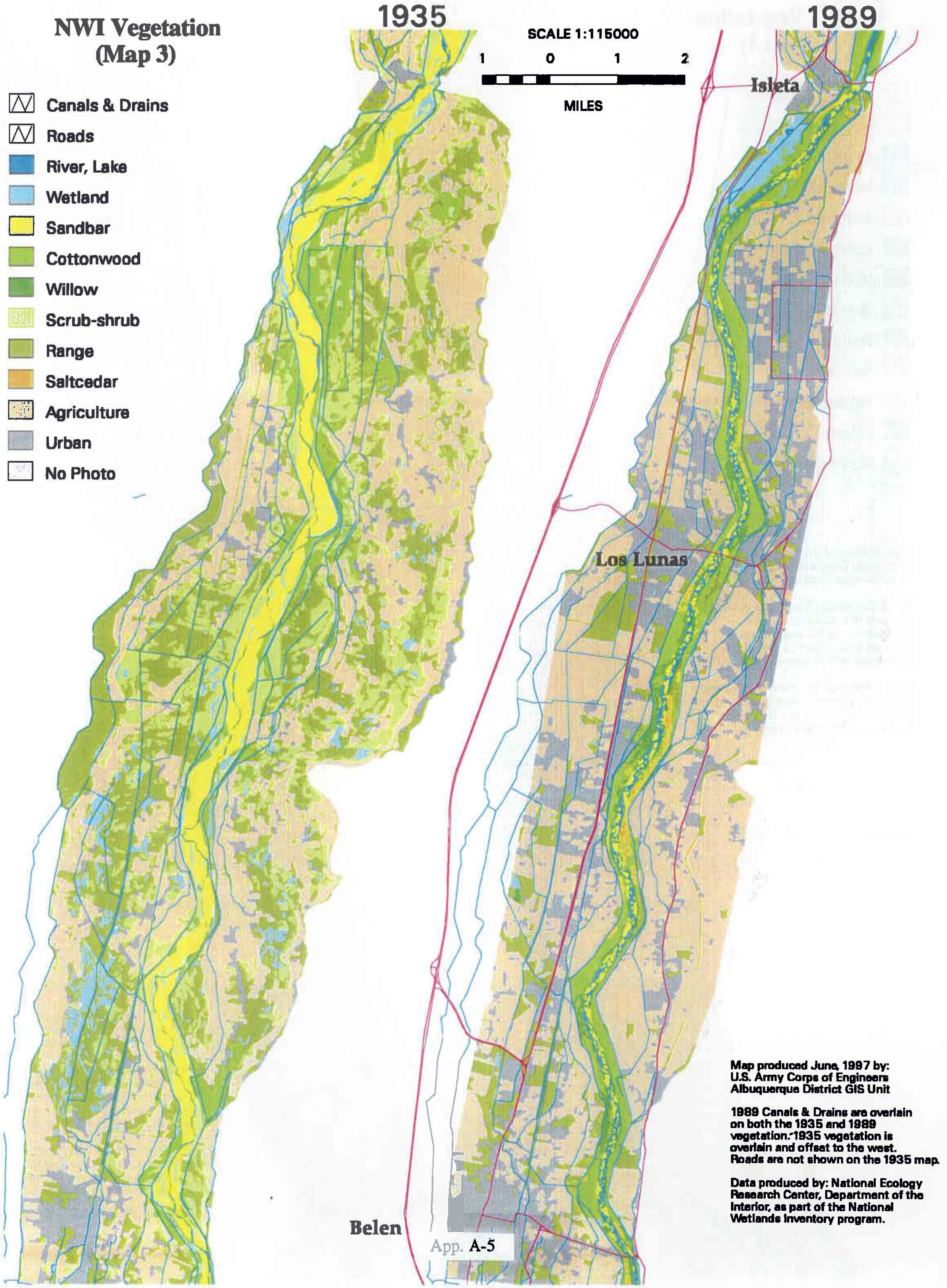


Figure A.1 Index to vegetation maps

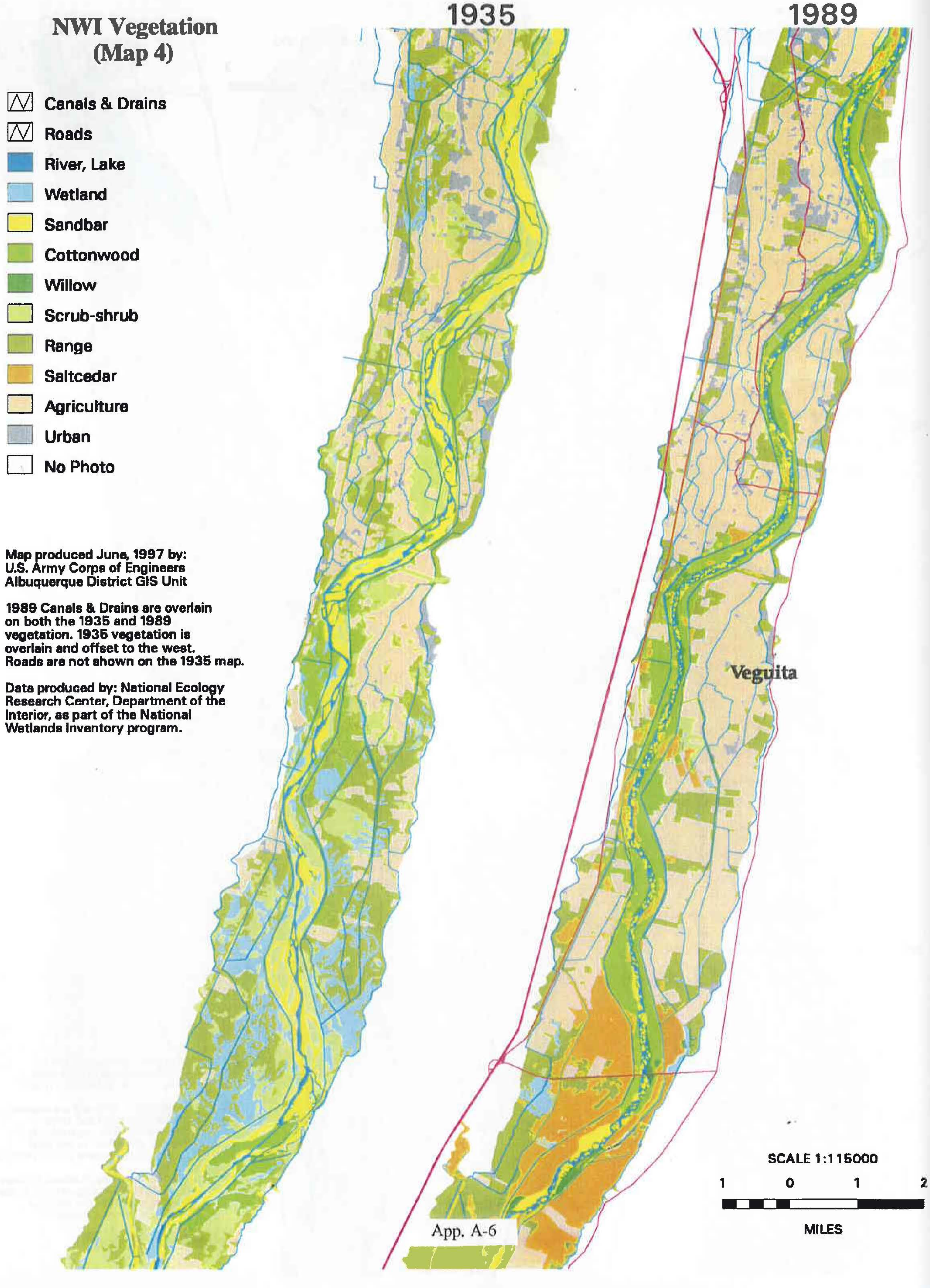


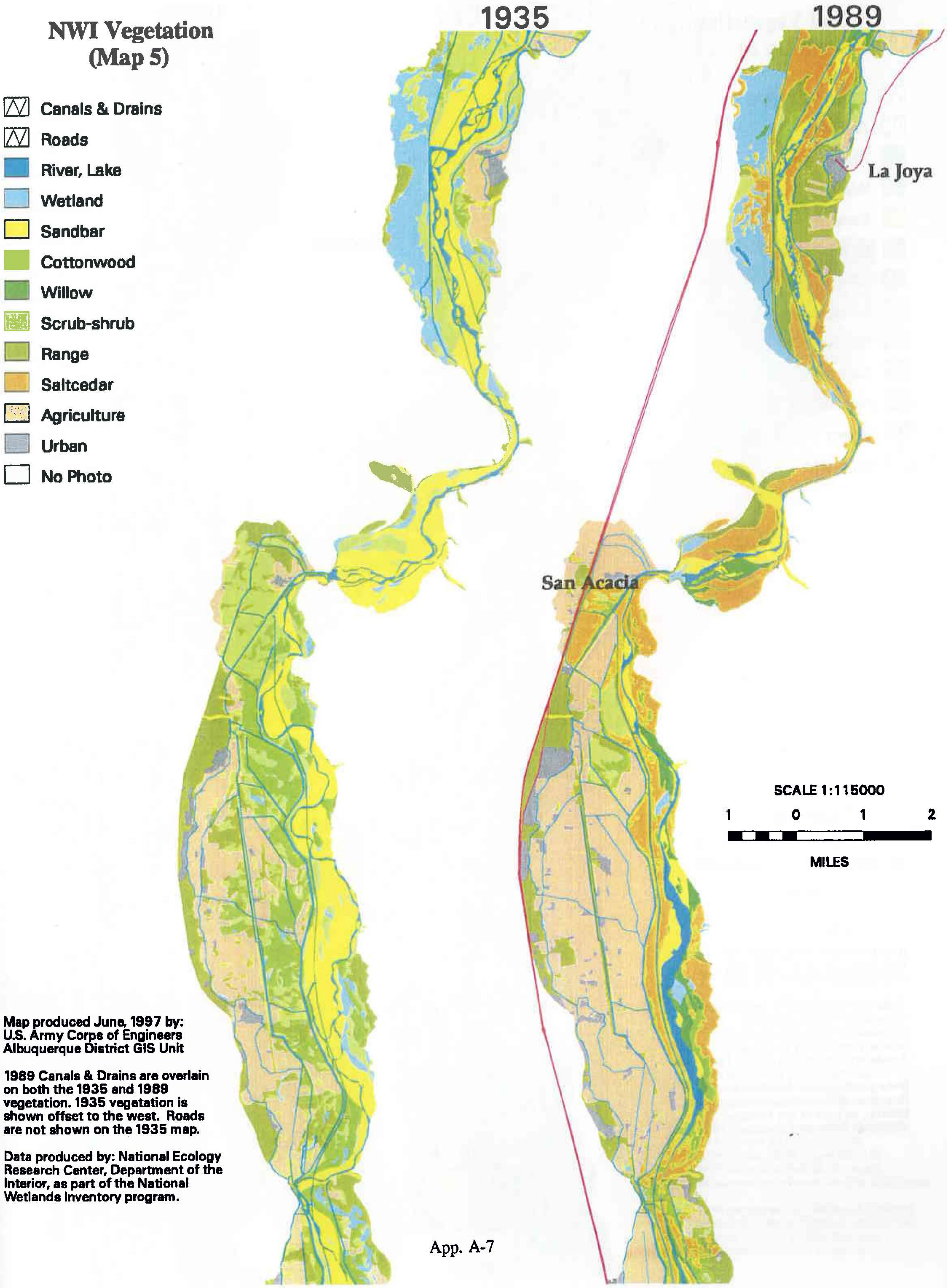
NWI Vegetation
(Map 1)
Canals & Drains
Roads
River, Lake
Wetland
Sandbar
Cottonwood
Willow
Scrub-shrub
Range
Saltcedar
Agriculture
Urban
No Photo
1935
1989
Bernalillo
Corrales
SCALE 1:115000
1 0 1 2
MILES
Map produced June, 1997 by:
U.S. Army Corps of Engineers
Albuquerque District GIS Unit
1989 Canals & Drains are overlain on both the 1935 and 1989 vegetation. 1935 vegetation is overlain and offset to the west. Roads are not shown on the 1935 map.
Data produced by: National Ecology Research Center, Department of the Interior, as part of the National Wetlands Inventory program.

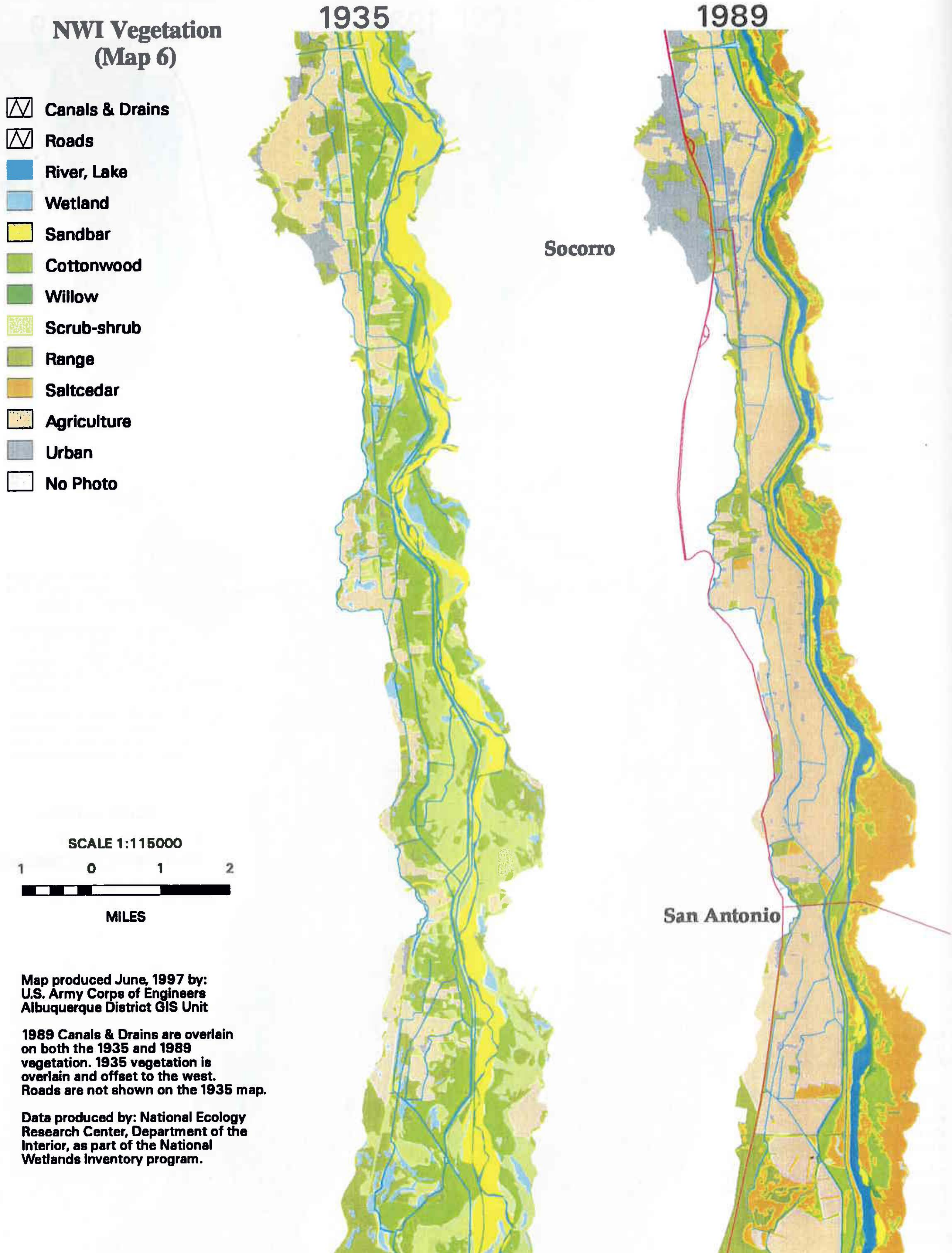

NWI Vegetation
(Map 2)
1935
1989
Canals & Drains
Roads
River, Lake
Wetland
Sandbar
Cottonwood
Willow
Scrub-shrub
Range
Saltcedar
Agriculture
Urban
No Photo
Albuquerqu
SCALE 1:115000
1 0 1
MILES
Map produced June, 1997 by:
U.S. Army Corps of Engineers
Albuquerque District GIS Unit
1989 Canals & Drains are overlain on both the 1935 and 1989 vegetation. 1935 vegetation is overlain and offset to the west. Roads are not shown on the 1935 m
Data produced by: National Ecology Research Center, Department of the Interior, as part of the National Wetlands Inventory program.



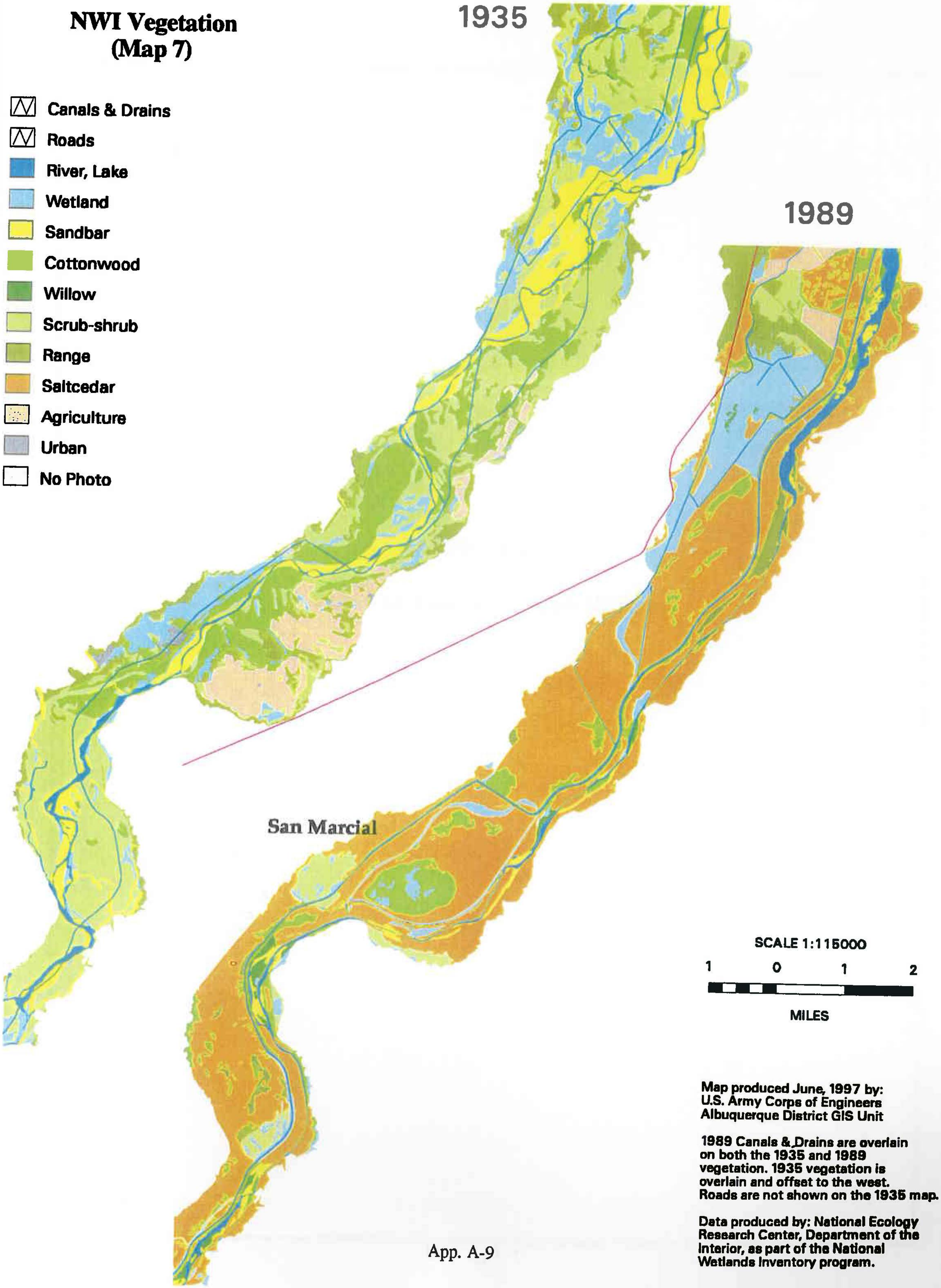
NWI Vegetation
(Map 3)
Canals & Drains
Roads
River, Lake
Wetland
Sandbar
Cottonwood
Willow
Scrub-shrub
Range
Saltcedar
Agriculture
Urban
No Photo
1935
1989
SCALE 1:115000
1 0 1 2
MILES
Isleta
Los Lunas
Belen
Map produced June, 1997 by:
U.S. Army Corps of Engineers
Albuquerque District GIS Unit
1989 Canals & Drains are overlain on both the 1935 and 1989 vegetation. 1935 vegetation is overlain and offset to the west. Roads are not shown on the 1935 map.
Data produced by: National Ecology Research Center, Department of the Interior, as part of the National Wetlands Inventory program.


NWI Vegetation
(Map 4)
1935
1989
Canals & Drains
Roads
River, Lake
Wetland
Sandbar
Cottonwood
Willow
Scrub-shrub
Range
Saltcedar
Agriculture
Urban
No Photo
Map produced June, 1997 by:
U.S. Army Corps of Engineers
Albuquerque District GIS Unit
1989 Canals & Drains are overlain on both the 1935 and 1989 vegetation. 1935 vegetation is overlain and offset to the west. Roads are not shown on the 1935 map.
Data produced by: National Ecology Research Center, Department of the Interior, as part of the National Wetlands Inventory program.
Veguita
SCALE 1:115000
1 0 1 2
MILES


NWI Vegetation
(Map 5)
Canals & Drains
Roads
River, Lake
Wetland
Sandbar
Cottonwood
Willow
Scrub-shrub
Range
Saltcedar
Agriculture
Urban
No Photo
1935
1989
La Joya
San Acacia
SCALE 1:115000
1 0 1 2
MILES
Map produced June, 1997 by:
U.S. Army Corps of Engineers
Albuquerque District GIS Unit
1989 Canals & Drains are overlain on both the 1935 and 1989 vegetation. 1935 vegetation is shown offset to the west. Roads are not shown on the 1935 map.
Data produced by: National Ecology Research Center, Department of the Interior, as part of the National Wetlands Inventory program.



NWI Vegetation
(Map 6)
1935
1989
Canals & Drains
Roads
River, Lake
Wetland
Sandbar
Cottonwood
Willow
Scrub-shrub
Range
Saltcedar
Agriculture
Urban
No Photo
Socorro
San Antonio
SCALE 1:115000
1 0 1 2
MILES
Map produced June, 1997 by:
U.S. Army Corps of Engineers
Albuquerque District GIS Unit
1989 Canals & Drains are overlain on both the 1935 and 1989 vegetation. 1935 vegetation is overlain and offset to the west. Roads are not shown on the 1935 map.
Data produced by: National Ecology Research Center, Department of the Interior, as part of the National Wetlands Inventory program.


NWI Vegetation
(Map 7)
Canals & Drains
Roads
River, Lake
Wetland
Sandbar
Cottonwood
Willow
Scrub-shrub
Range
Saltcedar
Agriculture
Urban
No Photo
1935
1989
San Marcial
SCALE 1:115000
1 0 1 2
MILES
Map produced June, 1997 by:
U.S. Army Corps of Engineers
Albuquerque District GIS Unit
1989 Canals & Drains are overlain on both the 1935 and 1989 vegetation. 1935 vegetation is overlain and offset to the west. Roads are not shown on the 1935 map.
Data produced by: National Ecology Research Center, Department of the Interior, as part of the National Wetlands Inventory program.

APPENDIX B

Table of Floods at San Marcial

Table B.1 Floods at San Marcial 1897–1924

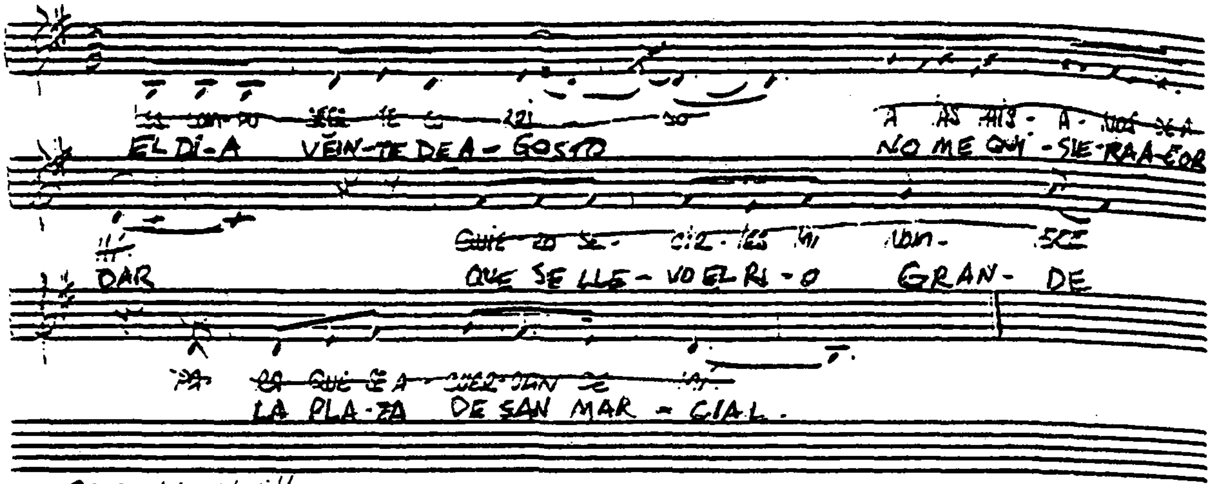
YEAR	FLOOD PERIODS	DAYS	MAX. DISCHARGE SEC. FT.
1897	May 6 – June 3	29	21,800
1897	October 10	1	15,500
1898	April 20	1	10,600
1898	April 30 – May 1	2	11,300
1898	July 16–18	3	16,800
1902	August 26	1	10,500
1903	June 9–25	17	18,800
1904	October 2–3	2	19,100
1904	October 9–15	7	33,000
1905	April 24–25	2	14,100
1905	May 4 – June 20	48	29,100
1906	May 13 – 15	3	10,400
1907	May 26– 30	5	11,500
1907	June 20 – 23	4	11,700
1907	August 31 – Sept. 1	2	10,600
1911	July 21 – 23	3	11,000
1911	October 7 – 11	5	11,800
1912	May 23 – June 12	21	15,300
1915	April 18	1	12,600
1915	May 21	1	10,400
1916	May 11 – 18	8	15,100
1916	October 15	1	11,400
1919	April 26 – May 1	6	12,700
1919	May 26 – 28	3	10,800
1920	May 12 – 18	7	13,100
1920	May 23 – June 21	30	22,500
1921	June 6 – 24	19	19,400
1921	July 25	1	10,900
1922	May 11	1	10,400
1924	April 18	1	10,000
1924	April 26 – 30	5	12,200
1924	May 12 – 28	17	12,400

Source: "The Situation at San Marcial," C.H. Howell

APPENDIX C

Sheet Music for *El Corrido de San Marcial*

924. El Corrido de San Marcial



925. El Novillero

APPENDIX D

Irrigation Developments Before 1926

Table D.1 Middle Rio Grande Developments. *Source:* MRGCD Official Plan (1928)

TIME OF CONSTRUCTION	NUMBER OF DITCHES	SECOND FEET CAPACITY	1910 IRRIGATION (ACRES)	ADDITIONAL POSSIBLE (ACRES)	TOTAL UNDER DITCH (ACRES)
Ancient and very old	15	405	11,100	7,830	18,930
Old	40	946	20,285	25,815	46,100
About 1700	2	40	1,300	1,300	2,600
Before 1800	6	221	4,500	7,400	11,900
Before 1850	5	143	3,000	5,350	8,350
To 1880	6	184	3,500	10,000	13,500
To 1910	5	197	1,535	21,885	23,420
TOTALS	79	2,145	45,220	79,580	124,800

(This table is given by Mr. Hedke as a summary of an investigation made in 1910 by Mr. H. W. Yeo of the United States Reclamation Service, at present State Engineer of New Mexico.)

Table D.2 Showing the Progess of Irrigation Developments in the Middle Rio Grande Valley based on the reports of: W.W. Follett, Engineer, International Boundary Commission; H.W. Yeo, Engineer, United States Reclamation Service; State of New Mexico, 1918 Drainage Survey. *Source:* MRGCD Official Plan (1928)

TIME UP TO	NO. OF DITCHES	SEC. FT. CAPACITY	ACRES UNDER DEVELOPMENT	ACRES FAILED	REMARKS
1600	22	537	25,555		Indian development.
1700	61	1,445	73,580		Indian with Spanish.
1800	70	1,808	100,380		Above with Spanish grants.
1850	80	2,099	123,315		Natural increase.
1880	82	2,145	124,800		Transcontinental traffic and civil war demand, completed developments
1896	71	1,779	50,000	74,800	Due to short water supply, rising water table, R.R. supply competition and R.R. labor demand
1910	79	2,121	45,220	79,580	Further shortage and further rising water table.
1918	65	1,957	47,000	77,800	War period.
1925	60	1,850	40,000	84,800	Estimated present condition.

The University of New Mexico

US Army Corps of Engineers

Controlling The Floods

The Role of the U.S. Army Corps of Engineers
In the History of the Middle Rio Grande Conservancy District

FINAL

CONTROLLING THE FLOODS:
The Role of the U.S. Army Corps of Engineers In the History of the Middle Rio Grande Conservancy District

Prepared by
William A. Dodge, Ph.D.
and
Abraham Santillanes

Karen Van Citters
Principal Investigator
Van Citters: Historic Preservation, LLC
Albuquerque, New Mexico

Prepared for
Albuquerque District Corps of Engineers
Contract No. W912PP-06-F-0053

November 2007

EXECUTIVE SUMMARY

Van Citters: Historic Preservation, LLC (VCHP) was contracted by the United States Army Corps of Engineers (USACE; contract no. W912PP-6-F0053) to inventory and assess the historic significance of structures and features constructed by the Middle Rio Grande Conservancy District (MRGCD) and later renovated by the Corps and the Bureau of Reclamation between the communities of Bernalillo and Belen with a special emphasis on that stretch of the river found within the Albuquerque District.

Upon its creation in 1928, the MRGCD began designing and building a comprehensive system of dams, canals, laterals, and drains to divert water from the Rio Grande for agricultural use and drain away excess water from the fields to reclaim prime farm land. The vagaries of the Rio Grande's flow characteristics also necessitated the construction of levees and jetties to channelize the river and help control periodic flooding that had plagued the residents of the middle Rio Grande valley since pre-Columbian times.

VCHP categorized the types of structures and features found within the MRGCD and determined that while no individual structures were eligible for the National Register of Historic Places due to a lack of historic integrity caused by renovations carried out in the 1950-60s, the system as a whole was eligible as a historic district under Criterion A, i.e., for its contributions to history of agriculture and urban development along the Rio Grande located within the study area. Should the MRGCD be determined eligible for the National Register, VCHP recommends that the USACE explore the possibility of developing a multi-agency programmatic agreement to assist with the management of effects that might occur to the district in the future.

LIST OF ACRONYMS & ABBREVIATIONS

MRGCD	Middle Rio Grande Conservancy District
NHPA	National Historic Preservation Act
National Register	National Register of Historic Places
PA	Programmatic Agreement
PWA	Public Works Administration
WPA	Works Progress Administration
RFC	Reconstruction Finance Corporation
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
VCHP	Van Citters: Historic Preservation, LLC

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I. INTRODUCTION

PROJECT DESCRIPTION

Since the early 1940s, the U.S. Army Corps of Engineers, Albuquerque District (USACE), has assisted the Middle Rio Grande Conservancy District (MRGCD) to prevent flood damage to the district's irrigation system, as well as private and commercial property along the middle Rio Grande valley. This system, consisting of canals, ditches, drains, and levees, was built in the early 1930s to reclaim agricultural land in the middle valley, improve farm land production, and control historically damaging floods. From the 1950s to the present day, the USACE, together with the U.S. Bureau of Reclamation (USBR) and MRGCD, has developed projects to update and improve the system by rehabilitating aging irrigation structures and building new structures to alleviate problems of high water tables, channel aggradation, and flooding. The USACE continues to develop projects in cooperation with the MRGCD, and since much of its work could have an effect on features of this water control and irrigation system which may eligible for inclusion in the National Register of Historic Places, the USACE contracted with Van Citters: Historic Preservation (VCHP) to undertake the following tasks:

1. Identify levees, acequias, drains, and other water control structures found along the middle Rio Grande valley within the Middle Rio Grande Conservancy District (MRGCD) and evaluate their significance;
2. Prepare a historic context in which to evaluate the significance of these structures; and
3. Assess the eligibility of these structures for inclusion in the National Register of Historic Places.

