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ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: HINKSON RANCH

ALTERNATE NAMES:
HINKSON CATLLE CO.

APACHE COUNTY MILS NUMBER: 96

LOCATION: TOWNSHIP 16 N RANGE 30 E SECTION 8 QUARTER C
LATITUDE: N 34DEG 48MIN 52SEC LONGITUDE: W 109DEG 10MIN 57SEC
TOPO MAP NAME: POTTER MESA TANK - 7.5 MIN

CURRENT STATUS: EXP PROSPECT

COMMODITY:
GEMSTONE PET WOOD
COAL
URANIUM

BIBLIOGRAPHY:
AEC 172-477, P. 11
ADMMR GEOLOGY FILE-COAL-HINKSON
PET. WOOD OCCURRENCE:T15N-R25E, SEC. 29-C
AREAS THAT SHOW PROMISE FOR STRIPPABLE
RESERVES:T17N-R13E SEC. 21 & T16N-R30E,
SEC. 24
ADMMR HINKSON RANCH FILE

COAL EXPLORATION PROGRAM
ON THE HINKSON RANCH PORTION OF THE
GALLUP-ZUNI COAL FIELD



MORRISON-KNUDSEN COMPANY, INC.
CONTRACTORS - ENGINEERS - DEVELOPERS

Morrison-Knudsen Company, Inc.

CONTRACTORS - ENGINEERS - DEVELOPERS

EXECUTIVE OFFICE
400 BROADWAY
P. O. BOX 7808, BOISE, IDAHO 83729
U. S. A.

April 1, 1975

Mr. A. J. Pfister
Salt River Project
P. O. Box 1980
Phoenix, Arizona 85001

Subject: Coal Exploration near St. Johns, Arizona

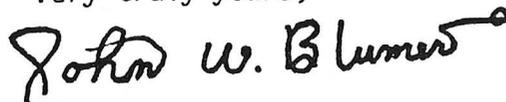
Dear Mr. Pfister:

We would like to submit our final reports for the coal exploration programs carried out near St. Johns, Arizona. The first report covers the results of the exploration program carried out on the Hinkson property in Arizona and New Mexico. The second report covers subsequent exploration near the town of Fence Lake, New Mexico.

Our studies include the basic data gathered in January and February of 1975 while evaluating the potential coal fields in the vicinity of the Coronado Generating station. Two areas of potential strippable coal reserves on the Hinkson property were drilled, mapped, and the tonnages calculated.

If additional clarification is needed in these reports, Morrison-Knudsen would be happy to respond with additional information as desired.

Very truly yours,



John W. Blumer
Manager Exploration & Geology

JWB/ph



COAL EXPLORATION PROGRAM
ON THE

HINKSON RANCH PORTION OF THE GALLUP-ZUNI COAL FIELD

APACHE COUNTY, ARIZONA AND
VALENCIA COUNTY, NEW MEXICO

by

Morrison-Knudsen Company, Inc.
Industrial and Mining Engineering Division
Exploration and Geology Department

March, 1975



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Access:

Access to the area is via Highway 666 north from St. Johns, Arizona, and eight to fifteen miles of ranch road. St. Johns is a small community with a resident population of about 1,300 people. Services available are limited to the basic necessities.

Except for the main road to the Hinkson ranch house, most of the ranch roads are unimproved and become very muddy during wet weather. Any roads directly on the Chinle formation or in Zuni Wash are locally impassable when wet. During dry weather, the roads are relatively smooth and accessible.

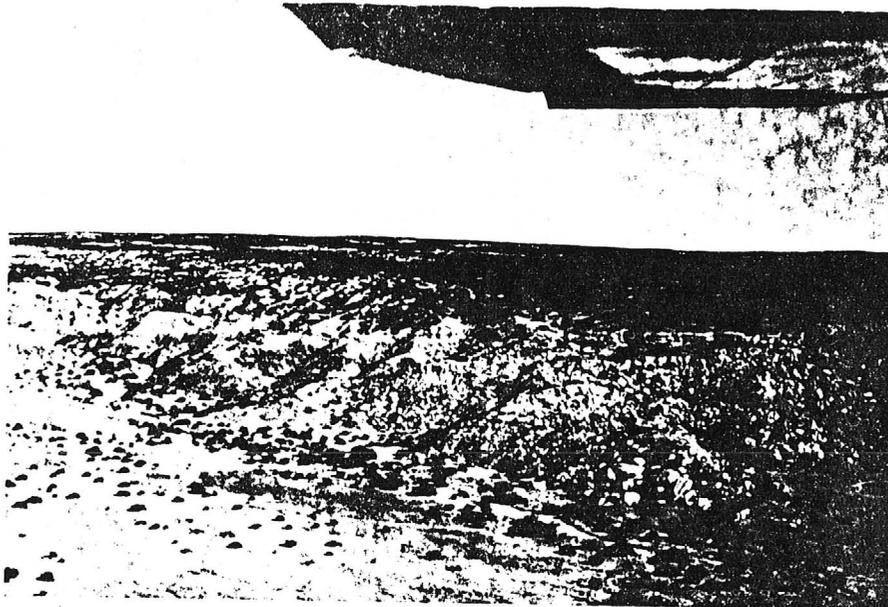


PLATE NO.1

South Zuni Area - mesa showing overburden with underlying Dakota sandstone and Triassic Chinle formation - slump block areas are located along the cliff faces.



PHASE III

- Final target drilling to delineate the coal reserves sufficiently to be 90% sure of reserve estimates.
- Detailed geologic mapping.
- Core analysis.
- Review all data with recommendations for further work.

Completion of Phase III would bring the reserve data to an indicated status giving quantity and quality of basic reserves. Detailed drilling would be required before engineering studies could commence.

Following the review of data at the end of each phase, Salt River Project had the option of proceeding to the next phase or terminating the project.

