INVESTIGATION OF ALLUVIAL VALLEY FLOORS IN THE SALT LAKE COAL AREA, WESTERN NEW MEXICO

Report to Ed Kelley, Director
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New Mexico Bureau of Mines and Mineral Resources
Open-File Report 217
September 1984

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INTRODUCTION

Agriculturally important alluvial valley floors were initially protected by the U.S. Congress (1977) from destruction by surface mining of coal. The State of New Mexico adopted surface coal mining regulations in 1980 which followed the U.S. Department of Interior's Office of Surface Mining guidelines regarding coal surface mining. The state regulations also protect alluvial valley floors:

> an alluvial valley floor exists if . . .
>
> (i) Unconsolidated streamlaid deposits holding streams are present; and
>
> (ii) There is sufficient water to support agricultural activities as evidenced by:
>
> > (A) The existence of flood irrigation in the area in question or its recent historical use;
> >
> > (B) The capability of an area to be flood irrigated by a prudent person for sustained agricultural activities, based on stream-flow, water yield, soils, water quality, and topography; or
> >
> > (C) Subirrigation of the lands in question, derived from the ground water system of the valley floor (CSMC Rule 80-1 as amended 3/15/83, p. 87-88).

Love, Hawley, and Hobbs (1981) reviewed the federal Office of Surface Mining guidelines and suggested more detailed criteria for identification of alluvial valley floors in New Mexico (Table 1). They also carried out a suggestion that studies of alluvial valley floors proceed in three phases, the first of which was to

Table 1. Guideline Criteria Indicative of Alluvial Valley Floors.

Surficial Geologic Criteria

1. Alluvual valley floors are underlain by nearly horizontal deposits of gravel, sand, silt and clay which are deposited by streams.

2. An alluvual valley floor is coursed by a bankful channel at least 3.0 feet wide and 0.5 feet deep.

3. Valley width is greater than 50 feet.

4. Low terraces and distal portions of alluvial fans integrated with modern streams in lowland areas adjacent to modern streams may be included as parts of alluvial valley floors.

Hydrologic Criteria

1. The watershed must be capable of producing flood irrigation or have a potential for subirrigation which could sustain agricultural activities (generally more than 2-acre-ft of water per acre for irrigation; shallow water table for subirrigation).

2. The nature of waters used for irrigation are of a quality which poses no detrimental effect to soils or plants.

3. To the point to which it is economically feasible, the water to be used for irrigation can be taken readily from the watershed, in a manner which does not violate state or federal laws, and will not adversely affect any downstream users.

4. There is evidence that either flood irrigation or subirrigation is a regional practice.

Vegetative Criteria

1. Abundant vegetation in lowlands compared with adjacent areas.

2. Agriculturally-useful vegetation indicative of a shallow water table.

3. Evidence of recent hay production.

Land-use Criteria (other than those mentioned above)

1. Regional pattern of flood irrigation or subirrigation.

2. Standards for water application must be consistent with regional practice.

3. Area of alluvial valley floor generally must be more than 10 acres.

Table 1 (cont'd)

Exclusions

1. Colluvial and other surficial deposits along the valley margins which are higher than the modern flood plain and "are not irrigated by diversion of natural flow or ephemeral flood flow and are not subirrigated by underflow" (U.S. House of Representatives, 1977a).
2. Upland areas which are underlain by thin colluvial deposits.
3. Valleys without stream channels.
4. Areas where water quality data or solids data indicate that long-term degradation of soil resource would result in reduction of the agricultural utility of the area.
5. Undeveloped range lands not significant to farming.
6. Small acreages within otherwise "clearly not alluvial valley floors".

distinguish between "possible alluvial valley floors" and "lands clearly not alluvial floors". Love and others (1981) looked at all active and proposed coal mining areas in the state (San Juan and Raton basins), but did not look at other parts of New Mexico because there was little interest in coal surface mining at the time. With increased interest in the Salt Lake coal area near Quemado, the Energy and Minerals Department decided that determination of the possible presence of alluvial valley floors was also warranted there. The Department and New Mexico Bureau of and Mineral Resources cooperated in this joint study during the summer of 1984.

METHODS

As in the previous investigation of other areas in the state, phase 1 AVF studies were designed to evaluate the surficial geological characteristics, hydrologic characteristics, biologic characteristics and land use characteristics that qualify or disqualify valley floors as potential alluvial valley floors. The evaluation included office review of available climatic, hydrologic and geomorphic information on the Salt Lake coal area as well as field reconnaissance of the major stream valleys in these areas. Hydrologic data from the U.S. Geological Survey (1951-81) were compiled for the area by Sylveen Robinson, and other reports (U.S. Department of Agriculture, 1981; U. S. Bureau of Land Management, 1984) were reviewed for hydrologic information. Data from ongoing monitoring of surface drainages by consultants to the Salt River Project is anticipated to aid in estimating amounts of runoff. Annual and monthly precipitation data were obtained from Gabin and Lesperance (1977) and from the National Climatic Center (1951-1981).