In its statement of work, the USACE defined the project area as the land on the river side of the MRGCD levees, the levees themselves, and the land between the landward side of the levees and the boundary to private property from both banks of the Rio Grande between the communities of Bernalillo and Belen. The USACE further directed VCHP to give special emphasis to the structures found between the North Diversion Channel and the South Diversion Channel in Albuquerque. By mutual agreement, this study focuses on the period between the initial construction of the MRGCD, beginning in 1930, and ends with the opening of Cochiti Dam in 1975. This end date was chosen because the closing of the dam, some 50 miles north of Albuquerque, was the last major flood control structure to be built on the Rio Grande and was designed to significantly diminish the threat of large-scale flooding in the middle valley. Its completion signaled a significant change in water control management strategies for the middle Rio Grande.

The types of irrigation and flood control structures found within the project area include levees, drains, canals, *acequias*, lateral ditches, feeder ditches, wasteways, siphons, flumes, headgates, and jetty jacks that were, for the most part, built to standardized specifications and which have been repaired, modified, and upgraded many times since their original installation in the 1930s. Understanding that very few of the existing structures are unmodified, the USACE and VCHP agreed that rather than identifying specific structures (unless they were original or unique in materials and design), VCHP would identify and describe the general types of MRGCD structures commonly found within the project area.

To properly evaluate the historic significance of MRGCD's engineering structures and features, VCHP developed a historic context for water control along the middle Rio Grande valley that includes a summary of pre-Columbian, Spanish, and Territorial water management strategies, followed by a more in-depth look at the creation of the MRGCD and the original design of the system. This section was prepared through an extensive literature search of primary documents and secondary sources from the following archives:

- The Center for Southwest Research, University of New Mexico,
- Zimmerman, Centennial, and Parish libraries, University of New Mexico,
- The Middle Rio Grande Conservancy District offices, Albuquerque,
- The Bureau of Reclamation, Albuquerque, and
- The Corps of Engineers, Albuquerque.

The following report includes:

(1) a summary of the Rio Grande's general characteristics and how they have played a significant role in the history of water control in the middle Rio Grande valley;
(2) a summary discussion of the types of flood control, irrigation, and drainage structures constructed in the valley prior to the establishment of the MRGCD;
(3) a more detailed account of the creation of the MRGCD, its irrigation and flood control structures, and how the USACE and the USBR provided assistance to the MRGCD following the Second World War, and the effects of urbanization on the original purpose of the district's Albuquerque Unit;
(4) a description of the types of engineering structures and features found in the MRGCD;
(5) an evaluation of the historic significance of the conservancy district and its engineering structures with recommendations of eligibility for the National Register of Historic Places; and
(6) management recommendations regarding the treatment of historic properties within the MRGCD system.

PREVIOUS STUDIES

This project has benefited from the research previously conducted in the Rio Grande valley on irrigation development and the history of the river and actions taken to manage its water flows. Arguably, the most comprehensive study of water resources in New Mexico is Ira Clark's *Water in New Mexico* (1987). Clark details the use of water in the state from pre-Columbian times to the late twentieth century, including the effects of international treaties and interstate agreements on state policies and the ever-increasing role of the federal government in managing the state's water resources.

In 1998, Dan Scurlock prepared a thorough study of the environmental history of the Rio Grande which offers a detailed look at systemic changes that have affected the river in historic times, particularly in the late nineteenth and first half of the twentieth centuries. His work provided an excellent overview of the Rio Grande's characteristics.

A report entitled, *The Development of Irrigation Systems in the Middle Rio Grande Conservancy District Central New Mexico: A Historical Overview* (1997), prepared by Neal W. Ackerly, David A. Phillips, Jr., and Kevin (Lex) Palmer for the Bureau of Reclamation, was an extremely valuable document for this study. The authors examined the MRGCD's role in the revitalization of the middle valley's agricultural economy by focusing on the contributions made by the USBR to the rehabilitation of the MRGCD's irrigation and drainage system. The present study dovetails very nicely with the research presented in the Ackerly report, and provides a more complete picture of post-World War II federal assistance provided to the conservancy district.

Frank Wozniak's *Irrigation in the Rio Grande Valley* (1998) is an updated version of his 1987 study for the USBR in which he presents an in-depth look at irrigation works from Spanish Colonial times through the 1960s. This study was an invaluable resource for understanding the types of irrigation practices utilized prior to the development of the MRGCD.

Other studies of particular interest to this project included Michael Welsh's history of the USACE published in 1987, especially the chapter on the middle Rio Grande valley. In 2002, Kathy Grassel completed a short study on jetty jack removal within the middle valley. Her work provided a good introduction into the history of these engineering structures and the issues concerning their removal and river restoration. Finally, this present study is a continuation of a history of the USACE's contributions to flood protection along the Rio Grande first set forth in a report prepared by K. Lynn Berry and Karen Lewis in 1997. Their historical documentation of engineering structures covered that portion of the river immediately north (Corrales) and south (from Belen to San Marcial) of our study area.

FIELDWORK

The fieldwork for this project was limited to spot checks of major MRGCD features, such as levees, canals, and drains to observe firsthand the design of this system, and examine the modifications made to these structures during the past 75 years.

II. THE MIDDLE RIO GRANDE AND A BRIEF HISTORY OF WATER CONTROL IN CENTRAL NEW MEXICO

THE RIVER

Formed some five million years ago, the Rio Grande is an ancient waterway that for centuries has provided a lifeline to people living along its banks (Figure 1). The river, most frequently called the "Rio del Norte" during the Spanish Colonial period, has historically been an unpredictable natural asset. While its yearly flooding cycles, generally one in the spring and one in the late summer, have provided the water that is so necessary

Figure 1. Aerial view of the Rio Grande winding through Albuquerque's South Valley, 1935. Tijeras Arroyo can be seen draining into the valley in the lower right corner. Source: MRGCD.

in this high desert region for the growing of crops and the rejuvenation of the riparian vegetation that grows along its banks, the vagaries of these floods and the river's unpredictable tendency to shift channels and change its course have resulted in the loss of life and property to those living adjacent to it. It has been this benefit, as well as this risk, that has caused communities and governments to invest time, money, and resources to controlling and managing this valuable asset in order to maximize its life-giving benefits while minimizing its destructive forces.

The headwaters of the river are found in the mountains of southern Colorado. From here, the waterway follows a southerly course through New Mexico to El Paso for almost 500 miles, until it bends gently to the southeast and makes its way to the Gulf of Mexico, some 1,885 miles from its starting point (Scurlock 1998, 184). Geographers and other researchers have divided the Rio Grande valley in New Mexico into three sections: the upper, middle, and lower valleys. This study is located within the middle Rio Grande valley, a section of the river located between the mouth of White Rock Canyon just above Cochiti Pueblo and the point where the Rio Salado joins the Rio Grande, just north of San Acacia – a total distance of approximately 160 miles. More specifically, the study area includes what is known as the Albuquerque Reach of the middle Rio Grande valley, namely, that stretch of the river between the communities of Alameda and Belen.

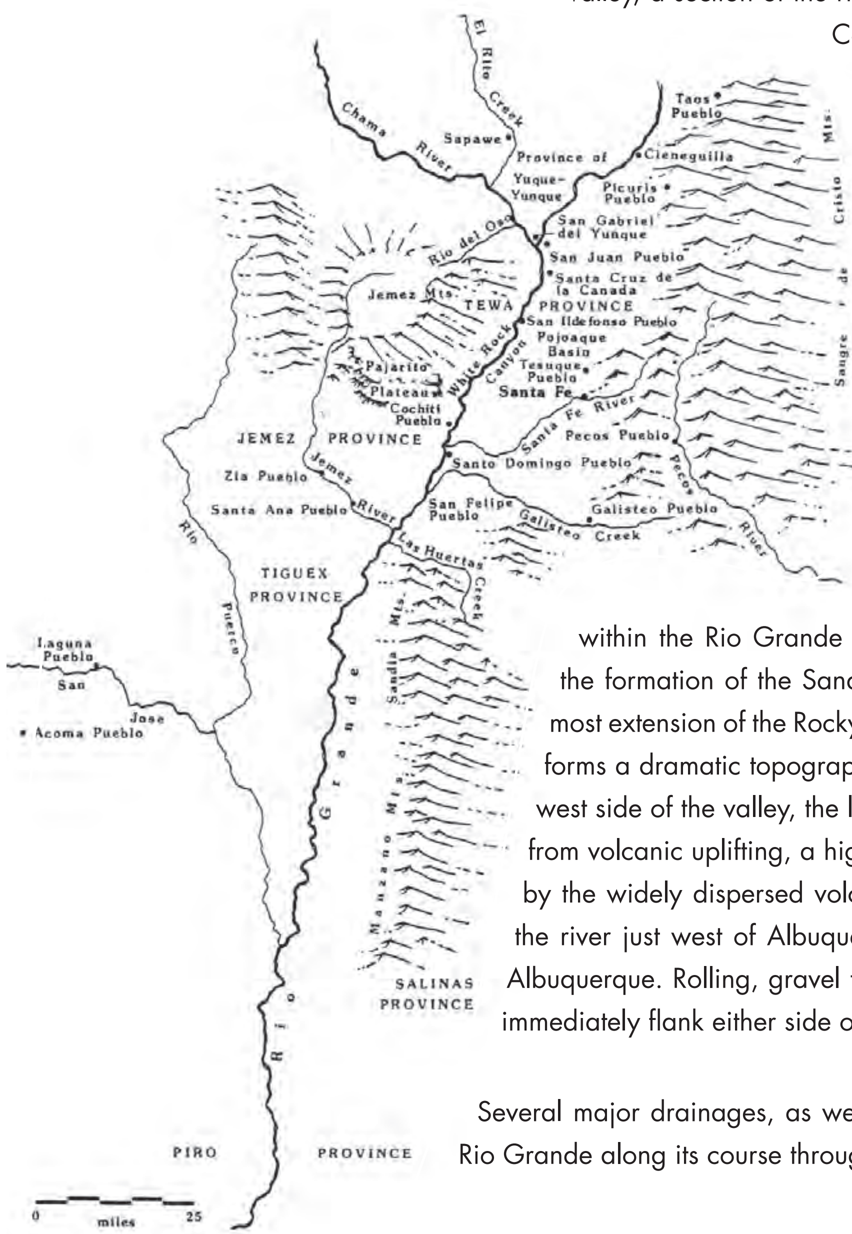


Figure 2. Rio Grande valley showing mountain ranges, major tributaries, and 17th century Spanish provinces. Source: Scurlock (1998, Figure 5).

The middle Rio Grande valley is situated within the Rio Grande rift, a geological feature that has resulted in the formation of the Sandia Mountains. The Sandias are the southern-most extension of the Rocky Mountains whose block-faulted western slope forms a dramatic topographic backdrop to the valley's east side. On the west side of the valley, the low-rising Jemez Mountains have been formed from volcanic uplifting, a highly geologically active zone also represented by the widely dispersed volcanic cinder cones found on the bluffs above the river just west of Albuquerque in an area referred to as the Llano de Albuquerque. Rolling, gravel terraces, remnants of ancient stream channels immediately flank either side of the river (Scurlock 1998, 181).

Several major drainages, as well as numerous smaller arroyos, feed into the Rio Grande along its course through the middle valley (Figure 2). To the north of

Albuquerque the major tributaries include the Santa Fe River, Las Huertas Creek, and the Jemez River, while the Rio Puerco and Rio Salado enter the river south of the city. This drainage area encompasses 24,760 square miles (Scurlock 1998, 181).

The inner valley, or floodplain, of this stretch of the Rio Grande varies from one-half mile to five miles wide (Bartolino and Cole 2002, 9). It is marked by variable flows corresponding with runoff from spring snow melts in the northern mountains, which can produce extensive flooding from April until June, and late summer thunderstorms occurring from July through September, which produce sudden, but short-lived flooding episodes. Scurlock (1988, 32) has documented eighty-two "moderate" to "major" floods (defined as river flows exceeding 10,000 cfs) between 1591 and 1942 including an 1828 flood that is estimated to have exceeded 100,000 cfs. According to the *Santa Fe New Mexican,* a spring flood in 1865 caused the evacuation of several small towns, including Sabinal, Padillas, Pajarito, and Atrisco (Carter 1953, 5, see also Yeo n.d., 13-14). The historian Marc Simmons (1982, 195) reports that the 1865 spring flood wiped out most of the wheat and corn fields in Bernalillo County, causing local residents to flee to the sand hills flanking the river and, later in the year, to request foodstuffs from the local Pueblos to make it through the winter. Records of river flooding became more reliable beginning in the 1850s, and between 1849 and 1942, Scurlock (1998, Table 17) notes that moderate or major flooding occurred every 1.9 years, including five years (1884, 1886, 1897, 1905, and 1911) in which there were two flood episodes each exceeding 10,000 cfs (Figure 3). This included floods in 1872 and 1884 that exceeded 100,000 cfs. The 1872 flood caused extensive damage, putting many communities between Alameda and Barelas under water, and left Albuquerque (present day Old Town) an island in the river (Yeo n.d., 16-17). Two years later, a flood estimated at 40,000 cfs caused Albuquerque residents to hastily build dikes to hold back the floodwaters (Carter 1953, 9). The river channel shifted again some 1.5 miles to the east.

Figure 3. Flooding in Albuquerque's North Valley, 1929; Barelas Bridge destroyed by Rio Grande flooding, 1912. Source: Biebel (1986, 62); Center for Southwest Research, Cobb Memorial Collection, University of New Mexico.

Perhaps the most devastating flood on the Rio Grande began on 21 May 1884 and lasted nine days (Nanninga 1982, 99; Scurlock 1998, Table 17, 38).[1] Although there were no gauging stations along the river, reliable estimates put the peak flow at 100,000 cfs. The flood damaged personal property, agricultural fields and *acequias* from Albuquerque to El Paso and took the lives of several residents of villages in its path. The severity of the flood obliterated all existing channels and created a new one. In 1904, two flood episodes were recorded in the study area. The second flood, estimated at 33,000 cfs, occurred in late September and resulted in the inundation of Corrales, Bernalillo, Barelas, and Atrisco (Yeo n.d., 33-34). The damage caused by these severe floods increased as the population along the river grew. The 1904 flood was described by *The Albuquerque Journal* on the morning of 1 October as follows:

> *The swollen Rio Grande has found its way around both ends of the Alameda Dike . . . Alameda, Los Corrales, and Barelas are as usual the heaviest sufferers. In Barelas yesterday the water stood 2 feet deep in many of the houses and people moved out all their belongings that could be taken at short notice. . . Looking down from the mesa, it looked as if the entire valley from foothill to foothill, was under water. Just west of the city the Rio Grande was fully four miles wide and yesterday the water found its way up to the grandstand in the fairgrounds . . .*[2]

A year later, these areas were hit again with one observer noting that Bernalillo looked like an "inland sea" (Yeo n.d., 38-39). In 1912, the bridge at Barelas was destroyed. A major flood in 1920 (estimated at 18,000 to 24,000 cfs) overflowed the river's banks at Los Griegos and Los Candelarias and caused considerable damage. Isleta Pueblo was also particularly hard hit, losing over 6,000 acres of agricultural land (ibid., 62-67).

Much of this late nineteenth and early twentieth century flooding was caused by land use practices that intensified the clearing of upland forests, increased livestock grazing, and utilized intensive agricultural practices all of which increased stream runoff and sedimentation. Although the flood benefits included the deposition of nutrient-rich sediments, adequate irrigation water, and flushed salts from the fields, as the population in the middle Rio Grande valley increased and villages, towns, and cities grew in land size, these floods became an increasing threat to life and property. In response to the damaging floods of the early twentieth century, the USACE and USBR constructed a series of dams upstream from the growing city of Albuquerque, including El Vado (1936), Jemez Canyon (1953), Abiquiu (1963), Galisteo (1970), and Cochiti (1975) (Scurlock 1998, 38; see also New Mexico State Engineer Office 1967, 137).

Another significant characteristic of the Rio Grande is its tendency to shift channels through the process of avulsion – the shifting of a river channel from a higher to lower elevation. Avulsion on the Rio Grande was exacerbated by the steady aggradation of the river prior to the construction of the aforementioned dams

[1] Robert Nanninga (1982) reports the year as 1874 rather than 1884, but based on Scurlock's data, this must be a typographical error since although there was a major flood in 1874 measuring 40,000 cfs, the great flood of 1884 was of such a magnitude as to receive the attention of numerous researchers and even the U.S. Court of Private Claims.

[2] The Territorial Fairgrounds in 1904 were located just to the west of present-day Central Avenue and Rio Grande Boulevard.

(Lagasse 1980, 8-9). Aggrading of the river bed is a natural tendency bolstered by the river's steep slope, especially in the reaches north of Albuquerque, and the heavy sediment load coming not only from the main stem of the Rio Grande, but its major tributaries as well.[3] Prior to the dams, the natural low sinuosity of the Rio Grande resulted in the formation of sediment bars, often with heavy vegetation, that caused channel reconfiguration. At the same time, the lack of rigid soil structure in the river bed made it prone to severe scouring, sometimes to a depth of ten to twenty feet. This scouring was not uniform throughout the width of the bed, however, in that the heaviest scouring would take place in the narrow section of the river and the resulting sediments would then be deposited in the wider sections naturally causing aggradation, bank erosion, and channel shifts.

A general westward shift of the Rio Grande occurred in the first half of the eighteenth century between San Felipe Pueblo and the colonial village of Belen, south of Albuquerque (Scurlock 1998, fig. 57). This channel shift destroyed homes and the church in the town of Bernalillo sometime before 1709. The river shifted from west to east again in 1763 when Spanish accounts stated that residents of "upper" Bernalillo had to move to the village of Algodones. The village of Alameda was also affected by this event. The original Spanish villa of Albuquerque was frequently left isolated amidst floodwaters as the Rio Grande regularly shifted channels to the east between present-day Fourth and Second streets (Scurlock 1998, 186).

The frequent flooding and shifts in the river channel, together with the increase in irrigation agriculture through time, resulted in the creation of thick stands of riparian woodlands, or *bosques*, as well as areas of low-lying marshes (*cienegas*), ponds (*charcos*), and swamps (*esteros*) (Scurlock 1998, 185). One particularly wet area, known as the *Esteros de Mejia*, was located just south of Albuquerque's New Town (present-day downtown) in the Barelas neighborhood (Simmons 1982, 40). Prior to deforestation for building materials and firewood by Hispanic and American settlers, the *bosque* along the Albuquerque Reach was extensive and lush. Thick stands of cottonwoods (*Populus deltoids*) and willow (*Salix* sp.), with an understory of salt grass (*Distichlis spicata*), populated the floodplain (Scurlock 1988; 1998, 201). A particularly dense stand located along the east side of the river between Alameda and Old Town Albuquerque was referred to as the *Bosque Grande de San Francisco Xavier* by early inhabitants of the villa (Adams and Chavez 1956, 145). In other areas, open, grassy lowlands (*vegas*) dominated the landscape. The Rio Grande's *bosques* were enhanced by the river's natural flood cycle, referred to in the biological community as the flood-pulse concept (Molles et al. 1998, 749). This cycle of a spring pulse that peaked in late May, sometimes lasting until late July, created braided river channels, marshes, and wet meadows, which maintained the diverse riverine ecosystem. The construction of dams, levees, and drains has subsequently altered this flood-pulse process and thus severely curtailed the rejuvenation of existing *bosques* and stunted the formation of new ones.

As one might expect, the deposition of sediments during annual floods was a boon to local farmers. Marc Simmons reports that one early New Mexican commented in 1773 that, "The water brings with it a thick mud which serves as manure for the land, leaving on top of the irrigated earth a glutinous scum resembling

[3] It is estimated that in the late 1970s, as much as three tons of sediment per year passed through the Otowi Bridge gauging station on the Rio Grande. Just downstream, an average of 1,800 acre-feet was deposited in the Cochiti Dam reservoir. The Jemez, Galisteo, and Cochiti dams thus controlled 80% of sediment inflow into the Rio Grande above Albuquerque (Lagasse 1980, 12-13).

lard" (1982, 96). However, by the late nineteenth century sedimentation was becoming a serious problem in the middle Rio Grande valley. Overgrazing, heavy logging activity and more intensive agricultural practices in southern Colorado and northern New Mexico dramatically increased the river's sediment load resulting in the Rio Grande becoming an aggrading riverbed (Wozniak 1998). Until checked by the construction of upstream dams, it was estimated that the river carried 75 billion pounds of sediments annually downstream (Simmons 1991, 69, 77). In the 1870s, the river had begun to noticeably slow down and spread out across its floodplain. Travelers report that at the Barelas crossing and at Isleta Pueblo the Rio Grande was 200 to 300 yards wide and three to four feet deep (Beadle 1973, 491; Cozzens 1988, 274-75). By 1879, the river between Albuquerque and El Paso ceased to run altogether for much of the year (Scurlock 1998, 188). Sediments in the river started to pile up and form islands, two of which were observed just opposite of Sandia Pueblo supporting a stand of cottonwoods and estimated to be 700 acres in size (Poore 1894, 111).

The Rio Grande offered a different "look" depending on the time of year and whether there had been heavy snows the previous winter. In the mid-1800s, Josiah Gregg described the river as follows:

> *The Rio del Norte . . . decreases in volume of the water as it descends. In fact, above the region of tide-water, it is almost everywhere fordable during most of the year, being seldom over knee-deep, except at the time of freshets. Its banks are generally very low, often less than ten feet above low-water mark; and yet, owing to the disproportionate width of the channel (which is generally three or four hundred yards), it is not subject to inundations. Its only important rises are those of the annual freshets, occasioned by the melting of the snow in the mountains.* (Quoted in Scurlock 1998, 187)

Another traveler, F. A. Wislizenus, described a mid-summer's flow in 1846 as "about 100 yards wide, and as usual, sandy, shallow, everywhere fordable and nowhere navigable, not even for canoes" (Wislizenus 1969, 34-35). In 1846, after the late summer rains, the Rio Grande at the Barelas crossing was observed to be "probably three hundred yards wide, the stream rapid, its depth four feet" (McNitt 1964, 153) (Figure 4). Other travelers to the Barelas found similar fall conditions (see Scurlock 1998, 187-88).

Figure 4. Old Town Bridge across the Rio Grande in Albuquerque, circa 1880s. Source: Center for Southwest Research, Cobb Memorial Collection, University of New Mexico.

The Rio Grande has been an invaluable resource to people living along its banks for hundreds of years; however, at the same time it has been an unpredictable force of nature that has wreaked havoc and destruction along its meandering path. The users of this all-important waterway have, over the years, tried to manipulate its flow and harness its life-giving force through a variety of means from the simplistic to the technologically complex. A brief history of water control along the river offers a better understanding of twentieth century methods of river management policy and techniques.

A HISTORICAL SUMMARY OF WATER CONTROL ON THE MIDDLE RIO GRANDE

The Rio Grande was an obvious, yet unreliable, natural resource easily accessible to the valley's earliest inhabitants. In an attempt to maximize the benefits of this invaluable resource, a variety of water control techniques was used by the pre-Columbian inhabitants of the Rio Grande valley. There is ample archaeological evidence for floodwater farming (known as *akchin*) techniques such as check dams, terraces, and small, temporary channels or ditches to direct runoff (Anschuetz 1984, Chapman and Biella 1977-79; Earls 1985; Marshall 1979). In addition the Pueblo farmers used a number of moisture conservation practices to retain soil moisture in the semi-arid climate. These practices included contour terraces, grid gardens, and gravel mulch.

A question continually asked by environmental historians and anthropologists has been: Is there evidence for more complex irrigation systems being used by the Pueblos along the Rio Grande prior to arrival of the Spanish in the sixteenth century? Certainly the technology for irrigation agriculture existed in the American Southwest as evidenced by the many miles of canals built by people of the Hohokam culture in the Gila and Salt river valleys of central Arizona as early as two thousand years ago (Haury 1967; Mabry et al. 1997; Masse 1981; Waters and Ravesloot 2001). But for many years it was thought that such canal irrigation systems were confined to waterways in the lower elevations of the American Southwest and northwest Mexico. More recently, there is evidence for small-scale canal irrigation prior to the Spanish Entrada on the Colorado Plateau in northern New Mexico (Anschuetz 1995; Grieser and Moore 1995; Moore 1995), and more recently at Zuni Pueblo (Damp, et al. 2002). However, these irrigation systems have not been found along the Rio Grande, but rather to serve fields adjacent to small permanent streams.

This is not to say that pre-Columbian farmers did not use the Rio Grande to water their crops. Historian Frank Wozniak (1998, 11-12) has argued that Pueblo farmers practiced various types of floodwater farming on sand bars and in the sandy soils of the floodplain.[4] The nature of the Rio Grande itself was probably the reason that more complex systems were not developed along the main channel of the river. Following the ideas first put forth by Southwestern archaeologist Linda Cordell (1984, 203), Wozniak (1998, 9) postulates that the river's frequent, and often heavy, flooding cycles posed a risk to the crops planted in the floodplain and that salinization of the soils would have resulted in a significant loss of acreage over time (see also, Hill 1998, 279). In addition, the dense vegetation found along the river banks would have reduced the amount of

[4] Wozniak (1988, 9) does concede that the Piro Pueblos, living along the river near present-day Socorro, developed "subirrigation" (i.e., the use of brush dams, gates, drains, and temporary ditches) into what was essentially a floodwater system.

arable land, while the river's propensity for standing, stagnant water would have caused insects and diseases to affect the crops.

Spanish records from the early expeditions into New Spain's northern frontier do little to clarify the irrigation question. Although chroniclers of the Coronado Expedition in 1540 noted the abundance of crops grown by Pueblo farmers, they do not comment on the whether or not irrigation agriculture was practiced. Some forty years later, however, the Rodriquez-Chamuscado Expedition apparently came upon an irrigation system at the confluence of Las Huertas Creek and the Rio Grande. The following year, 1582, the Espejo Expedition also found irrigated fields maintained by the Piro Pueblos in the Rio Arriba and to the west at the Pueblo of Zuni. In 1590, the Sosa Expedition spent two years traveling up the Rio Grande visiting the Keres and Tewa pueblos. Upon reaching the Pojoaque basin, north of Santa Fe, it reported irrigation canals coming off the Rio Grande's main tributaries (Wozniak 1998, 10-12).

Once again, as with the archaeological evidence, these expedition reports suggest irrigation techniques being used in smaller streams and side canyons rather than the Rio Grande itself. The Rio Grande was undoubtedly used by indigenous agriculturalists; however, as pointed out by Ira Clark (1987, 7)," conditions dictated method," and the difficulty of controlling the unpredictable waters of the Rio Grande meant that farmers had to use shallow, temporary ditches together with rudimentary mud and brush dams to divert water to their fields in the floodplain, while more permanent ditches and laterals could be built along the smaller, more predictable side streams and creeks without as much risk to the structures.

Following the Spanish colonization of New Mexico, the settlers created ditch irrigation systems not unlike those found in their homeland on the Iberian peninsula.[5] Pueblo communities borrowed directly from this system of dams, gates, and ditches (*acequias*); however they also continued to utilize multiple strategies for food procurement. For example, farmers from Cochiti Pueblo continued to use floodwaters to irrigate their crops into the 1880s, as well as dry farming techniques in the Jemez Mountains (Lange 1959, 78-79). In times of environmental stress, the Pueblos also stored surplus foodstuffs, collected wild plants, and traded with other communities.

When conditions were favorable, however, the Pueblos did rely on irrigation agriculture, in part because the crops introduced by the Spanish, such as wheat, barley, oats, and orchard fruit, became increasingly popular, and required the use of irrigation in the high desert climate (Scurlock 1998, 94). Although more labor intensive than floodwater farming, irrigation agriculture was less risky and produced consistently higher crop yields. Land under cultivation was estimated to be somewhere between 15,000 to 25,000 acres by the sixteenth century. This amount steadily increased until the 1880s when environmental conditions took a downturn – a condition that lasted until the Middle Rio Grande Conservancy District (MRGCD) instituted improvements in the late 1930s. Bolstered by the creation of the U.S. Indian Irrigation Service in 1905, and later the MRGCD, the total amount of irrigated Pueblo land in the middle Rio Grande valley ranged from 1,100 to almost 31,000 acres by 1945(Surlock 1998, Table 25).

[5] Irrigation agriculture had been practiced in Spain since Roman times; however, the Moors, during their conquest of the region between the 8th and 15th centuries, brought with them many of the structures used today to bring water to arid farm lands.

On 11 August 1598, the Spanish colonial leader, Juan de Oñate, directed Pueblo Indian laborers to construct an irrigation ditch for the newly founded villa de San Francisco (later renamed San Gabriel de Yunque) located across the river from the village of *Ohkay Owingeh* (San Juan Pueblo). This action initiated a change in land usage in New Mexico, and marked the beginning of intensive irrigation agriculture along the upper and middle Rio Grande valleys. Spanish colonial Indian policy in the early seventeenth century called for the Pueblos to provide European foodstuffs as tribute to the colonists under the *encomienda* and *repartimento* system (Weber 1992, 125-26). This system of tribute and public work was supported by a policy of *reducciones* whereby Pueblos were relocated and consolidated in order to facilitate Spanish religious, political, economic, and military control (Wozniak 1998, 17). The agricultural demands made by the colonial government resulted in a dramatic increase in the amount of irrigable land put into production and concomitantly increased the stress on the Pueblo labor force and agricultural surplus. This increase in tension between the two competing cultures in New Mexico, which was exacerbated by a period of drought, famine, and disease in the late seventeenth century, culminated in the Pueblo Revolt of 1680 that drove the Spanish colonists out of region.

After numerous unsuccessful attempts at reconquest, the Spanish were finally able to regain political control of the upper and middle Rio Grande valleys under the leadership of Diego de Vargas in 1692. Learning from the mistakes made in the pre-revolt era, the Spanish colonial government began to institute a new strategy for the colonization of New Mexico. Key to this new strategy was the institution of a new land grant policy where instead of giving large tracts to a few landowners, the alcalde mayors created self-sufficient farming and herding communities designed to work within a symbiotic land use relationship with the Pueblos (Wozniak 1998, 20-21).

The distinguishing feature of these new land grants was the long-lot. This parcel of land accommodated the formulation of community land grants while at the same time adapting to local environmental conditions. The system offered maximum access to the water resources so essential to agricultural success. It was also easily partitioned so that land owners' heirs would be able to continue to farm the area. The width of the lots, that is, how much was stream frontage was specified in *varas* (usually measuring 100 to 150), was dependent upon the total number of settlers on the grant and the amount of arable land available. As a result of this land use system, colonial settlements were strung out along the water courses, and grouped together only for defensive purposes during times of raiding by non-Pueblo tribes. In the Rio Arriba, the settlements were more tightly clustered than in the Rio Abajo because the water courses were smaller and located in narrower valleys. As the Rio Grande flowed south of its confluence with the Jemez River, the floodplain broadened out and offered more available agricultural land. Here, the settlements became more spread out despite the constant threat posed by raiding tribes. Thus, by the mid-eighteenth century, there were numerous small villages situated between Bernalillo (founded between 1700 and 1704) and Belen (1740), including Alburquerque (original spelling, 1706), Alameda (1710), Pajarito (1746), and Los Padillas (1750) (Wozniak 1998, 25-26).

Each land grant community had its own *acequia* system, which was regulated by government ordinances that followed recognized Spanish traditions for irrigation protocol. The systems themselves were relatively simple with regard to engineering and materials (Simmons 1972, 143). They worked using gravity flow

Figure 5. Acequia *system, circa 1890s. Source: Center for Southwest Research, Cobb Memorial Collection, University of New Mexico.*

and incorporated easily obtained materials, such as logs, brush, and stone, to construct the head works (Figure 5). These often proved to be very temporary structures especially when confronted by the force of Rio Grande floods. Such flooding, if not too severe, served a beneficial purpose as well by depositing a layer of nutrient rich silt over the fields (Carlson 1990, 23). Since these were community systems, each settlement had its own *acequia* association to oversee the operation and maintenance of the ditch network, and to serve as a local representative for arbitrating disputes.

