

IRRIGATION DATA
LONG RANGE PROGRAM

NAVAJO

Los Angeles, Calif.

January 29, 1944

F.W. 2514

NN001718

IRRIGATION DATA FOR LONG RANGE PROGRAM

NAVAJO RESERVATION
PART ONE - BASIC DATA

SECTION 1 - RESOURCES

Location, Date Established and Area of Reservation -

The Navajo Reservation, Coconino, Navajo and Apache Counties, Arizona, San Juan and McKinley Counties, New Mexico, and San Juan County, Utah, occupies a large area in the N.E. corner of Arizona, the N.W. corner of New Mexico, and the S.E. corner of Utah. The reservation is approximately 200 miles across from east to west and 150 miles from north to south, completely surrounding the Hopi Reservation, which is approximately 56 by 70 miles. It extends to the Colorado River on the northwest and to the San Juan, Montezuma Creek, and the Colorado line in the north, about 46 miles into New Mexico on the east, approximately to the A.T. & S.F. Railroad on the south, and somewhat beyond the Little Colorado on the southwest. In addition there are the Navajo community areas of Star Lake near Chaco Canyon National Monument, 50 miles northeast of Grants, N.M.; Canonicito, 15 miles east of Laguna, N.M.; Puertecito, 40 miles south of Laguna, on the Rio Salado, and Ramah, about 40 miles southeast of Gallup. The last three are under the United Pueblos jurisdiction. These are made up principally of trust and fee patents and purchases. There are also other allotments on the public domain outside the reservation. The nearest towns are Winslow, Holbrook and Gallup on the A.T. & S.F. Railroad, 10 miles, 18 miles, and 11 miles, respectively, south of the reservation, and Farmington on the D. & R. G. Railroad near the N.E. corner.

After the Navajos were returned from Fort Sumner they received, under the treaty of June 1, 1868, a block of land covering 3,328,000 acres in Eastern Arizona and Western New Mexico, south of the Utah-Colorado line.

Executive Order of Oct. 29, 1879, added a strip of land west of the treaty area.

Executive Order of Jan. 6, 1880, added a strip south and east of the treaty area.

Executive Order of Dec. 16, 1882, established the Hopi Reservation of 2,472,166 acres, for use of the Hopis and such other tribes as the Secretary saw fit to settle thereon. Hopi Land Management District No. 6 includes 641,797 acres. The remainder, 1,830,369 acres, is being used by the Navajos.

Executive Order of May 17, 1884, granted the Paiute strip in Utah and Arizona south of the San Juan River. A small area south of the San Juan in the vicinity of Fruitland, originally included in Executive Order of Jan. 6, 1880, and excluded by Executive Order of May 17, 1884, was recovered by Executive Order of Apr. 24, 1886.

Under the Allotment Act of Feb. 8, 1887, approximately 4700 patented allotments of 160 acres each were made from about 1908 to 1930.

Executive Order of Jan. 8, 1900, added about 1,750,000 acres in the vicinity of Tuba City. The Tuba City townsite and adjacent land were bought from the Mormons in 1903.

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Executive Order of Nov. 14, 1901, established the Leupp area.

Executive Orders of Nov. 9, 1907, and Jan. 28, 1908, created the Pueblo Bonita Reservation. This area was restored to public domain by Executive Order of Dec. 30, 1908, and Executive Order of Jan. 6, 1911, excepting the many allotments which had been made to the Indians under the Act of 1887.

Executive Order of Mar. 10, 1905, modified by Executive Order of May 15, 1905, and Act of Mar. 1, 1933, established the area in Utah north of the San Juan.

Executive Orders of Nov. 9, 1907, and Jan. 28, 1908, added approximately 1,500,000 acres to the southern part of the reservation.

Executive Orders of Jan. 19, 1918, May 23, 1930, and Act of June 14, 1934, added the Grey Mountain area west of Cameron and south of the Little Colorado River.

Act of May 23, 1930, also added the area north of the Little Colorado and east of the Colorado River.

Executive Orders of Nov. 19, 1892, -- 1908, and Act of Aug. 17, 1922, restored to public domain part of the Paiute strip established by Executive Order of May 17, 1884, but this was re-established by Act of Mar. 1, 1933.

Act of June 14, 1934, made additions to the reservation north of Winslow and in the vicinity of Houck.

In addition to areas acquired by Executive Orders and Acts of Congress, large areas have been purchased, with gratuity funds prior to Dec. 31, 1928, and thereafter from tribal reimbursable funds.

Purchases to 12/31/38

<u>State</u>	<u>Acreage</u>	<u>Price Paid</u>	<u>Av. per Acre</u>
Arizona	476,240.21	\$ 756,499.58	\$1,588
New Mexico	187,382.16	378,029.84	2.017
Utah	<u>1,920.11</u>	<u>5,212.00</u>	<u>2.741</u>
Total	665,542.48	\$1,139,741.42	1.712

The record to 12/31/38 shows that there were 3732 patented Indian allotments of approximately 160 acres each in trust status on the public domain in New Mexico and 75 Indian homestead entries of 640 acres each on the public domain. The Navajos also had obtained fee patents by citizen homestead entries and small-holding claims for approximately 930 acres.

