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L.M. UNIT 5

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UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

UNM 1116

LAND MANAGEMENT UNIT NO. 5

INTEGRATED REPORT

June 7, 1937

STUDY GROUP "C"

Walter R. McKinney

UNM 1117

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PART ONE - BASIC DATA

I. LAND MANAGEMENT UNIT NO. 5

A. INTRODUCTION:

The Land Planning Survey field work on Land Management Unit No. 5 was started February 10, and completed April 6, 1937. The preliminary oral report was given at Window Rock, Arizona, Navajo Central Agency, April 12, 1937.

The following men made the survey:

Forestry - - - - - - -	David W. Dresbach - - - - -	Jr. Forester
Agronomy - - - - - -	Ernest A. Nicholson - - - -	Jr. Agronomist
Biology - - - - - - -	Wayne W. Morris - - - - -	Agricultural Aide
Engineering - - - - -	Allen Stamm - - - - - - - -	Engineering Aide
Sociology - - - - - -	Gordon B. Page - - - - - -	Under Agricultural Aide
	Hasko Naswood - - - - - -	" "
Soils - - - - - - - -	Howard F. Johnson - - - -	Jr. Conservation
	Lucien A. Hill - - - - - -	" " Specialist
	Dewane E. Jensen - - - - -	" " "
Indian Irrigation - -	W. W. Perkinson - - - - -	Irrigation Service
Range Management - -	Walter R. McKinney - - - -	Jr. Range Examiner (Chief of Party)
	Johnny Russell - - - - - -	Under Agricultural Aide

The various branch reports were written by the following men:

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Forestry and Planting	David W. Dreshach
Agronomy	Ernest A. Nicholson
Biology	Wayne W. Morris
Engineering	Allen Starm
Sociology	Solon T. Kimball
Soils	Howard F. Johnson
Range Management	Walter R. McKinney

B. GEOGRAPHICAL FEATURES:

1. Description:

a. Location and Political History:

Land Management Unit No. 5 occupies the southwestern corner of the Navajo Indian Reservation in Arizona. The greater portion of the area lies in Coconino County, only a small part extending into Navajo County on the east. (See map No. 1). The greater portion of this area, or the "old Leupp Indian Reservation," was established as a part of the Navajo Reservation by an Executive order on November 14, 1901; that portion north of the 36°30' parallel of latitude and east of the 111°00' meridian of longitude was established by an Executive order on December 16, 1882; that portion north of the 35°30' parallel of latitude and west of the 111°00' meridian of longitude was annexed by an Executive order on January 8, 1900; and the area east of the Navajo - Coconino County line, except for railroad and patented lands not yet reconveyed, was added by the Congressional Act of June 14, 1934 (See Map No. 2).

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All of the Unit except the portion east of the Navajo - Coconino County line, and the portion north of the 35°30' parallel of latitude and east of the 111°00' degree of longitude is unsurveyed.

b. Area and Boundaries:

The area of Unit No. 5 is computed at 811,870 acres. All the boundaries are rather well defined and easy to follow in the field. The west boundary south of the Little Colorado River and the entire south boundary are fenced. The other boundaries follow mesa escarpments, ridges, washes, or proceed directly from one prominent land mark to another.

The original boundaries were not well defined and the present use by people and livestock was not properly divided. Therefore, several boundary changes were made in order to establish more definite boundaries and make a more easily manageable land unit. Five changes were made in the original boundaries, the compilation of which is shown in Table I below:

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TABLE I. Boundary Changes

Changes	Status	Surface Acres	Forage Acres	Carrying Capacity
Bird Springs	Addition	151,303	9,589	3,836
Tovar Mesa	"	16,110	1,045	418
Total Additions		167,413	10,634	4,254
Shonto Springs	Subtraction	9,210	785	314
Dinnebito	"	19,548	1,603	673
Black Falls	"	34,232	2,787	1,115
Total Subtractions . . .		62,990	5,255	2,102
Original Area		707,447	63,320	25,144
Present Area		811,870	68,695	27,396
Difference Added		104,423	5,375	2,252

The acreages of the changes shown in the above table are not exact. The Bird Springs change was an addition from Unit No. 7, Tovar Mesa an addition from Unit No. 6, Shonto Springs a subtraction thrown into Unit No. 6, and Dinnehbito and Black Falls were subtractions thrown into Unit No. 3.

c. Land Status:

All of the lands which have not yet been reconveyed or transferred to the Government are in that portion of the Unit east of the Coconino-Navajo County line or that portion which was added to the Reservation by the Congressional Act of June 14, 1934, excepting 74.57 acres along the Atchison, Topeka and Santa Fe Railroad right-of-way in the southwest corner of the Unit.

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Table No. 2 below shows the total acreage and carrying capacity of each class of land not owned by the Government in Unit No. 5.

Table No. 2. Land Status

Owner	Surface Acres	Forage Acres	Carrying Capacity S.U. YL.
A.T. & S.F. Railroad	4,799	452	181
New Mexico & Arizona Land Co.	68,393	5,042	2,017
Indian Allotments	2,720	267	107
Total . .	75,912	5,761	2,305

Map No. 2 shows in detail the land status of all lands in Unit No. 5 which are not owned by the Government.

2 . Physiography:

a. Elevation and Topography:

The elevation of this Unit varies from approximately 5800 feet on top of the mesas in the northern part to about 4500 feet on the west boundary where the Little Colorado River leaves the area. The elevation at Leupp is 4700 feet; at Tolchaco 4674 feet; and at Tolani Lake 4939 feet.

The topography is greatly influenced by the Little Colorado River valley. The northern portion slopes in a southwesterly direction and is crossed by several large drainages which empty into the Little Colorado River, namely; the Jeddito, the Polacca, the Oraibi, and the Dinnehbito. Newberry and Garcia

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Mesas are the largest and most important mesas in this portion of the Unit. They exhibit mesa walls or escarpments on the east, south and west sides but there are no lines of demarcation on the north since they gradually blend into the higher lands farther north. The southern portion slopes toward the Little Colorado River in a northeasterly direction and is crossed by Canyon Diablo. Canyon Padre, with its large tributary, San Francisco Wash, is the largest tributary of Canyon Diablo. All of the large drainages mentioned above have numerous lateral tributaries.

b. Geology:

A brief summary of the geology of this Unit has been written by Mr. Tom Meeks, Jr. Soil Conservator, and is quoted below in full:

" GEOLOGY OF LAND MANAGEMENT UNIT 5

In this Unit the geology is represented by strata of Permian, Triassic and Jurassic age with some recent lava flows in the western margin. The Permian is represented by the Kaibab Limestone, the Triassic by the Moenkopi, Shinarump, and Chin Lee formations and the Jurassic by the Wingate, Navajo (?) and Morrison formations.

PERMIAN

Kaibab Limestone

"The Kaibab limestone takes in only the southwestern corner of the Unit and is easily differentiated from the other forma-

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tions since it is the only limestone of any consequence on the entire reservation. It offers a marked contrast to the dark chocolate colored Moenkopi formation which overlies it. The Kaibab consists almost entirely of limestone with numerous bands and nodules of chert. Sandstones are present locally. The Kaibab is usually thin bedded and jointed and south of Winslow and Holbrook it has a marked tendency to form sink holes. Wells drilled in this Unit show the thickness to be from 200 to 250 feet thick.

TRIASSIC

Moenkopi Formation

"The Moenkopi formation is confined to the area west of the Little Colorado south of Leupp but crosses the river just north of Leupp and continues northward to the vicinity of Black Point where its margin again crosses to the west side of the river. Its western margin is clearly defined by the white beds of the underlying Kaibab. The Moenkopi is composed of dark red to chocolate brown sandstones and shales with gypsum present locally. Ripple marks are quite common in the sand stones of the Moenkopi.

Shinarump Conglomerate

"The Shinarump conglomerate occupies only a narrow strip between the Moenkopi and the Chin Lee formations north of Leupp but is present on top of many of the low mesas and buttes

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of the Moenkopi. In many places the Shinarump is entirely absent but its former presence is indicated by the pebbles left after its erosion. The Shinarump is usually a light brown, coarse grained sandstone with pebbles of silica and much petrified wood.

Chin Lee Formation

"The Chin Lee forms a wide band which extends entirely through the district east of the Little Colorado. It forms the first escarpment east of the river and continues to the dark red sandstone cliffs which occur near the northeastern margin of the unit. The Chin Lee is composed of four divisions, all of which are present on the unit. Division A, the upper, is composed of dark red siltstones with some shales. Division B, which forms the escarpment, is composed of alternating beds of cherty limestones and dark red shale. Division C is composed entirely of soft clays and marls which weather into badland forms. It is variegated in color with blues, grays, purple, and red being the dominant colors. Division C is composed of dark brown and red sandstone and shale which closely resembles the Moenkopi in some places. It weathers into low mesas and buttes caused by the resistant capping of sandstone.

JURASSIC

Wingate and Navajo Formations

"The Wingate is a massive, cross bedded red sandstone

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which forms the cliffs on the northeast margin of the area. It is conformable with Division A of the Chin Lee. Its exposures are confined to the cliff face. It is not certain that the Navajo is present in this locality but if it is it would be extremely difficult to differentiate it from the Wingate.

Morrison Formation

"The Morrison overlies the Navajo, Wingate on top of the red cliffs and is easily separated by its color. It is composed of a hard silicious sandstone near the margin but farther north it is a cross bedded, easily friable, fine grained sandstone with some shale lenses of red.

QUATERNARY LAVA FLOWS

"The lava flows of the San Francisco field barely penetrate the unit from the west but they have had a marked effect on the channel of the Little Colorado River. At Grand Falls the flow from the west entered the channel of the river by a tributary wash and filled the channel and passed beyond. The stream expanded as a lake and eventually found its way around the flow. A similar blocking of the channel occurred at Black Falls and another flow is reported to have diverted the river south of Grand Falls."

c. Soils and Erosion *

The soils of Unit No. 5 are quite variable because of

*From "Soils and Erosion Report"
by Howard F. Johnson, Jr.
Conservation Specialist

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the wide range of geological formations from which they are derived. Residual soils occupy the smooth to undulating uplands of the southwestern part of the Unit and the mesas and mesa remnants of the central and northern portions. Wind is the predominating erosional factor affecting these soils because sandy textures prevail. The degree of erosion varies from essentially none in the extreme southwestern portion of the Unit to severe in the northern portions. (See Map No. 10).

The deep alluvial soils along the Little Colorado River and in the valleys of the Jeddito, Polacca and Oraibi washes are much less extensive than the residual soils but are more important for agriculture. Both sheet and wind erosion are active on these soils and occasional gullies are present.

(1) Residual Soils:

The soils of sub-units Nos. 1 and 6, derived from basaltic cinder and lava, and from Kiabab limestone, are loose and permeable and have a medium texture. Where twelve inches or more in depth, these soils are rated among the better range soils of the Reservation. Surface water is almost lacking because of the rapid penetration, and surface tanks in this area are usually of little value because the soils do not seal, and because of the cracks in the limestone.

The Moenkopi series, found extensively in sub-units Nos. 1, 2, 5 and 6, and northeast of the soils previously

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mentioned, is easily recognized by its maroon color. Very severe erosion has resulted in a shallow intermittent soil cover that is slowly permeable and has a low water holding capacity. Natural geologic erosion is probably responsible, in part, for this condition. In any event it will be slow to respond to a range improvement program.

Small areas of the Shavano Series located on the remnants of the Shinarump conglomerate formation and associated with the Moencopi Series are permeable to water and deep enough to have a high water holding capacity. Erosion is slight to moderate in this series.

On the uplands and mesas in sub-units Nos. 3 and 4, the soils have a loose, sandy, highly permeable surface and sufficient depth to afford a moderate water holding capacity. However, these same characteristics render these soils readily susceptible to wind erosion where the vegetative cover is removed. Active wind cutting and drifting sands occur over a large part of the area. These soils are rated as "B" or "C" range land depending upon the severity of erosion. Generally they will respond readily to range improvement except where there are moving dunes.

(2) Alluvial Soils:

Soils of the Ives and Tolani Series occur in the valleys of the Jeddito, Polacca, and Oraibi Washes. These soils are friable and vary in texture from loamy sand to heavy clay

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and are generally low in alkali. Where the texture is not too heavy, they can be cultivated with favorable results. Sheet and wind erosion are moderately active and occasional gullies are present. Little difficulty should be experienced with earth structures if due consideration is given to soil texture.

Broad expanses of Winslow soils, situated on the second benches along the Little Colorado River and at the bases of mesas, are too high in alkali and heavy in texture for agricultural purposes, however, they are adapted to the growing of shadscale and saccaton. These soils are slowly permeable. Erosion by wind and water has removed a large part of the surface soil. Extreme caution should be exercised in using these soils in construction work. Range revegetation will be slow.

The river bottom soils, known as the Gila Series, are usually a clay loam in texture and are generally permeable to water. Alkali is present in many areas in sufficient quantities to limit plant growth. However, where alkali is not excessive they are suited to most crops adapted to the region. Wind deposits of sand from the river bed accumulate during the dry seasons and silt is deposited by water during floods.

d. Precipitation, Temperature and Growing Season:

Climatological data for this Unit were taken from records for Winslow, Keams Canyon, Leupp, Tuba City and Flagstaff and were supplemented with information and estimates

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from various parts of the Unit. The average annual precipitation is probably about eight inches and may be classified roughly as follows:

4100 to	4700	feet	elevation	-	6 to	7	inches	precipitation
4700 "	5300	"	"		7 "	8	"	"
5300 "	5800	"	"		8 "	9	"	"

The average annual temperature is probably around 55° F; at Winslow it is 55.0° F, at Tuba City 54.8° F, and at Keams Canyon 50.0° F. The maximum temperature for Leupp and Tuba City is approximately 105° F and the minimum -10° or -12° F. The growing season varies from about 145 days in the highest elevations to about 155 days along the Little Colorado River. At the Tolani Lakes agricultural area it probably varies from 150 to 155 days.

The average date of the first killing frost in the fall is probably about October 20, and the last killing frost in the spring about May 10. At Winslow, killing frosts have been known to occur as late as June 2, and as early as September 27. The following table (Table No. 3) shows in detail some of the climatological data on and near Unit No. 5.

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Table No. 3. Climatological Data from Weather Stations in or Near Land Management Units 5*

(1) Station and Length of Record ** (years)	(2) Elevation in Feet	(3) Length of Growing Season in Days	(4) Ave. Ann. Temp. (F°)	(5) Ave. Max. Temp. (F°)	(6) Ave. Min. Temp. (F°)	(7) Annual Min. Temp. (F°)	(8) Annual Max. Temp. (F°)
Flagstaff 27	6907	116	60.0	45.4	30.8	-25	92
Grand Canyon 21	6860	133	62.4	47.3	32.3	-22	98
Leupp - 9	4710	-	-	53.4	-	-12	105
Tuba City 22	4500	179	-	54.7	-	-15	104
Winslow - 18	4848	165	70.7	54.3	37.8	-10	106

Table No. 3 (Continued)

(9) Ave. Ann. Pp. cm. (inches)	(10) Av. Dt. Last Killing Frost	(11) Av. Dat. 1st Killing Frost	(12) Latest Dt. Killing Frost	(13) Earliest Dt. Killing Frost
22.8	June 6	Sept. 20	July 5	Sept. 9
18.13	May 21	Oct. 1	June 17	Sept. 5
-	-	-	-	-
6.94	Apr. 23	Oct. 19	May 9	Sept. 19
8.73	May 4	Oct. 16	June 2	Sept. 27

*"The Climate of Arizona" by H. V. Smith, University of Arizona, College of Agriculture, Bulletin No. 130, 1930.