While historical descriptions of colonial irrigation systems in New Mexico are not plentiful, Wozniak (1998, 57-61) has offered a synopsis of accounts relating to land grants found between Corrales and Belen (Figure 6). A visit by Fray Dominguez to the villa de Alburquerque and neighboring Pajarito in 1776 revealed a series of wide and deep *acequias* bringing water from the Rio Grande (or Rio del Norte as he called the river). He also noted similar conditions in Belen. Six years later, Fray

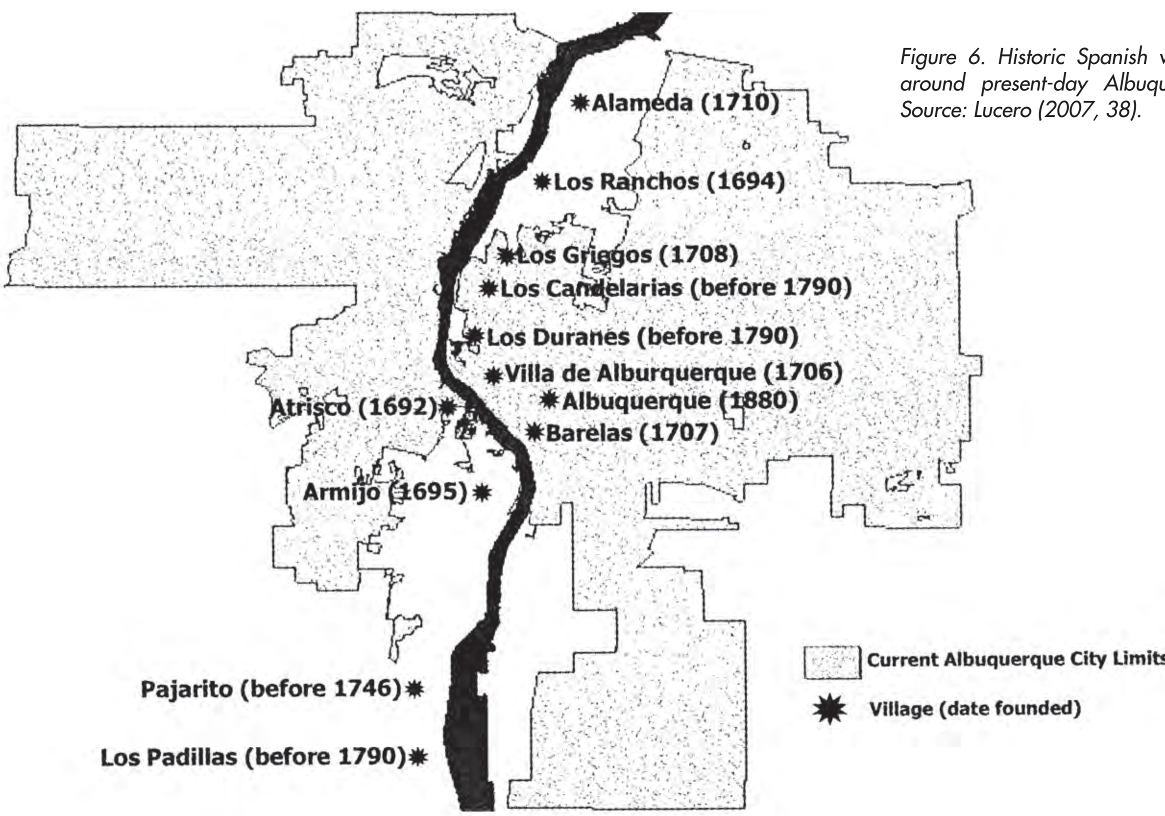


Figure 6. Historic Spanish villages around present-day Albuquerque. Source: Lucero (2007, 38).

Morfi noted that farm lands extended a league and a half up the river from the villa, and they were irrigated by *acequias* coming off the river. Spanish accounts also discuss the problems of sandy soils that hampered crop yields in Lower Corrales and Atrisco, while Upper Corrales and Bernalillo had somehow coped with this problem. All four communities used irrigation water from the Rio Grande. The number of ditches constructed in the middle Rio Grande valley steadily increased from 1600 to the late 1880s (Sorenson and Linford 1967, 154-56). It is estimated that by the early seventeenth century there were twenty-two *acequia* systems that watered 25,555 acres of valley land. By the beginning of the eighteenth century, this number had increased dramatically to sixty-one ditch systems irrigating more than 73,000 acres. Although the number of ditches and amount of acreage continued to rise slowly over the next 150 years, environmental problems, such as rising water tables, soil salinization and water logging, together with water hoarding by upstream users, began to plague the systems so that by the early 1900s there was a precipitous drop in irrigated acreage (from 124,800 in 1880 to only 45,220 in 1910).

The political regime governing New Mexico changed from Spain to the newly formed Republic of Mexico in 1821; however, there was little change in the everyday lives of those people living in the northern frontier. Subsistence-based irrigation agriculture was still the norm; however, changes in land use were on the horizon as the American government set its sights on acquiring the American Southwest and the natural resources it contained.

As General Stephen Watts Kearny and his Army of the West marched into New Mexico and took control of the territory in August of 1846, they observed an agrarian society based on an a*cequia* system that had been in place for nearly 200 years. Josiah Gregg, traveling through the territory in the 1830s (1954, 107-08), described the fertile bottomlands, which he contrasted with the semi-arid, non-irrigated uplands. He noted that the extensive a*cequia* system functioned quite well despite its primitive technology – wing diversion dams made of stone – and the use of crude plows and hoes by Hispanic and Pueblo farmers. The territory's settlements were strung out along the perennial waterways using *acequia madres* (main ditches) to divert water into the community ditches and laterals to water the fields planted primarily of corn and wheat. The irrigation systems relied on communal maintenance that was organized into ditch associations and headed by a *mayordomo* to keep the ditches running (see Crawford 1988). The importance of the a*cequia* system to the economic stability of the new American territory was clearly recognized by Kearny in the drafting of the "Organic Law of the Territory" (often referred to as the Kearny Code), which codified Spanish and Mexican laws into the United States law codes. Particular attention was given to the traditional irrigation system in New Mexico, and the long-standing regulations guiding the operation of these systems were incorporated into the American legal system (Wozniak 1998, 63).

From the late 1840s until the late 1880s there was very little change in the irrigation system as described by Gregg. Technological changes were minimal; however, the total number of *acequias* increased as the territory's population expanded, especially along the middle Rio Grande valley. The valley's irrigation agriculture was still dominated by Hispano and Pueblo farmers during this period as Anglo-Americans were generally unfamiliar with this type of farming practice and concentrated more on expanding the territory's livestock industry, harvesting the region's timber resources, and extracting its mineral wealth (Scurlock 1998, 276).

There were, however, early community-based attempts to control flooding particularly north of Albuquerque in the vicinity of Alameda. Following the devastating flood of 1874, residents of Albuquerque and Bernalillo County formed the River Commission (Clark 1987, 31). This commission had the power to levy small assessments on property within five miles of the Rio Grande in order to build earthen dikes above Alameda. Made of *terrones* (sod bricks), these dikes could not withstand the yearly flooding episodes and were eventually wiped out by the flood of 1884. Undeterred, between 1884 and 1891 the River Commission constructed additional levees, installed rip-rap along the river's banks, dug drainage ditches, reinforced bridges, and repaired the Alameda dike (which was again breached by the 1904 flood) (Sargeant and Davis 1986, 104; Simmons 1982, 301-02). Despite these efforts, flooding would be a significant problem facing the residents of the middle Rio Grande valley for many years to come.

While subsistence-based farming continued to dominate the valley, the arrival of the transcontinental railroad into the middle Rio Grande valley in 1881 generated interest in commercial rather than subsistence agriculture; but this was limited to acreage around the railroad towns such as Albuquerque, Belen, and Socorro (Wozniak 1998, 63) (Figure 7). In 1886, the territorial legislature passed a bill that encouraged the formation of private irrigation companies that hoped to buy up the land grants and develop modern irrigation projects. As one might expect, the traditional Hispanic land grant heirs resisted this movement and the big irrigation companies looked to the eastern plains around the Pecos River valley and to the south in Doña Ana County to set up operations (ibid., 76).

Figure 7. Territorial Fair exhibit by Old Town farmer Herman Blueher, circa 1890s. Poster in upper right hand corner reads: "New Mexico by Irrigation can easily support a million people." Source: Center for Southwest Research, Cobb Memorial Collection, University of New Mexico.

More critical to the survival of irrigation agriculture in the middle valley was the growing demand for water all along the Rio Grande. Water use was particularly increasing in the San Luis valley, just north of the New Mexico – Colorado border, which had a serious impact on downstream users. The increase in irrigation acreage was accompanied by new users who constructed poorly planned a*cequia* systems that wasted water. In addition, much of the spring runoff was lost to flooding due to the lack of water storage facilities along the river (Wozniak 1998, 74).

In addition to flooding, other environmental factors began to compound the problems facing the farmers of the area. In the late 1800s, the Rio Grande began to aggrade its stream channel so that the river bed actually rose above the adjacent valley lands. This resulted in a rising water table and the water logging of fields due to poor drainage (Wozniak 1998, 74). The buildup of silt in the river and frequent flooding were exacerbated by other factors such as deforestation in the mountains and overgrazing of valley slopes, causing erosion, silt build-up, and more severe seasonal flooding (Scurlock 1998, 280). Ironically, the heavy upstream water usage coincided with a period of drought in the 1890s that often left the Rio Grande dry for as long as four months at a time in the middle and lower valleys. This caused an international political controversy between the United States and Mexico in the late nineteenth century over a lack of water reaching the southern part of the river, which temporarily suspended large-scale irrigation development in New Mexico.[6] It also stimulated interest in a general arid lands water management policy for the American West that culminated in the passage of the Reclamation Act in 1906 (Wozniak 1998, 79). That, in turn, resulted in the building of the first of several large water storage facilities on the Rio Grande – the Elephant Butte Dam in 1916.

At the time of statehood, the problem of drainage in the middle valley was coming to a head. Waterlogged soils accounted for as much as 50,000 acres out of the possible 180,000 acres of arable land, and new housing and businesses in the growing city of Albuquerque were calling for <u>dry</u> land along the floodplain (Ritter 2000, 31; Wozniak 1998, 104). To address this issue, the newly created state legislature drew up drainage districts in 1912 that had taxing authority and the power of eminent domain for land improvements (Clark 1987, 186-87; Ritter 2000, 32). Unfortunately, these districts quickly ran into financial difficulties since the mostly Hispanic farmers who would be taxed had very little extra income to pay such taxes (see Ritter 2000). Thus, by 1918, there was increasing controversy over who would fund the improvements necessary for flood control and drainage along the middle Rio Grande and, in turn, who would manage the new facilities (Clark 1987, 188).

As New Mexico moved through the early twentieth century, there was a dramatic change in the traditional agricultural economy of the soon-to-be state. The ancestors of the early Hispano settlers still clung to their *acequias* and traditional lifeways; however, much of the original land grant acreage had been lost – through both legal and illegal means. The creation of the national forest system in 1905 also took away land that was traditionally utilized to complement the farming base. Increasing demand on land and the attraction of wage labor was beginning to break up the traditional farming village and promoted a more urbanized lifestyle.

[6] The political situation was eventually settled with the signing of a treaty between the United States and Mexico on 3 February 1944 recognizing Mexico's claim to 1.5 million acre-feet of water from the Rio Grande.

Finally, the once-fertile bottomlands of the Rio Grande were now water-saturated and provided a much diminished crop yield. It soon became clear to local political leaders that a comprehensive, systematized water control and management policy would have to be instituted to restore the Rio Grande agricultural community.

III. THE MIDDLE RIO GRANDE CONSERVANCY DISTRICT

ESTABLISHMENT OF THE DISTRICT

A 1912 soil survey of agricultural lands in the middle Rio Grande valley noted that the average water table was only twenty-three inches below the surface. By the early 1920s, this had not only limited the amount of arable land available to farmers, but had resulted in a high soil alkalinity and, together with the still ever-present seasonal flooding and stream bed aggradation, had contributed to the creation of marshes and stagnant ponds. In the words of historian Ira Clark, addressing the issues of "drainage and flood control were imperative if the Middle Rio Grande Valley were to be saved" (Clark 1987, 205).

Initial efforts by the newly created state legislature focused on forming irrigation districts to solve the problem. However, this plan ran into numerous political stumbling blocks including intra-state rivalries between potential districts and agencies, the issue of Pueblo Indian ditch rights, and the competing uses between urban versus rural interests of such a district. In 1918, the Albuquerque Chamber of Commerce held a meeting of interested businessmen and civic leaders to discuss the role of reclamation in helping the city prosper. Although it would seem that the valley's farmers would most directly benefit from such discussions, the push for a conservancy district did not come from farmers. Robert Dietz was the only chamber member who listed his occupation as a "farmer," but apparently his interest in the fledgling MRGCD did not fit with the interests of the mostly Hispanic farmers in the area, and his attempts to organize their support for the district was unsuccessful (Ritter 2000, 54). The civic leaders created the Middle Rio Grande Reclamation Association and tried unsuccessfully to secure federal and state aid for reclamation and flood control projects. However, as pointed out by Barbara Ritter, rather than promoting agricultural issues, the real objective of the organization seemed to be to advance urban development (ibid., 57). Civic boosters supported these initiatives, and an *Albuquerque Journal* editorial argued that reclamation would bring increases in population which would in turn guarantee economic prosperity for the region (*Albuquerque Journal,* 4 June 1922).

In 1921, the Rio Grande Valley Survey Commission was formed to work cooperatively with the United States Reclamation Service (renamed the Bureau of Reclamation in 1923) to study the problems of water control and irrigation management along the Rio Grande and develop a comprehensive plan to mitigate the problems caused by flooding and poor drainage, and examine the need for diversion dams, canals, and water storage facilities along the river (Clark 1987, 205-6). The outgrowth of this plan was the New Mexico Conservancy Act, passed by the state legislature in 1923. The act was modeled after similar legislation in Ohio and Colorado, and was based in the state's authority to preserve and protect the public health, safety, and welfare of its citizens. The act provided for the creation of conservancy districts, which would be political subdivisions of the state with all the powers accorded to public or municipal corporations, including the ability to levy taxes and use the power of eminent domain. A conservancy district would be directed by a three-member board of commissioners overseen by judges. The board had the discretionary power to carry out the district's objectives including taking all necessary steps to prevent flooding, regulate stream flow, reclaim land, develop irrigation works, generate electrical power, reclaim and develop water sources, and construct levees, dams, and drains (Clark 1987, 206-07).

Proponents of this legislation in the middle Rio Grande valley wasted little time in creating the Middle Rio Grande Conservancy District (Biebel 1986, 16; Clark 1987, 209). Approved by the state legislature on 26 August 1925, the boundaries of the district reached from the mouth of White Rock Canyon on the north, to just above the town of San Marcial in the south (Figure 8). This encompassed parts of four counties and six pueblos for a total of 277,760 acres. The district was then divided into four irrigation divisions – Cochiti, Albuquerque, Belen, and Socorro – each of which were divided into smaller units (e.g., the Corrales Unit).

The district named John L. Burkholder as its chief engineer, who immediately began to outline the new agency's goals and objectives (Clark 1987, 209; Wozniak 1998, 104). The official plan (Burkholder 1928) was approved on 15 August 1928 and specified the need for:

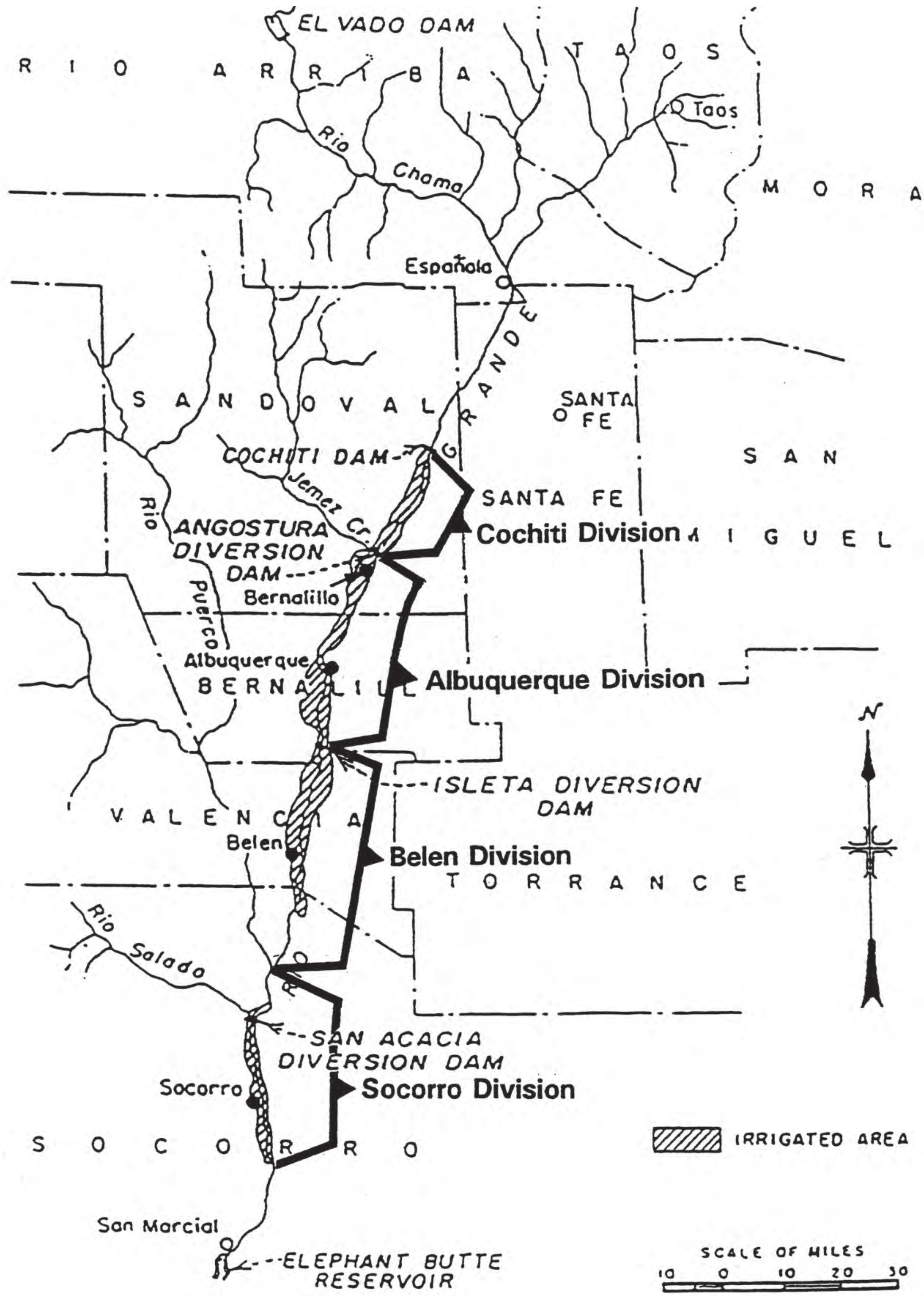
- Construction of the El Vado dam on the Chama River for water storage;
- A system of levees and jetties within the district boundaries for flood protection;
- A drainage system to lower the water table by four to six feet; and
- An irrigation system, consisting of four diversion dams and seven main canals, to provide water for 128,787 acres of land.

The estimated cost of the project was $10.3 million (Burkholder 1928, 17). As noted by R. G. Hosea, a conservancy district design engineer, "the Conservancy District is then an organization for the purpose of official preservation or protection of property" (*New Mexico State Tribune* 11/30/29). He observed that unlike other federal reclamation projects that created new irrigation systems on uninhabited lands in the West, the MRGCD also reclaimed existing agricultural lands.

The formation of the MRGCD created a great deal of excitement in the city. The *State Tribune* ran a special Conservancy Section on 30 November 1929 promoting the district (Figure 9). Prominent citizens, such as Senator Sam G. Bratton, predicted "prosperity, protection and happiness" for the valley. Governor R. C. Dillon asserted that the project must be completed as quickly as possible if Albuquerque intended to be a major commercial center. He further argued that the $10 million needed to complete the project would increase property values in the valley five to ten fold. Other prominent citizens repeated the danger of flooding and loss of farmland and, following the theme of growth and prosperity, noted that such events would threaten Albuquerque's progress. City commissioner Clyde Tingley stated that conservancy meant prosperity not only for Albuquerque but also for the whole of the middle Rio Grande valley.

The next challenge for the MRGCD was to find funding for the district's proposed projects. The Rio Grande Survey Commission requested federal monies from the Reclamation Service in order to fund the project but

Figure 8. Divisions of the MRGCD. Source: Ackerly et al. (1997, Figure 1).




CONSERVANCY SECTION

New Mexico State Tribune

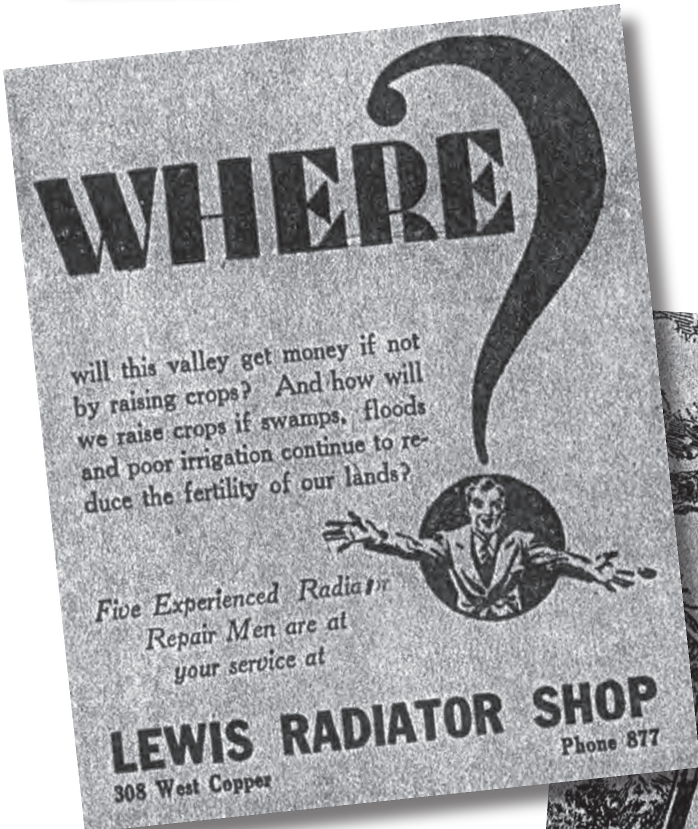
CONSERVANCY SECTION

SECOND SECTION

ALBUQUERQUE, NEW MEXICO

IN THE HEART OF THE HEALTH COUNTRY

CONSERVANCY SEEN AS VALLEY'S GREATEST NEED



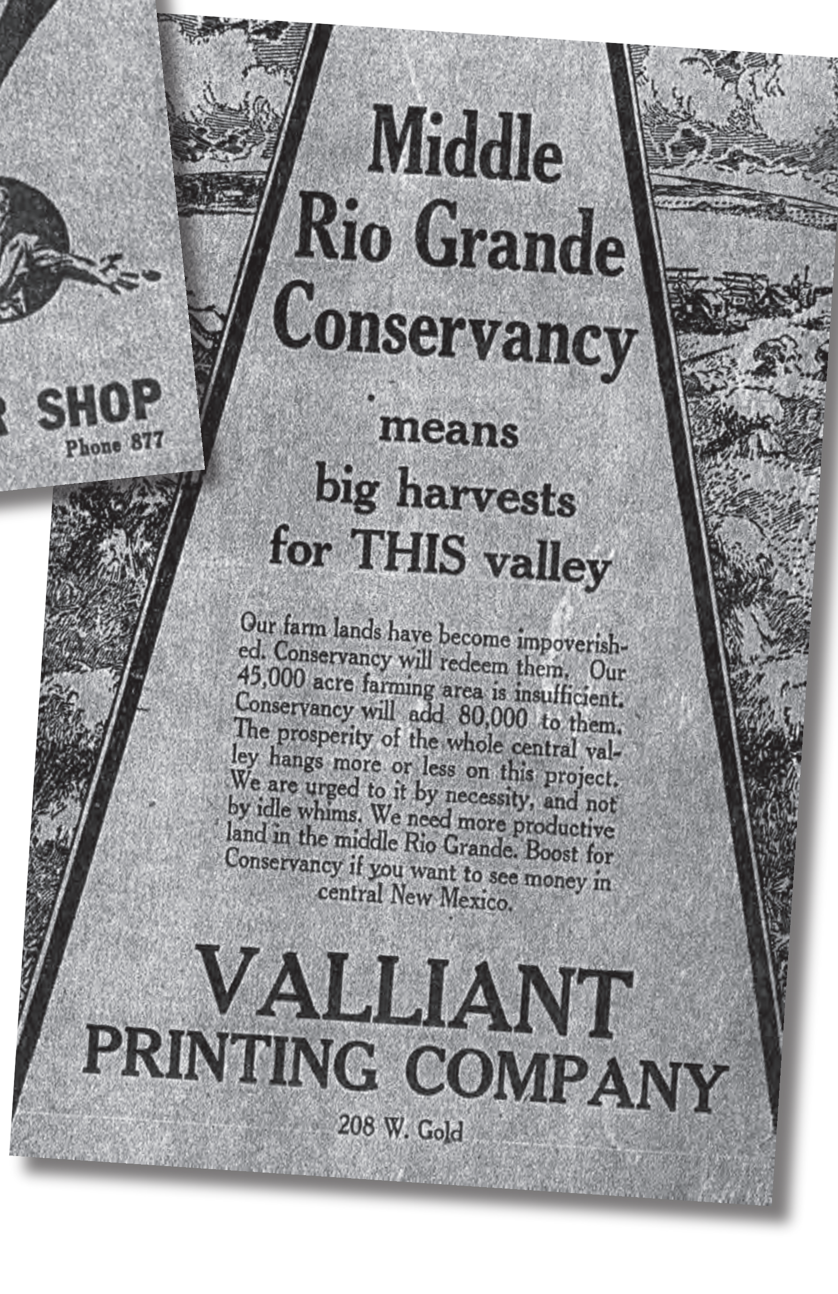


Figure 9. Headline and advertisements promoting the MRGCD. Source: New Mexico State Tribune, 11/30/29.

the funds were denied because New Mexico already had two ongoing reclamation projects. Federal law set quotas on a pro rata share for each state and New Mexico's programs had exceeded available funds (Ritter 2000, 37). Congress agreed to allow the Secretary of the Interior to fund the cost of the work on the affected Indian Pueblos and appropriated $50,000 to cover the Pueblos' preliminary share (Wozniak 1998, 108). Congress then passed a bill to establish an agreement between the MRGCD and the Secretary of the Interior that authorized the Federal Government to pay up to $1,593,311 for work on Pueblo lands, as long as the cost did not exceed $67.50 per reclaimed acre (Clark 1987, 210).

In 1929 the Middle Rio Grande Conservancy District issued bonds in order to finance the planned construction. Unfortunately, the effects of the Depression soon set in and the MRGCD was not able to sell all of their bonds, even offering a five and one-half percent interest rate (Clark 1987, 249). By 1932, however, with only thirty percent of the project completed, the MRGCD ran out of funds (Ritter 2000, 121). In reaction to the worsening financial crises through the country, Congress passed the Emergency Relief and Construction Act in the summer of 1932 that authorized creation of the Reconstruction Finance Corporation (RFC), which could make loans to commercial institutions or government agencies. The RFC bought the unsold MRGCD's bonds at ninety percent of par value to enable the MRGCD to continue with the project (Biebel 1986, 23; Ritter 2000, 121). Other federal agencies also made monies available; the Public Works Administration (PWA) aided the work of the MRGCD by providing funds for the construction of the El Vado Dam. The dam, one of the most important components of the conservancy district, cost $1,725,000 and took almost two years to complete. As originally designed, the gravel-filled El Vado Dam was 175 feet high and 1,300 feet long at its crown. It had a water storage capacity of 198,000 acre-feet and was designed for flood and sediment control.

By 1936, with the RFC funds being rapidly used up, most of the major tasks had been completed including construction of the El Vado Dam, four new diversion structures, the Corrales siphon, canal heads at Atrisco and San Juan, 180 miles of main canals, 294 miles of new laterals and 214 miles of rehabilitated laterals, 342 miles of drainage canals, and 200 miles of riverside levees with jetties (Clark 1987, 212). Despite these accomplishments, money was still needed to finish the planned facilities. From 1936 to 1939 the Works Projects Administration (WPA) gave the conservancy $400,000 to fund ten projects to build additional canals,

RIO GRANDE COMPACT

A significant political development, and one that would play a major role in the later expansion of the MRGCD, occurred in 1938 when New Mexico, Texas, and Colorado signed the Rio Grande Compact (New Mexico Office of the State Engineer 2007). This document set forth the provisions of appropriating the waters of the Rio Grande above Fort Quitman, Texas among the three states. It was to be administered by the Rio Grande Commission composed of representatives of the three states and overseen by the Federal Government. The genesis of the compact was the Texas claim that Colorado and New Mexico were using a disproportionate percentage of water, which left the river dry by the time it reached El Paso. The compact established water delivery obligations and depletion entitlements for the two upriver states, while recognizing that a credit and debit system for the resource was necessary due to the variable nature of yearly flows. The agreement set up gauging stations through which the water flow was measured in order to ensure compliance with the document. Congress approved the compact in 1939. The impact of this compact has had far-reaching effects on later MRGCD project including the construction of flood control structures.

Pueblo Lands

An important political element in developing the MRGCD was the incorporation of six Indian pueblos – Cochiti, Santo Domingo, San Felipe, Santa Ana, Sandia and Isleta – situated along the river into the district (Sando 1992, 123; Scurlock 1998, 347). This was accomplished through negotiations with the Secretary of the Interior who agreed to pay the Pueblos' share of the total project cost in hopes that they would reorganize their small, agricultural plots into larger, revenue-producing farms. The deal received presidential approval on 13 March 1928. In return, the MRGCD agreed to "provide conservation, irrigation, drainage, and flood control" for the Pueblos (Bayer et al. 1994, 240).

laterals, ditches, and other structures within the Albuquerque District. In 1939 and 1941, WPA grants totaling $2.12 million were awarded to the district for flood control improvements throughout the entire district (Biebel 1986, 61, 84-85).

CONSTRUCTION OF THE MRGCD PLAN

The MRGCD water control and management system was in full operation by the mid-1930s and its basic plan is still in operation today. The comprehensive system is based on three simple principles: (1) prevent damage to the system and other property from flooding; (2) drain excess water back to the river; and (3) deliver water to the adjacent agricultural fields (Burkholder 1928, 109). For discussion purposes the components of the MRGCD as built between 1930 and 1936 are divided into Flood Control Structures and Irrigation System (Figure 10). The structures and features are more fully described in Section IV of this report.

Flood Control Structures

Although the large flood control and irrigation dams found today along the middle and upper Rio Grande and its tributaries are not a part of the present study area, they are important components to the MRGCD. The El Vado dam and reservoir was the first of these structures to be built in 1935 (Figure 11). It was constructed on the Chama River some 175 miles northwest of Albuquerque, and was designed for the storage of water for irrigation purposes. Secondarily, it provided some measure of flood control although its location on a tributary of the Rio Grande and not the river itself, as well as its distance from Albuquerque, hampered this potential use.

Figure 11. El Vado Dam and reservoir. Source: USBR.

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Figure 12. Aerial view of the Rio Grande, MRGCD levee, and riverside drain, May, 1952. Source: USBR.