The results of Phase I were presented to Salt River Project in Phoenix on January 6, 1975. At this time, Salt River Project elected to proceed with Phase II, concentrating initially on the Hinkson Ranch.

The program on the Hinkson Ranch was slightly modified during Phase II to include more detailed drilling for a better overall evaluation of the Hinkson Ranch property. Thirteen holes were drilled rather than six as originally planned for Phase II.



INTRODUCTION

Location and Extent:

The Hinkson ranch is located in east-central Apache County, Arizona and southwestern Valencia County, New Mexico. The boundaries of the ranch are shown on the location map (page 3 of this section) and on Exhibits 1 and 2. The ranch includes approximately 120,000 acres of deeded land and 80,000 acres of state leased land.

The mineral rights as shown on Exhibit 1 contain several large contiguous blocks of Santa Fe Industries (hence called Santa Fe) ownership, a checkerboard of state and private sections, and minor Federal ownership.

For the purpose of this study, the Hinkson Ranch, in Arizona, has been divided into two areas: North and South Zuni. The dividing line between the two areas is the basalt outcrop south of Zuni Wash. South Zuni was further divided into Blocks A & B. Block A is predominately Santa Fe mineral rights and lies between the basalt and Township 15 North. Block B, which is to the south, is checkerboarded state and private mineral rights.

In New Mexico, the ranch has been further divided into Zuni Plateau and North Carrizo - Block A. The mineral rights are controlled by the Santa Fe in both cases, with some state and Federal sections included.

Previous Investigations:

The coal occurrences on the Hinkson Ranch were originally brought to the attention of Salt River Project by Darwin and Merwin Grant. Some initial work was done under the direction of Niles Grosvenor, Vice President of Gates Engineering Company's western operations. During this program,

ARIZONA
NEW MEXICO

HINKSON RANCH
BOUNDARY

PLANT SITE

AREA OF INTEREST
BOUNDARY

VALENCIA CO
CATRON CO.

SALT RIVER PROJECT COAL STUDY	
LOCATION MAP HINKSON RANCH ARIZONA & NEW MEXICO	
SCALE	3 MILES
DATE	
BY	
MERRILL N. KNUDSEN	INC.



GEOLOGY

Source of Information:

Several published and unpublished reports were used in compiling the original resource and geologic data. Information for Arizona was drawn heavily from U.S.G.S. Water Supply Paper 1771, by J. P. Aker, published in 1964.

The reports used most frequently for information in New Mexico are:

1. Geology and Coal Resources of the Gallup-Zuni Basin, N.M., by J. D. Sears in U.S.G.S. Bulletin 767 - 1925.
2. Stratigraphy of West Central New Mexico, in Guidebook to Geology of SW San Juan Basin - Four Corners Geologic Society, 2nd Field Conference, by C. H. Dame - 1959.
3. Cretaceous Sediments of the North Plains, McKinley, Valencia, and Catron Counties, in New Mexico Geologic Society Guidebook, Tenth Field Conference, by K. L. Gadway - 1959.
4. Cretaceous Stratigraphy of the San Juan Basin, New Mexico Geologic Society Guidebook - Second Field Conference, by Caswell Silver - 1951.

Additional information came from masters theses submitted to the University of Texas, from petroleum exploration well logs, from logs of uranium exploration holes, and from personal communications with Roy Foster and Frank Kottowski of the New Mexico Bureau of Mines and Mineral Resources of Socorro, New Mexico.



Rock Units:

Chinle formation: The basal unit exposed in the subject area is the Chinle formation of Triassic age. Though only the upper portion of the formation is exposed, petroleum exploration drilling information has shown that the unit is 1,500 feet thick in this area. The Chinle is characterized by a thick series of colorful lenticular beds of claystone, siltstone, sandstone and conglomerate. The upper part of the unit contains carbonaceous material and silicified wood fragments. The Chinle in Apache County, Arizona is divided in ascending order into the Shinarump, Mesa Redondo, and Petrified Forest members. In a southeast and south direction, the unit wedges out completely.

In the prospect area, the Chinle weathers into badlands topography, with small steep-sided hills and almost no vegetation. The colors are pastel with grey, orange and red predominating. The weathered rock is incompetent which causes the overlying Dakota sandstone to slump downward in relatively undisturbed blocks with only slight rotation. This slumping locally makes the stratigraphy difficult to decipher. Exploration drilling showed the first 50 feet of the Chinle formation to be a grey and green shale and siltstone. The contact is readily recognized on the geophysical logs because of a characteristic decrease in resistivity and increase in gamma ray count and density.

Dakota sandstone: The Chinle formation is unconformably overlain by the Dakota sandstone of Upper Cretaceous age. The unconformity is slightly angular on a regional basis, but the angularity is not evident in local exposures.

The Dakota consists of a basal conglomerate with chert, quartzite and limestone pebbles grading upward into a well to poorly sorted sandstone



composed of sub-angular quartz grains with local cross-bedding and interbedded grey shale, carbonaceous shale, and coal. The sandstone beds are commonly cliff formers and vary in color from white to light and medium orange brown. In North Zuni, just east of Highway 666, the Dakota is a light to medium red, similar to the underlying Chinle.

In the Hinkson Ranch area, the Dakota varies from 60-150 feet thick and thins even more further south. The shale interbeds with accompanying thin coal seams are more prominent in the upper one-third of the unit. One exception to this is an exposure in Section 32, T.15N., R.31E., which has coal and carbonaceous shale immediately above the basal conglomerate of the Dakota.

In the northern part of the North Zuni area, the Dakota has been planed off by erosion and the upper coal bearing units have been removed. This erosional surface was noted in drill holes SR 752, 755 and 757.