** The length of complete records.

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e. Relative Humidity, Evaporation and Wind:

There are no records on the relative humidity, evaporation or wind movement for this area.

The relative humidity is low, probably ranging from 40 to 60%.

Evaporation from soils and reservoirs is high. The highest evaporation occurs during the driest and hottest months, or May and June. Evaporation of water from tanks is estimated at about 70 inches per year.

The prevailing winds in this area are from the southwest, the highest wind velocities occurring during March and April. At times these winds carry a great amount of dust and sand, which results in some damage to vegetation and structures as well as personal annoyances. Wind velocities of fifty miles per hour, however, are rare.

3. Ecological Zonation:

a. Vegetative Zones and Types:

The vegetation of Unit No. 5 falls in the Upper Sonoran Zone. For general purposes, the vegetation may be classed into two major types, namely, Grassland and Browse. (See Map No. 3). Table No. 4 shows the surface acres, percent of area, forage acres, carrying capacity and percent of carrying capacity for each major vegetative type.

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Table No. 4 — Vegetative Types

Forage Type	Surface Acres	Percent of Area	Forage Acres	Carrying Capacity	Percent of C. C.
Grassland	278,515	34.30	36,037	14,415	52.46
Weeds	2,375	.29	21	8	.03
Sage brush	13,046	1.61	1,215	486	1.77
Browse	435,754	53.67	31,320	12,528	45.59
Waste	80,660	9.94	0	0	0
Pinon & Juniper*	865	.11	102	41	.15
Cultivated	655	.08	0	0	0
Total	811,870	100.00	68,695	27,478**	100.00

*Includes one small type of cottonwood woodland.

**Compiled on the basis of a 2.5 forage acre requirement. Buck pastures are compiled on the basis of a 3 forage acre requirement, making the carrying capacity of the Unit 27,396 sheep units yearlong.

The following is a list of the most common and important plant species on the Unit:

Grasses

Blue grama - - - - - - Bouteloua gracilis

Black grama - - - - - - Bouteloua eriopida

Galleta - - - - - - - Hilaria jamesii

Alkali sacaton - - - - Sporobolus airoides

Three awn - - - - - - - Aristida spp.

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Shrubs

Chamise - - - - - - -	Atriplex canescens
Shadscale - - - - - -	Atriplex confertifolia
Salt bush - - - - -	Atriplex cuneata
Yellow bush - - - -	Crysothamnus greenii
Mormon tea - - - - -	Ephedra spp.
Greasewood - - - - -	Sarcobatus vermiculatus
Rayless goldenrod - -	Applopappus heterophyllus

Weeds

Russian thistle - -	Salsola pestifer
Loco - - - - - - - -	Astragalus spp.
Sunflower - - - - - -	Helianthus spp.

Generally speaking, the vegetation is in very poor condition. An exceptionally poor condition exists along the Little Colorado River and along the valley floors of all the major drainages. A few areas in the southwestern corner and on top of some of the mesas are in better condition, however. These latter areas are the farthest from permanent water.

b. Poisonous Plants:

The most important poisonous plants on the Unit, from the standpoint of abundance and damage, are Loco and Rayless goldenrod. Whorled milkweed Asclepias galioides, Broadleaf milkweed Asclepias speciosa, and Cocklebur Xanthium commune are found in localized areas but are less important than Loco and Rayless goldenrod. (See Map No. 3). There is one small

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area of Whorled milkweed in Canyon Diablo Buck Pasture No. 2.

Loco is most abundant in the southwestern corner of the Unit. Wayless Goldenrod is found along the Little Colorado River and Dinnehbito Wash and many tributary drainages.

c. Native Wildlife:

The original predominant native wildlife species of the grass and browse-land of this area were as follows:

Game Mammals: Elk, deer, antelope, and rabbits. Bear may have inhabited some of the canyons but are not present now.

Birds: Horned larks; marsh, red-tailed, Swainson's and sparrow hawks; burrowing owls; quail; doves; water-fowl.

Predators and Furbearers: Coyotes, Bobcats, Mountain lions, badgers, skunks, beaver, foxes.

Rodents: Prairie dogs, kangaroo rats, ground squirrels, rock squirrels, mice, pocket-gophers and chipmunks.

4. Developmental Improvements:

a. Population and Population Centers:

There are 138 consumption groups or 1261 people distributed rather widely over the Unit. There are two areas, however, in which the people are more highly concentrated, namely: In sub-unit No. 4, especially near Tolani Lakes, and in sub-unit No. 6. (See Map No. 4)

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b. Roads, Telephones and Railroads:

The Winslow-Oraibi highway traverses this Unit from south to north, also there are four, maintained, secondary roads. The Leupp-Dilkon road intersects the Winslow-Oraibi road at Leupp and leaves the Unit at the east boundary near Bird Springs. The Leupp-Canyon Diablo road runs southwest from Leupp and leaves the Unit at Canyon Diablo. The "back road" extends west from Leupp, leaving the Unit eight miles south of Grand Falls. The Sunrise-Hibbard road connects Sunrise Trading Post and Hibbard and leaves the Unit south of Hibbard.

The Unit is well supplied with telephones. The mainline from Winslow follows the Winslow-Oraibi road to Leupp, then from Leupp to Indian Wells along the Leupp-Dilkon road. A branch line follows the Winslow-Oraibi road from Leupp to Red Lake Trading Post and Day School. An exchange is located at Leupp.

The Atchison, Topeka and Santa Fe Railroad crosses the southwest corner of the Unit and Canyon Diablo and Hibbard stations within the Unit. There is a siding at Canyon Diablo where coal and freight are set aside for Leupp. A large stockyard with two loading chutes and a set of stock scales is located at Hibbard.

c. Trading Posts, Schools and Hospitals:

There are four trading posts on the Unit; Leupp, Sunrise, Red Lake and Dilmehbito. Canyon Lodge, Airport, Meteor Mountain, and Winslow, are within easy reach of the people on the Unit.

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There is a boarding school at Leupp, a day school at Tolani Lake (ed Lake) and a hospital at Leupp.

C. EFFECT OF ENVIRONMENT ON HUMAN ACTIVITIES:

The location of this Unit is such that for many years these Indians have been in more or less close contact with the white man. Consequently, many of them have adopted some of the white man's ideas and ways. This influence is apparent in the type of sheep found in the area. Some Indians have realized the superiority of the white man's sheep and have bought bucks from them. The lack of woodland has a direct effect upon living conditions. We find many hogans built out of rock, railroad ties, or brush. Rabbit bush, chamise and greasewood are used for fuel. The lack of water for flood irrigation and the poor quality of the soil have made it necessary for greater numbers of these people to depend upon their livestock for a livlihood than in some other parts of the Reservation. The whole area is accessible and not far removed from highways and towns. Consequently, there are quite a number of automobiles and trucks owned by Indians.

The old established boarding school at Leupp, and before that the one at Tolchico, has resulted in a large percentage of educated Navajos. Easy access to the hospital at Leupp has influenced the people to depend upon medical aid and treatment more so than in many other parts of the Reservation. The distances to trading posts are not so great as in some other Units

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and we find that most of these people go to the trading posts about once each week, whereas on Unit No. 4 many of them do not visit a trading post oftener than once every two or three months. Therefore, these Indians appear to be more intelligent, progressive and in some cases, more energetic than in some other Units.

D. HUMAN ACTIVITIES:

1. Livestock and Range:

a. Present Resources:

(1) Area and Carrying Capacity:

The area of Unit No. 5 is 811,870 surface acres and the present estimated carrying capacity is 27,398 sheep units yearlong.*

(2) Seasonal Use and Class of Stock:

The whole Unit may be classed as yearlong range; that is, the whole Unit can and is grazed yearlong. It may be grazed at any season of the year which will result in the most efficient use of the land. With the exception of a few areas in the southwest portion of the Unit, browse is sufficiently abundant to furnish forage during winter snow storms when they occur. However, there are areas infested with loco and rayless goldenrod which should not be grazed when serious losses may result. (See Map No. 3)

The Unit is adapted to the grazing of either cattle or sheep.

*Based on a forage acre requirement of 2.5 forage acres per sheep unit yearlong from the grazing survey completed in the fall of 1934.

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(3) Water Development:

Livestock water is moderately abundant but more water is needed in some places. The extreme southwestern portion of the Unit, or the lava and cinder country, is in need of more water, but either temporary or permanent water is difficult to obtain because of the depth to permanent water, the very slight runoff and the lack of the ability of these soils to seal themselves. At the present time, there are nine temporary Indian surface tanks, 69 temporary government surface tanks, three semi-permanent government surface tanks, three permanent Indian dug wells, 26 permanent government dug wells, (two are dry now) three permanent undeveloped springs, four permanent developed springs, eight permanent deep drilled wells, and two temporary natural lakes or a total of 46 permanent and 80 temporary supplies. There is an average of one water supply for every 6,487 surface acres but only one permanent supply for every 18,041 surface acres. (See Map No. 3).

(4) Wildlife:

(a) Game:

The vegetation, topography and human activity render this area unadaptable to big game mammals such as elk, deer, and antelope.

(b) Migratory Waterfowl:

Migratory waterfowl may be found on many of the stockwater reservoirs and on Tolani Lakes, especially during migrations. Habitats for these birds can be greatly

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improved by protecting the watersheds of the water supplies and, in some cases, by planting shrubs and grasses.

Migratory waterfowl may become a limited source of food if their numbers increase.

(c) Upland Game Birds:

These birds are not abundant. However, doves are the most abundant and widely scattered. Quail are very scarce, but the chamise and greasewood flats are potentially good habitats. By exercising proper grazing practices and by protection of these birds, they may become sufficiently abundant to be of value.

(d) Furbearers:

The extremely high silt content of the stream and the lack of trees make this section of the Little Colorado River a poor habitat for beaver at the present. If enough trees could be grown along the River, beaver may be established successfully and be of some value as a furbearer.

Bob-cats are of very little value as furbearers because of their small numbers. The habitat here will probably never be favorable for them.

Coyotes have a very limited value as furbearers at the present time and probably never will be of but little importance.

Rabbits are used by the Indians as food, but due to their small numbers are of little importance. They may become more important if their numbers increase.

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(e) Rodents:

Prairie dogs have little value. However, they are used to a slight extent as food in a few limited areas.

Kangaroo rats, pocket gophers, and miscellaneous mice are of little or no value.

(5) Value of the Land:

The principal value of the land in this Unit is for watershed and grazing.

This Unit does not have as great a watershed value as some of the Units located higher up because it is at the bottom of the watershed. The Little Colorado River flows through this area but the distance occupied by Unit No. 5 is so small relatively, that little can be accomplished on this Unit alone.

The nature of the soil, the deep canyons, and the lack of water storing or waterspreading possibilities render all but a very small portion of this area unadaptable to farming. There are areas, the largest of which is along the Little Colorado River, which seem to offer a good possibility of being planted to trees for the purpose of erosion control, stream bed protection, and fuel supply. Except for the concentrated agricultural areas at Tolani Lakes and Leupp, this Unit can produce little income other than by the grazing of domestic livestock.

b. Utilization of Range Resources:

(1) Present Stocking:

The number of livestock on Unit No. 5 was taken from the 1936 dipping records. These records show 14,126 grown sheep, 1,506 grown goats, 768 grown cattle or 3,072 sheep units 1145

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of cattle, 1,400 horses or 7,000 sheep units of horses, making a total stocking of 25,703 sheep units of livestock. (See Table No. 5).

Table No. 5 — Present Stocking

Sub-Units	Carrying Capacity	Stocking	Percent of + or - Stocking
No. 1 & 2	3,279	1,685	- 45.43
No. 3	3,838	3,657	- 4.67
No. 4	9,062	13,650	+ 50.63
No. 5 & 6	11,219	6,811	- 39.29
Total	27,396	25,703	- 6.18

These records of stocking are doubtless low. In tabulating the figures obtained on livestock movements we find 915 head of cattle or 147 head more than are shown on the dipping records.

(2) Relation of Stocking to Carrying Capacity:

The present estimated maximum carrying capacity is 27,396 sheep units yearlong. The present stocking of 25,703 sheep units shows an understocking of 6.18% for the Unit.

(3) Distribution and Livestock Movements:

The majority of the livestock are found in sub-units 4, 5 and 6. (See Table No. 5.) Map No. 3 shows a number

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of the sheep and cattle movements on the Unit. At dipping and selling times, there are heavy concentrations around the trading posts. In the summer, heavier concentrations are found around Leupp and Tolani Lakes. Map No. 8 also shows the relative utilization for the Unit.

(4) Seasonal Use:

This whole Unit can be used at any season of the year which will result in the most efficient and satisfactory use of the land.

(5) Animal Husbandry Practices:

(a) Selection:

Although the sheep in Unit No. 5 are of relatively good type and quality, there are numerous cases where unprogressive selection is evident. The sale of the better lambs, ewes, cows and calves results in retrogressive selection.

(b) Bucks and Bulls:

Quite a large percentage of the bucks on this Unit are improved, but there is much room for improvement, especially in many of the smaller flocks. Many of the bucks are too old and are in poor condition at breeding time.

As a rule, bulls are not desirable from the standpoint of breeding and conformation. Many of them are too old to be of but little service.

(c) Breeding and Lambing:

In many cases, breeding and lambing take place at all times of the year. In most all cases, lambing

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is too early, which results in numerous losses of lambs and ewes.

Calves are born at all seasons of the year, resulting in an uneven calf crop, fewer animals ready for sale at marketing time, and death losses of both cows and calves. Many cows calve too young.

(d) Docking and Castrating:

Wether lambs are usually docked too long, giving them a shabby appearance. Consequently, sale prices are often lower and some lambs that would ordinarily be sold are rejected by the buyers. Both wethers and steers are not castrated young enough in many cases. The result is staggy animals which are harder to sell, and, if sold, bring a lower price. One reason for the practice of not castrating young enough is in an attempt to increase the weight of the animals at selling time. The fact is, that such a practice results in just the opposite end, as well as a decrease in price per pound.

(e) Shearing:

Shearing is almost invariably done by hand although probably most of these people would accept machine shearers if they were available. Some owners sort and tie their wool but much improvement can be made in these respects.

Shearing is almost invariably too early. In some cases, sheep are partly shorne, a spot here and there on the back and belly, in the middle of the winter. Fleeces are light,

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content of foreign material is high and bucks are often handicapped at breeding time by shearing too early. The traders are responsible to a large extent, for too early shearing.

(f) Herding:

The most common errors in herding practices are: Corraling in the same place for long periods of time, herding too closely, trailing from water to feed and back to the corral, corralling too early in the afternoon, keeping flocks in too late in the morning, herding too fast and grazing the same spot for months at a time. Wet ewes, dry ewes, bucks and wethers are very often not separated at lambing time.

Cattle are seldom properly handled when gathered for market or for any other purpose.

(g) Salting:

Very little salt is fed to the livestock in this Unit. There is little doubt but that many of the livestock are in need of salt, especially on the sandy portions of the Unit.

(h) Supplemental Feeding:

Supplemental feeding of cattle and sheep is practically unknown. Feeding of horses is practiced to some extent. One Indian at Tolani Lakes put up about three and a half or four tons of corn silage last year and seemed to have fairly good results in feeding it to sheep this spring.

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Supplemental feeding of livestock would have a very beneficial effect upon the livestock and range.

(6) Livestock Pests and Diseases:

Probably the most important livestock pest from the standpoint of damage is lice. Some lice are found on sheep, but mostly on cattle. In some cases, infestations are severe enough to cause considerable damage.

Horn flies, heel flies and ear ticks are abundant enough to cause some damage.

