UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, Secretary

BUREAU OF RECLAMATION
Floyd E. Dominy, Commissioner

REGIONAL 5
Leon W. Hill, Regional Director

APPENDIXES
(In Four Volumes)
to
VOLUME II - TRIBUTARY UNITS
DEFINITE PLAN REPORT
SAN JUAN-CHAMA PROJECT
COLORADO-NEW MEXICO

APPENDIX A - Hydrology

August 1967
Revised March 1968

Amarillo, Texas

Serial No. 4

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APPENDIXES

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APPENDIX B - GEOLOGY
APPENDIX C - PLANS AND ESTIMATES
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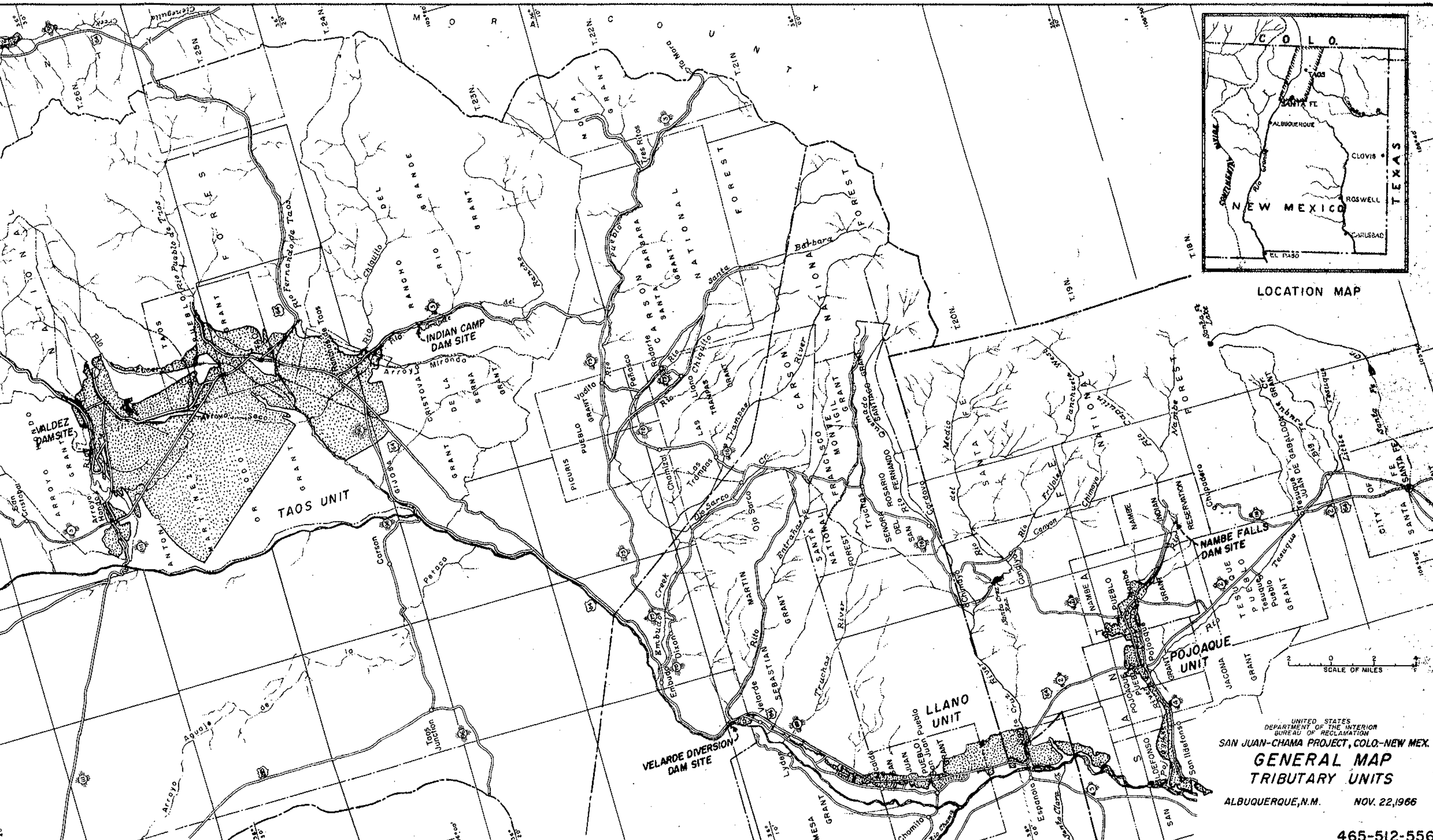
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COLO.
NEW MEXICO
TEXAS
SANTA FE
ALBUQUERQUE
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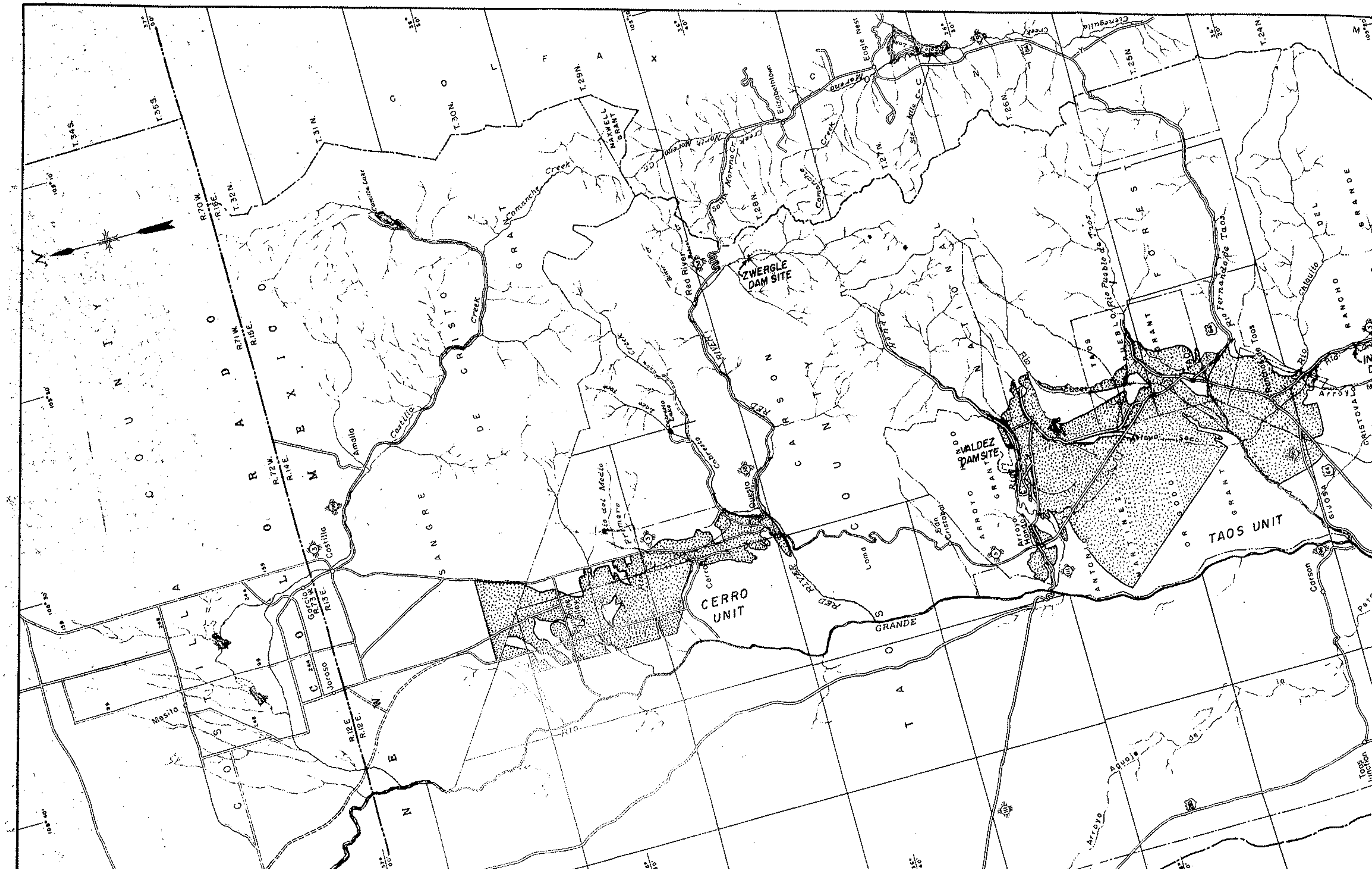
TAOS UNIT
INDIAN CAMP DAM SITE
VALDEZ DAMSITE
VELARDE DIVERSION DAM SITE
LLANO UNIT
NAMBE FALLS DAM SITE
POJOAQUE UNIT
SCALE OF MILES
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
SAN JUAN-CHAMA PROJECT, COLO.-NEW MEX.
GENERAL MAP
TRIBUTARY UNITS
ALBUQUERQUE, N.M.
NOV. 22, 1966
465-512-556



N
COSTILLA COUNTY
COLORADO
NEW MEXICO
COLFAX
TAOS COUNTY
SANGRE DE CRISTO GRANT
CARSON NATIONAL FOREST
MAXWELL GRANT
ZWERGLE DAM SITE
VALDEZ DAMSITE
CERRO UNIT
TAOS UNIT
RED RIVER
RIO GRANDE
Costilla Creek
Comanche Creek
North Moreno Cr.
South Moreno Cr.
Six Mile C.
Cienequilla Creek
Rio Hondo
Rio Pueblo de Taos
Rio Fernando de Taos
Rio Chiquito
Arroyo Hondo
Rio del Medio
Primero
Costilla
Amalia
Garcia
Jaroso
Masito
Questa
Cerro
Red River
Elizabethtown
Eagle Nest
Lama
San Cristobal
Arroyo Hondo
Carson
Taos Junction
Arroyo Aguaje de la
T.35S.
T.34S.
T.32N.
T.31N.
T.30N.
T.29N.
T.28N.
T.27N.
T.26N.
T.25N.
T.24N.
R.70W.
R.71W.
R.72W.
R.73W.
R.15E.
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R.13E.
R.12E.

APPENDIX A - HYDROLOGY

Introduction

General

Public Law 87-483, approved June 13, 1962, authorized the Secretary of the Interior to construct, operate, and maintain the Navajo Indian Irrigation Project and the initial stage of the San Juan-Chama Project as participating units of the Colorado River Storage Project.

The authorized San Juan-Chama Project provides for the construction of features to divert, convey, and reregulate water from the San Juan River Basin to the Rio Grande Basin for the purpose of providing water to existing irrigation projects in New Mexico and for municipal and industrial uses in Albuquerque, New Mexico.

Public Law 88-293, approved March 26, 1964, authorized the use of project water in a permanent pool for fish and wildlife and recreation purposes at the proposed Cochiti Reservoir near Santa Fe, New Mexico. The city of Albuquerque has agreed to accept a reduction of 5,000 acre-feet in its water allocation to supply the estimated annual evaporation resulting from the permanent pool. Initial filling of the pool estimated to be 50,000 acre-feet will be supplied from project water surplus to the water users needs. The filling of the pool is to take place as soon as water becomes available for municipal and industrial purposes.

Plan of Development

The plan of development provides for construction of the diversion and regulation element which includes three diversion dams, three tunnels, two siphons, one large storage dam and reservoir, and the modification of the outlet works at El Vado Dam. The plan also provides for water-use facilities consisting of reservoirs, dams, canals, laterals, and drainage systems, and associated works and appurtenances on the tributary irrigation units. This volume is only concerned with the facilities on the tributary irrigation units. The features of the tributary units are shown on Drawing 465-512-556, the General Map, preceding page 1.

Scope

The tributary irrigation units, as authorized, consisted of approximately 39,300 acres of land in the Pojoaque, Llano, Taos, and Cerro areas in the Middle Rio Grande Basin above Otowi, New Mexico.

The plans presented in this report are of feasibility grade and present a reevaluation of the tributary units. Modification of the authorized units was necessitated by unfavorable geologic findings, rising costs, and reduced water supplies. This report will also include recommendations as to other possible uses of the undistributed portion of the water allocated to the authorized tributary units.

Volume I of the Definite Plan Report covered the plans for diverting and regulating the project water and for the furnishing of water to the city of Albuquerque and the Middle Rio Grande Conservancy District. Volume III will cover the possible additional uses as recommended in this report and will include a revision of the Heron Reservoir operation study presented in Volume I.

Water Supply

Public Law 87-483 limits the diversion from the San Juan Basin to a maximum of 270,000 acre-feet in any one year and 1,350,000 acre-feet in any consecutive 10-year period starting with the first day of October after the project commences operation.

The yield from the Heron Reservoir operation study presented in Volume I was allocated in the following manner:

Use	Final allocation 1,000 acre-feet	Final allocation Percent
Municipal and industrial	53.2 1/	52.27
Middle Rio Grande Conservancy District	20.9	20.55
Tributary units	27.7	27.18
TOTAL	101.8	100.00

1/ Includes 5,000 acre-feet assigned to Cochiti Reservoir for recreation and fish and wildlife purposes.

The development of project-type irrigation on the tributary units would result in an annual depletion of the Rio Grande flows at the Otowi gaging station if not compensated for by San Juan-Chama Project water. During any year there could be both depletions of, and accretions to, the Rio Grande flows at Otowi. In general, depletions will occur when water is stored in the tributary unit reservoirs and when diversions of natural flows are greater than the historical, nonproject diversions. During periods of low flows, and during the nonirrigation season, there will be accretions resulting from additional return flows from diversions of stored water and greater diversions of natural flows. The depletions are to be offset by daily or other short-period releases of San Juan-Chama Project water from Heron Reservoir. The accretions can be used in meeting

POJOAQUE UNIT

the demands of the city of Albuquerque and the Middle Rio Grande Conservancy District for the San Juan-Chama Project water.

The municipal and industrial demands of the city of Albuquerque and the supplemental irrigation demands for the Middle Rio Grande Conservancy District are annual demands, while the demands of the tributary units would vary in accordance with the available water supply and its use on the units.

No project water user will be allowed to carry over, in Heron Reservoir, any unused portion of his allocated annual supply. Any unused portion of a project water user's supply at the end of a calendar year would revert to the common supply for all water users.

The additional amount of depletions of Rio Grande flows will be limited in any calendar year to the amount of water available from importation to and storage in Heron Reservoir.

Pojoaque Unit

General

The Pojoaque River, formerly the Rio Pojoaque, is located in northern Santa Fe County between Santa Fe and Espanola, New Mexico. The Pojoaque River originates on the western slope of the Sangre de Cristo Mountains and is bounded by the watershed of the Santa Cruz River on the north and the Santa Fe River on the south.

The upper portion of the stream is known locally as the Rio Nambe and was formerly called Nambe Creek. As the stream flows to its confluence with the Rio Grande just above Otowi Bridge, it is successively called the Pojoaque Creek and then the Pojoaque River.

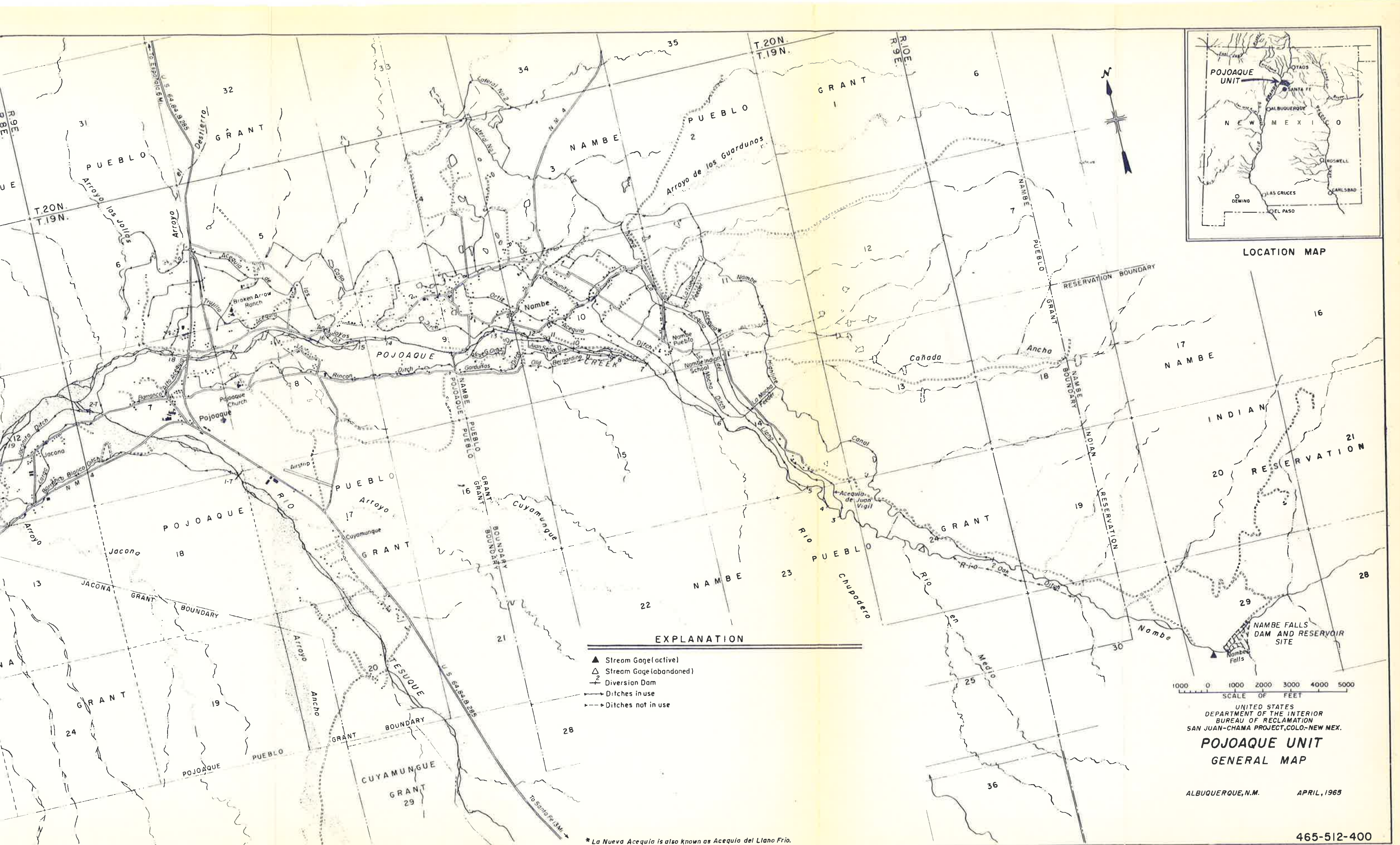
The portion called the Pojoaque Creek begins at the junction of the Rio Nambe and Rio en Medio, about 6 miles above the junction of the Pojoaque Creek and Rio Tesuque. Below the mouth of the Rio Tesuque, it is called the Pojoaque River.

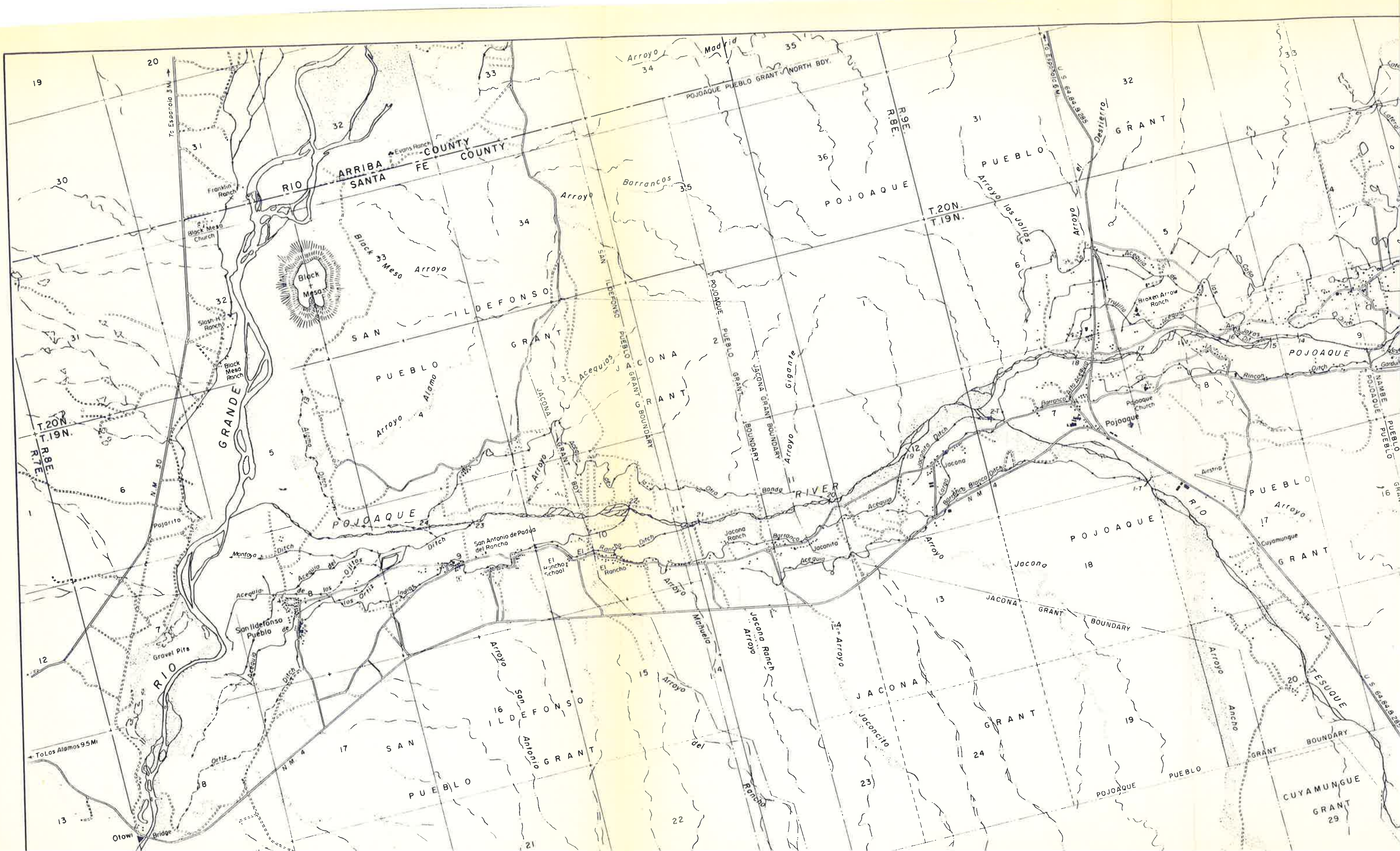
When the first Spaniards settled in the Pojoaque River Valley about 1610, they found three Indian pueblos (Nambe, Pojoaque, and San Ildefonso) where irrigation was being practiced. The irrigation has continued to the present time with the presently irrigated lands of the Pojoaque Unit being located along the Pojoaque River from its mouth to a point about 12.5 miles upstream. The presently irrigated area has been limited by the inadequate water supply as is shown by the irrigated acreage being less than the recognized water-right acreage. The features of the Pojoaque Unit are shown on Drawing 465-512-400, General Map.

The valley was formed by erosion of the Santa Fe formation, which is reported to be about 2,000 feet thick. The Santa Fe formation consists of clay, silt, fine sand, with some beds of sand and gravel. Overlaying the Santa Fe formation is an alluvial soil mantle consisting chiefly of sand, silt, and gravel derived from the Santa Fe formation. The thickness of the mantle ranges from as little as 10 feet to probably not more than 100 feet. The yield of wells that derive their source from the Santa Fe formation ranges from 1 to 40 gallons per minute. Wells drilled in the mantle yield from 200 to 400 gallons per minute.

Plan of Development

The general plan of development is to construct the Nambe Falls Dam and Reservoir to provide, through controlled storage of water, a


LOCATION MAP
POJOAQUE UNIT
NEW MEXICO
TAOS
SANTA FE
ALBUQUERQUE
ROSWELL
LAS CRUCES
CARLSBAD
DEMING
EL PASO
EXPLANATION
Stream Gage (active)
Stream Gage (abandoned)
Diversion Dam
Ditches in use
Ditches not in use
NAMBE FALLS DAM AND RESERVOIR SITE
Nambe Falls
1000 0 1000 2000 3000 4000 5000
SCALE OF FEET
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
SAN JUAN-CHAMA PROJECT, COLO.-NEW MEX.
POJOAQUE UNIT
GENERAL MAP
ALBUQUERQUE, N.M.
APRIL, 1965
465-512-400
* La Nueva Acequia is also known as Acequia del Llano Frio.
T.20N.
T.19N.
R.9E.
R.8E.
R.10E.
POJOAQUE PUEBLO GRANT
NAMBE PUEBLO GRANT
NAMBE PUEBLO GRANT BOUNDARY
NAMBE INDIAN RESERVATION
RESERVATION BOUNDARY
JACONA GRANT BOUNDARY
CUYAMUNGUE GRANT
Pojoaque
Pojoaque Church
Nambe
Nambe Pueblo
Nambe Indian School
Jacona
Cuyamungue
Broken Arrow Ranch
Airstrip
POJOAQUE CREEK
RIO TESUQUE
Rio Chupadero
Rio en Medio
Rio Nambe
Arroyo de los Guardunos
Arroyo los Jollas
Arroyo el Desierro
Arroyo Jacona
Arroyo Ancho
Arroyo Cuyamungue
Cañada Ancha
Acequia de Juan Vigil
La Mocha Feeder
Highline
Canal
U.S. 64, 84 & 285
N M 4
To Espanola 6 Mi.
To Santa Fe 13 Mi.



RIO ARRIBA COUNTY
SANTA FE COUNTY
RIO GRANDE
POJOAQUE RIVER
RIO TESUQUE
T.20N.
T.19N.
R.8E.
R.7E.
R.9E.
R.8E.
SAN ILDEFONSO PUEBLO GRANT
SAN ILDEFONSO PUEBLO GRANT BOUNDARY
POJOAQUE PUEBLO GRANT
POJOAQUE PUEBLO GRANT NORTH BDY.
POJOAQUE PUEBLO GRANT BOUNDARY
JACONA GRANT
JACONA GRANT BOUNDARY
JACONA GRANT BDY.
NAMBE PUEBLO
POJOAQUE PUEBLO
CUYAMUNGUE GRANT
Black Mesa
Black Mesa Arroyo
Black Mesa Church
Black Mesa Ranch
Franklin Ranch
Evans Ranch
Slash H Ranch
Broken Arrow Ranch
Pojoaque
Pojoaque Church
Airstrip
Cuyamungue
Jacona
Jaconita
Jacona Ranch
San Ildefonso Pueblo
San Antonio de Padua del Rancho
El Rancho
El Rancho School
Gravel Pits
Pojarito
Otowi
Bridge
To Los Alamos 9.5 Mi
To Espanola 3 Mi
To Espanola
NM 30
NM 4
U.S. 64, 84 & 285
Arroyo Madrid
Arroyo Barrancos
Arroyo Alamo
El Alamo Ditch
Arroyo de las Jollas
Arroyo el Destierro
Arroyo Gigante
Arroyo Manuela
Jacona Ranch Arroyo
Arroyo Jaconcito
Arroyo Ancho
Arroyo del Rancho
Arroyo San Antonio
Acequias
Acequia
Montoya Ditch
Acequia de los Ortiz
Acequia del Ojito
Jaconita Ditch
Barrancos Blanco Ditch
Otra Banda
Rincon Ditch
Trujillo
Ortiz
Barranco

better supply to the water-right lands in the unit. Presently, it is believed that there are 2,827 acres of water-right lands and it is estimated that on an average 2,300 acres could be irrigated. It was assumed that under project conditions the other irrigation facilities will be operated and maintained as they are presently. However, improvements to the distribution system will likely be made through the assistance and participation of State and other Federal agencies under their various programs. These improvements are not reflected in the water supply studies.

The authorized plan differs from the present plan in that it envisioned a slightly smaller dam, one new diversion dam, and a distribution system which would be enlarged and consolidated. It was previously assumed that 2,710 acres could be irrigated.

Water Rights

The Water Right Code of March 19, 1907, recognized and confirmed all beneficial uses at that time as a right to use New Mexico waters for beneficial purposes. Such rights are filed in the State Engineer Office in the form of declarations. After that date, new rights to public waters of the State could be acquired only by application to and approval by the State Engineer.

Water rights of the Pojoaque stream system have not as yet been adjudicated, but will be in the near future. The irrigated area determined by the New Mexico State Engineer's Hydrographic Survey, completed in 1963, is considered to be the water-right land for this report.

Rev. 3-6-68

Water Accounting

Volume I contains a copy of the report entitled "Accounting of Water, San Juan-Chama Project," dated February 1963, which was prepared in accordance with Sec. 8 of P. L. 87-483 to outline details of project operation essential to accounting for San Juan River and Rio Grande flows. The report provides that the effects of operation of the tributary units, including Pojoaque Unit, on the flows of the Rio Grande at Otowi shall be compensated for on a daily or short-period basis by releases of imported San Juan water from Heron Reservoir.

The presently irrigated lands of the Pojoaque Unit will be supplied supplemental water from the Nambe Falls Reservoir. Since the unit will contain no new lands, it will be assumed that there will be no increase in direct diversions of natural flow, and only accounting for storage effects, adjusted for return flow from diversions from storage, will be required.

Water Supply

The flow of the Rio Nambe near Nambe, New Mexico, was measured for water years 1933 through 1951. The gaging station was located about 6-1/2 miles upstream from the junction of Rio Tesuque and Pojoaque Creek. Nambe canal diverts 1,000 feet upstream from the gaging station, and this diversion has been combined with the flow of the Rio Nambe near Nambe to represent the virgin flow of the Rio Nambe above the irrigated area.

The virgin flow, Table A-1, was extended from 1951 through February 1963 by use of monthly correlations with the Santa Cruz River

Table A-1. Runoff of Rio Nambe near Nambe, New Mexico--(virgin flow)[1/]-Pojoaque Unit.

(Unit - 1,000 acre-feet) Drainage area 39.1 square miles

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1935	0.27	0.21	0.29	0.62	1.98	3.76	1.03	1.35	1.25	0.57	0.37	0.31	12.01
1936	0.24	0.20	0.31	0.97	1.67	0.79	0.48	0.75	0.61	0.74	0.50	0.30	7.56
1937	0.30	0.27	0.35	1.48	2.27	2.08	1.04	0.52	0.54	0.46	0.32	0.28	9.91
1938	0.19	0.17	0.27	0.65	1.43	0.99	0.66	0.42	0.65	0.66	0.41	0.32	6.82
1939	0.30	0.22	0.50	1.15	1.52	0.74	0.36	0.40	0.39	0.40	0.26	0.22	6.46
1940	0.22	0.21	0.49	1.04	2.14	1.37	0.50	0.45	0.40	0.44	0.31	0.28	7.85
1941	0.24	0.25	0.51	1.10	6.56	5.78	2.89	1.40	1.45	1.63	1.16	0.63	23.60
1942	0.51	0.31	0.46	3.25	5.02	3.37	0.86	0.42	0.69	0.41	0.31	0.27	15.88
1943	0.30	0.26	0.31	0.99	1.42	0.73	0.36	0.38	0.32	0.28	0.22	0.26	5.83
1944	0.22	0.19	0.24	0.56	2.45	2.01	1.25	0.79	0.42	0.52	0.36	0.27	9.28
1945	0.28	0.25	0.51	1.36	3.50	2.08	0.78	0.44	0.42	0.31	0.22	0.19	10.34
1946	0.20	0.15	0.24	0.84	0.75	0.30	0.33	0.80	0.40	0.48	0.39	0.32	5.20
1947	0.26	0.20	0.27	0.45	1.35	0.60	0.26	0.43	0.30	0.29	0.23	0.21	4.85
1948	0.19	0.18	0.26	1.04	2.29	1.75	0.68	0.46	0.23	0.24	0.21	0.21	7.74
1949	0.20	0.18	0.22	0.62	1.87	1.91	1.12	0.80	0.42	0.35	0.24	0.16	8.09
1950	0.21	0.16	0.19	0.39	0.38	0.28	0.24	0.17	0.14	0.15	0.09	0.07	2.47
1951	0.06	0.07	0.10	0.23	0.57	0.23	0.10	0.54	0.47	0.29	0.23	0.22	3.11
1952 2/	0.24	0.16	0.29	1.06	2.58	2.16	0.71	0.48	0.39	0.29	0.22	0.22	8.80
1953	0.26	0.18	0.30	0.52	1.43	1.28	0.71	0.37	0.25	0.28	0.26	0.21	6.05
1954	0.21	0.15	0.21	0.62	1.00	0.49	0.47	0.46	0.30	0.28	0.21	0.19	4.59
1955	0.21	0.17	0.16	0.30	1.08	0.76	0.69	1.45	0.84	0.38	0.27	0.28	6.59
1956	0.24	0.17	0.24	0.26	0.34	0.14	0.20	0.17	0.11	0.15	0.13	0.13	2.28
1957	0.16	0.12	0.20	0.84	1.81	2.03	1.07	1.92	1.15	0.64	0.54	0.41	10.89
1958	0.32	0.23	0.42	2.07	4.78	2.79	0.82	0.55	0.47	0.41	0.29	0.26	13.41
1959	0.21	0.11	0.15	0.32	0.72	0.45	0.33	0.80	0.33	0.32	0.22	0.20	4.16
1960	0.23	0.13	1.01	2.02	1.82	1.64	1.20	0.60	0.37	0.36	0.25	0.22	9.85
1961	0.21	0.14	0.22	0.95	1.63	1.01	0.60	0.83	0.62	0.46	0.35	0.27	7.29
1962	0.23	0.22	0.30	1.33	1.83	0.61	0.53	0.32	0.27	0.30	0.25	0.23	6.42
1963	0.22	0.17	0.51 3/	1.10	1.24	0.64	0.34	0.52	0.67	0.35	0.27	0.24	6.27
MEAN	0.24	0.19	0.33	0.97	1.98	1.48	0.71	0.66	0.51	0.43	0.31	0.25	8.06
MEAN 4/	(0.25)	(0.20)	(0.34)	(0.99)	(2.13)	(1.63)	(0.74)	(0.61)	(0.54)	(0.49)	(0.35)	(0.27)	(8.54)

1/Virgin flow equals sum of the discharge of Rio Nambe near Nambe, New Mexico, and diversions by Nambe canal.

2/Correlated with Rio Santa Cruz at Cundiyo, New Mexico.

3/Estimated as 113% of Rio Nambe at Nambe Falls, New Mexico based on drainage basin areas.

4/Based on recorded flows.

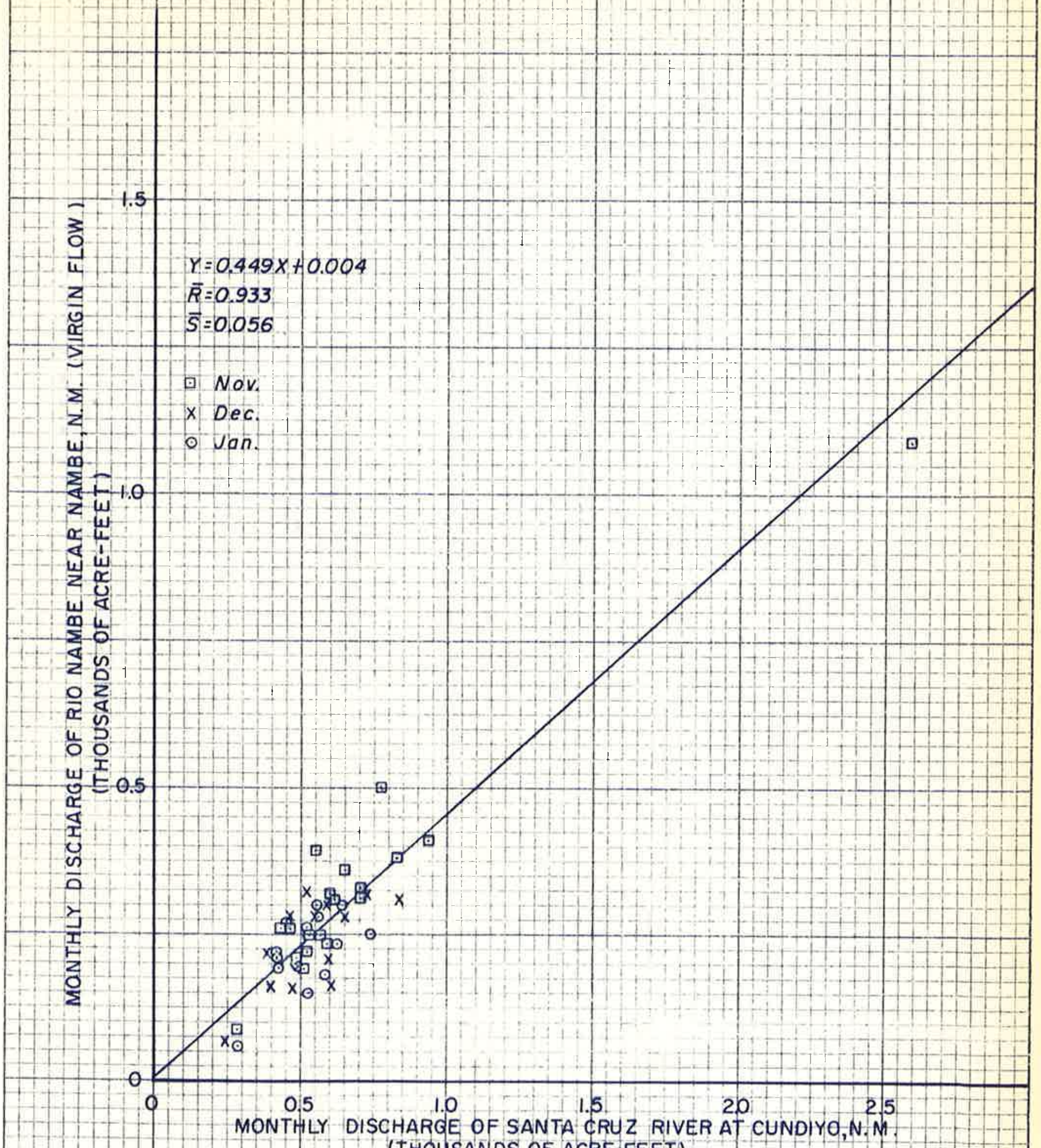
at Cundiyo, New Mexico. Correlations were derived for the following three monthly groupings: November through January, February through June, and July through October. The correlations are shown graphically on Figures A-1 through A-3.

Since February 1963, the flow of the Rio Nambe has been measured immediately below Nambe Falls. After February 1963, the virgin flow was estimated on a drainage area basis as 113 percent of the flow of the Rio Nambe at Nambe Falls.

The average annual yield of the Rio Nambe near Nambe, 1935 through 1963, is 8,060 acre-feet, or 206 acre-feet per square mile. Fifty-five percent of the annual flow occurs in April, May, and June, the snowmelt season; 29 percent from July through October, the summer thunderstorm season; and the balance, 16 percent, during the nonirrigation season. The maximum discharge of 5,580 c.f.s. on July 31, 1955, was obtained from a crest stage measurement. The minimum daily virgin flow of 0.4 c.f.s. occurred in December 1950 and January 1951.

Tributary inflow originating between Nambe Falls Reservoir and the Rio Nambe near Nambe gage was estimated to be 11.5 percent of the virgin flow passing the gage. Table A-2 presents the monthly inflow to Nambe Falls Reservoir. The Oak ditch diverts within this reach, but was not considered in the computations since the effect of the ditch would be reflected in the discharge records and the land under the ditch has been idle more than 5 years.

A gaging station was maintained on Pojoaque Creek at Pojoaque Bridge, near Nambe, New Mexico, from March 1936 through water year 1941.