Mancos Shale: The Mancos shale, which conformably overlies the Dakota, is a soft non-resistant unit and hence is usually not well exposed. One of the best exposures on the Hinkson Ranch is in Section 25, T.16N., R.30E. Here the unit is a relatively uniform light to medium grey-green shale and mudstone, with local areas of light yellowish-grey shale. The Mancos, which grades upward into the Mesa Verde group, increases in sandstone lenses and beds toward the top; it also becomes increasingly carbonaceous. This sequence is not exposed on the Hinkson Ranch.

The Mancos shale is locally fossiliferous and on the Hinkson Ranch is highly fossiliferous at its base. Numerous fragments of Gryphaea newberryi litter the ground in some areas. About 20 feet above the base is a concretionary mudstone layer about two feet thick, which contains brown calcite



filled vugs and locally has preserved ammonite fossils up to one and one-half feet in diameter.

The entire section is not exposed on the Hinkson Ranch, but to the east, in New Mexico, measured sections and drill hole information indicate that the unit is 300-500 feet thick. Further north, toward the type section in Colorado, the unit thickens to over one thousand feet.

Mesa Verde group: Evidence from the present drilling program and from reconnaissance geologic mapping, indicates that the Mesa Verde group is eroded away on the Hinkson Ranch.

Tertiary sediment: The higher areas on the Hinkson Ranch are covered by more than 100 feet of Tertiary sands, clays, and gravels that are poorly to moderately consolidated. This masking cover is present in varying thicknesses over a good portion of the Hinkson Ranch. The unit was deposited on an erosional surface of low to moderate relief.

Basalt flows: Just south of Zuni Wash is a narrow plateau, which is capped with one or more flows of dark grey vesicular basalt. The flows evidently followed an ancient river bed, and subsequent erosion has reversed the topography by eroding away the surrounding shales and sandstones. The flows appear locally to be at least 50 feet thick. Remnants of the same flow can be seen from Highway 666, just north of the Zuni River.

Recent alluvium: The bottoms of the washes and many of the ridges are covered by a 1-20 foot layer of recent alluvium - in most places an unconsolidated sand or clay, which is light grey to reddish brown. Windblown sand is common on the ridges and forms northeast trending ridges parallel to the prevailing winds.



EXPLORATION PROGRAM

Field Reconnaissance:

After completing data gathering and compilation, a brief reconnaissance of the south end of the Gallup-Zuni was undertaken. During this period an aerial reconnaissance was conducted using a Cessna 172, chartered in Gallup, New Mexico from Atsidi Aviation. All Dakota sandstone and Mesa Verde group outcrops in the target areas were flown at low level. Obvious coal shows were plotted on field maps for later field investigation.

Ground investigations were limited because of difficulty in obtaining access without causing excessive interest by the local ranchers. For this reason, no field work was done on the Hinkson Ranch, beyond the original examination by John Blumer and Dick Finger, until the option was accepted by the Hinksons.

Geologic Mapping:

Reconnaissance geologic mapping was carried out by Don Jennings, Sr. Geologist and Pat Roddy, Geologist for Morrison-Knudsen Company, prior to and during the drilling program. Because of the large area involved and the necessity of monitoring the drilling project closely, mapping was restricted to spot checks of strategically located outcrops and subsequent interpretation on 1:24,000 scale orthophotos. The number of excellent exposures and the simplicity of the structures allow the geology to be mapped at this scale with considerable detail based on relatively brief field observations.

Altimeter surveys were conducted concurrently with some of the geologic mapping in order to correlate outcrops with drill hole information



operation. Approximate drilling costs for the project were \$3/ft. which includes mobilization, demobilization, drilling hours (at \$45/hr.), bits, drilling mud, and lost circulation material.

Based on the experience gained from the present drilling program, penetration rates in the Mancos shale and Dakota sandstone should average 250-350 feet/day, including moves, with a 10 hour day. Bit consumption will be one to two bits per hole. The unconsolidated overburden, Tertiary deposits, and Mancos shale can be drilled with an insert finger-bit. The Dakota sandstone requires a soft formation tri-cone rock bit. Lost circulation can be expected at the top of the Dakota sandstone and also at various places in the unconsolidated overburden and the sandstone beds of the Dakota. None of the lost circulation zones proved to be severe.

Geophysics:

A geophysical logging unit was kept with the drill rig, and after each hole was drilled, density, gamma ray and resistivity logs were obtained to supplement the sample log prepared by Pat Roddy, M-K Geologist. The geophysical unit was supplied by United Logging from Alice, Texas and operated by Millard Parker.

The density log provides a measurement of relative density of the rock units up and down the hole, gamma ray gives a reading of the natural gamma radiation, and resistivity shows the electrical resistivity. Coal normally has a density significantly lower than shale and sandstone, low natural radiation, and very high electrical resistance.

The logs are obtained by lowering the sonde to the bottom of the hole and recording the variations on chart paper as the sonde is winched up. The procedure was repeated twice for each hole - once for the density and resistivity and again for the gamma ray log.



Several three foot exposures were observed, but proved to thin laterally. Multiple seams are common, but in no case exceed a composite thickness of four feet. Partings between seams are seldom less than five to ten feet and include both sandstone and shale. The local presence of black carbonaceous shale above and/or below the coal seams could make recognition of the coal difficult during mining.

Two areas which show some promise for strippable reserves are plotted on Exhibits 7 and 8. The first is the lowlands surrounding the Zuni Wash outcrop in Section 21, R.17N., R.31E., where there is an area of 2050 acres with a maximum overburden depth of 60 feet. Assuming a 2.5 foot thickness, as seen in SR 753, there would be nine million tons of potentially strip-pable coal in this block. This figure would depend upon the continuity of the bed and upon the amount of coal that has eroded away, in and adjacent to the main washes. Minor additional reserves may be found behind the outcrop of the coal to the west of this area, but these additional reserves are not expected to add significantly to the reserve figure for North Zuni.

