A History of Floods and Flood Problems in New Mexico

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New Mexico Floodplain Managers Association

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Introduction

This volume is only the beginning of a history of flooding in New Mexico. It is from two sources of information: Flood Insurance Studies for New Mexico, prepared by various contractors for the Federal Insurance Administration (FIA) and the minutes of a meeting held in 1941 in Santa Fe after major floods had ravaged areas all across the state.

- All readers are invited to provide information on historical floods in New Mexico. These may come from official files in their community, newspaper archives or other sources. Information should be documented with the source and date.

- All readers are invited to provide information on current flooding. Information should be documented with the source and date.

- All readers are invited to contribute photos of historical or current flooding, flood damage and similar information. Photos should be documented, if possible, with the photographer's name, the location and date of the photo and a description of the subject.

Notes on the flood insurance studies:

1. The flood insurance studies used for this publication were provided in Adobe © Acrobat © pdf files on a compact disk (CD) dated 14 May, 2003. As studies are revised and new studies performed, it will be necessary to update this publication.

2. The pdf files provided by FEMA were made from scanned pages. To produce this document, these pages were scanned using OmniPage Pro © version 12.0 optical character recognition (OCR) software. Some tables were entered in Microsoft © Excel © and copied into this document. Although this document was proofread, there may still be errors in the transcription from the graphic pages in the pdf files to the Microsoft © Word © files used for this document. Anyone who notes transcription errors should inform the NMFMA.

3. The flood insurance studies are well documented with references. If a reader is interested in learning more about flooding in a community, he/she should refer to the flood insurance study for that community. The references are not included in this document.

4. The flood insurance studies often include photographs of historic flooding and/or elevations of the base flood elevation at points in the community. Because of the process used by FEMA to produce the documents on CD, the quality of these photos is too poor to reproduce in this document.

5. The text in this document is verbatim from the text in the flood insurance studies, except that references to the references and photos that were in the flood insurance studies have been deleted in this document to avoid confusion.

The information from the Flood Insurance Studies varies considerably in detail from community to community. Some of the Flood Insurance Studies are almost 30 years old, so they cannot include more recent information. The Federal Emergency Management Agency (FEMA) has funds to redo many Flood Insurance Studies over the next few years, and as these studies are revised, this history should be revised.

Also, as these studies are being revised, the community floodplain managers and FEMA contractors should work together to ensure that these revised studies include as much information on community flood history as possible.

Notes on "Proceeding of Meeting:"

The transcript of the organizational meeting of the New Mexico Flood Control Association in 1941 were provided by Patsy Sanchez of Lincoln County. Let's get a little perspective on that meeting:

- The meeting was held in Santa Fe a little over a month after the worst of the flooding occurred in late September of 1941.
- The Nation was emerging from the Great Depression. The Civilian Conservation Corps (CCC) was a major economic force in New Mexico, although it was closing down.
- The Nation was preparing for war in Europe. A buildup in military capability was underway, which was why the CCC was closing down.
- The meeting was five and a half weeks before the attack on Pearl Harbor.
- The attendance at the meeting included an amazing number of top-level officials:
  - The Governor attended the meeting for the entire day. He apparently called the meeting.
  - Top-level representatives from all of the important federal agencies were there.
  - The State Engineer, the State Highway Engineer, and representatives from many other state agencies were there.
  - Mayors, city council members, county commissioners, city engineers and other municipal representatives were there.
  - Representatives of state-wide and regional industrial, commercial, agricultural and irrigation interests were there.

It is difficult to compare damage estimates from 1941 with today's costs. Based on the Consumer Price Index (ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt), something that would have cost $1.00 in 1941 would have cost $12.230 at the end of 2002. It is simple to look at the estimate of damage in the City of Roswell, $775,300, and say that the same damage would cost $9.5 million today. However, the Roswell City Engineer said that every street in Roswell was washed away. That may mean that the streets were unpaved then and suffered more damage than modern streets would suffer. On the other hand, the estimates to repair bridges was based on wooden bridges which probably cost a lot less than modern bridges made of steel reinforced concrete. As you read through the itemized damage in the Appendices, you can estimate for yourself the value of 20 chickens, 19 turkeys and 150 miles of fence.

As Mr. Pooler of the US Forest Service said early in the meeting, "We have felt that something like this couldn't occur, but we didn't look for such rainfall either, and we got too much rain …" (page 89)

There were two recurring themes in the meeting: how to prevent this kind of flooding in the future; and how to recover from this flood.

Consider that from 1900 to 1940, the population of the State had grown from about 195,000 to about 531,000. A large majority of the victims of the floods of 1941 had only been here for one or two generations, and they had just endured the Great Depression. New Mexico was a rural state with numerous small communities. There were few highways and fewer paved roads. New Mexicans were surely a hardier breed than we are today. They or their parents had carved out the farms and ranches of the State, and many lived in homes they had built.

In 1941, the way the country dealt with floods was by building flood control dams. The concept of staying out of the way of floods would not even be proposed for another eight years. If a community or farming valley got flooded, the residents and state and federal agencies started figuring out where to build a flood control dam to solve the flood problem.

The financial burden of this solution is evident in the minutes of the meeting and its attachments. The floods of 1941 indicted that dozens, or perhaps a hundred or more, flood control dams were needed in a state with a population of a little over a half million people. Projecting this across the country, the cost was staggering.

As the State Director of the Soil Conservation Service said, "… I think we might just as well face the fact that under present conditions in this country with this tremendous defense effort, we cannot hope for any large Federal appropriations for flood control in the regular course of events in the next few years, assuming that the World War will last for several years."

However, the prospects for recovery from these floods were also overwhelming. Property owners, municipalities, counties and state agencies had used all of their resources, and had barely begun to touch the problems. Federal assistance was urgently needed.

Although I recommend that you read the entire document, I have excerpted a few quotations that give you an idea of the impact that flood had on the State and various regions of the State:

- The State Highway Engineer stated that it would be "many months" before they could even determine the extent of damage to the highway system (page 105).
- Mr. Cameron of the US Weather Bureau: "We know why it rains; why it rains hard; but we don't know why the condition continues; that is, what force in nature allows this abnormal condition to continue for twelve full months. We are not ready to say it will continue for one month or whether it will go on for a period of several years." (Page 104)
- Mr. Stewart, representing the people of Grant County: "If that flood [on the Gila River] had come a few hours later in the evening there would have been 50 people drowned. They hung in willow and cottonwood trees and we could easily have lost 50 there." (Page 100)
- Mr. Rowland, Roswell City Engineer: "We are full of ideas. What we need is money and action." (page 93)
- Mr. Titsworth of Lincoln County: "Our irrigated lands, most of the lands in Lincoln County are on the Ruidoso, Bonito and Hondo. Every irrigation dam on our main

streams has been washed out and the damage is done. What we need is some help in restoring those and we must have it soon or those valleys will be depopulated. Many of them are poor people and lost their crops. They were ready to harvest them. There are some of us who are solvent but we are not able to put back those dams and ditches without assistance. The river needs cleaning out from the top of the White Mountains to Roswell, I guess. There are only about three months in which to put those dams and ditches back. However, that we cannot do." (page 90)

- The Lincoln County Superintendent of Schools: "The land is covered with sand from two to five feet. … We do have to have aid. First, we need bridges to be able to cross the river. Many people are not able to get to their homes unless they climb high to cross the river and walk a mile. We had some homes that were washed completely down. I know that we must have aid and we must have it right away if we do replace our dams. Without the water to irrigate our lands there is nothing we can to toward making our livelihood." (page 91)
- Mrs. Coe, representative of the Water Users' Association in Glencoe: "We must have labor from the CCC Camps. We must have heavy equipment. We need a drag line, a steam shovel and many trucks and caterpillars." (page 92)
- Mr. Losey, Pecos Valley Artesian Conservancy District: "You people have begun to realize we did have a flood in Chaves County doing unprecedented damage, so large that we have very definitely come to the conclusion that we ourselves cannot take care of the situation, and that we are going to have to have some help." (page 95)

This document makes it clear that a major, wide-spread flood affects communities, counties and the entire state. In 1941, damage to farms and irrigation systems threatened the livelihood and even the continued existence of many areas. Today, the impact might be felt more severely by industry, commerce or tourism, but it would still affect whole areas of the state.

If workers cannot get to work for a week or two because roads and bridges are damaged, they lose wages, their employer loses profit and state and local government loses tax revenue. If a community that relies on tourism loses a season or even a few weeks of business because of a summer flood, the local economy may be devastated.

Bernalillo County, City of Albuquerque, Village of Los Ranchos de Albuquerque, Village of Tijeras (FIS 35001C – 4/2/2002)

1. Community Description: Bernalillo County is located in central New Mexico, traversed by Interstate Highway 40 for east-west traffic and by Interstate Highway 25 for north-south traffic. Land area of the County is 1,170 square miles, and the unincorporated population is about 88,000, most of which live near Albuquerque. Large areas of Bernalillo County are government owned. Indian reservations are located in the western and southern portions, Kirtland Air Force Base is located southeast of Albuquerque, and Cibola National Forest is located in the eastern part of the County.

The Rio Grande flows southward through the center of the County, with the land rising on both sides of the river and forming mesas at elevations above 5,000 feet. To the east, the Sandia and Manzano Mountains rise to a maximum elevation of 10,678 feet and parallel the Rio Grande. The valley and mesa areas are arid, with an average annual precipitation near eight inches. In the mountains, average rainfall ranges from 15 to 30 inches, generally increasing with elevation.

The climate is classified as arid continental, characterized by fairly hot summers, mild winters, and short, temperate spring and fall seasons. About half of the precipitation falls as summer rains during brief, but often intense, thunderstorms. Winter precipitation falls as either rain or snow and is caused by frontal activity associated with storms moving across the country from the Pacific Ocean.

The City of Albuquerque is located in the central portion of both New Mexico and Bernalillo County. Albuquerque is situated approximately 60 miles south of Santa Fe, New Mexico, and 270 miles north of El Paso, Texas. The Rio Grande flows south through the city and is the principal river in New Mexico, with a drainage area of 14,500 square miles at Albuquerque. The total land area within the city limits is 158 square miles. The population (1990 census) is 384,736 within the city limits, and 599,416 within the metropolitan area.

Albuquerque can be divided into three general areas - the valley areas immediately next to the Rio Grande and the East and West Mesas, which flank the valley. The valley has low density residential and commercial development and the central business district. The East Mesa extends approximately 10 miles from the Rio Grande Valley to the base of the Sandia Mountains and is experiencing rapid medium to high density residential and commercial development. The West Mesa extends about 4 miles from the Rio Grande to the volcanic escarpment and is rapidly undergoing high-density residential development.

The Village of Los Ranchos de Albuquerque is located in northcentral Bernalillo County, along the Rio Grande, and is surrounded almost entirely by the City of Albuquerque. Los Ranchos de Albuquerque encompasses approximately 4.14 square miles of land and had a 1990 population of nearly 5,000.

The Village of Tijeras is located in central New Mexico, in the eastern portion of Bernalillo County, about six miles east of Albuquerque at the intersection of Interstate Highway 40 and New Mexico State Highway 14. The total land area of Tijeras is 0.31 square miles. Elevations in Tijeras and contributing drainage areas range from 6,000 to 7,000 feet. The population was about 170 when Tijeras was incorporated in 1973; currently (1980), the population is 311.

Tijeras is sparsely developed, with most of the older development west of State Highway 14, while most of the newer development is occurring east of Highway 14 and south of Interstate Highway 40.

Vegetation consists mainly of pinyon pine, juniper trees and native grasses. Higher elevation areas around Tijeras are forested mainly with Ponderosa pine, Douglas fir, white fir, Engelmann spruce and aspen.

2. Principal Flood Problems: Flooding within the unincorporated areas of Bernalillo County is most likely to occur during late summer as a result of intense short-duration thunderstorms. The resulting peak flows can be large but usually have relatively small volumes of water. Most of the stream channels within the Tijeras area are well incised and can carry large discharges. Generally, flood damages are limited to culverts and bridges that are damaged or washed away during high flows. Residences located near arroyos or located at elevations similar to the flow elevations within the arroyos can be damaged by high-velocity flood flows.

Historically, flooding in the Albuquerque area can be divided into two categories: flooding from the Rio Grande and runoff generated from local thunderstorms.

Flooding from the Rio Grande can be from rapid snowmelt induced by warm rains, or from widespread thunderstorms. Floodwaters from the Rio Grande can also block irrigation and drainage ditches with sediment, increasing the flood potential. Before the 1930s, flooding from the river had been widespread within the North and South Valley areas of the city. The present flood potential in the city from the Rio Grande is much less than historical data may suggest because of a levee system built in the 1930s. Also, several flood control structures have been built upstream of the city.

Other flooding within the city can result from brief, intense thunderstorms causing substantial localized flash flooding and serious sedimentation and erosion problems. The Sandia Mountains, east of Albuquerque, have steep bedrock outcrops which have high runoff potential. Flow runoff paths are unpredictable at the base of the mountains as the runoff spreads onto several alluvial fans. Continued development on the East Mesa at the base of the mountains and on the alluvial areas complicates the flow patterns and increases the potential for flood damage.

Flooding on the West Mesa can also result from intense thunderstorms, and the area has serious sedimentation-erosion problems. The area contains mostly fine sands and silts with minimal ground cover and is highly erodible. Flood flows can pond behind ditch levees and in low spots, depositing large quantities of sediment, or the floodwaters can flow into irrigation ditches, filling the ditches with sediment and causing the banks to be overtopped.

The low-lying valley areas along the Rio Grande are also subject to flooding from runoff from the east and west uplands. Residential and commercial development, channel levees, and irrigation embankments have obstructed the natural outfalls to the river and increased the flood hazard in many areas. Floodwaters flow rapidly into the valley areas, then spread into ponding areas because of the flat slopes and limited outlets to the river.

Recurrence intervals for historic floods on the Rio Grande are not relevant because the floods occurred before the flood control structures were built. The recurrence interval for the 1967 flood

along the Tijeras Arroyo is 20 years.

The history of flooding within the Tijeras area indicates flooding is most likely to occur during late summer as a result of intense short-duration thunderstorms. The resulting peak flows can be large but are usually of short duration. Most of the stream channels within Tijeras are well incised and can carry large discharges. Generally, flood damages are limited to culverts and bridges that are damaged or washed away during high flows. Residences located near arroyos or located at elevations similar to the flow elevations of the arroyos can be damaged by high-velocity flood flows. Quantitative flood information is limited to the discharge records of Tijeras Arroyo at the USGS stream gage 083305.00, located about three miles downstream of the study area in Tijeras. The maximum peak discharge for 26 years of record (1944-78) was 6,500 cubic feet per second (cfs) on June 24, 1967, and has an estimated return period of 20 years.

Chaves County (FIS 350125 – 3/17/2003)

1. Community Description: Chaves County is located in southeastern New Mexico. Most of the county lies in the Pecos Valley section of the Great Plains province. The southwestern portion of the county lies in the Sacramento section of the Basin and Range province. This section consists of mature block mountains of gently tilted strata and block plateaus. Elevations in the county range from approximately 7,000 feet above National Geodetic Vertical Datum of 1929 (NGVD) near Chimney Peak and One Tree Peak in the southwest, to about 3500 feet NGVD in the Pecos River Valley. The Sacramento Mountains are approximately 60 miles to the west, in Lincoln and Otero counties. The Guadalupe Mountains rise just south of Chaves County's extreme southern border.

The climate in Chaves County is generally semiarid, and characterized by low relative humidity, hot summers, and moderate winters with occasional severe cold waves. Summer thunderstorms are frequently intense but limited in areal extent. Winter storms of rain or snowfall occur in Roswell annually. Average annual precipitation varies from 10 inches at the Bitter Lake Wildlife Refuge to 26 inches in the mountains.

Roswell, the county seat, is the largest city in Chaves County. It is centered around the Rio Hondo near its confluence with the Pecos River. Retail and wholesale trade, public administration, educational institutions, recreation, and agriculture are of major economic importance to Roswell. Agriculture constitutes a significant economic activity in the rest of Chaves County. The Pecos River flood plain has been extensively developed for agricultural purposes. Principal crops are cotton and alfalfa. Ranching is common in the western portion of the county.

The major highways traversing Chaves County are U.S. Highways 70, 380, and 285. U.S. Highway 82 crosses the southwestern portion of the county. State Highways 13 and 31 also serve Chaves County. Rail transportation is provided by the Burlington Northern and Santa Fe Railroad, which parallels U.S. Highway 285 south of Roswell, and U.S. Highway 70 northeast of the city.

The Pecos River, Chaves County's principal stream, flows southerly through the center of the county. The active flood plain affects a relatively narrow band within the Pecos Valley.

Rio Hondo and Rio Felix are major tributaries of the Pecos River. The two watersheds are adjacent and cover a large portion of Chaves County. Rio Hondo originates in the foothills of the Sacramento Mountains, at the junction of Rio Ruidoso and Rio Bonita. From this point, it flows eastward for about 85 miles to its confluence with the Pecos River, east of Roswell. The principal tributaries of Rio Hondo within the unincorporated area of Chaves County are North Spring River, South Berrendo Creek, and North Berrendo Creek.

North Spring River begins in the low hills about six miles west of Roswell. The drainage channels are ill-defined in the upper reaches and consist of a group of broad, shallow draws which converge into a well-defined channel near the western edge of Roswell. From this point, the stream continues eastward through Roswell to its confluence with the Rio Hondo.

South Berrendo Creek is generally intermittent throughout its length and has its headwaters in a series of canyons on the southern slopes of the Capitan Mountains. The stream flows eastward

through northernmost Roswell. It joins Rio Hondo about 10.6 miles downstream of its origin, after flowing through the irrigated farmlands north and northeast of Roswell.

North Berrendo Creek headwaters begin in the vast plain between the foothills of the Capitan Mountains and the Rio Hondo River. The drainage channels traverse the range land northeast of Roswell until they converge into a well-defined channel north of Highway 285. North Berrendo Creek joins South Berrendo Creek near the Burlington Northern and Santa Fe Railroad crossing, northwest of Roswell.

Rio Felix originates on the eastern slopes of the Sacramento Mountains and follows an eastward course for about 60 miles to its confluence with the Pecos River just north of the Town of Hagerman.

The Pecos River and its two tributaries Rio Felix, and Rio Hondo causes most of the flooding problems in Chaves County. Smaller tributaries of the Pecos River which cause shallow flooding are Thirteen Mile Draw, Tumbleweed Draw, and South Spring River. Thirteen Mile Draw originates on a shallow limestone plateau nearly 27 miles west of the Pecos River. The watershed is approximately 20 miles long and 4 miles wide with the lower reach traversing a wholly cultivated area through which there are no welldefined channels nor outlets to the Pecos River.

Tumbleweed Draw begins southeast of Roswell in the alluvial plain range land west of Highway 285 near the community of Midway. The broad shallow drainage channel runs easterly toward the alluvial Pecos River bottom land.

South Spring River, a rather short, narrow drainage area also begins southeast of Roswell near the community of South Spring Acres. It flows for approximately five miles easterly to its confluence with the Pecos River.

2. Principal Flood Problems: The greatest flood-producing storms in Chaves County generally occur during the period from spring through fall, when movement of air masses is more pronounced. According to the COE, the June 18, 1965 flood is considered the maximum flood on record for Rio Hondo. Intense showers in Lincoln County, centered in the Ruidoso-Hondo area, produced a peak discharge of 54,800 cfs on Rio Hondo near Hondo, approximately 45 miles west of Roswell. Two Rivers Reservoir caught all of the flood runoff. No flooding was reported below Two Rivers Reservoir on Rio Hondo or on other streams in the study area. Heavy rainfall from September 20-29, 1941 produced peak flows of 27,000 cfs at the Diamond A Ranch gaging station, which is on Rio Hondo roughly 6 miles upstream of Two Rivers Reservoir. The Diamond A Ranch gage recorded another large flood f low on October 6, 1954, when a peak of 23,000 cfs rushed down the Rio Hondo.

The October 1954 storm produced a peak discharge of 19,400 cfs on South Berrendo Creek. This flow was recorded at the crest gage about 1200 feet downstream from the U.S. Highway 285 bridge north of Roswell. This flood has a recurrence interval of approximately 40 years. Five months earlier, on May 17, 1954, intense local thunderstorms occurred over the watersheds of North Spring River and South Berrendo Creek. A peak discharge of 23,400 cfs was recorded at the Roswell gaging station on South Berrendo Creek. This flood has a recurrence interval of almost 50 years. A peak discharge of 7000 cfs was recorded on North Spring River at Wyoming

Street in Roswell.

This flood has a recurrence interval of 200 years. Estimated damage for these floods was $816,000 (Reference 1). In May-June 1937, another intense storm occurred over the upper Rio Hondo watershed. Peak discharge on South Berrendo Creek was estimated to be 37,700 cfs at the Roswell gaging station. This flow has a recurrence interval of slightly less than 100 years.

The natural and improved channels in Chaves County cannot contain large flood flows. Channel capacities are further reduced in sections which are overgrown and full of debris. Channel growth and debris can block culverts and bridges, further aggravating flooding. Many bridges and culverts are not designed to carry the I 00-year frequency flood flows, which causes raised water levels upstream whenever their capacities are exceeded. Overflow of channels and flooding results. Because of flat overbank topography within Roswell, and the existence of buildings in the flood plain, such overflow from North Spring River and Rio Hondo is very broad and shallow. Thus, floodwaters moving through Roswell, to the east, cover a wide region. East of Roswell the overbank topography is more defined, resulting in deeper, more confined overbank flow.

City of Roswell (FIS 350006 – 3/17/2003)

1. Community Description: Roswell is located in southeastern New Mexico near the confluence of the Rio Hondo and Pecos River. Carlsbad lies 70 miles to the south, and Hondo is 45 miles to the west. U.S. Highways 380 and 285 carry traffic through the city. The Pecos Valley branch of the Atchison, Topeka, and Santa Fe Railway was extended to Roswell in 1894. Many state and federal park lands are located within a few hours drive. Carlsbad Caverns National Park is 106 miles to the south; Lincoln National Forest is 70 miles to the west. Bottomless Lakes State Park, which features a series of small sinkhole lakes, is approximately 17 miles to the east. The Bureau of Sport Fisheries and Wildlife operates the Bitter Lake Wildlife Refuge about 15 miles northeast of Roswell. In addition, many recreational lakes and reservoirs are within 200 miles of the city.

Roswell was incorporated on September 25, 1903. The population was estimated to be 2,000 in 1900. By 1970 Roswell had become the fourth largest city in New Mexico, with a population of 33,908. It is the Chaves County seat of government and the county's largest urban center. The city currently covers approximately 26.5 square miles. Retail and wholesale trade, public administration, educational institutions, recreation, and agriculture are of major. economic importance. The Pecos River flood plain, which has been developed for agricultural purposes, is adjacent to Roswell. Principal crops grown are cotton and alfalfa.

The Roswell area has a semi-arid continental climate characterized by low relative humidity, hot summers, and moderate winters with occasional severe cold waves. Major storms in the area result from unstable air masses arising in the gulf rainfall province. Hurricane activity off western Mexico sometime intensifies storms. Summer thunderstorms are frequently intense but limited in real extent. Winter storms of rain or snow can be moderately heavy and widespread.. Approximately ten inches of snow fall in Roswell annually. Average annual precipitation varies from• 10 inches at the Bitter Lake Wildlife Refuge to 26 inches in the mountains.

The city lies at an elevation of 3600 feet National Geodetic Vertical Datum of 1929 (NGVD) in the Rio Hondo Watershed. The Sierra Blanca and Sacramento Mountains form the western boundary of the watershed. The foothills of the Sacramento Mountains are about 80 miles west of Roswell. The Rio Hondo originates in these foothills at the junction of Rio Ruidoso and Rio Bonito. The Rio Hondo is regulated by the Two Rivers Dams approximately 12 miles southwest of Roswell. The river joins the Pecos River about seven miles east of Roswell.

The Rio Hondo and its tributaries, North Spring River and South Berrendo Creek, caused most of Rowell's flooding problems. The Rio Hondo enters Roswell from the west, and flows northeastward through the center of the city. Although the river has been controlled by Two Rivers Dams since 1963, runoff originating below the• dams still can cause appreciable flood damages.

North Spring River, which joins the Rio Hondo less than one mile east of Roswell, con also carry damaging flood waters. North Spring River originates in low hills approximately six miles west of the city. The drainage system consists of broad, shallow draws which converge into g well-defined channel near the western edge of Roswell. The river enters Roswell just south of the old municipal airport where it. is joined by flows from the Second Street tributary. It flows by the municipal golf course, Cahoon Park, Roswell Little Theater, and Spring River Park and Zoo before leaving the eastern edge of the city. North Spring has a drainage area of about 27 square miles above its confluence with Rio Hondo.

South Berrendo Creek is the fourth major flooding source in Roswell. This generally intermittent stream has its headwaters in a series of canyons on the southern slopes of the Capitan Mountains.

The stream flows eastward through northernmost Roswell. It joins Rio Hondo about 10.6 miles downstream of its origin after flowing though the irrigated farm lands north and northeast of Roswell. Total drainage area of this creek above its confluence with Rio Hondo is nearly 510 square miles.

2 Principal Flood Problems: The greatest flood-producing storms generally occur during the period from spring through fall, when movement of air masses is more pronounced. According to the COE (Reference 1), the June 18, 1965 flood is considered the maximum flood on record for Rio Hondo. Intense showers centered near Raton and the Ruidoso-Hondo area produced g peak discharge of 54,800 cfs on Rio Hondo near Hondo, approximately 45 miles west of Roswell. Two Rivers Reservoir caught all of the flood runoff. No flooding was reported below Two Rivers Reservoir on Rio Hondo or on other streams in the study area. Heavy rainfall from September 20-29, 1941 produced peak flows of 27,000 cfs at the Diamond A Ranch gaging station, which is on Rio Hondo roughly 6 miles upstream of Two Rivers Reservoir. The Diamond A Ranch gage recorded another large flood flow on October 6, 1954, when g peak of 23,000 cfs rushed down the Rio Hondo.

The October 1954 storm produced g peak discharge of 19,400 cfs on South Berrendo Creek. This flow was recorded at the crest gage about 1200 feet downstream from the U.S. Highway 285 bridge north of Roswell. This flood has g recurrence interval of approximately 40 years. Five months earlier, on May 17, 1954, intense local thunderstorms occurred over the watersheds of North Spring River and South Berrendo Creek. A peak discharge of 23,400 cfs was recorded at the Roswell gaging station on South BerrendoCreek. This flood has a recurrence interval of almost 50 years. A peak discharge of 7,000 cfs was recorded on North Spring River at Wyoming Street in Roswell. This flood had a recurrence interval of 200 years. Estimated damage for these floods was $816,000. In May-June 1937, another intense storm occurred over the upper Rio Hondo watershed. Peak discharge on South Berrendo Creek was estimated to be 37,700 cfs at the Roswell gaging~station. This flow has a recurrence interval of slightly less than 100 years. Figures 2 and 3 show the estimated 100-year flood depths North Spring River.

The natural and improved channels through Roswell cannot contain large flood flows. Channel capacities are further reduced in sections which are overgrown and full of debris. Channel growth and debris can block culverts and bridges, further aggravating flooding. Many bridges and culverts are not designed to carry the 100-year frequency flood flows, which causes raised water levels upstream whenever their capacities are exceeded. Overflow of channels and flooding results.

City of Grants (FIS 350090 – 1/5/1982)

1. Community Description: The City of Grants is located in the central portion of New Mexico in the north central portion of Cibola County and is approximately 70 miles west of Albuquerque. Major traffic arteries that pass through Grants are U.S. Highway 66, Interstate Highway 40 and the Atchison Topeka and Santa Fe Railway. The City of Milan is contiguous to the northwestern city limits of Grants. The population in 1970 was 8,768, and is estimated to be 14,105 in 1980, and 21,645 by 1990 (Reference 1). The population increase is apparently related to the uranium mining and milling process that employs approximately 50 percent of the labor force. Conversion of agricultural and other vacant lands to urban use for development of homes, commercial centers, and industrial plots is increasing with the population growth.

The City of Grants is bordered by foothills on the east and west, by lava beds on the south, and by Black Mesa and Grants Ridge on the north. Elevation of Grants varies from about 6,390 feet above National Geodetic Vertical Datum (NGVD) of 1929. The terrain slopes gently from the base of Black Mesa and the foothills to the Rio San Jose. Rio San Jose, the major drainage feature, flows southeasterly through Grants. Grants Canyon and Zuni Canyon contain major arroyos that drain through Grants and flow into the Rio San Jose.

The Rio San Jose has a flat gradient through Grants along its natural water course except in the extreme western part of the city where the channel has been realigned parallel to Interstate Highway 40.

The climate of Grants is characterized by sunny days, wide temperature changes, low humidity, and an average rainfall of 9 inches. About two-thirds of the annual rainfall occurs from May to October. Summer rainfall is generally of the thunderstorm variety, of brief duration and high intensity. Winter precipitation in the form of snow is generally the result of frontal activity and is of relatively low intensity.

2. Principal Flood Problems: Floods in Grants have been of two general types: (1) spring floods resulting primarily from snow melt, and (2) rainstorm generated flash floods that rise sharply to their peaks, then recede rapidly. The most significant recent known occurrences of flooding in Grants were the August 28, 1952 flow from Zuni Canyon and the September 8, 1967 flow from Grants Canyon, estimated to be 1510 feet 3/sec at Roosevelt Avenue. On September 7, 1969, a local thunderstorm caused local runoff flooding that damaged three areas in Grants.

Village of Milan (FIS 350093 – 1/5/1982)

1. Community Description: The Village of Milan is located in the central portion of New Mexico in the north central portion of Cibola County and is approximately 70 miles west of Albuquerque. Major traffic arteries that pass through the Village of Milan are U.S. Highway 66, Interstate Highway 40, and the Atchison Topeka and Santa Fe Railway. The Village of Milan is contiguous to the northwestern city limits of Grants. The population in 1970 was 1,800 and is estimated to be 7,605 in 1980 and 11,525 by 1990 (Reference I). The population increase is apparently related to the uranium mining and milling process that employs approximately 50 percent of the labor force. Conversion of agricultural and other vacant lands to urban use for development of homes, commercial centers, and industrial plots is increasing with the population growth.

The Village of Milan is bordered by foothills on the east and west, by lava beds on the south, and by Black Mesa and Grants Ridge on the northeast. Elevation of the Village of Milan varies from about 6,420 feet to 6,600 feet. The terrain slopes gently from the base of Black Mesa and the foothills to the Rio San Jose. Rio San Jose, the major drainage feature, f lows southeasterly through the Village of Milan.

The Rio San Jose has a f lot gradient through the Village of Milan along its natural water course except in the extreme eastern part of the village where the channel has been realigned parallel to Interstate Highway 40.

The climate of the Village Milan is characterized by sunny days, wide temperature changes, low humidity, and an average annual rainfall of 9 inches. About two-thirds of the annual rainfall occurs from May to October. Summer rainfall is generally of the thunderstorm variety of brief duration and high intensity. Winter precipitation is generally the result of frontal activity and is of relatively low intensity.

2.3 Principal Flood Problems: Floods in the Village of Milan have been of two general types: (1) spring floods resulting primarily from snow melt, and (2) rainstorm generated flash floods that rise sharply to their peaks, then recede rapidly.

City of Clovis (FIS 350010 – 9/23/1999)

1. Community Description: The City of Clovis is located in east-central New Mexico at an average elevation of 4,275 feet above sea level according to the National Geodetic Vertical Datum of 1929 (NGVD). U.S. Highway 60/84 runs east-west through the City and U.S. Highway 70 runs from the east and turns south in the City. The City of Clovis lies approximately 8 miles west of the New Mexico-Texas State line. The nearest city is the City of Portales, approximately 25 miles to the southwest. The City of Tucumcari is approximately 60 air miles to the northwest, and the City of Albuquerque, the commercial center of the State, is approximately 200 air miles to the west.

The City of Clovis lies on a rolling plain that slopes gently to the southeast and is dissected by several water courses, many of which terminate in sinkholes, which are locally called playas. All of the streams are ephemeral in character, flowing only during periods of heavy rainfall. Most of the area outside the City is productive crop land, while the remaining area is rural.

The City of Clovis has a semi-arid continental climate, characterized by distinct seasonal changes and large annual diurnal temperature ranges. The rainy season occurs in the summer when afternoon thunderstorms produce much of the yearly moisture. Eighty percent of the moisture falls during the 6 months from May through October.

2. Principal Flood Problems: Flooding in the City of Clovis is caused by several arroyos, and the contributing drainage basin comprises approximately 26 square miles of area north of the Atchison, Topeka, and Santa Fe Railway track, which passes east-west through the City. An arroyo entering the west-northwest boundary of the City has been intercepted by the Thomas Street (Worthington) Ditch, which extends southward from the intersection of 21st and Thomas Streets. The ditch, constructed in approximately 1941, is an open trapezoidal drainage channel 3 miles in length, which carries flow south along the west side of Thomas Street to the southwest corner of the corporate area and then southwesterly to the existing Conestoga Hills playa. Overflow from the Thomas Street Ditch flows through the City generally parallel to the Atchison, Topeka, and Santa Fe Railway and is referred to as the West Second Street Drain. A tributary to the Thomas Street Ditch flows through the Bella Subdivision and is designated the Thomas 2 flow path.

Green Acres Arroyo, an intermittent stream designated the Northwest Drainage flow path, enters the northwest corner of the City of Clovis corporate area and flows southeasterly through the City. New Pond playa is on Green Acres Arroyo and is located at the intersection of Llano Estacado Boulevard and Wheaton Street. Green Acres Lake is on Green Acres Arroyo and is situated just west of Main Street and just south of 21st Street.

The Northeast Drainage flow path flows through Sorgen Playa, which lies northwest of the intersection of Prince Street and Llano Estacado Boulevard, and serves as a collector of storm surface runoff from the outlying areas within the drainage basin. The Northwest Drainage flow path flows through residential areas to Goodwin Lake, which is located immediately south of Llano Estacado Boulevard and east of Prince Street. The Northwest and Northeast Drainage flow paths combine in Hillcrest Park and continue across Norris Street to flow south to Mabry Street.

The West Second Street Drain extends in a wedge shape from the Thomas Street Ditch eastward

to the intersection of Norris and Mabry Streets. Dennis Chavez playa lake is located in this drainage basin west of Thornton Street and immediately north of West 14th Street. At Mabry Drive, which runs parallel to the Atchison, Topeka, and Santa Fe Railway, all drainage paths combine.

During the period from June 4-20, 1923, the City of Clovis received 12.31 inches of recorded rainfall. Of this amount, 6.98 inches were recorded on June 7 and 8, followed by 2.62 inches on June 18. Atchison, Topeka, and Santa Fe Railway records show that a flood occurred on July 22, 1930, as a result of 3.85 inches of rainfall. The notes show that all the streets in the south part of the City were under water. The water was 2 to 4 feet deep on First Street opposite the depot with the water flowing east. The water flowed over track 79, washing out 75 cubic yards of fill under the track. The floodwater reached within 0.2 foot below the base of the rail of the mainline track.

Village of Fort Sumner (FIS 350011 - 8/4/1980)

1. Community Description: Fort Sumner is located in east central New Mexico at an elevation of 4050 feet National Geodetic Vertical Datum of 1929 (NGVD). It is in the county seat of De Baca County. The corporate area is about 3 square miles. U.S. Highways 60 and 84 connect to Clovis about 60 miles to the east. U.S. Highway 60 continues west to the Village of Vaughn 56 miles away, while U.S. Highway 84 turns northwest to Santa Rosa about 45 miles away. State Highway 20 leads southwest to U.S. Highway 285, thence southerly to Roswell about 85 miles away. The Belen cut-off of the Atchison Topeka and Santa Fe Railway passes through the Village.

Fort Sumner is a trade center for the farming community in the Fort Sumner Project and for ranchers in the surrounding area. Tourist travel on U.S. Highways 60 and 84, and State Highway 20 affords a modest increment of economic benefit. Population, according to U.S. Census Bureau figures for 1970, is 1,547.

The Pecos River, Las Truchas Creek, and Hitson Draw Watersheds are the principal sources of flooding in Fort Sumner. The drainage area of the Pecos River at the Village is 4390 square miles. Las Truchas Creek and Hitson Draw are tributaries to the Pecos River. Las Truchas Creek has a drainage area of 100 square miles and Hitson Draw has an area of 6 square miles.

