

Temp. Exhibit No. 34

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# HOPI INDIAN RESERVATION

ENGINEERING STUDIES

OF

LAND AND WATER RESOURCES

HOPI INDIAN RESERVATION  
LAND AND WATER RESOURCES

GENERAL

The Hopi Indian Reservation is located in northeastern Arizona and completely surrounded by the Navajo Indian Reservation.

Present irrigation development on this reservation is confined to four relatively small units lying in the "Central Water Requirement Zone" as established for the Navajo Reservation.

WATER SUPPLY

Summer rainfall averages about five inches with annual precipitation slightly more than 11 inches at Jeddito as shown in Table 1, and Figure 1. Water for irrigation of lands on the Hopi Indian Reservation comes from springs and intermittent streams. These streams or washes are dry for long periods of time during each summer. (See Figure 2) The small amounts of water used for irrigation on the units would, if not diverted, add little or nothing to the flow of the Colorado River. The small minimum flows, originating from small springs near the irrigated units, would be dissipated through evaporation and transpiration. There are several hundred miles of dry channel between the point of diversion for irrigation and the Colorado River. Only some 26 acre-feet of storage is available and water is not always available when and as needed to produce high crop yields regularly. There are no continuous records of streamflow on the reservation. Estimated

water yields of the streams on the Hopi and Navajo Reservation are given in Table 2. Table 3 lists the sources of supply, estimates of stream runoff and its characteristics together with miscellaneous measurements and observations.

LAND AREAS

Lands in the irrigated areas of the Hopi Indian Reservation were mapped and classified by the Bureau of Indian Affairs in 1956. The areas of lands that have been irrigated or that are suitable for future irrigation development are given in Table 4.

Acreages irrigated since 1937, and computed water requirements for the three major irrigated units are shown in Table 5.

WATER REQUIREMENTS

Water requirements for lands on the Hopi Indian Reservation were computed using the Blaney-Griddle method of computing consumptive use and allowing for reasonable application and conveyance efficiencies. It was assumed that crop practices and yields on these lands may improve in the future and that, if sufficient water is made available, consumptive use and irrigation practices will be similar to those used on non-Indian lands having about the same climate, soil and water supply conditions.

Estimates of non-agricultural water requirements assume that only limited industrial use will be made of the water. Most of such use will be for domestic and stockwater purposes within the irrigation project areas.

Following are the combined computed water requirements of the irrigated units:

A. Consumptive water requirement, acre-feet

1. Total irrigation requirement <u>1/</u>	1243
2. Non-agricultural requirement <u>2/</u>	<u>12</u>
3. Total	1255
4. Present consumption <u>3/</u>	<u>1172</u>
5. New or increased consumption	83

B. Diversion requirement

1. Project efficiency = 40 percent	
2. Diversion requirement	
1255 acre-feet @ 40 percent =	3138

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1/ 731 acres @ 1.70 acre-feet per acre.  
2/ Assumed to be one percent of agricultural consumption  
3/ 868 acres @ 1.35 acre-feet per acre. This includes 190 acres in non-irrigable Classes V-VIII that has been irrigated in the past. The water consumption value shown assumes adequate water for the past acreages and cropping pattern composed predominantly of corn and is thus lower than the requirement of 1.70 acre-feet per acre assumed for the future.

Table 1. HOPI INDIAN RESERVATION

Summer rainfall by months and total annual precipitation at  
Jeddito, Arizona <sup>1/</sup>