The second area is in the vicinity of Section 24, T.16N., R.30E., in South Zuni-Block A. The surrounding mineral rights are controlled by the Santa Fe. Coal occurs in a seam up to three feet thick near the top of the Dakota sandstone. The Dakota sandstone forms a dip slope which is dissected by several box canyons. The area with shallow cover is about 1470 acres in which about 320 acres of the coal bearing unit is eroded away. Beyond this shallow cover area, Mancos shale, and Tertiary sands and gravels thicken rapidly. Assuming an average thickness of two and one-half feet, the potentially strippable reserve for this area is about five million tons of coal. Locally the cover in this area is thin enough that the coal may



EXHIBIT NO. 4
DRILL DATA SHEETS

PROJECT ZUNI COAL FIELDS

FOR SALT RIVER PROTECT

HOLE NO. SR 751

PHOTO Wolford Springs ISE AZ 4868

STATE Arizona COUNTY Apache

MAP _____

LOCATION bbd, sec. 21, T17N,

DATE 26 Jan 1975

R31E

DRILLER (Type) H. Harvey w/ Mayhew 600

ELEVATION 6014 Ft.

GEOPHYSICS (Operator) M. Parker, United Logging Inc.

by altimeter

FR x, density (XX)

OWNERS (M) Hinkson (S) Hinkson

MUD CONTROL air to 30'

H₂O to 102'

no mud

REMARKS & SKETCH

	⊙			

GEOLOGIST P. Paddy

GEOLOGIC FORMATION Tertiary sediments

Cretaceous Dakota sandstone

Triassic chert fm.

LITHOLOGIC SAMPLES 0-20' - air samples,

20'-102' mud stained samples

@ 5' intervals - cuttings left at site

T. 17N R. 31E Sec. 21

Tract bbd

CORE none

NOTES: drag bit to 85'

rock bit 85'-102'

site on flat terrain at bottom of hill

HYDROLOGIC DATA H₂O at 20'

TOTAL DEPTH (D) 102 FT

PROJECT EUNI COAL FIELD
 HOLE NO. SR753
 PHOTO Welford Springs 1SE A2 4868
 DATE 29 Jan. 1975
 DRILLER (Name & Type) H. Harvey w/ Mayhew 600

FOR SALT RIVER
 STATE ARIZONA COUNTY APACHE
 LOCATION dacd, sec. 21,
T17N, R31E

LOGGING PHYSICS (Operator) M. Parker, United Logging
Inc. SP, X, density (xx)
 MUD CONTROL Aqua Gel 0-100'
bran 7-100'

ELEVATION 6050 Ft.
 by _____
 OWNERS (M) Hinkson (S) Hinkson

GEOLOGIST P. Roddy
 GEOLOGIC FORMATION Tertiary sediments
Cretaceous Mancos shale
Cretaceous Dakota sandstone

LITHOLOGIC SAMPLES mudstained to
100 Ft. @ 5' intervals;
cuttings left at site.

CORE none (see SR753C)
SR753C to 48', core 41-48'
recovery: 4.5'

HYDROLOGIC DATA -

TOTAL DEPTH (D) 100 Ft.

REMARKS & SKETCH

T. 17N R. 31E Sec. 21
 Tract dacd

NOTES: lost circ. at 7'- bran
drag bit to 30'
rock bit 30' - 100'

PROJECT ZUNI COAL FIELD
 HOLE NO. SR 755
 PHOTO Wolford Springs 1SWA2 4768
 MAP _____
 DATE 31 Jan. 1975
 DRILLER (Type) H. Harvey w/ Mayhew 600

FOR SALT RIVER PROJECT
 STATE Arizona COUNTY Apache
 LOCATION bad, sec. 23
T17N, R30E

GEOPHYSICS (Operator) Miner United Logging Inc., FE, X, density (XX)
 MUD CONTROL Agua gel 0'-232'
bran 86'-232'

ELEVATION 6129 ft.
 OWNERS (M) Hinkson (S) Hinkson

GEOLOGIST P. Roddy
 GEOLOGIC FORMATION Tertiary sediments
Cret. Mancos shale?
Cret. Dakota sandstone
Triassic Chinle fm.

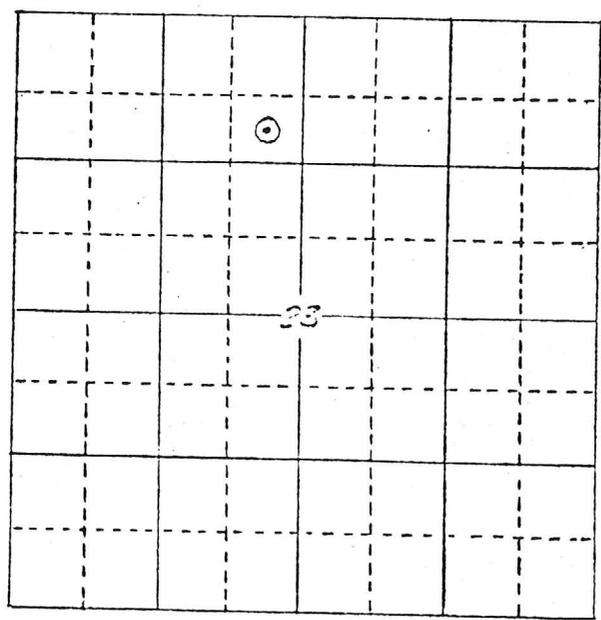
GEOLOGIC SAMPLES mid stream samples from 0'-232' @ 5' intervals; cuttings watered at site.

RE none

GEOLOGIC DATA water at 129 ft.