Fort Sumner has an average growing season of slightly over six months: the average date of the last freezing temperature in the spring is April 17, and the average date of the first freeze in fall, is October 24. Less than 15 inches of precipitation in an average year gives Fort Sumner a semi-arid climate.

Summers are moderately warm with daytime temperatures rising to 90 degrees F or higher much of the time from late May until mid-September and with readings of 100 degrees F or higher to be expected on several days each summer. Normally, there is considerable cooling at night. The valley location and the usual clear, dry air are conductive to rapid radiation and valley inversions. A drop in temperature of 30 degrees F or more from the day's high can be expected to result in comfortable cooling of most nights even during the hottest summer weather. Summer is also the rainy season: the six months, May through October, normally receive 80 percent of the year's moisture, much of it associated with brief afternoon and evening thundershowers, which tend to cool and freshen the summer air. Hail sometimes accompanies the more severe thunderstorms and small tornadoes have been reported in this section of the state, but there is no record of serious damage in Fort Sumner. This summer-rainfall maximum helps produce good forage on adjacent range lands.

Winters are generally dry, bringing less than one-half inch of moisture per month. Only one or two days a month from November to April have as much as one-tenth of an inch of precipitation. Winter skies are clear much of the time, resulting in moderate daytime temperatures so that, even in midwinter, shade temperatures normally exceed 50 degrees F.

On an average of only three days during the winter does the temperature fail to rise above freezing. Nights are cool, with lows falling below freezing temperatures most of the time from early November to mid-March; but readings of zero or below occur on the average of only once each winter. Some snow falls, but usually only a few inches at any time, which normally lies on

the ground for only one or two days. Moderately strong winds may accompany a winter storm and cause considerable drifting, but blizzard conditions are rare and of short duration.

2. Principal Flood Problems: The Las Truchas Creek, above the village limits, is deeply incised in a rocky walled, steep side canyon. As the Creek passes through the village, it opens out into a sandy flood plain. The stream is intermittent and its low flow stream bed alignment is well defined. During passage of flood flows, the stream bed alignment may change as flows overtop the channel banks and spread out in the overbank areas.

Hitson Draw, from Dunn Avenue to the Atchison Topeka and Santa Fe Railway is poorly defined and shows evidence of shifting. The Hitson Draw railroad bridge, located at the extension of Thirteenth Street, passes runoff water from a drainage area of 6 square miles. Hitson Draw comprised 1.5 square miles of this total; the remainder comes from the old airport area in the northwest corner of the village. Downstream of the Hitson Draw Railroad bridge, flood flows pass through a residential area where no defined stream exists. Several residential dwellings are subject to flooding in this area. As the flood flows reach U.S. Highways 60 and 84, they collect in a park area and pass under the Highway in a multiple concrete box culvert (Figure 2). Downstream of U.S. Highways 60 and 84, on Hitson Draw, flood flows are blocked by an embankment for the Fort Sumner Main Canal. This causes a large pool to form behind the canal banks. Large flows overtop the canal banks resulting in broad shallow flooding between the canal and the Pecos. The area upstream of the irrigation canal, occupied by flood water during a storm, is used as an athletic field when dry.

The flood plain of the Pecos River is approximately one-half mile wide at Fort Sumner. A sandy stream bed conveys a perennial flow. The remainder of the flood plain is vegetated. A highway bridge and a railroad bridge cross the Pecos, near Fort Sumner.

On September I, 1942, flow in the Pecos River passing Alamogordo Dam, approximately 16 miles upstream of Fort Sumner, was computed to be 42,800 cubic feet per second (CFS) by the Bureau of Reclamation. There has been no excessive flow since that time due to regulation by the dam. Inflow to Alamogordo Dam in June 1937 was determined to have been about 75,000 cfs; however, the dam modified downstream flow to a substantial but undetermined degree even though there was flow over the dam's uncompleted spillway.

There are no records of flow for either Las Truchas Creek or Hitson Draw. Flooding from these sources is most likely to occur as a result of intense thunderstorms.

Dona Ana County, Village of Hatch, City of Las Cruces, Village of Mesilla, City of Sunland Park (FIS 35013C – 9/6/1995)

1. Community Description: Dona Ana County is located in the south-central portion of New Mexico. It is bordered by the unincorporated areas of Luna County to the west, the unincorporated areas of Sierra County to the north, the unincorporated areas of Otero County to the east, the unincorporated areas of El Paso County, Texas to the southeast, and the State of Chihuahua, Mexico to the south. The City of Las Cruces, with a population of 54,601, is located in the heart of Dona Ana County.

Dona Ana County has a population of 127,000 and is currently one of the fastest growing areas of New Mexico. Presently, the main economic sources in the county are: agricultural products, such as cotton, chili, pecans, and alfalfa; aerospace research and manufacturing; tourism; and the New Mexico State University in Las Cruces.

The Rio Grande, which is controlled by Elephant Butte Reservoir, runs through the central portion of Dona Ana County in a north-south direction. The Rio Grande, along with an extensive system of irrigation canals, provides the water for the county's agricultural industry. Except for the Rio Grande, the remainder of the arroyos in Dona Ana County are ephemeral and have runoff as a result of short, intense summer thunderstorms.

The mountain ranges within Dona Ana County are, in general, aligned in a north-south direction, and include the San Andres, San Augustin, Organ, and the Franklin Mountains.

The climate of the county can be described as arid, except for semiarid areas at higher elevations, where precipitation is greater and temperatures are cooler. The native vegetation in many portions of the county has been greatly depleted by excessive use. Much of the acreage that was once desert grassland is now dominated by shrubs and annual forbs.

2. Principal Flood Problems: Most of the storms that produce large amounts of runoff occur in the months of June through September. Fall, winter, and spring are the dry seasons because much of the moisture in eastward circulation from the Pacific Ocean is removed as the air passes over the mountains west of New Mexico. In the summer, moisture-laden air from the Gulf of New Mexico enters southern New Mexico. Strong surface heating and upslope flow of the air cause brief, and often heavy, showers.

In the Chaparral area, the flooding is generally very shallow due to the lack of well-defined floodpaths. Flooding on streams on the West Mesa (west of Las Cruces), is characterized by high-velocity flows heavily charged with sediment and debris; it generally results from brief, intense thunderstorms. Flood hazards are further aggravated as these high-velocity sediment flows enter the Rio Grande valley. Upon reaching the escarpment, these flows spread out to form alluvial fans; these are cones of sediment at the base of the escarpment deposited by floods. The areas with alluvial fans are characterized by high-velocity flows, large amounts of sediment deposition, and unpredictable flow paths that may change during the same flood event.

During the week of August 3-10, 1984, Dona Ana County experienced heavy rainfall that caused flooding in many locations. In the Chaparral area, homes were surrounded by water and dirt streets turned into lakes that were impassible due to siltation and flooding. Pumping was required

to alleviate the problems. The county was also hit by heavy rain as recently as August 23 and 24, 1987, when over three inches of rainfall were recorded. Floodwater swamped homes, businesses, schools, and hundreds of acres of farmland, and over-taxed irrigation canals. Approximately $667,000 in damages was reported by the county. The arroyos west of the Rio Grande in Las Cruces were among the areas affected by the floodwaters.

Eddy County (FIS 350120 – 6/4/1996)

1. Community Description: Eddy County is located in the southeast portion of New Mexico. It is bordered by the unincorporated areas of the following counties: Lea County to the east; Chaves County to the north; Otero County to the west; Culberson County, Texas to the south; and Loving and Reeves Counties, Texas, to the southeast. The Cities of Artesia and Carlsbad and the Villages of Hope and Loving are located within the geographic area of Eddy County.

2. Principal Flood Problems: Concern over stream flooding in Eddy County centers on the portion of Hackberry Draw west of the corporate limits of the City of Carlsbad. This concern stems from current and planned development along Hackberry Draw.

City of Artesia (FIS 350016 – 3/9/1999)

1. Community Description: The City of Artesia is located in southeastern New Mexico, in the north-central part of Eddy County. The City lies in the middle of the Pecos River Basin. The total area within the corporate limits is approximately 3 square miles. U.S. Highway 285 connects with the City of Carlsbad approximately 36 miles to the south and the City of Roswell approximately 40 miles to the north. U.S. Highway 82 leads east approximately 52 miles to the City of Lovington and west approximately 110 miles to the City of Alamogordo. The Clovis-Carlsbad branch of the Atchison, Topeka & Santa Fe Railroad passes through the City.

Residences, small businesses, schools, parks, and churches occupy most of the corporate area of the City of Artesia. While there is some open land, there are no large single tracts. The City is the trade center for a rich farming area. Nearby ranching is a substantial economic factor. Exploration for oil and natural gas has encroached upon and surrounded the community, which is a supply point for the industry. According to the U.S. Bureau of the Census, the 1996 population of the City of Artesia was 11,197.

Flooding is caused by large flows in Eagle Creek, normally a dry arroyo. Eagle Creek heads in the foothills of the Sacramento Mountains approximately 50 miles west of the City of Artesia. The drainage area upstream from the City of Artesia, which is approximately 2 miles wide in the lower reach, approximately 4 miles wide in the middle reach, and not more than 6 miles wide in the foothill area, is relatively narrow. The total drainage area contributing to the Pecos River is approximately 203 square miles, of which approximately 185 square miles lie west of the City. South Eagle Creek has a small drainage area southwest of the City, estimated at not more than 3 square miles.

The City of Artesia has a semi-arid climate with characteristic seasonal temperature changes and large annual and diurnal temperature ranges typical of a continental location. Summers are moderately warm, with daily high temperatures averaging approximately 90°F from June through August. The temperature can be expected to exceed 90°F on 5 out of 6 days, and readings of 100°F or higher will occur on several days each summer. The moderate relative humidity and the usual clear skies favor radiational cooling after sundown, so that most summer nights are comfortably cool. Summer is also the rainy season, with two-thirds of the yearly precipitation normally falling from May through September, most of it brought by brief afternoon and evening thundershowers, which tend to alleviate the summer heat. Occasionally, the more severe thundershowers are accompanied by hail and brief, strong winds. Small tornadoes have been observed in the area, but damage from them is usually light.

Winters are generally mild and dry. Even in midwinter, daytime shade temperatures are mostly in the 50s, with an average of only 4 days each winter when the temperature fails to climb above freezing. The minimum temperature usually falls below 32°F from midNovember to mid-March, but only in approximately one winter out of three will the temperature drop to 0°F. Less than 0.5 inch of moisture a month can be expected from November to March, and only 1 or 2 days each month bring precipitation exceeding one-tenth of an inch. Some winter moisture falls as snow, but normally individual storms will not deposit more than 1 or 2 inches of snow, which soon melts.

Sunshine can be expected in the City of Artesia approximately 74 percent of the possible hours throughout the year. The high percentage is fairly consistent in all months, varying approximately 11 percent, from 68 percent in December to 79 percent in June. The relative humidity averages approximately 50 percent for the year, ranging from approximately 70 percent in the cool early morning hours to 30 percent during the warmer part of the day. It frequently falls below 20 percent in spring months. Winds are generally light, averaging less than 10 miles per hour for the year. Spring months are somewhat windier. At the same time, the average hourly velocity is approximately 12 miles per hour. Wind velocities exceeding 24 miles per hour can be expected only 3 percent of the time. The growing season extends for 206 days -- from the average date of the last spring freeze on April 7 to the first freezing temperature in the fall around October 30.

2. Principal Flood Problems: In the past, the 185-square-mile watershed of Eagle Creek would produce major flooding problems in the City of Artesia. During these historic floods, a flow split could occur 3 miles west of the City, causing widespread shallow flooding along South Eagle Creek, which borders the southern edge of the City. Second, near the western edge of the City, Eagle Creek can overflow and cause shallow flooding along Washington Avenue. Flooding problems were aggravated by road and railroad crossings that constricted flow.

In the early 1990s, the NRCS constructed the Eagle-Tumbleweed Draw Dam and a number of flood control channels to supplement the City's drainage system. The combined flood control system eliminated the two splits discussed above. It also reduced the uncontrolled watershed producing peak flows in Eagle Creek from a total drainage area of 194 square miles (at the eastern City limits) to 12 square miles. The reduction in the drainage area resulted in a reduction in peak flow and extent of the floodplain. Therefore, the principal flooding that remains in the City of Artesia is a result of local drainage problems only.

The history of flooding in the City of Artesia is composed principally of vivid memories and little analytical data. Major floods occurred in the City of Artesia area from September 26 through 30, 1904; July 20 through 26, 1905; July 24, 1911; April 28 through May 1, 1914; July 19 through 28, 1915; August 6 through 9, 1916; September 14 through 17, 1919; May 22 through June 4, 1937; May 20 through 27, 1941; September 20 through 24 and 27 through 30, 1941; and August 29 through September 2, 1942.

Press clippings record floods on Eagle Creek on October 7, 1954; June 16, 1964; July 29, 1965; July 24, 1966; August 24, 1966; May 26, 1969; March 26, 1972; September 10, 1972; and September 29, 1974.

All flooding was prior to the Urban Renewal project that channelized North Eagle Creek and made a parkway through the City.

The peak flow rate of the 1911 flood on Eagle Creek has been estimated at 26,000 cubic feet per second (cfs). This flow rate corresponds to a recurrence interval of between 100 and 500 years.

Based on available records (Reference 4), the 1954 and 1964 floods would have recurrence intervals of 40 and 30 years, respectively. The 1954 flood was caused by a general-type storm covering most of the watershed, while the 1964 flood was caused by a high-density thunderstorm

covering approximately 50 square miles of the Eagle Draw Watershed located just west of the City of Artesia. The storm also covered 30 square miles of the Cottonwood-Walnut Creek Watershed just northwest of the City of Artesia.

City of Carlsbad (FIS 350017 – 4/3/1996)

1. Community Description: Carlsbad, the county seat of Eddy County, is located on the banks of the Pecos River in southeastern New Mexico. It was organized in 1893 as the Town of Eddy to serve as a trading center for the surrounding ranching area and the newly developed irrigation farming section. The name was changed to Carlsbad in 1899, and the City was incorporated in 1918. Mining and refining of potash for use in agriculture fertilizers is the major industry in the Carlsbad area. Discovery of potash in the area was made in 1925. The area produces a large majority of the potash used in the United States. This industry ranks second to oil in mineral production for the State of New Mexico. Oil and gas fields are also found nearby. Agriculture is an important industry in the Carlsbad area, with irrigated farmland producing cotton, alfalfa, and sorghum. Carlsbad Caverns National Park is approximately 28 miles southwest of the City.

The City experienced a steady growth until World War II when industries other than agriculture began to expand at a more rapid rate. From a population of 7,116 in 1940, the City had grown to a population of 21,279 in 1970. Extensive commercial, industrial, and residential developments, as well as public utilities, encroach on the floodplains, including practically the entire downtown business area of Carlsbad. Transportation facilities that cross the floodplains include portions of U.S. Highways 62-180 and 285, and the Atchison, Topeka, and Santa Fe Railroad.

The Pecos River originates in the Sangre de Cristo Mountains in northern New Mexico. From its source, the river flows in a southeasterly direction for approximately 925 miles through eastern New Mexico and western Texas. At this point, it joins the Rio Grande River at the International Boundary of the United States and Mexico, approximately 10 miles north of the Amistad Reservoir. The drainage area of the Pecos River, above Dark Canyon Draw in Carlsbad, amounts to approximately 18,099 square miles. Elevations range from approximately 13,000 feet in the headwater region to 3,100 feet at Carlsbad. The streambed slope of the Pecos River through Carlsbad averages approximately 5.8 feet per mile (fpm), and the channel width is approximately 450 feet.

Dark Canyon Draw, a right-bank tributary of the Pecos River, rises in the Guadalupe Mountains in southwestern Eddy County and flows northeasterly for approximately 60 miles, to its confluence with the Pecos River in southern Carlsbad. It drains an area of approximately 451 square miles. Dark Canyon Draw is perennial in its upper mountainous reach and ephemeral in the lower reach. From its source at River Mile (RM) 12, the stream is confined to a steeply walled canyon. From RM 12 to the mouth, it flows across a broad, sloping plain. At RM 1.9, the Southern Canal siphon passes under Dark Canyon Draw, restricting Dark Canyon Draw to a narrow channel. The slope of Dark Canyon Draw averages approximately 22.0 fpm from the mouth to RM 2.0, 30.2 fpm to RM 3.4, and 26.6 fpm to RM 8.5. Above RM 8.5, the slope increases rapidly. At approximately RM 1.0, Dark Canyon Draw divides into two channels. The northernmost channel is referred to as an overflow channel and continues on to enter the Pecos River approximately 0.25 mile above the main channel of Dark Canyon Draw.

Hackberry Draw, a principal tributary of Dark Canyon Draw, rises in the dissected plains region approximately 7 miles west of Carlsbad. It flows in an easterly direction to the Southern Canal in West Carlsbad. At the canal, it is abruptly diverted south along the canal to join Dark Canyon Draw.

Carlsbad is in a semiarid region with an average annual precipitation of approximately 12.76 inches. It is in the western part of the Gulf rainfall province. Major storms are caused by unstable air masses from the Gulf of Mexico.

Analyses of rainfall records show that large-magnitude storms occur generally during the period of April through October. General precipitation may produce large volumes of runoff and high-peak discharges. Thunderstorms may cause local floods with comparatively small volumes and high-peak discharges. Floods on Dark Canyon Draw and tributaries are characterized by an extremely high ratio of peak discharge to total flood volume. Due to the high velocities produced by the steep slope and narrow channel of Dark Canyon Draw, major floods descend in waves or walls of water.

The vegetation cover in the study area includes a partial overstory of ocotillo, creosote bush, chamise, yucca, and some mesquite. Grasses have been identified by the U.S. Soil Conservation Service (SCS) as consisting of blue, black, sideoats, and hairy grama, in addition to tobosa and three awn.

2. Principal Flood Problems: Historical records refer to at least five major floods on the Pecos River at Carlsbad prior to 1904. Accounts beginning in 1865 indicate that major floods occurred in 1871, 1874, 1886, 1893, and 1900. The flood of August 1893 was particularly severe in the vicinity of Carlsbad, perhaps the worst in 50 years. Several bridges were damaged or destroyed during the 1893 flood. Floodwater was 1 -foot deep at Greene and Canyon Streets. Since 1904, six floods have occurred on the Pecos River that exceeded the channel capacity through Carlsbad. These floods occurred in 1904, 1905, 1915, 1916, 1941, and 1966. During the flood of August 7, 1916, the Pecos River attained an estimated peak discharge of 85,700 cubic feet per second (cfs), the largest discharge ever recorded at Carlsbad. Figures 2 through 8 are aerial views of the 1966 flood.

Information obtained from historical records and interviews with local residents indicates that at least nine floods with peak discharges exceeding channel capacity have occurred on Dark Canyon Draw since 1906. These floods occurred in 1906, 1908, 1911, 1915, 1916, 1919, 1925, and May and September 1941. The September 1941 flood was estimated at 100,000 cfs, the worst the older residents remembered. The May 1941 flood is reported to have moved in as a wave, or wall, of water, which swept lightly constructed buildings off their foundations. Twenty deaths were attributed to the May and September 1941 floods.

Flood problems in the Dark Canyon Draw floodplains are caused by encroachment and the Southern Canal siphon. Commercial interests have encroached on the floodplains, even though the City and county acquired title to a part of the floodplain to discourage occupation of the area. The Southern Canal siphon, which crosses under Dark Canyon Draw approximately 2 miles above its mouth, is too short to provide sufficient waterway for Dark Canyon Draw floodflows and, as a result, floodwaters are temporarily impounded by the Southern Canal embankment. In addition, there is usually flow in Hackberry Draw coincident with floods on Dark Canyon Draw, which increases the impoundage. During past floods, water impounded by the Southern Canal embankment has entered the developed area north of Lea Street.

Town of Silver City (FIS 350022 – 7/17/1997)

1. Community Description: The Town of Silver City is located in southwestern New Mexico, approximately 100 miles northeast of Las Cruces. It is completely surrounded by the unincorporated areas of Grant County. Silver City lies at the base of the Pinos Altos Mountains, just southeast of the continental divide.

The town originated in the 1870's as mining interests began to increase in the area. Rapid expansion continued until the 1890's when silver prices dropped and the high grade ore deposits were exhausted. Since the early 1900's, cattle ranching and renewed mining interests have been the principal industries. In past years, Grant County has been the leading metal producer in New Mexico, with Silver City enjoying the hub position.

Development in the Silver City area has maintained a steady pace over the last 50 years; however, the mining industry has slowed in recent years, and the extent of major development affecting the floodplains in the recent future is uncertain. Residential, commercial, and educational development closely borders the streams in Silver City. On the outer perimeter of the town, rural development has been occurring at a steady rate. Outlying areas fall under the city's 3 mile extra territorial jurisdiction, and the town does exercise its control in these areas.

All of the streams in the Silver City area are similar, characterized by steep slopes in the mountains decreasing to less than 1 percent in the lower valleys. Vegetation varies from mature forests of scrub juniper and pinon in the mountains to light grass and brush in the lower, more arid sections. The streams within the existing developed areas of the town are extremely well incised in the surrounding landscape. Bank slopes are nearly vertical, supported by stone masonry walls built in the 1930's by Civilian Conservation Corpsmen.

Numerous streams flow through the Silver City area, all of which are tributaries of San Vicente Arroyo. Beginning at the confluence of Pinos Altos and Silva Creeks, San Vicente Arroyo flows due south through the older Silver City business districts. Here, the arroyo's course is virtually linear as it now flows down what was once Main Street. Known locally as the Big Ditch, this reach of San Vicente Arroyo has an interesting history. As mining flourished in the 1890's, the Silver City watersheds were heavily lumbered and over grazed. Denuding of vegetation in the basin resulted in an enormous increase in runoff. Because the original site of Silver City was built in the bottom of a lush valley with Main Street at the center, Main Street became the principal floodway of the area. Within a 10 to 30 year period, much to the dismay of the townspeople and despite repeated efforts to prevent it, Main Street (or the Big Ditch) was lowered by erosion until bedrock was finally reached, approximately 40 feet below the original street grade. Since that time, the town has slowly encroached back upon San Vicente Arroyo, and today it remains with channel banks built of masonry walls that stand nearly vertical above the bedrock bottom. San Vicente Arroyo averages 40 feet deep and 40 feet wide as it passes through the heart of downtown. Further downstream, San Vicente Arroyo more closely resembles a typical southwestern sandy bottom channel. Its banks are bordered with intermittent residential districts, and vegetation consists of light grasses and brush with some areas of mature trees. Slopes of the stream vary from 2 percent at the upper portion of the study to less than 1 percent at the lower end of the study.

The San Vicente basin consists of two major tributaries: Silva Creek and Pinos Altos Creek. Silva Creek is the largest San Vicente tributary, encompassing a 21.6 square mile drainage area at its mouth. The continental divide forms the uppermost basin boundary of Silva Creek. Elevations at the divide reach over 8,000 feet on Bear Mountain. Little Walnut Creek and Tributary 5 to Silva Creek were upstream branches of Silva Creek. These two tributaries have long and narrow basin shapes in contrast to the remainder of the Silva Creek basin, which is more triangular being widest at the upper reaches and narrowing to a point in Silver City. Slopes in the Silva Creek basin range from over 10 percent in the high mountains to 1.5 percent in the lower reaches. Newer residential developments are located intermittently along higher reaches of Silva Creek, while more residential development exists downstream along the floodplain intermixed with commercial and educational districts. Pinos Altos Creek is similar to Silva Creek except that the basin is smaller with a drainage area of 4.9 square miles at its mouth. The Pinos Altos watershed is long and narrow, reaching 6 miles north to the continental divide while maintaining a fairly constant width of 0.75 mile.

Two miles east of San Vicente Arroyo lies the Maude's Canyon basin. Maude's Creek enters San Vicente Arroyo approximately 4 miles south of Silver City. The Maude's Creek basin totals over 18 square miles at its confluence with San Vicente Arroyo. Rural development is lightly scattered throughout Maude's Canyon; however, increased subdivision development may occur in the area. Maude's Canyon begins at the continental divide north of Silver City at elevations of over 7,000 feet on the east slopes of the Pinos Altos Mountains. Tributaries 1 and 2 both empty into Maude's Creek.

The climate around Silver City is semi-arid. Average temperatures range from the high 80°s (degrees Fahrenheit - °F) in summer to low 20's (°F) in winter. Average yearly rainfall is approximately 17 inches, with an average of 12 inches of snow. A majority of the yearly rainfall occurs in July. Flows in San Vicente Arroyo and its tributaries are mostly ephemeral in nature, with periods of zero flow.

2. Principal Flood Problems: Winter snowmelt, mountain springs, and summer thunderstorms are the primary sources of water for the streams in the Silver City area. Occasionally large frontal activities will develop from storms originating in the Pacific, moving east across Arizona and then encountering the Pinos Altos mountains around Silver City. Yearly peak flows occur most often in the months of July through September.

The maximum known peak flow for San Vicente Arroyo occurred on the night of July 21, 1895. The following is a newspaper account of that well known flood:

> At 8:45 last Sunday evening the long prayed-for rain, came and came in torrents. The somber clouds which for hours had hung threateningly over the Pinos Altos range, precipitated their pent-up flood upon the steep hillsides adjacent to Chloride Flat, which gathered the waters into a compact volume, from which place it swept down the narrow gorge with terrific force upon the town of Silver City. This flood, which attained its maximum in force and volume at 10:30, was the largest ever seen at Silver City up to that hour, carried away the walls of the Broadway Corral, the rear walls of the Broadway Hotel and worked general destruction. The waters of the first flood had receded below the danger limit at 11:30 when the great bank of black clouds which darkened the sky to the northwest came in contact with the towering peak of Bear Mountain, the highest in all Pinos Altos range. As if the bottom of sea were punctured by the peak, a vast volume of water descended accumulating in force as it converges in

> streams from the mountain sides, making a river in the canyon which leads through the town. At 11:45 this flood struck the town, in an immense wave, twelve feet in height and three hundred feet in width, carrying with it everything movable in its path. Down through the heart of town, through the principal business streets it swept, entering the houses through every crack and crevice, filling cellars full and overflowing, bursting open doors and smashing large windows, running through the first floor of nearly all the houses a depth of two to four feet. The steep mountain canyon through which the water ran before reaching the town, and the heavy down grade, lent impetus to the water till the velocity must have been fifteen miles per hour, as the flood passed through the town. (Reference 1).

The five largest discharges for San Vicente Arroyo are listed in the following tabulation:

DATE	STAGE[1] (FEET)	ELEVATION[1] (FEET)	PEAK DISCHARGE (CFS)
July 21, 1895	12.0	5,885.7	10,000[2]
September 9, 1938	9.1	5,882.8	6,800[3]
August 16, 1963	7.1	5,880.8	4,680[4]
August 11, 1960	6.0	5,879.7	3,660[4]
August 30, 1957	5.2	5,878.9	2,929[4]

[1] Depth on upstream side of the College Avenue bridge based on the 1985 streambed elevation of 5,873.7 feet.
[2] From newspaper accounts.
[3] From flood marks found in 1956.
[4] Gaged flows from USGS gage No. 8477600 on San Vicente Arroyo at Silver City.

This historic flood in 1895 had a discharge of 10,000 cubic feet per second (cfs), with an estimated recurrence frequency of approximately 130 years when compared to present basin characteristics. Significant changes in runoff characteristics have occurred in the basin since 1895, however, and the rainfall that produced this flood would most likely result in a smaller discharge by today's standards.

The largest discharge of recent record on San Vicente Arroyo occurred on August 16, 1963. Local newspapers reported:

> The floodwaters crested at six feet and for a time threatened the bridges spanning the big arroyo (Silva Creek) on west 12th Street and north Pope Street. The Big Ditch (San Vicente Arroyo) carried the largest flood in several years and the channel controlled the huge runoff preventing serious flood damage to the residential and the downtown areas of Silver City (Reference 2).

During this flood, a flow of 4,680 cfs was recorded at the USGS gage on San Vicente Arroyo in Silver City, with an estimated recurrence frequency of 13 years. The same storm produced a discharge of 2,560 cfs at the USGS gage on Silva Creek upstream of the 12th Street bridge and 3,140 cfs at the gage on Pinos Altos Creek upstream of 12th Street.

Past hydrologic investigations for the Silver City area have generally resulted in higher fre-

quency discharges than this study. The main reason for the differences are the hydrologic methods used and the emphasis placed on the 1895 historic discharge for San Vicente Arroyo. It is well established that at the time of the 1895 flood, the basin vegetation in the area had been severely reduced.

Within the 10 years after 1895, there is historic evidence of three floods of 40- to 100-year frequencies by today's standards. Since the early 1900's, the vegetation in the basin has been replaced and floods of these magnitudes have not occurred when compared with the systematic gaging records over the last 30 years. The analysis used in this study places less emphasis on the historic floods thus producing somewhat lower discharges than previous studies. It should also be noted that an increase in the magnitude of the frequency flows of 20 or 30 percent would not place a greatly increased amount of additional area in the floodplains.

Since the streams in the Silver City area are deeply entrenched due to past scouring of the bottoms, most of the rivers can contain a 40-year discharge when flowing bank full. Discharges of the 100-year frequency cause overbank flooding of the upper reaches of Pinos Altos Creek and Silva Creek, and the lower reaches of San Vicente Arroyo. For the most part, there is little existing development in these low-lying 100-year floodplains.

The principal flood-prone area in Silver City is located near the east bank of Silva Creek and the west bank of Pinos Altos Creek within 0.5 mile upstream of their confluences at the beginning of San Vicente Arroyo. These two stream have the capacity to carry the 100-year flows within their banks if not for several constrictive crossing structures. The U. S. Route 180, 12th Street, and Pope Street structures over Silva Creek cause backwater effects that force 100-year flows over the east bank through the heart of downtown. Once these flows escape the confines of their banks, they do not reenter the main channel until reaching the confluence and beginning of San Vicente Arroyo. A similar situation is produced by the structures at 12th Street and Hudson

City of Santa Rosa (FIS 350024 – 9/2/1980)

1. Community Description: The City of Santa Rosa has an incorporated area of approximately two square miles. It is the county seat of Guadalupe County. Santa Rosa is a trade center for a considerable ranching area. Its location, astride U.S. Highway 66, has produced a modest, but stable, economic base from tourist traffic during past years. A number of small lakes in the vicinity attract fishermen. The Chicago Rock Island and Pacific-Southern Pacific Railroad runs through the city.

From the City of Santa Rosa, Albuquerque lies 120 miles west, and Tucumcari some 60 miles east on Interstate Highway 40; Fort Sumner is approximately 45 miles southeast on U.S. Highway 84, and Vaughn is some 37 miles southwest on U.S. Highway 54.

The City of Santa Rosa is located on the banks of the Pecos River, which rises on the eastern slope of the Sangre de Cristo Mountains in North Central New Mexico. Measuring from the confluence with the Rio Grande, in Texas, Santa Rosa is located at river mile 754 at an average elevation of 4,600 feet above National Geodetic Vertical Datum of 1929 (NGVD). Elevation 12,000 feet NGVD is at river mile 926.4; the stream originates at an elevation of over 13,000 feet NGVD on the slopes of the Truchas Peaks. The contributory drainage area, at Santa Rosa, is approximately 22,650 square miles. The outer reaches of the watershed are mountainous and rugged; thalweg slopes exceed 60 feet per mile. Slopes flatten appreciably in what might be termed the foothill reach between river miles 812 and 862 with slopes averaging approximately 19 feet per mile. In the vicinity of Santa Rosa, slopes have flattened to something less than 10 feet per mile.

Santa Rosa has a semiarid continental climate, characterized by a distinct seasonal change and large annual and diurnal temperature ranges. Summers are moderately warm; average monthly temperatures for June, July and August are in the mid 70's. Summer is also the rainy season, when afternoon thundershowers produce much of the yearly moisture; 79 percent of which normally falls in the six-month period from May to October. This summer rainfall produces food forage on the ranges and makes some dry forming possible. Most of these summer showers are brief and tend to alleviate the summer heat. Prolonged rainy spells are rare. Hail may accompany the more severe summer storms, but damaging hail is usually confined to small areas.

Santa Rosa winters are mild, sunny, and dry. The lowest monthly average temperature is in the high 30's in January. Freezing temperatures may occur any time from late October to early April. Temperatures of 20 degrees F or below may occur any time from late November to early March. Much of the winter moisture falls as snow, which seldom lies on the ground for more than a day or two. Occasionally, high winds are associated with a winter storm, causing heavy drifting and near blizzard conditions for a few hours.

2. Principal Flood Problems: General precipitation lasting for several days is the cause of major floods on the Pecos. Short duration thunderstorms are the major cause of floods on tributaries to the Pecos in the Vicinity of Santa Rosa. The relatively small runoff volumes that result from the thunderstorms can cause damaging peak flow rates on the tributaries, but dissipate due to channel storage when they enter the Pecos. The. high volumes of runoff resulting from general precipitation, in combination with the flat channel slopes of the Pecos, results in flood stage

flow.

The flood plain of the Pecos River is approximately one-half mile wide at Santa Rosa. A sandy stream bed conveys a perennial flow. The remainder of the flood plain is heavily vegetated; some of the flood plain is cultivated. A highway bridge and a railroad bridge cross the Pecos, near Santa Rosa.

El Rito Creek enters Santa Rosa, near the northern city limits, in a steepwalled rocky canyon. The creek crosses Interstate Highway 40 through large culverts, some increase in water-surface elevation results from this constriction, but it does not cause flooding problems.

Downstream of Interstate Highway 40, El Rito Creek spreads out on a wider flood plain with a defined low flow stream bed. The flood plain topography limits outward expansion of floodwater resulting in confinement of flooding to land immediately adjacent to the Creek. Two bridges at road crossing restrict high flows.

Approximately one-quarter mile upstream of El Rito Creek's confluence with the Pecos River, Power Dam creates a small recreational Lake. Power Dam was originally constructed about 1910 to provide the city with a hydro-generator. With the dam's original purpose, long ago abandoned, it now appears in a state of disrepair. Figure 2 shows the dam looking west on El Rito Creek.

Flow measurements on the Pecos were begun about 1904. Apparently, prior to 1904, major floods occurred in 1871, 1874, 1886, 1897 and 1900. No estimates of flow rates are available for these floods.

The maximum recorded peak discharge for the Pecos River at Santa Rosa occurred June 2, 1937. The discharge measured on this date was 55,200 cubic feet per seconds (cfs). On the day following the June 2 peak, a second peak was observed at 24,200 cfs. Additionally, a flood flow of 40,600 cfs was recorded at Santa Rosa on September I , 1942.

Estimates of the recurrence interval of these major floods have not been made due to a major structure currently being constructed on the Pecos immediately upstream of Santa Rosa. This structure, the Los Esteros Dam, controls approximately 2,480 square miles of the 2,650 square mile drainage basin above Santa Rosa. Los Esteros Dam is located only seven miles above. the city. The dam has a substantial amount of floodwater storage capacity and will significantly modify peak discharges in the reach of river passing through Santa Rosa. Consequently, historic flooding events are not representative of flooding anticipated under existing conditions.

Flood flow measurements have not been made for El Rito Creek nor is any other quantitative or empirical data available from which the recurrence interval of observed flooding events may be estimated.

City of Lordsburg (FIS 350026 – 3/1978)

1. Community Description: The City of Lordsburg, which is located in the southwest corner of New Mexico, is the county seat of Hidalgo County. The population of Lordsburg is estimated by city officials to be 5,200 persons (Reference I), an increase of nearly 1,600 since 1970. The economy of the area is diversified, including ranching, mining, and railroading.

Lordsburg occupies a key location for transportation facilities in this region. It lies astride 1-10, which connects Tucson, Arizona (153 miles west) and Deming, New Mexico (58 miles east), and conducts switching services for the Southern Pacific Railroad. In addition, Lordsburg is located near the junctions of U.S. 70 and State Routes 90 and 464 with I-10.

The commercial areas are located primarily along Railroad Avenue (U.S. 80). Residential development is concentrated between Railroad Avenue and 1-10 and north of the Southern Pacific Railroad.

The principal stream through Lordsburg is Animas Wash, which runs northeasterly from the south center part of town through the residential area and empties into Armory Draw enroute to Lordsburg Draw. The construction of 1-10 and its accompanying drainage channel around the south side of the developed part of Lordsburg in 1973 removed most of the town from any significant flood plain. There remains primarily only shallow flooding and some ponding from flows generated north of I-10. These waters will cause minor flooding of residential structures and some businesses along Railroad Avenue.