The area on the reservation, according to the 1942 Statistical Supplement, was as follows:

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<u>State</u>	<u>Total</u>	<u>Trust Allotted</u>	<u>Tribal</u>	<u>Govt. Owned</u>
Arizona	11,414,450	90,545	11,323,905	-
New Mexico	3,508,232	599,275	2,592,242	316,715
Utah	1,211,043	10,720	1,200,323	-
Total	16,133,725	700,540	15,116,470	316,715

This apparently includes the Hopi Reservation, except 501,942 acres in Hopi Land Management District No. 6, which is shown under Hopi in the statistical data. It is understood that District 6 now includes 641,797 acres, which would reduce the Navajo-Arizona and total by 139,855 acres.

Elevation and Climate -

The elevation of the reservation varies from 2800' at the mouth of the Little Colorado to 10,416' on Navajo Mountain in the northwest. Carrizo Mountain in the northeast rises to 9420', and the Chuska range in the east central part reaches 9575'. About 6 per cent of the area is below 4000', 50 per cent between 4000' and 6000', 32 per cent between 6000' and 7000', 10 per cent between 7000' and 9000', and 2 per cent is over 9000'. Other elevations are given in the following table:

The climate is generally that of the Colorado Plateau, but is variable, being greatly influenced by topography. The general effect of elevation is greatly modified by secondary topographic features. The air is dry and the daily range of temperature is great.

The winters are quite severe, with rather meager snowfalls in the lower regions, ranging to heavy on the mountain tops. Winter precipitation is deficient.

The summers are characterized by warm days, cool nights and sudden short storms of great intensity in widely scattered locations, with considerable precipitation in June, July and August. Occasional hail storms are often of great severity.

Wind storms are frequent, the prevailing direction being from the southwest. Whirling columns of dust are often in sight. There are extensive areas of sand dunes and rippled flats and rocks polished and etched by wind-blown sands. Vegetation buried in sand and fields of corn whipped to shreds are common.

Climatological records are incomplete; a summary of the principal available data the various stations follows, using the four most important stations for which fairly complete data are available. These are located at widely scattered points typical of most of the irrigation projects.

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The temperature records for Fruitland, New Mexico, and Chinle, Fort Defiance--St. Michaels and Winslow, Arizona, show the following:

Fruitland, N.M., elevation 4800'; 32 years of record, 1891-1924; 1939-1942:

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Av.
Ext. Max.	71	86	83	92	97	108	110	109	98	94	90	79	-
Ext. Min.	-21	-14	6	8	13	31	34	39	24	11	-1	-17	-
Mean	28.8	34.8	43.2	51.1	59.9	69.1	74.7	72.8	64.7	52.7	39.9	30.7	51.9

Chinle, Ariz. elevation 5688'; 25 years of record, 1909-1928; 1935-1942:

Ext. Max.	65	70	80	85	95	103	102	102	95	90	78	68	
Ext. Min.	-32	-22	1	10	19	26	38	40	23	13	0	-27	
Mean	27.6	33.9	41.3	49.0	58.4	68.6	74.1	72.1	63.8	51.7	39.1	29.3	50.7

Ft. Defiance, Ariz., elevation 6750'; 31 years of record, 1882-1860; 1897-1905; 1929-1942:

Ext. Max.	60	72	72	80	95	98	97	96	90	81	74	67	
Ext. Min.	-25	-26	-9	12	20	28	31	39	25	10	-30	-26	
Mean	25.6	27.4	29.9	46.5	54.0	54.5	69.1	67.8	59.8	48.8	56.5	27.6	47.4

Winslow, Ariz., elevation 4860'; 22 years of record, 1888-1889; 1892-1893; 1898-1900; 1908-1942:

Ext. Max.	74	75	87	94	103	106	107	104	102	91	81	71	
Ext. Min.	-18	-9	6	14	23	23	42	44	22	17	-8	-19	
Mean	31.4	32.3	38.0	53.8	62.2	72.3	77.6	75.2	88.4	55.9	42.6	33.8	54.9

The frost-free growing period for Fruitland, based on a 27-year record ending 1942, is 157 days, from May 6 to October 9, with the latest killing frost of record on May 27, and the earliest on September 17. For Chinle, based on a 26-year record ending 1942, it is 139 days, from May 23 to October 8, with the latest killing frost of record on June 30, and the earliest on September 9. For Fort Defiance--St. Michaels, based on a 33-year record ending 1942, it is 133 days, from May 21 to October 1, with the latest killing frost of record June 19, and the earliest September 9. For Winslow, based on a 38-year record ending 1942, it is 172 days, from May 3 to October 22, with the latest killing frost of record June 2, and the earliest September 27.

The average precipitation is distributed as follows:

Fruitland. 33 years of record, 1891-1924; 1939-1942:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
.52"	.63"	.47"	.54"	.44"	.22"	.67"	.75"	.80"	.72"	.44"	.53"	6.93"

Chinle; 25 years of record, 1909-1928; 1935-1942:

.46"	.47"	.44"	.42"	.34"	.38"	1.63"	1.58"	.87"	.68"	.53"	.54"	8.34"
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Fort Defiance; 31 years of record, 1852-1860; 1897-1905; 1929-1942:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
.92"	1.02"	.79"	.72"	.67"	.72"	1.82"	2.26"	1.60"	.60"	.90"	.85"	12.76"

Winslow; 36 years of record, 1888-1889; 1892-1903; 1898-1900; 1908-1942:

