NEW MEXICO STATE UNIVERSITY

An Intensive Archaeological Clearance Survey of Four Sections of Indian Allotment Land Conducted for United Nuclear Corporation

Dabney Ford
Suzanne DeHoff

Report 77-SJC-078
of the
Cultural Resource Management Program
San Juan Campus
New Mexico State University

June 1977

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Permit 75-NM-018
Permit 75-NM-013

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ABSTRACT

Members of the Cultural Resource Management Program, San Juan Campus, NMSU, conducted an intensive archaeological clearance survey of Sections 12 and 13, Township 16 North, Range 17 West, and Sections 8 and 17, Townshio 16 North, Range 17 West in the Church Rock/Hard Ground Flats area, McKinley County, New Mexico, N.M.P.M. The purpose of the project was:

1. To locate and record all cultural resources in the designated area
2. To recommend measures to be taken for protection of the resources and,
3. To gather and synthesize data on the environmental adaptations, land use strategies, and settlement patterns of the prehistoric inhabitants of the Rio Puerco of the west.

INTRODUCTION

During the first two weeks of June 1977, Dabney Ford and Suzanne DeHoff of the Cultural Resource Management Program, San Juan Campus, NMSU, surveyed four sections of Navajo Tribal lands, public domain, and private lands. This area will be subject to uranium exploration and mining by United Nuclear Corporation. The specific areas surveyed include: 3/4 of Section 12, all of Section 13 in Township 16 North, Range 17 West, 1/8 of Section 7 and all of Sections 8 and 17 in Township 16 North, Range 16 West, N.M.P.M. (see Map 1). The entire area is in McKinley County, New Mexico. Subsurface minerals are federally owned; an account of specific surface land statis can be found in Map 2. The project was surveyed under Federal Antiquities permit 75-NM-018 and 75-NM-013.

METHODOLOGIES

The survey area was examined by using two methods depending upon the terrain to be covered. Linear transects are impractical in areas of considerabel topographic variability; mesa rims, canon bottoms and rims. In these areas survey techniques were adapted to fit the land forms. On the flood plains and foothills, transects were walked with 30 to 35 meters between crew members.

When cultural remains were encountered, the immediate area was intensively examined and categorized into one of three designations:

1. Occupation or Utilization Site - an area occupied or used by humans for a long enough period to create features or deposit a number of artifacts (West et.al., 1976). All cultural re-

sources designated as sites are considered here to be significant and require avoidance and/or protective measures. Recommendations for these measures are outlined in Table I.

2. Rock Art - All petroglyphs and pictographs located on this survey are recent historic (post 1940). Due to their location and nature, it is felt that graphically recording and locating these occurences is sufficient. Therefore, no avoidance or protective measures are recommended.
3. Isolated Occurences - These are areas or instances of cultural resources which lack valid horizontal or verticle context, sufficient data for interpretation, or immediate historical or archaeological significance. These occurances have value as research items or in broad interpretation. This is a catch-all category for occurences which merit recording and locating but no avoidance or protective measures.

Every site, rock art example, and isolated occurence located during the survey was given a field number and plotted on a U.S.G.S. topographic Quadrangle map and U.N.C. Orthophotographic topographic section map (of the latter, Section 7 and 17 were not available). It was originally planned to mark with yellow flagging all sites recorded. This proved to be unfeasable due to voracious herds of goats, and possible harmful consequences of blatant identification of artifact concentrations. Therefore, the sites flagged were ones which could not be pin pointed on the Quad maps, or readily recognized to be avoided.

Collections were made on a number of the sites and isolated occurences (see individual site reports and cultural resource section summaries). Sherds were collected for microscopic analysis when field identification was not possible. The policy for collecting on small isolated occurences was to break the collected sherd, taking only ½ for lab analysis. On large concentrations, sherds for collection were chosen for their diagnostic traits to aid in identification. These collections were non-random and do not reflect percentages of particular types on the site.

The following are section summaries which include general terrain, vegetation, cultural resources, and maps.

SECTION 7

A small portion of Section 7 was surveyed in addition to the four sections (see Figure 2). The area involved was composed of a steep sided canon in which no cultural resources of any kind were found.

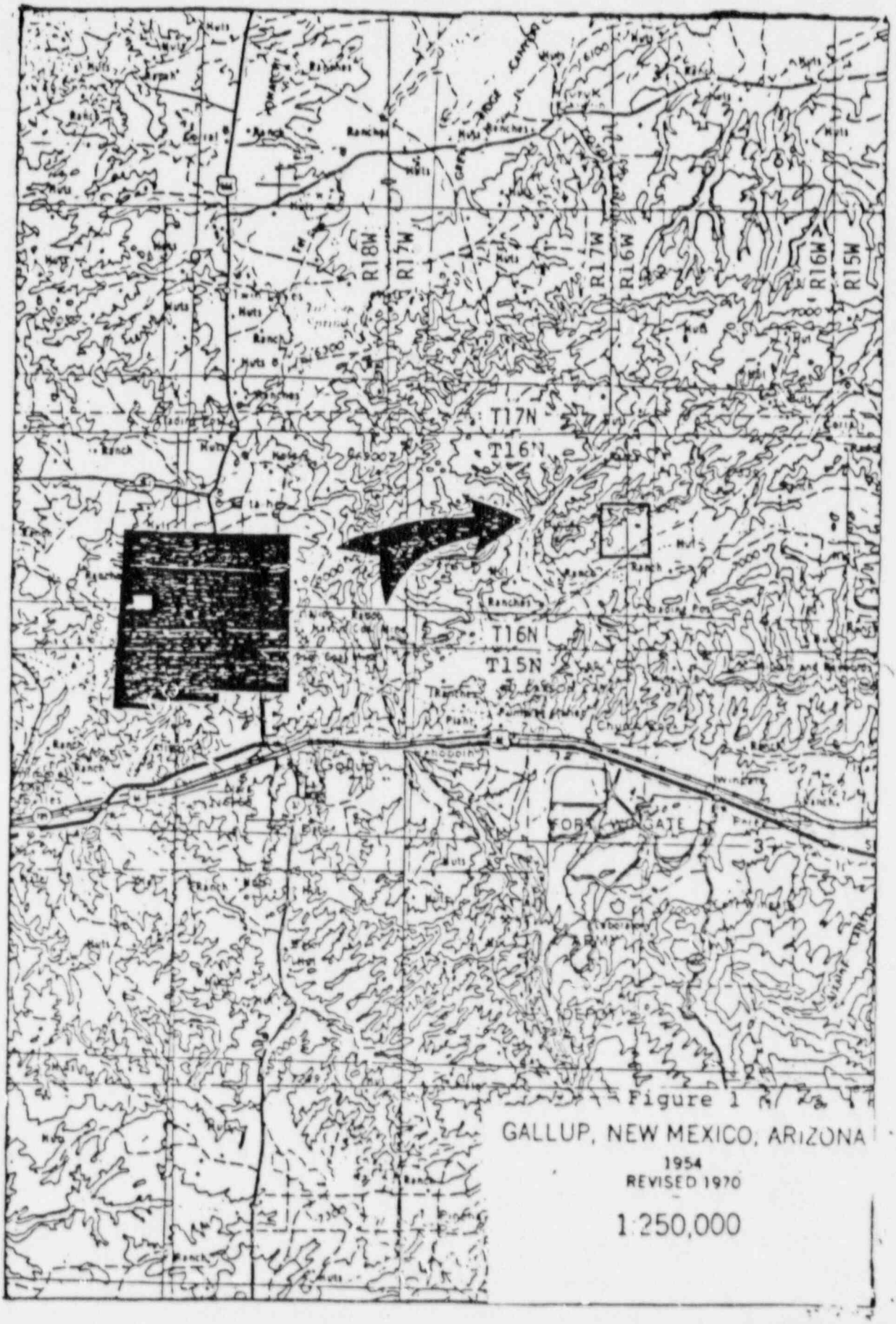

R18W
R17W
R17W
R16W
R16W
R15W
T17N
T16N
T16N
T15N
GALLUP, NEW MEXICO, ARIZONA
1954
REVISED 1970
1:250,000

Figure 1

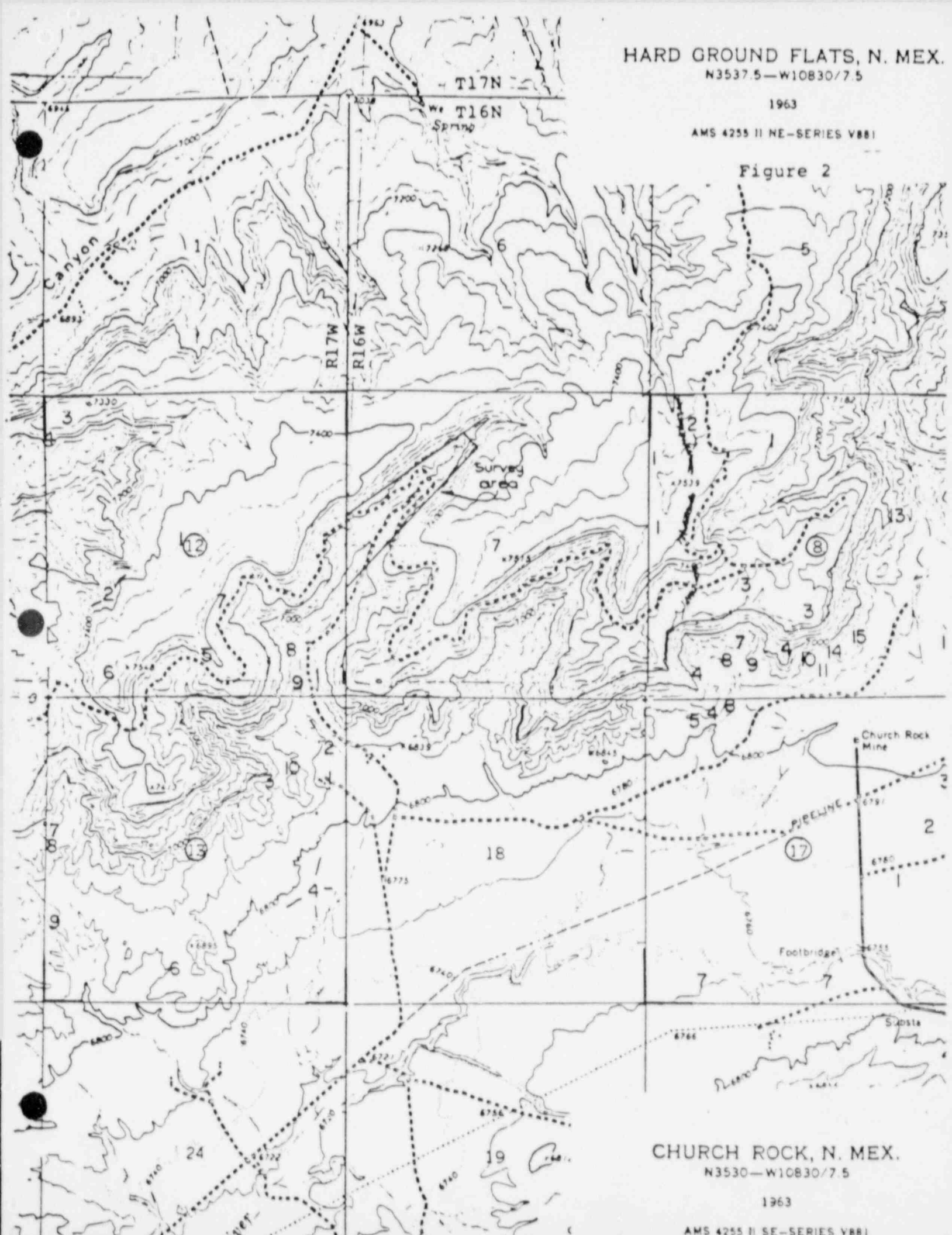
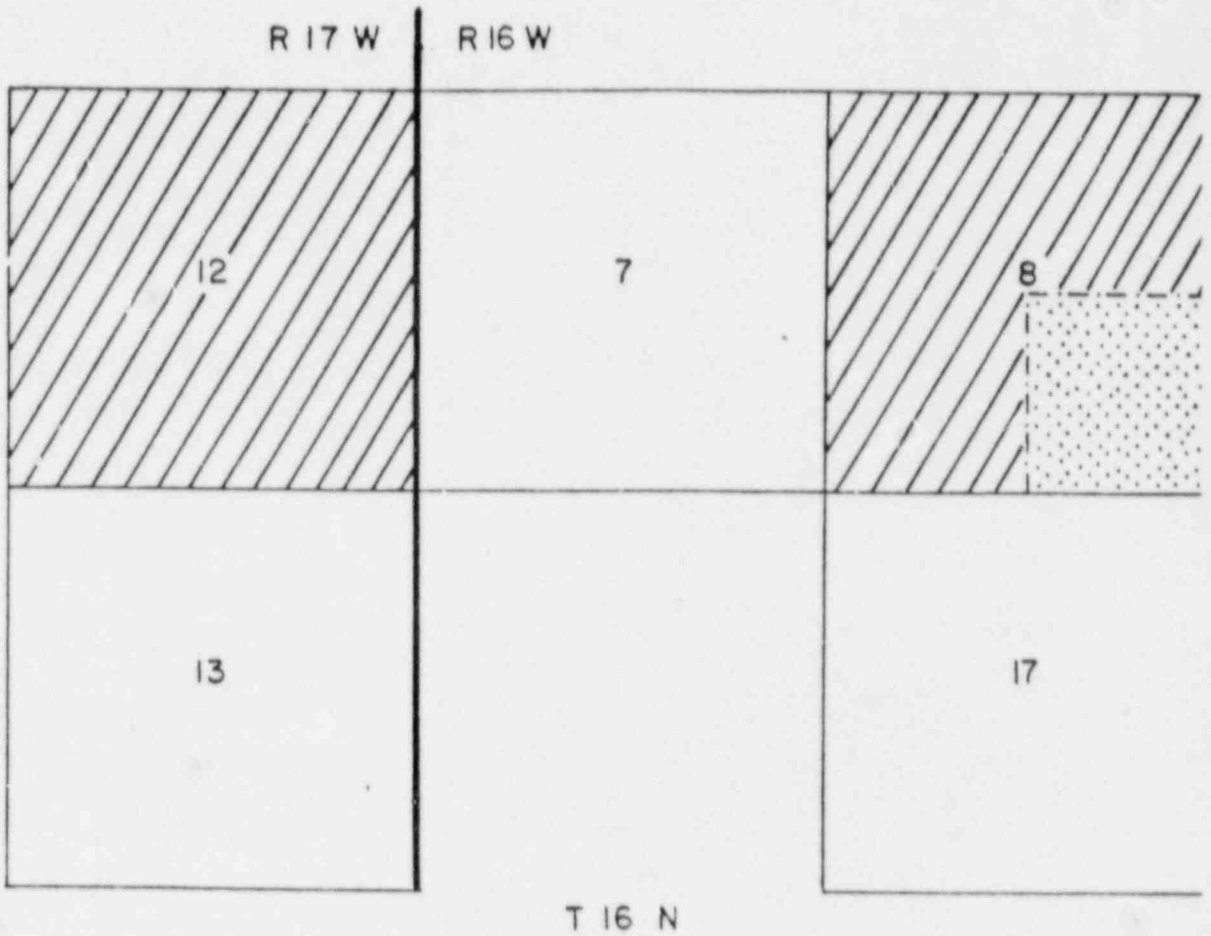

HARD GROUND FLATS, N. MEX.
N3537.5—W10830/7.5
1963
AMS 4255 II NE-SERIES V881
T17N
T16N
R17W
R16W
Canyon
Spring
Survey area
Church Rock Mine
PIPELINE
Footbridge
CHURCH ROCK, N. MEX.
N3530—W10830/7.5
1963
AMS 4255 II SE-SERIES V881

Figure 2

Map 2

*Land Status of survey area



*—taken from current Bureau of Land Management ownership maps

TABLE I

SITE MITIGATION RECOMMENDATIONS

As mentioned in the methodology section only those cultural resources designated as sites are to be avoided. The resources labeled "isolated occurences" and "Rock Art" were recorded and plotted on the quadrangle maps but, due to their limited data potential, do not require avoidance.

The following are those cultural resources requiring avoidance:

UNC 3: Sites

8-7	13-1
8-10	13-2
8-11	13-7
8-12	13-8
8-13	13-10
8-14	
8-15	17-5
	17-8
12-1	
12-4	
12-6	

SECTION 8

Approximately one third of Section 8 is mesa top. The dominant drainage off the mesa is to the east into the arroyo making up 1/3rd of the section. Two topographic zones form the balance of section 8; cañon or mesa rims and flood plain.

The soils on the mesa top are similar to the ones described in section 12 and 13, however vegetation appears more dense in section 8. Several north facing drainages in the NW¼ support a variety of shrubs including gambles oak (Quercus gambelii), mountain mahogany (Cercocarpus breuiflorus), squaw current (Ribes cereum), fragrant ash (Fraxinus cuspidata), shunkbush (Rhus nilobala). Also growing on the mesa were pinon (Pinus edulis), juniper (Juniperus monosperma), ponderosa pine (Pinus ponderosa), blue grama (Boutelbua gracilis), sagebrush (Artemesia tridentata), Ergonum spp., indian paintbrush (Castilleja integra), narrow leaf and Datil yuccas (Yucca angustissima and Y. baccata), rock speraea (Petrophytum caespitosum), and aster (Aster arenosus).

The upper mesa rims have a basic pinon/juniper plant cover. The lower rims, being mostly talus, have a sparce vegetative community. This is also due to their southern exposure as well as the less developed soils. The rims are from 7000 to 7200 feet in elevation.

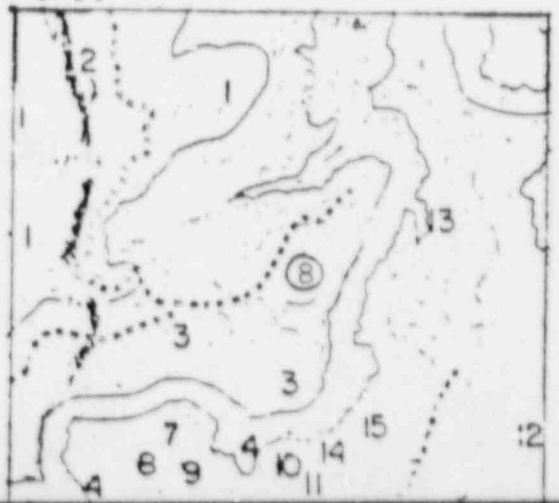
The major cañon in the area flows south directly into the Rio Puerco. The upper portion of the drainage system in section 8 is

composed of steep sheer-sided canon walls with several isolated stands of douglas fir (Pseudotsuga taxifolia). In the southeast ¼ of the section, the canon opens out on to the flood plain.

The Rio Puerco canon bottom, or flood plain, makes up the final topographic zone. Soils range from rocky gravelly clays near the mesa, clays and sandy clay nearer the Rio Puerco. The vegetation is difficult to identify due to heavy grazing but include several grasses, Bouteloua spp., Orycopsis spp., Muhlengergia spp., and Sporobolus spp.

Five prehistoric and two historic sites, four prehistoric and one historic isolated occurences, and one petroglyph were found in section 8. The following are a list of the cultural resources found and site reports.

UNC 3: 8-1 (I.O.) Sherd (B/W and Corrugated) scatter on mesa top and 1st rim down - 1 sherd per 30 sq. meters spread over ¼ of section.
UNC 3: 8-2 (I.O.) Axe-cut brush fence running north-south entire length of mesa and 1st and 2nd rims.
UNC 3: 8-3 (I.O.) Sherd scatter on 2nd rim, flake of pedernal chert 10-15 sherds total - spread over 1/6 of section.
UNC 3: 8-4 (I.O.) Sherd scatter on low benches above flood plain - 4 sherds total
UNC 3: 8-7 (Site) Large trenched pueblo, bulldozed road
UNC 3: 8-8 (I.O.) Possible water control
UNC 3: 8-9 (Petro) Two sandstone slab petroglyphs
UNC 3: 8-10 (Site) Western pueblo
UNC 3: 8-11 (Site) Middle pueblo
UNC 3: 8-14 (Site) Eastern pueblo
UNC 3: 8-13 (Site) Sweathouses
UNC 3: 8-12 (Site) Navajo rock ring
UNC 3: 8-15 (Site) Bulldozed pueblo



SECTION 8

UNC 3: 8 - 7

Site 8-7 is a large sandstone masonry pueblo with several associated surface structures and a kiva. The pueblo of 20 to 30 rooms appears to be single storied, with a central room block and two wings. Five meters north of the pueblo are two rather large square rooms constructed of large rough sandstone clasts. The kiva depression is directly south of the pueblo and is approximately 10 meters in diameter with 1.5 to 2.0 meters of fill. The artifact scatter is very heavy on and around the site. The lithics included chert, rhyolite, and possibly basalt cores, flakes, and flake tools. One rough metate and several sandstone rectangular manos made up the ground stone on the surface. Sherds included:

PII - PIII indented corrgated gray wares
Wingate black/red
Puerco black/white
Gallup black/white
Chaco black/white (?)
Red Mesa/Puerco black/white
Escouado black/wh

150 meters to the southwest is isolated occurence 8-8, a possible water control dam. This may be similar to the water control systems discussed in the UNC 3:8-14 site narrative.

Site 8-7 is on the southern slope of a bench directly below the mesa. It is in a protected "cove" and thus sits well back off the flood plain proper. A shallow (20cm) trench has been made across the site and recent heavy equipment tracks can be seen on the west section of the pueblo.

It is recommended that site 8-7 be avoided with the exception of

some recent disturbance (which appears to be relatively minor) the site is in good condition. Being one of the major habitation sites, the pueblo can yield data concerning local life systems as well as regional cultural and trade affiliations.

UNC 3: 8-10

Site 8-10 is one of three pueblos located within 5 meters of each other. This pueblo is the smaller and westernmost of the three. It is constructed of tabular sandstone in a "L" shape with 20-30 rooms. The rubble mound forming the east wing appears to be deep (3.0 to 3.5 meters) and may represent two stories. There is a distinct kiva depression to the south in the crook of the "L". An additional structure 100 meters south of the pueblo, is constructed of large sandstone clasts & has a 3-sided rectangular shape. The trash mound is southeast of the pueblo and may be from 1.0 to 1.5 meters deep. Lithics are mainly local cherts and petrified wood cores and flakes. Two sandstone trough metates and four sandstone manos (rectangular unifacial and round bifacial) were found on the rubble mound. Sherds are PII - PIII wares and include:

Neck coiled gray ware - Tohatchi banded ?
Chaco black/white
McElmo black/white
Puerco/Escovado black/white
Wingate black/red
St Johns black/red

The site is on a broad alluvial fan slightly raised above the Rio Puerco flood plain. There is a good sized arroyo due west of the pueblo and the Rio Puerco is 1 mile south. The trash mound and clast structure appear to have been archaeologically tested, evidenced by square test

pits. No information on who conducted the testing or when it was done.

It is recommended that Site 8-10 be avoided. It, in conjunction with the other two pueblos of the trio would be ideal subjects for studying inter and intra-site relations, social structure and systems, and external contacts if any.

UNC 3: 8-11

Site 8-11 is the middle and largest of the three associated pueblos. The site consists of a 20-30 room sandstone slab pueblo in a slight "U" shape, one kiva depression, a second slight depression, and a trash mound or midden. Associated spatially but not temporally are several historic petroglyph panels. These are on a large colluvial boulder behind or north of the pueblo. The distinctive kiva depression is south and partially surrounded by the pueblo. A second depression, probably a kiva, is northeast of the structure. The mid section of the pueblo has fill possibly 3 meters deep and may represent a two storied segment. The trash mound is southeast of the pueblo complex and, similarly to the accompanying two pueblos, has been archaeologically tested. No information on this testing could be found. This site is 15 meters east of 8-10 and the artifact scatters are essentially identical, especially with regards to the pottery.

Site 8-11 is on the same alluvial fan as 8-10 and 8-14 and also near an arroyo draining the mesa top.

It is recommended that Site 8-11 be avoided. As mentioned in the 8-11 narrative, this site is part of a unique complex which lends itself to a study of prehistoric social systems. In addition the presence of a second kiva may indicate a construction sequence and reveal possible reasons for expansion or addition.

UNC 3: 8-12

Site 8-12 is located on a small knoll on the edge of the valley bottom to the east of the arroyo in the SE¼ of Section 8.

The late historic Navajo site consists of a 2 meter circle of sandstone rocks. The height of the stones ranges from 10 to 25 cm. No mortar was found nor were any other sandstone slabs found which would indicate that the wall had ever been higher. The only cultural remains found near the stone circle were two modern pop bottles. There were no signs of any other remains or any sub surface structure.

The site appears to be in good condition and avoidance is recommended.

UNC 3: 8-13

Site 8-13 consisted of two seperate sweathouses. Both are constructed from axe cut juniper branches. They appear not to have been used recently and the larger brush is all that remains of the structures. Other materials in the area include fire cracked rocks of sandstone and a few quartzite cobbles.

The sweathouses are located on an eastern bench in the NE¼ of Section 8. 8-13 is about 20 feet lower than 8-13B and approximately 15 meters to the east (see drawing). 8-13 is about 2 meters in diameter and 1 meter high. There is fire cracked rock just to the west of the sweathouse. The doorway is facing south.

8-13B is approximately 1 meter wide and 2 meters long. There is a dug out area about 1½ feet deep on the interior of the sweathouse. The doorway is facing east. There is a tree on the west end.

Recommended mitigative action for the site is avoidance.

UNC 3: 8-14

Site 8-14 is the easternmost of the pueblo triplex. This site consists of an "L" shaped tabular sandstone pueblo, two depressions-probably kivas, two large square clast structures, a trash and rubble mound, and a possible water control device. The pueblo, 20-30 rooms, may be multistoried in the mid section. The kivas are south, and northeast of the pueblo - a pattern similar to Site 8-11. The two rough clast square surface rooms are north - northwest of the pueblo, similar to the ones on Site 8-7. The trash mound has considerable sandstone rubble in it and may represent a structure as well. It like the trash mounds at 8-10 and 8-11 has been tested within the last 3 or 4 years. The final feature on site 8-14 is a possible water control dam. The structure is dubious, being very hard to detect, but has resulted in a silt buildup behind it which is readily apparent. Whether from natural or man-made causes this silted area is richer (in soil nutrients) and slightly more moist than the surrounding soil in or outside of the arroyo. Consequently vegetation is somewhat different. Large cane cholla (Opuntia acanthocarpa) was found on the flood plain, but is rare in this particular area. In the silt behind the water control device there is an isolated stand of cholla. The ground stone found on 8-14 resembles examples found on 8-10 as do the lithics, with the addition of an obsidian core. Pottery sampled included:

Tohatchi banded ?
Puerco/Escovado black/white
Red Mesa/Puerco/Escovado black/white
Socorro black/white

This pueblo, like the other two is on a broad alluvial fan cut by the three arroyos draining the mesa top. The Puerco is less than

a mile to the south.

It is recommended that Site 8-14 be avoided. It's importance lies primarily in its association with the other two pueblos, and the possible presence of a water control system If in fact the latter is present, the site could provide substantial definitive data on subsistance strategies which could perhaps be applied to both a local and regional spectrum.

UNC 3: 8-15

This site is located on the south slope of the valley bottom between the bluffs and arroyo in the SW¼ of the SE¼ of Section 8.

The site is puebloan and consists of several one story room blocks 100 to 200 feet apart. The artifact abundance is in the 1000's and includes sherds, flakes, retouched lithics, ground stone, fire cracked rock, and sandstone blocks. The sherds indicate a PII - PIII time period. They include:

Tulorsa corrugated
Chaco corrugated
Wingate black/red
Chaco black/white
Red Mesa black/white
Gallup black/white
Puerco black/white

There are several other pueblos located to the west of this one and also one about 1 mile south just across the Puerco River. This indicates a large population in the area around 1000 A.D.

There are several drill holes and a road in and around the site and some disturbance has occured.

It is recommended that if the site cannot be further avoided, some test excavations be made. Since there are similar and better conditioned sites of the same period in the area, a full scale excavation would probably not be necessary.

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-126 Field number UNC 3:8-7

SW ¼ of the SE ¼ of the SW ¼, Sec. 8, T. 16 (N) S, R. 16 (E) (W), County McKinley State NM

Map source Hard Ground Flats Quad - USGS Elevation _____

Drainage: primary Rio Puerco secondary _____

Location on southern slope of bench coming off mesa's south expance also extends onto flood plain.

Nearest town _____ Nearest highway _____ Accessibility: foot ___ sedan ___ 4-wh. dr. ___ backhoe

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ___ Bench ___ Slope X Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other flood plain (alluvial fan) Area of site 10,000 sq. meters

FEATURES *(Indicate number)*: Pit houses ___ Kivas 1 Surface rooms: Slab 20-30 Masonry ___ Adobe ___ Other _____

Refuse area *(direction)* S Hearths ___ Burials ___ Sherd/Chipping area S Grnds/Dams/Terrace WSW Pictographs/Petroglyphs ___

Trails/Steps ___ Other _____

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped ___ C-shaped X F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other _____

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier X Part ___ tier ___ Orientation ___ Exposure ___

Nature & depth of fill rubble .5 to 2.5 meters Est. Wall height 3m Stratified? ___

Condition: Undisturbed ___ Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, ___. Modern struc some erosion, bulldozed road on 3 sides - trench thru

Surface: Level ___ Uneven ___ Slopes to *(direction)* S Surface deposits: Alluvium X Colluvium X Aeolian ___ Talus ___

Residual ___ Soil: Rocky X Gravelly X Sandy X Clayey ___ Other _____

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other gypsum

Arable land *(type, distance & direction)* flood plain - 50 meters west, 150 meters south

Water *(distance & direction)* River 3/4mile S Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? X Local vegetation patterns wolfberry, bunch grass, snake-weed, juniper

Photo B/W ___ Color ___

Other resources 30 to 40 room sandstone masonry pueblo (PII - PIII) Posible of 2 stories. Road bulldozed around it in attempt to miss it a shallow (20cm) trench has been dug thru it(see map) - sherd collection taken (pendant dots predominate) several nice chert cores, core tools, and flakes.

Field remarks _____

References Report 77-SJC-078

Excavation requirements: Labor _____ Time _____ Equipment _____

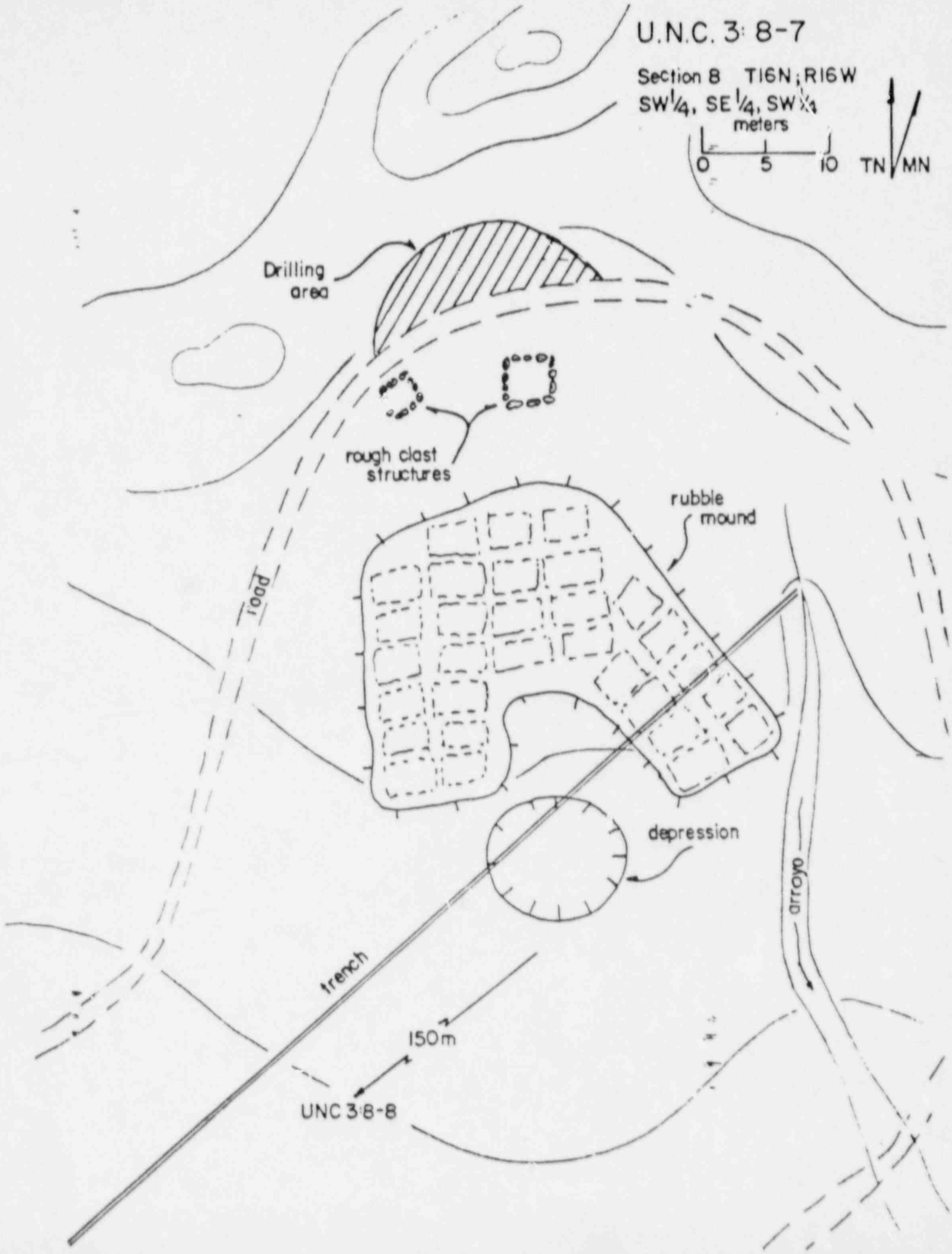
CULTURE _____ / _____ Phase/Date PII - PIII /

Zone _____ Locality _____ Lab class 1 2 3 4 5 6 7 8 9 10

Lab remarks _____

Field recorder Dabney Ford Date _____ Collections storage _____ Catalogue Nos. _____

Date _____ Sherd Cabinet _____ Drawer _____ Bulk _____


U.N.C. 3: 8-7
Section 8 T16N; R16W
SW1/4, SE1/4, SW1/4
meters
0
5
10
TN
MN
Drilling area
rough clast structures
rubble mound
road
depression
arroyo
trench
150m
UNC 3:8-8

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A _____

Site name SJC-127 Field number UNC 3: 8-10

NW ¼ of the SW¼ of the SE ¼, Sec. 8, T. 16 (N) S., R16 (E) (W), County McKinley State NM

Map source Hard Ground Flats Quad 7.5 min. UNC Ortho-topo Elevation 6875

Drainage: primary Rio Puerco secondary intermittent arroyo

Location on bench/alluvial fan extending south into Rio flood plain

Nearest town Church Rock Nearest highway 66 Accessibility: foot X sedan ___ 4-wh. dr. X backhoe

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ___ Bench X Slope ___ Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other alluvial fan Area of site 12,000 sq. meters

FEATURES *(indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab 20 to 30 Masonry ___ Adobe ___ Other ___

Refuse area *(direction)* S Hearths ___ Burials ___ Sherd/Chipping area S Gnds/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other ___

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped X C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other ___

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier X Part ___ tier ___ Orientation E-W Exposure S

Nature & depth of fill rubble up to 3.5 meters Est. Wall height 3.5m Stratified? no

Condition: Undisturbed ___ X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, 1000 sherds Modern stru test pitted?

Surface: Level X Uneven ___ Slopes to *(direction)* S Surface deposits: Alluvium X Colluvium ___ Aeolian ___ Talus ___

Residual ___ Soil: Rocky X Gravelly X Sandy ___ X Clayey ___ Other ___

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other gypsum

Arable land *(type, distance & direction)* 200 meters south

Water *(distance & direction)*: River 1 mile S Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? X Local vegetation patterns snakeweed, sagebrush, bunch gras juniper

Photo: B/W ___ Color ___

Other resources _____

Field remarks depth incredible, same as other two with addition of 2 trough sandstone metates, 3 manos (sandstone , 2 rect. unifacial 1 small round unifacial) wall (fallen)

References Report 77-SJC-078

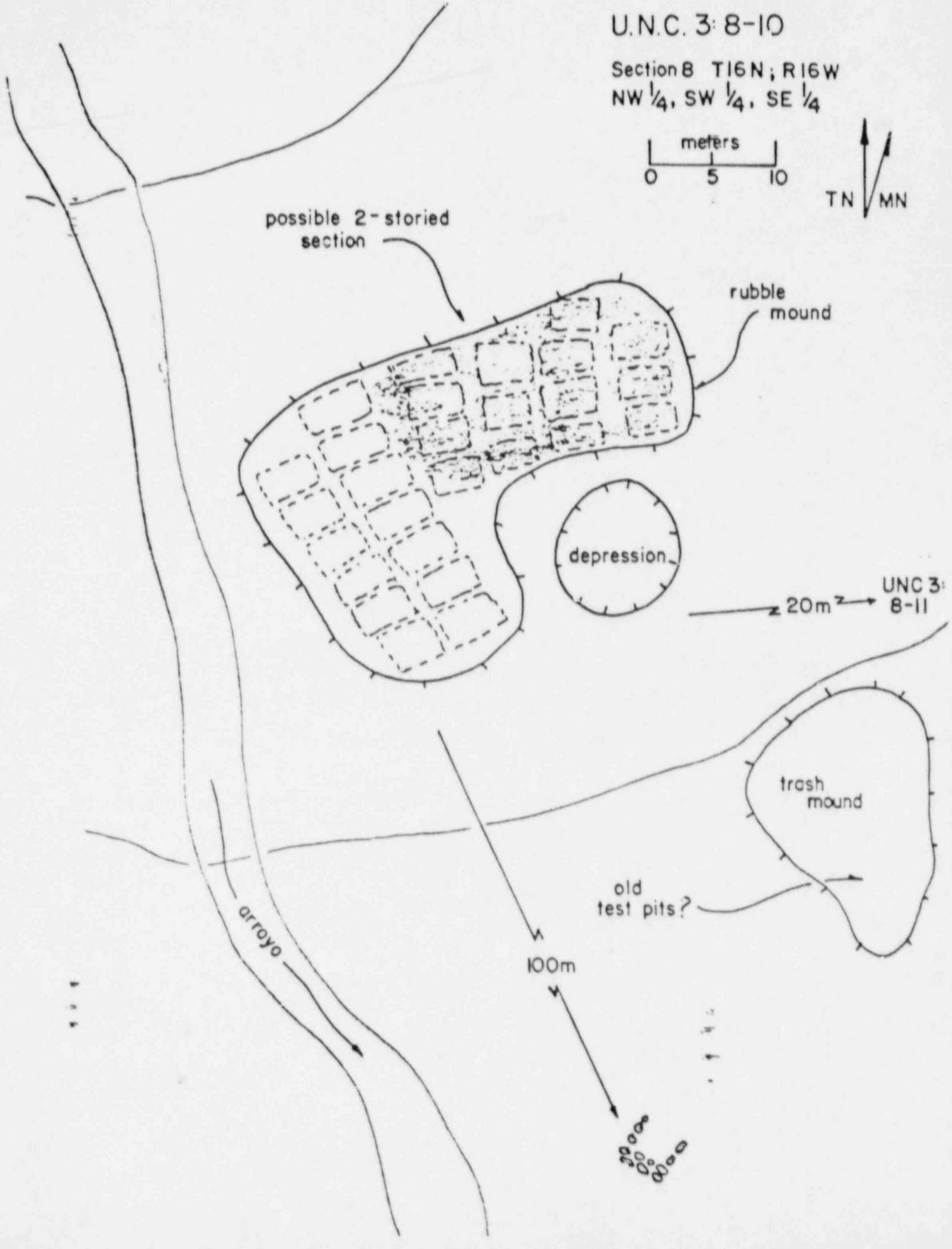
Excavation requirements: Labor ___ Time ___ Equipment ___

CULTURE ___ / ___ Phase/Date ___ / ___

Zone ___ ___ Locality ___ Lab class 1 2 3 4 5 6 7 8 9 10 ___

Lab remarks _____

Field recorder Dabney Ford Date ___ Collections storage ___ Catalogue Nos ___


U.N.C. 3: 8-10
Section 8 T16N; R16W
NW 1/4, SW 1/4, SE 1/4
meters
0 5 10
TN MN
possible 2-storied section
rubble mound
depression
20m
UNC 3: 8-11
trash mound
old test pits?
arroyo
100m

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-128 Field number UNC 3: 8-11

NW ¼ of the SW ¼ of the SE ¼, Sec. 8, T. 16 (N) S, R. 16 (E) W County McKinley State NM

Map source Hard Ground Flats Quad(USGS) UNC Ortho-topo "8" Elevation 6875

Drainage: primary Rio Puerco secondary intermittent arroyos

Location 75 meterswest of 8-16 on alluvial fan etc.

Nearest town Gallup Nearest highway 66 Accessibility: foot X sedan ____ 4-wh. dr. X backh

Ownership ____

Informant ____

Stake location ____

SITUATION (check ✓): Valley bottom ____ Bench X Slope ____ Ridge ____ Mesa top ____ Cliff edge ____ Overhang ____ Cave ____ Dune ____

Other alluvial fan Area of site ____

FEATURES (Indicate number): Pit houses ____ Kivas X Surface rooms: Slab 20 to 30 Masonry ____ Adobe ____ Other ____

Refuse area (direction) S Hearths ____ Burials ____ Sherd/Chipping area S Grids/Dams/Terraces ____ Pictographs/Petroglyphs N

Trails/Steps ____ Other water control E

PLAN: 1-room ____ Linear ____ Arc ____ L-shaped X C-shaped ____ F-shaped ____ E-shaped ____ ( )-shaped ____ Enclosed plaza: by a wall ____

by rooms ____ Scattered ____ Indeterminate ____ Other ____

Single-tier ____ Double-tier ____ ____-tiers ____ Part double-tier X Part ____ tier ____ Orientation E-W Exposure S

Nature & depth of fill rubble .5 to 3 meters Est. Wall height 3.5m Stratified? no

Condition: Undisturbed X Eroded ____ Pot-hunted ____ Pottery/Artifact abundance: 10's, 100's, 1000's, ____. Modern struc
test pitted/windmill ¼ mile S

Surface: Level X Uneven ____ Slopes to (direction) S Surface deposits: Alluvium X Colluvium ____ Aeolian ____ Talus ____

Residual ____ Soil: Rocky X Gravelly X Sandy X Clayey ____ Other ____

Local rock outcrops: Sandstone X Limestone ____ Shale X Caliche ____ Basalt ____ Tuff ____ Other gypsum

Arable land (type, distance & direction) flood plain 200 meters S

Water (distance & direction) River 1 mile Arroyo ____ Confluence ____ Spring ____ Seeps ____

Bedrock pool ____ Permanent? X Local vegetation patterns bunch grass, sankeweed, two cholla, juniper

Other resources water control Photo B/W ____ Color ____

Field remarks appears to be the largest (and middle) of three pueblos same artifacts as 8-16. Petroglyphs (historic) to the north

References Report 77-SJC-078

Excavation requirements: Labor ____ Time ____ Equipment ____

CULTURE ____ / ____ Phase/Date ____ / ____

Zone ____ Locality ____ Lab class 1 2 3 4 5 6 7 8 9 10 ____

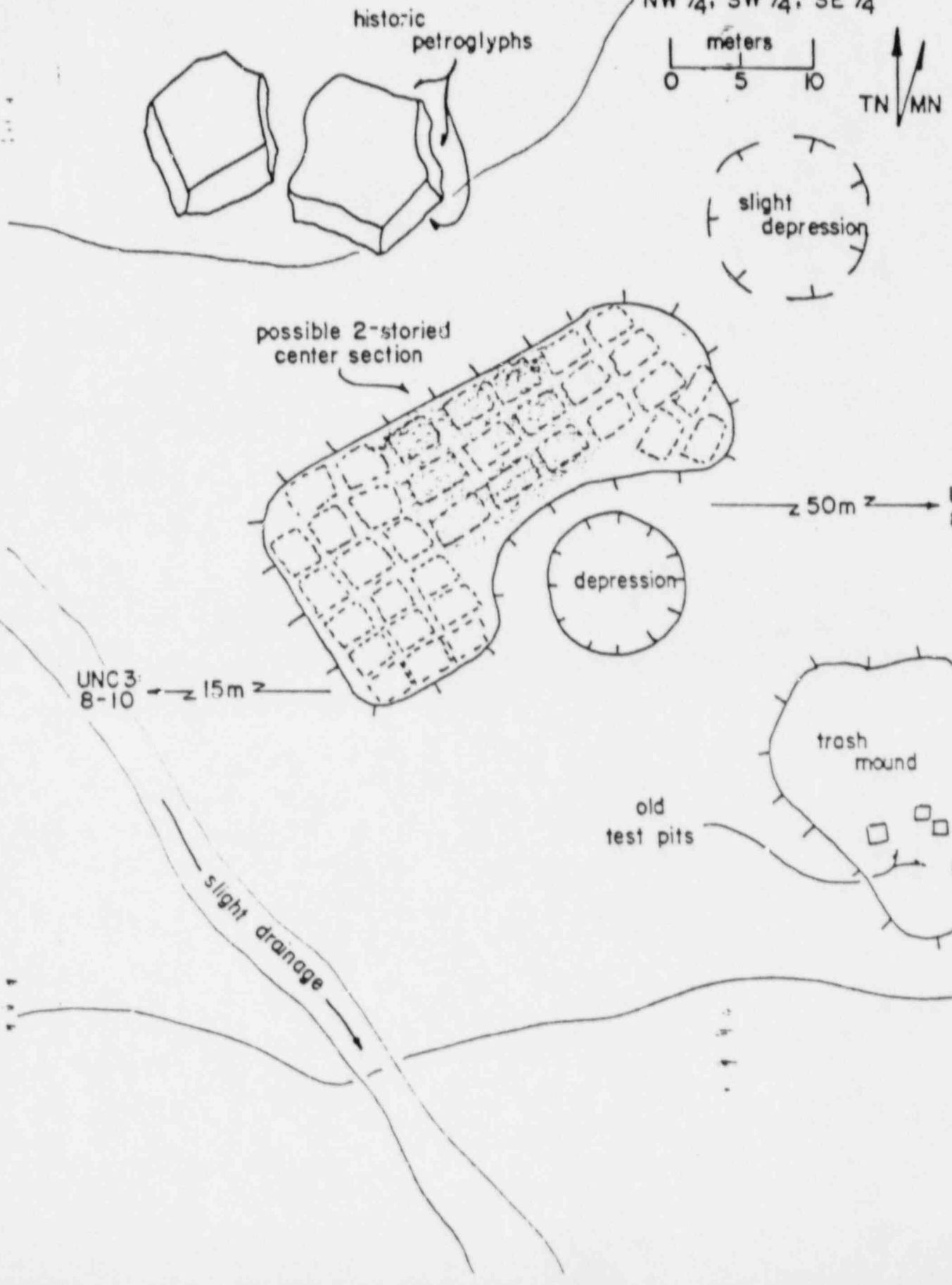
Lab remarks ____

Field recorder Dabney Ford Date ____ Collections storage ____ Catalogue Nos ____

Lab recorder ____ Date ____

U.N.C. 3 8-11

Section 8 T16N; R16W
NW 1/4, SW 1/4, SE 1/4



NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-129 Field number UNC 3: 8-12

NE ¼ of the SE ¼ of the SE ¼, Sec. 8, T. 16 S., R. 16 (N) (E) (W) County McKinley State NM

Map source USGS Elevation _____

Drainage: primary Rio Puerco secondary _____

Location on small knoll on edge of valley bottom to east of arroyo.

Nearest town Gallup Nearest highway _____ Accessibility: foot X sedan ___ 4-wh. dr. X backhoe.

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ___ Bench ___ Slope ___ Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___
Other small knoll jutting from cliff Area of site 5' circle

FEATURES *(Indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab ___ Masonry ___ Adobe ___ Other stone ring
Refuse area *(direction)* ___ Hearths ___ Burials ___ Sherd/Chipping area ___ Grids/Dams/Terraces ___ Pictographs/Petroglyphs ___
Trails/Steps ___ Other _____

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___
by rooms ___ Scattered ___ Indeterminate ___ Other _____

Single-tier X Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation ___ Exposure ___ ___
Nature & depth of fill surface Est. Wall height 6" Stratified? no

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, none. Modern struct

Surface: Level X Uneven ___ Slopes to *(direction)* ___ Surface deposits: Alluvium X Colluvium ___ Aeolian X Talus ___
Residual ___ Soil: Rocky ___ Gravelly ___ Sandy ___ Clayey ___ Other clay loam

Local rock outcrops: Sandstone ___ Limestone X Shale X Caliche ___ Basalt ___ Tuff ___ Other ___

Arable land *(type, distance & direction)* 100' west & 50' south

Water *(distance & direction)* River 3/4 mile Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns juniper, snakeweed, range grass

Photo: B/W ___ Color ___

Other resources _____

Field remarks _____

References Report 77-SJC-078

Excavation requirements: Labor _____ Time _____ Equipment _____

CULTURE _____ / _____ Phase/Date _____ / _____

Zone _____ Locality _____ Lab class 1 2 3 4 5 6 7 8 9 10 _____

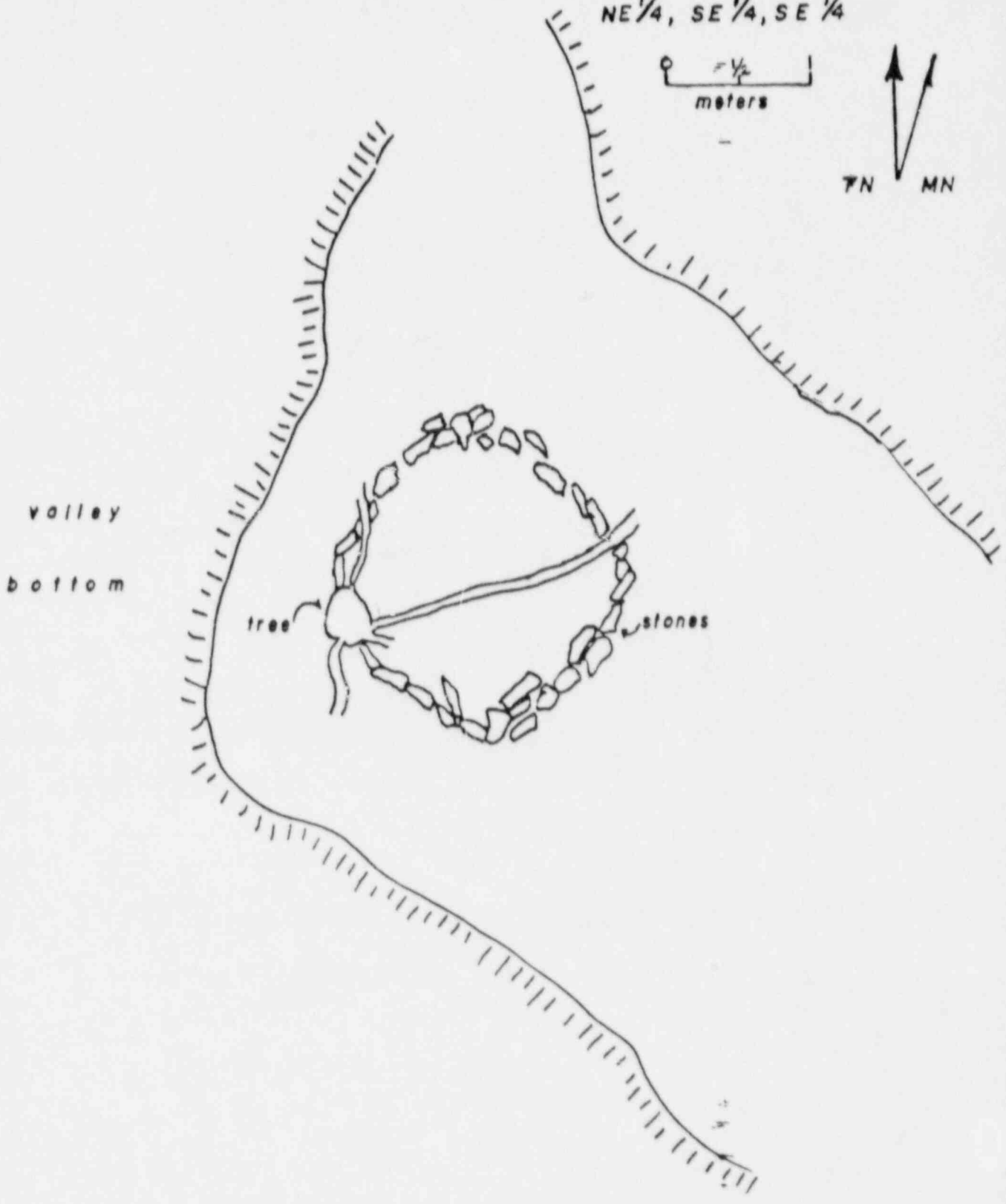
Lab remarks _____

Field recorder Suzanne DeHoff Date 6/5/77 Collections storage Catalogue Nos. _____

Lab recorder _____ Date _____ Sheet Cat. No. _____

U.N.C. 3:8-12

Section 8 T16N; R16W
NE¼, SE¼, SE¼



United Nuclear

NMSU San Juan Campus Archeological Survey Project SITE NO.: L.A.

Site name SJC-130 Field number UNC 3: 8-13

NW ¼ of the SE ¼ of the NE ¼, Sec. 8, T. 16 S., R. 16 (N/W/E) County McKinley State NM

Map source Hard Ground lats Quad - USGS Elevation

Drainage: primary Rio Puerco secondary

Location on bench overlooking canyon and arroyo to east.

Nearest town Gallup Nearest highway Accessibility: foot X sedan 4-wh. dr. backhoe

Ownership

Informant

Stake location

SITUATION (check ✓): Valley bottom Bench Slope Ridge Mesa top Cliff edge Overhang Cave Dune

Other B. 1 X 2 meters Area of site 2 meters circle A.