Until the construction of major dams upstream from the MRGCD's Albuquerque Division beginning in the 1950s, the primary tool used to control flooding along the Rio Grande was the construction of "spoil-bank" levees (Burkholder 1928, 112-116). The levees were designed to create channels that would withstand floods up 40,000 cfs along that portion of the river above Albuquerque, while the levee height was raised along the river paralleling Albuquerque (then confined primarily to land east of the river) and designed to hold back floods reaching 75,000 cfs (Figure 12). These levees were constructed of soil excavated from the large MRGCD drainage ditches and piled to a height of eight to nine feet above the ground surface, except in designated "critical areas," in which the levee height was raised to ten feet (Figure 13). One such area was a stretch of the river from just north of Alameda to just below Albuquerque, which contained valuable commercial, residential, and industrial property as well as important public utility facilities.

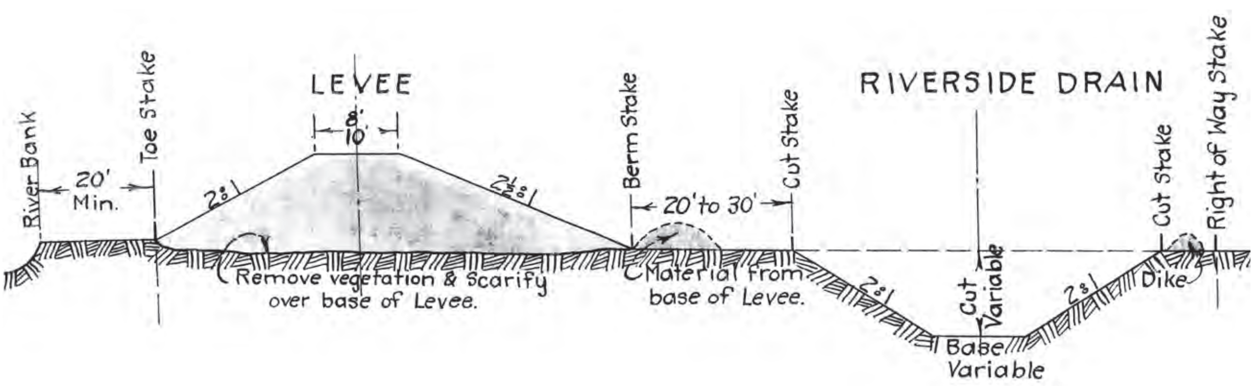

Figure 13. Drawing of spoil-bank levee and riverside drain, circa 1930s. Source: MRGCD construction specifications.

The levees were protected from erosion by vegetation cover, although trees were not allowed to grow within 30 feet of the structure (Figure 14). As added protection and to help scour the channel to prevent aggradation, low- flow channels ran alongside the levees. Permeable jetties, built of galvanized woven wire fencing, were constructed within these channels, again to protect the levees, and to help slow down the river's velocity. Other jetty systems were laid out in the floodplain to accelerate the accumulation of sediment and foster vegetation growth in order to help prevent bank erosion.

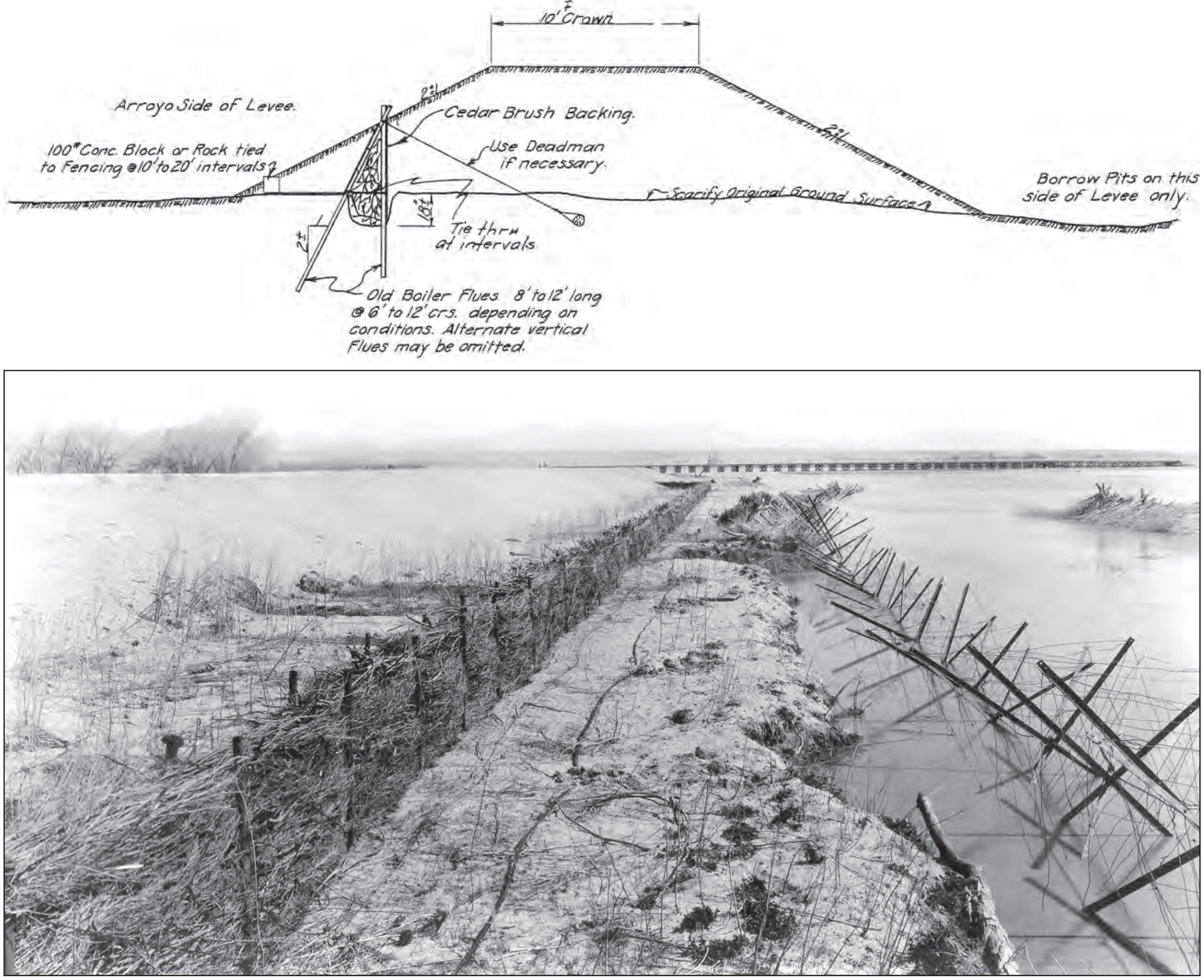

Figure 14. Drawing of levee protection, 1939; Brush protection structure with wire mesh fence on MRGCD levee, 1931. Source: MRGCD.

Irrigation System

The MRGCD's irrigation system consisted of diversion dams, main canals, laterals, and *acequias* (ditches), and drains (Figure 15).

The Albuquerque Division was served by the Angostura Diversion Dam located some twenty-four miles north of Albuquerque near the small village of Algodones (Figure 16) . The Albuquerque Main Canal headed at the east end of the diversion dam (Table 1). The canal ran along the valley floor between the east bank of the river and sand hills flanking the valley edge. As the canal passed the city, it ran underneath the Rio Grande through an inverted siphon made of reinforced concrete and traveled along the west side of the river through the Atrisco and Pajarito units. The canal ended at the Isleta Pueblo reservation boundary. The Corrales Main Canal diverted water from the Albuquerque Main Canal just south of the Alameda Grant boundary line and brought irrigation water to the west side of the river through a 1,200-foot long siphon.

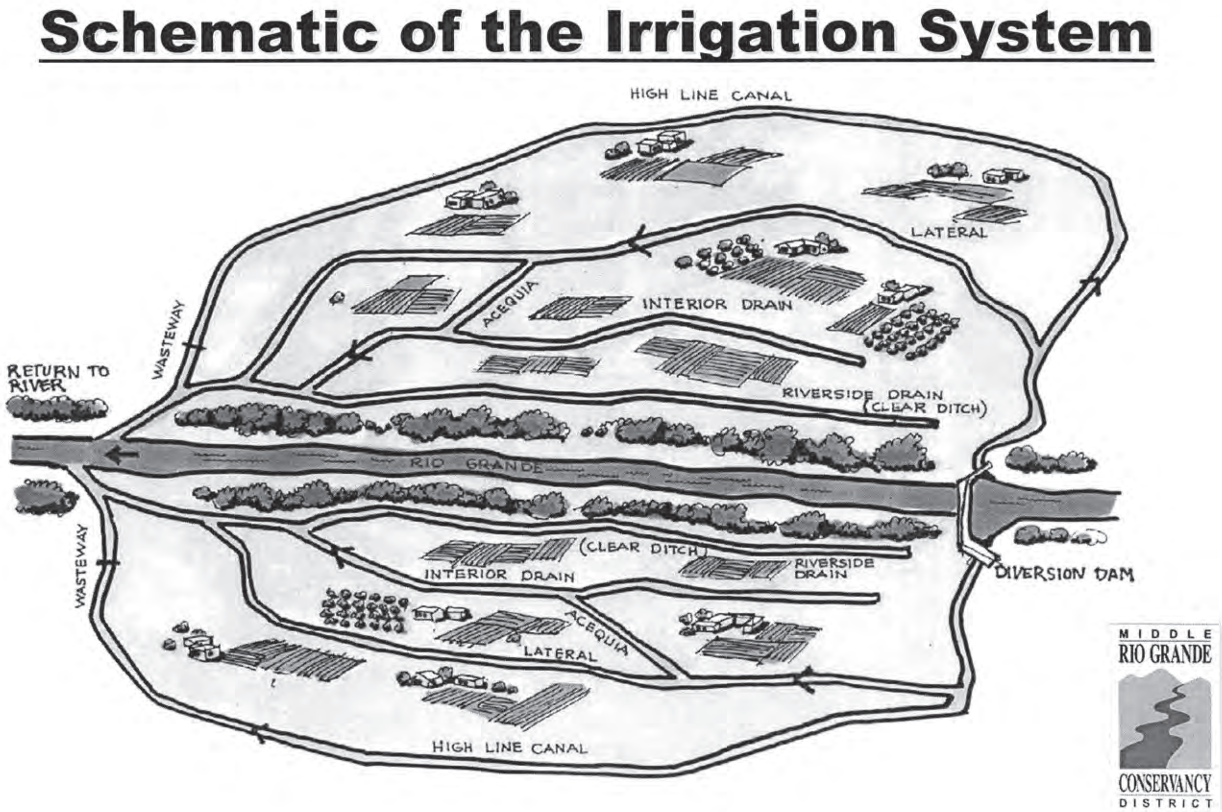

Figure 15. Schematic of the MRGCD irrigation system. Source: MRGCD.

Figure 16. Angostura Diversion Dam, looking west, 2007. Source: VCHP.

Table 1. MRGCD main canals, 1940. Source: Ackerly 1997, Table 6.

	No. miles	No. Checks / mile	No. Turnouts / mile
Albuquerque Division			
Corrales Canal	13.49	0.52	3.48
Albuquerque Canal	17.70	0.34	4.35
Arenal Canal	12.0	0.50	4.75
Barr Canal	10.5	1.43	4.76
Belen Division			
Belen Highline Canal	31.2	0.10	2.05
Peralta Canal	16.55	0.18	2.66
San Juan Canal	11.7	0.77	4.02

Running off the main canal were lateral channels that brought water from the main canal to the field specific irrigation ditches (Figure 17). During the construction of the MRGCD system, many of the existing ditches along the river (some perhaps dating to the eighteenth century) were incorporated into the system as laterals (Burkholder 1928, 125). Water coming through the laterals was controlled by simple headgate structures. As originally constructed, the Albuquerque Division was comprised of 114.3 miles of laterals (ibid., Table 19), including a 3,500-foot long flume on the Arenal Lateral. By 1940, there were 50 miles of non-Indian *acequias* in the Albuquerque Division, and 117 miles of *acequias* in the Belen Division (Ackerly et al. 1997, Table 6).

Figure 17. MRGCD irrigation ditch under construction near Laguna cut-off highway (later Route 66), 1931. Note use of horse teams and Fresno scrapers. Source: MRGCD.

All the laterals were served from either the Albuquerque Main Canal or the Corrales Main Canal, except in the Barr District south of Albuquerque where the fields were served from the Barr Canal and laterals coming off the Albuquerque Riverside Drain. It is also interesting to note that the MRGCD purchased the water rights from the Barelas Ditch located south of Marquette Avenue in the city in order to abandon the open ditch system that served the town at the time of its founding in 1881.

Figure 18. Isleta Diversion Dam, 1945. Source: USBR.

The Belen Division was served by the Isleta Diversion Dam located twenty-five miles south of Albuquerque on the Isleta Pueblo reservation (Burkholder 1928, 128) (Figure18). There were sluiceways located at each of the structures, which were controlled by six radial gates. These gates were capable of diverting 300 cfs of irrigation water at the east end into the Peralta Main Canal, and 1,000 cfs into the Belen High Canal that came off the west end of the structure. The Peralta Main Canal came off the east end of the Isleta dam and turned south through the communities of Peralta, Valencia, and Tomé. The canal ended at the base of Cerro Tomé. Due to grade differences, the canal dropped at one-half mile intervals.

The Belen High Line Canal, as originally designed, was the largest canal constructed by the MRGCD. The Belen canal had a maximum flow capacity of 1,000 cfs, designed to provide irrigation water to 10,000 acres. It served land on the west side of the river from the south boundary of the Isleta reservation to Belen. From the diversion dam, the canal headed west and then south as it passed through the communities of Los Lunas and Belen. There were no drops along the canal; however, a wasteway and sand trap were located three and one-half miles south of the diversion dam.

Just south of Belen, and outside the study area, the San Juan Main Canal branched off to the east and crossed the Rio Grande to serve the communities of Jarales and Sabinal.

Two types of drains were constructed to alleviate the problem of waterlogged fields: riverside drains and interior drains (Figure 19). The interior drains were located on the land side of the levees and spaced every one-half mile. They drained the fields into the wider riverside drains, which eventually returned the excess water back to the river (Burkholder 1928, 116). In 1940, a USBR report identified 46 miles and 50 miles of riverside drains and 51 miles and 61 miles of interior drains in Bernalillo and Valencia counties respectively (see Ackerly et al. 1997, Table 7).


New Mexico State Tribune
BEACH SECTION
CITY DUMP BECOMES RECREATION CENTER

1.

Creating Tingley Beach

One of the MRGCD's most visible and certainly most accessible projects for the general public was the construction of Conservancy Beach, better known as "Tingley Beach." Although plans for Conservancy Beach did not appear in Joseph L. Burkholder's original *Report of the Chief Engineer,* the idea for a recreation area was formulated soon after construction of the other engineering structures began, and the facility was in operation by August of 1931. Upon its opening, the beach, together with Rio Grande Park, became part of a large recreation area for the city, including the forested *bosque* located along the river, the Albuquerque Country Club, and the city zoo.

The idea for the "beach" occurred during construction of an auxiliary levee to protect the main riverside levee between the Old Town Bridge and the Barelas Bridge. It was noticed that a natural basin had been formed by an old streambed of the Rio Grande, which had susequently been turned into a city dump. Construction workers cleaned up the basin and used water from the MRGCD's drainage ditches to fill the ten-foot deep lake that stretched almost a mile long. The drain water flowed into the lake through a thirty-inch pipe containing a chlorinator and flowed out a pipe south of the pond. Next to a sandy beach, the facility featured bathhouses, a boat dock, diving platforms, and a slide (U.S. Army Corps of Engineers 2004, 1). Using city funds, the MRGCD widened the riverside levee to accommodate a scenic roadway, named Tingley Drive (*Albuquerque Journal* and *New Mexico State Tribune,* 8 August 1931). A children's wading pool was added in late 1937 using Works Progress Administration Grant funds (Biebel 1986, 81).


Attend the Grand Opening Sunday of
CONSERVANCY BEACH

Beach Opens at 9 a. m.

Always forging ahead! That's Albuquerque!

When Conservancy Park swimming pool is thrown open to the public for the first time Sunday morning at 9 o'clock, Albuquerque takes its place in the front rank with other cities of the southwest that have provided such a bathing place for its citizens, for Conservancy Park is the largest artificial swimming pool in the southwest.

HERE IS SCHEDULE OF RATES!

SWIMMING PRIVILEGES
Adults, 25c—Children, 10c
Bathing Suit and Swimming Privileges
Adults, 50c—Children, 15c

Exercises Start at 1:30 p. m.

Dedication exercises for the city's new bathing beach will get under way at 1:30 o'clock. Short talks will be made by Judge C. M. Botts, Senator Sam Bratton, Congressman Dennis Chavez, Ex-Governor Richard Dillon, Joe Dailey and Karl Johnson, president of the Albuquerque Trades Council. Following this Miss Betty Burkholder will christen the beach with a bottle of water from the Atlantic and Pacific Oceans. The municipal band will play.

HOW TO GET THERE!

Plenty of Parking Space

2.

The *New Mexico State Tribune* heralded the grand opening of the Conservancy Beach on Saturday, 8 August 1931. In a special section, the paper praised the project as an example of civic cooperation among the state and local governments, and the city's business community. The city planned a tremendous grand opening for what was now called "Conservancy Park." The city made plans for 15,000 people to attend the grand opening on Sunday afternoon – a figure that, for a city of 30,000 inhabitants, must be considered extremely optimistic planning. Notable politicos of the day gave speeches, and bottles of seawater from the Atlantic and Pacific Oceans were emptied into the lake by Betty Burkholder, daughter of Chief Engineer Joseph L. Burkholder. To inaugurate the bathing beach, Bill Cutter, a local pilot, flew over the beach and dropped swimsuits attached to small parachutes onto the crowd below. In June of 1948, the city renamed the beach in honor of World War II news correspondent and Albuquerque resident Ernie Pyle.


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COMPLETE BATTERY AND TIRE, ROAD SERVICE

3.

Within ten years, however, water quality problems (including cases of avian botulism) plagued Ernie Pyle (nee Conservancy) Beach. In 1948, the ponds lost their direct connection to the river after the levee system along the river was redesigned. After first trying unsuccessfully to rely on groundwater infiltration to replenish the water, wells had to be drilled to keep lake levels up. Finally, in August, 1952, health concerns related to the nationwide polio scare closed Ernie Pyle Beach to swimmers (*Albuquerque Tribune,* 18-19/52). City residents continued to use the facility for fishing; however, the area generally deteriorated due to a lack of maintenance. In 2006, the area now referred to as "Tingley Beach" was the site of major construction activity as the city rehabilitated the ponds for recreation activities, and connected it to the nearby zoo and BioPark.


4.


5.


6.


7.

1-3, Headline and advertisements heralding the opening of Conservancy Beach; 4, Conservancy Beach from the air shortly after completion in 1932. Note reclaimed land in the center of photo being developed as the Albuquerque Country Club and the Huning Castle Addition. 5, City dump along the Rio Grande soon to be transformed into Conservancy Beach; 6, Clyde Tingley at Conservancy Beach under construction, 1931; 7, Tingley (Conservancy) Beach after 2006 renovation, looking northwest, 2007 (approximately same view as adjacent photo). Note growth of cottonwood trees and understory along the Rio Grande in the left side of photo. Sources: New Mexico State Tribune, *8/8/31; Biebel (1986, 58); MRGCD (464 I&IV); VCHP.*

Figure 19. Brush and wire reinforcement structures on bank of the Albuquerque Riverside Drain, 1930; Cerro Interior Drain, 1955. Source: MRGCD; USBR.

Another problem facing the design engineers was how to accommodate the surface water entering the river from side arroyos and washes that drained the uplands adjacent to the Rio Grande floodplain. To solve this problem, they designed a "drainage inlet" that passed under the levees and entered the riverside drains. For large arroyos, where potential major flooding was a threat, the levees turned up the arroyo and extended for some distance in an attempt to keep water in the channel.

MRGCD'S FIRST DECADE: SUCCESS AND FAILURE

By the end of the 1940s, the immediate results were quite evident as the water table was lowered and almost 60,000 acres of waterlogged land was reclaimed (Scurlock 1998, 351). There were, of course, still problems to be solved. The river continued to aggrade due to sediment accumulation, and despite the construction of 190 miles of levees to hold back floodwaters, there were still no major flood control structures on the river itself. Proper maintenance of the irrigation ditches was a constant problem, in large part caused by the district's financial difficulties. The Great Depression had deflated agricultural prices causing farmers in the district to default on their district assessments. This lack of a stable revenue source only compounded the district's major problem, which was a huge financial debt, in addition to the yearly operation and maintenance expenses (Wozniak 1998, 116).

In 1941, a severe flood inundated the middle Rio Grande valley causing a significant amount of property damage, including damage to the structures belonging to the MRGCD. For 43 days, the river flowed at above 43,000 cfs and, although the levees were designed to contain flows of 75,000 cfs, this sustained rush of water caused twenty-five significant breaches in the levee system. The cost of repairs to the damaged structures put a serious strain on the conservancy district's financial resources and caused it to look to the federal government for assistance (Everhart 2004, 12; Welsh 1985, 166; Woodson and Martin 1963, 359).

THE IMPACT OF THE FEDERAL FLOOD CONTROL ACTS ON THE MRGCD

Early in the twentieth century, Congress recognized the national importance of flood control and the environmental damage being done by deforestation and by commercial and industrial development, particularly in the western United States. Beginning in 1917, Congress passed the first of what was to be a series of bills under the generic title known as the Flood Control Acts. The initial act, passed in 1917, established a role for the U.S. Army Corps of Engineers (USACE) in reducing damage caused by flooding on the country's major rivers. The importance of the act was dramatically emphasized in the 1928 version that followed the devastating flood on the Mississippi in 1927.

The Flood Control Act of 1936 further refined USACE policy and directed the USACE, in cooperation with the states, to become involved in flood control on all navigable rivers and their tributaries in the U.S. (Clark 1987, 259). Noting that major flooding was a threat to the national welfare, it divided responsibility for river management among the USACE, the Department of Agriculture (USDA), and the Bureau of Reclamation (USBR). The USACE was in charge of studying and improving the waterways, the USDA was to focus on watershed studies, runoff control, soil erosion, and flood retardation, and the USBR was to continue to direct reclamation projects. For the first time in U.S. history, the act called for an integrated flood control policy designed to attack the problem from several directions.

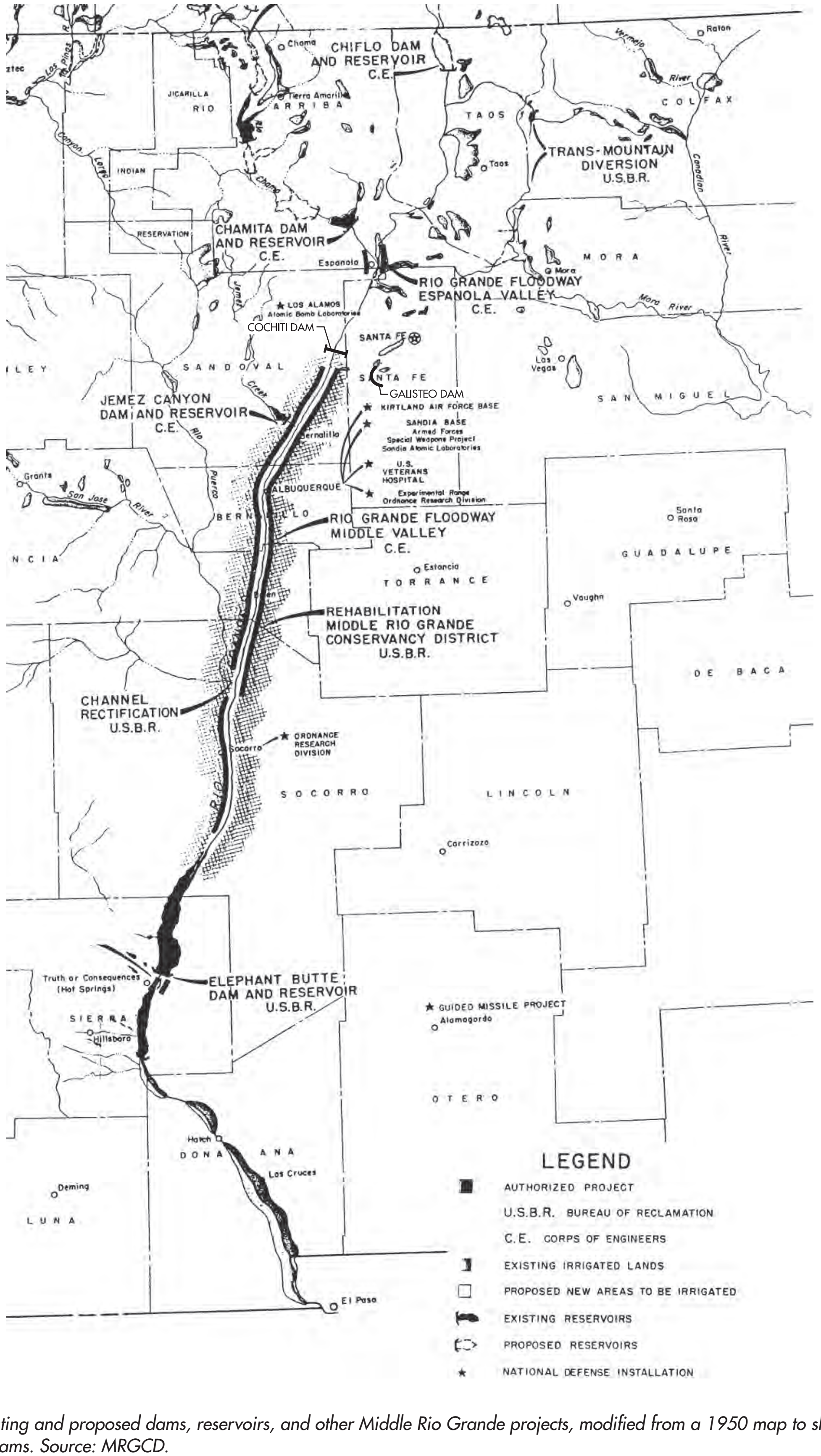

Figure 20. Existing and proposed dams, reservoirs, and other Middle Rio Grande projects, modified from a 1950 map to show the Cochiti and Galisteo dams. Source: MRGCD.

The Flood Control Acts of 1944 and 1948 had significant impacts on the middle Rio Grande valley (Clark 1987, 387-88). The former directed the War Department and the Department of the Interior to conduct a joint study of the middle valley with regard to flood control and irrigation. Their findings concluded that although the MRGCD had initially accomplished a great deal, the gains were short-lived due to financial problems. The minimal profits made by small farms affected the collection of district assessments and caused a backlog of unfinished maintenance projects. The acts directed the Department of the Interior to acquire all outstanding debts owed by the MRGCD and take ownership of riverside agricultural lands acquired through unpaid assessments incurred by landowners due to the depressed agricultural market. The Department of the Interior was then to sell or lease the land back to its original owners.

In addition, the findings noted that flooding was still a major concern due to the lack of flood control structures on the main stem of the Rio Grande. It recommended that the USACE construct three major dams – the Chamita, Chiflo, and Jemez – and additional levees (Figure 20). It further recommended that the USBR rehabilitate and extend the existing irrigation system. USBR and USACE formalized this agreement through a memorandum of understanding in 1947 (Welsh 1987, 118). The 1948 act approved funding for this plan, with the exception of the Chiflo Dam which was protested by Texas as being out of compliance with the requirements of the Rio Grande Compact, and thus dropped from the scope of work.

The cancellation of the Chiflo Dam was a particular blow to the legacy of New Mexico Senator Dennis Chavez. Long proponents of a flood control structure on the main stem of the Rio Grande, Chavez and other supporters of the dam thought that Chiflo was the answer to many years of wrangling over where to locate such a structure. Earlier plans for a dam on the Rio Grande closer to Albuquerque, near the Pueblos of San Felipe and Santo Domingo, had been discarded because they were not economically feasible and would have flooded valuable agricultural land. Such dams would have also displaced one or more of the Pueblos located upstream. The proposed Chiflo Dam, however, would have been sited upriver from prime agricultural land and not on Indian land. The major problem again, however, was cost effectiveness. As Welch (1987, 129) points out, the dam would cost $1.26 million a year to maintain for a benefit of only $384,000 in flood control. In addition, because it was to be situated so far upriver, it would have a minimum impact downstream on silt control. It was estimated that only one percent of the river's sediments would pass through the dam.

The Chamita Dam was proposed for the lower Chama River, nearer its confluence with the Rio Grande than the El Vado. It was hoped that such a location would help with flood and sediment control in the Albuquerque District and also provide hydroelectric power to nearby communities. By 1958, the USACE had changed course on the Chamita Dam and instead favored the construction of Abiquiu Dam further upstream, as well as the Chamita Low Dam. Abiquiu Dam was completed in 1963, while the Chamita Low Dam was never constructed.

The 1950 Flood Control Act authorized additional funding to complete the work plan outlined in the Rio Grande Project under the joint supervision of the USBR and the USACE. In 1954, the act addressed the problem of flash flooding from the Sandia Mountains along the river's east flank. It authorized construction of two diversion channels, one north of the city and one south, to divert the potentially massive runoff from the mountains, and the building of a detention dam across the Embudo Arroyo. Although these projects took some time to construct, the north diversion channel was completed in 1966, and the south channel in 1972, their completion greatly improved this flooding hazard facing the city.[1] The last major Flood Control Act affecting the middle valley was passed in 1960. It authorized rehabilitation work at the El Vado Dam, which was completed in 1966. It also authorized the construction of the Cochiti Dam across the Rio Grande at the mouth of White Rock Canyon just north of Cochiti Pueblo; and the Galisteo Dam across the Galisteo River, a tributary just south of Cochiti. These two new dams significantly helped to control sediment flow and downstream flooding; however, the Cochiti Dam in particular has led to a number of environmental problems including waterlogging of prime agricultural lands just below the dam's outlet structure on lands belonging to the Pueblo de Cochiti and the residents of the small Hispanic community of Peña Blanca.

Although additional funding from the Flood Control Acts helped the MRGCD make vitally needed improvements to the flood control system, by 1948 the system was in financial and physical trouble. The conservancy had not solved the problem of the aggrading riverbed and general maintenance had been neglected due to a lack of funds. It was also unable to raise the money to repay bonds issued some fifteen years earlier. The MRGCD requested help from the USBR and on 24 September 1951, the MRGCD entered into a contract with the USBR to rehabilitate the system, including the rehabilitation of the El Vado and diversion dams in 1954 and 1955, repairs to the system's laterals, and the channelization of 127 miles of river.[2] As a part of that contract, the USBR agreed to a repayment program whereby the district was allowed to repay, interest free, a total not to exceed $18,000,000 over forty years. The project, however, cost the USBR more than $35 million, and thus the MRGCD became responsible for an additional $15.7 million at the regular interest rate, which merely compounded their financial difficulties (Clark 1987: 388). In 1955, however, Congress agreed to a $5.3 million appropriation that purchased and retired the outstanding MRGCD bonds (BOR 1955, 19, 35).

THE MRGCD: POST-WAR FEDERAL ASSISTANCE

The post-war improvements made by the USACE and the USBR to the original 1930s MRGCD structures and installations provided necessary new facilities as well as upgraded aging existing ones. The omnipresent problem of flood control was significantly addressed with the construction of the Jemez, Abiquiu, Galisteo, and Cochiti dams. Although this collection of structures was not completed until the 1970s, almost thirty years after conceptualization, their importance in the post-war era is dramatized by a booklet prepared in July, 1950, by the Middle Rio Grande Flood Control Association entitled *The Facts About the Flood Control and Reclamation Project in the Middle Rio Grande Valley and Its Importance in the National Defense Program*. Prepared at the beginning of the Cold War, with the threat of nuclear war hanging over the country, the publication reminded the citizens of New Mexico how great a threat flooding by the Rio Grande and its

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[1] These two diversion channels, as well as the La Orilla storm water outfall, are operated and maintained by the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA).

[2] The agreement also called for the rehabilitation of the San Acacia diversion dam located outside the study area to the south of Belen.

tributaries was to the major national defense installations in the state. Using maps of the region, photographs of past flooding, and other strong visual images, it noted that strategic facilities such as Sandia Atomic Laboratories, the Armed Forces Special Weapons Project, Kirtland Air Force Base, and the experimental ordnance ranges were dependent upon Albuquerque's public utilities, most of which were located within the valley's floodplain (Figure 21).