Year	Month									Total annual
	April	May	June	July	Aug.	Sept.	Oct.	Nov.	May-Sept.	
1935	.54	.79	T	3.75	1.34	.63	.25	.77	6.51	13.13
1936	.32	.59	.05	1.44	3.22	2.58	1.16	.29	7.88	13.55
1937	.78	1.01	.02	2.62	.32	1.80	.28	.08	5.77	12.94
1938	.18	.03	1.75	.96	2.12	2.38	.07	.34	7.24	13.86
1939	.58	.06	0	.18	.73	1.43	.30	.79	2.40	6.05
1940	1.05	.38	.07	.47	2.10	2.91	1.25	1.17	5.93	15.77
1941	2.52	.97	.39	.76	2.51	2.39	2.75	.78	7.02	21.51
1942	1.90	0	0	.46	2.44	.81	1.84	.19	3.71	11.43
1943	.10	.61	.13	1.77	2.49	1.10	.93	.12	6.10	11.10
1944	1.32	1.26	.06	.48	.50	2.25	.22	1.46	4.55	11.91
1945	.54	.02	.34	1.87	1.20	.02	.82	0	3.45	9.80
1946	.35	.54	.03	.44	2.61	1.23	.38	1.77	4.85	9.99
1947	.09	1.80	.37	.33	3.05	.27	2.65	1.36	5.82	11.55
1948	.53	.12	1.07	.10	.56	1.10	1.83	T	2.95	10.59
1949	.35	.62	.95	3.81	1.05	1.28	1.17	.30	7.71	13.87
1950	0	.14	.40	1.25	.23	.55	0	.10	2.57	4.46
1951	.81	.59	0	.87	1.45	.24	.87	.87	3.15	8.30
1952	2.08	T	.62	1.97	1.97	1.60	0	1.16	6.16	13.14
1953	.48	.11	0	2.77	1.61	0	.26	.31	4.49	7.05
1954	.05	.61	0	2.79	.95	.38	1.14	T	4.73	8.13
1955	.19	.39	1.44	1.97	-	0	0	-	-	-
Mean <sup>2/</sup>	.77	.52	.30	1.30	1.79	1.20	.91	.61	5.11	11.24

<sup>1/</sup> From the Annual Summaries of Climatological Data published by the U. S. Weather Bureau. All values in inches.

<sup>2/</sup> Mean for period of record from 1954 Annual Summary Climatological Data, Arizona.

Table 2. HOPI AND NAVAJO INDIAN RESERVATIONS

Estimated runoff of streams

Stream & Irrigation Unit	Drainage area Sq.mi.	Estimated	
		Water yield depth inches	Runoff Acre-ft.
Ganado Wash above Coldfield	46	0.6	1500
Pueblo Colorado Wash above Ganado	177	0.6	5700
Kinlichee Wash above Kinlichee	87	0.7	3200
Klagetoh Wash above Klagetoh	100	0.4	2100
Black Creek above Houck	640	0.9	31000
Black Creek above Ft. Defiance	210	1.0	11200
Monito Creek above Ft. Defiance	69	1.1	4000
Black Creek above Red Lake	121	1.1	7100
Todilto Wash and Black Creek above Todilto Park	22	1.2	1400
Unamed Wash above Natural Bridge	7	0.7	260
Oak Springs Wash above Oak Springs	3	0.5	80
Dinnebito Wash above Natani's	556	0.2	5900
Dinnebito Wash above Lower Dinnebito*	263	0.3	4200
Moencopi Wash above Lower Moencopi	1883	0.12	12000
Moencopi Wash above Tuba	1853	0.12	11800
Shonto Wash above Shonto	25	0.5	670
Begashibito Wash above Begashibito*	144	0.4	3100
Jeddito Wash above Jeddito*	147	0.3	2400
Polacca Wash above Phillips Farm*	933	0.2	10000

\* Streams within Hopi Indian Reservation

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Table 3. HOPI INDIAN RESERVATION  
Summary of irrigation water supply conditions

Unit	Source of water supply	Maximum pres. canal capacity	Estimated av. annual runoff 1/	Reservoir storage capacity	Est. normal minimum summer flow	Irrigated & irrigable land area
		cfs	Ac.ft.	Ac.ft.	cfs	Acres
Begashibito	Begashibito (Cow Springs) Wash	8	3100	25 2/	0.30	249
Jedito	Jedito Wash	50	2400	0	0.05 3/	144
Lower Dinnebito	Dinnebito Wash	30	4200	0	0	288
Phillips Farm	Polacca Wash	4	10000	1.27	0.30 4/	50

1/ Based on size and characteristics of drainage area above unit.

2/ A reservoir having an original capacity of 250 acre-feet once served irrigated lands which are now classed as non-irrigable.

3/ Measured by N. C. Jennings 5-21-54.

4/ Estimated by H. V. Clotts, Asst. Director of Irrigation, Office of Indian Affairs in "Report on Plans and Estimates for Construction Projects," submitted June 30, 1943.

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Table 4. HOPI INDIAN RESERVATION  
Irrigated and irrigable land areas

Unit	Irrigated	Irrigable	Total
Begashibito	249 <u>1/</u>	0	249 <u>1/</u>
Jeddito	144	0	144
Lower Dinnebito	235	53	288
Phillips Farm Unit	50	0	50
Total	678	53	731

1/ Does not include 190 acres of land in Classes V to VIII which have been irrigated in the past. Thus, the total area irrigated in the past was 868 acres.