FEATURES (Indicate number): Pit houses Kivas Surface rooms: Slab Masonry Adobe Other sweathouses

Refuse area (direction) Hearths Burials Sherd/Chipping area Gnds/Dams/Terraces Pictographs/Petroglyphs

Trails/Steps Other fire cracked rock scattered to west

PLAN: 1-room Linear Arc L-shaped C-shaped F-shaped E-shaped (O)-shaped Enclosed plaza: by a wall

by rooms Scattered Indeterminate Other

Single-tier Double-tier -tiers Part double-tier Part tier Orientation S Exposure open

Nature & depth of fill surface - old wood sweathouse Est. Wall height 3' Stratified? no

Condition: Undisturbed X Eroded Pot-hunted Pottery/Artifact abundance: 10's, 100's, 1000's, none Modern struc

none

Surface: Level X Uneven Slopes to (direction) S Surface deposits: Alluvium X Colluvium Aeolian X Talus

Residual Soil: Rocky X Gravelly Sandy X Clayey Other

Local rock outcrops: Sandstone X Limestone Shale Caliche X Basalt Tuff Other

Arable land (type, distance & direction) 500' south and east

Water (distance & direction) River Arroyo X seasonal Spring Seeps

Bedrock pool Permanent? Local vegetation patterns serviceberry, pinon, snakeweed,

sage

Photo B/W 2 Color

Other resources

Field remarks very poor condition only forked poles remain

Cairn on valley bottom 200' east of sweathouse A. Cairn is 2.5' high,
4' circle of sandstone with post sticking out of it - lots of wood laying
around

References Report 77-SJC-078

Excavation requirements: Labor Time Equipment

CULTURE Navajo / Phase/Date /

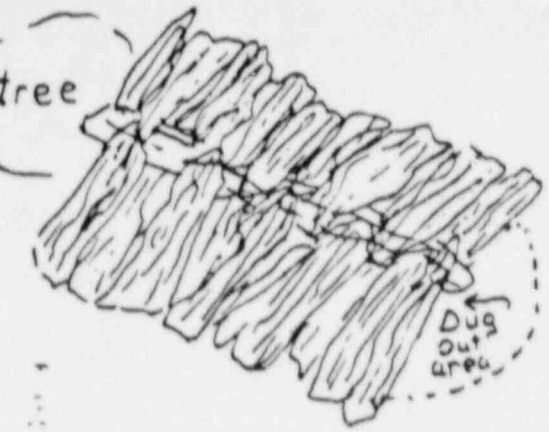
Zone Locality Lab class 1 2 3 4 5 6 7 8 9 10

Lab remarks

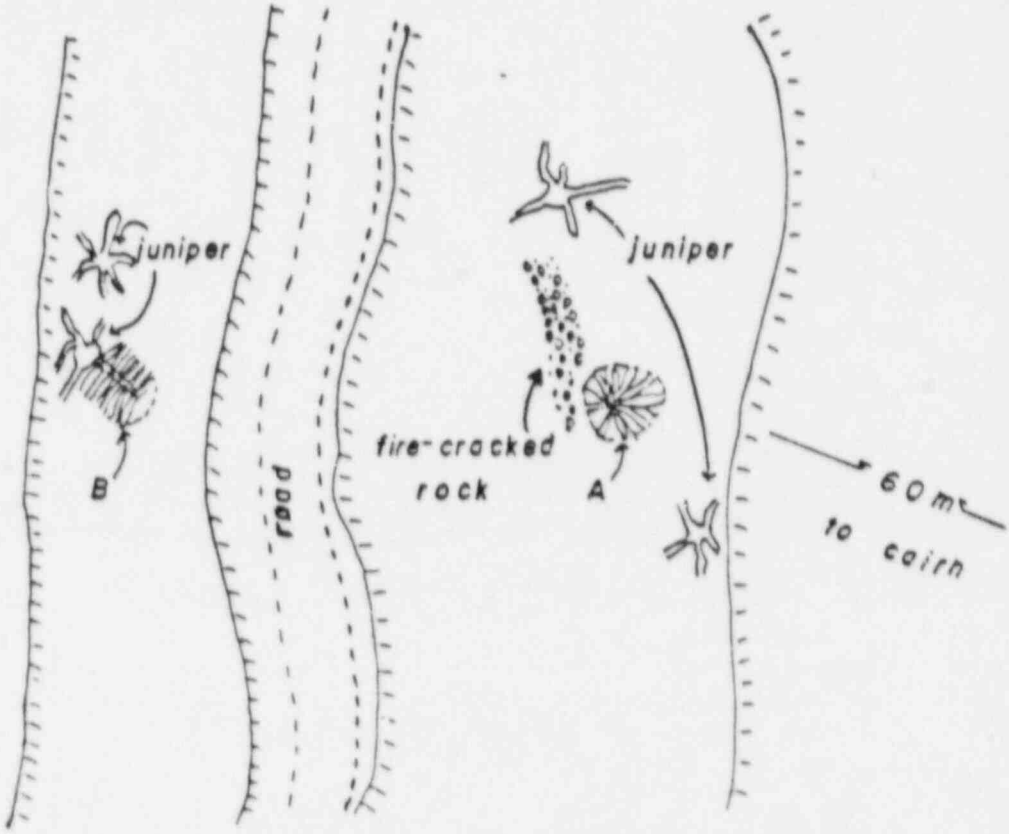
Field recorder Suzanne DeHoff Date 6-5-77 Collections storage Catalogue Nos

U.N.C. 3: 8-13

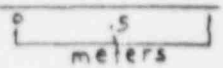
Section 8 T16N; R16W
NW 1/4, SE 1/4, NE 1/4

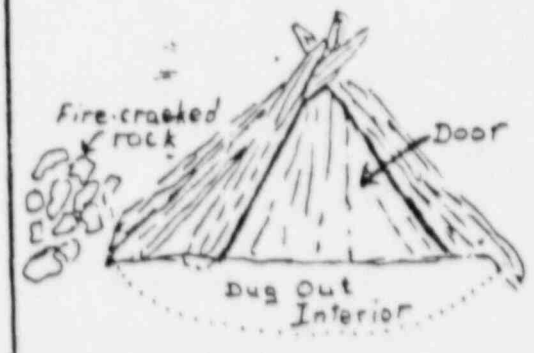


INSET B



INSET A





NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-131 Field number UNC 3: 8-14

NW ¼ of the SW ¼ of the SE ¼, Sec. 8, T. 16 S., R. 16 (N) (E) (W) County McKinley State NM

Map source Hard Ground Flats Quad UNC Ortho-topo 8 Elevation 6875

Drainage: primary Rio Puerco secondary sheet wash & interrmittent arroyos

Location an alluvial fan extending south into the Rio Puerco flood plain approximately 1 mile north of the Rio

Nearest town Church Rock Nearest highway 66 Accessibility: foot X sedan ___ 4-wh. dr. X backhoe ___

Ownership ___

Informant ___

Stake location ___

SITUATION *(check ✓)*: Valley bottom ___ Bench X Slope ___ Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other alluvial fan Area of site ___

FEATURES *(Indicate number)*: Pit houses ___ Kivas 1 Surface rooms: Slab 20 to 30 Masonry ___ Adobe ___ Other ___

Refuse area *(direction)* S Hearths ___ Burials ___ Sherd/Chipping area S Grnds/Dar.s/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other ___

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped X C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other ___

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier X Part ___ tier ___ Orientation E-W Exposure S

Nature & depth of fill rubble .50 meters - 2.5 meters Est. Wall height 3 meters Stabilized? no

Condition: Undisturbed ___ Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, ~~1000's~~, 1000 sherds Modern structur
test pitted windmill on floodplain ¼ mile south

Surface: Level X Uneven ___ Slopes to *(direction)* S Surface deposits: Alluvium X Colluvium ___ Aeolian ___ Talus ___

Residual ___ Soil: Rocky X Gravelly X Sandy X Clayey ___ Other ___

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other gypsum

Arable land *(type, distance & direction)* floodplain 1/8 mile south

Water *(distance & direction)* River 1 mile S Arroyo X Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns snakeweed, tumbleweed, bunch grass, ~~cholla~~ (one of very few in area) juniper

Other resources may be water control structures between 8-16 and 8-15 Photo B/W ___ Color ___

Field remarks the site is the eastern most of 3 pueblos situated in similar areas all within 1/8 linear mile of each other. Temporal affiliations same. Appears this one has had some test pitting done may have 2 kivas

References Lithic material mainly chert and petrified wood, sandstone pect mano, shapped sandstone slabs obsidian core.
Report 77-SJC-078

Excavation requirements: Labor ___ Time ___ Equipment ___

CULTURE ___ / ___ Phase/Date ___ / ___

Zone ___ Locality ___ Lab class 1 2 3 4 5 6 7 8 9 10 ___

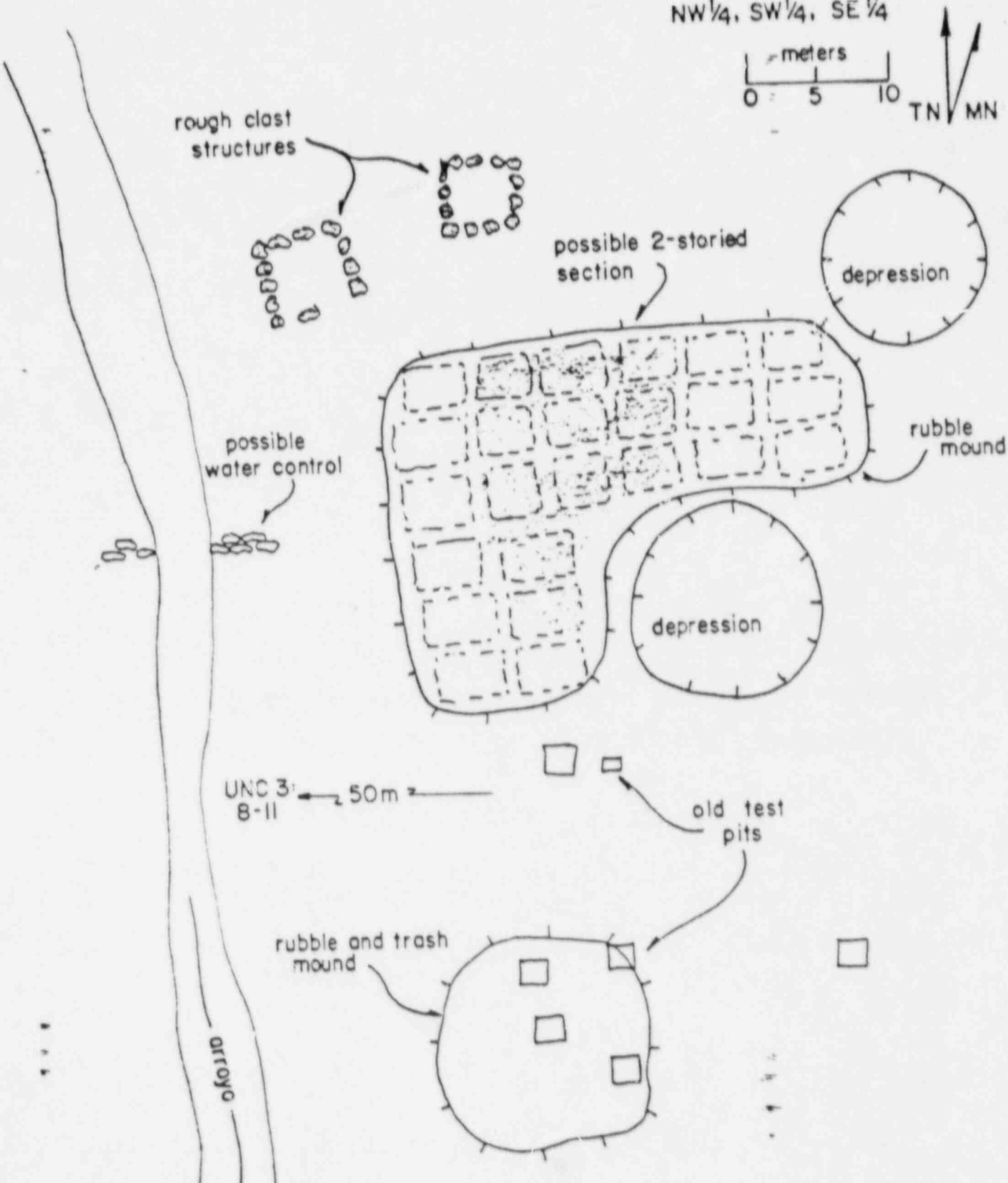
Lab remarks ___

Field recorder Dabney Ford Date ___ Collections storage ___ Catalogue Nos ___

Lab recorder ___ Date ___ Sherd Cabinet ___ Drawer ___ Bulk

U.N.C. 3: 8-14

Section 8 T16N ; R16W
NW¼, SW¼, SE¼



NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A _____

Site name SJC-132 Field number UNC 3: 8-15

NW ¼ of the SW ¼ of the SE ¼, Sec. 8, T. 16 N. S., R. 16 E. W., County McKinley State NM

Map source Hard Ground Flats Quad - USGS Elevation _____

Drainage: primary Rio Puerco secondary _____

Location on south slope of valley bottom between bluffs and arroyo

Nearest town Gallup Nearest highway _____ Accessibility: foot ___ sedan ___ 4-wh. dr. X backhoe

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom X Bench ___ Slope X Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other _____ Area of site _____

FEATURES *(Indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab ___ Masonry ___ Adobe ___ Other _____

Refuse area *(direction)* _____ Hearths ___ Burials ___ Sherd/Chipping area ___ Gnds/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other _____

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other several room blocks 100 to 200 feet apart

Single-tier X? Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation ___ Exposure ___

Nature & depth of fill Ind depth - pueblo pottery Est. Wall height Ind Stratified probabl

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's ___ Modern struc

also part had been disturbed by drill holes

Surface: Level ___ Uneven ___ Slopes to *(direction)* SE Surface deposits: Alluvium X Colluvium ___ Aeolian X Talus ___

Residual ___ Soil: Rocky ___ Gravelly ___ Sandy X Clayey X Other sandy loam

Local rock outcrops: Sandstone X Limestone ___ Shale ___ Caliche ___ Basalt ___ Tuff ___ Other _____

Arable land *(type, distance & direction)* 500' south

Water *(distance & direction)*: River ___ Arroyo 500'S Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns wolfberry, snakeweed, juniper,

Photo B/W ___ Color ___

Other resources _____

Field remarks northern part has been disturbed by drill holes - should be nominated for state register.

References Report 77-SJC-078

Excavation requirements: Labor _____ Time _____ Equipment _____

CULTURE Anasazi / Phase/Date _____ /

Zone _____ Locality _____ Lab class 1 2 3 4 5 6 7 8 9 10

Lab remarks _____

Field recorder Suzanne DeHoff Date _____ Collections storage _____ Catalogue Nos _____

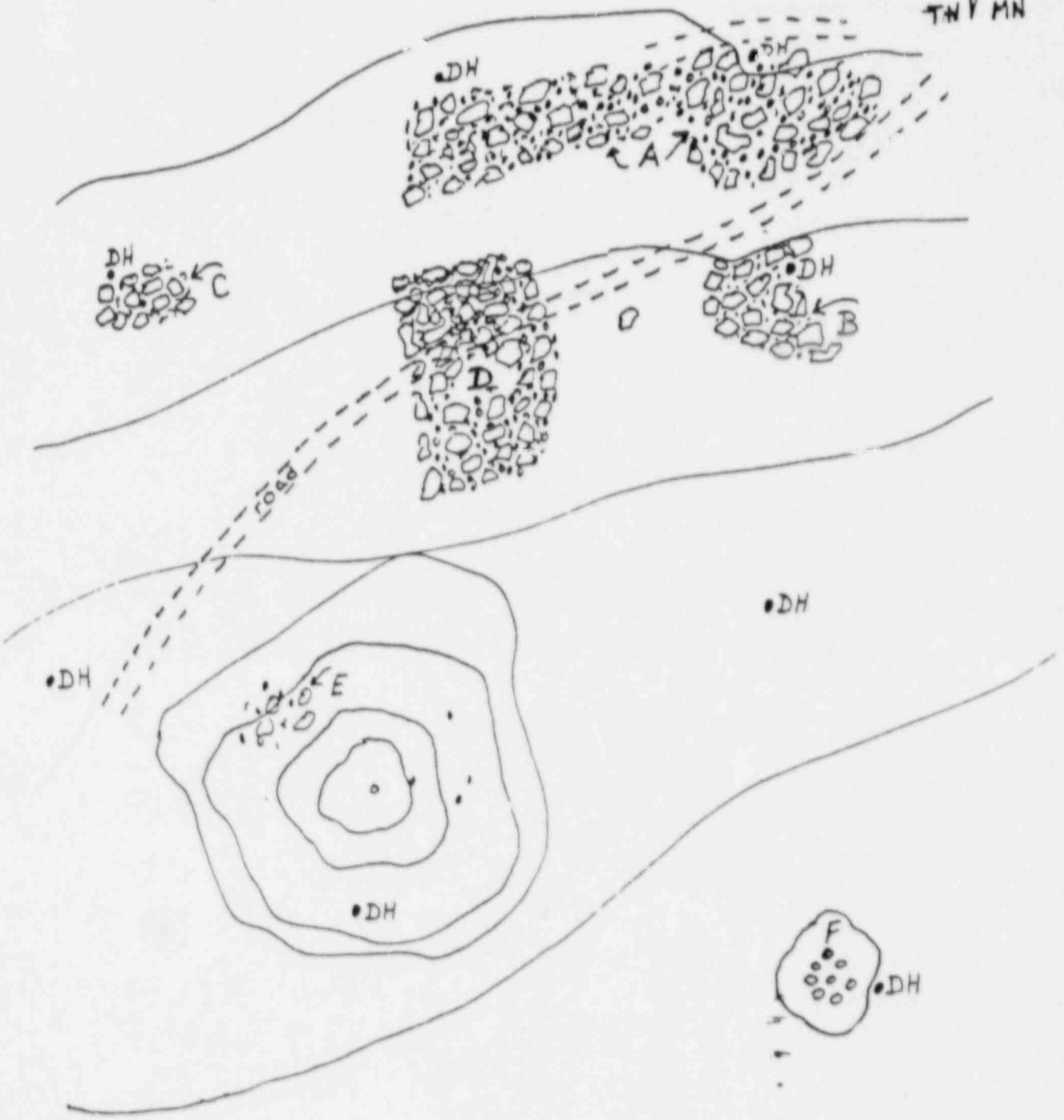
U.N.C. 3:8-15

DH = Drill Hole
A-F = Ruin Rubble
= Sandstone Blocks
= Flakes & Sherds

Section 8 T16N R16W
NW 1/4, SW 1/4, SE 1/4

0 10 20
meters

TN MN



SECTION 12

Section 12 can be divided into three major topographic zones: mesa top, mesa or cañon rims, and cañon floor.

The mesa top is oriented northeast-southwest and cut by two major cañons, one in the northwest corner, the other in the southeast corner. The mesa is relatively flat with a slight north northwest slope. It is covered with a well developed sandy loam soil, residual and alluvial in nature. The dominant vegetation is juniper (Juniperus monosperma), sagebrush (Artemesia tridentata), snakeweed (Gutierrezia sarothrae), pinon (Pinus edulis), mountain mahogany (Cercocarpus breviflorus), Gamble oak (Quercus gambelii), narrow leaf yucca (Yucca angustissima), dahl yucca (Yucca baccata), prickly pear (Opuntia spp.) perennial and annual forbs, and several grass species. Elevations on the mesa top range from 7350 to 7550 feet.

Mesa or cañon rims (depending on perspective)are a series of eroded sandstone terraces between the 7000' and 7350' elevations. The soil, mainly detritus and talus from the sandstone outcrops, is a rocky gravelly sandy loam. Vegetation along the rims includes squaw current (Ribes cereum), fragrant ash (Fraxinus cuspidata), skunkbush (Rhus trilobata), and isolated stands of douglas fir (Pseudotsuga taxifolia) along with the plants mentioned growing on the mesa.

The final topographic zone is the cañon floors. The cañon in the northwest quarter of the section is in a cutting stage with large sand-

stone boulders and sheer sides up to the first rim. The canon in the southeast quarter has a broader floor with some alluvial flood plain accumulation. Plants found in the other two zones were also growing in the canons in addition to blue grama (Bouteloua gracilis), and several other overgrazed unidentified grasses.

Both historic and prehistoric cultural resources were noted in Section 12. Three sites, three isolated occurances and three petroglyphs were located (see map 2).

UNC 3: 12-1	(Site)	Hearth and sherd scatter on mesa top
UNC 3: 12-2	(I.O.)	PII/PIII indented corrugated gray ware sherd scatter on mesa/canon upper rims-30 to 35 sherds scattered over ¼ of section.
UNC 3: 12-3	(I.O.)	Sherd scatter on mesa finger - Chaco black/white and PIII indented corrugated gray ware - 4 sherds
UNC 3: 12-4	(Site)	Reservation period hogan, corral and log trough
UNC 3: 12-5	(petro)	Historic petroglyphs
UNC 3: 12-6	(Site)	Pithouse depressions, sherd and lithic scatter, ground stone, hearths
UNC 3: 12-7	(petro)	Historic, date of "72"
UNC 3: 12-8	(petro)	Historic, horses, quadruped, "1940", "46"
UNC 3: 12-9	(I.O.)	Tabular sandstone structure with lumber near south section line - very recent and apparently associated with road construction.

UNC 3: 12-1

Site 12-1 consisted of a sherd (8-10) and lithic (10) concentration and two ground stone fragments scattered over an area 3 X 4 meters. There is a hearth area approximately ½ meter in diameter on the eastern side of the scatter. The pottery is of PII times and was 70% corrugated and 30% black/white. There was no evidence of structure and appears to be a single-occupation procurement/processing camp.

The site is on the mesa top near the middle of section 12 with a slight slope to the northwest. It is located about 30 feet north of a dirt road and approximately 200 feet east of the intersection of two roads.

The site, although small in area and artifact abundance, is in very good condition and may have sufficient fill for paleo botanical sampling. Recommendations are to avoid the site (see Table 1). If that is not possible and mitigation should become necessary, it would take two people four hours to map, collect, photograph, and test the site.

UNC 3: 12-4

Site 12-4 consists of a circular sandstone masonry hogan with axe-cut corbelled log roof, brush corral, log troughs, and a pole "arch". The hogan was probably built during the reservation period as described by Charles D. James (James, 1976). The walls are 1

meter high maximum near the entrance and taper with the land slope to 20 meters high. No mortar was found in the wall and fill inside the structure appears to be from 10-40 cm deep. The roof has fallen intact and clearly shows the building design of corbelled logs. There was an apparent smoke hole in the center top of the roof. The entrance, facing south southeast, was constructed of larger rocks, thickening the walls at the opening. Remnants of a brush corral could be seen approximately 10 meters west and south of the hogan. Two hand hewn juniper log troughs made up a portion of the barrier. The only datable artifact found on the site was a U. S. Army WW II tent post. It formed a part of an arch structure several meters in front of the entrance to the hogan.

The site sits on the first sandstone rim down from the mesa looking out over the steep canon which drains this ¼ of section 12. Here, in the northwest corner of the section, the mesa is merely a narrow finger seperating two drainages. There are several occupied Navajo homes approximately 8 kilometers north of the site, in Hard Ground Flats Canon.

The site is in excellent condition and not in immediate danger of erosion damage. Recommendations are to avoid the site.

UNC 3: 12-6

This site is composed of two circular depressions, a possible hearth area and a sherd, lithic, and ground stone scatter. The

westernmost and larger depression is 8 meters in diameter, the smaller one 6 meters across. There is a scatter of heat discolored rock and carbon stained soil 12 meters north of the depressions. The sherds are lightly scattered over an area 20m X 20m (1 sherd per 4 sq. meters) but are concentrated around the hearth area as are the lithics. A quartzite hammerstone and sandstone trough metate were found west of the depressions and hearths, 10m and 30m respectively. All of the pottery found is a plain gray ware identified in the lab as Lino Gray. It is likely that the depressions are pithouses and date into Pueblo I.

The site is just north of the highest point on the mesa approximately 30 meters from the rim. This particular part of the rim is the best place on the mesa to view the Rio Puerco valley. There is a dirt road less than 10 meters south of the pithouses and an area north of the hearths bulldozed for uranium testing.

The site is in good condition with minimal erosive damage. Site 12-6 is unique in its age, theme, and location and it is recommended that any adverse impact on the site be avoided.

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-133 Field number UNC 3: 12-1

SE ¼ of the SE ¼ of the NW ¼, Sec. 12, T. 16 (N) S., R. 17 (E) (W) County McKinley State NM

Map source USGS Hard Ground Flats, New Mexico Elevation 7400

Drainage: primary _____ secondary Hard Ground Canyon

Location 30' nw of main road - approximately 200' east of intersection

Nearest town Gallup Nearest highway _____ Accessibility: foot X sedan ___ 4-wh. dr. X backhoe.

Ownership Navajo tribe

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ___ Bench ___ Slope X Ridge ___ Mesa top X Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other _____ Area of site 3 X 4 meters

FEATURES *(indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab ___ Masonry ___ Adobe ___ Other ___

Refuse area *(direction)* ___ Hearths 1 Burials ___ Sherd/Chipping area ___ Grids/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other sherd lithic scatter

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other none

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___-tier ___ Orientation nw Exposure open

Nature & depth of fill Indeterminate Wall height none Stratified? no

Condition: Undisturbed X Eroded ___ Pot hunted ___ Pottery/Artifact abundance 10's, 100's, 1000's, _____ Modern struct

approximately 8 sherds & 10 flakes 2 ground stone

Surface: Level ___ Uneven X Slopes to *(direction)* NW Surface deposits: Alluvium X Colluvium ___ Aeolian X Talus ___

Residual X Soil: Rocky ___ Gravelly ___ Sandy ___ Clayey X Other red clay loam some sandstone frag.

Local rock outcrops: Sandstone ___ Limestone ___ Shale ___ Caliche ___ Basalt ___ Tuff ___ Other ___

Arable land *(type, distance & direction)* _____

Water *(distance & direction)*: River ___ Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns pinon, juniper, sage, grama, snakeweed

Other resources none Photo: B/W ___ Color ___

Field remarks appears to be short term camp site - charcoal area (possible hearth) flakes of petrified wood and chert - one quartzite cobble

References Report 77-SJC-078

Excavation requirements: Labor ___ Time ___ Equipment ___

CULTURE Anasazi / Phase/Date ___ /

Zone ___ Locality ___ Lab class: 1 2 3 4 5 6 7 8 9 10 ___

Lab remarks _____

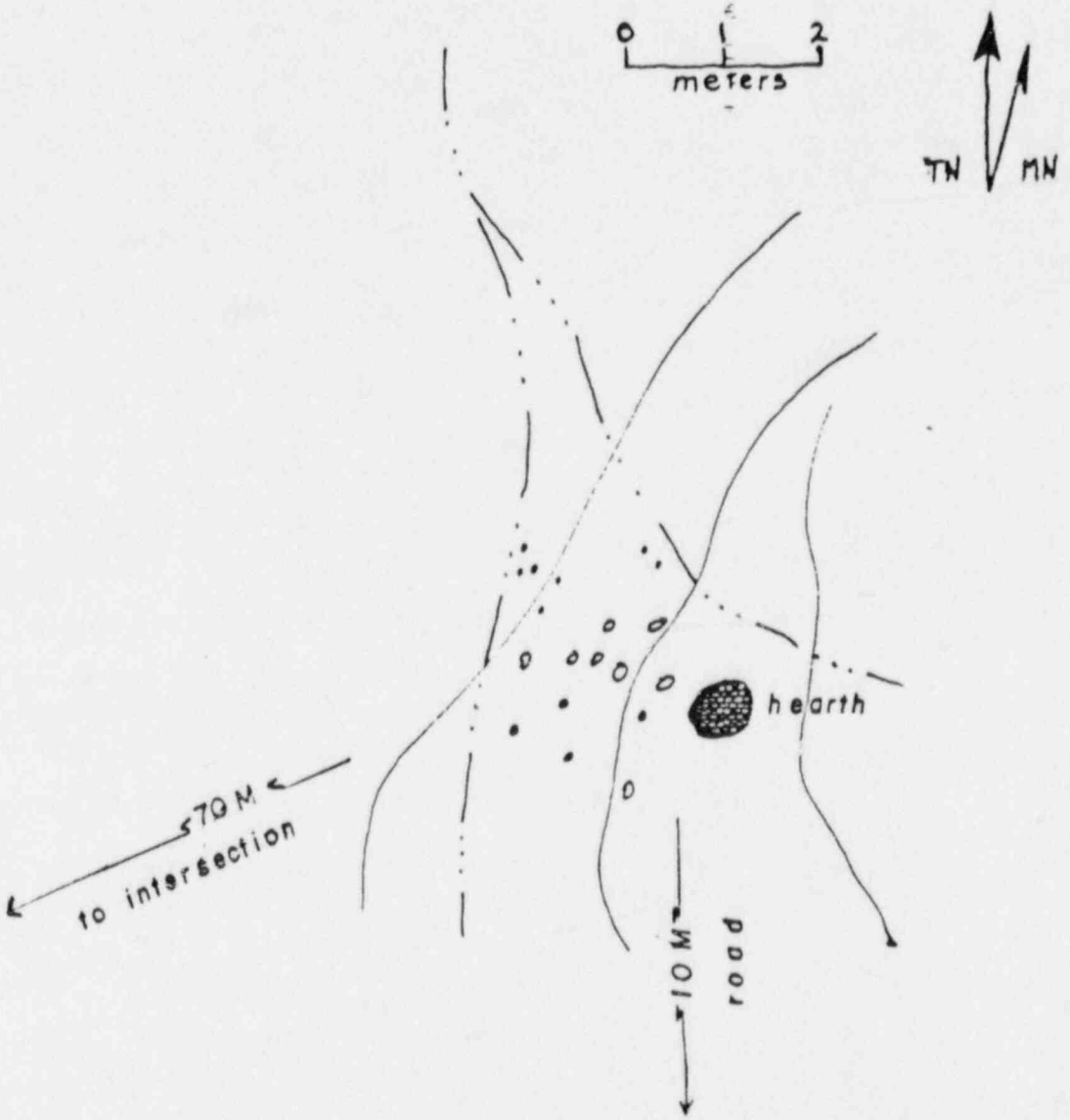
Field recorder Suzanne DeHoff Date 6-1-77 Collections storage ___ Catalogue Nos ___

Lab recorder ___ Date ___ Shard Cabinet ___ Bulk ___

U.N.C. 3 : 12 - 1

Section 12 T16N, R17W

SE 1/4, SE 1/4, NW 1/4



o = lithics

• = sherds

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-134 Field number UNC 3: 12-4

NW ¼ of the NW ¼ of the NW ¼, Sec. 12, T. 16 (N) S., R. 17 (E) (W), County McKinley State NM

Map source USGS Hard Ground Flats Quad Elevation 7240

Drainage: primary Hard Ground arroyo secondary _____

Location 2nd terrace down from the mesa top which is north border of Sec. 12, overlooking arroyo with south scutheast exposure

Nearest town Gallup Nearest highway _____ Accessibility: foot ___ sedan ___ 4-wh. dr. ___ backhoe ___

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ___ Bench ___ Slope X Ridge ___ Mesa top ___ Cliff edge X Overhang ___ Cave ___ Dune ___

Other _____ Area of site _____

FEATURES *(Indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab ___ Masonry X Adobe ___ Other hogan

Refuse area *(direction)* ___ Hearths ___ Burials ___ Sherd/Chipping area ___ Grids/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other two hollowed out troughs

PLAN: 1-room X Linear ___ Arc ___ L-shaped ___ C-shaped round ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other _____

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation E Exposure SSE

Nature & depth of fill 1½ meter aeolian & alluvium Est. Wall height 1m Stratified? no

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, none Modern struct

_____

Surface: Level X Uneven ___ Slopes to *(direction)* SSE Surface deposits: Alluvium ___ Colluvium ___ Aeolian X Talus ___

Residual ___ Soil: Rocky ___ Gravelly ___ Sandy X Clayey ___ Other loam

Local rock outcrops: Sandstone X Limestone ___ Shale ___ Caliche ___ Basalt ___ Tuff ___ Other _____

Arable land *(type, distance & direction)* ½ mile north arroyo flood plain

Water *(distance & direction)*: River ___ Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns _____

_____

Photo: B/W ___ Color ___

Other resources _____

_____

Field remarks _____

_____

_____

_____

References Report 77-SJC-078

_____

_____

Excavation requirements: Labor _____ Time _____ Equipment _____

CULTURE _____ / _____ Phase/Date _____ / _____

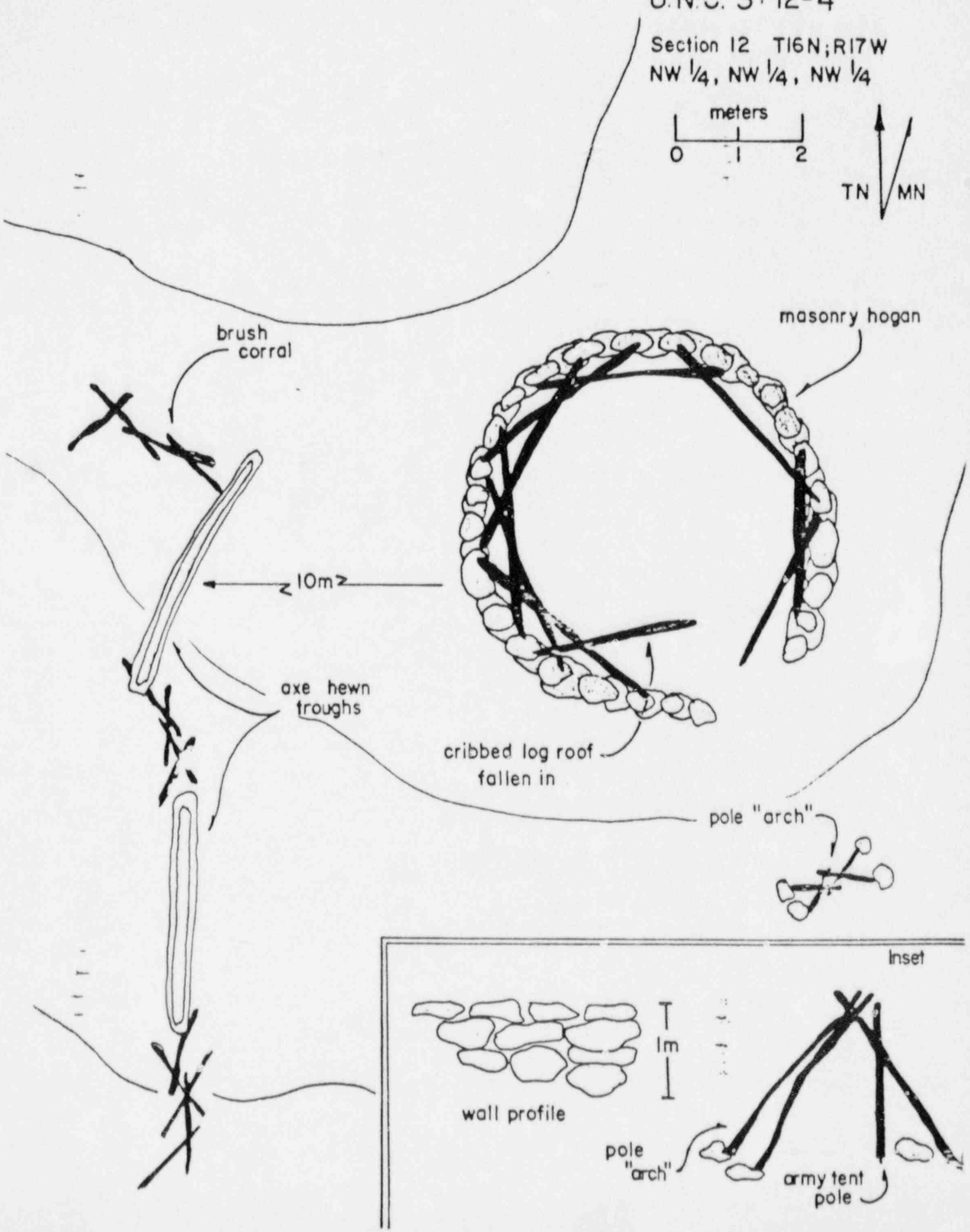
Zone _____ Locality _____ Lab. class 1 2 3 4 5 6 7 8 9 10 _____

Lab. remarks _____

_____

_____

Field recorder Dabney Ford Date _____ Collections storage _____ Catalogue Nos. _____


U.N.C. 3:12-4
Section 12 T16N;R17W
NW 1/4, NW 1/4, NW 1/4
meters
0 1 2
TN MN
masonry hogan
brush corral
10m
oxe hewn troughs
cribbed log roof fallen in
pole "arch"
Inset
1m
wall profile
pole "arch"
army tent pole

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. ____

Site name SJC-135 Field number UNC 3: 12-6

SE ¼ of the SW¼ of the SW ¼, Sec. 12, T. 16 S., R 17 (E)(W), County McKinley State NM

Map source USGS Hard Ground Flats Quad UNC Orthophoto Topo Elevation 7510

Drainage: primary Rio Puerco - North fork secondary intermittent arroyo

Location mesa top approximately 20 meters north and 75 meters east of rim of mesa - SW edge of mesa

Nearest town Gallup Nearest highway ____ Accessibility: foot ___ sedan ___ 4-wh. dr. X backhoe ___

Ownership ____

Informant ____

Stake location ____

SITUATION *(check ✓)*: Valley bottom ___ Bench ___ Slope ___ Ridge ___ Mesa top X Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other ____ Area of site ____

FEATURES *(Indicate number)*: Pit houses 2 Kivas ___ Surface rooms: Slab ___ Masonry ___ Adobe ___ Other ____

Refuse area *(direction)* ___ Hearths X Burials ___ Sherd/Chipping area ___ Gnds/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other ____

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other ____

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation ___ Exposure ___

Nature & depth of fill aeolian, alluvium .5-1m Est. Wall height ___ Stratified? no

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, ___ Modern struct

sherds 20-30, lithics 1-5, ground stone 1, pecked stone 1,

Surface: Level X Uneven ___ Slopes to *(direction)* N Surface deposits: Alluvium X Colluvium X Aeolian X Talus ___

Residual ___ Soil: Rocky X Gravelly ___ Sandy X Clayey ___ Other ____

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other ____

Arable land *(type, distance & direction)* 1 mile south on Rio Puerco

Water *(distance & direction)* River X Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? X Local vegetation patterns sagebrush, juniper, pinon, Mt. mahogany, snakeweed, grasses

Photo: B/W ___ Color ___

Other resources ____

Field remarks sherd scatter is 100% gray wares, near a hearth area of rock fragments and soil stain. 5-7 m south are two circular depressions - possible pithouses. A red sandstone basin metate and a quartzite hammerstone are near the depression - gray ware sample collected

References Report 77-SJC-078

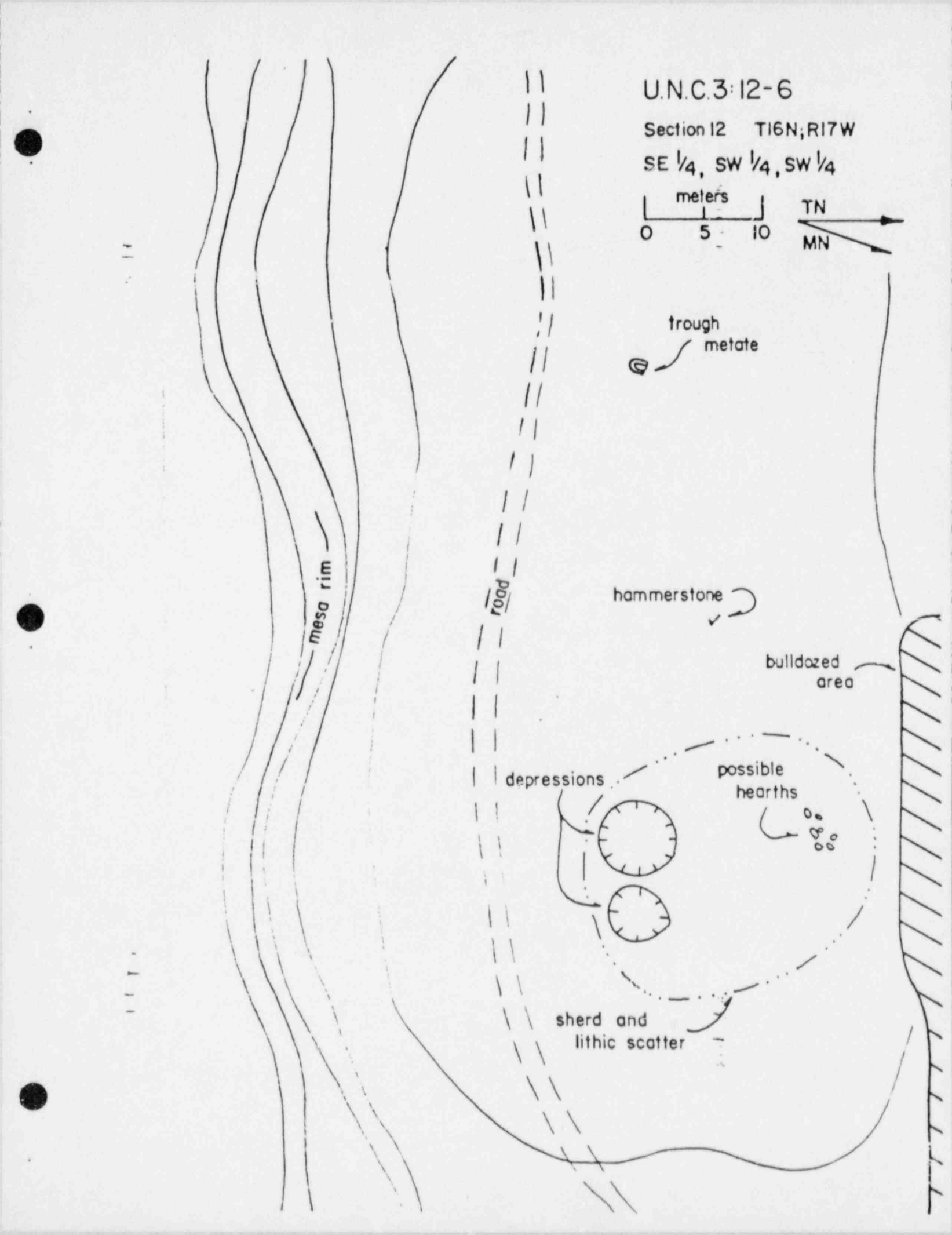
Excavation requirements: Labor ___ Time ___ Equipment ___

CULTURE ___ / ___ Phase/Date ___ / ___

Zone ___ Locality ___ Lab class 1 2 3 4 5 6 7 8 9 10 ___

Lab remarks ____

Field recorder Dabney Ford Date ___ Collections storage ___ Catalogue Nos ___


U.N.C.3:12-6
Section 12 T16N;R17W
SE 1/4, SW 1/4, SW 1/4
meters
0 5 10
TN
MN
trough metate
mesa rim
road
hammerstone
bulldozed area
depressions
possible hearths
sherd and lithic scatter

SECTION 13

Section 13 can be divided into three major topographic zones: mesa or canon slopes, mesa foot hills, and river flood plain.

Approximately one quarter of the section's terrain is represented by sheer cliffs and accompanying narrow terraces which make up the mesa or canyon slopes. The mesa foothills involve less than one eighth of the section, and the balance of the topography is classed as being a part of the general Rio Puerco flood plain. Soils include rocky sandy loams in the higher elevations, near pure clays and gypsum clay mixtures in the foot hills, and on the flood plain sandy loams and pure sand. The majority of the surface deposits are alluvial due to the sheer mesa slopes, there are areas of homogenious talus.

The mesa or canon slopes are a series of two and in places three eroded sandstone terraces ranging from 7000 feet to 7400 feet elevation. Vegetation growing in the rocky sandy loam includes: juniper (Juniperus monasperma), sagebrush (Artemesia tridentata), snakeweed (Gutierrezia sarothrae), pinon (Pinus edulis), mountain mahogany (Cercocarpus breuiflorus), Gamble oak (Quercus gambelii), narrow leaf yucca (Yucca angustissima), dahl yucca (Y. baccata), prickly pear (Opuntia spp.), Ereogonum spp., squawcurrent (Ribes cerem), skunkbush (Rhus trilobata). The dominant grasses are blue grama (Bouteloua gracilis), and galleta.

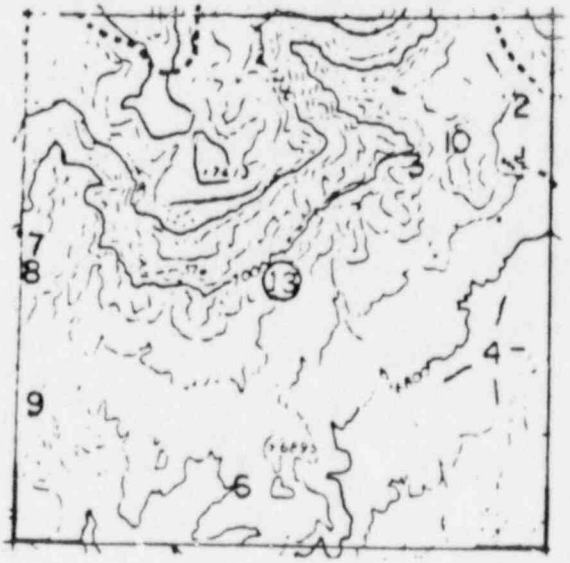
The mesa foothills are alluvially disected strata of near pure clay, clays mixed with shale, or gypsum bearing clays. This area

occupies the 6900 to the 7000 foot eleations. Very little vegetative growth is found on the foothills due to dynamic erosion and poor soil. In the areas where soil is heterogenius oak, juniper, blue grama and sagebrush can be found.

The river flood plain takes up about one half of the section and is characterized by a relatively flat terrain with a few low hills. The flood plain is cut by several deep narrow arroyos which drain the southern mesa top. The soils are sandy clay loam, rocky sandy loam, and in the arroyo bottoms, sand. Scattered conifers grow on the low hills but the dominant vegetation is sagebrush and several grasses. In areas of slightly higher water retention, saltbush (Atriplex canescans), wolfberry (Symphoricarpos occidentalis), and rabbitbrush (Chrysothamnus nausiosus) are common.

The cultural resources in section 13 include prehistoric and historic sites, isolated occurences, and petroglyphs. The following is a list of these resources. Their location can be found on Map 2.

UNC 3: 13-1	(Site)	Navajo house/hogan/corral/horno complex
UNC 3: 13-2	(Site)	Historic dugout
UNC 3: 13-3	(I.O.)	Shell (Glycimerous spp.) beads (2) on saddle
UNC 3: 13-4	(I.O.)	Sherd scatter on flood plain - SE¼ of section - 1 sherd per 20 sq. meters
UNC 3: 13-5	(I.O.)	Rock carin on East section line
UNC 3: 13-6	(I.O.)	Rock carins on South rim of central hills - probably grazing markers - one square structure
UNC 3: 13-7	(Site)	Sandstone "bin", lithics and historic brush corral
UNC 3: 13-8	(Site)	8-12 room pueblo on slope on West section line
UNC 3: 13-9	(I.O.)	Sherd scatter on bench South of 13-8 - 1 sherd per 5 sq. meters spread over 200 sq. meters
UNC 3: 13-10	(Site)	Pueblo and kiva on bench above 13-1



UNC 3: 13-1

Site 13-1 is a recent Navajo complex consisting of at least three domestic structures, corrals, lumber shed, stone oven, wood and lumber piles, and an extensive trash area. Beginning from north to south, the features include:

Several piles of axe-shaped timbers, possibly salvaged from the roof of the hogan.

A circular masonry hogan of shaped sandstone blocks, motared rock walls 1-1.25 meter high, roof absent, dirt floor, east southeast doorway.

Rectangular shaped sandstone block masonary house with factory made windows and doors, asbestos roof. Apparently used for storage, containing a pool table, boxes of canned goods, and some furniture.

Square cement foundation with remnants of masonry walls.

Sandstone oven partially toppled; parts of a buckboard including wheels, wooden axles, tongue; parts of a plow and/or tractor.

Two lumber structures,one a collapsed small square shed, one a large rectangular structure which may have been a stable.

Juniper brush circular corral with an east southeast opening.

Extensive trash scatter on down slope or eastern side of site,

a concentration in the form of a trash mound, primarily tin cans (crimped), broken glass, plastic, and metal scraps.

Judging from the structures and trash, the site was occupied roughly from 1930 to 1970 or later.

The site is just below the foothills of the mesa, on the extreme northern limits of the Puerco River bottom. The river is approximately 1.5 kilometers to the south.

Ethnographic and archival research should provide needed information on the site from the standpoint of being a cultural resource as well as the site being in current use, avoidance is recommended.

UNC 3: 13-2

This site is found on a flat gentle slope to the south in the NE¼ of the NW¼ of the NE¼ of Section 13. The area of the site is 10 X 15 meters and consists of a dugout house. The front wall is about 4 feet high. The roof is still intact and the entire site appears to be undisturbed. Associated artifacts include a partial harness and a plow. There are no artifacts which were culturally diagnostic, and the site is assumed to be historic anglo, although, there are several Navajo families in the immediate vicinity.

The front wall of the dugout is of sandstone blocks. The roof is of split timber supports and the adobe top is level with the ground.

There is a square wooden chimney vent in the middle of the roof. Avoidance of the site is recommended.

UNC 3; 13-7

Site 13-7 consists of a circular sandstone slab structure, a juniper brush corral, and two flakes. The sandstone bin-like feature is approximately .75 meter in diameter and appears to have been double walled. The fill isbetween .40 and .75 meter deep and the only surface artifacts are two chert flakes 7 and 8 meters from the structure. The brush corral is constructed from axe-cut juniper branches. There has been some alluvial deposition inside the corral and only the more stout branches have resisted rotting and erosion.

This is a multicomponent site; the corral a Navajo sheep pen, and the bin-structure and flakes prehistoric. The latter designation is based on several points: 1) this site is less than 200 meters north of a relatively large pueblo, 2) flakes and cores of the same chert are found on both sites, and 3) the amount of fill in the slab structure suggest considerable age. Based on these observations, the two features of the site appear to be unrelated and independant of each other.

This site is on a low bench top above an arroyo draining the south mesa face and flowing into the Rio Puerco. It is in the mesa foothills 2.4 kilometers north of the Rio.

It is recommended that this site be avoided as it may contain

valuable data to aid in umderstanding the pueblo site to the south. In addition, the historic corral may be obscuring other features associated with the prehistoric component.

UNC 3: 13-8

Site 13-8 is a masonry pueblo located on a 45° hill slope. There is an immense amount of sherds, lithics, and ground stone in and washing out of the structure, averaging from 4 to 6 artifacts per square meter up to 30 to 40 artifacts per square meter. The pueblo is constructed from tabular sandstone and appears to have 12 to 15 rooms. Because of its location on a steep hill slope there has been down slope alluvial washing but remaining fill may be up to 2.5 meters deep. The artifact scatter included rectangular uni- and bi-facial sandstone manos; trough and slab sandstone metates; quartzite hammerstones; bone awls; chert, quartzite, obsidian, andesite, and rhyolite lithics; and sherds (fine corrugated 60%, painted 28%, plain gray 10%, red slipped 2%). A sample was collected for lab analysis and the following types were identified:

Early PII painted neckbanded
PII - PIII indented corrugated
Gallup black/white
Chaco black/white
Puerco/Escovado black/white
Mesa Verde black/white
Escovado black/white
Wingate black/red

With reference to the pottery, the pueblo dates around PII - PIII. It should be noted that site 13-7 may be associated with this pueblo (see UNC 3: 13-7 discussion).

Site 13-8 is located on a rather steep east-facing hill slope in the foothills below the mesa. It is 75 meters from the arroyo which drains the southern face of this mesa and 2.3 kilometers from the Rio Puerco. The area immediately surrounding the site is too broken for cultivation but there is level flood plain approximately 2 kilometers to the south.

During the 4 section survey one other contemporary pueblo was found on a similar steep slope (see UNC 3: 17-5). The choice to build on a slope may itself aid in determining the subsistance strategies involved at the pueblo, or possibly climatic factors during the time of occupation. It is recommended that this site be avoided.

UNC 3: 13-10

Site 13-10 is a pueblo situated on a long finger-like knoll just behind a historic Navajo homestead site. It is located in the NW¼ of the SE¼ of the NE¼ of Section 13. There is a drill hole on the northern edge of the site but the habitation area is undisturbed.

It appears to be a one story pueblo of about 10 rooms and one kiva. Estimated wall height is approximately 2 feet. Artifacts include sherds, flakes, ground stone and some fire-cracked rock. The sherds are from the PIII time period.

At this time avoidance of the site is recommended. If further test holes or other construction should need to be done at a later date, excavation of the site would be recommended at that time.

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-136 Field number UNC 3: 13-1

NE ¼ of the SE ¼ of the NE ¼, Sec 13, T. 16 (N) S., R. 17 (E) (W) County McKinley State NM

Map source USGS Church Rock Quad, UNC Orthophoto topo Elevation 6825

Drainage: primary Rio Puerco secondary intermittent arroyos

Location valley bottom of Rio Puerco 1/8 mile from mesa rims on north side of Rio.

Nearest town Gallup Nearest highway _____ Accessibility: foot ___ sedan X 4-wh. dr. X backhoe

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom X Bench ___ Slope ___ Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other _____ Area of site 200 X 50 meters

FEATURES *(Indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab ___ Masonry X ___ Adobe ___ Other jacal, lumber

Refuse area *(direction)* E&S Hearths ___ Burials ___ Sherd/Chipping area ___ Grids/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other timber and lumber piles

PLAN: 1-room X Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other round hogan

Single-tier X Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation E Exposure S

Nature & depth of fill aeolian, alluvial, 0 - .5m Est. Wall height NA Stratified? _____

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, historic Modern struct

Surface: Level X Uneven ___ Slopes to *(direction)* E Surface deposits: Alluvium X Colluvium ___ Aeolian X Talus ___

Residual ___ Soil: Rocky ___ Gravelly ___ Sandy X Clayey X Other loam

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other _____

Arable land *(type, distance & direction)* flood plain - 50m E, 400m S

Water *(distance & direction)* River 1 mile Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? X Local vegetation patterns tumbleweed, small forbs, badly overgrazed

Photo B/W ___ Color ___

Field remarks: Site consists of several juniper post/lumber structures- probably corrals, some fallen down wooden shacks, a stone horno(fallen in), two stone houses(1 in good condition, 1 has had stones removed, both with cement foundations), 1 stone hogan with hand hewn juniper post roof, refuse includes tin cans, bottles, cold cream jars, old wagon (wooden wheel and axle), cast iron and enameled stoves, lumber, metal barrels, 1 sherd of prehistoric pottery, all appear to be post 1930-1940. bone awl from tibia of deer, large trash dump to SE of houses.