.68"	.49"	.49"	.49"	.30"	.30"	1.61"	1.84"	.78"	.52"	.61"	.68"	8.79"
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The percentage of possible sunshine at Fruitland, for a 4-year period, 1939-1942, is 72; at Chinle, for a 20-year period, 1917-1928, 1935-1942; it is 57; at Fort Defiance-St. Michaels, for a 24-year period, 1917-1927, 1930-1942, it is 68; and at Winslow, for a 26-year period, 1917-1942, it is 67. The monthly averages are as follows:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Av.
Fruitland:												
60	62	66	62	88	91	81	74	68	77	76	67	72
Chinle:												
56	51	52	57	62	88	40	43	61	70	69	54	57
Fort Defiance-St. Michaels:												
69	64	68	69	75	81	60	54	65	76	72	65	68
Winslow:												
68	60	63	66	75	81	57	56	71	78	70	59	67

The approximate average number of hours between sunrise and sunset are as follows:

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Fruitland (lat. 36°-45'):												
309	306	370	393	438	439	447	420	373	340	307	301	4,452
Chinle (lat. 36°-45'):												
309	306	370	393	438	439	447	420	373	340	307	301	4,452
Fort Defiance (lat. 35°-45')--St. Michaels (lat. 35°-37'):												
311	304	370	392	435	436	444	418	373	350	310	304	4,450
Winslow (lat. 35°-01'):												
313	305	370	392	434	434	442	417	373	351	311	305	4,450

The approximate average number of hours of sunshine, using the above percentages is:

Fruitland:												
185	159	244	244	385	399	362	311	254	269	233	202	3,247
Chinle:												
173	156	192	224	272	308	178	181	227	244	212	168	2,525
Fort Defiance-St. Michaels:												
215	195	252	271	326	353	266	226	242	266	223	198	3,038
Winslow:												
197	183	235	259	326	351	252	234	265	274	218	180	2,971

Erosion is a serious factor in the development of this reservation and has been given a great deal of attention by the Soil Conservation Service. The soils, owing to the nature of the rock formations from which they are derived, are mostly of fine sand and silt, which is easily broken down by action of wind and water. Large areas of the reservation are being denuded of vegetation, the best soils whipped out and drifted into sand dunes by the wind and washed away by water. The valleys are cut by ever-increasing arroyos, farm lands eroded or covered with sand, reservoirs filled with silt, diversion structures washed out and canals broken by cross-washes. These conditions make agricultural operations very hazardous. The cost of irrigation works is very high and maintenance very difficult and expensive.

Topography (1)

The Navajo Reservation is a part of the Colorado Plateau, a region of flat-lying or slightly tilted rocks, cut by canyons and surmounted by mesas and buttes on a grand scale. In general, the depth of canyons below 5500' is about equal to the height of the mountains above that elevation. Navajo and Carrizo Mountains are localithic in origin and rise domelike above the surrounding country. Chuska Mountains, Black and Segi Mesas are bordered by sheer cliffs of commanding proportions. There are many mesas of the second and third order and innumerable buttes of both igneous and sedimentary origin. Mesas, buttes, volcanic necks, canyons, washes and dunes are repeated indefinitely. Alcoves, recesses and erosion forms of great variety, color and rare beauty stand as ornamental carvings on the larger architectural features. Approximately 54 percent of the area drains into the San Juan, 39 per cent into the Rio Inereo and Little Colorado, and 7 per cent into the Colorado River. A small amount drains into the Rio Grande from the Star Lake, Canyoncito and Puerticito areas outside the main reservation.

Geology and Soils (1)

Pre-Cambrian is exposed at only one point, Quartzite Canyon near Fort Defiance. During Parmian time the land was near sea level and was probably repeatedly submerged.

The first recorded deposit of Triassic Age is the Shinarump conglomerate which followed the Permian deposits after a long erosion interval. During Jurassic time there was increasing aridity and elevation with bodies of water--salt, brackish and fresh--and sufficient forage for animals as indicated by evidences of dinosaurs. There was vigorous erosion, marked by the unconformity at the base of the Dakota, which has removed all traces of lower Cretaceous. During upper Cretaceous time streams were active and the Dakota was laid down. Repeated submergence and re-elevation occurred and shales and sandstones containing marine fossils and lignitic coal were deposited.

With the coming of the Tertiary the sea is believed to have been permanently excluded. Fresh water shells indicate lakes and cross-bedded sandstones suggest the work of winds. Volcanism was active and probably continued into the Quarternary. Major folds and consequent uplifts, several times repeated, have brought the land to its present position. Erosion became dominant during the Pliocene and reduced parts of the area

(1) Extracts from W.S.P. 360, The Navajo Country, by H. E. Gregory, 1916.

to a peneplain. The gradient was increased later by a regional uplift, greatly reducing the area occupied by Mesozoic and Cenozoic strata. Other uplifts of 3000' to 4000' enable the streams to cut the canyons which form so conspicuous a feature of Navajo topography.

The pre-Cambrian is represented only at Quartzite (Blue) Canyon near Fort Defiance. The Carboniferous-Pennsylvanian is found in the Canyon of the San Juan and at Grand Falls and several other points along the Little Colorado. Strata of this buff and brown Kaibab limestone are well exposed. The Permian beds consist of arenaceous shales and thin bedded sandstone, brown to chocolate in tone, charged with lime and gypsum, known as Moonkopi and the massive cross-bedded De Chelly sandstone.