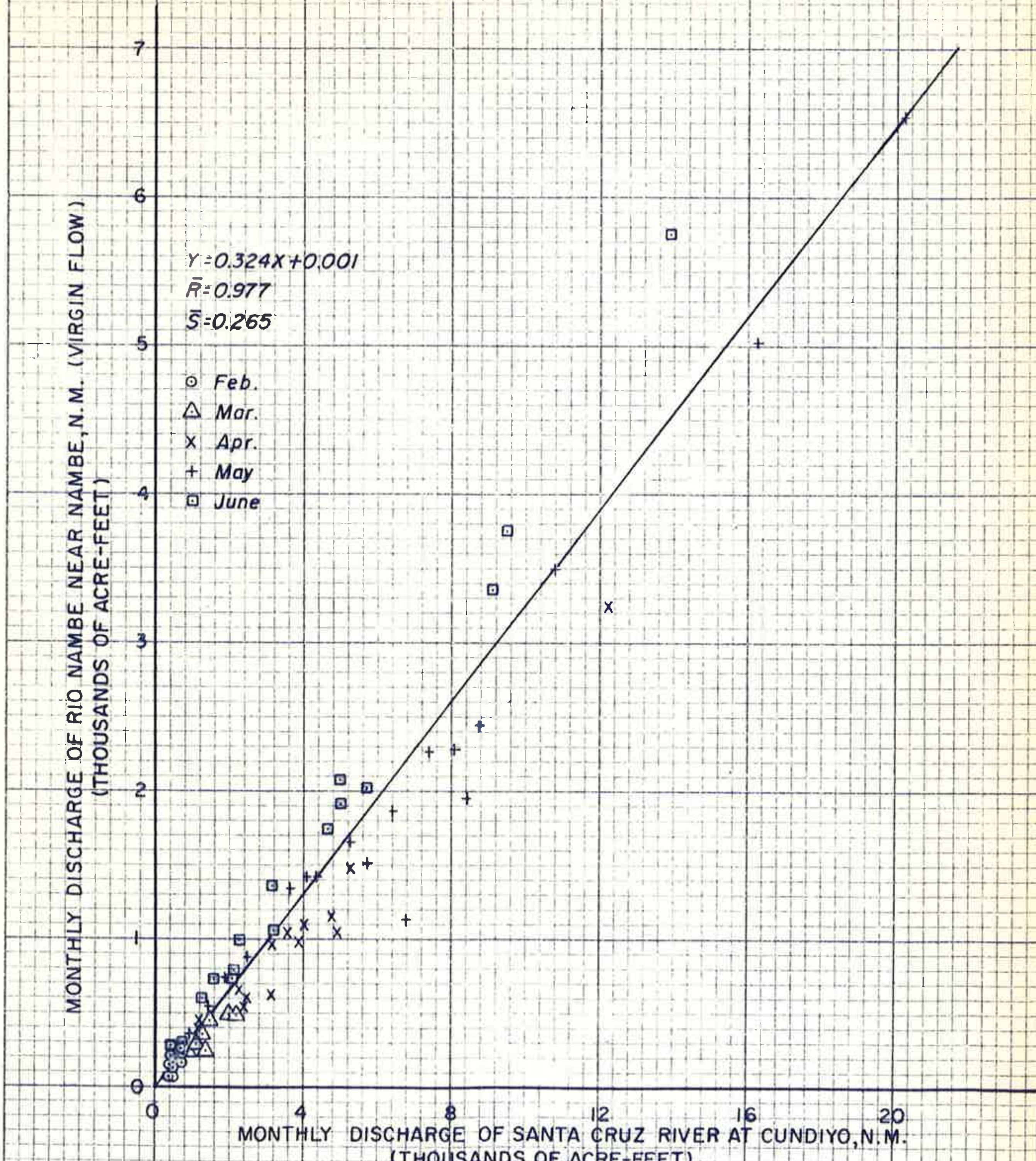


SAN JUAN-CHAMA PROJECT, COLO.-N.M.

DISCHARGE CORRELATION

RIO NAMBE Nr. NAMBE, N.M.
(VIRGIN FLOW)
Vs.
SANTA CRUZ RIVER At CUNDIYO, N.M.
(NOVEMBER THRU JANUARY)

FIGURE A-1

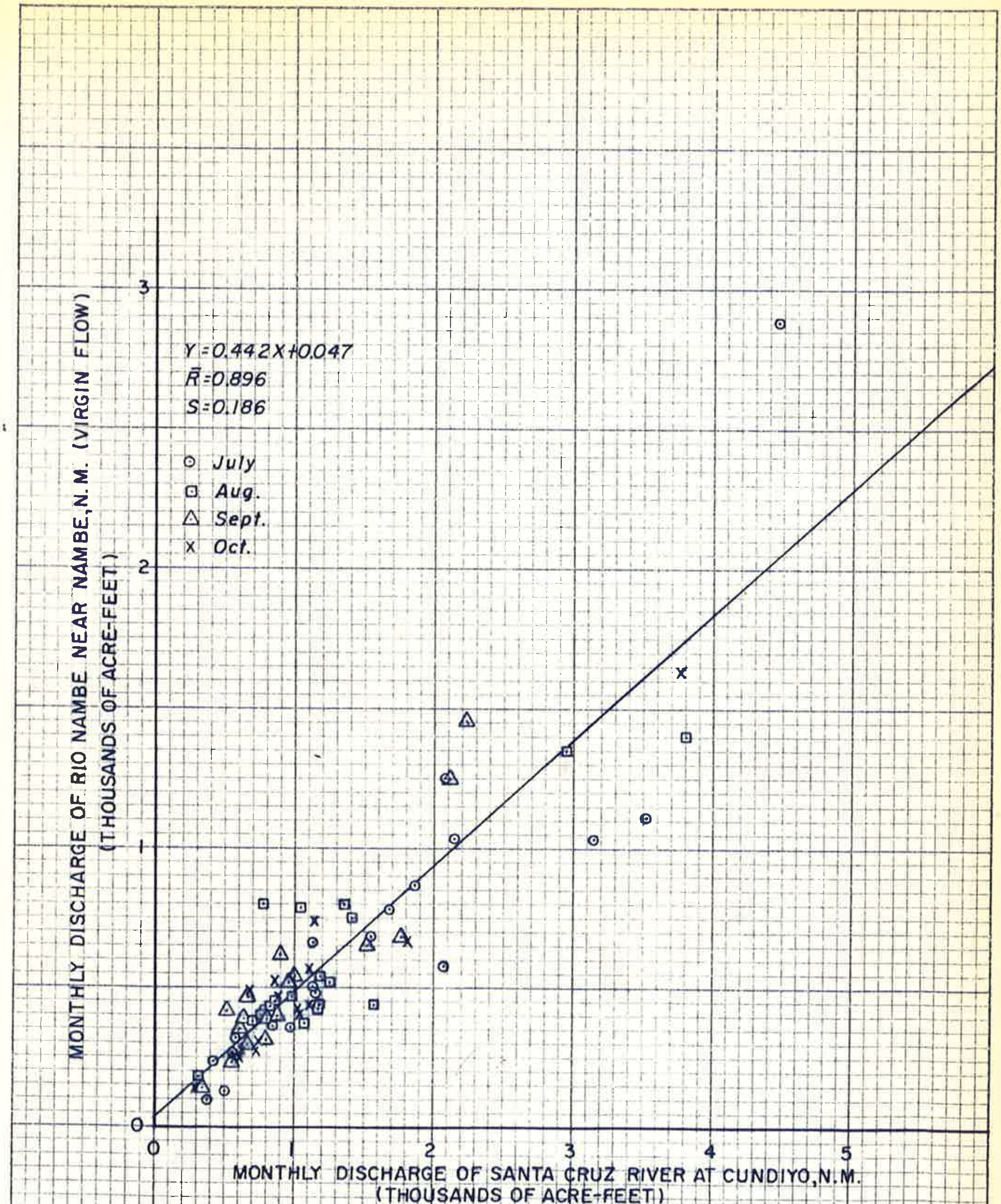


SAN JUAN-CHAMA PROJECT, COLO.-N.M.

DISCHARGE CORRELATION

RIO NAMBE Nr. NAMBE, N.M.
(VIRGIN FLOW)
Vs.
SANTA CRUZ RIVER At CUNDIYO, N.M.
(FEBRUARY THRU JUNE)

FIGURE A-2



SAN JUAN-CHAMA PROJECT, COLO.-N.M.

DISCHARGE CORRELATION

RIO NAMBE Nr. NAMBE, N.M.
(VIRGIN FLOW)
Vs.
SANTA CRUZ RIVER At CUNDIYO, N.M.
(JULY THRU OCTOBER)

FIGURE A-3

Table A-2. Runoff of Rio Nambe at Nambe Falls, New Mexico
(Unit - 1,000 acre-ft) Drainage area 34.6 sq. mi. Pojoaque Unit

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1935 1/	0.24	0.18	0.26	0.55	1.75	3.33	0.91	1.19	1.11	0.51	0.33	0.27	10.63
1936	0.21	0.18	0.27	0.86	1.48	0.70	0.42	0.67	0.54	0.65	0.44	0.27	6.69
1937	0.26	0.24	0.31	1.31	2.01	1.84	0.92	0.46	0.48	0.41	0.28	0.25	8.77
1938	0.17	0.15	0.24	0.57	1.27	0.87	0.58	0.37	0.58	0.58	0.37	0.28	6.03
1939	0.27	0.20	0.45	1.02	1.34	0.65	0.31	0.35	0.35	0.36	0.23	0.19	5.72
1940	0.20	0.19	0.43	0.92	1.89	1.21	0.44	0.40	0.36	0.39	0.27	0.25	6.95
1941	0.22	0.22	0.45	0.97	5.81	5.11	2.56	1.24	1.28	1.44	1.03	0.56	20.89
1942	0.45	0.27	0.41	2.88	4.44	2.98	0.76	0.38	0.61	0.36	0.27	0.24	14.05
1943	0.27	0.23	0.27	0.88	1.26	0.64	0.32	0.34	0.28	0.25	0.19	0.23	5.16
1944	0.19	0.17	0.21	0.49	2.17	1.78	1.11	0.70	0.38	0.46	0.31	0.24	8.21
1945	0.25	0.22	0.45	1.20	3.10	1.84	0.69	0.39	0.37	0.27	0.20	0.17	9.15
1946	0.18	0.13	0.21	0.74	0.66	0.27	0.29	0.71	0.36	0.43	0.34	0.28	4.60
1947	0.24	0.18	0.24	0.40	1.20	0.53	0.23	0.38	0.26	0.25	0.21	0.18	4.30
1948	0.16	0.16	0.23	0.92	2.03	1.55	0.60	0.41	0.21	0.21	0.19	0.18	6.85
1949	0.17	0.16	0.20	0.55	1.65	1.69	0.99	0.71	0.37	0.31	0.22	0.14	7.16
1950	0.18	0.14	0.17	0.34	0.34	0.25	0.21	0.16	0.13	0.13	0.08	0.06	2.19
1951	0.05	0.06	0.09	0.20	0.50	0.20	0.09	0.48	0.42	0.26	0.21	0.19	2.75
1952	0.21	0.14	0.26	0.94	2.28	1.91	0.63	0.42	0.34	0.26	0.20	0.20	7.79
1953	0.23	0.16	0.27	0.46	1.27	1.13	0.63	0.32	0.23	0.24	0.22	0.19	5.35
1954	0.19	0.13	0.19	0.55	0.88	0.43	0.42	0.40	0.27	0.25	0.18	0.17	4.06
1955	0.19	0.15	0.14	0.26	0.96	0.67	0.61	1.28	0.75	0.34	0.24	0.25	5.84
1956	0.21	0.15	0.21	0.23	0.30	0.12	0.18	0.15	0.10	0.14	0.11	0.12	2.02
1957	0.14	0.11	0.18	0.74	1.60	1.80	0.94	1.70	1.02	0.57	0.48	0.36	9.64
1958	0.28	0.21	0.37	1.83	4.23	2.47	0.72	0.49	0.42	0.36	0.26	0.23	11.87
1959	0.18	0.10	0.13	0.28	0.64	0.40	0.29	0.71	0.29	0.28	0.20	0.18	3.68
1960	0.20	0.12	0.90	1.78	1.61	1.45	1.06	0.53	0.33	0.32	0.22	0.19	8.71
1961	0.19	0.12	0.19	0.84	1.44	0.90	0.53	0.74	0.55	0.40	0.31	0.24	6.45
1962	0.21	0.20	0.26	1.17	1.62	0.54	0.47	0.28	0.24	0.27	0.22	0.20	5.68
1963	0.19	0.15	0.45	0.97	1.10	0.57	0.30	0.46	0.60	0.31	0.24	0.21	5.55
2/													
MEAN	0.21	0.17	0.29	0.86	1.75	1.30	0.63	0.58	0.46	0.38	0.28	0.22	7.13

1/88.5% of Rio Nambe near Nambe, New Mexico (virgin flow).
2/Recorded Rio Nambe at Nambe Falls, New Mexico.

The maximum discharge during this period was 4,700 c.f.s. on July 15, 1938. Comparing this with the comparable discharge of the Rio Nambe near Nambe of about 775 c.f.s., indicates that tributaries between the Nambe and Pojoaque gages contribute considerably to the flood peaks at the Pojoaque gage. However, these flood flows probably contribute only a minor volume to the flow of the river and were not considered as part of the available supply since they are unpredictable and erratic.

No discharge records are available for the Rio Tesuque at its mouth, but records are available for the Rio Tesuque above diversions near Santa Fe, New Mexico, from March 1936 through calendar year 1951. Inspection of these records and all available diversion records indicates that very little surface flow which can be diverted downstream reaches the mouth of Rio Tesuque. The Rio Tesuque was not considered as a part of the water supply. If under project conditions any tributary inflow is useable, the water supply study would be conservative.

The following tabulation lists the drainage areas and periods of stream records at various pertinent locations:

Location	Drainage area (square miles)	Period of record
Nambe Falls damsite	34.6 1/	None
Rio Nambe at Nambe Falls	34.6	March 1963-date
Rio Nambe near Nambe	39.1	October 1932-September 1951
Pojoaque Creek at Pojoaque Bridge	92. 2/	March 1936-September 1941
Rio Tesuque at mouth	79. 2/	None
Pojoaque River below Rio Tesuque	173. 2/	None

1/Assumed equal to Rio Nambe at Nambe Falls.
2/Approximate.

Diversion records are available for 17 of the 24 canals diverting from the Rio Nambe, Pojoaque Creek, and the Pojoaque River system from April 1936 through 1950. No winter records are available after December 1941. Estimates of the diversions of the 5 ungaged canals (Oak and Old Bernardino ditches not included because abandoned) were made using a ratio of the capacity of the ungaged ditch to the capacity of the gaged ditches immediately upstream and downstream.

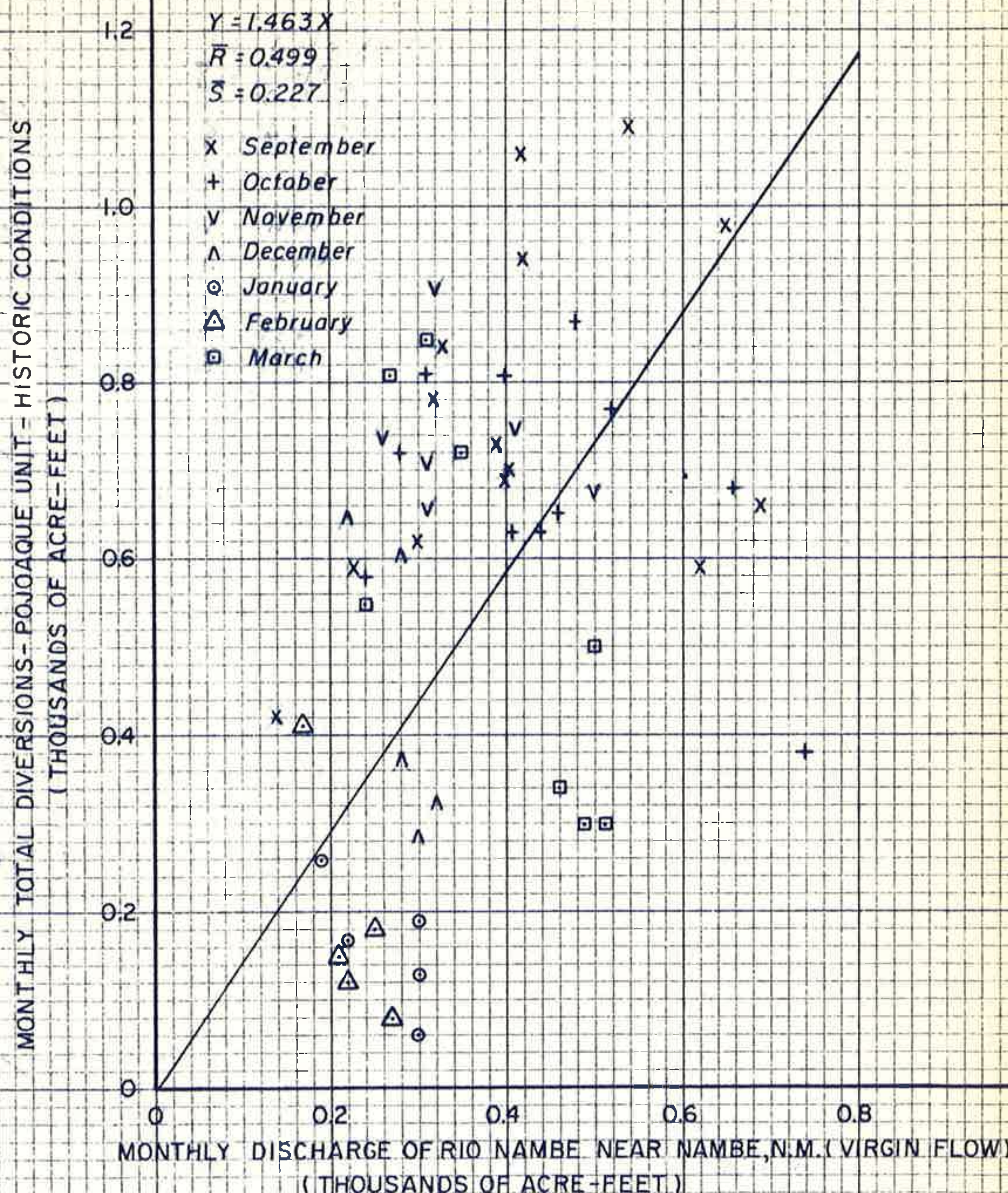
The diversion record of the 22 canals was extended back to 1935 and forward through calendar year 1963 by the use of correlations relating the total diversions with the virgin flow of the Rio Nambe near Nambe. These correlations are shown graphically in Figures A-4 through A-6, and the estimated monthly diversions are tabulated in Table A-3.

<u>Climatic Conditions</u>

Precipitation on the project area has been measured at two locations--Nambe 1 and Nambe 2. The record at Nambe 1 began April 1947 and continues to date, while the record at Nambe 2 began in 1942 and continued through February 1950.

The station at Nambe 1 is more centrally located and was considered to be representative of the entire project area. The record for Nambe 1 was extended back to 1935 in the following manner: the monthly precipitation at Nambe 2 was used whenever possible; if Nambe 2 records were missing, 96 percent of the monthly precipitation at Espanola was used; and if both Nambe 2 and Espanola records were missing, 69 percent of the monthly precipitation at Santa Fe was used.

The average monthly temperatures for the project were taken from the Nambe-Pojoaque-Tesuque Hydrographic Survey Report of the

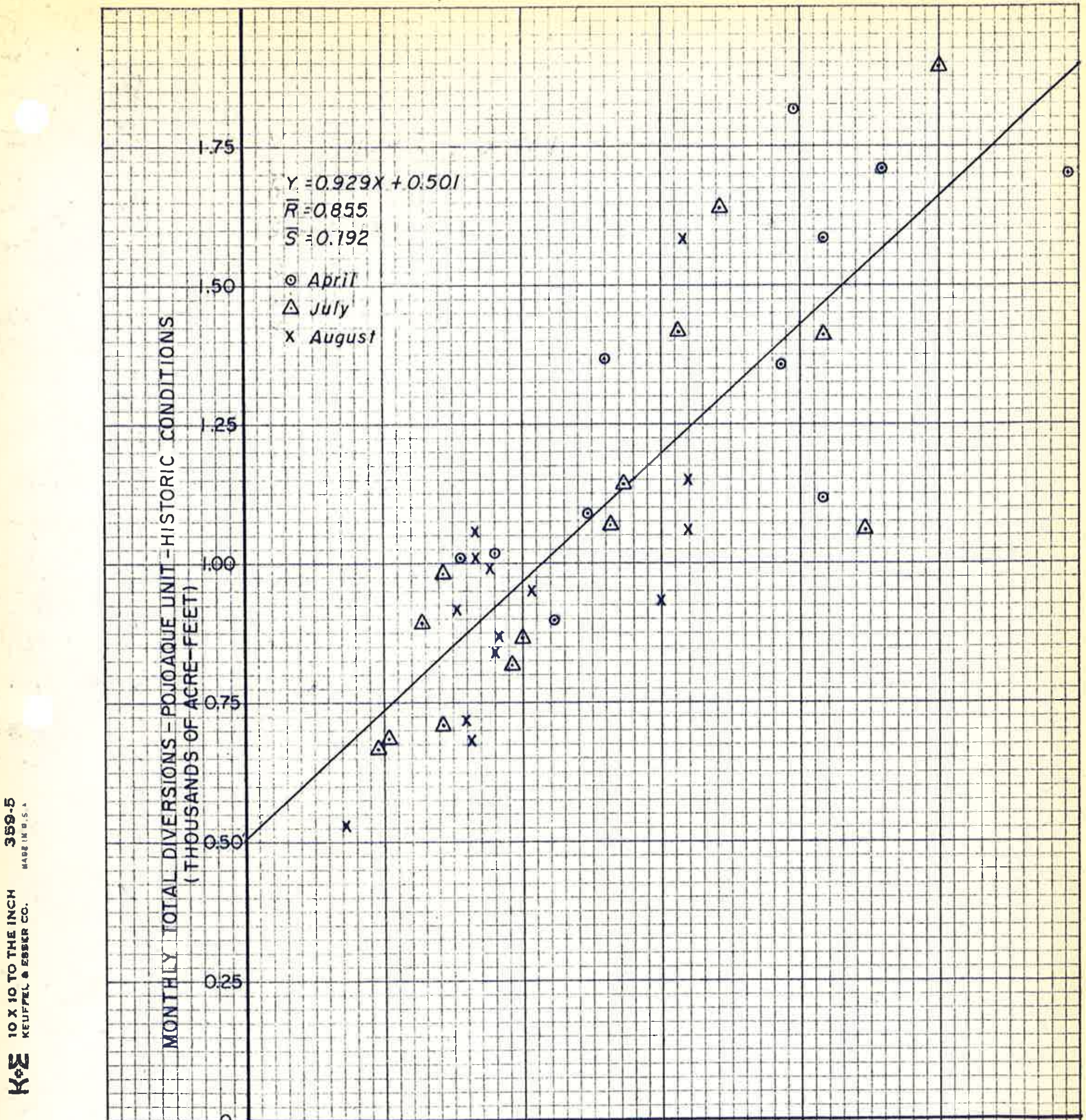


SAN JUAN-CHAMA PROJECT, COLO.-N.M.

DIVERSION CORRELATION

TOTAL DIVERSIONS-POJOAQUE UNIT
Vs.
RIO NAMBE Nr. NAMBE, N.M.
(VIRGIN FLOW)
SEPTEMBER THRU MARCH

FIGURE A-4



SAN JUAN-CHAMA PROJECT, COLO-N.M.

DIVERSION CORRELATION

TOTAL DIVERSIONS-POJOAQUE UNIT
Vs.
RIO NAMBE Nr. NAMBE, N.M.
(VIRGIN FLOW)
APRIL-JULY-AUGUST

FIGURE A-5

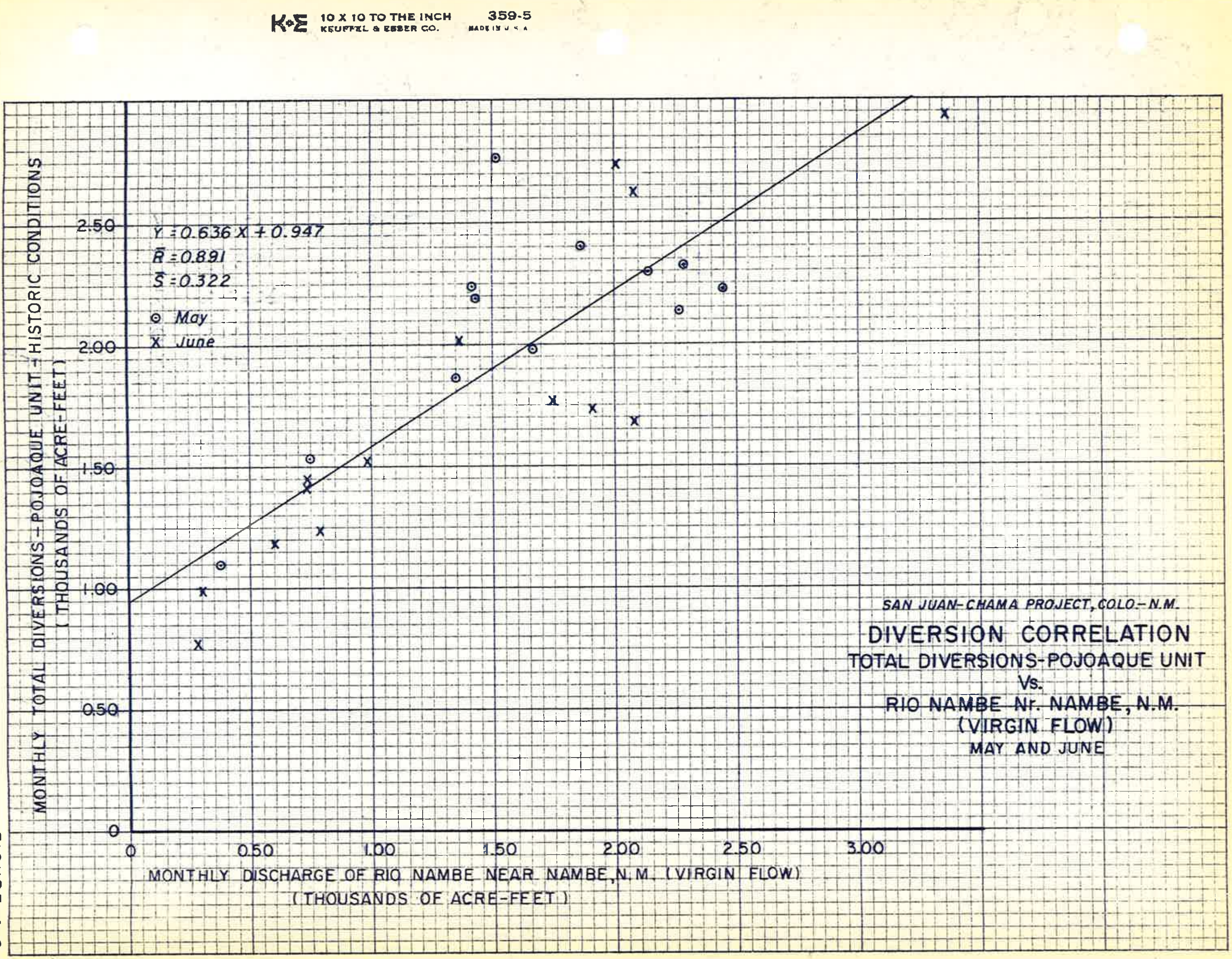

K+E 10 X 10 TO THE INCH KEUFFEL & ESSER CO.
359-5
Y = 0.636 X + 0.947
R̄ = 0.891
S̄ = 0.322
⊙ May
X June
2.50
2.00
1.50
1.00
0.50
0
0.50
1.00
1.50
2.00
2.50
3.00
MONTHLY TOTAL DIVERSIONS - POJOAQUE UNIT - HISTORIC CONDITIONS
(THOUSANDS OF ACRE-FEET)
MONTHLY DISCHARGE OF RIO NAMBE NEAR NAMBE, N.M. (VIRGIN FLOW)
(THOUSANDS OF ACRE-FEET)
SAN JUAN-CHAMA PROJECT, COLO.-N.M.
DIVERSION CORRELATION
TOTAL DIVERSIONS-POJOAQUE UNIT
Vs.
RIO NAMBE Nr. NAMBE, N.M.
(VIRGIN FLOW)
MAY AND JUNE

FIGURE A-6

Table A-3. Total historic diversions--Pojoaque Unit.
(Unit - 1,000 acre-feet)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1935 1/	0.39	0.30	0.43	1.07	2.21	3.34	1.46	1.76	1.83	0.84	0.55	0.45	14.63
1936	0.35	0.29	0.45	1.36	1.98	1.24	0.82	0.93	0.59	0.38	0.67	0.39	9.45
1937 2/	0.06	0.08	0.72	1.70	2.14	1.68	1.41	0.95	1.09	0.65	0.90	0.61	11.99
1938	0.26	0.41	0.81	1.37	2.19	1.52	1.07	1.01	0.98	0.68	0.74	0.33	11.37
1939	0.19	0.12	0.50	1.71	2.76	1.41	0.71	0.72	0.73	0.81	0.73	0.65	11.04
1940	0.17	0.15	0.30	1.58	2.30	2.01	0.87	0.84	0.69	0.63	0.70	0.38	10.62
1941	0.13	0.18	0.30	0.57	1.44	2.49	2.42	1.71	1.03	0.19	0.54	0.46	11.46
1942 1/	0.74	0.45	0.34	0.85	0.24	2.94	1.64	1.06	0.66	0.63	0.65	0.39	10.59
1943	0.44	0.37	0.85	1.82	2.24	1.45	0.98	0.92	0.78	0.72	0.32	0.38	11.27
1944	0.32	0.28	0.55	0.90	2.22	2.74	1.89	1.58	1.06	0.77	0.52	0.39	13.22
1945	0.41	0.37	0.74	1.76	3.17	2.62	1.42	0.99	0.84	0.81	0.33	0.28	13.74
1946	0.29	0.22	0.35	1.28	1.53	0.99	0.89	1.06	0.70	0.87	0.73	0.46	9.37
1947	0.39	0.30	0.39	1.02	1.86	1.19	0.68	0.68	0.62	0.42	0.34	0.30	8.19
1948	0.27	0.26	0.38	1.12	2.32	1.77	1.14	0.87	0.59	0.58	0.31	0.30	9.91
1949	0.29	0.26	0.32	1.09	2.40	1.74	1.06	1.15	0.94	0.51	0.36	0.23	10.35
1950	0.31	0.24	0.28	1.01	1.10	0.77	0.67	0.53	0.42	0.22	0.14	0.10	5.79
1951	0.09	0.10	0.14	0.71	1.31	1.09	0.60	1.00	0.69	0.43	0.34	0.31	6.81
1952	0.35	0.23	0.43	1.49	2.59	2.32	1.16	0.94	0.57	0.42	0.32	0.32	11.14
1953	0.38	0.26	0.44	0.98	1.86	1.76	1.16	0.84	0.37	0.40	0.37	0.31	9.13
1954	0.31	0.22	0.31	1.08	1.58	1.26	0.94	0.92	0.44	0.41	0.31	0.28	8.06
1955	0.31	0.25	0.24	0.78	1.64	1.43	1.14	1.85	1.23	0.56	0.40	0.41	10.24
1956	0.35	0.25	0.34	0.74	1.17	1.03	0.69	0.66	0.16	0.22	0.19	0.19	5.99
1957	0.24	0.18	0.30	1.28	2.10	2.24	1.49	2.28	1.69	0.93	0.79	0.60	14.12
1958	0.46	0.34	0.62	2.42	3.99	2.72	1.26	1.02	0.69	0.60	0.43	0.38	14.93
1959	0.30	0.17	0.21	0.80	1.40	1.23	0.81	1.25	0.48	0.46	0.32	0.30	7.73
1960	0.33	0.19	1.48	2.38	2.10	1.99	1.62	1.06	0.54	0.53	0.36	0.32	12.90
1961	0.31	0.20	0.32	1.39	1.98	1.59	1.06	1.28	0.91	0.67	0.51	0.40	10.62
1962	0.34	0.33	0.44	1.73	2.11	1.33	1.00	0.80	0.39	0.44	0.36	0.33	9.60
1963	0.32	0.25	0.74	1.52	1.74	1.36	0.82	0.98	0.99	0.51	0.39	0.35	9.97
MEAN	0.31	0.25	0.47	1.29	1.99	1.77	1.13	1.09	0.78	0.56	0.47	0.38	10.49
MEAN 3/	(0.16)	(0.19)	(0.55)	(1.24)	(1.91)	(1.77)	(1.18)	(1.00)	(0.78)	(0.64)	(0.71)	(0.47)	(10.60)

1/Correlation with sum of Rio Nambe near Nambe, and Nambe canal near Nambe.
2/ Sum of the recorded diversions of 17 canals and estimated diversions of 5 canals.
3/Based on recorded diversions.

New Mexico State Engineer Office and are based on 1938-65 averages for the Espanola weather station.

The mean monthly values of precipitation and temperature for the project are listed below:

Month	Average precipitation[1/] (inches)	Mean temperature[2/] (°F)
January----------	0.42	28.5
February---------	0.48	34.5
March------------	0.47	41.2
April------------	0.55	50.9
May--------------	0.88	59.4
June-------------	0.55	68.3
July-------------	1.34	72.9
August-----------	1.51	70.8
September--------	1.12	63.8
October----------	1.01	52.1
November---------	0.48	39.2
December---------	0.46	31.9
ANNUAL-----------	9.27	51.1

1/Average for period 1935-63 at Nambe 1.
2/Average for period 1938-65 at Espanola.

The maximum annual precipitation was 14.07 inches in 1941, or 152 percent of the average annual precipitation; and the minimum annual precipitation was 3.04 inches in 1956, or 33 percent of the average annual precipitation. There are on an average 26 days which have 0.1 inch or more precipitation, and 4 days which have 0.5 inch or more precipitation.

The beginning and ending dates for the frost-free period, May 12-October 3, and the growing season, April 1-October 20, were obtained from the Hydrographic Survey Report. The average frost-free period is 145 days, and the average growing season is 203 days.

The maximum temperature at Espanola of 106°F occurred in July, and the minimum temperature of -23°F occurred in January.

Consumptive Use Requirement

The consumptive use requirement for the various crops was computed by the Blaney-Criddle method. The growing season for each crop and the seasonal consumptive use coefficient (K) were taken from the Hydrographic Survey Report. Monthly consumptive use coefficients (k) were taken from the New Mexico State Engineer Technical Report 32, "Consumptive Use and Water Requirements in New Mexico," and then adjusted so that the total monthly use would equal the use computed from the seasonal coefficients. The seasonal coefficients are shown in Table A-4.

Table A-4. Seasonal consumptive use coefficients (K).

Crop	Growing season: Frost period	Growing season: Frost-free period
Alfalfa	0.50	0.85
Planted pasture	0.50	0.80
Native and planted pasture and hay	0.50	0.75
Native pasture	0.50	0.70
Orchard	0.40	0.65
Corn	0.40 1/	0.75
Gardens and Chili	0.40 1/	0.68
Spring grains	0.70	0.70

1/Use on preplanting irrigation.

The monthly consumptive use factors (f) were computed as shown in the following tabulation:

Monthly consumptive use factors

Month	Mean temperature (°F) (t)	Monthly percent of day-time hours of the year 1/ (p)	Monthly consumptive use factor (t)(p)/100 (f)
January----------	28.5	6.99	1.99
February---------	34.5	6.86	2.37
March-----------	41.2	8.35	3.44
April------------	50.9	8.85	4.50
May--------------	59.4	9.81	5.83
June-------------	68.3	9.83	6.71
July-------------	72.9	9.99	7.28
August-----------	70.8	9.40	6.66
September--------	63.8	8.36	5.33
October----------	52.1	7.85	4.09
November---------	39.2	6.92	2.71
December---------	31.9	6.79	2.17
ANNUAL-----------	51.1	100.0	53.08

1/Latitude: 35°56'.

Irrigation Requirement

The irrigation requirement was computed by subtracting the monthly effective precipitation from the consumptive use requirement. The effective precipitation for each month of the operation study was determined by the standard Bureau procedure using the monthly precipitation at Nambe 1 in accordance with the following tabulation:

Total monthly precipitation (inches)	Monthly effective precipitation 1/ (inches)	
	Incremental portion	Accumulated total
1	0.95	0.95
2	0.90	1.85
3	0.83	2.68
4	0.65	3.33
5	0.45	3.78
6	0.25	4.03

1/Average values from table presented in Volume IV, Chapter 4.1.12 of the Bureau of Reclamation Manual.

Historic Conditions

Sufficient records are available to permit an analysis of historic conditions, during the period April 1936 through March 1941, for a portion of the project area. The area studied was located above the Pojoaque Creek at Pojoaque Bridge gaging station, which was near the middle of the irrigated area.

The inflow to the reach is the virgin flow of the Rio Nambe near Nambe as presented in Table A-1. The outflow from the reach was measured at the Pojoaque Creek gage.

There were 18 canals which diverted within the study reach. Diversion records are available for 11 canals and the diversions for the remaining 5 canals (Oak and Old Bernardino ditches not included) were estimated, as described previously. Diversions during the months of November through March were assumed to be zero as it is believed that most of the diverted water is returned immediately to the river at the first wasteway. A small amount of stock watering may occur, but for the purpose of this study it was considered negligible.

The nonbeneficial depletion for 463 acres of nonproductive land was determined by the Blaney-Criddle method through the use of a vegetative cultural survey made in 1963 and (K) values presented in Table 4, Appendix B, of the report on "Water Supply of the Lower Colorado River Basin," November 1952. The nonbeneficial waste area includes the native vegetation growing along the creek channel and on the ditch banks plus a depletion on and along farmsteads, roads, etc., within the irrigated area. The type of vegetation, acreage, and areal density are shown in the following tabulation.

	Vegetation and type	Acres	Average areal density (%)
C-5	Cottonwood, low density	10	46
C-6	Cottonwood, medium density	13	69
C-7	Cottonwood, high density	70	100
E-7	Elm, high density	1	100
Mx-5	Mixed, low density	2	50
Mx-6	Mixed, medium density	2	66
W-6	Willow, medium density	23	64
W-7	Willow, high density	23	96
Subtotal		144	
River channel		157	
Farmsteads, roads, etc.		162	
TOTAL		463	

An average weighted (K) value of 0.68 was computed by assuming the following annual (K) values:

Type	Blaney (K) values
River channel	0.75
Farmsteads, etc.	0.40
Vegetation, low density	0.73
Vegetation, medium density	0.83
Vegetation, high density	1.00
Weighted	0.68

The nonbeneficial consumptive waste was 3.00 feet. It was assumed to be distributed monthly in a pattern similar to the use of alfalfa. The annual depletion of the 463 acres after the correction for use of precipitation was 2.30 feet, or 1,064 acre-feet.

The tributary inflow within the reach was determined by a "graphical scalping" process utilizing the hydrograph of daily flows at the Pojoaque gage. The tributary flows as computed represent that portion of the total inflow which reached the outflow station.

It was assumed, for this analysis and all subsequent analyses, that no tributary inflow entering the river below the Rio Nambe gage would be available for diversion. Twenty-five percent of the annual tributary inflow occurs during the nonirrigation season and is, therefore, not useable. Another 30 percent of the annual tributary inflow occurs during the summer thunderstorm season, July through October, as flood flows having high peak discharges and short durations. It is believed that only a small amount could be diverted. The remaining 45 percent occurs during April, May, and June, the spring snowmelt season. The spring tributary inflow becomes available at a more or less uniform rate and undoubtedly could be partially diverted. However, less accurate relationships than those previously presented were derived when an attempt was made to relate the diversions to the river flow plus tributary inflow. The assumption of no useable tributary inflow below the Rio Nambe gage results in a conservative estimate of the available water supply.

From the analysis of the data available, it was obvious that the return flow was high and, consequently, the overall irrigation efficiency was poor. The overall irrigation efficiency, or the percent of water diverted that could be consumptively used by the crops, was computed to be 36 percent. A summary of the annual historic conditions is shown in Table A-5, and the monthly conditions are shown in Table A-6.