References Report 77-SJC-078

Excavation requirements: Labor _____ Time _____ Equipment _____

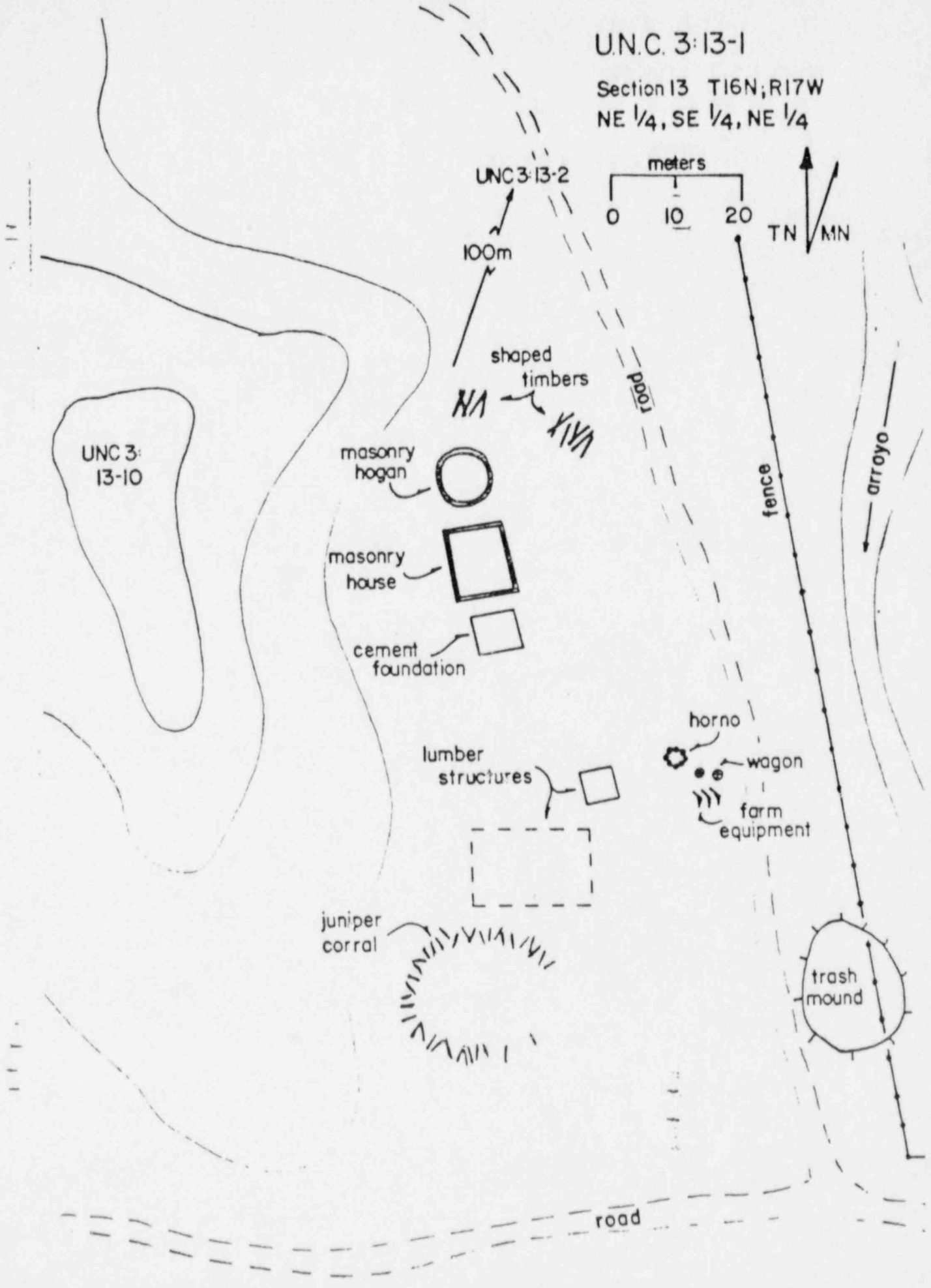
CULTURE _____ / _____ Phase/Date _____ / _____

Zone _____ Locality _____ Lab class 1 2 3 4 5 6 7 8 9 10 _____

Lab remarks _____

Field recorder Dabney Ford Date _____ Collections storage _____ Catalogue Nos _____

Lab recorder _____


U.N.C. 3:13-1
Section 13 T16N; R17W
NE 1/4, SE 1/4, NE 1/4
UNC 3:13-2
meters
0 10 20
TN MN
100m
shaped timbers
road
UNC 3: 13-10
masonry hogan
masonry house
cement foundation
fence
arroyo
horno
lumber structures
wagon
farm equipment
juniper corral
trash mound
road

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-137 Field number UNC 3: 13-2

NE ¼ of the NW ¼ of the NE ¼, Sec. 13, T. 16 N., R. 17 E., County McKinley State NM

Map source USGS Church Rock, New Mexico Elevation _____

Drainage: primary Rio Puerco secondary _____

Location near cliff - facing south to Puerco - flat gentle slope to the south

Nearest town Gallup Nearest highway _____ Accessibility: foot ___ sedan ___ 4-wh. dr. ___ backhoe

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom X Bench ___ Slope X Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other _____ Area of site 50 X 30 feet

FEATURES *(Indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab ___ Masonry X Adobe X Other _____

Refuse area *(direction)* _____ Hearths ___ Burials ___ Sherd/Chipping area ___ Gnds/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other None

PLAN: 1-room X Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other _____

Single-tier X Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation South Exposure open

Nature & depth of fill dugout in hillside Est. Wall height 6' Stratified? No

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, _____. Modern stru

harness and plow

Surface: Level X Uneven ___ Slopes to *(direction)* S Surface deposits: Alluvium X Colluvium ___ Aeolian X Talus ___

Residual ___ Soil: Rocky ___ Gravelly ___ Sandy X Clayey X Other loam

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other _____

Arable land *(type, distance & direction)* 100 to 500' south

Water *(distance & direction)* River ___ Arroyo X Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns snakeweed, range grasses

Photo B/W 2 Color ___

Other resources _____

Field remarks very nice dugout house

References Report 77-SJC-078

Excavation requirements: Labor _____ Time _____ Equipment _____

CULTURE Historic / _____ Phase/Date _____ / _____

Zone _____ Locality _____ Lab class 1 2 3 4 5 6 7 8 9 10 _____

Lab remarks _____

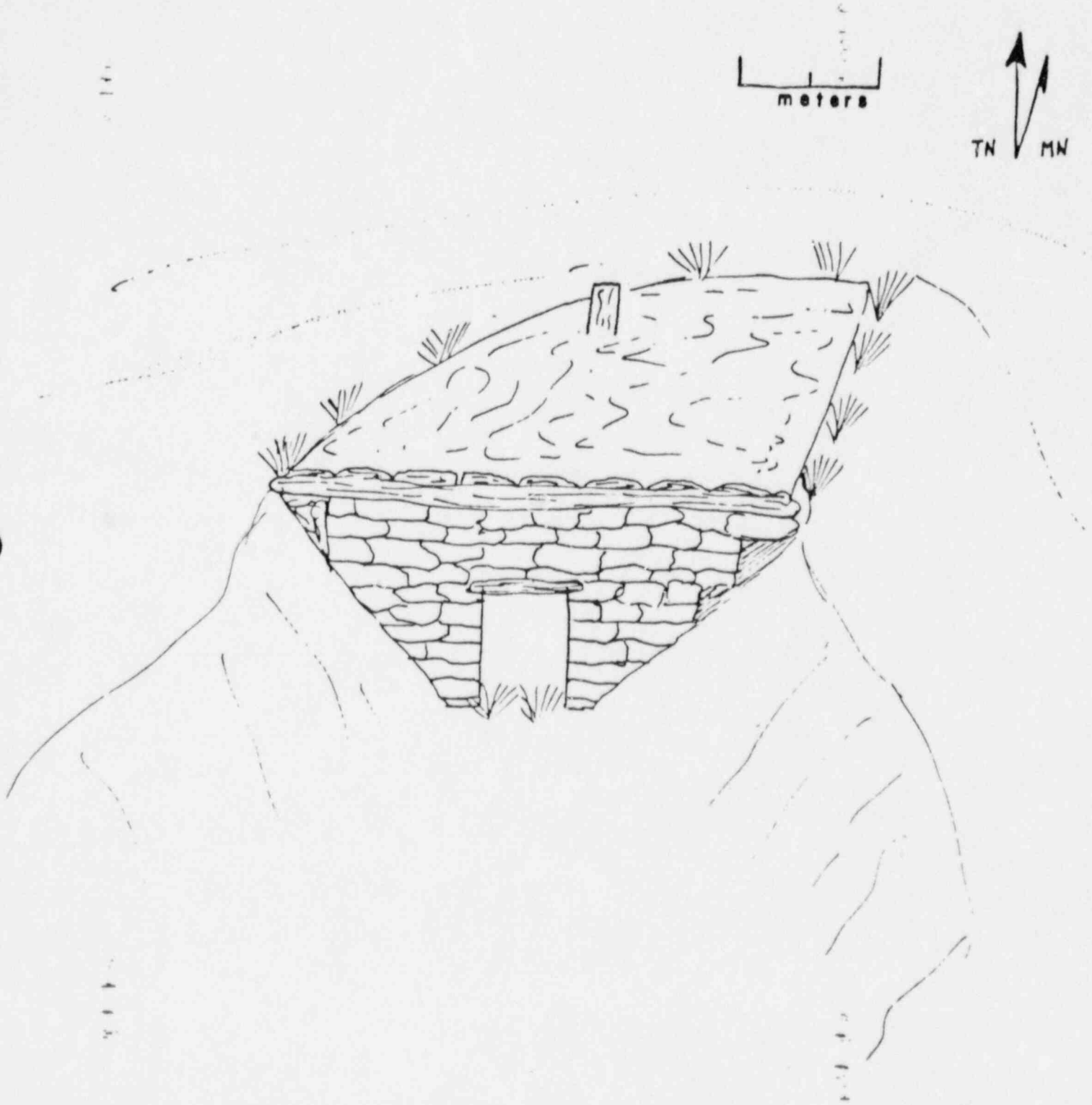
Field recorder Suzanne DeHoff Date 6/2/77 Collections storage _____ Catalogue Nos. _____

Lab recorder _____ Date _____ Sherd Cabinet _____ Drawer _____ Bulk _____

U.N.C. 3:13-2

Section 13 T16N; R17W

NE 1/4, NW 1/4, NE 1/4



NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-138 Field number UNC 3: 13-7

SW ¼ of the SW¼ of the NW ¼, Sec. 13, T. 16 (N) S., R. 17 (E) W, County McKinley State NM

Map source USGS Church Rock Quad, UNC Orthophoto topo Elevation 6885

Drainage: primary Rio Puerco secondary intermittent arroyos

Location low bench on west bank of arroyo paralleling the section line

Nearest town Gallup Nearest highway _____ Accessibility: foot X sedan ____ 4-wh. dr. X backhoe

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ____ Bench X Slope ____ Ridge ____ Mesa top ____ Cliff edge ____ Overhang ____ Cave ____ Dune ____

Other _____ Area of site 20m X 10m (E-W)

FEATURES *(Indicate number)*: Pit houses ____ Kivas ____ Surface rooms: Slab ____ Masonry ____ Adobe ____ Other corral

Refuse area *(direction)* ____ Hearths ____ Burials ____ Sherd/Chipping area S ____ Grids/Dams/Terraces ____ Pictographs/Petroglyphs ____

Trails/Steps ____ Other bin

PLAN: 1-room ____ Linear ____ Arc ____ L-shaped ____ C-shaped ____ F-shaped ____ E-shaped ____ ( )-shaped ____ Enclosed plaza: by a wall ____

by rooms ____ Scattered ____ Indeterminate ____ Other _____

Single-tier ____ Double-tier ____ ____-tiers ____ Part double-tier ____ Part ____ tier ____ Orientation ____ Exposure S

Nature & depth of fill alluvial .5 to 1m Est. Wall height ____ Stratified? ____

Condition: Undisturbed X Eroded ____ Pot-hunted ____ Pottery/Artifact abundance: 10's, 100's, 1000's, 5-10 flakes Modern stru

corral is modern Navajo

Surface: Level X Uneven ____ Slopes to *(direction)* S Surface depos Alluvium X Colluvium ____ Aeolian ____ Talus ____

Residual ____ Soil: Rocky X Gravelly ____ Sandy X Cla ____ Other loam

Local rock outcrops: Sandstone X Limestone ____ Shale X Caliche ____ Ba... ____ Tuff ____ Other _____

Arable land *(type, distance & direction)* ¼ to ½ mile south - floodplain

Water *(distance & direction)*: River 1 mile Arroyo ____ Confluence ____ Spring ____ Seeps ____

Bedrock pool ____ Permanent? X Local vegetation patterns sagebrush, pinon, juniper, snakeweed, cacti

Photo B/W ____ Color ____

Other resources _____

Field remarks slab bin .75m in diameter - double row of rock considerable fill The axe cut juniper branch corral is 12m SW of slab circle. It is 4m in diameter There is an extremely light scatter of chert flakes around the sit

References Report 77-SJC-078

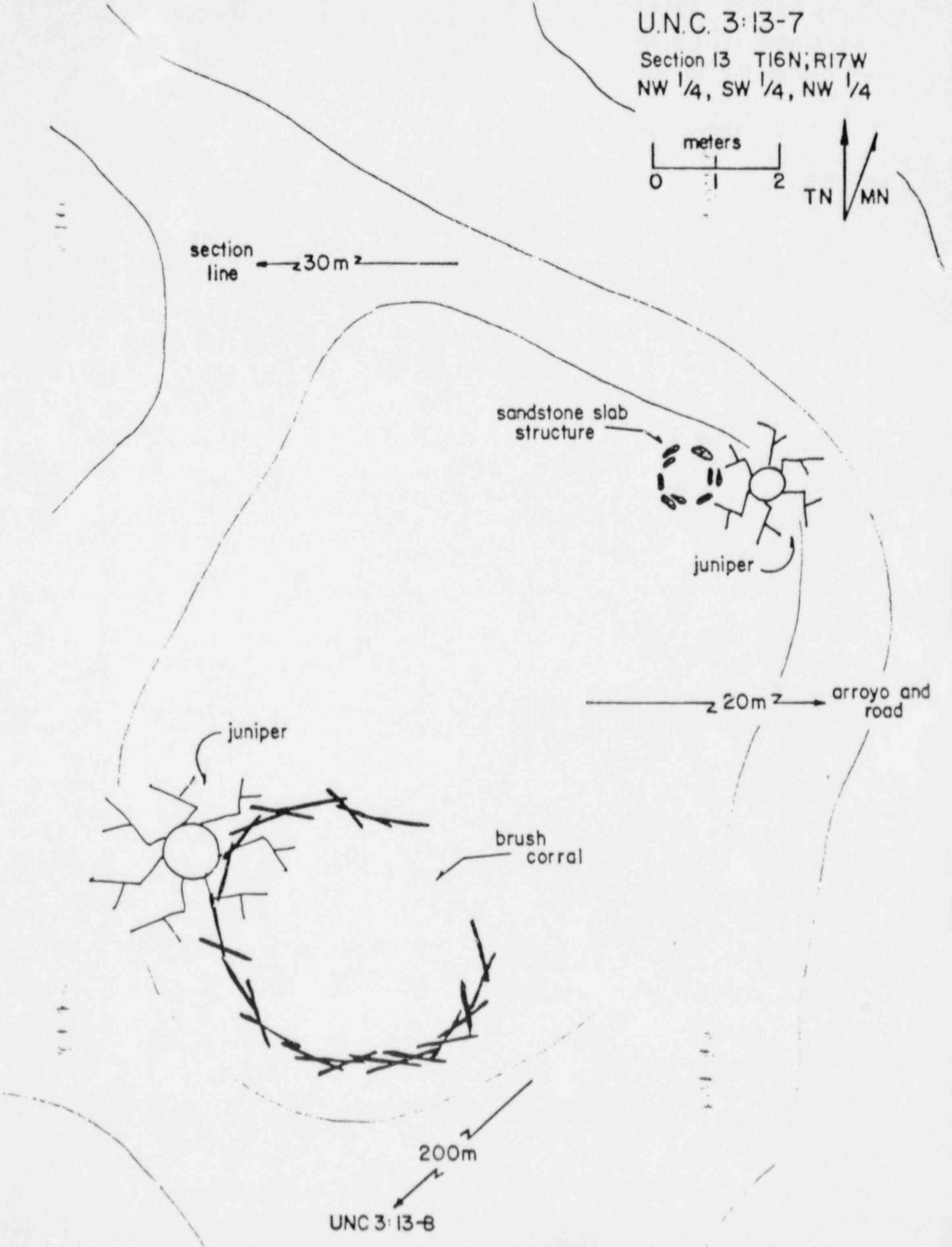
Excavation requirements: Labor ____ Time ____ Equipment ____

CULTURE ____ / ____ Phase/Date ____ / ____

Zone ____ Locality ____ Lab class 1 2 3 4 5 6 7 8 9 10 ____

Lab remarks _____

Field recorder Dabney Ford Date ____ Collections storage ____ Catalogue Nos ____


U.N.C. 3:13-7
Section 13 T16N; R17W
NW 1/4, SW 1/4, NW 1/4
meters
0 1 2
TN MN
section line
30 m
sandstone slab structure
juniper
20m
arroyo and road
juniper
brush corral
200m
UNC 3:13-8

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-139 Field number UNC 3: 13-8

NW ¼ of the NW ¼ of the SW ¼, Sec. 13, T. 16 (N) S., R. 17 E (W), County McKinley State NM

Map source USGS Church Rock Quad, UNC Orthophoto topo Elevation 6900

Drainage: primary Rio Puerco secondary intermittent arroyo

Location 75m SW of UNC 3: 13-7 on slope of hill on west section line

Nearest town Gallup Nearest highway _____ Accessibility: foot X sedan ___ 4-wh. dr. X backhoe

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ___ Bench ___ Slope X Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other _____ Area of site _____

FEATURES *(Indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab ___ Masonry ___ Adobe ___ Other _____

Refuse area *(direction)* E Hearths ___ Burials ___ Sherd/Chipping area E Grids/Dams/Terraces E Pictographs/Petroglyphs ___

Trails/Steps ___ Other _____

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ (▦)-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other _____

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation E-W Exposure E

Nature & depth of fill alluvial colluvial, 3m - .50m Est. Wall height 2m Stratified? _____

Condition: Undisturbed X Eroded X Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, 800-900sherds Modern struc

Surface: Level X Uneven X Slopes to *(direction)* E Surface deposits: Alluvium X Colluvium X Aeolian ___ Talus ___

Residual ___ Soil: Rocky X Gravelly ___ Sandy X Clayey ___ Other loam

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other _____

Arable land *(type, distance & direction)* 1/8 to ¼ mile south - floodplain

Water *(distance & direction)*: River X Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? X Local vegetation patterns sagebrush, juniper, pinon, greasewood, oak

Photo: B/W ___ Color ___

Overview: the site is located on a 60 slope facing East. The rooms begin 20-30 m down from the top of the hill and continue in split level or terraced fashion down to about 20m above flood plain. There appear to be at least a double row of rooms across and 4-6 up and down (E-W). Consturcted of tabular sandstone Sherds are fine corrugated 60%, plain gray 10%, painted 28%, and Wt.Mt. red ware 2%, B/W are probably Gallup, Puerco, Escovado 1 rectangular sandstone mano, 3 quartzite hammerstones, chert cores and flakes, samples collected

Field remarks

References Report 77-SJC-078

Excavation requirements: Labor _____ Time _____ Equipment _____

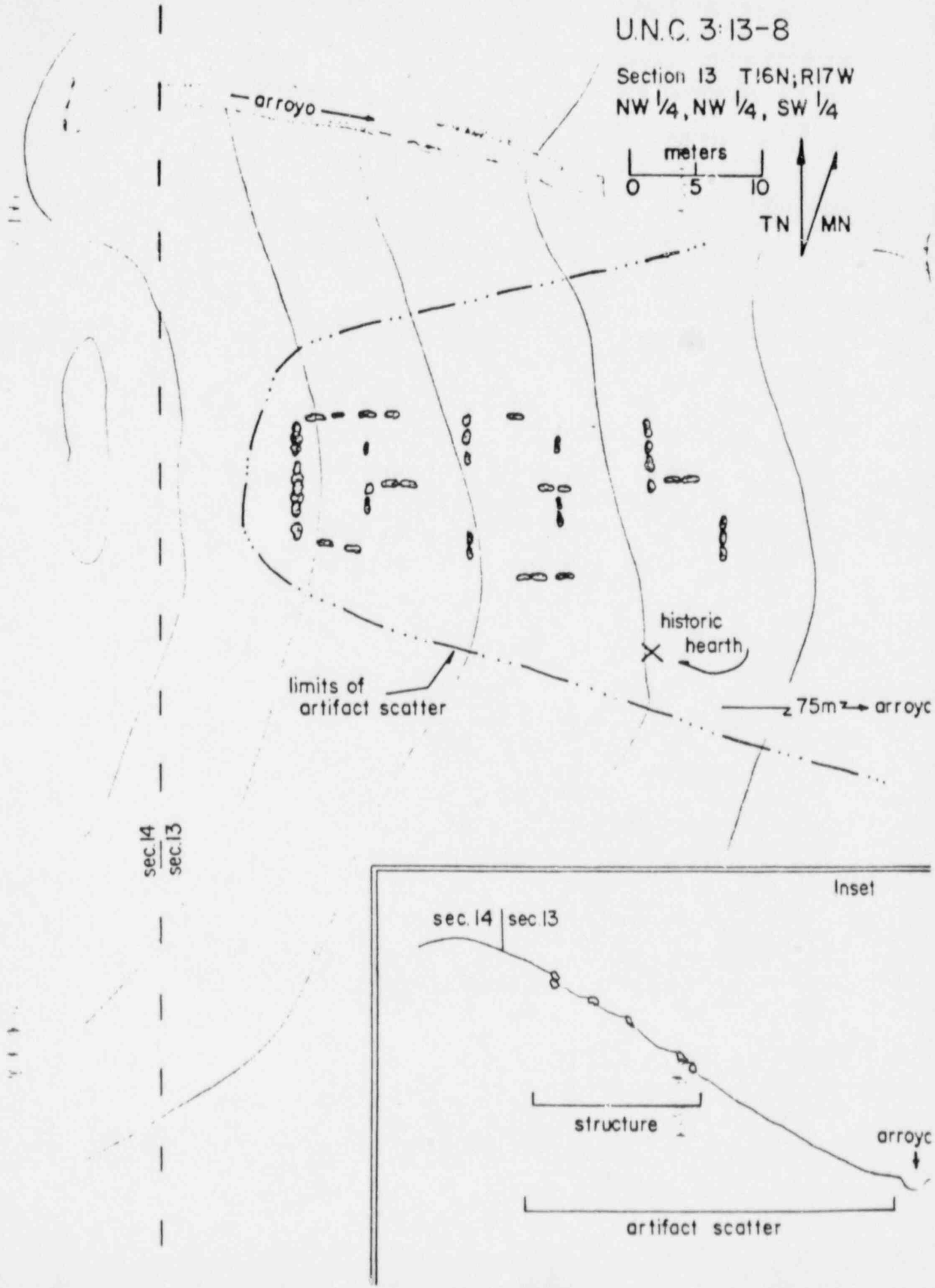
CULTURE _____ / _____ Phase/Date _____ / _____

Zone _____ Locality _____ Lab class 1 2 3 4 5 6 7 8 9 10 _____

Lab remarks _____

Field recorder Rabney Ford Date _____ Collections storage _____ Catalogue Nos _____

Lab recorder _____ Date _____


U.N.C. 3:13-8
Section 13 T16N;R17W
NW 1/4, NW 1/4, SW 1/4
meters
0 5 10
TN MN
arroyo
historic hearth
limits of artifact scatter
75m
arroyo
sec.14 sec.13
Inset
sec. 14 | sec 13
structure
arroyo
artifact scatter

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A. _____

Site name SJC-140 Field number UNC 3: 13-10

NW ¼ of the SE¼ of the NE¼, Sec 13, T. 16 (N) S., R. 17 (E) W., County McKinley State NM

Map source USGS Church Rock Elevation 6860

Drainage: primary Rio Puerco secondary _____

Location On a small bench or finger jutting out just behind a historic homestead (Navajo) site

Nearest town Gallup Nearest highway to mines Accessibility: foot ___ sedan X 4-wh. dr. ___ backhoe ___

Ownership _____

Informant _____

Stake location _____

SITUATION *(check ✓)*: Valley bottom ___ Bench X Slope ___ Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other _____ Area of site _____

FEATURES *(Indicate number)*: Pit houses ___ Kivas 1 Surface rooms: Slab 10 Masonry ___ Adobe ___ Other _____

Refuse area *(direction)* ___ Hearths ___ Burials ___ Sherd/Chipping area 2 Gnds/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other _____

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped X C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other _____

Single-tier X Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation E Exposure open

Nature & depth of fill PIII Pueblo - 1 story- Est. Wall height 2' Stratified? _____

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, low Modern structs

_____

Surface: Level X Uneven ___ Slopes to *(direction)* ___ Surface deposits: Alluvium X Colluvium ___ Aeolian X Talus ___

Residual ___ Soil: Rocky X Gravelly ___ Sandy ___ Clayey ___ Other sandy clay loam with shale

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other _____

Arable land *(type, distance & direction)* 200 yards E & SE

Water *(distance & direction)* River 1 mile Arroyo ___ Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns Sagebrush, juniper, snakeweed, overgrazed grasses

_____

Photo: B/W X Color ___

Other resources _____

Field remarks Drill hole just north

_____

_____

_____

References Report 77-SJC-078

_____

_____

Excavation requirements: Labor _____ Time _____ Equipment _____

CULTURE Anasazi / _____ Phase/Date _____ / _____

Zone _____ Locality _____ Lab class 1 2 3 4 5 6 7 8 9 10 _____

Lab remarks _____

_____

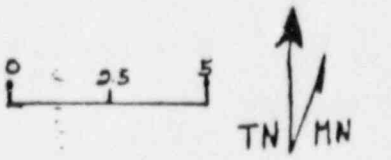
_____

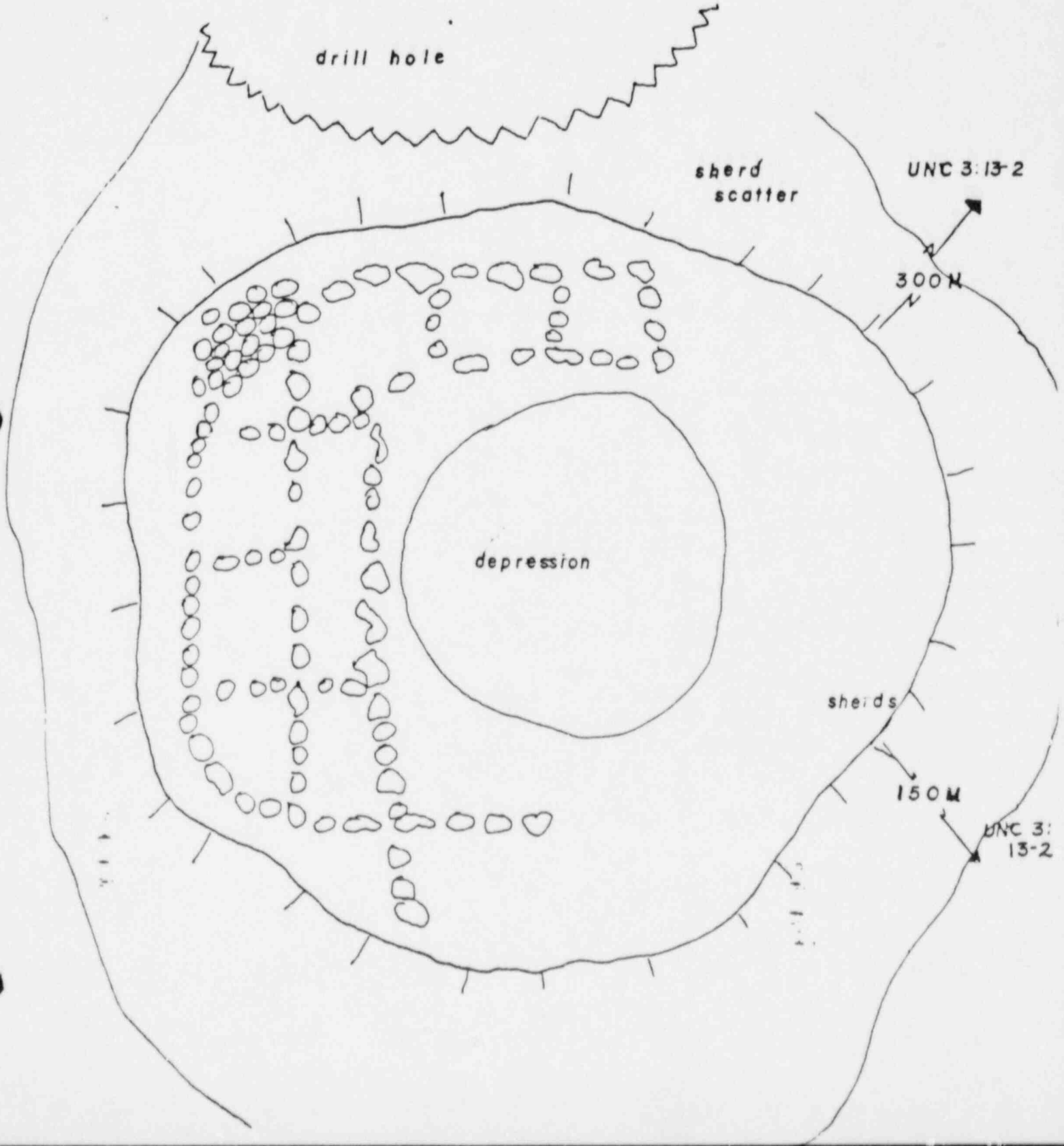
Field recorder Suzanne DeHoff Date 6-3-77 Collections storage _____ Catalogue Nos _____

UNC 3: 13-10

Section 13 T16N; R17W

NW 1/4, SE 1/4, NE 1/4



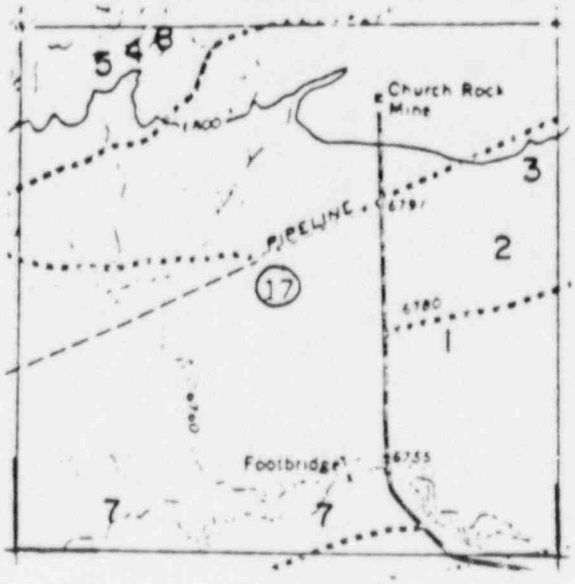


SECTION 17

Section 17 includes the Rio Puerco river bed and adjacent flood plains to the north and south. In addition, the extreme northwest corner of the section includes several low mesa foothills. The elevation ranges from 6760 feet to 6840 feet with a slight general westerly slope. Soil in the Rio Puerco canon bottom is near pure sand, however the river chanel cuts through a uniform sandy clay. The upper elevations tend toward a rocky sandy clay loam. Vegetation on the flood plain proper is difficult to identify due to heavy grazing. The identified species include: saltbush (Atriplex canescens), wolfberry (Symphoricarpos orephilus), wild onion (Allium palemerii), tumbleweed, and Sporobolus spp., Bouteloua spp., Muhlenbergia spp., and Hilaria spp. grass genera.

Two historic and two prehistoric isolated occurences, two prehistoric sites, and one example of "Rock Art" were found in Section 17. The following is a list of the cultural resources in this section.

UNC 3: 17-1	(I.O.)	Sherd scatter in mid east section - 4 sherds total
UNC 3: 17-2	(I.O.)	Rock marked for field boundry
UNC 3: 17-3	(I.O.)	Historic trash and tire sculpture
UNC 3: 17-4	(Pet.)	"1977" spelled out in sandstone slabs
UNC 3: 17-5	(Site)	Pueblo on steep slope of knoll
UNC 3: 17-7	(I.O.)	Sherd scatter on south side of Rio Puerco - 1 sherd per 10 sq. meters spread over 1/6 of section
UNC 3: 17-8	(Site)	Small pueblo on alluvial fan in flood plain



UNC 3: 17-5

Site 17-5 is a 10 to 15 room pueblo & associated artifact scatter. The pueblo is constructed from tabular sandstone, conforming to the 45° slope on which it is built in an arc shaped pattern. The fill within the structure appears to be from .5 to 2.0 meters deep although there has been some downslope washing. There is a heavy artifact scatter around the sturcture; sherds average from 2 to 4 per square meter to 20 to 25 per square meter, lithics approximately ½ the density of the sherds. Lithics are mostly a mottlel yellow or dark purple chert and a few examples of quartzite and obsidian. A sample of sherds was collected for lab analysis and the following types were identified:

McElmo/Mesa Verde black/white
Gallup black/white
Chaco black/white
Mancos black/white
Escovado black/white
Puerco/Escovado black/white
Ribbed corrugated
Gray ware with sand temper
Red slipped ware (too eroded for identification)

This pueblo, based on the pottery sample, dates PII - PIII. Its associated artifact assembly is essentially the same as other PII - PIII pueblos found in the survey area, but the location is unusual. Only Site 13-8 resembles this site's placement on a rather steep slope. The pueblo is situated on the south southeast side of the bench. There is ample flat areas on the saddle and bench top just north of the structures but the slope appears to be the prefered building location. It was thought the aforementioned flat areas may have served as specialized work areas but there is nothing on the surface to indicate this.

The bench slope on which the pueblo was built extends out onto the Rio Puerco flood plain. Thus the bench is surrounded on three sides by potential farm land. The Rio Puerco is 1.2 kilometers due south of the site.

The unusual location and undisturbed context of this site add to its potential for yielding data concerning land use strategies of the puebloan inhabitants. Therefore, avoidance is recommended.

UNC 3: 17-8

Site 17-8 consists of a small masonry room block and an associated sherd and lithic scatter. The structure is constructed of tabular sandstone and appears to have two or possibly three rooms. The artifact scatter is light, covering an area approximately 10m in diameter. Lithics included one core and flakes, manufactured

from the locally outcroping tan and purple chert, as well as a high grade red chert/chalceolony. Sherds were classed as PII - PIII wares, including Gallup black/white and Chacoan corrugated wares. There seems to have been minimal erosion and there may be 1 to 1.5 meters of fill in the structure.

The site is on a very low knoll or finger less than 3 meters above the Rio Puerco flood plain. It is surrounded on three sides by potential farm land and 100 meters west of one of the larger arroyos draining the mesa to the north.

It is recommended that this site be avoided. It appears to have been occupied at the same time the larger pueblos near it were. The sites small size and location far out in the flood plain suggest it may have had a rather specialized function. Thus information from 17-8 will aid in understanding systems and relationships of the related pueblos.

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A _____

Site name SJC-141 Field number UNC 3: 17-5

NE ¼ of the NW ¼ of the NW ¼, Sec. 17 T. 16 (N) S., R 16 (E) W County McKinley State NM

Map source USGS Hard Ground Flats Quad UNC Orthophoto Topo Elevation 6940

Drainage: primary Rio Puerco secondary sheet wash on flood plain

Location on the east and south side (slope) of a low bench projecting out onto the Rio Puerco flood plain 20m above the river

Nearest town Church Rock Nearest highway _____ Accessibility: foot X sedan ___ 4-wh. dr. X backhoe ___

Ownership _____

Informant _____

Stake location _____

SITUATION (check ✓): Valley bottom ___ Bench X Slope X Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___ Other ___ Area of site 900 sq. meters

FEATURES (Indicate number): Pit houses ___ Kivas ___ Surface rooms: Slab 10- Masonry ___ Adobe ___ Other ___

Refuse area (direction) S Hearths ___ Burials ___ Sherd/Chipping area 15 S Gnds/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other ___

PLAN: 1-room ___ Linear ___ Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped X Enclosed plaza: by a wall ___ by rooms ___ Scattered ___ Indeterminate ___ Other ___

Single-tier ___ Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation SE Exposure SSE

Nature & depth of fill rubble .5 to 2m deep Est. Wall height 1-2 m Stratified? ___

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, 700-900sherds Modern structures Navajo hogan, house, corrals, etc. 200m SW of site, plowed field 300m S X

Surface: Level ___ Uneven ___ Slopes to (direction) S, E Surface deposits: Alluvium X Colluvium X Aeolian ___ Talus ___ Residual ___ Soil: Rocky X Gravelly X Sandy X Clayey ___ Other loam

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other gypsum

Arable land (type, distance & direction) flood plain 200m SE, S, SW

Water (distance & direction) River 3/4 mile S Arroyo X Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns wolfberry, juniper, snakeweed, foxtail grass, prickly pear, hedgehog cactus.

Photo: B/W ___ Color ___

Other resources XXXXXXX Site built on 40-60° slope on the S and E sides of low knoll. Sherds (b/w, gray, corrugateds) collected for lab analysis. Lithics sparce but of mottled yellow chert. Rooms appear to be terraced down the slope and extend around the hill. Size of rooms not estimatable.

Field remarks _____

References Report 77-SJC-078

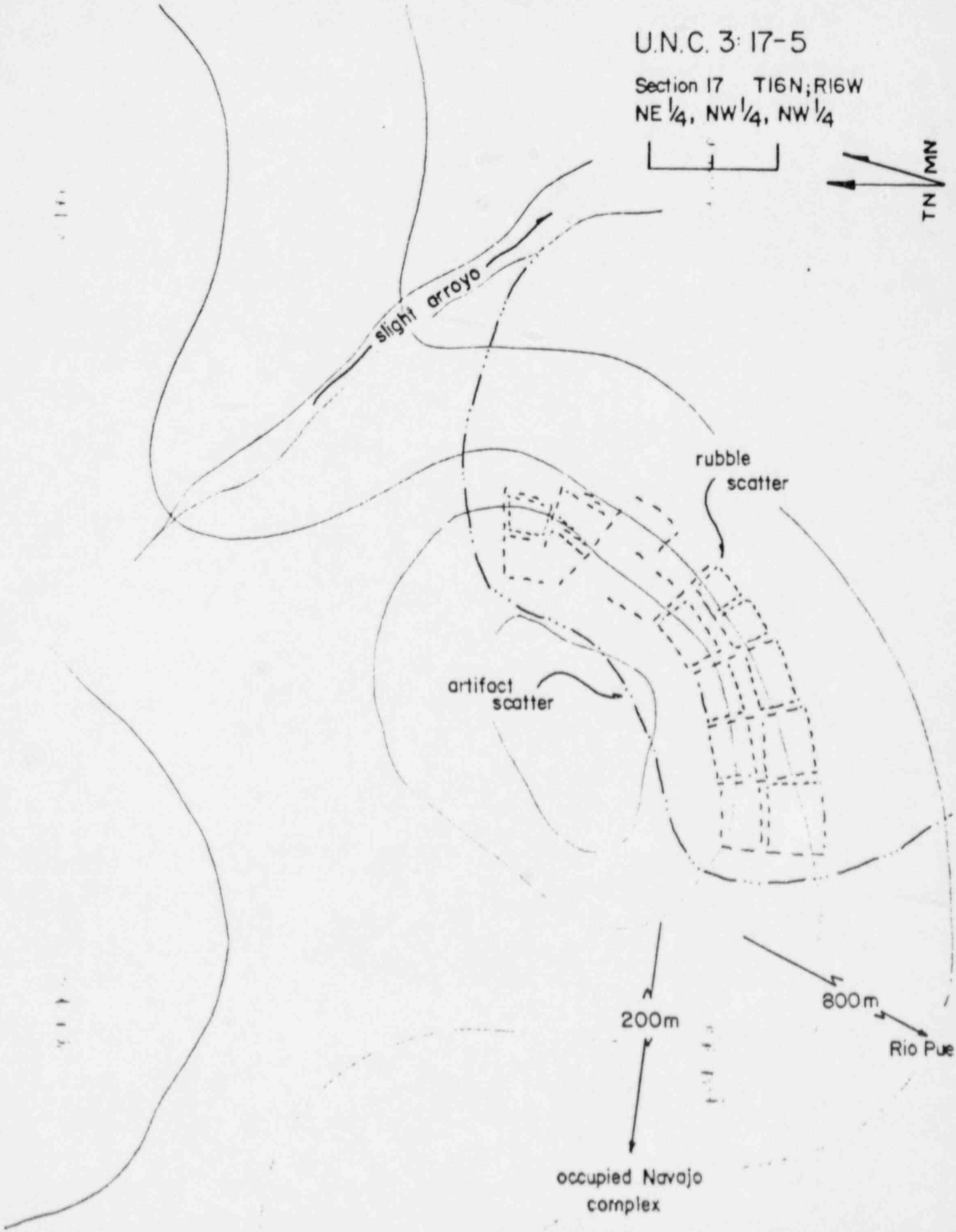
Excavation requirements: Labor ___ Time ___ Equipment ___

CULTURE ___ / ___ Phase/Date ___ / ___

Zone ___ Locality ___ Lab class 1 2 3 4 5 6 7 8 9 10 ___

Lab remarks _____

Field recorder Dabney Ford Date ___ Collections storage ___ Catalogue Nos ___


U.N.C. 3: 17-5
Section 17 T16N; R16W
NE 1/4, NW 1/4, NW 1/4
TN MN
slight arroyo
rubble scatter
artifact scatter
200m
800m
Rio Pue
occupied Navajo complex

NMSU San Juan Campus Archeological Survey United Nuclear Project SITE NO.: L.A ____

Site name SJC-142 Field numbe UNC 3: 17-8

SE ¼ of the SW ¼ of the SW¼, Sec. 17, T. 16 S, R. 16 (E) W, County McKinley State NM

Map source USGS Hard Ground Flats Quad Elevation ____

Drainage: primary Rio Puerco secondary ____

Location on a very low mound 3m above flood plain on extreme south section lin

Nearest town ____ Nearest highway ____ Accessibility: foot ___ sedan ___ 4-wh. dr. ___ backhoe ___

Ownership ____

Informant ____

Stake location ____

SITUATION *(check ✓)*: Valley bottom ___ Bench ___ Slope ___ Ridge ___ Mesa top ___ Cliff edge ___ Overhang ___ Cave ___ Dune ___

Other small knoll Area of site 100 sq. m

FEATURES *(indicate number)*: Pit houses ___ Kivas ___ Surface rooms: Slab 2 Masonry ___ Adobe ___ Other ___

Refuse area *(direction)* S Hearths ___ Burials ___ Sherd/Chipping area S Grids/Dams/Terraces ___ Pictographs/Petroglyphs ___

Trails/Steps ___ Other ___

PLAN: 1-room ___ Linear X Arc ___ L-shaped ___ C-shaped ___ F-shaped ___ E-shaped ___ ( )-shaped ___ Enclosed plaza: by a wall ___

by rooms ___ Scattered ___ Indeterminate ___ Other ___

Single-tier X Double-tier ___ ___-tiers ___ Part double-tier ___ Part ___ tier ___ Orientation E-W Exposure S

Nature & depth of fill rubble .5-1.5m Est. Wall height 1-2m Stratified? no

Condition: Undisturbed X Eroded ___ Pot-hunted ___ Pottery/Artifact abundance: 10's, 100's, 1000's, 20-30 sherds Modern struct

same as 8-5 only this site further east

Surface: Level ___ Uneven ___ Slopes to *(direction)* S Surface deposits: Alluvium X Colluvium ___ Aeolian ___ Talus ___

Residual ___ Soil: Rocky X Gravelly ___ Sandy X Clayey ___ Other loam

Local rock outcrops: Sandstone X Limestone ___ Shale X Caliche ___ Basalt ___ Tuff ___ Other gypsum

Arable land *(type, distance & direction)* 200m south, 50m east floodplain

Water *(distance & direction)* River 3/4 mile S Arroyo X Confluence ___ Spring ___ Seeps ___

Bedrock pool ___ Permanent? ___ Local vegetation patterns tumbleweed, snakeweed, burchgrass, juniper.

Photo B/W ___ Color ___

Other resources ___

Field remarks single surface rooms (1-3) on south slope of very low knoll. Artifact scatter light built of local outcropping material. nice pink/red chert flake.

References Report 77-SJC-078

Excavation requirements: Labor ___ Time ___ Equipment ___

CULTURE ___ / ___ Phase/Date ___ / ___

Zone ___ Locality ___ Lab class 1 2 3 4 5 6 7 8 9 10

Lab remarks ___

Field recorder Dabney Ford Date ___ Collections ___ Catalogue Nos ___

Negs ___

U.N.C. 3: 17-8

Section 17 T16N; R16W

NW 1/4, NE 1/4, NW 1/4

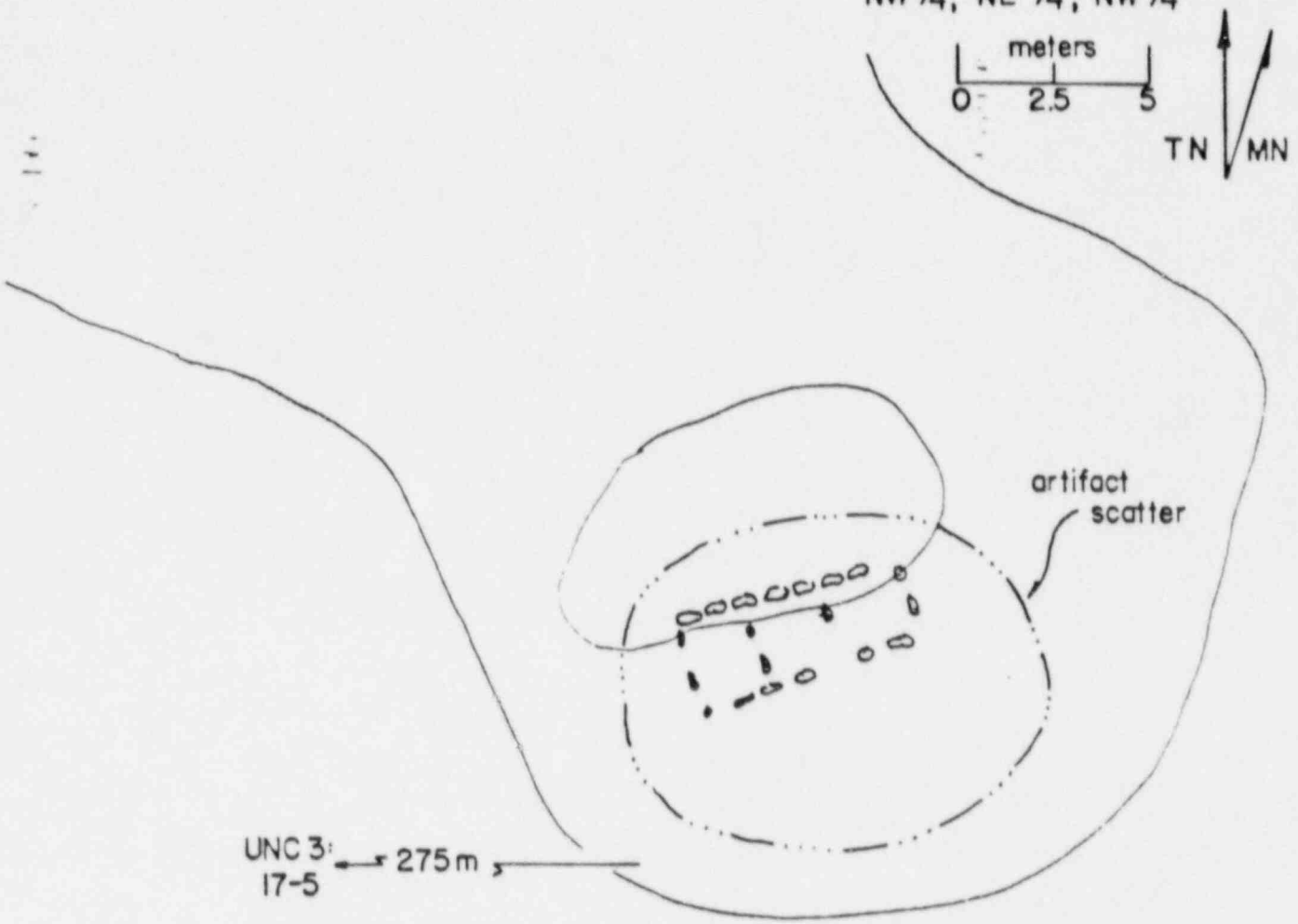


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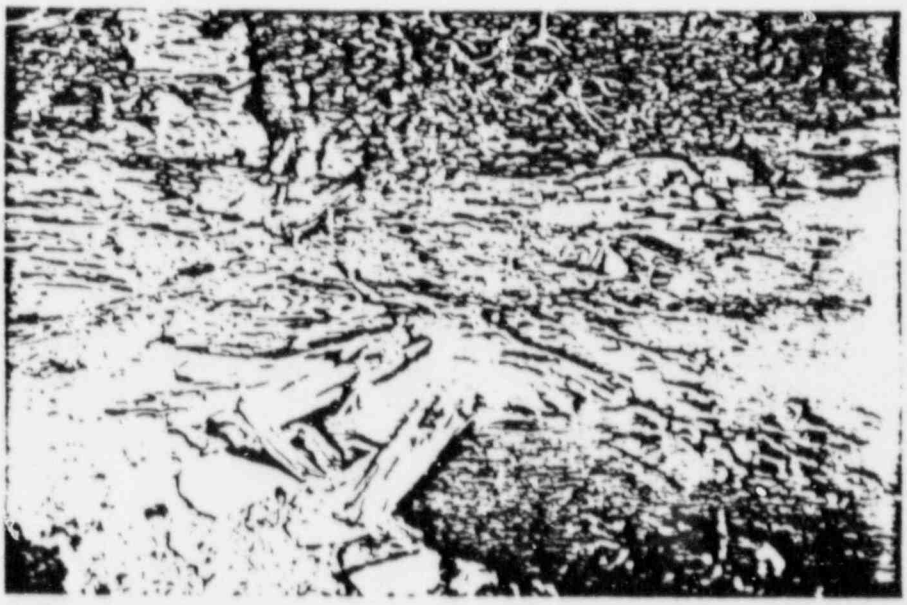
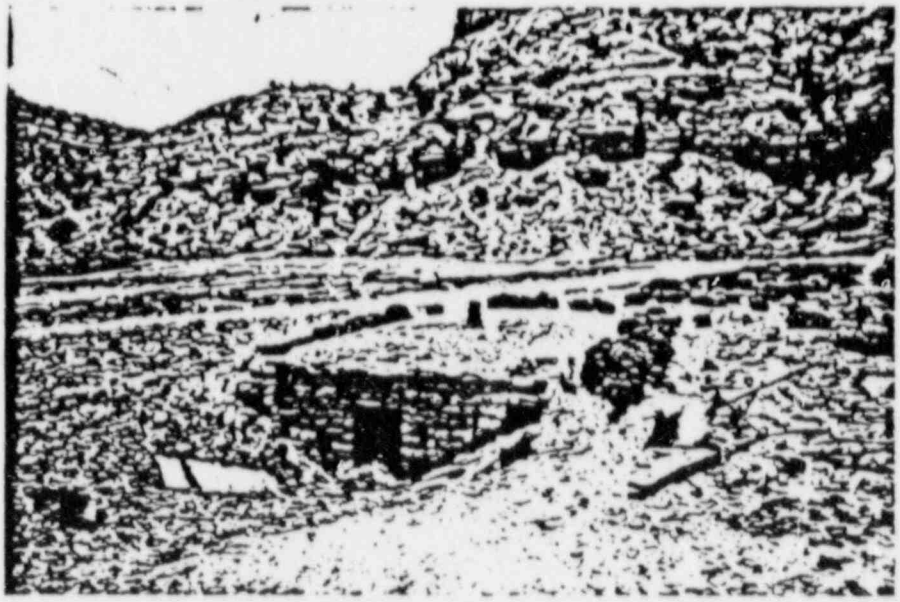
Plate I

Example of Historic Petroglyph
Petroglyph 12-5

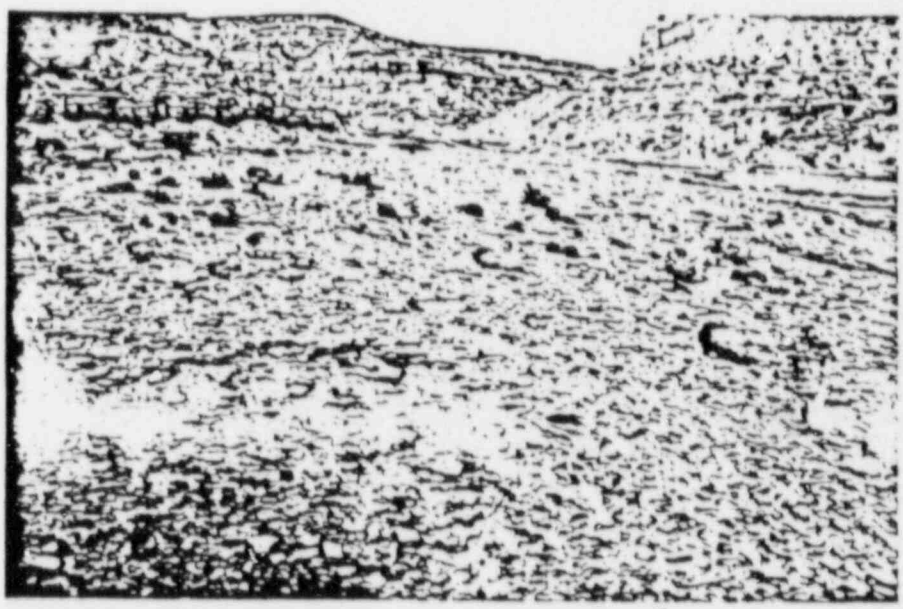


Example of Historic Navajo Structure
Sweathouse 8-13 #2

Plate II

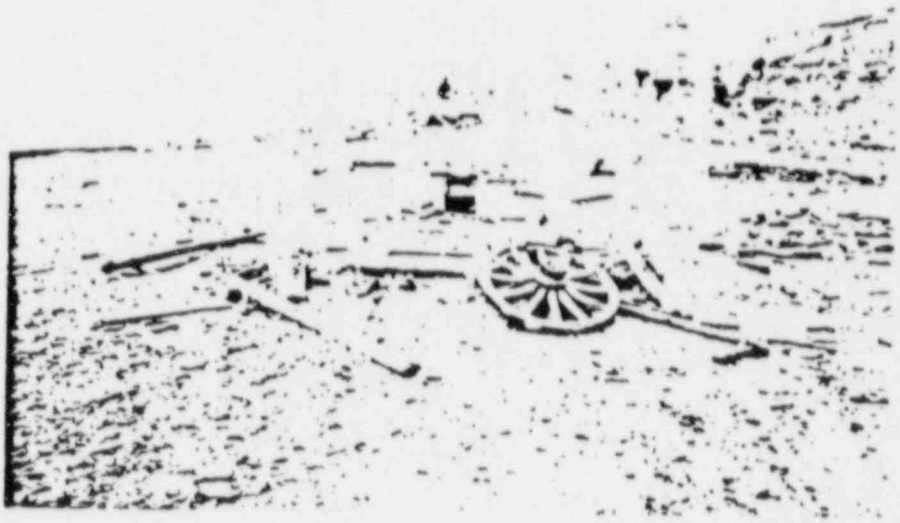


Example of Historic Anglo Structure
Dugout 13-2

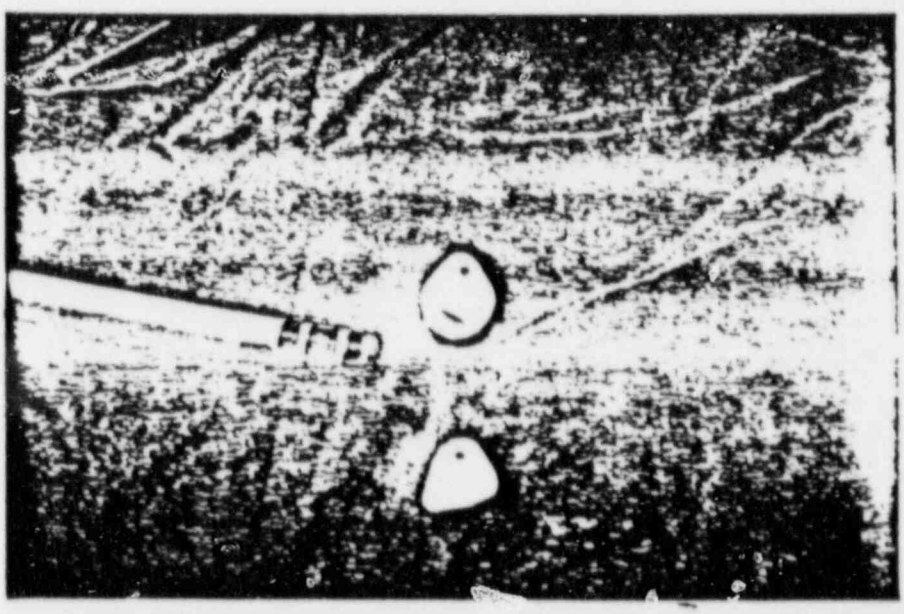


Example of Prehistoric Pueblo
Pueblo 8-15

Plate III



Example of Historic Navajo Homestead
Navajo Complex 13-1



Example of Isolated Occurance
Shell Beads 13-3

APPENDIX B

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. GS-1 (14.5/36.5)

T.D. ______ LOCATION: ______

BIT SIZE 5 1/8 kenclaw Tom Nunn

SAMPLE LOG BY Lichnaishey LEASE: (PROJECT)

DATE 9-29-87 11:25 Am COUNTY ______ STATE N. Mex.

