WORK REPORT

DETAILED CONSERVATION

SURVEY

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NATONI'S IRRIGATION PROJECT

LAND MANAGEMENT UNIT 5

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U. S. DEPARTMENT OF INTERIOR

S.M.C.O. NAVAJO SERVICE

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F. W. 1069

ALL SERIES NAMES

are provisional

PENDING FINAL CORRELATION

by

THE INTERBUREAU CORRELATION COMMITTEE

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INTRODUCTION

Natoni's Irrigation Project is located in the northwest portion of Land Management Unit 5, in the Coconino County, Arizona.

It is 20 miles north of Leupp, Arizona and 14 miles northwest of the Red Lake Trading and Day School by airline. It is approximately 35 miles from Leupp by road.

A secondary trail branching from the Oraibi-Leupp road approximately 5 miles north of the Red Lake turnoff leads to the project.

The 761 acres, all Federal owned, included in the Conservation Survey are below the Fly-line and lie between the Dinnebito and Oraibi Washes immediately above their confluence.

Initial investigations were made by Dave Chitwood and H.F. Johnson in November 1940. The detailed survey was made by L.A. Bronaugh and H. F. Johnson the week of March 10 to 15, 1941.

The purpose of the survey was to gather and compile data necessary to evaluate the quality and quantity of land adapted to irrigation below the heading.

The elevation of the area is approximately 4900 feet.

The topography is the typical gently sloping old alluvial fan type that is locally undulating as a result of wind action. A series of low benches having an average differences in elevation of about four feet are characteristic of the more gentle slopes.

Alkali sacaton (Sporobolus ariolides) is the predominate grass found over most of the area. Big rabbit brush (Chrysothamnus bigelovii) occurs in the local areas. Greesewood (Sarcobatus vermiculatus) occupies the hummocks where the most dispersed subsoil is exposed.

CLIMATE

No climatological data are available at the project. Records are available from Flagstaff, Grand Canyon, Leupp, Tuba City and Winslow, Arizona. Table No. I is a summary of this data in tabular form. An estimation of the climatological data for Natoni's is also included. The long growing season permits cultivation of most long season crops. The high temperatures makes the growing of the cooler climate crops such as head lettuce and celery uncertain.

Table I. Climatological Data from Weather Stations in or near L.M.U. 5 *

Station & Length of Complete Record	Elevation (Feet)	Length of Growing Season (Days)	Average Annual Temperature (F°)	Average Maximum Temperature (F°)	Average Minimum Temperature (F°)	Extreme Minimum Temperature (F°)
Flagstaff 27	6907	116	45.4	60.0	30.8	-25
Grand Canyon 21	6866	133	47.3	62.4	32.3	-22
Leupp 9	4700		53.4			-12
Tuba City 22	4500	179	54.7			-15
Winslow 18	4848	165	54.3	70.7	37.8	-10
Natoni's **	4900	160	53.0	68.0	36.0	-12

Table I. (cont)

Extreme Maximum Temperature (F°)	Average Annual Precipitation(in.)	Average Date Last Killing Frost in Spring	Average Date First Killing Frost in Fall	Latest Date of Killing Frost in Spring	Earliest Date of Killing Frost in Fall
92	22.8	June 6	Sept. 30	July 5	Sept. 9
98	18.13	May 21	Oct. 1	June 17	Sept. 5
105					
104	6.94	April 23	Oct. 19	May 9	Sept. 19
106	8.73	May 4	Oct. 16	June 2	Sept. 27
104	7.0	May 7	Oct. 14		

* University of Arizona, College of Agriculture. Agriculture Experiment Station Bulletin No. 130, "The Climate of Arizona", By H.V. Smith. Data from Establishment of Station to 1930, inclusive.

** Estimated

AGRICULTURE HISTORY AND PRACTICES

There is no evidence that farming has been practiced within the area in the recent past. [illegible] has constructed several temporary structures on the Dinnebito Wash and produced crops to the west of this area intermittently for several years, his success seemingly depending upon the time of flash floods which invariably distroy his diversions.

CONSERVATION SURVEY

The reconnaissance investigations of the area made in November 1940 covered approximately 1500 acres. This delineated in a general way the arable land to ascertain that sufficient land could be obtained and also serve as a guide to the extent of the Topographic Survey. No map was made at that time; however, the notes and samples taken were used in making the detailed study. The Detailed Conservation Survey was made on the soils below the Fly-line, extending to the heavy alkalied clay area to the south and east, to the Dinnebito Wash on the west, and ending where the area became narrow immediately above the confluence of the Oraibi and Dinnebito Washes to the southwest.

Engineering topographic maps on scale of 1" = 200' were used as base maps.

Five factors were mapped and indicated in a composite symbol; namely, soil type, slope group, erosion, land use and land class; the land class grouping is shown by cross hatching on the accompaning map; the other factors are shown in the symbol only.