Depth to water in some valleys was obtained from Dr. W. J. Stone who is investigating water movement in the vadose zone of the coal area (Stone, in preparation). Aerial photographs were used to check for possible agricultural areas involved in irrigation or subirrigation. Soil maps on orthophoto mosaics produced by the U. S. Soil Conservation Service (in preparation) were consulted to determine possible agricultural potential of the valleys.

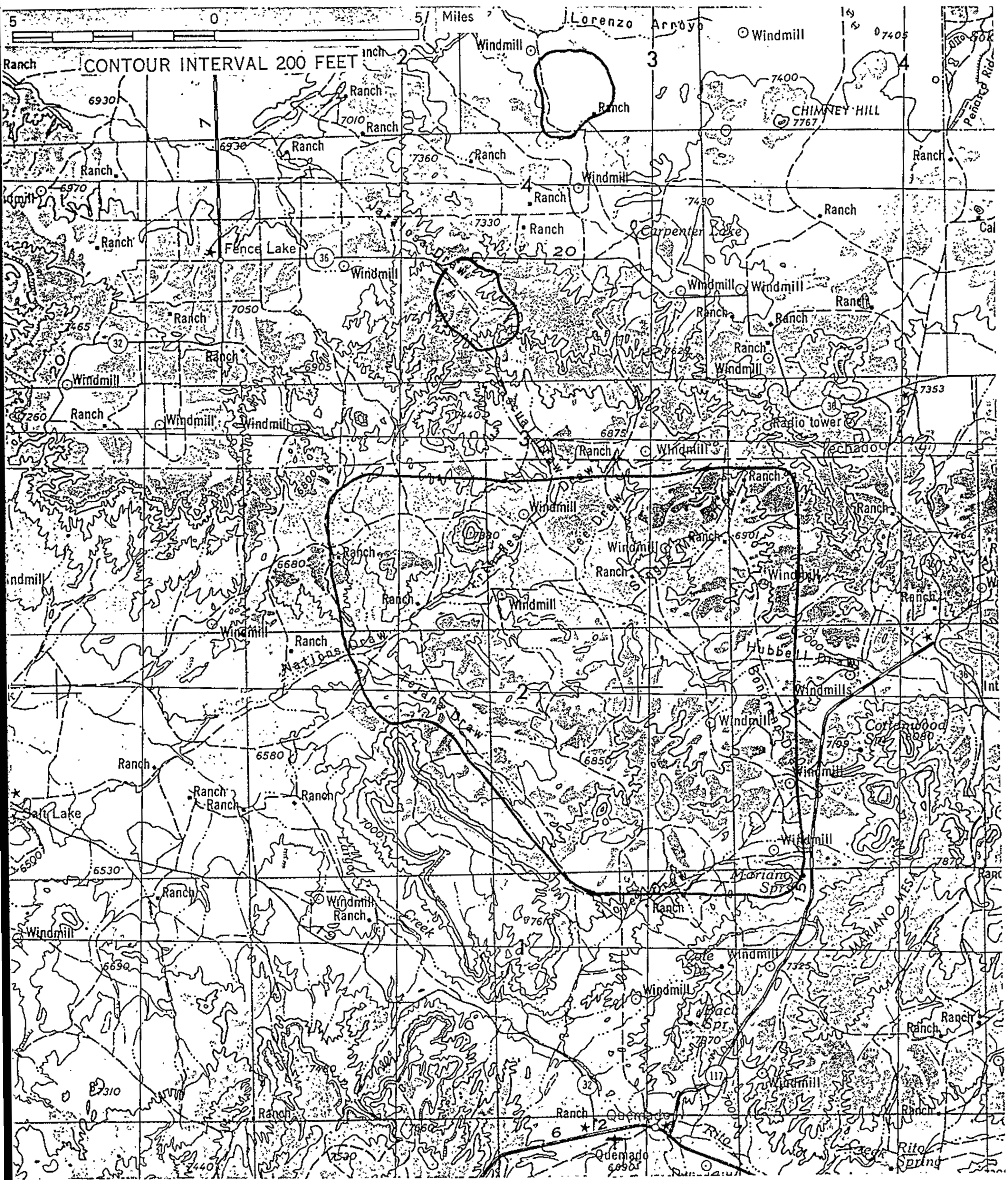
RESULTS

Stream valleys of the Salt Lake coal area are listed in Table 2 and shown in Figure 1. The valleys are underlain by at least 67 feet of alluvium. In general, the stream valleys abruptly change from being narrow, steep gullies with almost no floodplains in the headwater contributary nets along the margins of mesas and drainage divides to broad alluvial fan and floodplain-dominated valleys with gradients of 20 to 60 feet per mile farther downstream. Although definite incised channels dominate the contributary nets, the broad drainageways contain small and large discontinuous channels, fans and reaches with no channels (see documentary photographs in Appendix 1). Most discontinuous channels are relatively small, on the order of 5 to 10 feet wide at the top, and less than 3 feet deep, with a parabolic cross section. The large channels are up to 20 feet

Table 2. Drainages in the Salt Lake coal area.

Frenches Draw	Pascual Draw
Hubbell Draw	Single Mill Draw
Jaralosa Draw	Sonoreno Draw
Lee Draw	Tejana Draw
Lopez Draw	Unnamed tributaries
Nations Draw	

Figure 1. Map of drainages studied during Phase 1 investigations of valley floors in the Salt Lake coal area. Areas of shallow minable coal outlined in black.



deep and as much as 130 feet wide. Active channels have less vegetation and fresh-looking bedforms. None of the streams were flowing during our reconnaissance in July, 1984, except as a direct result of a major downpour one afternoon.

