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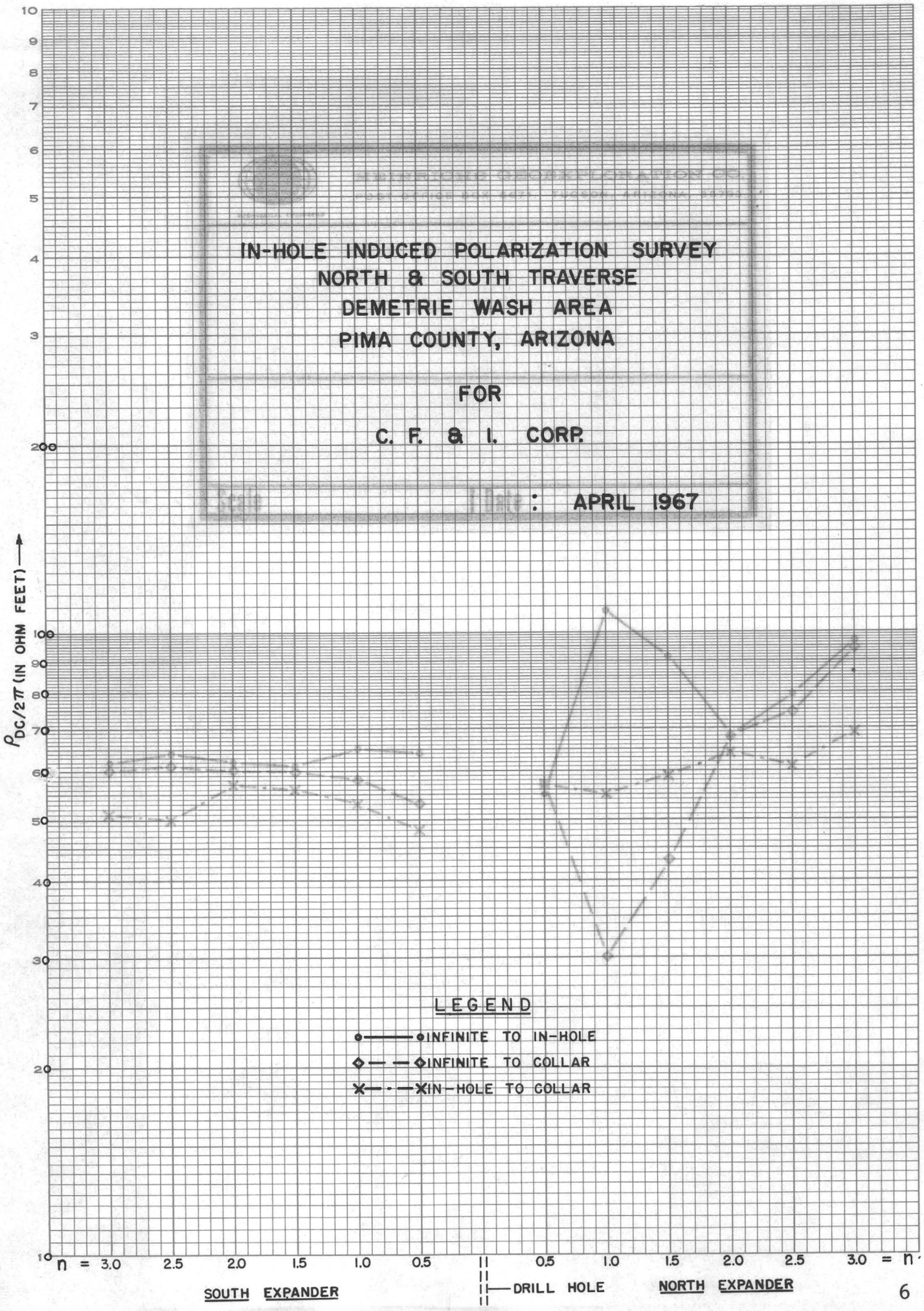
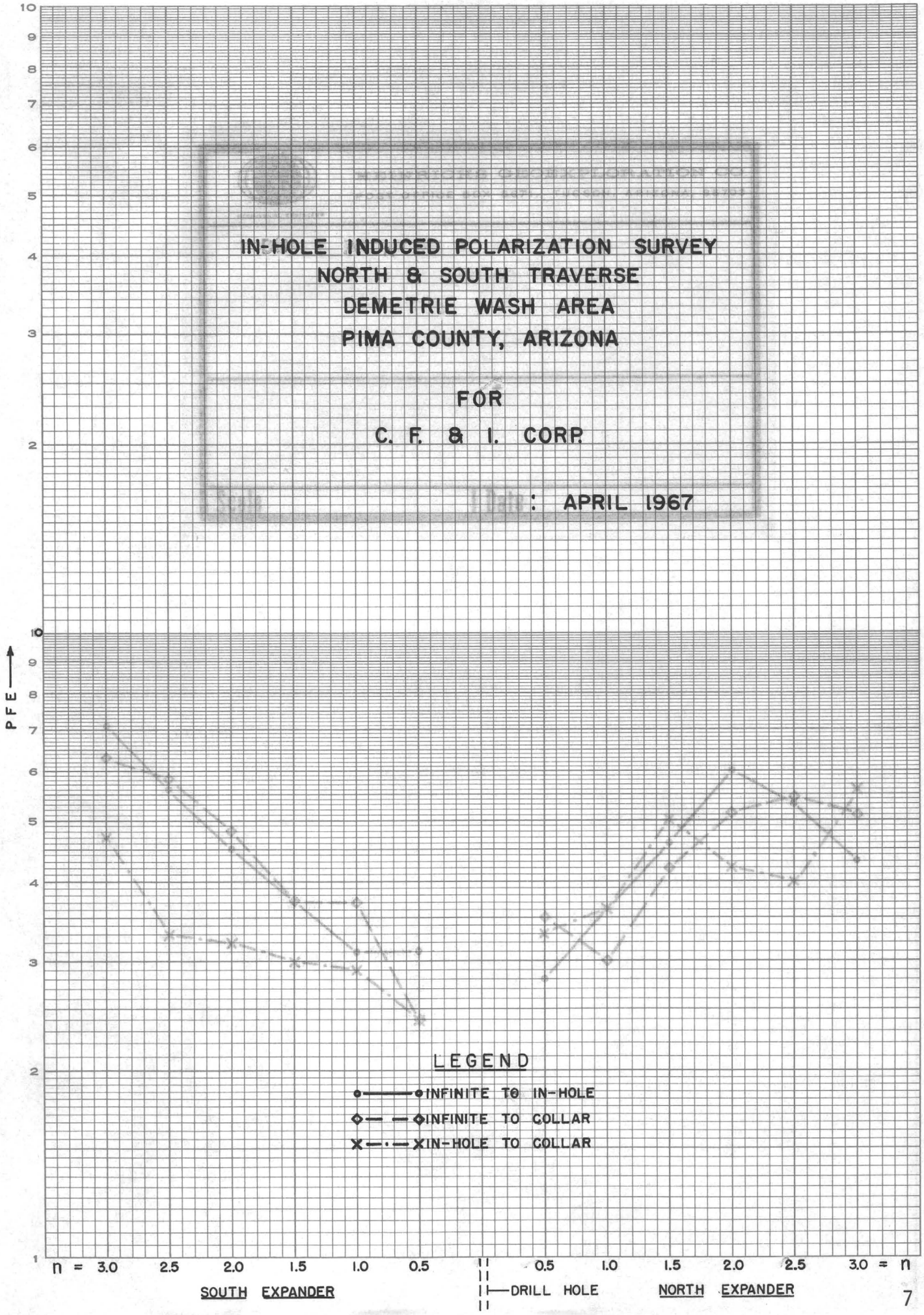
C.F & I Original graphs

RESISTIVITY



EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340R-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH

PFE



EUGENE DIETZGEN CO.