TOTAL DEPTH (D) 232 ft

REMARKS & SKETCH



T. 17N R. 30E Sec. 23
 Tract bad

NOTES: lost circ. at 86'
rock bit 0'-20'
drag bit 20'-135'
rock bit 135'-165'
new rock bit 165'-232'

PROJECT ZUNI COAL FIELD

FOR SALT RIVER PROJECT

HOLE NO. SR 756

PHOTO Wolford Springs, ISW AZ, 4768

STATE ARIZONA COUNTY APACHE

MAP _____

LOCATION da, sec. 33, T17N, R30E

DATE 3 Feb. 1975

DRILLER (Type) H. Harvey w/ Matthew 600

ELEVATION 6105 ft.

GEOPHYSICS (Operator) M. Parker, United Logging Co.

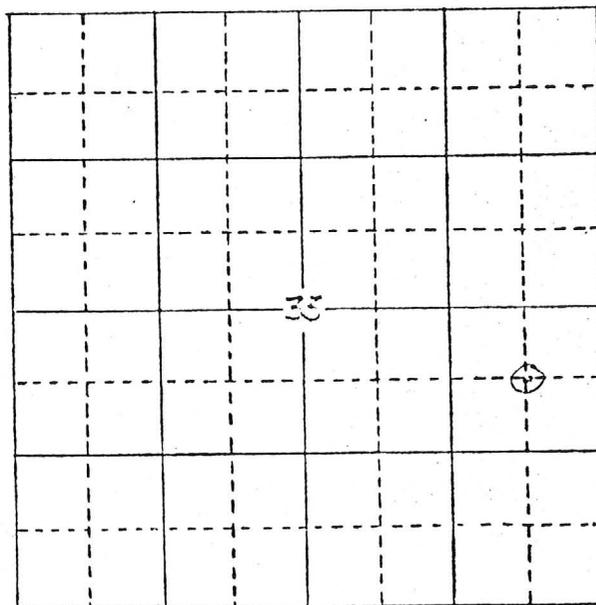
by altimeter

ER X, density (XX)

OWNERS (M) Hinkson (S) Hinkson

MUD CONTROL Super gel 0'-149'
brn 37'-149'

REMARKS & SKETCH



GEOLOGIST P. Roddy

GEOLOGIC FORMATION Quaternary Alluvium
Cret. Mancos shale
Cret. Dakota sandstone

T. 17N R. 30E Sec. 33

Tract da

LITHOLOGIC SAMPLES mud drilled to
149' @ 5' intervals, cuttings
scattered at site.

NOTES: lost circ. at 27'

CORE none

rock bit 0'-25'

drag bit 35'-149'

HYDROLOGIC DATA -

TOTAL DEPTH (D) 149 ft.

PROJECT ZUNI COAL FIELD
 HOLE NO. SR 759
 PHOTO Wolford Springs 4NW AZ 4769
 MAP _____
 DATE 5-6 Feb. 1975
 DRILLER (Type) H. Harvey w/ Mayhew 600

FOR SALT RIVER PROJECT
 STATE ARIZONA COUNTY APACHE
 LOCATION acbb, sec. 3, T15N, R30E

GEOPHYSICS (Operator) M. Parker, United Logging Inc ER, & density (88)
 MUD CONTROL Super gel 0 - 84.5'

ELEVATION 6252 ft.
by altimeter
 OWNERS (M) Hinkson (S) Hinkson

ELOGIST P. Roddy
 ELOGIC FORMATION Quaternary alluvium
Cret. Dakota sandstone
Triassic Chinle fm

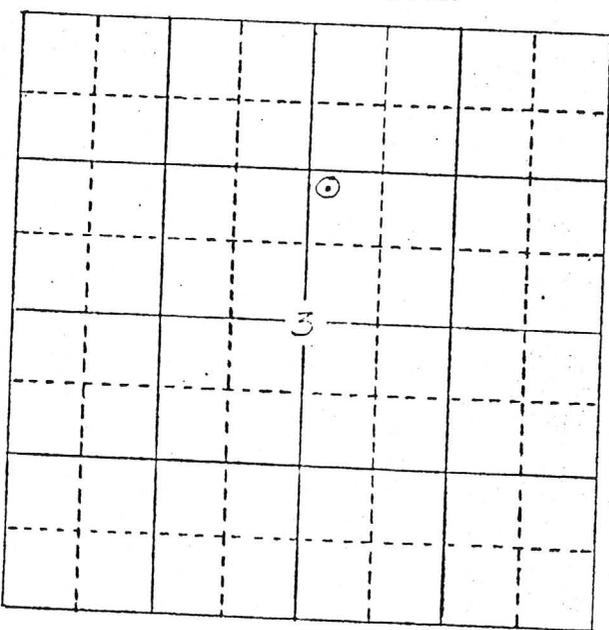
THOLOGIC SAMPLES undisturbed to 85 ft. @ 5' intervals; cuttings scattered at site

RE none

PROLOGIC DATA -

AL DEPTH (D) 85 ft

REMARKS & SKETCH



T. 15N R. 30E Sec. 3
 Tract acbb

NOTES: flat terrain at top of plateau
rock bit 0-38'
drag bit 38'-85'