No U. S. Geological Survey stream gages occur within the coal area. The gage on Largo Creek, 10 miles to the south, records only the maximum gage height for each year and does not record flow frequency. The annual flood peaks recorded for this station (U.S. Geological Survey, 1954-1982) indicate that overbank flood irrigation is not possible every year (Figure 2). Downstream from the gage, the channel dies out and the water is dispersed. A channelless reach occurs along Largo Creek close to the coal area.

The surface hydrology of many drainages is greatly modified by a large number of soil conservation dams, diversion dikes and erosion control structures. In many drainages, previously formed arroyos have been dammed every few hundred yards, preventing storm runoff from removing much sediment from the drainageway. Also along many drainages, water is spread across the valley floor, moving as overland flow or in small rills and shallow discontinuous channels.

Groundwater in the shallow alluvial aquifer was found to be at least 37 feet below the ground surface (Stone, in preparation), precluding the possibility of subirrigation of even the floors of the deepest arroyos (about 20 feet deep at most).

According to the U. S. Soil Conservation Service (in preparation), the Salt Lake coal area receives 12-15 inches of rain per year. The averge monthly distribution of precipitation

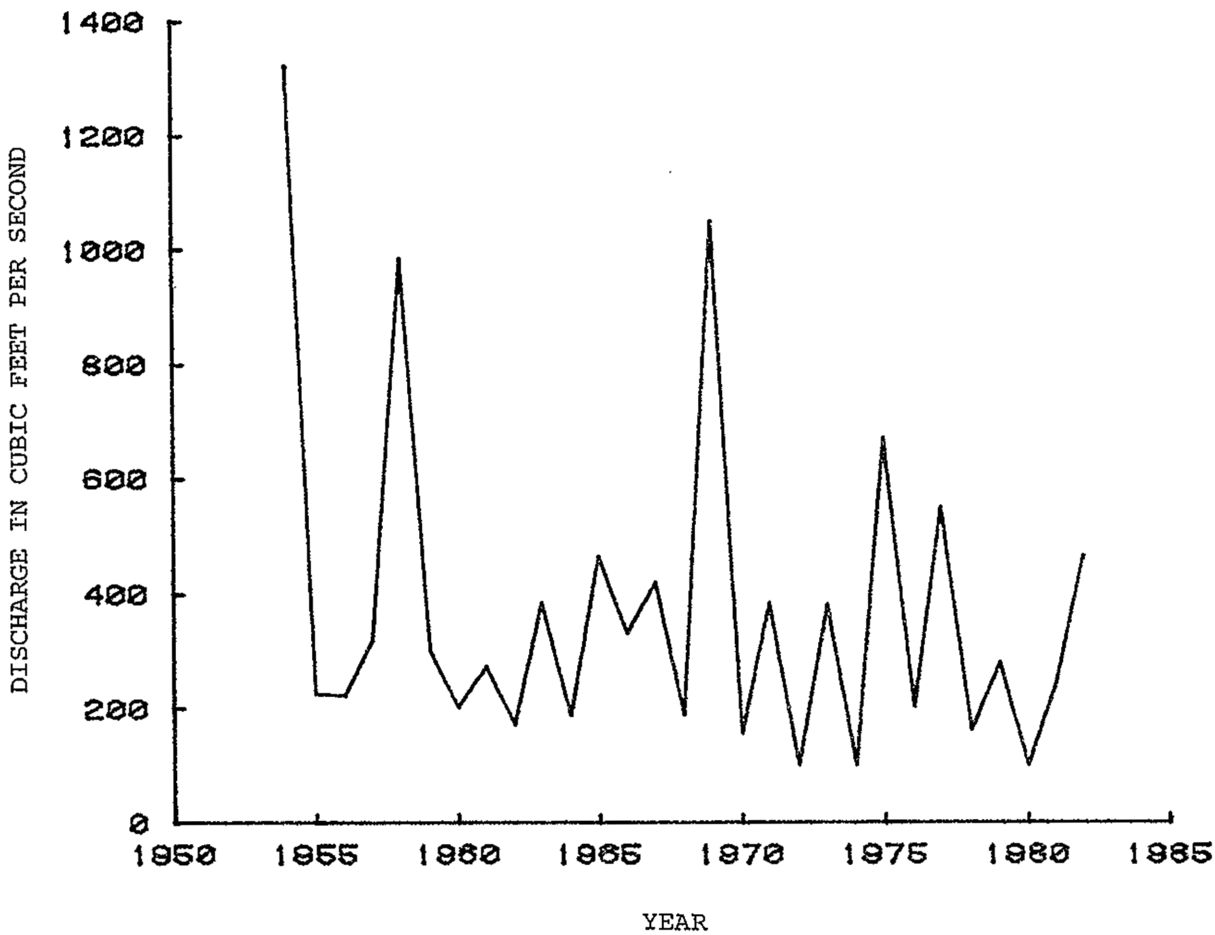


Figure 2. Annual peak discharge recorded on Largo Creek, 10 miles south of the Salt Lake coal area, 1954-1982. Bankfull discharge at the gage is presently about 1,000 cubic feet per second. Data from U.S. Geological Survey (1954- 1982).

rain per year. The averge monthly distribution of precipitation for Quemado Ranger Station (in Quemado) is shown in Figure 3. The variation in annual precipitation ranges from 4 to 15 inches per year (Fig. 4). Maximum 24-hour precipitation intensity in 100 years is estimated to be 2.8 inches (Miller and others, 1973). The growing season ranges from 74 to 130 days per year while the average annual temperature ranges from less than 47° to 54° F (R. A. O'Dell, 1984, personal communication; U. S. Conservation Service, in preparation).