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SEMI-LOGARITHMIC
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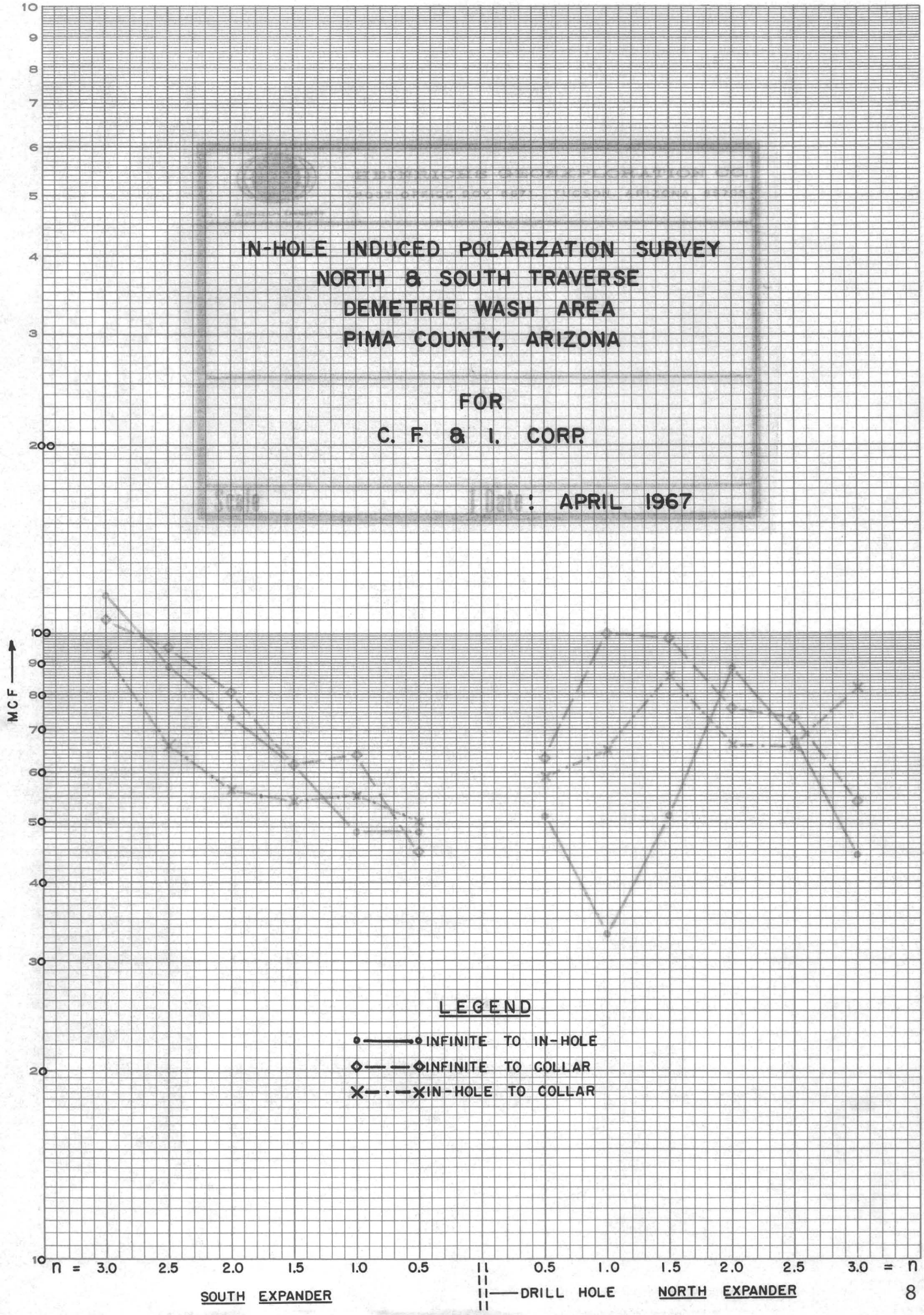
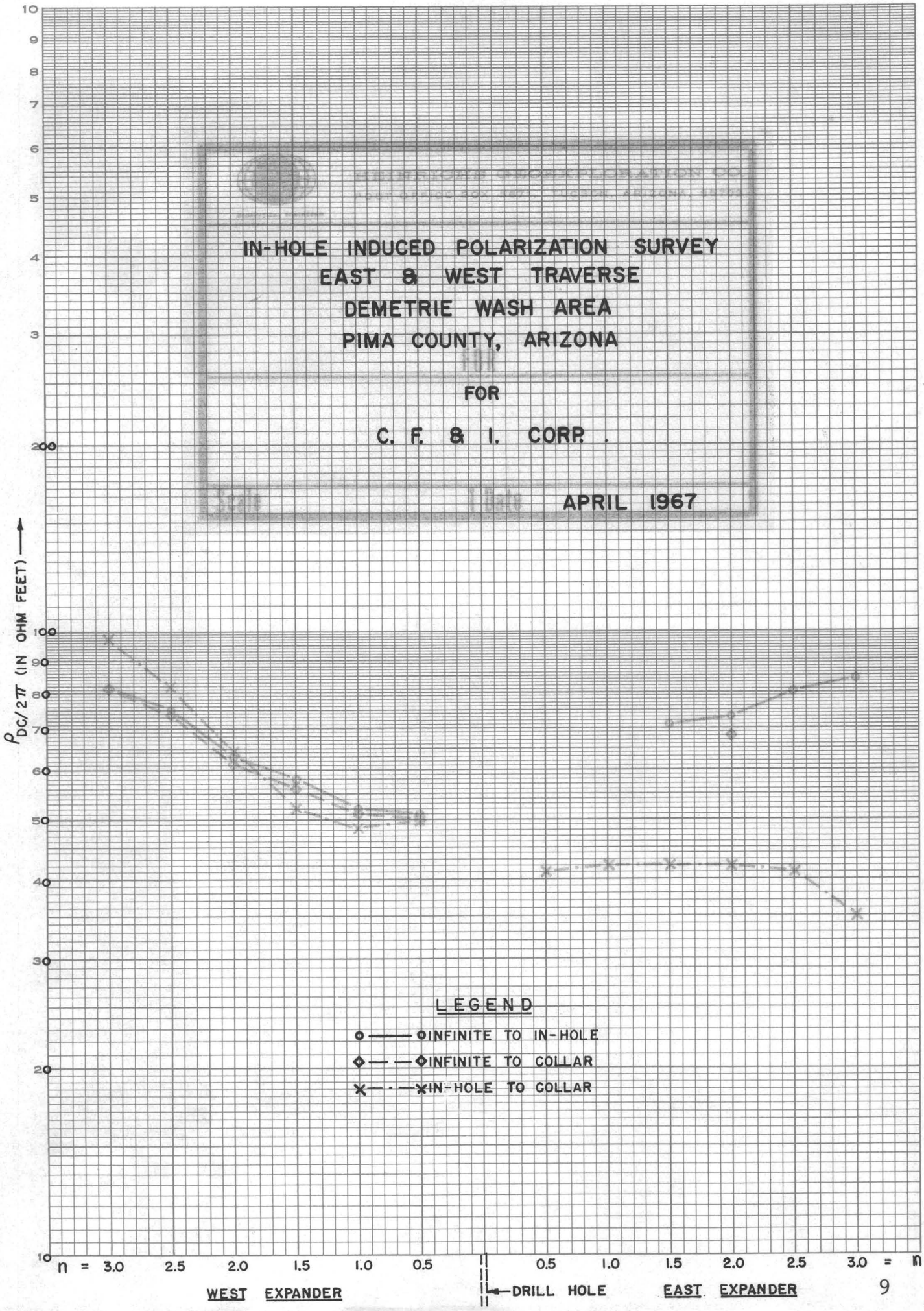
MCF


IN-HOLE INDUCED POLARIZATION SURVEY
NORTH & SOUTH TRAVERSE
DEMETRIE WASH AREA
PIMA COUNTY, ARIZONA
FOR
C. F. & I. CORP.
Date: APRIL 1967
MCF
LEGEND
INFINITE TO IN-HOLE
INFINITE TO COLLAR
IN-HOLE TO COLLAR
n = 3.0 2.5 2.0 1.5 1.0 0.5 0.5 1.0 1.5 2.0 2.5 3.0 = n
SOUTH EXPANDER
DRILL HOLE
NORTH EXPANDER
EUGENE DIETZGEN CO.
MADE IN U. S. A.