Column headings: DEPTH | LITHOLOGY | CARBON | PYRITE | OTHER Alteration | Alteration %: Primary Oxidation, Reduction, Secondary Oxidation | SAMPLE DESCRIPTION (Amounts in Percent, %)

L = Limonite (Lmn)
SOX = Surf Oxidation
Rd = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
Pt = Pyrite Tarnish
POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tn = Transition Zone
Fld = Feldspar
T = Trace
1 = Minor
2 = Moderate
3 = Abundant
C = Carbon
K = Kaolin
B = Bleached
Cht = Chert

Depth	Sample Description
0–10	Black sandy soil
10–20	Alluvium – black, sandy
20–30	Shale, dark yellowish brown, 10 YR 4/2 silty? surface oxidized
30–40	* Shale – black, wet, fissile, thin hard stringers (sandstone) lt gray, vfg, with mod cemented. Reduced !!!

Depth scale: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 10, 20, 30, 40, 50, 60, 70, 80, 90, 200

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-1 (147/363)

T.D. _____ LOCATION: _____

BIT SIZE 5 1/8 Kendaw

SAMPLE LOG BY Lithgow/Ley LEASE: (PROJECT) _____

DATE 9-29-87 COUNTY _____ STATE N. mex.

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER	Alteration % Primary Oxidation	Reduction	Secondary Oxidation

L = Limonite (Lmn)
SOX = Surf Oxidation
Red = Reduced
Red = Reduction
P = Pyrite (Pyr)
P_T = Pyrite Terrain
POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tra = Transition Zone
Fld = Feldspar

SAMPLE DESCRIPTION
(Amounts in Percent, %)

T = Trace
1 = Minor
2 = Moderate
3 = Abundant
C = Carbon
K = Kaolin
Bl = Bleached
Cht = Chert

200 Shale, black, N1, fissile, thin hard stringers of
10 (Sandstone, lt gray, vfg, well sorted and rounded, Reduced
20
30
40
50
60 X test circulation
70
80
90
300
10
20
30
40
50
60
70
80
90
400

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-1 (9.7 / 36.5)

T.D. _____ LOCATION: _____

BIT SIZE _____

SAMPLE LOG BY Lichnovsky LEASE: (PROJECT) _____

DATE 9-29-87 COUNTY _____ STATE _____

DEPTH | LITHOLOGY | CARBON | PYRITE | OTHER | Alteration: Primary Oxidation | Reduction | Secondary Oxidation

L=Limonite (Lmn)
SOX = Surf Oxidation
Rd = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
Py = Pyrite Tarnish

POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tn = Transition Zone
Fld = Feldspar

SAMPLE DESCRIPTION
(Amounts in Percent, %)

T = Trace
1 = Minor
2 = Moderate
3 = Abundant

C = Carbon
K = Kaolin
B = Bleached
Calc Cbrt

100 Shale, black, N1, fissiable, thin hair stringers of sandstone gray, vfg, well cemented Reduced

10

20

30

40

50 Sand, lt gray N6 vf-f grained, subangular grains abundant clay matrix to consolidation. Reduced stringers of black shale

60

70

80

90

500

10 Shale, black, N1 fissiable, contains a thin band stringers of sandstone, lt gray, vfg, well cemented Reduced

20

30

40

50

60

70

80

90

600 thin coal bed
Shale, black N1

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. ER-1 (W.2/36.5)

T.D. 650 LOCATION:

BIT SIZE 5 1/8

SAMPLE LOG BY Lichnovsky LEASE: (PROJECT)

DATE 9-30-86 COUNTY STATE N. Mex

L = Limonite (Lmn)
SOX = Surf Oxidation
Rd = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
Pt = Pyrite Tarnish

POX = Primary Oxid.
SOX = Base of Surf Oxid
SOX = Secondary Oxid
Tz = Transition Zone
Fld = Feldspar

SAMPLE DESCRIPTION
(Amounts in Percent, %)

T = Trace
1 = Minor
2 = Moderate
3 = Abundant

C = Carbon
K = Kaolin
B = Bleached
Calc = Calcite

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER	Alteration % Primary Oxidation	Reduction	Secondary Oxidation
0							
10							
20							
30							
40							
650 TD							
60							
70							
80							
90							
00							
10							
20							
30							
40							
50							
60							
70							
80							
90							
00							

Shale, black, N1, fissile, thin stringers of hard sandstone, laminar

Sandstone, light gray N6, vf-f grained, well sorted, well cemented, siliceous?, hard. Reduced.

Shale, black, N1, fissile, 1ft. coal bed? Reduced

Sandstone, light gray N6, vf-f grained, well sorted, well cemented, siliceous? Rd

Shale, black, N1, fissile, Reduced

Sandstone, light gray N6, vf-f grained, well sorted, well cemented, siliceous? Rd

Shale, very, dk gray, N3, massive

TD 650'

10' Samples 0-600 5' Samples 600 -

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☒ HOLE NO. 88-2 (147/375)

T.D. 680 LOCATION: 10 foot samples 0-

BIT SIZE 6 3/4 Tom Numa drilling

SAMPLE LOG BY Lichnovsky LEASE: (PROJECT) Churchwell sec. 8

DATE 10-3-87 COUNTY McKinney STATE N. Mex

L = Limonite (Lim) SOX = Surf Oxidation Rd = Reduced Red = Reduction P = Pyrite (Pyr) P_T = Pyrite Tarnish

POX = Primary Oxid BOX = Base of Surf Oxid SOX = Secondary Oxid Tn = Transition Zone Fld = Feldspar

SAMPLE DESCRIPTION (Amounts in Percent, %)

T = Trace 1 = Minor 2 = Moderate 3 = Abundant

C = Carbon K = Kaolin B = Bleached Chk Chert

DEPTH	LITHOLOGY	CARBON	PYRITE	Alteration %			
				Primary Oxidation	Reduction	Secondary Oxidation	
0							
10							Sandy soil
20							Valley fill - dark yellowish brown, weathered shale & sandstone.
30							
40							Shale, dark yellowish brown, 10YR 4/2, surface oxidized.
50							
60							Shale, dark, N1, fissionable, thin stringers of hard sandstone.
70							Hgray, vfg, well cemented, fractured.
80							
90							
100							
10							
20							Lost circulation. I believe it's in the top 40 feet. through we set 40 feet of surface casing. No samples 120 - 180 feet
30							
40							
50							
60							
70							
80							Shale, black, N1, fissionable, contains thin stringers of hard sandstone, Hgray, vfg, well cemented, Reduced
90							
200							

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-2 (147/37.5)

T.D. _____ LOCATION: _____

BIT SIZE 6 3/4

SAMPLE LOG BY Lichtwardt LEASE: (PROJECT)

DATE 10-6-87 COUNTY _____ STATE N Mex.

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Mineralogy	Alteration % Primary Oxidation	Reduction	Secondary Oxidation

L = Limonite (Limn)
SOX = Surf Oxidation
Rd = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
Py = Pyrite Tarnish
POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tn = Transition Zone
Fld = Feldspar

SAMPLE DESCRIPTION
(Amounts in Percent, %)

T = Trace
1 = Minor
2 = Moderate
3 = Abundant
C = Carbon
K = Kaolin
B = Bleached
Ch = Chert

00 shale, black, N1, fissable, contains thin stringers of hard, lt gray, vfg, well cemented sandstone. Reduced still losing water

10
20
30
40
50
60
70
80
90
300
10
20
30
40
50
60
70
80
90
400

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CRZ (N 7/ 37.5)

T.D. LOCATION:

10' Samples

BIT SIZE

SAMPLE LOG BY Lichnovsky LEASE: (PROJECT)

DATE 10-7-87 COUNTY STATE N Mex

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER	Alteration %: Primary Oxidation	Reduction	Secondary Oxidation	SAMPLE DESCRIPTION (Amounts in Percent, %)
400								Shale, black, N1, fissible, contains thin hard sandstone stringers (lt gy, vfg, well cemented) Reduced
10								
20								
30								Sandstone, light gray N7, vfg, moderately cemented, interbedded with thin discontinuous shale lenses. Reduced.
40								
50								
60								
70								
80								
90								Shale, black, N1, fissible, contains thin hard sandstone stringers. Reduced.
500								
10								
20								
30								
40								
50								
60								
70								Coal, black, N-1,
80								Shale, black, N-1, fissible,
90								Sandstone, lt gray, N7, vfg, well cemented, (siliceous?) Reduced
1000								

L: Limonite (Lmn); SOX: Surf Oxidation; Rd: Reduced; Rdt: Reduction; P: Pyrite (Pyr); Pt: Pyrite Tarnish; POX: Primary Oxid; BSOX: Base of Surf Oxid; 2OX: Secondary Oxid; Tn: Transition Zone; Fld: Feldspar; T: Trace; 1: Minor; 2: Moderate; 3: Abundant; C: Carbon; K: Kaolin; B: Bleached; Cht: Chert

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. cl-2 (14.7/37.5)

T.D. 680 LOCATION:

BIT SIZE ______ 600 - 5' samples

SAMPLE LOG BY Lichnovsky LEASE: (PROJECT)

DATE 10-8-87 COUNTY ______ STATE ______

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Alteration	Primary Oxidation	Reduction	Secondary Oxidation	SAMPLE DESCRIPTION (Amounts in Percent, %)
600								Sand, lt gray, N7, vf-f grained, moderately cemented, fair compaction. stringers well cemented Reduced.
10								
20								
30								Shale, lt gray, N7, massive?, trace greyish green clay (5G 5/2) Reduced.
40								
50								Sand, v lt gray, N8, f-c g, moderately compact, just getting a rounded q'z grains., Reduced
60								
70								Shale, greenish gray. 5G 6/1, massive.
80								TD 680
90								
700								
10								
20								
30								
40								
50								
60								
70								
80								
90								
00								

L: Limonite (Lmn); SOX: Surf Oxidation; Rd: Reduced; Rdt: Reduction; P: Pyrite (Pyr); Pt: Pyrite Tarnish; POX: Primary Oxid; BSOX: Base of Surf Oxid; ZOX: Secondary Oxid; Tn: Transition Zone; fld: Feldspar; T: Trace; 1: Minor; 2: Moderate; 3: Abundant; C: Carbon; K: Kaolin; B: Bleached; Cht: Chert

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-3(

T.D. _____ LOCATION: Core Description

BIT SIZE 4X3

CORE LOG BY Lichnovsky LEASE: (PROJECT) _____

DATE 11-4-87 COUNTY McKinley STATE N. Mex.

L = Limonite (Limo)
SOX = Surf Oxidation
Rd = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
Pa = Pyrite Tarnish
POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tn = Transition Zone
Fld = Feldspar

SAMPLE DESCRIPTION
(Amounts in Percent, %)

T = Trace
L = Minor
M = Moderate
A = Abundant
C = Carbon
K = Kaolin
B = Bleached Calc Cmt

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Mineralogy	Alteration % Primary Oxidation	Reduction	Secondary Oxidation
633							
634							
635							
636							
637							
638							
639							
640							
641							
642							
643							
60							
70							
80							
90							
100							

Shale, pale green, 5 G 7/2, silty, fracture with Calcite filling at 633' 11" 45° dip, fracture at 634'9" calcite filled, 40° dip, fracture at 634' 10" 70° dip, scattered blebs of carbonaceous clay

Shale, greenish gray, 5 G 5/2, slightly silty

Siltstone, light greenish gray, 5 G 8/1, fine clay matrix, streaks gray blebs scattered throughout. Black (carbonaceous) staining scattered throughout

Shale, dark greenish gray, 5 G 4/1, slightly silty.

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-3

T.D. ______ LOCATION: ______

BIT SIZE ______ ______

CORE LOG BY Lichnovsky LEASE: (PROJECT) ______

DATE 11-3-87 COUNTY ______ STATE ______

L: Limonite (Lmn) · SOX: Surf Oxidation · Rd: Reduced · Rdt: Reduction · P: Pyrite (Pyr) · Pt: Pyrite Tarnish · POX: Primary Oxid · BSOX: Base of Surf Oxid · SOX: Secondary Oxid · Tn: Transition Zone · Fld: Feldspar · T: Trace · 1: Minor · 2: Moderate · 3: Abundant · C: Carbon · K: Kaolin · B: Bleached · Cht: Chert

SAMPLE DESCRIPTION (Amounts in Percent, %)

Column headings: DEPTH · LITHOLOGY · CARBON · PYRITE · OTHER Alteration · Alteration %: Primary Oxidation · Reduction · Secondary Oxidation

DEPTH	SAMPLE DESCRIPTION
680	Shale, dark greenish gray, 5G 4/1, silty, streaks stringers of black (carbonaceous) material.
681	
682	
683	No Recovery
684	
685	
686	
687	
688	
689	
690	Siltstone, dark gray, N3, clay matrix, (carbonaceous ?), poorly sorted contains coarse qtz grains
691	Siltstone, dark greenish gray, 5G 4/1, clay matrix,
692	Sandstone, dark greenish gray, 5G 4/1, fine grained, some clay matrix, streaks of patches of light brown 5YR 6/4, thin carbonaceous stringers at top, scattered clay galls some with hematite halo, and some limonite stained.
693	Sandstone, light olive gray, 5Y 5/2, medium to coarse grained, poorly sorted graded bedding fining upwards, 10% [illegible], [illegible] weathered
694	3 separate beds 292'5" 294'4" / 294'4" - 296'4" / 296'4" - 299'5"
695	
696	297'10" - 299'5" fine dissiminated wood (carbonaceous) material. Occasionally green clay galls.
697	
698	
699	
700	

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-3

T.D. ________ LOCATION: ________

BIT SIZE ________

~~SAMPLE~~ Core LOG BY Lichnovsky LEASE: (PROJECT) ________

DATE 11-4-87 COUNTY ________ STATE ________

Legend: L: Limonite (Lmn); SOX: Surf Oxidation; Rd: Reduced; Rdt: Reduction; P: Pyrite (Pyr); Py: Pyrite Tarnish; POX: Primary Oxid; BSOX: Base of Surf Oxid; SOX: Secondary Oxid; Tn: Transition Zone; Fld: Feldspar; T: Trace; 1: Minor; 2: Moderate; 3: Abundant; C: Carbon; K: Kaolin; B: Bleached; Cht: Chert

SAMPLE DESCRIPTION (Amounts in Percent, %)

Depth	Sample Description
760	Sandstone, light olive gray, 5Y 5/2, medium to coarse grained, poorly sorted, 10% red micro olive, fresh, bedded, bedding dips at low angles 10-15°.
761	widely scattered clay galls & chert fragments.
762	trace fine disseminated pyrite 762'3" - 762'8"
763	
764	
765	
766	
767	
768	
769	
770	
771	
772	sandstone, dusky green, 5G 3/2, fine grained, poorly sorted, cemented, scattered chert fragments (ca 10%).
773	sandstone, dusky green, 5G 3/2, fine grained, chert fragments cemented
774	sandstone light olive gray, 5Y 5/2, fine to medium grained, poorly sorted, 10%-15% microcline, fresh to weathered, chert fragments and clay galls, horizontal bedding
775	
776	
777	
778	
779	
780	

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-3

T.D. ______ LOCATION: ______

BIT SIZE ______

~~SAMPLE~~ Core LOG BY Lichnovsky LEASE: (PROJECT) ______

DATE 11-4-87 COUNTY ______ STATE ______

Legend: L = Limonite (Lmn); SOX = Surf. Oxidation; Rd = Reduced; Rdt = Reduction; P = Pyrite (Pyr); Py = Pyrite Tarnish; POX = Primary Oxid; BSOX = Base of Surf. Oxid; SOX = Secondary Oxid; Tn = Transition Zone; Fld = Feldspar; T = Trace; 1 = Minor; 2 = Moderate; 3 = Abundant; C = Carbon; B = Bleached; K = Kaolin; Cht = Chert

Columns: DEPTH | LITHOLOGY | CARBON | PYRITE | OTHER Minerals | Alteration % (Primary Oxidation, Reduction, Secondary Oxidation) | SAMPLE DESCRIPTION (Amounts in Percent, %)

DEPTH	SAMPLE DESCRIPTION
780	Sandstone, olive gray, 5Y4/1, fine grained, moderately sorted, clay galls: moderately cemented,
781	
782	Sandstone, medium gray, N5 fine to medium grained, moderately sorted, 10% microcline, scattered clay galls. moderately cemented green clay matrix
783	
784	
785	sandstone, dark gray, N3, fine to medium, moderately sorted. 10%-15% microcline, clay galls at top. common black stain (humic or carbonaceous) carbonaceous (?) fragments scattered throughout, ore bearing, Trace (gypsum?) pore filling less than 5%.
786	
787	
788	
789	
790	
791	
792	sandstone, greenish gray 5G 6/1, fine grained, moderately sorted 10% - 15% microcline friable small [illegible]. 1" pale reddish brown (10R 5/4) [illegible] at top.
793	Sandstone, olive gray, 5Y 3/2, fine to medium grained, moderately sorted, friable, trace gypsum? in pore space less than 1%. light black staining.
794	
795	
796	
797	Sandstone dark gray, N3, coarse grained, poorly sorted. 10-15% microcline common black stain, trace gypsum in pore space. ? scattered 1/4" to 1/2" chert fragments, trace fragments of black (carbonaceous?) material.
798	
799	
800	

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-3

T.D. ______ LOCATION: ______

BIT SIZE 3"

Core LOG BY Lichnovsky LEASE: (PROJECT)

DATE 11-4-87 COUNTY ______ STATE ______

Columns: DEPTH | LITHOLOGY | CARBON | PYRITE | OTHER | Alteration % (Primary Oxidation, Reduction, Secondary Oxidation) | SAMPLE DESCRIPTION (Amounts in Percent, %)

L: Limonite (Lmn); SOX: Surf Oxidation; Re: Reduced; Ret: Reduction; P: Pyrite (Pyr); Pt: Pyrite Tarnish; POX: Primary Oxid; BSOX: Base of Surf Oxid; SOX: Secondary Oxid; Tz: Transition Zone; Fld: Feldspar; T: Trace; 1: Minor; 2: Moderate; 3: Abundant; C: Carbon; B: Bleached; K: Kaolin; Cht: Chert

Depth	Sample description
800–802	Sandstone, medium gray, N5, medium-coarse grained, moderately sorted, 10% microcline, slightly altered, trace black (carbonaceous) streaks. ore bearing
802–803	clay galls (1/8" to 1/2") light olive, 10YR 5/4,
803–810	Sandstone, light gray, N7, medium to coarse grained, moderately sorted, graded bedding, fining upwards, 10% microcline, orange, altered, weakly oxidized?
810–815	Sandstone, medium dark gray, N4, medium grained, moderately sorted, large clay fragments, qtz grains subrounded to rounded. <10% microcline.
815–818	Sandstone, olive gray, 5Y 4/1, medium to coarse grained, moderately sorted, indurated, many chert clasts.
818–819	Sandstone, light gray, N6, v. fine grained, well sorted, indurated,
819	Sandstone, olive gray, 5Y 4/1, fine to medium grained, moderately sorted, trace pyrite
819–820	Sandstone, grayish orange pink, 5YR 7/2, fine to medium grained, moderately sorted, well cemented, carbonaceous? elongated clay galls. oxidized

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-3

T.D. _____ LOCATION: _____

BIT SIZE 3

Core
~~SAMPLE~~ LOG BY L. Chenevey LEASE: (PROJECT)

DATE 11-9-87 COUNTY _____ STATE _____

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Mineralization	Alteration: Primary Oxidation	Reduction	Secondary Oxidation	SAMPLE DESCRIPTION (Amounts in Percent, %)
820								Sandstone, grayish orange pink, 5YR 7/2, fine to medium grained, trace pyrite well cemented, carbonaceous stringers, clay galls, oxidized
821								Shale, grayish green, 10GY 5/2, silty, stringers of carbonaceous material
822								Shale, dark yellowish orange, 10YR 6/6, silty, locally stained, oxidized
823								Shale, blackish red, 5R 2/2, silty, silty, siltstone stringer 823'-824' oxidized
824								
825								
826								
827								Shale, grayish green, 10GY 5/2, sandy - reduced -
		*						Sandstone pebbled, 5R 5/2, fine grained, clay matrix?, altered carbonaceous mat.
828		*						Conglomerate, grayish green 5G 6/1 to dark greenish gray 5G 4/1, fine to medium grained, moderately sorted, patchy clay matrix, clay clasts, trace carbonaceous?
829		*						Sandstone, light olive gray 5Y 6/1, fine to medium grained, moderately sorted, scattered black specks (carbonaceous material?).
830								
831							?	Sandstone, light gray N7, fine to medium grained, moderately sorted, well cemented 831-838, some clay matrix, microclines altered & orange in color, small spots of limonite & hematite, trace gypsum in 10% of pore spaces.
832								
833								
834								Sandstone, light olive gray, 5Y 6/1, medium grained, moderately sorted, some carbonaceous? material, fresh & altered microcline, slightly friable.
835								
836								Sandstone, light gray, N6, fine to medium grained, moderately sorted, slightly friable, 10% fresh, unaltered microcline, scattered chert stringers, trace gypsum in pore spaces, minor clay matrix.
837								
838								
839								
840								

Limonite (Lim) SOX: Surf. Oxidation Rd: Reduced Rdt: Reduction P: Pyrite (Pyr) Py: Pyrite Tarnish

POX: Primary Oxid BSOX: Base of Surf. Oxid SOX: Secondary Oxid Tn: Transition Zone Fld: Feldspar

T: Trace L: Minor M: Moderate A: Abundant

C: Carbon B: Blackhead Coal Chert R: Rocella

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-3

T.D. _____ LOCATION: _____

BIT SIZE _____

CORE SAMPLE LOG BY Lichnovsky LEASE: (PROJECT) [redacted]

DATE 11-12-87 COUNTY _____ STATE _____

L = Limonite (Lim)
SOX = Surf. Oxidation
Re = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
Pt = Pyrite Tarnish
POX = Primary Oxid.
BSOX = Base of Surf. Oxid
SOX = Secondary Oxid
Tn = Transition Zone
Tlg = Eclogite

SAMPLE DESCRIPTION
(Amounts in Percent, %)

T = Trace
L = Minor
M = Moderate
A = Abundant
C = Carbon
K = Kaolin
Bc = Bleached Core Chart

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER	Alteration %			
						Primary Oxidation	Reduction	Secondary Oxidation
840								
841								
842								
843								
844								
845								
846								
847								
848								
849								
850								
851								
852								
853								
854								
855								
856								
857								
858								
859								
860								

Sandstone, olive gray to light olive gray, 5Y 4/1 to 5Y 6/1, fine grained, moderately sorted, minor clay matrix, microcline + weathered,

Some carbonaceous material.

Sandstone, pale red 5R 6/2, fine grained, moderately sorted,

Sandstone, olive gray, 5Y 4/1, fine grained, moderately sorted, small blebs of green clay.

Sandstone, light gray N7, graded bedding fining upward, v. fine to medium grained, some of clay matrix mottled green & red.

Sandstone, grayish yellow green, 5GY 7/2, fine to medium grained, well sorted, common light yellow limonite stain.

Sandstone grayish green 5GY 6/1, fine-medium grained, moderately sorted, minor clay matrix,

Sandstone, light olive gray, 5Y 5/2, medium grained, moderately sorted, clay stringers, well rounded at base, minor clay matrix

Sandstone, grayish orange 10YR 7/4, fine to medium grained, moderately sorted, slightly friable, microcline slightly altered, minor clay matrix, light green, common orange limonite stain.

URANIUM RESOURCES

DRILLED WITH: AIR [ ] WATER [ ] HOLE NO. CR-3

T.D. ______ LOCATION: ______

BIT SIZE ______

~~SAMPLE~~ Core LOG BY Lichnovsky LEASE: (PROJECT) ______

DATE 11-12-87 COUNTY ______ STATE ______

Columns: DEPTH | LITHOLOGY | CARBON | PYRITE | OTHER Minerals | Alteration %: Primary Oxidation, Reduction, Secondary Oxidation

SAMPLE DESCRIPTION (Amounts in Percent, %)

L = Limonite (Lmn)
SOX = Surf. Oxidation
Re = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
Pt = Pyrite Tarnish
POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tz = Transition Zone
Fld = Feldspar

T = Trace
1 = Minor
2 = Moderate
3 = Abundant

C = Carbon
B = Bleached
K = Kaolin
Cht = Chert

Depth	Sample Description
860	Sandstone, dusky brown 5YR 2/2, to moderate yellowish brown 10YR 5/4 to dark yellowish brown 10YR 4/2, fine to coarse grained, graded bedding, fining upwards, well to moderately sorted, chert fragments at base, common orange limonite stain. trace red hematite stain.
861	
862	
863	
864	Sandstone, yellowish gray 5Y 7/2, fine grained, friable, limonite stained. Congl, pale red purple 5 RP6/2 shale galls in a poorly sorted coarse sand. numerous fragments of chert and granite, trace pyrite in shale galls.
865	Sandstone, dark 10YR 4/2 to moderate yellowish brown 10YR 5/4, fine to coarse grained, moderately sorted, chert & granite fragments at 865'6". Clay galls at 867'6". common yellow brown limonite stain, trace hematite stain.
866	
867	
868	Shale, reddish gray 5R 4/2, with a streak of grayish olive green 5GY 3/2 in the middle. numerous chert pebbles sandy stringers & trace pyrite.
869	Sandstone, yellowish gray, 5Y 7/2, fine to medium grained, moderately sorted, common light yellow limonite stain,
870	
871	Sandstone, grayish brown, 5YR 3/2, medium to coarse grained, moderately sorted, common altered black (carbonaceous ?) staining, pale red purple 5RP 6/2 clay galls.
872	
873	Sandstone, light olive gray, 5Y 6/1, fine grained, well sorted patchy grayish clay matrix, numerous chert fragments & clay galls, ~~common~~ clay galls grayish red purple 5RP 4/2, to dark greenish gray. common limonite staining
874	
875	
876	Sandstone grayish yellow, 5Y 8/4, fine to medium grained, well sorted, minor clay matrix, common limonite stain.
877	
878	
879	
880	

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-4

T.D. 932 LOCATION: Church Rock

BIT SIZE 7 7/8

SAMPLE LOG BY WDS LEASE: (PROJECT) Pump Test

DATE 11-16-87 COUNTY McKinney STATE New Mexico

SAMPLE DESCRIPTION (Amounts in Percent, %)

L = Limonite (Lmn); SOX = Surf Oxidation; Re = Reduced; Rdt = Reduction; P = Pyrite (Pyr); P_t = Pyrite Tarnish

POX = Primary Oxid; BSOX = Base of Surf Oxid; ZOX = Secondary Oxid; Tz = Transition Zone; (fld) Feldspar

T = Trace; 1 = Minor; 2 = Moderate; 3 = Abundant

C = Carbon; B = Bleached; K = Kaolin; Cht = Chert

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Alteration	Primary Oxidation	Reduction	Secondary Oxidation	SAMPLE DESCRIPTION
0								Shale, lt Redd & Brn, [illegible], fissile, [illegible]
10								
20								
30								Muddy Samples
40								Shale, Dk gry, Rd, fissile
50								calcite [illegible] in [illegible] fractured (veins/fracture [illegible])
60								
70								
80								
90								
100								
10								
20								
30								
40								
50								
60								
70								
80								
90								
200								A/A

Margin notes: SOX (0–40), Rd (40–200)

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-4

T.D. _____ LOCATION: _____

BIT SIZE _____

SAMPLE LOG BY _____ LEASE: (PROJECT) _____

DATE 11-16-87 COUNTY _____ STATE _____

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER MINERALS	Alteration % Primary Oxidation	Reduction	Secondary Oxidation

L = Limonite (Lmn)
SOX: Surf Oxidation
Rd = Reduced
Rdt = Reduction
Py = Pyrite (Pyr)
Pyt = Pyrite Terrain

SAMPLE DESCRIPTION
(Amounts in Percent, %)

POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tns Transition Zone
Fldr Feldspar

T = Trace
1 = Minor
2 = Moderate
3 = Abundant

C = Carbon
K = Kaolin
Bl = Bleached
Cht = Chert

10 Shale, Dk gray, N2, Fissile,
20
30 Muddy
40
50 Samples
60
70
80
90
300
10
20
30
40
50
60
70
80
90
400

A/A [illegible] silty shale [illegible]

PAGE ___ OF ___

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-4

T.D. ______ LOCATION: ______

BIT SIZE ______

SAMPLE LOG BY ______ LEASE: (PROJECT)

DATE 11-16-87 COUNTY ______ STATE ______

SAMPLE DESCRIPTION (Amounts in Percent, %)

L = Limonite (Lmn) · SOX = Surf Oxidation · Rd = Reduced · Rdt = Reduction · P = Pyrite (Pyr) · Pt = Pyrite Tarnish · POX = Primary Oxid · BSOX = Base of Surf Oxid · ZOX = Secondary Oxid · Tn = Transition Zone · Fld = Feldspar

T = Trace · 1 = Minor · 2 = Moderate · 3 = Abundant

C = Carbon · B = Bleached · K = Kaolin · Cht = Chert

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Alteration	Alteration % Primary Oxidation	Reduction	Secondary Oxidation	SAMPLE DESCRIPTION
10								Shale, Dk Gry N2, fissile, slightly silty ↓
20								
30								Sand, lt grey N6, fine-med, well sorted, ~10% [illegible], (K₀ / Two Wells)
40								good ϕ, ~10% shale (prob washed from above)
50								A/A
60								Shale, lt grey N5, silty, fissile, [illegible] sand [illegible] above?
70								(Note: no change in [illegible] bit [illegible] cuttings are finer)
80								
90								
500								
10								
20								
30								
40								
50								
60								
70								
80								
90								A/A, thin sand - poss stringers
600								↓

URANIUM RESOURCES

DRILLED WITH: AIR [ ] WATER [ ] HOLE NO. CR-4

T.D. ______ LOCATION: ______

BIT SIZE ______

SAMPLE LOG BY ______ LEASE: (PROJECT) ______

DATE 11-16-87 COUNTY ______ STATE ______

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Alteration	Alteration %: Primary Oxidation	Reduction	Secondary Oxidation	SAMPLE DESCRIPTION (Amounts in Percent, %)
0								Shale A/A
10								
20								
30								
40								Shale, lt greenish gray, moderate sand
50								
60								Sand, lt gray, fine-med well sorted, sbrnd, Cx Ø
70								Sand med-coarse, dk gray, Mod Shale, well sorted, sbrnd-sbang, quartz (shale is dk gray, [illegible], [illegible])
80								
90								Sand, lt gray, med, mod sorting sbrnd-sbang, ExcØ, 2OX?
100								11-19-87
110								SS, lt brownish gray 5YR 6/1, fine-coarse (mostly fine-med) fairly sorted sbang-sbrnd, [illegible] 10%-15% [illegible] of large grains, ExcØ, 2OX?
120								
130								Missing Shale
140								Suspect bogus sampling
150								
160								
170								
180								
190								A/A
200								Cored Interval - see attached

Legend: L = Limonite (Lmn); SOX = Surf Oxidation; Rd = Reduced; Rdt = Reduction; P = Pyrite (Pyr); Pyt = Pyrite Tarnish; POX = Primary Oxid; BSOX = Base of Surf Oxid; 2OX = Secondary Oxid; Tn = Transition Zone; Fld = Feldspar; T = Trace; 1 = Minor; 2 = Moderate; 3 = Abundant; C = Carbon; K = Kaolin; B = Bleached; Cal = Chert

Margin annotations: Rd (40–50); Ox (130–140)

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☒ HOLE NO. CR-6

T.D. ______ LOCATION: Church Rock, NM

BIT SIZE 7 7/8 (with 5 ⅞)

SAMPLE LOG BY WDS LEASE: (PROJECT) Church Rock - Pump Test

DATE 11-19-87 COUNTY ______ STATE ______

Column headings: DEPTH | LITHOLOGY | CARBON | PYRITE | OTHER Minerals | Alteration %: Primary Oxidation, Reduction, Secondary Oxidation | SAMPLE DESCRIPTION (Amounts in Percent, %)

L = Limonite (Lmn)
SOX = Surf Oxidation
Rg = Reduced
Rdt = Reduction
P = Pyrite (Pyr)
P_t = Pyrite Tarnish
POX = Primary Oxid
BSOX = Base of Surf Oxid
SOX = Secondary Oxid
Tz = Transition Zone
Fld = Feldspar
T = Trace
1 = Minor
2 = Moderate
3 = Abundant
C = Carbon
K = Kaolin
B = Bleached
Calc Chert

Depth	Sample Description
10	Clay, silty, red reddish brn, SOX — weathered Mancos
20	
30	
40	
50	A/A
60	Shale dk greyish black, fissile
70	
80	Air 60'-310'
90	
300	
10	
20	A/A, bd w/ carb frags to 1cm
30	SS, fine-med, lt gray, well sorted, [illegible], good ø [illegible]
40	
50	
60	
70	A/A
80	Shale, non fissile, sandy, lt grey (5-10% sand)
90	
400	

Muddy Samples 170-410-

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-6

T.D. ____ LOCATION: ____

BIT SIZE ____

SAMPLE LOG BY ____ LEASE: (PROJECT) ____

DATE ____ COUNTY ____ STATE ____

DEPTH	SAMPLE DESCRIPTION
4	
10	A/A
20	Shale, dk greyish black, fissile
80	A/A, but w/ fine-med sand stringers ~30% sand for φ for shale
90	A/A
100	A/A, less sand ~5% in stringers - maybe cutbank fr. above
110	SS, fine-med, ~20% shale, maybe fr. above, well sorted, subrnd-subang, good φ
120	Cored Interval - upper Brushy Basin
130	SS-shale mix as above sand/shale = 30/70
140	A/A
150	SS, fine-coarse, poorly sorted, lt greenish gray, subrnd-rnd, Exc φ ~8% alum
160	Cored Interval lower Brushy Basin
180	Shale w. Sandy, shale: dk greyish black, fissile; SS: med coarse, poorly sorted, ~20% kfsp; Calcite Seams - veins/fractures?

Slightly Muddy

Legend: L: Limonite (Lmn); SOX: Surf Oxidation; Rd: Reduced; Rdt: Reduction; P: Pyrite (Pyr); Pt: Pyrite Tarnish; POX: Primary Oxid; BSOX: Base of Surf Oxid; 2OX: Secondary Oxid; Tn: Transition Zone; Fld: Feldspar; T: Trace; 1: Minor; 2: Moderate; 3: Abundant; C: Carbon; K: Kaolin; B: Bleached; Cht: Chert

Columns: Lithology, Carbon, Pyrite, Other Alteration; Alteration %: Primary Oxidation, Reduction, Secondary Oxidation

URANIUM RESOURCES

DRILLED WITH: AIR ☐ WATER ☐ HOLE NO. CR-6

T.D. ______ LOCATION: ______

BIT SIZE ______ ______

SAMPLE LOG BY ______ LEASE: (PROJECT) ______

DATE ______ COUNTY ______ STATE ______

DEPTH	LITHOLOGY	CARBON	PYRITE	OTHER Alteration	Alteration % Primary Oxidation	Reduction	Secondary Oxidation	SAMPLE DESCRIPTION
600								Arkosic — Sandstone, lt olive gray, med-coarse, poorly sorted, strong-skewed (micaceous frags arg-strong ~10-15%), med-poor cement, Exc Ø, 2OX, <1% clay(shale?) frags. (Jmw)
10								
20								
30								← marky
40								
50								
60								
70								
80								
90								
700								
10								
20								
30								↓ A/A, strong skewed coarse, to minor shale
40								Cored Interval
50								
60								
70								
80								
90								
800								

L: Limonite (Lmn); SOX: Surf Oxidation; Rd: Reduced; Rdt: Reduction; P: Pyrite (Pyr); Pt: Pyrite Tarnish; POX: Primary Oxid; BSOX: Base of Surf Oxid; SOX: Secondary Oxid; Tn: Transition Zone; fld: Feldspar (Amounts in Percent, %)

T: Trace; 1: Minor; 2: Moderate; 3: Abundant; C: Carbon; K: Kaolin; B: Bleached; Cht: Chert

TD 797'

APPENDIX C

SOIL SURVEY

OF

HYDRO RESOURCES, INC.

CHURCHROCK PROPERTIES

McKINLEY COUNTY, NEW MEXICO

BY
ORAN F. BAILEY
SOIL SCIENTIST, CPSS

OCTOBER 1987

CONTENTS

LIST OF TABLES

Introduction

This report was prepared by Oran F. Bailey, certified professional soil scientist, in fulfillment of the letter of authorization signed by Mark S. Peliza for Hydro Resources, Inc., dated August 13, 1987. In accordance with the letter of authorization a detailed soil survey was conducted on Hydro Resources, Inc. Churchrock properties as follows:

T16N, R16W, SE 1/4 Section 8, NE 1/4 Section 17, NW 1/4 Section 7; T16N, R17W, E 1/2 Section 12, Section 13.

The soil survey covered approximately 1440 acres. Field work was performed during three trips to the area in August, September, and October 1987. The soils were examined, classified, and map units delineated on aerial photographs. Field notes, pedon descriptions, still camera photographs, and video .re used to document the soil survey. Selected soils were sampled and sent to a soil laboratory for analyses.

Soil Series description and Soil Interpretations Record, for each soil classified in the survey area, was obtained from the U. S. Soil Conservation Service, and are contained in the appendix. In addition Range and Woodland site descriptions were provided and are included.

Located in the back of the report are the soil maps. Within each map unit delineation is a number symbol. The soil name or components of each map unit can be identified by referring to Table 1 - Map Unit Legend. Range or Woodland sites are given in Table 4 - Range Sites. The classification of soil series is provided in Table 3 - Classification of Soil, and the acreage of soils is reported in Table 2 - Acreage of Soils.

Map Units

The map units shown on the soil map represent the kinds of soils in the soil survey area. Each map unit delineation contains a symbol that identifies the soil on the detailed soil maps. These map symbols and soil names are found in Table 1.

The map units on the soil map represent an area on the landscape made up mostly of the soil or soils for which the unit is named. They are described in the following pages.

A group of soils that have profiles that are almost alike make up a soil series. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Flugle series, for example, was named for an area in Catron County, New Mexico.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slopes, erosion, stoniness, salinity, wetness or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a soil phase commonly indicates a feature that affects use or management. For example, Flugle loam, 3 to 8 percent slopes, is a phase of the Flugle series.

Some map units are made up of two or more major soils. These map units are called soil complexes in this soil survey. A soil complex consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Pinitos-Ribera complex, 5 to 8 percent slopes, is an example.

Most map units include small, scattered areas of soil other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil. Included soils are named in the map unit descriptions.

The acreage of each map unit are given in Table 2. Information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in the official series descriptions and the Soil Interpretation Record in the Appendix.

Analyses of soil samples sent to Laboratory Consultants, Temple, Arizona are included in the Appendix.

MAP UNIT DESCRIPTIONS

1 Vessilla-Rock outcrop complex, 3 to 15 percent slopes

This map unit is on high mesas of sandstone bedrock controlled landscapes. Vessilla soils make up about 65 percent and Rock outcrop 20 percent of the total area. Slopes average about 8 percent. Soil areas are large and irregular in shape. Native vegetation is mainly oneseed juniper, pinyon pine with lesser amounts of shrubs and grass. Elevation is 7100 to 7500 feet. The average annual precipitation is about 12 to 14 inches, the average annual soil temperature is 47 to 55 degrees F, and the average frost-free season is 100 to 120 days.

The Vessilla soil is shallow and well drained. Typically, the surface layer is yellowish brown gravelly sandy loam about 3 inches thick. It is very friable, and moderately alkaline. The next layer is brown gravelly fine sandy loam about 9 inches thick. It is friable and moderately alkaline. At about 12 inches and below is yellowish brown sandstone.

Included in this unit are small areas of Ribera and Mion soils and unnamed shallow soils with sandy clay loam subsoils. Included areas make up about 20 percent of the total acreage.

Permeability of this soil is moderately rapid. Water holding capacity is very low. Effective rooting depth is 12 inches. Runoff is medium to rapid and the hazard of water erosion is high. The hazard of soil blowing is high.

Rock outcrop consists of nearly barren areas of exposed sandstone and in a few places shale.

This unit is used for woodland, grazing, and wildlife.

2 Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes

This map unit is on elevation breaks and canyon side slopes. It consists of sandstone outcrops that form escarpments, ledges, and vertical cliffs. Shale layers are between the sandstone. Rock outcrop makes up about 40 percent, Vessilla soils 25 percent, Mion soils 20 percent, and inclusions 15 percent of the total area. Slopes average about 40 percent. Soil areas are large and irregular in shape. Native vegetation consists of oneseed juniper, pinyon pine, shrubs and grass. North facing slopes have thicker stands of oneseed juniper and pinyon pine than south facing slopes. Vegetation is lacking on areas with rock exposed at the surface. Elevation is 6900 to 7500 feet. The average annual precipitation is about 10 to 13 inches, the average annual air temperature is 47 to 55 degrees F, and the average frost-free season is 115 to 130 days.

Rock outcrop consists of barren or nearly barren areas of exposed sandstone and shale.

The Vessilla soil is shallow and well drained. Typically the surface layer is yellowish brown gravelly sandy loam about 3 inches thick. It is very friable, and moderately alkaline. The next layer is brown gravelly fine sandy loam about 8 inches thick. It is friable and moderately alkaline. At about 12 inches and below is yellowish brown sandstone.

Permeability of the Vessilla soil is moderately rapid. Water holding capacity is very low. Effective rooting depth is 12 inches. Runoff is medium to rapid and the hazard of water erosion is high. The hazard of soil blowing is high.

The Mion soil is shallow and well drained. Typically the surface layer is light brownish gray clay about 6 inches thick. It is friable and mildly alkaline. The next layer is pale brown clay about 12 inches thick. It is firm and mildly alkaline. At about 18 inches and below is very dark gray shale.

Permeability of the Mion soil is very slow. Water holding capacity is low. Effective rooting depth is 14 inches. Runoff is medium to rapid and the hazard of water erosion high. The hazard of soil blowing is moderate.

This unit is used for wildlife habitat.

4 Pinitos clay loam, 5 to 15 percent slopes, eroded

This deep, well drained eroded soil is on high mesas of sandstone controlled landscapes. The subsoil is exposed on the surface because of erosion in most areas, and small to medium gullies are common. The soil formed in eolian and alluvial materials derived dominately from sandstone and shale. Slopes average about 8 percent. Soil areas are irregular in shape. Native vegetation is mainly oneseed juniper, pinyon pine, with lesser amounts of shrubs and grass. The average annual precipitation is about 12 to 14 inches, the average annual soil temperature is 47 to 55 degrees F, and the average annual frost-free season is 100 to 120 days.

Typically, the surface layer is brown clay loam about 9 inches thick. It is friable, and moderately alkaline. The next layer is about 44 inches thick and is brown to strong brown clay loam. It is friable and mildly alkaline. Underlying the subsoil is yellowish brown sandstone.

Included in this unit are small areas of Ribera and Vessilla soils. Included areas make up about 15 percent of the total acreage.

Permeability of this soil is moderate. Available water holding capacity is high. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for woodland, grazing, and wildlife.

5 Pinitos-Ribera complex, 5 to 8 percent slopes

This map unit is on high mesas of sandstone bedrock controlled landscapes. Slopes average about 6 percent. Areas are irregular and oblong in shape. The native vegetation is mainly pinyon pine, oneseed juniper, sagebrush and grass. Elevation is 7200 to 7400 feet. The average annual precipitation is about 12 to 14 inches, the average annual soil temperature is 47 to 55 degrees F, and the average frost-free season is 100 to 120 days.

This unit is 45 percent Pinitos sandy loam and 40 percent Ribera sandy loam. The soils occupy the same landscapes with plane to convex slopes.

Included in this unit are small areas of Vessilla soils that are shallow to sandstone. Inclusions make up about 15 percent of the total acreage.

The Pinitos soil is deep and well drained. It formed in eolian and alluvial materials derived dominately from sandstone and shale. Typically, the surface layer is brown sandy loam about 2 inches thick. It is very friable and neutral. The yellowish brown clay loam subsoil is about 42 inches thick. It is friable and moderately alkaline. Underlying the subsoil is yellowish brown sandstone.

Permeability of the Pinitos soil is moderate. Available water capacity is high. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Ribera soil is moderately deep and well drained. It formed in eolian and alluvial materials derived dominately from sandstone and shale. Typically, the surface layer is brown sandy loam about 2 inches thick. It is very friable and neutral. The brown sandy clay loam subsoil is about 34 inches thick. It is friable and moderately alkaline. Yellowish brown sandstone occurs below the subsoil.

Permeability of the Ribera soil is moderate. Available water capacity is moderate. Effective rooting depth is 34 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for woodland, grazing, and wildlife.

6 El Rancho sandy loam, 3 to 8 percent slopes, gullied

This deep well drained soil occupies narrow valleys that have been entrenched with deep gullies. It formed in alluvial materials derived mainly from sandstone and shale. Slopes average about 5 percent. Soil areas are long and narrow in shape. Native vegetation has mostly been replaced with weeds and a few scattered shrubs. Elevation is 6800 to 7000 feet. The average precipitation is 10 to 12 inches, the annual soil temperature is 50 to 56 degrees F, and the average frost-free period is 110 to 130 days.

Typically, the surface layer is brown sandy loam about 8 inches thick. It is very friable and neutral. The next layer to depths below 50 inches, is pale brown to brown stratified sandy loam, fine sandy loam, and sandy clay loam. It is very friable and moderately alkaline.

Included in this unit are small areas of soils with gravelly layers and in places a few sandstone boulders are on the surface. Included areas make up less than 15 percent of the total area.

Permeability of this soil is moderate. Water holding capacity is moderate. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion is high. The hazard of soil blowing is high.

This unit is used for grazing.

7 Flugle loam, 3 to 8 percent slopes, gullied

This deep, well drained soil is on alluvial fans and drainageways. The soil is eroded with frequent shallow and deep gullies. It formed in alluvial materials derived mainly from shale and sandstone. Slopes average about 5 percent. Soil areas are irregular in shape and are long and narrow. Native vegetation is mainly blue grama, alkali sacaton, big sagebrush, and scattered greasewood. Elevation is 6800 to 7000 feet. The average annual precipitation is about 10 to 12 inches, the average annual soil temperature is 50 to 56 degrees F, and the average annual frost-free period is 100 to 120 days.

Typically the surface layer is light brownish gray loam about 4 inches thick. It is friable and mildly alkaline. The clay loam subsoil is about 36 inches thick and is grayish brown in the upper part and light grayish brown in the lower part. It is firm and moderately alkaline. The substratum to a depth of 60 inches or more is light brownish gray fine sandy loam. It is friable and mildly alkaline.

Included in this unit are small areas of El Rancho and Mion soils. Included areas make up less than 15 percent of the total acres.

Permeability of this soil is moderately slow. Water holding capacity is high. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used for grazing.

8 Mion-Rock outcrop complex, 8 to 40 percent slopes

This map unit is on low hills, ridges, and side slopes adjacent to and below Rock outcrop-Vessilla-Mion complex. Mion soils make up about 50 percent and shale outcrops 35 percent of the total area. Slopes average about 20 percent. Soil areas are large and irregular in shape. Native vegetation is mainly western wheatgrass, galleta, scattered oneseed juniper and pinyon pine. Elevation is 6800 to 7100 feet. The average annual precipitation is about 10 to 12 inches, the average annual soil temperature 50 to 56 degrees F, and the annual frost-free period is 100 to 120 days.

The Mion soil is shallow and well drained. Typically the surface layer is light brownish gray clay about 6 inches thick. It is firm and mildly alkaline. The next layer is pale brown clay about 12 inches thick. It is very firm and mildly alkaline. At about 18 inches is very dark gray shale.

Permeability of the Mion soil is very slow. Water holding capacity is low. Effective rooting depth is 18 inches. Runoff is medium to rapid and the hazard of water erosion is high. The hazard of soil blowing is moderate.

Included in this unit are small areas of Galestina and Mikim soils. Included areas make up about 15 percent of the total acreage.

Rock outcrop consists of nearly barren areas of exposed shale and in a few places sandstone.

This unit is used for grazing and wildlife.

9 Galestina clay, 3 to 8 percent slopes, gullied

This deep well drained soil occupies alluvial fans that have been entrenched with shallow to deep gullies. It formed in materials derived mainly from shale and sandstone. Slopes average about 5 percent. Soil areas are irregular in shape. Native vegetation is mainly alkali sacaton, western wheatgrass, and greasewood. About 5 to 15 percent of the surface is barren. Elevation is 6700 to 7000 feet. The average annual precipitation is about 10 to 12 inches, the average annual soil temperature is 50 to 56 degrees F, and the frost-free period is 100 to 120 days.

Typically the surface layer is yellowish brown clay about 7 inches thick. It is firm and mildly alkaline. Cracks develop in the upper part of the soil when dry. The subsoil is pale brown, brown, and grayish brown clay about 42 inches thick. It is very firm and mildly alkaline. Alluvial material consisting of soil and shale fragments is at depths below 50 inches.

Included in this unit are small areas of Mikim soils and the less sloping and less eroded Galestina soil. Included areas make up less than 15 percent of the total acreage.

Permeability of this soil is slow. Water holding capacity is high. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion moderate. The hazard of soil blowing is moderate.

This unit is used for grazing.

10 Galestina clay loam, 1 to 3 percent slopes

This deep well drained soil occupies alluvial fans. It formed in materials derived mainly from shale and sandstone. Slopes average about 3 percent. Soil areas are elongated in shape. Native vegetation is mainly alkali sacaton, western wheatgrass, and greasewood. Elevation is 6700 to 7000 feet. The average annual precipitation is about 10 to 12 inches, the average annual soil temperature is 50 to 56 degrees F, and the frost-period is 100 to 120 days.

Typically the surface layer is yellowish brown clay about 7 inches thick. It is firm and mildly alkaline. Cracks develop in the upper part of the soil when dry. The subsoil is pale brown, brown, and grayish brown clay about 43 inches thick. It is very firm and mildly alkaline. Alluvial material consisting of soil and shale fragments is at depths below 50 inches.

Included in this unit are small areas of Mikim soils and El Rancho soils. Included areas make up less than 15 percent of the total acreage.

Permeability of this soil is slow. Water holding capacity is high. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion moderate. The hazard of soil blowing is moderate.

This unit is used for grazing.

11 Mikim clay loam, 3 to 5 percent slopes, gullied

This deep well drained soil is on alluvial fans that have been entrenched with shallow to deep gullies. It formed in alluvial materials derived from shale and sandstone. Slopes average about 4 percent. Soil areas are elongated in shape. Native vegetation is mainly galleta, alkali sacaton, western wheatgrass, broom snakeweed and greasewood. Elevation is 6700 to 6900 feet. The average annual precipitation is 10 to 12 inches, the average annual soil temperature is 50 to 56 degrees F, and the frost-free period is 100 to 120 days.

Typically, the surface layer is light brownish gray clay loam about 7 inches thick. It is friable and neutral. The next layer is about 35 inches thick and is light yellowish brown clay loam. It is friable and neutral to mildly alkaline. The underlying material to a depth of 60 inches is dark grayish brown clay loam. This layer is friable and mildly alkaline.

Included in this unit are small areas of Galestina soils and Mion soils. Included areas make up less than 15 percent of the total acreage.

Permeability of the Mikim soil is moderate. Available water holding capacity is high. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for grazing.

11A Mikim loam, 1 to 3 percent slopes

This deep well drained soil is on alluvial fans. It formed in alluvial materials derived from shale and sandstone. Slopes average about 2 percent. Soil areas are elongated in shape. Native vegetation has been replaced with weeds. Elevation is 6700 to 6900 feet. The average annual precipitation is 10 to 12 inches, the average annual soil temperature is 50 to 56 degrees F, and the frost-free period is 100 to 120 days.

Typically, the surface layer is light brownish gray clay loam about 7 inches thick. It is friable and neutral. The next layer is about 35 inches thick and is light yellowish brown clay loam. It is friable and neutral to mildly alkaline. The underlying material to a depth of 60 inches is dark grayish brown clay loam. This layer is friable and mildly alkaline.

Included in this unit are small areas of El Rancho soils. Included areas make up less than 5 percent of the total acreage.

Permeability of the Mikim soil is moderate. Available water holding capacity is high. Effective rooting depth is greater than 40 inches. Runoff is medium and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for grazing.

12 El Rancho sandy loam, 1 to 3 percent slopes

This deep well drained soil occupies alluvial fans. It formed in alluvial materials derived mainly from sandstone. Slopes average about 2 percent. Soil areas are elongated in shape. Native vegetation has been replaced with weeds. Elevation is 6700 to 6850 feet. The average annual precipitation is 10 to 12 inches, the average annual soil temperature is 50 to 56 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is pale brown sandy loam about 6 inches thick. It is very friable and moderately alkaline. The next layer to depths below 45 inches, is pale brown stratified sandy clay loam, sandy loam, and loam. It is very friable and moderately alkaline.

Included in this unit are small areas of Mikim soils. Also soils with gravelly layers and in places a few small sandstone rocks are on the surface and in the soil. A deep gully is included, in section 8, that has formed in the drainageway. Included areas make up less than 15 percent of the total area.

Permeability of this soil is moderate. Water holding capacity is moderate. Effective rooting depth is greater than 40 inches. Runoff is slow and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used for grazing.

12A El Rancho sandy loam, 5 to 8 percent slopes

This deep well drained soil occupies low ridges on alluvial fans. It formed in alluvial materials derived mainly from sandstone. Slopes average about 6 percent. Soil areas are elongated in shape. Native vegetation has been replaced with weeds. Elevation is 6700 to 6800 feet. The average annual precipitation is 10 to 12 inches, the average annual soil temperature is 50 to 56 degrees F, and the average frost-free period is 100 to 120 days.

Typically, the surface layer is pale brown sandy loam about 6 inches thick. It is very friable and moderately alkaline. The next layer to depths below 45 inches is pale brown stratified sandy clay loam, sandy loam, and loam. It is very friable and moderately alkaline.

Included in this unit are small areas of the less sloping El Rancho soils. Included areas make up less than 5 percent of the total acreage.

Permeability of this soil is moderate. Water holding capacity is moderate. Effective rooting depth is greater than 40 inches. Runoff is slow and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used for grazing.

13 Miscellaneous area

The soils in this area have been disturbed to various extent and are not classified. The area is mostly composed of ponds, pads, fill and embankments.

Classification of the Soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil Taxonomy"[1].

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In Table 3 the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among order are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending sol. An example is Alfisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or

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[1] United States Department of Agriculture. 1973. Soil Taxonomy, a basic system of soil classification for making and interpreting soil surveys.

that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustalf (Ust, meaning burnt, plus alf, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regime; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplustalfs (Hapl, meaning minimum horizon, plus ustalfs, the suborder of Alfisols that have an ustic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups; the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup, the intergrades, or transitional forms to other order, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great group. The adjective Aridic identifies the subgroup that is less moist than the Typic great group. An example is Aridic Haplustalfs.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below the surface layer are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture

equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, mesic Aridic Haplustalfs.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. An example is Flugle.