The upper Triassic is represented by Shinarump conglomerate consisting of coarse sandstone in cross-bedded lenses with fossil wood and by the Chinle formation of calcareous shales and sandstones highly colored and in pink, purple, gray and brown, and eroded into bedland forms of singular beauty.

The Jurassic-La Plata group consists of two formations of massive cross-bedded friable red sandstones of great thickness. The lower Wingate sandstone is in many places, separated by a band of limestone or of calcareous Todilto shale and sandstone from the upper Navajo sandstone. Above the La Plata group lies the McElmo formation of friable greenish-white sandstones and subordinate shales, easily eroded into scalloped and curtained cliffs and badlands.

The upper Cretaceous is represented by the Dakota sandstone, the Mancos shale, prevailingly argillaceous but containing many beds of sandstone and thin seams of coal, and the Mesa Verde, consisting of sandstones, shales and coal widely extended in Northeastern Arizona and Northwestern New Mexico.

The tops of Black Mesa, of Dutton, Chase and Manuelito plateaus and the floor of Chuska Valley are formed of the resistant members of the Mesa Verde, within which are found deposits of coal of high commercial value.

Tertiary strata cap the Chuska Mountains and cover a portion of Black Mesa. These include the Tohatchi shale and Chuska sandstone, the volcanic flows on top of Chuska Mountains, those in the Hopi Buttes region and along the Little Colorado River. Volcanic necks and dikes are distributed widely over the reservation.

The Quaternary deposits of post Tertiary erosion are represented by extensive deposits of alluvium forming the floor of wide washes and fringing canyon and mesa walls. Sand dunes ranging in size from small mounds to crescentic ridges 30' to 50' in height are found at many points, except in the forested highland areas.

Soils, ⁽¹⁾ two types of soils are found--residual or local soils, which have resulted from decomposition of the rocks immediately under the surface; and transported soils, which have been carried by natural agencies from their place of origin and redeposited. The scantiness of vegetation, severe showers, rapid runoff and strong winds, characteristic of this region, are unfavorable for the development and retention of soil in place, hence transported soil predominates.

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Residual soil, a few inches thick, is found on the flat tops of Chuska Mountains, of Defiance, Dutton and Chaco plateaus and of Black and Segi mesas. Large patches are found also on Carrizo and Navajo Mountains, in Monument and Chuska Valleys, and to a less extent elsewhere.

Transported soil, however, is widespread. The broad washes and their innumerable tributaries are flooded with stream-borne debris to depths exceeding 100 feet. Alluvial soil is also displayed in fans and slopes along valley sides and in terraces clinging to canyon walls, and a small amount marks the beds of extinct and ephemeral lakes. Bolian soils are found along the Little Colorado in the Tusayan washes, on Moenkopi, Kaibito and Shato plateaus and in the Chinle Valley, and blow dust is found on highland and lowland alike.

The soil of the Navajo country is derived from rocks relatively poor in mineral plant food. Limestone underlies probably less than 5 per cent of the area. The shales and sandstones of the Moenkopi formation contain relatively little plant food and are, in most places, charged with gypsum and other objectionable salts. The shinarump conglomerate furnishes no soil of value to plants and the shales of the Chinle formation develop characteristically into infertile, bad-land areas. The sandstones of the La Plata group and the McElmo formation are prevailingly quartzose and are sparingly provided with plant food.

The Cretaceous strata--Dakota, Mancos and Mesa Verde--contain a higher proportion of plant food than any of the other formations and the lavas (largely basaltic) furnish a soil of high fertility. However, in spite of its origin, the soil of the reservation is not lacking in fertility--a condition which is due largely to the arid climate. The plant foods, sparingly distributed in the rocks, are accumulated in the soils of the washes and alluvial fans and stored for long periods because continuous, vigorous ground-water movement is lacking, and the leaching of soluble constituents is correspondingly checked. The fertility of the soil is renewed by continuous redistribution of alluvium by showers, seasonal rains and wind, thus incorporating within the soil the vegetation which springs up rapidly where conditions allow.

Agronomy -

Dry-farming, as commonly known, is not practicable on the reservation, except in a few isolated places in the higher altitudes where certain crops can be raised without irrigation in favorable years. However, the practice of farming on sandy fans of the washes, which receive and hold moisture for long periods, has been developed to a remarkable degree. Crops, principally corn, are planted deep in large hills to reach the moisture and protect the interior stalks from the cutting action of wind-blown sand.

Irrigation farming has become the mainstay of agriculture and a large number of units have been developed or partially developed, most of them in the first instance, by the Indians in a small way. Assistance has been provided by the Government in the investigation, improvement and development of a large number of units.

A great many crops are raised. However, the majority are of the subsistence variety, consisting of corn, beans, squash and garden vegetables. Many difficulties are encountered in making efficient use of the irrigation projects. The land is usually rough, requiring subjugation, and is subject to erosion along stream channels or by cross-washes. Head-works and canal systems rarely can be constructed so well that frequent damage is not caused by floods, requiring heavy maintenance. The water supply, except where storage is available, is of flashy nature, requiring close attendance and often causing considerable damage. The Indians do not have the facilities or do not attain perfection in farming operations, all of which results in low production per acre.