Most of the flows affecting Lordsburg, particularly south of 1-10, originate in the Pyramid Mountains, which have elevations of about 5,100 feet National Geodetic Vertical Datum of 1929 (NGVD), and flow northward into the city, with an elevation of 4,200 feet NGVD. The Pyramid Mountains are composed of volcanic rhyolites and andesites. Soils formed from these materials are mainly gravely and stony sandy looms. In the lower reaches and within the city limits, the soils become finer in texture and are mostly gravely clay looms. Vegetation consists primarily of creosote bush.

The climate of Lordsburg is characterized by large annual and daily temperature ranges. Summers are warm but daily temperatures can vary as much as 30 degrees F. Winter temperatures are mild. The average annual precipitation of Lordsburg is about 10 inches. Because climatic and drainage area-characteristics are not conducive to continuous runoff, little streamflow occurs except during and immediately following intense rainfall.

2. Principal Flood Problems: Little documentation of past flooding in Lordsburg is available. The last flood that caused significant damage occurred in August 1957, when at least $100,000 worth of damage occurred in the east central part of Lordsburg. It is not likely that there will be any extensive flooding in Lordsburg in the future due to the drainage channel along I-10.

Some flooding will occur south of I-10 but will be generally less than two feet deep. Shallow flooding along most washes will cover areas less than 200 feet wide. Most of the flooding which will occur north of I-10 will be from local rainfall which cannot be routed through U.S. 80 and the Southern Pacific Railroad quickly enough to prevent minor backwater conditions and ponging along Railroad Avenue.

Additional flooding will occur at the underpass of Animas Avenue at 1-10 due to an undersized culvert having less than 100-year capacity under Animas Avenue. The resulting ponding effects along the drainage channel will cause some flooding at the underpass as the overflow is diverted into the section of Animas Wash north of I-10.

In the northern section of the city, undersized culverts at Mountain View Road and U.S. 70 cause flooding. Mountain View Road impedes the shallow flows of Olliver Wash, causing ponding to the height of the road. U.S. 70 will pond the I00-year flood on Lordsburg Draw. Although the highway will not be overtopped, the combination of mild gradients on Lordsburg Draw and insufficient openings through the highway will cause flooding in much of the northeast part of town. There is, however, very little development in this area.

City of Hobbs (FIS 350029 – 7/16/1991)

1. Community Description: The City of Hobbs is located in the southeast corner of New Mexico, approximately 70 miles northwest of Odessa, Texas. It is surrounded by the unincorporated areas of Lea County.

Numerous oil and gas wells are scattered throughout the area and are one of the principal sources of revenue for Hobbs. Ranching is an important industry in Lea County where approximately 90 percent of the county is rangeland for cattle, sheep, and horses. Farming also contributes to the economics of the area. Irrigated and dry land farms produce cotton, grains, and feed crops.

Stream 2 and Stream 3 have fairly well defined flow paths that impact developing residential and farming areas.

Stream I is a shallow flooding area that begins in the basins northwest of the Hobbs Industrial Air Park. Flows cross the air park and collect along the Missouri and Pacific railroad. Industrial and municipal development exists in the floodplain areas paralleling the railroad. The railroad embankment forms a barrier that diverts flows south, causing three of the large northwest parallel basins to combine along the tracks. The combined flows cross the railroad and Lovington Highway south of Green Meadow Lake where they impact developing residential areas of Hobbs. Here, flow paths are defined by major streets in the low-lying areas of the city. Stream 1 continues winding its way southeast, sometimes dividing and sometimes combining, forming broad shallow flooding areas in major residential areas. Flows from Stream 1 concentrate at the intersection of Dal Paso Boulevard and Bender Boulevard before travelling down Jefferson Street, branching through residential areas as shallow flooding. Stream 1 exits the corporate limits after crossing Marland Boulevard south of Stadium Street.

Shallow flooding is also experienced in the southern part of Hobbs, which is roughly bordered by Grimes Street, Broadway Street, the eastern corporate limits, and Stanolind Road. The American Red Cross has documented widespread flooding in this area during the severe storms of August 1984 and October 1985. Flow is generated from a 2 square mile basin located entirely within the city. The flow is generally from northwest to southeast.

The climate in Hobbs is semi-arid. Average yearly rainfall is 12 to 15 inches. The geography of the area is classified as slopes that are mostly flat to nearly flat. Hobbs is located near an area called caprock by local residents. This caprock is one of the largest unfractured geologic plates in the continental United States. The area makes up part of a larger geological feature known as the Permian basin. The land around Hobbs generally slopes to the southeast. Relief in the form of parallel ridges occurring at approximately 1 mile intervals is characteristic of the area. These ridges form the basin divides that, in turn, define the streams or draws. There are no well defined flow paths but low-lying areas show soil and vegetation changes. Runoff that develops between the larger basin ridges combines and divides at irregular intervals forming large shallow flooding areas that range from 500 to 2,000 feet in width and that are affected by elevation changes as small as 1 foot. Elevations of Streams 1, 2, and 3 range from approximately 3,600 to 3,700 feet. Slopes are generally less than 0.3 percent. Vegetation in the undeveloped areas is made up of short- and mid-grasses, and shrubs. Soils in the area are well drained gravely or clayey loams from 6 to 24 inches deep, which are underlain by indurated caliche.

2. Principal Flood Problems: Storms that produce flooding in the Hobbs area generally occur in the months from June to October. These storms often occur as intense thunderstorms that appear after long dry periods. Hail and tornadoes may be associated with the thunderstorms. Occasionally, hurricane systems moving out of the gulf or west coast will produce heavy rainfall in the area.

Flooding is produced in the low-lying areas and is generally less than 3 feet in depth. Due to the nature of the extremely flat terrain, many areas of the city are subject to ponding of floodwaters. Small features such as roadway embankments can produce large areas of shallow ponding water where little flow is occurring. In addition, there are several low-lying closed basins throughout the city that are inundated with ponding water produced by local runoff from developed areas of the city.

Some of the largest storms of record occurred from 1980 to 1985. On October 10, 1985, local newspapers reported that 6.66 inches of rain fell over a 24 hour period. Other storms occurred in 1981 and 1984 that produced over 4 inches of rainfall.

City of Lovington: (FIS 350031 – 9/4/2002)

1. Community Description: Lovington, the county seat of Lea County, is located in the center of the county. The City of Hobbs is located 20 miles to the southeast of Lovington and the Town of Tatum is located 20 miles to the north.

The City of Lovington had a population of 9,322 in 1990. The central business district of Lovington is located along State Route 18 (Main Street) which runs in a north-south direction through the city. Most residential development is located west of Main Street with light industrial to the east. Drainage flows in an east-southeast direction into Lovington from the high plains with elevations that range from 3,900 to 4,700 feet. The soils for the area to the west of Lovington that contribute runoff are loams and gravely loams with moderate permeability.

2. Principal Flood Problems: Most flooding occurs along Main Street Ditch from Jefferson Avenue south to Avenue M then east across the Texas New Mexico Railroad and the corporate limits.

Flooding occurs along Avenue R and the west side of the railroad from Ninth Street to the southeast corporate limit.

Village of Ruidoso: (FIS 350033 – 3/15/1994)

1. Community Description: The Village of Ruidoso is located in south-central New Mexico, in central southern Lincoln County. The Lincoln National Forest surrounds Ruidoso. The area of the corporate municipality is about ten and one half square miles. Most of the village lies above 6,600 feet in elevation; some parts are above 7,000 feet.

U.S. Highway 70 passes through the eastern part of the village: Roswell is approximately 67 miles east on U.S. Highway 70; Tularosa is 37 miles to the southwest. State Highway 37 connects with U.S. Highway 70 in eastern Ruidoso. For three and one half miles west of the intersection, State Highway 37 is the main street (Sudderth Drive) of the village. For five and one half miles north of the intersection, it is a main thoroughfare (Mechem Drive and Alto Drive). State Highway 37 continues northerly to, the Village of Capitan, 15 miles away.

The U.S. Census Bureau figures for Ruidoso show the population grew from 1,557 in 1960 to 2,216 in 1970, and 4,600 in 1992.

Ruidoso has been a summer retreat for people` in eastern and southern New Mexico and adjacent areas in Texas for many years. The relatively high altitude, surrounding forested hills, and cooler summer temperatures have been very inviting to persons living in hot desert areas. Horse racing at nearby Ruidoso Downs is a big attraction during the summer months white Sierra Blanca draws skiers and other winter sport enthusiasts. Individual residential and condominium construction is booming, indicating growth in year-round residents, as well as seasonal population. Tourist traffic on U.S. Highway 70 is a secondary economic factor.'

Because of the mountainous terrain surrounding Ruidoso, the climate cannot be classified as semi-arid continental. There are distinct seasonal changes and wide annual and diurnal temperature ranges. Summers are cool; based on records from 1951 to 1974, maximum summer temperatures above 90° degrees will be recorded for only 5 days on the average in any single year. The highest temperature ever recorded was 97° degrees in June 1951. Mean monthly temperatures for June, July, and August are in the low to mid-60s. On the average, the frost-free period extends from early June to mid-September; temperatures above 20° degrees extend from late April to late October. Although individual winter storms may be rather severe, the surrounding mountains and the altitude combine to offer moderate winter weather. The lowest mean monthly temperature is 33.5° degrees, and occurs in January. The record low temperature was -26° degrees recorded in February 1961. Precipitation averages above 21 inches per year; a maximum of 34.81 inches was recorded in 1965; a minimum of 12.27 inches was recorded in 1970. Seasonal snowfall averages 40 inches most of which occurs in the months of December, January, February, and March. Maximum seasonal snowfall was partly estimated for 1973-1974 as 78.8 inches; the least seasonal snowfall (11.5 inches) occurred in the winter of 1956-57. Published records do not include data on wind, humidity, and sunshine.

2. Principal Flood Problems: Excessive runoff of the Rio Ruidoso is the principal cause of flooding in Ruidoso. The Rio Ruidoso is a perennial river which flows approximately 6 miles through the village in an easterly direction. The source of the Rio Ruidoso is on the eastern slope of Sierra Blanca at an elevation of nearly 12,000 feet. The drainage area at the Hollywood gaging station is 125 square miles.

Excessive flow in the tributaries of the Rio Ruidoso causes the remaining flood problems in the community. The major tributaries to the Rio Ruidoso from upstream to downstream are: Brady Canyon, an intermittent stream which flows southeasterly; Carrizo Creek, a perennial stream which rises on the southeast slope of Sierra Blanca, then flows to the northeast; Cedar Creek, a perennial stream which flows southeasterly; and Cherokee Bill Canyon, which contains a northeasterly flowing intermittent stream. Cherokee Bill Canyon flow originates in the Sacramento Mountains.

There is a gaging station on the Rio Ruidoso at Hollywood approximately one mile downstream of the eastern corporate boundary of Ruidoso. The maximum discharge for the period of record, 1953 to 1978, was 1,600 cubic feet per second (cfs) on December 19, 1978. On June 17, 1965, a discharge of 1,340 cfs was measured. Based on results of the hydrologic analysis for the Ruidoso Flood Insurance Study, the 1965 flood has an estimated recurrence interval of 45 years. The 1978 flood has an estimated recurrence interval of 75 years.

Village of Ruidoso Downs (FIS 350034 – 1/5/1982)

1. Community Description: The Village of Ruidoso Downs is located in south central New Mexico. It is in central southern Lincoln County, surrounded by the Lincoln National Forest. The area of the corporate municipality is a little more than two square miles. Most of the village lies at about 6400 feet in elevation.

U.S. Highway 70 passes through the village. Roswell is 65 miles east on U.S. Highway 70; Tularosa is 37 miles to the southwest.

U.S. Census Bureau figures for the Village of Ruidoso Downs show that the population grew from 407 in 1960 to 702 in 1970. Growth has continued at a similar rate since 1970.

In the Village of Ruidoso Downs, the relatively high altitude, surrounding forested hills, and relatively cool summer temperatures are attractive to many people living in hot desert areas. Horse racing in Ruidoso Downs during the summer months has been well-attended since it began some years ago. There has been a continuing increase in year-round residents and the summer population in the surrounding area. Winter sports on the slopes of nearby Sierra Blanca attract increasing numbers of enthusiasts. Tourist traffic on U.S. Highway 70 is a secondary economic factor.

Because of the mountainous terrain surrounding Ruidoso Downs, the climate cannot be classified as semi-arid continental. There are distinct seasonal changes and wide annual and diurnal temperature ranges. Summers are cool: based on records from 1951 to 1974, maximum summer temperatures above 90 degrees F will be recorded for only 5 days on the average in any single year. The highest temperature ever recorded was 97 degrees F in June 1951. Mean monthly temperatures for June, July and August are in the low to mid-60s. On the average, the frost-free period extends from early June to mid-September; temperatures above 20 degrees F extend from late April to late October. Although individual winter storms may be rather severe, the surrounding mountains and the altitude combine to offer moderate winter weather. The lowest mean monthly temperature is 33.5 degrees F and occurs in January. The record low temperature was -26 degrees F, recorded in February 1951. Precipitation averages about 21 inches per year; a maximum of 34.81 inches was recorded in 1965; a minimum of 12.27 inches was recorded in 1970. Seasonal snowfall averages 40 inches, most of which occurs in the months of December, January, February, and March. Maximum seasonal snowfall was partly estimated for 1973-1974 as 78.8 inches; the least seasonal snowfall (11.5 inches) occurred in the winter of I956-57. Published records do not include data on wind, humidity, and sunshine.

2. Principal Flood Problems: Excessive runoff in the Rio Ruidoso is the principal cause of flooding in the Village of Ruidoso Downs. The Rio Ruidoso is a perennial stream which flows approximately three miles through the Village of Ruidoso Downs in an easterly direction. The source of the Rio Ruidoso is on the eastern slope of Sierra Blanca at an elevation of nearly 12,000 feet. The drainage area at the Hollywood gaging station (Reference 2) is 125 square miles.

Excessive runoff in Turkey Spring Canyon, an intermittent tributary of the Rio Ruidoso, is the other principal flood problem in the Village of Ruidoso Downs. Turkey Spring Canyon flows in

a northeasterly direction and drains an area of about 14 square miles.

There is a gaging station on the Rio Ruidoso at Hollywood, approximately one mile downstream of the western corporate boundary of Ruidoso Downs. The maximum discharge for the period of record, 1953 to 1978, was 1600 cubic feet per second (cfs) on December 19, 1978. On June 17, 1965, a discharge of 1340 cfs was measured. Many residents remember a flood on the Rio Ruidoso which occurred on September 29, 1941, but was not measured. Based on results of the hydrologic analysis for the Village of Ruidoso Downs flood insurance study, the 1965 flood has an estimated recurrence interval of 45 years. The 1978 flood has an estimated recurrence interval of 75 years.

Luna County and the Village of Columbus (FIS 35029C – 9/14/90

1. Community Description: Luna County is located in the southern portion of New Mexico. It is bordered by the unincorporated areas of Sierra County to the northeast; the unincorporated areas of Grant County to the northwest; the unincorporated areas of Dona Ana County to the east; Mexico to the south; and the unincorporated areas of Hidalgo County to the west.

2. Principal Flood Problems: The Mimbres River is the major source of flood hazards in the county, especially northeast of the City of Deming. Current and planned development along the Mimbres River has led "to concern over the effects of its flooding within the county. A crest stage gage on the Mimbres River at Deming, operated by the USGS from 1954 to 1980 and from 1983 to present, recorded a maximum discharge of 2,350 cubic feet per second (cfs) in 1978.

Pueblo of Zuni (FIS 350143 – 9/4/1987)

1. Community Description: The Pueblo of Zuni is located in west central New Mexico near the Arizona State line, approximately 39 miles south of Gallup, New Mexico. The pueblo is surrounded by the unincorporated areas of McKinley County, New Mexico, to the north and east; the unincorporated areas of Valencia County, New Mexico, to the south and east; and the unincorporated areas of Apache County, Arizona, to the west.

The pueblo is positioned at the base of the Zuni mountains just west of the continental divide. Areas of the Zuni Reservation are located on specified land grants originated by the King of Spain, although the Zuni Indians inhabited the area long before the Spanish Conquistadors appeared in the 1500s. The pueblo has its own system of government and no corporate limits exist within the reservation boundaries. Zuni is a village of over 3,000 people. The natives are highly skilled in silversmithing and produce fine quality jewelry that is easily distinguished. Farming is the basic way of life, and corn is the principal crop.

Major development in the pueblo area is minimal and no significant development affecting the floodplain is anticipated within the next five years. However, the Zuni River is closely bordered by numerous stone and adobe structures, of which some are of historical significance.

The Zuni River watershed encompasses approximately 950 square miles upstream of the pueblo, including 150 square miles considered as noncontributing. The non-contributing area lies in the most upstream portion of the basin between the Town of El Morro and the Continental Divide. This area is considered to be non-contributing due to the nearly flat slopes and numerous small closed basins. There are many small stock ponds and reservoirs in the contributing basin, the largest being Black Rock Reservoir, located approximately 4 miles upstream of the Pueblo of Zuni. Elevations in the watershed range from over 9,000 feet in the Zuni mountains to 6,250 feet at the west end of the study area. Slopes of the streams vary from 3 percent in the mountain areas to less than 0.5 percent near the Pueblo of Zuni.

The Zuni River flows intermittently with periods of zero flow along some reaches of the river. Rio Pescado and Rio Nutria are the largest tributaries on the Zuni River. Several springs supply perennial flows to reaches of these streams above the Pueblo of Zuni. Vegetation in the floodways consists mainly of marsh grasses and brush with some areas of mature trees. In the upstream reaches of the study, the river is well incised; however, the lower reaches, west of the pueblo, consist of broad, flat floodplains showing evidence of previous braid and meander patterns.

2. Principal Flood Problems: Mountain springs and summer thunderstorms are the primary source of water for the Zuni River. Flood stages are generally produced as a result of intense cloud bursts that occur most frequently during the months of July through September. Occasionally, storms occurring in February have produced yearly peak flows.

Mean annual precipitation averages 12 inches but is subject to variation with some long dry periods. Rainfall patterns in the area are hard to predict "due to the nature of the country and the peculiar conditions of heavy rains in one section and no precipitation in others a few miles distant."

Very little historical information is available on past flooding of the Zuni River. The five largest known discharges are shown in Table 1, "Five Maximum Known Flows on Zuni River."

TABLE 1 - FIVE MAXIMUM KNOWN FLOWS ON ZUNI RIVER

DATE	PEAK DISCHARGE (cfs)	ELEVATION* (in feet)	STAGE* (ft.)
1905	14,000**	6,305.9	13.0
8/4/74	5,200	6,301.8	8.9
8/24/82	4,160	6,299.7	6.8
8/20/76	3,310	6,298.6	5.7
8/18/83	2,560	6,297.4	4.5

* At upstream side of State Route 53, based on 1985 conditions.

**Flow estimated for gage above Black Rock Reservoir

The maximum known peak flow for the Zuni River occurred in 1905. The discharge of 14,000 cfs is estimated for the gage above Black Rock Reservoir. Near the pueblo, the flow would have been approximately 15,000 cfs. This flood of 1905 is estimated to have a recurrence frequency of approximately 180 years.

The largest discharge of recent record occurred August 4, 1974. The flow of 5,200 cfs produced from this storm has an estimated frequency of occurrence of 12 years.

On August 18, 1983, some damages occurred in the pueblo area due to a flow of 2,560 cfs. The estimated frequency of this discharge is 4 years.

Eustace Dam, located upstream of State Route 53, causes local flooding of the Zuni River. The principal spillway has very little capacity, thus causing flows to circumvent the embankment to the north and south. The embankment itself does not have sufficient freeboard and will probably fail in large flows. In addition, since the reservoir has little storage capacity due to sedimentation, embankment failure would not produce flood waves much larger than the peak inflows entering the reservoir during flood stages.

City of Alamogordo (FIS 350045 – 8/2/1990)

1. Community Description: Alamogordo is located in west-central Otero County in south-central New Mexico, 85 miles north-northeast of El Paso, Texas. The city is situated at the foot of the Sacramento Mountains near the central-eastern edge of the Tularosa (closed) Basin, which is a long narrow intermountain desert valley. Total land area within the corporate boundaries. is about 16.5 square miles and only about fifty percent of that is developed. Developments in the flood plains consist of businesses, industries, schools, churches, utilities, and residential. U.S. Highway 54/70 and the Southern Pacific Railroad serve the community and cross the flood plains. According to U.S. Census Bureau figures, the population of Alamogordo has increased from 23,035 in 1970 to 24,018 in 1980 (Reference I). The arroyos in Alamogordo head on the western slope of the Sacramento Mountains or on the alluvial outwash plains east of Alamogordo. There are four major and several small watersheds contributing floodflow to Alamogordo. The major watersheds from north to south are Dry, Beeman, Marble, and Alamo Canyons. Alamogordo is located on the alluvial fans of Beeman and Marble Canyons. The Dry Canyon fan borders the north edge of the city and the Alamo Canyon f an borders the east edge of the southern part of the city. All of the arroyos are ephemeral and, except for Dry Canyon, f low westward directly off the Sacramento escarpment. Dry canyon f lows northwestward to its outwash f an where it bends to the southwest and continues across the f an toward Alamogordo. All of the fans have numerous channels across them and flows shift back and forth. The channels are shallow even though the slopes of the fans are steep. The flows, in passing across the fan, feather out to the point where there are no definite channels, allowing f lows to spread over a wide area. The natural drainage pattern has been changed somewhat by the Southern Pacific Railroad and U.S. Highway 54/70.

Elevations vary from about 9,500 feet above National Geodetic Vertical Datum of 1929 (NGVD) in the mountainous areas to 4,400 feet NGVD at Alamogordo. All of the f lows from the mountains are dispersed at approximately elevation 4,700 feet NGVD into the maze of arroyos on the alluvial fans. Below the f an the gradient becomes f latter and stream flow disperses to the floor of the Tularosa Basin, which contains numerous sink holes. Stream slopes vary from 850 feet per mile in the area between Marble Canyon and Alamo Canyon to 269 feet per mile in Dry Canyon and 149 feet per mile in the area near the northern corporate limits.

The climate in southern New Mexico is characteristically semiarid continental. The average annual temperature is 61 degrees F and the recorded extremes are 110 and minus 10 degrees F. Average annual precipitation at Alamogordo is 10.39 inches, with about one-half of this amount occurring during July, August and September. The maximum amount recorded during a 24-hour period was 2.6 inches in September 1941.

2. Principal Flood Problems: Reliable and factual data concerning the details of flooding in Alamogordo are meager. Information furnished by the Southern Pacific Railroad indicates that from 1935 to 1959, eleven floods exceeded the capacity of the railroad's drainage structures and overtopped the tracks by as much as two feet. Three other floods during the same period were reported by individuals.

The flood problem at Alamogordo results from f lash f loods in Dry, Beeman, Marble and Alamo Canyons and several intervening unnamed arroyos all originating in the Sacramento Mountains

east of the city. These floodflows after entering the city are retarded and diverted by various obstructions such as buildings, roads, streets, walls and the railroad. Most of the drainage structures are inadequate to pass large f lows.

Discharges from Dry and Beeman Canyons and the unnamed arroyos diverted by the Tays-Holcomb ditch cause flooding in the north section of the city. Floodflows enter this section from the northeast and collect in a large flat area to the east of U.S. Highway 54/70 and north of the principal busi ness district. Outlets to the west under the highway and railroad can discharge these waters at the rate of about 1,500 cubic feet per second (cfs); but when the flow exceeds this amount, the water turns southward and passes through the business district.

Floods that originate in Marble Canyon and adjacent arroyos move westward through the south section of the city to drainage outlets under the highway and railroads; but these facilities are not adequate to pass flows in excess of 3,000 cfs. The channel capacity in the vicinity of Canyon Road is about 1,800 cfs. The topography at Alamogordo is such that surface waters flow at high velocities. Much of the flood damage is the result of scour and deposition of rocks and sediment. In some places the floodwater is temporarily obstructed, causing damage by ponding and inundation. Particularly heavy damages occur when the water accumulates and is held back by U.S. Highway 54/70 and the railroad embankment.

Flood of August 17, 1959: This storm started at 12:30 p.m. and ended at 2:20 p.m., during which 2.31 inches of rain fell at Alamogordo. Runoff in south Alamogordo was severe and caused McKinley ditch to overflow its banks. The ditch contained the flow from the upper end to just above the Cuba Avenue crossing where the double I0-X I 0-foot concrete box culvert could not pass the flow. The overflow reentered the ditch in the vicinity of the (Old) New Mexico Army National Guard area. The ditch overflowed at the firIst Street crossing. This overflow, augmented by sheet flow that came across the cemetery and flow from a ditch that intercepts an area southwest of Canyon Road, caused extensive flooding in the Plainview Acres subdivision. The overflow then reentered McKinley ditch in the vicinity of a wooden bridge on Florida Avenue extension. The north/south feeder ditch on Washington Avenue did not overflow but Bellamah ditch overflowed near its upstream end. This overflow channeled down Abbott Avenue and caused flood damage in that area. The overflow then entered McKinley ditch near its junction with Bellamah ditch. The flow from McKinley diverges into three channels which pass under the highway and railroad. The flow exceeded the capacity of the three highway culverts and overflowed the highway. The railroad trestles became plugged with debris and water overtopped the tracks for a distance of 3,000 feet. There is a low levee 20 feet east of the railroad embankment but water spread out of the channels and breached the levee. Flows dissipated in the area west of the railroad.

The USGS made f our slope-area determinations to estimate peak flows. The estimated peak discharges in the Washington Avenue ditch near the intersection of 7th Street and Washington Avenue was 245 d s, and on Bellamah ditch at I Oth Street was 1,130 cf s. Two determinations were made on McKinley ditch. The estimated peak discharges at Canyon Road bridge was 3,170 cfs, and near the Florida Avenue extension, 2,840 cfs. It is believed that the latter determination does not represent the total peak f low from the drainage area above that point because of the considerable overt low and spreading of water through the flooded area between Canyon Road Bridge and the bridge on the Florida Avenue extension.

Quay County, Village of Logan, Village of San Jon and City of Tucumcari (FIS 35037C – 5/5/2003)

1. Community Description: In 1999 the population of the Village of Logan was 922. The average annual temperature of the village is 58°F, with an average high of 75.1°F and an average low of 42.1°F. The average annual precipitation is 15.8 inches, most of which falls between May and September.

In 1999 the population of Quay County was 9,872. The average annual temperature of Quay County is 55°F, with an average high of 70.1°F and an average low of 40.5°F. The average annual precipitation is 17.9 inches, most of which falls between May and September.

San Jon is an incorporated village on the plains of east central New Mexico. It is located in Quay County approximately 22 miles east of the City of Tucumcari, the county seat. The State line is 17 miles east; Amarillo, Texas is approximately 90 miles east. U.S. Highway 66 (US66) traverses east to west through the village, connecting to the City of Tucumcari, and extending to the State line. U.S. Highway 39 (US39) runs north to south, connecting to Grady, 24 miles to the south. A branch of the Chicago Rock Island and Pacific Railroad passes through the village.

The population of the Village of San Jon was 292 in 1999. The village is a small trade center for ranches in the nearby farming communities; tourists provide a small amount of income for merchants.

Topographically, the Village of San Jon lies in a wide shallow trough about 4,030 feet above sea level. Storm drainage from the north passes through the village. This drainage area lacks a defined channel and is best described as sheet flow. Total area draining from the north is less than 1 square mile. To the southwest, storm runoff in San Jon Creek, an intermittent stream, originates from a drainage basin of approximately 15.5 square miles.

The Village of San Jon's climate is the semi-arid continental type typical of eastern New Mexico. The average annual precipitation is 16.7 inches, most of which falls between April and October. Afternoon thunderstorms, occasionally heavy, account for most of the precipitation. Much of the surrounding land is used for cattle grazing. Range condition is considered fair to good.

The average annual temperature of the Village of San Jon is 58°F, with an average high of 73.5°F and an average low of 43.3°F.

The City of Tucumcari is the county seat of Quay County and is located about 112 miles west of Amarillo, Texas, and about 176 miles east of Albuquerque in east-central New Mexico on 140. The city had its beginning when the railroads announced that a depot and railroad yard would be established in the area and that a railroad would be built into the northern part of the territory. The city became the trading center for the thinly populated cattle ranches and railroad employees. Dry farming developed in the area, and in 1950 the Tucumcari Irrigation Project was completed. The tourist trade became quite important to the local economy in later years. The relative isolation of the city made it a natural overnight stop for travelers.

The City of Tucumcari's economy is based on agriculture in the surrounding area, retail and small manufacturing businesses in the downtown area, and the tourist-oriented business estab-

lishments along US66 and U.S. Highway 54 (US54). The population was estimated to be 5,721 in 1999.

The original study area encompassed seven major arroyos (two named and five unnamed) and 17 tributaries. To readily identify the arroyos, they were numbered 1 through 7. Their tributaries were assigned the corresponding arroyo's number plus an alphabetical suffix. The arroyos with names are Arroyo 4, also known as Tucumcari Draw, and Arroyo 7, Bluewater Creek.

Arroyos 1 through 4 drain an area of about 18.3 square miles. Drainage is into Tucumcari Lake, which is located just outside of the eastern corporate limits of the City of Tucumcari. The lake also receives seepage and drainage from irrigated lands surrounding the lake.

Arroyos 5 through 7 drain an area of about 27 square miles southwest of the city; these arroyos are tributaries of Pajarito Creek.

Conchas Canal, built by the USBR for irrigation purposes, conveys water from the Conchas Reservoir about 30 miles northwest of the City of Tucumcari. The canal runs through the study area; it is siphoned under major arroyos and runs under part of the city. A few smaller arroyos discharge directly into the canal.

The original study area is within the Canadian River Valley. Landforms are those resulting primarily from deep erosion and dissection of a once-continuous plain. The area varies from nearly level to rolling, with numerous mesas and buttes. Elevations in the study area range from 4,967 feet National Geodetic Vertical Datum of 1929 (NGVD) at the top of Tucumcari Mountain on the southern edge of the study area to 4,006 feet NGVD at the deepest part of Tucumcari Lake.

The climate of the City of Tucumcari is semi-arid with moderate temperatures. The average annual temperature is 58°F, with an average high of 73°F and an average low of 44°F.

Average annual precipitation is 16.1 inches. Most significant storms occur from May through October, with the largest number in July and August. Storms are primarily convective thunderstorms and are characterized by intense precipitation of short duration. Although snowfall does not accumulate appreciably, it contributes significantly to the annual precipitation.

2.3 Principal Flood Problems: San Jon Creek is the principal source of flooding in the Village of San Jon. San Jon Creek has a very small, and at times completely undefined, streambed. It crosses US39 one mile south of the village at a low point in the highway. No culvert or other hydraulic structure exists at the crossing. The slope of the streambed is approximately 25 feet per mile. This very flat slope, the low capacity of the streambed, and the shallow topographic relief of the floodplain result in widespread flooding moving at a low velocity.

A major flooding event occurred on July 20, 1972. An article appearing in the Tucumcari News, dated Monday-Wednesday, July 24-26, 1972, stated that as a result of a flood in San Jon Creek, the south side of the village, south of US66, appeared to be sitting in a lake. During the night of July 20, several families were forced to leave their homes as floodwater entered the village. Depths of 4 to 5 feet were reported at some locations on US39, south of US66. The flood resulted from a rainfall of approximately 7 inches over a 2-day period, and corresponds to a flood

having a recurrence interval of approximately 75 years.

Tucumcari Lake has been the principal flood problem during historical floods in the City of Tucumcari. The lake formed in a natural depression some 60 or 70 feet below the surrounding surface. There is no natural outlet and the lowest point for outside drainage is about 45 feet above the bottom of the depression. Prior to the completion of the irrigation system in 1950, the lake was frequently dry or covered a small surface area between periods of heavy runoff. Since the completion of the irrigation system, seepage, drainage and other flowing water from the irrigation system maintain the lake at several hundred acres of water-surface area.

Overflows from the lake area were reported in 1935, 1941, 1944, 1950, 1954, 1959, and 1960, causing damage to agricultural land, highways and other property bordering the lake. Definitive data on the velocities, magnitudes, and duration of these floods were not available.

Rio Arriba County (FIS 350049 – 8/5/1997)

1. Community Description: Rio Arriba County is located in northern New Mexico. It is bordered by the following unincorporated areas: Archuleta and Conejos Counties, Colorado, to the north; Taos County to the east; Santa Fe, Los Alamos, and Sandoval Counties to the south; and San Juan County to the west.

2. Principal Flood Problems: Currently, concerns about stream flooding Rio Arriba County, New Mexico, center on two streams: Rio Grande and Embudo Creek. Flooding from these streams now affect homes and farmland along their banks. Certain reaches of the streams are areas projected to be developed in the near future. Such development will increase the potential for damage due to flooding.

Village of Chama (FIS 350050 – 8/5/1997)

1. Community Description: The Village of Chama is located in Rio Arriba County, 100 miles north of Santa Fe, New Mexico, and 6 miles south of the Colorado-New Mexico State line.

The Village of Chama was created by and for the railroad. There was very little activity in what is now the Village of Chama until news of a railroad route over Cumbres Pass brought in hundreds of speculators in 1879. The railroad to the Village of Chama was completed in January 1881. The Village of Chama soon became an important railroad station because it had a maintenance station with a large roundhouse and snow-removal operations over Cumbres Pass originated there.

Land speculators began selling land around 1879, and construction of buildings in what is now downtown Chama commenced shortly thereafter. By 1881, the Village of Chama was a boom town with a population of over 1,000 people. It was a rowdy little town, with gangs of outlaws making regular appearances on the scene. People from all over the United States and many foreign countries were attracted to the excitement and excellent job prospects promised by the fledgling town.

The original intention of the Rio Grande Railroad in putting a railroad line through northern New Mexico and southern Colorado was to provide access to the silver mines in Silverton, Colorado. Almost immediately after installation, however, logging companies began using the railroad as a convenient means of getting products to market. The area was rapidly stripped of its timber and, by 1916, the heyday of the logging industry in the Chama Valley had ended. It is said that at one time, because of the dense vegetation, it was difficult for a man on horseback to traverse the forests between Pagosa Springs and the Village of Chama.

Lumberton, New Mexico, was heavily forested and, as early as the 1920s, a forest of rotting stumps, the remains of what was once a dense and magnificent forest, could be seen between the Village of Chama and Tierra Amarilla.

Today the Village of Chama, in large part, still owes its existence to the railroad. Tourism is the Village's main industry, and the train attracts over 50,000 visitors to the Village each year.

The wide range in elevation has a marked influence on the climate in the Chama River Basin. Elevations within the river basin range from 7,629 to 13,000 feet. The annual total precipitation ranges from 15 to 30 inches in the lower elevations and higher mountains, respectively. The average annual rainfall in the Village of Chama is 19.7 inches.

Temperature is also affected by the elevation. The lowest and highest annual mean temperatures are 38°F and 46°F in the lower elevations and higher mountains, respectively.

Rainfall generally occurs during winter and early spring, with the maximum amount due to thunderstorms in July and August.

Summers are hot and relatively dry in the lower elevations. The average maximum temperature in July ranges from 80°F to slightly more than 100°F, depending on the elevation. In summer, the average daily maximum temperature for the Village of Chama ranges from 75-80°F and the

average daily minimum temperature ranges from 40-45°F.

Winters are long and relatively harsh. The average daily maximum temperature ranges from 35-50°F and the average daily minimum temperature ranges from 5-25°F. Precipitation ranges from over 30 inches in the mountains, usually in the form of snow, to less than 10 inches in the lower valleys.

The wide ranges in climatic conditions in the study area produce plant communities from cool-season grasses to coniferous forest. Depending on the amount of water available, most crops can be grown in a single growing season.

Agriculture is a small portion of the economy of Rio Arriba County, which ranks 20th among New Mexico Counties in cash receipts from agriculture.

2. Principal Flood Problems: Three types of storms produce flooding in the area. These are the general winter storm, occurring between November and April; the general summer storm, occurring between May and October; and the summer thunderstorm, which normally occurs between July and October.

Major flooding along the Chama River is normally a result of the large general storms. The thunderstorms cover comparatively small areas and are usually a major factor in the flooding of the smaller tributaries to the Chama River.