The collaborative effort by the USACE and the USBR to assist the MRGCD in maintaining their flood control and irrigation structures had three main goals: (1) construct sediment and flood control reservoirs (to be undertaken by the USACE); (2) rehabilitate the existing irrigation system (by the USBR); and (3) improve the levee system and stabilize the river channel (a joint USACE and USBR effort).

To help control sediment deposition and flooding, the USACE undertook the construction of four dams across the Rio Grande and its tributaries between 1951 and 1975. The USACE started construction on the Jemez Dam in 1951 and completed the structure, located some 20 miles northwest of Albuquerque, in 1953. Located at the confluence of the Jemez River and the Rio Grande, just above the town of Bernalillo, this earthen filled structure was 780 feet long and 136 feet high. The Jemez Dam was not designed to contain a permanent pool of water and was mainly important for sediment control. Ten years later, the Abiquiu Dam, constructed across the Chama River between the El Vado Dam and the river's juncture with the Rio Grande, was completed. This earthen filled dam was larger, measuring 1,540 feet long and 325 feet high and had a significant amount of water storage capacity and recreation potential.

In 1970, the Galisteo Dam project was completed across the Rio Galisteo, some 40 miles north of Albuquerque. Like the Jemez Dam, this was an earthen filled structure designed to help control the heavy sediment load brought down by the Rio Grande and was not designed for water storage. The final piece of the flood control puzzle was put in place with the closing of the Cochiti Dam in 1973 (Lagasse 1980, 14). This massive structure rises 250 feet above the stream bed and has a crest length of over five miles as its earthen embankment faced with lava rock sweeps across both the Rio Grande and Santa Fe River (Figure 22). The completion of this dam virtually alleviated the threat of destructive flooding between Cochiti and Elephant Butte Dam, including, of course, the fast-growing city of Albuquerque.

The newly constructed dams functioned to hold back sediments that contributed to the river's aggradation problem. Prior to the completion of Cochiti Dam in 1973, aggradation rates in the stretch of Rio Grande near Albuquerque had been raising the channel bed two feet every fifty years. By 1960, the channel was six to eight feet above the ground level behind the levees (Lagasse 1980, 19). The four new dams significantly reduced that sediment load. There was, however, a downside to the damming of the river, namely, a reduction in the magnitude of peak discharges, which naturally scour the channel bed and through inundation deposit beneficial new soil on the adjacent floodplain and farmlands. By harnessing the Rio Grande so tightly, the new dams prevented these processes from refreshing the river system naturally.

The USACE renovated the levees along the middle Rio Grande particularly within the Albuquerque District. The engineers raised the heights of the structures, widened their crests to twelve feet, and redesigned the levee using pervious material in the landside of the levee and random materials on the riverside. They also added

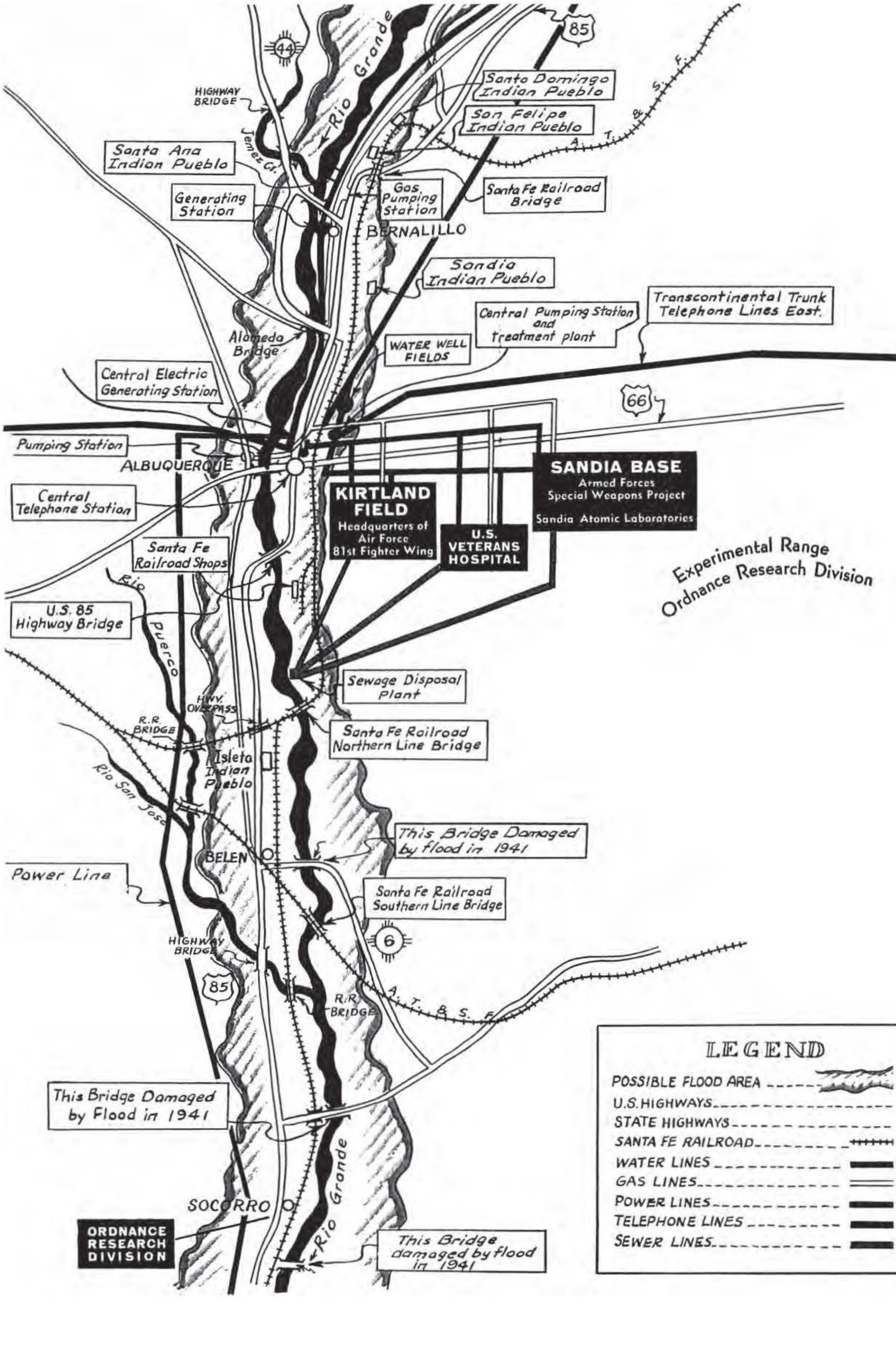
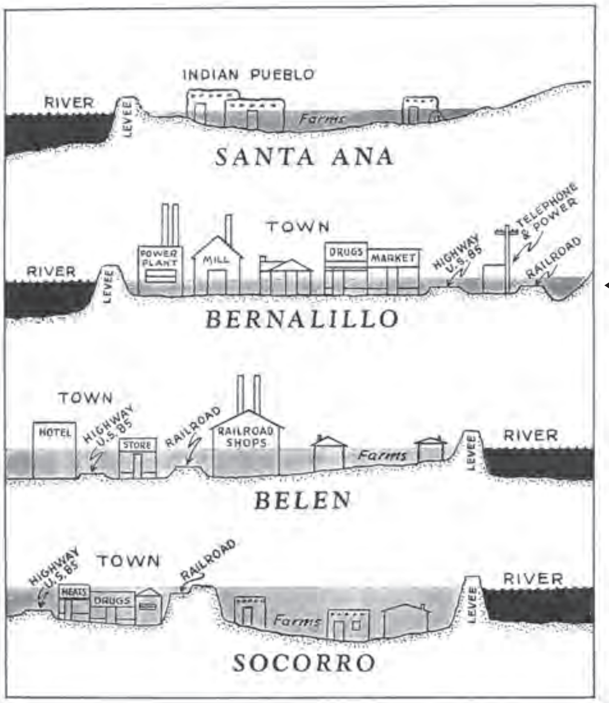

Rio Grande
Santo Domingo Indian Pueblo
San Felipe Indian Pueblo
HIGHWAY BRIDGE
Jemez Cr.
Santa Ana Indian Pueblo
A. T. & S. F.
Generating Station
Gas Pumping Station
Santa Fe Railroad Bridge
BERNALILLO
Sandia Indian Pueblo
Transcontinental Trunk Telephone Lines East.
Central Pumping Station and Treatment plant
Alameda Bridge
WATER WELL FIELDS
Central Electric Generating Station
Pumping Station
ALBUQUERQUE
SANDIA BASE
Armed Forces Special Weapons Project
Sandia Atomic Laboratories
KIRTLAND FIELD
Headquarters of Air Force 81st Fighter Wing
Central Telephone Station
U.S. VETERANS HOSPITAL
Santa Fe Railroad Shops
Experimental Range Ordnance Research Division
Rio Puerco
U.S. 85 Highway Bridge
Sewage Disposal Plant
HWY. OVERPASS
R.R. BRIDGE
Santa Fe Railroad Northern Line Bridge
Isleta Indian Pueblo
Rio San Jose
This Bridge Damaged by flood in 1941
BELEN
Power Line
Santa Fe Railroad Southern Line Bridge
HIGHWAY BRIDGE
85
6
44
66
R.R. BRIDGE
A. T. & S. F.
LEGEND
POSSIBLE FLOOD AREA
U.S. HIGHWAYS
STATE HIGHWAYS
SANTA FE RAILROAD
WATER LINES
GAS LINES
POWER LINES
TELEPHONE LINES
SEWER LINES
This Bridge Damaged by Flood in 1941
Rio Grande
SOCORRO
ORDNANCE RESEARCH DIVISION
This Bridge damaged by flood in 1941

Figure 21. (Opposite) Map and illustrations of middle Rio Grande valley showing national defense installations, transportation routes, important infrastructure features, and communities potentially threatened by Rio Grande flooding. Source: Middle Rio Grande Flood Association (1950).



Characteristic Valley Profiles

with the River at Four Foot Flood Level

The Valley Lies **Below the River**

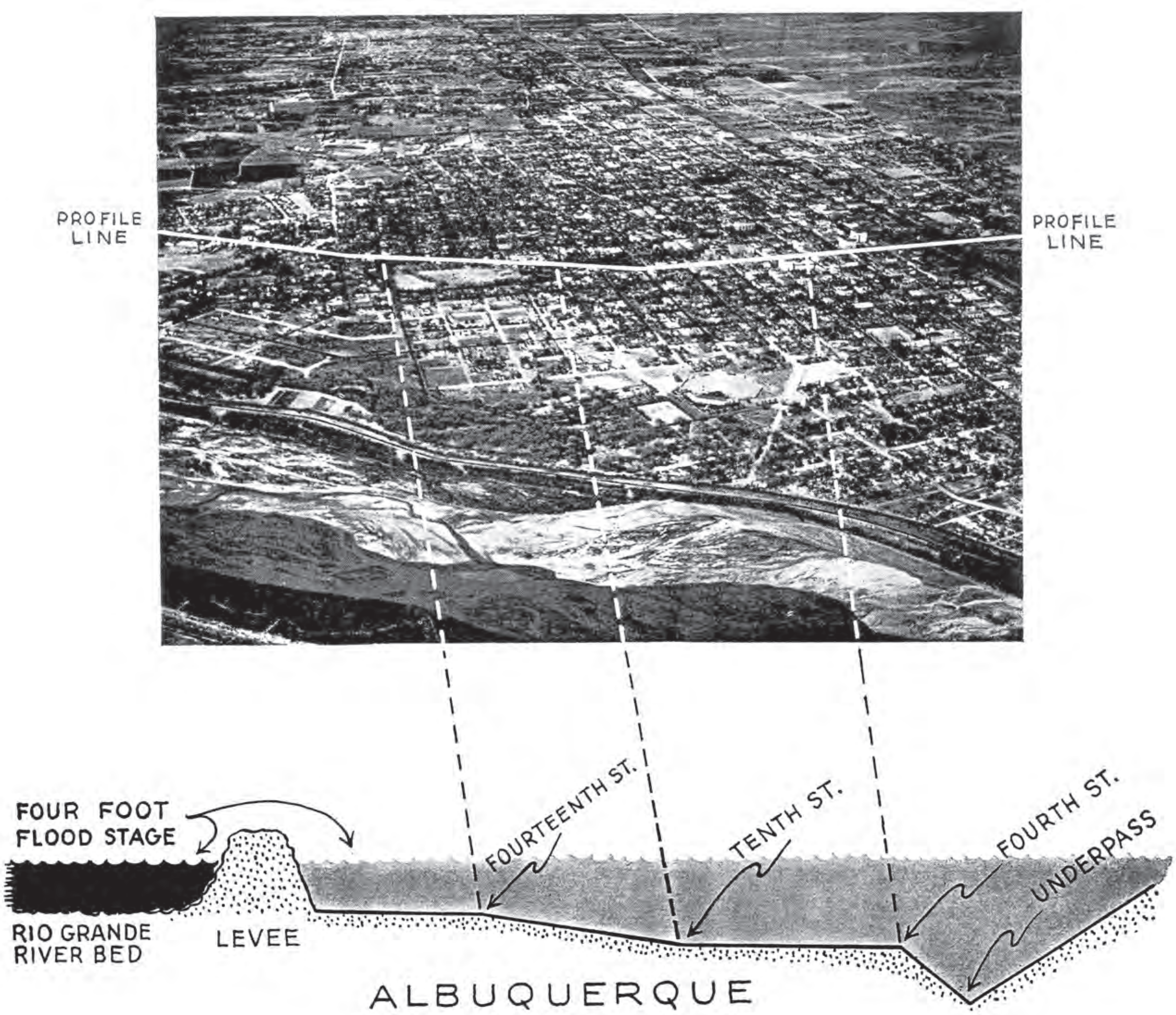


Figure 22. Aerial view of Cochiti Dam soon after completion, looking southeast. Source: USACE.

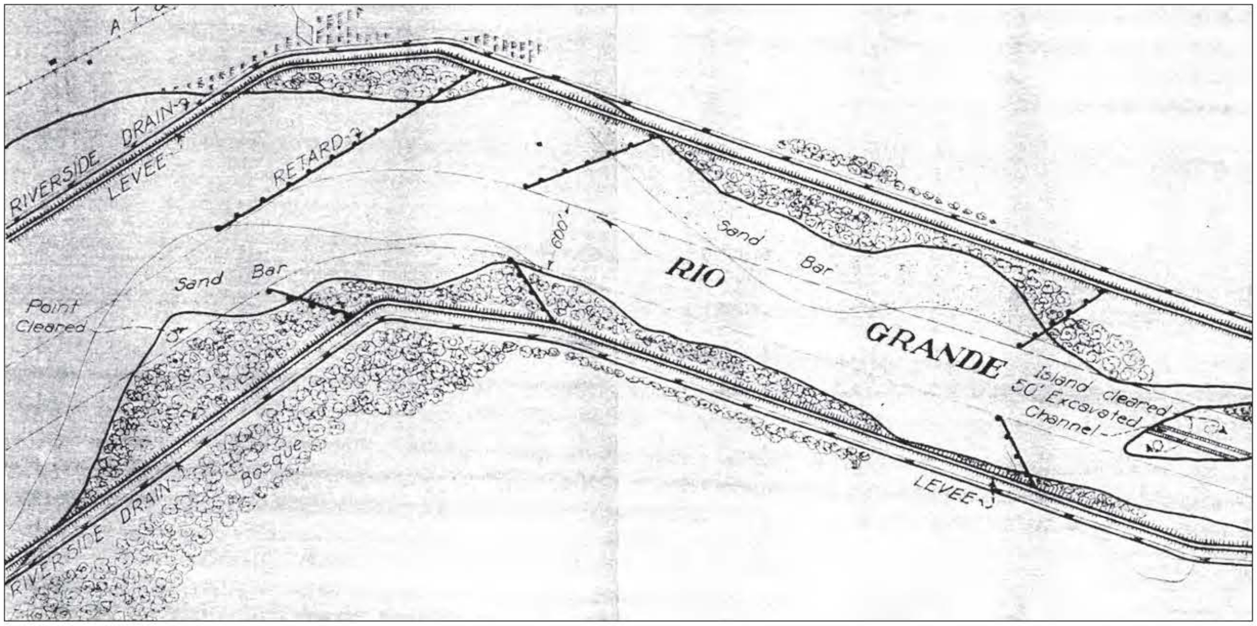
toe drains to help combat levee erosion.

Prior to the completion of the Cochiti Dam, arguably the most visible and effective construction project undertaken within the MRGCD was the installation of an extensive jetty system in the floodplain whose main purpose was to protect the river's natural banks as well as flood control structures, such as levees, from damage by major flood episodes by rectifying the river channel (Grassel 2002, 16-17; Lagasse 1980, 20-2; Woodson and Martin 1963, 361).

The Kellner jetty system, developed by H. F. Kellner in the 1920s, was a particularly effective method of channel rectification in heavy silt-laden streams such as the Rio Grande. The basic unit of the system, known as a "jack," was three pieces of angle iron bolted together and strung with steel cable. These jacks were laid out in diversion lines running parallel to the bank or levee with "tiebacks" or "retard" lines extending from the diversion lines back to the bank (Figures 23-25) . The system slows the velocity of the stream current and promotes deposition of sediments to form a new bank or restore a degraded one. During flood episodes, sediment and debris collect on the jetty jacks to accelerate the process. Levees, too, are vulnerable to scouring action and jacks can be used like riprap on the slopes and then tipped over to protect the levee base. Once soil has accumulated, vegetation soon grows to stabilize the bank or levee.

In earlier studies of the jetty jack system on the Rio Grande, Robert Woodson (1961) and Kathy Grassel (2002), both noted that the Kellner jetty system was first used in 1936 by the Santa Fe railroad to protect railroad embankments. However, drawings of "permeable jetties" by the design engineers for the original

Figure 23. (Opposite Top) Drawing of typical flood protection and channel improvement work, 1927. Source: MRGCD.
Figure 24. (Opposite Center) MRGCD jetty jack field in Rio Grande near Bosque, New Mexico, 1956. Source: USBR.
Figure 25. (Opposite Bottom) Jetties using brush structures and Kellner jacks (type C) near outlet of the Albuquerque Riverside Drain adjacent to Old Town, 1931. Note willow saplings planted on levee. Source: MRGCD.


A.T.
RIVERSIDE DRAIN
LEVEE
RETARD
600'
Sand Bar
Sand Bar
RIO
GRANDE
Point
Cleared
Island cleared
50' Excavated
Channel
Bosque
RIVERSIDE DRAIN
LEVEE

MRGCD plans show the inclusion of a modified Kellner jetty jack system, together with use of bundled timbers and brush, as an alternative method of channel stabilization. The use of the Kellner system was accelerated by the USBR and USACE in the 1950s. In 1954, 5,600 units were installed at scattered locations along the river where levees had been damaged. Two years later, an additional 17,000 units were installed in the Albuquerque unit, and in 1958, 50,000 more units were placed in the river channel. The installation of the system was facilitated by fact that the river experienced low flows in the mid-1950s. By 1962, a total of 115,000 jacks proliferated throughout the middle Rio Grande valley (Grassel 2002).

The MRGCD goal of channel rectification was accomplished by the installation of more than 100,000 jetty jacks. This, together with the control of sediments and improvements to the levees, stabilized and straightened much of the Rio Grande's original meandering pattern resulting in a more controlled and predictable river. The jetty jacks increased the sediment beds at a rate of approximately one foot per year and within two years new vegetation had "locked-in" the new bank lines (Grassel 2002, 18). The well-defined channel widths now range from 900 feet in the Cochiti area to 550 feet in the stretches of the river south of Belen.

To improve the irrigation system, the USBR renovated the El Vado Dam, as well as upgraded the Angostura and Isleta diversion dams in the study area (Figure 26). They also replaced flumes with siphons along the canals and lined some of the major ditches with concrete (Table 2). Although there has been an increase in the amount of acreage reclaimed for agriculture south of Albuquerque, this has been offset by the rapid rate of urbanization in the Albuquerque metropolitan area, which has converted most valley land into residential

Figure 26. Rehabilitation of the Isleta Diversion Dam, 1955. Source: USBR.

use. The USBR's improvements to the irrigation system, such as concrete lining of large ditches to reduce seepage and the installation of new headworks at the diversion dams, have made the system more up-to-date and efficient. Interestingly, the growth of Albuquerque and in particular its increase in water use, has significantly lowered the water table resulting in the obsolescence of the systems' interior drains (Thompson 1986, 46-49). The city's pumping of the water table for residential, commercial and industrial use has lowered the subsurface water levels so that the drains, originally intended to help lower the water table, no longer function in that capacity. As of the mid-1980s, almost two miles of drains had been abandoned in the Albuquerque area.

Table 2. MRGCD irrigation system, post-USBR renovations (circa early 1960s).
Source: Ackerly et al. 1997, 129.

	Albuquerque Division	Belen Division
No. of Main Canals	5	3
Total Miles	63.75	56.36
Acres Served	8,898	22,888
No. of Laterals	18	30
Avg. Lateral Length (mi)	2.61	3.88
No. *Acequias*	51	No data
Avg. Acequia Length (mi)	1.64	No data
No. Riverside Drains	6	8
No. Interior Drains	16	17
Avg. Drain Length (mi)	5.41	5.81

THE EFFECTS OF URBANIZATION ON MRGCD PLANNING

As noted earlier, following the Second World War, Albuquerque's East Mesa became the site of a major air force base, national defense weapons laboratory and testing facility. However, these prominent defense department operations were not the only link between the city and the Federal Government. Other agencies, such as the Bureau of Indian Affairs, the Forest Service, Bureau of Land Management, USBR, and the USACE located their regional or district offices in downtown Albuquerque. Albuquerque became known as "Little Washington" and, as might be expected, this concentration of Federal Government offices resulted in a dramatic increase in the city's population. The result was a large post-war expansion in residential and commercial real estate values that now had to be protected from damaging flood episodes.

While urban sprawl was perhaps more apparent to the town's residents in the 1950s and 60s, the urbanization of Albuquerque actually began in the years following the First World War, most notably in the late 1920s and early 1930s. Although much has been made of the rapid suburbanization of the city's East Mesa during this time period (see Kammer 1997; Wilson 1996), the area north of downtown, the so-called North Valley, was also experiencing a transition from farmland to house lots. So, while the reclamation of farmland in the more rural parts of the MRGCD was undoubtedly a prime factor in the establishment of the district, it is unlikely that the transition in land use in metropolitan Albuquerque in the late 1920s was going unnoticed by conservancy supporters.

Founded with the coming of the railroad into the middle Rio Grande valley in 1881, "New Town" Albuquerque's growth during its first three decades of existence was moderate and mostly confined to its original three square mile townsite (Table 3).[3] Housing for residents was generally located within walking distance of the city's downtown area. This pattern was expanded somewhat by the introduction of the streetcar in 1904, which allowed for housing developments, such as the Luna Place Addition on New York (Lomas) Avenue, to be created along these transportation corridors (Simmons 1982, 339). The city's population almost doubled between 1900 and 1910, and more than doubled again between 1910 and 1930. Other "suburbs" such as the Raynolds Addition (1912) and the area known as the "North End' (developed in the early 1920s) were contiguous to the city's boundaries. In 1924, new state annexation laws had allowed the city to add these contiguous suburbs and almost quadruple its physical size.

Table 3. Population of Albuquerque and geographical size by decade

Source: City of Albuquerque Planning Department.

Year	Population	% annual growth rate	% change over last census	City in square miles
1880	2,315			3.12
1890	3,785	5.0	63.5	3.12
1900	6,238	5.1	64.8	3.12
1910	11,020	5.9	76.7	3.12
1920	15,157	3.2	37.5	3.12
1930	26,570	5.8	75.3	11.1
1940	35,449	2.9	33.4	11.1
1950	96,815	10.6	173.1	48.27
1960	201,189	7.6	107.8	61.09
1970	244,501	2.	21.5	80.61

The problem of poor drainage and periodic flooding hampered the development of some areas west of downtown until the MRGCD completed construction of the drains and levees in this area. Upon their completion, new housing areas such as the Perea and Huning Castle additions began to develop quickly. Other housing subdivisions leapfrogged over agricultural land in the North Valley. The Paris Addition (1906), Monkbridge Addition (1917), and Albright-Moore Addition (1920) located well north of city boundaries foretold of future housing developments in the valley. Spurring this development in the North Valley was the rise of automobile usage by local residents. Automobile registrations in the state jumped from 17,720 in 1920 to more than 84,000 in 1930. In 1926, North Fourth Street was designated as U.S. Highway 66 and

[3] The term "New Town" distinguished the railroad town from the original Spanish villa of Alburquerque (original spelling), which was commonly referred to as "Old Town."

85 thus fueling its development as a commercial strip outside the city's heretofore traditional downtown core (see Wilson 1996).[4] The significance of this street can be seen in the platting of housing subdivisions along its route between Albuquerque and the community of Alameda in the 1930s and 40s.

While urbanization was gradually overtaking many of the North Valley's former farms, other changes to the valley's agricultural landscape were also occurring. The small farming plots that had characterized the area were being bought up and combined into larger parcels. Perhaps the best known example of this trend was the Dietz Farms property. Robert Dietz II, heir to R. E. Dietz Company of New York, one of the largest manufacturers of kerosene lanterns in the United States, came to Albuquerque in 1911 for health reasons. Beginning with 40 acres along the Rio Grande, he soon amassed 150 acres of prime North Valley farmland (Dale Bellamah 1950). Dietz was one of the early proponents of the MRGCD and played an important role in its establishment. Similarly, in the 1930s Albert Simms acquired a large tract of farmland that was once part of the community of Los Poblanos, a Spanish settlement founded around 1750, but abandoned in the early 1800s because of the rising water table in the valley (*Albuquerque Tribune,* 1/2/96). While these large tracts of open land remained undeveloped until after the war, except for the Anderson Field portion of Los Poblanos, which was purchased by the City of Albuquerque for open space, these lands represented some of the last vestiges of the valley's agricultural heritage.

Of course, the creation of post-World War I suburbs in the North Valley did not take place on uninhabited land. Hispanic communities, each marked by a plaza and church, had been founded along the *Camino Real* in the seventeenth and eighteenth centuries to serve the needs of local farmers as they tended their long lots (Lucero 2007). North Valley settlements such as Alameda, Los Ranchos, Los Griegos, Los Candelarias, and Los Duranes were well established at the time of the railroad's arrival, but within the next one hundred years were destined to become engulfed in the tide of urbanization that moved northward from downtown Albuquerque (Table 4). The once independent communities such as Los Duranes, Los Griegos, and Los Candelarias soon became neighborhoods within the city, while Alameda and Los Ranchos resisted formal annexation in an attempt to preserve their semi-rural character in spite of the city's urban sprawl. Settlement patterns were similar to the south of Albuquerque's downtown, again with historic villages such as Atrisco, Pajarito, Barelas, and Los Padillas stretching down the river towards Isleta Pueblo; however, the area was never as commercialized along a major arterial roadway as was the case along Fourth Street in the North Valley, so large subdivisions did not develop until quite late in the twentieth century. The individual farm lot is still a common sight in the South Valley today, and housing patterns tend towards subdividing these smaller lots with a couple of houses rather than platting larger, multi-home tracts (see Wheeler and Patterson 2007).

Table 4. Population figures from the 1880 census of the Hispanic communities bordering New Town Albuquerque at its founding.

Source: Biebel 1981; Lucero 2007.

[4] North Fourth was to remain a part of Route 66 until the highway cut through Tijeras Pass east of the city in 1936, thus straightening the east-west road and ultimately solidifying its status as the "Mother Road." Following this re-alignment, North Fourth continued to play an important part in the state's transportation system by being part of the Pan American Highway that stretched from Canada to Central America.

Community	Date Founded	Population
Atrisco	1692	750
Alameda	1710	570
Pajarito	Before 1746	400
Los Ranchos	1694	400
Barelas	1707	350
Los Padillas	Before 1790	350
Los Griegos	1708	300
Los Candelarias	Before 1790	200
Los Duranes	Before 1790	77

As a result of this urbanization process, the original intent of the MRGCD quickly shifted purpose in the metropolitan Albuquerque area. Although laced with conservancy district-built canals, laterals, ditches, and drains, the land use changed from rural agricultural farmland dating back to the Spanish Colonial period to a mixed density of housing, commercial businesses, and remnant farms (Figures 27 and 28). The *acequias* that once watered chile and alfalfa fields were now used to irrigate lawns and ornamental shrubbery (Figure 29).

SUMMARY: THE HISTORICAL SIGNIFICANCE OF THE MRGCD PROJECT

Addressing the water control and irrigation systems as originally planned in 1928, Frank Wozniak (1998, 139) summarized the impact of the MRGCD's facilities as follows:

> The changes in the character of irrigation agriculture in the middle and lower Rio Grande Valley of New Mexico included (a) the appearance of modern surveyed ditch alignments to replace the old meandering systems; (b) the construction of a small number of concrete diversion structures to replace the multitudes of primitive head works; (c) construction of large water storage structures to provide a virtually guaranteed source of water during the irrigation season; and (d) the institution of operation and maintenance methods using heavy machinery to replace human beings with shovels [Figure 30]. Many of the old problems of flooding, sedimentation, water logging, alkali poisoning, and unreliable water supply were resolved or at least held in check . . .

In 1910, agricultural needs in the middle Rio Grande valley were served by 79 distinct irrigation systems, all of which were independently maintained at various levels of adequacy and utilizing a technology little changed from the Spanish Colonial period (Ackerly 1996). As Wozniak points out, by the mid-1930s the valley's farmers were utilizing a state-of-the-art network of diversion dams, canals, and ditches to bring irrigation water to their fields, and had an extensive drainage system to rid their fields of excess water. But valley farmers were not the only benefactors of the newly created conservancy district. As early as the 1920s, the city's population had begun to slowly move northward in search of land for housing. Lands belonging

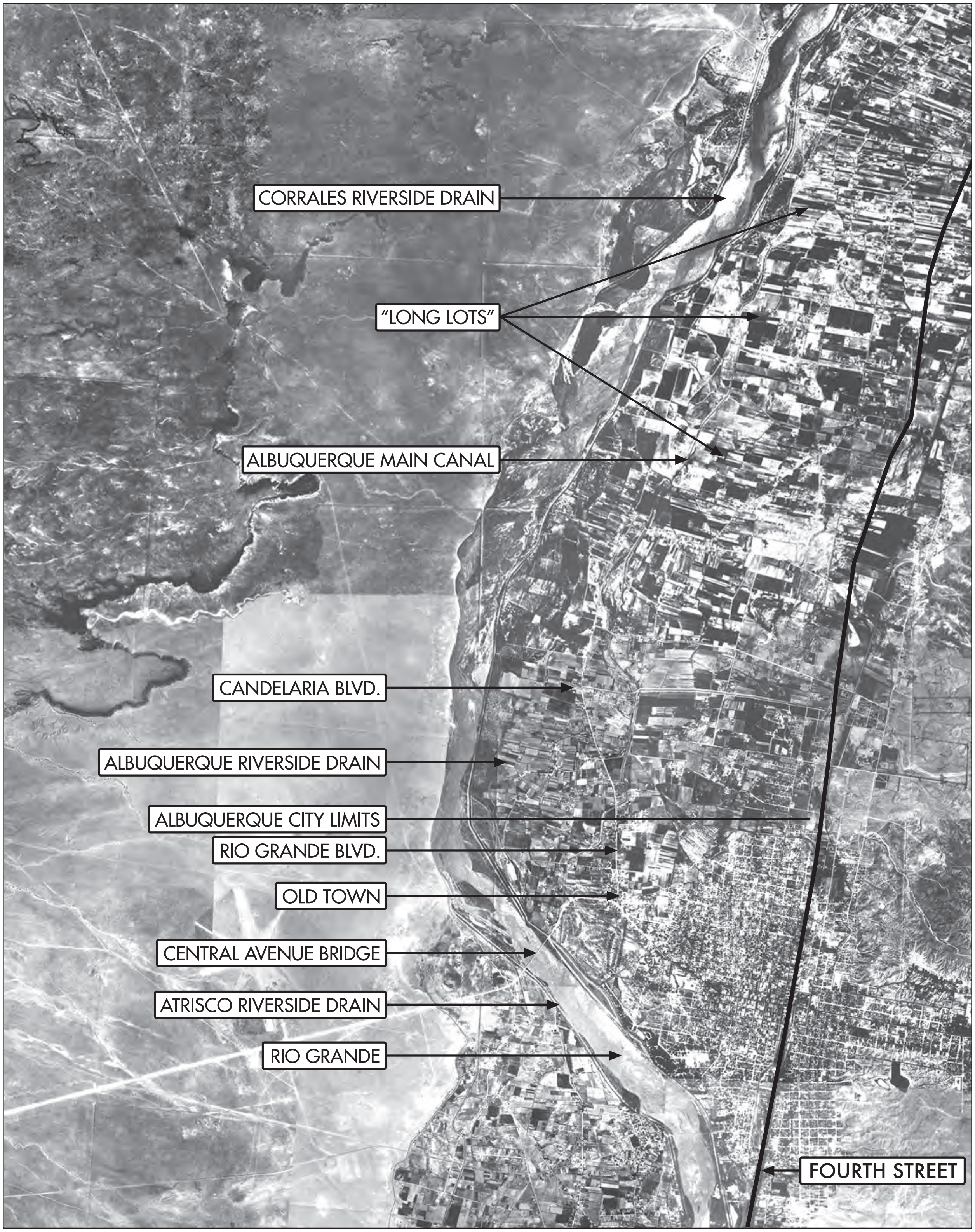


Figure 27. (Above) Aerial view of downtown Albuquerque and North Valley, 1935. Note the predominance of farmland to the north of the city and the commercial development along Fourth Street. Source: USBR.