Table 5. HOPI INDIAN RESERVATION

Area irrigated and computed water requirements by units 1/

Calendar Year	Begashibito Unit			Jeddito Unit			Lower Dinnebito Unit		
	Area 2/ irrigated	Computed		Area 2/ irrigated	Computed		Area 2/ irrigated	Computed	
		CIR 3/	DR 4/		CIR 3/	DR 4/		CIR 3/	DR 4/
	Acres	Ac.ft.	Ac.ft.	Acres	Ac.ft.	Ac.ft.	Acres	Ac.ft.	Ac.ft.
1937	33	45	112	-	-	-	-	-	-
1938	157	212	530	-	-	-	-	-	-
1939	-	-	-	-	-	-	-	-	-
1940	0	0	0	63	85	212	67	90	225
1941	-	-	-	67	90	225	189	255	638
1942	67	90	225	51	69	172	208	281	702
1943	68	92	230	54	73	182	184	248	620
1944	67	90	225	54	73	182	141	190	475
1945	68	92	230	55	74	185	0	0	0
1946	52	70	175	54	73	182	0	0	0
1947	43	58	145	31	42	105	0	0	0
1948	62	84	210	58	78	195	-	-	-
1949	64	86	215	62	84	210	-	-	-
1950	59	80	200	0	0	0	0	0	0
1951	60	81	202	0	0	0	0	0	0
1952	64	86	215	0	0	0	0	0	0
1953	28	38	95	0	0	0	0	0	0
1954	32	43	108	25	34	85	0	0	0
1955	42	57	142	27	36	90	0	0	0

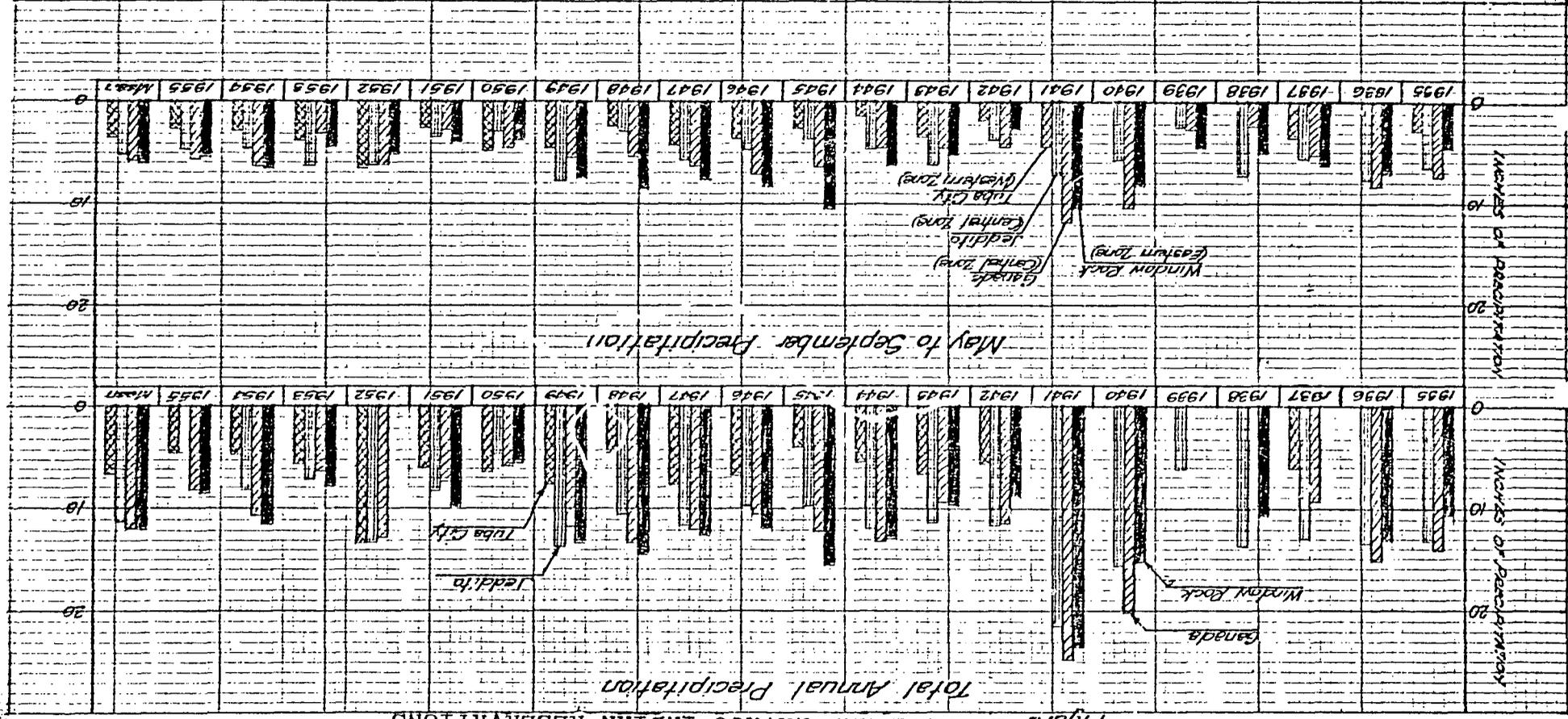
1/ Phillips Farm not given because data not separately available.