Examination of the monthly studies shows that a considerable portion of the diversions are rediverted. The monthly computation of net

Table A-5 Summary--historic conditions
Rio Nambe gage-Pojoaque Creek gage
Pojoaque Unit.
(Unit - acre-feet)

Period	Outflow	Inflow	Diversions	Tributary inflow	Nonbeneficial consumptive waste	Net return flow	Overall irrigation efficiency (%)
4/36-3/37	4,713	7,728	5,692	532	1,064	3,209	43.6
4/37-3/38	7,340	9,632	7,764	2,285	1,031	4,218	45.7
4/38-3/39	6,718	7,205	6,868	2,526	1,066	4,921	28.3
4/39-3/40	4,030	6,358	6,797	738	1,139	4,870	28.4
4/40-3/41	5,158	7,932	6,592	451	1,021	4,388	33.4
5-year average	5,592	7,771	6,743	1,307	1,064	4,321	35.9*

*Rounded to 36.0

Table A-6. Historic conditions--Rio Nambe gage-Pojoaque Creek gage
April 1936 through March 1941
Pojoaque Unit
(Unit - acre-feet)

Year	Month	Outflow	Inflow	Diversions	Tributary inflow	Nonbeneficial consumptive use	Net return flow
1936	April--------	380	968	1,002	0	95	509
	May----------	585	1,670	1,535	0	[illegible]	559
	June---------	51	788	1,051	0	[illegible]	513
	July---------	47	475	683	0	164	419
	August-------	646	753	679	296	174	[illegible]
	September----	408	615	491	54	59	[illegible]
	October------	709	738	251	97	65	[illegible]
	November-----	407	499	-	85	55	-122
	December-----	430	302	-	0	29	157
1937	January------	525	298	-	0	30	257
	February-----	337	269	-	0	30	98
	March--------	188	353	-	0	55	-110
	TOTAL--------	4,713	7,728	5,692	532	1,064	3,209
	April--------	1,090	1,480	1,290	314	88	674
	May----------	1,810	2,270	1,633	609	61	[illegible]
	June---------	1,970	2,080	1,425	688	129	[illegible]
	July---------	294	1,040	1,201	66	223	612
	August-------	102	521	799	17	180	543
	September----	129	544	938	26	72	569
	October------	862	465	478	565	69	379
	November-----	64	317	-	0	53	-200
	December-----	290	277	-	0	37	50
1938	January------	421	194	-	0	42	269
	February-----	208	173	-	0	25	60
	March--------	100	271	-	0	52	-119
	TOTAL--------	7,340	9,632	7,764	2,285	1,031	4,218

Continued--

Table A-6.(continued)--

Year	Month	Outflow	Inflow	Diversions	Tributary inflow	Nonbeneficial consumptive use	Net return flow
1938 (cont'd)	April-------	180	646	1,128	127	87	622
	May---------	464	1,430	1,815	276	133	706
	June--------	544	987	1,255	311	162	663
	July--------	1,160	656	736	855	179	564
	August------	94	421	771	0	191	635
	September---	618	650	689	225	91	523
	October-----	726	656	474	188	54	410
	November----	792	412	-	390	11	1
	December----	587	321	-	154	34	146
1939	January-----	478	302	-	0	20	196
	February----	455	220	-	0	33	268
	March-------	620	504	-	0	71	187
	TOTAL-------	6,718	7,205	6,868	2,526	1,066	4,921
	April-------	1,010	1,150	1,192	220	73	905
	May---------	407	1,520	2,198	145	147	1,087
	June--------	200	735	1,154	55	209	773
	July--------	370	355	522	187	190	540
	August------	109	399	558	0	196	464
	September---	158	392	541	0	96	403
	October-----	222	400	632	81	54	427
	November----	34	265	-	0	40	-191
	December----	175	218	-	0	42	-1
1940	January-----	334	224	-	0	41	151
	February----	349	212	-	0	28	165
	March-------	662	488	-	50	23	147
	TOTAL-------	4,030	6,358	6,797	738	1,139	4,870

Continued--

Table A-6 (continued)--

Year	Month	Outflow	Inflow	Diversions	Tributary inflow	Nonbeneficial consumptive use	Net return flow
1940 (cont'd)	April-------	420	1,040	1,116	30	88	554
	May---------	1,630	2,140	1,652	217	108	1,033
	June--------	272	1,370	1,570	0	204	676
	July--------	34	500	693	0	213	440
	August------	37	447	643	0	182	415
	September---	244	404	508	97	84	335
	October-----	456	438	410	24	65	469
	November----	162	309	-	0	3	-144
	December----	414	280	-	0	4	138
1941	January-----	435	246	-	0	26	215
	February----	361	251	-	0	21	131
	March-------	693	507	-	83	23	126
	TOTAL-------	5,158	7,932	6,592	451	1,021	4,388

return flow shows that the return flow occurs almost simultaneously with the diversion. The return flow during the irrigation season amounted to 91 percent of the computed annual net return flow.

It is estimated that the present farm irrigation efficiency is approximately 50 percent. This is the same efficiency as was used in the Hydrographic Survey Report. Using an overall efficiency of 36 percent as determined from the historic condition study and the 50 percent average farm irrigation efficiency, results in a distribution efficiency of 72 percent. The distribution efficiency would be considerably lower if rediversion did not occur.

Present Conditions

The present land use is comprised primarily of small supplemental-income farms, whose owners work in Santa Fe or at Los Alamos and only farm to supplement their salaried incomes. The predominant irrigated crops, alfalfa, planted or native pasture, and hay, amount to about 67 percent of the total irrigated acreage.

The general practice in the area is to build up the soil moisture during the spring snowmelt runoff and to use this soil moisture during the summer months when the surface supply is limited.

The New Mexico State Engineer completed a crop survey of the Pojoaque area in 1963. The acreages and crop distribution determined from the survey were assumed to be representative of present conditions and are as follows:

Crop	Area (acres)	Percent
Alfalfa----------------------------	665	36.1
Planted pasture--------------------	197	10.7
Native & planted pasture & hay----	95	5.2
Native pasture--------------------	274	14.8
Orchard----------------------------	200	10.8
Corn-------------------------------	113	6.1
Gardens----------------------------	131	7.1
Small grains-----------------------	169	9.2
TOTAL IRRIGATED--------------------	1,844	100.0

Consumptive use requirement. The monthly consumptive use requirement for the growing season was computed for the Pojoaque area using the above crop distribution and is shown in Table A-7. The average annual consumptive use requirement was computed to be 24.84 inches, or 2.07 feet.

Irrigation requirement. The average annual effective precipitation for 1935 through 1963 was computed to be 8.58 inches, or 92.6 percent of the average annual precipitation. The effective precipitation during the growing season was 5.28 inches, or 0.44 feet.

The monthly irrigation requirement for the growing season was obtained by subtracting the effective precipitation from the consumptive use requirement. The average annual irrigation requirement was computed to be 19.56 inches, or 1.63 feet.

Diversion demand. The average annual diversion demand is computed by adding the farm and distribution losses to the crop irrigation requirement.

Present conditions are assumed to have the same farm irrigation efficiency, 50 percent, and distribution system efficiency, 72 percent, as the historic conditions. The overall efficiency would equal 36 percent.

Table A-7. Present conditions--consumptive use requirement.
Pojoaque Unit

Crop and growing season	Percent of area	April (k)	April Use (inch)	May (k)	May Use (inch)	June (k)	June Use (inch)	July (k)	July Use (inch)	August (k)	August Use (inch)	September (k)	September Use (inch)	October (k)	October Use (inch)	Season (K)	Season Use (inch)
Alfalfa:	36.1																
FP 1/ 4/11-5/11		0.50	1.50	0.50	1.03											0.50	2.53
FFP 2/ 5/12-10/3				0.74	2.80	0.84	5.62	0.93	6.78	0.93	6.20	0.74	3.96	0.65	0.26	0.85	25.62
FP 10/4-10/11														0.50	0.53	0.50	0.53
																0.79	28.68
Planted pasture:	10.7																
FP 4/1-5/11		0.50	2.25	0.50	1.04											0.50	3.29
FFP 5/12-10/3				0.68	2.56	0.78	5.23	0.88	6.37	0.88	5.83	0.73	3.89	0.58	0.23	0.80	24.11
FP 10/4-10/20														0.50	1.12	0.50	1.12
																0.73	28.52
Native and planted pasture plus hay:	5.2																
FP 4/1-5/11		0.50	2.25	0.50	1.04											0.50	3.29
FFP 5/12-10/3				0.64	2.40	0.73	4.90	0.82	5.97	0.82	5.46	0.68	3.65	0.55	0.22	0.75	22.60
FP 10/4-10/20														0.50	1.12	0.50	1.12
																0.69	27.01
Native pasture:	14.8																
FP 4/11-5/11		0.50	1.50	0.50	1.03											0.50	2.53
FFP 5/12-10/3				0.61	2.31	0.69	4.63	0.77	5.58	0.77	5.10	0.61	3.27	0.52	0.21	0.70	21.10
FP 10/4-10/11														0.50	0.53	0.50	0.53
																0.67	24.16
Orchard:	10.8																
FP 4/21-5/11		0.40	0.60	0.40	0.83											0.40	1.43
FFP 5/12-10/3				0.59	2.21	0.72	4.80	0.74	5.40	0.72	4.77	0.42	2.24	0.42	0.17	0.65	19.59
FP 10/4-10/20														0.40	0.90	0.40	0.90
																0.61	21.92
Corn:	6.1																
PPI 3/ 5/11-5/15				0.40	0.39											0.40	0.39
5/16-9/20				0.51	1.50	0.72	4.83	0.82	5.99	0.82	5.48	0.72	2.55			0.75	20.35
																0.74	20.74
Gardens and chili:	7.1																
PPI 4/26-4/30		0.40	0.30													0.40	0.30
5/1-10/3				0.50	2.92	0.67	4.50	0.78	5.68	0.78	5.19	0.64	3.41	0.50	0.20	0.68	21.90
																0.67	22.20
Spring grains:	9.2																
4/1-7/10		0.43	1.93	0.54	3.14	0.97	6.48	0.86	2.03							0.70	13.58
Weighted consumptive use requirement:																	
Inches			1.38		3.38		5.26		5.80		5.12		3.16		0.74	0.72	24.84
Feet																	2.07

1/FP = frost period. 2/FFP = frost-free period. 3/PPI = preplanting irrigation

The following tabulation presents the derivation of the diversion demand for present conditions:

	Acre-feet per acre
Crop consumptive use----------------------------------	2.07
Effective precipitation-------------------------------	-0.44
Crop irrigation requirement---------------------------	1.63
Farm waste and deep percolation losses (50%)------	1.63
Farm delivery demand----------------------------------	3.26
Distribution system losses (28%)------------------	1.27
Diversion demand--------------------------------------	4.53

Operation study. The present condition operation study was computed from recorded and estimated discharge and diversion records. It was assumed that the historic water supply represents present conditions. The irrigated acreage, 1,844 acres, determined from the 1963 crop survey was assumed representative of present conditions. The study was computed in the following manner:

1. The inflow to the irrigated area is equal to the virgin flow of the Rio Nambe near Nambe (presented in Table A-1).

2. The divertible flow is equal to the measured or estimated historic diversions for the months of April through October (presented in Table A-3).

3. The diversion demand was computed monthly by subtracting the monthly effective precipitation from the average monthly crop consumptive use and then correcting for farm and distribution losses.

4. The diversion was assumed equal to the diversion demand plus a quantity necessary for proper operation of the soil moisture reservoir. The diversion was limited to the divertible flow. Although there are about 10 days in October outside of the growing season, the divertible flow for the entire month was used if necessary to refill the soil moisture reservoir.

5. The soil moisture reservoir was operated so as to be maintained half full whenever possible. Any water stored in the soil moisture reservoir is useable during periods of limited water supply. The soil moisture reservoir varies with the individual crops. For the cropping pattern used for present conditions, the average soil moisture reservoir was assumed to be about 6.3 inches. One-half of the soil moisture reservoir represents a diversion of 1,340 acre-feet.

   Examination of the weather and use data shows that the effective precipitation approximates the winter use and, therefore, no nonirrigation depletion of the soil moisture reservoir occurs.

6. The shortage represents the difference between the diversion demand and the total supply available (river plus soil reservoir) when the diversion demand is the larger.

7. The onsite depletion represents the historic depletion of the water supply by the irrigated area. The depletion is equal to the diversions multiplied by the overall efficiency, 36 percent.

The annual summary of the present condition operation study is shown in Table A-8, and the monthly operation study is shown in Table A-9.

<u>Summary</u>. The average annual diversion demand for the 1,844 acres was 8,360 acre-feet. The maximum annual demand was 9,760 acre-feet in 1956, and the minimum annual demand was 7,170 acre-feet in 1941.

An average annual shortage of 1,120 acre-feet, or 13.4 percent, is estimated to occur under present conditions. The lands received a full supply in only 5 of the 29 years. The maximum annual shortage of 4,430 acre-feet occurred in 1956. This shortage represents 45.4 percent. The maximum shortage for 2 consecutive years totaled 73.6 percent in 1950 and 1951.

Table A-8. ANNUAL SUMMARY--OPERATION STUDY--PRESENT CONDITIONS

POJOAQUE UNIT

(Unit – 1,000 Acre-feet)

YEAR		Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (–) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
1935		12.01	12.51	8.37	8.92	0.55	0.00	0.0	3.21
1936		7.56	7.30	7.93	5.48	-1.16	1.29	16.3	1.97
1937		9.91	9.62	7.36	7.48	0.62	0.50	6.8	2.69
1938		6.82	8.82	8.35	7.54	-0.21	0.60	7.2	2.71
1939		6.46	8.85	9.18	6.93	0.04	2.29	24.9	2.49
1940		7.85	8.92	8.81	7.21	-0.23	1.37	15.6	2.60
1941		23.60	9.85	7.17	8.11	0.94	0.00	0.0	2.92
1942		15.88	8.02	7.83	7.17	-0.29	0.37	4.7	2.58
1943		5.83	8.91	9.10	6.89	-0.53	1.68	18.5	2.48
1944		9.28	11.16	8.32	9.14	0.82	0.00	0.0	3.29
1945		10.34	11.61	9.22	7.99	-0.73	0.50	5.4	2.88
1946		5.20	7.32	7.92	7.10	0.10	0.92	11.6	2.56
1947		4.85	6.47	8.17	5.68	-0.54	1.95	23.9	2.04
1948		7.74	8.39	8.58	7.68	0.31	1.21	14.1	2.76
1949		8.09	8.89	7.38	7.36	-0.02	0.00	0.0	2.65
1950		2.47	4.72	8.50	4.72	-0.46	3.32	39.1	1.70
1951		3.11	5.83	8.58	5.83	0.21	2.96	34.5	2.10
1952		8.80	9.49	7.80	7.45	-0.11	0.24	3.1	2.68
1953		6.05	7.37	8.95	7.37	0.14	1.72	19.2	2.65
1954		4.59	6.63	7.91	6.45	-0.04	1.42	18.0	2.32
1955		6.59	8.63	8.38	8.63	0.46	0.21	2.5	3.11
1956		2.28	4.67	9.76	4.67	-0.66	4.43	45.4	1.68
1957		10.89	12.01	8.27	9.61	1.34	0.00	0.0	3.46
1958		13.41	12.70	8.56	7.12	-0.97	0.47	5.5	2.56
1959		4.16	6.43	7.55	6.41	0.09	1.23	16.3	2.31
1960		9.85	10.22	8.81	8.29	0.07	0.59	6.7	2.98
1961		7.29	8.88	8.80	8.25	-0.10	0.45	5.1	2.97
1962		6.42	7.80	8.66	6.87	-0.16	1.63	18.8	2.47
1963		6.27	7.92	8.31	7.74	0.52	1.09	13.1	2.79
TOTAL		233.60	249.94	242.53	210.09	0.00	32.44	13.4	75.61
MEAN		8.06	8.62	8.36	7.24	0.00	1.12	13.4	2.61

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
	DEC								
	JAN	0.27							
	FEB	0.21							
	MAR	0.29							
	APR	0.62	1.07	0.41	0.96	0.55			0.34
	MAY	1.98	2.21	0.71	0.71				0.26
1935	JUNE	3.76	3.34	2.22	2.22				0.80
	JULY	1.03	1.46	1.99	1.46	-0.53			0.53
	AUG	1.35	1.76	1.68	1.76	0.08			0.63
	SEPT	1.25	1.83	1.10	1.55	0.45			0.56
	OCT	0.57	0.84	0.26	0.26				0.09
	NOV	0.37							
	DEC	0.31							
	TOTAL	12.01	12.51	8.37	8.92	0.55			3.21
	JAN	0.24							
	FEB	0.20							
	MAR	0.31							
	APR	0.97	1.36	0.55	0.55				0.20
	MAY	1.67	1.98	0.97	0.97				0.35
	JUNE	0.79	1.24	2.13	1.24	-0.89			0.45
1936	JULY	0.48	0.82	1.65	0.82	-0.45	0.38		0.29
	AUG	0.75	0.93	1.84	0.93		0.91		0.33
	SEPT	0.61	0.59	0.56	0.59	0.03			0.21
	OCT	0.74	0.38	0.23	0.38	0.15			0.14
	NOV	0.50							
	DEC	0.30							
	TOTAL	7.56	7.30	7.93	5.48	-1.16	1.29	16.3	1.97
	JAN	0.30							
	FEB	0.27							
	MAR	0.35							
	APR	1.48	1.70	0.50	1.66	1.16			0.60
	MAY	2.27	2.14	0.41	0.41				0.15
	JUNE	2.08	1.68	1.31	1.31				0.47
1937	JULY	1.04	1.41	2.29	1.41	-0.88			0.51
	AUG	0.52	0.95	1.91	0.95	-0.46	0.50		0.34
	SEPT	0.54	1.09	0.69	1.09	0.40			0.39
	OCT	0.46	0.65	0.25	0.65	0.40			0.23
	NOV	0.32							
	DEC	0.28							
	TOTAL	9.91	9.62	7.36	7.48	0.62	0.50	6.8	2.69

Table A-9. MONTHLY OPERATION STUDY--PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
1938	DEC								
	JAN	0.19							
	FEB	0.17							
	MAR	0.27							
	APR	0.65	1.37	0.50	1.04	0.54			0.37
	MAY	1.43	2.19	1.24	1.24				0.45
	JUNE	0.99	1.52	1.70	1.52	-0.18			0.55
	JULY	0.66	1.07	1.81	1.07	-0.74			0.39
	AUG	0.42	1.01	2.03	1.01	-0.42	0.60		0.36
	SEPT	0.65	0.98	0.89	0.98	0.09			0.35
	OCT	0.66	0.68	0.18	0.68	0.50			0.24
	NOV	0.41							
	DEC	0.32							
	TOTAL	6.82	8.82	8.35	7.54	-0.21	0.60	7.2	2.71
1939	JAN	0.30							
	FEB	0.22							
	MAR	0.50							
	APR	1.15	1.71	0.40	1.15	0.75			0.41
	MAY	1.52	2.76	1.40	1.40				0.50
	JUNE	0.74	1.41	2.24	1.41	-0.83			0.51
	JULY	0.36	0.71	1.94	0.71	-0.51	0.72		0.26
	AUG	0.40	0.72	2.08	0.72		1.36		0.26
	SEPT	0.39	0.73	0.94	0.73		0.21		0.26
	OCT	0.40	0.81	0.18	0.81	0.63			0.29
	NOV	0.26							
	DEC	0.22							
	TOTAL	6.46	8.85	9.18	6.93	0.04	2.29	24.9	2.49
1940	JAN	0.22							
	FEB	0.21							
	MAR	0.49							
	APR	1.04	1.58	0.50	1.21	0.71			0.44
	MAY	2.14	2.30	0.96	0.96				0.35
	JUNE	1.37	2.01	2.19	2.01	-0.18			0.72
	JULY	0.50	0.87	2.19	0.87	-1.16	0.16		0.31
	AUG	0.45	0.84	1.93	0.84		1.09		0.30
	SEPT	0.40	0.69	0.81	0.69		0.12		0.25
	OCT	0.44	0.63	0.23	0.63	0.40			0.23
	NOV	0.31							
	DEC	0.28							
	TOTAL	7.85	8.92	8.81	7.21	-0.23	1.37	15.6	2.60

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
	DEC								
1941	JAN	0.24							
	FEB	0.25							
	MAR	0.51							
	APR	1.10	0.57	0.34	0.57	0.23			0.21
	MAY	6.56	1.44	0.84	1.44	0.60			0.52
	JUNE	5.78	2.49	1.96	2.07	0.11			0.74
	JULY	2.89	2.42	1.87	1.87				0.67
	AUG	1.40	1.71	1.59	1.59				0.57
	SEPT	1.45	1.03	0.52	0.52				0.19
	OCT	1.63	0.19	0.05	0.05				0.02
	NOV	1.16							
	DEC	0.63							
	TOTAL	23.60	9.85	7.17	8.11	0.94			2.92
1942	JAN	0.51							
	FEB	0.31							
	MAR	0.46							
	APR	3.25	0.85	0.00	0.00				0.00
	MAY	5.02	0.24	1.44	0.24	−1.20			0.08
	JUNE	3.37	2.94	2.13	2.94	0.81			1.06
	JULY	0.86	1.64	2.21	1.64	−0.57			0.59
	AUG	0.42	1.06	1.81	1.06	−0.38	0.37		0.38
	SEPT	0.69	0.66	0.04	0.66	0.62			0.24
	OCT	0.41	0.63	0.20	0.63	0.43			0.23
	NOV	0.31							
	DEC	0.27							
	TOTAL	15.88	8.02	7.83	7.17	−0.29	0.37	4.7	2.58
1943	JAN	0.30							
	FEB	0.26							
	MAR	0.31							
	APR	0.99	1.82	0.59	0.88	0.29			0.32
	MAY	1.42	2.24	1.16	1.16				0.42
	JUNE	0.73	1.45	1.90	1.45	−0.45			0.52
	JULY	0.36	0.98	2.28	0.98	−0.89	0.41		0.35
	AUG	0.38	0.92	1.72	0.92		0.80		0.33
	SEPT	0.32	0.78	1.25	0.78		0.47		0.28
	OCT	0.28	0.72	0.20	0.72	0.52			0.26
	NOV	0.22							
	DEC	0.26							
	TOTAL	5.83	8.91	9.10	6.89	−0.53	1.68	18.5	2.48

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (—) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
	DEC								
	JAN	0.22							
	FEB	0.19							
	MAR	0.24							
	APR	0.56	0.90	0.22	0.90	0.68			0.32
	MAY	2.45	2.22	1.31	1.45	0.14			0.52
1944	JUNE	2.01	2.74	2.14	2.14				0.77
	JULY	1.25	1.89	1.79	1.79				0.65
	AUG	0.79	1.58	1.62	1.58	-0.04			0.57
	SEPT	0.42	1.06	1.24	1.06	-0.18			0.38
	OCT	0.52	0.77	0.00	0.22	0.22			0.08
	NOV	0.36							
	DEC	0.27							
	TOTAL	9.28	11.16	8.32	9.14	0.82			3.29

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (—) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
	JAN	0.28							
	FEB	0.25							
	MAR	0.51							
	APR	1.36	1.76	0.33	0.33				0.12
	MAY	3.50	3.17	1.41	1.41				0.51
	JUNE	2.08	2.62	2.19	2.19				0.79
1945	JULY	0.78	1.42	2.30	1.42	-0.88			0.51
	AUG	0.44	0.99	1.70	0.99	-0.46	0.25		0.36
	SEPT	0.42	0.84	1.09	0.84		0.25		0.30
	OCT	0.31	0.81	0.20	0.81	0.61			0.29
	NOV	0.22							
	DEC	0.19							
	TOTAL	10.34	11.61	9.22	7.99	-0.73	0.50	5.4	2.88

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (—) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
	JAN	0.20							
	FEB	0.15							
	MAR	0.24							
	APR	0.84	1.28	0.53	1.26	0.73			0.46
	MAY	0.75	1.53	1.33	1.33				0.48
	JUNE	0.30	0.99	2.15	0.99	-1.16			0.36
1946	JULY	0.33	0.89	1.94	0.89	-0.18	0.87		0.32
	AUG	0.80	1.06	0.84	1.06	0.22			0.38
	SEPT	0.40	0.70	0.97	0.70	-0.22	0.05		0.25
	OCT	0.48	0.87	0.16	0.87	0.71			0.31
	NOV	0.39							
	DEC	0.32							
	TOTAL	5.20	7.32	7.92	7.10	0.10	0.92	11.6	2.56

Table A-9. MONTHLY OPERATION STUDY--PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (—) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
	DEC								
	JAN	0.26							
	FEB	0.20							
	MAR	0.27							
	APR	0.45	1.02	0.58	1.02	0.44			0.37
	MAY	1.35	1.86	0.88	1.07	0.19			0.38
1947	JUNE	0.60	1.19	2.21	1.19	-1.02			0.43
	JULY	0.26	0.68	2.14	0.68	-0.32	1.14		0.24
	AUG	0.43	0.68	1.21	0.68		0.53		0.25
	SEPT	0.30	0.62	0.90	0.62		0.28		0.22
	OCT	0.29	0.42	0.25	0.42	0.17			0.15
	NOV	0.23							
	DEC	0.21							
	TOTAL	4.85	6.47	8.17	5.68	-0.54	1.95	23.9	2.04
	JAN	0.19							
	FEB	0.18							
	MAR	0.26							
	APR	1.04	1.12	0.47	1.12	0.65			0.40
	MAY	2.29	2.32	1.23	1.75	0.52			0.63
	JUNE	1.75	1.77	1.63	1.63				0.59
1948	JULY	0.68	1.14	2.23	1.14	-1.09			0.41
	AUG	0.46	0.87	1.76	0.87	-0.25	0.64		0.31
	SEPT	0.23	0.59	1.16	0.59		0.57		0.21
	OCT	0.24	0.58	0.10	0.58	0.48			0.21
	NOV	0.21							
	DEC	0.21							
	TOTAL	7.74	8.39	8.58	7.68	0.31	1.21	14.1	2.76
	JAN	0.20							
	FEB	0.18							
	MAR	0.22							
	APR	0.62	1.09	0.38	1.09	0.71			0.39
	MAY	1.87	2.40	1.20	1.35	0.15			0.49
	JUNE	1.91	1.74	1.26	1.26				0.45
1949	JULY	1.12	1.06	1.47	1.06	-0.41			0.38
	AUG	0.80	1.15	1.77	1.15	-0.62			0.42
	SEPT	0.42	0.94	1.03	0.94	-0.09			0.34
	OCT	0.35	0.51	0.27	0.51	0.24			0.18
	NOV	0.24							
	DEC	0.16							
	TOTAL	8.09	8.89	7.38	7.36	-0.02			2.65

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
	DEC								
	JAN	0.21							
	FEB	0.16							
	MAR	0.19							
	APR	0.39	1.01	0.49	1.01	0.52			0.36
	MAY	0.38	1.10	1.24	1.10	-0.14			0.40
1950	JUNE	0.28	0.77	1.95	0.77	-0.84	0.34		0.28
	JULY	0.24	0.67	1.69	0.67		1.02		0.24
	AUG	0.17	0.53	2.04	0.53		1.51		0.19
	SEPT	0.14	0.42	0.77	0.42		0.35		0.15
	OCT	0.15	0.22	0.32	0.22		0.10		0.08
	NOV	0.09							
	DEC	0.07							
	TOTAL	2.47	4.72	8.50	4.72	-0.46	3.32	39.1	1.70
	JAN	0.06							
	FEB	0.07							
	MAR	0.10							
	APR	0.23	0.71	0.51	0.71	0.20			0.26
	MAY	0.57	1.31	0.92	1.31	0.39			0.47
	JUNE	0.23	1.09	2.24	1.09	-0.59	0.56		0.39
1951	JULY	0.10	0.60	2.21	0.60		1.61		0.22
	AUG	0.54	1.00	1.20	1.00		0.20		0.36
	SEPT	0.47	0.69	1.28	0.69		0.59		0.25
	OCT	0.29	0.43	0.22	0.43	0.21			0.15
	NOV	0.23							
	DEC	0.22							
	TOTAL	3.11	5.83	8.58	5.83	0.21	2.96	34.5	2.10
	JAN	0.24							
	FEB	0.16							
	MAR	0.29							
	APR	1.06	1.49	0.40	1.49	1.09			0.54
	MAY	2.58	2.59	0.68	0.72	0.04			0.26
	JUNE	2.16	2.32	2.15	2.15				0.77
1952	JULY	0.71	1.16	1.92	1.16	-0.76			0.42
	AUG	0.48	0.94	1.40	0.94	-0.46			0.34
	SEPT	0.39	0.57	0.93	0.57	-0.12	0.24		0.20
	OCT	0.29	0.42	0.32	0.42	0.10			0.15
	NOV	0.22							
	DEC	0.22							
	TOTAL	8.80	9.49	7.80	7.45	-0.11	0.24	3.1	2.68

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
	DEC								
	JAN	0.26							
	FEB	0.18							
	MAR	0.30							
	APR	0.52	0.98	0.52	0.98	0.46			0.35
	MAY	1.43	1.86	1.16	1.86	0.70			0.67
1953	JUNE	1.28	1.76	2.08	1.76	-0.32			0.63
	JULY	0.71	1.16	1.77	1.16	-0.61			0.42
	AUG	0.37	0.84	1.99	0.84	-0.33	0.82		0.30
	SEPT	0.25	0.37	1.27	0.37		0.90		0.13
	OCT	0.28	0.40	0.16	0.40	0.24			0.15
	NOV	0.26							
	DEC	0.21							
	TOTAL	6.05	7.37	8.95	7.37	0.14	1.72	19.2	2.65
	JAN	0.21							
	FEB	0.15							
	MAR	0.21							
	APR	0.62	1.08	0.59	1.08	0.49			0.39
	MAY	1.00	1.58	0.79	1.40	0.61			0.50
	JUNE	0.49	1.26	2.09	1.26	-0.83			0.45
1954	JULY	0.47	0.94	1.81	0.94	-0.51	0.36		0.37
	AUG	0.46	0.92	1.45	0.92		0.53		0.33
	SEPT	0.30	0.44	0.97	0.44		0.53		0.16
	OCT	0.28	0.41	0.21	0.41	0.20			0.15
	NOV	0.21							
	DEC	0.19							
	TOTAL	4.59	6.63	7.91	6.45	-0.04	1.42	18.0	2.32
	JAN	0.21							
	FEB	0.17							
	MAR	0.16							
	APR	0.30	0.78	0.47	0.78	0.31			0.28
	MAY	1.08	1.64	0.87	1.64	0.77			0.59
	JUNE	0.76	1.43	2.24	1.43	-0.81			0.52
1955	JULY	0.69	1.14	1.82	1.14	-0.47	0.21		0.41
	AUG	1.45	1.85	1.37	1.85	0.48			0.67
	SEPT	0.84	1.23	1.29	1.23	-0.06			0.49
	OCT	0.38	0.56	0.32	0.56	0.24			0.20
	NOV	0.27							
	DEC	0.28							
	TOTAL	6.59	8.63	8.38	8.63	0.46	0.21	2.5	3.11

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
1956	DEC								
	JAN	0.24							
	FEB	0.17							
	MAR	0.24							
	APR	0.26	0.74	0.59	0.74	0.15			0.26
	MAY	0.34	1.17	1.25	1.17	-0.08			0.42
	JUNE	0.14	1.03	1.99	1.03	-0.73	0.23		0.37
	JULY	0.20	0.69	2.27	0.69		1.58		0.25
	AUG	0.17	0.66	2.01	0.66		1.35		0.24
	SEPT	0.11	0.16	1.35	0.16		1.19		0.06
	OCT	0.15	0.22	0.30	0.22		0.08		0.08
	NOV	0.13							
	DEC	0.13							
	TOTAL	2.28	4.67	9.76	4.67	-0.66	4.43	45.4	1.68
1957	JAN	0.16							
	FEB	0.12							
	MAR	0.20							
	APR	0.84	1.28	0.41	1.28	0.87			0.46
	MAY	1.81	2.10	0.97	1.44	0.47			0.52
	JUNE	2.03	2.24	2.25	2.24	-0.01			0.81
	JULY	1.07	1.49	1.79	1.49	-0.30			0.54
	AUG	1.92	2.28	1.50	1.81	0.31			0.65
	SEPT	1.15	1.69	1.35	1.35				0.48
	OCT	0.64	0.93	0.00	0.00				0.00
	NOV	0.54							
	DEC	0.41							
	TOTAL	10.89	12.01	8.27	9.61	1.34			3.46
1958	JAN	0.32							
	FEB	0.23							
	MAR	0.42							
	APR	2.07	2.42	0.23	0.23				0.08
	MAY	4.78	3.99	1.17	1.17				0.42
	JUNE	2.79	2.72	2.15	2.15				0.77
	JULY	0.82	1.26	2.30	1.26	-1.04			0.45
	AUG	0.55	1.02	1.78	1.02	-0.30	0.46		0.37
	SEPT	0.47	0.69	0.70	0.69		0.01		0.25
	OCT	0.41	0.60	0.23	0.60	0.37			0.22
	NOV	0.29							
	DEC	0.26							
	TOTAL	13.41	12.70	8.56	7.12	-0.97	0.47	5.5	2.56

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
1959	DEC								
	JAN	0.21							
	FEB	0.11							
	MAR	0.15							
	APR	0.32	0.80	0.45	0.80	0.35			0.29
	MAY	0.72	1.40	0.76	1.38	0.62			0.50
	JUNE	0.45	1.23	1.92	1.23	-0.69			0.44
	JULY	0.33	0.81	2.28	0.81	-0.65	0.82		0.29
	AUG	0.80	1.25	0.85	1.25	0.40			0.45
	SEPT	0.33	0.48	1.29	0.48	-0.40	0.41		0.17
	OCT	0.32	0.46	0.00	0.46	0.46			0.17
	NOV	0.22							
	DEC	0.20							
	TOTAL	4.16	6.43	7.55	6.41	0.09	1.23	16.3	2.31

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1960	JAN	0.23							
	FEB	0.13							
	MAR	1.01							0.53
	APR	2.02	2.38	0.59	1.47	0.88			0.45
	MAY	1.82	2.10	1.24	1.24				0.66
	JUNE	1.64	1.99	1.83	1.83				0.58
	JULY	1.20	1.62	1.89	1.62	-0.27			0.38
	AUG	0.60	1.06	2.16	1.06	-1.07	0.03		0.19
	SEPT	0.37	0.54	1.10	0.54		0.56		0.19
	OCT	0.36	0.53	0.00	0.53	0.53			
	NOV	0.25							
	DEC	0.22							
	TOTAL	9.85	10.22	8.81	8.29	0.07	0.59	6.7	2.98

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1961	JAN	0.21							
	FEB	0.14							
	MAR	0.22							
	APR	0.95	1.39	0.49	1.30	0.81			0.47
	MAY	1.63	1.98	1.44	1.44				0.52
	JUNE	1.01	1.59	2.22	1.59	-0.63			0.57
	JULY	0.60	1.06	2.13	1.06	-0.71	0.36		0.38
	AUG	0.83	1.28	1.24	1.28	0.04			0.46
	SEPT	0.62	0.91	1.04	0.91	-0.04	0.09		0.33
	OCT	0.46	0.67	0.24	0.67	0.43			0.24
	NOV	0.35							
	DEC	0.27							
	TOTAL	7.29	8.88	8.80	8.25	-0.10	0.45	5.1	2.97

Table A-9. MONTHLY OPERATION STUDY-- PRESENT CONDITIONS
POJOAQUE UNIT
(Unit - 1,000 Acre-feet)

YEAR	MONTH	Inflow	Divertible Flow	Diversion Demand	Diversion	Diversions to (+) and from (−) Soil Moisture Reservoir	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion
1	2	3	4	5	6	7	8	9	10
1962	DEC								
	JAN	0.23							
	FEB	0.22							
	MAR	0.30							
	APR	1.33	1.73	0.56	1.47	0.91			0.53
	MAY	1.83	2.11	1.44	1.44				0.52
	JUNE	0.61	1.33	2.11	1.33	-0.78			0.48
	JULY	0.53	1.00	1.47	1.00	-0.47			0.36
	AUG	0.32	0.80	2.11	0.80	-0.09	1.22		0.28
	SEPT	0.27	0.39	0.80	0.39		0.41		0.14
	OCT	0.30	0.44	0.17	0.44	0.27			0.16
	NOV	0.25							
	DEC	0.23							
	TOTAL	6.42	7.80	8.66	6.87	-0.16	1.63	18.8	2.47

YEAR	MONTH	3	4	5	6	7	8	9	10
1963	JAN	0.22							
	FEB	0.17							
	MAR	0.51							
	APR	1.10	1.52	0.57	1.52	0.95			0.55
	MAY	1.29	1.74	1.44	1.56	0.12			0.56
	JUNE	0.64	1.36	2.10	1.36	-0.74			0.49
	JULY	0.34	0.82	1.96	0.82	-0.60	0.54		0.30
	AUG	0.52	0.98	1.53	0.98		0.55		0.35
	SEPT	0.67	0.99	0.48	0.99	0.51			0.36
	OCT	0.35	0.51	0.23	0.51	0.28			0.18
	NOV	0.27							
	DEC	0.24							
	TOTAL	6.27	7.92	8.31	7.74	0.52	1.09	13.1	2.79

YEAR	MONTH	3	4	5	6	7	8	9	10
	JAN								
	FEB								
	MAR								
	APR								
	MAY								
	JUNE								
	JULY								
	AUG								
	SEPT								
	OCT								
	NOV								
	DEC								
	TOTAL								

Since the maximum shortages, both annual and consecutive, are within normal acceptable limits, but the average annual shortages and number of years of shortage are not, it is evident that minor storage would provide considerable benefit.

The average annual onsite depletion is 2,610 acre-feet. The maximum annual depletion is 3,460 acre-feet in 1957, and the minimum annual depletion is 1,680 acre-feet in 1956.

Because of the variability of the water supply, it was thought that possibly the irrigated lands may have expanded and contracted with the supply. Two present condition operation studies were computed to cover this possibility. The first study was based on a constant acreage of 1,865 acres. The second study consisted of a variable acreage selected each year so that the percent shortage would approximate the average annual shortage obtained in the first study. The acreage was limited to 2,660 acres. The second study resulted in an average annual acreage of 1,849 acres, or a difference of only 16 acres. The use of a constant acreage for the purpose of estimating present depletions appears justified.

Future Conditions

The general plan of development will consist of the construction of the Nambe Falls Dam. The dam will be located about 100 feet upstream from Nambe Falls and about 1.8 miles above the first major diversion dam in the project area. No improvement in the distribution system is considered in the plan of development. However, it is anticipated that improvement will be made through the assistance and participation of State and other Federal agencies under their various programs. This improvement is not reflected in the future condition operation study.

The water supply is so limited that full development of the water-right acreage is impossible. The plan will provide, through the storage facility, a firm supply to a larger acreage than is presently irrigated. With the dependable supply, the land use is expected to change to a pattern of crops providing greater monetary return.

Nambe Falls Reservoir capacity. Several capacity-yield studies were made for the purpose of deriving a capacity-yield relationship. Very little yield was obtained by increasing the active conservation capacity above 1,600 acre-feet. The capacity-yield curve is shown on Figure A-7. The difference in yield between a conservation capacity of 1,600 acre-feet and 2,000 acre-feet amounted to 1,200 acre-feet for the 29-year period, or an average annual increased yield of about 41 acre-feet. To evaluate the possibility of reducing the reservoir below 1,600 acre-feet, the percent of the time that the reservoir would have been fully used was determined. A 1,200 acre-foot reservoir would have been fully used 14 times during the period of study, or 48 percent of the time; a 1,500 acre-foot reservoir would have been fully used 6 times, or 21 percent of the time; while the 1,600 acre-foot reservoir was used 4 times, or 14 percent of the time. The difference in yield between the 1,500 and 1,600 acre-foot reservoir was only 430 acre-feet, or less than 15 acre-feet per year. The above analyses were made with a demand 15 percent larger than that finally used in the operation study.