Summary Crop Report for Calendar Year 1942

<u>Crop</u>	<u>Irrigated Acres</u>	<u>Yield</u>		<u>Market Value</u>		<u>No. Indians Farming</u>
		<u>Per Acre</u>	<u>Total</u>	<u>Per Acre</u>	<u>Total</u>	

Total	17,838			\$16.65	\$297,037	
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SECTION 2 - PRESENT DEVELOPMENT & USE

Irrigation -

Irrigation on the Navajo Reservation dates from 1885, when some small ditches were constructed by the Indians. Investigations and surveys were made by the Indian Service as early as 1904. Several small projects were constructed within a few years after this, and development has continued at an ever-increasing rate. The work was carried on through the Albuquerque office of the Supervising Engineer until the beginning of the fiscal year 1936, when it was turned over to the reservation Superintendent. Cooperative work has been done on many projects by Irrigation, E.C.W., CCC-ID, S.C.S., and Rehabilitation.

The following tabulation shows, by States, all the units on which work has been done, investigations made or work proposed, with costs, irrigation data and estimates of cost to complete.

There are 120 units listed. Irrigation funds, totaling \$2,908,902.35, have been expended on 93 of these, and other agencies have spent \$354,150.75 on 41 units, plus an unknown amount on three units, eight of which were not covered by Irrigation funds, making a total of 101 on which

funds have been expended. This includes several investigated or partly constructed but now abandoned, two Hopi projects, several school units, subsistence gardens, experimental well, drainage and quarters, 28 in all which are not strictly Indian irrigation projects. This leaves 75 active projects and 19 proposed projects on the list. Seventy of the active projects are completed or partially completed, with 26,198 acres ready for cultivation (the principal works are constructed for a considerably larger acreage). On 67 of these, 17,833 acres were cropped in 1942 with a crop value of \$297,037.

Additional surveys, investigations and construction are proposed on 82 projects, of which only 15 are new in the sense that no funds have been expended on them heretofore. The total estimate of \$2,838,700 is incomplete, as detailed surveys and plans have not been made in most cases and as it includes only the cost of surveys on 15 of the projects, some of which are quite large.

It is contemplated that the above estimate would complete the existing units to a point where the approximate ultimate acreage of 67,000 could be satisfactorily cropped.

The economic unit of irrigated land is probably about 10 acres per family under conditions which exist on the Navajo Reservation. This is more in the nature of a compromise subsistence unit, based upon the limited agricultural possibilities, rather than the full acreage required for economic independence. Even so, it would involve more than twice the acreage of irrigable land now in sight. When considered in connection with stock-raising, which is the major industry, the 10-acre unit affords a good measure of assistance in the economic status of the Indians.

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SUMMARY OF NAVAJO IRRIGATION PROJECTS
(Nos. refer to Nos. in Postwar Estimates 6/30/43)