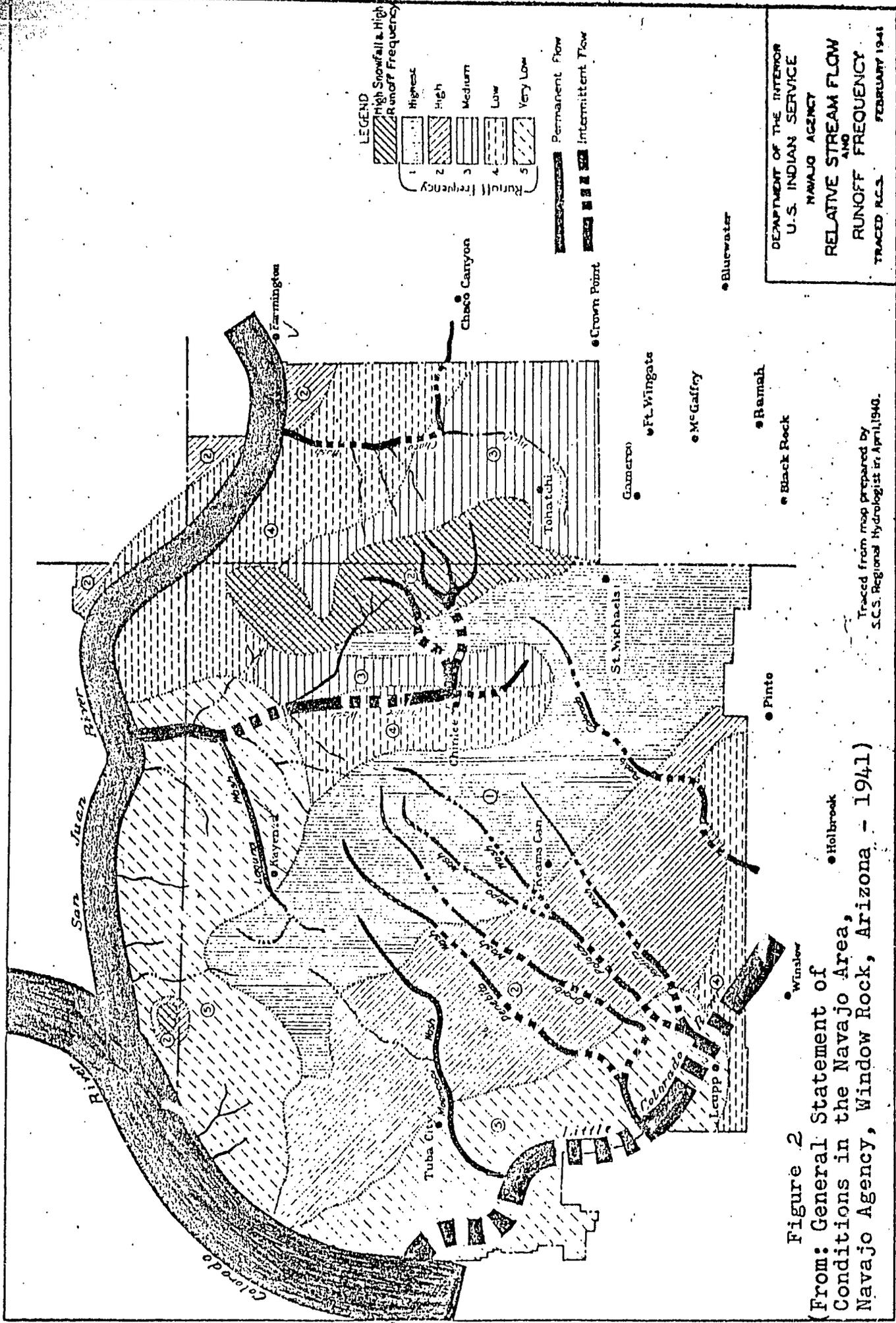
2/ From Annual Irrigation Crop Reports.