The U. S. Soil Conservation Service (in preparation) mapped the broad valleys of the Salt Lake coal area as belonging to the Pietown-Hickman and Catman-Hickman Complexes. These soil complexes are torrifluvents, haplargids, and haplustolls of fine sandy loam, sandy clay loam and clay loam in alluvial materials. These complexes include eolian dunes and playa areas, some of which are saline. The potential for erosion by water is considered moderate, but erosion by wind is considered moderate to high (U. S. Soil Conservation Service, in preparation). Our field reconnaissance showed that many of these bottomlands have large vertical cracks breaking the soil surface in a polygonal pattern to a depth of 20 inches or more. Such cracks are a hallmark of vertisols.

Biotic communities in the coal area include plains and desert grasslands, piñon-juniper woodlands, and mixed ponderosa and piñon-juniper woodlands (U. S. Department of Agriculture, 1981). The valleys are dominated by shrubs and grasslands of western wheatgrass, spike muhly, mat muhly, ring muhly, alkali sacaton, blue grama, vine-mesquite, bottlebrush squirreltail,

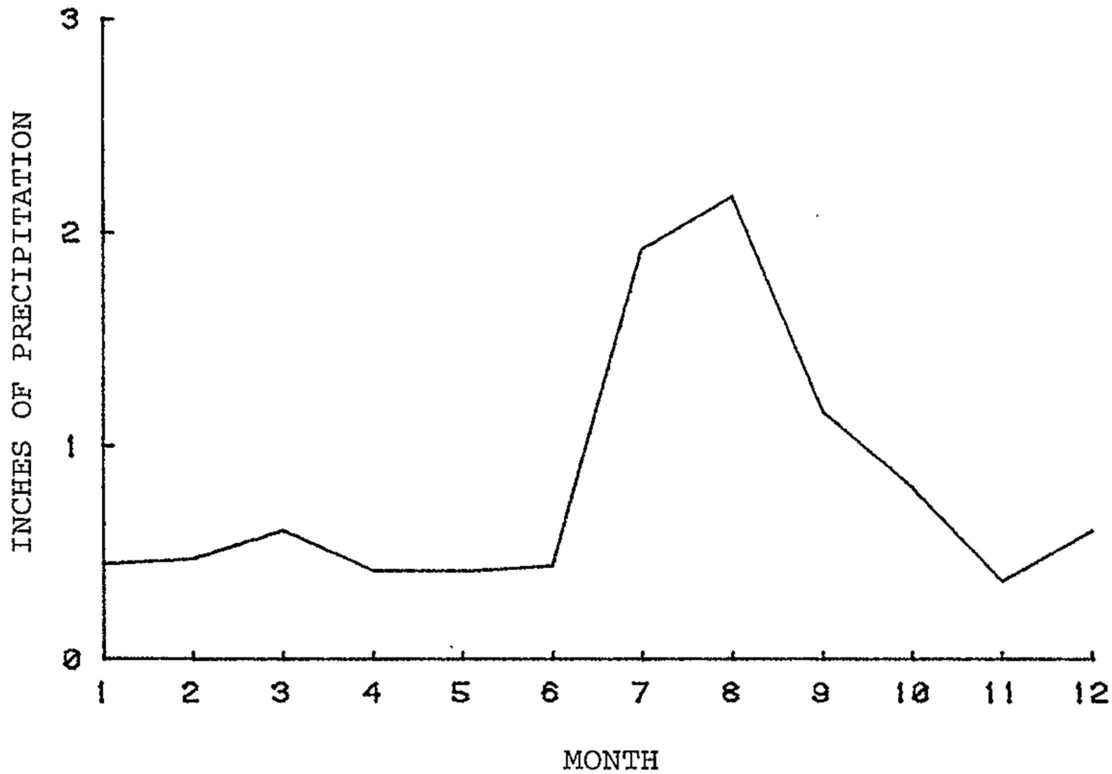


Figure 3. Distribution of average monthly precipitation for Quemado Ranger Station. Data from Gabin and Lesperance (1977).