From the above analyses, a reservoir having an active conservation capacity of 1,490 acre-feet was selected. Combining this capacity with the 200 acre-foot sediment pool at the end of 50 years and dead

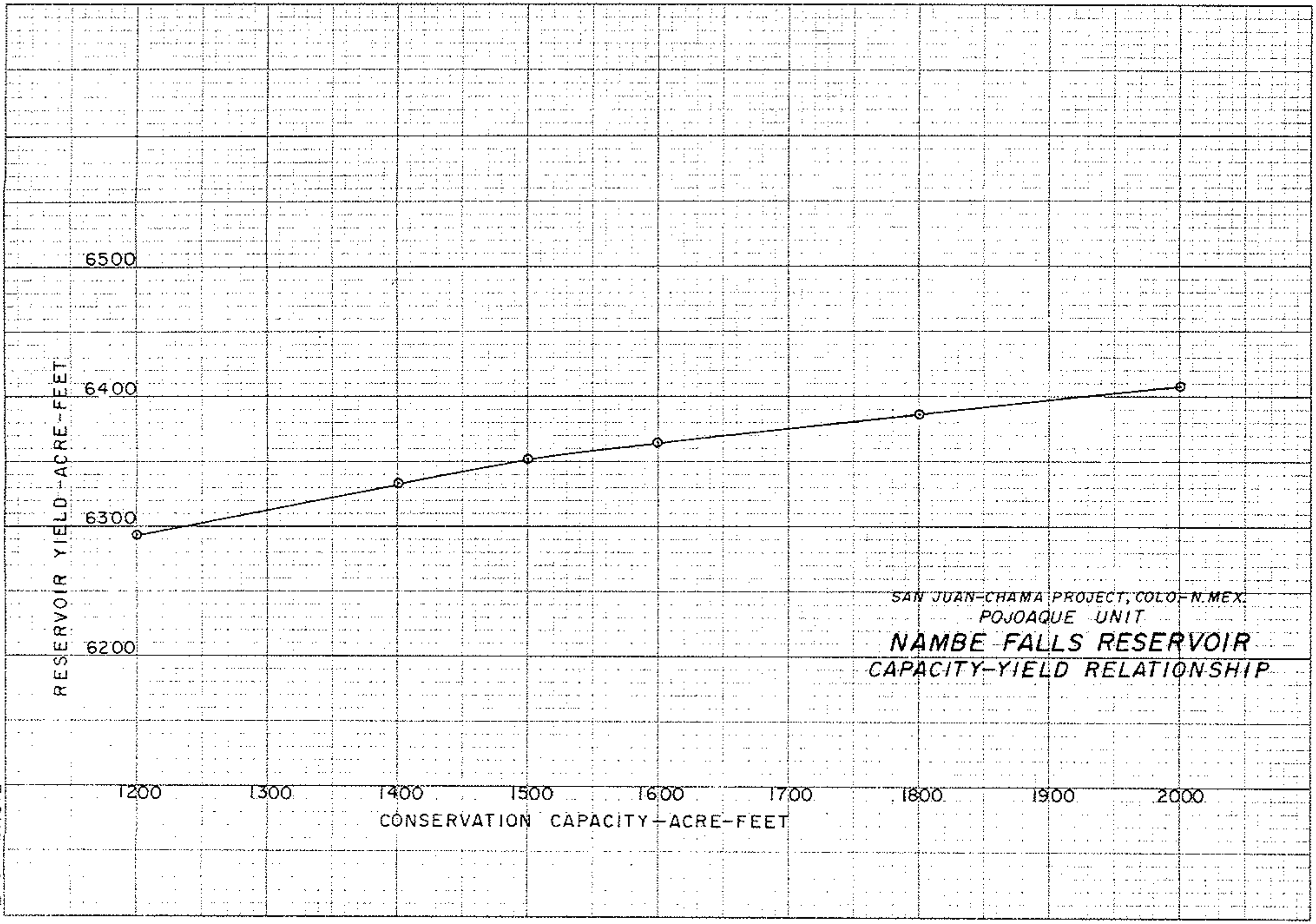

SAN JUAN-CHAMA PROJECT, COLO.-N.MEX.
POJOAQUE UNIT
NAMBE FALLS RESERVOIR
CAPACITY-YIELD RELATIONSHIP
RESERVOIR YIELD-ACRE-FEET
6200
6300
6400
6500
CONSERVATION CAPACITY-ACRE-FEET
1200
1300
1400
1500
1600
1700
1800
1900
2000

FIGURE A-7

storage below elevation 6,826.3 feet resulted in a reservoir having a total capacity of 2,000 acre-feet. The sediment computations are presented later in the appendix. The following tabulation shows the reservoir allocation for the initial, 50-year, and 100-year condition.

Capacity in acre-feet

	Initial	50 years	100 years
Conservation------	1,600	1,490	1,370
Sediment----------	0	200	400
Dead--------------	400	310	230
TOTAL-------------	2,000	2,000	2,000

Consumptive use requirement. With a dependable water supply available, it was determined that it could be possible to irrigate 2,300 acres and improve the land use by increasing the acreage of orchards.

The following tabulation shows the assumed cropping distribution for future conditions:

Crop	Area (acres)	Percent
Alfalfa--------------	925	40.2
Planted pasture------	220	9.6
Orchards-------------	925	40.2
Gardens--------------	230	10.0
TOTAL IRRIGATED	2,300	100.0

The monthly consumptive use requirement for the growing season was computed for the Pojoaque area using the crop distribution above. Table A-10 is a monthly summary of consumptive use requirements for the growing season. The average annual consumptive use requirement for the growing season was computed to be 25.30 inches, or 2.11 feet.

Irrigation requirement. The average annual effective precipitation from 1936 through 1963 amounted to 8.58 inches. The effective precipitation during the growing season was 5.67 inches, or 0.47 feet.

Table A-10. Future conditions--consumptive use requirement.

Pojoaque Unit

Table A-10.

Crop and growing season	Percent of area	April (k)	April Use (inch)	May (k)	May Use (inch)	June (k)	June Use (inch)	July (k)	July Use (inch)	August (k)	August Use (inch)	September (k)	September Use (inch)	October (k)	October Use (inch)	Season (k)	Season Use (inch)
Alfalfa:	40.2																
FP 1/4/11-5/11		0.50	1.50	0.50	1.03											0.50	2.53
FFP 2/5/12-10/3				0.74	2.80	0.84	5.62	0.93	6.78	0.93	6.20	0.74	3.96	0.65	0.26	0.85	25.62
FP 10/4-10/11														0.50	0.53	0.50	0.53
																0.79	28.68
Planted pasture:	9.6																
FP 4/1-5/11		0.50	2.25	0.50	1.04											0.50	3.29
FFP 5/12-10/3				0.68	2.56	0.78	5.23	0.88	6.37	0.88	5.83	0.73	3.89	0.58	0.23	0.80	24.11
FP 10/4-10/20														0.50	1.12	0.50	1.12
																0.73	28.52
Orchard:	40.2																
FP 4/21-5/11		0.40	0.60	0.40	0.83											0.40	1.43
FFP 5/12-10/3				0.59	2.21	0.72	4.80	0.74	5.40	0.72	4.77	0.42	2.24	0.42	0.17	0.65	19.59
FP 10/4-10/20														0.40	0.90	0.40	0.90
																0.61	21.92
Garden and chili:	10.0																
PPI 3/4/26-4/30		0.40	0.30													0.40	0.30
5/1-10/3				0.50	2.92	0.67	4.50	0.78	5.68	0.78	5.19	0.64	3.41	0.50	0.20	0.68	21.90
																0.67	22.20
Weighted consumptive use requirement:																	
Inches			1.09		3.40		5.14		6.07		5.49		3.21		0.90	0.70	25.30
Feet																	2.11

1/ FP = frost period. 2/ FFP = frost-free period. 3/PPI = preplanting irrigation.

The monthly irrigation requirement for the growing season was obtained by subtracting the effective precipitation from the consumptive use requirement. The average annual irrigation requirement was computed to be 19.63 inches, or 1.64 feet.

Diversion demand. The average annual diversion demand is computed by adding the farm and distribution losses to the crop irrigation requirement. Under project conditions, it was assumed that through better control of the water supply the farm irrigation efficiency would increase from 50 to 60 percent. It was also assumed that the distribution efficiency of 72 percent would not change. This would result in an overall efficiency of 43.2 percent.

The following tabulation presents the derivation of the diversion demand for future conditions:

	Acre-feet per acre
Crop consumptive use	2.11
Effective precipitation	-0.47
Crop irrigation requirement	1.64
Farm waste and deep percolation losses (40%)	1.10
Farm delivery demand	2.74
Distribution system losses (28%)	1.06
Diversion demand	3.80

Sedimentation. Most of the drainage basin above Nambe Falls Dam and Reservoir is characterized by steep mountain slopes where the surface geology is of Pennsylvanian and Precambrian age. It is located in the Santa Fe National Forest and is well covered with ponderosa, pinon, spruce, and aspen. Grass is plentiful, rainfall retention rates are moderate, and sediment yields are very low. Just above the damsite, the drainage is from the Santa Fe sediments. The cover is sparse and the sediment yield is considerably greater than that of the area upstream. The drainage area is approximately 34 square miles. Reservoir sedimentation studies were made for the site using the standard Bureau procedure for flow duration, suspended sediment rating curve analysis.

The daily flow duration curve, shown on Figure A-8, was derived from recorded daily total flows of the Rio Nambe near Nambe, New Mexico, during the period October 1, 1932-September 30, 1951. The Rio Nambe near Nambe gage, drainage area about 39 square miles, was discontinued at the end of the 1951 water year. It was assumed the river's flow characteristics on a mean-daily basis have not changed significantly since 1951, so the flow duration curve was not adjusted to reflect the full period used in the operation study. The United States Geological Survey has a new gage in operation below Nambe Falls, but the period of record is not long enough to analyze.

The suspended sediment rating curve, shown on Figure A-9, was derived for the Rio Nambe near Nambe, New Mexico, using Geological Survey instantaneous suspended sediment records for the new gaging station below Nambe Falls during the period October 5, 1961-November 29, 1963. Records are also available from the Corps of Engineers for Pojoaque Creek at Pojoaque, New Mexico, during the period April 17, 1937-July 24, 1943.

An analysis of concurrent suspended sediment data collected by the Geological Survey and the Corps of Engineers was made to determine if the records of the two agencies were compatible. The comparison was made for the Rio Chama near Abiquiu, New Mexico, for the period

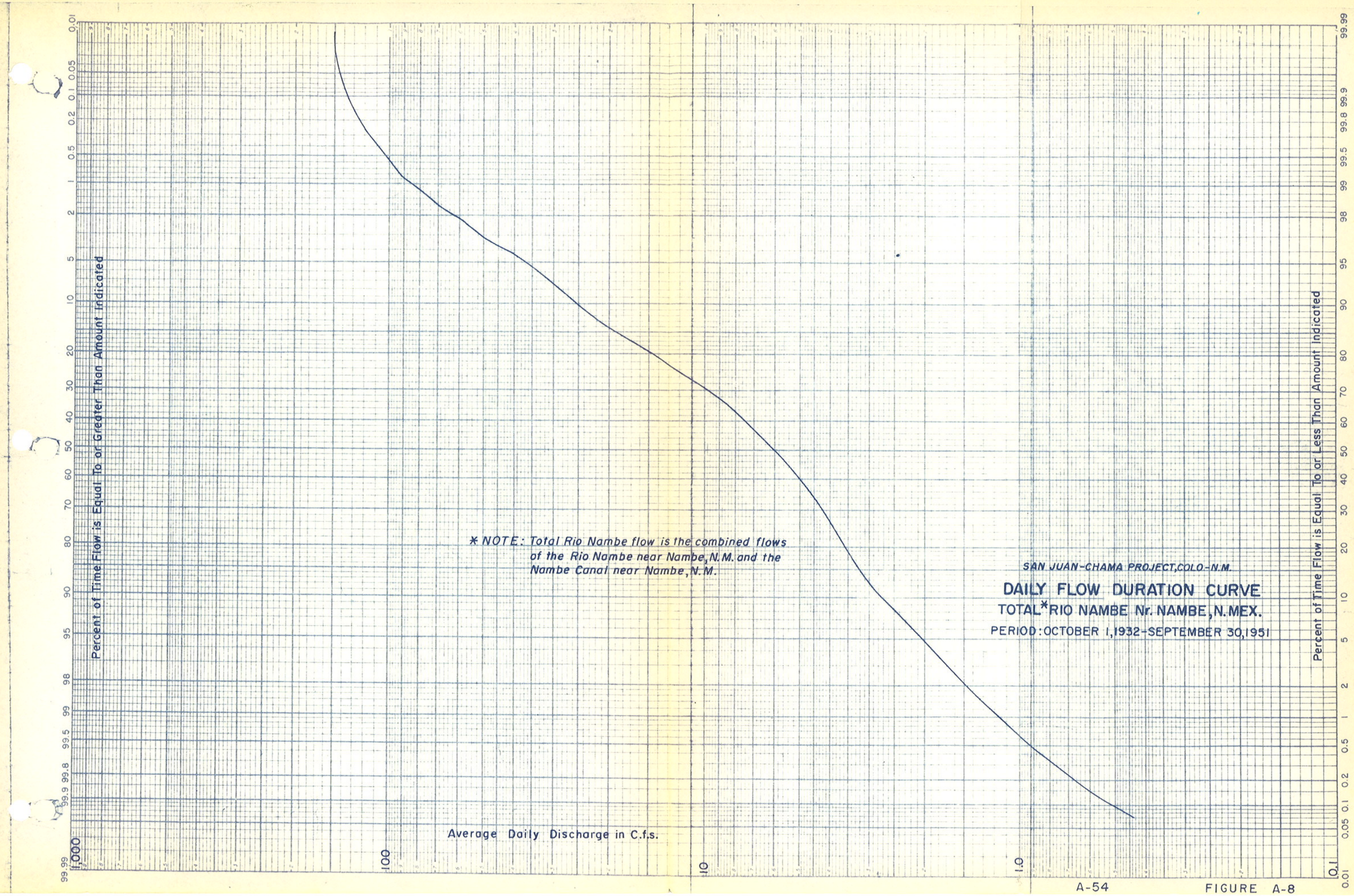
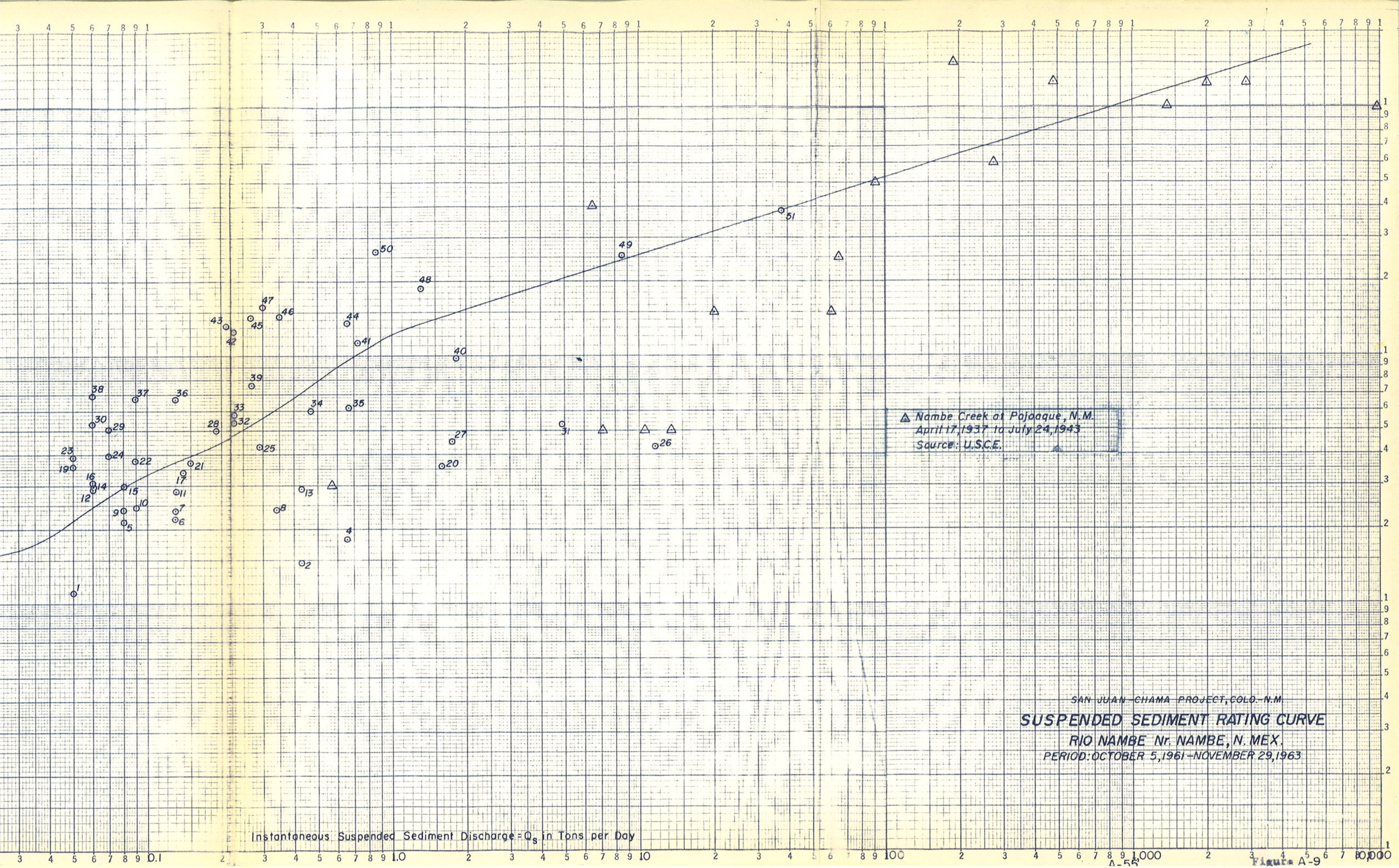
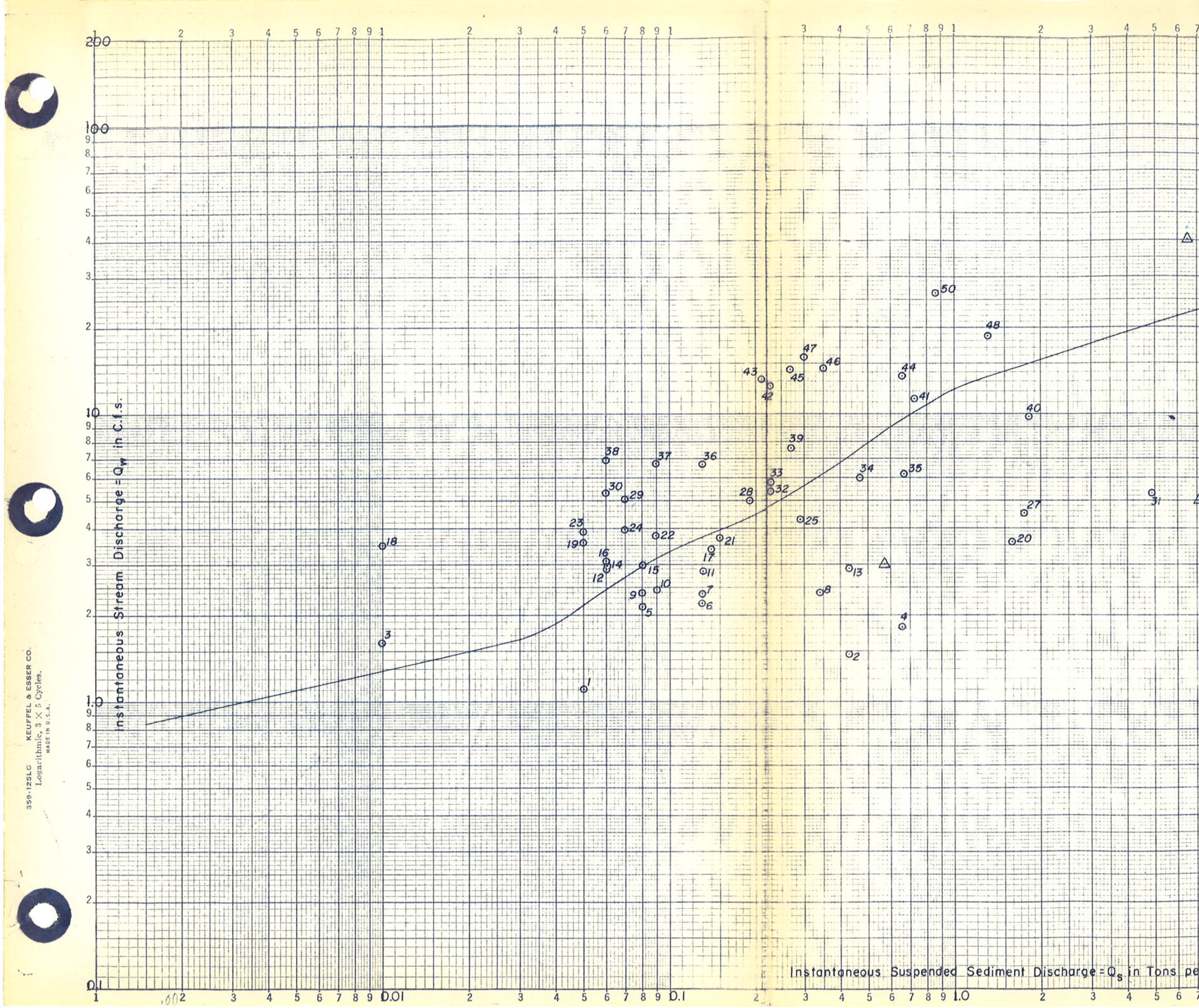

Percent of Time Flow is Equal To or Greater Than Amount Indicated
Percent of Time Flow is Equal To or Less Than Amount Indicated
* NOTE: Total Rio Nambe flow is the combined flows of the Rio Nambe near Nambe, N.M. and the Nambe Canal near Nambe, N.M.
Average Daily Discharge in C.f.s.
1,000
100
10
1.0
0.1
SAN JUAN-CHAMA PROJECT, COLO-N.M.
DAILY FLOW DURATION CURVE
TOTAL* RIO NAMBE Nr. NAMBE, N.MEX.
PERIOD: OCTOBER 1, 1932-SEPTEMBER 30, 1951

FIGURE A-8



Nambe Creek at Pojoaque, N.M.
April 17, 1937 to July 24, 1943
Source: U.S.C.E.
Instantaneous Suspended Sediment Discharge = Q_s in Tons per Day
SAN JUAN-CHAMA PROJECT, COLO.-N.M.
SUSPENDED SEDIMENT RATING CURVE
RIO NAMBE Nr. NAMBE, N. MEX.
PERIOD: OCTOBER 5, 1961 - NOVEMBER 29, 1963

Figure A-9


Instantaneous Stream Discharge = Q_w in C.f.s.
Instantaneous Suspended Sediment Discharge = Q_s in Tons per
KEUFFEL & ESSER CO.
359-12SLG Logarithmic, 3 X 5 Cycles.
MADE IN U.S.A.

July 16-October 30, 1943, and it showed the records did agree so the Geological Survey data were used to draw the curve while Corps data plotted on the curve were used as an aid in extrapolating the curve up to the range of discharges covered by the flow duration analysis.

The suspended sediment at the Rio Nambe near Nambe gage was computed from the flow duration and sediment rating curves discussed above and was 172 tons per square mile per year. Table A-11 shows the computations for suspended sediment inflow. The unmeasured load was assumed to be 15 percent of the suspended sediment inflow all in the sand fraction. The total sediment load was 198 tons per square miles per year.

The average inflow suspended sediment particle-size analysis is 20.3 percent sand, 38.7 percent silt, and 41.0 percent clay. This distribution was obtained from measurements made by the Geological Survey and the Corps of Engineers. Figure A-10 shows the size distribution of both the suspended and total load sediments.

In computing the 100-year unit weight of 70 pounds per cubic foot for the total load sediments, the condition of "sediment always submerged or nearly submerged" was used because of the dead pool in the reservoir. The average of Lane and Koelzer and Trask values for unit weight was used because neither sand nor clay predominates in the total load size distribution.

The Nambe Falls Reservoir was estimated to have a trap efficiency of about 90 percent as determined from Gunnar Brune's lower envelope curve with a capacity-inflow ratio of 0.28. The average annual sediment

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Table A-11

PROJECT INVESTIGATIONS DIVISION
HYDROLOGY BRANCH

SUSPENDED SEDIMENT INFLOW

SECTION	PERIOD	RIVER
Pojoaque Unit (Virgin flow)	Flow duration: 10/1/32-9/30/51. Sediment rating: 10/5/61-11/29/63.	Rio Nambe at Nambe (Virgin flow) D.A. = 39 sq.mi.
COMPUTED BY: P.L.P	CHECKED BY: R.A.P.	DATE: February 4, 1964

1 % LIMITS	2 % INTERVAL	3 % MID. ORD.	4 Qw	5 Qs	6 2x4 Qw. DISCH.	7 2x5 Qs. DISCH.
0.00-0.03	0.03	0.015	150.0	3050	0.045	0.915
0.03-0.04	0.01	0.035	147.5	2880	0.015	0.288
0.04-0.06	0.02	0.05	144.0	2670	0.029	0.534
0.06-0.10	0.04	0.08	139.0	2400	0.056	0.960
0.10-0.20	0.10	0.15	130.0	1910	0.130	1.910
0.20-0.30	0.10	0.25	120.5	1500	0.120	1.500
0.30-0.40	0.10	0.35	112.5	1210	0.112	1.210
0.40-0.60	0.20	0.50	102.5	910	0.205	1.820
0.60-0.80	0.20	0.70	95.5	705	0.191	1.410
0.80-1.00	0.20	0.90	89.5	565	0.179	1.130
1.00-1.50	0.50	1.25	77.5	357	0.388	1.785
1.50-2.50	1.00	2.00	62.0	170	0.620	1.700
2.50-3.50	1.00	3.00	50.7	89.5	0.507	0.895
3.50-4.50	1.00	4.00	42.5	51.5	0.425	0.515
4.50-5.50	1.00	5.00	37.0	33.2	0.370	0.332
5.50-6.50	1.00	6.00	33.5	23.7	0.335	0.237
6.50-7.50	1.00	7.00	30.8	18.1	0.308	0.181
7.50-9.00	1.50	8.25	28.2	13.7	0.423	0.206
9.00-11.00	2.00	10.00	25.3	9.7	0.506	0.194
11.00-13.00	2.00	12.00	22.7	6.8	0.454	0.136
13.00-15.00	2.00	14.00	20.1	4.6	0.402	0.092
15.00-17.00	2.00	16.00	18.0	3.23	0.360	0.065
17.00-19.00	2.00	18.00	16.2	2.32	0.324	0.046
19.00-21.00	2.00	20.00	14.7	1.73	0.294	0.035
21.00-23.00	2.00	22.00	13.4	1.29	0.268	0.026

TOTAL

Qw.A.D. = D.D.x365x1.9835 = (AF)/yr.

Qs.A.D. = D.D.x365 = Tons/yr.

_____ Percent Correction for Bedload = _____ Tons/yr.

Total Sediment Discharge = Tons/yr.

Sediment

A.D. = _____ Tons/yr. / Tons/(AF) _____ = (AF)/yr.

Yield = _____ Tons/yr. / Tons/(AF)xD.A. _____ = (AF)/sq.mi.

Concentration = _____ Qs A.D.x100 / Qw A.D.x1361 _____ = Percent

Runoff

Rate = _____ Qw A.D. / D.A. _____ = (AF)/sq.mi.

D.D.=Daily Discharge
A.D.=Annual Discharge
D.A.=Drainage Area
=lbs./cubic foot
=Tons/acre foot

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Bureau of Reclamation

Table A-11

PROJECT INVESTIGATIONS DIVISION
HYDROLOGY BRANCH
SUSPENDED SEDIMENT INFLOW

SECTION Pojoaque Unit (Virgin flow)
PERIOD Flow duration: 10/1/32-9/30/51. Sediment rating: 10/5/61-11/29/63.
RIVER Rio Nambe at Nambe (Virgin flow) D.A. = 39 sq.mi.
COMPUTED BY P.L.P.
CHECKED BY R.A.P.
DATE February 4, 1964

1 % LIMITS	2 % INTERVAL	3 % MID. ORD.	4 Qw	5 Qs	6 2x4 Qw. DISCH.	7 2x5 Qs. DISCH.
23.00-27.00	4.00	25.00	11.90	0.955	0.476	0.038
27.00-33.00	6.00	30.00	9.80	0.685	0.588	0.041
33.00-39.00	6.00	36.00	8.15	0.525	0.489	0.032
39.00-45.00	6.00	42.00	7.15	0.435	0.429	0.026
45.00-55.00	10.00	50.00	6.00	0.333	0.600	0.033
55.00-65.00	10.00	60.00	5.00	0.245	0.500	0.024
65.00-75.00	10.00	70.00	4.22	0.176	0.422	0.018
75.00-83.00	8.00	79.00	3.65	0.123	0.292	0.010
83.00-87.00	4.00	85.00	3.23	0.094	0.129	0.004
87.00-91.00	4.00	89.00	2.84	0.075	0.114	0.003
91.00-95.00	4.00	93.00	2.32	0.055	0.093	0.002
95.00-97.00	2.00	96.00	1.87	0.040	0.037	0.001
97.00-98.00	1.00	97.50	1.58	0.025	0.016	—
98.00-98.80	0.80	98.40	1.36	0.013	0.011	—
98.80-99.20	0.40	99.00	1.16	0.0062	0.005	—
99.20-99.60	0.40	99.40	0.98	0.003	0.004	—
99.60-100.00	0.40	99.80	0.67	—	0.003	—
				TOTAL	11.274	18.354

19 year average from WSPS = 11.311
0.33% error

Qw.A.D. = 11.274 / 11.311 D.D. x ~~365~~ 365.24 x 1.9835 = 8,167 / 8,194 (AF)/yr.

Qs.A.D. = 18.354 D.D. x 365.24 = 6,704 Tons/yr. $\frac{6,704}{39}$ = 172 tons/sq mi./year.

_____ Percent Correction for Bedload = _____ Tons/yr.

Total Sediment Discharge = Tons/yr.

Sediment

A.D. = ______ Tons/yr. / Tons/(AF) ______ = (AF)/yr.

Yield = ______ Tons/yr. / Tons/(AF)xD.A. ______ = (AF)/sq.mi.

Concentration = ______ Qs A.D.x100 / Qw A.D.x1361 ______ = Percent

Runoff

Rate = ______ Qw A.D. / D.A. ______ = (AF)/sq.mi.

D.D.=Daily Discharge
A.D.=Annual Discharge
D.A.=Drainage Area
=lbs./cubic foot
=Tons/acre foot

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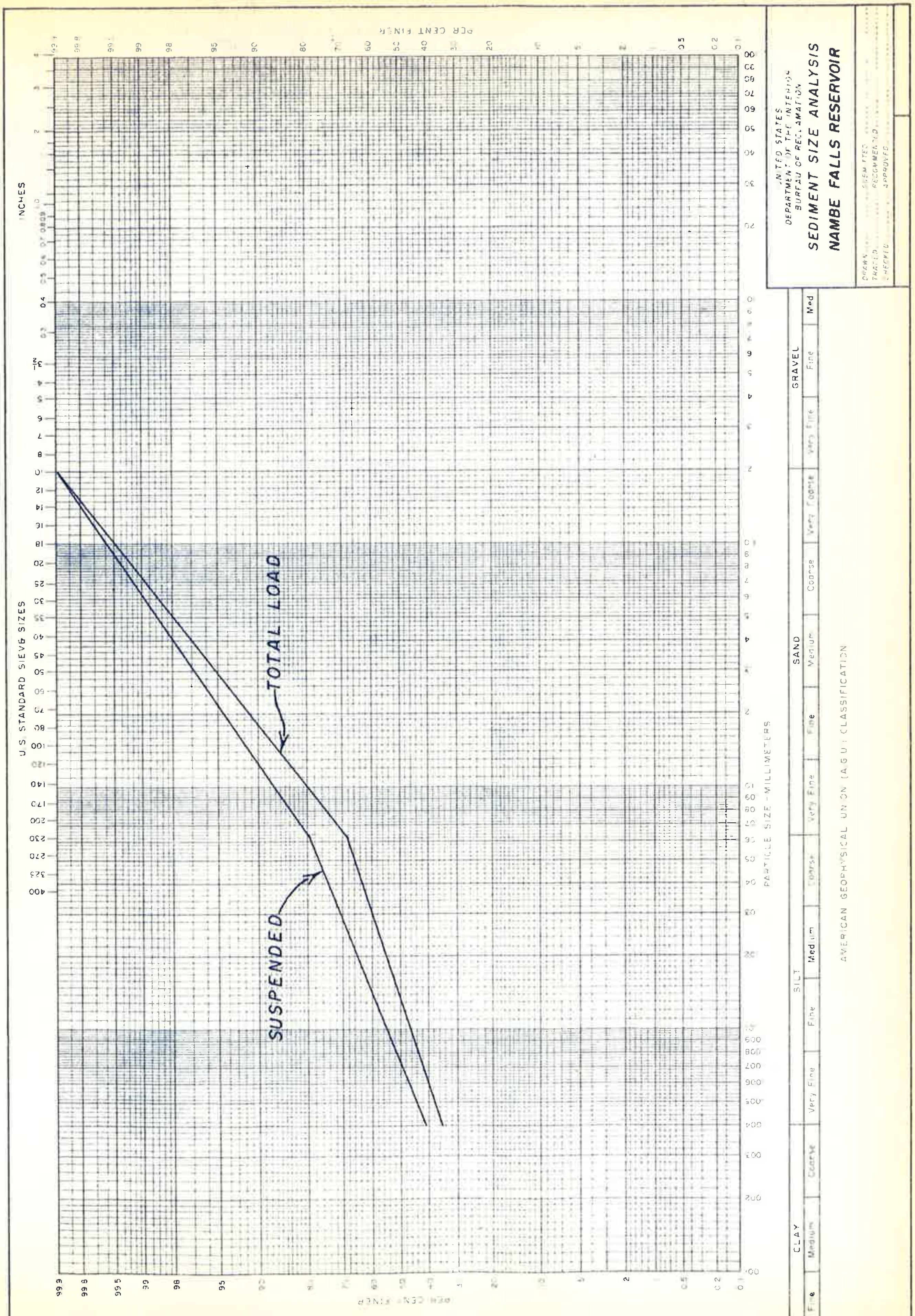

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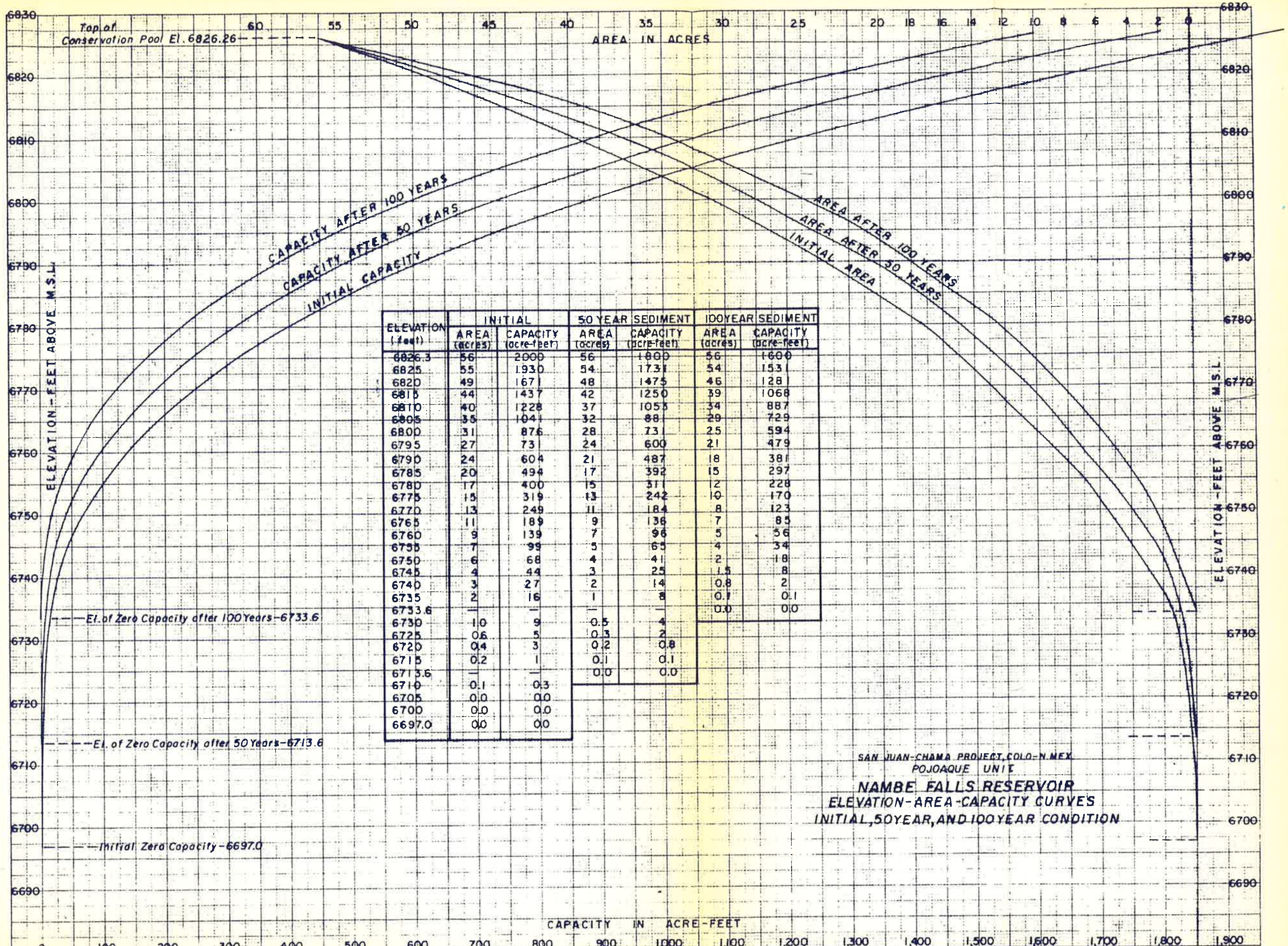
FIGURE A-10

deposited would be 39.7 acre-feet per year, or 397 acre-feet in 100 years. The 100-year deposition was rounded to 400 acre-feet.

Generally accepted sediment yield from the mountainous area is no less than 0.1 acre-foot per square mile per year, and the Santa Fe sediments 1.0 acre-foot per square mile per year. Applying these yields to the drainage comprised of 32.9 square miles of mountainous area and 1.1 square miles of Santa Fe sediment results in a sediment inflow of about 4.4 acre-feet per year. This checks the yield determined by the sediment rating curve method. The yield from the Santa Fe sediments was supported by studies made on Galisteo Creek, a tributary draining the Sangre de Cristo Mountains south of Santa Fe.

Reservoir sediment distribution studies were made for 50- and 100-year conditions in Nambe Falls Reservoir. The reservoir is Type I and the empirical area reduction method resulted in 36.6 feet of sediment against the dam in 100 years. Figure A-11 is the elevation-area-capacity curve for the original, 50-, and 100-year conditions.