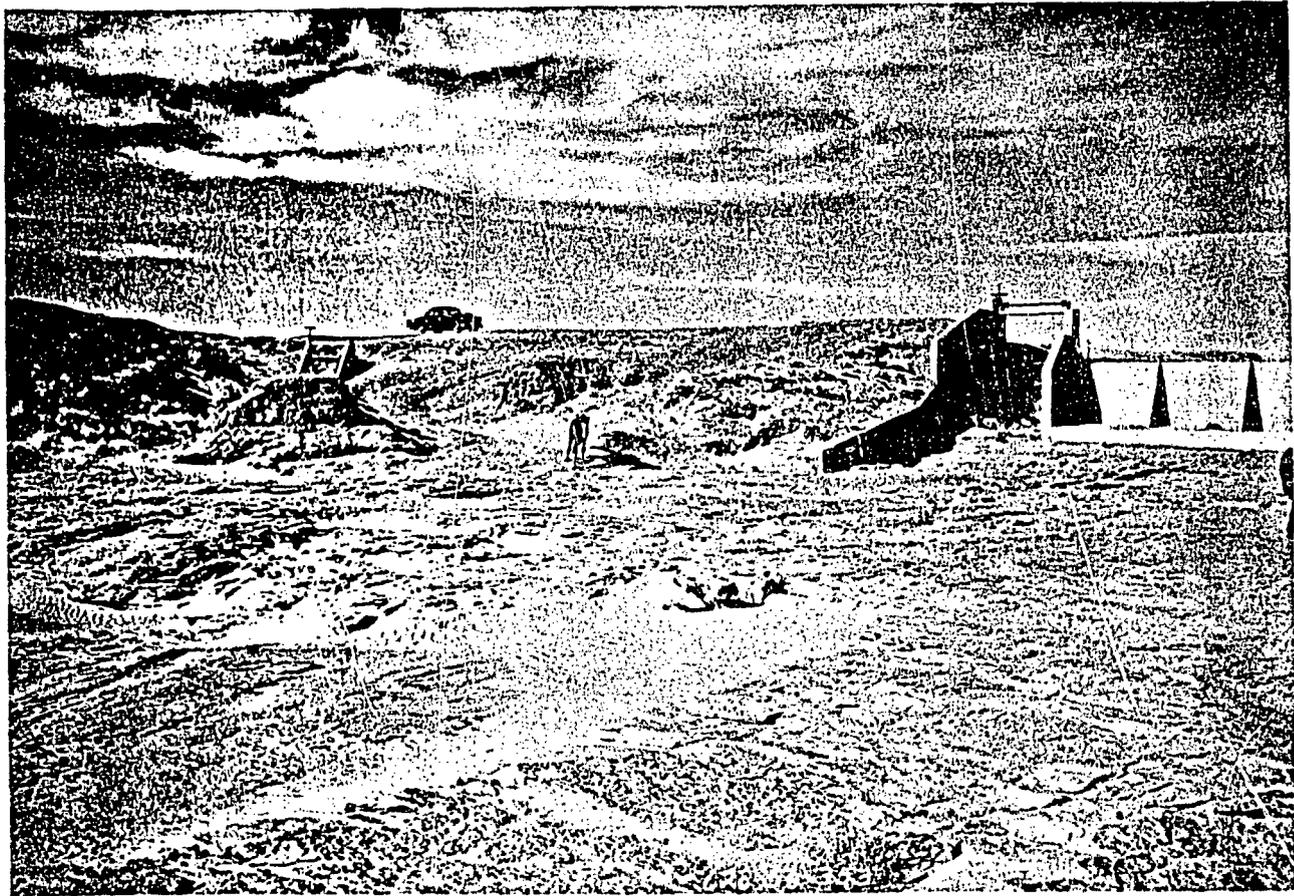
3/ Based on a consumptive irrigation requirement of 1.35 acre-feet per acre.