Grub-in-the-head and screw worms are seldom found.

Infectious diseases are practically unknown at the present time. Dourine in horses and scab in sheep were present at one time.

(7) Range Rodents:

Rabbits are not abundant. Cottontail rabbits are present in small numbers in the southern portion of the Unit. Jackrabbits are very scarce but widely scattered over the Unit. The use of this species as food keeps their population at a minimum, therefore there is no immediate danger of them competing for range forage.

Prairie dogs are scattered in relatively small areas over the Unit, the largest and most important areas being on the Polacca Wash, north of Sand Springs and in the southwest corner of the Unit. (See Map No. 5). Although prairie dog damage is not great at present, these rodents may become very detrimental if not controlled.

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Kangaroo rats occur in varying concentrations over most all the Unit. The areas of heaviest infestation and where the most damage to the range is being done are north of Sand Springs, west of Dinnehbito Wash, along the Little Colorado River, south of Leupp, and northwest of Bird Springs. (See Map No. 5).

Pocket gophers do some damage to stock tanks, irrigation structures, and earth erosion control structures. The heaviest infestation is in the southwest portion of the Unit in type No. M-10. (See Map No. 5.)

Rodent control has been carried on near Canyon Diablo and at Tolani Lakes (See Map No. 6).

(8) Predatory Animals:

Bobcats may cause a few lamb losses along Canyon Diablo and Canyon Padre but those losses are of little consequence.

Coyotes cause but few sheep losses at present because of the close herding practices of the sheep owners. Some losses may be expected under open herding methods and some control may be needed in the future.

Navajo dogs may occasionally become sheep killers but none were reported at the time of the survey.

(9) Poisonous Plants: (See Map No. 3)

The area of Whorled milkweed in Canyon Diablo Buck Pasture No. 2 may prove to be dangerous but in the past has caused but two losses of bucks.

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On an average of approximately once every five years, loco has a sufficient abundance to cause notable losses. These losses, however, are confined to horses mainly. The remaining four years these losses may be considered negligible.

Rayless goldenrod losses are of cattle principally. Losses occur during the winter, especially during snowstorms.

c. Marketing:

(1) Home Consumption:

Very little information was obtained on the number of livestock consumed at home. However, on the basis of what information was obtained there seems to be a tendency for those people with the least agricultural land or wage income to consume the most sheep per capita.

In the case of wool there is also very little information but there appears to be a correlation between the size of the flock and the number of rugs sold. The larger owners seem to weave fewer rugs than the smaller owners. How much of the wool put into the rugs woven by the smaller owner was purchased elsewhere is not known. We can say, however, that a percentage of the livestock are consumed at home and that some of the wool is used for making rugs.

(2) Sale, Trade and Barter:

The majority of the income from livestock is derived from the sale of live animals. However, some beef and mutton are sold to the Leupp Agency and Schools. Once in a while some meat is sold to retail concerns in Winslow. Quite

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often, meat is sold to the traders or given in trade for groceries and merchandise. Although no evidence was obtained, no doubt some barter is carried on between the Indians. Now and then one Indian will give another a cow, horse, or some sheep in exchange for agricultural products, etc.

The sale of horses is usually to people off the Reservation for fox feed or soap manufacture. Generally, the horses are of such inferior quality that they have no other value.

2. Farming:

a. Present Resources:

(1) Present Farmland:

(a) Acreage and Type:

There are 688 acres of farmland in this Unit at present. 637 acres are flood irrigated and 51 acres are dry farmed. There is no irrigated land in the Unit.

(b) Location and Distribution:

The majority of the farm land is near Tolani Lakes and at Leupp. (See Map No. 9). 194 acres were farmed at Tolani Lakes and 123 acres at Leupp in 1933. The remaining 371 acres are scattered farms found mostly in the northern portion of the Unit. That portion south of the Little Colorado River is without farmland.

(c) Agricultural Soils:

The Tolani, Hunt and Winslow soil series have a number of characteristics in common. They are derived from Chinle and Moenkopi formations, are high in harmful salts, are

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highly dispersed, and are very susceptible to wind erosion. The Tolani soils are usually located at the toe of slopes where flooding or irrigating is difficult. The salt content is lower than in the Hunt or Winslow series but they are very susceptible to wind erosion which rates them as C or poor agricultural land. The Hunt series is found at locations which are more favorable for flooding or irrigating. The sub-soil is usually heavy and slowly permeable, causing them to be rated low as agricultural land. However, if the sub-drainage is adequate the sandy loam and clay loam are rated as B or C agricultural land. The clay type is usually rated D or non-irrigable. The Winslow series has a dense B horizon and when the surface soil is intact, is usually adapted to irrigation or flood irrigation. The heavy B horizon serves as a water storing reservoir. However, the surface soil in this series has been severely eroded following severe over-grazing, leaving exposed an unproductive sub-soil. Many areas have a high alkali content which rates them as D agricultural land.

The Ives series is a recent alluvial deposit along the drainage channels and on fans. (See Map No. 10). This series is characterized by a friable surface soil over a medium-to-heavy sub-soil. Usually allbut the clay is rated as agricultural land. The Teec-Nos-Pos series is an old alluvial terrace twelve miles east of Leupp. (See Map No. 10). This soil is well adapted to irrigation and is free from alkali. The Gila

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series is made up of river bottom soils which are favorably located from the standpoint of water supply. They are rated as good agricultural soils except where alkali concentration reduces them to the D group.

(d) Yields:

The most important crops are corn, beans, melons and squash. The present average yield on flood irrigated land is around eighteen bushels of corn per acre and on dry farms about nine bushels. Beans 200 pounds, melons and squash 1500 pounds.

(2) Potential Farmland:

(a) Acreage, Type and Location:

There is a possibility of developing 5,450 acres of additional land in this Unit. Of this, 4,300 acres are at Tolani Lakes and 800 at Leupp. The additional 350 acres of potential land are scattered over the Unit. (See Map No. 9). The soil at Tolani Lakes is a clay to sandy loam over a clay sub-soil. There are 2,000 acres of A, and 2,500 acres of B potential agricultural land at Tolani Lakes. At Leupp the soil is a sandy loam and the 800 acres of potential land are classed as A agricultural land.

(b) Expected Yields:

The expected yields on the potential land have been estimated to be approximately 25 bushels of corn, 400 pounds of beans, 2,000 pounds of melons and squash, three tons

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of alfalfa, three tons of potatoes, and 20 to 25 bushels of wheat per acre.

(3) Wildlife on Agricultural Land:

(a) Rodents:

At the present time, rodents do not appear to be seriously damaging farm crops. However, kangaroo rats and ground squirrels are numerous around the Toland Lakes farming area and will do damage to both crops and structures if not controlled.

(4) ~~(b)~~ Present Utilization of Farm Resources:

(a) ~~(1)~~ Present Crops:

The most important crops are beans, melons, and squash. The present yields can be increase. The proper subjugation of the present farmland, more efficient use of water, field selection of seed, correct use of simple farm machinery, crop rotation, fall plowing, strip cropping where wind erosion is serious, and improved seed bed preparation.

Corn was the principal crop grown representing 65% of the land under cultivation in 1936. Melons and squash represented 4%, beans 1% and idle land 30%.

Other crops which may be grown to advantage are potatoes, alfalfa, wheat and sorghum.

(5) ~~(2)~~ Present Farming Methods:

(a) Type of Farming:

Farming practices vary consider-

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ably from one part of the Unit to another. At Tolani Lakes there is a tendency toward intensive farming, whereas on other parts of the Unit very extensive farming is practiced.

(b) Location of Farms:

Usually, farms are located on the lighter textured soils and on fans at the mouths of washes. Along the Little Colorado River, sand bars often are planted when moisture conditions are favorable, but Usually, these crops are washed out or blown out before they are mature, ~~but~~ If they do mature, a crop has been made with very little effort.

(c) Planting and Cultivating:

Corn is usually planted by hand directly behind the plow or with a stick or hoe.

The hoe and horse drawn blade are used for cultivating.

(d) Use of Water:

It is seldom that the proper use of water is made, resulting in excessive erosion and a minimum of moisture penetration.

(e) Harvesting and Storing:

All crops are harvested by hand. Corn is dried in the sun, shelled, sacked, and stored in underground bins or sold to the trader. Livestock are allowed to graze on the fields as soon as the grain is harvested. The complete removal of vegetation and trampling leaves the soil unprotected and subject to severe wind erosion.

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(f) Pests and Present Methods of Control:

Cutworms, grasshoppers, and army worms cause considerable damage. Little is done toward their control unless poison is given the Indian by some government agency. Fall plowing would help control insect pests.

Rats and mice do some damage to stored grains. Improved storehouses and the removal of dead brush and weeds from fence corners, etc. would relieve this situation materially.

Weeding is usually done with a hoe or horse drawn blade. Fall plowing would help to control weeds.

(4) Marketing:

(a) Home Consumption:

No records on the home consumption of farm crops were obtained. In all probability, almost all of the agricultural products are consumed at home.

(b) Sale and Trade:

The figures obtained from the traders show that an extremely small amount of agricultural products were purchased from the Indians.

No doubt there is some barter among the Indians. Now and then one Indian will trade agricultural products for livestock.

5. Woodland:

a. Present Resources:

(1) Acreage and Locations:

There are approximately 5,640 acres of woodland on this Unit, 3,170 acres are occupied by scattered cotton-

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woods, 1,570 acres by cottonwood stands and 880 acres by Juniper stands. All but twenty acres of the cottonwoods are along the Little Colorado River. The Juniper is in the southwest portion of the Unit. (See Map No. 1[illegible]). Black walnut, cottonwood and hackberry are found in Canyon Diablo.

(2) Class, Site and Conditions

With the exception of twenty acres of eight-year old trees at Toland Lakes and the young planted trees at Houpp, all of the cottonwood stands contain only mature and over-mature age classes. The Juniper stands are grouped into four age classes; over 200 years, 40%; 80 to 200 years, 45%; 20 to 80 years, 13%, and under 20 years (reproduction) 2%. No young reproduction was found in the cottonwood stands. Usually the youngest trees are from thirty to forty years old. No site or condition classification has been given to the cottonwood stands but we know that they are poor. The Juniper stands have all been classed as Site III, condition (c). Type A-1 (See Map No. 11) has a density of twenty to forty trees per acre and a crown cover of 4 to 8 percent. The largest trees are fifteen feet in height with a crown diameter of eighteen feet. The average height is ten feet and the average number of stems per tree is five. Type B-1 has a crown cover of about 2%. Trees are between fifteen and twenty feet high with a d. b. h. of eight to ten inches. Their form is better than in Type A-1. Type B-2 is similar to Type B-1.

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(3) Available Products:

The following table shows the density, volume per acre and total volume for the woodland in Unit No. 5:

Table No. 6 — Available Woodland Products

Type		Trees per Acre	Volume per Acre (cords)*	Total Volume (cords)*
Cottonwoods				
Scattered	(3170A)	1	1/2	1,600 -
Stands	(1570A)	5	2-1/2	3,900 +
Total	(4740A)	2-1/4	1 +	5,500 +
Junipers				
A-1	(720A)	20	1	700 +
Total . . .	5460A	-	-	6,200 +

*Ricked, 40 cubic feet of actual wood.

There is a quantity of dead cottonwood material in the form of drift logs, dead trees, etc. along the Little Colorado River which can be used for fuel. There is no dead material of any kind in the Juniper stands, due to its having been removed for fuel.

The use of palatable range browse as fuel is a serious practice especially near Tolani Lakes and northwest of Bird Springs.

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(4) Grazing Value:

The entire cottonwood stands have very little value as grazing land since most of the area is barren or has a very sparse stand of range forage plants.

The Juniper stands are on good grazing land.

(5) Watershed Value:

The actual watershed value of the cottonwood stands is negligible. However, the value of these stands in stream flow and river bank protection is believed to be high.

The watershed value of the Juniper stands is low because of the small area covered.

(6) Wildlife:

The wildlife in the woodland stands consists principally of kangaroo rats, mice, wood rats, squirrels and chipmunks. If more shrubs could be grown, the cottonwood stands along the Little Colorado River would be a very good habitat for scaled quail.

b. Utilization of Woodland Products:

(1) Cutting Practices:

Heavy overcutting has taken place in the Juniper stands and in some cases only dead stumps are left.

Very little use has been made of the cottonwood stands. The dead material is not used and, in some cases, people living in the cottonwood stands go to the Coconino National Forest for Juniper wood. The lack of use of the dead cottonwood

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material may be because of its toughness and its poor fuel properties. However, some of these difficulties may be met by cutting the logs into usable lengths with saws.

(2) Pests and Disease:

At the present time pest and disease damage is probably very little.

(3) Fire Damage:

Fire damage is negligible at present. Fire hazards will increase under grazing protection in the cottonwood stands.

(4) Wind Damage:

Wind does considerable damage to all species of trees in this Unit, especially to young trees. Damage is manifested in the poor form and loss in height growth.

(5) Grazing Damage:

Grazing damage is probably the most extensive and severe damage to the woodland in that there appears to be an almost complete destruction of reproduction. This damage is indicated by the lack of young reproduction and the lack of trees less than ten years old. This is especially true of the cottonwood stands which are along the river adjacent to permanent water and subject to severe overgrazing.

c. Marketing:

(1) Home Consumption and Sale:

There is no evidence of any of the woodland products being sold from this Unit. The Indians do buy and

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haul wood from the Coconino National Forest east of Flagstaff.

4. Income:

The following table (No. 7) shows an analysis of the commercial and non-commercial income for Unit No. 5:

Table No. 7 INCOME *

Item	Commercial	%	Per Capita Income	Non-commercial	Total Income	% Total Income	Total Per Capita Income
Wages	$50,182	57.20	$39.30	-	$50,182	40	$39.30
Livestock	31,334	35.72	24.53	$24,975	56,309	44	44.65
Agriculture	223	.25	.18	14,186	14,409	11	11.45
Rugs	5,215	5.94	4.13	-	5,215	4	4.13
Miscellaneous	782	.89	.62	-	782	1	.62
Total	$87,736	100.00	$69.57	$39,161	$126,897	100	$100.63

*Wage income was obtained from the various Government agency reports. The remainder of the commercial income was obtained from the traders.
The non-commercial income for livestock and agriculture was obtained by using a sample obtained from Indians and projecting this sample to include the whole Unit.

The commercial income from livestock is divided as follows:

Sheep, goats, and lambs	$ 5,184.00	
Wool and mohair	20,167.00	
Cattle	4,763.00	
Pelts and hides	778.00	
Meat	442.00	
Total	$31,334.00	100 %

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The wage income came from the various Governmental agencies as follows:

S. C. S. - - - - - - - - - - - -	$ 16,484.00
E. C. W. - - - - - - - - - - - -	15,000.00
Indian Service Roads - - - - -	8,038.00
Indian Service - - - - - - - - - (estimated)	10,000.00
Traders - - - - - - - - - - - -	660.00
Total - - - -	$50,182.00

Miscellaneous income was divided as follows:

Jewelry - - - - - - - - - - - - -	$ 170.00
Wood (Probably came from Coconino National Forest) - -	95.00
Pinons (Not produced on the Unit)- - -	517.00
Total - - - -	$ 782.00

II. SUB-UNITS:

Unit No. 5 has been divided into six sub-units but sub-units Nos. 1 and 2, and 5 and 6 have been combined in some cases because of similarity of conditions.

The boundaries of the sub-units were put along natural barriers as much as possible. An attempt was made also, to establish these sub-units in such a manner as to group similar conditions into one area and to divide the present

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livestock and human uses into natural land management subdivisions. In almost every case these boundaries are easily followed in the field (See Map No. 3).