No.	ARIZONA	Name	Irrig. Cost to 6/30/43	CCC-ID Cost to 6/30/42	Ultimate Irrig. Area	Ready for Cultivation	Cropped 1942	Crop Value	Est. Cost to Complete	Proposed Work
108		Agua Sol	0	0	100	0	0	0	0	None.
2		Balanced Rock	0	0	300	234.5	199.5	2,125	10,700 M	Masonry diversion dam, canals and structures, \$6,500; subj. 100 acres, \$4,000; surveys, \$200.
3		Beautiful Valley	0	4,504.56	300	67	87	928	31,700	Rehab. 3,000' canal, inc. flume, wasteway, drop and f.o.'s, and subj. 300 acres.
4		Beganibito	10,755.41	0	300	0	0	0	3,500	Pipe distribution system to conserve water.
6		Big Sage Mesa	1,106.84	0	300	0	0	0	1,000S	Complete surveys, plans and estimates.
6		Rita Ho Chae	0	0	300	0	0	0	10,300 M	Masonry diversion dam, 1 mile main canal, laterals and structures.
0		Black Falls	2,345.76	51,666.80	0	0	0	0	28,000	Canal improvement and extension 4,000', subj. 600 acres.
109		Canyon Diablo	232.12	0	75	0	0	0	5,300 M	Diversion dam and distribution system for 75 acres.
14		Chilohobito	0	5,501.00	1,720	1,470	1,100	8,923	1,000S	Survey and estimate for diversion dam and rehabilitation distribution system.
15		Chinle	21,658.75	0	0	0	0	0	0	None.
		Chinle School	0	0	0	0	0	0	0	None; abandoned account infeasible diversion.
110		Coldfields	0	0	0	0	0	0	0	Reconstruct div. dams, \$5,000; canals, \$4,000; subj., 350 acres, \$14,000; surveys, \$500.
17		Corn Wash	685.05	1,163.43	350	138	121.5	1,395	23,500	Masonry dam for 100 acres if feasible.
18		Cove	0	0	100	0	0	0	2,700 M	Reconstruct 3 miles canal, \$8,000; subj. 800 acres, \$18,500; surveys, \$1,000.
19		Cow Canyon	0	0	800	637	302.2	1,091	27,500	None.
24		Demotsoo	30,467.68	8,958.49	288	288.5	118	4,186	0	None.
25 & 10		Fort Defiance & Bonita Cr.	0	0	0	0	0	0	0	None.
		Fort Defiance School	15,087.61	32,769.61	2,825	1,451	1,030	25,098	1,000S	Surv., plans and est. for improvement and extension to include Cornfields.
		Genado and Cornfields	197,195.55	0	750	235	154.5	2,045	43,000	Repair diversion dam, \$1,000; improve distrib. system, \$10,000; subj. 750 acres, \$32,000.
27		Houck	17,360.85	0	0	0	0	0	0	None.
31		Indian Wells	54.30	0	0	52	51	2,212	0	Construct lateral system and subj. 50 acres.
111		Yadito	31,296.75	0	250	200	130	3,100	15,000	None, water supply questionable.
106		Kinlechee	31,245.42	0	500	350	300	6,016	0	Surveys and investigations for possible irrigation development.
36		Klagetuch	23,425.14	0	250	0	0	0	200S	None.
37		Kletchla Valley	437.93	10,555.00	200	57	30	782	200S	None.
38		Lakassand	54.98	40,238.00	0	0	0	0	5,700 M	Diversion dam, \$4,000; canals, \$700; structures, \$500; surveys, \$200.
39		Left Bank	0	0	0	0	0	0	0	None, flood protection. Project turned over to W.R.A.
40		Lapp (Flood protection)	28,377.46	0	300	234	208.2	3,693	0	None, water supply questionable.
43		Lower Desabito	61,414.78	839.95	400	130	45	665	10,500	Reconstruct diversion dam, canals to 270 acres; subj. 270 acres.
44		Lower Montcopi	36,262.83	6,329.52	2,000	800	719.5	12,386	102,200	Complete lateral system, sluiceway, weir at intake, and subj. 1,200 acres.
45		Lower Rock Point	208,877.62	1,000	970	927.8	8,022	77,000	0	Extend canal, rehab. Priest Lake storage, and subj. 100 acres.
47, 68 & 94		Luxabugai-Tonotso, Priest Lake	2,248.76	4,885.80	8,460	1,081.5	947	6,966	409,000	Extend distribution system, 300' metal flume, pumping plant, and subj. 7,000 acres.
48		Mary Farms	299,479.86	6,658.09	400	363.25	350.7	2,320	18,250	Reconstruct feeder canal, extend laterals, windbreak and subjugation.
50		Marsh Pass	71,849.97	7,576.00	0	0	0	0	0	None.
		Marsh Pass School	2,138.40	0	0	0	0	0	0	None.
117		Mexican Waters	342.05	0	0	85.5	85.5	2,865	9,000	Develop springs and raise several reservoirs.
62		Moenave	3,754.41	1,791.33	640	640	578	9,440	20,500	Reconstruct diversion dam, sluiceway, laterals, flood protection and subjugation.
63		Montcopi (Tube)	54,505.29	923.00	175	100	61	152	4,200	Subjugate 75 acres.
64		Natonis	12,176.70	11,019.00	2,000	28.5	15.5	585	195,000	Enlarge storage dam, const. diversion dam, new canal & structures, & subj. 2,000 acres.
68		Natural Bridge	9,031.20	0	100	51	50.8	987	300S	Surveys and investigations to determine feasibility.
33		Nativo and Jones Canyon	197.13	14,526.00	0	0	0	0	0	None.
65		Nativo and Jones Canyon	568.62	0	0	0	0	0	511	Rehab. canal through deep cut and reconstruct flumes.
69		Nativito	26,355.07	3,615.00	100	20	15.4	972	3,100 M	Improve main canal and subjugate 50 acres.
64		Oak Springs	0	0	50	42.25	41.8	0	0	This is now a Hopi project--Hardrocks.
67		Ortado Wash (Hopi)	16,019.561	1,297.00	175	172.25	172.2	2,348	15,500	Reconstruct diversion dam, construct laterals and structures, and subjugate 175 acres.
67		Palute Canyon	7,021.22	0	0	0	0	0	0	None.
112		Pinon	894.00	0	0	0	0	0	0	None.

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SUMMARY OF NAVALO IRRIGATION PROJECTS
(Nos. refer to Nos. in Feature Estimates 6/20/43)