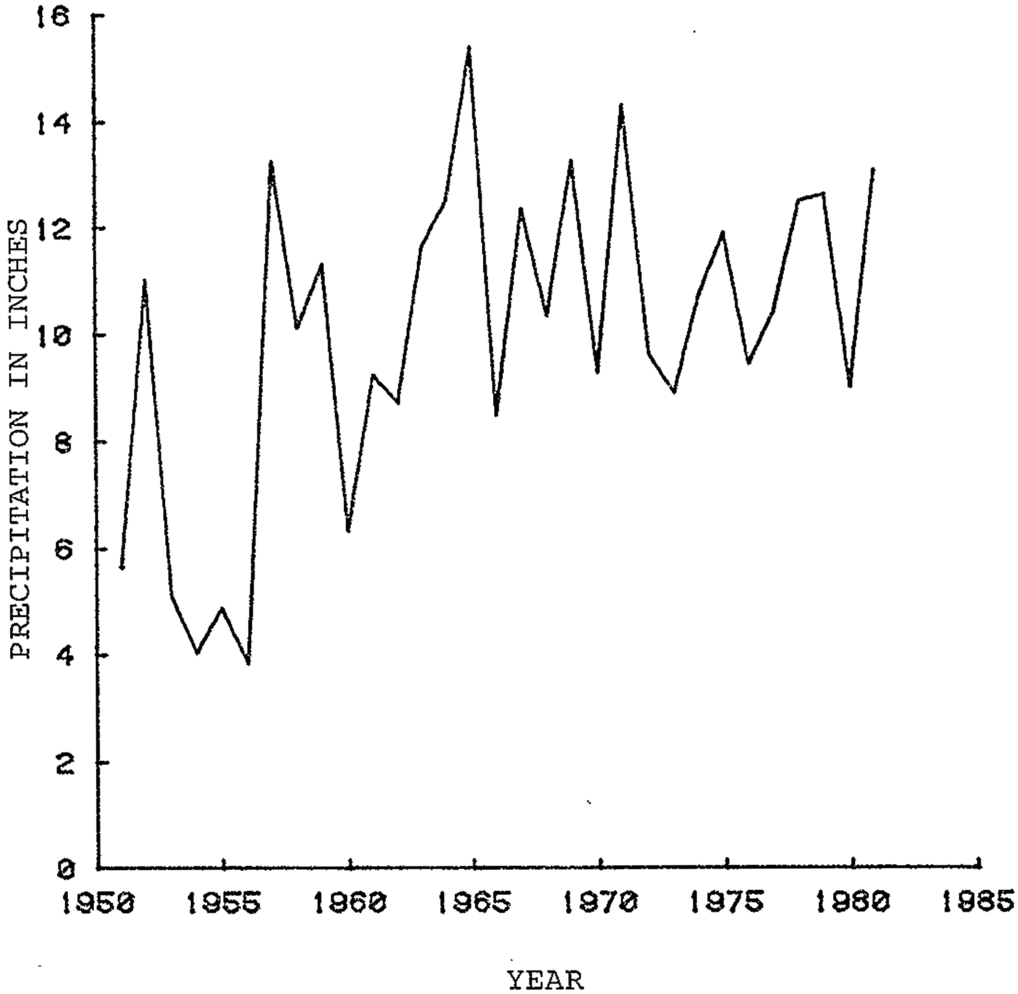


Figure 4. Annual precipitation at Quemado Ranger Station, 1951 to 1981. Data from National Climatic Center (1951-1981).

rabbitbrush, greasewood, and fourwing saltbush grasslands. The U. S. Soil Conservation Service (in preparation) indicates that the rooting depth along the valley floors is about 60 inches. The U. S. Soil Conservation Service indicates that all of their map units are suitable for properly managed livestock grazing. They do not mention or suggest any irrigation agriculture. Dryland farming has occurred and continues in some drainages and uplands in the northern part of the study area east of Fence Lake. No ranchers that we talked to in the area remembered any irrigation or subirrigation of fields along the valleys. Because vegetation is relatively lush along some reaches of the major valleys, some ranchers winter their cattle along the drainages in order to take advantage of the "chamise" (fourwing saltbush; M. Hubbell, 1984, personal communication; R. A. O'Dell, 1984, personal communication).

CONCLUSIONS

The geologic, hydrologic, pedologic, biologic and land-use characteristics of the stream valleys in the Salt Lake coal area do not fit the legal definition of alluvial valley floors. Little surface irrigation or subirrigation takes place, and there is no historic record of irrigation agriculture in these valleys. The ephemeral surface runoff and the depth of the alluvial aquifer preclude irrigation agriculture.

Nonetheless, several aspects of this area warrant consideration for mitigation during mining. First, compared to many of the valleys investigated by Love and others (1981), these valleys are exceptionally well vegetated for valleys in New Mexico. The ranchers manage these valleys for winter forage. Moreover, other management measures include erosion-control structures which are extensive and (for the most part) well maintained. This tradition of soil and water conservation and range management should be maintained. Finally, small areas in the headwaters of drainages and more extensive areas on the uplands are dryland-farmed. These productive areas are a unique aspect of New Mexico's agriculture and deserve to be considered for mitigation when mining is proposed.