A. SUB-UNITS NUMBER 1 and 2:

Sub-units Nos. 1 and 2 are in the southern part of the Unit. (See Map No. 3). They are bounded on the west by Canyon Diablo, on the south by the Reservation boundary fence and on the east and north by the Little Colorado River. Sub-units 1 and 2 are separated by a fence. There is very little "crossing over" of livestock into or from other sub-units.

In the southwest portion of sub-unit No. 1 is some of the best range land on the Reservation both from the adaptability of the soil and from the amount and kind of vegetation now present. The soils and vegetation on the whole of sub-unit 2 and the northeastern portion of sub-unit No. 1 are poor and range revegetation and recovery will be very slow.

There is no farmland in these sub-units and no potential land. These people farm in sub-units No. 3 and 6 near Leupp and along the Little Colorado River above Leupp.

Table No. 8 shows in a tabular form the basic resources for the various sub-units. Map No. 8 shows the relative range utilization for Unit No. 5. Sub-units Nos. 1 and 2 show to be over-utilized while the 1936 dipping records show that they are understocked 45.43%. This discrepancy is due in part to inaccurate dipping records and to a lack of rain during the growing season in 1938. The low rainfall resulted in some of

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this livestock moving to other portions of the Unit.

Table No. 9 shows the percent of area, percent of waste, percent of carrying capacity, and the surface acres per sheep by sub-units.

B. SUB-UNIT NO. 3:

Sub-unit No. 3 is in the southeastern part of the Unit (See Map No. 3). The south boundary is the Little Colorado River and the south Reservation boundary fence, the west and north boundary is Corn and Jeddito Washes and the east boundary is the east boundary of Unit No. 5. There is some crossing over of people and livestock at Leupp and along the Jeddito Wash to farm and to trade.

There are over eighty acres of scattered land that was farmed in 1936 and there are fifty acres of "A" class flood potential land. At the present time some of these Indians move into sub-units Nos. 4 and 6 to farm.

The soils of the range land in this sub-unit are classified as varying from C to D. The northeastern portion is sandy and subject to wind erosion. The southeastern portion is steep and broken in some places with Chinle shale clays predominating the soil types. The range along the River is very poor from the standpoint of the present vegetation and in general the soil is too heavy and too high in alkali to permit anything but a very slow response to a range improvement program.

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C. SUB-UNIT NO. 4:

Sub-unit No. 4 includes practically all the northern portion of the Unit. (See Map No. 3). There is some "crossing-over" of livestock and people near Dinnehbito Trading Post to graze and to trade. However, this "crossing-over" is not serious at present.

There are 422 acres of land that were farmed in 1936. The most of this land is at Tolani Lakes where the most concentrated type of farming on the Unit is found.

There are no available wood products in this sub-unit. Consequently, Chamiso, greasewood, shadscale and rabbit brush are used extensively as fuel.

The soils of the range land are rated as varying from B to D. The D class soils are found along the valley floors mostly. The greater portion of the soils of the sub-unit are sandy and subject to severe wind erosion when the vegetation is removed. Except in areas where moving sand dunes are present, these soils will respond readily to range improvement.

Table No. 8 shows in a tabular form the basic resources of this sub-unit.

Table No. 9 shows that 35.87 surface acres are required per sheep unit yearlong.

The 1936 dipping records show this sub-unit to be 50.63% overstocked. This percent of overstocking is undoubtedly high but it is overstocked.

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Miscellaneous
Total Commercial
Per Capita

32.00

D. SUB-UNITS NUMBER 5 and 6:

These sub-units are in the western and southwestern parts of the Unit. (See Map No. 3).

There are 166 acres of farmland all of which are in sub-unit No. 5. Sub-unit No. 6 has no farmland. There are 900 acres of "A" class potential flood land, 800 acres of which are at Leupp and 100 acres scattered. All of the potential land is in sub-unit No. 5.

There are four consumption groups in sub-unit No. 5 and 33 consumption groups in sub-unit No. 6. Three of the four consumption groups in sub-unit No. 5 derive the major portion of their income from trucking for the Leupp Agency. Those people living in sub-unit No. 6 were large stock owners at one time, but droughts and confinement on the Reservation have reduced their income to the point of where they are in need of more farmland or other additional income. Farmland is available at Leupp in sub-unit No. 5. (See Map No. 9).

From the standpoint of soils and present vegetation some of the best range land on the reservation is in sub-unit No. 6. However, livestock water is difficult to obtain because of the depth to permanent water and because of the permeability of the soils. This sub-unit has the lowest surface acre requirement per sheep unit. (See Table No. 9).

These Units are 39.29% understocked, according to the 1938 dipping records. (See Table No. 8). Unless more water can be

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Other	[illegible]	[illegible]	32.50	360.00	[illegible]	[illegible]
Miscellaneous	32.00	[illegible]	732.50	732.00		
Total Commercial	3,609.00	7,183.75	13,659.50	25,252.85	50,095.90	37,726.00
Per Capita	41.57	41.52	22.35	66.28	39.73	69.57
Non-Commercial						
Livestock	?	?	10,572.00	?	?	24,575.00
Agriculture	?	?	?	?	?	14,186.00
Total Non-commercial	?	?	?	?	?	39,161.00
Total Income	?	?	?	?	?	126,897.00
Consumption						
Home Produced and Consumed	?	?	?	?	?	39,161.00
Purchased from Trader						
Home Produced	?	?	?	?	?	410.00
Imports	?	?	?	?	?	38,507.00
Total	?	?	?	?	?	78,078.00
Producible Imports	?	?	?	?	?	11,941.00
Wood Products						
Source	12.6% of total. All in S.W. 32	Along river 50.3% of total	None	Cottonwood along River, Juniper in S. W. corner	Along River, 36.7% of total	
Kind	Cottonwood along river. Juniper & cottonwood	Cottonwood		Cottonwood	Cottonwood	
Site and Condition	34-D111-C "C" (W-Poor	Poor 50.3% of total		Poor		
Amount	Dead cottonwood only	Dead cottonwood	Use palatable range	Dead cottonwood only	Dead cottonwood	
Fuel			Browse			
Posts and Poles	0	0	0	0	0	
Planting Possibilities						
Erosion Control	2,810 Acres	4,020 Acres	1,550 Acres	3,140 Acres	11,560 Acres	
Range	6,400 "	940 "	1,140 "	0 "	8,780 "	
Windbreak	200 "	0 "	8,400 "	2,070 "	10,670 "	
Biology	40 "	100 "	340 "	310 "	790 "	
Woodlot	0 "	3,180 "	10,140 "	540 "	13,860 "	
Total	9,450 "	8,300 "	21,750 "	6,060 "	45,660 "	
Rodent Damage (Acreage Needing Treatment)						
Prairie dog	3,558 "	851 "	3,028 "	4,414 "	11,851 "	
Kangaroo rats	5,838 "	38,319 "	50,282 "	56,861 "	151,300 "	
Total	9,396 "	39,170 "	53,310 "	61,275 "	163,151 "	

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Miscellaneous	32.00	[illegible]	32.50	360.00	732.50	782.00
Total Commercial	3,609.80	7,403.75	13,659.50	25,252.85	50,095.90	87,729.00
Per Capita	41.57	41.52	22.35	66.28	39.73	82.57
Non-Commercial						
Livestock	?	?	10,572.00	?	?	24,975.00
Agriculture	?	?	?	?	?	14,186.00
Total Non-commercial	?	?	?	?	?	39,161.00
Total Income	?	?	?	?	?	126,897.00
Consumption						
Home Produced and Consumed	?	?	?	?	?	39,161.00
Purchased from Trader						
Home Produced	?	?	?	?	?	410.00
Imports	?	?	?	?	?	38,507.00
Total	?	?	?	?	?	78,078.00
Producible Imports	?	?	?	?	?	11,941.00
Wood Products						
Source	12.6% of total. All in S.W. #2 Cottonwood along river.	Along river 50.3% of total	None	Cottonwood along River, Juniper in S. W. corner	Along River, 36.7% of total	
Kind	Juniper & cottonwood	Cottonwood		Cottonwood	Cottonwood	
Site and Condition	34-8111-C "C" (W-Poor	Poor		Poor		
Amount		50.3% of total				
Fuel	Dead cottonwood only	Dead cottonwood	Use palatable range	Dead cottonwood only	Dead cottonwood	
			Browse			
Posts and Poles	0	0	0	0	0	
Planting Possibilities						
Erosion Control	2,810 Acres	4,020 Acres	1,530 Acres	3,140 Acres	11,560 Acres	
Range	6,400 "	910 "	1,140 "	0 "	8,780 "	
Windbreak	200 "	0 "	8,400 "	2,070 "	10,670 "	
Biology	40 "	100 "	340 "	310 "	790 "	
Woodlot	0 "	3,100 "	10,140 "	540 "	13,860 "	
Total	9,450 "	8,300 "	21,750 "	6,060 "	45,660 "	
Rodent Damage (Acreage Needing Treatment)						
Prairie dog	3,558 "	851 "	3,028 "	4,414 "	11,851 "	
Kangaroo rats	5,838 "	38,319 "	50,282 "	56,861 "	151,300 "	
Total	9,396 "	39,170 "	53,310 "	61,275 "	163,151 "	

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TABLE NUMBER 8

S - U N I T S (Summary)

Item	Sub-Units Nos. 1 & 2	Sub-Unit No. 3	Sub-Unit No. 4	Sub-Units Nos. 5 & 6	Unit Total	From Trader Records and Other Sources
Number of Consumption Groups	9	14	78	37	138	
Number of People	89	190	611	331	1,261	
Surface Acres	21,207	151,303	1,095	254,255	811,870	
Carrying Capacity	3,279	3,836	1,062	11,219	27,396	
Range Soils						
Acreage and Class	A--- 4,405	A- 0	A- 397	A- 28,319	A- 33,121	
" " "	B- 46,116	B- 89,206	B- 76,338	B- 62,461	B- 194,111	
" " "	C- 16,642	C- 157,957	C- 181,187	C- 49,657	C- 309,437	
Present Stocking	D- 137,004	D- 5,941	D- 31,919	D- 66,816	D- 141,680	
Sheep and Goats	E- 5,040	E- 48,135	E- 35,264	E- 47,012	E- 135,415	
Cattle						
Horses						
Total	1,585	3,657	3,650	6,811	25,703	
Percent of Stocking						
Overstocking	45.43%	4.67%	50.63%	39.29%	6.63%	
Understocking						
Farm Land						
Present Farm Land	0	80	422	166	668	
Acres						
Soils						
Acreage and Type						
" "						
Yield						
Remarks						
Potential Farm Land	Farm in S. U. No. 6					
Acres	0	50	4,500	900	5,450	
Soils						
Acreage and Type		"A" Flood Scattered	2,000 "A" Flood 2,500 "B" Flood	800 "A" Flood at Loupe 100 "A" Flood - Scattered		
" "						
Yield	See Page No. 48A					
Remarks						
Income	Available in S. U. No. 6		All at Tolani Lakes			
Commercial						
Wages	2,024.00	2,916.00	14,149.00	9,439.00	18,798.00	50,102.00
Livestock	1,293.80	3,019.75	6,510.20	11,058.85	21,082.60	31,324.00
Agriculture	0	0	?	?	?	223.00
Rugs	350.00	1,240.00	2,607.80	4,395.00	8,602.80	5,215.00
Miscellaneous	32.00	300.00	32.50	360.00	732.50	702.00
Total Commercial	3,699.80	7,475.75			50,095.50	87,756.00
Per Capita	41.57					
Non-Commercial						

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The soils of Unit No. 5 have been classified as A, B, C, D, & E range soils and A B C & D agricultural soils with A representing the best soil of each class. A, B, & C agricultural soils are irrigable while D is non-irrigable. Alkali concentration, water penetration, water holding capacity, and slope were the determining factors in classifying these soils. In the case of agricultural soils the feasability of applying water is the limiting factor in the subjugation of these areas.

AGRICULTURAL LAND GROUPS BY SUB-UNITS

	A	B	C	D	Total
Sub-unit #1 -----				619	619
2 -----			51,101	27,275	38,376
3 -----	722	9,232	30,413	28,497	68,864
4 -----	1,364	41,875	27,524	38,221	108,984
5 -----	1,706	5,575	6,825	23,836	37,942
6 -----		572		1,727	2,299
Total	3,792	57,254	11,863	120,175	297,084

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obtained and the distribution of livestock improved, the number of livestock should not be increased on these sub-units.

Table No. 9 Range Value of Sub-units

Sub-Unit	Percent of Area	Percent of Waste	Percent of, C. C. S. Yearlong		Surface Acres per Sheep Unit
No. 1	4.33	.06	7.78		16.60
No. 2	5.67	15.04	4.19		40.12
No. 3	18.64	26.39	14.00		39.44
No. 4	40.04	31.61	33.07		35.87
No. 5	16.19	23.88	12.24		31.21
No. 6	15.13	3.82	28.72		15.31
Total	100.00	100.00	100.00	Ave.	29.63

III. THE EFFECT OF HUMAN ACTIVITY ON THE NATURAL RESOURCES:

A. DESTRUCTION OF VEGETATION AND SOIL AND WATER LOSS:

- Improper Range Management:

Continued misuse of the range for a long period of time has resulted in a very depleted condition of the range in Unit No. 5. This condition is especially true along the Little Colorado River, along all the major drainages, and adjacent to all permanent waters. In 1876 the Hashknife Cattle Company brought large herds of cattle into northern Arizona. There was permanent

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water along the Little Colorado River and this area was heavily overgrazed. The result is that there are large barren areas along the river which once supported a fair stand of saccaton and chamise. Since this land has been made Indian Reservation, permanent water has been developed at various places. The inadequate supply of water and the large numbers of livestock have resulted in seriously overgrazed conditions around these water supplies. The trailing of livestock for long distances to water and feed has further aided in increased range depletion. Consequently, there are large areas on which the vegetation has been depleted to such an extent that excessive soil and water losses now occur. Along the valleys of all the major drainages deep, straight-sided gullies are found, and all the streams carry large amounts of silt. Severe sheet and wind erosion occur over large areas. In many places, more than 75% of the top soil has been removed. (See Map No. 10). The depletion of vegetation increases the rate and amount of runoff and decreases water penetrations.

2. Improper Woodland Management:

The most important woodland on Unit No. 5 is the Cottonwood along the Little Colorado River. (See Map No. 11). These stands have been subjected to severe misuse by overgrazing for many years. The result is that all of the trees are old and there is an entire lack of reproduction. Also, the misuse of these stands has resulted in a decreased protection

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of the banks of the Little Colorado River. Consequently, the river has cut channels, channels change from year to year, and the floods are fast moving with a minimum of water penetration.

The small areas of Juniper woodland in the southwestern part of the Unit probably never were large enough to be of value as watershed protection. However, these stands have been severely misused and over-cut.

B. CHANGE OF VEGETATION:

1. Indicators of Overgrazing:

Over the whole unit there is an abundance of Snakeweed and yellow bush. In numerous areas rabbit bush is the predominating vegetation. Russian thistle and other annual weeds make up a large percentage of the vegetation on numerous areas. Probably at one time the predominant vegetation was more palatable and nutritious but these species have been killed out, to a large extent, by overgrazing, allowing the less palatable species to take their places. In other places the complete denudation of expansive areas has resulted. (See Map No. 3).

The shrubs which invade the range land are not so well adapted to hold the soil and water in place and the annual weeds are effective only during the growing season. Therefore, the changes in vegetation as a result of the misuse of the range, aids materially in the loss of soil and water.