Sta.	ARIZONA (cont'd.) Name	Irrig. Cost to 5/30/43	CC-UD Cost to 5/30/42	Ultimate Irrig. Area	Ready for Cultivation	Cropped 1942	Crop Value	Est. Cost to Complete	Proposed Work
107	Polacca-Nevo Wash	\$ 4,582.89	0	0	0	0	0	0	None; abandoned as infeasible.
108	Carters	3,720.65	901.00	350	212	164.9	1,952	10,000	Complete main canal and subjugate 350 acres. Survey, plans and estimate 300 acres.
109	Red Lake	9,752.10	801.00	3,000	225	194	2,682	10,800	Survey, plans and estimate 300 acres. Install metal flume and subjugate 200 acres.
110	Red Rock	2,052.80	680.00	300	251.5	69	1,706	6,600	Install metal flume and subjugate 200 acres.
111	Red Rock Valley	1,583.30	0	300	274.25	274.2	7,124	400	Topo project-survey, map and investigate to see if further work needed.
112	Reservoir Canyon (Eopl)	2,107.47	4,894.71	1,500	0	0	0	25,500	Construct diversion dam, canal, siltway, and subjugate. Enlarge reservoir to 600 ac. ft. and subjugate 300 acres.
113	Rock Point	56,621.76	0	100	168	139.1	2,117	17,700	Reconstruct diversion dam, construct canals, and subjugate. Reconstruct diversion dam, construct canals, and subjugate.
114	Rock Point	1,863.70	20.25	100	400	20.3	688	14,500	Reconstruct diversion dam, construct canals, and subjugate.
115	Small Canal	6,343.21	5,225.00	500	0	135.3	1,394	4,500	Reconstruct diversion dam, feeder canal and storage reservoir.
116	Silt Washers	1,707.42	0	0	0	0	0	0	None.
117	Sonia Butte	1,707.42	0	400	436	261	5,277	5,000	Survey, investigation and estimate of cost.
118	Tanner Springs	27,136.62	0	600	186.5	181	4,684	4,000	Survey and investigation to determine feasibility and cost.
119	Tanner Springs	7,603.78	0	200	66	18	570	26,500	Construct two-way diversion dam, 2 canals and structures, and subjugation.
120	Tanner Springs	7,106.76	0	200	66	18	570	14,800	Extend canal structures, erosion control, flood protection, and subjugation.
121	Tanner Springs	7,106.76	0	200	66	18	570	3,800	Construct 2,800 canal from storage dam, 200 ac. ft. Reservoir, 3,800 canal, and subjugation.
122	Toll Lake	2,813.46	4,895.00	300	125	48	1,608	3,700	Reconstruct diversion dam, construct canals, and subjugate. Reconstruct diversion dam, construct canals, and subjugate.
123	Toll Lake	9,599.00	1,875.00	340	82	48	1,608	3,700	Reconstruct diversion dam, construct canals, and subjugate. Reconstruct diversion dam, construct canals, and subjugate.
124	Toll Lake	675.96	0	40	25	21	676	5,500	Protect land and reservoir from area washes.
125	Toll Lake	675.96	0	40	25	21	676	5,500	Protect land and reservoir from area washes.
126	Toll Lake	675.96	0	40	25	21	676	5,500	Protect land and reservoir from area washes.
127	Toll Lake	675.96	0	40	25	21	676	5,500	Protect land and reservoir from area washes.
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141	Toll Lake	675.96	0	40	25	21	676	5,500	Protect land and reservoir from area washes.
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222	Toll Lake	675.96	0	40	25	21	676	5,500	Protect land and reservoir from area washes.
223	Toll Lake	675.							

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SUMMARY OF SALVADO IRRIGATION PROJECTS
(Nos. refer to Nos. in Postwar Estimates 6/30/43)

No.	NEW MEXICO (cont.)	Irri. Cost to 6/30/43	CC-ED Cost to 6/30/42	Ultimate Irr. Area	Ready for Cultivation	Cropped 1942	CCED Value	Est. Cost to Complete	
58	57 Monument Rock	\$ 345.71	Unknown	70	80	8	0	10,000	Survey and investigation to determine cooperation with U.S.R.S. in Arizans Project. Will cost \$10,000. Distribution system, 31,200; subj. 100 acres, 36,000.
59	58 Monument Hill	0	0	200	182	134.5	2,971	17,500	Construct diversion dam, install sluice and head-gates, and subj. 200 acres.
60	59 Mascull-Brolets	28,824.44	8,265,000	500	300	30	3,131	25,200	Construct diversion dam for feeder canal.
61	60 Southern	6,876.00	0	250	30	0	0	0	None; siltling of reservoir and poor soil do not justify expansion.
62	61 Pueblo Bendito	11,828.51	0	0	0	0	0	0	None.
63	62 San Juan Drainage	6,680.77	0	0	0	0	0	0	None.
64	63 San Juan Pumping	312.60	0	0	0	0	0	0	None.
65	64 San Juan Investigation	1,893.61	0	0	0	0	0	0	None.
66	65 San Juan School	7,112.33	0	1,000	795.5	591	5,167	25,500	Repair diversion dam and structures, build additional canal structures, and subjugation.
67	66 Escobedo & Beautiful Mtn.	10,181.54	0	500	338.75	173.3	620	17,400	Construct 3 diversion dams, 3 mi. canal, and subj. 500 acres.
68	67 Shaprock Wells	10,177.57	2,282.00	0	0	0	0	0	None.
69	68 Standing Rock	(1,250.00)	0	20	50	30	50	10,000	None. To obtain data on this project.
70	69 Standing Water	3,113.97	2,187.00	300	270.47	270.5	256	19,700	Reconstruct main canal, and subjugation.
71	70 Tualuma, Inc. Hudson Lake	15,701.23	0	200	200	103	546	9,000	Replace log crib div. dam with conb. Reconstruct Hudson Lake storage dam, stabilize main canal, and subjugation.
72	71 Tualuma Park	8,316.15	0	500	48.5	17	313	12,550	Install additional structures, and subjugation.
73	72 Tualuma	8,561.90	0	100	255	170.7	983	4,000	Install additional structures on T.O. and check in main canal, and subjugation.
74	73 Tualuma	284.71	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
75	74 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
76	75 Tualuma	3,436.00	0	100	0	0	0	0	Rebuild storage dam and riprap slopes.
77	76 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
78	77 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
79	78 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
80	79 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
81	80 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
82	81 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
83	82 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
84	83 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
85	84 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
86	85 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
87	86 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
88	87 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
89	88 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
90	89 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
91	90 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
92	91 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
93	92 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
94	93 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
95	94 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
96	95 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
97	96 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
98	97 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
99	98 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
100	99 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
101	100 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
102	101 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
103	102 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
104	103 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
105	104 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
106	105 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
107	106 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
108	107 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
109	108 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
110	109 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
111	110 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
112	111 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
113	112 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
114	113 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
115	114 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
116	115 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
117	116 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
118	117 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
119	118 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
120	119 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
121	120 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
122	121 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
123	122 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
124	123 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
125	124 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
126	125 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
127	126 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
128	127 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
129	128 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
130	129 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
131	130 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
132	131 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
133	132 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
134	133 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
135	134 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
136	135 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
137	136 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
138	137 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
139	138 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
140	139 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
141	140 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
142	141 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
143	142 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
144	143 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
145	144 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
146	145 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
147	146 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
148	147 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
149	148 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
150	149 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
151	150 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
152	151 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
153	152 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
154	153 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
155	154 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
156	155 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
157	156 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
158	157 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
159	158 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
160	159 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
161	160 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
162	161 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
163	162 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
164	163 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
165	164 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
166	165 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
167	166 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
168	167 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
169	168 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
170	169 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
171	170 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
172	171 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
173	172 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
174	173 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
175	174 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
176	175 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
177	176 Tualuma	1,792.00	0	30	0	0	0	0	Rebuild storage dam and riprap slopes.
178	177 Tualuma	1,792.00	0	30	0				