Range Sites

In areas that have similar climate and topography, the kind and amount of vegetation produced on rangeland are closely related to the kind of soil (Table 4). Effective management is based on the relationship between the soils and vegetation and water.

The range site descriptions in the Appendix show for each soil in the survey area, the range site; the total annual production of vegetation in good (favorable) and poor (unfavorable) years; the climax (characteristic) vegetation; and the average percentage of each species.

A range site is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content and surface texture are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable and unfavorable years. In a favorable

year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air dry moisture.

Under characteristic vegetation the grasses, forbs and shrubs that make up most of the potential natural plant community of each soil is listed by common name. The expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water and

control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat and protects soil and water resources.

Prime Farmland

Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and is available for these uses. It has the soil quality, growing season and moisture supply needed to economically produce sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods (Federal Register, Vol. 43, No. 21, Tuesday, January 31, 1978, Section 657.5(a)).

No prime farmland occurs in the survey area.

Table 1. Map Unit Legend

Map Symbol	Soil Name
1	Vessilla-Rock outcrop complex, 3 to 15 percent slopes
2	Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes
4	Pinitos clay loam, 5 to 15 percent slopes, eroded
5	Pinitos-Ribera complex, 5 to 8 percent slopes
6	El Rancho sandy loam, 3 to 8 percent slopes, gullied
7	Flugle loam, 3 to 8 percent slopes, gullied
8	Mion-Rock outcrop complex, 8 to 40 percent slopes
9	Galestina clay, 3 to 8 percent slopes, gullied
10	Galestina clay loam, 1 to 3 percent slopes
11	Mikim clay loam, 3 to 5 percent slopes, gullied
11A	Mikim loam, 1 to 3 percent slopes
12	El Rancho sandy loam, 1 to 3 percent slopes
12A	El Rancho sandy loam, 5 to 8 percent slopes
13	Miscellaneous area

Table 2. Acreage of Soils

Map Symbol	Soil Name	Total Acreage
1	Vessilla-Rock outcrop complex, 3 to 15 percent slopes	206.8
2	Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes	472.4
4	Pinitos clay loam, 5 to 15 percent slopes, eroded	31.2
5	Pinitos-Ribera complex, 5 to 8 percent slopes	28.6
6	El Rancho sandy loam, 3 to 8 percent slopes, gullied	46.8
7	Flugle loam, 3 to 8 percent slopes, gullied	3.9
8	Mion-Rock outcrop complex, 8 to 40 percent slopes	173.3
9	Galestina clay, 3 to 8 percent slopes, gullied	109.5
10	Galestina clay loam, 1 to 3 percent slopes	29.0
11	Mikim clay loam, 3 to 5 percent slopes, gullied	111.9
11A	Mikim loam, 1 to 3 percent slopes	16.0
12	El Rancho sandy loam, 1 to 3 percent slopes	117.9
12A	El Rancho sandy loam, 5 to 8 percent slopes	41.1
13	Miscellaneous area	51.6
	TOTAL ACREAGE	1,440.0

Table 3. Classification of Soils

Soil Name	Taxonomic Class
El Rancho	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents
Flugle	Fine-loamy, mixed, mesic Aridic Haplustalfs
Galestina	Fine, mixed, mesic Aridic Paleustalfs
Mikim	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents
Mion	Clayey, mixed (calcareous), mesic, shallow Ustic Torriorthents
Pinitos	Fine-loamy, mixed Aridic Haplustalfs
Ribera	Fine-loamy, mixed Aridic Haplustalfs
Vessilla	Loamy, mixed (calcareous), mesic Lithic Ustorthents

Table 4. Range Sites

Map Symbol	Soil Name	Range Site
1	Vessilia-Rock outcrop complex, 3 to 15 percent slopes	P-J site
2	Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes	
	Vessilla part	P-J site
	Mion part	Clayey WP-1
4	Pinito clay loam, 5 to 15 percent slopes, eroded	Loamy WP-1
5	Pinitos-Ribera complex, 5 to 8 percent slopes	
	Pinitos part	Loamy WP-1
	Ribera part	Loamy WP-1
6	El Rancho sandy loam, 3 to 8 percent slopes, gullied	Loamy WP-1
7	Flugle loam, 3 to 8 percent slopes, gullied	Loamy WP-1
8	Mion-Rock outcrop complex, 8 to 40 percent slopes	
	Mion part	Clayey WP-1
	Rock outcrop part	--
9	Galestina clay, 3 to 8 percent slopes, gullied	Clayey WP-1
10	Galestina clay loam, 1 to 3 percent slopes	Clayey WP-1
11	Mikim clay loam, 3 to 5 percent slopes, gullied	Loamy WP-1
11A	Mikim loam, 1 to 3 percent slopes	Loamy WP-1
12	El Rancho sandy loam, 1 to 3 percent slopes	Sandy WP-1
12A	El Rancho sandy loam, 5 to 8 percent slopes	Sandy WP-1
13	Miscellaneous area	--

Table 5. Terminology

SOIL DEPTH	INCHES
Very shallow	0-10
Shallow	10-20
Moderately deep	20-40
Deep	40+

SOIL PERMEABILITY	INCHES/HOUR
Very slow	less than 0.06
Slow	0.06-0.20
Moderately slow	0.20-0.60
Moderate	0.60-2.00
Moderately rapid	2.00-6.00

SOIL REACTION	pH
Slightly acid	6.1-6.5
Neutral	6.6-7.3
Mildly alkaline	7.4-7.8
Moderately alkaline	7.9-8.4

AVAILABLE WATER CAPACITY	INCHES
High	7.5-10.0
Moderate	5.0-7.5
Low	3.5-5.0
Very low	less than 3.5

APPENDIX I

SOIL SERIES,
SOIL INTERPRETATIONS RECORDS
AND RANGE SITES

LOCATION EL RANCHO 7/86 NM

Established Series
RD: JJF/RJA
7/86

EL RANCHO SERIES

The El Rancho series consists of deep, well drained, moderately permeable soils that formed from igneous and sedimentary rocks on valley bottoms and [redacted] terraces. Slopes are 0 to 15 percent. The mean annual precipitation is 11 inches and the mean annual temperature is about 53 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents.

TYPICAL PEDON: El Rancho sandy clay loam--irrigated. (Colors are for dry soil unless otherwise stated.)

A--0 to 10 inches; light reddish brown (5YR 6/3) sandy clay loam, reddish brown (5YR 4/3) moist; weak fine granular structure; soft, very friable, slightly sticky, slightly plastic; slightly effervescent; moderately alkaline (pH 8.4); clear smooth boundary. (6 to 12 inches thick)

C1--10 to 18 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; slightly effervescent; moderately alkaline (pH 8.4); clear smooth boundary. (10 to 14 inches thick)

C2--18 to 60 inches; light brown (7.5YR 6/4) sandy clay loam, reddish brown (5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; slightly effervescent; moderately alkaline (pH 8.4).

TYPE LOCATION: Santa Fe County, New Mexico - Pojoaque community; SW 1/4 sec. 33, T.19N., R.9E.

RANGE IN CHARACTERISTICS:

Soil Moisture: Dry in all parts of the soil moisture control section 50 to 75 percent of the time that the soil temperature is above 41 degrees F. The driest periods occur between early October and May.

Soil Temperature: 51 to 56 degrees F.

Calcium carbonate equivalent: less than 5 percent to depths of at least 40 inches. Calcium carbonate is mostly disseminated but may occur as very few indistinct lime segregations.

Control section: Reaction - moderately to strongly alkaline

Rock fragments: 0 to 5 percent, dominantly pebbles

Organic matter: decreases regularly with depth

A horizon - Hue: 5YR or 7.5YR or *10YR
Value: 5 or 6 dry, 3 or 4 moist
Chroma: 3 or 4
Texture: sandy clay loam, loam, clay loam and sandy loam

C horizon - Hue: 5YR or 7.5YR or *10YR
Value: 5 through 7 dry, 3 through 5 moist
Chroma: 3 through 6
Texture: sandy loam, fine sandy loam, loam or sandy clay loam and averages more than 50 percent sand in the particle-size control section.

COMPETING SERIES: These are the Kim, Kishona, Manikan, Mikim, Neville, Paradox, Pojoaque, Shavano, Sixmile, Thedlund, Theedle and Tsosie soils. Kim and Neville soils have heavy loam and clay loam textures in the control section. Kishona soils are dry more than 75 percent of the time when the soil is above 41 degrees F. between July and October. Manikan soils contain gypsum. Mikim soils average less than 50 percent sand in the particle-size control section. Paradox soils have precipitation evenly distributed throughout the year. Pojoaque soils have 15 to 35 percent rock fragments. Shavano, Sixmile, Thedlund, and Theedle soils have bedrock at depths of 20 to 40 inches. Tsosie soils have hues yellower than 7.5YR.

GEOGRAPHIC SETTING: El Rancho soils are on *valley bottoms and terraces at elevations of 5,000 to 7,000 feet. They formed in parent materials derived from a variety of rocks, including Precambrian igneous rocks and quaternary -Tertiary sandstone sediments. The climate at the type location is semiarid continental. Slopes range from 0 to 15 percent. Mean annual precipitation is 10 to 13 inches with a marked summer maximum. Mean annual temperature is about 49 to 54 degrees F. Frost-free period is 120 to 150 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Ancho, Bluewing, Fruitland, and Pojoaque soils. Ancho soils have mollic epipedons and fine-silty control sections. Bluewing soils have very gravelly and sandy control sections. Fruitland soils have sandy loam control sections.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: Used primarily as irrigated cropland where water is available, and as rangeland. Present vegetation is blue grama, sand dropseed and Indian ricegrass.

DISTRIBUTION AND EXTENT: Northcentral New Mexico. This soils is of moderate extent.

SERIES ESTABLISHED: Santa Fe County (Santa Fe Area), New Mexico, 1970.

REMARKS: DIAGNOSTIC HORIZONS AND FEATURES RECOGNIZED IN THIS PEDON ARE:

* added for CHURCHROCK AREA -

Ochric epipedon: The zone from 0 to 10 inches. (A horizon)

Entisol feature: Lack of diagnostic horizons.

NATIONAL COOPERATIVE SOIL SURVEY
U.S.A.

MLRA(S): 36, 37
REV. JJT-DSP, 7-86
USTIC TORRIORTHENTS, FINE-LOAMY, MIXED (CALCAREOUS), MESIC

EL RANCHO SERIES

THE EL RANCHO SERIES CONSISTS OF DEEP, WELL DRAINED SOILS THAT FORMED IN ALLUVIUM ON TERRACES. ELEVATION IS ABOUT 6500 FEET. MAP IS ABOUT 12 INCHES, MAAT IS ABOUT 50 F, FFP IS 150 TO 170 DAYS. TYPICALLY, THE SURFACE LAYER IS REDDISH BROWN SANDY CLAY LOAM 10 INCHES THICK. THE SUBSTRATUM IS LIGHT REDDISH BROWN AND LIGHT BROWN SANDY CLAY LOAM TO A DEPTH OF 60 INCHES OR MORE. SLOPES ARE 0 TO 5 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT >3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	LIQUID LIMIT	PLAS-TICITY INDEX
0-10	SCL, L	CL, SC	A-6	0	100	100	65-75	45-55	30-40	10-20
0-10	SL	SM-SC	A-4	0	100	100	50-65	35-50	25-30	5-10
0-10	CL	CL	A-6	0	100	100	80-90	55-75	35-40	15-20
10-60	SCL, CL	CL, SC	A-6	0	100	100	55-65	45-55	25-40	10-20

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEA-BILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CONCRETE
0-10	20-35	1.20-1.30	0.6-2.0	0.14-0.16	7.9-8.4	-	MODERATE	.32	5	4L	.5-.9	HIGH	LOW
0-10	15-20	1.40-1.50	2.0-6.0	0.11-0.13	7.9-8.4	-	LOW	.24	5	3	.5-.9		
0-10	30-35	1.45-1.55	0.2-0.6	0.19-0.21	7.9-8.4	-	MODERATE	.32	5	4L	.5-.9		
10-60	18-35	1.20-1.30	0.6-2.0	0.13-0.16	7.9-8.4	<2	MODERATE	.32					

FLOODING FREQUENCY	DURATION	MONTHS	HIGH WATER TABLE DEPTH (FT)	KIND	MONTHS	CEMENTED PAN DEPTH (IN)	HARDNESS	BEDROCK DEPTH (IN)	HARDNESS	SUBSIDENCE INIT. (IN)	TOTAL (IN)	HYD GRP	POTENTIAL FROST ACTION
NONE-RARE			>6.0			-		>60		-	-	B	MODERATE

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	NONE: MODERATE-PERCS SLOWLY RARE: MODERATE-FLOODING, PERCS SLOWLY
SEWAGE LAGOON AREAS	0-3%: MODERATE-SEEPAGE 3-5%: MODERATE-SEEPAGE, SLOPE
SANITARY LANDFILL (TRENCH)	NONE: SLIGHT RARE: MODERATE-FLOODING
SANITARY LANDFILL (AREA)	NONE: SLIGHT RARE: MODERATE-FLOODING
DAILY COVER FOR LANDFILL	GOOD

CONSTRUCTION MATERIAL

ROADFILL	FAIR-SHRINK-SWELL
SAND	IMPROBABLE-EXCESS FINES
GRAVEL	IMPROBABLE-EXCESS FINES
TOPSOIL	FAIR-TOO CLAYEY

BUILDING SITE DEVELOPMENT

SHALLOW EXCAVATIONS	SLIGHT
DWELLINGS WITHOUT BASEMENTS	NONE: MODERATE-SHRINK-SWELL RARE: SEVERE-FLOODING
DWELLINGS WITH BASEMENTS	NONE: MODERATE-SHRINK-SWELL RARE: SEVERE-FLOODING
SMALL COMMERCIAL BUILDINGS	0-4% NONE: MODERATE-SHRINK-SWELL 4-5% NONE: MODERATE-SHRINK-SWELL, SLOPE RARE: SEVERE-FLOODING
LOCAL ROADS AND STREETS	NONE: MODERATE-SHRINK-SWELL, FROST ACTION RARE: MODERATE-SHRINK-SWELL, FLOODING, FROST ACTION
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	SLIGHT

WATER MANAGEMENT

POND RESERVOIR AREA	0-3%: MODERATE-SEEPAGE 3-5%: MODERATE-SEEPAGE, SLOPE
EMBANKMENTS DIKES AND LEVEES	MODERATE-PIPING
EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DRAINAGE	DEEP TO WATER
IRRIGATION	0-3% SCL,L,CL: FAVORABLE 3+% SCL,L,CL: SLOPE 0-3% SL: SOIL BLOWING 3+% SL: SLOPE, SOIL BLOWING
TERRACES AND DIVERSIONS	SCL,L,CL: FAVORABLE SL: SOIL BLOWING
GRASSED WATERWAYS	TOO ARID

REGIONAL INTERPRETATIONS

RECREATIONAL DEVELOPMENT

CAMP AREAS	SCL,SL,CL,VGY: SLIGHT L,NONC: MODERATE-DUSTY RARE: SEVERE-FLOODING		PLAYGROUNDS	0-2% SCL,SL,CL: SLIGHT 2-5% SCL,SL,CL: MODERATE-SLOPE 0-2% L: MODERATE-DUSTY 2-5% L: MODERATE-SLOPE,DUSTY
PICNIC AREAS	SCL,SL,CL: SLIGHT L: MODERATE-DUSTY		PATHS AND TRAILS	SCL,SL,CL: SLIGHT L: MODERATE-DUSTY

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY NIRR	CAPABILITY IRR.	ALFALFA HAY (TONS) NIRR	ALFALFA HAY (TONS) IRR.	APPLES (BU) NIRR	APPLES (BU) IRR.	CORN SILAGE (TONS) NIRR	CORN SILAGE (TONS) IRR.	PEPPERS, FRESH CHILI (TONS) NIRR	PEPPERS, FRESH CHILI (TONS) IRR.	BARLEY (BU) NIRR	BARLEY (BU) IRR.	WHEAT, WINTER (BU) NIRR	WHEAT, WINTER (BU) IRR.	PASTURE (AUM) NIRR	PASTURE (AUM) IRR.
0-1% IRR	6C	1	-	7	-	775	-	31	-	8.5	-	85	-	55	-	22
1-3% IRR	6C	2E	-	7	-	700	-	30	-	8.0	-	75	-	50	-	20
3-5% IRR	6C	3E	-	5.5	-	[illegible]	-	22	-	6.0	-	55	-	45	-	15
0-5% NIRR	6C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	MANAGEMENT PROBLEMS: EROSN HAZARD	EQUIP. LIMIT	SEEDL. MORTY	WINDTH HAZARD	PLANT COMPET	POTENTIAL PRODUCTIVITY: COMMON TREES	SITE INDX	PROD CLASS	TREES TO PLANT
							NONE			

WINDBREAKS (B)

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT
IRR	EASTERN REDCEDAR	20	ROCKY MT. JUNIPER	20			RUSSIAN-OLIVE	30
	HONEYLOCUST	25			SIBERIAN ELM	40	SKUNKBUSH SUMAC	12
	PINYON	15	GREEN ASH	25	GOLDEN WILLOW	25	FOURWING SALTBUSH	6
NIRR	AMUR HONEYSUCKLE	7	LILAC	14				
	FOURWING SALTBUSH	8	SKUNKBUSH SUMAC	8				

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS: GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	POTENTIAL AS HABITAT FOR: OPENLD WILDLF	WOODLD WILDLF	WETLAND WILDLF	RANGELD WILDLF
0-3% IRR	GOOD	GOOD	FAIR	-	-	POOR	GOOD	FAIR	FAIR	-	FAIR	POOR
3-5% IRR	FAIR	GOOD	FAIR	-	-	POOR	POOR	V. POOR	FAIR	-	V. POOR	POOR
0-5% NIRR	POOR	FAIR	FAIR	-	-	POOR	POOR	V. POOR	POOR	-	V. POOR	POOR

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

COMMON PLANT NAME	PLANT SYMBOL (NLSPN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE: DRY	MOIST			
WESTERN WHEATGRASS	AGSM	5	10			
INDIAN RICEGRASS	ORHY	15	-			
BLUE GRAMA	BOGR2	15	20			
GALLETA	HIJA	15	-			
SAND DROPSEED	SPCR	5	-			
BOTTLEBRUSH SQUIRRELTAIL	SIHY	5	5			
BIG SAGEBRUSH	ARTR2	10	-			
WINTERFAT	CELA	-	5			
OTHER PERENNIAL FORBS	PPFF	10	-			
OTHER SHRUBS	SSSS	10	-			
SPIKE MUHLY	MUWR	-	10			
NEEDLEGRASS	STIPA	-	5			
POTENTIAL PRODUCTION (LBS./AC. DRY WT): FAVORABLE YEARS		800	880			
NORMAL YEARS		530	-			
UNFAVORABLE YEARS		320	375			

FOOTNOTES

A DRY: 03TX002NM MOIST: 03CP112NM.

B NEDIP

LOCATION FLUGLE 7/86 NM

Established Series
RD: PJM/WRJ/RJA
7/86

FLUGLE SERIES

The Flugle series consists of deep, well drained, moderately permeable soils that formed in eolian material and alluvium from shale and sandstone on hills and fan terraces. Slope ranges from 0 to 25 percent. The mean annual precipitation is about 14 inches, and the mean annual temperature is about 50 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, mesic Aridic Haplustalfs.

TYPICAL PEDON: Flugle sandy loam--rangeland. (Colors are for dry soil unless otherwise stated.)

A--0 to 3 inches; brown (7.5YR 5/2) sandy loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; few fine and common very fine roots; neutral; clear smooth boundary. (2 to 5 inches thick)

Bt1--3 to 9 inches; brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and very fine roots; few thin clay films on faces of peds; neutral, clear wavy boundary. (6 to 15 inches thick)

Bt2--9 to 17 inches; brown (7.5YR 4/4) sandy clay loam, brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common medium fine and very fine roots; few thin clay films on faces of peds; abrupt wavy boundary. (7 to 10 inches thick)

BC--17 to 29 inches; brown (7.5YR 5/4) sandy clay loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few medium and fine, common very fine roots; neutral; clear smooth boundary. (2 to 12 inches thick)

C--29 to 60 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few fine and very fine roots; slightly effervescent; mildly alkaline.

TYPE LOCATION: Catron County, New Mexico; about 5 miles north of Pietown on the Diamond T Ranch in the SE 1/4, NW 1/4, sec. 25, T. 2 N., R. 13 W.

RANGE IN CHARACTERISTICS:

Soil Moisture - The soil moisture control section is moist in some part during the 120 days following the winter solstice and is moist in all

parts less than 25 percent of the time that the soil temperature at 20 inch depths is above 41 degrees F.

Soil Temperature - 49 to 56 degrees F.

~~Depth to the base of the Bt horizon - 15 to 30 inches.~~

Calcium carbonate equivalent - 0 to 10 percent. In some pedons, secondary carbonates occur below the Bt horizons.

Rock fragments - 0 to 15 percent on a weighted average.

A horizon - Hue: 7.5YR or 10YR
Value: 4 through 6 dry, 3 through 5 moist
Chroma: 2 through 4
Texture: Loamy fine sand, sandy loam, fine sandy loam or loam

B horizon - Hue: 5YR, 7.5YR or 10YR
Chroma: 2 through 6
Clay content: 18 to 35 percent
Sand content: More than 35 percent

C or Bk horizon - Hue: 7.5YR or 10YR
Value: 5 through 7 dry, 4 through 6 moist
Chroma: 3 through 6
Texture: Sandy loam, fine sandy loam, loam, sandy clay loam or clay loam

COMPETING SERIES: These are the Augustine, Celacy, Dalhart, Deschell, Goesling, Hennessy, Maia, Nyjack, Orlie, Pinitos, Ribera and Vibo series. Augustine soils have secondary carbonates in the argillic horizon. Celacy, Nyjack and Ribera soils have a paralithic or lithic contact within 40 inch depths. Dalhart soils are moist in all parts of the soil moisture control section more than 25 percent of the time. Deschell, Goesling, Hennessy, Maia and Vibo soils have calcic horizons within depths of 40 inches. Orlie soils have less than 35 percent sand. Pinitos soils are moist in all parts of the soil moisture control section 30 to 40 consecutive days following the winter solstice.

GEOGRAPHIC SETTING: Flugle soils are on hills and fan terraces with slopes of 0 to 25 percent. Flugle soils formed in eolian material and alluvium from shale and sandstone at elevations of 5,600 to 8,000 feet. The mean annual temperature is 47 to 54 degrees F., and the mean annual precipitation is 12 to 15 inches. The frost-free period is 110 to 135 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Catman, Diatee, Gustspring, Jacee, Jacques, Loarc, Veteado, Viuda and the competing Celacy and Goesling soils. Jacee soils are moderately deep. Diatee and Gustspring soils have contrasting layers. Jacee, Jacques and Catman soils are fine textured. Loarc has a mollic epipedon. Viuda has a lithic contact within depths of 20 inches.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate

permeability.

USE AND VEGETATION: These soils are used for livestock grazing and wood production. Native vegetation is pinyon, oneseed juniper, blue grama, ring muhly, sage wort, and rubber rabbitbrush.

DISTRIBUTION AND EXTENT: The Flugle soils are of moderate extent in western and northcentral New Mexico.

SERIES ESTABLISHED: Catron County, New Mexico, 1982.

REMARKS: DIAGNOSTIC HORIZONS AND FEATURES RECOGNIZED IN THIS PEDON ARE:

Ochric epipedon - The zone from the surface to about 3 inches. (A horizon)

Argillic horizon - The zone from about 3 to 17 inches. (Bt1, Bt2 horizons)

NATIONAL COOPERATIVE SOIL SURVEY

U.S.A.

MLRA(S): 36 FLUGLE SERIES
REV. WTJ, 4-85
ARIDIC HAPLUSTALFS, FINE-LOAMY, MIXED, MESIC

FLUGLE SERIES CONSISTS OF DEEP WELL DRAINED SOILS FORMED IN ALLUVIUM FROM MIXED SOURCES ON HILLS AND FANS. ELEVATION IS 6900 TO 7800 FEET. A.A.P. IS 12 TO 15 INCHES. A.A.A.T. IS 47 TO 54 F. F.F.S. IS 115 TO 130 DAYS. TYPICALLY, THE SURFACE LAYER IS BROWN SANDY LOAM ABOUT 3 INCHES THICK. THE SUBSOIL IS BROWN SANDY CLAY LOAM ABOUT 22 INCHES THICK. THE SUBSTRATUM IS LIGHT YELLOWISH BROWN AND LIGHT BROWN SANDY LOAM TO A DEPTH OF 60 INCHES OR MORE. SLOPES RANGE FROM 0 TO 15 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT >3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	LIQUID LIMIT	PLASTICITY INDEX
0-3	SL, FSL	SM-SC	A-2, A-4	0	100	90-100	50-60	30-40	20-25	5-10
0-3	LFS	SM	A-2, A-4	0	100	75-100	75-90	25-40	15-20	NP-5
0-3	L	CL-ML	A-4	0	100	90-100	65-80	55-65	20-30	5-10
3-25	SCL, CL, L	CL, SC	A-6	0	100	90-100	60-80	40-60	30-40	10-20
25-60	SL, FSL	SM-SC	A-2, A-4	0	100	90-100	50-60	30-40	20-30	5-10

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CONCRETE
0-2	12-17	1.35-1.45	2.0-6.0	0.11-0.13	6.6-7.3	-	LOW	.24	5	3	1-3	HIGH	LOW
0-3	5-10	1.45-1.55	6.0-20	0.09-0.10	6.6-7.3	-	LOW	.20	5	2	1-3		
0-3	10-20	1.35-1.45	0.6-2.0	0.16-0.18	6.6-7.3	-	LOW	.37	5	5	1-3		
3-25	20-35	1.45-1.55	0.6-2.0	0.15-0.18	6.6-8.4	-	MODERATE	.37					
25-60	10-20	1.45-1.55	0.6-2.0	0.11-0.13	7.4-8.4	<2	LOW	.24					

FLOODING FREQUENCY	DURATION	MONTHS	HIGH WATER TABLE DEPTH (FT)	KIND	MONTHS	CEMENTED PAN DEPTH (IN)	HARDNESS	BEDROCK DEPTH (IN)	HARDNESS	SUBSIDENCE INIT. (IN)	TOTAL (IN)	HYD GRP	POTENT'L FROST ACTION
NONE			>6.0			-		>60		-		B	MODERATE

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	0-8%: MODERATE-PERCS SLOWLY 8-15%: MODERATE-PERCS SLOWLY,SLOPE
SEWAGE LAGOON AREAS	0-2%: MODERATE-SEEPAGE 2-7%: MODERATE-SEEPAGE,SLOPE 7+%: SEVERE-SLOPE
SANITARY LANDFILL (TRENCH)	0-8%: SLIGHT 8-15%: MODERATE-SLOPE
SANITARY LANDFILL (AREA)	0-8%: SLIGHT 8-15%: MODERATE-SLOPE
DAILY COVER FOR LANDFILL	0-8%: GOOD 8-15%: FAIR-SLOPE

CONSTRUCTION MATERIAL

ROADFILL	GOOD
SAND	IMPROBABLE-EXCESS FINES
GRAVEL	IMPROBABLE-EXCESS FINES
TOPSOIL	0-8%: FAIR-TOO CLAYEY,SMALL STONES 8-15%: FAIR-TOO CLAYEY,SMALL STONES,SLOPE

BUILDING SITE DEVELOPMENT

SHALLOW EXCAVATIONS	0-8%: SLIGHT 8-15%: MODERATE-SLOPE
DWELLINGS WITHOUT BASEMENTS	0-8%: MODERATE-SHRINK-SWELL 8-15%: MODERATE-SHRINK-SWELL,SLOPE
DWELLINGS WITH BASEMENTS	0-8%: SLIGHT 8-15%: MODERATE-SLOPE
SMALL COMMERCIAL BUILDINGS	0-4%: MODERATE-SHRINK-SWELL 4-8%: MODERATE-SHRINK-SWELL,SLOPE 8+%: SEVERE-SLOPE
LOCAL ROADS AND STREETS	0-8%: MODERATE-SHRINK-SWELL,FROST ACTION 8-15%: MODERATE-SHRINK-SWELL,SLOPE, FROST ACTION
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	0-8%: SLIGHT 8-15%: MODERATE-SLOPE

WATER MANAGEMENT

POND RESERVOIR AREA	0-3%: MODERATE-SEEPAGE 3-8%: MODERATE-SEEPAGE,SLOPE 8+%: SEVERE-SLOPE
EMBANKMENTS DIKES AND LEVEES	SLIGHT
EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DRAINAGE	DEEP TO WATER
IRRIGATION	0-3% SL,FSL,L: FAVORABLE 3+% SL,FSL,L: SLOPE 0-3% LFS: FAST INTAKE 3+% LFS: SLOPE,FAST INTAKE
TERRACES AND DIVERSIONS	0-8% L: ERODES EASILY 8+% L: SLOPE,ERODES EASILY 0-8% SL,FSL,LFS: ERODES EASILY,SOIL BLOWING 8+% SL,FSL,LFS: SLOPE,ERODES EASILY, SOIL BLOWING
GRASSED WATERWAYS	0-8%: TOO ARID,ERODES EASILY 8+%: TOO ARID,SLOPE,ERODES EASILY

REGIONAL INTERPRETATIONS

RECREATIONAL DEVELOPMENT

CAMP AREAS	0-8% SL,FSL,LFS: SLIGHT 8-15% SL,FSL,LFS: MODERATE-SLOPE 0-8% L: MODERATE-DUSTY 8-15% L: MODERATE-SLOPE,DUSTY	PLAYGROUNDS	0-2% SL,FSL,LFS: SLIGHT 2-6% SL,FSL,LFS: MODERATE-SLOPE 0-2% L: MODERATE-DUSTY 2-6% L: MODERATE-SLOPE,DUSTY 6+%: SEVERE-SLOPE
PICNIC AREAS	0-8% SL,FSL,LFS: SLIGHT 8-15% SL,FSL,LFS: MODERATE-SLOPE 0-8% L: MODERATE-DUSTY 8-15% L: MODERATE-SLOPE,DUSTY	PATHS AND TRAILS	SL,FSL,LFS: SLIGHT L: SEVERE-ERODES EASILY

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR	NIRR	IRR
ALL	6C															

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	MANAGEMENT PROBLEMS: EROSN HAZARD	EQUIP. LIMIT	SEEDL. MORTTY	WINDTH HAZARD	PLANT COMPET	POTENTIAL PRODUCTIVITY: COMMON TREES	SITE INDX	PROD CLAS	TREES TO PLANT
SMDS-15	1A	SLIGHT	SLIGHT	SLIGHT	SLIGHT	SEVERE	PINYON ONESEED JUNIPER	40	1	
SMDI-15	1A	SLIGHT	SLIGHT	SLIGHT	SLIGHT	SEVERE	PINYON ONESEED JUNIPER	13	1	

WINDBREAKS

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS: GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	POTENTIAL AS HABITAT FOR: OPENLD WILDLF	WOODLD WILDLF	WETLAND WILDLF	RANGELD WILDLF
ALL	POOR	FAIR	FAIR	-	-	FAIR	POOR	V. POOR	FAIR	-	V. POOR	FAIR

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

COMMON PLANT NAME	PLANT SYMBOL (NLSPN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE: RED PRT	COOL	MAP12-14	WOODLAND	
BLUE GRAMA	BOGR2	15		20	10	
WESTERN WHEATGRASS	AGSM	10	15	10	15	
NEEDLEGRASS	STIPA	5	5	-	5	
OTHER PERENNIAL FORBS	PPFF	5	5	-		
OTHER HALF SHRUBS	HHSS	5	5	-		
INDIAN RICEGRASS	ORHY	5	10	-	10	
OTHER SHRUBS	SSSS	5	5	-		
PINYON	PIED	15	5	-		
JUNIPER	JUNIP	5	15	-		
OTHER PERENNIAL GRASSES	PPGG	30	5	-	15	
SPIKE MUHLY	MUWR	-	-	5		
BOTTLEBRUSH SQUIRRELTAIL	SIHY	-	-	5		
FOURWING SALTBUSH	ATCA2	-	-	5		
WINTERFAT	EULA5	-	-	5		
POTENTIAL PRODUCTION (LBS./AC. DRY WT): FAVORABLE YEARS		875	850	950	400	
NORMAL YEARS		-	500	-		
UNFAVORABLE YEARS		300	325	375	150	

FOOTNOTES

A RED PRT=036B127NM MAP12-14: 036B112NM COOL: 036B113NM.

LOCATION GALESTINA 6/86 NM

Established Series
IRD: CEM/TLP/RJA
6/86

SOIL SERIES FILE

GALESTINA SERIES

The Galestina series consists of deep, well drained, slowly permeable soils that formed in alluvium. Galestina soils are on hills and mesas. Slopes are 1 to 8 percent. Mean annual precipitation is about 15 inches and mean annual temperature is about 49 degrees F.

TAXONOMIC CLASS: Fine, mixed, mesic Aridic Paleustalfs.

TYPICAL PEDON: Galestina sandy loam--rangeland. (Colors are for dry soil unless otherwise noted.)

A--0 to 2 inches; yellowish brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; common fine and very fine roots; common fine vesicular pores; neutral; abrupt smooth boundary. (2 to 3 inches thick)

BA--2 to 7 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common fine tubular and few fine vesicular pores; mildly alkaline; clear smooth boundary. (2 to 7 inches thick)

Bt1--7 to 24 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, very sticky and very plastic; common very fine and fine roots; common fine tubular pores; continuous thick clay films on faces of peds and in pores; mildly alkaline; clear smooth boundary. (6 to 17 inches thick)

Bt2--24 to 31 inches; yellowish brown (10YR 5/4) clay, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; common very fine and few fine roots; few fine tubular pores; many thick clay films on faces of peds and in pores; mildly alkaline; clear smooth boundary. (2 to 5 inches thick)

Bk1--31 to 42 inches; yellowish brown (10YR 5/6) clay, yellowish brown (10YR 5/6) moist; massive; very hard, very firm, very sticky and very plastic; few very fine roots; common very fine and interstitial pores; strongly effervescent; disseminated calcium carbonates and segregated as few medium irregular soft masses; mildly alkaline; gradual smooth boundary. (10 to 16 inches thick)

Bk2--42 to 46 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; massive; very hard, very firm, very sticky and very plastic; few very fine roots; few very fine

interstitial pores; strongly effervescent; disseminated calcium carbonates and segregated as common medium irregular soft masses; mildly alkaline; clear wavy boundary. (4 to 8 inches thick)

2Cr--46 to 60 inches; shale.

TYPE LOCATION: Cibola County, New Mexico; in western Cibola County about 0.5 mile north of the Ojo Pueblo Ruins in Pinitos Draw. 2,160 feet east and 600 feet north of the southwest corner of section 21, T. 8 N., R. 16 W.

RANGE IN CHARACTERISTICS:

Soil Moisture - The soil moisture control section is moist in all parts 30 to 40 consecutive days during the 120 days following the winter solstice and is moist in all parts 35 percent of the time when the soil temperature at 20 inch depths is above 41 degrees F.

Depth to the base of the Bt horizon - 12 to 35 inches.

Depth to the paralithic contact - 40 to 60 inches.

A Horizon - Hue: 7.5YR or 10YR
Value: 4 or 5 dry, 3 or 4 moist.
Chroma: 3 through 6.

Bt Horizon - Value: 4 or 5 dry, 3 through 5 moist.
Chroma: 3 through 6.
Texture: Clay or clay loam.
Clay Content: 35 to 60 percent.

Bk Horizon - Value: 4 through 6 dry, 4 or 5 moist.
Chroma: 4 through 8.
Calcium carbonate equivalent - less than 15 percent.
Texture: Sandy clay loam, clay loam or clay.

Cr Horizon - Dominated by shale but can be interbedded by sandstone.

COMPETING SERIES: There no series in the same family. A similar soil in another family is the Disterheff series. Disterheff soils have montmorillonitic mineralogy.

GEOGRAPHIC SETTING: Galestina soils are on of hills and mesas. Slopes are 1 to 8 percent. Elevations range from 6,800 to 7,300 feet. The mean annual precipitation is 14 to 16 inches and the mean annual air temperature is 47 to 51 degrees F. The average frost-free period is 100 to 120 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Catman, Moncha, Nogal, Pinitos, Ribera and Silkie soils. Catman and Silkie soils have cracks that remain open periodically. Moncha soils have less than 15 percent fine or coarser sand. Nogal soils have a lithic contact between 20 and 40 inches. Pinitos and Ribera soils are fine-loamy.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; slow permeability.

USE AND VEGETATION: Galestina soils are used for livestock grazing. Present vegetation is western wheatgrass, blue grama, sideoats grama and scattered pinyon and oneseed juniper.

DISTRIBUTION AND EXTENT: The series is of small extent in west central New Mexico.

SERIES ESTABLISHED: Cibola County, New Mexico, 1985.

REMARKS: This draft changes the classification of this series from Typic to Aridic based on better knowledge of the precipitation and soil moisture patterns in the general area. Morphology and lab data indicate that these soils have a large increase in clay content at the upper boundary of the argillic horizon. The series is reclassified from fine, mixed, mesic Typic Haplustalfs to fine, mixed, mesic Aridic Paleustalfs.

DIAGNOSTIC HORIZONS AND FEATURES RECOGNIZED IN THIS PEDON ARE:

Ochric Epipedon - The zone from the surface to a depth of about 7 inches (A, BA horizons). When colors meet the requirements of a mollic epipedon, the horizon is too thin.

Argillic Horizons - The zone from about 7 to 31 inches (Bt1, Bt2 horizons).

Bk Horizons - The zone from about 31 to 46 inches (Bk1, Bk2 horizons).

Aridic Ustalf Feature - The soil moisture control section is dry in some parts, more than six-tenths of the time the soil temperature exceeds 41 degrees F.

NATIONAL COOPERATIVE SOIL SURVEY

U.S.A.

NM0836

SOIL INTERPRETATIONS RECORD

MLRA(S): 36
REV. CIM,TLP, 1-87
ARIDIC PALEUSTALFS, FINE, MIXED, MESIC

GALESTINA SERIES

THE GALESTINA SERIES CONSISTS OF DEEP, WELL DRAINED SOILS FORMED IN ALLUVIUM ON HILLS AND MESAS. ELEVATION IS ABOUT 7000 FEET. M.A.A.P. IS ABOUT 15 INCHES, M.A.A.T. IS ABOUT 50 F, F.F.S. IS ABOUT 110 DAYS. TYPICALLY, THE SURFACE LAYER IS YELLOWISH BROWN SANDY LOAM 2 INCHES THICK. THE UPPER 5 INCHES OF THE SUBSOIL IS YELLOWISH BROWN LOAM. THE LOWER 24 INCHES IS YELLOWISH BROWN CLAY. THE SUBSTRATUM IS YELLOWISH BROWN CLAY 15 INCHES THICK. SHALE IS AT A DEPTH OF 46 INCHES. SLOPES RANGE FROM 1 TO 8 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT >3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	LIQUID LIMIT	PLASTICITY INDEX
0-2	SL	SM-SC	A-2, A-4	0	100	100	60-75	30-45	20-30	5-10
2-7	L, SCL, CL	CL-ML, CL	A-4, A-6	0	100	100	85-95	60-75	20-35	5-15
7-46	C, CL	CL, CH	A-6, A-7	0	100	100	90-100	75-95	35-55	15-30
46-60	WB									

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CONCRETE
0-2	10-19	1.45-1.55	2.0-6.0	0.11-0.13	6.6-7.3	-	LOW	.24	3	3	.5-.9	MODERATE	LOW
2-7	15-30	1.25-1.35	0.6-2.0	0.16-0.18	6.6-7.8	-	MODERATE	.37					
7-46	35-60	1.35-1.50	0.06-0.2	0.16-0.18	6.6-7.8	-	HIGH	.28					
46-60	-												

FLOODING FREQUENCY	DURATION	MONTHS	HIGH WATER TABLE DEPTH (FT)	KIND	MONTHS	CEMENTED PAN DEPTH (IN)	HARDNESS	BEDROCK DEPTH (IN)	HARDNESS	SUBSIDENCE INIT. (IN)	TOTAL (IN)	HYD GRP	POTENT'L FROST ACTION
NONE			>6.0			-		40-60	SOFT	-		C	LOW

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	SEVERE-PERCS SLOWLY
SEWAGE LAGOON AREAS	1-2%: MODERATE-DEPTH TO ROCK 2-7%: MODERATE-DEPTH TO ROCK,SLOPE 7-8%: SEVERE-SLOPE
SANITARY LANDFILL (TRENCH)	SEVERE-DEPTH TO ROCK,TOO CLAYEY
SANITARY LANDFILL (AREA)	MODERATE-DEPTH TO ROCK
DAILY COVER FOR LANDFILL	POOR-TOO CLAYEY,HARD TO PACK

CONSTRUCTION MATERIAL

ROADFILL	POOR-SHRINK-SWELL,LOW STRENGTH
SAND	IMPROBABLE-EXCESS FINES
GRAVEL	IMPROBABLE-EXCESS FINES
TOPSOIL	POOR-TOO CLAYEY

BUILDING SITE DEVELOPMENT

SHALLOW EXCAVATIONS	MODERATE-TOO CLAYEY
DWELLINGS WITHOUT BASEMENTS	SEVERE-SHRINK-SWELL
DWELLINGS WITH BASEMENTS	SEVERE-SHRINK-SWELL
SMALL COMMERCIAL BUILDINGS	SEVERE-SHRINK-SWELL
LOCAL ROADS AND STREETS	SEVERE-SHRINK-SWELL,LOW STRENGTH
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	SLIGHT

WATER MANAGEMENT

POND RESERVOIR AREA	1-3%: MODERATE-DEPTH TO ROCK 3-8%: MODERATE-DEPTH TO ROCK,SLOPE
EMBANKMENTS DIKES AND LEVEES	MODERATE-THIN LAYER,HARD TO PACK
EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DRAINAGE	DEEP TO WATER
IRRIGATION	1-3%: SOIL BLOWING,PERCS SLOWLY 3-8%: SLOPE,SOIL BLOWING,PERCS SLOWLY
TERRACES AND DIVERSIONS	ERODES EASILY,SOIL BLOWING,PERCS SLOWLY
GRASSED WATERWAYS	ERODES EASILY,PERCS SLOWLY

REGIONAL INTERPRETATIONS

RECREATIONAL DEVELOPMENT

CAMP AREAS	SLIGHT	PLAYGROUNDS	1-2%: SLIGHT 2-6%: MODERATE-SLOPE 6+%: SEVERE-SLOPE
PICNIC AREAS	SLIGHT	PATHS AND TRAILS	SLIGHT

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY NIRR	CAPABILITY IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.
ALL	6E															

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	MANAGEMENT PROBLEMS: EROSN HAZARD	EQUIP. LIMIT	SEEDL. MORTLY	WINDTH HAZARD	PLANT COMPET	POTENTIAL PRODUCTIVITY: COMMON TREES	SITE INDX	PROD CLAS	TREES TO PLANT
							NONE			

WINDBREAKS

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT
	NON.							

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS: GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	POTENTIAL AS HABITAT FOR: OPENLD WILDLF	WOODLD WILDLF	WETLAND WILDLF	RANGELD WILDLF
ALL	POOR	FAIR	GOOD	*	*	GOOD	POOR	V. POOR	FAIR	*	V. POOR	GOOD

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

COMMON PLANT NAME	PLANT SYMBOL (NLSPN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS-DETERMINING PHASE: MAPIA-16				
WESTERN WHEATGRASS	AGSM	15				
BOTTLEBRUSH SQUIRRELTAIL	SIHY	5				
NEEDLEGRASS	STIPA	5				
BLUE GRAMA	BOGR2	20				
GALLETA	HIJA	5				
FOURWING SALTBUSH	ATCA2	5				
WINTERFAT	EULA5	5				
OTHER PERENNIAL GRASSES	PPGG	15				
OTHER PERENNIAL FORBS	PPFF	5				
OTHER SHRUBS	SSSS	5				
POTENTIAL PRODUCTION (LBS./AC. DRY WT): FAVORABLE YEARS		450				
NORMAL YEARS						
UNFAVORABLE YEARS		375				

FOOTNOTES

A MAPIA-16: 036R112NM.

Established Series
BWC/JPP/GB
1/83

MIKIM SERIES

The Mikim series consists of deep, well drained soils formed in alluvium from sandstone and shale. Mikim soils are on alluvial fans, toeslopes and foothill valleys and have slopes of 0 to 15 percent. Mean annual soil temperature is about 51° F., and mean annual precipitation is about 16 inches.

Taxonomic Class: Fine-loamy, mixed (calcareous), mesic Udic Torriorthents.

Typical Pedon: Mikim loam - rangeland. (Colors are for dry soil unless otherwise noted).

A1—0 to 3 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; weak, fine granular structure; soft, very friable; nonsticky, nonplastic; neutral (pH 7.2); clear smooth boundary. (2 to 10 inches thick)

A2—3 to 9 inches; pale brown 910YR 6/3) loam, dark grayish brown (10YR 4/2) moist; very weak, coarse granular structure; soft, very friable; nonsticky, nonplastic; neutral (pH 7.2); clear smooth boundary. (5 to 10 inches thick)

C1—9 to 30 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak, medium subangular blocky structure parting to weak, fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly effervescent; mildly alkaline (pH 7.8); gradual smooth boundary. (20 to 30 inches thick)

C2—30 to 60 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly effervescent; mildly alkaline (pH 8.0).

Type Location: La Plata County, Colorado; 1,650 feet north and 650 feet east of the southwest corner of Section 24, T. 34 N., R. 10 W.

Range in Characteristics: The particle size control section is typically loam or light clay loam, and has 18 to 35 percent clay, 20 to 55 percent silt, and 15 to 50 percent sand, with more than 15 percent, but less than 35 percent being fine or coarser sand. Some pedons are weakly stratified with sandy loam. Coarse fragments range from 0 to 15 percent and are mostly gravel. Depth to uniformly calcareous material is 0 to 10 inches. Exchangeable sodium is usually less than 5 percent throughout the control section. Mean annual soil temperature is 48° to 53° F., and mean summer soil temperature is 61° to 66° F. The moisture control section is dry for 15 consecutive days from May 15 to July 15 when the soil temperature at 20 inches is greater than 41° F. (5° C.). It is not dry in all parts of the moisture control section for at least 45 consecutive days following the summer solstice to October 20, and for at least 90 cumulative days during the period.

The A horizon has hue of 10YR or 2.5Y, value of 5 through 7, 3 through 6 moist, and chroma of 2 through 4. It is typically a loam or sandy loam. It is neutral to moderately alkaline.

The C horizon has hue of 2.5Y through 7.5YR, value of 5 through 7, 3 through 6 moist, and chroma of 2 through 4. It is mildly alkaline through strongly alkaline. Visible calcium carbonate occurs as soft masses and streaks in some pedons.

Competing Series: These are the El Rancho, Kim, Kishona, Meville, Pojoaque, Shavano, Sixmile, and Thedalund series. The El Rancho soils have sandy loam or sandy clay loam in the particle size control section and receives most of the precipitation in summer and fall months. Kim soils are moist in some parts of the moisture control section from May 15 to July 15, are in a climatic setting that receives 3/4 of the precipitation between April and September, and has a PE Index of about 20 at the type location. Meville and Pojoaque soils have hue of 5YR or redder in the control section. Shavano, Sixmile, and Thedalund soils have bedrock at depths of 20 to 40 inches. Kishona soils are moist for 60 consecutive days following April 21-27, when the soil temperature is 41° F., or greater and they are dry in all parts of the moisture control section for 60 consecutive days from July 15 to October 25.

Geographic Setting: Mikim soils are on alluvial fans, toeslopes, and foothill valleys. Slopes range from 0 to 15 percent. The soils formed in medium textured alluvium derived from sandstone and shale. Mean annual precipitation ranges from 14 to 18 inches and is distributed fairly evenly throughout the year. About half the precipitation falls between April and September with May and June being the driest months. The PE Index is about 42 at the type location and ranges from 30 to 55 for the series. Mean annual temperature ranges from 45° to 53° F., and the mean summer temperature ranges from 62° to 70° F. Elevation ranges from 5,000 to 7,000 feet. The frost free period is 100 to 150 days

Geographically Associated Soils: These are the Arboles, Bayfield, Dulce, Lazear, Shalona, Sili, Travessilla, and Zyme soils. Arboles, Bayfield, Sili, and Zyme have more than 35 percent clay in the particle size control section. Zyme soils are also less than 20 inches to shale. Dulce, Lazear, and Travessilla soils are less than 20 inches to sandstone. Shalona soils have a mollic epipedon.

Drainage and Permeability: Well drained; medium runoff; moderate permeability. Some areas are seasonally wet due to seepage from irrigation and irrigation supply canals.

Use and Vegetation: These soils are used primarily for range; however, they are used as dryland or irrigated cropland in some localities. Rangeland vegetation consists of Indian ricegrass, junegrass, muttongrass, western wheatgrass, big sagebrush, pinon pine, and juniper.

Distribution and Extent: Western Colorado. The series is of moderate extent.

Series Established: La Plata County, Colorado, 1982.

National Cooperative Soil Survey
U. S. A.

C00825

S O I L   I N T E R P R E T A T I O N S   R E C O R D

MLRA(S): 35
REV. MKS,JMD, 6-94
USTIC TORRIORTHENTS, FINE-LOAMY, MIXED (CALCAREOUS), MESIC

MIKIM SERIES
DRY

THE MIKIM SERIES ARE VERY DEEP, WELL DRAINED SOILS FORMED IN ALLUVIUM FROM MIXED SEDIMENTARY ROCKS ON BENCHES AND FAN TERRACES UNDER WYOMING BIG SAGEBRUSH AND GRASSES. MAAT IS 46 TO 49 F. AAP IS 12 TO 14 INCHES. FFP IS [illegible] TO 110 DAYS. A TYPICAL PROFILE HAS A BROWN SANDY LOAM SURFACE LAYER 5 INCHES THICK. THE UNDERLYING LAYER IS A PALE BROWN LOAM AND CLAY LOAM TO A DEPTH 60 INCHES OR MORE. SLOPES ARE 2 TO 8 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT >3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	LIQUID LIMIT	PLASTICITY INDEX
0-5	SL	SM	A-4	0	100	100	60-70	35-45	20-30	NP-5
0-5	L	CL-ML	A-4	0	100	100	85-90	60-75	20-25	5-10
5-60	L, CL	CL	A-6	0	100	100	80-100	60-80	30-40	10-20

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CONCRETE
0-5	10-18	1.35-1.45	2.0-6.0	0.10-0.13	7.9-8.4	<2	LOW	.28	5	3	.5-1	HIGH	MODERATE
0-5	18-27	1.25-1.35	0.6-2.0	0.13-0.19	7.9-8.4	<2	LOW	.32	5	4L	.5-1		
5-60	25-35	1.25-1.30	0.2-0.6	0.17-0.18	8.0-9.0	<2	MODERATE	.32					

FLOODING FREQUENCY	DURATION	MONTHS	HIGH WATER TABLE DEPTH (FT)	KIND	MONTHS	CEMENTED PAN DEPTH (IN)	HARDNESS	BEDROCK DEPTH (IN)	HARDNESS	SUBSIDENCE INIT. (IN)	TOTAL (IN)	HYD GRP	POTENTIAL FROST ACTION
NONE			26.0			-		26Ø		-		B	MODERATE

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	SEVERE-PERCS SLOWLY
SEWAGE LAGOON AREAS	2-7%: MODERATE-SLOPE 7-8%: SEVERE-SLOPE
SANITARY LANDFILL (TRENCH)	SLIGHT
SANITARY LANDFILL (AREA)	SLIGHT
DAILY COVER FOR LANDFILL	GOOD

CONSTRUCTION MATERIAL

ROADFILL	POOR-LOW STRENGTH
SAND	IMPROBABLE-EXCESS FINES
GRAVEL	IMPROBABLE-EXCESS FINES
TOPSOIL	GOOD

BUILDING SITE DEVELOPMENT

SHALLOW EXCAVATIONS	SLIGHT
DWELLINGS WITHOUT BASEMENTS	MODERATE-SHRINK-SWELL
DWELLINGS WITH BASEMENTS	MODERATE-SHRINK-SWELL
SMALL COMMERCIAL BUILDINGS	2-4%: MODERATE-SHRINK-SWELL 4-8%: MODERATE-SHRINK-SWELL,SLOPE
LOCAL ROADS AND STREETS	SEVERE-LOW STRENGTH
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	SLIGHT

WATER MANAGEMENT

POND RESERVOIR AREA	2-3%: SLIGHT 3-8%: MODERATE-SLOPE
EMBANKMENTS DIKES AND LEVEES	MODERATE-PIPING
EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DRAINAGE	DEEP TO WATER
IRRIGATION	2-3% L: FAVORABLE 3-8% L: SLOPE 2-3% SL: SOIL BLOWING 3-8% SL: SOIL BLOWING,SLOPE
TERRACES AND DIVERSIONS	L: FAVORABLE SL: SOIL BLOWING
GRASSED WATERWAYS	FAVORABLE

REGIONAL INTERPRETATIONS

MIKIM SERIES
DRY

CO0825

RECREATIONAL DEVELOPMENT

CAMP AREAS	SLI SLIGHT LI MODERATE-DUSTY	PLAYGROUNDS	2-6% SLI MODERATE-SLOPE 2-6% LI MODERATE-SLOPE,DUSTY 6+%I SEVERE-SLOPE
PICNIC AREAS	SLI SLIGHT LI MODERATE-DUSTY	PATHS AND TRAILS	SLI SLIGHT LI MODERATE-DUSTY

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY		ALFALFA HAY (TONS)		PASTURE (AUM)		BARLEY (BU)									
	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.
ALL	6E	2E		5		3.5		85								

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	EROSION HAZARD	EQUIP. LIMIT	SEEDLING MORTTY.	WINDTH. HAZARD	PLANT COMPET.	COMMON TREES	SITE INDX	TREES TO PLANT
							NONE		

(MANAGEMENT PROBLEMS: EROSION HAZARD, EQUIP. LIMIT, SEEDLING MORTTY., WINDTH. HAZARD, PLANT COMPET.; POTENTIAL PRODUCTIVITY: COMMON TREES, SITE INDX)

WINDBREAKS

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT
	NONE							

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLD WILDLF	WOODLD WILDLF	WETLAND WILDLF	RANGELD WILDLF
NIRR	POOR	POOR	FAIR	-	POOR	FAIR	POOR	V. POOR	POOR	FAIR	V. POOR	FAIR
IRR	GOOD	GOOD	GOOD	-	GOOD	GOOD	POOR	V. POOR	GOOD	GOOD	V. POOR	GOOD

(POTENTIAL FOR HABITAT ELEMENTS: GRAIN & SEED through WATER; POTENTIAL AS HABITAT FOR: OPENLD WILDLF through RANGELD WILDLF)

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

COMMON PLANT NAME	PLANT SYMBOL (NLSPN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE: DRY				
MUTTONGRASS	POFE	5				
BLUE GRAMA	BOGR2	5				
GALLETA	HIJA	5				
INDIAN RICEGRASS	ORHY	15				
SAND DROPSEED	SPCR	5				
NEEDLEANDTHREAD	STCO4	15				
BOTTLEBRUSH SQUIRRELTAIL	SIHY	5				
OTHER PERENNIAL GRASSES	PPGG	5				
OTHER PERENNIAL FORBS	PPFF	5				
WYOMING BIG SAGEBRUSH	ARTRW	20				
FOURWING SALTBUSH	ATCA2	5				
WINTERFAT	EULA5	5				
OTHER SHRUBS	SSSS	5				
POTENTIAL PRODUCTION (LBS./AC. DRY WT):						
FAVORABLE YEARS		1300				
NORMAL YEARS		1000				
UNFAVORABLE YEARS		800				

FOOTNOTES

A UP. LOAM 035-306.