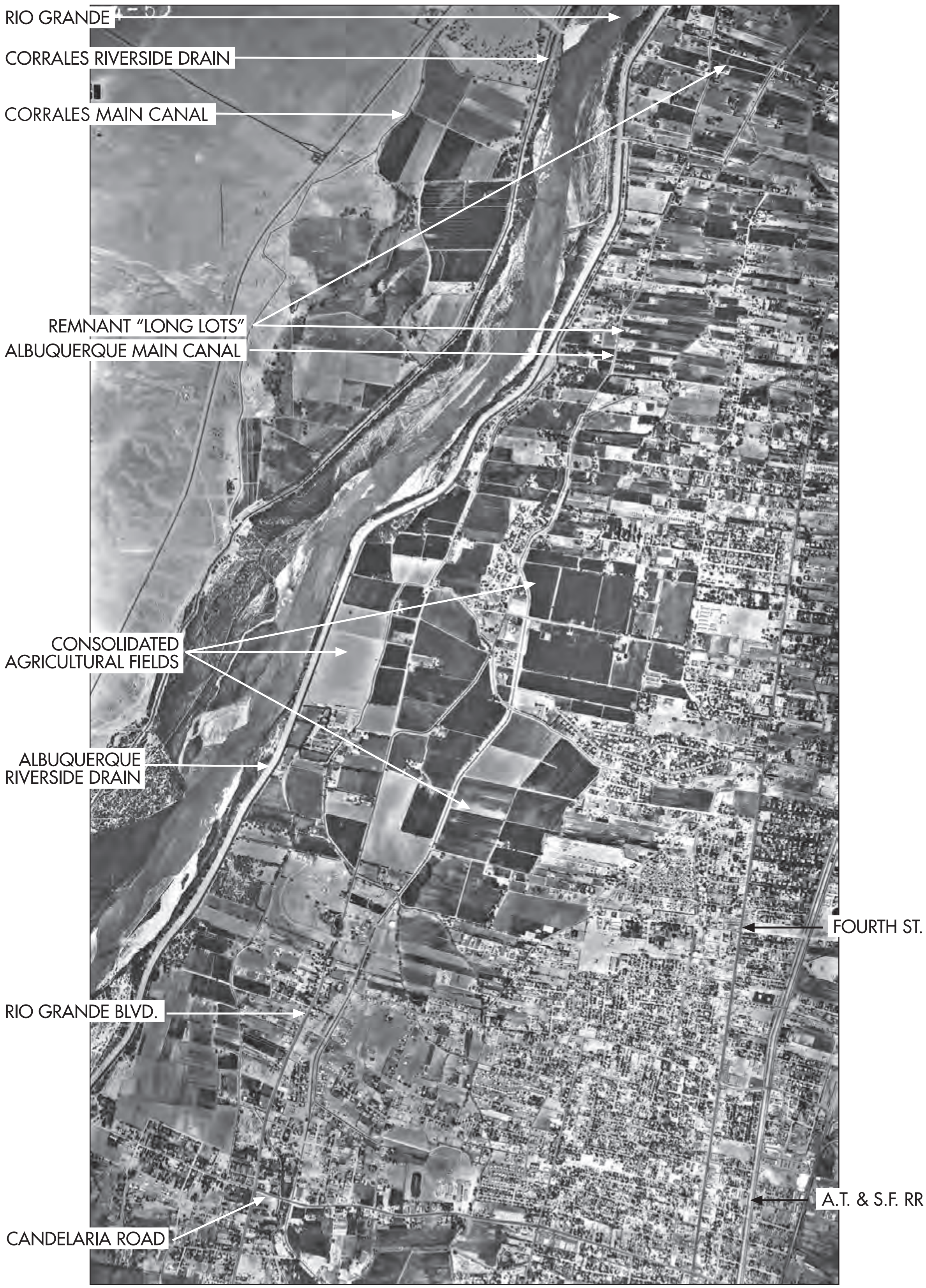


Figure 28. Aerial view of North Valley, 1963. Note the encroachment of residential development, the pockets of farmland, and the loss of traditional "long lots." Source: USBR.

Figure 29. North Valley acequia off the Gallegos Lateral, 2007. Note residential lawns at the end of the ditch; Gallegos Lateral west of Rio Grande Blvd. in the North Valley, 2007. Source: VCHP.

Figure 30. Specialized equipment ("ditcher with spoil wings") designed for renovating MRGCD structures at Los Chavez Acequia, 1956 (compare with Figure 17). Source: USBR.

to the residents of the traditional Hispanic villages in the North Valley were soon becoming incorporated into the city's boundaries, and as transportation corridors became established in response to the increasing popularity of the automobile, farmlands were subdivided into house lots or commercial zones. Although less pronounced in the city's South Valley, this trend was more evident in areas immediately south and southwest of the city where the success of the MRGCD drainage system allowed land to be reclaimed not necessarily for agriculture, but for housing. Although interrupted by a general slowdown in housing and urban development during the Second World War, this trend not only continued, but accelerated following the war as federal employment opportunities in the city blossomed, which was then inevitably followed by other commercial prospects. As a result, the MRGCD served not only the agricultural interests of Hispanic, Anglo, and Pueblo farmers up and down the Rio Grande and reclaimed thousands of new acres in areas especially to the south of Isleta Pueblo, but also protected valuable private and commercial property in the newly developed portions of the valley flanking the fast-growing city of Albuquerque.

In addition, the impact of the Federal Government upon the affairs of the MRGCD following World War II cannot be overstated. The influx of new funding, oversight, and management allowed the district to maintain viability and in fact expand the system during a period of fiscal restructuring. The construction of dams, particularly the completion of the Cochiti Dam, alleviated flood concerns that had plagued the valley from the time of the first indigenous farmers until the maturation of the city as a Sunbelt metropolis.

IV. TYPES OF ENGINEERING STRUCTURES WITHIN THE STUDY AREA OF THE MIDDLE RIO GRANDE CONSERVANCY DISTRICT

Several types of engineering structures were constructed, or re-constructed, between 1930 and 1975 by the MRGCD, the USBR, and the USACE along the Rio Grande within the Albuquerque and Belen units. For analytical purposes, these structures have been divided into two main categories: (1) structures associated with flood control and channel rectification; and (2) structures associated with irrigation systems. Although the basic system was constructed between 1930 and 1935, there were many modifications made to the original system from the mid-1950s to the early 1960s. These modifications have upgraded materials and added new technological advancements to the system; however, the basic operating procedures remain virtually the same as when the structures were first built. This section will describe the original structures from drawings created in the 1920s and 30s, and whenever possible, discuss how these features have changed (or remained the same) since their initial construction.

FLOOD CONTROL AND CHANNEL RECTIFICATION STRUCTURES

Levees

The MRGCD levees are "spoil bank" levees constructed of soil excavated from the large drainage ditches. As originally designed, levee heights reached up to eight or nine feet above the ground surface, except in designated "critical areas," in which the levee height was raised to ten feet (Figure 31). The levee crowns

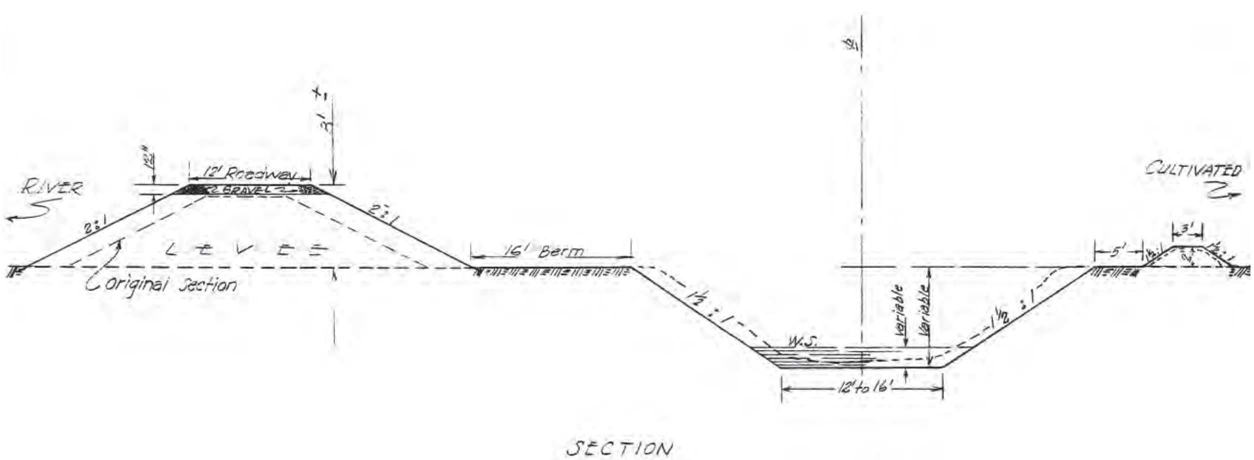


Figure 31. Drawing of typical section of riverside drain and levee, 1939. Source: MRGCD.

were eight to ten feet wide with slopes of 1½ to1 along the land side and 2½ to1 on the river side (Figure 32). In the 1950s, when they were renovated by the USACE and USBR, a new "engineered" levee was built (Figure 33). Less permeable soil was brought in from borrow pits to form a core within the levee structure that would be more resistant to erosion.

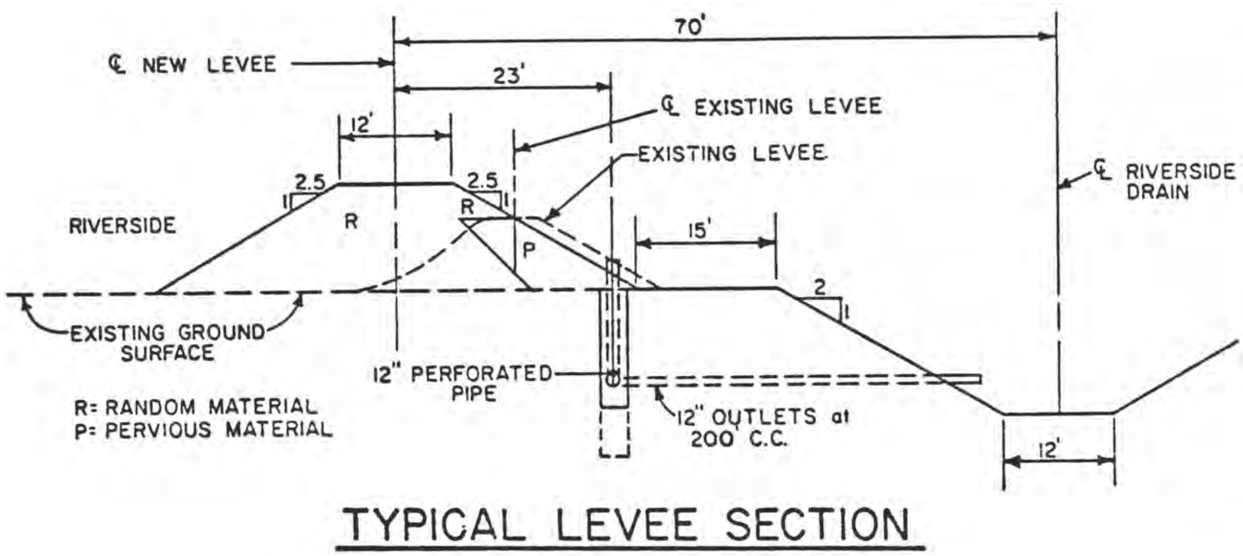


Figure 32. Drawing of typical levee renovation, showing use of pervious materials and toe drain design, circa 1980s. Source: USACE.

Figure 33. "Engineered" levee just north of Central Ave. Bridge, Albuquerque, 2007. Source: VCHP.

The earliest MRGCD design drawings show Chief Engineer Burkholder's concern for levee protection. One of the original designs for levee protection was a structure featuring eight-inch wood pilings, hog wire fencing, and brush (Figure 34). The pilings were driven twenty feet into the bank with the 36-inch high hog wire fence sitting on the river bank. Brush was then piled up against the spoil bank (Figure 35). A "deadman" tied the fencing into the bank.

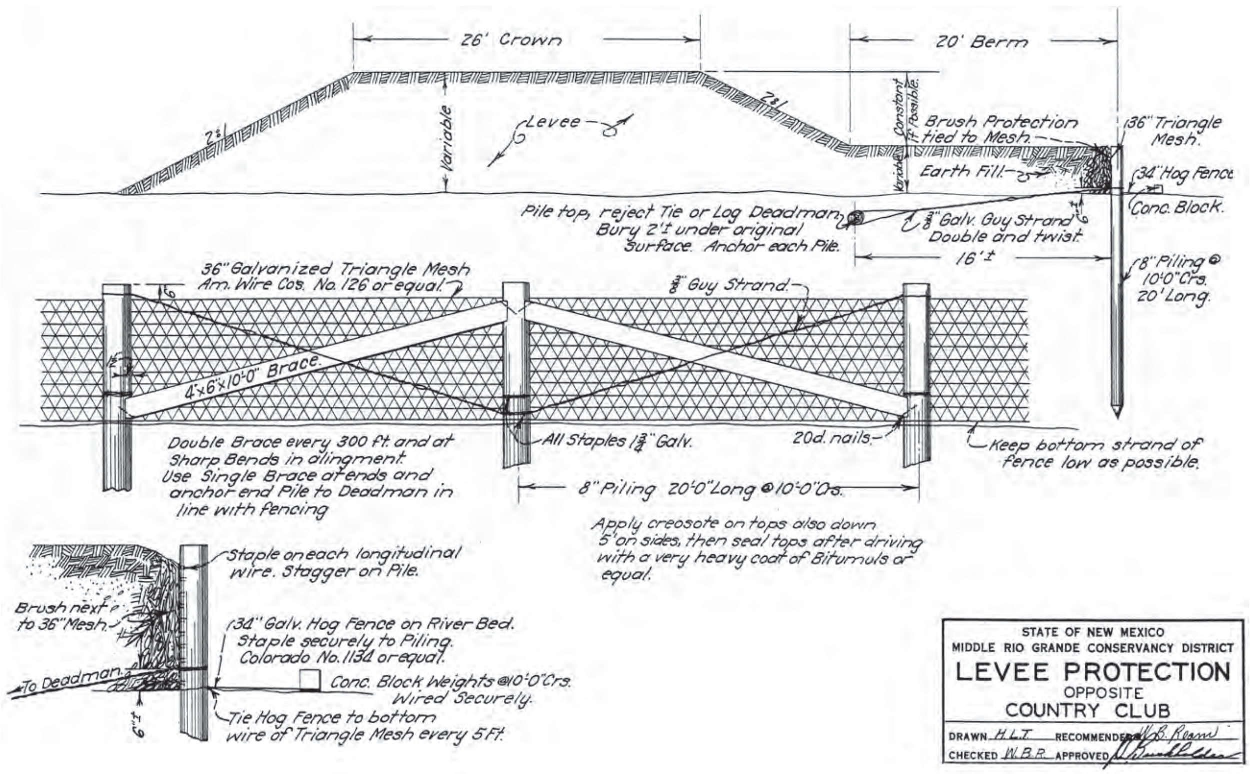
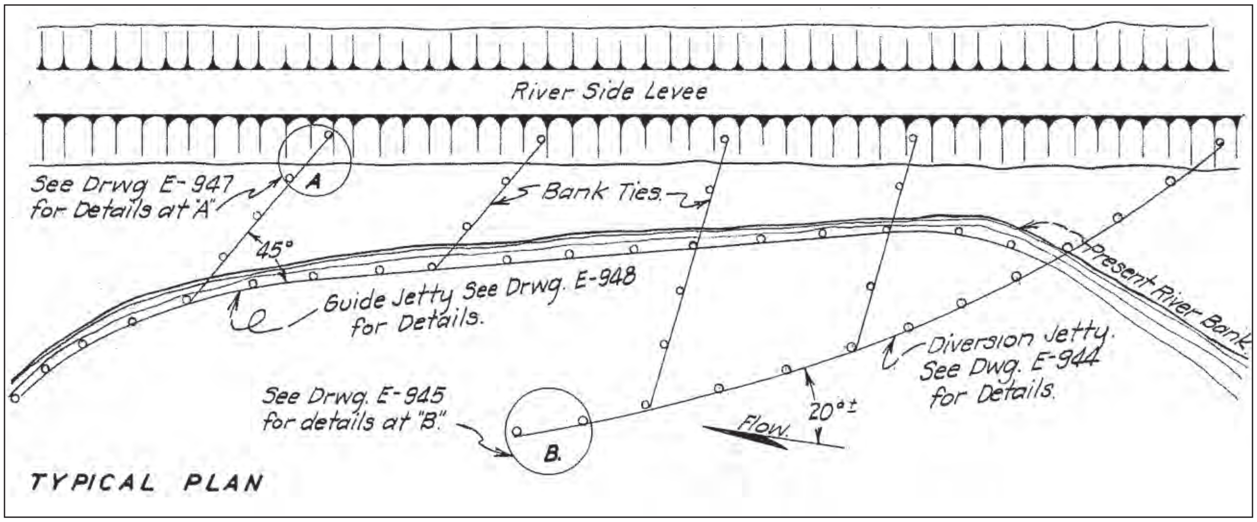


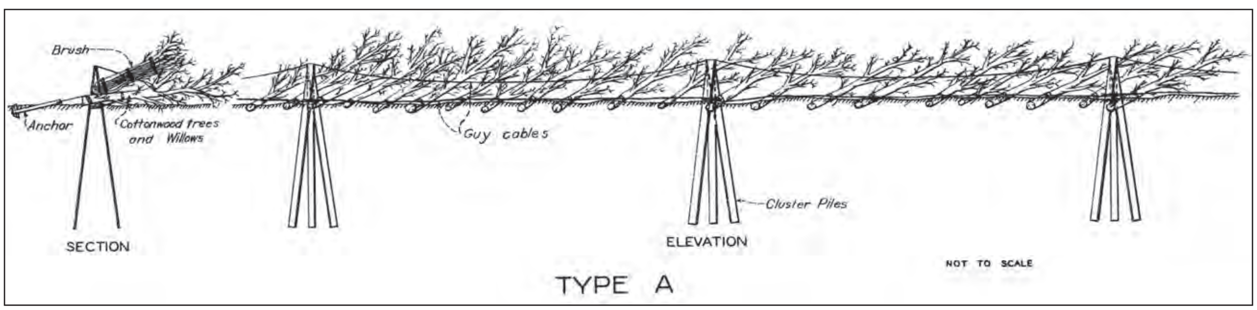
Figure 34. Drawing of MRGCD levee protection featuring pilings with triangle mesh wire fencing in the Country Club area of Albuquerque, 1928. Source: MRGCD.

Figure 35. Pilings and wire fencing protecting levee bank near Old Town, 1931. Source: MRGCD.

Permeable Jetties

MRGCD engineers recognized early in their planning that a jetty system had to be devised to control the flow of the river (Figure 36). Initial plans showed designs for three types of permeable jetty systems that when placed in the river would slow down its flow and allow silt to be deposited in the channel. This, in turn, would





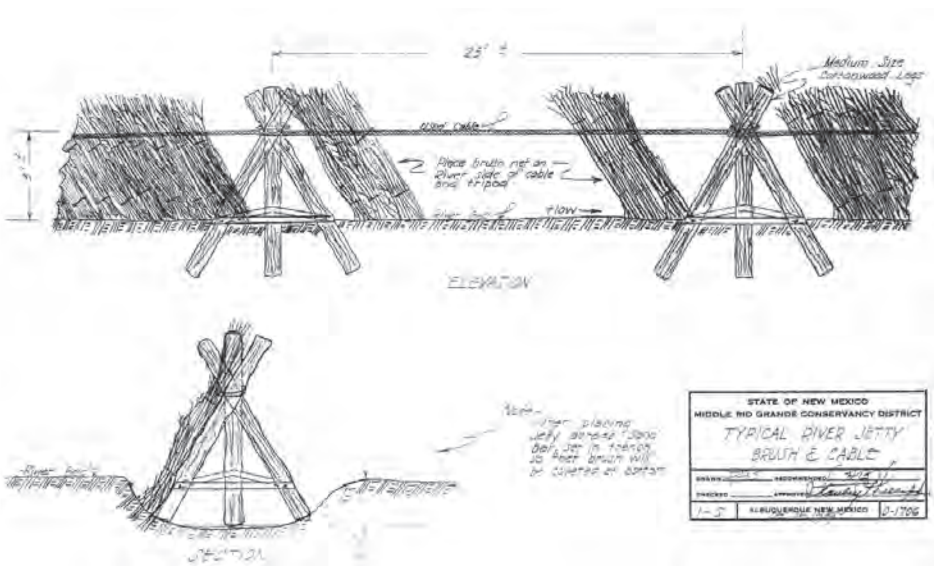


Figure 36. (Top) Drawing of typical plan for river protection work, 1928. Source: MRGCD.

Figure 37. (Center) Drawing of type A permeable jetty featuring pilings and brush structures, 1928. Source: MRGCD.

Figure 38. (Left) Drawing of typical river jetty made of brush and cable, 1939. Source: MRGCD.

create a new or enlarged river bank and narrow the river channel. Narrowing the channel also increased the velocity of the water, which scoured the river bottom and washed excess sediment downstream and helped minimize the aggradation problem (Burkholder 1928, 80). Burkholder's "Type A" jetty was a simple combination of wood pilings that anchored a brush structure comprised of cottonwood and willow trees cut from the adjacent floodplain, together with miscellaneous brush, held in place by steel cables (Figures 37 and 38). "Type B" was made of "galvanized woven wire metal fencing held in place by steel piling or other devices" (Burkholder 1928, 115) (Figure 39). "Type C" was the modified Kellner jack consisting of two steel cross braces tied together by a horizontal piece of angle steel (Figure 40).

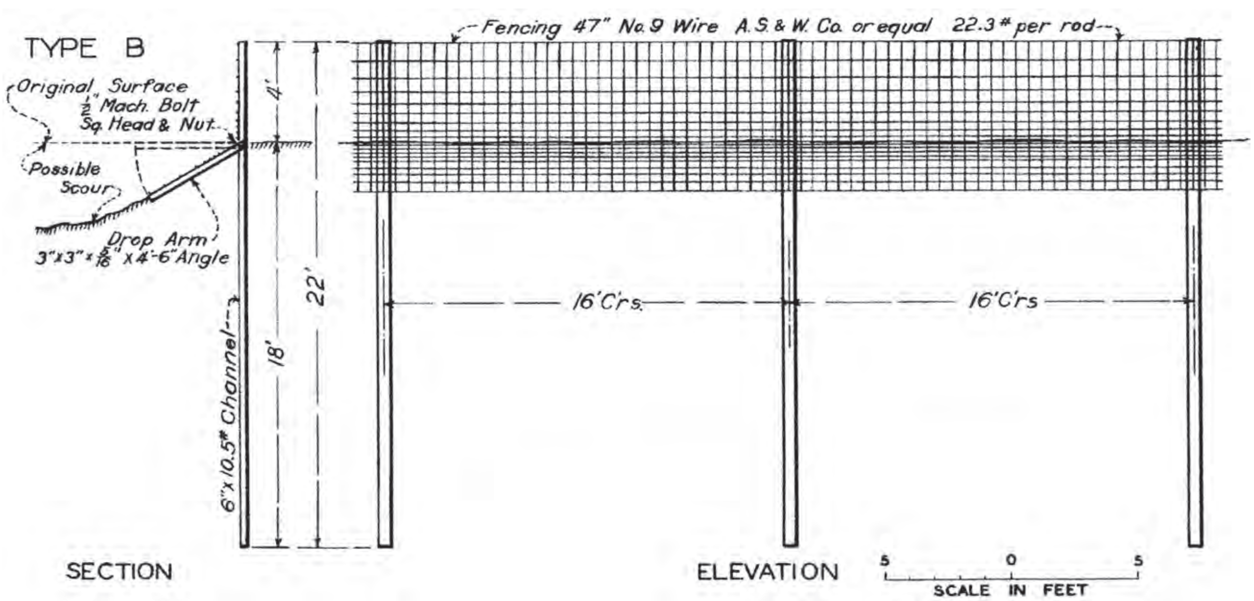
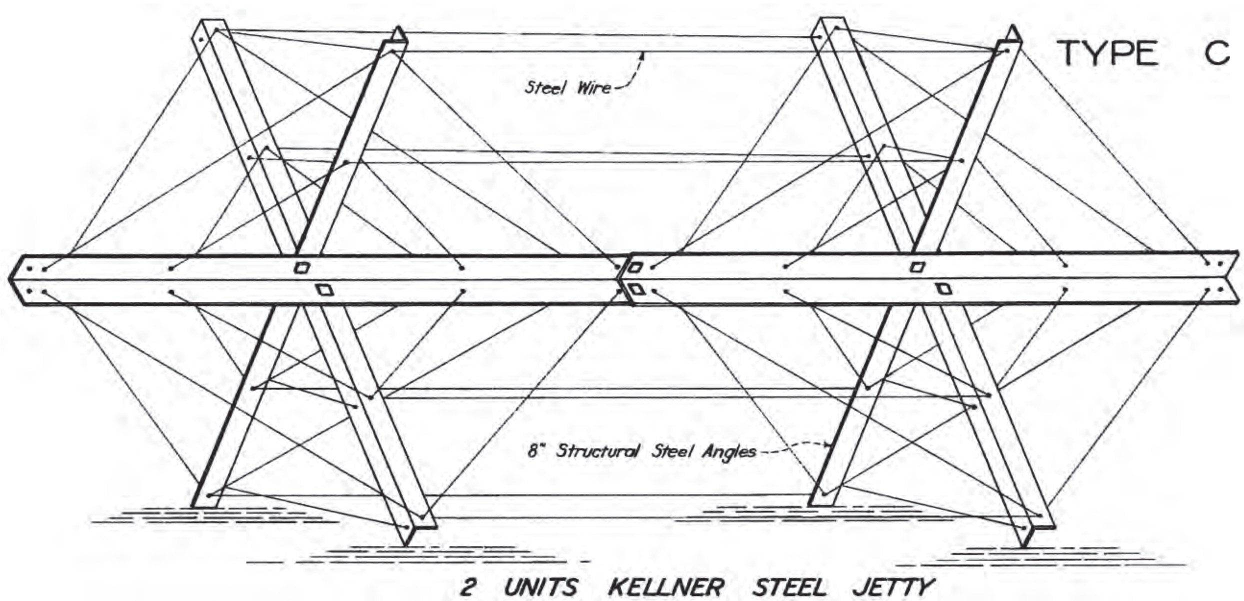


Figure 39. Drawing of type B permeable jetty featuring wire fencing, 1928. Source: MRGCD.

Figure 40. Drawing of a non-typical Kellner steel jack design, referred to as the MRGCD type C, 1928. Source: MRGCD.



In the 1950s when the USACE began to rehabilitate the MRGCD levee system, they relied on the latest design of the Kellner jack to provide levee protection (Grassel 2002, 11). Like other types of permeable jacks, the Kellner jack utilized the sediment built up along the base of the jack to form a bank or levee (Figure 41).

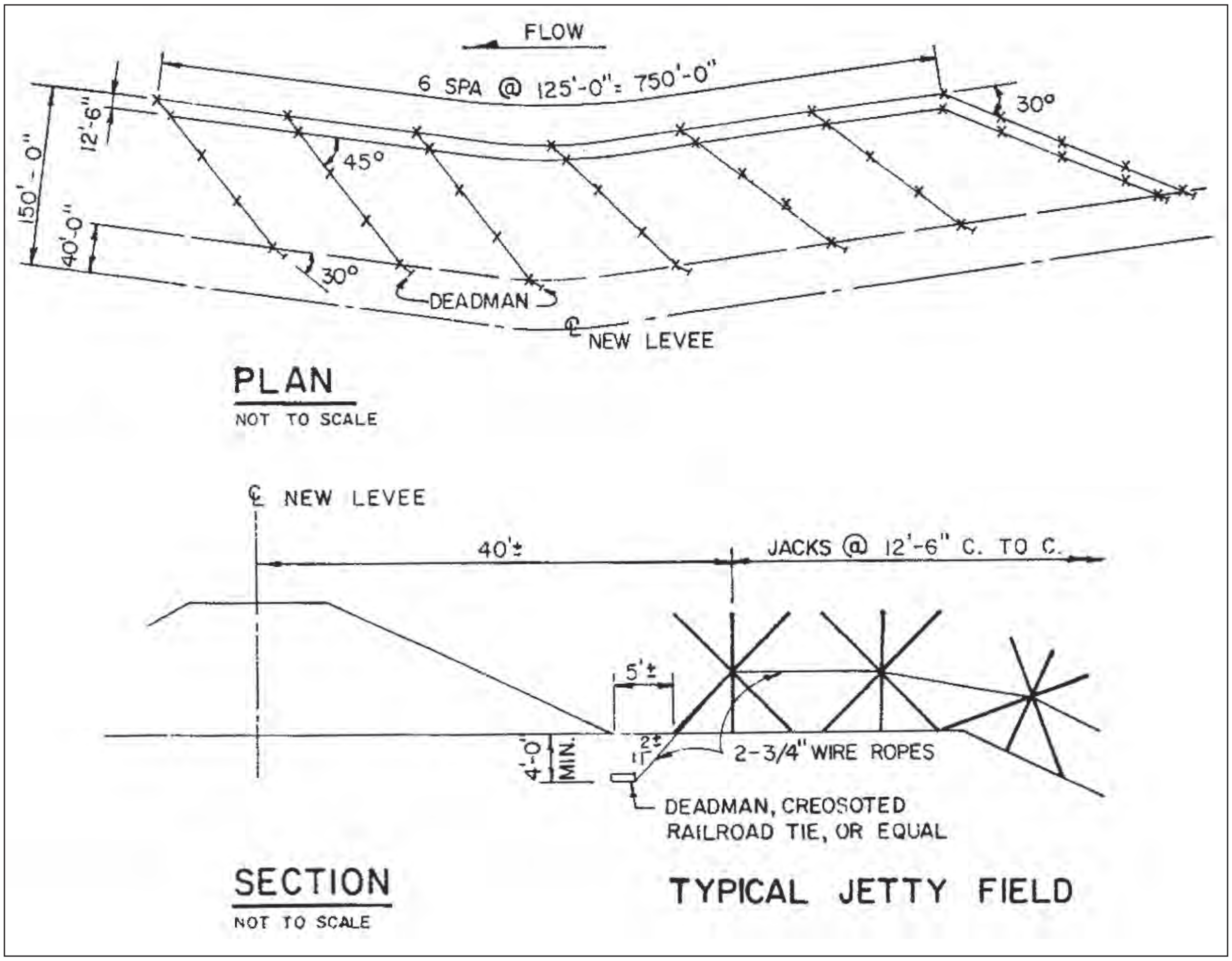


Figure 41. Drawing of typical jetty field, circa 1980s. Source: MRGCD.