2. Available Forage:

In some cases the actual ground cover of vegetation may not be materially below that it was before the introduction of

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domestic livestock. However, the available forage has decreased because the original species have been replaced by less palatable species. How much of the vegetational change is due to grazing and how much to natural ecological change is not known, but certainly a large amount of it is due to improper grazing by domestic livestock.

Another factor of vital importance in determining the amount of available forage is the volume growth of the forage species. Apparently, almost all of the palatable species are low in vitality. They are veryslow to respond to favorable moisture and temperature conditions and a small volume of growth is obtained during the growing season. Probably the most important cause of the low volume growth is over-grazing. The low vitality of the forage may result in a high mortality of plants during growing seasons which have a low amount of precipitation. The climatological records show that the amount of precipitation during the growing season varies from year to year. Several years may be required for the vegetation to recover from the damage occurring during one growing season of low rainfall. Therefore, extreme care must be taken to not overgraze any part of the range in this Unit if we are to decrease the amount of soil and water losses now occurring or likely to occur in the future.

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C. DESTRUCTION OF FARMLAND AND SOIL AND WATER LOSS:

1. Improper Subjugation and Use of Water:

Numerous errors are made by the Indians on their farmland. The following is a list of some of the most common mistakes:

1. Plowing with the slope of the land, which allows the water to start gullies.
2. Leveling is not practiced, which allows the water to flow fast, thereby decreasing the amount of water penetration.
3. Bordering should be practiced so as to increase water penetration.
4. Contour listing and furrowing are seldom practiced, which allows excessive water runoff.
5. Available water may be too much or too little.
6. Diversion ditches could be used more extensively.
7. Diversion ditches often are put on too steep a grade with no provisions for the control of erosion.
8. Surplus water usually is not taken care of so that gully heads often form inside or at the lower margin of the farm.
9. Soils are often too heavy and too high in alkali to permit the proper growth of crops.
10. Wind erosion usually is not controlled.

2. Improper Cultural Methods:

The present cultural methods employed by the Navajos of this Unit usually are not conducive to the proper farm management

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practices. Following is a list of some of the most common cultural errors:

1. Fall plowing is not practiced.
2. Row crops are often planted with the slope of the land.
3. Complete removal of fodder by grazing livestock, resulting in an entire lack of protection of the soil from wind erosion.
4. Fall and winter cover crops are seldom planted, leaving the land open to wind and sheet erosion during the fall, winter and spring months.

D. DESTRUCTION OF WILDLIFE AND WILDLIFE HABITAT:

Deer and antelope have been killed out of this Unit by hunting and forced out by competition with domestic livestock for feed. The beaver habitat along the Little Colorado River has been destroyed by overgrazing and the beaver have been killed out by people.

The rabbit population is held at a minimum by the use made of them for food.

Quail are very scattered on this Unit, probably because of the destruction of their habitat by grazing animals and because they have been killed out for food.

The habitat for waterfowl is very poor. Probably the only value that the surface tanks in this Unit have is for a resting

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place during migrations.

Probably the only favorable habitat that can be developed is for scaled quail along the Little Colorado River.

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PART TWO. ESTABLISHMENT OF PROPER LAND USE

I. NECESSARY ADJUSTMENTS: (WORK PLAN)

A. PROPER RANGE CONTROL:

1. Grazing Dates:

Unit No. 5 shall be grazed yearlong. At the present time there is no reason why this range should not be grazed yearlong. If in the future, seasonal use is considered desirable and practical any part of this range may be used at any season of the year desired.

2. Proper Class and Number of Livestock:

Six horses per consumption group or 828 horses, 800 cattle and 20,056 sheep shall be the maximum numbers of livestock allowed on this Unit. These livestock shall be distributed as follows:

Sub-Unit	Horses	Cattle	Sheep
No. 1	24	25	1,912
No. 2	24	20	947
No. 3	84	75	3,116
No. 4	468	455	4,902
No. 5	24	50	3,032
No. 6	204	175	6,147
Total - - -	828	800	20,056

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3. Sires and Their Care:

Three bucks per hundred ewes or approximately 600 bucks, 32 bulls, and five stallions should be allowed.

The bucks shall be cared for in buck pastures. Two pastures have already been fenced with an aggregate carrying capacity of 450 bucks for ten and one-half months. Another pasture is yet to be built and it must be large enough to carry 150 bucks for ten and one-half months.

The bulls should be cared for in a separate pasture and the stallions should be kept at the Unit headquarters.

4. Breeding and Lambing:

The breeding season shall be from November 10 to December 20 for sheep and from July 10 to November 10 for cattle. This will make the lambing dates from April 10 to May 20 and the calving dates from April 10 to August 10.

5. Shearing:

The shearing dates shall be from June 1 to June 10. Four machine shearing plants should be installed at the following locations: (See Map No. 3)

1. At the stock corral at Bird Springs in sub-unit No. 3.
2. At the stock corral eight miles northwest of Red Lake Trading Post near well No. 5-N-14 in sub-unit No. 4.
3. At the stock corral eight miles west of Leupp near drilled well No. 5-N-139 in sub-unit No. 6.
4. At the stock corral seven miles southwest of Leupp near drilled well No. 5-N-94 in sub-unit No. 1.

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6. Range Water Developments:

Water developments shall consist of eighteen maintenance jobs and thirty new projects as shown in the construction program. (See Page 75 of this report).

7. Livestock Movements and Distribution:

No more livestock shifts are to be made than is necessary to effect the proper distribution and management of the range. The people who now make shifts from this Unit to other Units will have to decide where they want to stay and then stay there. All excessive concentrations adjacent to permanent water supplies shall be eliminated as nearly and quickly as possible. All range adjacent to temporary water supplies shall be used when water is available and the range around permanent supplies conserved for use when temporary water has dried up. The concentrations along the Little Colorado River in the fall and early winter are to be discontinued. Concentrations around the farming areas at Leupp and Toland Lakes are to be stopped.

Two range riders are needed, one at Sand Springs and one at Red Lake.

8. Protection from Poisonous Plants:

Eliminate the concentrations of livestock, especially cattle, along the Little Colorado River during the winter.

Eradicate the [illegible] milkweed in the Canyon Diablo Buck Pasture.

Do not graze the cocklebur area at Toland Lakes.

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D. Reduction of Injurious Range Rodents:

Range Rodent control is needed on various parts of this Unit and shall be done according to the following recommendations: (Priority as listed)

Prairie Dog Control

1. Treatment of Types M-15 and M-17 (See Map No. 6): If possible, arrange with private land owners for them to treat their lands adjoining the Reservation in this locality.

8000 acres - - - - - - - - - - $1,140

2. Treatment of Types M-1 and M-11 (See Map No. 6):

6000 acres - - - - - - - - - - 860

Total - - - 14,000 acres - - - - - - - - - - $2,000

Kangaroo Rat Control

1. Retreatment of Toland Lakes Area

10,000 acres - - - - - - - - - - $1,240

2. Retreatment of Type M-14 (See Map No. 6)

3,000 acres - - - - - - - - - - 370

3. Treatment of Types M-3 and M-8 (See Map No. 6)

156,000 acres - - - - - - - - - - 19,390

Total - - 169,000 acres - - - - - - - - - - $21,000

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10. Control of Predatory Animals:

At the present time, no control is needed. However, if the numbers of coyotes increase, some control will be needed in localized areas.

11. Wildlife Developments:

Scaled quail can be planted along the Little Colorado River. ~~The concentration of livestock and overgrazing shall be eliminated to a scaled quail habitat.~~ Eight existing and seven proposed desilting plots have been recommended for planting according to Diagram L-468 on page 72 of this report. The locations and numbers of these projects are listed on page 75 Table No. 12, and on Map No. ~~15~~ 7.

12. Range Waterspreading and Erosion Control:

The most important waterspreading and erosion control project recommended on this Unit is in sub-unit No. 4 and shown on Map No. 9 as Waterspreading and erosion control project No. 1. In this project there would be approximately 6000 surface acres benefitted or about 1000 forage acres. The cost is estimated at $7,646. This whole area will become severely eroded if not treated immediately.

Erosion control and water spreading project No. 2 (See Map No. 9) is important and needed to save approximately 8000 surface acres of range land in this Unit. Gullies are forming at the lower end of the valley and will result in the loss of about 700 forage acres if not controlled. No estimate will be

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made on this project until further study is made on the watershed in Unit No. 7.

Erosion control on approximately fifteen miles of wagon trails near Sand Springs at a cost of $27 per mile has been recommended. The total estimated cost is $405 and probably would protect about 500 acres of range land.

13. Range Planting Possibilities:

No extensive range plantings are recommended but three areas have been selected to be planted experimentally to determine the feasibility of planting on the heavy clay flats in this Unit. These areas are shown on Map No. ~~13~~ 7, as 5-R-1, 5-R-2 and 5-R-3. It is thought that if artificial revegetation on these areas can be secured economically, more range planting should be done on numerous similar areas in this unit, but 25 acres of range planting should be sufficient for the present.

14. Education and Demonstrations:

Education and demonstration of proper range management and animal husbandry practices should be carried on at all times. Education as to the proper methods of handling livestock should be carried on at dipping and selling time. The buck pastures should be used as demonstration areas to illustrate the proper management and care of range resources. Education in the care and management of wildlife and wildlife habitats is needed. Constant individual and group advice should be given the Indians in all parts of the Unit.

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B. FARM IMPROVEMENT:

1. Present Farmland:

a. Subjugation and Flood Irrigation:

Table No. 10 on page 65 shows the farms, the acreage, present crops, suggested crops, present yields, expected yields, type of farm, acres of potential land, acres to be subjugated, cost per acre and total cost for each farm on the Unit. The amount of available water or the soil texture has caused some of these farms to be recommended for abandonment. 367 acres of the present farmland has been recommended for subjugation and are shown on Table No. 10, page 65. The present farm land to be subjugated is distributed as follows: Sub-unit No. 3, 50 acres; sub-unit No. 4, 194 acres; sub-unit No. 5, 123 acres. Contour listing, strip cropping, etc are not considered to be subjugation treatments.

b. Recommended Cultural Practices

Table No. 10, page 65 , gives a list and the acreages of farmland and the recommended improved cultural methods such as lister planting, contour listing, strip cropping and fall plowing.

c. Erosion Protection:

(1) Planting:

11,610 acres have been recommended for windbreak planting on and around farms as follows: Sub-unit No. 2, 200 acres; sub-unit No. 3, 940 acres; sub-unit No. 4, 8,400 acres;

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sub-units Nos. 5 and 6, 2070 acres; (see Map ~~13~~ 7 and Table No. 12, page 69). Not all of the area shown as potential planting sites is to be planted but it is believed that the area indicated can be planted if need be. Experimental planting should be made first, as is indicated in Table No. 12.

(2) Engineering Structures:

The engineering work on the present farmland consists of subjugation, as is shown on Table No. 10, Page 65. No treatment for gully head protection, etc. has been recommended.

d. Protection from Pests:

Fall plowing is recommended to help control insect pests such as cut worms, grasshoppers, and army worms. The poisoning of insects around farms will be necessary from time to time.

Rodent control is needed at Leupp and Tolani Lakes Agricultural areas. 10,000 acres are recommended for immediate rodent control treatment at Tolani Lakes.

Treatment of 10,000 acres at Tolani Lakes
(See Map No. 6)

10,000 acres - - - - - $1,000

e. Harvesting and Storing:

Crops are harvested by hand, which is satisfactory at present. However, the development of additional farmland, increased yields and improved cultural practices will necessitate the use of machinery for harvesting crops. This

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is especially true in the case of hay and small grain crops. Such machinery as mowers, robes, hay wagons, hay balers, etc., will be needed.

Store houses must be made rodent proof and rodent control around storehouses and grain bins will be needed from time to time.

f. Marketing:

The hay which will probably be produced in the future will have to be baled; beans, corn and small grains will have to be threshed and sacked before it is sold. Therefore, threshing machines, hay balers, etc., will be needed. Care must be taken that the Indians do not sell all of their produce but that they retain enough to meet their needs during the winter and spring. The selection of seed for the following year should be made at harvest time.

The exchange and trade of agricultural products for other foods should be encouraged.

The feeding of agricultural products to livestock should be encouraged wherever possible.

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			Grass 15	Alfalfa								
18	25	15	Idle	Corn	0	Flood	C	Sand / Clay	Abandon except in wet years			
16	14	8	Corn	Corn, beans & sorghum	Corn 12 Bu.	Flood	A	SL	Contour list & strip crop			
16	15	3	Idle	Corn	0	Flood	A	Sand	Contour list			
69	1	4	Corn	Corn, beans & sorghum	Corn 10 Bu.	Flood	B	Clay & SL / Clay	Lister plant			
96	39	4	Peach trees Corn - 4	Corn & melons	Corn 10 Bu.	Flood	B	SL	None			
96	40	6	Corn	Corn, beans, sorghum	Corn 12 Bu.	Rainfall	A	[illegible]	Strip crop and contour list.			
96	41	2	Idle	Corn	-	Flood	B	LS	Contour list.			
	Total	338	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	4,500	2,194	$32,910

Sub-Unit Nos. 5 and 6:

18	2)											
18	3)	35	Idle	Corn	0	Flood	B	CL	Contour list			
18	6)											
18	7)	123	Corn 116	Same	Beans 100#	Flood	A	SL	Lister plant and windbreaks 800	123	$ 5	$ 615
18	8)		Squash 3		Corn 15 Bu.					800	5	4,000
18	1)		beans 1									
			melons 3									
68	1	2	Corn	Corn	Corn 5 Bu.	Flood	B	Clay	Contour list			0
68	2	6	Idle	Corn	0	Flood	A	Sand & LS	None			
68	3	Proposed expansion of 100 acres B Class Flood Irrigated								100	100	$15 $ 1,500
69	2	1	Corn	Corn, squash	Corn 15 Bu.	Irrigated from tank when water	A	CL to Clay	None			
	Total . . .	167	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	900	1,023	$ 6,115
GRAND TOTAL		668	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	. . . . .	5,450	3,317	$40,525

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Table No. 10

PRESENT FARMLAND

Quad. No.	Farm No.	Acreage	Present Crops	Suggested Crops	Present Yield	Type of Farm	Class of Land	Soils	Recommendations	Acres Potem.	Acres to be Subjg.	Cost per Acre	Total Cost
Sub-Unit Nos. 1 & 2: 1? 2?		5	Idle	Corn	0	Flood	B	C+ CL / Clay	Lister Plant.	0	0	$ 0	$ 0
Sub-Unit No. 3:													
64	6	40	Idle	Corn	0	Flood	B	Sand	None				
64	7	8	Idle	None	0	Flood	C	Sand & Clay	Abandon				
64	8	8	Idle	None	0	Flood	C	Sand & Clay	Abandon				
64	10	50	Idle	Corn	0	Flood	B	SL / Clay	Subjugate after erosion control is completed above.	50	100	$15	$ 1,500
18	4)												
18	5)	40	Corn	Corn	Corn 10 Bu.	Flood	B	Clay to CL	None				
65	1	7	Melons 2 Corn 5	Corn, beans/ Melons	Corn 12 Bu	Flood	A	Sand	None - outside Reservation				
65	2	1/2	Vegetables	Vegetables	-	Irrigated from well	B	Clay & Sand	Fall Plowing				
65	3	5	Beans 1 Corn 4	Corn, peas, Sudan Grass	Corn 15 Bu.	Flood	A	Clay & Sand	None				
	Total	158								50	100		$1,500
Sub-Unit No. 4:													
17	1	2	Corn	Corn	Corn 5 Bu.	Rainfall	C	LS	Abandon				
17	2	8	Idle	-	0	Rainfall	C	LS	Abandon				
17	3	8	Corn	Corn	Corn 10 Bu.	Flood	B	CL to LS	Contour list only				
17	5	20	Idle 15 Corn 5	Corn, beans/ melons, wheat	Corn 15 Bu.	Flood	A	SL	Strip crop and windbreaks				
17	6	15	Corn	Corn-sorghum	Corn 8 Bu.	Rainfall	A	SL & LS	Strip crop and contour list				
17	7	40	Melons 2 Beans 1 Corn 37	Corn, beans/ melons, sorghum	Corn 15 Bu.	Flood	A	SL & CL	Abandon - no water now.				
17	8	4	Corn	Corn	Corn 10 Bu.	Flood	A	SL	Contour list				
18	10	5	Idle	Corn, sorghum	-	Flood	C	Clay	Contour list				
18	11 to 22 inc.	194	Corn 177 Beans 1 Squash 1 Melons 15	Corn, beans, melons oats, wheat alfalfa	Beans 200 # Corn 20 Bu.	Flood	A	Clay to S L	Leveling and bordering	4,500	2,194	$15	$32,910
18	25	15	Idle	Corn	0	Flood	C	Sand	Abandon [illegible]				

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NN0055586

2. Potential Farmland:

By diversion and economical use of flood water, 5450 acres of new agricultural land can be put under cultivation in this Unit. Table No. 11 shows the location, acreage, class of lands, soils classification, and expected yields for the potential land.