The soils vary greatly in their productive capacity. However, most of the area considered non-irrigatable because of excess alkali was not mapped but instead serves as the boundary along the south and east edge. Approximately 433 acres or 56 percent are adapted to irrigated agriculture, and the remaining 323 acres or 44 percent are considered doubtful or marginal because of their excessive alkali content and high dispersion ratio.

SOILS

Four soil types are recognized, namely, loamy sand, sandy loam, sandy clay and light clay all Dinnehotso series. See Appendix I for a typical description of this series. A skeleton description of each soil sample taken is shown in Appendix II. Two areas of sandy clay loam soil type, one located along the Base line Station 140+00 and 160+00, the other in the northeast corner of the area southeast of Base line Station 111+74 are probably the best adapted to irrigation with the sandy loam and loamy sand areas, respectively, next. Figure III is a profile picture of the sandy clay type.

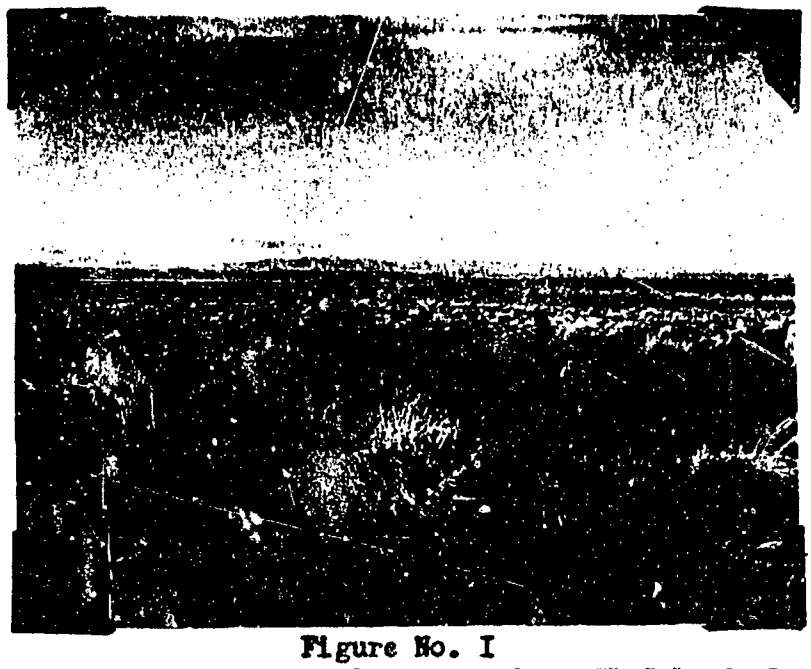

Figure No. I

Dinnehotso Loamy Sand Soil Type. Class "B" land. Looking southwest of Base Line Station 111/24. Note the result wind action on the surface as exemplified by hummocks and small blow holes. The flag immediately back of the Pickup (at x) is on the Fly-line approximately where water will come out.

Figure No. II

Dinnehotso Light Clay Type. Class "C" land. Looking northwest toward Base line Station 150/52 700' away. The dispersed area in the front (y) is exposed subsoil and delinistes approximately the boundary between class "B" and "C" land.

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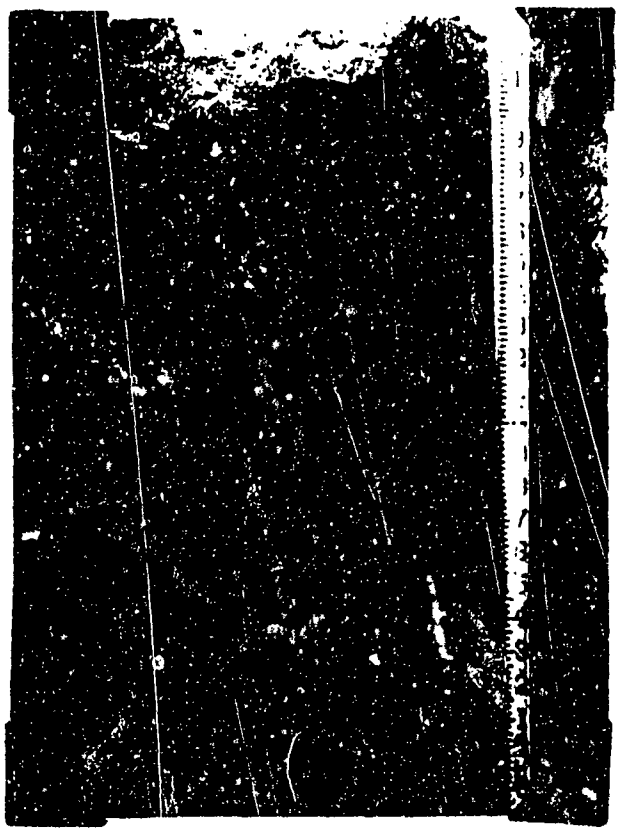

Figure No. III
Profile of Pinnehotsa Sandy Clay Loam Soil Type. At the sample location 27, 500' northeast of Base line Station 166+52. Note approximately 1.3' of friable sandy clay loam over a clay subsoil.