Established Series
Rev. GWA/BDS/CDL
5/83

MION SERIES

The Mion series consists of shallow, well drained, very slowly permeable soils that formed in material weathered from shale on hills ~~and uplands~~ with slopes of 1 to ~~35~~ percent. The mean annual precipitation is about 16 inches. The mean annual ~~air~~ temperature is about 48 degrees F.

Taxonomic Class: Clayey, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical Pedon: Mion silt loam-rangeland.
(Colors are for dry soil unless otherwise noted.)

A--0 to 4 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, plastic; many fine roots; few fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary. (2 to 5 inches thick)

AC--4 to 14 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, firm, slightly sticky and plastic; many fine roots; common fine and medium tubular pores; strongly effervescent; moderately alkaline; abrupt smooth boundary. (4 to 15 inches thick)

2Cr--14 to 22 inches; light brownish gray (2.5Y 6/2) shale, dark grayish brown (2.5Y 4/2) moist; many fine roots between plates in upper inch; thin lime deposits between plates in upper few inches.

Type Location: Colfax County, New Mexico; about 9 miles west of Maxwell; 350 feet south and 1,580 feet west of NE corner of section 28, T. 26 N., R. 21 E.

Range in Characteristics: Depth to shale or claystone ranges from 10 to 20 inches. The soils are neutral to moderately alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 4 through 6 dry, 3 or 4 moist, and chroma of 2 through 4. It is silt loam, silty clay loam, clay loam, gravelly sandy loam ~~or~~ gravelly clay loam.

The AC horizon has hue of 10YR through 5Y, value of 4 through 6 dry, 3 through 5 moist, and chroma of 2 through 4. It is silty clay, clay loam or clay and has 35 to 60 percent clay.

Competing Series: This is the Orella series. Close competitors in other families are the Chantier, Danko, Epsie, Lismas, Midway, and Samsil series. Chantier, Danko, Epsie, Lismas, Midway and Samsil soils have montmorillonitic mineralogy. Orella soils are strongly or very strongly alkaline and have 8 to 30 percent exchangeable sodium.

Geographic Setting: The Mion soils are on hills, ridges, and plains at elevations of 5,500 to 7,800 feet. Slopes are 1 to 35 percent. The soils formed in fine textured material weathered from shale, claystone or sandstone. The climate is semiarid continental with mean annual air temperature of 47 to 56 degrees F., and a mean summer temperature of 65 to 70 degrees F. Annual precipitation is 10 to 18 inches with about 70 percent falling during the frost-free season, which lasts 115 to 160 days.

Geographically Associated Soils: These are the Colmor, Litle, Penrose, Swastika and Vermejo soils. Colmor, Swastika, and Vermejo soils lack a paralithic contact. Litle soils have a paralithic contact at depths of 20 to 40 inches. Penrose soils have limestone at depths of 10 to 20 inches.

Drainage and Permeability: Well drained; medium to rapid runoff; very slow permeability.

Use and Vegetation: Range, wildlife habitat, and watershed. Vegetation is sideoats grama, blue grama, little bluestem, needleandthread, fringed sage, yucca, oak, pinyon, and juniper.

Distribution and Extent: Northern New Mexico and possibly Colorado and Wyoming. This series is of moderate extent.

Series Established: Colfax County, New Mexico, 1974.

National Cooperative Soil Survey

U.S.A.

NM0158 — SOIL INTERPRETATIONS RECORD

MLRA(S): 70, 36 — MION SERIES

REV. GWA-PGM, 3-86

USTIC TORRIORTHENTS, CLAYEY, MIXED (CALCAREOUS), MESIC, SHALLOW

THE MION SERIES CONSISTS OF SHALLOW, WELL DRAINED SOILS. THEY FORMED IN RESIDUUM FROM SHALE ON HILLS, BREAKS AND UPLANDS. ELEVATIONS IS ABOUT 6500 FEET. MEAN ANNUAL PRECIPITATION IS ABOUT 14 INCHES. MEAN ANNUAL SOIL TEMPERATURE IS ABOUT 50 F. FROST-FREE SEASON IS ABOUT 140 DAYS. TYPICALLY, THE SURFACE LAYER IS A SILT LOAM ABOUT 4 INCHES THICK. THE NEXT LAYER IS SILTY CLAY UNDERLAIN BY SHALE AT A DEPTH OF 14 INCHES. SLOPES RANGE FROM 1 TO 65 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT >3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	LIQUID LIMIT	PLASTICITY INDEX
0-4	SIL	CL	A-6	0	100	100	90-100	70-90	30-35	10-15
0-4	SICL, CL	CL	A-6	0	100	100	90-100	80-90	35-40	15-20
0-4	L	CL	A-5	0	100	100	80-90	70-85	30-35	10-15
4-14	SIC, C, CL	CL, CH	A-7	0	100	100	90-100	75-95	45-55	20-30
14	WB									

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CONCRETE
0-4	20-27	1.30-1.40	0.6-2.0	0.19-0.21	7.4-8.4	-	LOW	.43	1	4L	1-3	HIGH	LOW
0-4	27-35	1.40-1.50	0.6-2.0	0.19-0.21	7.4-8.4	-	MODERATE	.37	1	4L	1-3		
0-4	20-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	-	LOW	.37	1	4L	1-3		
4-14	38-55	1.35-1.45	<0.06	0.15-0.17	7.4-8.4	<2	HIGH	.32					
14													

FLOODING FREQUENCY	DURATION	MONTHS	HIGH WATER TABLE DEPTH (FT)	KIND	MONTHS	CEMENTED PAN DEPTH (IN)	HARDNESS	BEDROCK DEPTH (IN)	HARDNESS	SUBSIDENCE INIT. (IN)	TOTAL (IN)	HYD GRP	POTENT'L FROST ACTION
NONE			>6.0			-		10-20	SOFT	-		D	LOW

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-DEPTH TO ROCK,SLOPE
SEWAGE LAGOON AREAS	1-7%: SEVERE-DEPTH TO ROCK 7+%: SEVERE-DEPTH TO ROCK,SLOPE
SANITARY LANDFILL (TRENCH)	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-DEPTH TO ROCK,SLOPE
SANITARY LANDFILL (AREA)	1-8%: SLIGHT 8-15%: MODERATE-SLOPE 15+%: SEVERE-SLOPE
DAILY COVER FOR LANDFILL	1-15%: POOR-DEPTH TO ROCK,HARD TO PACK 15+%: POOR-DEPTH TO ROCK,HARD TO PACK,SLOPE

CONSTRUCTION MATERIAL

ROADFILL	POOR-DEPTH TO ROCK,SHRINK-SWELL,LOW STRENGTH
SAND	IMPROBABLE-EXCESS FINES
GRAVEL	IMPROBABLE-EXCESS FINES
TOPSOIL	1-15%: POOR-DEPTH TO ROCK,TOO CLAYEY 15+%: POOR-DEPTH TO ROCK,TOO CLAYEY,SLOPE

BUILDING SITE DEVELOPMENT

SHALLOW EXCAVATIONS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-DEPTH TO ROCK,SLOPE
DWELLINGS WITHOUT BASEMENTS	1-15%: SEVERE-SHRINK-SWELL 15+%: SEVERE-SHRINK-SWELL,SLOPE
DWELLINGS WITH BASEMENTS	1-15%: SEVERE-DEPTH TO ROCK,SHRINK-SWELL 15+%:SEVERE-DEPTH TO ROCK,SLOPE,SHRINK-SWELL
SMALL COMMERCIAL BUILDINGS	1-8%: SEVERE-SHRINK-SWELL 8+%: SEVERE-SHRINK-SWELL,SLOPE
LOCAL ROADS AND STREETS	1-15%: SEVERE-SHRINK-SWELL,LOW STRENGTH 15+%: SEVERE-SHRINK-SWELL,LOW STRENGTH,SLOPE
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-SLOPE,DEPTH TO ROCK

WATER MANAGEMENT

POND RESERVOIR AREA	1-8%: SEVERE-DEPTH TO ROCK 8+%: SEVERE-DEPTH TO ROCK,SLOPE
EMBANKMENTS DIKES AND LEVEES	SEVERE-THIN LAYER
EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DRAINAGE	DEEP TO WATER
IRRIGATION	1-3%: PERCS SLOWLY,DEPTH TO ROCK 3+%: SLOPE,PERCS SLOWLY,DEPTH TO ROCK
TERRACES AND DIVERSIONS	1-8%: DEPTH TO ROCK,ERODES EASILY 8+%: SLOPE,DEPTH TO ROCK,ERODES EASILY
GRASSED WATERWAYS	1-8%: TOO ARID,ERODES EASILY 8+%: TOO ARID,SLOPE,ERODES EASILY

REGIONAL INTERPRETATIONS

RECREATIONAL DEVELOPMENT

CAMP AREAS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-SLOPE,DEPTH TO ROCK	PLAYGROUNDS	1-6%: SEVERE-DEPTH TO ROCK 6+%: SEVERE-SLOPE,DEPTH TO ROCK
PICNIC AREAS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-SLOPE,DEPTH TO ROCK	PATHS AND TRAILS	1-25%: SEVERE-ERODES EASILY 25+%: SEVERE-SLOPE,ERODES EASILY

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.
0-15%	7[illegible]															
15+%	7[illegible]															

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	MANAGEMENT PROBLEMS: EROSN HAZARD	EQUIP. LIMIT	SEEDL. MORTY	WINDTH HAZARD	PLANT COMPET	POTENTIAL PRODUCTIVITY: COMMON TREES	SITE INDX	PROD CLASS	TREES TO PLANT
RN33-33	1D	SLIGHT	MODER.	MODER.	SEVERE	MODER.	PINYON ONESEED JUNIPER	20	1	
RMD35+55	1D	SEVERE	SEVERE	MODER.	SEVERE	MODER.	PINYON ONESEED JUNIPER	20	1	

WINDBREAKS

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT
	NONE							

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS: GRAIN & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	POTENTIAL AS HABITAT FOR: OPENLD WILDLF	WOODLD WILDLF	WETLAND WILDLF	RANGELD WILDLF
NIRR	V. POOR	V. POOR	FAIR	-	-	FAIR	V. POOR	V. POOR	V. POOR	-	V. POOR	FAIR
IRR	FAIR	GOOD	FAIR	-	-	FAIR	GOOD	POOR	FAIR	-	FAIR	-

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

COMMON PLANT NAME	PLANT SYMBOL (NLSPN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS-DETERMINING PHASE: MOIST	DRY	MAP10-12	WOODLAND	LOW PPT
SIDEOATS GRAMA	BOCU	10	15	10	5	30
LITTLE BLUESTEM	SCSC	-	15	-	5	10
BLUE GRAMA	BOGR2	15	20	25	10	10
ALKALI SACATON	SPAI	15	-	-	-	
WESTERN WHEATGRASS	AGSM	15	-	-	10	
VINE MESQUITE	PAOB	10	-	-	-	
FOURWING SALTBUSH	ATCA2	10	-	-	-	
OTHER PERENNIAL FORBS	PPFF	5	10	-	-	5
OTHER PERENNIAL GRASSES	PPGG	15	15	20	-	15
OTHER SHRUBS	SSSS	5	5	5	10	5
GAMBEL OAK	QUGA	-	10	-	5	
PINYON	PIED	-	5		5	5
ONESEED JUNIPER	JUMO	-	5	5	5	
HAIRY GRAMA	BOHI2	-	-	25	5	
NEEDLEGRASS	STIPA					10
POTENTIAL PRODUCTION (LBS./AC. DRY WT): FAVORABLE YEARS		1300	1100	750	400	700
NORMAL YEARS		1000	900	-	-	
UNFAVORABLE YEARS		600	600	375	250	275

FOOTNOTES

A MOIST-070A015NM DRY-070AC09NM MAP10-12-036B131NM LOW PPT-036B121NM.

irregular soft masses; mildly alkaline.

TYPE LOCATION: Cibola County, New Mexico; about one mile east of Balok Ranch, 1,080 feet west, 700 feet north of the southeast corner of section 3, T. 8 N., R. 16 W.

RANGE IN CHARACTERISTICS:

Soil Moisture - The soil moisture control section is moist in all parts 30 to 40 consecutive days during the 120 days following the winter solstice and is moist in all parts about 35 percent of the time that the soil temperature at 20 inch depths is above 41 degrees F.

Soil Temperature - 49 to 53 degrees F.

Depth to Calcium Carbonate - 18 to 31 inches.

Depth to the base of the Bt horizon - 18 to 31 inches.

A Horizon - Hue: 7.5YR or 10YR.
Value: 5 or 6 dry.
Chroma: 3 or 4 moist.
Texture: Sandy loam or loam.

Bt Horizon - Hue: 7.5YR or 10YR.
Value: 4 or 5 dry, 3 or 4 moist.
Chroma: 4 or 6 dry.
Texture: Sandy clay loam or clay loam.
Clay Content: 20 to 35 percent.
Sand Content: More than 35 percent.

Bk Horizons - Hue: 7.5YR or 10YR.
Value: 4 through 6 dry, 3 through 5 moist.
Chroma: 4 or 6.
Texture: Sandy loam, sandy clay loam or clay loam.
Calcium Carbonate Equivalent: Less than 15 percent

COMPETING SERIES: These are the Augustine, Celacy, Dalhart, Deschell, Flugle, Goesling, Hennessy, Maia, Nyjack (T), Orlie (T), Ribera and Vibo series. Augustine, Flugle, Goesling, Orlie and Vibo soils are not moist in all parts 30 to 40 consecutive days following the winter solstice and are moist in all parts less than 35 percent of the time that the soil temperature is above 41 degrees F. Da hart soils have secondary carbonates in the Bt horizons and are not moist in all parts 30 to 40 consecutive days following the winter solstice. Deschell, Hennessy and Maia soils have calcic horizons within depths of 40 inches. Celacy, Nyjack and Ribera soils have a lithic or paralithic contact at depths from 20 to 40 inches. Orlie soils also have less than 35 percent sand.

GEOGRAPHIC SETTING: Pinitos soils are on hills, mesas, cuestas and fan terraces. Slopes are 1 to 15 percent. The soils formed in eolian and alluvial materials derived from sandstone and shale. Elevation is 6,800 to 7,600 feet. Average annual temperature is 47 to 51 degrees F. Average annual precipitation is 14 to 16 inches. Frost-free period is

LOCATION PINITOS 7/86 NM

Established Series
RD: MWR/TLP/RJA
7/86

PINITOS SERIES

The Pinitos series consists of deep, well drained, moderately permeable soils that developed in eolian and alluvial material derived from sandstone and shale on hills, fan terraces, and mesas. Slopes range from 1 to 15 percent. Mean annual precipitation is about 15 inches. Mean annual temperature is about 49 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, mesic Aridic Haplustalf.

TYPICAL PEDON: Pinitos sandy loam--rangeland. (Colors are for dry soil unless otherwise noted.)

A--0 to 2 inches; light brown (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; few very fine and fine roots; common very fine irregular pores; neutral; clear smooth boundary. (1 to 4 inches thick)

Bt1--2 to 6 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; common very fine and fine and few medium roots; common very fine irregular and few very fine tubular pores; few thin clay films on faces of peds and in pores; neutral; clear smooth boundary. (3 to 5 inches thick)

Bt2--6 to 14 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, sticky and slightly plastic; common fine and very fine and few medium roots; common fine tubular pores; many moderately thick clay films on faces of peds and in pores; mildly alkaline; clear smooth boundary. (6 to 10 inches thick)

Bt3--14 to 24 inches; light brown (7.5YR 6/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak coarse subangular blocky structure; hard, friable, slightly sticky and nonplastic; common very fine and few fine roots; few fine tubular pores; few thin clay films in pores and bridging between sand grains; mildly alkaline; abrupt smooth boundary. (8 to 12 inches thick)

Bk1--24 to 38 inches; light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/6) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; few very fine irregular pores; slightly effervescent; mildly alkaline; clear smooth boundary. (10 to 14 inches thick)

Bk2--38 to 60 inches; light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; few very fine irregular pores; strongly effervescent; calcium carbonate occurs as common medium

100 to 120 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Silkie (T) and Catman soils. Silkie soils have greater than 35 percent clay in the control section. Catman soils have more than 60 percent clay in the control section.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: These soils are used as rangeland. Principal native vegetation is blue grama, pinyon and juniper.

DISTRIBUTION AND EXTENT: Westcentral and northcentral New Mexico. This series is of moderate extent.

SERIES ESTABLISHED: Cibola County, New Mexico, 1985.

REMARKS: DIAGNOSTIC HORIZONS AND FEATURES RECOGNIZED IN THIS PEDON ARE:

Ochric Epipedon: The zone from the surface to a depth of 2 inches (A Horizon).

Argillic Horizon: The zone from about 2 to 24 inches (Bt1, Bt2, Bt2 Horizons).

NATIONAL COOPERATIVE SOIL SURVEY
U.S.A.

MLRA(S): 36
REV. MWR:TLF, S-RF
ARIDIC HAPLUSTALFS, FINE-LOAMY, MIXED, MESIC

THE PINITOS SERIES CONSISTS OF DEEP, WELL DRAINED SOILS FORMED IN ALLUVIAL AND EOLIAN MATERIAL ON HILLS AND MESAS. ELEVATION IS 6600 TO 7200 FEET. AAP IS 13 TO 16 INCHES, AAAT IS 47 TO 51 F, FFS IS 100 TO 120 DAYS, TYPICALLY, THE SURFACE LAYER IS LIGHT BROWN SANDY LOAM 2 INCHES THICK. THE SUBSOIL IS BROWN AND LIGHT BROWN SANDY CLAY LOAM 22 INCHES THICK. THE SUBSTRATUM IS LIGHT BROWN SANDY LOAM TO A DEPTH OF 60 INCHES OR MORE. SLOPES RANGE FROM 1 TO 15 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	LSDA TEXTURE	UNIFIED	AASHTO	FRACT >3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	LIQUID LIMIT	PLASTICITY INDEX
0-2	IFSL	SM-SC, CL-ML	A-4	0	100	100	70-85	40-55	25-30	5-10
0-2	ISL	SM-SC	A-2, A-4	0	100	100	60-70	30-40	20-25	5-10
0-2	IL	CL-ML, CL	A-4, A-6	0	100	100	80-90	65-75	20-30	5-15
2-24	AISCL, CL	CL, SC	A-6	0	100	100	75-85	45-55	30-40	10-20
24-6	GISL, SCL	SM-SC, SC	A-2, A-4, A-6	0	100	100	65-80	30-50	20-30	5-15

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND ERODIBILITY GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CORROSIVITY CONCRETE
0-2	11-20	1.45-1.55	2.0-6.0	0.17-0.19	6.6-7.3	-	LOW	0.28	5	3	0.5-0.9	MODERATE	LOW
0-6	11-18	1.45-1.55	2.0-6.0	0.11-0.17	6.6-7.3	-	LOW	0.24	5	3	0.5-0.9		
0-6	11-25	1.45-1.55	0.6-2.0	0.16-0.18	6.6-7.3	-	LOW	0.37	5	4	0.5-0.9		
2-24	20-35	1.40-1.55	0.6-2.0	0.17-0.19	6.6-7.8	-	MODERATE	0.32					
24-60	11-25	1.40-1.50	2.0-6.0	0.13-0.19	7.4-7.8	-	LOW	0.28					

FLOODING FREQUENCY	FLOODING DURATION	FLOODING MONTHS	WATER TABLE DEPTH (FT)	WATER TABLE KIND	WATER TABLE MONTHS	CEMENTED PAN DEPTH (IN)	CEMENTED PAN HARDNESS	BEDROCK DEPTH (IN)	BEDROCK HARDNESS	SUBSIDENCE INITIAL (IN)	SUBSIDENCE TOTAL (IN)	HYDROPOTENTIAL ICE ACTION	HYDROPOTENTIAL FROST ACTION
NONE			>6.0			-		>60		-	-	LOW	MODERATE

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	1.0%: SLIGHT 6-15%: MODERATE-SLOPE	
SEWAGE LAGOON AREAS	1-7%: SEVERE-SEEPAGE 7+%: SEVERE-SEEPAGE,SLOPE	
SANITARY LANDFILL (TRENCH)	SEVERE: SEEPAGE	
SANITARY LANDFILL (AREA)	SEVERE: SEEPAGE	
DAILY COVER FOR LANDFILL	1.0%: MOD 6-15%: FAIR-SLOPE	
SMALL EXCAVATIONS	1.0%: SLIGHT 6-15%: MODERATE-SLOPE	

CONSTRUCTION MATERIAL

ROADFILL	GOOD	
SAND	IMPROBABLE: EXCESS FINES	
GRAVEL	IMPROBABLE: EXCESS FINES	
TOPSOIL	1-8%: FAIR-TOO CLAYEY 8-15%: FAIR-TOO CLAYEY,SLOPE	

WATER MANAGEMENT

POND RESERVOIR AREA	1-8%: SEVERE-SEEPAGE 8+%: SEVERE-SEEPAGE,SLOPE	
EMBANKMENTS DIKES AND LEVEES	SLIGHT	
EXCAVATED PONDS AQUIFER FED	SEVERE: NO WATER	
DRAINAGE	DEEP TO WATER	
IRRIGATION	1-3%: FAVORABLE 3+%: SLOPE 1-3% FSL,SL: SOIL BLOWING 3+% FSL,SL: SLOPE,SOIL BLOWING	
TERRACES AND DIVERSIONS	1-8% FSL,SL: FAVORABLE 8+% FSL,SL: SLOPE 1-8% L: ERODES EASILY 8+% L: SLOPE,ERODES EASILY	
GRASSED WATERWAYS	1-8% FSL,SL: FAVORABLE 8+% FSL,SL: SLOPE 1-8% L: ERODES EASILY 8+% L: SLOPE,ERODES EASILY	

RECREATIONAL INTERPRETATIONS

DWELLINGS WITHOUT BASEMENTS	1-8%: SLIGHT 8-15%: MODERATE-SLOPE	
DWELLINGS WITH BASEMENTS	1.0%: SLIGHT 6-15%: MODERATE-SLOPE	
SMALL COMMERCIAL BUILDINGS	1.0%: SLIGHT 6-8%: MODERATE-SLOPE 8+%: SEVERE-SLOPE	
LOCAL ROADS AND STREETS	1-8%: MODERATE-FROST ACTION 8-15%: MODERATE-SLOPE,FROST ACTION	
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	1-8%: SLIGHT 8-15%: MODERATE-SLOPE	

RECREATIONAL DEVELOPMENT

CAMP AREAS	1-8%: SLIGHT 8-15%: MODERATE-SLOPE	PLAYGROUNDS	1-2%: SLIGHT 2-6%: MODERATE-SLOPE 6+%: SEVERE-SLOPE
PICNIC AREAS	1-8%: SLIGHT 8-15%: MODERATE-SLOPE	PATHS AND TRAILS	FSL,SL: SLIGHT L: SEVERE-ERODES EASILY

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.
ALL	4C															

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	MANAGEMENT PROBLEMS: EROSN HAZARD	EQUIP. LIMIT	SEEDL. MORT'Y	WINDTH HAZARD	PLANT COMPET	POTENTIAL PRODUCTIVITY: COMMON TREES	SITE INDX	PROD CLAS	TREES TO PLANT
SMD1-15	1	SLIGHT	SLIGHT	MODER.	SLIGHT	MODER.	PINYON	45	1	PINYON
							ONESEED JUNIPER			

WINDBREAKS

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT
	NONE							

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS: GRAIN SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	POTENTIAL AS HABITAT FOR: OPENLD WILDLF	WOODLD WILDLF	WETLAND WILDLF	RANGELD WILDLF
ALL	POOR	FAIR	GOOD	-	GOOD	GOOD	POOR	V. POOR	FAIR	GOOD	V. POOR	GOOD

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

COMMON PLANT NAME	PLANT SYMBOL (NLSPN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE: WOODLAND	MED FRT			
WESTERN WHEATGRASS	AGSM	15	15			
BLUE GRAMA	BOGR2	10	10			
NEW MEXICO FEATHERGRASS	STNE2	10	10			
INDIAN RICEGRASS	ORHY	5	-			
MOUNTAIN BIG SAGEBRUSH	ARVA2	5	-			
MUTTONGRASS	POFE	-	5			
BOTTLEBRUSH SQUIRRELTAIL	SIHY		5			
PINYON RICEGRASS	PIFI		5			
OTHER PERENNIAL GRASSES	PPGG		5			
OTHER PERENNIAL FORBS	PPFF	-	5			
OTHER ANNUAL FORBS	AAFF		5			
POTENTIAL PRODUCTION (LBS./AC. DRY WT): FAVORABLE YEARS		600	450			
NORMAL YEARS		-				
UNFAVORABLE YEARS		150	250			

FOOTNOTES

A MED FRT: D36AD06NM.

LOCATION RIBERA 3/85 KY

Established Series
IRD - SLS/TEH/CDL
3/85

SOIL SERIES FILE

RIBERA SERIES

The Ribera series consists of moderately deep, well drained soils that formed in mixed material deposited by wind and water on fan terraces and valley fill side slopes. Slopes are 1 to 10 percent. Mean annual precipitation is about 16 inches. The mean annual temperature is about 49 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, mesic Aridic Haplustalfs.

TYPICAL PEDON: Ribera fine sandy loam--rangeland. (Colors are for dry soil unless otherwise noted.)

A--0 to 5 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots; neutral; clear smooth boundary. (3 to 9 inches thick)

BA--5 to 9 inches; brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; neutral; clear smooth boundary. (2 to 7 inches thick)

Bt--9 to 17 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate coarse prismatic structure parting easily to moderate medium subangular blocky; very hard, firm, sticky and plastic; common fine and medium roots; many fine and common medium tubular pores; few thin clay films on peds and lining pores; mildly alkaline; clear wavy boundary. (6 to 12 inches thick)

Btk--17 to 26 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate coarse prismatic structure parting easily to moderate medium subangular blocky; very hard, firm, slightly sticky and plastic; few fine and common medium roots; many fine and common tubular pores; few thin clay films on peds and lining pores; slightly effervescent; calcium carbonate segregated into few fine discontinuous filaments; moderately alkaline; clear wavy boundary. (6 to 11 inches thick)

Bk--26 to 31 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; strongly effervescent; calcium carbonate segregated into common fine nearly continuous filaments; moderately alkaline; abrupt wavy boundary. (5 to 12 inches thick)

2R--31 inches; sandstone with lime deposits on surface and in cracks.

TYPE LOCATION: San Miguel County, New Mexico; 1,330 feet west of center of section 33, T. 15 N., R. 13 E.

RANGE IN CHARACTERISTICS:

Soil Moisture - The soil moisture control section is moist in all parts 30 to 40 consecutive days during the 120 days following the winter solstice and is moist in all parts about 35 percent of the time that the soil temperature at 20 inch depths is above 41 degrees F.

Soil Temperature - 49 to 53 degrees F.

Depth to the base of the Bt horizon - 11 to 31 inches.

Depth to bedrock - 20 to 40 inches.

A horizon - Hue: 2.5YR through 10YR.
Value: 4 or 5 dry, 3 or 4 moist.
Chroma: 3 or 4.
Texture: Sandy loam, fine sandy loam or loam.
Reaction: Neutral or mildly alkaline.

BA horizon - Hue: 2.5YR through 10YR.
Value: 4 or 5 dry, 3 or 4 moist.
Chroma: 3 through 6.
Texture: loam or sandy clay loam.

Bt horizon - Hue: 2.5YR through 10YR.
Value: 4 through 6 dry, 3 through 5 moist.
Chroma: 4 or 6.
Texture: Sandy clay loam or clay loam.
Clay content: 20 to 35 percent.
Reaction: Mildly alkaline or moderately alkaline.
Other features: In some pedons, segregated calcium carbonates or free calcium carbonates are lacking in the lower part and some lack visible clay films in the lower part.

Bk horizons - Hue: 2.5YR, 7.5YR or 10YR.
Value: 5 through 7 dry, 4 through 6 moist.
Chroma: 3 through 6.
Texture: sandy loam, loam, sandy clay loam or clay loam.
Calcium carbonate equivalent: 1 to 14 percent.

COMPETING SERIES: These are the Augustine, Celacy, Dalhart, Deschell, Fluple, Goesling, Hennessey, Maia, Nyjack, Orlie, Pinitos and Vibo series. The Augustine, Dalhart, Deschell, Fluple, Goesling, Hennessey, Maia, Orlie, Pinitos and Vibo series are deep. Celacy soils have a paralithic contact at depths between 20 to 40 inches and are not moist in all parts 30 to 40 consecutive days following the winter solstice and are moist in all parts less than 25 percent of the time that the soil temperature is above 41 degrees F. Nyjack soils have pebble-sized fragments of pumice and tuft and lack Bk horizons.

GEOGRAPHIC SETTING: Ribera soils are on upland fans and valley fill side slopes with slopes of 1 to 10 percent. The soils formed in eolian and alluvial deposits derived mainly from sandstone and shale. The elevation is 6,000 to 7,500 feet. Mean annual precipitation is 14 to 18 inches. The mean annual temperature is 47 degrees F. The frost-free period is 100 to 140 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the competing Leyba soils and the Dean, Diego (T), Laporte, Quintana, Tapia, and Teco soils. Dean and Tapia soils are underlain by indurated caliche. Diego soils do not have a lithic contact at depths of 20 to 40 inches.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: These soils are used for livestock grazing and wood products. Native vegetation is blue grama, and cropseed, snakeweed, cholla, pinyon, and juniper.

DISTRIBUTION AND EXTENT: Northern New Mexico. The series is of moderate extent.

SERIES ESTABLISHED: San Miguel County Area, San Miguel County, New Mexico, 1977.

REMARKS: The classification has been changed from Typic to Aridic due to better knowledge and concepts of moisture occurrence and pattern.

DIAGNOSTIC HORIZONS AND FEATURES RECOGNIZED IN THIS PEDON ARE:

Ochric Epipedon: The zone from the surface to a depth of about 5 inches (A horizon).

Argillic Horizon: The zone from about 9 to 26 inches (Bt, Btk horizon).

Secondary Carbonates: The zone from about 17 to 31 inches (Btk, Bk horizons).

Lithic Contact: The boundary at about 31 inches (2R horizon).

NATIONAL COOPERATIVE SOIL SURVEY

U.S.A.

NM0362 SOIL INTERPRETATIONS RECORD

MLRA(S): 70 RIBERA SERIES
REV. S.S.,GA, 5-86
ARIDIC HAPLUSTALFS, FINE-LOAMY, MIXED, MESIC

THE RIBERA SERIES CONSISTS OF MODERATELY DEEP, WELL DRAINED SOILS FORMED IN EOLIAN AND ALLUVIAL DEPOSITS FROM SANDSTONE AND SHALE ON UPLAND FANS AND VALLEY FILL SIDESLOPES. TYPICALLY THE SURFACE LAYER IS BROWN FINE SANDY LOAM ABOUT 5 INCHES THICK. THE SUBSURFACE IS A BROWN LOAM ABOUT 4 INCHES THICK. THE SUBSOIL IS A BROWN CLAY LOAM ABOUT 17 INCHES THICK. THE UNDERLYING MATERIAL IS A BROWN LOAM ABOUT 5 INCHES THICK OVER SANDSTONE. AVERAGE ANNUAL PRECIPITATION IS ABOUT 17 RANGES FROM 15 TO 18 INCHES. FROST-FREE SEASON IS ABOUT 120 TO 140 DAYS. SLOPES RANGE FROM 1 TO 10 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT >3 IN (PCT)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO. 4	10	40	200	LIQUID LIMIT	PLASTICITY INDEX
0-5	FSL, SL	CL-ML, SM-SC	A-4	0	100	100	70-90	40-60	20-25	5-10
0-5	L	CL-ML	A-4	0	100	100	80-90	55-65	20-25	5-10
9-26	CL, SCL	CL	A-6	0	100	100	85-95	50-75	30-35	10-15
26-31	L, SL	CL-ML, SM-SC	A-4	0	100	100	70-90	45-60	20-25	5-10
31	UWB									

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	T	WIND EROD. GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CONCRETE
0-5	12-18	1.30-1.40	0.6-2.0	0.13-0.16	6.6-7.8	-	LOW	.28	2	3	.5-1	HIGH	LOW
0-5	12-18	1.20-1.30	0.6-2.0	0.16-0.18	6.6-7.8	-	LOW	.37	2	4	.5-1		
9-26	20-30	1.20-1.30	0.6-2.0	0.16-0.19	7.4-8.4	-	LOW	.32					
26-31	12-18	1.55-1.65	0.6-2.0	0.13-0.16	7.9-8.4	<2	LOW	.32					
31													

FLOODING FREQUENCY	DURATION	MONTHS	HIGH WATER TABLE DEPTH (FT)	KIND	MONTHS	CEMENTED PAN DEPTH (IN)	HARDNESS	BEDROCK DEPTH (IN)	HARDNESS	SUBSIDENCE INIT. (IN)	TOTAL (IN)	HYD GRP	POTENTIAL FROST ACTION
NONE			>6.0			-		20-40	HARD	-		C	MODERATE

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	SEVERE-DEPTH TO ROCK
SEWAGE LAGOON AREAS	1-7%: SEVERE-DEPTH TO ROCK 7+%: SEVERE-DEPTH TO ROCK,SLOPE
SANITARY LANDFILL (TRENCH)	SEVERE-DEPTH TO ROCK
SANITARY LANDFILL (AREA)	SEVERE-DEPTH TO ROCK
DAILY COVER FOR LANDFILL	POOR-DEPTH TO ROCK

BUILDING SITE DEVELOPMENT

SHALLOW EXCAVATIONS	SEVERE-DEPTH TO ROCK
DWELLINGS WITHOUT BASEMENTS	1-8%: MODERATE-DEPTH TO ROCK 8-10%: MODERATE-SLOPE,DEPTH TO ROCK
DWELLINGS WITH BASEMENTS	SEVERE-DEPTH TO ROCK
SMALL COMMERCIAL BUILDINGS	1-4%: MODERATE-DEPTH TO ROCK 4-8%: MODERATE-SLOPE,DEPTH TO ROCK 8+%: SEVERE-SLOPE
LOCAL ROADS AND STREETS	1-8%: MODERATE-DEPTH TO ROCK,LOW STRENGTH 8-10%: MODERATE-DEPTH TO ROCK,LOW STRENGTH, SLOPE
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	1-8%: MODERATE-DEPTH TO ROCK 8-10%: MODERATE-SLOPE,DEPTH TO ROCK

CONSTRUCTION MATERIAL

ROADFILL	POOR-DEPTH TO ROCK
SAND	IMPROBABLE-EXCESS FINES
GRAVEL	IMPROBABLE-EXCESS FINES
TOPSOIL	FAIR-DEPTH TO ROCK,TOO CLAYEY,THIN LAYER

WATER MANAGEMENT

POND RESERVOIR AREA	1-3%: MODERATE-SEEPAGE,DEPTH TO ROCK 3-8%: MODERATE-SEEPAGE,DEPTH TO ROCK,SLOPE 8+%: SEVERE-SLOPE
EMBANKMENTS DIKES AND LEVEES	SEVERE-THIN LAYER
EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DRAINAGE	DEEP TO WATER
IRRIGATION	1-3% L: DEPTH TO ROCK 3+% L: SLOPE,DEPTH TO ROCK 1-3% FSL,SL: SOIL BLOWING,DEPTH TO ROCK 3+% FSL,SL: SLOPE,SOIL BLOWING,DEPTH TO ROCK
TERRACES AND DIVERSIONS	1-8% FSL,SL: DEPTH TO ROCK 8+% FSL,SL: SLOPE,DEPTH TO ROCK 1-8% L: DEPTH TO ROCK,ERODES EASILY 8+% L: SLOPE,DEPTH TO ROCK,ERODES EASILY
GRASSED WATERWAYS	1-8% FSL,SL: DEPTH TO ROCK 8+% FSL,SL: SLOPE,DEPTH TO ROCK 1-8% L: ERODES EASILY,DEPTH TO ROCK 8+% L: SLOPE,ERODES EASILY,DEPTH TO ROCK

REGIONAL INTERPRETATIONS

RIBERA SERIES

RECREATIONAL DEVELOPMENT

CAMP AREAS	1-8%: SLIGHT 8-10%: MODERATE-SLOPE	PLAYGROUNDS	1-2%: SLIGHT 2-6%: MODERATE-SLOPE,DEPTH TO ROCK 6+%: SEVERE-SLOPE
PICNIC AREAS	1-8%: SLIGHT 8-10%: MODERATE-SLOPE	PATHS AND TRAILS	FSL,SL: SLIGHT L: SEVERE-ERODES EASILY

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS* DETERMINING PHASE	CAPA-BILITY	IRR	IRR, WIND	IRR, WIND	IRR, WIND	IRR	IRR, WIND	IRR, WIND	IRR, WIND	IRR, WIND	IRR, WIND
ALL	6E										

WOODLAND SUITABILITY

CLASS* DETERMINING PHASE	ORD SYM	MANAGEMENT PROBLEMS: EROSION HAZARD	EQUIP. LIMIT	SEEDL. MORTAL	WIND HAZARD	PLANT COMPET	POTENTIAL PRODUCTIVITY: COMMON TREES	SITE INDEX	PROD	TREES TO PLANT
GRASSLAND	3A	SLIGHT	SLIGHT	SLIGHT	SLIGHT	MODER.	PINYON ONESEED JUNIPER	45	1	PINYON

WINDBREAKS

CLASS* DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT
	NONE							

WILDLIFE HABITAT SUITABILITY

CLASS* DETERMINING PHASE	POTENTIAL FOR HABITAT ELEMENTS: GRAIN & SEED	GRASS & LEGUME	WILD HERB	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLD WILDLF	WOODLD WILDLF	POTENTIAL AS HABITAT FOR: WETLAND WILDLF	RANGELD WILDLF
WARP	POOR	FAIR	GOOD	-	-	GOOD	POOR	V. POOR	FAIR	-	V. POOR	GOOD
WOODLAND	POOR	FAIR	GOOD	-	GOOD	GOOD	POOR	V. POOR	FAIR	GOOD	V. POOR	GOOD

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

COMMON PLANT NAME	PLANT SYMBOL (LYLE PN)	PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE: WOODLAND	COOL
BLUE GRAMA	BOGR2	20	10	10
WESTERN WHEATGRASS	AGSM	15	15	
BLACK GRAMA	BOER4	5	-	15
VINE MESQUITE	PAOB	5	-	
PLAINS LOVEGRASS	ERIN	5	-	
SIDEOATS GRAMA	BOCU	10	-	15
SAND DROPSEED	SPCR	10	-	10
OTHER PERENNIAL GRASSES	PPGG	10	5	25
OTHER PERENNIAL FORBS	PPFF	10	5	5
OTHER SHRUBS	SSSS	10	-	15
NEW MEXICO FEATHERGRASS	STNE2	-	10	
MUTTONGRASS	POFE	-	5	
BOTTLEBRUSH SQUIRRELTAIL	SIHY	-	5	
PINYON RICEGRASS	PIFI	-	5	
OTHER ANNUAL FORBS	AAFF	-	5	
POTENTIAL PRODUCTION (LBS./AC. DRY WT): FAVORABLE YEARS		1500	450	1500
NORMAL YEARS		-	-	-
UNFAVORABLE YEARS		400	250	250

FOOTNOTES

A P() PPT=070C109NM COOL=070C112NM

LOCATION VESSILLA 5/86 NM

Established Series
RD: LWH/GBM/CDL
5/86

VESSILLA SERIES

The Vessilla series consists of shallow, well drained, moderately permeable soils that formed in material weathered from sandstone. Vessilla soils are on narrow ridges, hills and mesas of bedrock controlled landscapes. Slopes are 1 to 65 percent. Mean annual precipitation is about 14 inches, and mean annual temperature is about 48 degrees F.

TAXONOMIC CLASS: Loamy, mixed (calcareous), mesic Lithic Ustorthents.

TYPICAL PEDON: Vessilla gravelly fine sandy loam--woodland. (Colors are for dry soil unless otherwise noted.)

A--0 to 2 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; common fine and medium roots; 25 percent pebbles; strongly effervescent; moderately alkaline; clear smooth boundary. (0 to 5 inches thick)

C--2 to 11 inches; light brown (7.5YR 6/4) gravelly fine sandy loam, brown (7.5YR 5/4) moist; massive; loose, nonsticky and nonplastic; common fine roots; 20 percent pebbles; strongly effervescent; moderately alkaline; abrupt smooth boundary. (2 to 15 inches thick)

2R--11 inches; sandstone.

TYPE LOCATION: Sandoval County, New Mexico. Approximately 15 miles northwest of San Ysidro, New Mexico and 3 miles southeast of the Holy Ghost Campgrounds. State plane coordinates 3,068,000 feet east and 1,705,620 feet north.

RANGE IN CHARACTERISTICS:

Soil Moisture: Moist in some part periodically from July through October and dry in all parts periodically during May and June but not dry in all parts more than 50 percent of the time when the soil temperature is above 41 degrees F. The soil moisture control section is moist in some or all parts from November through March.

Soil Temperature: 47 to 55 degrees F.

Depth to sandstone: 6 to 20 inches

Reaction: Mildly or moderately alkaline; calcareous in all parts

Rock Fragments: 0 to 5 percent cobbles and 5 to 30 percent pebbles

A and C horizons - Hue: 5YR, 7.5YR or 10YR
Value: 5 through 7 dry, 4 or 5 moist
Chroma: 3 through 6

A horizon - Texture: sandy loam, fine sandy loam, very gravelly sandy loam or gravelly fine sandy loam

C horizon - Texture: sandy loam, fine sandy loam, loam, gravelly sandy loam, gravelly fine sandy loam or gravelly loam

COMPETING SERIES: This is the Canlon series in the same family. Similar series in other families are Skyvillage and Travessilla. Canlon soils are moist in all parts more than 40 percent of the time. Skyvillage and Travessilla soils are dry in all parts of the soil moisture control section more than 50 percent of the time when the soil temperature is greater than 41 degrees F.

GEOGRAPHIC SETTING: The Vessilla soils occupy narrow ridges, hills, and mesas of sandstone controlled landscapes. Slopes are 1 to 65 percent. Average annual precipitation ranges from 12 to 16 inches. Average annual temperature is about 45 to 53 degrees F., and average frost-free period is about 100 to 130 days. Elevation ranges from 5,700 to 8,000 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Hickman, Menefee and Sparham soils. The Hickman and Sparham soils are deep. The Menefee soils are on fractured shale at 8 to 20 inch depths.

DRAINAGE AND PERMEABILITY: Well drained; medium to rapid runoff; moderately rapid permeability.

USE AND VEGETATION: These soils are used for wood products, livestock grazing and wildlife. Present vegetation is pinyon pine, Rocky Mountain juniper, oneseed juniper, Indian ricegrass, mountainmahogany, antelope bitterbrush, blue grama, oak, yucca, big sagebrush, and Bigelow sagebrush.

DISTRIBUTION AND EXTENT: This soil occurs in northwestern New Mexico and is of moderate extent.

SERIES ESTABLISHED: Cibola County, New Mexico, 1980.

REMARKS: The Type Location was changed to obtain a profile that reflects the concept of the series.

DIAGNOSTIC HORIZONS AND FEATURES RECOGNIZED IN THIS PEDON ARE:

Ochric Epipedon - The zone from the surface to a depth of about 2 inches. (A horizon)

Entisol Feature - Lack of diagnostic horizons. (A, C horizons)

Lithic Subgroup - Lithic contact at about 11 inches. (2R horizon)

Reaction Class - Calcareous throughout. (A, C horizons)

NATIONAL COOPERATIVE SOIL SURVEY
U.S.A.

NLRA(S): 36
REV. CDL, 5-96
LITHIC USTORTHENTS, LOAMY, MIXED (CALCAREOUS), MESIC

VESSILLA SERIES
GRAVELLY

THE VESSILLA, GRAVELLY CONSISTS OF SHALLOW AND VERY SHALLOW, WELL DRAINED SOILS FORMED IN MATERIAL DERIVED FROM SANDSTONE ON RIDGES AND MESAS. ELEVATION IS 6500 TO 8000. MAP IS 12 TO 14 INCHES. MAAT IS 48 TO 51 F. FFD IS 110 TO 130 DAYS. TYPICALLY, THE SURFACE LAYER IS LIGHT YELLOWISH BROWN GRAVELLY FINE SANDY LOAM ABOUT 2 INCHES THICK. AND THE UNDERLYING SOIL MATERIAL IS 9 INCHES OF LIGHT BROWN GRAVELLY FINE SANDY LOAM. SANDSTONE BEDROCK IS AT 11 INCHES. SLOPES RANGE FROM 1 TO 65 PERCENT.

ESTIMATED SOIL PROPERTIES

DEPTH (IN.)	USDA TEXTURE	UNIFIED	AASHTO	FRACT (>3 IN)	PERCENT OF MATERIAL LESS THAN 3" PASSING SIEVE NO.				LIQUID LIMIT	PLASTICITY INDEX
				(PCT)	4	10	50	200		
0-2	SGR-FSL	SM-SC	A-2	0-10	60-90	55-75	50-65	15-30	25-30	5-10
0-2	SGRV-SL	SM-SC	A-1, A-2	0-10	60-80	55-75	45-60	15-25	20-30	5-10
2-11	SGR-FSL, GR-L	SM-SC, GM-GC	A-1, A-2, A-4	0-10	60-80	55-75	40-60	15-40	15-25	5-10
11-15	UWB									

DEPTH (IN.)	CLAY (PCT)	MOIST BULK DENSITY (G/CM3)	PERMEABILITY (IN/HR)	AVAILABLE WATER CAPACITY (IN/IN)	SOIL REACTION (PH)	SALINITY (MMHOS/CM)	SHRINK-SWELL POTENTIAL	EROSION FACTORS K	EROSION T	WIND ERODI GROUP	ORGANIC MATTER (PCT)	CORROSIVITY STEEL	CORROSIVITY CONCRETE
0-2	10-20	1.45-1.55	2.0-6.0	0.10-0.12	6.6-8.4	-	LOW	.15	5	3	.5-.9	MOD	LOW
0-2	10-20	1.45-1.55	2.0-6.0	0.06-0.08	6.6-8.4	-	LOW	.10	5	6	.5-.9		
2-11	8-18	1.50-1.60	2.0-6.0	0.11-0.14	7.4-8.4	<2	LOW	.20					
11-15													

FLOODING			HIGH WATER TABLE			PERMFROST	BEDROCK		RISK OF CORROSION		POTENTIAL FROST ACTION
FREQUENCY	DURATION	MONTHS	DEPTH (FT)	KIND	MONTHS	DEPTH TO HARDNESS (IN)	DEPTH (IN)	HARDNESS	UNCOATED STEEL	CONCRETE	
NONE			>6.0				5-20	SOFT	-	-	HIGH

SANITARY FACILITIES

SEPTIC TANK ABSORPTION FIELDS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-DEPTH TO ROCK,SLOPE
SEWAGE LAGOON AREAS	1-7%: SEVERE-DEPTH TO ROCK 7+%: SEVERE-DEPTH TO ROCK,SLOPE
SANITARY LANDFILL (TRENCH)	1-15%: SEVERE-DEPTH TO ROCK,SEEPAGE 15+%: SEVERE-DEPTH TO ROCK,SEEPAGE,SLOPE
SANITARY LANDFILL (AREA)	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-DEPTH TO ROCK,SLOPE
DAILY COVER FOR LANDFILL	1-15%: POOR-DEPTH TO ROCK,SMALL STONES 15+%: POOR-DEPTH TO ROCK,SMALL STONES,SLOPE

BUILDING SITE DEVELOPMENT

SHALLOW EXCAVATIONS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-DEPTH TO ROCK,SLOPE
DWELLINGS WITHOUT BASEMENTS	1-8%: MODERATE-DEPTH TO ROCK 8-15%: MODERATE-SLOPE,DEPTH TO ROCK 15+%: SEVERE-SLOPE
DWELLINGS WITH BASEMENTS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-DEPTH TO ROCK,SLOPE
SMALL COMMERCIAL BUILDINGS	1-4%: MODERATE-DEPTH TO ROCK 4-8%: MODERATE-SLOPE,DEPTH TO ROCK 8+%: SEVERE-SLOPE
LOCAL ROADS AND STREETS	1-8%: MODERATE-DEPTH TO ROCK,FROST ACTION 8-15%: MODERATE-DEPTH TO ROCK,SLOPE,FROST ACTION 15+%: SEVERE-SLOPE
LAWNS, LANDSCAPING AND GOLF FAIRWAYS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-SLOPE,DEPTH TO ROCK

CONSTRUCTION MATERIAL

ROADFILL	1-25%: POOR-DEPTH TO ROCK 25+%: POOR-DEPTH TO ROCK,SLOPE
SAND	IMPROBABLE-EXCESS FINES
GRAVEL	IMPROBABLE-EXCESS FINES
TOPSOIL	1-15%: POOR-DEPTH TO ROCK,SMALL STONES 15+%: POOR-DEPTH TO ROCK,SMALL STONES,SLOPE

WATER MANAGEMENT

POND RESERVOIR AREA	1-8%: SEVERE-DEPTH TO ROCK 8+%: SEVERE-DEPTH TO ROCK,SLOPE
EMBANKMENTS DIKES AND LEVEES	SEVERE-THIN LAYER
EXCAVATED PONDS AQUIFER FED	SEVERE-NO WATER
DRAINAGE	DEEP TO WATER
IRRIGATION	1-3%: DEPTH TO ROCK 3+%: SLOPE,DEPTH TO ROCK
TERRACES AND DIVERSIONS	1-8%: DEPTH TO ROCK 8+%: SLOPE,DEPTH TO ROCK
GRASSED WATERWAYS	1-8%: DEPTH TO ROCK 8+%: SLOPE,DEPTH TO ROCK

RECREATIONAL INTERPRETATIONS

VESSILLA SERIES
GRAVELLY

RECREATIONAL DEVELOPMENT

CAMP AREAS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-SLOPE,DEPTH TO ROCK	PLAYGROUNDS	1-6%: SEVERE-SMALL STONES,DEPTH TO ROCK 6+%: SEVERE-SLOPE,SMALL STONES,DEPTH TO ROCK
PICNIC AREAS	1-15%: SEVERE-DEPTH TO ROCK 15+%: SEVERE-SLOPE,DEPTH TO ROCK	PATHS AND TRAILS	1-15%: SLIGHT 15-25%: MODERATE-SLOPE 25+%: SEVERE-SLOPE

CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE (HIGH LEVEL MANAGEMENT)

CLASS-DETERMINING PHASE	CAPABILITY NIRR	CAPABILITY IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.	NIRR	IRR.
1-30%	7S															
30+%	7E															

WOODLAND SUITABILITY

CLASS-DETERMINING PHASE	ORD SYM	EROS'N HAZARD	EQUIP. LIMIT	SEEDL. MORT'Y	WINDTH HAZARD	PLANT COMPET	COMMON TREES	SITE INDX	PROD CLAS	TREES TO PLANT
SM325-35	1D	MODER.	SEVERE	SEVERE	SEVERE	SEVERE	PINYON	9	1	
							ONESEED JUNIPER			
SM335-55	1D	SEVERE	SEVERE	SEVERE	SEVERE	SEVERE	PINYON	9	1	
							ONESEED JUNIPER			

CLASS-DETERMINING PHASE	SPECIES	HT	SPECIES	HT	SPECIES	HT	SPECIES	HT
	NONE							

WILDLIFE HABITAT SUITABILITY

CLASS-DETERMINING PHASE	GRAI. & SEED	GRASS & LEGUME	WILD HERB.	HARDWD TREES	CONIFER PLANTS	SHRUBS	WETLAND PLANTS	SHALLOW WATER	OPENLD WILDLF	WOODLD WILDLF	WETLAND WILDLF	RANGELD WILDLF
ALL	FAIR	FAIR	FAIR	-	FAIR	GOOD	V. POOR	V. POOR	FAIR	FAIR	V. POOR	FAIR

(POTENTIAL FOR HABITAT ELEMENTS: GRAI. & SEED through SHALLOW WATER; POTENTIAL AS HABITAT FOR: OPENLD WILDLF through RANGELD WILDLF)

POTENTIAL NATIVE PLANT COMMUNITY (RANGELAND OR FOREST UNDERSTORY VEGETATION) (A)

PERCENTAGE COMPOSITION (DRY WEIGHT) BY CLASS DETERMINING PHASE

COMMON PLANT NAME	PLANT SYMBOL (NLSPN)	MAP12-14
PINYON	PIED	10
ONESEED JUNIPER	JUMO	10
GALLETA	HIJA	5
SIDEOATS GRAMA	BOCU	25
BLUE GRAMA	BOGR2	10
LITTLE BLUESTEM	SCSC	10
NEW MEXICO FEATHERGRASS	STNE2	10
POTENTIAL PRODUCTION (LBS./AC. DRY WT): FAVORABLE YEARS		700
NORMAL YEARS		450
UNFAVORABLE YEARS		150

FOOTNOTES

A MAP 12-14: 036B122N SANDSTONE HILLS.

RANGE SITE DESCRIPTION

Section IIE, Technical Guide

A. SITE NO. 036A002N Clayey (WP-1)

B. PHYSIOGRAPHIC FEATURES

This site occurs on upland drainageways, broad valleys, and adjacent low hills and benches. The site may be dissected by shallow rivulets which will develop into deep gullies when the vegetation has deteriorated. Slopes range from 1 to 10 percent. Elevations range from 6,000 to 7,500 feet above sea level.

C. CLIMATIC FEATURES

1. Mean annual precipitation varies from 9 to 14 inches. Deviations of 4 inches or more are quite common. Approximately 60 percent of the precipitation is received during the native plant growth period, April through September. During July, August, and September 4 to 5 inches of precipitation influence the presence and production of warm-season plants. Fall and spring moisture is conducive to the growth of cool-season herbaceous plants. Maximum shrub growth also occurs during this time. Summer precipitation is characterized by brief, localized thundershowers. Winter moisture usually occurs as snow or light rain.

2. Mean annual temperature varies from 64 degrees F in July to 21 degrees F in January. The maximum is near 100 degrees F. The minimum is near 40 degrees F. The average last killing frost in the spring is around mid-May. The first killing frost in the fall is late September or early October. The frost-free period is approximately 120 to 140 days, but freezing temperatures have been recorded for every month except July and August. Temperatures are generally conducive for herbaceous plant growth from April through September.

3. Wind velocities are relatively light most of the year with stronger winds occurring in spring and early summer. These stronger winds, which may exceed 25 miles per hour, increase transpiration rates of plants and rapidly dry the soil surface. Also, small soil particles are often displaced by the stronger winds which can result in structural damage to native plants, particularly young seedlings.

D. SOILS

1. The soils are moderately deep to deep. Surface textures are medium to fine-textured with a fine-textured subsoil. Some surface coarse fragments may be present, especially when adjacent to interbedded sandstone and shale sites. Permeability is moderately slow to slow, water holding capacity is high, and runoff is medium to rapid.