Table No. 11 — Potential Land

Sub-Unit and Location	Acreage	Class of Land	Soils	Expected Yields Per Acre
Quad. 88, Farm 10 No.3, East of Leupp	50	B	SL Clay	Corn - 25 Bu. Beans -400 #
No. 4, at Tolani Lakes	2000 2500	A B	Clay to SL Clay	Melons -2000# Alfalfa - 3 T
No. 5, at Leupp	800	A	Sandy Loam	Potatoes - 3 Tons
No. 5, 8½ Mi. West Leupp	100	B	CL SCL	Wheat - 25 Bu.
Total -	5,450			

Of the potential land available, the 2000 acres of A land at Leupp should be developed first, and the 800 acres at Leupp second. The 100 acres of B land eight and one-half miles west of Leupp should not be subjugated unless further surveys show that the 800 acres at Leupp cannot be subjugated.

The cost of subjugating the potential land is estimated

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2. Potential Farmland:

By diversion and economical use of flood water, 5450 acres of new agricultural land can be put under cultivation in this Unit. Table No. 11 shows the location, acreage, class of lands, soils classification, and expected yields for the potential land.

Table No. 11 — Potential Land

Sub-Unit and Location	Acreage	Class of Land	Soils	Expected Yields Per Acre
Quad. 68, Farm 10 No.3, East of Leupp	50	B	SL Clay	Corn - 25 Bu. Beans -400 #
No. 4, at Tolani Lakes	2000 2500	A B	Clay to SL Clay	Melons -2000# Alfalfa - 3 T
No. 5, at Leupp	800	A	Sandy Loam	Potatoes - 3 Tons
No. 5, 8½ Mi. West Leupp	100	B	CL SCL	Wheat - 25 Bu.
Total -	5,450			

Of the potential land available, the 2000 acres of A land at Leupp should be developed first, and the 800 acres at Leupp second. The 100 acres of B land eight and one-half miles west of Leupp should not be subjugated unless further surveys show that the 800 acres at Leupp cannot be subjugated.

The cost of subjugating the potential land is estimated

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to be $12.30 per acre, on 2950* acres or a total cost of $36,250. An immediate survey is needed to determine the feasibility of developing the 800 acres of potential land at Loupp. This land is needed by the 34 consumption groups or 300 people in sub-unit No. 6. If this land cannot be developed, some of these people, at least, will have to be given land at the Tolani Lakes Project.

C. WOODLAND MANAGEMENT:

1. Cutting and Marking:

There shall be absolutely no cutting of live trees on this unit until satisfactory reproduction and young tree growth is established. After this condition is attained all live trees to be cut shall be marked.

2. Fire Protection:

The present vegetative condition in the tree stands is such that no fire hazard is present. However, the fire hazard will be increased by proper range control and provisions for fire protection will have to be made.

3. Reforestation and Afforestation:

There is a possibility of establishing natural reproduction in the cottonwood stands by excluding livestock. Additional studies should be made of the soil, soil moisture, water table

*This figure does not include the cost of subjugation on the 2600 acres of Class "B" potential land at Tolani Lakes but does include the 2000 acres of Class "A" land at that project.

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and adapted species to determine the feasibility of increasing the woodland by planting. Map No. 13 shows the various woodlot planting possibilities on Unit No. 5, and Table No. 12 shows the acreage and amount of each area that should be planted experimentally before extensive planting is done.

D. EROSION AND STREAM CONTROL PLANTING:

A number of erosion and stream control planting possibilities have been located on Unit No. 5. Successful plantings at these locations would have a direct and equal effect upon all the phases of land management, including range, woodland, farmland, wildlife, and sociological developments. (refer to Map No. ~~12~~ 7 and Table No. 12).

Rodent control should precede all plantings.

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Table No. 12 — Potential Planting Possibilities

Type of Planting	Planting Number	Sub-Units Nos.1 & 2 (Acres)	Sub-Units No. 3 (Acres)	Sub-Unit No.4 (Acres)	Sub-units Nos.5 & 6 (Acres)	Suggested Acreage for Experimental Plantings	Suggested Species
Erosion	5-E-9 bw	100				1	
"	5-E-7	1,900				19	
"	5-E-7 sc	460				5	
"	5-E-7 c	250				2	
"	5-E-7 t	50				1	
"	5-E-8	50				1	
"	5-E-1		100			1	
"	5-E-2		50			1	
"	5-E-3		100			1	
"	5-E-4		70			1	
"	5-E-5		50			1	
"	5-E-7		2,500			25	
"	5-E-7 sc		550			6	
"	5-E-7 c		50			1	
"	5-E-7 t		100			1	
"	5-E-6			100		1	
"	5-E-10			50		1	
"	5-E-10 s			100		1	
"	5-E-11			1,000		10	
"	5-E-12			200		2	
"	5-E-13			80		1	
"	5-E-8				350	4	
"	5-E-8 sc				350	4	
"	5-E-8 t				10	1	
"	5-E-10				200	2	
"	5-E-8				1,800	18	
"	5-E-8 sc				220	2	
"	5-E-8 t				10	1	
"	5-E-9 bw				200	2	
Total - - -		2,810	3,580	1,530	3,140	117	

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NN005591

Table No. 12 (Cont'd) Potential Planting Possibilities

Type of Planting	Planting Number	Sub-Units Nos.1 & 2 (Acres)	Sub-Unit No.3 (Acres)	Sub-Unit No.4 (Acres)	Sub-Units Nos.5 & 6 (Acres)	Suggested Acreage for Experimental Plantings	Suggested Species
Biology	5-B-3	40				Plant according to diagram No.L-468	
"	5-B-1		60			" " " " "	
"	5-B-2		40			" " " " "	
"	5-B-8			40		" " " " "	
"	5-B-9			40		" " " " "	
"	5-B-10			100		" " " " "	
"	5-B-11			40		" " " " "	
"	5-B-12			80		" " " " "	
"	5-B-15			40		" " " " "	
"	5-B-7				80	" " " " "	
"	5-B-14				100	" " " " "	
"	5-B-4				60	" " " " "	
"	5-B-5				40	" " " " "	
"	5-B-6				30	" " " " "	
	Total - - -	40	100	340	310		
Windbreak	5-F-1	200				2	
"	5-F-1		440			4	
"	5-F-2		500			5	
"	5-F-2			30		1	
"	5-F-3			8,300		50	
"	5-F-3 sc			20		1	
"	5-F-3 t			50		1	
"	5-F-1				2,000	20	
"	5-F-1 t				70	1	
	Total - - -	200	940	8,400	2,070	85	

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NN005592

Table No. 12 (Cont'd) Potential Planting Possibilities in Acres

Type of Planting	Planting Number	Sub-Units Nos. 1 & 2 (Acres)	Sub-Unit No. 3 (Acres)	Sub-Unit No. 4 (Acres)	Sub-Units Nos. 5 & 6 (Acres)	Suggested Acreage For Experimental Plantings	Suggested Species
Woodlot	5-W-1 c		160			2	
"	5-W-2		800			8	
"	5-W-2 sc		280			3	
"	5-W-2 c		690			7	
"	5-W-3		160			2	
"	5-W-3 sc		1,030			10	
"	5-W-3 c		60			1	
"	5-W-8			1,200		12	
"	5-W-9			8,700		50	
"	5-W-11			160		2	
"	5-W-12			50		1	
"	5-W-13			30		1	
"	5-W-4 sc				160	2	
"	5-W-4 c				250	3	
"	5-W-6 sc				100	1	
"	5-W-7				30	1	
"	5-W-5 c				100	1	
	Total - - -		3,180	10,140	640	107	
Range	5-R-1	6,400				10	
"	5-R-2			1,200		12	
"	5-R-3			240		2	
	Total - - -	6,400		1,440		24	
GRAND	TOTAL - - -	9,450	7,800	21,930	6,160	525	

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NN005593

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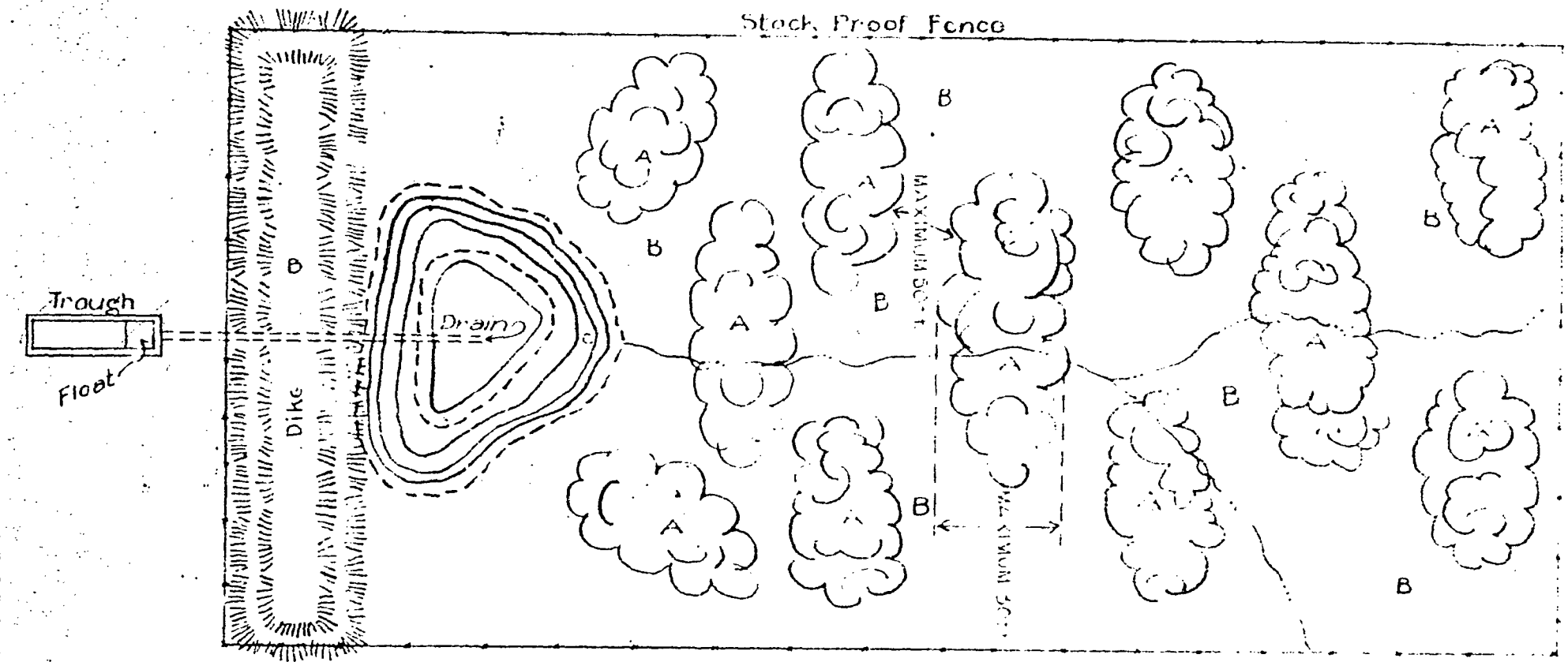
UNM 196



Plants Suggested for Propagation

A - Suitable shrubs such as, Chamisa, Greasewood, Willow, Tamarisk, Hackberry, etc.

B - Planted or natural grasses.

C - Wild Millet or Chufa in intermittent water.

Note: An arrangement of shrubs [illegible] merely to illustrate the importance of thicket cover and is not to be followed [illegible]. Spacing of drain tube [illegible] of water at average level [illegible] See diagram L-468.

DIAGRAM SHOWING USE OF SHRUB CLUMPS AS BAFFLES TO IMPEDE THE FLOW OF WATER IN RESERVOIRS, AND ALSO TO FURNISH COVER, FOOD AND MAXIMUM TENSION ZONE FOR WILDLIFE.

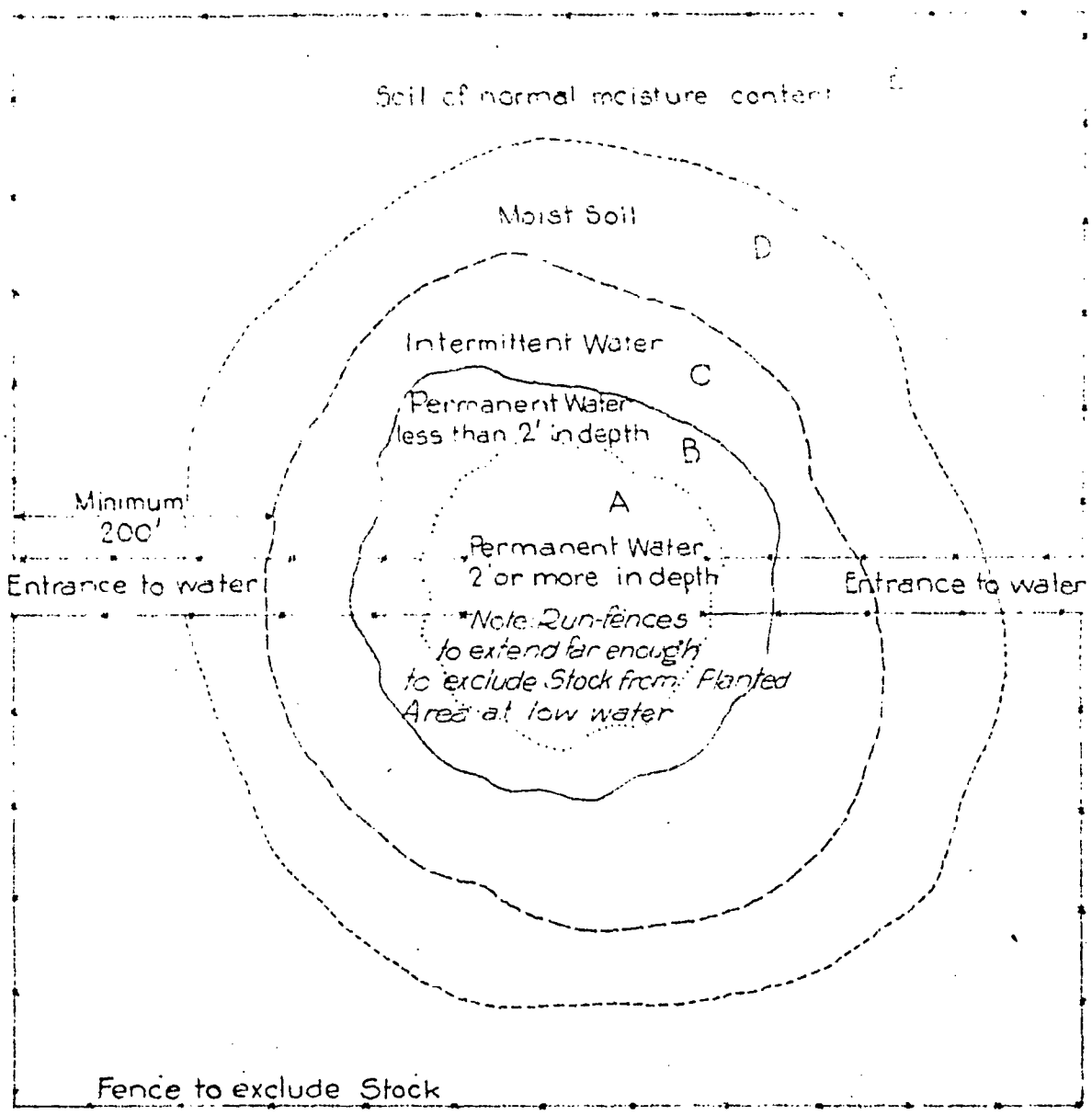
SHOWS ALSO A SUGGESTED PLAN FOR INCREASING THE VALUE OF STOCK WATERING RESERVOIRS TO WATERFOWL.