<u>Evaporation</u>. Using Plate 2 of the "Climatological Study, Rio Grande Basin, New Mexico, North of Otowi Bridge," a mean annual temperature of 49°F was selected as representative of the Nambe Reservoir area. Using Table 5 of the same study, the mean temperature for the period May through October was determined to be 61.6°F. Entering this on the temperature-evaporation curve, Figure A-12, the annual pan evaporation was determined to be 70 inches. The water surface evaporation would then be 49 inches annually (70 x 0.7). Using the Santa Fe monthly distribution



ELEVATION (feet)	INITIAL		50 YEAR SEDIMENT		100 YEAR SEDIMENT	
	AREA (acres)	CAPACITY (acre-feet)	AREA (acres)	CAPACITY (acre-feet)	AREA (acres)	CAPACITY (acre-feet)
6826.3	56	2000	56	1800	56	1600
6825	55	1930	54	1731	54	1531
6820	49	1671	48	1475	46	1281
6815	44	1437	42	1250	39	1068
6810	40	1228	37	1055	34	887
6805	35	1041	32	881	29	729
6800	31	876	28	731	25	594
6795	27	731	24	600	21	479
6790	24	604	21	487	18	381
6785	20	494	17	392	15	297
6780	17	400	15	311	12	228
6775	15	319	13	242	10	170
6770	13	249	11	184	8	123
6765	11	189	9	136	7	85
6760	9	139	7	96	5	56
6755	7	99	5	65	4	34
6750	6	68	4	41	2	18
6745	4	44	3	25	1.5	8
6740	3	27	2	14	0.8	2
6735	2	16	1	8	0.1	0.1
6733.6	—	—	—	—	0.0	0.0
6730	1.0	9	0.5	4		
6725	0.6	5	0.3	2		
6720	0.4	3	0.2	0.8		
6715	0.2	1	0.1	0.1		
6713.6	—	—	0.0	0.0		
6710	0.1	0.3				
6705	0.0	0.0				
6700	0.0	0.0				
6697.0	0.0	0.0				

SAN JUAN-CHAMA PROJECT, COLO.-N.MEX.
POJOAQUE UNIT

NAMBE FALLS RESERVOIR

ELEVATION-AREA-CAPACITY CURVES
INITIAL, 50 YEAR, AND 100 YEAR CONDITION

FIGURE A-11

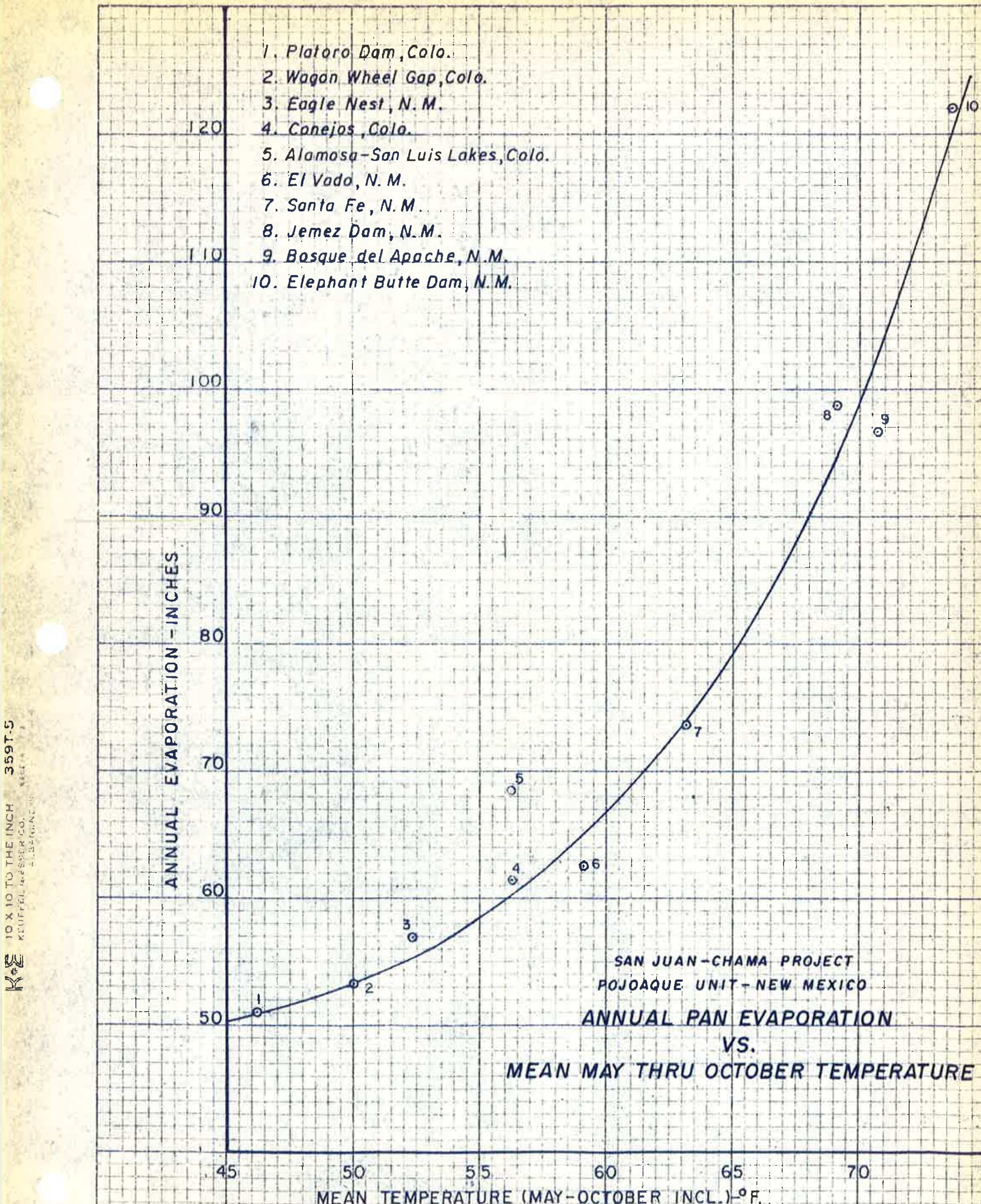

1. Platoro Dam, Colo.
2. Wagon Wheel Gap, Colo.
3. Eagle Nest, N. M.
4. Conejos, Colo.
5. Alamosa-San Luis Lakes, Colo.
6. El Vado, N. M.
7. Santa Fe, N. M.
8. Jemez Dam, N. M.
9. Bosque del Apache, N. M.
10. Elephant Butte Dam, N. M.
ANNUAL EVAPORATION - INCHES
120
110
100
90
80
70
60
50
45
50
55
60
65
70
MEAN TEMPERATURE (MAY-OCTOBER INCL.) - °F.
SAN JUAN-CHAMA PROJECT
POJOAQUE UNIT - NEW MEXICO
ANNUAL PAN EVAPORATION
VS.
MEAN MAY THRU OCTOBER TEMPERATURE
10 X 10 TO THE INCH 359T-5
KEUFFEL & ESSER CO.

FIGURE A-12

of evaporation and subtracting the mean effective precipitation for Weather Station Nambe 1, the following monthly net evaporation rates were determined:

Month	Evaporation (feet)
December	0.05
January, February	0.09
November	0.12
March, October	0.21
September	0.33
April, August	0.375
May, July	0.47
June	0.61

These evaporation rates and the area-capacity curve adjusted for 50 years of sediment deposition were then used to prepare an evaporation table for Nambe Reservoir (see Table A-12).

Operation study. The future condition operation study was computed using the 50-year condition in Nambe Falls Reservoir. The reservoir was assumed to fluctuate from 310 acre-feet (dead pool) to 1,800 acre-feet. The farm efficiency was assumed to increase 10 percent over present conditions. The diversion demands for the 2,300 acres were based upon a cropping pattern derived to reflect a change to higher land use. The study was computed in the following manner:

1. The inflow to the reservoir equals the runoff of Rio Nambe at Nambe Falls (Table A-2).

2. If possible, the irrigation release was made to satisfy the portion of the diversion demand and the requirements of the soil moisture reservoir that were not met by the tributary inflow between the dam and the irrigated area.

3. Spill from the reservoir occurred when inflow was in excess of that required to fill the reservoir after corrections were made for irrigation releases and evaporation loss. Maximum content was 1,800 acre-feet.

Table A-12. Net evaporation, Nambe Reservoir.
Pojoaque Unit

Evaporation (1,000 acre-feet)	Nambe Reservoir content--1,800 acre-feet 50-year sediment depletion							
	December	January February	November	March October	September	April August	May July	June
	Net evaporation in inches							
	0.05	0.09	0.12	0.21	0.33	0.375	0.47	0.61
	Capacity in acre-feet							
0.00	1,800	1,800	1,240	575	320	265	175	120
0.01			1,800	1,800	1,375	1,175	875	600
0.02					1,800	1,800	1,655	1,215
0.03							1,800	1,800
0.04								

4. Tributary inflow originating between Nambe Falls Reservoir and the head of the irrigated lands equalled 11.5 percent of the virgin flow of the Rio Nambe near Nambe.

5. The total inflow to the irrigated area equals the sum of the irrigation release and spill from the reservoir and the tributary inflow.

6. The flow diverted was determined by combining the total inflow to the irrigated area with the diversion correlations shown in Figures A-4 through A-6. No diversions were made during the period November through March.

7. The soil moisture reservoir was operated so as to be maintained half full whenever possible. Any water stored in the soil reservoir is useable during periods of limited water supply. The soil moisture reservoir varies with the individual crops. For the cropping pattern used for future conditions, the average soil moisture reservoir was assumed to be about 7.1 inches. One-half of the soil reservoir represents a diversion of 1,570 acre-feet.

8. The shortage represents the difference between the diversion demand and the total supply available (river plus soil reservoir) when the diversion demand is the larger.

9. The onsite depletion represents the future depletion of the water supply by the irrigated area. The depletion is equal to the diversions multiplied by the overall efficiency of 43.2 percent plus the evaporation from the reservoir and any gain or loss in storage.

The annual summary of the future condition operation study is shown in Table A-13, and the monthly operation study is shown in Table A-14.

Summary. The average annual diversion demand for the 2,300 acres was 8,740 acre-feet. The maximum annual demand was 10,300 acre-feet in 1956, and the minimum annual demand was 7,400 acre-feet in 1941.

Spills from the reservoir occurred in 22 of the 29 years. The average annual spill was 2,270 acre-feet or 31.8 percent of the inflow.

Table A-13. ANNUAL SUMMARY--OPERATION STUDY--POJOAQUE UNIT--FUTURE CONDITIONS (Unit-1,000 Acre-feet)

	YEAR	Nambe Falls Reservoir					Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion		On-Site Effect	
		Inflow	Irrigation Release	Spill	Evaporation	Content End-of-Year									Future Condition	Present Condition		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
						0.31												
	1935	10.63	5.91	3.10	0.13	1.80	1.38	10.39	9.54	8.79	0.75	0.00			5.74	3.21	2.53	
	1936	6.69	4.42	2.94	0.11	1.02	0.87	8.23	8.03	8.21	1.19	1.37			2.80	1.97	0.83	
	1937	8.77	4.04	4.79	0.12	0.84	1.14	9.97	7.58	7.70	0.67	0.79			3.21	2.69	0.52	
	1938	6.03	4.93	0.86	0.12	0.96	0.78	6.57	8.74	8.72	1.11	1.09			4.02	2.71	1.31	
	1939	5.72	4.10	1.75	0.10	0.73	0.74	6.59	7.28	9.64	0.66	1.57	1.45	15.0	3.01	2.49	0.52	
	1940	6.95	5.30	1.45	0.10	0.83	0.90	7.65	8.70	9.22	1.55	1.57	0.50	5.4	3.96	2.60	1.36	
	1941	20.89	4.53	15.21	0.18	1.80	2.71	22.45	8.61	7.40	1.21	0.00			4.87	2.92	1.95	
	1942	14.05	5.04	9.51	0.13	1.17	1.83	16.38	8.31	8.31	0.85	0.85			3.09	2.58	0.51	
	1943	5.16	3.52	1.97	0.11	0.73	0.67	6.16	6.76	9.55	0.16	1.57	1.38	14.5	2.59	2.48	0.11	
	1944	8.21	6.71	0.69	0.14	1.40	1.07	8.47	10.15	8.74	1.41	0.00			5.19	3.29	1.90	
	1945	9.15	5.38	4.37	0.12	0.68	1.19	10.94	8.51	9.70	0.21	1.40			3.08	2.88	0.20	
	1946	4.60	4.29		0.06	0.93	0.60	4.89	7.82	8.17	2.02	1.90	0.47	5.8	3.69	2.56	1.13	
	1947	4.30	4.17	0.27	0.09	0.70	0.56	5.00	7.20	8.48	1.17	1.57	0.88	10.4	2.97	2.04	0.93	
	1948	6.85	5.37	1.40	0.10	0.68	0.89	7.66	8.88	8.98	1.72	1.57	0.25	2.8	3.92	2.76	1.16	
	1949	7.16	5.03	1.55	0.14	1.12	0.93	7.51	9.06	7.74	1.32	0.00			4.49	2.65	1.84	
	1950	2.19	2.64	0.12	0.10	0.45	0.28	3.04	5.44	8.91	0.00	1.57	1.90	21.3	1.78	1.70	0.08	
	1951	2.75	2.43		0.06	0.71	0.36	2.79	6.08	8.96	1.10	0.94	3.04	33.9	2.95	2.10	0.85	
	1952	7.79	6.01	1.68	0.10	0.71	1.01	8.70	9.06	8.15	1.43	0.52			4.01	2.68	1.33	
	1953	5.35	4.62	0.62	0.10	0.72	0.70	5.94	7.85	9.38	0.71	1.57			3.50	2.65	0.85	
	1954	4.06	4.05		0.07	0.66	0.53	4.58	7.22	8.21	1.52	1.57	0.67	7.1	3.13	2.32	0.81	
	1955	5.84	5.63		0.07	0.80	0.76	6.39	9.34	8.78	1.92	1.36	0.94	11.4	4.24	3.11	1.13	
	1956	2.02	2.22		0.06	0.54	0.26	2.48	5.50	10.30	0.85	1.57	4.08	39.6	2.18	1.68	0.50	
	1957	9.64	6.54	1.69	0.15	1.80	1.25	9.48	10.21	8.64	1.57	0.00			5.82	3.46	2.36	
	1958	11.87	5.08	7.67	0.12	0.80	1.54	14.29	8.50	9.00	0.35	0.85			2.79	2.56	0.23	
	1959	3.68	3.71		0.08	0.69	0.48	4.19	6.84	7.83	1.29	1.89	0.39	5.0	2.92	2.31	0.61	
	1960	8.71	6.20	2.36	0.12	0.72	1.13	9.69	9.77	9.21	1.63	1.07			4.37	2.98	1.39	
	1961	6.45	5.62	0.58	0.11	0.86	0.84	7.04	8.99	9.18	0.91	1.10			4.13	2.97	1.16	
	1962	5.68	4.52	1.19	0.10	0.73	0.75	6.46	7.65	9.01	0.98	1.57	0.77	8.5	3.27	2.47	0.80	
	1963	5.55	5.43		0.09	0.76	0.72	6.15	8.70	8.59	2.14	1.57	0.46	5.4	3.88	2.79	1.09	
	TOTAL	206.74	137.44	65.77	3.08		26.87	230.08	236.32	253.50	32.40	32.40	17.18	6.8	105.60	75.61	29.99	
	MEAN	7.13	4.74	2.27	0.11		0.93	7.94	8.15	8.74	1.12	1.12	0.59		3.64	2.61	1.03	

NOTE: Acreage irrigated any one year = 2,300 acres.

Capacity in acre-feet

	Initial	50 years	100 years
Conservation	1,600	1,490	1,370
Sediment	0	200	400
Dead	400	310	230
TOTAL	2,000	2,000	2,000

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir					Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion		On-Site Effect	
		Inflow	Irrigation Release	Spill	Evaporation	Content End-of-Month									Future Condition	Present Condition		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					0.31												
1935	JAN	0.24			0.00	0.55	0.03	0.03							0.24		0.24	
	FEB	0.18			0.00	0.73	0.02	0.02							0.18		0.18	
	MAR	0.26			0.01	0.98	0.03	0.03							0.26		0.26	
	APR	0.55	0.55		0.01	0.97	0.07	0.62	1.08	0.33	0.75				0.47	0.34	0.13	
	MAY	1.75	0.00	0.90	0.02	1.80	0.23	1.13	0.74	0.74					1.17	0.26	0.91	
	JUNE	3.33	1.63	1.67	0.03	1.80	0.43	3.73	2.26	2.26					1.00	0.80	0.20	
	JULY	0.91	1.65		0.02	1.04	0.12	1.77	2.15	2.15					0.19	0.53	-0.34	
	AUG	1.19	1.29		0.01	0.93	0.16	1.45	1.85	1.85					0.70	0.63	0.07	
	SEPT	1.11	0.64		0.01	1.39	0.14	0.78	1.14	1.14					0.96	0.56	0.40	
	OCT	0.51	0.15		0.01	1.74	0.07	0.22	0.32	0.32					0.50	0.09	0.41	
	NOV	0.33		0.26	0.01	1.80	0.04	0.30							0.07		0.07	
	DEC	0.27		0.27	0.00	1.80	0.04	0.31							0.00		0.00	
	TOTAL	10.63	5.91	3.10	0.13		1.38	10.39	9.54	8.79	0.75				5.74	3.21	2.53	
1936	JAN	0.21		0.21	0.00	1.80	0.03	0.24							0.00		0.00	
	FEB	0.18		0.18	0.00	1.80	0.02	0.20							0.00		0.00	
	MAR	0.27		0.26	0.01	1.80	0.04	0.30							0.01		0.01	
	APR	0.86	0.00	0.84	0.02	1.80	0.11	0.95	0.45	0.45					0.22	0.20	0.02	
	MAY	1.48	0.00	1.45	0.03	1.80	0.19	1.64	1.01	1.01					0.46	0.35	0.11	
	JUNE	0.70	1.82		0.03	0.65	0.09	1.91	2.16	2.16					-0.19	0.45	-0.64	
	JULY	0.42	0.75		0.01	0.31	0.06	0.81	1.25	1.78		0.53			0.21	0.29	-0.08	
	AUG	0.67	0.66		0.01	0.31	0.09	0.75	1.20	2.04		0.84			0.53	0.33	0.20	
	SEPT	0.54	0.54		0.00	0.31	0.07	0.61	0.89	0.49	0.40				0.39	0.21	0.18	
	OCT	0.65	0.65		0.00	0.31	0.08	0.73	1.07	0.28	0.79				0.46	0.14	0.32	
	NOV	0.44			0.00	0.75	0.06	0.06							0.44		0.44	
	DEC	0.27			0.00	1.02	0.03	0.03							0.27		0.27	
	TOTAL	6.69	4.42	2.94	0.11		0.87	8.23	8.03	8.21	1.19	1.37			2.80	1.97	0.83	
1937	JAN	0.26			0.00	1.28	0.04	0.04							0.26		0.26	
	FEB	0.24			0.00	1.52	0.03	0.03							0.24		0.24	
	MAR	0.31		0.02	0.01	1.80	0.04	0.06							0.29		0.29	
	APR	1.31	0.00	1.29	0.02	1.80	0.17	1.46	0.59	0.41	0.18				0.28	0.60	-0.32	
	MAY	2.01	0.00	1.98	0.03	1.80	0.26	2.24	0.42	0.42					0.21	0.15	0.06	
	JUNE	1.84	0.31	1.50	0.03	1.80	0.24	2.05	1.30	1.30					0.59	0.47	0.12	
	JULY	0.92	2.01		0.02	0.69	0.12	2.13	2.48	2.48					-0.02	0.51	-0.53	
	AUG	0.46	0.83		0.01	0.31	0.06	0.89	1.33	2.12		0.79			0.20	0.34	-0.14	
	SEPT	0.48	0.48		0.00	0.31	0.06	0.54	0.79	0.66	0.13				0.34	0.39	-0.05	
	OCT	0.41	0.41		0.00	0.31	0.05	0.46	0.67	0.31	0.36				0.29	0.23	0.06	
	NOV	0.28			0.00	0.59	0.04	0.04							0.28		0.28	
	DEC	0.25			0.00	0.84	0.03	0.03							0.25		0.25	
	TOTAL	8.77	4.04	4.79	0.12		1.14	9.97	7.58	7.70	0.67	0.79			3.21	2.69	0.52	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir: Inflow	Nambe Falls Reservoir: Irrigation Release	Nambe Falls Reservoir: Spill	Nambe Falls Reservoir: Evaporation	Nambe Falls Reservoir: Content End-of-Month	Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion: Future Condition	On-site Depletion: Present Condition	On-Site Effect	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					0.84												
1938	JAN	0.17			0.00	1.01	0.02	0.02							0.17		0.17	
	FEB	0.15			0.00	1.16	0.02	0.02							0.15		0.15	
	MAR	0.24			0.01	1.39	0.03	0.03							0.24		0.24	
	APR	0.57	0.14		0.02	1.80	0.07	0.21	0.70	0.40	0.30				0.73	0.37	0.36	
	MAY	1.27	0.38	0.86	0.03	1.80	0.16	1.40	1.29	1.29					0.59	0.45	0.14	
	JUNE	0.87	1.11		0.03	1.53	0.11	1.22	1.72	1.72					0.51	0.55	-0.04	
	JULY	0.58	1.48		0.02	0.61	0.08	1.56	1.95	1.95					-0.06	0.39	-0.45	
	AUG	0.37	0.66		0.01	0.31	0.05	0.71	1.16	2.25		1.09			0.21	0.36	-0.15	
	SEPT	0.58	0.58		0.00	0.31	0.07	0.65	0.95	0.89	0.06				0.41	0.35	0.06	
	OCT	0.58	0.58		0.00	0.31	0.08	0.66	0.97	0.22	0.75				0.42	0.24	0.18	
	NOV	0.37			0.00	0.68	0.05	0.05							0.37		0.37	
	DEC	0.28			0.00	0.96	0.04	0.04							0.28		0.28	
	TOTAL	6.03	4.93	0.86	0.12		0.78	6.57	8.74	8.72	1.11	1.09			4.02	2.71	1.31	
1939	JAN	0.27			0.00	1.23	0.04	0.04							0.27		0.27	
	FEB	0.20			0.00	1.43	0.02	0.02							0.20		0.20	
	MAR	0.45		0.07	0.01	1.80	0.06	0.13							0.38		0.38	
	APR	1.02	0.00	1.00	0.02	1.80	0.13	1.13	0.60	0.32	0.28				0.28	0.41	-0.13	
	MAY	1.34	0.63	0.68	0.03	1.80	0.18	1.49	1.46	1.46					0.66	0.50	0.16	
	JUNE	0.65	2.02		0.02	0.41	0.08	2.10	2.28	2.28					-0.39	0.51	-0.90	
	JULY	0.31	0.40		0.01	0.31	0.04	0.44	0.91	2.10		1.19			0.30	0.26	0.04	
	AUG	0.35	0.34		0.01	0.31	0.05	0.39	0.86	2.31		0.38	1.07		0.38	0.26	0.12	
	SEPT	0.35	0.35		0.00	0.31	0.04	0.39	0.57	0.95			0.38		0.25	0.26	-0.01	
	OCT	0.36	0.36		0.00	0.31	0.05	0.41	0.60	0.22	0.38				0.26	0.29	-0.03	
	NOV	0.23			0.00	0.54	0.03	0.03							0.23		0.23	
	DEC	0.19			0.00	0.73	0.02	0.02							0.19		0.19	
	TOTAL	5.72	4.10	1.75	0.10		0.74	6.59	7.28	9.64	0.66	1.57	1.45	15.0	3.01	2.49	0.52	
1940	JAN	0.20			0.00	0.93	0.02	0.02							0.20		0.20	
	FEB	0.19			0.00	1.12	0.02	0.02							0.19		0.19	
	MAR	0.43			0.01	1.54	0.06	0.06							0.43		0.43	
	APR	0.92	1.06		0.02	1.38	0.12	1.18	1.60	0.41	1.19				0.55	0.44	0.11	
	MAY	1.89	0.00	1.45	0.02	1.80	0.25	1.70	1.00	1.00					0.87	0.35	0.52	
	JUNE	1.21	1.84		0.03	1.14	0.16	2.00	2.22	2.22					0.33	0.72	-0.39	
	JULY	0.44	1.26		0.01	0.31	0.06	1.32	1.73	2.37		0.64			-0.07	0.31	-0.38	
	AUG.	0.40	0.39		0.01	0.31	0.05	0.44	0.91	2.14		0.93	0.30		0.40	0.30	0.10	
	SEPT	0.36	0.36		0.00	0.31	0.05	0.41	0.60	0.80			0.20		0.26	0.25	0.01	
	OCT	0.39	0.39		0.00	0.31	0.05	0.44	0.64	0.28	0.36				0.28	0.23	0.05	
	NOV	0.27			0.00	0.58	0.03	0.03							0.27		0.27	
	DEC	0.25			0.00	0.83	0.03	0.03							0.25		0.25	
	TOTAL	6.95	5.30	1.45	0.10		0.90	7.65	8.70	9.22	1.55	1.57	0.50	5.4	3.96	2.60	1.36	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir: Inflow	Nambe Falls Reservoir: Irrigation Release	Nambe Falls Reservoir: Spill	Nambe Falls Reservoir: Evaporation	Nambe Falls Reservoir: Content End-of-Month	Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion: Future Condition	On-site Depletion: Present Condition	On-Site Effect	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					0.83												
1941	JAN	0.22			0.00	1.05	0.03	0.03							0.22		0.22	
	FEB	0.22			0.00	1.27	0.03	0.03							0.22		0.22	
	MAR	0.45			0.01	1.71	0.06	0.06							0.45		0.45	
	APR	0.97	0.93		0.02	1.73	0.13	1.06	1.49	0.28	1.21				0.69	0.21	0.48	
	MAY	5.81	0.00	5.71	0.03	1.80	0.75	6.46	0.88	0.88					0.48	0.52	-0.04	
	JUNE	5.11	0.98	4.10	0.03	1.80	0.66	5.74	1.99	1.99					0.89	0.74	0.15	
	JULY	2.56	1.30	1.23	0.03	1.80	0.33	2.86	2.02	2.02					0.90	0.67	0.23	
	AUG	1.24	1.18	0.04	0.02	1.80	0.16	1.38	1.75	1.75					0.78	0.57	0.21	
	SEPT	1.28	0.14	1.12	0.02	1.80	0.17	1.43	0.45	0.45					0.22	0.19	0.03	
	OCT	1.44	0.00	1.43	0.01	1.80	0.19	1.62	0.03	0.03					0.02	0.02	0.00	
	NOV	1.03		1.02	0.01	1.80	0.13	1.15							0.00		0.00	
	DEC	0.56		.56	0.00	1.80	0.07	0.63							0.00		0.00	
	TOTAL	20.89	4.53	15.21	0.18		2.71	22.45	8.61	7.40	1.21				4.87	2.92	1.95	
1942	JAN	0.45		0.45	0.00	1.80	0.06	0.51							0.00		0.00	
	FEB	0.27		0.27	0.00	1.80	0.03	0.30							0.00		0.00	
	MAR	0.41		0.40	0.01	1.80	0.05	0.45							0.01		0.01	
	APR	2.88	0.00	2.86	0.02	1.80	0.37	3.23	0.00	0.00					0.02	0.00	0.02	
	MAY	4.44	0.31	4.10	0.03	1.80	0.58	4.99	1.51	1.51					0.68	0.08	0.60	
	JUNE	2.98	1.52	1.43	0.03	1.80	0.39	3.34	2.16	2.16					0.96	1.06	-0.10	
	JULY	0.76	1.94		0.02	0.60	0.10	2.04	2.40	2.40					-0.14	0.59	-0.73	
	AUG	0.38	0.66		0.01	0.31	0.05	0.71	1.16	2.01		0.85			0.22	0.38	-0.16	
	SEPT	0.61	0.50		0.01	0.41	0.08	0.58	0.85	0.00	0.85				0.48	0.24	0.24	
	OCT	0.36	0.11		0.00	0.66	0.05	0.16	0.23	0.23					0.35	0.23	0.12	
	NOV	0.27			0.00	0.93	0.04	0.04							0.27		0.27	
	DEC	0.24			0.00	1.17	0.03	0.03							0.24		0.24	
	TOTAL	14.05	5.04	9.51	0.13		1.83	16.38	8.31	8.31	0.85	0.85			3.09	2.58	0.51	
1943	JAN	0.27			0.00	1.44	0.04	0.04							0.27		0.27	
	FEB	0.23			0.00	1.67	0.03	0.03							0.23		0.23	
	MAR	0.27		0.13	0.01	1.80	0.04	0.17							0.14		0.14	
	APR	0.88	0.00	0.86	0.02	1.80	0.11	0.97	0.48	0.48					0.23	0.32	-0.09	
	MAY	1.26	0.25	0.98	0.03	1.80	0.16	1.39	1.21	1.21					0.55	0.42	0.13	
	JUNE	0.64	1.45		0.03	0.96	0.08	1.53	1.92	1.92					0.02	0.52	-0.50	
	JULY	0.32	0.96		0.01	0.31	0.04	1.00	1.43	2.48		1.05			-0.02	0.35	-0.37	
	AUG	0.34	0.33		0.01	0.31	0.04	0.37	0.84	1.90		0.52			0.37	0.33	0.04	
	SEPT	0.28	0.28		0.00	0.31	0.04	0.32	0.47	1.31			0.54		0.20	0.28	-0.08	
	OCT	0.25	0.25		0.00	0.31	0.03	0.28	0.41	0.25	0.16		0.84		0.18	0.26	-0.08	
	NOV	0.19			0.00	0.50	0.03	0.03							0.19		0.19	
	DEC	0.23			0.00	0.73	0.03	0.03							0.23		0.23	
	TOTAL	5.16	3.52	1.97	0.11		0.67	6.16	6.76	9.55	0.16	1.57	1.38	14.5	2.59	2.48	0.11	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir: Inflow	Nambe Falls Reservoir: Irrigation Release	Nambe Falls Reservoir: Spill	Nambe Falls Reservoir: Evaporation	Nambe Falls Reservoir: Content End-of-Month	Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion: Future Condition	On-site Depletion: Present Condition	On-Site Effect	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					0.73												
1944	JAN	0.19				0.92	0.03	0.03							0.19		0.19	
	FEB	0.17				1.09	0.02	0.02							0.17		0.17	
	MAR	0.21			0.01	1.29	0.03	0.03							0.21		0.21	
	APR	0.49	1.09		0.02	0.67	0.07	1.16	1.58	0.17	1.41				0.08	0.32	-0.24	
	MAY	2.17	0.38	0.63	0.03	1.80	0.28	1.29	1.37	1.37					1.75	0.52	1.23	
	JUNE	1.78	1.69	0.06	0.03	1.80	0.23	1.98	2.17	2.17					0.97	0.77	0.20	
	JULY	1.11	1.41		0.02	1.48	0.14	1.55	1.94	1.94					0.54	0.65	-0.11	
	AUG	0.70	1.30		0.01	0.87	0.09	1.39	1.79	1.79					0.17	0.57	-0.40	
	SEPT	0.38	0.84		0.01	0.40	0.05	0.89	1.30	1.30					0.10	0.38	-0.28	
	OCT	0.46			0.01	0.85	0.06	0.06							0.46	0.08	0.38	
	NOV	0.31				1.16	0.04	0.04							0.31		0.31	
	DEC	0.24				1.40	0.03	0.03							0.24		0.24	
	TOTAL	8.21	6.71	0.69	0.14		1.07	8.47	10.15	8.74	1.41				5.19	3.29	1.90	
1945	JAN	0.25				1.65	0.03	0.03							0.25		0.25	
	FEB	0.22		0.07		1.80	0.03	0.10							0.15		0.15	
	MAR	0.45		0.44	0.01	1.80	0.06	0.50							0.01		0.01	
	APR	1.20		1.18	0.02	1.80	0.15	1.33	0.26	0.26					0.13	0.12	0.01	
	MAY	3.10	0.44	2.63	0.03	1.80	0.40	3.47	1.48	1.48					0.67	0.51	0.16	
	JUNE	1.84	1.76	0.05	0.03	1.80	0.24	2.05	2.22	2.22					0.99	0.79	0.20	
	JULY	0.69	2.06		0.02	0.41	0.09	2.15	2.50	2.50					-0.29	0.51	-0.80	
	AUG	0.39	0.48		0.01	0.31	0.05	0.53	0.99	1.88		0.89			0.34	0.36	-0.02	
	SEPT	0.37	0.37			0.31	0.05	0.42	0.61	1.12		0.51			0.26	0.30	-0.04	
	OCT	0.27	0.27			0.31	0.04	0.31	0.45	0.24	0.21				0.20	0.29	-0.09	
	NOV	0.20				0.51	0.03	0.03							0.20		0.20	
	DEC	0.17				0.68	0.02	0.02							0.17		0.17	
	TOTAL	9.15	5.38	4.37	0.12		1.19	10.94	8.51	9.70	0.21	1.40			3.08	2.88	0.20	
1946	JAN	0.18				0.86	0.02	0.02							0.18		0.18	
	FEB	0.13				0.99	0.02	0.02							0.13		0.13	
	MAR	0.21			0.01	1.19	0.03	0.03							0.21		0.21	
	APR	0.74	1.10		0.01	0.82	0.10	1.20	1.62	0.43	1.19				0.34	0.46	-0.12	
	MAY	0.66	0.59		0.01	0.88	0.09	0.68	1.38	1.38					0.67	0.48	0.19	
	JUNE	0.27	0.83		0.01	0.31	0.03	0.86	1.49	2.18		0.69			0.09	0.36	-0.27	
	JULY	0.29	0.28		0.01	0.31	0.04	0.32	0.80	2.10		0.88	0.42		0.35	0.32	0.03	
	AUG	0.71	0.70		0.01	0.31	0.09	0.79	1.23	0.90	0.33				0.54	0.38	0.16	
	SEPT	0.36	0.36			0.31	0.05	0.41	0.60	0.98		0.33	0.05		0.26	0.25	0.01	
	OCT	0.43	0.43			0.31	0.05	0.48	0.70	0.20	0.50				0.30	0.31	-0.01	
	NOV	0.34				0.65	0.04	0.04							0.34		0.34	
	DEC	0.28				0.93	0.04	0.04							0.28		0.28	
	TOTAL	4.60	4.29		0.06		0.60	4.89	7.82	8.17	2.02	1.90	0.47	58	3.69	2.56	1.13	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir					Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion		On-Site Effect	
		Inflow	Irrigation Release	Spill	Evaporation	Content End-of-Month									Future Condition	Present Condition		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					0.93												
1947	JAN	0.24				1.17	0.03	0.03							0.24		0.24	
	FEB	0.18				1.35	0.02	0.02							0.18		0.18	
	MAR	0.24			0.01	1.58	0.03	0.03							0.24		0.24	
	APR	0.40	1.07		0.02	0.89	0.05	1.12	1.54	0.47	1.07				0.00	0.37	-0.37	
	MAY	1.20	0.00	0.27	0.02	1.80	0.16	0.43	0.91	0.91					1.32	0.38	0.94	
	JUNE	0.53	1.96		0.02	0.35	0.07	2.03	2.24	2.24					-0.46	0.43	-0.89	
	JULY	0.23	0.26		0.01	0.31	0.03	0.29	0.77	2.32		1.55			0.30	0.24	0.06	
	AUG	0.38	0.37		0.01	0.31	0.05	0.42	0.89	1.32		0.02	0.41		0.39	0.25	0.14	
	SEPT	0.26	0.26			0.31	0.04	0.30	0.44	0.91			0.47		0.19	0.22	-0.03	
	OCT	0.25	0.25			0.31	0.03	0.28	0.41	0.31	0.10				0.18	0.15	0.03	
	NOV	0.21				0.52	0.03	0.03							0.21		0.21	
	DEC	0.18				0.70	0.02	0.02							0.18		0.18	
	TOTAL	4.30	4.17	0.27	0.09		0.56	5.00	7.20	8.48	1.17	1.57	0.88	10.4	2.97	2.04	0.93	
1948	JAN	0.16				0.86	0.02	0.02							0.16		0.16	
	FEB	0.16				1.02	0.02	0.02							0.16		0.16	
	MAR	0.23			0.01	1.24	0.03	0.03							0.23		0.23	
	APR	0.92	1.33		0.01	0.82	0.12	1.45	1.85	0.38	1.47				0.39	0.40	-0.01	
	MAY	2.03	0.26	0.77	0.02	1.80	0.26	1.29	1.28	1.28					1.55	0.63	0.92	
	JUNE	1.55	0.89	0.63	0.03	1.80	0.20	1.72	1.64	1.64					0.74	0.59	0.15	
	JULY	0.60	2.00		0.02	0.38	0.08	2.08	2.43	2.43					-0.35	0.41	-0.76	
	AUG	0.41	0.47		0.01	0.31	0.05	0.52	0.98	1.94		0.96			0.37	0.31	0.06	
	SEPT	0.21	0.21			0.31	0.03	0.24	0.35	1.21		0.61	0.25		0.15	0.21	-0.06	
	OCT	0.21	0.21			0.31	0.03	0.24	0.35	0.10	0.25				0.15	0.21	-0.06	
	NOV	0.19				0.50	0.03	0.03							0.19		0.19	
	DEC	0.18				0.68	0.02	0.02							0.18		0.18	
	TOTAL	6.05	5.37	1.40	0.10		0.89	7.66	8.88	8.98	1.72	1.57	0.25	2.8	3.92	2.76	1.16	
1949	JAN	0.17				0.85	0.02	0.02							0.17		0.17	
	FEB	0.16				1.01	0.02	0.02							0.16		0.16	
	MAR	0.20			0.01	1.20	0.02	0.02							0.20		0.20	
	APR	0.55	1.14		0.01	0.60	0.07	1.21	1.63	0.31	1.32				0.11	0.39	-0.28	
	MAY	1.65	0.27	0.16	0.02	1.80	0.22	0.65	1.26	1.26					1.76	0.49	1.27	
	JUNE	1.69	0.27	1.39	0.03	1.80	0.22	1.88	1.26	1.26					0.57	0.45	0.12	
	JULY	0.99	1.02		0.03	1.74	0.13	1.15	1.57	1.57					0.65	0.38	0.27	
	AUG	0.71	1.48		0.02	0.95	0.09	1.57	1.96	1.96					0.08	0.42	-0.34	
	SEPT	0.37	0.66		0.01	0.65	0.05	0.71	1.04	1.04					0.16	0.34	-0.18	
	OCT	0.31	0.19		0.01	0.76	0.04	0.23	0.34	0.34					0.27	0.18	0.09	
	NOV	0.22				0.98	0.03	0.03							0.22		0.22	
	DEC	0.14				1.12	0.02	0.02							0.14		0.14	
	TOTAL	7.16	5.03	1.55	0.14		0.93	7.51	9.06	7.74	1.32				4.49	2.65	1.84	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir: Inflow	Nambe Falls Reservoir: Irrigation Release	Nambe Falls Reservoir: Spill	Nambe Falls Reservoir: Evaporation	Nambe Falls Reservoir: Content End-of-Month	Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion: Future Condition	On-site Depletion: Present Condition	On-Site Effect	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					1.12												
1950	JAN	0.18			0.00	1.30	0.02	0.02							0.18		0.18	
	FEB	0.14			0.00	1.44	0.02	0.02							0.14		0.14	
	MAR	0.17			0.01	1.60	0.02	0.02							0.17		0.17	
	APR	0.34	0.00	0.12	0.02	1.80	0.04	0.16	0.40	0.40					0.39	0.36	0.03	
	MAY	0.34	0.50		0.03	1.61	0.04	0.54	1.29	1.29					0.40	0.40	0.00	
	JUNE	0.25	1.53		0.02	0.31	0.03	1.56	1.94	1.98		0.04			-0.44	0.28	-0.72	
	JULY	0.21	0.20		0.01	0.31	0.03	0.23	0.71	1.82		1.11			0.32	0.24	0.08	
	AUG	0.16	0.15		0.01	0.31	0.02	0.17	0.66	2.27		0.42			0.30	0.19	0.11	
	SEPT	0.13	0.13		0.00	0.31	0.02	0.15	0.22	0.75			1.19		0.09	0.15	-0.06	
	OCT	0.13	0.13		0.00	0.31	0.02	0.15	0.22	0.40			0.53		0.09	0.08	0.01	
	NOV	0.08			0.00	0.39	0.01	0.01					0.18		0.08		0.08	
	DEC	0.06			0.00	0.45	0.01	0.01							0.06		0.06	
	TOTAL	2.19	2.64	0.12	0.10		0.28	3.04	5.44	8.91		1.57	1.90	21.3	1.78	1.70	0.08	
1951	JAN	0.05			0.00	0.50	0.01	0.01							0.05		0.05	
	FEB	0.06			0.00	0.56	0.01	0.01							0.06		0.06	
	MAR	0.09			0.01	0.64	0.01	0.01							0.09		0.09	
	APR	0.20	0.52		0.01	0.31	0.03	0.55	1.01	0.42	0.59				0.12	0.26	-0.14	
	MAY	0.50	0.49		0.01	0.31	0.06	0.55	1.30	0.95	0.35				0.57	0.47	0.10	
	JUNE	0.20	0.19		0.01	0.31	0.03	0.22	1.09	2.28		0.94	0.25		0.48	0.39	0.09	
	JULY	0.09	0.08		0.01	0.31	0.01	0.09	0.58	2.40			1.82		0.26	0.22	0.04	
	AUG	0.48	0.47		0.01	0.31	0.06	0.53	0.99	1.31			0.32		0.44	0.36	0.08	
	SEPT	0.42	0.42		0.00	0.31	0.05	0.47	0.69	1.34			0.65		0.30	0.25	0.05	
	OCT	0.26	0.26		0.00	0.31	0.03	0.29	0.42	0.26	0.16				0.18	0.15	0.03	
	NOV	0.21			0.00	0.52	0.03	0.03							0.21		0.21	
	DEC	0.19			0.00	0.71	0.03	0.03							0.19		0.19	
	TOTAL	2.75	2.43		0.06		0.36	2.79	6.08	8.96	1.10	0.94	3.04	33.9	2.95	2.10	0.85	
1952	JAN	0.21			0.00	0.92	0.03	0.03							0.21		0.21	
	FEB	0.14			0.00	1.06	0.02	0.02							0.14		0.14	
	MAR	0.26			0.01	1.31	0.03	0.03							0.26		0.26	
	APR	0.94	1.21		0.01	1.03	0.12	1.33	1.74	0.33	1.41				0.48	0.54	-0.06	
	MAY	2.28	0.00	1.49	0.02	1.80	0.30	1.79	0.70	0.70					1.09	0.26	0.83	
	JUNE	1.91	1.69	.19	0.03	1.80	0.25	2.13	2.18	2.18					0.97	0.77	0.20	
	JULY	0.63	1.62		0.02	0.79	0.08	1.70	2.08	2.08					-0.09	0.42	-0.51	
	AUG	0.42	0.89		0.01	0.31	0.06	0.95	1.38	1.53		0.15			0.13	0.34	-0.21	
	SEPT	0.34	0.34		0.00	0.31	0.04	0.38	0.56	0.93		0.37			0.24	0.20	0.04	
	OCT	0.26	0.26		0.00	0.31	0.03	0.29	0.42	0.40	0.02				0.18	0.15	0.03	
	NOV	0.20			0.00	0.51	0.03	0.03							0.20		0.20	
	DEC	0.20			0.00	0.71	0.02	0.02							0.20		0.20	
	TOTAL	7.79	6.01	1.68	0.10		1.01	8.70	9.06	8.15	1.43	0.52			4.01	2.68	1.33	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir					Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion		On-Site Effect	
		Inflow	Irrigation Release	Spill	Evaporation	Content End-of-Month									Future Condition	Present Condition		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15.	16	17	18	19
	DEC					0.71												
	JAN	0.23			0.00	0.94	0.03	0.03							0.23		0.23	
	FEB	0.16			0.00	1.10	0.02	0.02							0.16		0.16	
	MAR	0.27			0.01	1.36	0.04	0.04							0.27		0.27	
	APR	0.46	0.39		0.02	1.41	0.06	0.45	0.92	0.42	0.50				0.47	0.35	0.12	
	MAY	1.27	0.24	0.62	0.02	1.80	0.17	1.03	1.21	1.21					0.93	0.67	0.26	
1953	JUNE	1.13	1.68		0.03	1.22	0.15	1.83	2.11	2.11					0.36	0.63	-0.27	
	JULY	0.63	1.43		0.01	0.41	0.08	1.51	1.91	1.91					0.03	0.42	-0.39	
	AUG	0.32	0.41		0.01	0.31	0.04	0.45	0.92	2.21		1.29			0.31	0.30	0.01	
	SEPT	0.23	0.23		0.00	0.31	0.03	0.26	0.38	1.33		0.28	0.67		0.16	0.13	0.03	
	OCT	0.24	0.24		0.00	0.31	0.03	0.27	0.40	0.19	0.21				0.17	0.15	0.02	
	NOV	0.22			0.00	0.53	0.03	0.03							0.22		0.22	
	DEC	0.19			0.00	0.72	0.02	0.02							0.19		0.19	
	TOTAL	5.35	4.62	0.62	0.10		0.70	5.94	7.85	9.38	0.71	1.57	0.67	7.1	3.50	2.65	0.85	
	JAN	0.19			0.00	0.91	0.02	0.02							0.19		0.19	
	FEB	0.13			0.00	1.04	0.02	0.02							0.13		0.13	
	MAR	0.19			0.01	1.22	0.02	0.02							0.19		0.19	
	APR	0.55	1.37		0.01	0.39	0.07	1.44	1.84	0.48	1.36				-0.02	0.39	-0.41	
	MAY	0.88	0.00		0.01	1.26	0.12	0.12	0.82	0.82					1.23	0.50	0.73	
1954	JUNE	0.43	1.36		0.02	0.31	0.06	1.42	1.85	2.12		0.27			-0.13	0.45	-0.58	
	JULY	0.42	0.41		0.01	0.31	0.06	0.47	0.94	1.96		1.02			0.42	0.34	0.08	
	AUG	0.40	0.39		0.01	0.31	0.05	0.44	0.91	1.59		0.28	0.40		0.40	0.33	0.07	
	SEPT	0.27	0.27		0.00	0.31	0.04	0.31	0.45	0.99			0.54		0.19	0.16	0.03	
	OCT	0.25	0.25		0.00	0.31	0.03	0.28	0.41	0.25	0.16				0.18	0.15	0.03	
	NOV	0.18			0.00	0.49	0.02	0.02							0.18		0.18	
	DEC	0.17			0.00	0.66	0.02	0.02							0.17		0.17	
	TOTAL	4.06	405		0.07		0.53	4.58	7.22	8.21	1.52	1.57	0.94	11.4	3.13	2.32	0.81	
	JAN	0.19			0.00	0.85	0.02	0.02							0.19		0.19	
	FEB	0.15			0.00	1.00	0.02	0.02							0.15		0.15	
	MAR	0.14			0.01	1.13	0.02	0.02							0.13		0.13	
	APR	0.26	1.07		0.01	0.31	0.03	1.10	1.52	0.38	1.14				-0.15	0.28	-0.43	
	MAY	0.96	0.22		0.01	1.04	013	0.35	1.17	0.90	0.27				1.25	0.59	0.66	
1955	JUNE	0.67	1.38		0.02	0.31	0.09	1.47	1.88	2.28		0.40			0.10	0.52	-0.42	
	JULY	0.61	0.60		0.01	0.31	0.08	0.68	1.13	1.97		0.84			0.49	0.41	0.08	
	AUG	1.28	1.27		0.01	0.31	0.17	1.44	1.84	1.49	0.35				0.81	0.67	0.14	
	SEPT	0.75	0.75		0.00	0.31	0.10	0.85	1.24	1.36		0.12			0.54	0.44	0.10	
	OCT	0.34	0.34		0.00	0.31	0.04	0.38	0.56	0.40	0.16				0.24	0.20	0.04	
	NOV	0.24			0.00	0.55	0.03	0.03							0.24		0.24	
	DEC	0.25			0.00	0.80	0.03	0.03							0.25		0.25	
	TOTAL	5.84	5.63		0.07		0.76	6.39	9.34	8.78	1.92	1.36			4.24	3.11	1.13	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir: Inflow	Nambe Falls Reservoir: Irrigation Release	Nambe Falls Reservoir: Spill	Nambe Falls Reservoir: Evaporation	Nambe Falls Reservoir: Content End-of-Month	Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion: Future Condition	On-site Depletion: Present Condition	On-Site Effect	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1956	DEC					0.80												
	JAN	0.21			0.00	1.01	0.03	0.03							0.21		0.21	
	FEB	0.15			0.00	1.16	0.02	0.02							0.15		0.15	
	MAR	0.21			0.01	1.36	0.03	0.03							0.21		0.21	
	APR	0.23	0.86		0.01	0.72	0.03	0.89	1.33	0.48	0.85				-0.05	0.26	-0.31	
	MAY	0.30	0.51		0.01	0.50	0.04	0.55	1.30	1.30					0.35	0.42	-0.07	
	JUNE	0.12	0.30		0.01	0.31	0.02	0.32	1.15	2.02		0.87			0.32	0.37	-0.05	
	JULY	0.18	0.17		0.01	0.31	0.02	0.19	0.68	2.46		0.70	1.08		0.30	0.25	0.05	
	AUG	0.15	0.14		0.01	0.31	0.02	0.16	0.65	2.24			1.59		0.29	0.24	0.05	
	SEPT	0.10	0.10		0.00	0.31	0.01	0.11	0.16	1.43			1.27		0.07	0.06	0.01	
	OCT	0.14	0.14		0.00	0.31	0.02	0.16	0.23	0.37			0.14		0.10	0.08	0.02	
	NOV	0.11			0.00	0.42	0.01	0.01							0.11		0.11	
	DEC	0.12			0.00	0.54	0.01	0.01							0.12		0.12	
	TOTAL	2.02	2.22		0.06		0.26	2.48	5.50	10.30	0.85	1.57	4.08	39.6	2.18	1.68	0.50	
1957	JAN	0.14			0.00	0.68	0.02	0.02							0.14		0.14	
	FEB	0.11			0.00	0.79	0.02	0.02							0.11		0.11	
	MAR	0.18			0.01	0.96	0.02	0.02							0.17		0.17	
	APR	0.74	1.38		0.01	0.31	0.10	1.48	1.88	0.34	1.54				0.17	0.46	-0.29	
	MAY	1.60	0.00	0.09	0.02	1.80	0.21	0.30	1.04	1.01	0.03				1.96	0.52	1.44	
	JUNE	1.80	1.87		0.03	1.70	0.23	2.10	2.28	2.28					0.92	0.81	0.11	
	JULY	0.94	1.43		0.02	1.19	0.12	1.55	1.94	1.94					0.35	0.54	-0.19	
	AUG	1.70	1.02	0.05	0.02	1.80	0.22	1.29	1.65	1.65					1.34	0.65	0.69	
	SEPT	1.02	0.84	0.16	0.02	1.80	0.13	1.13	1.42	1.42					0.64	0.48	0.16	
	OCT	0.57	0.00	0.56	0.01	1.80	0.07	0.63	0.00	0.00					0.01	0.00	0.01	
	NOV	0.48		0.47	0.01	1.80	0.06	0.53							0.01		0.01	
	DEC	0.36		0.36	0.00	1.80	0.05	0.41							0.00		0.00	
	TOTAL	9.64	6.54	1.69	0.15		1.25	9.48	10.21	8.64	1.57				5.82	3.46	2.36	
1958	JAN	0.28		0.28	0.00	1.80	0.04	0.32							0.00		0.00	
	FEB	0.21		0.21	0.00	1.80	0.03	0.24							0.00		0.00	
	MAR	0.37		0.36	0.01	1.80	0.05	0.41							0.01		0.01	
	APR	1.83	0.00	1.81	0.02	1.80	0.24	2.05	0.18	0.18					0.10	0.08	0.02	
	MAY	4.23	0.00	4.20	0.03	1.80	0.55	4.75	1.22	1.22					0.56	0.42	0.14	
	JUNE	2.47	1.63	0.81	0.03	1.80	0.32	2.76	2.19	2.19					0.97	0.77	0.20	
	JULY	0.72	2.06		0.02	0.44	0.09	2.15	2.50	2.50					-0.26	0.45	-0.71	
	AUG	0.49	0.61		0.01	0.31	0.06	0.67	1.12	1.97		0.85			0.36	0.37	-0.01	
	SEPT	0.42	0.42		0.00	0.31	0.05	0.47	0.69	0.66	0.03				0.30	0.25	0.05	
	OCT	0.36	0.36		0.00	0.31	0.05	0.41	0.60	0.28	0.32				0.26	0.22	0.04	
	NOV	0.26			0.00	0.57	0.03	0.03							0.26		0.26	
	DEC	0.23			0.00	0.80	0.03	0.03							0.23		0.23	
	TOTAL	11.87	5.08	7.67	0.12		1.54	14.29	8.50	9.00	0.35	0.85			2.79	2.56	0.23	