2. Characteristic soils are:

Billings silty clay loam, 0 to 5 percent

3. Other soils are:

E. POTENTIAL NATURAL PLANT COMMUNITY

1. This is a grassland site with fourwing saltbush and big sagebrush forming a shrub savannah aspect. Pinyon and juniper trees, if any, are scattered. Forbs are conspicuous through the site when in bloom.

2. Composition of Potential Plant Community

Approximate percentage of total annual production.

Grasses and Grasslikes - 75-80%		(Shrubs, half-shrubs, vines, and trees) Woody - 5-15%		Forbs - 5-8%	
western wheatgrass	20-30	fourwing saltbush) shadscale)	5-8	green sagewort) trailing fleabane)	5-8
alkali sacaton	15-25	big sagebrush) low sagebrush)	5-8	globemallow) wild buckwheat) thistles) others)	
bottlebrush squirreltail	5-10	winterfat) rabbitbrush) spineless horsebrush) others)	3-5		
muttongrass) prairie junegrass)	5-8				
galleta	5-7				
spike muhly	3-5				
blue grama	3-5				
Indian ricegrass) others*)	3-5				

* Other species include silver bluestem, ring muhly, mat muhly, sixweeks fescue, cheatgrass, threeawns, Russian thistle, locoweed, Apacheplume, cholla cactus, black greasewood, and juniper-pinyon.

3. Canopy Cover

Trees, shrubs, and half-shrub canopy - 8 percent

4. Ground Cover (Percent of Surface Area)

Grasses and forbs	25
Bare ground	50
Surface gravel	5
Surface cobble and stones	-
Litter - percent of area	20
average depth in cm	2

F. TOTAL ANNUAL HERBAGE PRODUCTION (Average, Air-dry, lbs./ac.)

Favorable years	-	1,200
Unfavorable years	-	600

G. SITE INTERPRETATIONS

1. Grazing

Approximately 90 percent of the vegetation produced on this site is suitable forage for domestic livestock or wildlife. Grazing distribution need not be a problem as long as waterings and saltings are adequately located.

Deterioration of the potential plant community is indicated by a decrease in western wheatgrass, muttongrass, prairie junegrass, spike muhly, and fourwing saltbush. Those that increase include alkali sacaton, bottlebrush squirreltail, galleta, blue grama, big sagebrush, and rabbitbrush. Severe deterioration is indicated by a heavy infestation of big sagebrush and/or rabbitbrush with very little herbaceous understory.

In addition to domestic livestock, this site is well suited to use by deer, elk, small mammals, and birds.

2. Wood Products

No significant wood products are produced on this site.

3. Habitat for Wildlife

Wildlife indigenous to this site will be provided as it is developed.

4. Hydrologic Interpretations

Soil Series	Hydrologic Group

Runoff curve numbers are determined by field investigations using hydrologic cover conditions and hydrologic soil groups.

5. Recreation and Natual Beauty

This site is not noted for its natural beauty or recreational value.

6. Endangered Plants and Animals

Presently, there are no known endangered species on this site. If any are identified, they will be added.

H. OTHER PERTINENT INFORMATION

1. Guide to Suggested Initial Stocking Rates - Acres per Animal Unit Month

Range Condition	Ac/AUM
Excellent	2.3 - 3.0
Good	2.9 - 4.5
Fair	4.4 - 9.0
Poor	9.0+

2. Relative Quality of Plants for Animal Use

(a)

Primary	Secondary	Low Value

I. IDENTIFICATION AND AUTHORIZATION

1. USDA-SCS
   Albuquerque, NM
   MLRA 36

2. Field Offices:

3. Field Office Sample Location:

4. Approved:

State Range Conservationist Date

WNTC Range Conservationist Date

Legend and Definitions for Range Site Descriptions.

1/ This rating system provides general guidance as to animal preference for plant species. It also indicates possible competition between kinds of animals for the various plants. Grazing preference changes from time to time and place to place, depending upon the animals, upon plant palatability and nutritive value, stage of growth and season of use, relative abundance, and associated plants. Grazing preference does not necessarily reflect a plant's ecological place in the climax plant community.

The following definitions apply to cattle, sheep, goats, deer, and antelope grazing:

Primary: These species generally decrease when the climax plant community is subjected to continuous heavy grazing pressure by the animals listed. These species are normally grazed first and preferred by the designated grazing animals when given free choice.

Secondary: These plants usually increase initially, then decrease when the site is subjected to continuous heavy grazing use by the animals listed. These plants are normally grazed after primary plants become scarce under free choice, or along with them under intensive grazing systems.

Low Value: These plants continue to increase with heavy, continuous grazing use of the site. These plants are not normally grazed until primary and secondary species are gone and animals are forced to eat them.

RANGE SITE DESCRIPTION

Section IIE, Technical Guide

A. SITE NO. 036A006N Loamy (WP-1, HV-2)

B. PHYSIOGRAPHIC FEATURES

This site occurs on mesas, plateaus, low rolling hills, and broad upland valleys. It usually is level to nearly level but slopes range to 15 percent. Elevations range from 6,400 to 7,800 feet above sea level.

C. CLIMATIC FEATURES

1. Mean annual precipitation varies from 9 to 14 inches. Deviations of 4 inches or more are quite common. Approximately 60 percent of the precipitation is received during the native plant growth period, April through September. June is the driest month. During July, August, and September 4 to 5 inches of precipitation influence the presence and production of warm-season plants. Fall and spring moisture is conducive to the growth of cool-season herbaceous plants. Maximum shrub growth also occurs during this time. Summer precipitation is characterized by brief, localized thundershowers. Winter moisture usually occurs as snow or light rain.

2. Mean annual temperature varies from 64 degrees F in July to 21 degrees F in January. The maximum is near 100 degrees F. The minimum is near 40 degrees F. The average last killing frost in the spring is around mid-May. The first killing frost in the fall is late September or early October. The frost-free period is approximately 120 to 140 days, but freezing temperatures have been recorded for every month except July and August. Temperatures are generally conducive for herbaceous plant growth from April through September.

3. Wind velocities are relatively light most of the year with stronger winds occurring in spring and early summer. These stronger winds, which may exceed 25 miles per hour, increase transpiration rates of plants and rapidly dry the soil surface. Also, small soil particles are often displaced by the stronger winds which can result in structural damage to native plants, particularly young seedlings.

D. SOILS

1. The soils generally are deep and well-drained. The surface soils range from sandy loam to clay loam. Subsoils range from loam to clay loam and clay. Some coarse fragments may exist in the soil profile but are generally less than 35 percent. Permeability is moderate, water holding capacity is medium to high, and runoff is medium.

2. Characteristic soils are:

Oelop loam, 0 to 5 percent slopes
Buckle silt loam, 0 to 5 percent slopes

3. Other soils included are:

Fernando clay loam, 1 to 5 percent
Silva loam, 0 to 10 percent
Tenorio loam, 0 to 5 percent

E. POTENTIAL NATURAL PLANT COMMUNITY

1. This is a grassland site with scattered shrubs throughout the site. Forbs are conspicuous when in bloom but otherwise a minor component.

2. Composition of Potential Plant Community

Approximate percentage of total annual herbage production.

Grasses and Grasslikes - 70-75%		(Shrubs, half-shrubs vines and trees) Woody - 15-20%		Forbs - 5-10%	
western wheatgrass	20-30	big sagebrush	5-10	fringed sagewort)	
Indian ricegrass)		fourwing saltbush)	5-10	locoweed)	
needleandthread)	10-15	winterfat)		Indian paintbrush)	5-10
New Mexico feathergrass)		rabbitbrush)		alfileria)	
galleta	5-10	spineless horsebrush)	1-5	wild buckwheat)	
blue grama	5-10	others)		others)	
alkali sacaton)					
spike muhly)	3-10				
muttongrass)					
prairie junegrass)	3-7				
bottlebrush squirreltail	3-7				
others*	1-5				

* Other species include sideoats grama, sand dropseed, pine dropseed, mat muhly, cheatgrass, pingue, wooly Indianwheat, globemallow, praire coneflower, oneseed juniper, pinyon, pale wolfberry, broom snakeweed, yucca species, cholla cactus, and antelope bitterbrush.

3. Canopy Cover

Trees, shrubs, and half-shrubs canopy - 10 percent

4. Ground Cover (Percent of Surface Area)

Grasses and forbs	25
Bare ground	50
Surface gravel	5
Surface cobble and stones	0
Litter - percent of area	20
average depth in cm.	1

F. TOTAL ANNUAL HERBAGE PRODUCTION (Average Air-dry, lbs./ac.)

Favorable years	-	1,100
Unfavorable years	-	600

G. SITE INTERPRETATIONS

1. Grazing

Approximately 90 percent of the vegetation produced on this site is suitable for grazing or browsing by domestic livestock and wildlife. Grazing distribution is generally not a problem if adequate waterings are provided. Continuous grazing, which allows repetitive grazing of the desirable plant species, eventually can lead to reduced vigor and an eventual decrease in production and composition of the desirable species. Such a deterioration is indicated by a decrease in western wheatgrass, muttongrass, and other cool-season grasses as well as fourwing saltbush and winterfat. Species that increase include blue grama, galleta, ring and mat muhly, big sagebrush, rabbitbrush, and broom snakeweed. Juniper and pinyon may invade from adjacent sites.

A planned grazing system with periodic grazing and rests is best to maintain the desired composition and high productivity.

In addition to domestic livestock, deer, pronghorn, small mammals, and birds also use this site.

2. Wood Products

This site produces no significant wood products in its potential plant community.

3. Habitat for Wildlife

Wildlife species indigenous to this site will be added as developed.

4. Hydrologic Interpretations

Soil Series	Hydrologic Group

5. Recreation and Natural Beauty

This site, though not noted for its outstanding natural beauty, is well suited for horseback riding, camping, and hunting.

5. Endangered Plants and Animals

Presently, there are no known endangered species which are indigenous to this site.

H. OTHER PERTINENT INFORMATION

1. Guide to Suggested Initial Stocking Rate - Acres Per Animal Unit Month

Range Condition	Ac/AUM
Excellent	2.5 - 3.4
Good	3.3 - 5.1
Fair	5.0 - 10.0
Poor	10.0+

2. Relative Quality of Plants for Animal Use

Primary	Secondary	Low Value

I. IDENTIFICATION AND AUTHORIZATION

1. USDA-SCS
   Albuquerque, NM
   MLRA 36, 51

2. Field Offices:

3. Field Office Sample Location:

4. Approved:

State Range Conservationist Date

WNTC Range Conservationist Date

Legend and Definitions for Range Site Descriptions.

1/ This rating system provides general guidance as to animal preference for plant species. It also indicates possible competition between kinds of animals for the various plants. Grazing preference changes from time to time and place to place, depending upon the animals, upon plant palatability and nutritive value, stage of growth and season of use, relative abundance, and associated plants. Grazing preference does not necessarily reflect a plant's ecological place in the climax plant community.

The following definitions apply to cattle, sheep, goats, deer, and antelope grazing:

Primary: These species generally decrease when the climax plant community is subjected to continuous heavy grazing pressure by the animals listed. These species are normally grazed first and preferred by the designated grazing animals when given free choice.

Secondary: These plants usually increase initially, then decrease when the site is subjected to continuous heavy grazing use by the animals listed. These plants are normally grazed after primary plants become scarce under free choice, or along with them under intensive grazing systems.

Low Value: These plants continue to increase with heavy, continuous grazing use of the site. These plants are not normally grazed until primary and secondary species are gone and animals are forced to eat them.

RANGE SITE DESCRIPTION

Section IIE, Technical Guide

A. SITE NO. 036A011N Sandy (WP-1)

B. PHYSIOGRAPHIC FEATURES

This site occurs on nearly level to gently sloping plains and alluvial fans. Slopes range from 1 to 8 percent and average about 5 percent or less. Elevations range from 6,400 to 7,200 feet above sea level.

C. CLIMATIC FEATURES

1. Mean annual precipitation varies from 9 to 14 inches. Deviations of 4 inches or more are quite common. Approximately 60 percent of the precipitation is received during the native plant growth period, April through September. During July, August, and September 4 to 6 inches of precipitation influence the presence and production of warm-season plants. Fall and spring moisture is conducive to the growth of cool-season herbaceous plants. Maximum shrub growth also occurs during this time. Summer precipitation is characterized by brief, localized thundershowers. Winter moisture usually occurs as snow or light rain.

2. Mean annual temperature varies from 64 degrees F in July to 21 degrees F in January. The maximum is near 100 degrees F. The minimum is near 40 degrees F. The average last killing frost in the spring is around mid-May. The first killing frost in the fall is late September or early October. The frost-free period is approximately 120 to 140 days, but freezing temperatures have been recorded for every month except July and August. Temperatures are generally conducive for herbaceous plant growth from April through September.

3. Wind velocities are relatively light most of the year with stronger winds occurring in spring and early summer. These stronger winds, which may exceed 25 miles per hour, increase transpiration rates of plants and rapidly dry the soil surface. Also, small soil particles are often displaced by the stronger winds which can result in structural damage to native plants, particularly young seedlings.

D. SOILS

1. Soils are moderately deep to deep. The surface textures range from sand to loamy sand and sandy loam and do not exceed 36 inches in depth. Permeability is rapid with water holding capacity moderately low to low. Runoff is slow.

2. Characteristic soils are:

E. POTENTIAL NATURAL PLANT COMMUNITY

1. This site provides a mixed grass-shrub aspect. Fourwing saltbush and winterfat are the dominant shrubs with big sagebrush and rabbitbrush occurring in lesser amounts. Few, if any, trees occur on this site. Forbs are a minor component except during spring emergency.

2. Composition of Potential Plant Community

Approximate percentage of total annual production.

Grasses and Grasslike - 70-80%		(Shrubs, half-shrubs vines, and trees) Woody - 15-25%			Forbs - 3-5%	
Indian ricegrass	15-20	fourwing saltbrush	5-15		animal buckwheat	3-5
needleandthread		winterfat			alfileria	
New Mexico feathergrass		big sagebrush	3-10		wooly Indianwheat	
western wheatgrass	10-15	rabbitbrush			fringed sagewort	
spike dropseed	5-10	spineless horsebrush			locoweed	
sand dropseed		sand sagebrush			others*	
galleta	5-10	juniper	0-3			
blue grama	3-5	others*				
muttongrass	3-5					
prairie junegrass						

* Other species include ring muhly, sandhill muhly, switchgrass, little bluestem, sand bluestem, wolftail, spike muhly, Morman-tea, broom snakeweed, and yucca.

3. Canopy

Tree, shrub, and half-shrub canopy on this site average 15 to 20 percent.

4. Ground Cover (Percent of Surface Area)

Grasses and forbs	25
Bare ground	60
Surface gravel	0
Surface cobble and stones	0
Litter - percent of area	15
average depth in cm.	1

F. TOTAL ANNUAL HERBAGE PRODUCTION (Average air-dry, lbs./ac.)

Favorable years	-	900
Unfavorable years	-	500

G. SITE INTERPRETATIONS

1. Grazing

Approximately 95 percent of the vegetation produced on this site is suitable for grazing or browsing by domestic livestock and wildlife. Grazing distribution is generally not a problem if adequate waterings are properly located. However, continuous grazing leads to a repetitive, selective grazing of the most desirable species which reduces their vigor and productivity. The result is a deterioration of the potential plant community. This deterioration is indicated by a decrease in Indian ricegrass, needleandthread, New Mexico feathergrass, western wheatgrass, fourwing saltbush, and winterfat. Species that increase include dropseeds, blue grama, ring muhly, big sagebrush, rabbitbrush, and an invasion of juniper from adjacent sites. A planned grazing system, which prevents the repetitive grazing of selected species and allows for periodic replinishment of carbohydrates in the roots, is desirable.

In addition to domestic livestock, deer, elk, pronghorn, small mammals, and birds also use this site.

2. Wood Products

This site produces no significant wood products.

3. Habitat for Wildlife

Wildlife indigenous to this site will be added later.

4. Hydrologic Interpretations

Soil Series	Hydrologic Group

5. Recreation and Natural Beauty

This site is well adapted to hunting and horseback riding, although it is not noted for having scenic beauty.

6. Endangered Plants and Animals

Presently, no known endangered species indigenous to this site.

H. OTHER PERTINENT INFORMATION

1. Guide to Suggested Stocking Rates - Acres Per Animal Unit Month

Range Condition	AC/AUM
Excellent	2.8 - 3.9
Good	3.8 - 5.8
Fair	5.7 - 11.6
Poor	11.6

2. Relative Quality of Plants for Animal Use [1/]

(a) cattle

Primary	Secondary	Low Value
Indian ricegrass	sand dropseed	big sagebrush
needleandthread	spike dropseed	rabbitbrush
New Mexico feathergrass	galleta	spineless horsebrush
western wheatgrass	blue grama	sand sagebrush
muttongrass	bottlebrush squirreltail	juniper
fourwing saltbush		
winterfat		

(b) deer

I. IDENTIFICATION AND AUTHORIZATION

1. USDA-SCS
   Albuquerque, NM
   MLRA 36

2. Field Offices:

3. Field Office Sample:

4. Approved:

State Range Conservationist	Date	WNTC Range Conservationist	Date

Legend and Definitions for Range Site Descriptions.

1/ This rating system provides general guidance as to animal preference for plant species. It also indicates possible competition between kinds of animals for the various plants. Grazing preference changes from time to time and place to place, depending upon the animals, upon plant palatability and nutritive value, stage of growth and season of use, relative abundance, and associated plants. Grazing preference does not necessarily reflect a plant's ecological place in the climax plant community.

The following definitions apply to cattle, sheep, goats, deer, and antelope grazing:

Primary: These species generally decrease when the climax plant community is subjected to continuous heavy grazing pressure by the animals listed. These species are normally grazed first and preferred by the designated grazing animals when given free choice.

Secondary: These plants usually increase initially, then decrease when the site is subjected to continuous heavy grazing use by the animals listed. These plants are normally grazed after primary plants become scarce under free choice, or along with them under intensive grazing systems.

Low Value: These plants continue to increase with heavy, continuous grazing use of the site. These plants are not normally grazed until primary and secondary species are gone and animals are forced to eat them.

For quail and dove, the terms also relate to use for cover and protection where it is obvious these birds do not eat the plant.

GRAZING GUIDE FOR WOODLAND

SOIL CONSERVATION SERVICE

New Mexico

MLRA D-36
NM-AZ Plateaus and Mesas
Sub-Resource Area WP-1

Woodland Community Type--Pinyon-juniper-shrub
Woodland Suitability Group--(Not yet developed)
Soil Great Group--Haplustalfs and Haplargids (fine, fine-loamy)
Soil Series -- Vesilla

These soils are light brown with medium surface textures. They have formed in alluvial material derived from sandstone and shales. Soil family is fine-loamy. They are shallow to moderately deep and have moderate permeability.

Precipitation ranges from 10 to 14 inches. Over half of the precipitation falls in other than summer months.

A. Nature of the woodland community:

This is a pinyon-juniper-shrub site on soils of sandstone and shale origin. Slopes range from 10 to 13 percent and consist of mesas, questas, and rolling foot slopes of the mountains. There are wide variations in exposure. About one-half to two-thirds of the overstory is pinyon-pine. The remaining one-half to one-third is made up of Rocky Mountain juniper, Utah juniper, oneseed juniper, oaks (mainly Gambel), fragrant ash, New Mexico olive, and scattered ponderosa pine. Canopy ranges from sparse to dense. Greatest forage production occurs in openings or under sparse canopy, on concave positions. The understory composition by weight of the annual growth is about 35 percent. Seedlings and saplings and lower 4 1/2 foot of trees; 40 percent shrubs and half-shrubs, 15 percent forbs, and 10 percent grasses. It is multilayered and quite patchy and interrupted. Understory vegetation plant density varies conversely as a function of overstory tree canopy but might average about 10 percent under 30 percent tree canopy.

B. Relative grazing value of the understory for:

1. Cattle and elk

Grasses

Preferred	Desirable	Low Value
muttongrass	galleta	threeawn spp.
western wheatgrass	sand dropseed	tumblegrass
bottlebrush squirreltail	needleandthread	
sideoats grama	blue grama	
elk sedge		
Indian ricegrass		
little bluestem		
big bluestem		

3. Goats and Deer

Grasses and Grasslike

Preferred	Desirable	Low Value
muttongrass	Indian ricegrass	threeawn spp.
Kentucky bluegrass	bottlebrush squirreltail	bluegrama
pinyon ricegrass		galleta

Forbs

Preferred	Desirable	Low Value
white prairieclover	Palmer penstemon	silky crazyweed
filaree	Indian paintbrush	alkali poisonvetch
winterfat	multiflower gilia	Wooton locoweed
	groundsel	
	wildbuckwheat spp.	

Woody

Preferred	Desirable	Low Value
moutainmahogany	oak spp.	spineless horsebrush
cliffrose	mountain big sagebrush	pinyon
antelope bitterbrush	Rocky Mountain juniper	small soapweed
fragrant ash	creeping mahonia	broom snakeweed
Utah serviceberry	Douglas rabbitbrush	

C. Determination of forage value rating:

Forage value rating	Minimum percentage of preferred and desirable species, by weight
Very high	50 preferred + desirable = 90
High	30-49 preferred + desirable = 60
Moderate	10-29 preferred + desirable = 30
Low	Less than 10 preferred

Forbs

Preferred	Desirable	Low Value
globemallow	salsify	silky crazyweed
annual sunflower	Indian paintbrush	golden corydalis
filaree	smooth four-o'clock	tanseymustard spp.
	fleabane spp.	pingue
		larkspur spp.

Woody

Preferred	Desirable	Low Value
mountainmahogany	oak spp.	spineless horsebrush
cliffrose	small soapweed	basin big sagebrush
winterfat	mountain big sagebrush	broom snakeweed
fragrant ash	Rocky Mountain juniper	creeping mahonia
Bigelow sagebrush		pinyon
		oneseed juniper
		Utah juniper

2. Sheep and antelope

Grasses and grasslike

Preferred	Desirable	Low value
muttongrass	western wheatgrass	galleta
Indian ricegrass	bottlebrush squirreltail	threeawn
blue grama	needleandthread	tumblegrass
	Lettermans needlegrass	

Forbs

Preferred	Desirable	Low value
white prairieclover	manyflower gilia	golden corydalis
salsify	Indian paintbrush	pingue
prickly lettuce	larkspur	silky craxyweed
yellow blossom sweetclover	glovemallow spp.	alkali poisonvetch
filaree	fewflowered peavine	lupine
mariposa lily	groundsel	spring parsley
	wildbuckwheat	birdsbeak
		broom snakeweed

Woody

Preferred	Desirable	Low value
mountainmahogany	Bigelow sagebrush	spineless horsebrush
Fendler ceanothus	basin big sagebrush	pinyon
Stansbury cliffrose	juniper spp.	
winterfat	oak spp.	

D. Suggested initial stocking rates:

Forage value rating	Canopy Class		
	Sparse 1/ (0-10%)	Medium (10-40%)	Dense (40-70%)
		Acre/AUM	
Very high 2/	2.0-3.5	3.3-7.0	6.5-20.0
High	2.6-5.5	5.3-10.0	9.5-
Medium	5.5-10.0	10.0-20.0	
Low	15.0-		
Seeded 3/			

1/ Sparse includes cutover land and poorly stocked stands.

2/ Conservationists must use considerable judgment because in places, an area in the very high forage value class could be producing less than normal volumes, and adjustments would need to be made in the initial stocking rate.

3/ See field office Technical Guide for seeding recommendations.

E. Wildlife values:

This site provides excellent cover and good to excellent food for a variety of wildlife. Mule deer are yearlong residents. This is an extremely important area for wintering herds in years of heavy snowfall. Wild turkey, (Merriam) feed on muttongrass and Kentucky bluegrass seed heads in early spring, mast (especially acorns) in the fall, and browse buds and persistent fruits and drupes in the winter. Other wildlife, seasonal or resident, include coyote, bobcat, gray fox, desert cottontail rabbit, pinyon mouse, great horned owl, ferruginous hawk, red-tailed hawk, porcupine, pinyon jay, broadtail and Rufus hummingbird, prairie rattlesnake, and gray rock squirrel.

F. Effect on total environment:

This resource, in addition to providing important wildlife wintering habitat, provides recreation, watershed cover, limited wood products, and ornamental plants and a very limited understory vegetation for forage that could be grazed by domestic livestock. If the understory vegetation is utilized by domestic livestock, careful control and management of the domestic grazing animals is required to maintain or enhance the potential for wildlife habitat, watershed, and aesthetic values. When forage resources are allocated to domestic livestock, a decline in use by grazing, browsing, and seed-eating forms of wildlife can be anticipated. The understory is an integral part of this ecosystem and its management must be coordinated with the management of the pinyon-juniper-shrub overstory. Total resource management includes wildlife habitat and woodland management with limited consideration for grazing. The soil resource is unstable and the erosion hazard and subsequent sediment yield potential is high if the vegetation is mismanaged. Proper resource use, treatment, and management will hold soil loss and downstream pollution by sediment to an acceptable minimum.

G. Watershed values (hydrologic interpretations):

The soils in this site are typically in the hydrologic group C with some B and D. Due to the variability in the hydrological condition of the vegetative cover, field investigations are necessary to determine hydrologic curve numbers.

H. Threatened or endangered species:

Presently there are no known threatened or endangered species of animals which are indigenous to this site. The only threatened or endangered plant known to occur on this site is Erigeron rhizomatus which is indigenous to the shallow shale slopes. As reliable information becomes available on species officially designated, they will be added to this section as appropriate for this site.

Gene D. Sylvester
State Range Conservationist

APPENDIX II

LABORATORY DATA

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: DRAN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2232

SOIL FERTILITY REPORT

El Rancho

SAMPLE MARKING	6 0-8	CROP		DATE RECEIVED	7/28/87
		YIELD GOAL	@ N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	7.7	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT		SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %	2.6					lbs/A
ORGANIC NITROGEN	ppm	lbs/A 92		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth, in.	ppm	lbs/A		TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AVAILABLE NITROGEN			N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm			P_2O_5	lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm			K_2O	lbs/A		
SULFATE - SULFUR, ppm Depth, in.			S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm			MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm			Zn	lbs/A	STARTER	
AVAILABLE COPPER, ppm			Cu	lbs/A		
AVAILABLE IRON, ppm			Fe	lbs/A		
AVAILABLE MANGANESE, ppm			Mn	lbs/A		
AVAILABLE BORON, ppm			B	lbs/A		
LIME REQUIREMENT			Ag - Lime (100% effectiveness)	Tons/A		
GYPSUM REQUIREMENT			Gypsum (100% basis)	Tons/A		

SOIL TEXTURE	SANDY CLAY LOAM	% SAND	53.6	% SILT	12.8	% CLAY	33.6

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 6.5	Adapted to growth of acid tolerant crops
6.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air when roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime: (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants

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Telephone (602) 893-1788

SUBMITTED BY	ORAL F BAILEY
ADDRESS	
GROWER	HYDRO RESOURCES
LAB NO.	2233

El Rancho

SOIL FERTILITY REPORT

SAMPLE MARKING	6 8-16	CROP		DATE RECEIVED	5/28/87
		YIELD GOAL	2 N/A	DATE REPORTED	6/31/87

SATURATION PERCENTAGE		SOIL pH	7.9	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs A		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth in	ppm / lbs A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	**BROADCAST**
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A	
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A	
SULFATE - SULFUR, ppm Depth in		S		lbs/A	
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A	
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn		lbs/A	**STARTER**
AVAILABLE COPPER, ppm		Cu		lbs/A	
AVAILABLE IRON, ppm		Fe		lbs/A	
AVAILABLE MANGANESE, ppm		Mn		lbs/A	
AVAILABLE BORON, ppm		B		lbs/A	
LIME REQUIREMENT		Ag Lime		Tons/A	
GYPSUM REQUIREMENT				T(ons)/A	
SOIL TEXTURE	SAND		% SAND	20.4	% SILT 6.8 % CLAY 2.8

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY H

BY [signature]

PLEASE NOTE SPECIAL COMMENTS ON 2nd

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

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Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

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POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

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GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2234

El Rancho

SOIL FERTILITY REPORT

SAMPLE MARKING	6 16-40	CROP		DATE RECEIVED	5/28/87
		YIELD GOAL	0 N/A	DATE REPORTED	6/31/87

SATURATION PERCENTAGE		SOIL pH	7.8	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE NITROGEN Depth in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5	lbs/A	**BROADCAST**	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A		
SULFATE SULFUR, ppm Depth in.		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn	lbs/A	**STARTER**	
AVAILABLE COPPER, ppm		Cu	lbs/A		
AVAILABLE IRON, ppm		Fe	lbs/A		
AVAILABLE MANGANESE, ppm		Mn	lbs/A		
AVAILABLE BORON, ppm		B	lbs/A		
LIME REQUIREMENT		Ag. Lime (100% effectiveness)	Tons/A		
GYPSUM REQUIREMENT		Gypsum (90% purity)	Tons/A		
SOIL TEXTURE	SANDY CLAY LOAM	% SAND 51.6	% SILT 24.8	% CLAY	

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a soil, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 6.5	Adapted to growth of acid tolerant crops
6.5 - 8.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 60% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

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Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

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Labora[illegible] C[illegible]nts
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Telepho[illegible] (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2235

SOIL FERTILITY REPORT

El Rancho

SAMPLE MARKING	6 40-50	CROP		DATE RECEIVED	7/28/87
		YIELD GOAL	@ N/A	DATE REPORTED	8/3/87

SATURATION PERCENTAGE		SOIL pH	7.8	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT		SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %							lbs/A
ORGANIC NITROGEN	ppm	lbs/A		SIDEDRESS			lbs/A
NITRATE - NITROGEN Depth in.	ppm	lbs/A		TOPDRESS			lbs/A
				STARTER			lbs/A
				FERTIGATION			lbs/A
AVAILABLE NITROGEN			N		lbs/A	TOTAL	lbs/A
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AVAILABLE PHORUS — BICARBONATE P, ppm					lbs/A		
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SULFATE -SULFUR, ppm Depth in.			S		lbs/A		
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LIME REQUIREMENT @			Ag - Lime 100% effectiveness		Tons/A		
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L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

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SUBMITTED BY: ORAN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2283

SOIL FERTILITY REPORT

El Rancho

SAMPLE MARKING: 12 0-6
CROP:
YIELD GOAL: C N/A
DATE RECEIVED: 4/8/87
DATE REPORTED: 4/11/87

SATURATION PERCENTAGE:
SOIL pH: 7.9
FREE LIME:
ELECTRICAL CONDUCTIVITY mmhos/cm:
EXCHANGEABLE SODIUM PERCENTAGE:

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN
ORGANIC MATTER, %	2.2				lbs/A
ORGANIC NITROGEN	ppm / lbs/A: 57		SIDEDRESS		lbs/A
NITRATE NITROGEN, Depth in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
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LIME REQUIREMENT		Ag - Lime 100% effectiveness		Tons/A	
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SOIL TEXTURE	SANDY LOAM		SAND 59.2	SILT 12.8	CLAY

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BY

PLEASE NOTE SPECIAL COMMENTS ON BACK

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Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5–7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20–30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent—ECCE—of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: DRAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2284

SOIL FERTILITY REPORT

El Rancho

SAMPLE MARKING	12 6-16	CROP		DATE RECEIVED	7/6/67
		ONE LB GOAL	P N/A	DATE REPORTED	7/12/67
SATURATION PERCENTAGE		SOIL pH	7.5	FREE LIME	
ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE			

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN
ORGANIC MATTER, %					lbs A
ORGANIC NITROGEN	ppm / lbs A		SIDEDRESS		lbs A
NITRATE NITROGEN Depth in	ppm / lbs A		TOPDRESS		lbs A
			STARTER		lbs A
			FERTIGATION		lbs A
AVAILABLE NITROGEN		N		lbs A	TOTAL lbs A
AVAILABLE PHORUS — BRAY P1, ppm		P_2O_5		lbs A	BROADCAST
AVAILABLE PHORUS — BICARBONATE P, ppm				lbs A	
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs A	
NITRATE SULFUR, ppm Depth in		S		lbs A	
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs A	
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn		lbs A	STARTER
AVAILABLE COPPER, ppm		Cu		lbs A	
AVAILABLE IRON, ppm		Fe		lbs A	
AVAILABLE MANGANESE, ppm		Mn		lbs A	
AVAILABLE BORON, ppm		B		lbs A	
LIME REQUIREMENT		Ag. Lime		Tons A	
GYPSUM REQUIREMENT		Gypsum		Tons A	
TEXTURAL CLASS	SANDY CLAY LOAM	% SAND	53.2	% SILT 14.8	% CLAY

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a soil, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 6.5	Adapted to growth of acid tolerant crops
6.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
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Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

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This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by applicaton of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

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Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

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Laboratory Consultants

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SUBMITTED BY:	ORAN F BAILEY
ADDRESS:	
GROWER:	HYDRO RESOURCES
LAB NO.	2285

SOIL FERTILITY REPORT

El Rancho

SAMPLE & MARKING	12 16-32	CROP		DATE RECEIVED	9/8/87
		YIELD GOAL	@ N/A	DATE REPORTED	9/11/87

SATURATION PERCENTAGE		SOIL pH	7.9	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS		RESULT		SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %								lbs/A
ORGANIC NITROGEN		ppm	lbs/A		SIDEDRESS			lbs/A
NITRATE NITROGEN	Depth in.	ppm	lbs/A		TOPDRESS			lbs/A
					STARTER			lbs/A
					FERTIGATION			lbs/A
AVAILABLE NITROGEN				N		lbs/A	TOTAL	lbs/A
AVAILABLE PHORUS	BRAY P1, ppm					lbs/A	BROADCAST	
	BICARBONATE P, ppm			P_2O_5		lbs/A		
EXCHANGEABLE POTASSIUM, ppm				K_2O		lbs/A		
SULFATE - SULFUR, ppm	Depth in.			S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm				MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm								
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AVAILABLE ZINC, ppm				Zn		lbs/A	STARTER	
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AVAILABLE IRON, ppm				Fe		lbs/A		
AVAILABLE MANGANESE, ppm				Mn		lbs/A		
AVAILABLE BORON, ppm				B		lbs/A		
LIME REQUIREMENT				Ag. Lime (100% effectiveness)		Tons/A		
GYPSUM REQUIREMENT				Gypsum (100% purity)		Tons/A		
TEXTURE		SANDY CLAY LOAM		SAND	59.2	SILT	12.0	CLAY

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

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SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2286

SOIL FERTILITY REPORT

El Rancho

SAMPLE MARKED	12 32-45	CROP		DATE RECEIVED	5/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	5/11/87

SATURATION PERCENTAGE		SOIL pH	7.9	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT		SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
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AVAILABLE NITROGEN			N		lbs/A	TOTAL	lbs/A
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AVAILABLE MANGANESE, ppm			Mn		lbs/A		
AVAILABLE BORON, ppm			B		lbs/A		
LIME REQUIREMENT			Ag. Lime 100% effectiveness		Tons/A		
GYPSUM REQUIREMENT			Gypsum 100% purity		Tons/A		
TEXTURE	CLAY LOAM			SAND 40.8	SILT 9.6	CLAY 5.	

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BY Harry Ames

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Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.8-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO. 2263

SOIL FERTILITY REPORT

Flugle

SAMPLE MARKING	7 0-4	CROP		DATE RECEIVED	9/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	9/11/87

SATURATION PERCENTAGE		SOIL pH	7.4	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS		RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %		1.2				lbs/A
ORGANIC NITROGEN		ppm / lbs A: 22		SIDEDRESS		lbs/A
NITRATE - NITROGEN	Depth in	ppm / lbs A		TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AVAILABLE NITROGEN			N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS	BRAY P1, ppm		P_2O_5	lbs/A	BROADCAST	
	BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm			K_2O	lbs/A		
SULFATE - SULFUR, ppm	Depth in		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm			MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm			Zn	lbs/A	STARTER	
AVAILABLE COPPER, ppm			Cu	lbs/A		
AVAILABLE IRON, ppm			Fe	lbs/A		
AVAILABLE MANGANESE, ppm			Mn	lbs/A		
AVAILABLE BORON, ppm			B	lbs/A		
LIME REQUIREMENT			Ag - Lime (100% effective)	Tons/A		
GYPSUM REQUIREMENT			Gypsum (100% equiv)	Tons/A		

SOIL TEXTURE	LOAM	% SAND	47.2	% SILT	32.0	% CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Lance

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a soil, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
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NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

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Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

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Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20—30 gallons/acre beginning as soon as sufficient leaf foilage is present to intercept the spray. The spray application may need to be repeated if yellowing of foilage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

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GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

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Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture effects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: DRAN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2264

SOIL FERTILITY REPORT

Flugle

SAMPLE MARKING	7 4-13	CROP		DATE RECEIVED	9/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	9/11/87

SATURATION PERCENTAGE		SOIL pH	8.3	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	0	EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5	lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A		
SULFATE - SULFUR, ppm Depth in.		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
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LIME REQUIREMENT		Ag - Lime 100% effectiveness	Tons/A		
GYPSUM REQUIREMENT		Gypsum 100% equiv.	Tons/A		
SOIL TEXTURE	CLAY LOAM	% SAND 36.8	% SILT 28.4	% CLAY	

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
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pH	PLANT RESPONSE
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Telephone (602) 893-1788

SUBMITTED BY	DRAN F BAILEY
ADDRESS	
GROWER	HYDRO RESOURCES
LAB NO.	2265

Flugle

SOIL FERTILITY REPORT

SAMPLE MARKED	7 13-30	CROP		DATE RECEIVED	9/8/87
		YIELD GOAL	2 N/A	DATE REPORTED	9/11/87

SATURATION PERCENTAGE		SOIL pH	8.2	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT		SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %							lbs/A
ORGANIC NITROGEN	ppm	lbs/A		SIDEDRESS			lbs/A
NITRATE-NITROGEN Depth in.	ppm	lbs/A		TOPDRESS			lbs/A
				STARTER			lbs/A
				FERTIGATION			lbs/A
AVAILABLE NITROGEN			N		lbs/A	TOTAL	lbs/A
AVAILABLE PHORUS — BRAY P1, ppm			P_2O_5		lbs/A	BROADCAST	
AVAILABLE PHORUS — BICARBONATE P, ppm					lbs/A		
EXCHANGEABLE POTASSIUM, ppm			K_2O		lbs/A		
SULFATE-SULFUR, ppm Depth in.			S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm			MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm							
EXCHANGEABLE SODIUM, ppm							
AVAILABLE ZINC, ppm			Zn		lbs/A	STARTER	
AVAILABLE COPPER, ppm			Cu		lbs/A		
AVAILABLE IRON, ppm			Fe		lbs/A		
AVAILABLE MANGANESE, ppm			Mn		lbs/A		
AVAILABLE BORON, ppm			B		lbs/A		
LIME REQUIREMENT			Ag - Lime (100% effectiveness)		Tons/A		
GYPSUM REQUIREMENT			Gypsum (100% equiv.)		Tons/A		

SOIL TEXTURE	CLAY LOAM	% SAND	39.2	% SILT	45.8	% CLAY	15

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Elmore

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a soil, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 6.5	Adapted to growth of acid tolerant crops
6.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in startgr fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foilage is present to intercept the spray. The spray application may need to be repeated if yellowing of foilage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2266

SOIL FERTILITY REPORT

Flugle

SAMPLE MARKING	7 30-40	CROP		DATE RECEIVED	9/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	9/11/87

SATURATION PERCENTAGE		SOIL pH	8.0	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %						lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS			lbs/A
NITRATE - NITROGEN Depth in.	ppm / lbs/A		TOPDRESS			lbs/A
			STARTER			lbs/A
			FERTIGATION			lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	**BROADCAST**	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A		
SULFATE - SULFUR, ppm Depth in.		S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm		Zn		lbs/A	**STARTER**	
AVAILABLE COPPER, ppm		Cu		lbs/A		
AVAILABLE IRON, ppm		Fe		lbs/A		
AVAILABLE MANGANESE, ppm		Mn		lbs/A		
AVAILABLE BORON, ppm		B		lbs/A		
LIME REQUIREMENT		Ag - Lime (100% effectiveness)		Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% purity)		Tons/A		

SOIL TEXTURE: CLAY LOAM — % SAND 29.2 — % SILT 32.0 — % CLAY

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
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Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

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Lime Sulfur	0.78
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TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
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Laboratory Consultants

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SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2267

SOIL FERTILITY REPORT

Flugle

SAMPLE MARKING	7 40-60	CROP	
YIELD GOAL	0 N/A	DATE RECEIVED	5/E/87
		DATE REPORTED	5/11/87

SATURATION PERCENTAGE		SOIL pH	7.7	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth in.	ppm / lbs/A		TOPDRESS		lbs/A
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LIME REQUIREMENT		Ag. Lime 100% effectiveness		Tons/A	
GYPSUM REQUIREMENT		Gypsum 100% basis		Tons/A	
TEXTURE	CLAY LOAM		% SAND 27.2	% SILT 35.8	% CLAY 37.

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

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LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY:	ORAN F BAILEY
ADDRESS:	
GROWER	HYDRO RESOURCES
LAB NO.	2268

SOIL FERTILITY REPORT

Galestina

SAMPLE MARKING	9 0-7	CROP		DATE RECEIVED	7/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	7/12/87

SATURATION PERCENTAGE		SOIL pH	7.9	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	1.3	EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %	1.6					lbs/A
ORGANIC NITROGEN	ppm / lbs/A: 48		SIDEDRESS			lbs/A
NITRATE NITROGEN (Depth in.)	ppm / lbs/A		TOPDRESS			lbs/A
			STARTER			lbs/A
			FERTIGATION			lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	**BROADCAST**	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A		
SULFATE - SULFUR, ppm (Depth in.)		S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm		Zn		lbs/A	**STARTER**	
AVAILABLE COPPER, ppm		Cu		lbs/A		
AVAILABLE IRON, ppm		Fe		lbs/A		
AVAILABLE MANGANESE, ppm		Mn		lbs/A		
AVAILABLE BORON, ppm		B		lbs/A		
LIME REQUIREMENT		Ag - Lime (80% effectiveness)		Tons/A	SAR: 4.6	
GYPSUM REQUIREMENT		Gypsum (100% basis)		Tons/A		
SOIL TEXTURE (1:2 DILUTION)	CLAY		% SAND 20.8		% SILT 25.4	% CLAY

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
5.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract meesures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by applicaton of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

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GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

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Sulfuric Acid	0.61
Lime Sulfur	0.78
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TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
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Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: GRANT BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2269

SOIL FERTILITY REPORT

Galestina

SAMPLE OR MARK NO.	9 7-22	CROP		DATE RECEIVED	7/8/87
		YIELD GOAL	? N/A	DATE REPORTED	7/11/87

SATURATION PERCENTAGE		SOIL pH	7.9	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	1.9	EXCHANGEABLE SODIUM PERCENTAGE	7.

LAB TESTS		RESULT		SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %								lbs/A
ORGANIC NITROGEN		ppm	lbs/A		SIDEDRESS			lbs/A
NITRATE-NITROGEN	Depth, in.	ppm	lbs/A		TOPDRESS			lbs/A
					STARTER			lbs/A
					FERTIGATION			lbs/A
AVAILABLE NITROGEN				N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS	BRAY P1, ppm			P_2O_5		lbs/A	BROADCAST	
	BICARBONATE P, ppm					lbs/A		
EXCHANGEABLE POTASSIUM, ppm				K_2O		lbs/A		
SULFATE-SULFUR, ppm	Depth, in.			S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm				MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm								
EXCHANGEABLE SODIUM, ppm								
AVAILABLE ZINC, ppm				Zn		lbs/A	STARTER	
AVAILABLE COPPER, ppm				Cu		lbs/A		
AVAILABLE IRON, ppm				Fe		lbs/A		
AVAILABLE MANGANESE, ppm				Mn		lbs/A		
AVAILABLE BORON, ppm				B		lbs/A		
LIME REQUIREMENT				Ag. Lime (100% effectiveness)		Tons/A	SAR: 3.4	
GYPSUM REQUIREMENT				Gypsum (100% pure)		Tons/A		
SOIL TEXTURE		CLAY			% SAND 32.8		% SILT 16.4	% CLAY

L = VERY LOW l = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
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Laboratory Consultants

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Telephone (602) 893-1788

SUBMITTED BY: DRAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2270

SOIL FERTILITY REPORT

Galestina

SAMPLE MARKED	9 22-31	CROP		DATE RECEIVED	5/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	5/11/87

SATURATION PERCENTAGE		SOIL pH	7.8	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	3.1	EXCHANGEABLE SODIUM PERCENTAGE	4.

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth, in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER —		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
AVAILABLE PHORUS — BRAY P1, ppm		P_2O_5	lbs/A	BROADCAST	
AVAILABLE PHORUS — BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A		
SULFATE - SULFUR, ppm Depth, in.		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn	lbs/A	STARTER	
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AVAILABLE IRON, ppm		Fe	lbs/A		
AVAILABLE MANGANESE, ppm		Mn	lbs/A		
AVAILABLE BORON, ppm		B	lbs/A		
LIME REQUIREMENT		Ag - Lime 100% effectiveness	Tons/A		
GYPSUM REQUIREMENT		Gypsum 100% purity	Tons/A	SAR: 3.8	
SOIL TEXTURE	CLAY	% SAND 19.2	% SILT 14.0	% CLAY	

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Danny Amos

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20—40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air when roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.8—7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20—30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime: (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent—ECCE—of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2271

Galestina

SOIL FERTILITY REPORT

SAMPLE MARKING	9 31-40	CROP		DATE RECEIVED	5/E/E7
		YIELD GOAL	0 N/A	DATE REPORTED	-/11/E7

SATURATION PERCENTAGE		SOIL pH	7.7	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE NITROGEN Depth in	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5	lbs/A	**BROADCAST**	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A		
SULFATE SULFUR, ppm Depth in		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn	lbs/A	**STARTER**	
AVAILABLE COPPER, ppm		Cu	lbs/A		
AVAILABLE IRON, ppm		Fe	lbs/A		
AVAILABLE MANGANESE, ppm		Mn	lbs/A		
AVAILABLE BORON, ppm		B	lbs/A		
LIME REQUIREMENT		Ag. Lime (100% effectiveness)	Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% effectiveness)	Tons/A		
TEXTURE	CLAY	SAND 19.4	SILT 30.8	CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY: [signature]

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
5.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

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Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate–nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate–nitrogen available to the crop during the growing season.

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Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants
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Telephone (602) 893-1788

SUBMITTED BY: DRAN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2272

SOIL FERTILITY REPORT

Galestina

SAMPLE MARKING	9 42-50	CROP		DATE RECEIVED	4/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	4/11/87

SATURATION PERCENTAGE		SOIL pH	7.6	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT		SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %							lbs/A
ORGANIC NITROGEN	ppm	lbs/A		SIDEDRESS			lbs/A
NITRATE - NITROGEN Depth, in.	ppm	lbs/A		TOPDRESS			lbs/A
				STARTER			lbs/A
				FERTIGATION			lbs/A
AVAILABLE NITROGEN			N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm			P_2O_5		lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm					lbs/A		
EXCHANGEABLE POTASSIUM, ppm			K_2O		lbs/A		
SULFATE - SULFUR, ppm Depth, in.			S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm			MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm							
EXCHANGEABLE SODIUM, ppm							
AVAILABLE ZINC, ppm			Zn		lbs/A	STARTER	
AVAILABLE COPPER, ppm			Cu		lbs/A		
AVAILABLE IRON, ppm			Fe		lbs/A		
AVAILABLE MANGANESE, ppm			Mn		lbs/A		
AVAILABLE BORON, ppm			B		lbs/A		
LIME REQUIREMENT			Ag - Lime (100% effectiveness)		Tons/A		
GYPSUM REQUIREMENT			Gypsum (100% basis)		Tons/A		
TEXTURE	CLAY			% SAND	12.4	% SILT 28.8	% CLAY

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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Laboratory Consultants

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Telephone (602) 893-1788

SUBMITTED BY:	ORAN F BAILEY
ADDRESS:	
GROWER:	HYDRO RESOURCES
LAB NO.:	2274

SOIL FERTILITY REPORT

Celestine

SAMPLE MARKED	10 0-4	CROP		DATE RECEIVED	4/8/87
		YIELD GOAL	0 N/A	DATE REPORTED	4/11/87

SATURATION PERCENTAGE		SOIL pH	7.9	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	2.78	EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS		RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %		1.5				lbs/A
ORGANIC NITROGEN		ppm / lbs/A: 26		SIDEDRESS		lbs/A
NITRATE-NITROGEN	Depth, in	ppm / lbs/A		TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AVAILABLE NITROGEN			N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS	BRAY P1, ppm		P_2O_5	lbs/A	**BROADCAST**	
	BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm			K_2O	lbs/A		
SULFATE-SULFUR, ppm	Depth, in		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm			MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm			Zn	lbs/A	**STARTER**	
AVAILABLE COPPER, ppm			Cu	lbs/A		
AVAILABLE IRON, ppm			Fe	lbs/A		
AVAILABLE MANGANESE, ppm			Mn	lbs/A		
AVAILABLE BORON, ppm			B	lbs/A		
LIME REQUIREMENT			Ag. Lime (100% effectiveness)	Tons/A	SAR: 1.8	
GYPSUM REQUIREMENT			Gypsum (100% purity)	Tons/A		

TEXTURE	CLAY LOAM	% SAND	35.2	% SILT	39.8	% CLAY	

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Dunn

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a soil, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 6.5	Adapted to growth of acid tolerant crops
6.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen avaliable to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: GRAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2275

SOIL FERTILITY REPORT

Galestina

SAMPLE MARKED	10 4-22	CROP		DATE RECEIVED	9/6/87
		YIELD GOAL	0 N/A	DATE REPORTED	9/11/87

SATURATION PERCENTAGE		SOIL pH	7.6	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	2.70	EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %						lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS			lbs/A
NITRATE - NITROGEN Depth in.	ppm / lbs/A		TOPDRESS			lbs/A
			STARTER			lbs/A
			FERTIGATION			lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	**BROADCAST**	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A		
SULFATE - SULFUR, ppm Depth in.		S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm		Zn		lbs/A	**STARTER**	
AVAILABLE COPPER, ppm		Cu		lbs/A		
AVAILABLE IRON, ppm		Fe		lbs/A		
AVAILABLE MANGANESE, ppm		Mn		lbs/A		
AVAILABLE BORON, ppm		B		lbs/A		
LIME REQUIREMENT		Ag - Lime (90% effectiveness)		Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% equiv.)		Tons/A	SAR: 2.0	

TEXTURAL CLASS	CLAY	% SAND	15.2	% SILT	14.8	% CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

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SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
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GYPSUM REQUIREMENT:

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Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
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Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

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SUBMITTED BY:	ORAN F BAILEY
ADDRESS:	
GROWER:	HYDRO RESOURCES
LAB NO.:	2226

Vessilla

SOIL FERTILITY REPORT

SAMPLE IDENTIFICATION	1 @ 3-10	CROP		DATE RECEIVED	8/28/87
		YIELD GOAL	@ N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	7.3	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %	2.8					lbs/A
ORGANIC NITROGEN	ppm / lbs/A: 84		SIDEDRESS			lbs/A
NITRATE - NITROGEN Depth in.	ppm / lbs/A		TOPDRESS			lbs/A
			STARTER			lbs/A
			FERTIGATION			lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
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SULFATE - SULFUR, ppm Depth in.		S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm						
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AVAILABLE BORON, ppm		B		lbs/A		
LIME REQUIREMENT		Ag - Lime (100% effective)		Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% pure)		Tons/A		

SOIL TEXTURE	SANDY CLAY LOAM	% SAND	52.4	% SILT	12.0	% CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2225

Vessilla

SOIL FERTILITY REPORT

SAMPLE MARKING	1 0-3	CROP		DATE RECEIVED	8/28/87
		YIELD GOAL	@ N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	6.8	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER %	2.9					lbs/A
ORGANIC NITROGEN	ppm / lbs/A: 38			SIDEDRESS		lbs/A
NITRATE NITROGEN Depth in	ppm / lbs/A			TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
ILABLE PHORUS — BRAY P1, ppm		P_2O_5		lbs/A	BROADCAST	
BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A		
NITRATE SULFUR, ppm Depth in		S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AILABLE ZINC, ppm		Zn		lbs/A	STARTER	
AILABLE COPPER, ppm		Cu		lbs/A		
AILABLE IRON, ppm		Fe		lbs/A		
AILABLE MANGANESE, ppm		Mn		lbs/A		
AILABLE BORON, ppm		B		lbs/A		
REQUIREMENT		Ag. Lime		Tons/A		
GYPSUM REQUIREMENT		Gypsum		Tons/A		

SOIL TEXTURE: SANDY LOAM — % SAND 76.4 — % SILT 20.0 — % CLAY 3.

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
5.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate–nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate–nitrogen available to the crop during the growing season.

Nitrate–nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20–40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5–7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in startgr fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20–30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
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Texture affects plant nutrient holding capacity, aeration, water penetration, and water holding capacity.

Laboratory Consultants

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Telephone (602) 893-1788

Pinitos

SUBMITTED BY:	DRAN F BAILEY
ADDRESS:	
GROWER:	HYDRO RESOURCES
LAB NO.:	2231

SOIL FERTILITY REPORT

SAMPLE MARKING	4 42-53	CROP		DATE RECEIVED	8/28/87
		YIELD GOAL	0 N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	7.8	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE NITROGEN Depth in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	**BROADCAST**
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A	
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A	
SULFATE-SULFUR, ppm Depth in.		S		lbs/A	
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A	
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn		lbs/A	**STARTER**
AVAILABLE COPPER, ppm		Cu		lbs/A	
AVAILABLE IRON, ppm		Fe		lbs/A	
AVAILABLE MANGANESE, ppm		Mn		lbs/A	
AVAILABLE BORON, ppm		B		lbs/A	
LIME REQUIREMENT		Ag - Lime (100% effectiveness)		Tons/A	
GYPSUM REQUIREMENT		Gypsum (100% basis)		Tons/A	
SOIL TEXTURE	SANDY CLAY	% SAND 46.4	% SILT 38.0	% CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
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Texture effects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

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Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2230

Pinitos

SOIL FERTILITY REPORT

SAMPLE MARKING	4 3½-42	CROP		DATE RECEIVED	8/28/87
		YIELD GOAL	C N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	8.2	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS		RESULT		SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %							lbs/A
ORGANIC NITROGEN		ppm	lbs/A		SIDEDRESS		lbs/A
NITRATE - NITROGEN	Depth in.	ppm	lbs/A		TOPDRESS		lbs/A
					STARTER		lbs/A
					FERTIGATION		lbs/A
AVAILABLE NITROGEN				N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS	BRAY P1, ppm			P_2O_5	lbs/A	BROADCAST	
	BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm				K_2O	lbs/A		
SULFATE - SULFUR, ppm	Depth in.			S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm				MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm							
EXCHANGEABLE SODIUM, ppm							
AVAILABLE ZINC, ppm				Zn	lbs/A	STARTER	
AVAILABLE COPPER, ppm				Cu	lbs/A		
AVAILABLE IRON, ppm				Fe	lbs/A		
AVAILABLE MANGANESE, ppm				Mn	lbs/A		
AVAILABLE BORON, ppm				B	lbs/A		
LIME REQUIREMENT				Ag - Lime 100% effectiveness	Tons/A		
GYPSUM REQUIREMENT				Gypsum 100% basis	Tons/A		

SOIL TEXTURE: CLAY LOAM — SAND 32.4 — %SILT 35.0 — %CLAY 32.6

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
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SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizers may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium effected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2229

SOIL FERTILITY REPORT

Pinitos

SAMPLE MARKING	4 22-34	CROP		DATE RECEIVED	8/28/87
		YIELD GOAL	@ N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	8.1	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth, in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5	lbs/A	**BROADCAST**	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A		
SULFATE - SULFUR, ppm Depth, in.		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn	lbs/A	**STARTER**	
AVAILABLE COPPER, ppm		Cu	lbs/A		
AVAILABLE IRON, ppm		Fe	lbs/A		
AVAILABLE MANGANESE, ppm		Mn	lbs/A		
AVAILABLE BORON, ppm		B	lbs/A		
LIME REQUIREMENT		Ag - Lime	Tons/A		
GYPSUM REQUIREMENT		Gypsum	Tons/A		

SOIL TEXTURE	CLAY LOAM	% SAND	36.4	% SILT	30.8	% CLAY	33

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Henry Ahmr

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
5.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem. However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate–nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate–nitrogen available to the crop during the growing season.