The factors affecting flooding are natural obstructions to flood flow, which include brush, large trees, and other vegetation growing along the streambanks in the floodplain. Manmade obstructions in the study area include bridges that cross the Rios Chama and Chamita. In general, obstructions restrict flood flows and can cause overbank flows; unpredictable areas of flooding; destruction of or damage to bridges, homes, and businesses; and increased velocity of flows immediately downstream.

Damaging floods on major water courses are known to have occurred in the vicinity of the Village of Chama in 1858, 1904, 1911, 1917, 1926, 1932, 1937, 1941, 1952, 1965, 1979, 1986, and 1991.

City of Portales (FIS 350054 – 6/6/2001)

1. Community Description: The City of Portales, the County seat of Roosevelt County, is located on the high plains of eastern New Mexico at an elevation of approximately 4,000 feet. There are approximately 4 square miles within the corporate limits.

The City of Clovis is located approximately 19 miles northeast of the City of Portales, on U.S. Highway 70, and the City of Roswell is located approximately 90 miles southwest of the City of Portales, on U.S. Highway 70.. State Highway 88 runs east from the City; State Highways 267, 236 and 467 run westerly, northwesterly and northerly, respectively; and State Highway 206 runs southerly.

The Clovis-Carlsbad branch of the Burlington Northern Santa Fe Railway passes through the City of Portales.

The entire corporate area is well developed. Eastern New Mexico University is located in the City. Except for the university, the City is typical of a trade center in an agricultural area.

According to the U.S. Bureau of the Census, the 1996 population of the City of Portales was 11,356.

The City of Portales has a semi-arid continental climate with distinct seasonal changes. Summer days are moderately warm, but normally experience the wide diurnal temperature range characteristic of a dry continental climate. Most summer nights are comfortably cool, with the temperature usually dropping to the low 60s. In mid-summer, daytime temperatures can be expected to go above 90°F on approximately 2 out of 3 days, and normally there are approximately 5 days with temperatures above 100°F. Winters are generally clear, sunny, and mild. January shade temperatures climb to the low 50s on most days; and although freezing night temperatures are the rule, an average of only 1 day a year finds the mercury falling below 0°F. Also, there are only 4 days in the normal winter when temperatures fail to rise above freezing.

The average annual precipitation in the City of Portales is approximately 17 inches. Summer (May through September) is the rainy season, when 73 percent of the yearly moisture falls. This large summer rainfall favors agriculture and produces good grazing on nearby range land. Most of this summer rain falls during brief but. sometimes heavy thundershowers, usually occurring during the afternoon and early evening. These showers have a cooling and invigorating effect but do not materially interfere with outdoor activities. Even during the rainy months, rainfall exceeding one-tenth of an inch can be expected on only 4 days a month. Hail damage to crops and buildings and a few tornadoes have been observed in the area, although no serious damage or loss of life has been reported from these storms. Winter precipitation is usually light; on the average only 1 day a month gets as much as one-tenth of an inch of moisture, some of which is snow. Snowfalls exceeding 3 inches in one storm are infrequent, and snow rarely lies on the ground for more than a few hours.

This area can expect approximately 75 percent of the year's possible sunshine, with the winter and spring months normally clear and sunny. The growing season averages approximately 6 months, from April 19, the average date of the last freezing temperature in the spring, to October 21, the average date of the first freezing temperature in the fall.

2. Principal Flood Problems: There are no well-drained flooding sources for the City of Portales. Rainfall runoff from a drainage area of approximately 12 square miles slowly migrates southeasterly across the City of Portales. The Burlington Northern Santa Fe Railway, which runs from the southwest to the northeast, obstructs this flow. There are several small culverts under the railroad, and the combined capacity passes runoff from only the smallest storms. Runoff from the larger storms ponds up behind the railroad, then spills over the rails.

The streets are the major drainage paths through the City of Portales. Runoff water is handled reasonably well by the streets, considering the very flat topography, but shallow flooding still occurs due to their limited hydraulic capacity.

The most recent period of inundation was on July 5, 1977, following a rain storm of considerable intensity. Compilations of flooding data and high-water marks do not exist. As there are no defined streams in the City of Portales, there are no gaging stations to record flood flows. Figures 1 and 2 show the levels of projected floods at two locations in the City

San Juan County (FIS 350064 – 5/15/2002)

1. Community Description: San Juan County is located in the northwestern corner of New Mexico. It is bordered by the unincorporated areas of Montezuma and La Plata Counties, Colorado, to the north; the unincorporated areas of Rio Arriba and Sandoval Counties to the east; the unincorporated areas of McKinley County to the south; and the unincorporated areas of Apache County, Arizona, to the west.

2. Principal Flood Problems: Flood problems in San Juan County are limited to occasional overflow of the San Juan and Animas Rivers. The magnitude of the estimated 100-year flood for tributary inflows was considered negligible to the main stream magnitudes.

Local residents were asked to provide any information pertaining to historical flood elevations to the local newspaper. Information of any extreme high-water elevations was not recovered from any local residents.

City of Aztec (FIS 350065 – 7/15/1988)

1. Community Description: The City of Aztec is located in the northeastern portion of San Juan County in northwestern New Mexico. It is completely surrounded by the unincorporated areas of San Juan County.

2. Principal Flood Problems: Aztec flooding problems are limited to occasional overflow of the Animas River. Hampton Arroyo, study reach 10, is contained within the main channel. The magnitude of the estimated 100-year flood for tributary inflows was considered negligible to the main stream magnitudes.

Study reaches in Aztec were limited to the Animas River, which extended one bridge width above U. S. Route 550 and Hampton Arroyo, which also was within the corporate limits.

Local residents were asked to provide any information pertaining to historical flood elevations to the local newspaper. Information of any extreme high-water elevations was not recovered from any local residents.

City of Farmington (FIS 350067 – 5/15/2002)

1. Community Description: Farmington lies in northwest New Mexico in north-central San Juan County at an average elevation of 5,400 feet above sea level according to the North American Vertical Datum of 1988 and in a region that is characterized by mountain ranges and high plateaus. The city is approximately 150 miles northwest of Santa Fe, the state capital; 165 miles south of Grand Junction, Colorado; and 40 miles southwest of Durango, Colorado. The nearest communities are Aztec, the county seat, 14 miles northwest; Bloomfield, 13 miles to the east; and Fruitland, 10 miles to the west. The city is located north of the confluence of the Animas and San Juan Rivers. The La Plata River joins the San Juan River near the southwest sector of Farmington.

From the time Farmington was founded in 1876 to the early 1950s, the community was a small, agriculturally oriented trade and service center. Then development of oil and gas resources reached boom proportions as thousands of wells were developed in the surrounding area. That development led to an unprecedented expansion of industrial and manufacturing activities and tremendously increased the economic importance of those activities on the local level. The boom period began to recede about 1958 and the city reverted to a rural trade and service center in which non-industry related activities gained in economic importance. The short period of recession that began in 1958 leveled off in the mid 1960s as the employment structure became more stabilized. In addition to employment associated with the oil and gas industry, job opportunities in the construction trades and various manufacturing plants became more plentiful. Also, increased demand for personal and public (governmental) services, public utility and transportation services, and meeting the needs of increasing numbers of vacationists and recreationists added to a more diversified economic base for the community. Expansion of retail trade has made Farmington the dominant retail sales center of the Four Corners region.

Farmington had an estimated population of 33,997 in 1990 and continued growth is anticipated.

Surface access in the Farmington area consists principally of two important northwestern New Mexico highways. U.S. Highway 550, a major truck highway, leads to the west and northeast, and State Highway 17 provides connections to the east and north. State Highway 371, a minor route, provides access to the south. A network of city streets and county roads provides arterial routes for local traffic. Scheduled airline flights are maintained to Farmington.

The area around Farmington is predominantly desert-like and comprises extensive plateaus with low, protruding mesas. Terrain to the north and east rises abruptly to high mountain ranges; those to the east forming a portion of the Continental Divide. A high plateau cut by numerous arroyos lies to the south. Evolution of the present surface structures of northwestern New Mexico started near the close of the Mesozoic era (about 70 million years ago). At that time, a great physical change of the earth, referred to as the Laramide Revolution, was begun. Tremendous forces in the crustal portion of the earth precipitated an extensive uplifting which resulted in the forming of the Rocky Mountains. There followed a period of glaciation and then erosion caused by weathering and streamflow. Through many centuries, agents of weathering slowly eroded away the high ranges, and water removed millions of tons of rock material from the mountains. Following the period of surface wasting and erosion, layers of sands, clays, and gravels (referred to as the Eocene beds) were deposited over much of the region, which then had a general level

appearance with occasional areas of relief. A renewal of volcanic action with consequential deposition of volcanic residue then occurred and was followed by a period of widespread erosion, alluviation and plateau formation during which the present main drainage patterns were established. Subsequently, a general uplifting of the entire region took place and great faulting occurred. As valleys deepened, streamways were superimposed on the older underlying rock and throughout the region an old-age erosion surface evolved. Later, glaciers became prevalent in the higher elevations and upon their melting many terminal moraines were deposited. The huge canyons of the region were eventually excavated, due mainly to the efforts of flowing water. Continual erosion associated with streamflow and weathering and favored by aridity resurrected mountains, cut great gorges or water gaps, and ultimately produced the present landscape.

The area consists chiefly of sandstone and some lesser amounts of shale. Cretaceous coal-bearing rock formations (Mesa Verde series) are widespread around the edges of the Upper San Juan Basin and constitute an important resource in the region. After many centuries of erosion in an arid climate, the landscape is distinguished by mesas, cuestas, rock terraces, retreating escarpments, canyons, and dry washes. In some parts, volcanic necks and buttes are prevalent. The physical features of the area are generally sharply separated. Some land areas rise table-like on all sides above the surrounding terrain; others abut against higher land in step-like fashion; and some have steep inclines while others have gentle slopes. They also differ in the degree of dissection by streams, and, due to varying elevation and stages in the erosion cycle, the various features may have different temperatures, rainfall and vegetation.

The floodplains of the streams under study are moderately to sparsely developed. Residential, commercial, agricultural and light industrial properties are in floodplain areas. Along the washes and arroyos, some residential development exists and there are some irrigation facilities and small commercial establishments. Lands along the San Juan and La Plata Rivers are mainly agricultural with scattered residences and some industrial development. Residential and commercial developments are prevalent along the lower reach of Farmington Glade. Development along the Animas River is quite extensive and includes residential, commercial and light industrial developments; agricultural land; and recreation facilities. Oil and gas wells are prominent throughout the area, some within the floodplains of several of the streams. Increased pressure for more use of floodplains will continue. Residential, commercial and industrial growth will continue to impinge on open or agricultural lands, generally in the north-northeastern sector of Farmington.

The San Juan, Animas and La Plata Rivers flow year-round, whereas Porter, Hood, Dustin, Butler, and Wyper Arroyos, Washes A and B, and Farmington Glade normally have running water only after rainstorms that occur most frequently during the summer months. The San Juan River is the principal waterway in northwestern New Mexico and all other streams under study are direct or indirect tributaries to it. The San Juan River is the second largest tributary of the Colorado River, originating on the western slope of the Continental Divide in the Rocky Mountains in southwestern Colorado. The river flows through Colorado, New Mexico, and Utah, joining the Colorado River at Lake Powell in Utah. The Animas River, the largest tributary of the San Juan River, originates in the San Juan Mountains in Colorado at elevations over 14,000 feet and combines with the San Juan River at the City of Farmington. Porter, Hood, and Wyper Arroyos and Wash B, tributaries to the Animas River, flow in a general southerly direction throughout their courses and drain the northeastern sector of the study area. Wash A flows

southerly for about half its course then southwesterly for the other half to join Farmington Glade, which meanders from north to south through the study area until joining the San Juan River. In general, Wash A and Farmington Glade drain the north and northwestern sectors. The La Plata River follows a south-southwesterly course through the study areas, drains the western sector, and joins the San Juan River west of the city. The Animas River trends a southwesterly course along the southeastern portion of the study area, drains the eastern sector, and combines flows with the San Juan River south of the city. The San Juan River winds along the southern edge of the study area in a westerly direction and drains the southern sector.

For the restudy, six arroyos were studied by detailed methods. All of the arroyos are ephemeral in character, flowing only during periods of heavy rainfall. Wyper Arroyo discharges into the Animas River within the City of Farmington and is the northernmost arroyo analyzed. Carl Arroyo is west of Wyper Arroyo. Hood Arroyo is west of Carl Arroyo. The next Arroyo downstream is Porter Arroyo. Dustin Arroyo is west of Porter Arroyo and Butler Arroyo discharges into Dustin Arroyo.

There are no major bodies of water in or near the City of Farmington. The principal bodies of water in the tributary drainage area are manmade lakes developed for irrigation, flood control, power generation, recreation, and municipal and industrial water supply.

Farmington has a semi-arid climate with topography significantly influencing precipitation and temperature. Normal annual precipitation ranges from about 8 inches at Farmington to more than 50 inches in the highest headwater regions. About half the annual precipitation occurs as rain during the months of July through October when cloud burst storms produce high intensity but short duration rainfall, and about half occurs almost uniformly during the remainder of the year. Most of the precipitation in the higher headwater regions occurs as snow. Winters are relatively cold with an average daily temperature of about 32 degrees Fahrenheit (°F) and summers are warm with average daily temperatures of about 73°F. Temperature extremes at Farmington have ranged from a winter low of -20°F to a summer high of 103°F. The average growing season between killing frosts is about 150 days.

Soils in the study area include a wide range of types that directly affect local runoff. With the alluvial soils which occupy the nearly level landscapes that lie adjacent to or are intermingled with the Animas, San Juan, and La Plata Rivers, runoff is slow and flood hazards are severe. The soil series used for irrigated cropland, pasture, residential and industrial areas consist of somewhat excessively drained soils and permeability ranging from moderately slow to rapid. The most abundant soil type found in the drainage basins of Farmington Glade, the arroyos and the washes has moderately rapid permeability and medium runoff, and the erosion hazard is severe.

Several critical factors such as elevation, exposure, temperature and moisture availability determine the native vegetation found in the study area drainage basin from Farmington up to the headwaters. Vegetation around Farmington is sparse and consists of annual grasses, desert shrubs, cedar and cottonwood. In the foothills, pinon pine, juniper, oak, mountain mahogany, sagebrush, service-berry, and annual grasses predominate. Plateau areas are barren and nearly void of plant cover. In the higher elevations, vegetation consists of native grasses, brush, ponderosa pine, spruce, and stands of Douglas fir and aspen. The mountain areas above timberline have alpine vegetation.

2. Principal Flood Problems: Floods in the Farmington area result from general rainstorms, snowmelt sometimes augmented by rain and from cloudburst storms. General rain floods have caused the most severe damage along the Animas and La Plata Rivers at Farmington and have usually occurred during the months of September and October. This type of flood results from prolonged heavy rainfall over tributary areas and is characterized by high peak flows of moderate duration. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions, or when the ground is frozen and infiltration is minimal. The more frequent floods on the San Juan River (recurrence interval of 10-50 years) would result from general rain on the tributary drainage area downstream from the Navajo Project (a multiple-purpose reservoir about 40 miles upstream from Farmington). Major floods (recurrence interval of 100 or more years) would result from excessive snowmelt runoff generated in the watershed upstream from Navajo Reservoir. As previously mentioned, general rainstorms normally occur during September and October. Flood flows generated by snowmelt generally occur during the period from May through July. Snowmelt flooding is characterized by moderate peak flows, large volume and long duration, and marked diurnal fluctuation in flow. Rainfall on melting snow may hasten the melting process and increase flooding. As noted earlier, cloudburst storms of small area! extent, which account for about half of the normal annual precipitation in the Farmington area, can be expected during the summer and fall months. Cloudburst storms lasting from several minutes to a few hours create the most severe flooding along Farmington Glade; Porter, Hood, Carl, Dustin, Bulter, and Wyper Arroyos; and Washes A and B. Cloudburst floods characteristically have high peak flows and high velocities, short duration and small volume of runoff.

The Farmington area has a long history of flooding with the earliest flood of record occurring in 1859, but little definitive data are available on 19th century floods or cloudburst floods that have occurred. Since 1904 until 1976, a total of 23 flood events (on individual streams -- not concurrent flooding on all streams) were recorded. A flood that occurred as a result of a severe rainstorm in October 1911 over the southwestern corner of Colorado and the northwest corner of New Mexico is generally considered the largest and most damaging ever known in the Farmington area. A peak flow of 30,000 cubic feet per second (cfs) was estimated to have occurred on the Animas River at Farmington during that flood. Although the U.S. Geological Survey (USGS) stream gage on the Animas River at Farmington had not yet been installed, a stream gage existed on the river at Aztec with a drainage area of approximately 1,265 square miles. A peak of 23,800 cfs at the Aztec gage was recorded by the State Engineers Office. Peak flows of the La Plata and San Juan Rivers are not available, but were undoubtedly of great magnitude. Three lives were lost during the flood and 150 miles of river bottoms were devastated. Houses, personal property, farm buildings, crops and bridges were swept away by floodwaters, and erosion was widespread. Only two bridges in the entire county were undamaged. Miles of the Denver and Rio Grande Western Railroad were destroyed. Railroad losses were estimated to be in the millions and other flood damages were estimated to total about one-half million dollars.

Major rain floods occurred on the La Plata River in 1904 and 1909. On the Animas and San Juan Rivers, snowmelt flooding occurred in 1884, rain flooding in 1909. During the latter part of June 1927, melting snow augmented by general rain over the San Juan River basin created the highest flows and most widespread flood on the La Plata, Animas and San Juan Rivers since the flood of October 1911. The rainstorm lasted from June 26 to 28 and produced a peak flow of 25,000 cfs on the Animas River at Farmington. During the 1927 flood, damage to railroad bridges and inundation of roads and bridge approaches caused railroad and highway traffic to be temporarily

discontinued between Farmington and neighboring communities. Some erosion and crop damage occurred in bottom land areas.

Recent floods in Farmington occurred in 1941, 1947, 1970, 1972, 1978, 1986, 1987, and 1988. The May 1941 flooding on the Animas, San Juan and La Plata Rivers resulted from general rains over large areas of the three drainage basins and unseasonable hot weather that precipitated excessive snowmelt runoff. A peak flow of 12,800 cfs on the Animas River was recorded at Farmington as a result of the combined rain and snowmelt flood. Stream channels and irrigation ditches were severely eroded, ditch headings were damaged, and agricultural lands and crops were damaged or destroyed. In August 1947, a cloudburst storm caused extensive damage and destruction along the arroyos; culverts, irrigation facilities, and agricultural lands and crops were damaged or destroyed. A portion of U.S. Highway 550 was washed out and traffic was disrupted for several days. Stream channels were eroded, and many acres of farmland were eroded or covered with debris.

In October 1972, severe flooding in Farmington Glade closed sections of Navajo Street, Municipal Drive and West Apache Street. During this event, the Federal Aviation administration in Farmington recorded 0.60 inches of rainfall on October 16 and an additional 0.63 inches on October 17. In Aztec, a reported 1.50 inches of rain fell during a one-hour period on October 17. In May 1978, rain mixed with melting snow contributed to minor flooding in Farmington. In July 1986, 2.21 inches of rain fell in five days in the Farmington area, and a summer rainstorm in August 1987 produced nearly an inch of rain in three quarters of an hour and flooded several homes and businesses in Farmington. The City of Aztec experienced damage to the streets and bridges during the flood of June 1988 when observers reported 1.10 inches of rain during the 45-minute storm; rainstorms in August 1988 again closed Navajo and Apache Streets in Farmington.

Floods that occurred on the Animas River in October 1911, June 1927, September 1909, and May 1941 have estimated recurrence frequencies of 100 years, 60 years, 30 years, and 10 years, respectively. Due to the lack of reliable streamflow records on the La Plata River and the limited period of streamflow records on the San Juan River since completion of Navajo Dam in 1962, data necessary to estimate the frequency of all floods except those of September 1970 and October 1972 (recurrence intervals of about once every 5 years) are not available for those streams. Data necessary to estimate the frequency of past floods on Farmington Glade; Porter, Hood, Carl, Butler, Dustin, and Wyper Arroyos; and Washes A and B are not available.

City of Las Vegas (FIS 350068 – 8/18/1986)

1. Community Description: The City of Las Vegas is located in the west-central portion of San Miguel County in north-central New Mexico, approximately 40 miles east of the City of Santa Fe. It is completely surrounded by unincorporated areas of San Miguel County.

Situated at the divide between the Sangre De Cristo Mountains and the eastern New Mexico plains, Las Vegas is a historic stopping point on the old Santa Fe Trail. In the early 1900s, the city thrived on the activities surrounding the Atchison Topeka and Santa Fe Railway. Today, the pace has slowed from that of earlier railroad times. Las Vegas is a quiet rural community consisting mainly of residential and small business areas, with an emphasis on the historic quality of the city. As home of Highlands University, much of the Las Vegas activities center around a collegiate atmosphere. Small farms scattered throughout the countryside have sparked the development of an extensive irrigation system that surrounds Las Vegas.

Little development has occurred around Las Vegas recently. Significant development affecting the flood plains is not expected within the next five years.

Elevations in the Las Vegas watersheds vary from over 12,000 feet in the Sangre De Cristo Mountains to below 6,400 feet at the southern end of the city. Slopes of the streams range from over four percent in the high mountains to approximately one percent in the city. The two major streams affecting Las Vegas are Gallinas Creek and Arroyo Pecos.

Gallinas Creek originates on the eastern slope of the Sangre De Cristo Mountains northeast of Las Vegas. Before passing through the center of the city, a large portion of the Gallinas Creek flows are diverted into the Storrie Lake intake canal. The remaining portion of Gallinas Creek enters Las Vegas from the north. As the stream travels through the center of the city, its banks are bordered by business, residential, and educational districts. Vegetation in the flood plains consists of mature trees, understory brush, and heavy grasses.

Most of the Arroyo Pecos flows begin on the mesa east of Las Vegas where they collect along the eastern edge of the city and begin flowing south. It eventually merges with Gallinas Creek southeast of Las Vegas. Approximately 20 percent of the Arroyo Pecos basin begins in the Sangre De Cristo Mountains north of Gallinas Creek. These waters are temporarily stored by SCS floodwater retarding dam No. 1, located north of Storrie Lake and Las Vegas. The Arroyo Pecos flows are slowly discharged from the flood control structure into the North Storrie Lake intake canal where they enter Storrie Lake. Arroyo Pecos is bordered by Interstate 25 to the west and irrigated farmlands to the east. Vegetation along the channel consists mainly of grasses due to the recent interstate construction and channel improvements.

Arroyo Hermanos and Arroyo Pajarito are small streams located in west Las Vegas. They pass through the residential area on the west side of the city before flowing into Gallinas Creek near National Street and Prince Street.

2. Principal Flood Problems: Spring snowmelt, mountain springs, and summer thundershowers are the primary sources of water to maintain the normal flows for the streams in the Las Vegas area. However, flood stages are generally produced as the result of intense sustained rainstorms that occur most frequently from August through October.

Historic information on area flooding is primarily available for Gallinas Creek. Arroyo Pecos and other streams around the Las Vegas area can be expected to behave in a manner similar to Gallinas Creek, but to lesser magnitudes.

Five of the largest discharges on record for Gallinas Creek are listed in Table 1. Discharges shown in Table 1 are from the gaging station (No. 08380506) located near Montezuma, New Mexico.

TABLE 1 - FIVE HIGHEST RECORDED FLOWS - GALLINAS CREEK

Date	Stage* (feet)	Elevation* (feet)	Peak Discharge (cubic feet per second)
September 30, 1904	14.0	6,433.5	11,600
August 4, 1957	13.3	6,432.8	9,140
August 2, 1966	12.8	6,432.3	7,120
September 3, 1942	11.6	6,431.1	4,540
September 23, 1941	10.5	6,430.0	3,790

*Depth at upstream side of the National Street bridge based on 1983 conditions. Stream bed elevation is 6,419.5.

The maximum peak flow on Gallinas Creek occurred in 1904. The discharge of 11,600 cubic feet per second (cfs) was computed at a point 200 yards below the gaging station at Montezuma (Reference 2). During the night of September 29, 1904, four timber dams above Las Vegas and Hot Springs were washed out. The volume of water released destroyed three bridges above Hot Springs as well as the Hot Springs bath house and several masonry walls at the nearby railroad station located near the mouth of the canyon. Six miles down the valley, three more railroad bridges were washed out, and the railroad tracks were damaged. The old railroad station at Las Vegas, a large frame structure on the north bank of Gallinas Creek, was completely washed out due to erosion. The flood of 1904 had an estimated recurrence interval of approximately 120 years.

The most recent flood occurred in August 1966. Local newspapers reported that flows of over 5,000 cfs flowed down the Storrie Lake intake canal. This storm had an estimated recurrence interval of 55 years.

In 1971, flood damage occurred near the National Street and Prince Street bridges from an estimated peak flow of 863 cfs. The estimated recurrence interval was 8 years. As a result of this flooding, the City of Las Vegas requested help from the COE, and the COE completed an 8,000 cfs channel clearing project. Flood damage occurring in 1971 was most likely the result of sediment deposits and heavy vegetation in the channel of Gallinas Creek. If the damage-producing flood of 1971 is compared with that of the 1904 flood, the importance of keeping the channel clear of sediment and vegetation is easily seen.

Sandoval County, Town of Bernalillo, Village of Corrales, Village of Cuba, Village of Jemez Springs, City of Rio Rancho and Village of San Ysidro (FIS 35043C – 7/16/1996)

1. Community Description: Sandoval County is located in central New Mexico. It is bordered by Cibola, McKinley, and San Juan Counties to the west; Rio Arriba County to the north; Los Alamos and Santa Fe Counties to the east; and Bernalillo County to the south.

The population within Sandoval County is expected to be 77,827 by 1995. Within the corporate limits of the City of Rio Rancho, the population is approximately 38,000; about 8,000 people live in the Village of Corrales; the population of the Town of Bernalillo is approximately 2,500; and the population of Jemez Springs is about 500. Many people living in Rio Rancho, the Village of Corrales, and the surrounding Counties of Valencia and Torrance commute to Albuquerque to work. The combined 1990 census population of Bernalillo, Sandoval, Valencia, and Torrance Counties was 599,416.

The climate is classified as arid continental, characterized by fairly hot summers, mild winters, and short, temperate spring and fall seasons. The average annual precipitation is 8.9 inches, with about half of the precipitation falling between July and September as brief, often intense thunderstorms. Precipitation in winter is mainly snowfall and averages about 2 inches of moisture per year.

The Village of Corrales is located mainly in the southern portion of Sandoval County, extending south into Bernalillo County. The total land area within the community is 9.8 square miles. The Corrales valley is bounded on the east by the Rio Grande, and has very little topographic relief. Significant elevation changes are generally a result of development, such as road embankments, irrigation ditch levees, and building foundations. Valley vegetation consists mainly of native trees and shrubs and irrigated field crops. Land use is mainly agricultural between the Rio Grande and Corrales Road (State Highway 46), mixed commercial and residential along Corrales Road, and residential development west of Corrales Road. Low-density residential development is occurring within most of the community.

The City of Rio Rancho is located directly west of Corrales, and 2 miles west of the Rio Grande Valley. The total land area within the corporate limits is 46 square miles. Located 5 miles northwest of the City of Albuquerque, Rio Rancho is experiencing medium- to high-density residential and commercial development.

The Town of Bernalillo is located about 20 miles north of Albuquerque. Land area within the Town is 1.6 square miles. The Rio Grande, the principal river in New Mexico, flows north-south on the western side of Bernalillo.

The Village of Jemez Springs is located along the Jemez River, which is a significant tributary to the Rio Grande, having a drainage area of 1,038 square miles. The Jemez River confluence with the Rio Grande is located about 13 miles north of Albuquerque. The Jemez River is perennial and receives approximately 15.7 inches of average annual precipitation in Jemez Springs, with the most intense precipitation events occurring as thunderstorms between June and October. However, the maximum normal monthly peak discharges occur from spring snow melt in the months from March through June.

2. Principal Flood Problems: Historically, flooding in the City of Rio Rancho is a result of runoff generated from local thunderstorms. Brief, intense thunderstorms cause substantial localized flash flooding and serious sedimentation and erosion problems.

The drainage areas in Rio Rancho and Corrales have serious sedimentation-erosion problems because they contain highly erodible fine sands and silts with minimal ground cover. Flood flows can pond behind ditch banks and in low spots, depositing large quantities of sediment, or the floodwaters can flow into irrigation ditches, filling the ditches with sediment and causing the banks to be overtopped.

The low-lying valley areas along the Rio Grande are also subject to flooding from runoff from the western uplands. Residential and commercial development, channel levees, and irrigation embankments have obstructed the natural outfalls to the river and increased the flood hazard in many areas. Floodwaters flow rapidly into the valley areas, then spread into ponding areas because of the flat slopes and limited outlets to the river.

Flooding from the Arroyo de Los Montoyas occurred on August 19, 1976. No rain fell in Corrales, but the community experienced a flash flood that ponded behind the Corrales Main Canal, broke the levees, and flooded a large area of the valley to depths of 3 feet. The peak discharge was estimated to be 9,540 cubic feet per second (cfs), and has a recurrence interval of about 170 years.

A U.S. Army Corps of Engineers (USACE) study indicates that flows up to the 100-year flood along the Rio Grande, originating upstream of Cochiti Dam, will be controlled by the dams within the Rio Grande system. Flooding in Corrales could occur, however, from rainfall-runoff from the unregulated drainage areas downstream of Cochiti Dam. Cochiti Dam is located about 35 miles upstream from Corrales.

The existing Flood Insurance Rate Map for the Village of Corrales indicates a large floodplain generally east of the Corrales Main Canal. This floodplain was a result of assumed levee failure near the north end of Corrales; however, the USACE is proposing to reconstruct the levee in 1995, which will eliminate the floodplain resulting from the Rio Grande.

Historically, flooding has occurred in Bernalillo from the Rio Grande and from flash floods originating east of the Town on the slopes of the Sandia Mountains. Levee construction along the Rio Grande in 1933 has since prevented flooding from the Rio Grande.

The Jemez River flooding generally results from spring snow melt runoff. The flooding occurs when high flows exceed the banks in some locations and also at small bridges that sometimes become blocked by trees, catching more debris, which causes flood flows to overtop the bridge and flood the surrounding area.

Santa Fe County (FIS 350069 – 11/4/1988)

1. Community Description: Santa Fe County is located in north-central New Mexico northeast of the City of Albuquerque. It is bordered by the unincorporated areas of San Miguel County to the east; the unincorporated areas of Torrance County to the south; the unincorporated areas of Bernalillo County to the southwest; the unincorporated areas of Sandoval County to the west; the unincorporated areas of Los Alamos County, and the Cities of White Rock and Santa Domingo to the northwest; the unincorporated areas of Rio Arriba County, and the Cities of Santa Clara, Espanola, and Chimayo to the north; and the unincorporated areas of Mora County to the north-east.

The City of Santa Fe is located in the heart of Santa Fe County and is the oldest capital city in the United States. Various Indian tribes were the original inhabitants of the county. In the early 1600's, the Spanish began settling in the area. The northern Pueblo Indians drove the Spaniards out of the City of Santa Fe in 1680, and they held the settlement until 1692 when the Spanish recaptured the capital. In 1821, Mexico won independence from Spain and Santa Fe County was officially under Mexican jurisdiction. The United States occupied the area in 1846 and made New Mexico a U. S. Territory.

The Santa Fe Trail was a major thoroughfare from the east in the 1800's. This trail, along with the railroad, made the area a major trade center in the southwest. While trading was a major economic factor, the area also prospered from agriculture, lumbering, and various mining interests.

Today, Santa Fe County has a population of approximately 38,000.

The area is growing at a moderate rate, and continued growth is anticipated in the future. Presently, the main economic sources are tourism, government operations, trade, agriculture, manufacturing, and mining. The area has a significant amount of tourism income due to the historic and cultural activities as well as the pleasant climate and recreational facilities.

The Santa Fe River and Arroyo de Los Chamisos flow through the City of Santa Fe, while Arroyo Hondo lies just south of the corporate limits of the city. The Santa Cruz River flows through the City of Espanola. All four streams are tributaries off the Rio Grande River. The Santa Fe River is the principal drainage stream in the area, and Arroyo Hondo and Arroyo de Los Chamisos are tributaries. These streams are bordered by a mixture of residential, commercial, and industrial, properties.

The Santa Fe River has a total drainage area of approximately 250 square miles where it enters the Rio Grande. Headwaters of the Santa Fe River are in the Sangre de Cristo Mountains. Elevations in the mountains reach over 12,000 feet. Santa Fe Lake is at an elevation of 11,600 feet and provides a perennial flow for the Santa Fe River in the high reaches. These flows are captured in a series of three reservoirs for municipal water supplies and any remainder is lost to the sandy soil in the lower elevations near the City of Santa Fe. The lower portions of the Santa Fe River are ephemeral with long periods of zero flow.

The Arroyo Hondo and Arroyo de Los Chamisos are similar to each other. Flows for these arroyos develop in the western foothills of the Sangre de Cristo mountains overlooking the City

of Santa Fe at elevations between 6,500 to 8,000 feet. These arroyos are ephemeral with the exception of some lower sections where springs provide small perennial flows.

Santa Fe County is bordered by the Sangre de Cristo and Jemez Mountain ranges to the north, east, and west, while the southern portion lies in the central New Mexico plains. Vegetation in the high mountain areas consists of a variety of forest cover including large spruce, pines, juniper, and pinon trees. Heavy understory vegetation of brush, grasses, and wildflowers exists. In the lower elevations near the City of Santa Fe, vegetation changes dramatically due to the heat and lack of moisture. Sparse areas of smaller pinon and juniper exist with shrub brush; however, the largest percentage of cover consists of grammes and other grasses scattered across the exposed sandy soil.

Generally, the climate around Santa Fe County is semi-arid below elevations of 7,000 feet. The high mountain streams receive a significant amount of snowfall; however, for the most part, the populated areas of the county receive a majority of their moisture from rainfall in the summer months. The average annual precipitation in the City of Santa Fe is approximately 14 inches.

2. Principal Flood Problems: Most of the storms that produce large amounts of runoff occur in the months of June through September. Flood stages sometimes occur in these months when moist tropical air moves north out of the Gulf forming intense thunderstorms across the hot New Mexico land masses. Runoff occurring from these storms is generally termed flash flooding due to the large volumes of water that surge down the normally dry arroyo channels with high velocities.

Most historical information on past floods in the county center around the Santa Fe River. Arroyo Hondo and Arroyo de Los Chamisos are subject to the same flood conditions as the Santa Fe River and can be expected to behave in a similar manner. Major floods of record occurred on the Santa Fe River on August 24, 1957, and July 25, 1968 (Reference 1). Indirect measurements by the USGS resulted in discharge estimates of 1,450 and 3,420 cfs, respectively, measured on the Santa Fe River at Castillo Street. These flows have an estimated recurrence frequency of 4 and 15 years, respectively, based on the hydrology used for this study. There are several up-stream reservoirs located on the Santa Fe River, but their effects on these two discharges are unknown.

A stream flow gaging station, Santa Cruz River at Cundiyo, operated on the Santa Cruz River since 1930 has recorded a maximum discharge of 2,420 cfs in September 1931.

In general, 100-year magnitude discharges are confined to the main channel of the Santa Fe River in Santa Fe County and most of the development is on high ground. The 100-year magnitude discharges for Arroyo de Los Chamisos, Arroyo Hondo, and the Santa Cruz River are mostly confined to the channel, but there are some areas of low-lying overbank floodplains where development is occurring. Most of the undeveloped floodplain areas are used for cattle and agricultural purposes.

City of Santa Fe (FIS 350070 – 4/2/1993)

1. Community Description: The City of Santa Fe, located in north central New Mexico, is surrounded entirely by Santa Fe County.

A Pueblo settlement until 1610, Santa Fe was controlled by the Spanish until 1821 when it became a Mexican territory. Santa Fe became part of the New Mexican territory of the *United* States.

The Santa Fe River, which flows through the center of the city, is a river that rises in the Sangre De Cristo Mountains to the northeast and flows southwest about 25 miles before discharging into the Rio Grande in Sandoval County.

Arroyo de los Chamisos flows in a generally westerly direction near the southern limits of the city, passing outside the corporate limits at the western side of the city. The north and south forks of the Arroyo de los Chamisos are contained entirely within the city.