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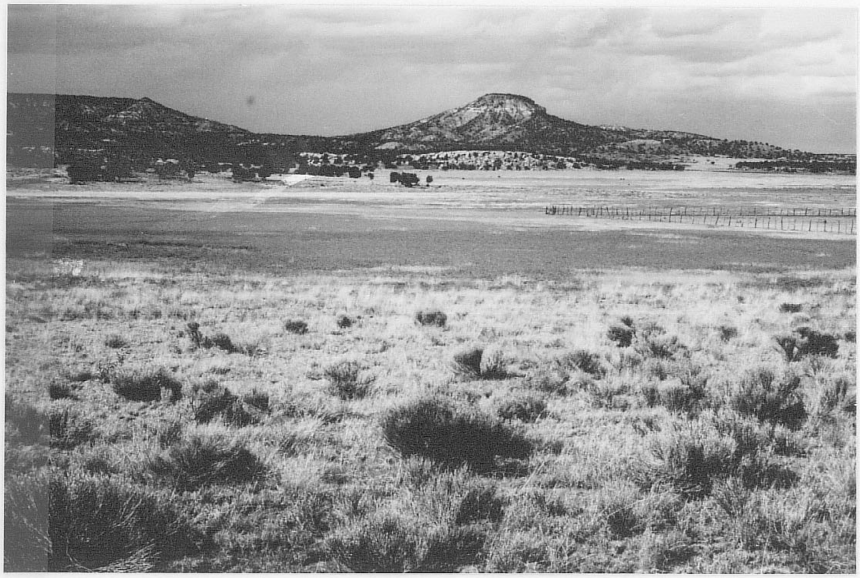
APPENDIX 1. PHOTOGRAPHS OF DRAINAGES IN THE SALT LAKE COAL AREA

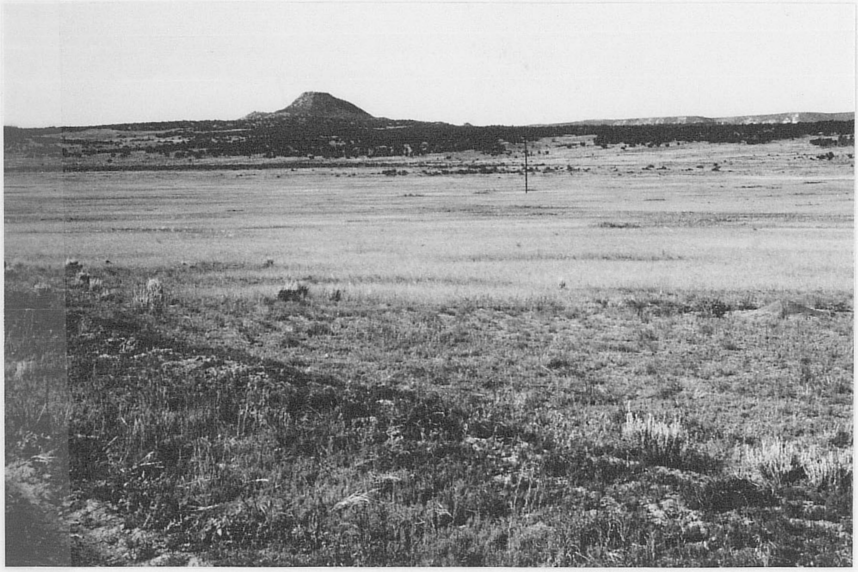
Frenches Draw incised downstream from Williamson Ranch, NE 1/4 sec. 16, T. 4 N., R. 16 W.

Frenches Draw (unincised) near Cerro Prieto Windmill, NE 1/4 sec. 19, T. 4N., R. 16 W.



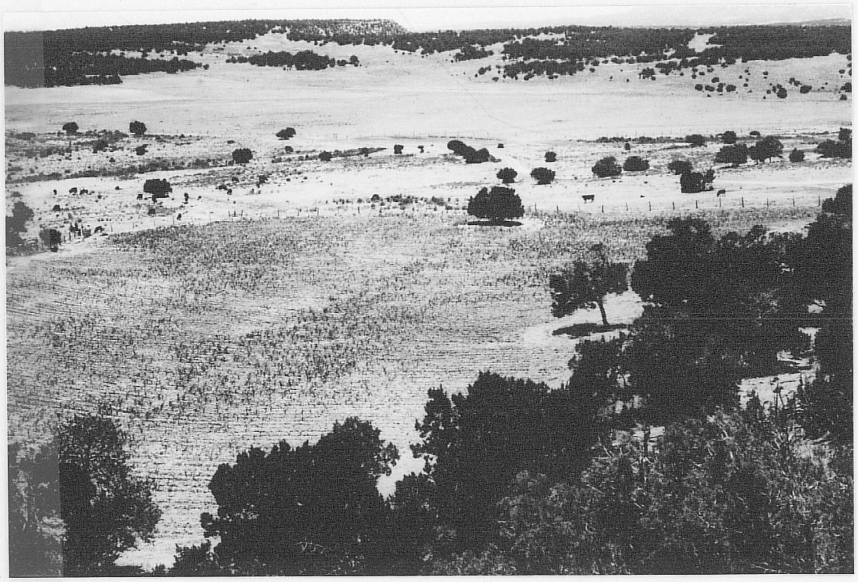
Vegetation-covered "playa" along tributary to Frenches Draw near Taylor Windmill, NW 1/4 sec. 23, T. 4 N., R. 17 W.

Hubbell Draw in shallow channel in SE 1/4 sec. 6, T. 3 N., R. 15 W.