4/ Diversion requirements based on an assumed overall project efficiency of 40 percent.

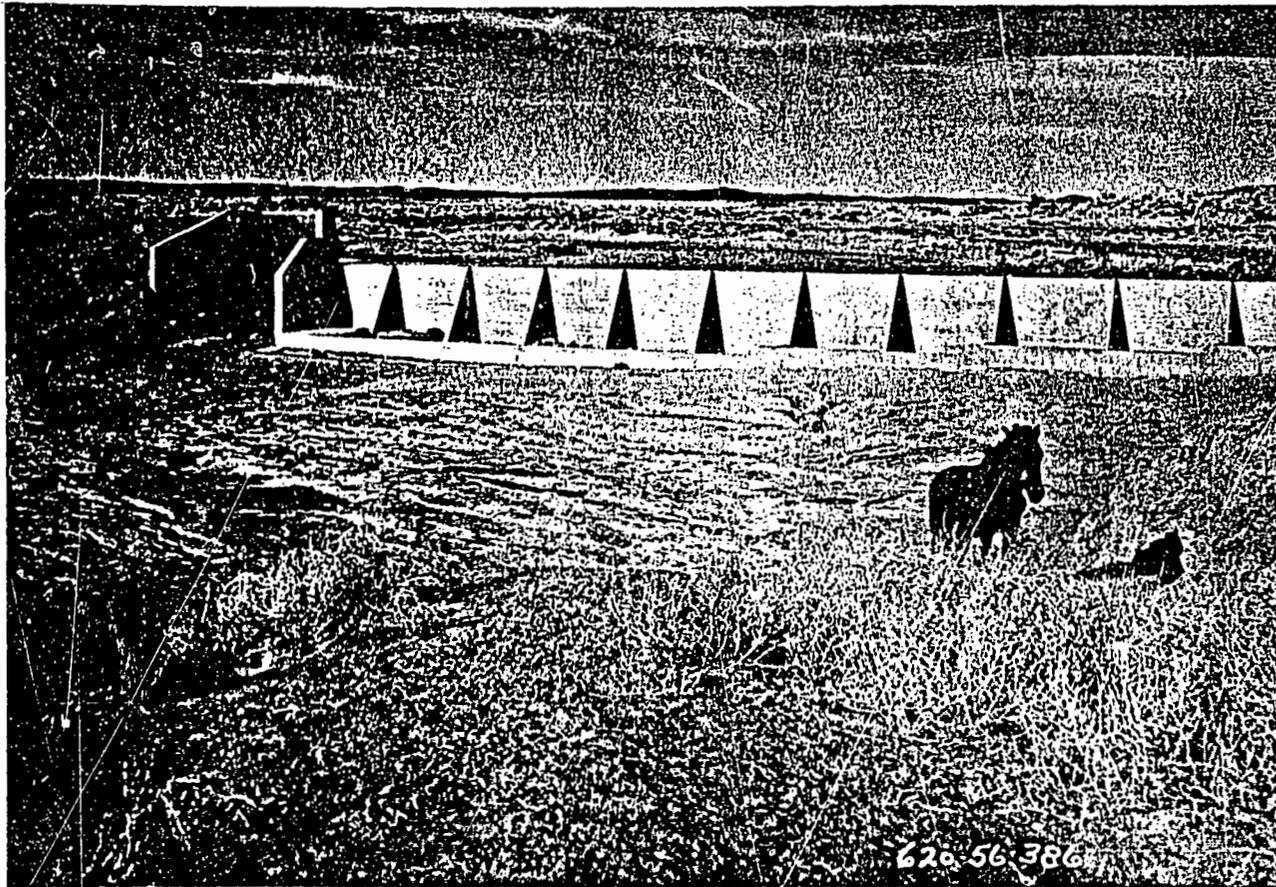
Figure 1. HOPI AND NAVAJO INDIAN RESERVATIONS