Residential areas flank the Santa Fe River on its east and west ends, while commercial and cultural areas are along the river in the historic downtown area.

High density residential zones line the Piedra and Ranchito Arroyos while both commercial and residential zones flank the Mascaras, Saiz, and Rincon Arroyos. Arroyo Torreon flows through an undeveloped area.

2. Principal Flood Problems: The main flood season for the streams in the vicinity of Santa Fe occurs during the May-October period. Over 70 percent of the average annual precipitation is received during this time. Summer rainfall is usually a result of thunderstorm activity with maximum rainfall occurring in July. These thunderstorms usually produce high runoff for relatively short periods of time which results in serious local flash flooding of a longer duration.

Major floods have been recorded in the Santa Fe area in 1872, 1904, 1914, 1921, 1929, 1957, and 1968. The COE indicates that there are no reliable flood records prior to 1872. Over one million in damages were caused throughout the city by the 1968 flood of the Santa Fe River. No major flooding has been reported in Santa Fe since 1968; however, minor flooding, with no reports of property damage, occurred July 12, 1976.

Sierra County (FIS 350071 – 6/16/1996)

1. Community Description: The City of Truth or Consequences is located in the central section of Sierra County, in southwestern New Mexico. Sierra County is bounded on the north by Socorro County, on the east by Lincoln and Otero Counties, on the south by Dona Ana and Luna Counties, and on the west by Grant and Catron Counties. The Village of Williamsburg is west of the City of Truth or Consequences.

The Rio Grande runs north to south through the center of the county, to the east and south of the City of Truth or Consequences. The Caballo and San Andres Mountains are located east of the Rio Grande, while the Black Mountains are located to the west. The area is fairly mountainous, with the highest elevation at 9,850 feet and the lowest at 3,000 feet.

The City of Truth or Consequences is characterized by a semiarid climate, with a summer average daily high temperature of 102°F and a winter average daily low temperature of 27°F. The annual precipitation is 10 to 12 inches. Snow falls in winter months, but usually melts within 24 hours. Normal humidity is 10 to 15 percent, with higher humidity occurring in July and August.

Sierra County's population, according to the 1990 census, is 9,912. The City of Truth or Consequences and the Village of Williamsburg are estimated to contain 65 percent of the total population.

Most of the land is undeveloped desert. Less than 1 percent is used as irrigated cropland. Agriculture, forestry, and fisheries make up a large percentage of the employment in the county, and mining is also prevalent.

2. Principal Flood Problems: Sierra County has a complex system of arroyos, and this, combined with very nonporous soil, has led to problems with flash floods and flooding due to rainfall runoff.

The area averages about 315 days of sunshine per year, and thus most of the 10 to 12 annual inches of precipitation occurs within a very short timeframe, intensifying the flooding problems (References 2 and 3). Extensive flooding also occurs typically in the spring along the Rio Grande, because of snowmelt from the mountains of Colorado.

City of Truth or Consequences (FIS 350073 – 7/16/1996)

1. Community Description: The City of Truth or Consequences is located in the central section of Sierra County, in southwestern New Mexico. Sierra County is bounded on the north by Socorro County, on the east by Lincoln and Otero Counties, on the south by Dona Ana and Luna Counties, and on the west by Grant and Catron Counties. The Village of Williamsburg is west of the City of Truth or Consequences.

The Rio Grande runs north to south through the center of the county, to the east and south of the City of Truth or Consequences. The Caballo and San Andres Mountains are located east of the Rio Grande, while the Black Mountains are located to the west. The area is fairly mountainous, with the highest elevation at 9,850 feet and the lowest at 3,000 feet.

The City of Truth or Consequences is characterized by a semiarid climate, with a summer average daily high temperature of 102°F and a winter average daily low temperature of 27°F. The annual precipitation is 10 to 12 inches. Snow falls in winter months, but usually melts within 24 hours. Normal humidity is 10 to 15 percent, with higher humidity occurring in July and August.

Sierra County's population, according to the 1990 census, is 9,912. The City of Truth or Consequences and the Village of Williamsburg are estimated to contain 65 percent of the total population.

Most of the land is undeveloped desert. Less than 1 percent is used as irrigated cropland. Agriculture, forestry, and fisheries make up a large percentage of the employment in the county, and mining is also prevalent.

2. Principal Flood Problems: Sierra County has a complex system of arroyos, and this, combined with very nonporous soil, has led to problems with flash floods and flooding due to rainfall runoff.

The area averages about 315 days of sunshine per year, and thus most of the 10 to 12 annual inches of precipitation occurs within a very short timeframe, intensifying the flooding problems. Extensive flooding also occurs typically in the spring along the Rio Grande, because of snowmelt from the mountains of Colorado.

Village of Williamsburg: (FIS 350074 – 7/16/1996

1. Community Description: The Village of Williamsburg is located in the central section of Sierra County, in southwestern New Mexico. Sierra County is bounded on the north by Socorro County, on the east by Lincoln and Otero Counties, on the south by Dona Ana and Luna Counties, and on the west by Grant and Catron Counties. The City of Truth or Consequences is east of the Village of Williamsburg.

The Rio Grande runs north to south through the center of the county, to the east and south of Williamsburg. The Caballo and San Andres Mountains are located east of the Rio Grande, while the Black Mountains are located to the west. The area is fairly mountainous, with the highest elevation at 9,850 feet and the lowest at 3,000 feet.

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The area averages about 315 days of sunshine per year, and thus most of the 10 to 12 annual inches of precipitation occurs within a very short timeframe, intensifying the flooding problems. Extensive flooding also occurs typically in the spring along the Rio Grande, because of snowmelt from the mountains of Colorado.

City of Socorro (FIS 350077 – 5/17/1988)

1. Community Description: The City of Socorro is located in the south-central portion of Socorro County in west central New Mexico, approximately 71 miles south of Albuquerque and approximately 73 miles north of Truth or Consequences. It is completely surrounded by the unincorporated areas of Socorro County.

Socorro has a mild, semiarid, continental climate that is characterized by light precipitation, abundant; sunshine, and low relative humidity. The average annual precipitation is 9.36 inches.

2. Principal Flood Problems: On August 12, 1929, the Rio Grande valley between San Acacia and San Marcial was flooded. This flood was the result of a general storm that occurred August 8-11, 1929, in southern Colorado and northern and western New Mexico. During this period, much of the area received over 2 inches of precipitation. The heaviest rainfall centered over the Rio Chama, Rio Puerco, and Rio Salado watersheds, as well as the side arroyo drainage areas in the vicinity of Socorro.

Taos County: (FIS 350078 – 1/5/1989)

1. Community Description: Taos County is located on the central northern boundary of New Mexico. It is bordered by the following unincorporated areas: Conejos and Costilla Counties, Colorado, to the north; Coif ox County to the east; Mora County to the southeast; and Rio Arriba County to the west.

2. Principal Flood Problems: Concern over stream flooding in Taos County centers on two streams: Rio Lucero and Rio Pueblo de Taos. Recent years have witnessed a varying degree of damage wrought by flooding on these two streams. County officials feel that development will increase along these streams in the future, increasing the potential for damage.

Town of Red River (FIS 350079 – 6/6/2001)

1. Community Description: The Town of Red River is located in Taos County in north-central New Mexico. The 1990 census population was 387, and the estimated 1998 population is 434. The town lies in a narrow mountainous valley in the southern Rocky Mountains, part of the Sangre de Cristo Range. It is completely surrounded by the Carson National Forest.

Trappers and hunters were early visitors to the Red River Valley. Gold mining turned the town into a boomtown in the late 1800s. The town was revitalized when a ski area opened in 1959. The Red River ski area is located on the south side of town. Tourism, especially winter activities, is now the primary industry.of the area.

The Town of Red River is located at an elevation of 8,750 feet with average winter temperatures of 40 degrees (°) Fahrenheit (F) day and -12 °F night and average summer temperatures of 75°F day and 38°F night. The average snowfall is 188 inches per year with an average annual precipitation of approximately 19 inches.

The Red River flow through the town and is an east bank tributary of the Rio Grande whose confluence lies approximately 20 miles to the west. The study incorporates the Red River watershed from its headwaters to the western limits of the Town of Red River. The watershed ranges in elevation from 13,161 feet at its tributary headwater to 8,640 feet at the Town of Red River.

The principal runoff in the watershed originates from three sources: snowmelt, rainfall, and snowmelt augmented by rainfall. Major rain floods along the Red River generally result from large general summer storms occurring between May and October; however, the thunderstorms cover comparatively small areas and are usually a factor in the flooding of the smaller tributaries of the Red River. The change from summer to winter is characterized by the sudden disappearance of thunderstorm activity followed by the clear winter weather that dominates this area between frontal passages. During the winter months, heavy snowfall occurs in the mountainous area of the watershed. Snow usually remains in the mountains from the beginning of heavy snows in December until early April when snowmelt runoff begins.

2. Principal Flood Problems: A search for published data on past floods in the Red River area furnished no information although local residents remember two large events: one occurring in the late 1960s and one in 1979. Residents reported minimal damage during these events. However the Town of Red River is concerned about the effects of high flows from the Red River and its tributaries and the existence and severity of flood hazards in the area and the potential for development in or near flood-prone areas.

Town of Estancia (FIS 350082 – 7/16/1990)

1. Community Description: The Town of Estancia is located in the central portion of Torrance County in central New Mexico. It is completely surrounded by the unincorporated areas of Torrance County.

The Unnamed Arroyo originates west of the town. The natural channel of the arroyo has been leveled for agricultural use to the east and west of Estancia, and graded within the town.

2. Principal Flood Problems: Flooding along the Unnamed Arroyo causes total inundation of the Town of Estancia.

City of Moriarty (FIS 350083 – 9/30/1988)

1. Community Description: The City of Moriarty is located in central New Mexico, approximately 30 miles east of the City of Albuquerque. It is surrounded by the unincorporated areas of Torrance County.

Moriarty had its beginnings as an agricultural and ranching community. In the early 1900's, farms prospered around the Estancia Valley. Rainfall in those times generally occurred more often than today, making irrigation and dry farming profitable. Nearby timber and rangelands added to the early economy of the region. Today, farming is less prevalent in the area due to climatic changes and a general slump of the industry. Much of Moriarty's population commutes to work in other areas, returning to Moriarty for the joy of country living.

Streams in the city are poorly defined since runoff is only generated after fairly heavy rains. The streams are characterized by low lying swales without a well defined channel.

Salt Draw has its headwaters at the base of the northeast slopes of the Manzano Mountains. A majority of the basin area forms on an alluvial fan near those mountains. Elevations range from 6,550 feet at the top of the basin to 6,200 feet at the end of the study. Slopes are approximately 1 percent in the mountains, while quickly decreasing to less than 0.3 percent in the bottom half of the basin. Salt Draw is bordered by newly developing residential districts near State Road 41.

City Draw, Duke Country Draw, and Crossley Draw are shallow flooding streams located near the center of the city, and they have small basins that are partially developed.

Climate in the Moriarty area is semi-arid. Average annual precipitation is approximately 11 inches; however, this figure varies widely from year to year. Most of this moisture falls in the summer months.

Moriarty lies east of the Manzano Mountains in the central New Mexico plains. The topography of the region is mildly sloping to the east. Slopes near the city are generally less than 0.3 percent. Soils are Witt loams, which absorb water at a moderate rate, and produce slow to medium surface runoff. Vegetation consists of grama grasses, brush and cactus.

2. Principal Flood Problems: Most of the storms that produce large amounts of runoff occur in the months of June through September. Intense thunderstorms form as a result of warm moist air masses moving out of the Gulf of Mexico and encountering the hot New Mexico land masses. These thunderstorms may drop several inches of rainfall in very short periods, over small areas, causing local flooding. Flooding is aggravated in the shallow flooding areas by man-made features such as roadway embankments that impound water.

Reliable historical information on past floods in the Moriarty area is generally unavailable. City personnel have no recollection of large floods over the past 15 years.

Valencia County (FIS 350086 – 2/9/2000)

1. Community Description: Valencia County is located in west-central New Mexico. It is bordered by Bernalillo County to the north, Torrance County to the east, Socorro County to the south, and Cibola County to the west.

The climate, which is classified as arid continental, is characterized by fairly hot summers and mild winters, and short, temperate fall and spring seasons. The average annual precipitation is approximately 8 inches. Approximately one half of the precipitation falls from July through September as brief, often intense, thunderstorms. Snowfall is approximately 10 inches in winter, and contributes an average of 2 inches of moisture per year.

2. Principal Flood Problems: Before the construction of levees on the Rio Grande, the river caused extensive flooding. Hells Canyon Wash has a drainage area of approximately 165 square miles and has caused minor flooding.

City of Belen (FIS 350088 – 4/3/1986)

1. Community Description: The City of Belen is located in Valencia County along the western banks of the Rio Grande, approximately 30 miles south of Albuquerque. The 1977 population estimate of the city was 7,261.

The Rio Grande originates in Colorado and drains an area of 15,291 square miles. All but 1,935 square miles of this area is controlled by dams that are operated primarily as flood control structures. Belen is built in the river valley at an elevation that is in some places equal to or slightly lower than the elevation of the river bed. The city is, however, protected from most flooding that could stem from the Rio Grande by a series of dikes and levees and by an area of relatively high ground between it and the river. Belen is at an elevation of approximately 4,800 feet.

A main north-south highway artery, Interstate Highway 25, passes just to the west of Belen. Belen Mesa lies approximately 2.5 miles to the west of the city. There are a number of arroyos that originate on the scarp of the mesa. They flow down the alluvial slope and discharge into the valley where Belen is situated. Channel definition for these arroyos end where they enter the valley; hence, there are no channels to carry flood waters to the river.

The arroyos that emanate from Belen Mesa are dissected by Interstate Highway 25 and by two ditches: Belen Highline Canal and New Belen Acequia. The culverts under the Interstate Highway have the effect of attenuation on the flood peaks. The embankment tends to somewhat reduce the volume by storage and ponding behind it. The two ditches act as dams and impound the water, or pass it into the ditch, or in cases of fairly heavy flood, breach the ditch and pass the flood water and the ditch water into the valley.

Belen is in the Mexican Highlands section of the Basin and Range Physiographic Province and is in a semi-arid climatic zone. The mean annual temperature is approximately 56 degrees Fahrenheit (°F), with a record high of 105°F and a low of -25°F. The diurnal fluctuation of temperatures is high. The average annual precipitation is approximately 8 inches; approximately half of this occurs as thunderstorms during the months of July, August, and September. These thunderstorms are usually high intensity, low duration storms that cause "flashy" rises in the arroyos that are characterized by high peaks and low volumes.

2. Principal Flood Problems: Flooding in the City of Belen in the recent past has been a result of flood waters from the arroyos emanating from Belen Mesa to the west of the city. In some cases, the flooding has been augmented by water from breached irrigation ditches.

Significant flooding from this local runoff source has occurred in the city during the years 1900, 1919, 1937, 1957, 1961, 1967, and 1969. The floods of May 28, 1937, and June 15, 1969, caused fairly extensive damages through ponding, silting, and erosion. During the 1969 flood, heavy runoff from the arroyos entered the Belen Highline Canal at several points overloading it with flood water and a large amount of silt; consequently, the canal breached at a number of points and stormwater, along with an estimated 400-600 cubic feet per second (cfs) of water that was being carried in the canal, swept down across New Belen Acequia and into Belen. Water ponded in Belen at depths of up to 2.5 to 3.0 feet during both the 1937 and the 1969 floods.

The main levee system that protects Belen from Rio Grande flood waters was built during the 1930's. Prior to this time, there were a number of floods on historical record that apparently flooded much of the land in the Rio Grande valley.

A flood that occurred in May and June of 1828, flooded most of the existing villages along the river and has been estimated to have been as high as 100,000 cfs. Major flooding also occurred during 1851, 1865, 1874, 1884, 1886, 1903, 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. The floods of 1911, 1929, and 1935 were the result of heavy thunderstorms over the watershed. The 1911 storm occurred in early October and was the result of a large moisture inflow from a tropical Pacific cyclone off the west coast of Mexico.

Although no flooding has occurred in Belen as a result of breaking of the levees along the Rio Grande, this potential does exist. The entire valley would be susceptible to this type of flooding, but the areas that would especially be susceptible would be the agricultural lands near the river to the east of Belen.

Flooding from the Belen Mesa arroyos occurs mainly during the summer months as a result of intense thunderstorms. The problems that arise from this type of flooding are dependent not only on the magnitude of the peaks but also on the volume of water involved and on the amount of sediment being carried by the floods.

A study of this flooding problem was made by the Soil Conservation Service (SCS) in 1974. They analyzed volume frequencies and sediment amounts and the effect these phenomena will have on the two ditches: Belen Highline Canal and New Belen Acequia. Breaching of the ditches, mainly Belen Highline Canal, will be dependent on the amount and rate of water and sediment being discharged into a ditch, on the capacity of the canal, and on the amount of irrigation water being carried by the canal at the time of the flood. The canal will breach when the volume of water is greater than the carrying capacity of the canal. That is, runoff from a number of tributaries could enter the canal causing a sustained high volume that would cause breaching; a momentary large discharge from a single tributary could cause breaching; a large buildup of silt could restrict the canal such that a relatively small flow would cause breaching at that point; or more likely, breaching would occur as a result of a combination of these factors. The SCS has estimated that breaching of the Belen Highline Canal would occur during events with a 4 percent or less chance of occurrence. There are specific points along the canal where the breaching would most likely occur, but under varying conditions, there are almost any number of places where breaching could occur.

Village of Bosque Farms (FIS 350142 – 2/9/2000)

1. Community Description: The Village of Bosque Farms is located in central New Mexico, in the northwest corner of Valencia County, approximately 15 miles south of Albuquerque. Total land area within the village limits is 3.71 square miles. The Village of Bosque Farms was incorporated in August 1974 and had a population of 2,496. The 1980 Census indicated the population was 3,325.

The Rio Grande, the principal river in New Mexico, flows north-south along the western side of Bosque Farms. The Rio Grande, which extends from Colorado to Texas, has a drainage area of 18,100 square miles at Isleta, approximately 3 miles upstream of Bosque Farms.

The climate is classified as arid continental, characterized by fairly hot summers, mild winters, with short, temperate spring and fall seasons. The average annual precipitation is 8 inches. About one half of the precipitation falls from July through September as brief, often intense thunderstorms. Snowfall is about 10 inches in winter, which contributes an average of 2 inches of moisture per year.

Bosque Farms has very little topographic relief. Significant elevation changes are generally a result of development, such as road embankments, irrigation canal levees and building foundations. Valley vegetation consists mainly of native trees and shrubs and irrigated field crops. Land use is mainly small acreage agricultural with low density residential development.

2. Principal Flood Problems: Before 1933, the Bosque Farms area was largely swampland covered by trees and dense underbrush. Levees were constructed on either side of the Rio Grande through the Bosque Farms area in 1933 and the swamp was drained by 1935. Shortly thereafter, the area began to be settled. Since the construction of the riverside levees, the Rio Grande has not caused any flooding in the Village of Bosque Farms.

East of the village lies Hell's Canyon Wash, with a drainage area of approximately 165 square miles, and several small drainage areas. Due to the numerous canals and levees, principally the Tome Drain and Chical Ditch, flows from these drainage areas have caused only minor flooding in the undeveloped land east and north of the village.

Village of Los Lunas (FIS 350144 – 4/6/2000)

1. Community Description: The Village of Los Lunas incorporated in 1928 and is located in central New Mexico, in the north-central corner of Valencia County, approximately 19 miles south of Albuquerque. According to the 1990 census, Los Lunas has a population of 6, 013.

The Rio Grande, the Rio Grande, which extends from Colorado to Texas, has a drainage area of 18,100 square miles at Isleta, approximately 7 miles upstream of Los Lunas.

The climate is classified as arid continental, characterized by fairly hot summers and mild winters, with an average summer temperature of 90°F, average winter temperatures in the 30s, and short, temperate spring and fall seasons. The average annual precipitation is 8 inches. About one-half of the precipitation falls from July through September as brief, often intense thunder-storms. Snowfall is about 10 inches in winter, which contributes an average of 2 inches of moisture per year).

Los Lunas has very little topographic relief. Located in a flat valley between bluffs, Los Lunas is slowly changing from an agricultural valley to a low-density residential community.

2. Principal Flood Problems: Before the 1930s, the Los Lunas area was mainly swampland covered by trees and dense underbrush. In 1933, the Middle Rio Grande Conservancy District constructed channels, drains, and levees along the Rio Grande and surrounding areas to divert the flow, and the area was drained by 1935. Since the construction of the riverside levees, the river has not caused any flooding in Los Lunas.

Northeast of the village lies Hells Canyon Wash, with a drainage area f approximately 154 square miles. Because of the numerous canals and levees, principally the Tome Drain and Chical Ditch, flows from these drainage areas have caused only minor flooding in the undeveloped land east and north of Los Lunas.

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PROCEEDINGS OF MEETING
OF
NEW MEXICO FLOOD CONTROL ASSOCIATION
Council Chamber, City Hall,
Santa Fe, New Mexico
October 30, 1941

REPORTED BY:
Kay O'Bannon Parker,
Reporter for the State
Departments of New Mexico,
Santa Fe, New Mexico.

Jane E. Campbell,
Reporter for the U. S. Bureau
of Reclamation,
Albuquerque, New Mexico.

PROCEEDINGS

Meeting called to order by the Honorable John E. Miles, Governor of the State of New Mexico.

GOVERNOR MILES: If the house will please come to order I will try to express my thoughts. The purpose I had in mind in calling this delegation together -- evidently I didn't consult the weather man before I set the date; it looks a little bad. I don't know any more about conducting a flood meeting than a frog and I am talking about one of these dry land terrapins. When I first came to New Mexico I filed on a homestead and I met a man hauling water. I asked him how far he was hauling it and he said five miles. I asked if it wouldn't be cheaper to drill a well and he said it would be about the same distance both ways. That is about all I know about flood control. We have had some serious floods, and except in one or two places it has been something unusual and very serious. There are certain parts of the State where it seems that they have been a little more unfortunate than others in the way of floods and they probably know a little more about it than some of the rest of us. I don't know that there is anything that the State of New Mexico could do about matters of that kind other than to call in the representatives of the State to formulate some plan in which eventually in the future, the problem could be discussed and some relief afforded those who have been already damaged by floods, and as I say, I am just as much at a loss to make suggestions along that line as a man could be, but I have asked people to come in who do know something about floods and flood control work and are in a position to make suggestions that would be valuable. I would like, in the beginning, to just open the meeting. I suggest we start with this row and have each person rise and state his name and where he is from, and if he represents any State Department or Federal Department, state the name of such department.

Delfin Salazar	State Planning Board
W. G. Koogler	U. S. Forest Service, Albuquerque, New Mexico
Hugh G. Calkins	Soil Conservation Service Albuquerque, New Mexico
Frank C. W. Pooler	U. S. Forest Service, Albuquerque, New Mexico
Mrs. C. H. Dietrich	Chairman of New Mexico Association on Indian Affairs
Miss Catherine Farrelly	With Mrs. Dietrich and interested in tile same Association
W. A. Losey	Pecos Valley Artesian Conservancy District, Hagerman, New Mexico
R. H. Grissom	Educational Budget Auditor, Santa Fe, New Mexico
R. L. Malone, Jr.	City Attorney, Roswell, New Mexico
Thomas J. Hall	Mayor of the City of Roswell
L. H. Hewett	U. S. Corps of Engineers, Galveston, Texas
J. H. Mullis	Pecos Valley Artesian Conservancy District, Roswell, New Mexico

Fred Witty	President of Transportation System for the Schools
Roy Daniel	City Councilman, Roswell, New Mexico
Sophia D. Aberie	U. S. Indian Service, Albuquerque, New Mexico
Ted Formhalls	U. S. Indian Service, Albuquerque, New Mexico
Walter Goodwin	Interested in general problem of flood control districts
Dick Westaway	Interstate Streams Commission
H. R. Rodgers	State Land Office
Harry Puryear	Chairman, County Board of Commissioners, Chaves County
J. D. Hannah	Assistant State Comptroller
Frank Butt	Middle Rio Grande Conservancy District
H. Vearle Payne	Representing the people on the Gila River
Will Robinson	Public Relations Officer, Selective Service Board
E. C. Minton	New Mexico CCC District Office, Galveston, Texas
A. T. Hannett	Interstate Streams Commission
R. S. Carter, Jr.	State Engineer's Office
Wm. C. G. Sinkpiel	U. S. Geological Survey, Denver, Colorado
Sam Samson	City Engineer, Carlsbad, New Mexico
S. J. Horne	Mayor of the City of Carlsbad
C. W. Beeman	Carlsbad Irrigation District
L. E. Foster	Bureau of Reclamation, Carlsbad, New Mexico
Paul H. Berg	Secretary, Rio Grande Compact Commission, Santa Fe, N. M.
D. C. Cameron	U. S. Weather Bureau, Albuquerque, New Mexico
Henry Rockwood	U. S. Weather Bureau, Fort Worth, Texas
Berkeley Johnson	U. S. Geological Survey, Santa Fe, New Mexico
Stanley Phillipi	Middle Rio Grande Conservancy District, Albuquerque, New Mexico
Tom McClure	State Engineer for New Mexico
Tom Summers	Chief, New Mexico State Police
C. B. Beyer	County Engineer, Bernalillo County, Albuquerque, New Mexico
0. J. Todd	Bureau of Reclamation, Albuquerque, New Mexico
Lea Rowland	City Engineer, Roswell, New Mexico
Burton G. Dwyre	State Highway Engineer
John McMillan	Grant County Farm Bureau

Stewart Sterling	Representing the people in Grant County
Walter McDonald	Grant County Boosters Group
J. C. O'Leary	Representing people in Grant County, Silver City, New Mexico
Felix Rayme	County Clerk, Carrizozo, New Mexico
Ola C. Jones	Superintendent of Schools, Lincoln County
George A. Titsworth	Lincoln County, Capitan, New Mexico
Mrs. Louise Coe	Representing Water Users' Association, Glencoe, New Mexico
A. T. Pfingston	Lincoln, New Mexico
R. H. Runder	U. S.. Corps of Engineers Galveston, Texas:

GOVERNOR MILES: At the time when I first fixed a date to hold a meeting such as this one called here today that date was in conflict with a meeting that was being held in Phoenix concerning water matters. There was a meeting held in Los Angeles at a later date which pertained to the same matters, so this meeting was delayed until this date. At the time when I called the meeting so many people were calling me about floods that I didn't know what else to do but call the meeting. I knew that some of them were desperate and needed relief of some kind. Since the date has been set and between then and now I believe there have been some meetings held. I am sure that there was, one held at Roswell and I believe one at Carlsbad and one at Alamogordo, and one at Silver City. Probably matters were discussed at those meetings and some of these problems solved. Not having been advised as to just what took place at those meetings and what problems were worked out I am not in position to say, but probably there are those here who can tell us what was accomplished. Before we start on that I would like to have us organized into some kind of a committee so that what we do here can be of value to others and we will have a definite record and something that we can present to Washington.

New Mexico is not in a position to compete with what is happening in the State in the way of floods and we are going to have to go to the Government, In my opinion, if the proper kind of relief is given. I would like to have somebody make a suggestion as to what we should do here in the way of setting this up. I would like to elect a Chairman, a Secretary, and as I said before, I know nothing about water or flood hearings and I want someone selected who has already sat in at one of these hearings and knows what to do. I would like to have some advice along that line. Tom McClure, Governor Hannett, and I am sure Mr. Mullis sat in at the meeting in Roswell. Will someone make a suggestion as to organization and what procedure we can follow here today? In calling the meeting I called it for the relief for myself. I had so many calls I couldn't answer. Mr. McClure, would you care to make a suggestion?

MR. McCLURE: Governor, if you think that it would be advisable to get all damages as near as possible; estimate of damages that occurred in these floods so that they could be compiled and correlated and the various sections set up in proceedings of some kind that might be of value to the Congressional delegation, that would be one suggestion that I would make.

GOVERNOR MILES: Suppose we start off by electing a chairman to conduct this meeting.

MR. HANNETT: I suggest you be made chairman of this meeting and appoint someone to act as Secretary.

GOVERNOR MILES: I would much prefer that someone else be selected as chairman; someone else who has conducted meetings of this kind.

MR. RODGERS: I would like to suggest Torn McClure: as Chairman.

MR. CALKINS: I second the motion. Motion carried.

GOVERNOR MILES: You heard the motion. Mr. McClure, will you come forward and take the chair, please sir? I am sure while Mr. McClure is taking his seat you gentlemen won't be backward about making statements as to what you think should be done and about what has happened, and any other suggestions. We want to accomplish something if it is at all possible to do so.

MR. RODGERS: I move that the chair appoint a secretary. Motion seconded and carried.

MR. McCLURE: Would that be someone who has the facilities of a State office where he could have stenographic work done, or should we name just a temporary secretary for this one meeting, such as one of the ladies here at the desk?

MR. WESTAWAY: I suggest that you appoint one of the ladies present to act as temporary secretary.

MR. PAYNE: Mr. Chairman, my idea is that we should have a secretary to take care of the correspondence after this meeting is over with. We are just going to be starting. It is my suggestion, and I so move, that whoever is appointed secretary be authorized to keep in touch with the various groups. In my opinion, we should have someone to correlate those efforts.

MRS. COE: I second the motion. Motion carried.

MR. McCLURE; I think that would be a better idea. The information will have to come in after this meeting, as I see it, to get a complete picture of the whole State and also probably statements as to damages that are not prepared and ready to present right now. I believe I will appoint Mr. Vearle Payne to act as Secretary.

GOVERNOR MILES: I suggested Mr. Payne to Mr. McClure for one reason; because he is here at the capitol and attorney for the Tax Commission, and will be in position to work with Mr. McC lure. I know he has the ability and I know he will make a good secretary.

MR. McCLURE: We have our organization now. I would like to have suggestions as to procedure that we will carry out at this meeting; things you want to accomplish here and what procedure we should follow.

MR. HANNETT: I notice from the roll call that there are representatives of the War Department, Reclamation Service and Soil Conservation here -- three of the major Government agencies who have intimate knowledge of the situation. The War Department is charged with

making surveys of flood control; the Reclamation Service is in close touch with the situation everywhere in the State and the Soil Conservation Service likewise. It seems to me that if those representatives were called upon that they could be of service in giving us estimates of damage in various communities and what, if anything, the Government is doing at this time or would be willing to do in cooperating and formulating a comprehensive plan for flood control throughout the State.

MR. SALAZAR: Mr. Chairman, I have had occasion to attend the meetings down at Alamogordo and some places near Cloudcroft (at Mayhill). I noticed they were preparing to make a survey of the damages over there. As I understand it, a number of Federal Agencies have been quite active in making such surveys and estimates. Perhaps it would be well if they submitted them and a report on them before we can tell where we are and before we can take action.

MR. McCLURE: I think those suggestions are very good. We might start with the Federal agencies first and find out what is being done along those lines and then get down to communities, if possible, and what surveys are completed and their estimates as to damages, and get those of record if that is agreeable? That is the way we will proceed. I think I will call on Colonel Hewett, in charge of the Pecos River, to explain their set-up, what work they are doing, their plans, etc.

COLONEL HEWETT: Mr. Chairman, gentlemen, ladies, as you know, the War Department, is charged with flood control, among some of its other duties, and we are at the present time actively engaged in preparing a flood control project on the Pecos River. This report, which has been delayed, and I am sure beyond the time when all you people had hoped it would be submitted, is now being further delayed in an effort to secure all the damages which occurred as a result of the recent floods. The residents of the different localities have been and are cooperating with our Department to the fullest extent.

Of course, in recommending to the War Department that certain flood protection works be constructed, or that some others be omitted, we have to be guided by the fact that the benefits to be derived from these proposed structures are economically feasible, and that the amortization of those is less than the average loss due to floods. The recent floods have changed the picture to a considerable extent. The frequency curves which we used in our original studies are entirely out at the present time because we have had, during the past two years, several floods which have been more dangerous than any we have had previously and which occurred much more frequently, so that the probability of maKing our report appear economically justified is greater now than it was some time in the past.

I would hesitate to say at this time that a favorable report can be made. However, we will make every effort to accumulate all the damages that have occurred in this area and if you gentlemen and ladies present will assist us so that we do not omit any particular area in our study and furnish us with that detail, it will assist us greatly in the preparation of our report and also in the preparation of a favorable report, which I am sure you are all interested in. The Bureau of Reclamation (Department of the Interior) and Department of Agriculture are also cooperating on this work.

We are getting a great deal of cooperation and valuable information from those Departments, as well as State Departments and governments of various localities. All of that when accumulated, consists of a tremendous amount of information which must be evaluated and properly presented so that we can work up our figures. If I might suggest it, I would think that we should have all the information rather than submitting to the State for action. I believe it Is a good idea for the State to know about everything that is being done, but I believe that the Federal Agencies who, according to the statement of the Governor, are going to be called upon to do the work, probably should have the full data submitted to them so that we can make our reports as strong as possible.

I do not feel that the Federal Departments are taking it out of the State's hands at all, but if we are going to accomplish anything we have to have all the information available that you have or can get, and the sooner we can get this information the better off all of us will be, and the better we will all like it. If we can get a committee formed which will accumulate the damages that have occurred in the various counties and localities and submit that to the secretary and have the secretary forward that to the various Governmental departments interested in this work, I believe that would act to the best interests of all concerned.

GOVERNOR MILES: On behalf of the representatives in Washington, who were all invited along with Mr. Dempsey, they have written and stated it would not be possible for them to be here, but that they were very interested in the matter and would like to have a report of this meeting sent to them for analysis, Invitations were sent to the various departments in Washington and they have expressed regret that they could not be present today.

MR. McCLURE: I would like to hear from Mr. Calkins.

MR. CALKINS; Mr. Chairman, Ladies and Gentlemen: It seems to me that the problem that now confronts the people of New Mexico might be divided into two parts; first, the emergency problem of repairing the damage that has been done during the past several months, particularly in the State, and which perhaps is now going on in some parts of the State at this very moment. The other is the long range job of preventing future damage from floods. Touching on the latter first, the Soil Conservation Service is one of the agencies in the Department of Agriculture which is responsible under flood control legislation passed by the Congress to make surveys that supplement those of the Corps of Engineers of the War Department in the upper parts of the water sheds and which are primarily concerned with what is known as water retardation and soil erosion control. That means that in a less extensive way—in a less massive way—we are concerned very directly with this problem of flood control. I might say that we leave off in the lower reaches of these rivers where the work of the War Department begins and stop in the upper reaches, more or less, where that of the Forest Service starts, because the fact we have lost sight of, I think is that the Forest Service in the headwaters has a very real responsibility for helping to check these peak flows when they start; and in the lower reaches, and sometimes that is pretty well up, the Bureau of Reclamation is very directly concerned.

In the matter of surveys, we are very much in the same position regarding the Pecos, that Colonel Hewett described, and that was that we should have completed our surveys sometime ago, but they have been held up recently because of the necessity of getting in damage data in these upper reaches, and we hope that the report will be submitted in a very short time. Whatever damage data we get or gather are either gathered in cooperation with representatives of the Corps of

Engineers in the field or are of the type with which they are not ordinarily concerned, those that effect the very small tributaries in the upper part of the watershed. We are now conducting a separate survey in a part of the Rio Grande watershed and have completed a survey on another watershed. We are in about the same stage of progress on the Upper Gila except that this survey has been going on so very long that I feel very apologetic about it. On all of these we have men out in the field who have gathered a great deal of data not only about current damages but also about what can be expected in the future unless remedial measures are taken. What all these surveys are leading to is another thing. The surveys will contain a plan of flood control supplementing that of the Corps of Engineers, or other Departments or agencies, such as the Reclamation Service. All I can say on that is that we are just as anxious as we can be to get the surveys in and acted upon in Washington and we sincerely hope that they will lead to action. On the other hand,

It seems to me that it is perfectly logical to take the position that we cannot allow this sort of thing to go on if there is any way to prevent it. Every year the situation gets worse and the correction of the trouble is going to be just that much more serious. I don't know what can be done about it. I might say that this other field of work is that of emergency help and the Soil Conservation Service has attempted to be helpful in a number of cases; notably, in the case of floods on the Rio Grande early last summer. We have done work in other areas of that nature on parts of the Pecos and Upper Gila, but there again, our facilities are very limited. A few years ago if this had happened we would have been in a very fine position to help because of the large number of CCC camps and emergency labor. Now, this hits us at a time when our CCC camps and other sources of labor or other sources of money to employ labor, are at the very lowest ebb, so that with all the willingness in the world to help in both long range operations and in immediate emergency repairs, we find ourselves unable to be of as much practical assistance as we should like.