PROJECT 3 1 2001 FIELD

FO SALT RIVER PROJECT

HOLE NO. SP 7510

PHOTO _____

STATE ARIZONA COUNTY YAVAPAI

MAP _____

LOCATION acba, sec. 5,
T15N, R31E

DATE 6 Feb 1975

DRILLER (Type) H. Harvey

ELEVATION 6535

w/ Mayhew 600

GEOPHYSICS (Operator) W. Butler United Loggers

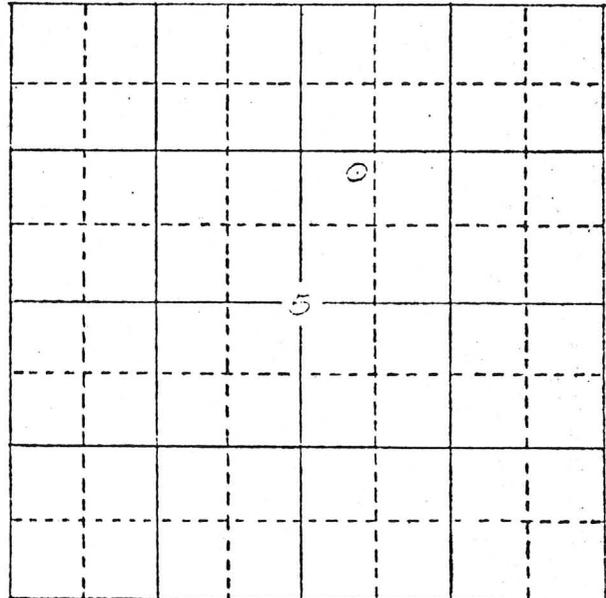
by calibration

for density

OWNERS (M) Harvey (S) Harvey

MUD CONTROL Super salt solution

REMARKS & SKETCH



GEOLOGIST S. J. ...

GEOLOGIC FORMATION ...

LITHOLOGIC SAMPLES ...

CORE ...

HYDROLOGIC DATA Fluid level at 110'

TOTAL DEPTH (D) 300'

T. 15N R. 31E Sec. 5

Tract acba

NOTES: ...

DRILL LOG

7 Feb 1975

DEPTH FROM	IN FEET TO	LITHOLOGY
0'	15'	clay, silty w/ sand; yellow brown to reddish brown; calcareous zone
15'	30'	silt, red w/ clay and sand; calcareous zone
30'	48'	shale, light brown to dark brown w/ silt, sand, and gravel
48'	52'	sandstone, lt. brown w/ clay & silt, semi-consolidated
52'	79'	shale, brown interbedded w/ sands & silts
79'	82'	shale; yellow to light brown w/ silt, sand & gravel
82'	105'	shale, yellow to olive green, w/ yellow-orange siltstone, white to gray clay and dark green claystone
105'	145'	shale, gray, olive, black w/ silt; interbedded w/ light to dark gray sandstone
145'	150'	sandstone, light to dark gray w/ black shale
150'	159'	shale gray w/ coal, orange siltstone, and carbonaceous clay
159'	165'	sandstone, gray w/ siltstone
165'	171'	shale interbedded w/ light to med. gray sandstone
171'	241'	sandstone, light to dark gray w/ carbonaceous bands and interbedded w/ gray shales, siltstones, white clays.
241'	255'	shale, light gray w/ black shales, gray siltstone, white clay and orange siltstones.

PROJECT ZC 1 COAL FIELD FC SALT RIVER PROJECT

HOLE NO. SR7513

PHOTO Wolford Springs 4NEA24869 STATE Arizona COUNTY Apache

MAP _____ LOCATION CC, sec. 19, T15N, R31E

DATE 8-9 Feb. 1975

DRILLER (Type) H. Harvey w/ Mayhew 600

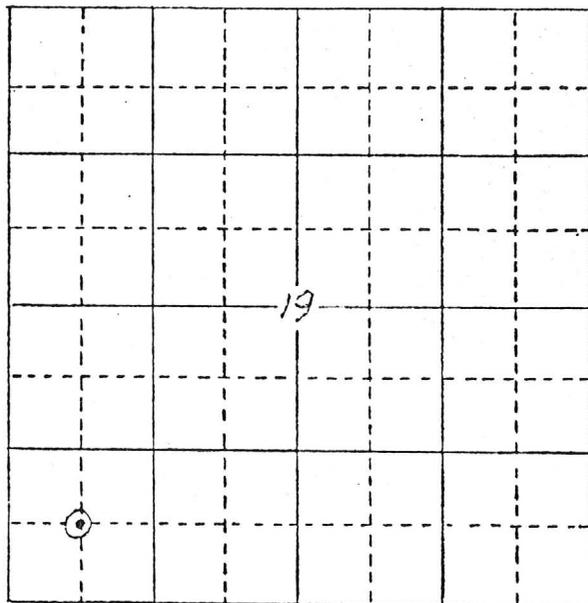
ELEVATION 6595 ft

GEOPHYSICS (Operator) M. Parker, United Logging Inc. by altimeter

ER, γ , density γ OWNERS (M) Hinkson (S) Hinkson

MUD CONTROL Super gel 0-300'

REMARKS & SKETCH



GEOLOGIST P. Roddy

GEOLOGIC FORMATION Tertiary sediments

Cret. Mancos shale

Cret. Dakota sandstone

LITHOLOGIC SAMPLES undisturbed to 300' @ 5' intervals; cuttings scattered at site

T. 15N R. 31E Sec. 19

Tract CC

CORE none

NOTES: Tricone roller rock bit
0'-20', 250'-300'; drag bit
20'-250'