Table A-14. MONTHLY OPERATION STUDY.. POJOAQUE UNIT..FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir					Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion		On-Site Effect	
		Inflow	Irrigation Release	Spill	Evaporation	Content End-of-Month									Future Condition	Present Condition		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					0.80												
	JAN	0.18			0.00	0.98	0.02	0.02							0.18		0.18	
	FEB	0.10			0.00	1.08	0.01	0.01							0.10		0.10	
	MAR	0.13			0.01	1.20	0.02	0.02							0.13		0.13	
	APR	0.28	0.36		0.01	1.11	0.04	0.40	0.87	0.37	0.50				0.30	0.29	0.01	
	MAY	0.64	0.00		0.02	1.73	0.08	0.08	0.78	0.78					0.98	0.50	0.48	
1959	JUNE	0.40	1.51		0.02	0.60	0.05	1.56	1.94	1.94					- 0.28	0.44	- 0.72	
	JULY	0.29	0.57		0.01	0.31	0.04	0.61	1.07	2.48		1.41			0.18	0.29	- 0.11	
	AUG	0.71	0.70		0.01	0.31	0.09	0.79	1.23	0.91	0.32				0.54	0.45	0.09	
	SEPT	0.29	0.29		0.00	0.31	0.04	0.33	0.48	1.35		0.48	0.39		0.21	0.17	0.04	
	OCT	0.28	0.28		0.00	0.31	0.04	0.32	0.47	0.00	0.47				0.20	0.17	0.03	
	NOV	0.20			0.00	0.51	0.03	0.03							0.20		0.20	
	DEC	0.18			0.00	0.69	0.02	0.02							0.18		0.18	
	TOTAL	3.68	3.71		0.08		0.48	4.19	6.84	7.83	1.29	1.89	0.39	5.0	2.92	2.31	0.61	
	JAN	0.20			0.00	0.89	0.03	0.03							0.20		0.20	
	FEB	0.12			0.00	1.01	0.01	0.01							0.12		0.12	
	MAR	0.90		0.10	0.01	1.80	0.12	0.22							0.80		0.80	
	APR	1.78	0.93	0.83	0.02	1.80	0.23	1.99	1.58	0.48	1.10				0.70	0.53	0.17	
	MAY	1.61	0.34	1.24	0.03	1.80	0.21	1.79	1.30	1.30					0.59	0.45	0.14	
	JUNE	1.45	1.23	0.19	0.03	1.80	0.19	1.61	1.85	1.85					0.83	0.66	0.17	
1960	JULY	1.06	1.58		0.02	1.26	0.14	1.72	2.04	2.04					0.36	0.58	- 0.22	
	AUG	0.53	1.47		0.01	0.31	0.07	1.54	1.93	2.40		0.47			- 0.11	0.38	- 0.49	
	SEPT	0.33	0.33		0.00	0.31	0.04	0.37	0.54	1.14		0.60			0.24	0.19	0.05	
	OCT	0.32	0.32		0.00	0.31	0.04	0.36	0.53	0.00	0.53				0.23	0.19	0.04	
	NOV	0.22			0.00	0.53	0.03	0.03							0.22		0.22	
	DEC	0.19			0.00	0.72	0.02	0.02							0.19		0.19	
	TOTAL	8.71	6.20	2.36	0.12		1.13	9.69	9.77	9.21	1.63	1.07			4.37	2.98	1.39	
	JAN	0.19			0.00	0.91	0.02	0.02							0.19		0.19	
	FEB	0.12			0.00	1.03	0.02	0.02							0.12		0.12	
	MAR	0.19			0.01	1.21	0.02	0.02							0.19		0.19	
	APR	0.84	0.36		0.02	1.67	0.11	0.47	0.94	0.40	0.54				0.89	0.47	0.42	
	MAY	1.44	0.70	0.58	0.03	1.80	0.19	1.47	1.51	1.51					0.81	0.52	0.29	
	JUNE	0.90	1.94		0.03	0.73	0.12	2.06	2.26	2.26					- 0.07	0.57	- 0.64	
1961	JULY	0.53	0.94		0.01	0.31	0.07	1.01	1.44	2.31		0.87			0.21	0.38	- 0.17	
	AUG	0.74	0.73		0.01	0.31	0.10	0.83	1.27	1.35		0.08			0.56	0.46	0.10	
	SEPT	0.55	0.55		0.00	0.31	0.07	0.62	0.91	1.06		0.15			0.39	0.33	0.06	
	OCT	0.40	0.40		0.00	0.31	0.05	0.45	0.66	0.29	0.37				0.29	0.24	0.05	
	NOV	0.31			0.00	0.62	0.04	0.04							0.31		0.31	
	DEC	0.24			0.00	0.86	0.03	0.03							0.24		0.24	
	TOTAL	6.45	5.62	0.58	0.11		0.84	7.04	8.99	9.18	0.91	1.10			4.13	2.97	1.16	

Table A-14. MONTHLY OPERATION STUDY -- POJOAQUE UNIT -- FUTURE CONDITIONS (Unit - 1,000 Acre-feet)

YEAR	MONTH	Nambe Falls Reservoir					Tributary Inflow	Total Inflow	Flow Diverted	Diversion Demand	Diversion to Soil Moisture	Diversion Demand met from Soil Moisture	Shortage	Shortage as Percent of Diversion Demand	On-site Depletion		On-Site Effect	
		Inflow	Irrigation Release	Spill	Evaporation	Content End-of-Month									Future Condition	Present Condition		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	DEC					0.86												
1962	JAN	0.21			0.00	1.07	0.03	0.03							0.21		0.21	
	FEB	0.20			0.00	1.27	0.03	0.03							0.20		0.20	
	MAR	0.26			0.01	1.52	0.03	0.03							0.26		0.26	
	APR	1.17	0.59	0.28	0.02	1.80	0.15	1.02	1.19	0.46	0.73				0.81	0.53	0.28	
	MAY	1.62	0.68	0.91	0.03	1.80	0.21	1.80	1.51	1.51					0.68	0.52	0.16	
	JUNE	0.54	1.81		0.02	0.51	0.07	1.88	2.14	2.14					-0.34	0.48	-0.82	
	JULY	0.47	0.66		0.01	0.31	0.06	0.72	1.17	1.57		0.40			0.32	0.36	-0.04	
	AUG	0.28	0.27		0.01	0.31	0.04	0.31	0.79	2.35		1.17	0.39		0.35	0.28	0.07	
	SEPT	0.24	0.24		0.00	0.31	0.03	0.27	0.40	0.78			0.38		0.17	0.14	0.03	
	OCT	0.27	0.27		0.00	0.31	0.04	0.31	0.45	0.20	0.25				0.19	0.16	0.03	
	NOV	0.22			0.00	0.53	0.03	0.03							0.22		0.22	
	DEC	0.20			0.00	0.73	0.03	0.03							0.20		0.20	
	TOTAL	5.68	4.52	1.19	0.10		0.75	6.46	7.65	9.01	0.98	1.57	0.77	8.5	3.27	2.47	0.80	
1963	JAN	0.19			0.00	0.92	0.02	0.02							0.19		0.19	
	FEB	0.15			0.00	1.07	0.02	0.02							0.15		0.15	
	MAR	0.45			0.01	1.51	0.06	0.06							0.45		0.45	
	APR	0.97	1.26		0.02	1.20	0.13	1.39	1.79	0.47	1.32				0.49	0.55	-0.06	
	MAY	1.10	0.75		0.02	1.53	0.14	0.89	1.51	1.51					1.00	0.56	0.44	
	JUNE	0.57	1.77		0.02	0.31	0.07	1.84	2.12	2.12					-0.29	0.49	-0.78	
	JULY	0.30	0.29		0.01	0.31	0.04	0.33	0.81	2.12		1.31			0.36	0.30	0.06	
	AUG	0.46	0.45		0.01	0.31	0.06	0.51	0.97	1.69		0.26	0.46		0.43	0.35	0.08	
	SEPT	0.60	0.60		0.00	0.31	0.08	0.68	0.99	0.40	0.59				0.43	0.36	0.07	
	OCT	0.31	0.31		0.00	0.31	0.04	0.35	0.51	0.28	0.23				0.22	0.18	0.04	
	NOV	0.24			0.00	0.55	0.03	0.03							0.24		0.24	
	DEC	0.21			0.00	0.76	0.03	0.03							0.21		0.21	
	TOTAL	5.55	5.43		0.09		0.72	6.15	8.70	8.59	2.14	1.57	0.46	5.4	3.88	2.79	1.09	
	JAN																	
	FEB																	
	MAR																	
	APR																	
	MAY																	
	JUNE																	
	JULY																	
	AUG																	
	SEPT																	
	OCT																	
	NOV																	
	DEC																	
	TOTAL																	

Normally this spill would appear excessive; however, a check was made on the original sizing studies and it was found that the benefits derived from a larger reservoir did not exceed the additional costs required for a larger dam.

The reservoir was reduced to dead storage in all but 4 years. River-run conditions existed for 47.3 percent of the time during the irrigation season.

An average annual shortage of 590 acre-feet, or 6.8 percent, is estimated to occur under future conditions. Shortages occurred in 14 of the 29 years, or about 48 percent of the time. The maximum annual shortage of 4,080 acre-feet occurred in 1956. This shortage represents 39.6 percent. The maximum shortage for 2 consecutive years totaled 55.2 percent in 1950 and 1951.

The average annual onsite depletion is 3,640 acre-feet. The maximum annual depletion is 5,820 acre-feet in 1957, and the minimum annual depletion is 1,780 acre-feet in 1950.

Project Effect

The average annual difference in onsite depletion between the present and future conditions results in an onsite effect of 1,030 acre-feet. The onsite effect reflects the additional water applied to the land in the future as compared to present plus the effect of storage in Nambe Falls Reservoir and reservoir evaporation. No change in deep percolation loss is expected to occur. This assumption was based upon the great difference in water yield that is known to occur between the alluvium and underlying Santa Fe formation, the existence of springs caused apparently by rock outcrop in the upper portion of the project area, and the high water table that exists at the mouth of the Pojoaque River.

The maximum annual onsite effect is 2,530 acre-feet in 1935, and the minimum onsite effect is 80 acre-feet in 1950. The maximum monthly onsite effect was 1,440 acre-feet during May 1957, and the minimum monthly onsite effect was an accretion of 900 acre-feet during June 1939.

The San Juan-Chama Project has to supply any losses on water delivery occurring during the replacement of the project effects at Otowi. Due to the proximity of the mouth of the Pojoaque River to the Rio Grande at Otowi, no losses were assumed for this reach. Based on a monthly routing study, it was found that the reduction in losses on the Rio Grande and Rio Chama above Otowi during periods of negative project effect (accretion at Otowi) would offset the losses occurring when the project effect was positive (depletion at Otowi).

The average annual project effect is 1,030 acre-feet. The adjustment for the filling of the dead pool was not included. The effect of filling the dead pool if spread over 100 years is beyond the accuracy of the study. The annual demand of 1,030 acre-feet represents 3.72 percent of the 27,700 acre-feet allocated to the tributary units.

It is recognized that the above demands may vary somewhat under final water accounting procedures; however, the change will probably be minor and should not affect the feasibility of the unit.

Water Quality

A sample of the canal water, taken at the upper end of the unit near the Nambe Indian School, showed the water was medium in salinity and low in sodium. Because of the light textured soils and the good permeability in this area, the canal water can be considered suitable for irrigation use.

Drainage

There are a few areas in the Pojoaque Unit with drainage problems at the present time. For the most part the soils are open and freely drained. Two localized areas of high water table occur, one in the vicinity of the confluence of the Pojoaque and Tesuque Rivers, and the other along the Rio Grande near the western edge of the unit. The estimated income from the lands in these areas would not support the cost of providing corrective drainage works. Therefore, these areas were considered nonirrigable.

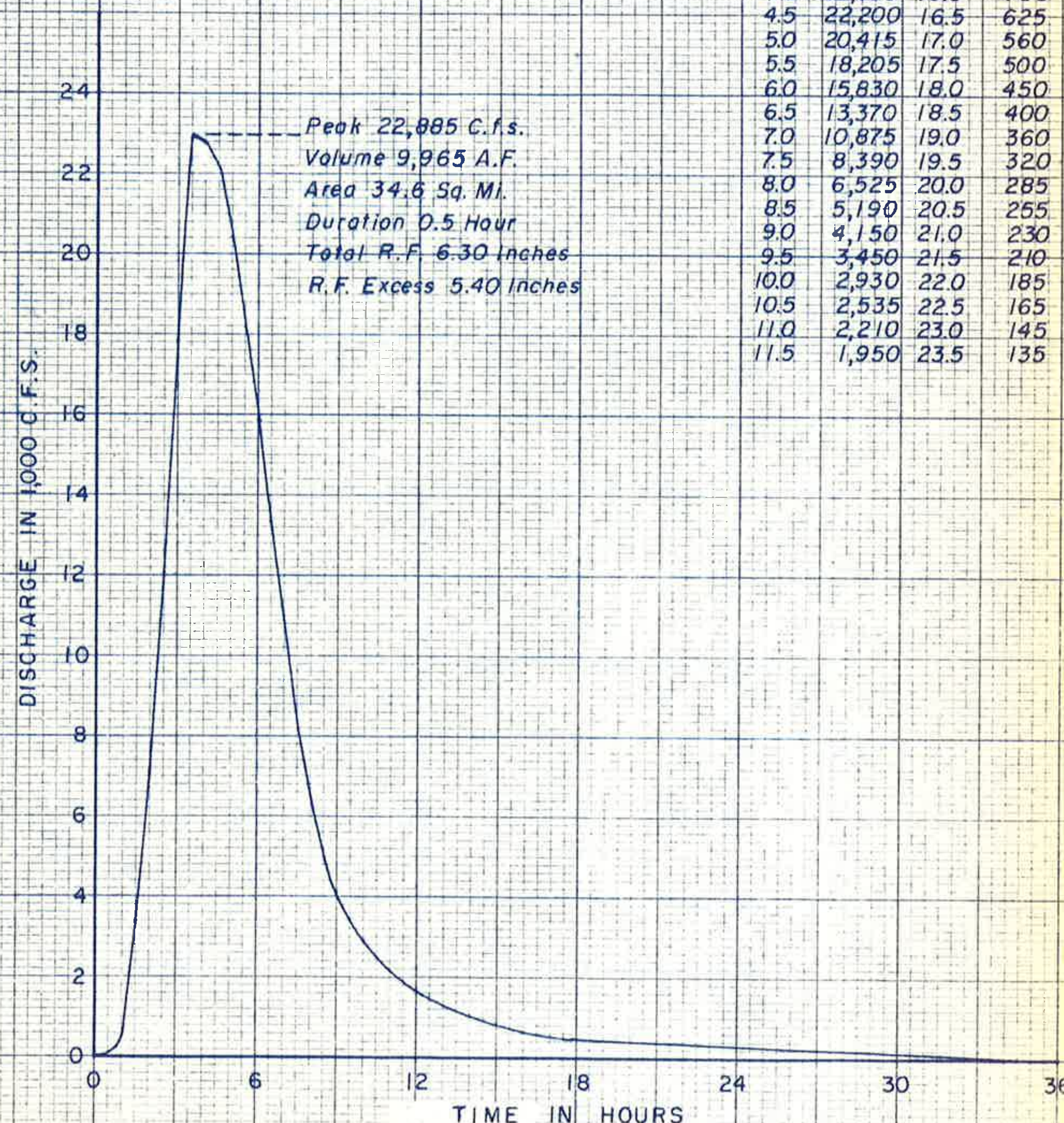
Under project operations there will probably be other localized areas that will develop drainage problems, or the present areas of high water table may become larger. However, it is believed that the area affected will be small and corrective costs will be relatively minor.

Inflow Design Flood

The inflow design flood peak, caused by a cloudburst-type rainfall of 6.3 inches occurring in 5 hours, was computed as 22,900 cubic feet per second at the proposed Nambe Falls damsite. This storm was estimated to produce a runoff of 9,970 acre-feet in 34.5 hours. The inflow design flood due to a thunderstorm is shown on Figure A-13.

THUNDERSTORM

HOUR	C.F.S.	HOUR	C.F.S.	HOUR	C.F.S.
0	0	12.0	1,725	24.0	115
0.5	140	12.5	1,525	24.5	105
1.0	530	13.0	1,360	25.0	95
1.5	3,370	13.5	1,215	25.5	90
2.0	7,095	14.0	1,085	26.0	85
2.5	12,035	14.5	975	26.5	80
3.0	17,855	15.0	870	27.0	75
3.5	22,885	15.5	780	27.5	70
4.0	22,835	16.0	700	28.0	65
4.5	22,200	16.5	625	28.5	60
5.0	20,415	17.0	560	29.0	55
5.5	18,205	17.5	500	29.5	50
6.0	15,830	18.0	450	30.0	45
6.5	13,370	18.5	400	30.5	35
7.0	10,875	19.0	360	31.0	30
7.5	8,390	19.5	320	31.5	25
8.0	6,525	20.0	285	32.0	15
8.5	5,190	20.5	255	32.5	10
9.0	4,150	21.0	230	33.0	10
9.5	3,450	21.5	210	33.5	5
10.0	2,930	22.0	185	34.0	4
10.5	2,535	22.5	165	34.5	0
11.0	2,210	23.0	145		
11.5	1,950	23.5	135		



SAN JUAN-CHAMA PROJECT
POJOAQUE UNIT

NAMBE FALLS DAMSITE
INFLOW DESIGN FLOOD
THUNDERSTORM

FIGURE A-13

An inflow design flood comprising a general-type spring rainstorm occurring in conjunction with snowmelt runoff was also analyzed. The combined peak inflow was 11,400 cubic feet per second, and the combined volume of runoff was 20,600 acre-feet in 15 days. The inflow design flood due to a combined rain and snowmelt flood is shown on Figure A-14. The two inflow design floods were computed from data obtained or derived in the subsequent paragraphs.

Lag curve and dimensionless graph. For the purpose of obtaining a lag curve and dimensionless graph (or graphs), several storms which have occurred on eastern slope tributaries to the Rio Grande were analyzed. No analysis proved satisfactory. In all instances, the volume of the storm runoff was not sufficiently large to warrant the assumption that the storm covered the entire area above the gage being analyzed.

Since it was impossible to derive unitgraphs from recorded events, the Buckhorn Creek dimensionless graph was used for unitgraph derivation for the watershed above the damsite. The dimensionless graph is shown on Figure A-15.

A lag curve for mountain streams which exhibit a small amount of interflow was used to determine the lag.

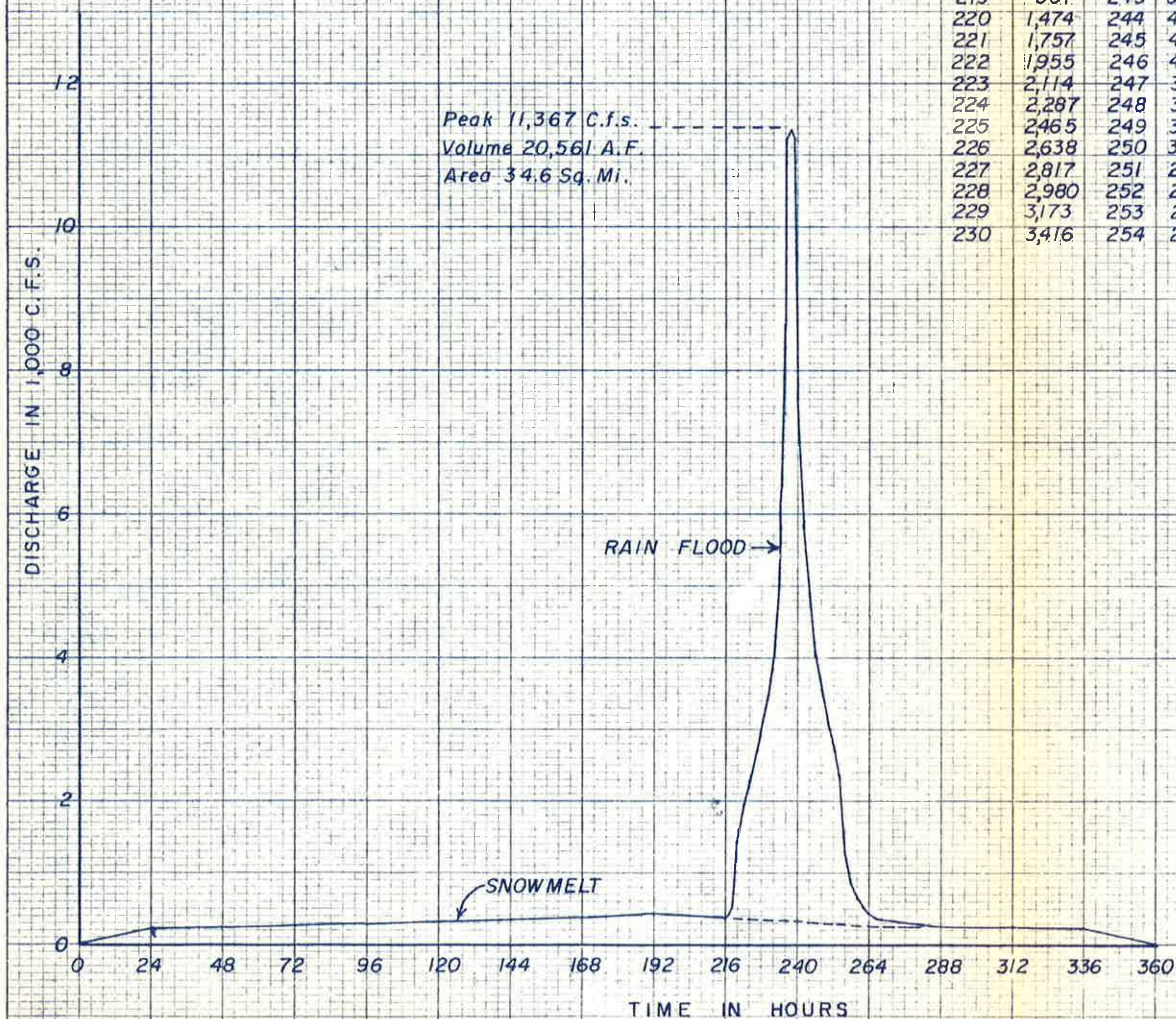
$$\text{Lag, hours} = 2.22\ (LL_{ca}/S^{0.5})^{0.38}$$

The lag curve is shown on Figure A-16.

Retention rates. The retention rate used for the general-type storm was 0.10 inch per hour for the entire storm. For the summer-type thunderstorm, an initial loss of 0.50 inch was used for the first hour and a retention rate of 0.10 inch per hour thereafter.

COMBINED RAIN AND SNOWMELT FLOOD

HOUR	C.F.S.	HOUR	C.F.S.	HOUR	C.F.S.	HOUR	C.F.S.
0	0	231	3,670	255	1,839	279	289
24	207	232	4,008	256	1,288	280	288
48	235	233	4,466	257	981	281	286
72	272	234	5,114	258	805	282	283
96	288	235	6,243	259	694	283	282
120	304	236	8,571	260	607	284	282
144	333	237	10,869	261	546	285	281
168	386	238	11,367	262	500	286	281
192	402	239	9,366	263	458	287	280
216	366	240	7,664	264	427	288	280
217	379	241	6,547	265	391	312	258
218	567	242	5,821	266	376	336	223
219	981	243	5,290	267	360	360	0
220	1,474	244	4,829	268	345		
221	1,757	245	4,387	269	334		
222	1,955	246	4021	270	324		
223	2,114	247	3,765	271	318		
224	2,287	248	3,563	272	308		
225	2465	249	3,322	273	302		
226	2,638	250	3,076	274	302		
227	2,817	251	2,909	275	296		
228	2,980	252	2,783	276	296		
229	3,173	253	2,662	277	292		
230	3,416	254	2,345	278	291		



SAN JUAN-CHAMA PROJECT
POJOAQUE UNIT
NAMBE FALLS DAMSITE
INFLOW DESIGN FLOOD
COMBINED RAIN AND SNOWMELT FLOOD

FIGURE A-14

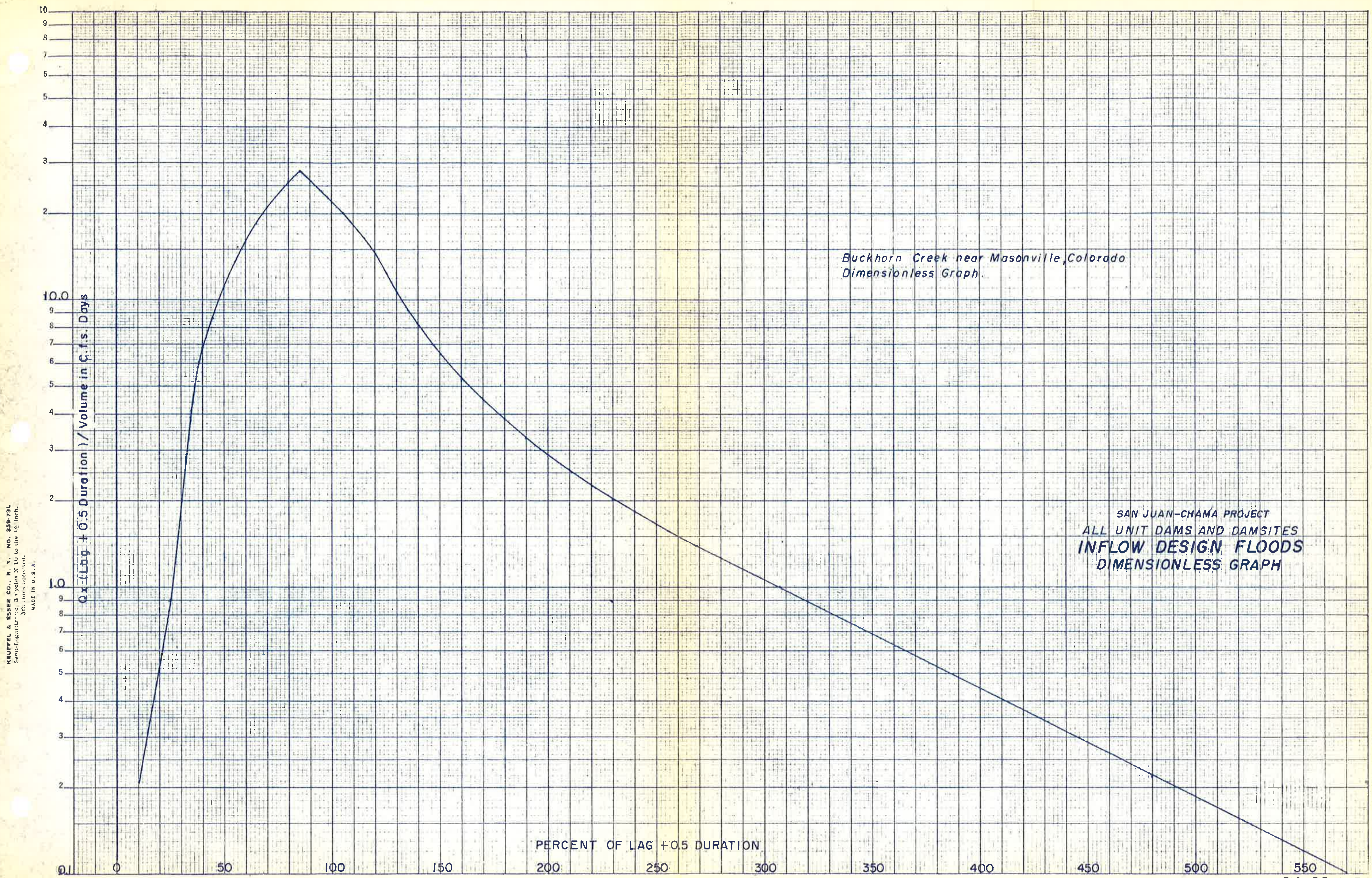

Buckhorn Creek near Masonville, Colorado
Dimensionless Graph.
SAN JUAN-CHAMA PROJECT
ALL UNIT DAMS AND DAMSITES
INFLOW DESIGN FLOODS
DIMENSIONLESS GRAPH
Q x (Lag + 0.5 Duration) / Volume in C.f.s. Days
PERCENT OF LAG + 0.5 DURATION
0
50
100
150
200
250
300
350
400
450
500
550
0.1
1.0
10.0
KEUFFEL & ESSER CO., N. Y. NO. 359-73L

FIGURE A-15

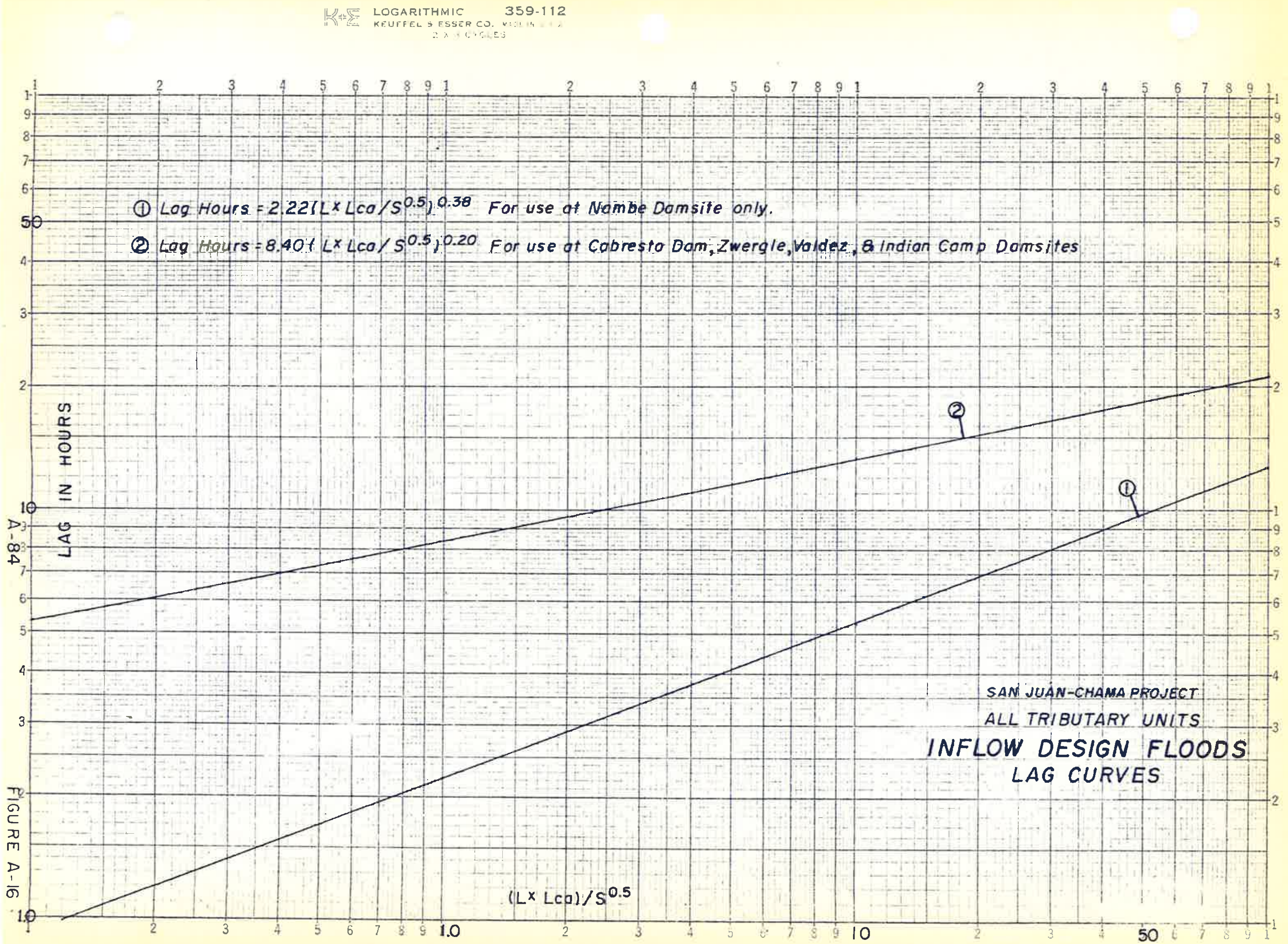

K+E LOGARITHMIC 359-112
KEUFFEL & ESSER CO.
① Lag Hours = 2.22(L x Lca/S^0.5)^0.38 For use at Nambe Damsite only.
② Lag Hours = 8.40(L x Lca/S^0.5)^0.20 For use at Cabresto Dam, Zwergle, Valdez, & Indian Camp Damsites
LAG IN HOURS
(L x Lca)/S^0.5
SAN JUAN-CHAMA PROJECT
ALL TRIBUTARY UNITS
INFLOW DESIGN FLOODS
LAG CURVES

FIGURE A-16

Design storm rainfall. The design storm rainfall for both the spring storm and the thunderstorm for the Nambe Falls damsite is shown in Table A-15.