I might add that our activities cover the State of New Mexico fairly well in that we have the State divided up into what we call "Administrative Areas," with headquarters at Santa Fe, Albuquerque, Las Cruces and Clovis. The Clovis office reports to the Regional Office of the Soil Conservation Service at Amarillo, but it is all a part of the same organization. Each of these areas is divided up into smaller units where we have men who are in position to help to be best of their ability. We have all the facilities to be helpful except money and labor, and I think another medium through which a good deal might be accomplished in the future is that of the Soil Conservation districts. They are now being formed in a good many parts of New Mexico and with which most of you are familiar. There again, the amount of assistance which can be rendered depends on the ability of the people who organized the districts to take an active part and contribute machinery, some money, etc., and the ability of the Federal agencies to help. Just off-hand, all I have to add is that we are, as I said before, actively engaged in getting information together on damages in some places we are cooperating with other agencies in getting data on stream flow and related factors so that any information that we may have is available to this group at any time. We are not prepared to submit to them any complete plans for flood control or soil or moisture conservation in the upper watershed because those areas that I mentioned have not been completed.

I imagine that one step worth considering would be to divide the State into major areas, divided pretty well by drainage, and have some local groups work in those areas so that they can bring

the various agencies together and get whatever help and information the various agencies—state, local and federal—can contribute.

MR. McCLURE: Thank you, Mr. Calkins. Mr. Pooler of the Forest Service.

MR. POOLER: Mr. Calkins said we in the Forest Service are very closely interested and associated with the upper watershed areas in our national forests and we are connected with the various survey projects that he has referred to. Now, in the immediate past we have been making some supplemental informal surveys of our own. They are not very accurate, but they are based upon estimates of damage as we could hurriedly get them together and we have some data that gives a general idea of what has happened. We have also had men on the ground going over the watershed areas in a rather extensive sort of way to see what happened to the watersheds themselves, to see if there is any relationship between the volume of flow and the condition of the cover. We have been checking on the flow conditions in the timber areas, virgin forests, and coming from where they cut over, whether constructively large or consecutively long. While we have nothing specific to report at the present moment, we do think that there is a problem that probably the administration would have to take care of currently. That is through management practices to reduce the effects of these floods.

I am not so sure but what it might be possible to get some legislation through Congress that would be helpful in improving the cover conditions on privately owned land. For example, there are in the Lincoln Forest, from which a great deal of this water came, some private lands that are being cut over. They were private lands, but they became Government lands either through the process of Government land exchange or through outright purchase, but those lands were secured subject to timber rights and those timber rights are being exercised. Through close cooperative arrangements we are getting those lands left in somewhat better condition than the operator would be compelled to leave them under his timber rights. It seems to me that if we could get some legislation which would enable the Federal Government to exchange some standing timber for standing timber that this operator is able to take under his existing timber rights, we could probably induce him to leave the heavier timber as his logging progresses. I think that is something of merit and something that could be presented and might get long-time results that would be important.

I had prepared a draft of a measure of that kind. It would simply be extending the principle of land exchange to timber and provide for certain timber exchanges that would leave the private lands as cut-over in much better condition and at no additional cost to the individual because he would be compensated by additional timber, so in the recent past we have been making some of these studies to see what did happen. One of the things that we have established pretty well is that there is a relationship, of course, between cover and ability of the soil to hold moisture. What we have run into particularly is that the rains came in such volume that no cover could hold the water back. As the soil became completely saturated, additional storms came and the water ran off and accumulated in the channels and gouged out those channels and made them larger than they were before. Some of the most serious damage in the upper country is due to that very fact—that the channels were cut deeper—and it is going to be much more difficult to irrigate these lands in the future than it was in the past. The water is deeper and harder to get it to the lands involved. On the Lincoln Forest a rough estimate of the damage to the channel facilities is

somewhat in the nature of a quarter of a million dollars, and that is represented in damage to fences, stock-tanks that have been built and washed out, etc.

In damage of that kind we haven't anything reliable as to damage to private lands except what came in from County Committees who have made cursory examinations and have made some effort to estimate what happened. It is just as Mr. Calkins said, there are two sides to this whole problem; one is long term planning and long term measures to, as far as possible, prevent recurrences of what happened, and the other is to do what we can to remedy what has happened so far as that can be done. We are interested in both of those. As Mr. Calkins says, our facilities also have been, like his, very seriously cut down.

We now have in the state only four CCC Camps. One of those camps happens to be at Ruidoso. It was scheduled to move somewhere else for the winter and back again for the summer. We are making every effort to have that camp put in condition to have it occupied throughout the winter. The camp is located in the very best place it could possibly be to be helpful during the coming winter. We are making every effort to assure you of the cooperation of all parties. The Director of the CCC aided in accomplishing the immediate steps for winter occupancy. What we have been engaged in there is simply repair—making certain impassable roads passable; putting in temporary bridges so that people could get across the streams where they were absolutely blocked before, and in various other ways doing a sort of temporary job or rehabilitation. There remains a more extensive job that will take longer and will require perhaps more than we can give in the way of facilities. Our camp, as far as is available, is going to be engaged exclusively on this type of work. There is a lot of channel clearing that I think is of very great importance above the Ruidoso. Where we have a back-store condition of fallen virgin timber it is going to block the channel and present a menace as long as it is there. We have to clear that out, and our men are going to be engaged on that as long as they are up in the mountain country.

In whatever way we can, we are using those facilities that we have to be helpful in correcting some of the damage that has occurred. I think that any information that we get that is reliable as to damages, we would be very glad to turn over to whatever agency is set up to receive the reports of that kind. To date our work has been somewhat preliminary, but it does give us an idea of what happened and I think it points in a long-time way to perhaps less reliance than we have been given in the past on proper management of the forest itself.

We have felt that something like this couldn't occur, but we didn't look for such rainfall either, and we got too much rain, and I think perhaps that out of it will come some determinations as to up-stream structures that will be needed to help hold the water back, but of course, that is just looking into the future. I can assure you that whatever we have in the way of resources will be used in trying to improve this situation. We have these few camps and they are distributed—each forest has had its share of this sort of emergency damage growing out of a very wet season, and these several camps are all engaged in rectifying some of the damage. For instance, we have a camp that has moved into the Glenwood country. That is above the Gila on the Gila watershed. It will probably be engaged in doing this work on that watershed. I don't know that there is anything further I can add to that.

MR. McCLURE: Thank you, Mr. Pooler. Right now I will call on Mrs. Coe of the Water Users' Association to outline and present the damage done in her particular area.

GOVERNOR MILES: I believe there are some here who have come in since we organized. If there are, will they please give their names.

MR. RUNDER: R. H. Runder, Corps of Engineers, Galveston, Texas.

MRS. COE: Mr. George Titsworth of Capitan, is chairman of our delegaton and is from our county. I would like to have Mr. Titsworth speak at this time.

GOVERNOR MILES: Most of my troubles have been coming from those people who have been damaged. That is where I get my telephone calls and I want some of those who have been damaged by the floods to express themselves here as to what they do need to help them, and then see if there are any agencies. Before I forget it, I certainly want to thank all government agencies and all state departments for their cooperation. We have never called on any of them who have not given us their full cooperation, and I want them to know I appreciate it. I am sure I am speaking for all the people of the state. If not for their assistance I don't know what we would have done.

MR. TITSWORTH: We vote 100 per cent. I don't want to have anything to say about long range propositions, and we are not greatly concerned about them right now. We have some needs that are urgent. Our irrigated lands, most of the lands in Lincoln County are on the Ruidoso, Bonito and Hondo. Every irrigation dam on our main streams has been washed out and the damage is done. What we need is some help in restoring those and we must have it soon or those valleys will be depopulated. Many of them are poor people and lost their crops. They were ready to harvest them. There are some of us who are solvent but we are not able to put back those dams and ditches without assistance. The river needs cleaning out from the top of the White Mountains to Roswell, I guess. There are only about three months in which to put those dams and ditches back. However, that we cannot do.

Personally, I am interested more in the vicinity of the Hondo. We have some dams—there are three or four of them. They are all gone. The channels have widened and deepened. It will take $3.00 to $1.00 to put another dam back. We haven't the money to do it with. What we want is some of that three per cent money that is available, and we want some labor and machinery. If we can get those dams back and they work, then those valleys will probably come out of it. If they don't they will be largely depopulated and those people won't come back. The Forest Service people could help quite a lot if they would donate some logs to help on those dams, and no doubt they would do so if properly approached. The labor is going to be a big item. We have a camp at Hondo and another at Ruidoso. The camps are undermanned and I would like to criticize some of their work, if permitted to do it. They have some rather long range propositions and contracts signed up for building fences, tanks and things out there in the mountains. If that work is delayed for a year it won't hurt much. We need work on the dams on the river and need it bad, but can't get it. The man in charge says he has some definite contracts. Why can't they get those contracts changed? By the time they get the work done that they have outlined our time for fixing up these places to irrigate will be largely gone.

There are extensive orchards up on the Ruidoso and Hondo. There are hundreds of thousands of tons of debris in those orchards. Some hang in the branches. The silt is two to four feet around the trees. The trees are going to die if silt not dug out. There are rocks in the orchards. The

streams cut new channels. If heavy machinery could be brought in they could rectify this damage to a large extent. I can check back on this valley for 72 years and nothing like this ever happened before. We have had floods and damages and had dams go out but we have never had all of them go out. That is what happened this time.

If there are any camps where the work they have is not urgent—we have the accommodations over there to take care of lots of men. The new camp at Hondo is understaffed and they do not have enough men. I don't know if they are furnished with the money to buy material. We are willing to buy material to put in dams if we can borrow the money and get labor. Most of us, especially on the Hondo, can pay it back after a while. Some of those people on the Ruidoso—I don't know how they can pay it back.

There are native people who have been making their way and will continue to do so if they can get some help. If they don't the country will be abandoned and those people will go on relief. Unless we can get relief the valley is going to be abandoned to a very large extent at least, and that land for taxation purposes is valued at $60.00 per acre. If it goes back to dry land it will be valued at about $1.70 per acre. Those are nice little valleys. We like them. We think they are worth saving, but no long range proposition is going to save them. It will help them after a while, but we must have some immediate help or there will be trouble. Mrs. Coe can tell you much better about conditions on the Upper Ruidoso. There are many small tracts in the Upper Ruidoso. From the Hondo down the lands are held in larger tracts. The people there are able to help themselves if they can get some assistance.

MR. McCLURE: We will be glad to hear from Mrs. Coe.

MRS. COE: Mrs. Jones is County Superintendent of Schools of Lincoln County—Mrs. Jones.

MRS. JONES: I don't know that I can say anything further. Mr. Titsworth stressed the need for immediate aid, and in asking for aid some of those people are going to have to have aid, not only in labor and equipment, but also in materials. Personally speaking, unless some aid is given it is going to effect the entire county set-up because in these valleys so much of our revenue is derived from this valuable land. I don't think it would be worth $1.70 per acre as dry land. Nothing to graze on it. What crops weren't completely destroyed washed away entirely in my section of the valley. The land is covered with sand from two to five feet. We have located furniture and doors and logs and most anything. We don't know what else we might find. We do have to have aid. First, we need bridges to be able to cross the river. Many people are not able to get to their homes unless they climb high to cross the river and walk a mile. We had some homes that were washed completely down. I know that we must have aid and we must have it right away if we do replace our dams. Without the water to irrigate our lands there is nothing we can to toward making our livelihood.

MRS. COE: Going back to the camps—I have spoken to at least half a dozen boys whose time has expired. They have been in the camp for two years and they cannot return, although they would like very much to return to the camps. I wonder if we, today, could not make some type of resolution to change the rule to allow the boys to have more time. They would like to have more time. They would like to go back and work in the CCC Camp. After two years they have learned to be efficient in that work. At Ruidoso I have spoken to at least six boys who would

like to go back but because of that limited time they cannot go back. Then I understand the Grazing Division has two camps that are doing some work over in the Socorro country. Those camps have been moved over. I feel the Grazing Service Division camps and the work they are doing in building fences, should be delayed to assist in the work in these particular valleys where unless we can get this work in the next few weeks or few months it will be absolutely too late.

We must have labor from the CCC Camps. We must have heavy equipment. We need a drag line, a steam shovel and many trucks and caterpillars. I understand the Game Department has some heavy equipment North of Roswell, about eight miles, that is not being used. This information is abroad in the Ruidoso area. I hope that the Game Department is represented here so we may know if they have such equipment available. If they have why can't that be brought to the Ruidoso Valley to assist us in the emergency? Our land is covered with sand and rock. A good many of our trees have been washed down. Those trees will have to be dug out and replaced with small trees. The land is going to have to be reclaimed by most of us on the Ruidoso and we are willing to do our part. We will borrow the money, mortgage our farms if necessary, because we still think, despite the flood and damage, that there are great possibilities in the Ruidoso Valley.

Some of the people have been there for from sixty to seventy years. We know what the valley produces and what fine living it provides and do not expect to leave it. But I think the Soil Conservation Service and the Forest Service are willing to agree that our needs are specific and are immediate, and I hope that we may have the opportunity for these agencies to get the bridge timbers. We have been trying to get logs. The men who supplied logs at $1.50 to $5.00 apiece have now gone up to $15.00 to $20.00 apiece. We cannot afford to pay for the logs. We must look to the Forest Service to cut that timber to provide for the bridges. The rock is available and we can get the cement if we can get trucks to haul it. We need a drag line and a steam shovel to clean out our channels.

It seems odd to me he fact that the Ruidoso, Bonito and Hondo Valleys are a populated section of this state, a wonderful agricultural area, and we have not had the service of the REA. There is no area more entitled to it. It is going to be impossible on some of the farms to rebuild a dam to get up the water at a cost that would be comparable to what we could pay. If we had REA we might be able to put pumps in and irrigate in that valley. I think the committee could do a great deal about bringing the REA to that vicinity. It would provide cooperative marketing for our apples, cabbage and corn, but our immediate need is the CCC labor and big equipment. We hope today we may be able to take back to those people, something definite from the various agencies.

Speaking of the Highway Department, we know the roads are important. We can go over bad roads. We have done it before, and can for two or three weeks to get equipment off the highways for a few days in order to fix up a farm that pays the taxes to keep up the roads. I telephoned our Highway Engineer about an emergency because we had another flood. I told the Highway Engineer that one day's work with a bulldozer would clean that out so it would not endanger farms for at least a mile. He informed me that when the bridge in the highway went out they would fix it and not before. That isn't right. One day with the bulldozer would have cleaned out the channel and prevented the fear of not having the highway and bridge out by our homes and farms. I don't like to go into such specific details because some of you are not interested in a small valley, but I think our situation is comparable to the Penasco and I know it is

to the Hondo and Bonito Valleys. We should delay some of the work in the long range prevention plan and give us immediate relief to get us back on our feet and we will pay the taxes and help in any way we can.

MR. McCLURE: Now, the Roswell area. Mr. Hall.

MR. HALL: Mr. McClure, we down there are getting along fairly well with our proposition. We have sustained a great deal of damage and we will call on Mr. Lea Rowland a few minutes later to give us that amount. We are proceeding with our own little problem of flood control within the city itself. We hope to get started next week. We have our drag line on the ground, and feel that we have to move along with the Federal Agencies showing good faith and doing our part in making the Spring River carry seven times the amount of water it has carried previously, the Hondo four times, and we hope it will dovetail the proposition any Federal Agency devolves down there to prevent any flood in the future. We are intensely interested, of course, in the proposition of prevention in the future. In a city of 14, 000 we will stand together 100 per cent on any such proposition, or behind any Federal Agency that will take the job and move into it. Mr. Rowland has detailed information as to the damages sustained within the city and I know Mr. Losey and Mr. Mullis are here and Mr. Puryear, Chairman of County Commissioners, is here to give you a statement as to county wide damage.

GOVERNOR MILES: At that meeting held at Roswell sometime ago were there any other matters discussed except those in that area?

MR. HALL: You mean the time Mr. Dempsey was there?

GOVENOR MILES: Yes, sir.

MR. HALL: We talked about the matter as to whether or not it was a Reclamation Service proposition. Mr. Dempsey was of the opinion that it was a Reclamation proposition and could be carried on under the Reclamation Service in that we were not interested in the water itself. We didn't claim the water. Carlsbad and Red Bluff were trying to divide that water among themselves. We didn't care who got it but the proposition was as I stated at the meeting, we didn't want it to run in our front door and out our back door in order to get it to them. We would fix the Hondo channel so that it would carry 3,000 second feet of water which would be ample to drain any waters that would be stored to the West, and a very short time after the flood peak had passed we would fix the channel for them to use, but we don't want any sloshed out in town. Mr. Rowland.

MR. ROWLAND: I have these figures representing damage sustained in Roswell and I will file this here, and also one from the County Agent as to crops and if that is in order, I will file it. Damage is over $1,000,000 in Chaves County.

GOVERNOR MILES: Was any suggestion made as to remedies?

MR. ROWLAND: The Army Engineers are working on that problem now and I know that the State Engineer has evolved plans to take care of Roswell. We are full of ideas. What we need is money and action.

MR. HALL: Colonel Hewett is conversant with that situation down there. Colonel Hewett and his Corps of Engineers have a very minute set-up on that whole area down there, and we in Roswell are very much encouraged over the outlook and feel that something is going to be done. We are going to stay on the job until we can get the job done. Any assistance we can give these agencies will be forthcoming.

MR. McCLURE: Colonel Hewett, do you have anything to say on that particular project?

COLONEL HEWETT: The only thing I can say is more or less what I said before. I think that the City of Roswell has a very definite problem and there is a very definite answer. Whether the answer will be within the funds available or not, I cannot say until our survey is completed. The situation at Roswell is not insurmountable—the answer is fairly evident.

MR. McCLURE: Is there any possibility of the Corps of Engineers making a specific report on projects in areas like Carlsbad and Roswell? Assuming that the Pecos River as a whole was not feasible as a flood control district, could you go in and specifically set out any parts of the stream system, such as the Hondo or any other particular area? Is that allowable under your regulations?

COLONEL HEWETT: It is our intention to set forth what we consider to be the most economical remedial measures to be taken in these various places where they have encountered the most damages. We will set those out, whether economical or not economical. If we are able to justify them so much the better. If not, they are something to shoot at.

MR. McCLURE: What I was more or less anxious to know was whether you could recommend in your report any particular parts of a drainage basin.

COLONEL HEWETT: Yes, there is no objection whatsoever. If the damages to any particular locality justify that protection there certainly would be no objection to including it in the report, and we shall do so.

MR. POOLER: Something has been said about replacing certain beneficial structures and irrigation structures on the Ruidoso and some of the mountain streams. I wonder if that is going to be possible without a very definite engineering survey in there to see what will now serve in the way of structures and how they would have to be placed, because it doesn't seem to me that you can go right back to the old plan and replace one dam with another dam of very much larger size. It seems you are starting from scratch again and that before putting in more dams there should be a comprehensive engineering survey by qualified irrigation engineers to determine what kind of a system is going to be required now to replace the one that is gone, and unless such a survey is made it seems to me it is going to be very difficult to work very intelligently on that proposition.

MR. McCLURE: I think that is true in many cases.

MR. TITSWORTH: If all of this is done, by that time we will be pretty well out of the picture.

MR. McCLURE: As I see it—I have not been personally on the ground, but what you need is immediate relief for next spring. I realize that, but the whole thing is if a permanent structure

goes in there with your river as I understand it, that is twice as wide in many places and cut deeper, the type of dams are not sufficient for the channel now and it will take some kind of designing to set them up so they will stay in there.

MR. TITSWORTH: That is a serious condition, but it is getting worse all the time. Some of the dams have stood for fifteen or twenty years.

MR. McCLURE: I realize that.

MR. TITSWORTH: If it is delayed a great deal we will not need any dams. We are willing to assume the obligation of getting the money ourselves.

MR. McCLURE: I realize what you need is right now and before next spring so that you will be ready for next year. That is true of all our flood areas, but in many cases if they did go in with small log dams those won't stay in at all now if they attempt that kind of construction. In some cases they would. That is not a point to argue. Is there anyone here from the Penasco area?

MR. SALAZAR: I have a report that has been submitted to the State Planning Board from Mr. Spence, Chairman of the Planning Commission for Otero County, and I will submit it to you. (see Appendix C)

MR. MULLIS: Mr. Losey and I are here, and I would like to have him make a report.

MR. McCLURE: I noticed that we did have the Conservancy District that includes the area of Eddy and Chaves Counties represented here today.

MR. LOSEY: It includes practically all the Artesian Basin in Eddy County, City of Roswell and City of Artesia and incorporated communities of Dexter, Lake Arthur and Hagerman. The report I have covers the damage within the Conservancy District outside of the incorporated cities and towns. There were 758 farms. The damage amounts to more than $400,000, a figure arrived at by personal contact with each farmer and land operator. You people have begun to realize we did have a flood in Chaves County doing unprecedented damage, so large that we have very definitely come to the conclusion that we ourselves cannot take care of the situation, and that we are going to have to have some help.

We cannot do it all ourselves. We are of the opinion that we are going to have to have some federal help. The purpose of the survey of the Conservancy District was to assist the governmental agencies in arriving at figures covering damage outside of the incorporated cities and towns to see whether or not it would be justifiable for them to come in and spend government money to prevent recurrence of these conditions that recently existed.

There is one point I would like to make. I think the matter of a flood control is of primary importance, some type of construction that will prevent the damage to our homes and property, as well as to our lives. Next to that, it seems to be very necessary that whatever we do in this arid State of New Mexico that we try to incorporate in that activity some conservation of the water involved. The water is very valuable to us. We must protect our homes and people and property, but we must try to do it in some manner where the water will give us the greatest efficiency. I request that in any consideration given to the matter of flood control that we not

overlook the possibility of conserving every drop of water we can. I will file this copy of our Conservancy District report with Mr. McClure as a matter of permanent record. I thank you (See Appendix D).

MR. TITSWORTH: I would like to submit this report (See Appendix E).

MR. McCLURE: I believe we had better recess this meeting until after lunch and reconvene here at 1:30. Will that be agreeable to everyone?

GOVERNOR MILES: I do want to ask that each and every one be present here this afternoon. If at all possible, we want to get something constructive before this meeting, so I am going to ask everyone to be present this afternoon. There are a lot of people we have not heard from and I am anxious to hear from them and I know the rest of you are.

Meeting recessed until 1:30 P.M.

GOVERNOR MILES: Mr. Chairman, I want to say a few things, but I don't want to do all the talking. If possible, we do want o get down to where we can accomplish something. We don't want to leave anyone unheard but we will have to make it as short as possible in order to hear from all of them. Mr. Barker is here of the Game and Fish Department and he is very busy. Something was mentioned this morning about machinery that belonged to the Game & Fish Department. I find out from him that what often happens to us is that a lot of times people call us and tell us that machinery is sitting idle or that machinery which belongs to us is not in use and they would like to be allowed to use it. When an investigation is made we find the machinery is not ours but belongs to someone else and we can't use it. I was talking to Mr. Barker about his machinery and he advised me that was what happened.

Another thing, I do wish we were in position so that every time the 'phone rang we would have a piece of machinery to send down to open up a road to someone's home or fix a road. They usually say it will take a half day. We find that sometimes it takes from ten days to two weeks, but if we let this machinery travel on the road every time it was requested, it would wear out the wheels and it wouldn't do anything else but wear out the road. Where it can be of service, or where there are emergencies, we are anxious to have it serve that purpose, but we have had several roads that are Federal Aid roads that have been blocked ever since the flood last spring. Not a day passes but what I get several calls, and the Highway Department gets calls, asking as to when we will get them open, and if we don't they will send a delegation in to see us. We are doing everything possible. We may sometimes have some lost motion that we can't control at all times, but our machinery and our men have been doing everything possible since the floods began last spring. We have been pretty busy keeping the roads open. All we try to do is to keep them open to travel on. I am sure that Mr. Dwyre will have an opportunity to talk after a while. We are doing everything we can, under the circumstances. Mr. Barker.

MR. BARKER: Governor, Mr. Chairman: I don't have any desire to take up more than just a moment of your time this afternoon, but I did want to explain just a little about the machinery that was referred to this morning. I think it was the impression that it belonged to the Game & Fish Department. I think that machinery was at the Bitter Lake Project somewhere northeast of Roswell. All of that machinery belongs to the Fish & Wildlife Service. You might think it is

tied in with the Fish & Game Department. That is a Federal Bureau operating under the Interior Department, and our department or the State of New Mexico has nothing in the world to do with that. They do have some big machinery out there, I understand, but whether or not it is available I couldn't say. We do not have any big machinery. One little bulldozer and caterpillar are the only pieces of road machinery that are owned by the Game Department. That has been busy most of the time this summer in protecting our own property up in the Red River Country from the floods there. We have, however, at Roswell had a couple of trucks in that area. We had them last spring and also during the flood the last of September. We sent them in both instances to Carlsbad to help in moving out people.

I want you to know that the Game Department is desirous of being helpful in any way possible at any time. We are not equipped with construction machinery to do very much. If we have been negligent at any time, and if something has happened that we could have been more helpful and failed, I am glad to have that brought to our attention. Should these floods be repeated or recur and our Department or any personnel of our Department, or if any of our machinery can be used, what little we have, we will certainly be glad to help out.

Of course, our department is interested in the long range program for this flood control. Our immediate needs naturally must turn to rehabilitation and helping out those who have been so severely damaged by the recent floods, but we believe that while that remedy, of course, is very important and necessary, that it is high time that we were looking to a long range flood control program over the State as a whole. As I see it, that will take two things—the very careful protection of our watersheds and the very careful use of the watersheds so as to minimize the run-off just as much as possible, and if we do get those floods and run-off any way, regardless, we simply must have some flood control projects that we can dam up the water and prevent a recurrence of what has happened in the past. It seems to me that unless we can work out some program, both on the Pecos and its various tributaries and the Rio Grande and its tributaries, that we will be headed for trouble from now on. I hope some way will be found that we can work it out. Building of flood control dams will react to the State's benefit in many other ways.

The point we are interested in is in making a program of flood control and reclamation projects that will handle floods and thus bring more money to the State.

GOVERNOR MILES: Does any one know whether Colonel Minton is coming back or not?

MR. McCLURE: Colonel Minton talked with me before the lunch hour and stated he had to leave this afternoon and he said his only interest and the only thing he could do was in regard to the CCC Camps—in feeding them or moving them in and setting up barracks. He was ready to do that any time that they got their orders to move the camps or increase the camps. That was the only function where he came into the picture. He said he was moving winter barracks into the Ruidoso. He said all we would have to do in moving in and setting up the camps would be to notify him and he would be ready to act. I believe on the Pecos we got down about to the Carlsbad Area. If we could hear from Mayor Horne of the Carlsbad Irrigation District.

MR. HORNE: Mr. Chairman, Ladies and Gentlemen: I can sympathize with the Governor about the telephone calls because it seems to me as though everyone in the State called me during the two floods we had. Of course, they were our neighbors. The calls were about

chickens on up. They complained seriously, and with reference to machinery we borrowed everything we could get our hands on. The streets and roads are in very bad shape. We had two floods—one in May and one in September, at Carlsbad. The one in May did more damage to our local housing situation in Carlsbad than the last one, although the last one reached out and did damages that the previous one didn't. We haven't attempted to compile a report for filing here today for the reason that it is impossible. Our reports are being made and will be analyzed by the Army Engineers who are working there now and reconciled properly with theirs and any necessary reconciliation will be checked. After the last flood I immediately began contacting our representatives in Washington for some kind of definite relief for the Pecos Valley, Carlsbad included. Out of it came a meeting of the various mayors in the Pecos Valley held at Carlsbad on October 16. Colonel Scott and Colonel Hewett of Galveston met with us.

I believe Colonel Hewett was here this morning. It was a gathering something the size of this, representing the interested districts comprising the Pecos Valley. Some of them were from up in the Hondo Valley, some were from Roswell, some from Penasco, some from the Red Bluff District, Barstow, Carlsbad and various other effected districts. At that meeting there seemed to be harmony. The spirit of the meeting was that it was one time for everybody to work together and forget any selfish interest or motive and apply for relief and work together for it, but I noticed a certain headline—not a headline necessarily but a news item—in the Fort Worth Star Telegram yesterday morning that some of our good neighbors were seriously concerned over any attempt we were making to retard the water on the Pecos.

Well, I don't have the solution. I have often made the remark that it was too highly technical. I understand the Army Engineers complained seriously of no contour maps of the surrounding country and nothing definite to work with. They have had to hunt it out for themselves in their minds, gather pictures, etc. Consequently, it is a slow job, but I see no reason why we should not definitely depend upon the surveys now being made of the Pecos Valley by the Army Engineers. I think there are around 18 or 20 headquartered in Carlsbad right now. They definitely promised me that the report will be complete and ready to deliver to the Rivers & Harbors Committee within 60 days, and then, of course, when that is analyzed our representatives in Congress will be able to take up with each effected community and inaugurate legislation, as they think best, to relieve the distressed areas.

Carlsbad is a highly technical location in this flood area. We are like most of the rest of the valley—we are dependent upon the water, and at the same time we are just like, so to speak, sitting on the bluff of all the storage, and the question that arises is as to any arrangements that can be made to protect us from it; whether it will effect the water supply; or whether it is economically sound, or in other words, whether we can afford it. Of course, that is to be taken into consideration from the standpoint of possible loss of life and property. I have never attempted to suggest to you gentlemen any definite remedy. As I stated before, I have confidence in those boys who are there. I thing they are among the best, if not he best. It doesn't necessarily mean that their report will be final. I think the residents in the effected area reserve the right to reverse it if it is found that it should be desirable, or necessary, and I think within 60 days the report will be available as to what the Army's recommendations are and then we can begin to fight, but I want to say this that during our troubles in Carlsbad we have certainly had the cooperation from the Governor on down so far as the State officials are concerned, from the different departments of the Governmental agencies, CCC Camps, Red Cross, and Soil

Conservation. They did everything that you could imagine—so many of them that I didn't know who all they were.

Of course, we thanked them and the CCC boys. I can appreciate their position. Their power of doing things is delegated to them and they just can't exceed those things, and God knows I don't know what we would have done without them, and we appreciate them. I don't know whether it would be any remedy to ask for any delegated authority change for supervision of their work. We have found them to cooperate with us in everything they could do. I don't know but that you folks will probably be asked to sponsor some relief. We expect it and I don't think any of these communities expect someone to come in and do all the work for them. We don't expect it.

We are sitting in the most precarious or dangerous position in the entire flood area. We have a possibility in our part of the valley of being completely wiped out and the Dark Canyon Draw is serious and also the Hackberry Draw. We have other tributaries—the Penasco and Rocky Arroyo—any of them under maximum rainfall such as fell in the Dark Canyon on one day and three days on the Penasco—either one of them are capable of flooding Carlsbad if the river at the time they would meet with the Pecos waters was as high as it was at its maximum, such as in May. We have about five or six tributaries meeting right in and around Carlsbad that are very dangerous. I don't know of any permanent suggestion to make to this meeting—only that I can gladly say that I am willing to cooperate in any way in the world and that we are not selfish enough to ask any favors. We are willing to go 50/50 with any of them, and if any disaster hits your community we will work with the same spirit.

MR. McCLURE: I think in order not to deprive anyone of being heard and in order to get everything before the meeting and allow us to get over the areas, we will try to limit all the talks to not exceed ten minutes for any one. Now, we have cleared the Pecos pretty well with the exception of the upper regions. Any one here from the upper regions of the Pecos—Santa Rosa, Fort Sumner or up into the Las Vegas area? Anyone from the Penasco here? Mr. Salazar, we have the report from Otero County.

MR. SALAZAR: Mr. Chairman, perhaps it would be well to read the report. It has a few recommendations that might throw some light into the meeting. It states what they expect over there in the way of relief.

GOVERNOR MILES: Mr. Salazar, could you state in a few words, without reading it now, what is contained in the report? If you have a general idea you could give it to us.

MR. SALAZAR: Well, the meeting that we had at Mayhill—those people were looking forward at the time to having the Federal Agencies, such as the Soil Conservation Service, Farm Security, Forest Service, and all of those agencies participating in farm work, to undertake a program to rehabilitate not only the people but the lands. The flood damages in those areas that I went through are quite disastrous, to say the least. Many people lost their lands; lost their crops; and to top everything they are at the present time indebted to the Federal Government—perhaps to the Farm Security Administration or perhaps to some of the other agencies, and to the banks. To go into a lending program to rehabilitate those people naturally it will burden them to the extent that it is going to discourage further farming operations there.

It is quite likely that a situation similar to the Santa Cruz or the Middle Rio Grand Conservancy District might be worked out whereby the farmers there will undertake a program beyond their ability to pay. It is my opinion that in coordinating our efforts we should, perhaps, follow the recommendations of Mr. Pooler—ask for congressional action. I have known of some other flood damages such as those on the Ohio River some years ago. I might state the position that Mr. Dempsey took while we were discussing these flood damages with him. Mr. Spence from Alamogordo was with me. I asked him if the damages in the southeastern part of the state and the northwestern part, combined with Texas and Arizona, didn't warrant congressional action. He immediately pointed out the position Congress took on the Ohio River flood damages. They voted $25,000,000 to rehabilitate those people. Well, this may be on a small scale, but it warrants the same consideration unless the agencies over here can undertake the matter themselves.

MR. McCLURE: I guess we can proceed to the Gila now. Anyone here from the Gila?

MR. STERLING: Mr. Chairman, we prepared a brief a number of years ago on flood structures on the Gila River. The matter of the defense program came up and disrupted flood control projects that were considered for the Gila. However, there are a number of men here who were at the National Reclamation meeting at Phoenix a short time ago. One thing that impressed me was the fact that we need a permanent organization to represent New Mexico either on reclamation projects or flood control structures. There also came up at the meeting the question as to just how much water the states were entitled to; a recommendation on authority of States rights was considered.

The brief we prepared became rather archaic after this last flood. We have lots of additional information to put in it. Even the matter of life came in. If that flood had come a few hours later in the evening there would have been 50 people drowned. They hung in willow and cottonwood trees and we could easily have lost 50 there. I believe the thing is simmering down because of shortage of labor and equipment and because of the priority angle. We have to decide just which structures must be put in to protect lives that might be in jeopardy should another flood come on soon, using what equipment and manpower we have for those structures. I believe, after being at Phoenix with 17 western states represented, that water is going to be power and we should have some strong organization in this state to protect our water rights.

We should have a definite, clear brief made on each watershed so that when this critical defense program is over, the millions of men who will be out of employment will have something to do and the hundreds of millions of dollars worth of heavy equipment won't rust and can be put to productive jobs.

Thee are so many agencies interested; for instance, the Reclamation is tying up very much to the development of electric energy. The flood control money that has been appropriated for flood control has been earmarked and is being kept over. The brief that has been prepared is a little bit archaic. We hope still to be able to take care of the drainage over about 2,000 square miles of country with the Soil Conservation Service and the Federal Projects on the Upper Gila. I hope we can do that. It would increase the lives of our people and Coolidge Dam. Our farms are at the bottom of Coolidge Dam today. Chemistry says nothing that has been created can be destroyed, but in my opinion our farms are at the bottom of Coolidge Dam and in my opinion,

are rather definitely destroyed. I really believe we need a permanent organization. We should get more information on the Wheeler Case Act, and on the different agencies that can help, so that we can correlate their jobs and see what we can do for New Mexico because these other States are looking after themselves quite well—Arizona and Texas. We think Arizona is just a trifle selfish about the water situation.

MR. HANNETT: I might say that the Army officer in charge of the investigation on the Gila prepared a report on the Gila flood control and it will be ready for release about the first of December. A copy will be made available to the State Engineer's Office.

MR. SALAZAR: Do you know anything about the Pecos River Joint Investigation report sponsored by the National Resources Planning Board and participated in by other agencies? Would that be adequate for a basis?

MR. McCLURE: The Pecos report is out with the exception of the flood control part that the Army will supply. They planned to have that report available by June first, but the excessive floods in Dark Canyon and in the area around Carlsbad have held it up for a little more study. By that time they got another flood that was larger, and also on the Hondo and now it is held up again. We hope that it will be out in the near future. The rest of the Pecos River Joint Investigation report is out covering the work of all the other Federal Agencies.