Edison Bowman — Approved [illegible] — Compiled [illegible]

L-468

72

NN005594



Plants Suitable for Propagation

A Sago Pondweed. (*Potamogeton pectinatus*)
B Wapato (*Sagittaria latifolia*), Bulrush (*Scirpus americanus*)
C Wild Millet (*Echinochloa crus-galli*), Chufa (*Cyperus esculentus*)
D Wild Millet (*Echinochloa crus-galli*), Native Sedges (*Carex sp.*)
E Native shrubs & high grasses.

IDEAL PLAN OF REFUGE FOR MIGRATORY WATERFOWL
Compiled by Paul Phillips
April 16, 1936
Reference: W L McAtee. U.S.D.A. Bulletin 465

Hale P. Benton Approved J. [illegible] L-350

UNM 1198

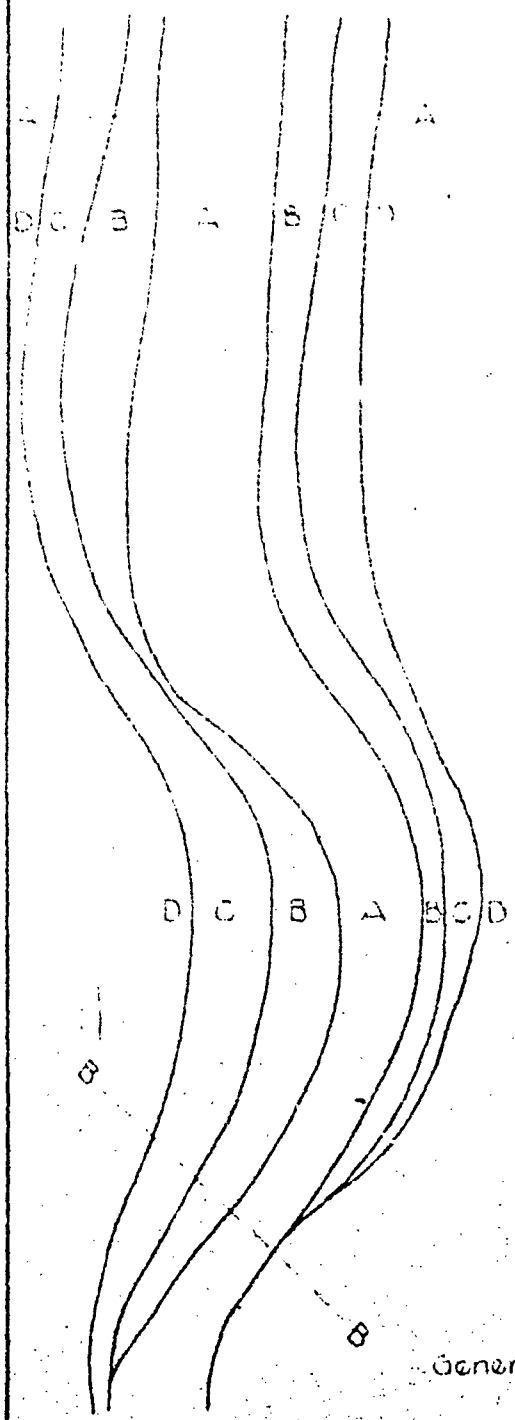


Diagram showing zonation of wash.

Section at A—A

Section at B—B

EXPLANATION

Zone A Actual stream bed, carries water at each run-off. No Planting.

Zone B. Slightly elevated above stream bed, flooded during moderate run-off. Plant with Willow.

Zone C. Semi-permanent bank, flooded during heavy run-off. Plant with cottonwood, Tamarisk, Silver-leaf Popular or Russian Olive.

Zone D. Permanent bank, rarely flooded. Plant with Chamiza or Forestaria, or Hackberry.

General Notes: This diagram is intended merely to illustrate the desired relation of shrubs and tree vegetation and is not to be followed exactly.

Number of rows of plants to be placed in zone is dependant upon width of zone.

Plantings in "Zone D" to be made in plowed furrow approximately 4' from edge of bank.

SUGGESTED PLAN FOR EROSION PLANTING ALONG WASHES, CONSIDERATION BEING GIVEN TO POTENTIAL WILDLIFE VALUES

L-470

Approved T. L. Hagen
Jerry Williams.

L-470

Compiled by Paul Phillips & D.B. Beach. Sept 30, 1936.

73A

UNM 1199

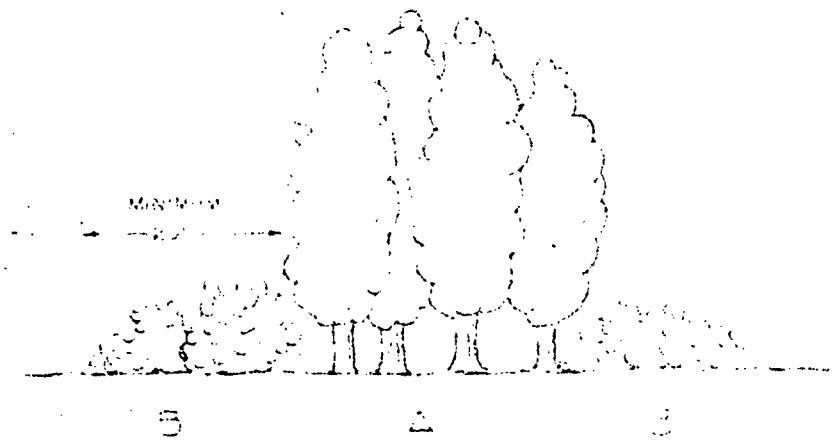


DIAGRAM OF CROSS SECTION OF WINDBREAK SHOWING PLAN FOR INCREASING VALUE TO WILDLIFE.

EXPLANATION

A-Planted to trees suitable for windbreak.

B-Planted to shrubs suitable for cover and for wildlife, suggested species include Chamiza, Greasewood, Squawbush, Redeye, Hackberry, etc.

Approved

Jerry Williams

L-479

Compiled - Paul Phillips, October 13, 1936.

73B

E. ADJUSTMENT OF WAGE INCOME:

The adjustments in land management that must be made are for the purpose of managing the natural resources on a sustained yield basis, and at the same time, the income from natural resources may increase to such an extent that additional wage work will be unnecessary.

At the present time, the major portion of the wage income in this Unit is of a temporary nature. The natural resources and their products will have to take the place of the greater part of these temporary wages. However, little is known about the effect that these wages have had on the Indians. Even though the income from the natural resources does increase to an amount commensurate with the present income from natural resources and wages, there is a possibility that the Indians have come to depend upon these wages to such an extent that stopping all temporary wages will be impossible except by a gradual reduction, allowing for a period of adjustment to new conditions.

UNM 01200

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II. CONSTRUCTION PROGRAM

A. RANGE MANAGEMENT DEVELOPMENTS

1. Range Waters

a. Maintenance Work (In Order of Priority)

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
S-M-2	Permanent ECW Spring No.41A. Put pipe deeper in ground and bring it up through bottom of trough so it won't freeze.	110°45'x35°45' 10-1/8Wx2-1/4S	SA 5085 FA 500		yearlong	120	$ 300	0	$ 25
S-M-3	Permanent Drilled Well. Repair shut-off valve, bank dirt 3 feet high around tank and overflow pipe. Fix end of overflow so it won't freeze or stop up.	110°45x36°00' 6-1/2Wx13-7/8S	SA 5000 FA 500		Yearlong	200	$ 600	0	$ 35
S-M-17	Permanent Shallow Dug Well. Fill in with dirt so water won't run in well.	110°45'x35°30' 13-1/2Wx11-3/4S	SA 2500 FA 238		Yearlong	95	$ 233	0	$ 10
S-M-28	Temporary ECW Surface Tank. Replace diversion dyke and make spillway 10 feet wider.	110°45'x35°30' 4-3/4Wx7-3/4S	SA 2400 FA 95		5 mo.	58	$ 95	?	$585

UNM 1201

NN005599

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
5-M-30	Permanent Shallow Dug Well. Re-leather pump.	110°45'x35°30' 5-3/8Wx4-1/4S	SA 5860 FA 410		Yearlong	164	$ 410	0	$ 10
5-M-34	Temporary ECW Surface Tank. Replace dam and build spillway. Dam - 1000 cu.yd. at 45¢. Spillway 400 cu.yd. at $1.50.	110°45'x35°30' 1/4W x 5-1/4S	SA 7185 FA 395		6 Mo.	158	$ 395	$ 375	$1050
5-M-35	Permanent Shallow Dug Well. Bank dirt around well to keep water out. 60 cu.yd. @ 50¢ per cu. yd.	110°45'x35°30' 3 W x 8-1/4S	SA 4025 FA 150		Yearlong	80	$ 150	0	$ 30
5-M-40	Permanent Shallow Dug Well. Re-leather handpump.	110°45'x35°30' 3 W x13-3/4S	SA 5220 FA 80		Yearlong	32	$ 80	0	$ 5
5-M-47	Permanent Shallow Dug Well. Repair hand pump.	110°45'x35°15' 1/4Wx1/4S	SA 2200 FA 90		Yearlong	33	$ 90	0	$ 5
5-M-58	Temporary ECW Charco. Repair diversion dyke. 1500 cu.yds. @ 45¢.	110°30'x35°15'	SA 5000 FA 240		6 Mo.	96	$240	$100	$675
5-M-68	Permanent Developed Spring. Clean out pipe and trough and catch the rest of the water.	111°00'x35°45' 1-1/2Wx16 S	SA 3500 FA 600		Yearlong	240	$600	0	$ 70

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NN005600

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
5-M-73	Permanent Shallow Dug Well and Spring. Repair hand pump.	110°45'x35°45' 7 W x 4 S	SA 6000 FA 720		Yearlong	288	$720	0	$ 20
5-M-86	Permanent Deep Drilled Well. Change oil in windmill.	110°45'x35°15' 11-1/8Wx3-1/2S	SA 5650 FA 420		Yearlong	168	$420	0	$ 5
5-M-88	Permanent Deep Drilled Well. Re-leather pump and change oil in windmill.	110°45'x35°15' 10-1/2Wx5-3/4W	SA 4089 FA 152		Yearlong	61	$152	0	$ 25
5-M-111	Permanent Shallow Dug Well. Repair hand pump.	111°00'x35°30' 3 W x 10-7/8S	SA 3000 FA 60		Yearlong	24	$ 60		$ 10
5-M-122	Permanent Deep Drilled Well. Fix overflow pipe so that water will drain away from it.	111°00'x35°15' 9-1/2Wx4-1/4S	SA16000 FA 3000		Yearlong	1200	$3000	0	$ 15
5-M-62	Temporary ECW Surface Tank #98B. Clean out tank. 1000 cu.yd.@ 45¢.	110°30'x35°45' 9-1/2Wx9-5/8S	SA 4100 FA 428		6 Mo.	171	$428	$100	$450
5-M-115	Temporary Surface Tank. Clean silt out of tank. 600 cu.yd. @ 45¢.	111°00'x35°30' 7 W x 10-7/8S	SA 4220 FA 581		6 Mo.	232	$581	0	$270
							Total - - - - -		$3,295

UNM 1203

CV-6417-201

NN005601

CV-6417-201

b. New Developments

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
5-H-9	Temporary ECW Charco. Clean cut silt, dig to depth of 10 feet and put silt traps in desilting plot. Deepening - 2000 cu.yds.@ 45¢. Silt traps, rock and wire, 200 cu.yd. @ $3.00.	110°45'x35°30' 8-5/8Wx2-3/8S	SA 3515 FA 225		3 Mo.	90	$225	$37.50	$1500
5-H-19	Permanent Shallow Dug Well. 15,000 gal. steel storage tank, float and float box, 60' concrete trough. Put tank on high ground 100 feet north of well.	110°45'x35°30' 13-1/8Wx15-5/8S	SA 3660 FA 330		Yearlong	132	$330	Dipping Vat	$630
5-H-20	Semi-permanent ECS Surface Tank. Put a masonry core wall through dam the length and height of water basin, as near the upper edge as possible. Masonry core wall - 80 cu. yd. @ $6.00 Excavation - 500 cu. yd. @ 75¢.	110°45'x35°30' 10-7/8Wx3-7/8S	SA 2932 FA 410		12 Mo.	164	$410	Buck Pasture	$855
5-H-44	Temporary ECW Surface Tank. Fence a 60-acre desilting plot above tank.	110°30'x35o15' 4 W x 3-7/8S	SA 6520 FA 700	1½	5 Mo.	280	$700	$225	$525

UNM 1204

NN005602

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
3-M-14	Permanent Shallow Dug Well. Clean out well, put up an 8-foot windmill, 15,000 gal. storage tank, float and float box, a and 20 ft. more concrete trough. Cleaning out well . . $10 Windmill . . . . . 325 Storage tank . . . 450 Trough . . . . . 60 Float box 60	110°45'x35°45' 10-3/4Wx15-3/4S	SA 7000 FA 935		Yearlong	374	$935	0	$935
5-M-22	Temporary ECW Charco. Deepen bar pit. 2200 cu.yd. @ 45¢ Fence an 80-acre desilting plot.	111°00'x35°30' 5-1/4Wx2-5/8S	SA 4470 FA 460	1¼	3 Mo.	184	$460	$75	$1427
5-M-26	Temporary ECW Charco. Deepen bar pit, 2200 cu.yds. at 45¢. Fence an 80-acre desilting plot.	111°00'x35°30' 3/8Wx6-3/8S	SA 9000 FA 385	1¼	4 Mo.	154	$385	$100	$1427
5-M-52	Permanent Shallow Dug Well. Excavate spring and pipe out into a concrete cistern and trough.	110°30'x35°30' 8-5/8Wx12-1/2S	SA 6500 FA 760		Yearlong	304	$760	0	$300
5-M-62	Temporary ECW Surface Tank No. 988. Fence a 40-acre desilting plot as soon as tank is cleaned.	110°30'x35°45' 9-1/2Wx9-5/8S	SA 4100 FA 428	1¼	5 Mo.	171	$428	0	$488
5-M-71	Temporary Surface Tank. Fence an 80-acre desilting plot above dam and remove old fences.	110°45'x35°45' 5-7/8Wx9-1/2S	SA 4070 FA 460	1½	6 Mo.	184	$460	$100	$585