Lag time. The lag time at the Nambe Falls damsite was computed from the above equation as follows:

$L = 11.29$ miles; $L_{ca} = 6.65$ miles; $LL_{ca} = 75.08$ miles

Elevation at damsite (feet)-------------------	6,700
Maximum upper elevation (feet)----------------	12,600
Average upper elevation (feet)----------------	11,000
Difference in elevation (feet)----------------	4,300
Difference in elevation per mile = S (feet per mile)------------------------------------	380.87
$S^{0.5}$ (feet per mile)--------------------------	19.51
$(LL_{ca}/S^{0.5})$ (lag factor)---------------------	3.85
Lag (hours) [from Figure A-16]----------------	3.70

Unitgraphs. Two unitgraphs were derived with the first based on a 1-hour duration and the second on a 1/2-hour duration. The unitgraphs are presented on Figure A-17.

The duration time of a unitgraph should not be greater than approximately one-fourth the lag time. Although the duration time of the 1-hour unitgraph equalled 27 percent of the lag time, it was deemed acceptable.

The 1-hour unitgraph was computed for the spring-type storm and the 1/2-hour unitgraph for the cloudburst-type storm (thunderstorm). The excess precipitation for the thunderstorm was determined on 1/2-hour increments, thereby necessitating the computation of the 1/2-hour unitgraph.

Thunderstorm inflow design flood. The rainfall excess, from Table A-15, for the thunderstorm design storm was applied to the 0.5-hour unitgraph, Figure A-17, to obtain the thunderstorm-type inflow design flood with the following results:

Table A-15. Design storm rainfall in inches
Nambe Falls damsite--Pojoaque Unit
San Juan-Chama Project.

Spring storm			
Hours	Total	Excess	Design
0- 1	1.06	.96	.09
1- 2	.59	.49	.08
2- 3	.48	.38	.09
3- 4	.43	.33	.09
4- 5	.39	.29	.10
5- 6	.35	.25	.10
6- 7	.33	.23	.12
7- 8	.33	.23	.12
8- 9	.30	.20	.13
9-10	.29	.19	.13
10-11	.29	.19	.15
11-12	.27	.17	.16
12-13	.27	.17	.17
13-14	.26	.16	.19
14-15	.26	.16	.23
15-16	.25	.15	.25
16-17	.23	.13	.33
17-18	.23	.13	.49
18-19	.22	.12	.96
19-20	.23	.13	.38
20-21	.23	.13	.29
21-22	.22	.12	.23
22-23	.22	.12	.20
23-24	.22	.12	.19
24-25	.20	.10	.17
25-26	.20	.10	.16
26-27	.20	.10	.13
27-28	.20	.10	.12
28-29	.19	.09	.13
29-30	.19	.09	.12
30-31	.20	.10	.10
31-32	.19	.09	.10
32-33	.19	.09	.09
33-34	.18	.08	.10
34-35	.18	.08	.09
35-36	.19	.09	.08
Total	10.26	6.66	6.66

Thunderstorm			
Hours	Total	Excess	Design
0-0.5	2.50	2.25	2.25
0.5-1.0	.90	.65	.65
1.0-1.5	.60	.55	.55
1.5-2.0	.60	.55	.55
2.0-2.5	.50	.45	.45
2.5-3.0	.40	.35	.35
3.0-3.5	.35	.30	.30
3.5-4.0	.35	.30	.30
4.0-4.5	.05	.00	
4.5-5.0	.05	.00	
Total	6.30	5.40	5.40

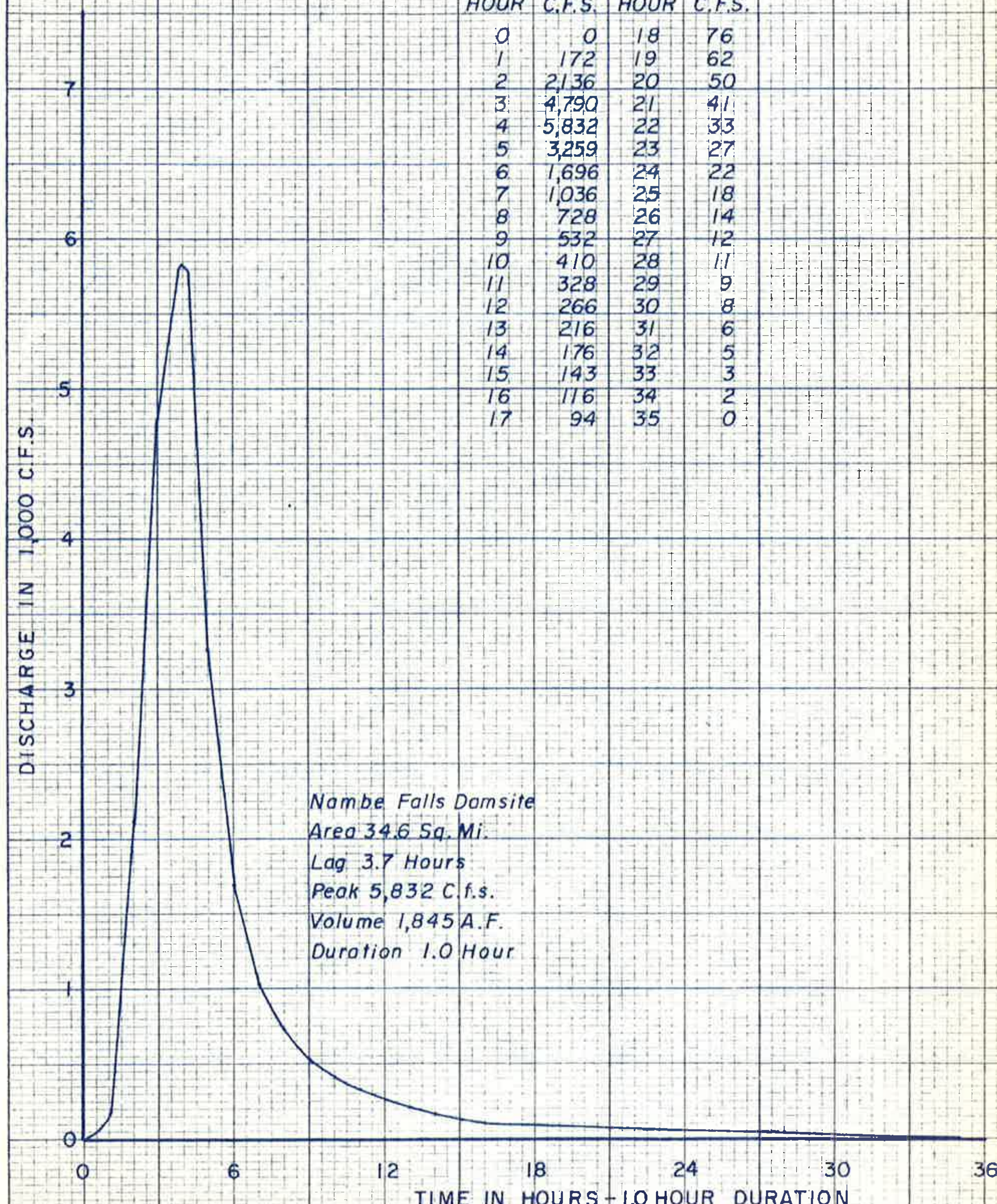
Retention rates

Spring storm:
0.10 inch per hour.

Thunderstorm:
0.50 inch per hour for 0 to 1.0 hour, thereafter 0.10 inch per hour.

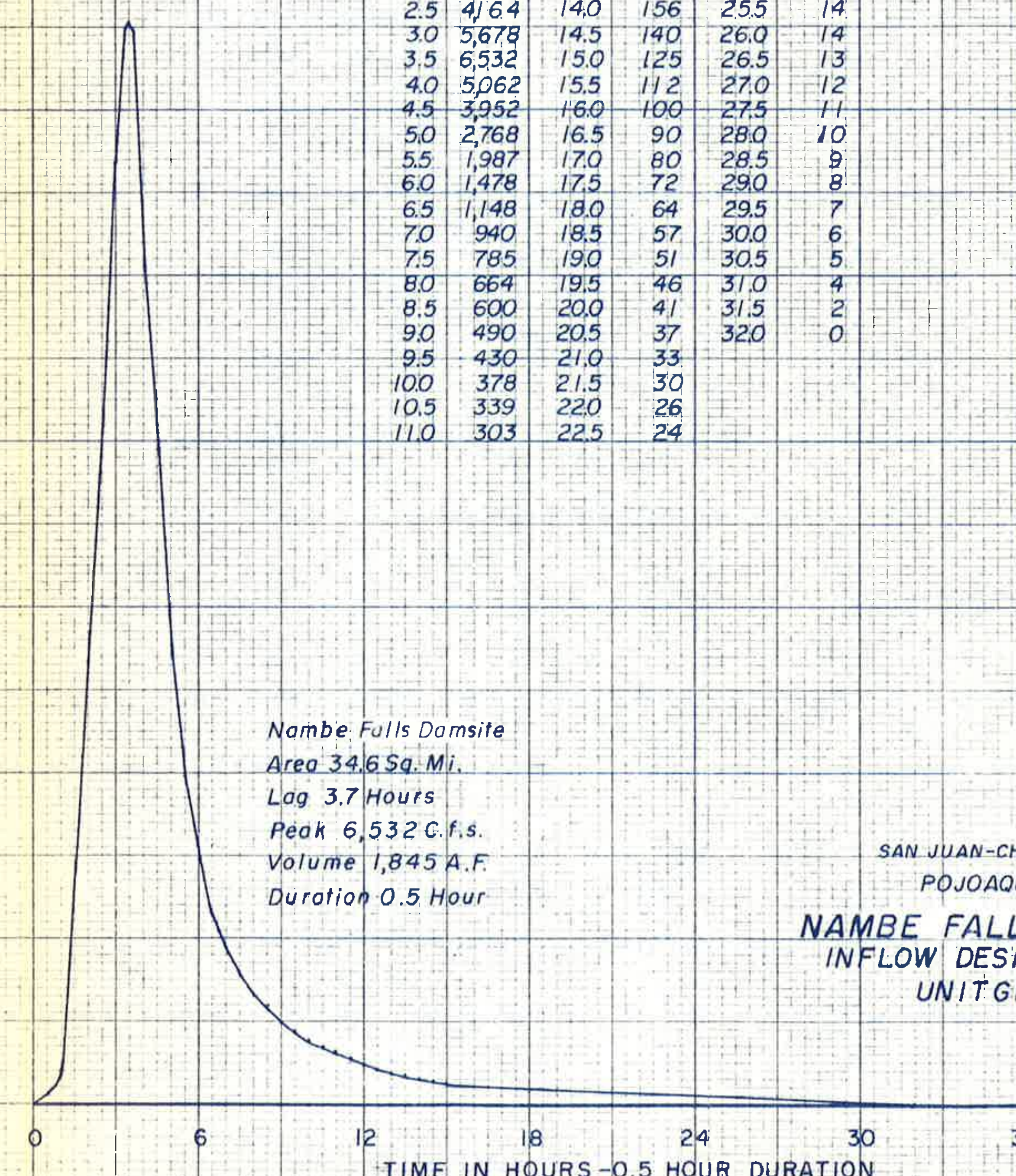
1.0 HOUR UNITGRAPH

HOUR	C.F.S.	HOUR	C.F.S.
0	0	18	76
1	172	19	62
2	2,136	20	50
3	4,790	21	41
4	5,832	22	33
5	3,259	23	27
6	1,696	24	22
7	1,036	25	18
8	728	26	14
9	532	27	12
10	410	28	11
11	328	29	9
12	266	30	8
13	216	31	6
14	176	32	5
15	143	33	3
16	116	34	2
17	94	35	0



0.5 HOUR UNITGRAPH

HOUR	C.F.S.	HOUR	C.F.S.	HOUR	C.F.S.
0	0	11.5	272	23.0	21
0.5	62	12.0	243	23.5	19
1.0	218	12.5	217	24.0	17
1.5	1,420	13.0	195	24.5	15
2.0	2,674	13.5	174	25.0	14
2.5	4,164	14.0	156	25.5	14
3.0	5,678	14.5	140	26.0	14
3.5	6,532	15.0	125	26.5	13
4.0	5,062	15.5	112	27.0	12
4.5	3,952	16.0	100	27.5	11
5.0	2,768	16.5	90	28.0	10
5.5	1,987	17.0	80	28.5	9
6.0	1,478	17.5	72	29.0	8
6.5	1,148	18.0	64	29.5	7
7.0	940	18.5	57	30.0	6
7.5	785	19.0	51	30.5	5
8.0	664	19.5	46	31.0	4
8.5	600	20.0	41	31.5	2
9.0	490	20.5	37	32.0	0
9.5	430	21.0	33		
10.0	378	21.5	30		
10.5	339	22.0	26		
11.0	303	22.5	24		



SAN JUAN-CHAMA PROJECT
POJOAQUE UNIT

NAMBE FALLS DAMSITE
INFLOW DESIGN FLOOD
UNITGRAPHS

FIGURE A-17

Peak, 22,900 c.f.s. at 3.5 hours
Volume, 9,970 acre-feet
Total storm rainfall in 5.0 hours, 6.30 inches
Total rainfall excess in 4.0 hours, 5.40 inches

Spring rain inflow design flood. The rainfall excess, from Table A-15, for the spring rain design storm was applied to the 1.0-hour unitgraph to obtain the spring rain-type inflow design flood, with the following results:

Peak, 11,000 c.f.s. at 22.0 hours
Volume, 12,300 acre-feet
Total storm rainfall in 36.0 hours, 10.26 inches
Total rainfall excess in 36.0 hours, 6.66 inches

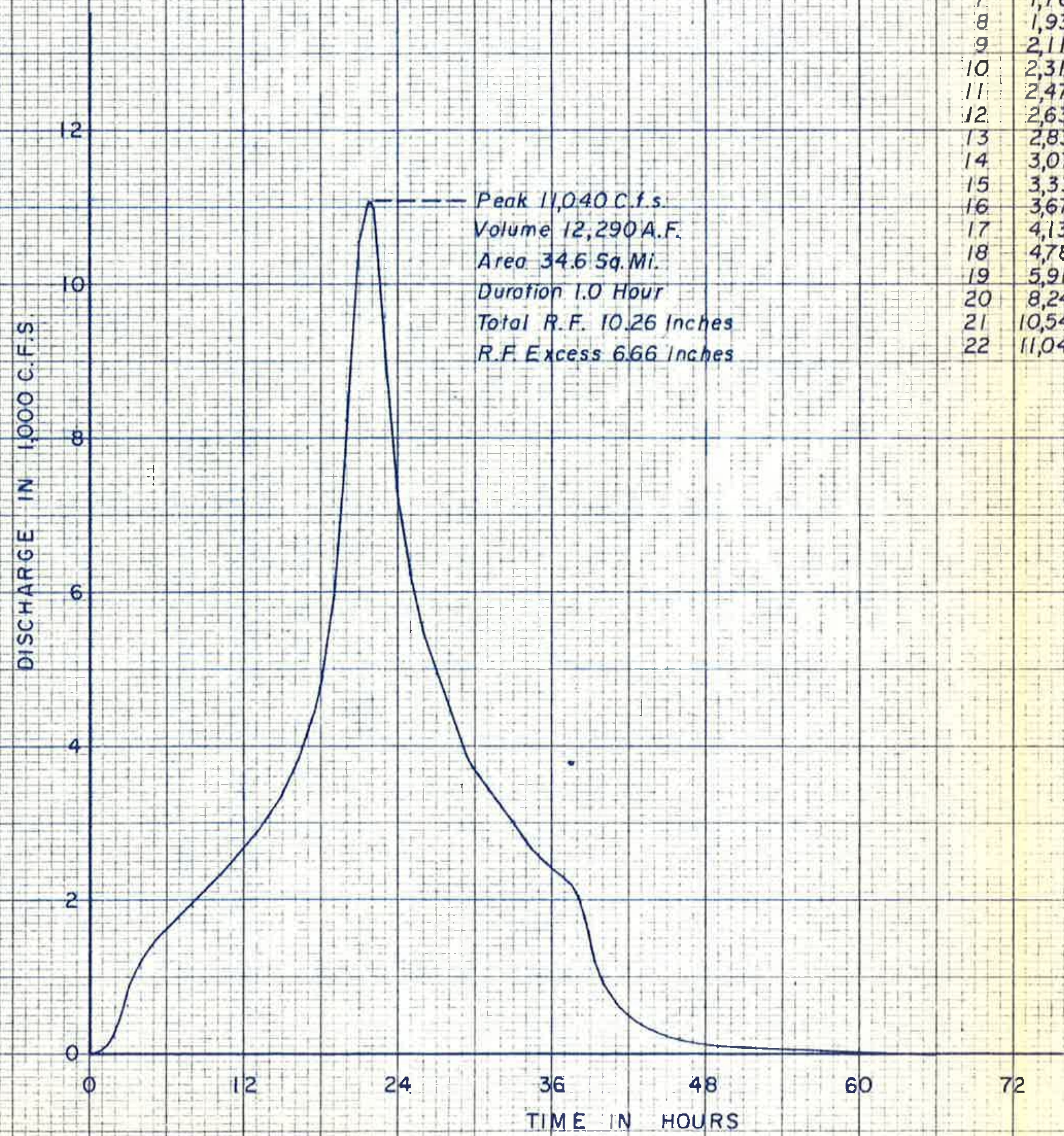
The hydrograph of the spring rain-type flood is shown on Figure A-18.

Snowmelt flood. The 15-day snowmelt flood was computed in accordance with the procedures as set forth in the Manual, Volume IV, Part 6, Flood Hydrology, Chapter 6.9.8 to 6.9.12, inclusive. The following variations were made from the standard manual procedure: the entire area above the damsite was assumed to have snow cover instead of only a portion of the area; and, the retention rate of the spring rain flood was not altered due to the concurrent snowmelt flood.

The recorded maximum 15-day volumes at the Rio Nambe gage near Nambe, corrected for the water diverted at the Nambe diversion dam, were used in this study. The average dates of the 15-day volumes for the period of record, 1933 to 1951, were May 13 to May 27, inclusive. The years 1934, 1950, and 1951 were not used on account of low volume. The average annual recorded 15-day volume for the remaining 16 years of the record is 705 second-foot days, and the average annual total snowmelt volume for the same period is 1,720 second-foot days.

SPRING STORM

HOUR	C.F.S.	HOUR	C.F.S.	HOUR	C.F.S.
0	0	23	9,040	46	205
1	15	24	7,340	47	165
2	205	25	6,225	48	135
3	620	26	5,500	49	100
4	1,115	27	4,970	50	85
5	1,400	28	4,510	51	70
6	1,600	29	4,070	52	55
7	1,760	30	3,705	53	45
8	1,935	31	3,450	54	35
9	2,115	32	3,250	55	30
10	2,310	33	3,010	56	20
11	2,470	34	2,765	57	15
12	2,635	35	2,600	58	15
13	2,830	36	2,475	59	10
14	3,075	37	2,355	60	10
15	3,330	38	2,040	61	7
16	3,670	39	1,535	62	6
17	4,130	40	985	63	5
18	4,780	41	680	64	4
19	5,910	42	505	65	3
20	8,240	43	395	66	0
21	10,540	44	310		
22	11,040	45	250		



SAN JUAN-CHAMA PROJECT
POJOAQUE UNIT
NAMBE FALLS DAMSITE
INFLOW DESIGN FLOOD
SPRING RAIN FLOOD

FIGURE A-18

A relationship was developed for estimating the mean temperature gradient (average mean temperature for May and June) versus elevation. This relationship is shown in Table A-16 and also on Figure A-19. The temperature stations used to obtain the mean adjusted temperature of the area above the Rio Nambe gage, which has a mean elevation of 9,400 feet and a mean temperature of 46.1 degrees, were as follows:

Temperature adjustment

Station	Elevation (feet)	Mean temperature (°F)	Adjustment (°F)
Santa Fe Airport------	5,312	63.2	-17.1
Santa Fe--------------	7,100	61.7	-15.6
Red River-------------	8,676	49.2	-3.1

The mean daily adjusted temperature greater than 32 degrees was computed for an elevation of 9,400 feet for each day concurrent with the dates of the maximum 15-day volume, and accumulated for each year of the record. The 15-day volume in inches of runoff divided by the 15-day accumulated adjusted mean daily temperature greater than 32 degrees for the same period, gives the melt rate in inches per degree day. The estimated snowmelt volume following the maximum 15-day volume is added to the maximum 15-day volume and the total runoff converted to inches. This total snowmelt volume in inches of runoff is then plotted with the corresponding melt rate for that year and the maximum melt rate determined from Figure A-20.

The maximum mean daily accumulated temperature greater than 32 degrees which occurred on the first day of the 16-year record is then tabulated. The same thing is done for the second day and on through the 15th day. This tabulation, therefore, represents the maximum possible accumulation of mean daily temperatures over the watershed during the 16-year period of record, and is used to compute the snowmelt flood.

Table A-16. Temperature and precipitation gradients
All tributary unit dams and damsites
San Juan-Chama Project.

Temperature gradient

Item	Weather station	Elevation (feet)	Period of record	Mean temperature - °F May	June	Weighted average
1	Red River----------	8,676	1931-62	45.1	53.4	49.2
2	Cerro-------------	7,695	1931-62	51.7	60.2	56.0
3	Taos--------------	6,975	1931-62	55.0	64.2	59.6
4	Santa Fe----------	7,100	1931-62	56.9	66.6	61.7
5	Santa Fe Airport-	6,312	1941-58	58.4	68.0	63.2

Let X = elevation in 100-foot units, and Y = average temperature in °F.

For Cabresto Dam, Zwergle, Valdez, and Indian Camp damsites, use curve determined by items 1, 2, and 3, only. (Curve I).

For Nambe Falls damsite, use curve determined by items 1, 2, 3, 4, and 5. (Curve II).

Curve I. $\text{Log } Y = 2.12327 - 0.00495X$ $S = 0.5°F$ or 0.9% of Ym.

Curve II. $\text{Log } Y = 2.11014 - 0.00475X$ $S = 1.3°F$ or 2.3% of Ym.

Precipitation gradient

Weather station	Elevation (feet)	Precipitation (inches)
Red River--------	8,676	18.78
Truchas----------	8,025	14.92
Santa Fe---------	7,100	13.56
Taos-------------	6,975	12.16
Santa Fe Airport-	6,312	11.27
Espanola---------	5,590	9.43
Penasco Ranger Station--------	7,900	15.36
Nambe No. 1 1/---	6,050	9.72
Cerro 2/---------	7,695	12.25

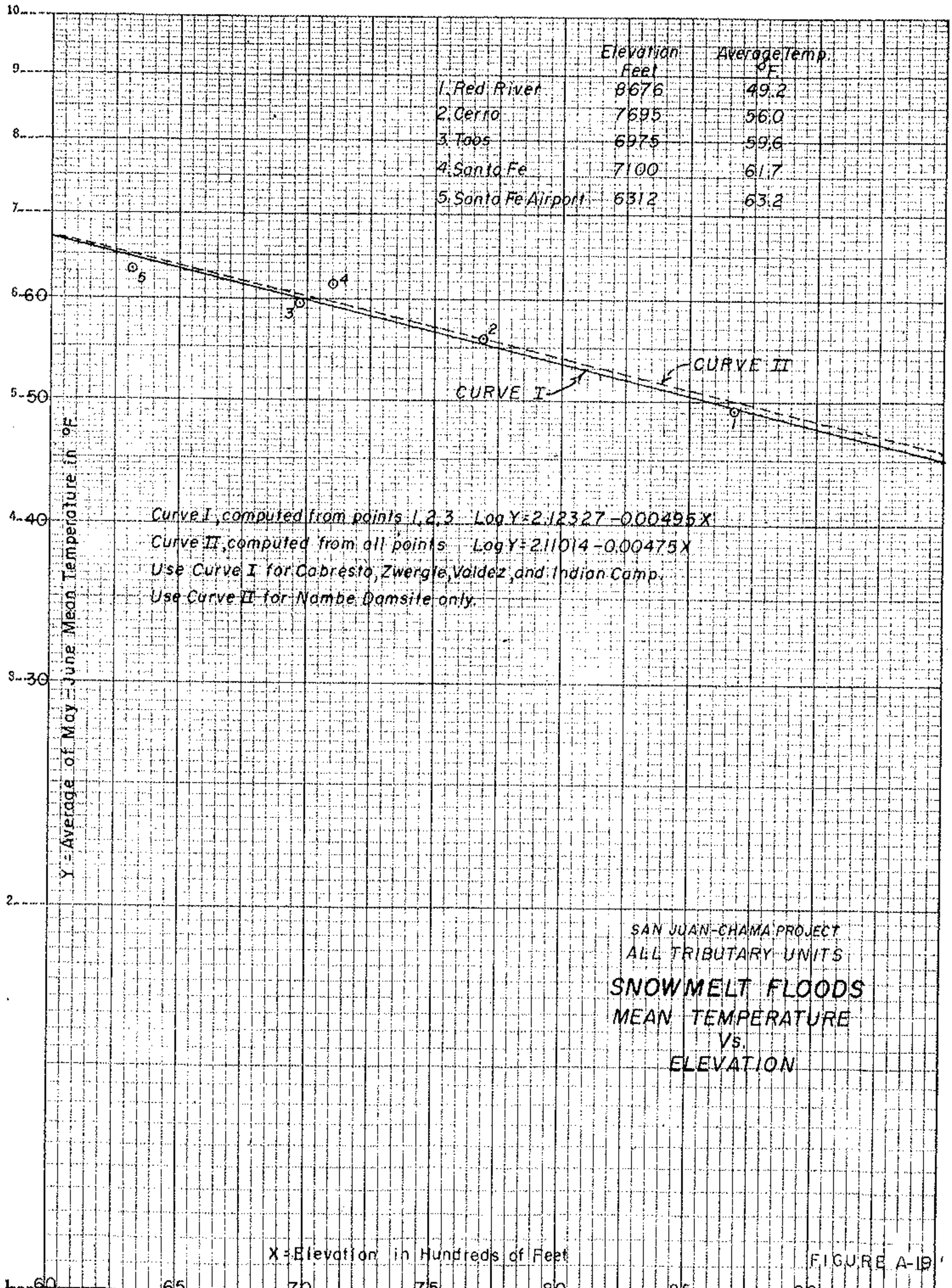
Let X = elevation in 100-foot units.

Let Y = precipitation in inches.

Then $Y = 0.289X - 7.30$.

$S = 0.64$ inches or 4.9% of mean Y.

1/ 1941-59.
2/ Not used.


Elevation Feet
Average Temp °F
1. Red River 8676 49.2
2. Cerro 7695 56.0
3. Taos 6975 59.6
4. Santa Fe 7100 61.7
5. Santa Fe Airport 6312 63.2
CURVE I
CURVE II
Curve I, computed from points 1, 2, 3 Log Y = 2.12327 - 0.00495 X
Curve II, computed from all points Log Y = 2.11014 - 0.00475 X
Use Curve I for Cabresto, Zwergle, Valdez, and Indian Camp.
Use Curve II for Nambe Damsite only.
Y = Average of May - June Mean Temperature in °F
X = Elevation in Hundreds of Feet
60
50
40
30
60
65
70
75
80
85
90
SAN JUAN-CHAMA PROJECT
ALL TRIBUTARY UNITS
SNOWMELT FLOODS
MEAN TEMPERATURE
Vs.
ELEVATION
FIGURE A-19

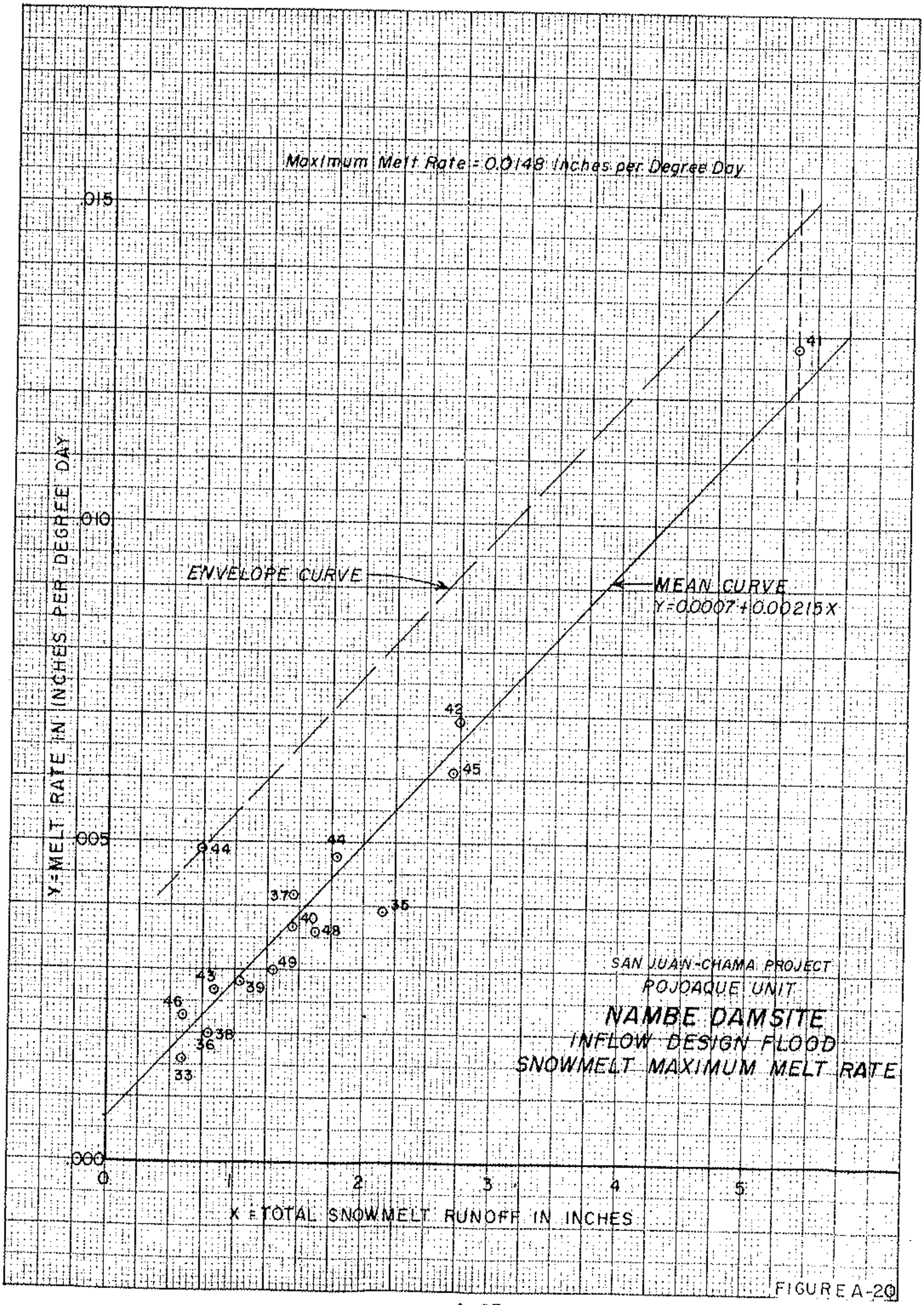

Maximum Melt Rate = 0.0148 Inches per Degree Day
.015
.010
.005
.000
Y = MELT RATE IN INCHES PER DEGREE DAY
ENVELOPE CURVE
MEAN CURVE
Y=0.0007+0.00215X
41
42
45
44
44
37
35
40
48
49
43
39
46
38
36
33
0
1
2
3
4
5
X = TOTAL SNOWMELT RUNOFF IN INCHES
SAN JUAN-CHAMA PROJECT
POJOAQUE UNIT
NAMBE DAMSITE
INFLOW DESIGN FLOOD
SNOWMELT MAXIMUM MELT RATE

FIGURE A-20

Snowmelt flood--Nambe Creek gage near Nambe
Area - 39.1 square miles

Days	Maximum adjusted mean temperature greater than 32 degrees, in degree days			Maximum melt rate is 0.0148 inches per degree day (inches)	Snowmelt runoff (s.f.d.)
	Accumulative	Incremental	Design		
1	25.9	25.9	12.4	.184	193
2	49.3	23.4	12.9	.191	201
3	68.7	19.4	15.9	.235	247
4	81.1	12.4	17.4	.258	271
5	94.0	12.9	17.9	.265	278
6	108.9	14.9	19.4	.287	302
7	125.8	16.9	[illegible]	.317	333
8	143.2	17.4	25.9	.383	403
9	155.6	12.4	23.4	.346	364
10	173.5	17.9	21.4	.317	333
11	194.9	21.4	18.4	.272	286
12	216.3	21.4	17.4	.258	271
13	233.7	17.4	16.9	.250	263
14	249.6	15.9	14.9	.221	232
15	268.0	18.4	12.4	.184	193
SUM	-	268.0	268.0	3.968	4,170

Although the drainage area of the Nambe Falls damsite is 34.6 square miles, the snowmelt flood was computed for the Rio Nambe gage near Nambe with a drainage area of 39.1 square miles. As the difference in area is only 4.5 square miles and at a relative low elevation, no adjustment in snowmelt runoff was made. The snowmelt flood is, therefore, assumed to occur at the Nambe Falls damsite. For the purpose of combining the snowmelt flood with the spring rain flood, the computed snowmelt flood in second-foot days was converted to a conventional hydrograph in c.f.s. units without change in volume, as shown in the following tabulation:

Snowmelt flood
Nambe Falls damsite

Day	Hour	c.f.s.
0	0	0
1	24	207
2	48	235
3	72	272
4	96	288
5	120	304
6	144	335
7	168	386
8	192	402
9	216	366
10	240	324
11	264	292
12	[illegible]	280
13	312	258
14	336	223
15	360	0

Peak-------------------402 c.f.s. at 192 hours
Volume-----4,170 s.f.d., or 8,270 acre-feet

Combined spring rain flood with snowmelt flood. The spring rain-type inflow design flood is assumed to occur during the progress of the 15-day snowmelt flood. The peak of the snowmelt flood occurs at the end of the 8th day, or at 192 hours. The spring rain flood starts 1 day later, or at 216 hours. The 2 floods are combined and the resulting total inflow design flood is as follows:

Combined spring rain with snowmelt flood

Flood	Peak (c.f.s.)	Volume (acre-feet)
Spring rain flood----------	11,000	12,300
Snowmelt flood------------	400	8,300
TOTAL FLOOD---------------	11,400	20,600

Diversion during Construction

The diversion during construction hydrographs were prepared from frequency studies based on records of the Rio Nambe near Nambe gage. The volume of flow used in the frequency studies was the summation of the Rio Nambe gage and the Nambe canal near Nambe. No correction in peak discharge was made since the effect of the canal in respect to peak discharge would be insignificant. The maximum recorded mean daily diversion was only 5.2 cubic feet per second.

The frequency curves are shown on Figure A-21, and the diversion during construction hydrographs are shown on Figure A-22.

Outlet Requirements

Under project conditions the only demand that will be placed on the reservoir will be for irrigation. The reservoir will be exempt from any regulation by the Rio Grande Compact because any storage effect will be compensated for by releases from Heron Reservoir. During the non-irrigation season no releases are required.

The outlet works should be designed to pass a discharge of 52 cubic feet per second at an elevation of 6,785.0. The required capacity is slightly larger than the capacity of the outlet works as designed. An increase of 7 c.f.s. was not considered large enough to warrant a redesign of the dam. The required discharge rate is the peak demand during July assuming no precipitation has occurred which would reduce the diversion demand. The peak demand was computed by the Shockly-Woodward method. The storage at elevation 6,785.0 represents approximately 5 percent of the conservation capacity under initial conditions. It is

See app a -
DPR - Llano Unit -
Jan 1972

LLANO UNIT

See App. A –
DPR – Indian Camp System –
Taos Unit, May 1971

TAOS UNIT

CERRO UNIT

Cerro Unit

Introduction

The Cerro Unit is the northernmost tributary unit of the San Juan-Chama Project as it was originally envisioned in the authorizing report. The unit was planned with the proposed Zwergle Dam and Reservoir on Red River but, like the Valdez site in the Taos Unit, the Zwergle site has also been found geologically unsound. With no other good storage sites available, the plan would be limited to the area that could be served by direct diversion. Thus, the Cerro Unit can no longer be considered on the same basis as that used in the previous report.

For any further consideration, the unit would have to be developed under some direct diversion scheme. A portion of the Red River flows are not presently being beneficially used, but without a storage and regulating structure the possibility of any irrigation benefits exceeding costs was extremely doubtful.

Because of this doubt, it was decided that a rough estimate based upon previous studies would indicate whether additional detailed studies were justified. Direct diversion studies were made as part of the hydrology supporting material for the authorizing report. Although no new operation studies were made, new data on irrigated acreage and consumptive use have been related to the diversions made in the previous studies.

Climatic Conditions

Precipitation has been measured at the Cerro weather station since June 1910 and continuous monthly records are available since February 1932.

Temperature has been measured at the Cerro weather station since June 1910 and continuous monthly records are available since January 1932.

The mean monthly values (1935 through 1963) of precipitation and temperature for the Cerro weather station are considered to be representative of the Cerro Unit lands and are listed below:

Month	Average precipitation (inches)	Mean temperature (°F)
January	0.62	21.3
February	0.57	26.9
March	0.64	34.0
April	0.97	43.9
May	1.18	51.8
June	0.81	60.3
July	1.63	65.1
August	1.80	64.0
September	1.32	58.2
October	1.19	47.8
November	0.57	34.0
December	0.60	24.9
ANNUAL	11.90	44.4

The maximum annual precipitation was 18.33 inches in 1957, or 154 percent of the average annual precipitation; and the minimum annual precipitation was 8.33 inches in 1962, or 70 percent of the average annual precipitation.

The beginning and ending dates for the frost-free period, May 30 to September 25, were obtained from Table 3 of Technical Report 32 of the State Engineer of New Mexico, "Consumptive Use and Water Requirements in New Mexico." The average frost-free period is 118 days.

Present Condition

General. The present land use is comprised primarily of small suppelemental income farms, whose owners work in the molybdenum mines near Questa, New Mexico, or in Taos, and only farm to supplement their salaried incomes. The predominant irrigated crop, small grain, amounts to 46.7 percent of the total irrigated acreage. The New Mexico State Engineer completed a reconnaissance land use survey of the Cerro area in 1960. The acreages and crop distribution determined from the survey were assumed to be representative of present condition and are as follows:

Crop	Acreage	Percent
Alfalfa-----------------------	962	27.4
Native hay and pasture--------	793	22.6
Corn--------------------------	37	1.0
Small grain-------------------	1,640	46.7
Garden------------------------	81	2.3
TOTAL IRRIGATED---------------	3,513	100.0

Consumptive use requirement. The monthly consumptive use requirement for the growing and nongrowing seasons was computed for the Cerro area using the crop distribution shown above. Table A-44 is a monthly summary of the consumptive use requirements for the growing season.

Table A-44 also presents the beginning and ending dates of the growing season, the monthly and seasonal consumptive use for each of the crops, and differentiates between the frost-free and the pre-frost-free portions of the growing season.

Table A-44. Present condition--consumptive use requirement.
Cerro Unit

Table A-44.