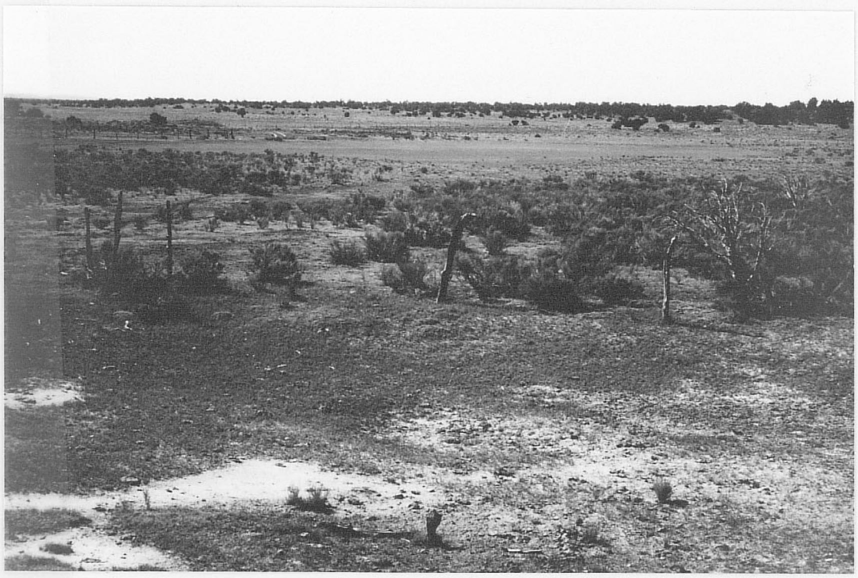


Hubbell Draw (unincised) in sec. 2, T. 3N., R. 16 W.

Jaralosa Draw in SW 1/4 sec. 19, T. 5N., R. 16 W.



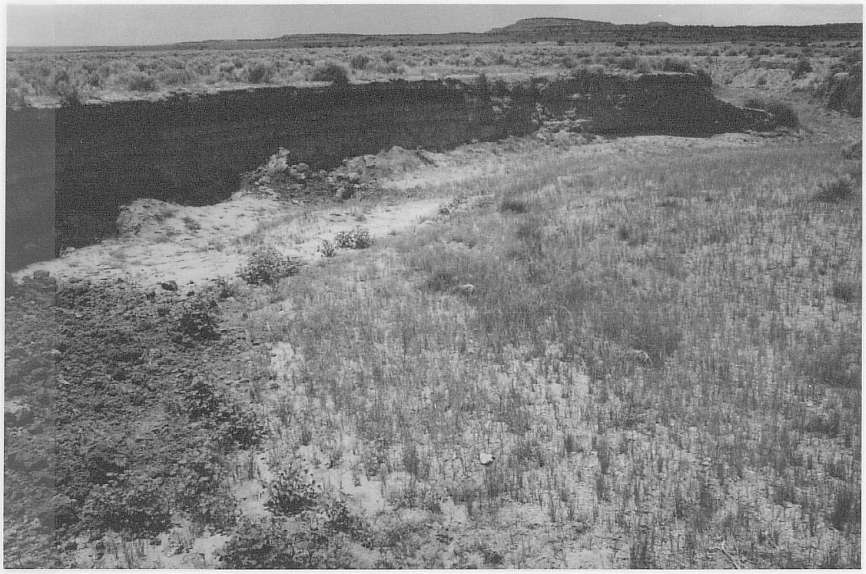
Cornfield in tributary drainage to Jaralosa Draw, Bedford Dye farm, NE 1/4 sec. 19, T. 5 N., R. 16 W.



Vegetated "playas" connected by shallow channels near Paz well, NE 1/4 sec. 32, T. 6 N., R. 16 W., tributary to Lorenzo Arroyo and Jaralosa Draw.

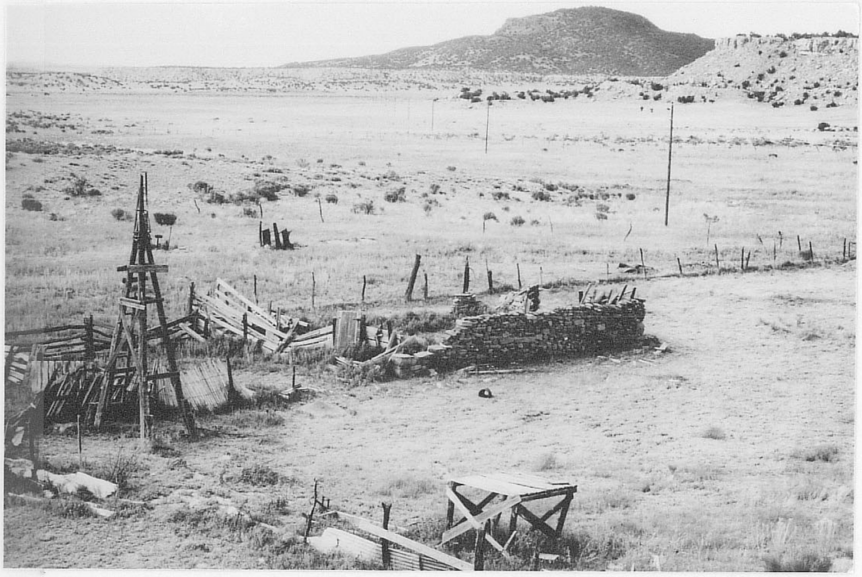
Dryland farming on valley border-upland surface,
O'Dell farm, SW 1/4 sec. 28, T. 6 N., R. 16 W.