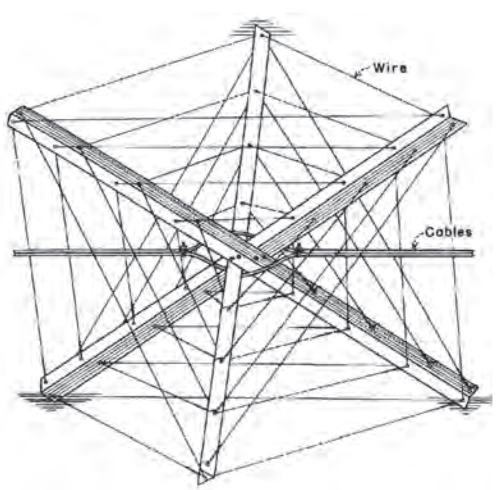


Figure 42. Drawing of standard Kellner jack design used post-WW II. Compare with Figure 40. Source: Woodson and Martin (1963, Figure 3).

The jacks were effective, inexpensive, and simple to construct. The jack was assembled from three 16-foot lengths of four-inch angle steel (Figure 42). The angles were bolted together at their midpoints and placed back-to-back with their longitudinal axes at right angles to each other. The angles were then laced with wire at 15-inch intervals. The jacks were then linked together by a thick cable to form a jetty (Grassel 2002, 17). This basic design has remained unmodified for more than fifty years (Figure 43-45).

Figure 43. (Top) Assembling Kellner jacks, circa 1950s. Source: USBR.

Figure 44. (Center) Placing Kellner jacks in Rio Grande floodplain, Belen Division, 1956. Source: USBR.

Figure 45. (Right) Kellner jack field north of Central Ave. Bridge, Albuquerque, 2007. The Rio Grande is located behind the line of trees on the right of the photo – some distance from the jetty jack field. Source: VCHP.

IRRIGATION SYSTEM FEATURES

Diversion Dams

Diversion dams are low dams used to back up the river in order to divert the flow into main irrigation canals. The Albuquerque Division is served by the Angostura Diversion Dam located some twenty-four miles north of Albuquerque near the village of Algodones. In 1928, its design was described as a low, flat, "Indian" type weir situated on sand and gravel bars in the river (Burkholder 1928, 127). In its original design it had a length of 938 feet including the sluiceway with a top slope made of hand-laid rock measuring 520 feet. It was six feet high with a base that was 70 feet wide. The river section of the dam was comprised of loose rock held in place by sheet pilings and concrete walls. The toe of the dam was rip-rapped for protection. The sluiceway was located at the east end of the structure and had five openings, each 20 feet wide. Five radial gates, each measuring 20 feet wide by 6.4 feet high, controlled the flow. The concrete floor of the structure extended 57 feet upstream and 40 feet downstream. The headworks of the dam consisted of a skimming weir, 149 feet long, that kept heavy sands and gravels from entering the irrigation canal. The canal gate was a radial design with the same dimensions as the sluiceway gate, and was located 150 feet downstream from the weir. These headworks were designed to divert 550 cfs into the canal for irrigation purposes (Figure 46). The Angostura Diversion Dam was rehabilitated by the USBR in 1958 (Ackerly et al. 1997, Appendix G).

Figure 46. Outlet works at the Angostura Diversion Dam, 2007. Source: VCHP.

The Belen Division is served by the Isleta Diversion Dam located twenty-five miles south of Albuquerque on the Isleta Pueblo reservation. The dam was designed as a flat, crested concrete slab, 692 feet long on a foundation of silt and fine sand (Burkholder 1928, 128). Its crest was 40 feet wide and the structure was protected by rip-rap 20 feet wide and 5 to 10 feet thick. There were sluiceways located at each end of the structure, which were controlled by six radial gates, 20 feet wide and 6.4 feet high. The headworks had skimming structures measuring 170.5 feet and 84.5 feet and water entered the canals at each end through headgates. These gates were capable of diverting 300 cfs of irrigation water at the east end into the Peralta Main Canal, and 1,000 cfs into the Belen High Canal that came off the west end of the structure. The Isleta Diversion Dam was rehabilitated by the USBR in 1955 (Ackerly et al. 1997, Appendix G).

Canals

Canals are the primary water structure in the irrigation system. As planned they would head at the diversion dam and run the length of the division. The Albuquerque Main Canal headed at the east end of the diversion dam (Figures 47 and 48). Its base was 20 feet wide with a crown of 12 feet and it held 5.8 feet of water. The slope of the canal walls was 1½ to 1. The canal ran along the valley floor between east bank of the river and sand hills flanking the valley edge. As the canal passed the city, it ran underneath the Rio Grande through an inverted siphon made of reinforced concrete and traveled along the west side of the river through the Atrisco

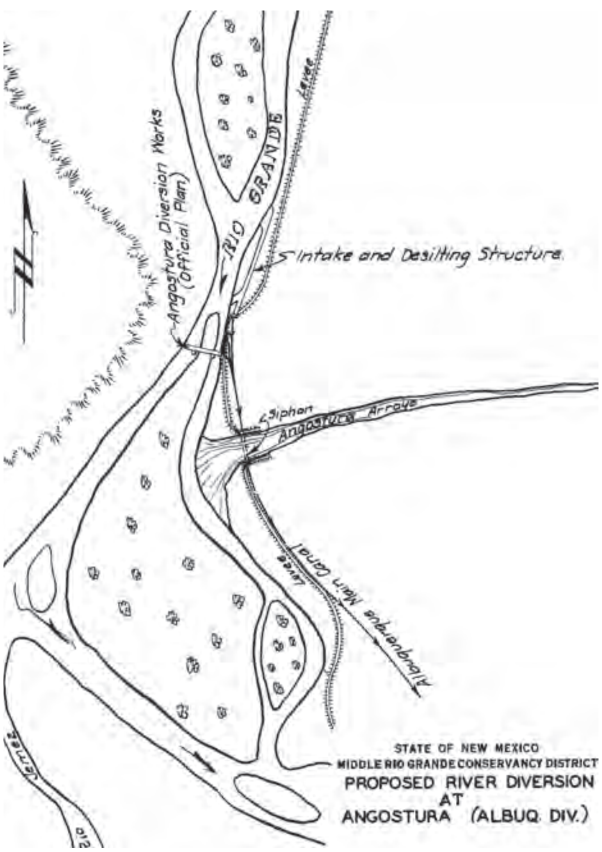


Figure 47. Proposed plan of the river diversion at Angostura dam, 1928. Source: MRGCD.

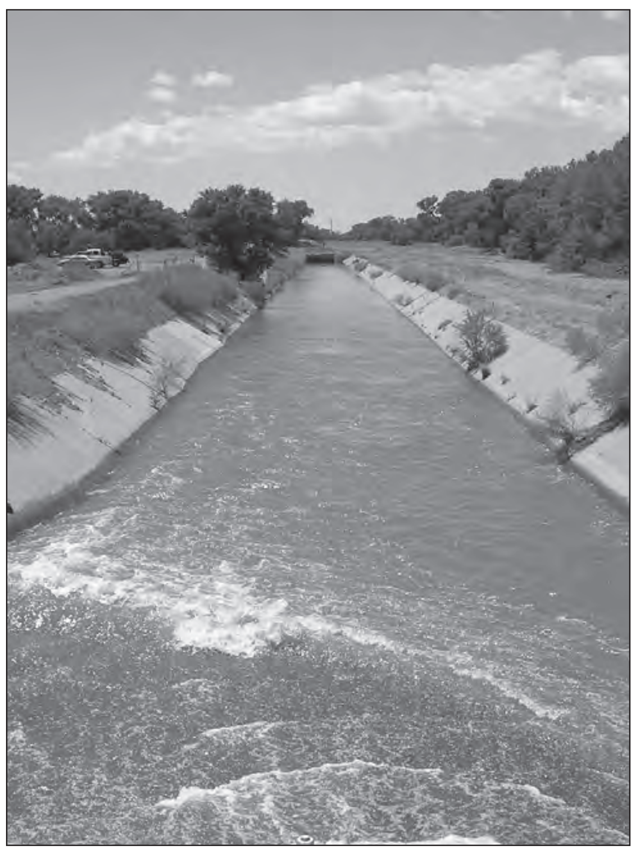


Figure 48. Concrete lined Albuquerque Main Canal looking south from the Angostura diversion dam, 2007. Source: VCHP.

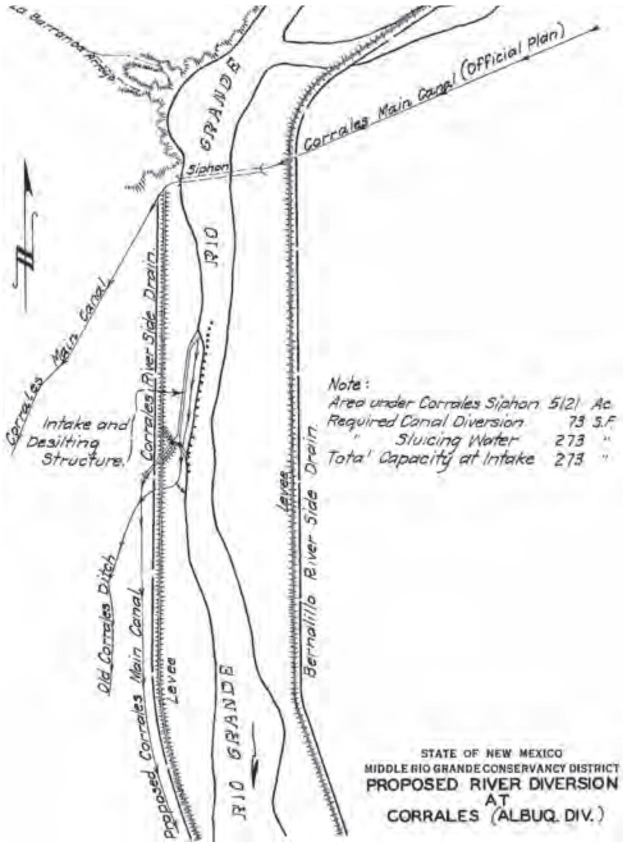


Figure 49. (Above) Drawing of proposed river diversion at Corrales (Albuquerque Diversion), 1928. Source: MRGCD.

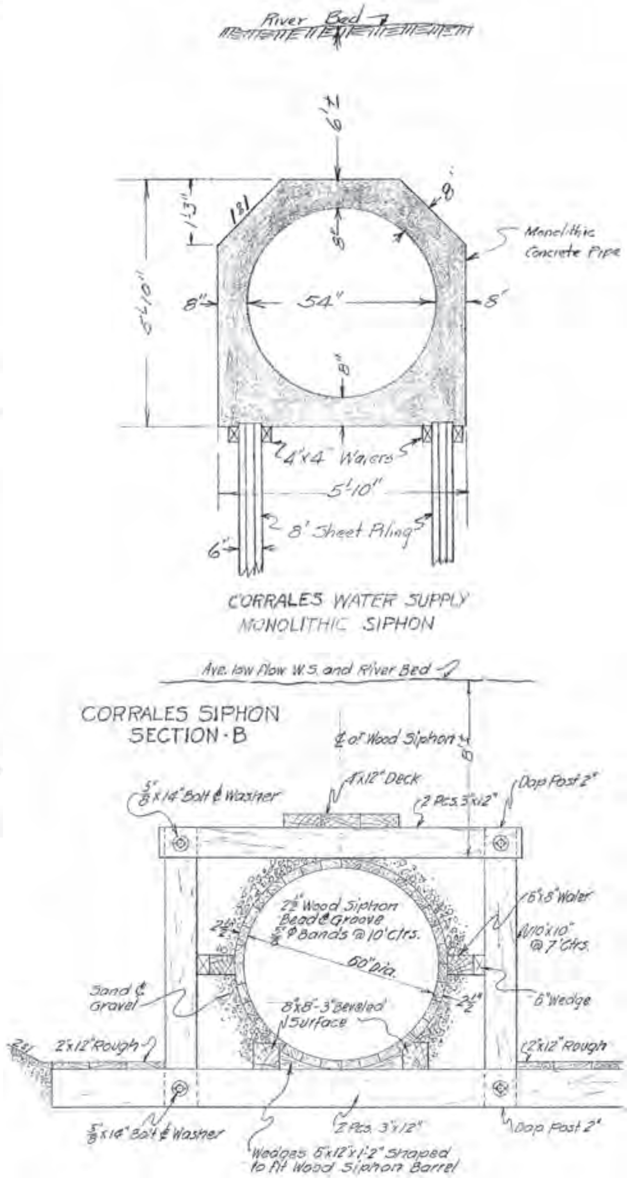


Figure 50. (Right) Construction drawings of a monolithic concrete siphon and an alternative wooden siphon proposed for the Corrales unit, 1933. Source: MRGCD.

and Pajarito units (Figure 49). The canal ended at the Isleta Pueblo reservation boundary. The Corrales Main Canal diverted water from the Albuquerque Main Canal just south of the Alameda Grant boundary line and brought irrigation water to the west side of the river through a 1,200-foot long siphon (Figure 50).

The Peralta Main Canal came off the east end of the Isleta dam and turned south through the communities of Peralta, Valencia, and Tomé. The canal ended at the base of Cerro Tomé. The structure was 12 feet wide with a crown of 14 feet and a water depth of 4.8 feet. Due to grade differences, the canal dropped at one-half mile intervals. The Belen High Line Canal, as originally designed, was the largest canal constructed by the MRGCD. The Belen canal measured 30 feet wide at its base and had a crown of 18 feet. It had a water depth of 8 feet with maximum flow capacity of 1,000 cfs, designed to provide irrigation water to 10,000 acres. There were no drops along the canal; however, a wasteway and sand trap were located three and one-half miles south of the diversion dam.

The MRGCD canals, together with its laterals, *acequias,* and drains, were substantially rebuilt by the USBR between 1956 and 1962. New features such as the Atrisco siphon were constructed, and the earthen canals were finished with concrete (Figure 51). As noted in the Ackerly report, "[B]y the time the BOR [USBR] was done, the only thing remaining of the original canal or drain was its location. In a few cases, moreover, totally new features were built as part of the revitalized system" (Ackerly et al. 1997, 58) (Figures 52-55).

Figure 51. (Left) Rehabilitation of the Atrisco Siphon, 1956. Source: USBR.

Figure 52. (Center Left) Rehabilitation of Albuquerque Riverside Drain showing installation of 72-inch concrete pipe, 1955. Source: USBR.

Figure 53. (Center Right) Renovation of the Alameda Interior Drain, 1955. North Second Street and the now demolished Star Drive-In can be seen on the right side of the photo. Source: USBR.

Figure 54. (Bottom Left) Construction of a new concrete drop structure for Belen Wasteway, 1957. Source: USBR.

Figure 55. (Bottom Right) Cleaning operations on the Lower Old Jarales Acequia, 1957. Source: USBR.

Laterals

Laterals carry water from the main canals to the *acequias* or fields. Burkholder described laterals as being of a similar structure to canals but smaller and less expensive to build (Figure 56). The original plan called for the 378.2 miles of laterals to be built throughout the Conservancy District, with 114.3 miles in the Albuquerque division (Burkholder 1928: 125) (Figure 57). In 1940, MRGCD sources indicate that 87.7 miles of laterals had been constructed in the Albuquerque division, while the Belen division had 158 miles (Ackerly et al. 1997, Table 6).

Figure 56. Huning Lateral in the Belen Area showing new concrete check structure, 1957. Source: USBR.

Figure 57. Acequia turnouts located along the Gallegos Lateral in the North Valley, 2007. Source: VCHP.

Acequias

Acequias or "ditches" were the smallest water transporting component of the MRGCD. These are still generally earthen structures that carry a maximum flow of 15 to 60 cfs (Figure 58). Many of these features are remnants of nineteenth century (or perhaps even earlier) *acequias* that were incorporated into the MRGCD in the 1930s (Figure 59). As early as 1939, these features were undergoing design modification.

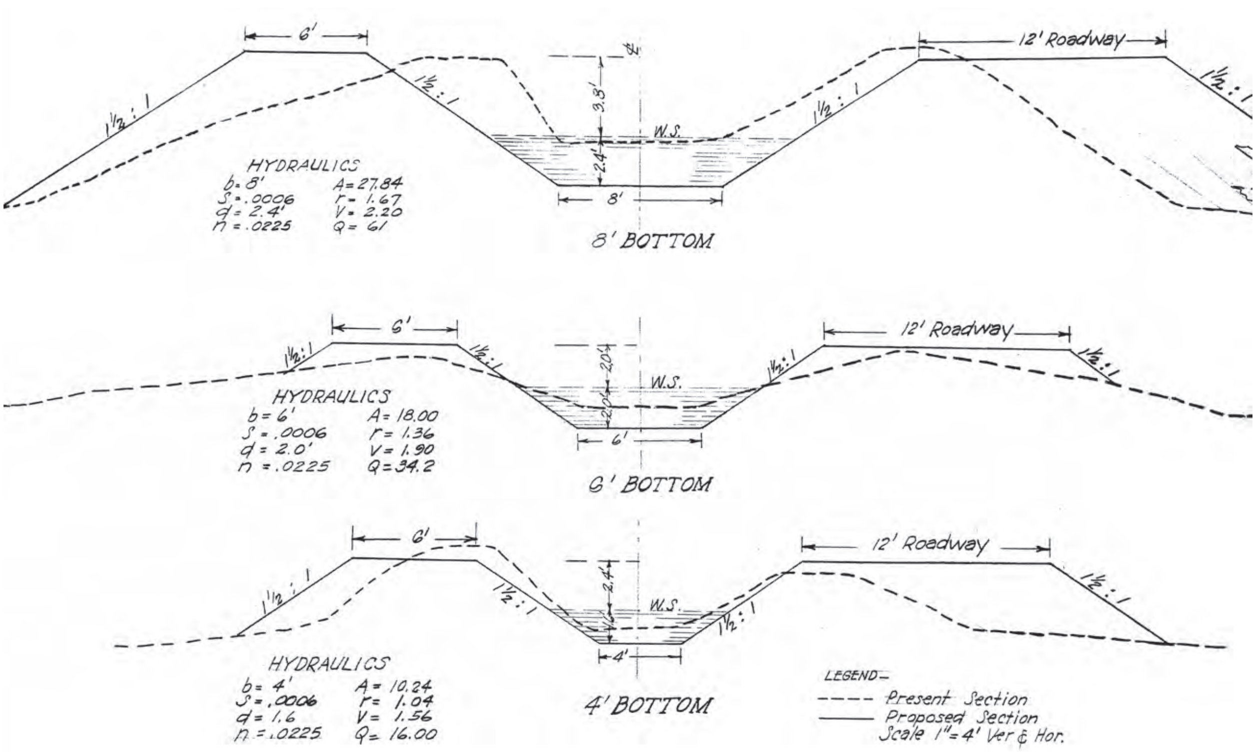


Figure 58. (Above) Drawing of typical sections for irrigation ditch renovations, 1939. Source: MRGCD.

Figure 59. (Left) Old style acequia near Algodones, 2007. Source: VCHP.

Canal and Lateral Features

The canals and laterals required a number of water control features to move water from the canals to the farm fields. These included: checks to hold back water in the canals, gates – which functioned similarly to checks – and farm turnouts to feed water into the *acequias.* Checks and gates were originally designed of wood, but were later fabricated from concrete and metal. They featured screw or ratchet lifts that were hand operated to open the gates (Ackerly et al. 1997, 148) (Figures 60 and 61). Turnouts were metal gates that would slide in a steel frame and discharge into a metal pipe of 12, 15 or 18 inch diameter (Figures 62 and 63). The 1928 plan called for a turnout to be placed approximately every quarter mile on laterals and every half-mile when placed directly on a canal. The conservancy district anticipated a need for 3,000 of the turnout gates (Burkholder 1928: 100).

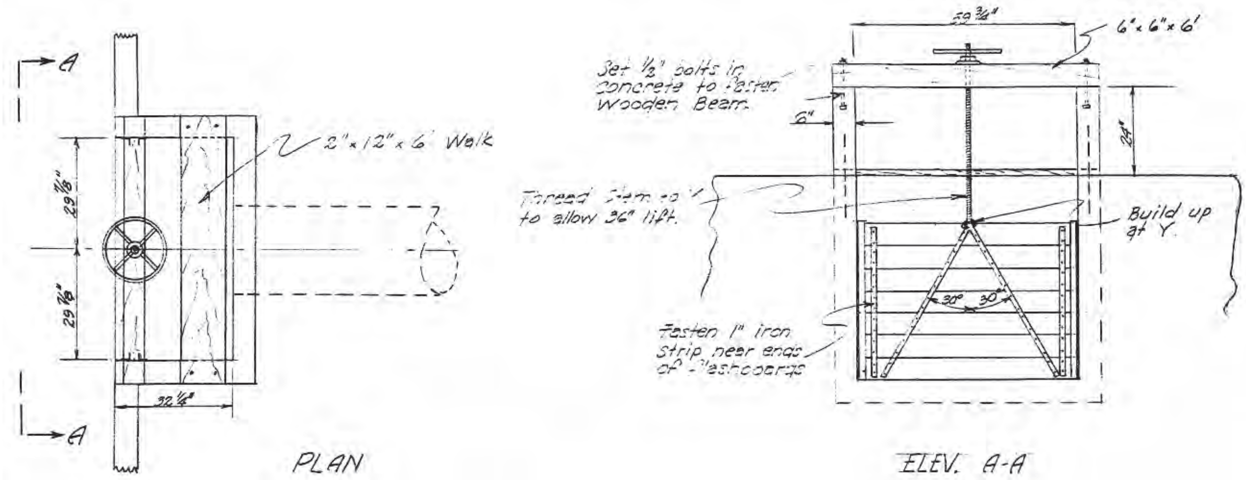


Figure 60. (Above) Construction drawing of flash-board hoists for turnout, date unknown. Source: MRGCD.

Figure 61. (Left) Metal turnout on Old Jarales Acequia, 2007. Source: VCHP.

Figure 62. Metal turnout and precast concrete headwall installed on Old Jarales Acequia, 1957. Source: USBR.

Figure 63. Radial gate check on unidentified lateral in the Socorro Division, 1952. Source: USBR.

Canals also featured a concrete lining, called a drop, that was placed where a canal changed grade and was designed to prevent erosion. Flumes were built to convey canal water over obstacles, such as drains or other ditches, and a number of bridges were constructed throughout the system to allow vehicles and pedestrians access to the canals, laterals, and drains (Ackerly et al. 1997, 148) (Figure 64). Like other MRGCD features, most of these were originally constructed of wood and later replaced by concrete or steel materials (Figure 65).

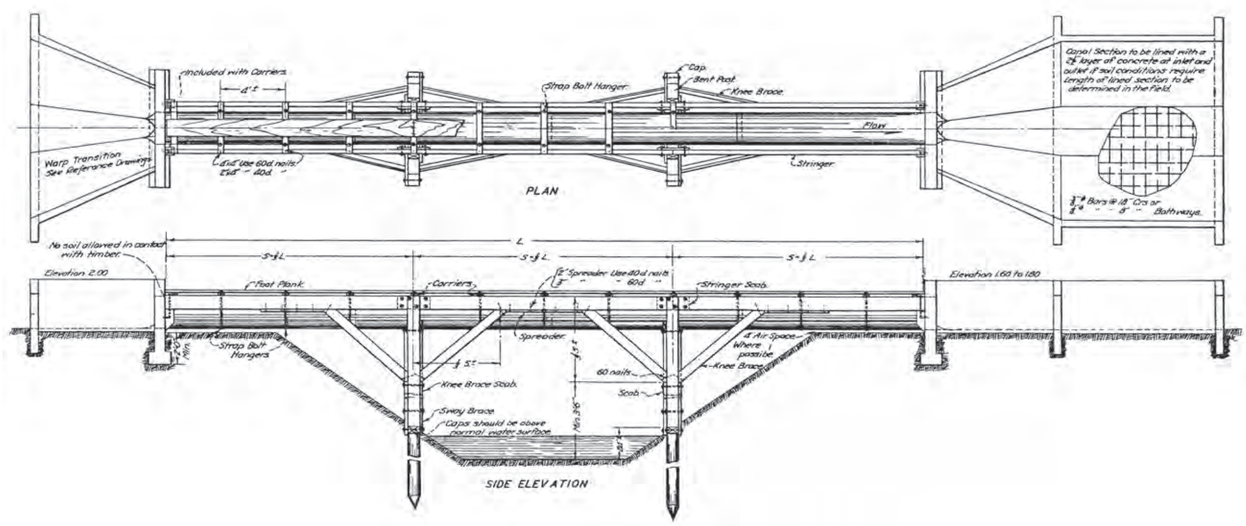


Figure 64. Drawing of standard pipe flumes with timber substructure, 1930. Source: MRGCD.

Figure 65. Gallegos irrigation flume crossing the Alameda Interior Drain, 1930; Covered flume carrying irrigation water over the Alameda Interior Drain near Old Town, 1930. Source: MRGCD.

Drains

The engineering staff for the MRGCD designed two types of drains: (1) riverside drains and (2) interior drains. The system also has wasteways, which are shorter sections of drains that move excess water away from the fields and into the larger drains or the river. Riverside drains were constructed alongside a levee and were formed as trenches were dug to provide material to build the levees (Figure 66). The riverside drains were designed to be 6 to 8 feet below ground level with a bed width of a minimum of ten to twenty feet and a slope of 1-½ :1 foot (Burkholder 1928:117). This type of drain was excavated below the groundwater level in order to catch subsurface water and seepage from the river. The water would then be returned to the river to continue its flow downstream (Figure 67).

Figure 66. Albuquerque Riverside Drain (left side of photo) looking south near Old Town, 1931. Note wooden footbridge across drain. Source: MRGCD.

Figure 67. Albuquerque Riverside Drain at the Griegos Heading, 1952. Source: USBR.

Interior drains were constructed to run through the irrigated fields and designed to drain away excess water. Interior drains were designed to lower the water table by transporting subsurface water to riverside drains for eventual deposit into the river (Figure 68). The interior drains were wider and deeper than the riverside drains. They were eight to fourteen feet wide and built to a depth of ten feet as they ran through the fields and decreased in depth as the drain fed into the shallower riverside drain. The system was designed so that no field was farther than one half mile from an interior drain.

Figure 68. Alameda Interior Drain, looking north along Second St., 2007. Note water coming out of culvert from adjacent land formerly used for farm fields, but now built up with suburban housing. Compare with Figure 54. Source: VCHP.

V. EVALUATION OF NATIONAL REGISTER SIGNIFICANCE FOR MRGCD ENGINEERING STRUCTURES AND FEATURES

This section will evaluate the historic significance of the engineering structures and features constructed by the MRGCD in accordance with the criteria set forth in the National Register Bulletin for applying National Register criteria (National Park Service, 1997). Much of this discussion will incorporate the recommendation on historic significance and integrity of the MRGCD's irrigation system made by Ackerly, et al (1997, 149-53) to the USBR. This previous study focused on the district's diversion dams, drains, canals, laterals, and *acequias*. No recommendations were made with regard to levees and channelization structures, such as jetty jacks. The present study will comment on Ackerly's evaluation of significance for the irrigation system and include VCHP's evaluation for the structures not previously considered.

All the structures discussed are components of the original 1928 plan for the district (Burkholder 1928), and most were built between 1930 and 1941. Many of these structures have undergone subsequent modifications or alterations in design and materials, primarily between 1956 and 1963, as new technologies were developed and funding was made available to rehabilitate and upgrade the system. There have also been additional laterals and ditches constructed, and some laterals and drains abandoned, since that initial construction period; however, the MRGCD *system* itself remains relatively unchanged, and thus the conservancy district as a whole meets the "50 years or older" age criterion.

Ackerly's report found none of the MRGCD structures or features <u>individually</u> eligible for the National Register of Historic Places (National Register). VCHP concurs with this finding and, in addition, finds that no individual levee structures or jetty jacks to be individually eligible. However, VCHP agrees with the Ackerly report that the structures and features that comprise the MRGCD do constitute a <u>historic district</u>. According to the National Register Bulletin (1997, 5): **A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development.**

The diversion dams, canals, laterals, *acequias*, drains, and their associated appurtenances (headgates, turnouts, siphons, etc.), together with the levees and jetty jack fields, were conceived in 1928 and constructed over a ten year period (1930-40) to create an interconnected engineering system to enhance irrigation agriculture and control flooding along the middle Rio Grande valley. The MRGCD was planned from the beginning to work as a system in which all the major engineering structures played an integral and interrelated part in making the system work. Without any one of these structures, the system would have failed or at least would have been less effective. As such, these engineering structures and features should be considered <u>contributing elements</u> to the historic district.

In accordance with National Register guidelines, "A district must be significant, as well as being an identifiable entity." The district's historic significance must be considered under the National Register criteria discussed in the Bulletin (1997, 12-24). VCHP concurs with the Ackerly report that the MRGCD is eligible for the National Register under **Criterion A: Properties associated with events that have made a significant contribution to the broad patterns of our history.** Specifically, the district is eligible under the areas of significance pertaining to agriculture and, to a lesser extent, engineering (this qualification will be explored below).

As noted by Ackerly, et al (1997, 150): "[T]he creation of the MRGCD [is an] important chapter in a long-term historic trend from numerous, small-scale, locally managed acequias to a single, large-scale, centrally planned system whose waters are allocated at the interstate level." The conservancy district was part of the historical trend of irrigation agriculture in the Western United States that emphasized water management and control and the reclamation of previously undeveloped land. The MRGCD was unique, however, in that it built upon an existing, small-scale system developed in Spanish Colonial (and perhaps even pre-Columbian) times that had fallen into disrepair and failing environmental conditions. So, in addition to reclaiming previously unused "desert lands," the MRGCD rehabilitated and rejuvenated existing farmlands. The district followed a common pattern of transitioning from individually managed, small-scale ditch systems, to larger systems backed by large capital investment to the seemingly inevitable involvement of the Federal Government for not only capital improvements, but management of the system. The result was the doubling of cultivated acreage and the elimination of environmental problems such as seepage and alkali buildup. The MRGCD also concerned itself with flood control on the Rio Grande, which of course was intimately tied to the valley's agricultural practices, but in addition was a major factor in the city of Albuquerque's urban development during the 1930s and following World War II.

The significance of the MRGCD with historic engineering themes has been compromised by the rehabilitation of the system by the USBR and the USACE in the 1950s and 60s. At that time many of the original features, often made of wood, were replaced with concrete and steel materials. On the other hand, the system itself retains its original design and function, albeit with new component materials. It is still a relatively simple, hand-operated, gravity-fed irrigation system. For this reason, the system, together with its contributing elements, still maintains a sense of its engineering history; however, strictly speaking the modifications made to the structures and features have negated its significance with regard to **Criterion C: Properties that embody the distinctive characteristics of a type, period, or method of construction.** In other words, the MRGCD system is still identified with the irrigation history of the Rio Grand valley, and thus eligible under Criterion A, but substantial modifications to the individual structures prevent the MRGCD from being eligible for its identification with specific historical agricultural engineering solutions under Criterion C (see also discussion in Ackerly 1997, 152).

In addition to historical significance, to be considered eligible for the National Register a district must retain integrity, which, as defined by the National Register Bulletin, means "the ability of a property [or district] to convey its significance" (1997, 44). The Bulletin defines seven aspects of integrity to be considered: location, design, setting, materials, workmanship, feeling, and association.

The MRGCD essentially retains its integrity with regard to location, design, and setting. The conservancy district has not substantially relocated the basic structures and features that make up the irrigation and flood control system. Although some individual canals, laterals, ditches, and drains have been added, relocated, or abandoned over the past seventy-five years, the system itself is still in the same location as designed. Similarly, the design of the system has not been altered. It is still a gravity-fed irrigation system in which the headgates and turnouts are still manually operated. Again, although some of these individual features have been replaced with new materials, the functioning of the system is still the same as when designed in 1928. The setting of the MRGCD, especially outside the metropolitan Albuquerque area, is still predominately rural as it was at the time of the project's inception. Urbanization, in the form of commercial properties and housing subdivisions, have intruded upon this landscape, particularly in the area immediately north and south of the city; however, it should be remembered that this urban "sprawl" was already underway in Albuquerque's North Valley when construction of the MRGCD was started.