Crop and growing season	Acres	Percent area	April (k)	April Use (inch)	May (k)	May Use (inch)	June (k)	June Use (inch)	July (k)	July Use (inch)	August (k)	August Use (inch)	September (k)	September Use (inch)	Growing season (K)	Growing season Use (inch)
Alfalfa------------------------	962	27.4														
FP 1/ 5/15-5/29-----------					0.70	1.73									0.70	1.73
FFP 2/ 5/30-9/25-----------					0.75	0.12	0.82	4.86	0.91	5.92	0.91	5.48	0.73	2.95	0.85	19.33
															0.84	21.06
Native hay and pasture-------	793	22.6														
FP 5/15-5/29-----------					0.60	1.48									0.60	1.48
FFP 5/30-9/25-----------					0.62	0.10	0.71	4.22	0.80	5.22	0.80	4.82	0.67	2.70	0.75	17.06
															0.74	18.54
Corn-------------------------	37	1.0														
FFP 6/10-9/25-----------							0.69	2.74	0.79	5.15	0.79	4.76	0.69	2.80	0.75	15.45
Small grain------------------	1,640	46.7														
FP 4/15-5/29-----------			0.41	0.79	0.41	2.02									0.41	2.81
FFP 5/30-8/1------------					0.50	0.08	0.92	5.45	0.81	5.31	0.79	0.15			0.86	10.99
															0.70	13.80
Garden-----------------------	81	2.3														
FFP 5/30-9/25-----------					0.50	0.08	0.65	3.86	0.75	4.92	0.75	4.55	0.62	2.51	0.70	15.92
Weighted Consumptive Use Requirement:																
Inches ---				0.37		1.85		4.95		5.45		2.81		1.50	0.75	16.93
Feet---																1.41

1/FP = Frost period.
2/FFP = Frost-free period.

The consumptive use requirement was computed by the Blaney-Criddle method. The growing season for each crop was taken from Table B5 of Technical Report 32 of the State Engineer of New Mexico. A 15-day pre-frost-free period was added to the growing seasons of alfalfa and native hay and pasture. As no growing season was given for corn in the Cerro area, the growing season for corn in the Taos area was used. The growing season for garden was taken as the frost-free period. Monthly growing season consumptive use coefficients (k) were taken from Table 7 of Technical Report 32 and then adjusted so that the total monthly use would equal the use computed from the seasonal (K) factors taken from Table 6 of the report. A seasonal (K) factor of 0.30 for perennial crops and 0.20 for annual crops was used for the nongrowing season. For the pre-frost period, a (K) of 0.70 was used for alfalfa while 0.60 was used for native hay and pasture. The seasonal and monthly (K) factors are shown in the following tabulation:

Seasonal consumptive use coefficients (K)

Crop	Growing season: Frost period	Growing season: Frost-free period
Alfalfa	0.70	0.85
Native hay and pasture	0.60	0.75
Corn	-	0.75
Small grain	0.70	0.70
Garden	-	0.70

The monthly consumptive use factors (f) were computed as shown in the following tabulation:

Monthly consumptive use factors

Month	Mean temperature (°F) (t)	Monthly percent of day-time hours of the year 1/ (p)	Monthly consumptive use factor (t)(p)/100 (f)
January	21.3	6.95	1.48
February	26.9	6.83	1.84
March	34.0	8.35	2.84
April	43.9	8.86	3.89
May	51.8	9.85	5.10
June	60.3	9.87	5.95
July	65.1	10.03	6.53
August	64.0	9.43	6.04
September	58.2	8.37	4.87
October	47.8	7.83	3.74
November	34.0	6.89	2.34
December	24.9	6.74	1.68
ANNUAL	44.4	100.0	46.30

1/Latitude 36°45'.

Irrigation requirement. The irrigation requirement is determined by subtracting the effective precipitation from the consumptive use requirement.

The effective precipitation was computed using the following tabulation:

Total monthly precipitation (inches)	Monthly effective precipitation 1/ (inches): Incremental portion	Monthly effective precipitation 1/ (inches): Accumulated total
1	0.95	0.95
2	0.90	1.85
3	0.83	2.68
4	0.65	3.33
5	0.45	3.78
6	0.25	4.03

1/Average values from table presented in Volume IV, Chapter 4.1.12 of the Bureau of Reclamation Manual.

The average annual effective precipitation for 1935 through 1936 was 10.87 inches, or 91 percent of the average annual precipitation. The effective precipitation during the growing season was 4.61 inches and for the nongrowing season, 6.26 inches.

The irrigation requirement for the growing season was obtained by subtracting the effective precipitation from the consumptive use requirement and amounted to 12.32 inches.

Soil moisture deficiency. As the winter consumptive use, 5.81 inches, was less than the effective precipitation, 6.26 inches, there was no soil moisture deficiency under present conditions.

Farm irrigation efficiency and distribution efficiency. Under present conditions, a farm irrigation efficiency of 50 percent and a distribution efficiency of 65 percent was used, which resulted in an overall efficiency of 32.5 percent.

Diversion demand. The average annual diversion demand was computed as follows:

	Acre-feet per acre
Crop consumptive use----------------------	1.41
Effective precipitation------------------	-0.38
Irrigation requirement-------------------	1.03
Farm waste and deep percolation losses (50%)--------------------------------	1.03
Farm delivery demand---------------------	2.06
Distribution system losses (35%)---------	1.11
Diversion demand-------------------------	3.17

The average annual diversion demand for 3,513 acres would be 11,140 acre-feet.

Operation study. Table A-45 is the present (historic) condition study which was partially presented in the authorizing report. The period of study was water year 1928 through 1951. The operation is described below.

The present condition study was made in the following manner.

1. Total flow available to Cerro ditch was the sum of flow in Latir Creek, Rio del Medio, and Rio Primero. See the schematic diagram in Table A-45. Flow was based on records for Latir Creek near Cerro, New Mexico. The records for this station were April 1937 through September 1951 with irrigation season records only prior to 1946. Missing data for the station were derived from correlation with Red River near Questa records. It was assumed that Rio del Medio and Rio Primero had the same unit runoff as Latir Creek. Thus, total flow available was derived on a drainage area basis. Total drainage area and runoff was 1.73 times area and runoff from Latir Creek.

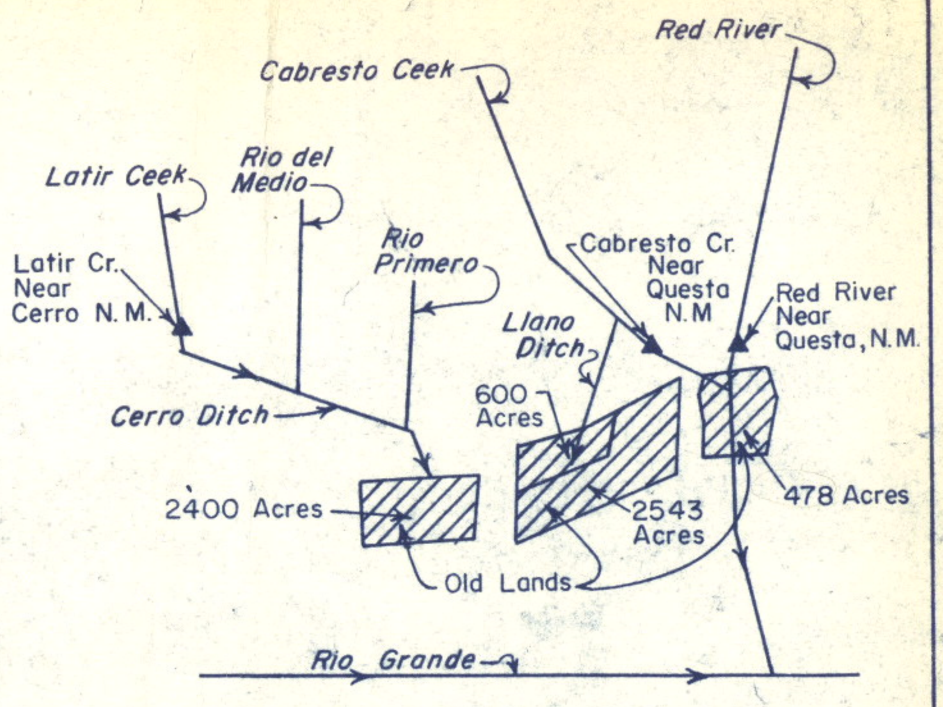
2. Flow below diversions was controlled by the capacity of Cerro ditch. Maximum capacity was 25 c.f.s.; all mean-daily flows of 25 c.f.s or less were considered diverted during the irrigation season. All excess, including diversions greater than demand by 2,400 acres, was considered as flow below diversions.

3. The period of record for Llano ditch diversions and Cabresto Creek near Questa, New Mexico, was September 1943 through September 1951. Recorded Cabresto Creek represents depleted conditions since Llano ditch diverts 1/4 mile upstream. Cabresto Creek above diversions was obtained by adding Llano canal diversions to creek flows. Records were extended back to September 1928 by correlating Cabresto Creek above and below diversions to Red River near Questa. No records were available for content of Cabresto Reservoir. It was assumed that historic operation of the reservoir was adequate and would remain the same under present conditions. In the operation study, Cabresto Creek after Llano ditch diversions became Cabresto Creek near Questa less the diversion demand for 600 acres served by Llano canal. Thus, there were no shortages on this canal. Cabresto Creek was further depleted by diversions to supply demand for 2,543 acres.

…5. ANNUAL SUMMARY OF OPERATION AND DEPLETION STUDY-CERRO UNIT-PRESENT CONDITIONS

…After Diversions	TOTAL SHORTAGE Acre - Feet	TOTAL SHORTAGE Percent	PRESENT CONDITION STUDY DATED 1953 FOR DIRECT DIVERSION DEPLETION OF RIO GRANDE — CERRO DITCH Demand Supplied	CERRO DITCH Return Flow	CERRO DITCH Flow Below Diversion	CERRO DITCH Flow to Rio Grande	CABRESTO AREA Demand Supplied	CABRESTO AREA Return Flow	CABRESTO AREA Flow After Diversion	CABRESTO AREA Flow to Rio Grande	RED RIVER Demand Supplied	RED RIVER Return Flow	RED RIVER Flow to Rio Grande	Total Flow To Rio Grande	Virgin Flow To Rio Grande	Total Depletions	WATER YEAR
…6	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	1
452	3089	22.9	4036	1009	3335	4344	5291	1323	3702	5025	1071	268	35720	45089	52887	7798	1928
509	1614	12.0	4632	1158	3755	4913	6170	1543	4068	5611			40777	51301	60205	8904	1929
979	909	6.7	5075	1269	3812	5081	6432	1608	4656	6264			43247	54592	64025	9433	1930
939	4888	36.2	3351	-838	2460	3298	4177	1044	2934	3978			28007	35283	41732	6449	1931
029	931	6.9	4970	1242	7154	8396	6515	1629	8740	10369			59297	78062	87479	9417	1932
989	3983	29.5	3608	902	2249	3151	4825	1206	2127	3333			28257	34741	41869	7128	1933
781	6926	51.4	2402	600	1604	2204	3088	772	1906	2678			19049	23931	28852	4921	1934
358	2291	17.0	4365	1091	4596	5687	5760	1440	4633	6073			43626	55386	63783	8397	1935
295	3569	26.5	3893	973	2637	3610	4954	1238	3268	4506			31563	39679	47118	7439	1936
529	1830	13.6	4066	1016	4173	5189	6520	1630	9816	11446			64797	81432	90175	8743	1937
804	1550	11.5	4358	1090	5559	6649	6508	1627	6304	7931			51072	65652	74604	8952	1938
939	3507	26.0	4347	1087	3619	4706	4562	1140	4108	5248			33207	43161	50646	7485	1939
920	4057	30.1	4038	1010	2508	3518	4321	1080	2135	3215			25188	31921	38993	7072	1940
803	1216	9.0	4855	1214	7574	8788	6345	1586	11142	12728			72071	93587	102790	9203	1941
829	808	6.0	4968	1242	11406	12648	6640	1660	12342	14002			76097	102747	112256	9509	1942
999	4626	34.3	3232	808	2123	2931	4558	1140	2495	3635			27267	33833	40478	6645	1943
549	2236	16.6	4485	1121	5163	6284	5695	1424	4522	5946			46817	59047	67485	8438	1944
709	1259	9.3	4714	1178	7034	8212	6443	1611	9193	10804			55977	74993	84164	9171	1945
763	6727	49.9	3012	753	2243	2996	2677	669	1979	2649			17031	22676	27745	5069	1946
709	1977	14.7	4739	1185	4871	6056	5700	1425	4804	6229			38977	51262	59894	8632	1947
209	2439	18.1	4427	1107	4715	5822	5550	1388	4217	5605			42477	53904	62189	8285	1948
637	1656	12.3	4734	1184	5518	6702	6026	1506	5816	7322			47905	61929	70802	8873	1949
339	6220	46.1	2653	663	1722	2385	3543	886	2121	3007			21607	26999	32449	5450	1950
025	5794	43.0	3069	767	1415	2182	3553	888	1761	2649	1071	268	19293	24124	29894	5770	1951
894	74102	549.6	98029	24507	101245	125752	125853	31463	118789	150253	25704	6432	969326	1245331	1432514	187183	Total
121	3088	22.9	4086	1021	4219	5240	5244	1311	4950	6261	1071	268	40388	51888	59688	7799	Mean

SCHEMATIC DIAGRAM



▲ - Denotes U.S.G.S. Gaging Stations

REMARKS

TABLE A-45

TABLE A-45. ANNUAL SUMMARY OF OPERATION AND DEPLETION STUDY-C

WATER YEAR	CERRO DITCH					CABRESTO AREA						RED RIVER				TOTAL SHORTAGE		PRESENT CONDITION STUDY				
																		CERRO DITCH				
	Total Flow Available	Water Diverted (Max. 25 cfs)	Demand (2400 acres)	Shortage	Flow Below Diversion	Cabresto Creek Near Questa N.M.	Demand For Llano Ditch (600 acres)	Cabresto Creek After Llano Ditch Diversion	Demand (2543 acres)	Shortage	Flow In Cabresto Creek After Diversions	Red River Near Questa N.M.	Fish Water at Questa N.M.	Demand (478 acres)	Flow In Red River After Diversions	Acre - Feet	Percent	Demand Supplied	Return Flow	Flow Below Diversion	Flow to Rio Grande	Demand Supplied
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1928	7371	4753	5376	1340	3335	8993	1344	7649	5696	1749	3702	36523	10864	1071	35452	3089	22.9	4036	1009	3335	4344	529
1929	8387	6014		744	3755	10238		8894		870	4068	41580			40509	1614	12.0	4632	1158	3755	4913	617
1930	8887	6222		301	3812	11088		9744		608	4656	44050			42979	909	6.7	5075	1269	3812	5081	643
1931	5811	3763		2025	2460	7111		5767		2863	2934	28810			27739	4888	36.2	3351	-838	2460	3298	417
1932	12124	6379		406	7154	15255		13911		525	8740	60100			59029	931	6.9	4970	1242	7154	8396	651
1933	5857	3936		1768	2249	6952		5608		2215	2127	29060			27989	3983	29.5	3608	902	2249	3151	482
1934	4006	2656		2974	1604	4994		3650		3952	1906	19852			18781	6926	51.4	2402	600	1604	2204	308
1935	8961	5081		1011	4596	10393		9049		1280	4633	44429			43358	2291	17.0	4365	1091	4596	5687	576
1936	6530	4530		1483	2637	8222		6878		2086	3268	32366			31295	3569	26.5	3893	973	2637	3610	495
1937	8239	4553		1310	4173	16336		14992		520	9816	65600			64529	1830	13.6	4066	1016	4173	5189	652
1938	9917	5442		1018	5559	12812		11468		532	6304	51875			50804	1550	11.5	4358	1090	5559	6649	650
1939	7966	5223		1029	3619	8670		7326		2478	4108	34010			32939	3507	26.0	4347	1087	3619	4706	456
1940	6546	4567		1338	2508	6456		5112		2719	2135	25991			24920	4057	30.1	4038	1010	2508	3518	432
1941	12429	6504		521	7574	17487		16143		695	11142	72874			71803	1216	9.0	4855	1214	7574	8788	634
1942	16374	6370		408	11406	18982		17638		400	12342	76900			75829	808	6.0	4968	1242	11406	12648	664
1943	5355	3595		2144	2123	7053		5709		2482	2495	28070			26999	4626	34.3	3232	808	2123	2931	455
1944	9648	5416		891	5163	10217		8873		1345	4522	47620			46549	2236	16.6	4485	1121	5163	6284	569
1945	11748	6093		662	7034	15636		14292		597	9193	56780			55709	1259	9.3	4714	1178	7034	8212	644
1946	5255	3513		2364	2243	4656		3312		4363	1979	17834			16763	6727	49.9	3012	753	2243	2996	267
1947	9610	6095		637	4871	10504		9160		1340	4804	39780			38709	1977	14.7	4739	1185	4871	6056	570
1948	9142	5214		949	4715	9767		8423		1490	4217	43280			42209	2439	18.1	4427	1107	4715	5822	555
1949	10252	5922		642	5518	11842		10498		1014	5816	48708			47637	1656	12.3	4734	1184	5518	6702	602
1950	4375	2858		2723	1722	5664		4320		3497	2121	22410			21339	6220	46.1	2653	663	1722	2385	354
1951	4484	3225	5376	2307	1415	5314	1344	3970	5696	3487	1761	20096	10864	1071	19025	5794	43.0	3069	767	1415	2182	355
Total	199274	117924	129024	30995	101245	244642	32256	212386	136704	43107	118789	988598	260736	25704	962894	74102	549.6	98029	24507	101245	125752	12585
Mean	8303	4914	5376	1291	4219	10193	1344	8849	5696	1796	4950	41192	10864	1071	40121	3088	22.9	4085	1021	4219	5240	524

4. Red River near Questa, New Mexico, records were for undepleted conditions. Irrigation for 478 acres occurs below the gaging station. Fish water at Questa necessary to maintain fish life was considered to be the minimum mean daily runoff for each month of record. That minimum was bypassed and flows in excess were used to supply the demand from 478 acres. There were no shortages on this land.

5. Rio Grande depletions were determined by assuming annual return flow from irrigation water at 25 percent with a monthly distribution based on McElmo Creek in Colorado.

6. The sum of bypass and return flow was considered to be depleted total flow to the Rio Grande while virgin flow was the sum of the flow available to Cerro ditch, undepleted Cabresto Creek near Questa, New Mexico, and Red River near Questa, New Mexico. Thus, total depletions were virgin flow less total flow.

Although there was a large reduction in the acreage considered to be presently irrigated between the previous study and the current study, the diversion demand in both studies (13,500 acre-feet and 11,140 acre-feet) exceeded the divertible supply (10,400 acre-feet). Therefore, it would appear that the former study is adequate for present needs.

The increase in unit diversion demand from 2.24 acre-feet per acre in the previous study to 3.17 acre-feet per acre in the current study results from a change in the method of computing consumptive use and effective precipitation, as well as changes in farm and distribution losses.

Future Condition

Consumptive use requirement. Under future conditions, it was determined that it would be possible to irrigate 5,430 acres of land.

This would include the lands presently being irrigated, 3,513 acres, plus an additional 1,917 acres.

The following tabulation shows the assumed cropping distribution:

	Acreage	Percent
Alfalfa and planted pasture-------	4,340	80.0
Native hay and pasture------------	595	11.0
Corn------------------------------	19	0.3
Small grain-----------------------	176	3.2
Garden----------------------------	300	5.5
TOTAL IRRIGATED-------------------	5,430	100.0

The monthly consumptive use requirement for the growing season and the nongrowing season was computed for the Cerro area using the crop distribution presented above. Table A-46 is a monthly summary of consumptive requirements for the growing season. The average annual consumptive use requirement for the growing season was computed to be 20.25 inches.

Irrigation requirement. The average annual effective precipitation from 1935 through 1963 amounted to 10.87 inches. The effective precipitation during the growing season was 5.30 inches and during the nongrowing season, 5.57 inches.

The irrigation requirement for the growing season was obtained by subtracting the effective precipitation from the consumptive use requirement and amounted to 14.95 inches.

Soil moisture deficiency. As the winter consumptive use, 6.21 inches, exceeded the effective precipitation, 5.57 inches, by only 0.64 inch, no soil moisture deficiency was considered.

Table A-46. Future condition--Consumptive use requirement.
Cerro Unit

Crop and growing season	Acres	Percent area	April (k)	April Use (inch)	May (k)	May Use (inch)	June (k)	June Use (inch)	July (k)	July Use (inch)	August (k)	August Use (inch)	September (k)	September Use (inch)	Growing season (K)	Growing season Use (inch)
Alfalfa and planted pasture--	4,340	80.0														
FP 1/ 5/15-5/29-----------					0.70	1.73									0.70	1.73
FFP 2/ 5/30-9/25-----------					0.75	0.12	0.82	4.86	0.91	5.92	0.91	5.48	0.73	2.95	0.85	19.33
															0.84	21.06
Native hay and pasture-------	595	11.0														
FP 5/15-5/29-----------					0.60	1.48									0.60	1.48
FFP 5/30-9/25-----------					0.62	0.10	0.71	4.22	0.80	5.22	0.80	4.82	0.67	2.70	0.75	17.06
															0.74	18.54
Corn-------------------------	19	0.3														
FFP 6/10-9/25-----------							0.69	2.74	0.79	5.15	0.79	4.76	0.69	2.80	0.75	15.45
Small grain------------------	176	3.2														
FP 4/15-5/29			0.41	0.79	0.41	2.02									0.41	2.81
FFP 5/30-8/1					0.50	0.08	0.92	5.45	0.81	5.31	0.79	0.15			0.86	10.99
															0.70	13.80
Garden-----------------------	300	5.5														
FFP 5/30-9/25-----------					0.50	0.08	0.65	3.86	0.75	4.92	0.75	4.55	0.62	2.51	0.70	15.92
Weighted Consumptive Use Requirement:																
Inches -----------				0.02		1.73		4.75		5.77		5.18		2.80	0.82	20.25
Feet-----------																1.69

1/FP = Frost period.
2/FFP = Frost-free period.

Farm irrigation efficiency and distribution efficiency. Under future conditions it was assumed that with better project control the farm irrigation efficiency would increase from 50 to 60 percent. It was also assumed that the distribution efficiency, 65 percent, would remain the same. This would result in an overall efficiency of 39.0 percent.

Diversion demand. The average annual diversion demand was computed as follows:

	Acre-feet per acre
Crop consumptive use	1.69
Effective precipitation	-0.44
Irrigation requirement	1.25
Farm waste and deep percolation losses (40%)	0.84
Farm delivery demand	2.09
Distribution system losses (35%)	1.12
Diversion demand	3.21

Operation study. The future condition study was made similar to the present condition study. For water supply purposes Latir canal was assumed to replace Cerro ditch. New lands and the proposed Sunshine Valley canal were added to historic condition physical features to simulate a future condition direct diversion project. The annual summary is presented in Table A-47. The study is described below:

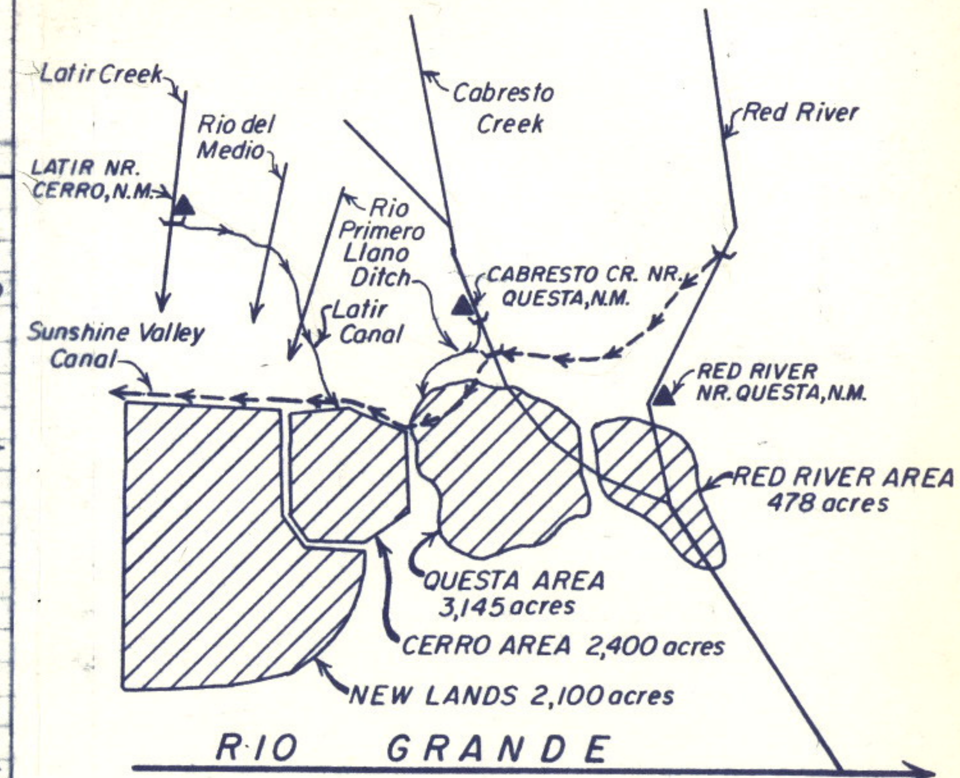
1. Flow below Latir canal diversion was the same as flow below Cerro ditch diversion except that diversions in excess of demand by 2,400 acres were used as diversion to supply 2,100 acres of new land. See schematic diagram in Table A-47.

2. Flow after diversions in Cabresto Creek were the same as in the present condition study except that

...RY OF OPERATION AND DEPLETION STUDY–CERRO UNIT–FUTURE CONDITIONS

Lands of to the Latir Area	Latir Diversion to New Lands	Red River Diversion to Old and New Lands	FUTURE CONDITION STUDY DATED 1953 FOR DIRECT DIVERSION DEPLETION OF RIO GRANDE														Water Year
			LATIR CANAL					CABRESTO AREA					RED RIVER				
			Total Flow Available	Flow Below Diversion	Irrigation Water	Return Flow 25% of Col.27	Rio Grande Depletion	Cabresto Creek near Questa, N.M.	Flow after Diversion	Irrigation Water	Return Flow 25% of Col.32	Rio Grande Depletion	Irrigation Col.16+Col.24	Return Flow 25% of Col.35	Rio Grande Depletion	Total Depletion	
	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	1
50	510	5151	7371	2825	4546	1136	3410	8993	3152	5841	1460	4381	6222	1556	4666	12457	1928
7	697	4236	8387	3058	5329	1332	3997	10238	3141	7097	1774	5323	5307	1327	3980	13300	1929
4	699	3319	8887	3113	5774	1444	4330	11088	3062	8026	2006	6020	4390	1098	3292	13642	1930
61	90	5034	5811	2370	3441	860	2581	7111	2673	4438	1110	3328	6105	1526	4579	10488	1931
91	1181	2763	12124	5973	6151	1538	4613	15255	7049	8206	2052	6154	3834	958	2876	13643	1932
22	209	5174	5857	2040	3817	954	2863	6952	2105	4847	1212	3635	6245	1561	4684	11182	1933
0	84	4672	4006	1520	2486	622	1864	4994	1906	3088	772	2316	5743	1436	4307	8487	1934
9	479	4312	8961	4117	4844	1211	3633	10393	3234	7159	1790	5369	5383	1346	4037	13039	1935
5	436	5590	6530	2201	4329	1082	3247	8222	2663	5559	1390	4169	6661	1665	4996	12412	1936
27	309	3162	8239	3864	4375	1094	3281	16336	6789	9547	2387	7160	4233	1058	3175	13616	1937
8	486	3850	9917	5073	4844	1211	3633	12812	4386	8426	2106	6320	4921	1230	3691	13644	1938
67	563	3843	7966	3056	4910	1228	3682	8670	3441	5229	1307	3922	4914	1228	3686	11290	1939
0	325	4941	6546	2183	4363	1091	3272	6456	1775	4681	1170	3511	6012	1503	4509	11292	1940
21	1135	2171	12429	6439	5990	1498	4492	17487	9121	8366	2092	6274	3242	811	2431	13197	1941
46	973	2293	16374	10433	5941	1485	4456	18982	10096	8886	2222	6664	3364	841	2523	13643	1942
9	84	7006	5355	2039	3316	829	2487	7053	2276	4777	1194	3583	8077	2019	6058	12128	1943
73	716	2993	9648	4447	5201	1300	3901	10217	2749	7468	1867	5601	4064	1016	3048	12550	1944
07	1102	3454	11748	5932	5816	1454	4362	15636	7786	7850	1962	5888	4525	1131	3394	13644	1945
	84	2692	5255	2159	3096	774	2322	4656	1979	2677	669	2008	3763	941	2822	7152	1946
9	751	4794	9610	4120	5490	1372	4118	10504	4325	6179	1545	4634	5865	1466	4399	13151	1947
5	581	4189	9142	4134	5008	1252	3756	9767	2922	6845	1711	5134	5260	1315	3945	12835	1948
29	942	4089	10252	4576	5676	1419	4257	11842	4487	7355	1839	5516	5160	1290	3870	13643	1949
0	84	6208	4375	1638	2737	684	2053	5664	2121	3543	886	2657	7279	1820	5459	10169	1950
9	84	3945	4484	1331	3153	788	2365	5314	1462	3852	963	2889	5016	1254	3762	9016	1951
89	12604	99881	199274	88641	110633	27658	82975	244642	94700	149942	37486	112456	125585	31396	94189	289620	Total
4	525	4162	8303	3693	4610	1152	3457	10193	3946	6248	1562	4686	5233	1308	3925	12068	Mean

SCHEMATIC DIAGRAM



REMARKS

TABLE A-47. ANNUAL SUMMARY OF OPERATION AND DEPLETION STUDY-CERRO

LATIR CANAL					CABRESTO AREA						RED RIVER							TOTAL SHORTAGE					FUTURE CONDITIO — LATIR CANA		
Availab…	Diverted (Max. 25 c.f.s.)	Demand (2400 acres)	Shortage	Flow Below Diversion	Cabresto Creek near Questa, N.M.	Demand for Llano Ditch (600 acres)	Flow after Llano Diversion	Demand (2543 acres)	Shortage	Flow after Diversion	Flow in Red River near Questa, N.M.	Fish Water at Questa, N.M.	Sunshine Valley Canal Diversion Capability (Max. 100 c.f.s.)	Demand (478 acres)	Flow after Diversions	Combined Shortage (Col. 5 + Col. 11)	Demand from New Lands (2100 acres)	Acre-feet	Percent	Cabresto Creek Diversions to New Lands or to the Latir Area	Latir Diversion to New Lands	Red River Diversion to Old and New Lands	Total Flow Available	Flow Below Diversion	Irrigation Water
	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
…71	4753	5376	1340	2825	8993	1344	7649	5696	1749	3152	36523	10864	17755	1071	30301	3089	4704	1582	8.7	550	510	5151	7371	2825	4546
…87	6014		744	3058	10238		8894		870	3141	41580		23787		36273	1614		458	2.5	927	697	4236	8387	3058	5329
…87	6222		301	3113	11088		9744		608	3062	44050		25462		39660	909		1	0	1594	699	3319	8887	3113	5774
…11	3763		2025	2370	7111		5767		2863	2673	28810		12637		22705	4888		4207	23.1	261	90	5034	5811	2370	3441
…24	6379		406	5973	15255		13911		525	7049	60100		24886		56266	931		0	0	1691	1181	2763	12124	5973	6151
…57	3936		1768	2040	6952		5608		2215	2105	29060		12969		22815	3983		3282	18.0	22	209	5174	5857	2040	3817
…06	2656		2974	1520	4994		3650		3952	1906	19852		6622		14109	6926		6874	37.8	0	84	4672	4006	1520	2486
…61	5081		1011	4117	10393		9049		1280	3234	44429		18939		39046	2291		805	4.4	1399	479	4312	8961	4117	4844
…30	4530		1483	2201	8222		6878		2086	2663	32366		16673		25705	3569		1642	9.0	605	436	5590	6530	2201	4329
…39	4553		1310	3864	16336		14992		520	6789	65600		25145		61367	1830		36	0.2	3027	309	3162	8239	3864	4375
…17	5442		1018	5073	12812		11468		532	4386	51875		24629		46954	1550		0	0	1918	486	3850	9917	5073	4844
…66	5223		1029	3056	8670		7326		2478	3441	34010		15261		29096	3507		3138	17.3	667	563	3843	7966	3056	4910
…46	4567		1338	2183	6456		5112		2719	1775	25991		12390		19979	4057		3135	17.2	360	325	4941	6546	2183	4363
…229	6504		521	6439	17487		16143		695	9121	72874		23876		69632	1216		593	3.3	2021	1135	2171	12429	6439	5990
…74	6370		408	10433	18982		17638		400	10096	76900		25161		73536	808		0	0	2246	973	2293	16374	10433	5941
…55	3595		2144	2039	7053		5709		2482	2276	28070		12925		19993	4626		2021	11.1	219	84	7006	5355	2039	3316
…48	5416		891	4447	10217		8873		1345	2749	47620		20081		43556	2236		1458	8.0	1773	716	2993	9648	4447	5201
…48	6093		662	5932	15636		14292		597	7786	56780		22351		52255	1259		0	0	1407	1102	3454	11748	5932	5816
…55	3513		2364	2159	4656		3312		4363	1979	17834		4682		14071	6727		8655	47.6	0	84	2692	5255	2159	3096
…10	6095		637	4120	10504		9160		1340	4325	39780		17096		33915	1977		657	3.6	479	751	4794	9610	4120	5490
…42	5214		949	4134	9767		8423		1490	2922	43280		18340		38020	2439		1078	5.9	1295	581	4189	9142	4134	5008
…52	5922		642	4576	11842		10498		1014	4487	48708		22172		43548	1656		0	0	1329	942	4089	10252	4576	5676
…375	2858		2723	1638	5664		4320		3497	2121	22410		8152		15131	6220		4632	25.5	0	84	6208	4375	1638	2737
…284	3225	5376	2307	1331	5314	1344	3970	5696	3487	1462	20096	10864	8604	1071	15080	5794	4704	6170	33.9	299	84	3945	4484	1331	3153
…274	117924	129024	30995	88641	244642	32256	212386	136704	43107	94700	988598	260736	420595	25704	863013	74102	112896	50424	277.1	24089	12604	99881	199274	88641	110633
…303	4914	5376	1291	3693	10193	1344	8849	5696	1796	3946	41192	10864	17525	1071	35959	3088	4704	2101	11.5	1004	525	4162	8303	3693	4610

TABLE A-47. ANNUAL SUMMA

	LATIR CANAL					CABRESTO AREA						RED RIVER							TOTAL SHORTAGE		
Water Year	Total Flow Available	Diverted (Max. 25 c.f.s.)	Demand (2400 acres)	Shortage	Flow Below Diversion	Cabresto Creek near Questa, N.M.	Demand for Llano Ditch (600 acres)	Flow after Llano Diversion	Demand (2543 acres)	Shortage	Flow after Diversion	Flow in Red River near Questa, N.M.	Fish Water at Questa, N.M.	Sunshine Valley Canal Diversion Capability (Max. 100 c.f.s.)	Demand (478 acres)	Flow after Diversions	Combined Shortage (Col. 5 + Col. 11)	Demand from New Lands (2100 acres)	Acre-feet	Percent	Cabresto Creek Diversions to New
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1928	7371	4753	5376	1340	2825	8993	1344	7649	5696	1749	3152	36523	10864	17755	1071	30301	3089	4704	1582	8.7	5
1929	8387	6014	↑	744	3058	10238	↑	8894	↑	870	3141	41580	↑	23787	↑	36273	1614	↑	458	2.5	9.
1930	8887	6222		301	3113	11088		9744		608	3062	44050		25462		39660	909		1	0	15
1931	5811	3763		2025	2370	7111		5767		2863	2673	28810		12637		22705	4888		4207	23.1	2
1932	12124	6379		406	5973	15255		13911		525	7049	60100		24886		56266	931		0	0	16
1933	5857	3936		1768	2040	6952		5608		2215	2105	29060		12969		22815	3983		3282	18.0	
1934	4006	2656		2974	1520	4994		3650		3952	1906	19852		6622		14109	6926		6874	37.8	
1935	8961	5081		1011	4117	10393		9049		1280	3234	44429		18939		39046	2291		805	4.4	13
1936	6530	4530		1483	2201	8222		6878		2086	2663	32366		16673		25705	3569		1642	9.0	6
1937	8239	4553		1310	3864	16336		14992		520	6789	65600		25145		61367	1830		36	0.2	3
1938	9917	5442		1018	5073	12812		11468		532	4386	51875		24629		46954	1550		0	0	19
1939	7966	5223		1029	3056	8670		7326		2478	3441	34010		15261		29096	3507		3138	17.3	6
1940	6546	4567		1338	2183	6456		5112		2719	1775	25991		12390		19979	4057		3135	17.2	3
1941	12429	6504		521	6439	17487		16143		695	9121	72874		23876		69632	1216		593	3.3	2
1942	16374	6370		408	10433	18982		17638		400	10096	76900		25161		73536	808		0	0	2
1943	5355	3595		2144	2039	7053		5709		2482	2276	28070		12925		19993	4626		2021	11.1	2
1944	9648	5416		891	4447	10217		8873		1345	2749	47620		20081		43556	2236		1458	8.0	17
1945	11748	6093		662	5932	15636		14292		597	7786	56780		22351		52255	1259		0	0	14
1946	5255	3513		2364	2159	4656		3312		4363	1979	17834		4682		14071	6727		8655	47.6	
1947	9610	6095		637	4120	10504		9160		1340	4325	39780		17096		33915	1977		657	3.6	47
1948	9142	5214		949	4134	9767		8423		1490	2922	43280		18340		38020	2439		1078	5.9	12
1949	10252	5922		642	4576	11842		10498		1014	4487	48708		22172		43548	1656		0	0	13
1950	4375	2858	↓	2723	1638	5664	↓	4320	↓	3497	2121	22410	↓	8152	↓	15131	6220	↓	4632	25.5	
1951	4484	3225	5376	2307	1331	5314	1344	3970	5696	3487	1462	20096	10864	8604	1071	15080	5794	4704	6170	33.9	2
Total	199274	117924	129024	30995	88641	244642	32256	212386	136704	43107	94700	988598	260736	420595	25704	863013	74102	112896	50424	277.1	24
Mean	8303	4914	5376	1291	3693	10193	1344	8849	5696	1796	3946	41192	10864	17525	1071	35959	3088	4704	2101	11.5	10

excess water was used to irrigate new lands or in the Latir area. Capacity of Cabresto Reservoir is very small in comparison to runoff of Cabresto Creek, so it was assumed the reservoir would have little or no effect on the future condition water supply. Therefore, the reservoir was not considered in the study.

3. Flow in Red River after diversions was present condition flow less diversions to old and new lands.

4. Sunshine Valley canal diversion capability on a mean-daily basis was a maximum of 100 c.f.s. after bypass for fish life requirements.

The average annual diversion shown by the operation study was 16,090 acre-feet. With the average annual diversion demand of 3.21 acre-feet per acre, and assuming a tolerable shortage of about 8 percent, the water supply would be sufficient for 5,430 acres.

The 5,430 acres include 3,513 acres of presently irrigated land and 1,917 acres of additional land. The additional land would consist of 1,369 acres of presently fallow and idle land which would be returned to irrigation and 548 acres of new land. The 436 acres presently being irrigated from Red River should not be included as part of the project since they are presently getting a full supply. Of the remaining 3,077 acres presently irrigated, 374 acres are Class 6W lands.

The on-site effect of the unit would be the increased depletions occurring on the land. Under present conditions it is assumed that depletions would equal 70 percent of the diversions, or 7,280 acre-feet. Under future conditions it is assumed that the depletions would equal 75 percent of the diversions, or 12,070 acre-feet. Thus, the on-site effect would be 4,790 acre-feet.

Since the on-site effect occurs on the Rio Grande above Otowi, the loss that would have occurred on this water reduces the effect at Otowi. The demand at Otowi would be 4,690 acre-feet. Routing the Otowi demand up to Heron results in a demand on storage of 4,840 acre-feet.

From the above rough analysis, it was concluded that the amount of benefits from 5,183 acres of project irrigable land would have a benefit-cost ratio of less than 0.5 to 1. It was, therefore, concluded that detailed studies were not required.

The fish requirements used in the study are less than the requirements presently recommended. The Bureau of Sport Fisheries and Wildlife has recommended that the fish bypass below diversion dam be 18 cubic feet per second or the inflow, whichever is less, from May through November, and 10 cubic feet per second or the inflow, whichever is less, from December through April. This new recommendation would limit the water supply to the unit still further.