Yellow sweetclover along unincised portion of Lee Draw,
NW 1/4 sec. 22, T. 4 N., R. 16 W.



Nations Draw incised to depth of 12 feet, SW 1/4 sec. 4, T. 3 N., R. 17 W.

Unnamed tributary to Nations Draw near Cox Ranch, NW 1/4 sec. 28, T. 4 N., R. 17 W. Drainage exhibits discontinuous incised channels.

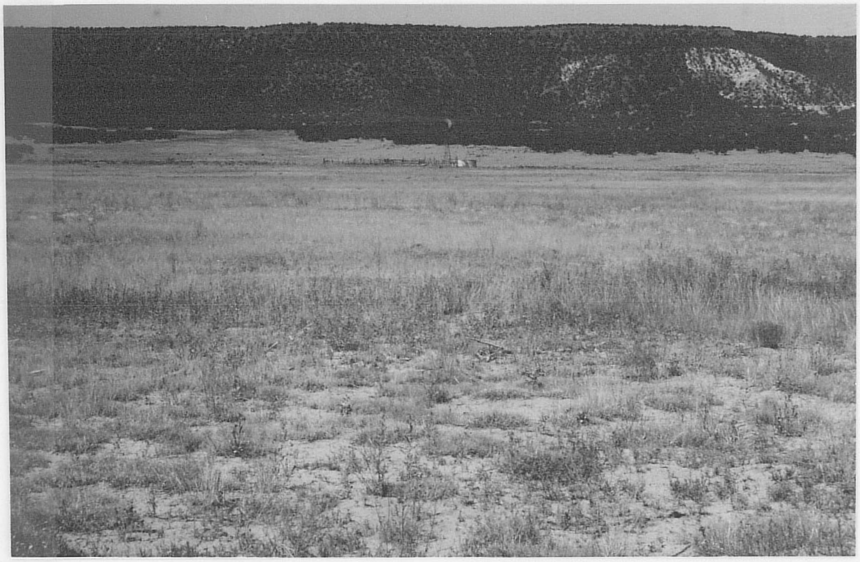


Unnamed tributary to Nations Draw at Strang Ranch, NW 1/4 sec. 6, T. 3 N., R. 16 W.

Pascual Draw near Montaño Well, NW 1/4 sec. 8, T. 4 N., R. 16 W.

Single Mill Draw near Single Mill Well, SW 1/4 sec. 26, T. 4 N., R. 16 W.

Unnamed tributary to Single Mill Draw, NW 1/4 sec. 25, T. 4 N., R. 16 W.

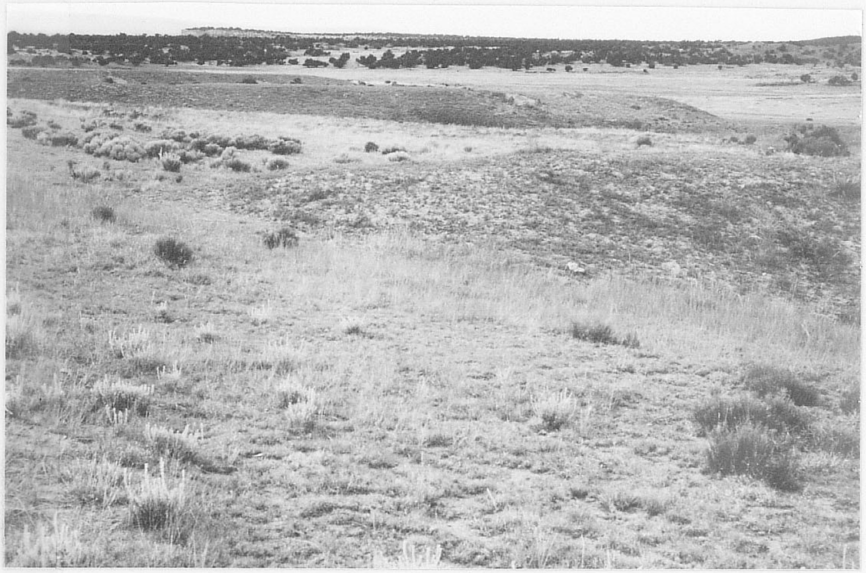


Tejana Draw (unincised), NE 1/4 sec. 24, T. 3N., R.17 W.

Headcut along lower Tejana Draw near confluence with Nations Draw, SW 1/4 sec. 4, T. 3 N., R. 17 W.

Maximum stage gage and sediment sampler in Tejana Draw between check dams, SE 1/4 sec. 11, T. 3 N., R. 17 W.

Polygonal soil cracks in alluvial flat adjacent to Tejana Draw, SE 1/4 sec. 11, T. 3 N., R. 17 W.



Series of earthen check dams along unnamed tributary of Tejana Draw, SW 1/4 sec. 7, T. 3 N., R. 16 W.