HYDROLOGIC DATA -

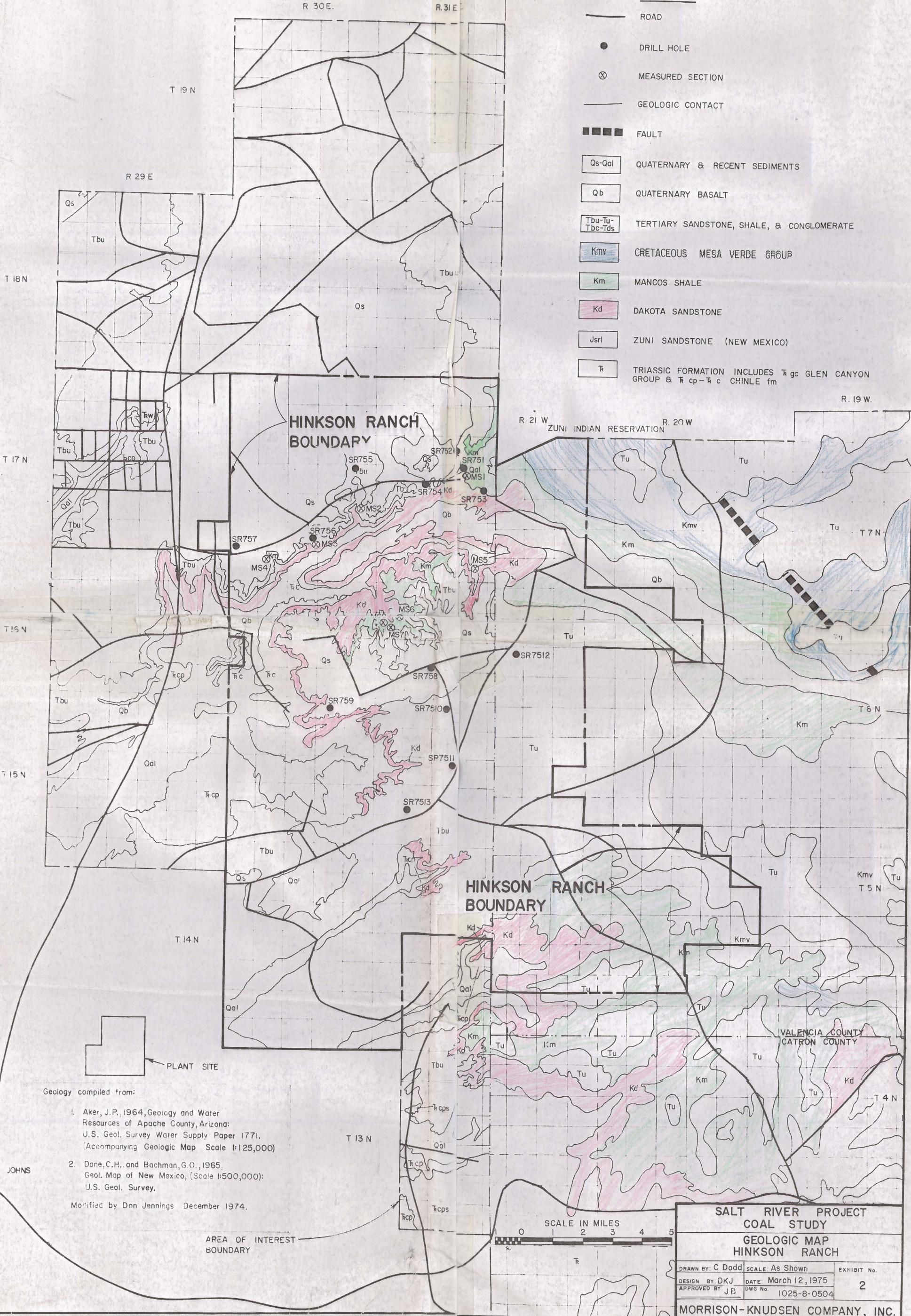
TOTAL DEPTH (D) 300 ft.

DRILL LOG

DEPTH FROM	IN FEET TO	LITHOLOGY
0'	5'	silt, brown w/ fine sand and clay
5'	25'	sand and clay, gray w/ gravel: chert and calcareous grains
25'	45'	sand, red-brown w/ silt, clay, and pebbles
45'	91'	clay, yllw-brn to brn; w/ sand silt and chert; calc. zone
91'	154'	sandstone, yllw to brn, fine grained, interbedded w/ rounded pebbles; not well consolidated
154'	160'	sandstone, brn; very fine
160'	172'	shale, yellow to white w/ yllw sandstone and pebbles
172'	175'	siltstone, orange to yellow w/ clay and sand
175'	203'	shale, light green to white w/ orange clay & silt; interbedded w/ red and orange siltstone
203'	205'	shale, yellow w/ white, orange and red silts and clays; white sand
205'	210'	shale, lt. gray w/ greenish-yllw clay
210'	226'	shale, green w/ orange siltstone, yellow clay interbedded w/ gray shales and pebbles
226'	230'	sand, gray w/ carbonaceous clay, some <u>coal</u>
230'	249'	shale, lt. gray to green gray w/ orange silt, black to brown clay, carbonaceous clay, orange to brown claystone
249'	252'	shale, gray w/ <u>coal</u> , black clay
252'	275'	shale, lt. gray to black to blue gray w/ orange & red claystone, gray clay
275'	283'	shale, lt. green to gray w/ silt & sand
283'	300'	shale, lt. green, purple, dk. red brown w/ lt. green sandstone, gray-bk clay

LEGEND

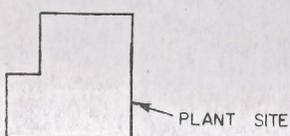
- ROAD
- DRILL HOLE
- ⊗ MEASURED SECTION
- GEOLOGIC CONTACT
- ■ ■ ■ FAULT
- Qs-Qal QUATERNARY & RECENT SEDIMENTS
- Qb QUATERNARY BASALT
- Tbu-Tu-Tbc-Tds TERTIARY SANDSTONE, SHALE, & CONGLOMERATE
- Kmv CRETACEOUS MESA VERDE GROUP
- Km MANCOS SHALE
- Kd DAKOTA SANDSTONE
- Jsr1 ZUNI SANDSTONE (NEW MEXICO)
- T TRIASSIC FORMATION INCLUDES T gc GLEN CANYON GROUP & T cp-T c CHINLE fm



HINKSON RANCH BOUNDARY

HINKSON RANCH BOUNDARY

VALENCIA COUNTY CATRON COUNTY



PLANT SITE

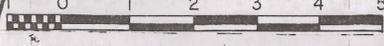
Geology compiled from:

1. Aker, J.P., 1964, Geology and Water Resources of Apache County, Arizona: U.S. Geol. Survey Water Supply Paper 1771. (Accompanying Geologic Map Scale 1:125,000)
2. Dane, C.H., and Bachman, G.O., 1965. Geol. Map of New Mexico, (Scale 1:500,000): U.S. Geol. Survey.