SECTION 4 - SERVICES PROVIDED BY GOVERNMENT

Irrigation -

A great many of the existing irrigation projects were initiated by the Indians, who, during their wanderings over the reservation grazing their sheep and goats, planted small fields on the fans of washes where the crops could be irrigated by spreading the flood water by simple ditches. In time, more difficult projects were undertaken, requiring diversion of water from the washes and construction of canals to more and better land. Irrigation farming soon became a very important item in the economy of the Navajos and the Government began to assist the Indians in the laying out and construction of the more difficult projects, especially by providing engineering assistance and materials. In this work the Indians generally contributed most of the labor.

As the projects grew in size and difficulty and other reservation activities competed for labor, the Government undertook the entire construction of most projects, paying full wages and all material costs. This developed into the Government's taking care of maintenance during construction and, as the construction of most projects is now quite completed, the Government actually maintains most of the projects, especially the larger ones, where failure to do so for any length of time would jeopardize the entire project. The smaller projects usually run along for some time with very little repair work, but when major damages occur the Government must do the work, with or without Indian contribution. This is evidenced by the expenditure to June 30, 1943, of \$685,524 for O. & M. from irrigation funds alone. This is about 25.5 per cent of the irrigation construction cost.

F. W. 2528

PART TWO - OVERALL PLAN

SECTION 1 - GENERAL

General -

The Navajos are primarily dependent upon stock-raising, for which the reservation is best adapted, although necessarily limited in comparison with the population. Agricultural possibilities are secondary and also limited. Taken together and operated in accordance with the desires and capabilities of the Indians, these two occupations can be developed to provide the major part of a fair income for these people so long as the population does not increase materially. Other activities and resources also provide a considerable income.

SECTION 2 - DEVELOPMENT BY FEATURES

Irrigation -

The projects listed in the above tabulation constitute the greater part of the possible irrigation developments on the Navajo Reservation. However, it should be noted that the total acreage and estimated cost are not the true measure of these developments. Several of the larger proposed projects, such as Monument Rock and San Juan, and several small ones, have not reached the stage of investigation where either acreage or cost can be given with any degree of accuracy, hence the figures are not included in the totals. Aside from these, the totals show that 67,312 acres are classed "ultimate irrigable," with 26,198 acres ready for cultivation. The estimated cost, \$2,338,700, plus, to complete is, with the exception of a few items for surveys and investigation of the indefinite projects, the amount required to complete the existing units and several of the smaller proposed units to a point where the approximate ultimate acreage can be utilized.

The names of the units and the principal essential data are shown on the above tabulation and, to avoid repetition, will not be repeated here.

F. W. 2529

SECTION 4 - ESTIMATED COSTS BY YEARS & FEATURES
(From Supt.'s Budget Estimate for 1945, submitted Aug. 23, 1943)

<u>Irrigation</u>	<u>Project</u>	<u>Total</u>	<u>1945</u>	<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>Addl.</u>
Fruitland									
	Distribution	\$ 45,000	15,000	15,000	15,000				
	Subjugation	53,642	5,000	24,320	24,322				
	Total	\$ 98,642	20,000	39,320	39,322				
Hogback									
	Distribution	\$ 24,000	8,700	15,300					
	Subjugation	73,000	3,000	22,000	33,000	15,000			
	Drainage	15,000	800	14,400					
	Pumping plant	25,000					25,000		
	Total	\$ 137,000	12,300	51,700	33,000	40,000			
Ganado & Cornfields									
	Subjugation	\$ 75,000	20,000	20,000	35,000				
	Storage dam	20,420	20,420						
	Total	\$ 95,420	40,420	20,000	35,000				
Many Farms									
	Distribution	\$ 28,000	8,000	10,000	10,000				
	Subjugation	402,220	7,000	15,000	140,220	30,000	30,000	30,000	150,000
	Total	\$ 430,220	15,000	25,000	150,220	30,000	30,000	30,000	150,000
Misc. Projects		\$1,739,789	27,700	50,000	100,000	150,000	150,000	150,000	1,112,089
Grand Total		\$2,501,071	115,420	186,020	324,542	213,000	220,000	180,000	1,262,089

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F. W. 2530