As indicated by the analysis, see Table III, the textures within the delineations vary somewhat; that is small areas of sand and sandy loam occur within the loamy sand soil type, etc.

The soils are brown or reddish brown in color, very low in organic matter content, and rich in lime carbonate, gypsum, and various calcium, magnesium and sodium salts. Phosphate, while probably present in comparatively large quantities, occurs as an insoluble compound with calcium and is largely unavailable to plants. See Table III. The low organic matter content should be built up heavy applications of barnyard manure; green manure crops and legumes should be incorporated in the rotation as heavy as possible. It is suggested that small tracts be treated with treble super phosphate to observe if this stimulates plant growth sufficiently to warrant its extensive use on the project. Small alkali "slick spots" within cultivated areas will disappear

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more rapidly if given heavy individual treatments of barnyard manure. The surface textures range from light to heavy; the texture of the arable land range from extremely light to medium, the heavier soil generally being excessively high in alkali.

The light textured surface soils will blow badly, absorb water very rapidly and cut badly if irrigated down very steep slopes even with small heads of irrigation water. See Figure I. However, universally they are underlain by a fairly well developed somewhat dispersed subsoil which should prevent water from percolating out of reach of plant roots too rapidly. This occurs at a depth varying from 18 to 30 inches. Care should be exercised not to remove all the surface soil in subjugation practices as the underlying subsoil will be very unproductive. The slick spots, noted throughout are exposed alkali subsoil.

Slope

The slope grouping is an array of slopes as outlined in Appendix IV. These are general and not as accurate in anyway as the topographic map.

Erosion

Wind erosion is active over most of the area. The classification given each soil type varied directly as to the amount of topsoil remaining. Since the topsoil is relatively shallow and is underlain by a somewhat dispersed subsoil, every precaution must be taken to keep it intact. Irrigation water should be applied as soon as possible after leveling and tilling to help prevent excessive wind removals.

Land Class

The limitations of each land class is outlined in the discussion under Appendix III.

No land is given class A because of the dispersion universally present in the profile. The class B and B- (minus) land, totaling 433 acres, see Table II, are recommended for irrigation.

The 328 acres of class C land are of doubtful value for irrigation, because the surface soil has been removed by erosion, leaving the unproductive, dispersed subsoil exposed.

No class D is mapped. Extensive areas which probably would fall in this class are found to the south and east of the survey. Sample 28 is very close to this land. See Table III for analysis of soil samples.

IRRIGATION, DRAINAGE AND ALKALI

Irrigation is necessary for the production of crops in this area. It

is proposed to irrigate from the Linnebito Wash by direct diversion utilizing the permanent flow. As indicated by the analysis of water, Table IV, this water is relatively high in total salts and the ratio of sodium to calcium plus magnesium is approaching the limit generally recommended for use. However, it is believed to be safe because of the open, and generally light textured surface and substratum.

The total salt content is generally medium to low.

The somewhat poor physical condition of the soil, as indicated by the dispersion in almost every set of samples collected, is probably caused by the sodium present. This amount of dispersion, while avoided where possible, is not considered particulary serious if managed carefully with light textured soils having a relatively high content of lime, calcium carbonate ($CaCO_3$).

There appears to be ample sand in the substratum to facilitate subdrainage. However, seepage from canals and the application of excess water may alter this. Areas most apt to become water logged are (1) the edge of the low benches, (2) the area of clay to the south and east side of the survey, and (3) the small swale immediately below the Fly-line in the vicinity Base line Station 120/00.

While the total salt content is generally low, the dispersion ratio of the subsoil is almost universally high. The pH is also high. However it is believed, because of the open nature of the substratum, that alkali will not become a major problem if the "slick spots" and high alkali areas are avoided as much as possible and carefull management is practiced.

SUMMARY

433 acres under the survey, evaluated classes B and B- (minus) land are recommended for irrigation.

Wind erosion is probably the major hazard. Any of the soil newly worked and not in a moist condition will blow. Irrigation ditches will catch blowing sand and probably be very difficult to keep open for that reason. Excluding stock from an area to the windward side to permit vegetation to become established would undoubtly help stop the moving sand.

Howard F. Johnson

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Assistant Soil Technologist

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May 1950

District #5 Natoni

Estimated cost to complete 20,000

Ultimate acreage 175

Under canal 100

Maximum acreage cultivated to date 70

Directi Diversion

Water supply limited.

Radial gate in Diversion dam destroyed; needs replacing.