Nitrate–nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20–40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5–7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

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MANGANESE, COPPER AND BORON:

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LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

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Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration and water holding capacity.

Laboratory Consultants

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Telephone (602) 893-1788

SUBMITTED BY:	GRAN F BAILEY
ADDRESS:	
GROWER:	HYDRO RESOURCES
LAB NO.	2228

Pinitos

SOIL FERTILITY REPORT

SAMPLE MARKING	4 9-22	CROP		DATE RECEIVED	8/28/87
		YIELD GOAL	Ø N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	8.1	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT		SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %						lbs/A
ORGANIC NITROGEN	ppm	lbs/A		SIDEDRESS		lbs/A
NITRATE NITROGEN Depth in.	ppm	lbs/A		TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AVAILABLE NITROGEN			N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm			P_2O_5	lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm			K_2O	lbs/A		
NITRATE - SULFUR, ppm Depth in.			S	lbs/A		
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AVAILABLE MANGANESE, ppm			Mn	lbs/A		
AVAILABLE BORON, ppm			B	lbs/A		
LIME REQUIREMENT			Ag - Lime	Tons/A		
GYPSUM REQUIREMENT			Gypsum	Tons/A		
SOIL TEXTURE	CLAY LOAM		% SAND	36.4	% SILT 32.8	% CLAY

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
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The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

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pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
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Telephone (602) 893-1788

SUBMITTED BY: DRAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2227

Pinitos

SOIL FERTILITY REPORT

SAMPLE MARKING	4 0-9	CROP		DATE RECEIVED	8/28/87
		YIELD GOAL	0 N/A	DATE REPORTED	8/31/87

SATURATION PERCENTAGE		SOIL pH	8.0	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %	1.1				lbs/A
ORGANIC NITROGEN	ppm / lbs/A: 42		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
AVAILABLE PHORUS — BRAY P1, ppm		P_2O_5	lbs/A	BROADCAST	
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SULFATE -SULFUR, ppm Depth in.		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
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AVAILABLE IRON, ppm		Fe	lbs/A		
AVAILABLE MANGANESE, ppm		Mn	lbs/A		
AVAILABLE BORON, ppm		B	lbs/A		
LIME REQUIREMENT		Ag - Lime	Tons/A		
GYPSUM REQUIREMENT		Gypsum	Tons/A		
TEXTURE	CLAY LOAM			SAND 46.4	SILT 26.8	CLAY 27.0

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

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Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by applicaton of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in startgr fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foilage is present to intercept the spray. The spray application may need to be repeated if yellowing of foilage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture effects plant nutrient holding capacity, aeration, water penetration, and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: ORAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2262

SOIL FERTILITY REPORT

Mion

SAMPLE MARKING: 6-1B 8

CROP:

NEED GOAL: @ N/A

DATE RECEIVED: 9/8/97

DATE REPORTED: 9/11/97

SATURATION PERCENTAGE: | SOIL pH: 7.7 | FREE LIME: | ELECTRICAL CONDUCTIVITY mmhos/cm: | EXCHANGEABLE SODIUM PERCENTAGE:

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE NITROGEN	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	BROADCAST
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A	
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A	
SULFATE - SULFUR, ppm		S		lbs/A	
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A	
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn		lbs/A	STARTER
AVAILABLE COPPER, ppm		Cu		lbs/A	
AVAILABLE IRON		Fe		lbs/A	
AVAILABLE MANGANESE, ppm		Mn		lbs/A	
AVAILABLE BORON, ppm		B		lbs/A	
LIME REQUIREMENT		Ag. Lime (90% effectiveness)		Tons/A	
GYPSUM REQUIREMENT		Gypsum (90% effectiveness)		Tons/A	
SOIL TEXTURE CLASS	CLAY				

% SAND 6.4 % SILT 34.8 % CLAY 58.8

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

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pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
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7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem. However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
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High	25 - 50
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TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

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Sand	50 microns to 2 millimeters
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Texture affects plant nutrient holding capacity, aeration, water penetration, and water holding capacity.

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SUBMITTED BY: JOHN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2261

MION

SOIL FERTILITY REPORT

SAMPLE MARKING	3 P-6 &	CROP		DATE RECEIVED	4/8/87
		YIELD GOAL	P N/A	DATE REPORTED	4/11/87

SATURATION PERCENTAGE		SOIL pH	7.P	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	EXCHANGEABLE SODIUM PERCENTAGE

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %	1.6					lbs/A
ORGANIC NITROGEN	ppm / lbs/A: 43			SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth in.	ppm / lbs/A			TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A		TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5	lbs/A		BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm			lbs/A			
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A			
SULFATE - SULFUR, ppm Depth in.		S	lbs/A			
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A			
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm		Zn	lbs/A		STARTER	
AVAILABLE COPPER, ppm		Cu	lbs/A			
AVAILABLE IRON, ppm		Fe	lbs/A			
AVAILABLE MANGANESE, ppm		Mn	lbs/A			
AVAILABLE BORON, ppm		B	lbs/A			
LIME REQUIREMENT		Ag - Lime 100% effectiveness	Tons/A			
GYPSUM REQUIREMENT		Gypsum 100% basis	Tons/A			
SOIL TEXTURE	CLAY	% SAND	5.8	% SILT	24.4	% CLAY

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

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SUBMITTED BY: ORAN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2282

SOIL FERTILITY REPORT

Mikim

SAMPLE MARKING	11 42-62	CROP		DATE RECEIVED	4/6/87
		YIELD GOAL	N/A	DATE REPORTED	4/11/87

SATURATION PERCENTAGE		SOIL pH	7.7	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm	EXCHANGEABLE SODIUM PERCENTAGE

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %						lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS			lbs/A
NITRATE - NITROGEN Depth in	ppm / lbs/A		TOPDRESS			lbs/A
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AVAILABLE MANGANESE, ppm		Mn		lbs/A		
AVAILABLE BORON, ppm		B		lbs/A		
LIME REQUIREMENT		Ag - Lime (90% effectiveness)		Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% purity)		Tons/A		

SOIL TEXTURE	CLAY LOAM	% SAND	43.2	% SILT	15.8	% CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Amos

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
5.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem. However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
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Texture affects plant nutrient holding capacity, aeration, water penetration, and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: FRAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 22E1

SOIL FERTILITY REPORT

Mikim

SAMPLE MARKED	11 25-42	CROP		DATE RECEIVED	7/E/E7
		YIELD GOAL	0 N/A	DATE REPORTED	/1:/E/

SATURATION PERCENTAGE		SOIL pH	7.5	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %						lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS			lbs/A
NITRATE NITROGEN Depth in.	ppm / lbs/A		TOPDRESS			lbs/A
			STARTER			lbs/A
			FERTIGATION			lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A		
SULFATE SULFUR, ppm Depth in.		S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm		Zn		lbs/A	STARTER	
AVAILABLE COPPER, ppm		Cu		lbs/A		
AVAILABLE IRON, ppm		Fe		lbs/A		
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LIME REQUIREMENT		Ag. Lime (100% effective)		Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% basis)		Tons/A		
SOIL TEXTURE	CLAY LOAM		% SAND 38.8	% SILT 42.4	% CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

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TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

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Laboratory Consultants

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SUBMITTED BY	ORAN F BAILEY
ADDRESS	
GROWER	HYDRO RESOURCES
LAB NO.	2280

SOIL FERTILITY REPORT

Mikim

SAMPLE MARKING	11 7-25	CROP		DATE RECEIVED	8/8/87
		YIELD GOAL	C N/A	DATE REPORTED	8/11/87

SATURATION PERCENTAGE		SOIL pH	7.3	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth in	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
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AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
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EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A		
SULFATE - SULFUR, ppm Depth in		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
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EXCHANGEABLE SODIUM, ppm					
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TEXTURE	CLAY LOAM	% SAND	45.2	% SILT	36.8	% CLAY	18.0

L = VERY LOW l = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

PLEASE NOTE SPECIAL COMMENTS ON BACK

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If soils contain more than 1% free lime the following materials may be used in place of gypsum. Convert tons/A of gypsum required to tons of the material selected by using the appropriate factor.

MATERIAL (100% BASIS)	TONS OF MATERIAL EQUIVALENT TO 1 TON OF GYPSUM
Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration, and water holding capacity.

Laboratory Consultants

9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: DRAN E BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2279

Mixin

SOIL FERTILITY REPORT

SAMPLE MARKING	11 @-7	CROP		DATE RECEIVED	4/8/87
		YIELD GOAL	@ N/A	DATE REPORTED	4/11/87

SATURATION PERCENTAGE		SOIL pH	7.1	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %	1.5					lbs/A
ORGANIC NITROGEN	ppm / lbs/A: 45			SIDEDRESS		lbs/A
NITRATE NITROGEN (Depth in)	ppm / lbs/A			TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL		lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5	lbs/A	BROADCAST		
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm			lbs/A			
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A			
SULFATE - SULFUR, ppm (Depth in)		S	lbs/A			
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A			
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm		Zn	lbs/A	STARTER		
AVAILABLE COPPER, ppm		Cu	lbs/A			
AVAILABLE IRON, ppm		Fe	lbs/A			
AVAILABLE MANGANESE, ppm		Mn	lbs/A			
AVAILABLE BORON, ppm		B	lbs/A			
LIME REQUIREMENT		Ag - Lime (100% effectiveness)	Tons/A			
GYPSUM REQUIREMENT		Gypsum (100% purity)	Tons/A			

TEXTURE	CLAY LOAM	% SAND	36.8	% SILT	32.4	% CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
5.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem; However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by application of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate-nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate-nitrogen available to the crop during the growing season.

Nitrate-nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3.5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20-40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

Legume crops can utilize nitrogen from the air. When roots are properly nodulated nitrogen fertilizer will not be beneficial. Seed inoculation may be beneficial in many cases.

PHOSPHORUS:

Phosphorus, a non-mobile nutrient, is easily converted to unavailable forms especially in high pH, calcareous soils, or in moderate to extremely acid soils. The conversion of fertilizer phosphorus to unavailable forms is less rapid in soils that have a pH range of 5.5-7.5 but does occur over a period of time. Application of phosphorus fertilizer in a band along side and below the seed will generally increase fertilizer efficiency and is recommended for soils that have a high phosphorus fixing capacity. Application rates of phosphorus fertilizer can usually be reduced by 50% when banded. Excessive rates of phosphorus fertilizer will reduce the availability of zinc, possibly iron which may result in yield reduction of some crops.

POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizers may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20-30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

LIME REQUIREMENT:

A lime requirement is determined on soils that have a pH of 6.2 or less. By liming acid soils, better crop growth and increased yields can often be achieved. Optimum soil pH values vary depending on the crop being grown, but, in general, should be between 6.0 and 7.5. Before liming, study the following factors to determine the necessity of lime (1) pH in the subsoil should be less than 6.2, (2) amount of lime being applied in the irrigation water, (3) crop being grown. Thorough incorporation of lime into the surface 8" of soil is necessary for maximum effectiveness. Apply lime only after the soil has been tested since too much lime may be as harmful as too little. The lime recommendation is based on an effective calcium carbonate equivalent--ECCE--of 60%. The recommended liming rate will increase soil pH to approximately 6.5 in 3 years. ECCE is dependent on fineness of lime, purity, and amount of water present. Know the ECCE before applying lime so that the necessary adjustment in application rates can be made.

GYPSUM REQUIREMENT:

Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

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Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
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SUBMITTED BY: URAN F BAILEY
ADDRESS:

GROWER: HYDRO RESOURCES
LAB NO.: 2278

SOIL FERTILITY REPORT

Celestine

SAMPLE MARKING	12 42-45	CROP		DATE RECEIVED	9/2/87
		YIELD GOAL	0 N/A	DATE REPORTED	9/11/87

SATURATION PERCENTAGE		SOIL pH	7.5	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %						lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS			lbs/A
NITRATE-NITROGEN Depth, in.	ppm / lbs/A		TOPDRESS			lbs/A
			STARTER			lbs/A
			FERTIGATION			lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5		lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm				lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O		lbs/A		
SULFATE-SULFUR, ppm Depth, in.		S		lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO		lbs/A		
EXCHANGEABLE CALCIUM, ppm						
EXCHANGEABLE SODIUM, ppm						
AVAILABLE ZINC, ppm		Zn		lbs/A	STARTER	
AVAILABLE COPPER, ppm		Cu		lbs/A		
AVAILABLE IRON, ppm		Fe		lbs/A		
AVAILABLE MANGANESE, ppm		Mn		lbs/A		
AVAILABLE BORON, ppm		B		lbs/A		
LIME REQUIREMENT		Ag. Lime		Tons/A		
GYPSUM REQUIREMENT		Sulphur		Tons/A		

SOIL TEXTURE: LOAM — % SAND 45.2 — % SILT 42.8 — % CLAY ...

L = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

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pH	PLANT RESPONSE
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Telephone (602) 893-1788

SUBMITTED BY	DRAN F BAILEY
ADDRESS	
GROWER	HYDRO RESOURCES
LAB NO.	2277

Galestina

SOIL FERTILITY REPORT

SAMPLE MARKING	10 30-42	CROP		DATE RECEIVED	4/2/87
		YIELD GOAL	0 N/A	DATE REPORTED	4/13/87

SATURATION PERCENTAGE		SOIL pH	7.8	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS			FERTILIZATION PLAN	
ORGANIC MATTER, %						lbs/A
ORGANIC NITROGEN	ppm / lbs/A			SIDEDRESS		lbs/A
NITRATE - NITROGEN, Depth in.	ppm / lbs/A			TOPDRESS		lbs/A
				STARTER		lbs/A
				FERTIGATION		lbs/A
AVAILABLE NITROGEN		N		lbs/A	TOTAL	lbs/A
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SULFATE - SULFUR, ppm, Depth in.		S		lbs/A		
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AVAILABLE MANGANESE, ppm		Mn		lbs/A		
AVAILABLE BORON, ppm		B		lbs/A		
LIME REQUIREMENT		Ag - Lime (100% effectiveness)		Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% basis)		Tons/A		

SOIL TEXTURE	CLAY	%SAND	31.2	%SILT	8.0	%CLAY	

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY

PLEASE NOTE SPECIAL COMMENTS ON BACK

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
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POTASSIUM, MAGNESIUM, CALCIUM, SODIUM:

Potassium deficiency is most commonly associated with acid and/or sandy soils. Magnesium deficiency is much less common than potassium deficiency but can occur in sandy soils. Calcium or sodium deficiency is seldom, if ever, found in soils. The presence of excess sodium is evaluated with the exchangeable sodium percentage. Irrigation water contains varying amounts of these elements and should be considered when determining a soil fertility program.

SULFUR:

Sulfur deficiency is generally associated with sandy soils that have an organic matter level less than 1.3%. Application of some of the sulfur fertilizer in a starter fertilizer may prevent early season deficiency in some crops. Varying amounts of sulfur can be found in irrigation water and should be considered when applying sulfur fertilizer.

ZINC:

Zinc fertilizer recommendations are for an inorganic source such as zinc sulfate which is broadcast and incorporated. This method of applying zinc fertilizers should have a residual effect for 2-4 years. Zinc fertilizer can also be included in starter fertilizer and banded at about 20% of the recommended broadcast rate. This method of application will probably need to be repeated annually depending on soil test values. Zinc chelate fertilizer may be used at about 1/3 the application rate of inorganic products.

IRON:

Broadcast applications of inorganic iron fertilizer, such as ferrous sulfate, are ineffective in correcting iron deficiency because inorganic iron is quickly tied up in the soil. An iron deficiency is best corrected by spraying the crop with a 2% ferrous sulfate solution (1% for potatoes) at a rate of 20–30 gallons/acre beginning as soon as sufficient leaf foliage is present to intercept the spray. The spray application may need to be repeated if yellowing of foliage persists.

MANGANESE, COPPER AND BORON:

Yield response to these nutrients is unlikely in most cases. However, some crops do have a higher requirement for these nutrients and a yield response may occur, such as in sandy soils where the organic matter level is low. Excessive applications of these nutrients may cause toxicities in some soils. Use fertilizers containing these nutrients with caution.

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Gypsum requirement recommendations are made when the exchangeable sodium percentage exceeds 10%. The recommendation is given in tons/A of 100% gypsum. Gypsum (calcium) is required to reclaim soils high in sodium (sodic soils). In addition to application of gypsum, the sodium affected soil must have proper drainage and be leached with good quality water (high calcium, low sodium) to remove the excess sodium.

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Popcorn Sulfur	0.19
Elemental Sulfur	0.19
Sulfuric Acid	0.61
Lime Sulfur	0.78
Ferric Sulfate	1.09

TEXTURE:

Texture is a USDA classification based on the percentage of sand, silt and clay in the soil. Sand, silt and clay particles are divided according to size.

PARTICLE	PARTICLE SIZE
Sand	50 microns to 2 millimeters
Silt	2 to 50 microns
Clay	Less than 2 microns

Texture affects plant nutrient holding capacity, aeration, water penetration, and water holding capacity.

Laboratory Consultants
9213 South Hardy Drive, Tempe, Arizona 85284
Telephone (602) 893-1788

SUBMITTED BY: FRAN F BAILEY
ADDRESS:
GROWER: HYDRO RESOURCES
LAB NO.: 2276

SOIL FERTILITY REPORT

Celestina

SAMPLE MARKING	10 22-30	CROP		DATE RECEIVED	2/8/87
		YIELD GOAL	N/A	DATE REPORTED	2/11/87

SATURATION PERCENTAGE		SOIL pH	7.7	FREE LIME		ELECTRICAL CONDUCTIVITY mmhos/cm		EXCHANGEABLE SODIUM PERCENTAGE	

LAB TESTS	RESULT	SUGGESTED RECOMMENDATIONS		FERTILIZATION PLAN	
ORGANIC MATTER, %					lbs/A
ORGANIC NITROGEN	ppm / lbs/A		SIDEDRESS		lbs/A
NITRATE - NITROGEN Depth, in.	ppm / lbs/A		TOPDRESS		lbs/A
			STARTER		lbs/A
			FERTIGATION		lbs/A
AVAILABLE NITROGEN		N	lbs/A	TOTAL	lbs/A
AVAILABLE PHOSPHORUS — BRAY P1, ppm		P_2O_5	lbs/A	BROADCAST	
AVAILABLE PHOSPHORUS — BICARBONATE P, ppm			lbs/A		
EXCHANGEABLE POTASSIUM, ppm		K_2O	lbs/A		
SULFATE - SULFUR, ppm Depth, in.		S	lbs/A		
EXCHANGEABLE MAGNESIUM, ppm		MgO	lbs/A		
EXCHANGEABLE CALCIUM, ppm					
EXCHANGEABLE SODIUM, ppm					
AVAILABLE ZINC, ppm		Zn	lbs/A	STARTER	
AVAILABLE COPPER, ppm		Cu	lbs/A		
AVAILABLE IRON, ppm		Fe	lbs/A		
AVAILABLE MANGANESE, ppm		Mn	lbs/A		
AVAILABLE BORON, ppm		B	lbs/A		
LIME REQUIREMENT		Ag - Lime (100% effectiveness)	Tons/A		
GYPSUM REQUIREMENT		Gypsum (100% basis)	Tons/A		

SOIL TEXTURE	CLAY	%SAND	15.2	%SILT	36.0	%CLAY	48

VL = VERY LOW L = LOW M = MEDIUM H = HIGH VH = VERY HIGH

BY Harry Ames

SATURATION PERCENTAGE:

Grams of water required to wet 100 grams of soil to the saturation point. The saturation percentage is related to soil texture.

SATURATION PERCENTAGE	TEXTURE
Below 20	Sand or Loamy Sand
20 - 35	Sandy Loam
35 - 50	Loam or Silt Loam
50 - 65	Clay Loam
65 - 135	Clay
Above 135	Usually organic peat or muck

The water holding capacity of a field, when irrigated and allowed to drain, is approximately half the saturation percentage. About half the water holding capacity is available for crop use.

pH:

The pH of a soil paste wet to saturation measures the degree of acidity or alkalinity. A pH less than 7.0 is acid, pH 7.0 is neutral, and a pH greater than 7.0 is alkaline.

pH	PLANT RESPONSE
Below 4.2	Too acid for most crops to do well
4.2 - 5.5	Adapted to growth of acid tolerant crops
5.5 - 6.0	Adapted to growth of most crops
6.0 - 7.5	Optimum range for crop growth
7.5 - 8.4	Adapted to growth of most crops
Above 8.4	Indicates a severe sodium problem. However, sodium problems can occur at pH values lower than 8.4.

FREE LIME:

A positive test (Yes) indicates that the soil contains greater than 1% free lime.

ELECTRICAL CONDUCTIVITY:

Electrical conductivity (EC_E) of the saturation paste extract measures the soil salinity. Plant tolerance to salinity varies, but above some level all crop yields begin to decline. The following table relates salinity levels to expected crop response.

SALINITY LEVEL	EXPECTED YIELD REDUCTION, %
Very Low	0
Low	0 - 10
Medium	10 - 25
High	25 - 50
Very High	50 - 100

Poor water quality, management, or water penetration cause salinity problems. Soil salinity is reduced only by leaching with good quality water. A leaching requirement can be calculated if the crop to be grown, and soil, and irrigation water salinity are known.

EXCHANGEABLE SODIUM PERCENTAGE:

This value indicates the degree to which the soil exchange complex is saturated with sodium. Excess exchangeable sodium reduces water permeability and is toxic to some plants.

EXCHANGEABLE SODIUM PERCENTAGE	EXPECTED PROBLEM
Below 10	Generally no permeability problem due to sodium. However, sodium sensitive crops may show leaf burn.
10 - 15	Possible permeability problems with clay loams and clays.
Above 15	Permeability problems are likely on all mineral soils with possible exceptions of sands and loamy sands.

High sodium soils can be reclaimed by applicaton of a calcium source (see Gypsum Requirement) and thorough leaching.

ORGANIC MATTER:

Soil organic matter consists of decaying plant and animal residues. The amount present in soil is influenced by the climate of the area and management practices. Organic matter influences soil structure, aeration, water penetration, water holding capacity, and provides a source of plant nutrients especially nitrogen, phosphorus and sulfur.

NITROGEN:

Nitrogen recommendations are based on organic matter or organic nitrogen, nitrate-nitrogen, crop to be grown, and yield goal. Organic nitrogen is the nitrogen bound to organic matter. Approximately 2.5% of this nitrogen becomes available during the growing season. Nitrate–nitrogen is the form of nitrogen most available to plants. Available nitrogen is the amount of organic nitrogen and nitrate–nitrogen available to the crop during the growing season.

Nitrate–nitrogen is easily leached through the soil profile and lost to the crop. When high nitrogen rates are recommended on sandy soils or long season crops, split applications will better utilize the applied nitrogen and help to avoid late season deficiency. If nitrogen fertilizer is added to water used for flood irrigation, the nitrogen recommendations may have to be increased up to 40% depending on efficiency.

Where 10 tons of manure/A or more are applied, reduce N recommendation by 3-5 lbs./A/ton.

High amounts of nitrogen remaining after a crop indicates an accumulation of nitrogen is occuring and the amount of fertilizer should be gradually reduced. An acceptable level of residual nitrogen is 20–40 lbs./A. Levels greater than 100 lbs./A are excessive and should be reduced.

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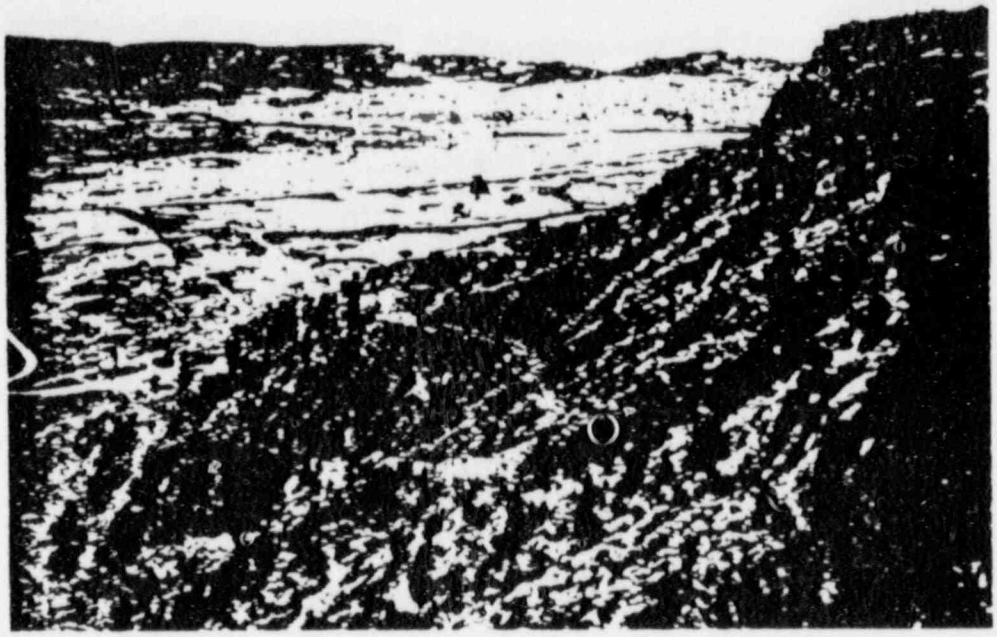
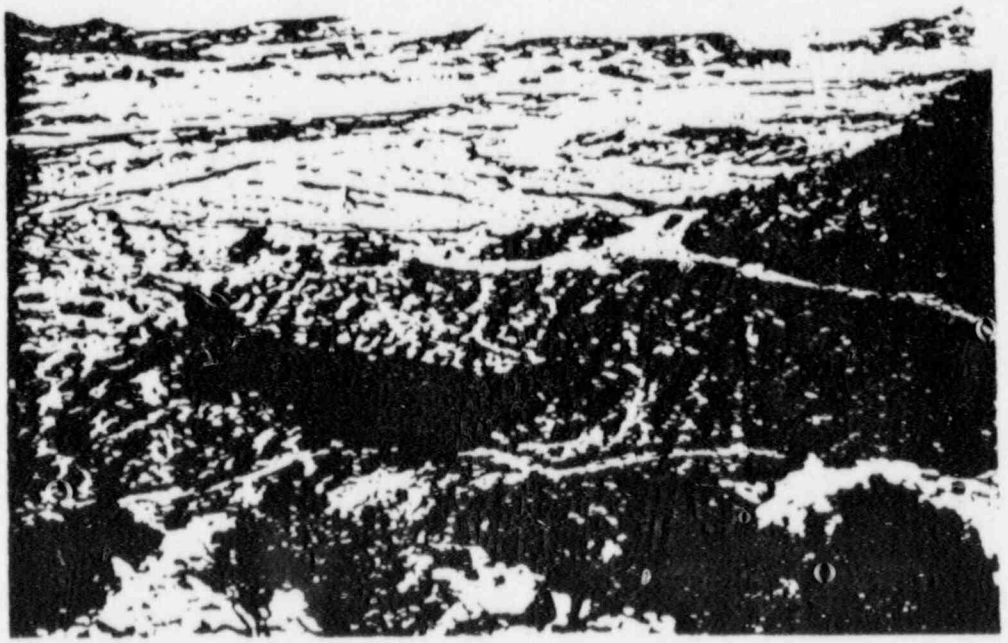
APPENDIX III

SOIL PHOTOGRAPHS

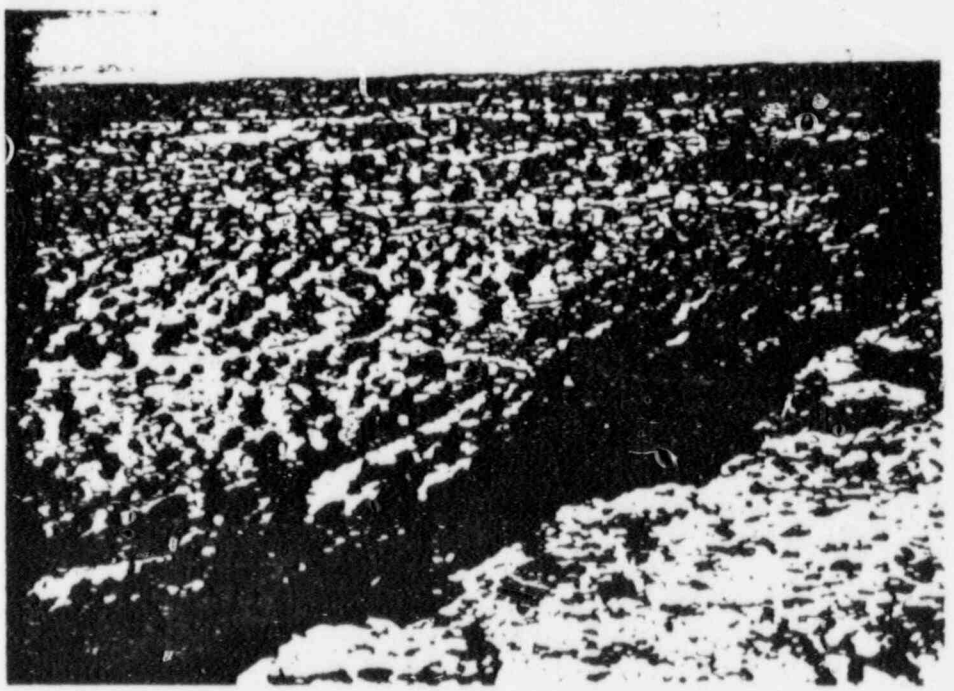


Broad view of parts of Sections 8 and 17

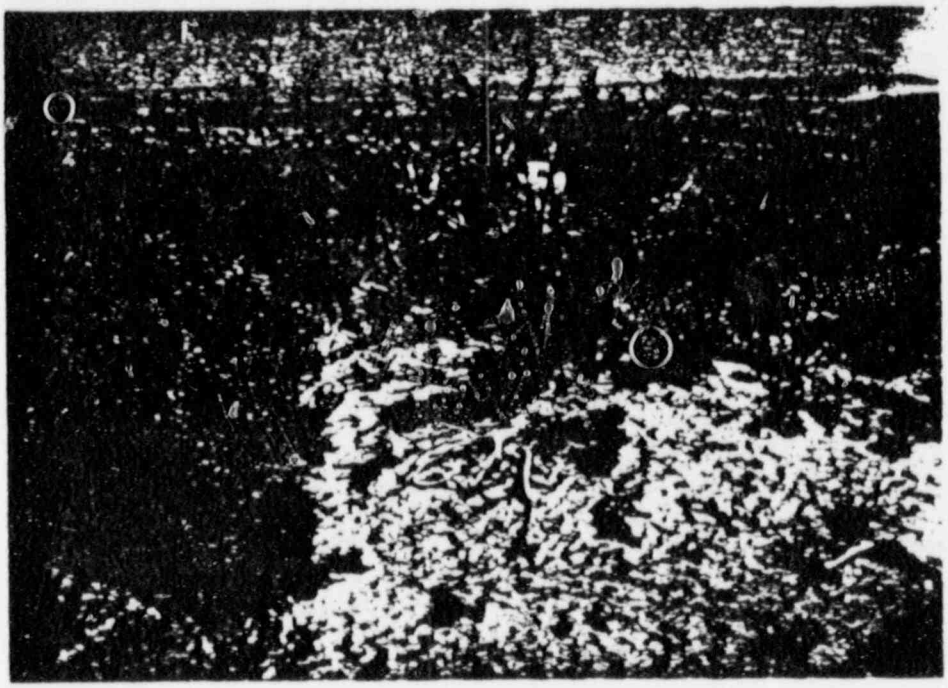


Broad view of part of Section 13

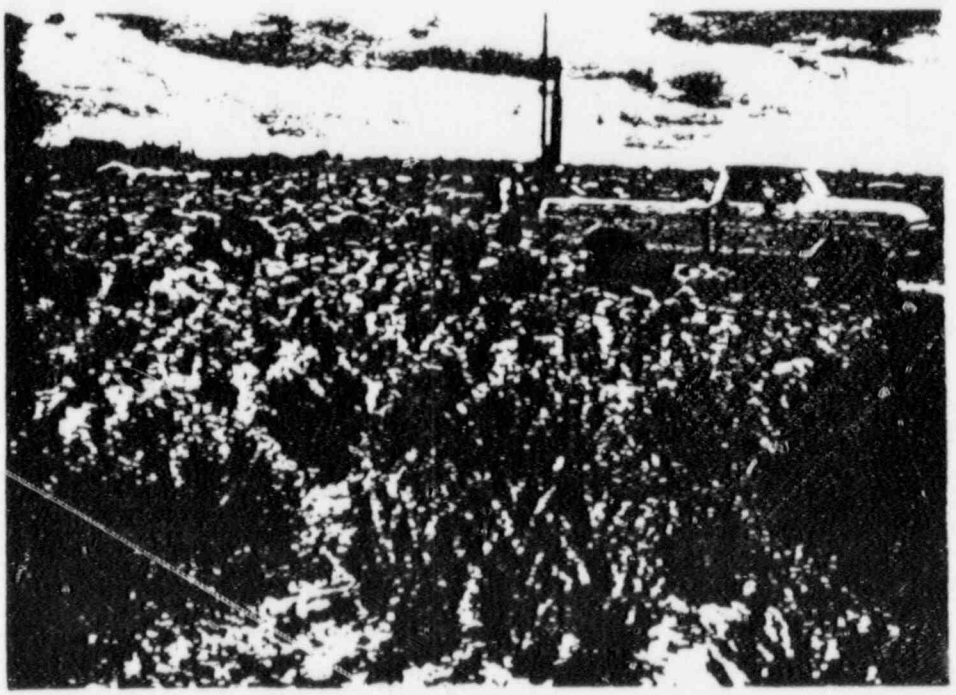
Map Unit 1 - Vessilla-Rock outcrop complex, 3 to 15 percent slopes



Map Unit 2 - Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes



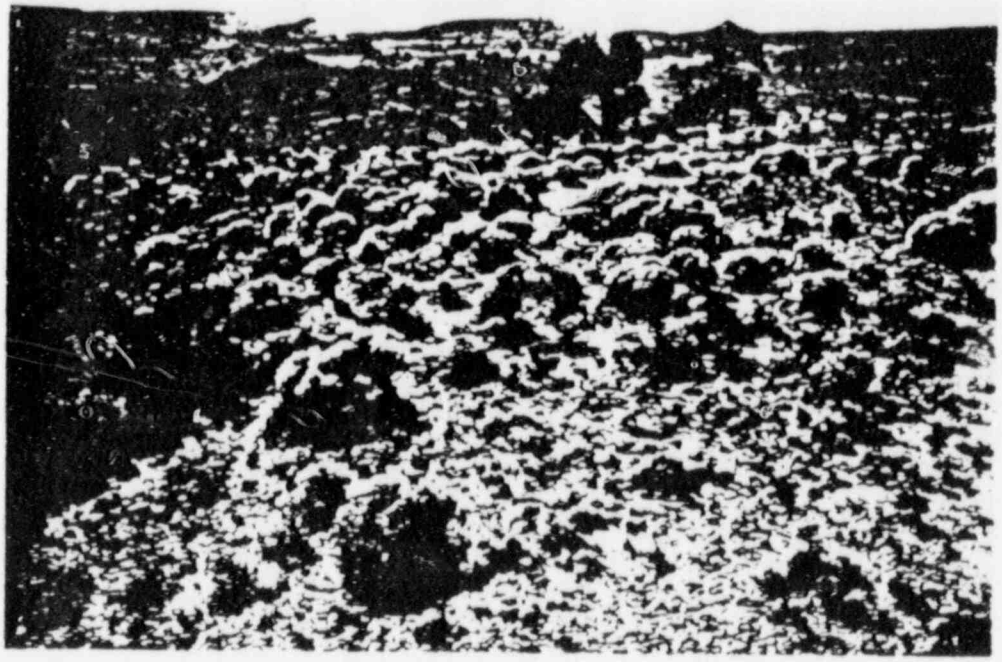
Map Unit 4 - Pinitos clay loam, 5 to 15 percent slopes, eroded



Map Unit 5 - Pinitos-Ribera complex, 5 to 8 percent slopes

Map Unit 6 (in valley) - El Rancho sandy loam, 3 to 8 percent slopes, gullied
Map Unit 2 (on sides of valley) - Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes

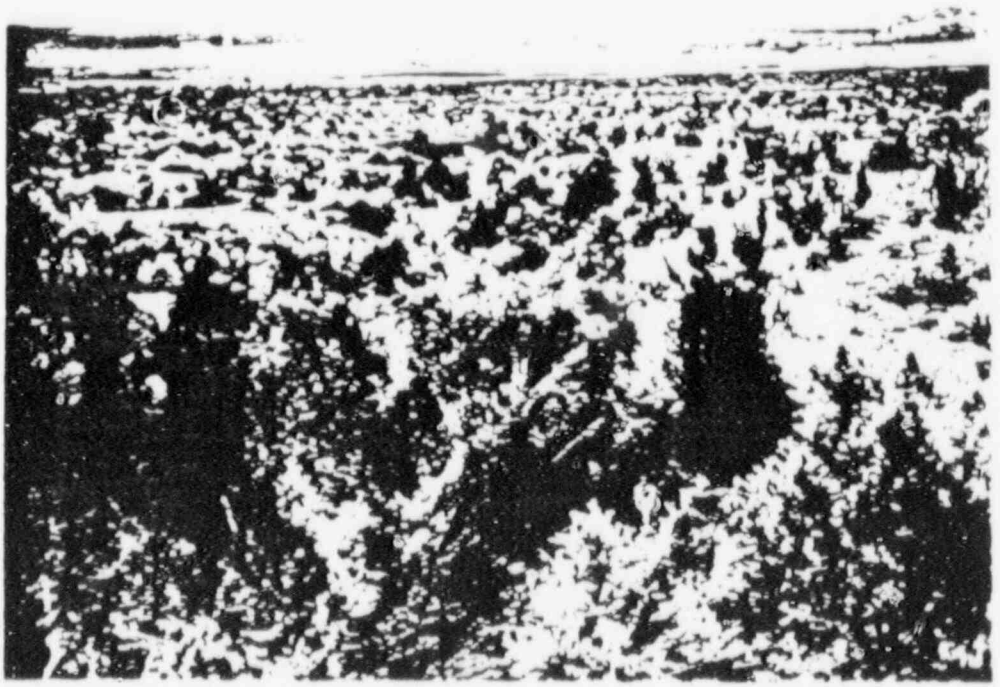
Map Unit 7 (foreground) - Flugle loam, 3 to 8 percent slopes, gullied
Map Unit 2 (in background) - Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes
Map Unit 8 (in background) - Mion-Rock outcrop complex, 8 to 40 percent slopes



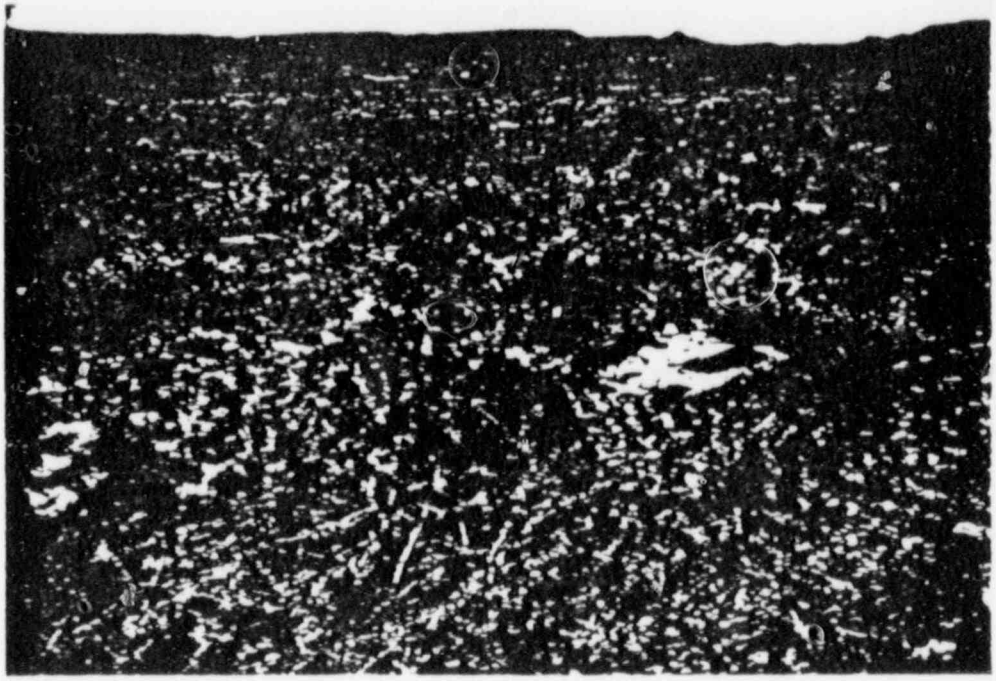
Map Unit 8 - Mion-Rock outcrop complex, 8 to 40 percent slopes

Map Unit 9 - Galestina clay, 3 to 8 percent slopes, gullied

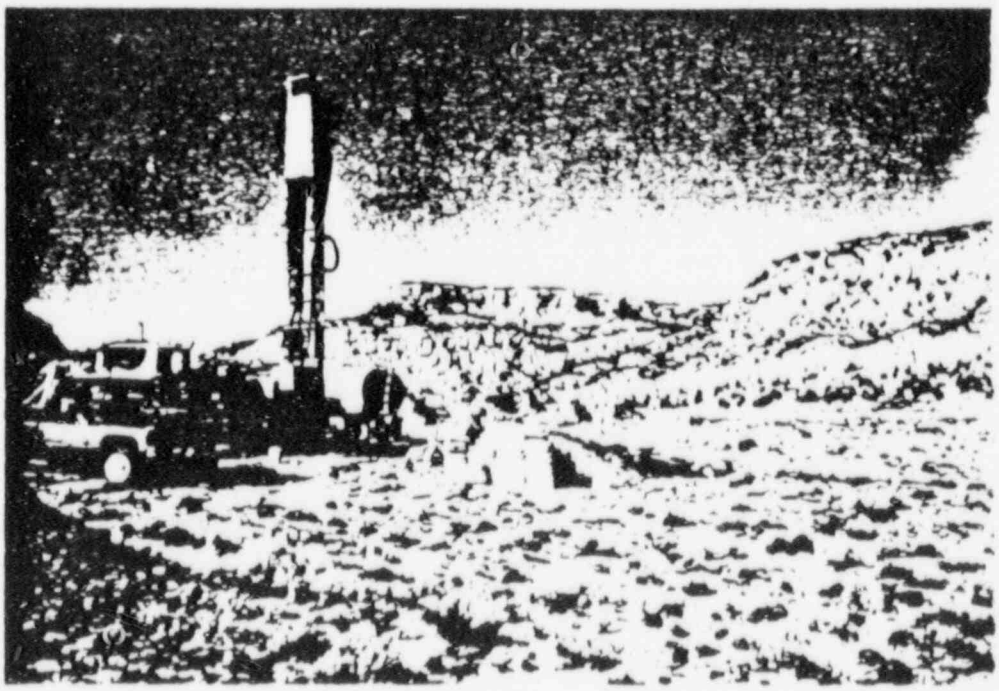
Map Unit 10 - Galestina clay loam, 1 to 3 percent slopes



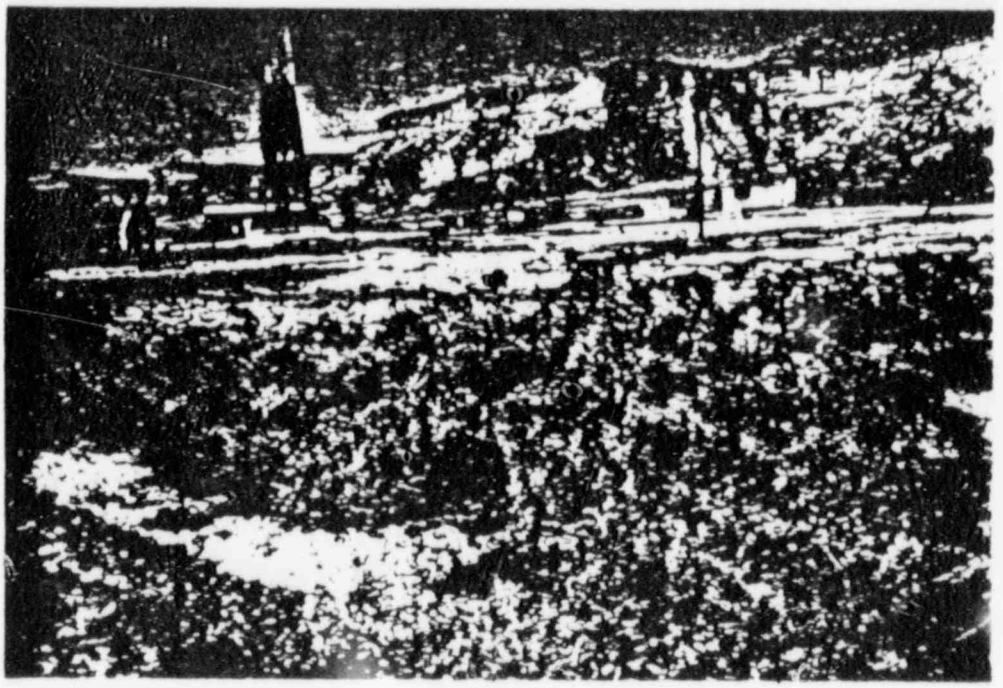
Map Unit 11 - Mikim clay loam, 3 to 5 percent slopes, gullied



Map Unit 12 - El Rancho sandy loam, 1 to 3 percent slopes



Map Unit 12A - El Rancho sandy loam, 5 to 8 percent slopes
Map Unit 2 (in background) - Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes



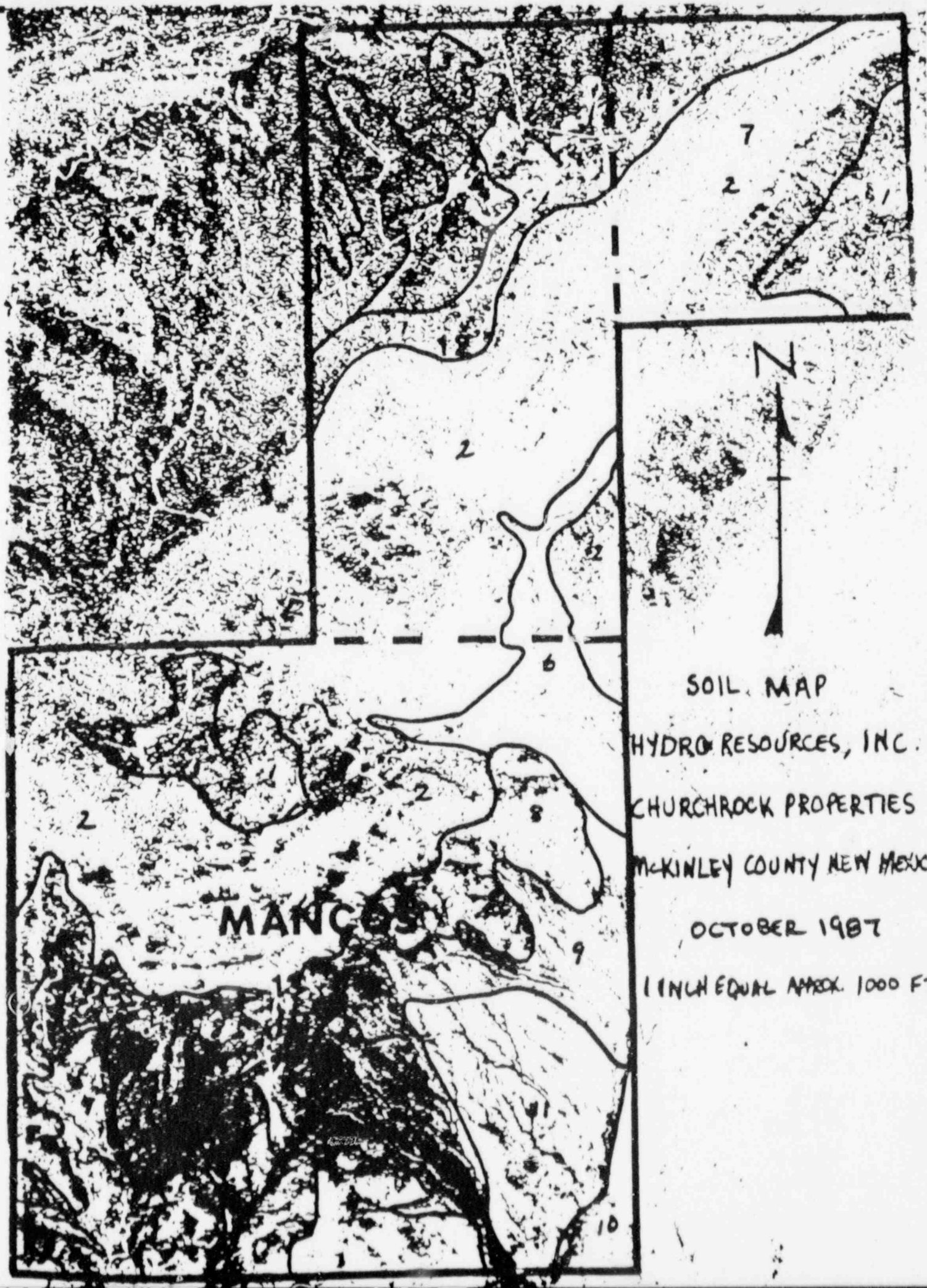
Map Unit 13 - Miscellaneous area

APPENDIX IV

MAP UNIT LEGEND
AND
SOIL MAPS

Map Unit Legend

Map Symbol	Soil Name
1	Vessilla-Rock outcrop complex, 3 to 15 percent slopes
2	Rock outcrop-Vessilla-Mion complex, 8 to 100 percent slopes
4	Pinitos clay loam, 5 to 15 percent slopes, eroded
5	Pinitos-Ribera complex, 5 to 8 percent slopes
6	El Rancho sandy loam, 3 to 8 percent slopes, gullied
7	Flugle loam, 3 to 8 percent slopes, gullied
8	Mion-Rock outcrop complex, 8 to 40 percent slopes
9	Galestina clay, 3 to 8 percent slopes, gullied
10	Galestina clay loam, 1 to 3 percent slopes
11	Mikim clay loam, 3 to 5 percent slopes, gullied
11A	Mikim loam, 1 to 3 percent slopes
12	El Rancho sandy loam, 1 to 3 percent slopes
12A	El Rancho sandy loam, 5 to 8 percent slopes
13	Miscellaneous area



SOIL MAP

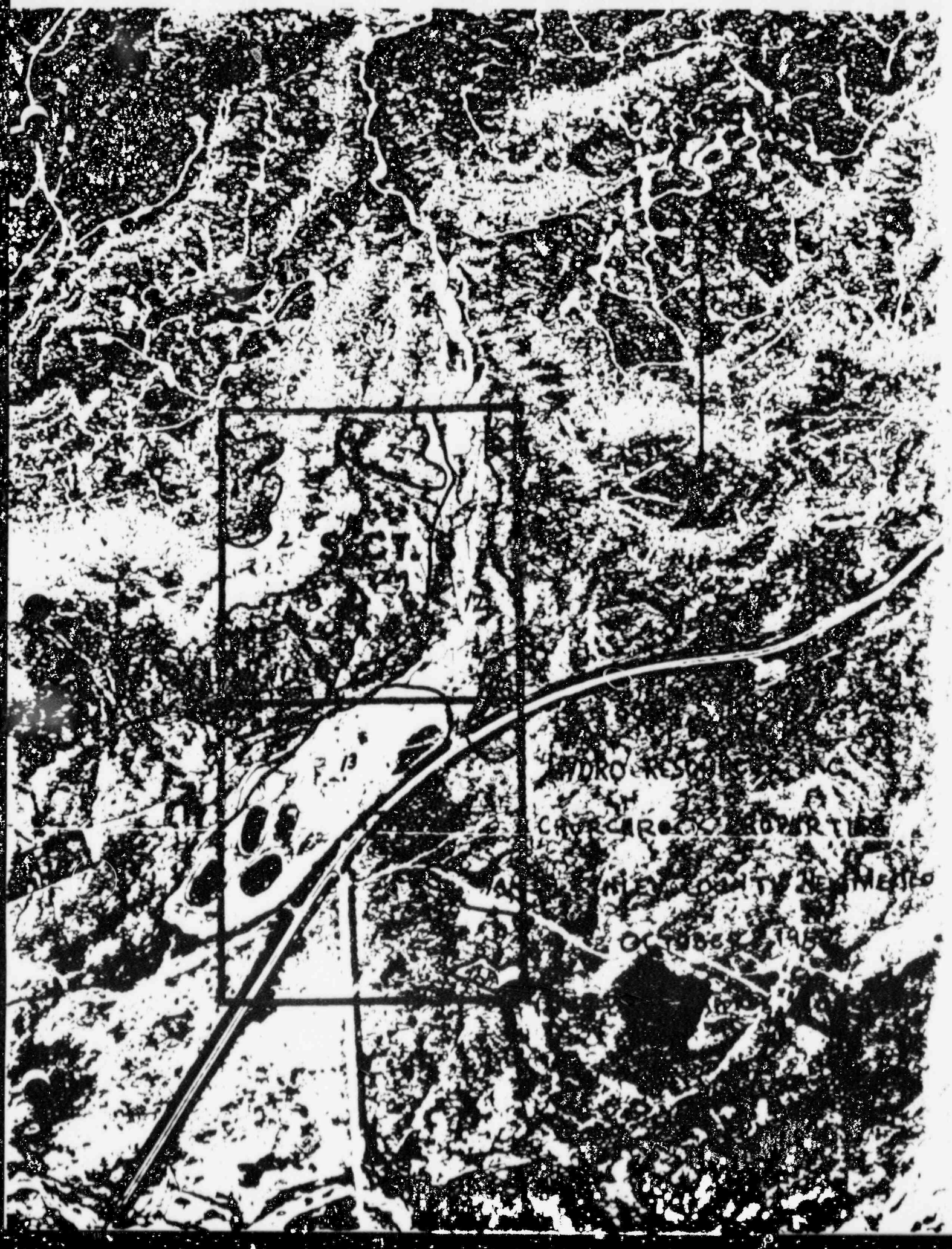
HYDRO RESOURCES, INC.

CHURCHROCK PROPERTIES

McKINLEY COUNTY NEW MEXICO

OCTOBER 1987

1 INCH EQUAL APPROX. 1000 FT


SECT.
13
HYDRO RESOURCES INC.
CAVE CANYON FEDERAL
MILEY COUNTY NEW MEXICO
OCTOBER 1985

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NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARDS 1

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