UNM 1205

CV-6417-201

NN005603

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
5-M-46	Temporary ECW Charco. Fence a 40-acre desilting plot above dam.	110°30'x35°15' 14W x 1/4 S	SA 4130 FA 410	1¼	7 Mo.	164	$410	?	$435
5-M-59	Semi-permanent ECW Surface Tank. Fence a 100-acre desilting plot above tank.	110°30'x35°30' 9-7/8Wx4-3/4S	SA 5638 FA 430	2¼	12 Mo.	172	$430	$85	$883
5-M-63	Temporary ECW Charco. Put 200 l. ft. of rock & wire sausage in spillway. 40 cu.yds. @ $4.00.	110°45'x35°45' 3-3/8Wx16-1/2S	SA 3000 FA 180		4 Mo.	72	$180	$75	$160
5-M-65	Temporary Surface Tank ECW No. 0-75. Put wire silt traps in gullies in desilting plot. 300 L. ft. @ 15¢.	110°30'x35°45' 13-1/4Wx9-1/8S	SA 4725 FA 452		8 Mo.	181	$452	$350	$ 45
5-M-66	Temporary ECW Surface Tank No. 92. Fence 100-acre desilting plot.	110°30'x35°45' 7 S x 13 W	SA 3750 FA 235	2¼	8 Mo.	94	$235	$300	$683
5-M-75	Permanent Undeveloped Spring. Dig out and pipe out into 20' concrete trough.	111°00'x35°45' 10-5/8Wx13-3/8S	SA 5000 FA 715		Yearlong	286	$715	0	$300
5-M-80	Temporary ECW Surface Tank No. 86-C. Fence a 40-acre desilting plot above tank.	110°30'x35°45' 7 W x 13 S	SA 5000 FA 300	1	4 Mo.	120	$300	?	$350

UNM 1206

CV-6417-201

NN005604

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
5-M-76	Temporary Surface Tank ECW No. 0-79. Fence an 80-acre desilting plot above dam.	111°00'x35°45' 1-3/8Wx9-3/4S	SA 6000 FA 240	2½	6 Mo.	96	$240	$75	$675
5-M-115	Temporary Surface Tank. Fence a 40-acre desilting plot.	111°00'x35°30' 10-7/8Sx7 W	SA 4220 FA 581	1	6 Mo.	232	$581	?	$350
5-M-128	Permanent Shallow Dug Well. 15,000 gal. storage tank $450 10 ft. windmill . . . . 325 Trough, 20' concrete . 60 Float box, concrete . . 30	110°45'x35°30' 6-1/4Wx15-1/4S	SA 3520 FA 860		Yearlong	344	$860	0	$865
5-M-129	Proposed drilled well. Drilling - 150' @ 7.00 $1050 Tank, 15,000 gal. . . . 450 Float box, concrete . . 30 Trough, 40', concrete . 120 Windmill, 14' 530	110°30'x35°45' On Wash 1-3/4W x 22ft	SA 11000 FA 800		Yearlong	320	$800	0	$2180
5-M-130	Proposed Drilled Well. Drilling - 150' @ $7 . $1050 Windmill . . . . . 530 Tank, 15,000 gal. . . 450 Trough, concrete . . . 120 Float box 30	110°45'x35°45' 1/2 W x 8-7/8S on Oraibi Wash	SA 9000 FA 625		Yearlong	250	$625	0	$2180

UNM 1207

CV-6417-201

NN005605

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
5-K-132	Proposed Drilled Well. Drilling - 200' @ $7 . $1400 Windmill, 14' . . . . 530 Tank, 15,000 gal. . . . 450 Trough, 40' concrete . . 120 Float box, concrete. . . 30	111°00'x35°30' 6-7/8Wx4 S	SA 9440 FA 1243		Yearlong	497	$1243	0	$2530
5-K-133	Proposed Drilled Well. Drilling - 300' @ $7 . $2100 Windmill, 18' . . . . . 530 Tank, 15,000 gal. . . . 450 Trough, 40' concrete . . 120 Float box, concrete . . 30	110°30'x35°30' 13-1/4Wx11-3/4S	SA10500 FA 700		Yearlong	280	$700	0	$3230
5-K-15[illegible]	Permanent Shallow Dug Well. Deepen well and case off quick sand. Put in hand pump.	111°00'x35°30' 2-1/2Wx13-1/4S	SA 5115 FA 524		Yearlong	209	$524	0	$ 55
5-K-25	Shallow Dug Well. Dig 10' deeper. 10' @ $2.50 . . . . . $ 22.50 Trough, 20' concrete . 60.00 Hand pump 35.00	111°00'x35°30' 7-5/8Wx1-1/4S	SA 3555 FA 362		Yearlong	145	$362	0	$118
5-K-69	Temporary Indian Surface Tank. Clean out and build up old tank. 1500 cu.yd. @ 45¢.	110°45'x35°45' 8-1/4Wx13-1/4S	SA 5640 FA 306		6 Mo.	122	$306	?	$675

UNM 1208

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NN005606

Project Number	Description and Recommendations	Location	Area Serviced	Miles of Fence	Length of Service Period	C.C. S.U. Y.L.	Est. Value to Stock	Est. Value for Erosion Control	Est. Cost
5-M-131	Proposed Drilled Well Drilling - 100' @ $7 . . $700 Windmill, 12' . . . . . 530 Tank, 15,000 gal. . . . . 450 Trough, 40', concrete . . 120 Float box, concrete . . . 35	110°45'x35°45' 3-7/8x15 S	SA19000 FA 600		Yearlong	240	$600	0	$1835
5-M-135	Proposed Surface Tank 3500 cu. yds. @ 45¢ 80-acre desilting plot.	111°00'x35°45' 12-3/4x6-3/4S	SA 4750 FA 418	2	6 Mo.	167	$418	$100	$1825
5-M-134	Proposed Surface Tank 2500 cu. yds. @ 45¢ 80-acre desilting plot.	110°45'x35°45' 4-7/8x12-7/3S	SA 7500 FA 320	2½	6 Mo.	128	$320	$200	$1875
							Total - - - - -		$29,611
							GRAND TOTAL - - - - -		$32,906

DNM 1209

CV-6417-201

NN005607

2. Dipping Vats:

a. Maintenance:
(In Order of Priority)

1. Sand Springs Dipping Vat

110°45' x 35°45' - 10-1/8" W x 2-1/4" S

at Dinnehbito Trading Post.

Clean out the well and repair pump. Repair house so as to eliminate further damage to equipment.

Well and pump repair	Estimated cost	$ 25
Repairing house	Estimated cost	$ 30
	Total	$ 55

2. Tolani Lakes Dipping Vat

110°45' x 35°30' - 5-3/8" W x 4-1/4" S

at Red Lake Trading Post.

Replace the pinon posts in these corrals with juniper posts and build a house around the scales to protect them from the wather and trespass.

Posts, 50 8-foot Juniper @ 50¢	$ 25
Setting posts	$ 30
Scale house	100
Total . . .	$155

Total Maintenance - - - - - - $210

UNM 1210

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b. New Developments:

Leupp Dipping Vat

110°45' x 35°30' - at Leupp Agency.

Move this vat to windmill No. 5-15-19. Put the vat and pens on high ground 500 feet north of windmill. Put up a 5000 gallon tank at the vat, an engine at the well (2½ H. P.) and a pipeline from the well to the tank at the vat.

Vat (concrete) and corrals	$1,500
Tank, 5000 gal. steel	250
Pipe, 1-1/2" galv. 500' @ 32¢	160
Engine, 2½ H. P.	80
Pump jack	40
Total	$2,030

Grand Total on Dipping Vats ---- $2,240
Total of all Range Management Projects $35,146
Total of Range Management Projects $35,146

UNM 1211

CV-6417-201 NN005609

B. FARMLAND DEVELOPMENTS

1. Subjugation of Present Farmland
(Projects in Order of Priority)

Quad. No.	Farm No.	Acreage	Present Crops	Suggested Crops	Type of Farm	Class of Land	Soils	Erosion	Available Water	Recommendations	Acres to be Subju.	Cost per Acre	Total Cost
Sub-Unit No. 4:													
18	11 to 22	194	Corn 177 Beans 1 Squash 1 Melons 15	Corn Beans Melons Sorghum Alfalfa Oats Wheat	Flood	A	Clay to SL	Slight wind and slight gully	Sufficient (Agronomy)	Leveling and bordering	194	$15	$2910
Sub-Unit No. 5:													
18	6 7 8 1	123	Corn 116 Squash 3 Beans 1 Melons 3	Same	Flood	A	SL	Mod. wind	Low except when River overflows (Agronomy)	Li.ter planting and windbreaks	123	$ 5	$615
Sub-Unit No. 3:													
64	10	50	Idle	Corn	Flood	B	SL Clay	Severe wind	Low (Agronomy)	No subjugation until erosion control is completed on the whole valley.	50	$15	$750
										Total . . .	367	. . .	$4275

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UNM 1212
NN005610

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2. Subjugation of Potential Farmland
(Projects in Order of Priority)

Quad. No.	Farm or Project Number	Suggested Crops	Type of Land	Class of Land	Soils	Erosion	Available Water	Recommendations	Acres to be Subju.	Cost per Acre	Total Cost
Sub-Unit No. 4:											
18	Farms 11 to 22 Tolani Lakes	Corn Beans Melons Sorghum Alfalfa Oats Wheat	Flood	A	Clay to SL	Slight wind and Slight gully	7000 acre ft. or approx. 2 acre feet per acre of land (Engineering)	Leveling and Bordering	2000	$15	$30,000
Sub-Unit No. 5:											
18	Farms 6, 7, 8 and 1. At Leupp.	Corn Squash Beans Melons	Flood	A	SL	Moderate wind	Low	Lister plant. Detailed soils and engineering surveys needed.	800	$ 5	$ 4,000
Sub-Unit No. 3:											
64	Farm 10	Corn	Flood	B	SL Clay	Severe wind	Low	No subjugation until erosion control is completed on the whole valley	50	$15	$ 750
								Total . .	2850		$34,750

UNM 1213

NN005611

Quad. No.	Farm or Project Number	Suggested Crops	Type of Land	Class of Land	Soils	Erosion	Available Water	Recommendations	Acres to be Subju.	Cost per Acre	Total Cost
Sub-Unit No. 5:											
68	Farm #3 Eng. Project No. 6	Corn Sorghum Melons Alfalfa	Flood	B	CL SCL	Slight wind	Sufficient (Agronomy) Pump water	Leveling and bordering. Not to be developed unless the land at Leupp (Farms 6, 7, 8 and 1, Quad. No. 18) cannot be developed and there is not enough land at Tolani Lakes.	100 To put the water on land would cost about $16,500 or approximately $165 per acre.	$15	$1500

UNM 1214

CV-6417-201

NN005612

C. ENGINEERING STRUCTURES

1. Range Waterspreading and Erosion Control
(In Order of Priority)

Watershed and Location	Description of Project	Project Number	Quad. No.	Soil	Max. Flow	Rangeland Benefited: Surface Acres	Rangeland Benefited: Forage Acres	Rangeland Benefited: Value	Estimated Cost	Remarks
Oraibi Between the Leupp-Oraibi Highway and the Dennehbito Wash north west of Tolani Lakes	Four structures are recommended. These structures are to be rock and wire drop structures. At each structure there are to be earth diversion dykes,* auxillary spillways, etc. (See engineering report for further details.) *spreader dykes,	EC #1	110°45'x 35° 30' and 111°00'x 35°45'		1500 to 2400 s/f	App. 6000	App. 1000	$7500	$7546	The project proposes to protect valuable range land which will destroyed if not protected. The vegetation is saccaton and chamise. Further justification can be warranted by the fact that if this area is not protected the Tolani Lakes Irrigation project will be endangered.
Jeddito At the junction of Coyote and Jeddito Washes.	Earth dykes and drop structures to protect severe head cutting.	EC#2			1500 s/f	App. 4000	App. 350	$2625	$4500	No work recommended until further surveys completed on the drainage in Unit No. 7. 40 acres of farmland to be protected here also.

UNM 1215
CV-6417-201
NN005613

Watershed and Location	Description of Project	Project Number	Quad. No.	Soil	Max. Flow	Rangeland Surface Acres	Benefited Forage Acres	Value	Estimated Cost	Remarks
Jeddito From its confluence with Coyote Wash north to quad. line.	Gully head protection and water spreading.	EC #3			?	App. 4000	App. 350	No estimates or recommendations have been made because no study of this watershed has been made in Unit No. 7. Recommendations and estimates will be made upon the completion of study in Unit No. 7.		

2. Roads

Construction of 15 miles of car trail along the east side of the Dinnehbito Wash beginning at Sand Springs and runing south and east, (around Garcia Mesa) to the Leupp - Oraibi road at a point just north of the Tolani Lake Bridge.

Gullying and headcutting protection is needed. Value to range land estimated at $50.00 to $75.00. Estimated cost - 15 miles at $27.00 per mile -- $405.00

UNM 1216

CV-6417-201
NN005614

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3. Rejected Potential Farmland Developments

Watershed and Location	Description of Project	Project Number	Quad. Number	Soil	Water	Acreage	Cost	Reasons for Rejection
Little Colorado River, 13 miles east of Leupp on north side of river.	Would necessitate a heading in the Little Colorado River, bordering and leveling.	#2	110°00'x35°15'	300 acres of "B" and "C" 480 acres of C and D.	Low at present. Would have water only when river was running. Floods may do great damage.	780	? (High)	Alkali content high. Could raise only native hay. In a few years this project would be denuded of all vegetation because the alkali concentrations would tend to increase.
Little Colorado River. 2½ miles below the Sunrise Bridge on the north side of the river.	Would necessitate a heading in the Little Colorado River and bordering and leveling.	#3	110°00'x35°30'	200 acres of "B" land Ag. land.	Low at present. Floodwater when river running.	200	$1500 for wanal heading $3000 to subjigate Total app. $4500	Detailed soil survey needed before any work is done. Project would probably be short lived because of the unstable nature of a heading in the river. Land isn't needed at the present time. Alkali concentrations may increase.

UNM 1217

NN005615

CV-6417-201

3. Rejected Potential Farmland Developments

Watershed and Location	Description of Project	Project Number	Quad. Number	Soil	Water	Acreage	Cost	Reasons for Rejection
Polacca Wash 8 miles N.E. of Red Lake Day School	A masonry partial diversion structure.	#4	110°45'x35°30' 1"Sx2"W	1000 acres "A" and "B" Ag. land	Excess	1000	? (High)	Land not needed at present. May be needed if Tolani Lake project doesn't work as expected. Detailed soils and engineering surveys will be needed if this project is to be developed. Cost will be high but lands apparently good.
Dinnehbito Wash Natani Diversion Dam	A masonry partial diversion 25 ft. high with a weir opening 175 ft. x 9 ft.	#5	111°00'x35°45'	90 acres of "B" and "C" land	Not at present. Excess if diversion dam were built	90	$15,000 for dam	Cost too high. No range land benefited. Black alkali present which may become dangerous in a short time.

UNM 1218

NN005616

D. Fencing for Erosion Control

Fence for erosion control app. 4,800 acres.

Location: 110°45' X35°45'-- 9½"W X 7"S.

7 miles of fence @ $300----------$2100

There are active sand dunes at this location which are moving in a north easterly direction and threatening valuable range land.

UNM 1219

CV-6417-201 NN005617