GOVERNOR MILES: The secretary has asked that he have the addresses of all the Government men. I think we know the addresses of most of them in the State. Before you do go away, will you please give the stenographers the address where they can get in touch with you? Several people have asked whether or not a representative from the Disaster Loan Corporation is here, or if anyone here can explain as to just what they have to do to borrow money from the department or corporation. If anybody here can explain it, I am sure a number are interested.

MR. O'LEARY: I would like to report, however, that following this last heavy and disastrous flood on the Gila, Governor Miles sent Colonel Powell over and I spent two days with him while he made a survey of conditions on the Gila and on down into Duncan. He made a report to the Governor and I would like to have that report incorporated in the minutes of this meeting (See Appendix F), showing the actual conditions existing after the most recent flood.

MR. LOSEY: I served as a member of the Board on the Disaster Loan Corporation in 1937. We set up an office in Roswell. We made a number of loans to the people injured in the flood, extending up in the mountains in the Roswell-Hondo area and wherever there was a loss from the flood. Those same people are the same representative of that agency. They came back into the Pecos Valley during the last flood and opened up a branch office at Carlsbad out of the El Paso office. They have recently opened up a branch office of the Carlsbad office in Roswell. I think if any individual who has been damaged by the flood will contact them by letter or telephone, and make application for a loan, those loans will all have very favorable and careful consideration. Those loans are for a period of years and have a very low rate of interest. They take any security that is offered. They consider the loan on the basis of need and security offered. I am sure in the Roswell area and in the Carlsbad area, that those loans are now available on very short notice. They made most of loans in 1937 and are ready to make them again.

MR. HORNE: Mr. R. L. McKennon of El Paso is the man in charge of the Disaster Loan Corporation at El Paso. He asked me to sit in on loans in Carlsbad and we have applications in for over $100,000 there.

See Exhibit F

MR. PAYNE: I don't see anyone else here from Hidalgo County and the Red Rock area in Grant County. I want to make a brief report, at least on the Virden area, which is in the country I come from. There are several types of aid needed in those districts. Mr. Sterling reported that we needed a flood control dam on the Gila. It should not be limited to one dam. If any of you know the situation on the Gila River, there are several different valleys. Between each valley there are large canyons. In the Virden area we were in one of the worst flood stages before the crest of the water hit us because all water coming down Bear Creek and other large canyons was so large that we had a flood before the flood from the upper Gila ever reached us.

In my opinion we need flood control dams at the head of each valley—one at the head of the Gila Valley would give us some relief but it wouldn't give us adequate relief. We need at least one at the head of Red Rock Valley and one at the head of the Virden Valley. At least, if not large, of a size to give some relief. As you know, in the Virden area we lost the dam as well as losing our bridge connecting us with Lordsburg and the highway, and we are going to need aid in the Highway Division and from the Flood Control Division. The Wheeler Act is something that should be studied and perhaps provisions of it could be put into effect. It provides that forty per cent of the work on these dams can be done by WPA and other agencies.

With reference to these loans, it is true that some of these people need loans but I don't think that should be the ultimate aim. Suppose the Forest people cut off the forest and the grazing people cut off grazing, the farmers down here in the Valley would get the brunt of it. For that reason I don't think we should be called upon to stand all the burden of damage caused by the floods. That is the fate of all of us. I think the State as a whole and the Federal Government as a whole should take hold of these problems rather than leaving them to the device of individual groups effected. In the neighborhood of the Virden area (about 6 miles), a most conservative estimate of personal damage would be $50,000, which amounts to $1,000 for each of the fifty families.

Many of the men had to leave and go to the mines and make sufficient money to keep their families this fall. The dam went out and they were unable to raise their second crops. They sometimes raise two crops. They were unable to get the ditches back into shape in time to do anything. They haven't machinery heavy enough to put these ditches back into shape. At the head of the Sunset Canal it took all the soil away and left the bare bluffs. We have had floods there occasionally but this flood is the worst in recorded history. I think that we now have the concensus of opinion on the Upper Gila where even Arizona will join with us in requesting aid on these dams; at least, in the Duncan-Safford Valley the people will join with us in requesting that these flood control dams be put in. These people have always objected under the Federal Decree. Now is the time to strike when these people are with us and we should try to put those things over now. I was requested by the people of that valley to state their position and their desires, and that they are only too happy to cooperate in any way they can, but it is a problem too big for any little group to handle.

MR. McCLURE: Anyone here from the San Juan? Anyone on the Canadian? I guess the Rio Grande is next. I would like to hear from Mr. Butt.

MR. BUTT: We have told our troubles so much and so often there is no use of repeating them. We will all have to get together and have a unified program. I don't think we can get any money from the Government. We ought to have the money now to get any use of it. It won't do us any good in the next two or three years. What we need is money now. It may be necessary to have a special session of the legislature to pass certain laws to get any money, and if necessary, this meeting should go on record as favorable. We ought to do something about it. We can't get anywhere discussing it. Our troubles are plenty, but there is no use in repeating them.

MR McCLURE: Anyone else?

MR. HORNE: With reference to legislation for relief, I don't believe that I am betraying any confidence in saying that I was asked at the meeting in Carlsbad to build up a supporting case for our representatives in Congress. That is why we are definitely determined on the recommendation of the Army officers working there now to help us build that case. We had numerous estimates of damages filed at that meeting. These Army engineers are trying to reconcile their reports with those same problems. To be plain about it, it is like the lawyer building his case. Those men who represent us in Congress have to have some reason to go to that body of men and ask for assistance, but after all there are only three up there from New Mexico and the rest from Louisiana, Maine, or Vermont, or what not. They have intentions of asking for direct appropriation.

Whether this will be in line with the recommendation of the Army I don't know. I built such a case that they asked me to take off a little pressure so that they could report on it, and they promised us a report within sixty days. I know some of the things that they are going to recommend, but I would be treating them unfair to suggest what they have in mind. I think the other communities are entitled to consideration also. We are in danger of our lives if our dam should break. We wouldn't have any sort of protection. You might say, the whole city would be wiped out. That is an emergency that doesn't exist in most towns, but I state this fact because of the gentleman's suggestion over there that a direct appropriation is necessary to get any immediate relief. We can repair small minor dams, with individual communities helping each other, but if it is to be permanent it has to be done in a permanent way.

MR. McCLURE: Mr. Foster, do you have anything to say for the Bureau of Reclamation?

MR. FOSTER: No, I don't believe so. I have been directed by the Denver Office to make some estimates. We are making these estimates of damage up and down the river and we are working in cooperation with the Army Engineers in getting that data. I don't believe there is anything else that I have in mind. You know, the Bureau is not a flood control agency. I has to do with irrigation; however, most of our dams are in a measure flood control projects that flatten out to some extent when floods come down the river, and I think the Reclamation Service is willing to cooperate in every way they can under the law. We will probably go ahead and make some investigations on our own responsibility. I mean the Denver Office when I say "we."

MR. McCLURE: Mr. Humphries of Sierra County and the Hop Springs Chamber of Commerce at Hot Springs was in my office yesterday. The people there are more or less perturbed about what is going to happen next spring from the Elephant Butte project. It has more water now than ever in its history. It has very little capacity left before spilling and naturally they are pretty much perturbed. The river below the dam will have a capacity of approximately 4,000 second feet, and there is a possibility of a much greater spill that would do damage. They requested that I bring that up at this meeting, due to the fact that they could not stay over. Here is a wire addressed to the Governor from the Mayor of Hot Springs: "May I especially urge you to present at your meeting today the matter of river channelization here or other means of flood control. I believe it to be of special importance that immediate precautionary measures be taken against possible flood menace. Thomas B. Williams, M.D., Mayor, Town of Hot Springs."

The estimate now for the first of November for Elephant Butte is 2,100,000 acre foot storage. That is getting pretty well up to its maximum capacity. I would like to hear something from the Weather Bureau, if they are present, I would like to see what they know about the future and whether it is going to rain.

MR. CAMERON: Mr. Fitzpatrick of the New Mexico Magazine solved that with Dr. Krick. I won't make any comments about long range forecast. All we have to do is to look outside to see that we are in a wet stage. We make absolutely no attempt to forecast rainfall or possible snow depths beyond 48 hours on a daily scheme of five days, which we issue twice a week. However, you can see from our weather maps that we prepare each day that apparently at the present time there is no immediate change in view of this wet period. We know why it rains; why it rains hard; but we don't know why the condition continues; that is, what force in nature allows this abnormal condition to continue for twelve full months. We are not ready to say it will continue for one month or whether it will go on for a period of several years.

There is no argument that conditions like now at the end of October, which is normally a dry period, are pretty serious. We have had men up in Colorado establishing snow stations. One of them returned to Albuquerque day before yesterday, and the snow on the ground right now in the Upper Rio Grande watershed is considerably above normal—probably one of the heaviest early months of snow on the ground. They had a flood situation on the San Juan last week—the La Platte. The fact that considerable rain turned into snow probably prevented a much more serious flood. The condition of the ground on the Upper Rio Grand watershed is so different from what is was last year that even a normal snowfall for this winter will concern everyone here next spring. It is possible to get a normal snowfall and have it come off in such a way that it might not be serious, but with reservoirs full and in such condition as they are now, with considerably more water than they should have, such as at El Vado and Elephant Butte, I say a normal season would produce a situation next spring to warrant some concern at this time of the year.

The situation last spring (I wasn't here at that time) was that the ground underneath the snow was of such character it absorbed a considerable portion of the run-off which came in such a series of flows that it was not as serious as it could have been, but we are definitely still in a wet spell. October will rank about the third wettest month in the State, after September, which was the wettest of all history, and even at this early time of the season it should give some concern, but beyond that the Weather Bureau doesn't make any attempt to say what the snowfall will be for

the coming winter or what the run-off will be from that snow. It is absolutely an impossibility, even for Dr. Krick.

MR. McCLURE: We will hear from Dr. Aberle next.

DR. ABERLE: The Indian lands, of course, comprise a small percent of the lands of the State. They are very checker-boarded. The Indian Service works with the Indians and non-Indians. On some of our reservations there are as many non-Indians as Indians. Last May the Indians lost a great deal of good agricultural land, and of course, the loss was heavy. We have made a survey of the damages which occurred during the flood in May which we will be very glad to turn over to this committee when it is available. (See Appendix G) We have offered it to several agencies. We have also made plans with what appropriations we have to do what work we can for the protection of these lands and that is now under way. We do not have the adequate appropriations to do the kind of work that should be done, but we are doing all we can. In planning our work, of course, we plan it in connection with districts of the State or Federal Agencies who are working in this connection, so in protecting Indian lands we always try to adjust our work to be of as much protection to the Indians as to the other inhabitants of the State.

MR. McCLURE: Thank you, Dr. Aberle. We will be glad to receive that estimate of damages if you will send it in as soon as it is available. We will now call on Mr. Dwyre.

MR. DWYRE: Mr. Chairman, Governor, we haven't made an attempt to compile the total damage which has been done to the highways in the State. That will probably require some six or eight months. Many of our more remotely located roads and bridges have been destroyed and damaged to the extent we have not been able to determine and shall not be able to for many months. I was out of the State at the time the estimate of damage to the highways was made and published. When I saw that estimate I was a little afraid it was high, but since I have had time to go over the situation more carefully and actually go into the necessary work to recondition all of our highways, I can say that the damage will reach into several million dollars.

The Highway Department has made it a matter of policy to be of assistance wherever it can. We haven't statutory authority to do work off the State highways, but for many years we have been doing such work in amounts that we can without seriously crippling operations of the Highway Department. Governor Miles has always insisted that we help wherever we can and we have followed that policy very carefully. Our wide flung operations make us easily and readily available at all times and by reason of this fact we are called upon to do a great deal of work which we can't possibly do. If we were to attempt this the main-line routes of the Highway Department would suffer and this would bring criticism from the Public Roads Administration, which we are obliged to work with.

I know there are instances where our engineers may be a little hasty and may cut people off short on requests that they make for aid. I regret that this is the case but I am always mindful of the fact that these men are only human beings and when they are working on flood control and besieged with telephone calls, there may be times when they don't exercise the best of judgment. I can say at this time, and I believe that the Governor has gone into this matter sufficiently that he will know I am stating the facts, the Highway Department is not in any condition to be of any great service to flood stricken areas. We have many times more work on hand to complete than

we will be able to do and keep our main roads in shape; in fact, if we should have even one more flood next spring of what we might call normal proportions, it is entirely likely and possible that we will have to ask for additional money.

Our maintenance funds this year were raised some $600,000 over what we normally use and we have spent to date approximately one-half of the new maintenance budget on flood work alone, leaving us $600,000 less with which to maintain the roads than we normally have. I want to take this opportunity to thank the various Governmental agencies who have been operating in this State for their valuable help to the Highway Department during the many floods we have had, and also I want, from personal observation, to say that I consider the people of the State have been more than patient. I can say that they realize that this is an unusual situation; an unusual amount of rainfall; and that the trouble they are having is not the fault of the Highway Department. We want to get out and fix the roads up as rapidly as possible and with as little inconvenience as possible. I want to stress to you that for us to undertake any operations outside the Highway Department work is going to be very difficult, if not entirely impossible.

MR. PAYNE: Is this question of priorities causing any trouble in securing materials for bridge building in the State?

MR. DWYRE: Not to date. We have given up all hope of obtaining steel. We are redesigning our bridges and using entirely wood. We are getting good service on the supply of timber. The deliveries are made in about sixty days which is not a bad average.

MR. McCLURE: Thank you, Mr. Dwyre. We will now call on Mr. Todd of the Bureau of Reclamation. Mr. Todd.

MR. TODD: The Bureau of Reclamation has initiated investigations on the Rio Grande. They began the investigations last May and we had engineers in the field to watch the progress of the water at the time of the flood. The observations that were made at the time of the flood, ending about June 15th, led our engineers to believe that perhaps the emphasis had not been thoroughly stressed on the need for a reservoir system as against the present on the Rio Grande. However, we are not prepared to draw definite conclusions until we complete our investigations. As fast as Civil Service Rules will permit our getting staffed we will get into this from the state line down to Elephant Butte. We hope that within a year to have a report of the efforts put into it. We have in mind not only protecting the interest of irrigation but silt control and floods, and such power as may be developed.

MR. McCLURE: I would be glad to have suggestions and resolutions that we might take up and what procedure to follow to get some action. We might take about a five minute recess. (Recess from 3:05 to 3:10 P.M.)

MR. McCLURE: The meeting will come to order. Are there any suggestions, resolutions, or anything you think we can go ahead with?

MR. TODD: I move a vote of thanks be given to those two State Agencies who helped us so well. I refer to the Office of the State Engineer and the Middle Rio Grande Conservancy District. All governmental agencies are supposed to cooperate with other governmental

agencies. I mention those two State Agencies because they went out of their way to help us in the work we started.

MR. PAYNE: I move you, Sir, that we make a permanent organization that be named some particular or appropriate name, to handle this flood situation such as the Flood Committee. That this organization be comprised of three men chosen from the state of a representative capacity to work with the State Engineer, Mr. McClure, as a permanent flood control committee to coordinate the efforts of various areas. I further move that it be the concensus of this meeting that each of the watersheds, for instance the Gila, San Juan, Rio Grande, Pecos, Hondo and any other water sheds involved—each of those watersheds organize itself into a flood control body in that particular area, and submit from time to time, reports and recommendations to this State Committee, and this State Committee coordinate these reports and the efforts of these various communities; that they make reports from time to time, to our Congressional Representatives in Washington and such other reports deemed necessary; also secure various reports of the governmental bodies and agencies that might be interested in this work and that committee act in this respect; that from time to time future meetings be called of representative bodies to discuss these matters. There may be some amendments.

MR. PHILLIPI: Along the line of Mr. Payne's remarks, we who attended the National Reclamation Association meeting in Phoenix of which there were about 46 from New Mexico representing practically every section of the state, agreed at the time of the meeting which we held in Phoenix to organize a New Mexico Reclamation Association, which seems to me could handle the work which an organization of this sort proposes to do. We organized ourselves there as a temporary organization and called a meeting to be held at Albuquerque, New Mexico, on the 21st and 22nd of November, in which to perfect the State Organization. We have drawn up a constitution and have prepared it to submit for adoption at the meeting. We are extending invitations to everybody interested in reclamation, flood control and land use problems, to attend the meeting and join the Association which we propose to form and definitely organize at that time.

I can see no reason why all the problems which have been presented at this meeting cannot be handled through that association which is already in the formative stages. At the meeting in Phoenix, Congressman Anderson was there, and Jack Dempsey, former Congressman, and they both strongly supported the move. The fact is, it was at Congressman Anderson's instigation that the move was made. He brought out in a couple of meetings that Representatives in Congress are faced with resolutions, letters and petitions of all sorts from various irrigation districts or areas in the State for aid, and there is no way for him to determine which has merit and which one has any priority over any other. He suggested the Association organize for the purpose of correlating this material and making it a clearing house through which we could present all state problems to the Congressional Delegation for presentation to Congress if necessary.

In the organization and constitution as we have it prepared, but of course which has not been adopted yet, but which it is intended to be adopted at the meeting with such changes as are necessary, the state has been divided into drainage area districts with representation on the board from each of those districts, communities, etc. A representative could be appointed by each district to bring up the problems of each drainage area to the central organization to be passed

upon. I make the suggestion that rather than form a permanent organization here, that the organization be incorporated in the New Mexico Reclamation Association which is now in the formative stages.

MR. PAYNE: I don't want to throw any cold water on anything that is being done by any of these people, but I have in mind certain things that I think will make what I term more effective than this organization mentioned by Mr. Phillipi. I think our organization should have the color at least of a semi-official organization, and that is why I suggested that it clear through the State Engineer's Office. In the first place, I think that our Governmental Agencies, as well as our Representatives in Congress, will pay more attention to an organization that is a semi-official organization working through the State Engineer's Office, in conjunction with the Governor, Interstate Streams Commission and other State Organizations, than if we make it purely a private organization with no official connection with our State Agencies. In the second place, I am afraid there will be more chance for sectional jealousy and strife in securing benefits if it is handled through a group as suggested by Mr. Phillipi.

Mr. Phillipi has a high reputation and my remarks are not to reflect on him. Naturally, Mr. Phillipi is interested in the Middle Rio Grande Conservancy District and others are interested in the Gila. I think that this body would be less apt to become involved in sectional jealousy if matters are cleared through the State Engineer and if our State Engineer who is in charge of all waters in New Mexico, was the clearing house mentioned by Mr. Phillipi.

MR. SALAZAR: Mr. Chairman, in my work in connection with the State Planning Board, one of the hardest things is to keep up with what all organizations are doing. We have the Inter-Agency Council composed of various Federal and State Agencies. We have the Land Use Advisory Council that goes into studies of land use and water facilities and flood control and this and that, and of course, this organization that you are trying to form at this time is to look after this emergency.

MR. PAYNE: My opinion was that it should be made a permanent agency not only to look after this emergency, but to future long range planning as well as to make it a permanent thing, so these people who come up here will feel they have started something. In Arizona and some other states they have had these organizations for years and the Congressman and Senators can keep a finger on the pulse. We want to have it so that our representatives, not only in this emergency but in our long range planning, will be definitely interested in the pulse of this committee and this group.

MR. SALAZAR: One thing that we are trying to work out through the Land Use Council is the duplication of effort in investigating these problems. We find among the Federal Agencies and State Agencies that always, not always, but on many occasions, they are investigating the same thing whereby they are duplicating their efforts for the sake of their own files. I have no objection to the organization—I am for it.

MR. STERLING: I believe what Mr. Payne suggested is a good plan, because the State Engineer's Office is permanent, it located at the capitol and has rainfalls, contour maps, and everything for every area in the State. He could keep every district in touch with the progress of the briefs that they are submitting and what structures they are advancing. It seems to me that

the State Engineer's Office would be a very permanent office with a world and fund of information already available.

MR. SHEPARD: Second the motion.

MR. ROWLAND: The Constitution, as tentatively drawn, provides that the membership of the Association shall be composed of the Governor of the State of New Mexico, the State Engineer, the members of and the attorney for the Interstate Streams Commission, the Congressional Senators and Representative of the State of New Mexico and all individuals and organizations, including irrigation and drainage; then it is cut into six districts. This is the Constitution as is proposed to be adopted at this meeting in November: District (1) San Juan (Northwest); District (2) Canadian (Northeast); District (3) Middle Rio Grande; District (4) Gila; District (5) Lower Rio Grande; and District (6) Pecos (Southeast). Each district has one member on the Board of Directors. There are seven directors. It looks like a duplication of effort if we set up the same thing again.

MR. PHILLIPI: Mr. Payne brought out the fact that Arizona knew what they were about. They have an Arizona Reclamation Association. Montana, Idaho and Washington have. Out of the seventeen western states represented at the meeting, eleven have State Reclamation Associations. I don't believe there is a more powerful lobby in Congress today than the National Reclamation Association. Even in the day with defense spending, they lobbied out of Washington $113,000,000, which is about $20,000,000 more than they ever received during any one year prior to that time, and working through that Association I think we can get a lot more than working through individual groups.

MR. McCLURE: There is one thing that I would like to call to your attention in connection with your National Reclamation Association, and that is they don't deal with the question we are dealing with. We are dealing with flood control. They might have lobbied $113,000,000, but I bet not over $5,000,000 for flood control, the rest for Reclamation projects. That is the difference as I see it. We must have action on emergency money for flood control, leaving the Reclamation out of it.

MR. HANNETT: Mr. Chairman, I attended a meeting one day in Phoenix when the Association was to be formed. I understand there is a National Reclamation Association and various states have State Associations which belong to the National Association. It has been said the principal function of the National Association is to bring to the attention of the Congress of the United States the needs of various localities in the various states. I can't see how an organization such as proposed here will conflict in any way with this proposed state organization to be affiliated with the national organization. As Mr. McClure pointed out, this gathering was brought together by his Excellency, the Governor, for the express purpose of doing something now on flood control. It is very probable, and I feel certain, that we can count on the fullest cooperation from the Reclamation Association if, as and when the same is formed. They can help build up in their respective communities throughout the state, a lively interest not only in reclamation but in flood control, and I can see no reason why the two organizations would conflict. That is just a thought I have.

GOVERNOR MILES: As I say, when I called the first meeting, or set a date for it, I found there were conflicting dates that interfered with other meetings, so therefore I delayed it until this date. The reason is that I realize for a long range program it takes considerable thought and planning. So many people called me who had had their small farms destroyed and their crops destroyed, and had no means of financing themselves. They were calling on me for help and to know what they should do. That was the purpose of calling this meeting. No one said anything to me about the Reclamation Association or anything else to meet the situation. While I do not want to interfere with the Reclamation Association or any other organization, I do not see why this organization would interfere with the Reclamation Association, or whatever it is termed, because I am sure we would be glad to work in harmony with them. I do believe for the purpose which we are trying to accomplish that this organization would be willing to be organized and to be helpful to the Reclamation Association.

MR. McCLURE: The motion is that this body be made a permanent committee under any name that might be decided on to clear all information and correlate all flood damage through the State Engineer's Office, and use what Government and Federal reports that are available, and what information that Federal Agencies can give us, and correlate that material in such a way that we can keep the Congressional delegation informed of what each individual drainage basin committee organized may want and need, and what its desires are.

MR. CALKINS: I think that probably the idea is incorporated in the motion and it seems it should be made pretty clear, that the local organizations are going to be formed for action as well as planning and reporting. I haven't any wording, but it might be straightened out somewhat by bringing that thought in—in other words, that there is a long range planning job to be done and there is need for emergency action after disasters happen, and organizations for emergency work in anticipation of floods. That latter is particularly important right now because of the situation that some of these areas may be facing this spring and summer.

MR. PAYNE: I suggest that be included as part of motion.

MR. McCLURE: Motion carried. Are there any resolutions that anybody might want to draw up to be sent any place at the end of the meeting?

MR. PAYNE: Mr. Chairman, I haven't talked with anyone else, but I think that a group should be named at this meeting to work with Mr. McClure in the correlation of these reports, and efforts be made to secure the data from all districts and recommendations as to what should be done in those districts; that this body be organized immediately so there won't be any lapse of time between this meeting and the time to get started on this work. I suggest that this organization be carried out at this meeting.

MR. McCLURE: I suppose what we should carry forward is a nomination and voting on who shall be the three members.

MR. PAYNE: I wonder if they would like to have a recess and talk it over.

MR. CALKINS: Wouldn't it be advisable for the State Committee to make some suggestions as to what units should be organized locally? I don't know but that they could suggest some sort of division of the State into local watersheds.

MR. PAYNE: My idea was that this State Committee should be chosen today and that they should contact the leading citizens of the particular communities, or can make suggestions here. For instance, in my area on the Gila, we have three counties—Grant, Hidalgo and Catron. We have Captain Sterling who has acted in that capacity in Grant County, and those men of other groups should get together and call a meeting and perfect an organization of their groups. I think this committee should submit suggestions to these various groups in the different watersheds. That is my idea

MR McCLURE: Do you want to recess for five minutes?

MR. TITSWORTH: Is this route going to delay the speedy action we are hoping and praying for?

MR. McCLURE: We hope to make it more speedy. It is hoped we may be able to make a clear picture as to what is needed for our Congressional delegation. They are the ones we are going to have to depend on to get the money.

GOVERNOR MILES: Mr. Titsworth, we will be glad to have any suggestions from you as to what could be done to speed it up.

MR. PAYNE: I move that we recess for five minutes.

MR. McCLURE: We shall recess for five minutes.

RECESS

MR. PAYNE: Mr. Chairman, after discussing this thing with some of the people in the congregation, it is suggested that we have a member from each of the major drainage areas so that each would be represented on this committee. It is also suggested that it be the first duty of this committee to take care of the emergency, temporary flood relief, and that it be the second order of business to work out a long range program. Later on, they could look into the matter as to what should be done; therefore, I wish to amend my motion to the effect that a delegation be elected from each of the six major drainage areas: San Juan, Upper Rio Grande, Lower Rio Grande, Gila, Canadian and Pecos, and that these six areas be represented on this committee.

MRS. COE: We feel that our problem is so different to the Pecos problem.

MR. McCLURE: Of course, the Rio Grande has the same thing with its tributary areas, and the Gila has the same thing.

MRS. COE: I guess that's right.

MR. McCLURE: They both have tributaries that need work done on them.

MR. TITSWORTH: Does the Pecos include the Roswell district?

MR. McCLURE: The Penasco and the Upper Pecos—the whole drainage system.

MR. PHILLIPI: I second the motion.

MR. McCLURE: It has been moved and seconded that membership of this committee be increased to the six main drainage basins of the State. If there is no further discussion on it we will put the question to a vote.

Motion carried.

MR. McCLURE: I believe it was suggested that we appoint temporary members for the other basins that are not represented—the Canadian, San Juan and Lower Rio Grande—so that we can start functioning and so that they can take it up with their people. We would like to have names suggested for the Gila.

MR. McMILLAN: I would like to suggest Mr. Bartley McDonald.

Nomination seconded.

MR. McCLURE: I declare Mr. Bartley McDonald duly appointed. Now, the Pecos.

MR. HALL: I nominate Mr. Lea Rowland.

Nomination seconded.

MR. McCLURE: Mr. Lea Rowland has been duly appointed. Now, the Upper Rio Grande.

MR. BEYER: I nominate Mr. Stanley Phillipi.

Nomination seconded.

MR. McCLURE: I declare Mr. Stanley Phillipi duly appointed. No one here from the San Juan? No one here from the Canadian? No one here from the Lower Rio Grande?

MR. SALAZAR: Mr. Chairman, in view of the purpose of this meeting I want to make a motion that this committee or organization confine its activities or efforts, to start with, the problem that we are confronted with—to the emergency—to take care of the flood damages—before they go into long range plans and programs. I believe it is proper that we should arrive at that conclusion as a result of our gathering here. Later on, if they choose to go into a long range planning program, it is perfectly all right.

MR. HORNE: Mr. Chairman, this is an emergency. We have been called in to discuss ways and means to take care of it and deal with long range problems. I do not think that we should handicap this group by saying that they should do this or that or the other thing. It looks to me like we should have them go ahead and carry on and we try to help them.

MR. PAYNE: I think the idea was to take care of the emergency first, and then take care of the long range planning, if there is no objection. It was my understanding that we would give the emergency priority and then if they intend to branch out they can do so. Is that correct, Mr. Salazar?

MR. SALAZAR: That is correct; that they confine their efforts to this emergency before they go into any long range planning program. Once they have solved this problem I will be glad to join hands with the organization and go into long range planning programs. It will be quite helpful, I am sure.

GOVERNOR MILES: On the Canadian I would like to suggest the name of James L. Briscoe.

MR. HORNE: Mr. Chairman, I object to tying this committee down in any shape or form. They are going to do the necessary things. If it becomes necessary in the emergency to get something done now to be correlated with long range planning a year or two or three years from now, why tie their hands? These are capable and honest men who understand why this meeting was called. Let's give them a free hand.

MR. SALAZAR: My motion does not tie the hands of the committee in any way, except that it gives a priority for action to handle this emergency first. I believe that is the purpose of the meeting and it is entirely in order. If the long range planning program is more important than to handle this emergency, then I am with you, but it must be proven.

MR. BUTT: There are 50 agencies doing long range planning now, and it seems to me it is getting longer all the time.

MR. McCLURE: Any further discussion? A motion is before the house to set up a priority on emergency work by the committee before any long range planning is taken up. Let's have a vote on that motion.

Motion denied.

The committee will act without instructions. The Governor has suggested Jim Briscoe from Tucumcari. I think Jim is a very good man for the Canadian. I have worked with him on flood control committees and I feel he is a good man for the job. We must name three temporary members so that we can notify somebody what action we have taken.

MR. PHILLIPI: Do you want nominations for those areas now? I move that Mr. Briscoe of the Canadian be named a temporary member.

Nomination seconded.

MR. McCLURE: I declare Mr. Briscoe duly appointed.

MR. PHILLIPI: In the San Juan I suggest that Ed Foster be appointed.

Nomination seconded.

MR. McCLURE: I declare Mr. Foster a temporary member of this committee. Do you have any suggestions for the Lower Rio Grande?

GOVERNOR MILES: I suggest the name of J. Minor Beene.

Nomination seconded.

MR. McCLURE: I declare Mr. Beene duly appointed. What does the meeting desire now?

MR. PHILLIPI: I don't believe that this organization has a name. Can we call it something?

MR. PAYNE: I suggest that we call it the "New Mexico Flood Control Committee."

MR. PFINGSTON: I second the motion.

MR. PHILLIPI: Mr. Chairman, may I suggest we change that name to the "New Mexico Flood Control Association" instead of "New Mexico Flood Control Committee"? That throws it open to the entire State.

MR. McCLURE: It has been moved and seconded that the name of the organization be the "New Mexico Flood Control Association." Let's take a vote on it.

Motion seconded and carried.

GOVERNOR MILES: Mr. Coe, do you have any suggestions now as to what should be done?

MRS. COE: Governor, Mr. Chairman, I am just at a loss to know what we can do to get down to brass tacks and be more specific and try to get something definite done. I don't know but what it might do some good to mention that I understand they have taken out seven CCC camps in the State in the last few months. They have had terrific floods in Missouri and in Kansas, and all over the country. Would it do any good for us to petition the authorities to place CCC camps in the emergency areas; for instance, on the Gila? These men tell me that they have no camps. As poor as we are, we are willing to divide with them, but surely there are some camps in the country that are not serving such areas that are in need as badly as they are in the Gila, Penasco, and in our own area. And then another thing, I understand that we have 123 men in our Soil Conservation Camp at Hondo. The capacity is 250. Would it do any good for us to ask that the camps that can take care of more men be given more men until this emergency is over, say six months or three months?

I hate to leave this meeting without us asking for labor and for equipment because we cannot put our land back into condition to farm this spring by our own efforts. If any of the Government agencies do have any equipment that could be transferred for a short period of time, I think we should ask for it. That is the big need in these three areas—the Penasco, Bonito and Hondo areas—we need labor and big equipment. We cannot buy a bulldozer and we cannot buy a steam shovel and we cannot buy a dragline. They are definitely needed. There are many smarter brains than mine here and I wish someone would suggest something definite, at least that we could devolve some resolution for publicity to let the people know what this meeting is trying to do in getting immediate aid to the people who are suffering right now and who need this assistance. Isn't that one of the chief functions of this committee that has just been appointed?

MR. SALAZAR: No, not necessarily.

GOVERNOR MILES: We intend to take up immediate needs first. That is one of them.

MR. TITSWORTH: I would like to ask if there are any CCC camps that are working in grazing districts that could leave their work there without any serious inconvenience?

MR. McCLURE: I couldn't answer.

MR. TITSWORTH: If there are such camps, we need them for a period of sixty or ninety days.

MR. McCLURE: I did notice some bulldozer equipment north between Roswell and Vaughn that was working on stock tanks, but I do not know what department it belongs to.

MR. PAYNE: I move that Mr. McClure, the State Engineer, act as chairman of this committee; at least, for the time being, and call them together as soon as the other members can be notified, and that this committee go into these phases and see what can be done. Unless we have an organization to call these men together it might cause a little friction and delay and that is why I make that suggestion.

MR. HALL: We have heard from every community of its trials and tribulations, and I don't believe that a group of this size can get anywhere with a definite plan. You have selected a committee of six. I think that we have a fine group of men capable of doing the job and I think that the purpose for which this meeting was called has been completed and I think it is time for us to get back to the Pecos Valley.

MR. TITSWORTH: I move that this meeting be adjourned.

Motion seconded and carried.

Meeting adjourned at 4:50 P.M.

Minutes of 10/30/1941 Meeting

October 11, 1941

Mr. Thos. J. Hall, Mayor
Roswell, New Mexico

Dear Mr. Hall:

Complying with your request, I have made a complete survey of the damages of the two floods of September 22nd, and September 29, 1941. I have confined this report to the damages incurred inside the city limits of the City of Roswell. The very large damages incurred on farms and ranches in this county will be covered by persons more competent than myself to judge same.

You are aware that the City of Roswell through its police power used every means possible to confine the damages to the lowest possible figure. The Home Guard was called out to assist the local and state police. All cars except those having legitimate business were not allowed on the streets of the city. By taking all of these precautions a considerable amount of damage, in my opinion, was prevented. You are also aware that the City was able to warn all citizens of the community that the flood was coming in ample time for them to protect their property in the best possible manner, with the means at hand. The flood of September 22nd, was not as high as the one of September 29th, however, the flood of September 22nd, softened up many of the streets of the city to such an extent that the flood of September 29th, washed them completely out of existence. The water from the flood of the 29th, stopped running through the west part of the city on October 10, 1941.

You will note that I have listed 1346 houses and business buildings damaged. You will also note that I have averaged this damage at $150.00 per building. I am positive this is a very low average when we all know that some homes wee damaged to the extent of thousands of dollars. We also know that this damage in many instances will show up in years to come.

I have contacted the garages in the city and I am positive that the number of cars I have listed as damaged by the floods is conservative, to say the least. As you know, the damage to cars may be two or three months in showing up and I have only listed the number being repaired at the present time.

Damages to our sewers are extensive. This year I was able to finally clean out all the silt caused by the 1937 flood, in other words, we have been working on our sanitary sewers for four years. This work must be done all over. The figure of $500.00 a mile is a low estimate. Our man holes were damaged, sewer mains in some instances will have to be relaid, and I might say very little of our sanitary system escaped damage.

Practically every basement in the City of Roswell was flooded and most of them are flooded at the present date because of the ground waters seeping into them. This is a constant expense in pumping and in my estimation will be for sometime to come, in some instances two or three months.

I have used the 1940 census as a basis to determine the loss in retail business. As you know, our annual fair had to be called off on account of the flooded condition of the city; also, this is a season of the year when our retail business is at its best, therefore I have added 50% to the average in computing the losses in retail business. I am sure this is a fair and reasonable basis to figure this loss.

The losses in wages, I have only figured the people of the community working on an hourly basis because most of the employees in the city work on a monthly basis and, no doubt, received compensation for the days they did not work. I feel sure that you will agree with me that we have at least a thousand people in this city working on an hourly basis and that their wages will amount to $5.00 per day.

Our loss in tourist travel is exceedingly large and I feel you will agree with me that the amount set up for loss in tourist travel is small, however, I have tried to keep all the figures of losses close to the amount they would be.

I feel that I can substantiate every item listed in the attached itemized list of losses and will be only too glad to do so.