The MRGCD lacks integrity in the aspects of materials, workmanship, feeling, and association. This is due primarily to the rehabilitation of the system undertaken following the Second World War. Many of the original earthen irrigation ditches were lined with concrete to prevent seepage and wood water control structures were replaced by ones made of concrete and steel. This modernization of materials altered the historic qualities of these structures in regard to their workmanship, and consequently resulted in the loss of feeling and association of the engineering designs used to construct the original structures in the 1930s (see also Ackerly 1997, 151-52).

The Ackerly report (1997, 152) summarizes the argument in favor of integrity as follows: "In summary, the MRGCD system completed in 1936 is eligible to the National Register of Historic Places because it is associated with the important events in local history and retains the ability to convey that historic significance, but not as an important example of historic engineering design." VCHP agrees with the Ackerly report that the totality of the MRGCD system, including both the irrigation system and flood control structures, still retains its overall integrity through its identification with the history of agriculture in the middle Rio Grande valley, and for its contribution to the development of the city of Albuquerque. It is VCHP's recommendation that the levees and jetty jacks, as well as the irrigation system features previously identified in the Ackerly report, are eligible as contributing elements to the historic district under Criterion A.

VI. MANAGEMENT RECOMMENDATIONS FOR THE LEVEES AND JETTY JACKS AS CONTRIBUTING ELEMENTS TO THE HISTORIC DISTRICT

The Ackerly report (1997, 152-53) addresses the issue of managing the contributing elements that make up the MRGCD historic district. The authors note that the district is eligible under Criterion A, and not Criterion C, and, therefore, to avoid effects on the integrity of the system "it is not necessary to preserve specific engineering solutions if the overall ability of the system to convey its historic importance is preserved." For example, while the infilling of the main canals would have an adverse effect on the district's ability to convey the history of the conservancy district, the replacement of a turnout, check, bridge would not have such an effect on the district's historic integrity.

VCHP agrees with this conclusion, and also supports the finding by Ackerly et al. that the best action to be taken to protect the district would be a multi-agency programmatic agreement (PA), including the USACE, the USBR, and the MRGCD, that would stipulate those contributing elements which would require consultation under Section 106 of the NHPA and those which could be programmatically excluded from the review process as long as the proposed undertaking was in conformance with the PA.

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DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

98447

December 20, 2013

rec'd by J. Decker 1/23/14

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

RECEIVED
DEC 23 2013
HISTORIC PRESERVATION DIVISION

Dr. Jeff Pappas
State Historic Preservation Officer
Historic Preservation Division
Bataan Memorial Building
407 Galisteo Street, Suite 236
Santa Fe, NM 87501

Dear Dr. Pappas:

Pursuant to 36 CFR Part 800, the U.S. Army Corps of Engineers, Albuquerque District, (Corps) is planning levee rehabilitation for a portion of the Rio Grande Floodway in Bernalillo and Valencia Counties, New Mexico. The formal project name for this undertaking is the Middle Rio Grande Flood Protection Project, Bernalillo to Belen, New Mexico. The project sponsor is the Middle Rio Grande Conservancy District (MRGCD). The existing spoil-bank levee is located along east side of the Rio Grande in the Mountain View Units and the east and west sides of the Belen Unit of the Rio Grande Floodway (Enclosure 1). The Preliminary Preferred Plan consists of rehabilitation of the existing spoil-bank levee (non-engineered) by constructing a structurally sound, engineered earthen levee extending approximately 30 miles along parts of the east and west banks of the Rio Grande, from its northernmost point at the Albuquerque South Diversion Channel southward to the town of Jarales, downstream of Belen (Enclosure 1). The Corps is seeking your concurrence in our determination of "No Adverse Effect to Historic Properties" for the project.

The currently proposed project is one unit within the comprehensive plan of development for flood control in the Rio Grande Basin, New Mexico that was authorized by the Flood Control Acts of 1948 (P.L. 80-858, Section 203) and 1950 (P.L. 81-516), in accordance with the recommendations of the Chief of Engineers, as found in House Document No. 243, 81st Congress, 1st Session, dated April 5, 1948. The Authority provided a comprehensive plan for coordinated development of water resource and flood risk management on the Rio Grande, by the Corps and U.S. Bureau of Reclamation, commencing near Truth or Consequences at about river mile 123 extending upstream to the lower end of the Rio Grande Canyon 14 miles upstream from Española, New Mexico at about river mile 394. The comprehensive plan included channel rectification, improvement of irrigation works, dredging, construction of three reservoirs and levee enlargement and construction. Levee rehabilitation for this particular section of the Middle Rio Grande was originally studied by the Corps in the 1970s and documented in a 1979 feasibility report entitled "Middle Rio Grande Flood Protection, Bernalillo to Belen, New Mexico, Interim Feasibility Report" which documented the flooding problems along the Middle Rio Grande between Bernalillo and Belen. The 1979 feasibility report studied seven total units including Bernalillo, Corrales, Mountain View, Isleta East, Isleta West, Belen East and Belen

The levee system has deteriorated to the point that in 2005 the regulated release to Albuquerque could not be made to the 7,000 cfs peak flow as planned. As flow was approaching 6,000 cfs it became apparent that at least one reach of spoil levee in the vicinity of the Isleta Pueblo and Bosque Farms on the east side of the Rio Grande would be in jeopardy of failure if flow was maintained or increased as planned. This was a general seepage failure through and under the spoil levee for an extensive reach approaching a length of a mile or more. To add to the problem, monsoonal rain storms can fall within the watershed below the reservoirs and therefore, cannot be regulated. These flows can reach much greater flows, albeit for much shorter durations. The higher flows could also result in failure(s) of the existing spoil bank levees and cannot be influenced by reservoir operations to lessen the impact.

Proposed project activities include replacing the existing spoil-bank levees with engineered, trapezoidal levees that would provide protection from the one-percent chance exceedence flood event (formerly the 100-year flood) plus an additional three feet of freeboard. The engineered levees would be constructed within the same footprint of the existing spoil banks, and the spoil banks themselves would be utilized as fill material for the newly constructed levees. The spoil banks were constructed through decades of dumping spoil materials from the riverside drains onto the piles to create an irregularly-shaped alignment paralleling the riverside drain. As such, the footprint of the spoil banks throughout the project area is larger than is necessary for the engineered levees. The engineered levees, therefore, will fit within the existing disturbed area created by the spoil banks, and will not increase the footprint of disturbance. Because the new levees will follow the existing alignment, no changes will be made to the alignment, function or form of the riverside drains or the access road that follows the drain along the landward toe of the levees. Existing access roads are currently maintained along the spoil banks by MRGCD, and these roads will be used to access the project area. A 15-foot buffer from the toe of the engineered levee on both the land and riverside will need to be maintained free of woody vegetation to protect the structural integrity of the levee. The landside buffer will include the access road and riverside drain, while the riverside buffer will need to be periodically maintained by MRGCD. The construction process proposed for this project will be the same as was used in previous consultations with your office for the Corrales Levee (HPD Consultation #53692), Albuquerque West Levee (HPD Consultation #84586) and has been approved for the San Acacia to San Marcial Levee (HPD Consultation #54093).

Pursuant to 36 CFR 800.4, the area of potential effect (APE) for this project will be within the current alignment of the spoil banks, as well as any access roads and staging areas that may be necessary during construction. Construction is not anticipated to begin until at least 2015 and is expected to be undertaken in phases over a ten-year period. Due to the phased nature and considerable length of construction, staging areas will not be selected until planning begins for an individual phase. Cultural resources survey and consultation with your office, the public and any interested tribes related to these staging areas and access roads will take place during planning for each phase as necessary.

Pursuant to 36 CFR 800.2, consulting parties in the Section 106 process identified for the undertaking include the Corps, the MRGCD, Isleta Pueblo and your office. Consistent with the Department of Defense's American Indian and Alaska Native Policy of 1998, and pursuant to 36 CFR 800.2(c)(2)(i), tribal consultation on this project was conducted in 2010 with all Native

Recognizing the long term need to improve flood protection in the Middle Rio Grande and the fact that this would result in the reconstruction of many of these historic spoil-bank features, the Corps completed an intensive documentation of the Middle Rio Grande flood protection works from Corrales to San Marcial (Berry and Lewis 1997), as well as an historical context for MRGCD flood protection in the Middle Rio Grande (Dodge and Santillanes 2007). The documents were produced under a programmatic agreement between your office and the Corps dated June 7, 1996 as mitigation for adverse effects to the spoil-bank features throughout the Middle Rio Grande (Enclosure 6). These two documents provide an excellent overview of the historic Middle Rio Grande flood protection system and its individual features and have been widely distributed to the public since publication.

In sum, the entire proposed alignment for levee rehabilitation has been previously surveyed and no historic properties were identified other than the historic spoil banks themselves. While the project will result in the reconstruction of the spoil banks, impacts to the historic spoil banks have been mitigated through documentation and thus, the Corps is of the opinion that the effect will not be adverse. Therefore, the Corps is seeking your concurrence in our determination of "No Adverse Effect to Historic Properties" for the proposed levee rehabilitation for the Middle Rio Grande Flood Protection Project, Bernalillo to Belen, New Mexico. Pursuant to 36 C.F.R. 800.13, should previously unknown artifacts or cultural resource manifestations be encountered during construction, work would cease in the immediate vicinity of the resource. A determination of significance would be made, and further consultation with your office and with tribes interested in the project area would be conducted to determine the best course of action.

If you have questions or require additional information regarding the proposed Middle Rio Grande Flood Protection Project levee rehabilitation, please contact Jeremy Decker, Archaeologist at (505) 342-3671 or jeremy.t.decker@usace.army.mil or myself, at (505) 342-3281.

Sincerely:

Julie Alcon
Chief, Environmental Resources
Section

Enclosures

Concur with recommendations as proposed.

Jan 21, 2014
for NM State Historic Preservation Officer

Decker, Jeremy SPA

From:	Henry Walt [henryj@toast.net]
Sent:	Monday, September 28, 2015 3:15 PM
To:	Decker, Jeremy SPA
Cc:	poi60002@Isletapueblo.com
Subject:	[EXTERNAL] Re: Status of Consultation Package for USACE Levee Construction on Isleta Pueblo (UNCLASSIFIED)

Hello Jeremy,

Thank you for consulting with our office on the plans for the levee rehabilitation on Pueblo of Isleta lands. I have reviewed the cultural resource survey by Bargman (NMCRIS 59915) and concur with the findings. We find there to be "No adverse effect to historic properties" for the project on Isleta lands. Please contact me if you have any questions.

Best

Henry Walt
Pueblo of Isleta THPO
505-255-7481

Copy

PROGRAMMATIC AGREEMENT
BETWEEN
THE U.S. ARMY CORPS OF ENGINEERS, ALBUQUERQUE DISTRICT
AND THE NEW MEXICO STATE HISTORIC PRESERVATION OFFICER
REGARDING THE IMPLEMENTATION OF THE
RIO GRANDE LEVEE REHABILITATION PROGRAM

WHEREAS, the U.S. Army Corps of Engineers, Albuquerque District (Corps) proposes to administer the Rio Grande Flood Protection Program, initially authorized by **The Flood Control Act of 1948** and most recently by PL99-662, the **Water Resources Development Act of 1986**. The program is a multi-year project that is designed to promote improved flood protection along the Rio Grande from southern Colorado to the United States/ Mexican border. The current focus of this program is the renovation and rehabilitation of spoilbank levee structures within the Rio Grande floodplain. The Levee Rehabilitation Program shall be constructed in three phases along three reaches of the Rio Grande. The northernmost of these reaches is the Corrales Unit, located along approximately 12 miles of the west or "right" bank of the river near the Village of Corrales, Sandoval County, New Mexico. The second segment is the Belen Unit, located along approximately 21 miles of both banks of the Rio near the town of Belen, Valencia County, New Mexico. The southernmost reach is the San Acacia Unit, located along approximately 43 miles of the west bank of the Rio between the Villages of San Acacia and San Marcial, Socorro County, New Mexico, and

WHEREAS, previous cultural resource coordination between the Corps and the New Mexico State Historic Preservation Officer (SHPO) has determined that the existing spoilbank levee systems along the Rio Grande are eligible for the National Register of Historic Places under criteria "a" of 36 CFR 60.4, for their historical importance to the settlement of the middle Rio Grande river valley. The Corps and the New Mexico SHPO also agree that the Rio Grande Flood Protection Program may have an effect upon properties included in or eligible for inclusion in the National Register of Historic Places. The Corps has consulted with the New Mexico SHPO pursuant to Section 800.13 of the regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f); and the Substitution Agreement between the New Mexico SHPO and the Advisory Council on Historic Preservation (Council; under 36 CFR 800.7), and

NOW, THEREFORE, the Corps and the New Mexico SHPO agree that the Rio Grande Flood Protection Program shall be administered in accordance with the following stipulations to satisfy the Corps' Section 106 responsibility for all individual undertakings of the program.

Stipulations

Prior to the alteration of a levee system, the Corps will ensure that the following measures are carried out:

1. Initial Resource Inventory: The Corps shall conduct a cultural resources inventory of all levee project areas to evaluate the effects that may occur to nearby, but separate, historic properties. Levee project areas shall include all construction zones, access roads, staging areas, and sites for borrow acquisition or waste disposal. The Corps will evaluate the historical significance of historic properties identified during the inventory in accordance with 36 CFR Part 800.4(c), and will apply the Criteria of Effect and Adverse Effect at 36 CFR Part 800.9 to determine if the proposed work will have an effect on historic properties and if that effect will be adverse. The Corps will submit the results of the inventory along with their determinations of eligibility to the SHPO for a 30-day review.

2. Adverse Effect to Separate Cultural Properties: If it should be determined, with the concurrence of SHPO, that cultural or historic properties, that are not direct elements of spoilbank systems, will be affected by the undertaking, the Corps will consult with the SHPO in accordance with 36 CFR 800.5 - 800.6 in lieu of the procedures provided for under this Programmatic Agreement.

3. Adverse Effects to the Spoilbank Systems: The Corps has determined that the undertaking will adversely affect the existing fabric of Middle Rio Grande spoilbank levees. The Corps shall record said systems in the following manner, prior to any alteration:

   a. A written historical narrative of the levee system shall be produced. The narrative shall be prepared by personnel qualified under the guidelines of Section V of the **Manual for Editing HABS/HAER Documentation**.

b. The Corps shall also provide a drawing set on archivally stable mylar to accompany the historical narrative. The drawing set will use existing engineering documentation of the Rio Grande Spoilbank System. This drawing set shall include the following:

1. A vicinity map;

2. Site location map;

3. A key map for the drawing set;

4. Photographs along the levee showing existing conditions and the location of the proposed baseline for the new levee;

5. A key plan for these photographs;

6. Aerial photographs which show the Rio Grande, existing spoilbank levees, and new levee alignments;

7. Current and future levee profiles (both longitudinal and cross section);

8. Selected construction details that focus on generic elements of levee structures;

9. Selected field data that elucidate or otherwise compliment the written narrative.

c. The Corps shall submit the assembled information outlined in Items a and b to the New Mexico SHPO and ensure that documentation has been completed and accepted by SHPO prior to the alteration of the property. The Corrales Unit of the program will be the first segment constructed. Initial consultation for this segment has been completed. An initial draft report predominantly containing information relative to the Corrales unit shall be submitted in early June 1996. Comments on this draft shall be incorporated into the final documentation package that shall include all three segments of the rehabilitation project.

d. Upon acceptance by SHPO, the Corps shall provide one (1) copy of the final documentation package, including the mylar drawing set, to the New Mexico State Library and Archive in Santa Fe. The Corps shall also produce copies of the documentation package that shall include reduced paper reproductions of the drawing set. These reports will be distributed as follows; one (1) copy each shall be provided to the community libraries of Corrales, Albuquerque, Belen, and Socorro, Two (2)copies shall be provided to the New Mexico SHPO one of which shall be provided to the Laboratory of Anthropology, Museum of New Mexico to be incorporated into its Archaeological Records Files in Santa Fe, Two (2) copies shall be provided to the Middle Rio Grande Conservancy District, and a copy shall be kept on file by the Corps at the Albuquerque District Offices.

4. Monitoring: The New Mexico SHPO may monitor activities carried out pursuant to this Programmatic Agreement, and the Council will review such activities if so requested. The Corps will cooperate with New Mexico SHPO in carrying out their monitoring and review responsibilities.

5. Objections: Should the SHPO object within 30 days to any actions proposed pursuant to this agreement, the Corps shall consult with the SHPO to resolve the objection. If the Corps determines that the objection cannot be resolved, the Corps shall request the further comments of the Council pursuant to 36 CFR Part 800.6(b). Any Council comment provided in response to such a request will be taken into account by the Corps in accordance with 36 CFR Part 800.6(c)(2) with reference only to the subject of dispute; the Corps' responsibility to carry out all actions under this agreement that are not the subjects of the dispute will remain unchanged.

6. Completion of Agreement: In the event the Corps does not carry out the terms of the Programmatic Agreement, the Corps will comply with 36 CFR Part 800.4 though 800.6 with regard to individual undertakings covered by this Programmatic Agreement.

7. Amendment: Any party to this Agreement may request that it be amended, whereupon the parties will consult in accordance with 36 CFR Part 800.13 to consider such amendment.

8. Cancellation: This agreement shall become effective upon approval of the SHPO and shall remain in effect unless formally terminated by the Corps, the SHPO, or the Council. Either party to this Programmatic Agreement may terminate it by providing thirty (30) days notice to the other party, provided that the parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination. In the event of termination, the Corps will comply with 36 CFR Part 800.4 through 800.6 with regard to individual undertakings covered by this Programmatic Agreement.

Execution of this Programmatic Agreement and implementation of its terms evidence that the Corps has afforded the SHPO the opportunity to comment on the rehabilitation of Rio Grande Levee Systems and its effect on the historic property, and that the Corps has taken into account the effects of the undertaking on the historic property.

U.S. ARMY CORPS OF ENGINEERS, ALBUQUERQUE DISTRICT

By: Lloyd S Wagner Date: 6/7/96
Lloyd S. Wagner
Lieutenant Colonel, EN
District Engineer

NEW MEXICO STATE HISTORIC PRESERVATION OFFICER

By: Lyn Sebastian Date: 5-20-96
Dr. Lynne Sebastian
Acting New Mexico State Historic Preservation Officer

Copy

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

October 1, 2010

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Joe Shirley
President, Navajo Nation
Post Office Box 9000
Window Rock, Arizona 86515

Dear President Shirley:

As part the planning process for the proposed rehabilitation of the existing non-engineered levees in the Mountain View, Isleta, and Belen Units of the Middle Rio Grande Flood Protection Project (see enclosed map), the U.S. Army Corps of Engineers (Corps), Albuquerque District, is seeking your input with respect to any concerns you may have in this area. Such concerns could include cultural or biological issues, traditional use or gathering areas, and other traditional cultural properties. The existing levees are non-engineered, spoil-bank (piles of dirt) levees resulting from the 1930s Middle Rio Grande Conservancy District's excavation of irrigation drains adjacent to the Rio Grande. They are essentially piles of dirt dumped along the river and cannot withstand sustained high flows of water during major floods. The purpose of this project is to provide reliable flood risk management for communities along approximately 20 river miles of the Rio Grande in Bernalillo and Valencia Counties, New Mexico.

The proposed project area extends approximately 20 miles south from the southern border of Albuquerque to just past the southern border of Belen (where the BN&SF railroad crosses the existing spoil-bank levees). The study was authorized by the 1941 Flood Control Act (Public Law 228) and updated by Section 401 of the 1986 Water Resources and Development Act (Public Law 662). Levee rehabilitation will occur on the east side of the Rio Grande within the Mountain View Unit and on the east and west sides of the river within the Isleta and Belen Units.

There are two important aspects of the proposed project. The first is that the on-going modeling of river flows and projected volumes of water during flood events indicate that the proposed engineered levees may be smaller in both height and width than the existing spoil-bank levees. The second is that the material in the spoil-bank levees may be used in the rehabilitation of the proposed engineered levees. Therefore, essentially all of the construction will occur in areas originally disturbed in the mid-1930s, and no new quarry areas may be required. Access for construction already exists on a network of paved and dirt roads, and to the extent possible, staging locations for equipment will be in previously disturbed locations. There are no archaeological sites within the disturbed area.

As the final design for the project is refined during the next year or so, and if new staging areas or new borrow areas for fill or rock are required, we will provide you with the proposed locations in sufficient time for you to consider your potential interests in the locations and to relay those concerns to us.

If you have questions or require additional information regarding the Mountain View, Isleta, and Belen Units of the Middle Rio Grande Flood Control Project, please contact me at (505) 342-3281 or John Schelberg, Archaeologist, at (505) 342-3359 or John.D.Schelberg@usace.army.mil. Thank you very much for your attention to this matter.

Sincerely,

Julie Alcon
Chief, Environmental Resources
Section

Enclosure

Copies furnished w/ enclosure:

Mr. Alan Downer
Navajo Nation
Post Office Box 4950
Window Rock, Arizona 86515

Mr. Ron Maldonado
Navajo Nation
PO Box 4950
Window Rock, Arizona 86515

Mr. Tony H. Joe, Jr.
Navajo Nation
Post Office Box 4950
Window Rock, Arizona 86515

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
4101 JEFFERSON PLAZA NE
ALBUQUERQUE NM 87109-3435

October 1, 2010

Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section

Leroy Shingoitewa
Chairman, Hopi Tribal Council
Post Office Box 123
Kykotsmovi, Arizona 86039

Dear Chairman Shingoitewa:

As part the planning process for the proposed rehabilitation of the existing non-engineered levees in the Mountain View, Isleta, and Belen Units of the Middle Rio Grande Flood Protection Project (see enclosed map), the U.S. Army Corps of Engineers (Corps), Albuquerque District, is seeking your input with respect to any concerns you may have in this area. Such concerns could include cultural or biological issues, traditional use or gathering areas, and other traditional cultural properties. The existing levees are non-engineered, spoil-bank (piles of dirt) levees resulting from the 1930s Middle Rio Grande Conservancy District's excavation of irrigation drains adjacent to the Rio Grande. They are essentially piles of dirt dumped along the river and cannot withstand sustained high flows of water during major floods. The purpose of this project is to provide reliable flood risk management for communities along approximately 20 river miles of the Rio Grande in Bernalillo and Valencia Counties, New Mexico.

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As the final design for the project is refined during the next year or so, and if new staging areas or new borrow areas for fill or rock are required, we will provide you with the proposed locations in sufficient time for you to consider your potential interests in the locations and to relay those concerns to us.

If you have questions or require additional information regarding the Mountain View, Isleta, and Belen Units of the Middle Rio Grande Flood Control Project, please contact me at (505) 342-3281 or John Schelberg, Archaeologist, at (505) 342-3359 or John.D.Schelberg@usace.army.mil. Thank you very much for your attention to this matter.

Sincerely,

Julie Alcon
Chief, Environmental Resources
Section

Enclosure

Copies furnished w/ enclosure:

Mr. Leigh Kuwonwosiwma
Hopi Tribal Council
Post Office Box 123
Kykotsmovi, Arizona 86039

no historic properties significant to the Hopi Tribe affected

Margaret
for
Kuwanwisiwma
10-8-10

Office of:
The Governor
The Secretary
The Treasurer

PUEBLO OF LAGUNA
P.O. BOX 194
LAGUNA, NEW MEXICO 87026

(505) 552-6598
(505) 552-6654
(505) 552-6655

October 13, 2010

Ms Julie Alcon
Chief Environmental Resources
Department of The Army
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Dear Ms. Alcon:

RE: Proposed rehabilitation of existing non-engineered levees in the Mountain View, Isleta, and Belen Units of the Middle Rio Grande Flood Protection Project

The Pueblo of Laguna appreciates your consideration to comment on the possible interests your projects may have on any traditional or cultural properties.

The Pueblo of Laguna has determined that the undertaking WILL NOT have a significant impact at this time. However, in the event that any new archaeological sites are discovered and any new artifacts are removed, we request to be notified to review items. We also request photographs of items. According to our unpublished migration history, our ancestors journeyed from the north through that area and settled for periods of time before traveling to our present location. Therefore, the possibilities of some findings may exist.

We thank you and your staff for the information provided.

Sincerely,

for John E. Antonio, Sr.
Governor
Pueblo of Laguna

White Mountain Apache Tribe Heritage Program
PO Box 507 Fort Apache, AZ 85926
1 (928) 338-3033 Fax: (928) 338-6055

To: Julie Alcon, U.S. Army Corps of Engineers Chief Environemental Resources Section
Date: October 14, 2010
Prjoect: Proposed Rehabilitation of the levees in the Middle Rio Grande Flood Protection Project.

....

The White Mountain Apache Historic Preservation Office (THPO) appreciates receiving information on the proposed project, dated October 1, 2010 In regards to this, please attend to the checked items below.

▶ ***There is no need to send additional information unless project planning or implementation results in the discovery of sites and/or items having known or suspected Apache Cultural affiliation.***

☐ The proposed project is located within an area of probable cultural or historical importance to the White Mountain Apache Tribe (WMAT). As part of the effort to identify historical properties that maybe affected by the project we recommend an ethno-historic study and interviews with Apache Elders. The Cultural Resource Director, ***Mr. Ramon Riley*** would be the contact person at (928) 338-4625 should this become necessary.

▶ Please refer to the attached additional notes in regards to the proposed project:

We have received and reviewed the information regarding the proposed rehabilitation project of the existing non-engineered levees in the Mountain View, Isleta, and Belen Units of the Middle Rio grande Flood Protection Project, and after careful considerations we've determined the proposed porject will ***not have an effect*** on the White Mountain Apache tribe's Cultural Heritage Resources and/or historic properties. Regardless, any/all proposed ground disturbing activities should be monitored ***if*** there are reasons to believe that human remains and/or funerary objects are present, if such remains and/or objects are encountered all construction activities should be stopped and the proper authorities and/or affiliated tribe(s) be notified to evaluate the situation.

We look forward to continued collaborations in the protection and preservation of places of cultural and historical significance.

Sincerely,

Mark T. Altaha

White Mountain Apache Tribe
Historic Preservation Officer
Email: markaltaha@wmat.us

Ysleta del Sur Pueblo
Tribal Council – Javier Loera – (War Captain/Tribal Historic and Preservation Officer) E-mail jloera@ydsp-nsn.gov
119 South Old Pueblo Road * P.O. Box 17579 * El Paso, Texas 79917 * (915) 859-8053 * Fax: (915) 859-4252

October 27, 2010

Mr. John Schelberg
Archaeologist
Planning, Project and Program Management Division
Planning Branch
Environmental Resources Section
Department of the Army
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, NM 87109-3435

Dear Mr. Schelberg:

This letter is in response to the correspondence received in our office in which you provide the Ysleta del Sur Pueblo the opportunity to comment on the planning process for the proposed rehabilitation of the existing non-engineered levees in the Mountain View, Isleta, and Belen Units of the Middle Rio Grande Flood Protection Project, the U.S. Army Corps of Engineers (Corps), Albuquerque District.

While we do not have any comments on the proposed rehabilitation project and believe that this undertaking will not adversely affect traditional, religious or culturally significant sites of our Pueblo and have no opposition to it; we would like to request consultation should any human remains or artifacts unearthed during this project be determined to fall under Native American Graves Protection and Repatriation Act (NAGPRA) guidelines. Copies of our Pueblo's Cultural Affiliation Position Paper and Consultation Policy are available upon request.

Thank you for allowing us the opportunity to comment on the proposed project.

Sincerely,

Javier Loera

Javier Loera
War Captain/Tribal Historic and Preservation Officer
Ysleta del Sur Pueblo
E-mail: jloera@ydsp-nsn.gov.

Memorandum for Record
USACE and Pueblo of Isleta Tribal Consultation
November 26, 2018

Since 2013, the Corps has consistently engaged the Pueblo of Isleta in consultation regarding the management of cultural resources in the vicinity of the proposed Bernalillo to Belen levee construction project. Consultation has included three face-to-face field visits, as well as numerous conversations by email and telephone.

June 25, 2013-Initial field trip to view engineered levees comparable to the proposed project

- Early in 2013 the Pueblo expressed concerns about the construction of the proposed levee, and in particular the creation of a 15-foot vegetation free zone on the river side of the levee, having a negative impact on cultural resources on the Pueblo of Isleta Reservation. The Corps and Pueblo both attended site visit to look at the recently-constructed Albuquerque West Levee as an example of a completed engineered levee. The Pueblo reiterated their concerns that the creation of a vegetation free zone may greatly impact vegetation that is culturally significant to the Pueblo, and may impact an important cultural site. The Pueblo requested to continue consultation as the design for the project was being developed. Members of the Pueblo of Isleta Cultural Committee attended the meeting, along with other Pueblo staff.

February 5, 2015-Pre-Consultation Package

- Corps archaeologist Jeremy Decker sent a pre-consultation package to the Pueblo of Isleta Tribal Historic Preservation Officer (THPO) to provide him with all archaeological survey documents, as well as proposed levee alignments and footprints.

April 16, 2015-Consultation and meeting and site visit with cultural committee and THPO

- Following receipt of the pre-consultation package and review of its materials, the Pueblo of Isleta THPO, Dr. Henry Walt, and Corps archaeologist Jeremy Decker scheduled a meeting to visit an important cultural site on Pueblo land in order to determine a plan for protecting the site. Mr. Decker and Mr. Walt were also accompanied by members of the Pueblo's Cultural Committee. During this meeting the cultural committee showed Mr. Decker the approximate location of the site, identified as an important Traditional Cultural Property (TCP) and sacred site. Committee members explained that the function and exact location of the TCP are confidential, and could not be disclosed. The Committee expressed concern that the removal of vegetation adjacent to the levee alignment would make the TCP more visible, and would remove the "screen" that keeps its location private. Conversations regarding replacement of this vegetation screen occurred, and it was agreed to have a follow up meeting to discuss the possibility of the vegetation screen being included in future habitat mitigation for the project.

August 11, 2015-Meeting with Pueblo staff to discuss potential habitat mitigation sites

- Discussed possibility of using an area adjacent to the TCP as a way to both mitigate for habitat loss and to provide protection to the TCP. Attendees included Mr. Decker, USACE biologist Dr. Michael Porter, Pueblo of Isleta Cultural Committee members, and Pueblo of Isleta environmental resources and emergency management staff. During this meeting it was agreed that the area adjacent to the TCP would be an appropriate area for habitat mitigation.

August 27, 2015-Formal THPO consultation

- The Corps formally consulted with The Pueblo of Isleta THPO by letter dated August 27, 2015. The letter summarized the results of previous consultation and provided a plan for protecting the TCP site to include erecting fencing adjacent to the construction area and planting native vegetation following construction to re-establish the vegetation screen. The THPO concurred with the Corps' finding of "no adverse effect to historic properties" on September 28, 2017.

September 13, 2017-Notice of Availability Letter

- The Corps provided the Pueblo of Isleta with a Notice of Availability letter for the draft SEIS.

October 5, 2017-Public Meeting at Isleta Pueblo

- Staff from SPA conducted a public meeting at the Pueblo of Isleta Senior Center. Corps staff provided information on the proposed project and collected comments from Pueblo members and Pueblo staff.

June 11, 2018-Notice of Availability Letter

- The Corps provided the Pueblo of Isleta with a Notice of Availability letter for the draft SEIS.

June 27, 2018-Project Meeting Pueblo of Isleta THPO

- Archaeologist Jeremy Decker and Civil Works Project Manager Amanda Velasquez met with Pueblo of Isleta THPO, Dr. Henry Walt, and Cultural Committee Chair, Mr. Daniel Waseta, to discuss Corps projects with the Pueblo. Mr. Decker and Ms. Velasquez provided on update on the Bernalillo to Belen Levee project, and confirmed that there were no new cultural resources concerns from the Pueblo.

September 14, 2018-Pueblo of Isleta Partnering Meeting

- Corps staff accompanied SPA Commander, Lt. Col. Caswell, to a meeting with Pueblo of Isleta Governor Benavides and his staff. During this meeting the Bernalillo to Belen Levee project was discussed in detail. The Governor and is staff requested the Corps provide an in depth response to several comments the Pueblo had previously provided to the Corps regarding the proposed levee alignment. The Corps provided the requested response on November 16, 2018.

Expected 2019-State and Agency Review of the SEIS

- The Corps will provide Tribes the opportunity to comment on the draft SEIS as part of the State and Agency Review expected to occur in 2019.