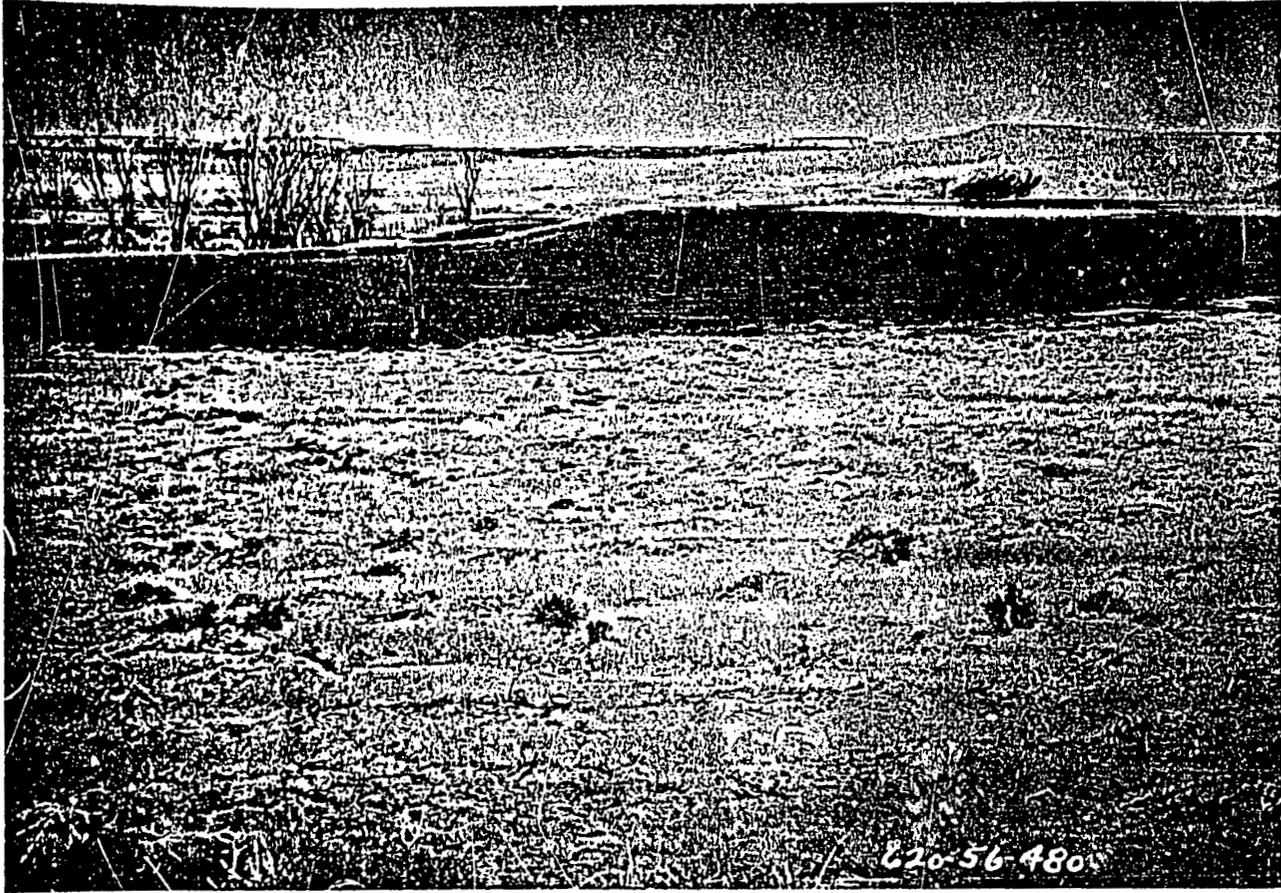




HOPI, ARIZONA - LOWER DINNEBITO UNIT - AN UPSTREAM  
VIEW OF THE DIVERSION DAM ACROSS THE DINNEBITO WASH  
SHOWING THE MAIN SLUICE, A PORTION OF THE WEIR AND A  
SMALL SLUICEWAY LEADING FROM THE CANAL AT THE LEFT.



HOPI, ARIZONA - LOWER DINNEBITO UNIT - AN UPSTREAM  
VIEW OF THE DIVERSION DAM ACROSS THE DIMMEBITO  
WASH SHOWING THE WEIR, SLUICeway AND CANAL INTAKE  
CONTROL STRUCTURE.



HOPI - BEGASHIBITA UNIT - VIEW OF THE BEGASHIBITO RESERVOIR  
SHOWING THE DAM, RESERVOIR, SPILLWAY AND CANAL INTAKE  
STRUCTURE.



HOPI - BEGASHIBITO UNIT - VIEW OF THE LEFT END OF THE DAM,  
SHOWING THE OUTLET CONTROL STRUCTURE AND PORTION OF THE  
RESERVOIR.