ITEMIZED LIST OF LOSSES

Salaries (1000 @ $5.00 for 8 days)	$ 40,000.00
Homes and Buildings (1346 @ $150.00)	201,900.00
Damage to streets and bridges (377 blocks streets @ $200.00 per block)	75,400.00
Parks	15,000.00
Sewers (48 miles @ $500.00 per mile)	24,000.00
Retail business loss – 8 days (annual business $7,664,000.00 1940 census)	168,000.00
Plus 50 per cent for season of year	84,000.00
Damage to cars (200 @ $85.00 each)	17,000.00
Loss of tourist travel	150,000.00
	$775,300.00

Respectfully submitted,

(Signed) Lea Rowland
City Engineer

AGRICULTURAL FLOOD DAMAGE SURVEY ON FARMS AND RANCHES CHAVES COUNTY, NEW MEXICO

In computing estimates of flood damage occurring from the recent floods in Chaves County, the first flood being September 21, 1941 and followed by the second on September 27, 1941, all interested agencies cooperating developed insofar as possible, facts and figures to cover the situation.

Under the Hondo drainage, which would involve farms located west of the City of Roswell and continuing through to the northeast and east portion of town, it has been estimated that 944 acres was damaged, on the Felix, approximately 588 acres, and on the Walnut 135 acres, and on the Pecos and at points where the above mentioned streams flow into it, it is estimated 7,035 acres, giving a total of flood damaged lands in Chaves County located along the Pecos Valley, 8,702 acres at an estimated damage of $268,980.

These above mentioned figures were secured by representatives of the Conservancy District, who in obtaining them made some 110 individual farm contacts, and the estimated amount of damage as shown in dollars were figures compiled from estimates given by the farmers themselves.

The actual crop condition as it pertains to the various crops, are as follows: A considerable acreage of cotton located in the lowlands, was completely destroyed, and is still covered with quite a depth of silt. In some of the other areas, the cotton was somewhat damaged, due to high water, but the crop being late with a very small percentage of bolls open or cracked, did not receive the degree of damage that was anticipated. As a whole, with the exception of the completely destroyed area, the main damage caused by the flood waters in regard to this crop, can be attributed to the loss of growing season. However, it is impossible to determine the extent of loss, as it will largely depend upon the date of the first killing frost, and in addition of course, some damage had previously developed by injurious cotton insects, angular leaf spot, and last, a heavy infestation of leaf worm. It is, however, at present estimated by various individuals, that the county average production of cotton will be in the neighborhood of from 350 to 400 lbs. per acre, as compared to 600 lbs. average in 1940.

Relative to the feed crop situation, there has been a tremendous loss, particularly grain sorghum, which was caused by the flood and by excessive rainfall. In most cases, the feed had been bundled and was stacked in the field, in which event considerable damage was caused by rotting. However, there is still a fairly large percentage of feed available, and insofar as the livestock feeding program is concerned, it is very doubtful if the loss that has occurred will affect the feeding program to any degree.

Regarding alfalfa hay, it can be stated that not more then 5% of the total hay produced in the country, would be classified as U. S. No. 1 extra leafy, extra green hay, nor would it classify as a choice commercial grade. This condition, however, cannot be attributed to the flood, except possibly a couple of thousand acres which were covered by silt and flood waters and were destroyed or mudded down to such a degree that rejuvenation is doubtful. The major factor which caused such a heavy damage to the hay crop was, of course, excessive rainfall during the harvest season, and even during periods when there was no rain, heavy dews were prevalent, and

caused practically the same degree of damage as light showers, this being discoloration. While in many instances hay crops were not damaged to a degree that they could not be utilized in any way, the commercial value was reduced to where the majority will have to be used and sold through the form of livestock fed out.

The Penasco Valley, located in the southwestern portion of the county, was in my opinion, the worst damaged of any section in the county, but while their acreages and extent of damage does not compare with that occurring in the valley, the percentage of total crop land damaged was far greater. Facts and figures secured by Mr. J. B. Runyan, a farmer and rancher in the Penasco Valley, give in detail the exact situation. It is estimated that in the entire Penasco Valley, there is a total of 867 acres of crop land. Of this amount, 56 acres were totally destroyed and cannot be reclaimed. 90 acres had a loss of the top soil. Regarding their irrigation systems, it is estimated that a 45% damage occurred, this amounting to around $5,000. 1,840 feet of flumes were destroyed, at an estimated cost of $5,000. Four bridges were lost, and 11 ditch or diversion dams. In addition to these figures, 228 acres of corn were destroyed, 40,000 lbs. of corn (snapped ears and corn in bid), 9 acres of grain sorghum, 18 acres of cabbage, 62 acres of alfalfa, 101 fruit trees, 97 acres of winter wheat, 1,500 bushels of apples, 48 tons of oat hay, 167 tons of sudan and other hay, 17 acres of rye and 20 acres of hegari. Loss of poultry and livestock was as follows: 20 chickens, 19 turkeys, 15 hogs and 8 sheep.

The remaining area of the county which suffered a large degree of damage, was the ranching area located in the western portion, and while no actual figures can be given, information secured from individual contacts supply the following estimates: Approximately 50 ranches received in some degree, damage during the recent flood, the largest damage being the loss of fences, and in this respect it is estimated that from 100 to 150 miles of fence will have to be thoroughly repaired and in many instances completely rebuilt; also the loss of such permanent structures as stock tanks and reservoirs, which were damaged to where they will have to be repaired, cleaned out, and in many instances, completely rebuilt. The loss of livestock was, of course, lower than anticipated, but nevertheless a few sheep and a few head of cattle, etc. were killed during the flood. Considerable damage was also done to various ranches in that new arroyo channels were developed by water erosion. This, of course, will necessitate the practice of water spreading and replacing of diversion and check dams, which were completely destroyed.

There is no way that the above information can be classified as definite and accurate, but an attempt has been made to summarize, insofar as possible, damage occurring from the recent floods. The Conservancy District officials, the Farm Security Administration and the Soil Conservation Service, together with assistance given by various operators, should be given credit for their time and effort in preparing these facts and figures.

Respectfully submitted,

/S/ Tom Reid, County Agent.

October 16, 1941

NARRATIVE REPORT OF FLOOD DAMAGES AND REMEDIAL MEASURES FOR THE PENASCO DRAINAGE AND ITS TRIBUTARIES AND AREAS WITHIN OTERO COUNTY

The recent heavy rains which occurred in the Sacramento Mountains seriously damaged considerable quantities of farm lands, and totally destroyed many crops.

It has been estimated that more than 90% of the crops on the Penasco were completely destroyed, and that approximately 200 acres of farm lands were so damaged that expense of reclaiming would exceed the value of the land. Estimate of damage to irrigation facilities, roads, farms and fences, in terms of dollars and cents is attached.

It is obvious that rain near the summit was in the nature of a steady down pour and not torrential down pour as was the case ten or twelve miles below the summit. Therefore flooding was not as serious as might have been.

Much of the torrential down pour occurred on the Pinon-Juniper type, which is not suitable for timber production but which is used for grazing. It must be recognized that much of the flood was caused by serious over grazing which has been practiced in the past, but in which greatly improved practices have already been effected.

Every possible attention must be given in a long time program to the rehabilitation or improvement of these grazing lands. This will require a closer coordination between private land owners, the Forest Service, AAA, Soil Conservation District and other parties who participate in the use of these lands.

At the same time the fact must not be overlooked that since cut-over timber areas did produce a great deal of un off with a steady down pour a torrential down pour would have resulted in much greater destruction of property. Much closer attention must necessarily be given to prevent this run off, by beginning at the source.

It has been estimated that slightly in excess of one million dollars expenditure will be required for conservation work to reduce the flood hazard on the entire Pecos drainage within Otero County, to a reasonable degree. This is divided into 2,279 man years of common labor, 100 years of technical labor, and with the remainder divided between materials and equipment, facilitating the labor.

On one of the major tributaries, James Canyon, a detailed inventory of conservation work has been made. A total cost of $351,000.00 is anticipated, divided into 872 years of unskilled labor, 10 years of skilled labor, material cost of approximately $35,000.00 and equipment consisting largely of terracing machinery, 35,000 hours.

Mayhill Unit

Undoubtedly the most serious damage occurred on the Penasco Valley, much of which was caused by run off from its main tributaries, James Canyon, Cox Canyon and Wills Canyon. Most of the irrigation facilities were carried away and must be replaced before a new crop can be planted. In several cases great amounts of debris were deposited on the farm land and in some cases farm lands were badly washed. Most of the crops, however, were covered up rather than washed away. A number of farmers must have financial assistance, perhaps three or four in the form of grants and a much larger number in the form of loans, in order to continue farming and produce a crop in the next year.

Requests are being made of the Farm Security Administration to give financial assistance and perhaps additional funds should be requested for this purpose and undoubtedly some grant funds should be requested. Assistance must be given in the restoration of water facilities, which are being planned on a more permanent basis. A water facility program covering all of the area under discussion was prepared sometime in the past and is now before the Water Facility Board in Washington, D. C., for their approval. Funds are available for loan but no funds for grants are available in New Mexico at present. It is probable that water facilities on a loan basis will be adequate for the Penasco unit, but it might be possible to hurry approval of the docket by the Water Facility Board, in order to expedite planning and construction of the needed water facilities which will largely consist of diversion dams.

A Soil Conservation CCC camp, located at Mayhill, has been assisting in removing water from the fields and returning it to its channel. However, water supply at this camp is inadequate and it has, therefore been impossible to fully man this CCC camp.

It might be desirable to urge development of a more adequate water supply at this camp upon the proper authorities. Undoubtedly a much larger work force than is at present available will be necessary, to complete conservation measures, if similar disasters are to be avoided in the future.

Plans for enlarging the channel of the Penasco river have been prepared which will alleviate to some extent the flood problem on this canyon. However it is recognized that the present flood control problem of the Penasco lies in the control of floods from its many tributaries, and that many years work for a large group of men will be required to complete the necessary conservation measures. A conservation program for this purpose has already been prepared.

James Canyon Unit

James Canyon, one of the major tributaries to the Penasco, on which a work plan for Soil Conservation has been completed, empties into the Penasco immediately above Mayhill and has long been a source of considerable damage. This drainage consists of approximately 35,000 acres, of which about 500 acres are cultivated, the remainder being range and timber land. A considerable portion of timber and range land is state owned land, with a smaller portion being privately owned, while the major portion is Lincoln National Forest property.

Principal sources of run off are in order of importance:

(1) Cut-over forest land. (2) Cultivated lands. (3) Roads and trails.

Plans already under way provided for terracing and contour farming of the cultivated lands, which will largely take care of run off from these lands and from the highways. This work can largely be accomplished by farmers with the aid of technical assistance from the Soil Conservation District and from additional equipment, which has been requested by the Soil Conservation Service for loan to the District.

A series of stabilizing or silt retaining dams have been planned for the gully which runs throughout the length of James Canyon and also for several large tributaries, mainly, Eight Mile Canyon, Hyatt Canyon and others. The labor forces of two CCC Camps would be required for a period of one year to complete all of these structures.

In addition to this, it is highly important that every precaution be taken to fill up all old log trails and to keep new log trails brushed up closely behind the logging crews.

Cox Canyon Unit

Another major tributary of the Penasco is Cox Canyon, which is very similar to James Canyon with the exception that truck farming is practiced on Cox Canyon as opposed to grain farming. However the problem of watershed control is almost the same, there being slightly less cultivated land in Cox Canyon. The same general type of stabilizing structures for the gullies and tributaries are recommended.

Wills Canyon Unit

Wills Canyon, another important tributary of the Penasco, is perhaps the least important, in that fewer families live on the canyon itself. However, as the tributary contributes to flood damage below, it must not be overlooked and its importance is accented by the fact that considerable logging operations are under way.

A number of complaints have been received from inhabitants of the valley, that log trails were left open and that logs were left in such a way as to clog up the main channels and cause considerable damage. This situation should be investigated immediately.

Agua Chiquita Unit

Agua Chiquita is perhaps he largest tributary on the Penasco and provides a livelihood for a considerable number of people.

It differs from the Penasco in that a large channel exists and therefore, damage from overflow to crop lands, occurs in only a few instances. However the problem is greater in that, due to the larger channel, more expensive irrigation diversion dams will be required.

A large number of tributaries such as, Hay Canyon, Spring Canyon, Potato Canyon and others are very similar to James Canyon, except lesser in extent. Considerable assistance in

reestablishment of water facilities will be essential and very likely some grants should be made. Requests for water facilities funds available for grants for this area should perhaps be made. Also one or two grants may be necessary to assist families through the winter in cases where especially serious damage was experienced by families already in financial difficulty.

Probably the farmers will be able to do the largest part of the work towards rehabilitation of their farms before another crop year, provided the necessary financial assistance can be given through the Farm Security, Water Facilities or other programs.

OWNERS	FARM ACRES	CROP ACRES	OWNERS	FARM ACRES	CROP ACRES
J. O. Arthur	61.0	20.0	J. Cox	1420.0	36.0
Artesia Camp	158.0	25.0	A. Criedbring	160.0	35.0
Mrs. C. A. Arthur	160.0	25.0	Crocket	548.0	18.0
E. T. Baird	268.0	108.0	T. M. Curtis	85.0	25.0
Geo. Towns	160.0	39.0	F. H. Davis	160.0	33.0
J. G. Barkley	96.0	35.0	R. B. Davis	160.0	36.0
Homer Barkley	110.0	35.0	S. Davis	160.0	27.0
N. C. Bass	259.5	20.0	Mrs. W. D. Davis	385.0	20.0
W. R. Batte	80.0	25.0	R. G. Deering	116.0	25.0
W. E. Begley	120.0	35.0	W. H. Eckhorst	140.0	55.0
Chas. Bonnell	480.0	96.0	J. H. Formwalt	320.0	20.5
Frank Bonnell	760.0	87.5	Mamie Frizzell	1120.0	65.0
E. P. Bradshaw	80.0	15.5	J. R. Fuller	160.0	35.0
Fred Brantley	96.0	18.0	W. A. Gage	280.0	56.5
Geo. Brown	320.0	62.0	Howard Goss	80.0	17.6
A. W. Boyce	157.0	25.0	Nedd Goss	320.0	85.0
W. W. Buckner	158.9	26.0	Philip Green	195.0	29.0
Mark Brantley	120.0	13.0	D. Guilliams	45.0	20.0
Vernon Cady	110.0	40.0	H. A. Guilliams	445.0	20.0
L. G. Cady	420.0	50.0	Hadley Brothers	154.0	50.0
E. C. Calentine	465.0	107.0	E. A. Hadley	160.0	11.5
R. P. Calkins	150.0	30.0	V. C. Hadley	160.0	27.0
W. P. Calkins	160.0	28.0	Harvey Fox Farm	80.0	74.0
J. J. Carner	55.0	18.0	J. E. Hudman	317.0	42.0
Carter Watts	40.0	18.0	E. E. Jernigen	480.0	66.0
R. E. Chalk	80.0	20.0	Geo. Jewett	160.0	8.0
E. J. Chandler	94.0	24.0	Otis Jones	160.0	17.0
Garlim – Clark	80.0	29.5	Ross Jones	85.0	30.0

OWNERS	FARM ACRES	CROP ACRES	OWNERS	FARM ACRES	CROP ACRES
Rex Lewis	320.0	188.0	Leo Rogers	276.0	16.0
J. F. Mahill	637.0	115.0	Jasper Scott	80.0	11.0
Tom Mills	112.0	15.0	V. C. Scott	40.0	11.0
T. M. Mills	134.0	38.0	H. Sewell	160.0	40.0
C. B. Mitchell	240.0	27.0	Nellie Shields	160.0	30.0
Elizabeth &			C. W. Talley	160.0	17.0
Lee Mosiers	2238.0	38.0	Geo. H. Talley	33.0	10.0
Mae Mumson	160.0	17.0	H. C. Talley	320.0	61.5
Otero Inv. Co.	186.0	165.0	Mary L. White	160.0	59.0
E. C. Owens	160.0	30.0	Geo. Wimsatt	552.0	147.0
C. R. Parker	60.0	55.0	J. A. Wofford	40.0	37.0
J. L. Parker	160.0	21.0	R. C. Woods	160.0	25.0
J. W. Parker	390.0	35.0	E. White	6400.0	50.0
R. W. Parker	360..0	80.0	D. S. York	160.0	38.0
A. Patrick	160.0	12.0	W. F. Culbertson	18.8	18.8
A. Pendergrass	176.0	23.5	Bennie Bounds	172.0	17.8
R. P. Polson	160.0	18.0	J. Akers	332.0	59.0
E. H. Posey	306.0	88.0	E. E. Ferguson	160.0	30.0
Ollie Posey	154.0	50.0	K. S. Weems	112.0	21.0
Kenneth Potter	170.0	16.0	J. F. Wright	148.0	25.0
Roy Roach	161.0	45.0	Mrs. J. M. Reed	84.0	26.0
Roy Raoch	25.0	7.0	Mrs. W. L. Jones	153.0	19.5
W. F. Robinson	80.0	20.0	A. A. Russell	120.0	43.3

FLOOD DAMAGE MAYHILL AREA

Replacement of Irrigation Ditches and Small Dams

Penasco Canyon	20 miles @ $5000 per mile	$100,000
Agua Chiquita	12 miles @ $3000 per mile	36,000
James Canyon	10 miles @ $2000 per mile	20,000
Cox Canyon	5 miles @ $2000 per mile	10,000
		$166,000

State Roads

Mayhill to Forest Boundary (7 miles)	$ 20,000
Mayhill to Cloudcroft	5,000
Mayhill to Weed	20,000
Forest Roads	10,000
	$ 55,000

Miscellaneous

Fences	150 miles	$ 25,000
Orchard lands ruined	40 acres @ $500 per acre	20,000
Leveling farm lands	2,000 acres @ $50 per acre	100,000
Out of 30 farms, land completely ruined	203 acres @ $200 per acre	40,600
		$185,600
	GRAND TOTAL	$406,600

Note: Above prepared by Mr. Spence, Chairman, Otero County Land Use Planning Board and Mr. Beatty, Otero County Agricultural Extension Agent.

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PECOS DRAINAGE OF OTERO COUNTY

Inventory of Conservation Work for a Long Time Program
For Stabilization of the Soil and Flood Control

Terracing	8,000 acres	288 man years	$120,000
Water spreading dike	90,000 lin. ft.	34 man years	14,000
Fencing	150 miles	59 man years	37,500
Reseeding	400 acres	2 man years	1,200
Stabilizing dams	2,000 each	1173 man years	600,000
Smaller gully plugs	8,000 each	50 man years	6,000
Revetments	1,600 rods	2 man years	3,470
Channel realighment	20 miles	2 man years with dragline	10,000
Detention Reservoir	1 each		60,000
			$852,170

Geo. D. Perrine, Roswell
District 1

M. Y. Monical, Hagerman
President
District 3

Jessie I. Funk, Lake Arthur
District 4

J. H. Mullis, Roswell
Sec'y-Treas.
District 2

S. A. Lanning, Artesia
District 5

PECOS VALLEY ARTESIAN CONSERVANCY DISTRICT
ROSWELL, NEW MEXICO
October 17, 1941.

The following estimates of damage suffered by 156 farmers of the Pecos River bottoms and tributaries of the Pecos were obtained by personnel of the Pecos Valley Artesian Conservancy District. They went to each individual farm that they could reach and took the stories and estimates of the owners of damage they suffered. The acreages are estimated as those actually under water. The flood damage on the Pecos River proper takes into consideration a previous flood in May of this year.

This report is confined to the farming population. The towns and cities that are within the Conservancy District have their own facilities for setting up their flood damages and this report does not take any of their damage into consideration nor does it take cognizance of any damage outside the boundaries of the Conservancy District or any damage to roads and bridges.

Pecos River	9727 Acres	$274,435.00 Damage
Hondo	944 Acres	25,900.00 Damage
Felix	588 Acres	12,245.00 Damage
Walnut	135 Acres	4,050.00 Damage
Cottonwood	690 Acres	23,300.00 Damage
Eagle	272 Acres	7,600.00 Damage
Penasco	918 Acres	52,990.00 Damage
Seven Rivers	250 Acres	3.200.00 Damage
	13,524 Acres	$403,720.00 Damage

(Signed) M. Y. Monical,
President

REPORT OF PROGRAM PLANNING COMMITTEE ON FLOOD DAMAGES IN BONITO, HONDO AND RUIDOSO VALLEYS

OCTOBER 3, 1941

A special tour of members of the Program Planning Committee, governmental and county officials was organized by the Co. Extension Agent and conducted on Friday, October 3, 1941. The purpose of the tour was to make a survey of the Bonito, Hondo, and Ruidoso Valleys to determine the extent of damage that had been done by the floods which occurred chiefly on September 21 and 28, 1941.

Those attending the tour were:

L. D. Merchant, Chairman, Program Planning Committee, and Chairman, County Agricultural Conservation Association, Capitan
George A. Titsworth, Farmer and Rancher, Capital
Wilbur F. Coe, Farmer and Rancher, Glencoe
George Smith, Manager, Titsworth Farms, Tinnie
A. T. Pfingsten, Agent, Southern Pacific Railroad Farms, Hondo
J. V. Tully, Farmer and Rancher, Glencoe
B. J. Bonnell, Farmer and Rancher, Glencoe
Edward Penfield, Merchant, Lincoln
W. W. Gallacher, Chairman, Board of County Commissioners, Carrizozo
Manuel Corona, Member, Board of County Commissioners, San Patricio
Felix Ramey, County Clerk, Carrizozo
L. A. Whitaker, Representative, Carrizozo Business Mens' Club, Carrizozo
Mrs. Ola C. Jones, County School Superintendent, Carrizozo
Mrs. Blanche Shilling, County Supervisor, Department of Public Welfare, Carrizozo
Mrs. George McQuillen, County Nurse, Carrizozo
John Paul Jones, R. R. Supervisor, Farm Security Administration, Carrizozo
Gordon Gray, U. S. Forest Ranger, Capitan
Clarence A. Henderson, Area Conservationist, Soil Conservation Service, Capitan
Marvin E. Bezemek, District R. R. Supervisor, Farm Security Administration, Albuquerque
J. R. Isler, District Manager, Work Projects Administration, Roswell
Grady Mayfield, Farm Debt Adjuster, Farm Security Administration, Amarillo, Texas
George D. Hardaway, Associate Engineer, U. S. Forest Service, Albuquerque
Lee Beall, Assistant Forest Supervisor, U. S. Forest Service, Alamogordo
Carl P. Radcliff, County Extension Agent, Carrizozo

After the tour, a meeting was held at Mr. B. J. Bonnell's ranch for the purpose of compiling information and to discuss with representatives of the various governmental agencies ways in which their agency could contribute to the solution of some of the problems that resulted from the flood.

The meeting was called to order by Mr. Radcliff, the County Extension Agent. Mr. L. D. Merchant, Chairman of the Program Planning Committee was asked to preside. Mr. Merchant

discussed the purpose of the meeting, after which the County Agent presented a questionnaire which he had prepared previously, which might be used in obtaining information and recommendations. The questionnaire was approved by the Committee and was followed in obtaining the following information.

(1) It was found that four families were in immediate need of food, clothing, and shelter.

(2) There will be approximately 200 families who will need direct aid in the near future. Although their homes were not destroyed, their small farms, which were their chief means of livelihood, were badly damaged or destroyed by the flood.

(3) Approximately 148 diversion dams, 50 farm and private bridges, and 100 miles of diversion ditches were destroyed or damages. The cost of reconstruction will be so great that many of the farmers must have financial assistance before reconstruction and repair work can be done. It will be necessary also that laborers be made available, since at this time, there is a shortage of laborers in the valleys. Failure to secure assistance will mean that the irrigation of truck crops and orchards will be impossible in the future. Orchards that survived the flood will soon suffer, and eventually die, for the lack of water.

It was also pointed out that many farmers who own small plots of land depend partly on employment from the higher-income farmers; and, unless help is given to the latter group, as well as to the low-income group, it will mean that many of the families in the valleys will be compelled to abandon their farms, since they are not large enough for an economic unit. This is especially true in the Bonito Valley where practically all of the farmers are tenants.

There was considerable discussion and variation in the opinion of members of the committee as to the cost of reconstructing the dams. Some estimated that it would take a million dollars to replace the dams and diversion ditches. It was finally agreed that it would cost on the average of $2000 to replace each dam. The committee wished to go on record that these were merely preliminary figures and that an engineer had not estimated the cost. It was the consensus of opinion that although dams had been constructed at a total cost of $1000 to $1500 each, as a result of the flood the channel would perhaps be too low an estimate for the building of new dams.

(4) Approximately 10 per cent of the farm land in the valleys was estimated to be completely destroyed, as a result of the river changing its course in places and in the widening of the channel.

(5) Approximately 25 per cent of the farm land in the valleys was badly damaged; but, can be reclaimed in time to crop in 1942, provided the farmers can receive assistance through C.C.C. and W.P.A. labor projects.

(6) Approximately 75 acres of orchards were completely destroyed and 650 acres damaged. The damaged orchards can be reclaimed provided labor can be made available to the farmers in the near future.

(7) Approximately 110 miles of fence were destroyed. Estimating the total cost of the fence to be $175 to $200 per mile, it would cost approximately $19,250 to $22,000 to replace the fences.

REPORT ON THE RUIDOSO AREA

Since the bridges were out, it was impossible for the committee to visit the Ruidoso area; however, after the committee adjourned, Mr. W. A. Hart, of Ruidoso telephoned the County Extension Agent and asked that the following information on the Ruidoso area be included in this report. It is understood that the information was compiled by Messrs. W. A. Hart, Jack Hull, and Ike Wingfield, of Ruidoso. The information listed was not approved by the Program Planning Committee; but, is being submitted in order that the estimated damages in this area may be included.

(1) There were 25 cabins destroyed or badly damaged.

(2) In the resort area there were 15 bridges destroyed at an estimated cost of $2000 each.

(3) Four bridges on the main highway were destroyed—one on the Carrizozo; one on the Alto-Ruidoso road; one at the edge of Ruidoso; and one above the Ruidoso Lodge. The total estimated damages of these bridges was $24,000.

(4) It was estimated that it will cost $10,000 to replace highways that are completely washed out. Six miles of paved roads will have to be completely recapped, at an estimated cost of $21,000.

(5) It is estimated that it will cost $15,000 to clean and repair crossings or roads that are now closed.

(6) Total damages or cost of reconstruction in the Ruidoso area is estimated at approximately $100,000.

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After the questionnaire on the estimates of damage was completed, representatives of the various governmental agencies were called on to outline the assistance that their agency could offer.

During the discussions, questions and answers revealed:

(1) That there was not need for National Red Cross assistance. It was pointed out that Mr. Frank Adams, Chairman, of the County Red Cross Chapter, had been authorized to issue relief orders to the extent of $300. It was the opinion of the committee that this assistance, together with the help that has been given by the County Nurse and the Department of Public Welfare, and the further assistance that can be obtained by the Department of Public Welfare, was sufficient to take care of the immediate emergency needs.

(2) The Committee was of the opinion that an emergency W.P.A. project or arrangements for special assistance from the C.C.C. Camp should provide labor for reconstructing the dams and diversion ditches. Mr. Isler, District Manager, W.P.A., stated that at the present time

there was no agency established through which a W.P.A. project could be sponsored; therefore, his agency could not assist with labor to rebuild the dams and ditches.

(3) The question of securing assistance from the C.C.C. Camp was asked, and Mr. Henderson, Area Conservationist, was asked to outline how the Soil Conservation Service could assist with the problems. Mr. Henderson stated that the term "emergency" as interpreted by his agency involved a matter of life and death, and before they could give immediate help that an emergency would have to be declared by some higher official. He commented on the fact that the organization of a Soil Conservation District is well underway, and that two supervisors had been appointed and the date for electing the other three supervisors had been set for October 25. He stated further that after the district was organized, the supervisors had informed him they would be glad to offer whatever assistance was possible.

(4) Mr. J. V. Tully asked what had developed from the recommendation that the Program Planning Committee had made relative to securing assistance through the Water Facilities Program. Mr. Radcliff explained that the Program Planning Committee had recommended that the Bureau of Agricultural Economics conduct a survey in the county to determine the practicability of developing wells. He then recommended that the Program Planning Committee amend the recommendation and ask the B.Z.E. to make a survey relative to making loans to farmers in the flooded valleys through which they could reconstruct their dams and diversion ditches. The recommendation was accepted, and Mr. Radcliff stated that he would send a report of the meeting to the Bureau of Agricultural Economics and ask that an immediate survey be made.

Mr. John Paul Jones, R. R. Supervisor, F.S.A. and Mr. Henderson then commented as to how their agencies would function in cooperation with the B.A.E. Mr. Bezemek pointed out that application for Water Facilities could be placed with either the Soil Conservation Service, the Farm Security Administration, or the Extension Service and expressed hope of being able to make some loans through the Water Facilities Program.

(5) Mr. Hardaway, Associate Engineer, of the U. S. Forest Service, was asked to outline the assistance which might be offered by his service. He pointed out that the Forest Service cannot work on private lands, and that they, themselves, were in need of several thousand dollars to reconstruct their own damages, especially roads. Mr. Hardaway then commented on the Wheeler Case and suggested that it be investigated as a possibility of securing aid through this means.

(6) The chairman called for other recommendations and suggestions for relieving the acute situation. Mr. Gallacher, County Commissioner, stated that the State Comptroller's office had promised $1500 to repair roads and that the County Commissioners were doing all they could to give as much assistance as possible. He explained that the Commissioners and the County Clerk had asked that the funds on a $18,000 W.P.A. labor project be transferred as a flood emergency project, but had been informed that this was not possible. He stated further that the County Clerk had received a telegram from Representative Clinton P. Anderson stating that he would do all he could to rush through a project for final approval when it reached the Washington Office.

(7) Mr. Merchant pointed out that conservation practices should be carried out as quickly and completely as possible, not only to aid this but future generations also. In discussing conservation practices, Mr. Beall, of the Forest Service, was asked what effect the over-grazing of the ranges had contributed to the flood. He stated that the water sheds in the forest were in exceptionally good condition above the flooded area, and that in his opinion the damages in the areas adjoining the forest were due to the unusual amount of rainfall and not to over-grazing.

(8) Mr. Whitaker, who was officially representing the Business Mens' Club, of Carrizozo reported that the Club had sent telegrams to government officials requesting immediate aid.

Following the discussions and recommendations, a committee consisting of Mr. George Titsworth, Chairman, Mrs. Ola C. Jones, Mr. J. V. Tully, and Carl P. Radcliff was appointed to prepare a telegram to be sent to the Honorable John E. Miles, Senators Carl A. Hatch and Dennis Chaves, and Representative Clinton P. Anderson, requesting that they use their influence in whatever way possible to secure immediate aid.

The following telegrams was prepared and approved by the committee:

"Members of County Program Planning Committee and County officials have visited as a group flooded areas of Bonito, Hondo, and Ruidoso Valleys to determine extent of flood damages. Committee declares state of emergency exists and appeals to you to use your influence to secure immediate aid as indicated in report that follows."

(Signed) TELEGRAM COMMITTEE
Chairman, George A. Titsworth
Mrs. Ola C. Jones
J. V. Tully
Carl P. Radcliff"

The following were appointed as a committee to meet with the Governor at the special flood meeting which the Governor has stated that he will call in the near future. A large committee was appointed, since some of the members were not sure that they could attend. Representatives of some of the governmental agencies stated that their agency would be represented by district officials.

Carl P. Radcliff, Chairman	John E. Hall
Mrs. Ola C. Jones	L. D. Merchant
J. V. Tully	Felix Ramey
W. F. Coe	W. A. Hart
George A. Titsworth	A. T. Pfingsten
George Smith	B. J. Bonnell
W. W. Gallacher	

At the request of the Committee, Mr. Radcliff promised to compile a report of the meeting and submit a copy to each member of the Committee. The meeting adjourned at 7:30 P.M.

First Regiment
NEW MEXICO STATE GUARD
Santa Fe

October 9, 1941

Honorable John E. Miles, Governor
State of New Mexico
Executive Office
Santa Fe, New Mexico

Dear Governor Miles:

Confirming my verbal report to you on the Gila flood situation, this report is made as a matter of record.

In compliance with your direction on October 2nd I proceeded to Silver City and contacted Mr. John O'Leary, Secretary of the Chamber of Commerce, and we were able with the assistance of Mr. John T. McMillan to survey the upper area affected by the flood, known as the Cliff and Gila area, that afternoon. Thursday evening we met with the various organizations working on the flood situation and were able to develop a coordinated program for the relief of those affected by the flood.

On Friday we attempted to survey the other areas, but it was impossible to reach the Red Rock area as the bridge was out and the only access was by boat. We did however cover the Virden area by going to Duncan, Arizona and going up the north side of the river.

The approximate number of families in all three areas affected by the flood and in need of help seems to be 27, and a check of the number would indicate probably 140 to 150 men, women and children. The families in the Virden area are largely connected with the Mormon Church, which will take care of all of their requirements. Most of the other families are clients of the Farms Security Administration, which will take care of them as soon as they can get action.

We contacted Mrs. Katherine Edward, Disaster Worker for the Red Cross, who had been sent into Duncan by the San Francisco office and found that while New Mexico is normally handled from the St. Louis office that Mrs. Edwards had been authorized to handle the upper Gila territory due to the fact that it was largely one area, and she was expected to arrive in Silver City on Monday, October 6th. In the interim period Mrs. Chapman of the Silver City Red Cross was handling the relief in Grant County.

The immediate distress of the families affected would therefore seem to be taken care of, and the remaining necessity would be a long range program covering rehabilitation of the irrigation ditches and diversion dams that were washed out by the flood. Also considerable silt in many instances was deposited on the land and will require deep cultivation with heavy machinery in order to turn it under. In some instances the river cut new channels, causing some loss of cultivated lands. There is the additional problem of removal of debris from the channel bottom areas and fences in order to allow free flow of any additional flash floods.

All of those contacted were highly appreciative of your efforts in their behalf and were particularly pleased that a CCC Camp was being moved in to the area to assist in the clean-up work. The residents of the Virden area were particularly desirous of securing the use of a power shovel for the purpose of reconstructing their diversion dams in order to get water into their upper ditches to finish their crop this year.

The question of flood detention dams on the upper Gila in order to impound these waters was discussed, but it is a matter for detailed survey and future planning by competent authorities.

Respectfully submitted,

(Signed) W. H. Powell
WILLIAM H. POWELL
Lt. Colonel, NMSG
Commanding.

WHP/WD.
Incls: None.

SUMMARY OF FLOOD DAMAGE WITHIN UNITED PUEBLOS AGENCY JURISDICTION

A study of flood damages was made following the receding of the high water, by Agency personnel, and this study showed that there had been a considerable loss to crops, as well as actual loss of cultivated lands.

At Cochiti 50 acres of cropped land were flooded, resulting in a complete loss from this area, and in addition 152 acres of non-cropped land were flooded.

At Santo Domingo 50 acres of cultivated land were completely washed away, 55 acres of cropped land flooded with only partial returns to be expected in this area, and 60 acres of non-cropped land flooded.

At San Felipe 25 acres of cultivated land were washed away and 462 acres of cropped lands flooded, and an additional 60 acres of non-cropped land flooded.

At Jemez 93 acres of cropped lands were lost and an additional 21 acres cropped land flooded.

The loss of crops for the above flooded lands will mean a considerable loss to the people of the above pueblos. Two Indian Service bridges were damaged, one at Cochiti and one at Santo Domingo, and it will require $10,000 to repair the damages to the Cochiti bridge, and $4,000 to repair the Santo Domingo bridge.

In fighting the flood, personnel from the Agency, with field equipment of trucks, tractors, gasoline shovels, and other equipment, resulted in an additional cost to the Agency of approximately $45,812. This is broken down as follows:

Supervisory personnel	$ 3,000
Skilled labor	1,350
Enrollee labor	5,100
Cost of operating trucks	29,400
Cost of operating tractors	3,600
Cost of operating gasoline shovels	2,400
Rations & other misc. expense	962

The estimated cost to repair irrigation structures is as follows:

San Ildefonso, revetment work	$ 2,000
Santa Clara, repair of canal & headworks	6,000
Santo Domingo, repair to laterals	1,000
Jemez, repair to canal, diversion dam and revetment work	30,000
Zia, repairs to diversion dam and canal change	15,000
TOTAL	$54,000