Modified by Don Jennings December 1974.

AREA OF INTEREST BOUNDARY

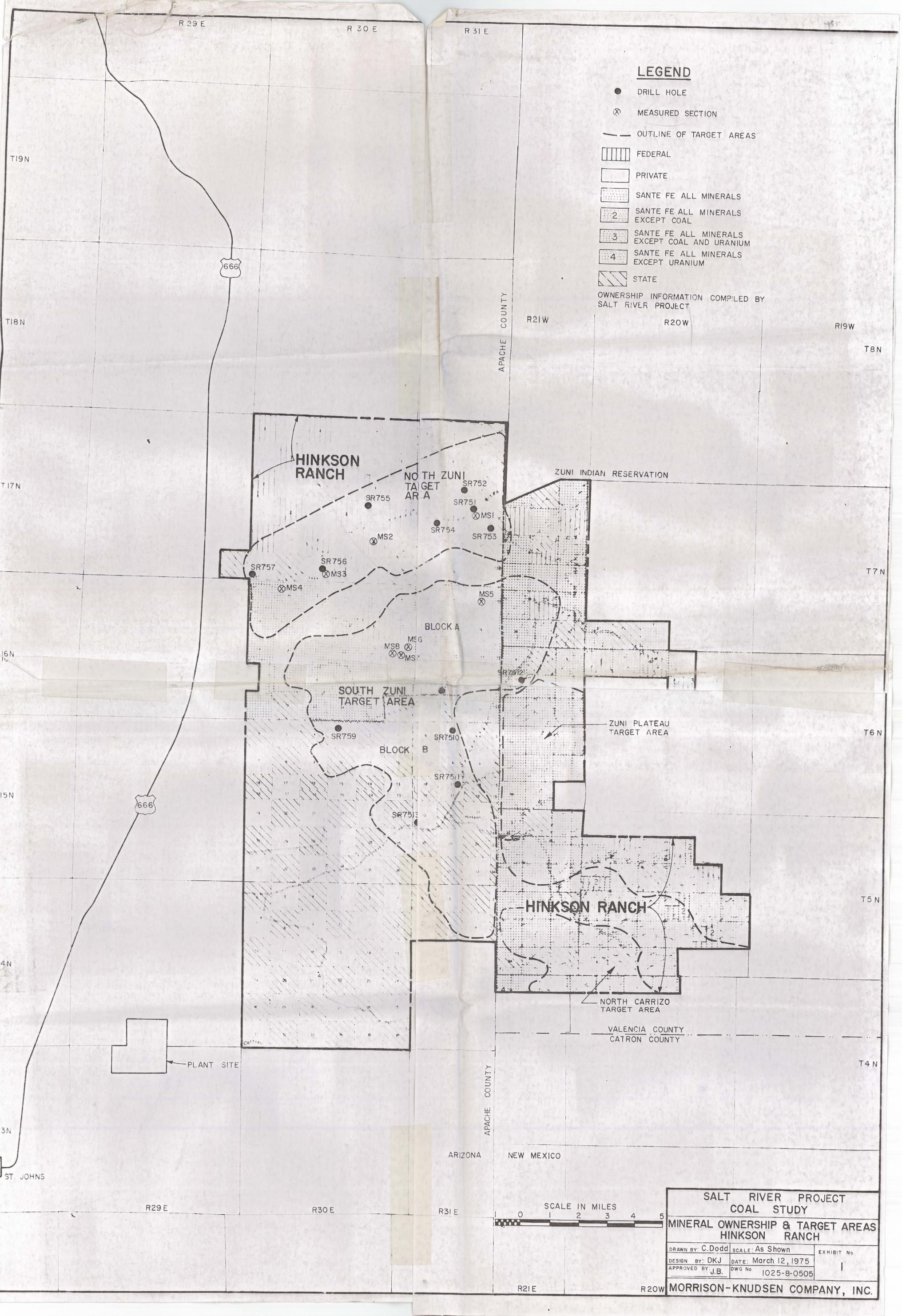
SCALE IN MILES



SALT RIVER PROJECT
COAL STUDY
GEOLOGIC MAP
HINKSON RANCH

DRAWN BY: C Dodd	SCALE: As Shown	EXHIBIT No.
DESIGN BY: DKJ	DATE: March 12, 1975	2
APPROVED BY: JB	DWG No. 1025-8-0504	

MORRISON-KNUDSEN COMPANY, INC.



LEGEND

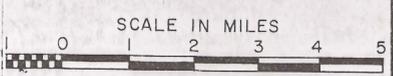
- DRILL HOLE
 - ⊗ MEASURED SECTION
 - OUTLINE OF TARGET AREAS
 - ▨ FEDERAL
 - PRIVATE
 - ▤ SANTE FE ALL MINERALS
 - ▥ SANTE FE ALL MINERALS EXCEPT COAL
 - ▧ SANTE FE ALL MINERALS EXCEPT COAL AND URANIUM
 - ▩ SANTE FE ALL MINERALS EXCEPT URANIUM
 - STATE
- OWNERSHIP INFORMATION COMPILED BY SALT RIVER PROJECT

**SALT RIVER PROJECT
COAL STUDY**

**MINERAL OWNERSHIP & TARGET AREAS
HINKSON RANCH**

DRAWN BY: C. Dodd	SCALE: As Shown	EXHIBIT No.
DESIGN BY: DKJ	DATE: March 12, 1975	1
APPROVED BY: J.B.	DWG No. 1025-8-0505	

MORRISON-KNUDSEN COMPANY, INC.



PLANT SITE

ARIZONA
NEW MEXICO

APACHE COUNTY

APACHE COUNTY

R21W R20W R19W
T8N T7N T6N T5N T4N

R29E R30E R31E

T19N T18N T17N T16N T15N T14N T13N

ST. JOHNS