Main canal through deep cut difficult to clean.

Some concrete pipe installed, perhaps on extension of pipeline, would improve condition and operation.

Subjugation areas need some releveling due to wind and blow sand.

No expansion of project planned.

	1950 Estimate
Diversion Dam	2,000
Main canal (Pipe)	8,000
Releveling--100 acres	10,000
	20,000

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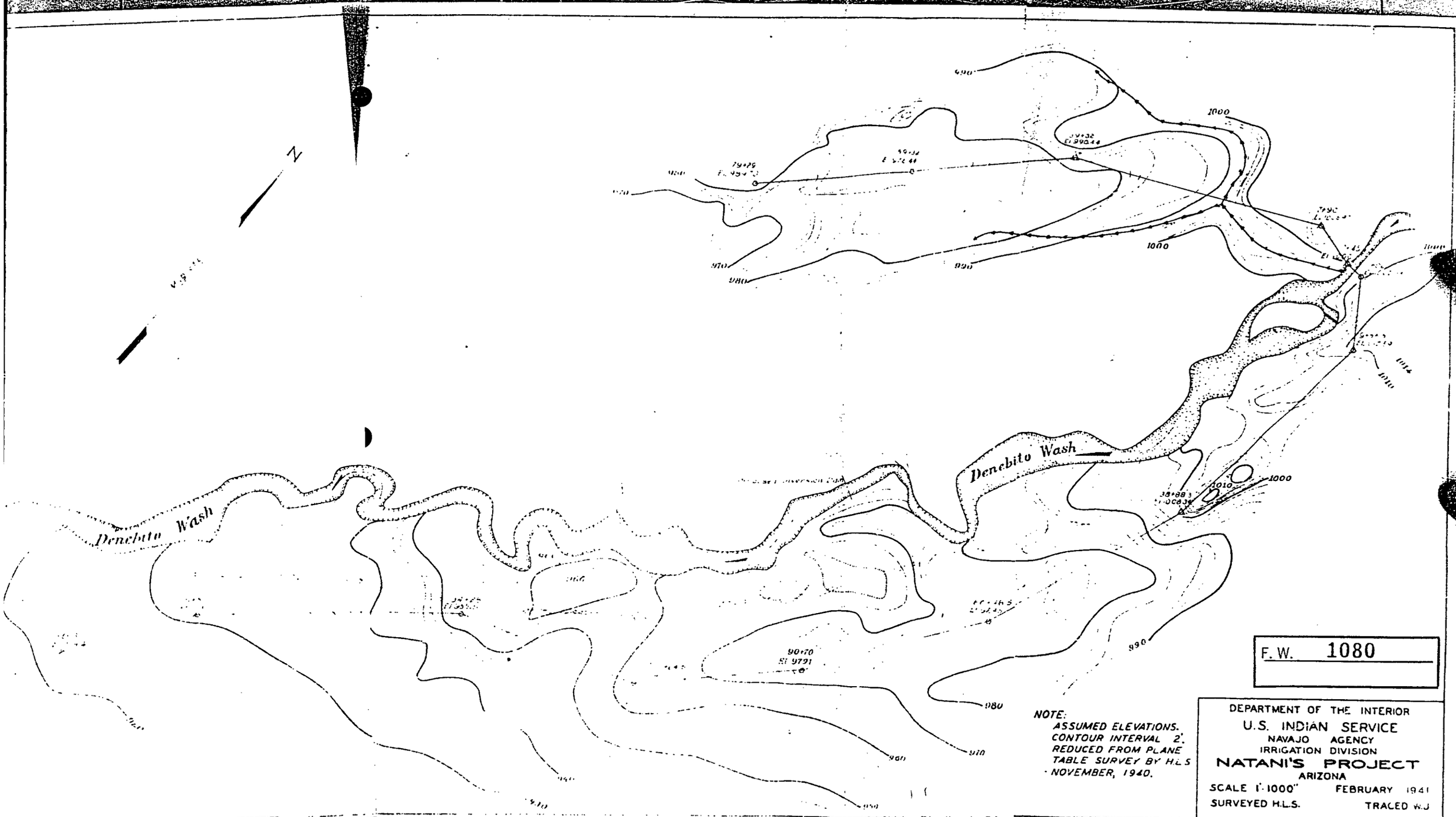

NOTE:
ASSUMED ELEVATIONS.
CONTOUR INTERVAL 2'.
REDUCED FROM PLANE TABLE SURVEY BY H.L.S
NOVEMBER, 1940.

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DEPARTMENT OF THE INTERIOR
U.S. INDIAN SERVICE
NAVAJO AGENCY
IRRIGATION DIVISION
NATANI'S PROJECT
ARIZONA
SCALE 1"-1000' FEBRUARY 1941
SURVEYED H.L.S. TRACED W.J

FILE Nº

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