NO. 340R-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH

RESISTIVITY



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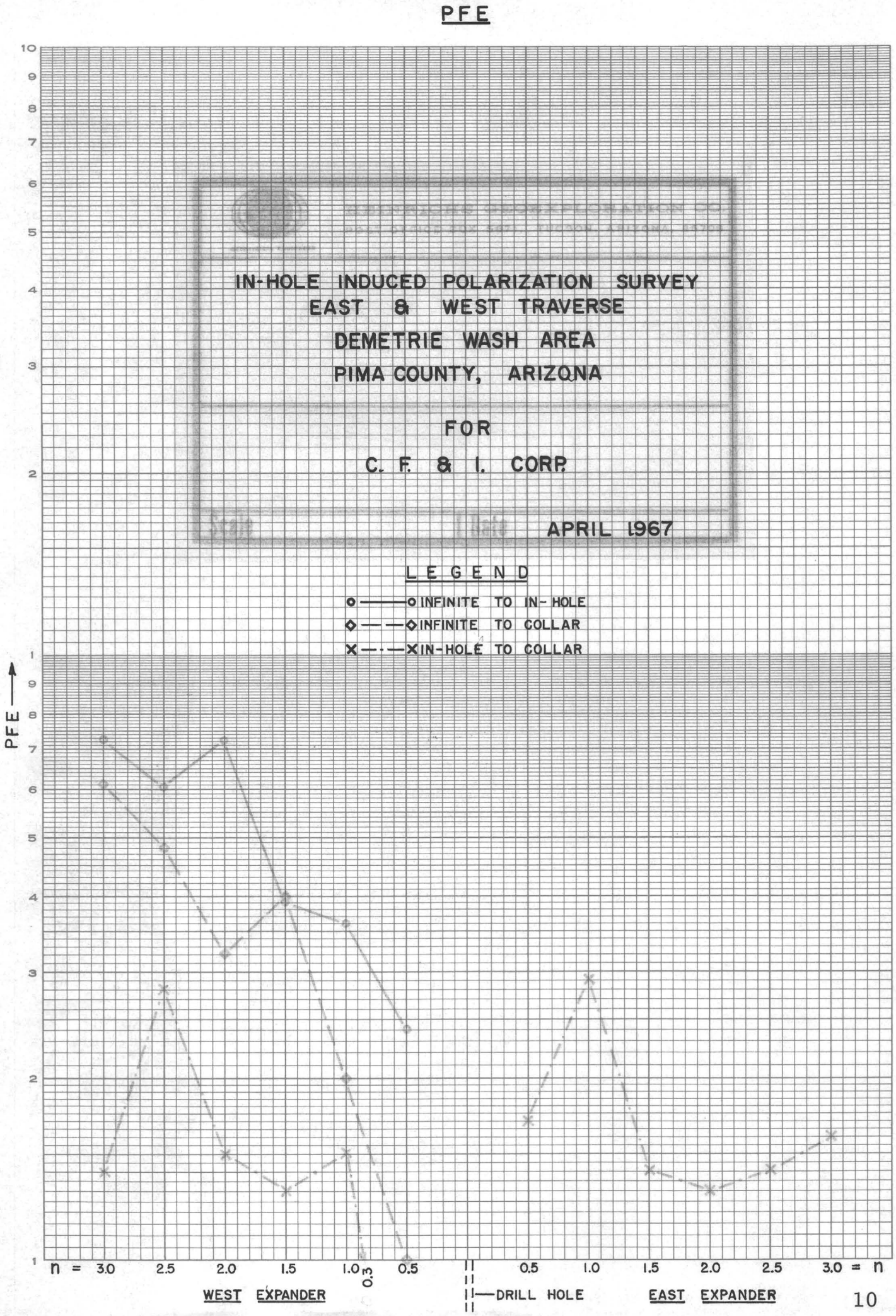
PFE
IN-HOLE INDUCED POLARIZATION SURVEY
EAST & WEST TRAVERSE
DEMETRIE WASH AREA
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C. F. & I. CORP.
APRIL 1967
LEGEND
INFINITE TO IN-HOLE
INFINITE TO COLLAR
IN-HOLE TO COLLAR
PFE
n = 3.0 2.5 2.0 1.5 1.0 0.3 0.5
0.5 1.0 1.5 2.0 2.5 3.0 = n
WEST EXPANDER
DRILL HOLE
EAST EXPANDER
EUGENE DIETZGEN CO.
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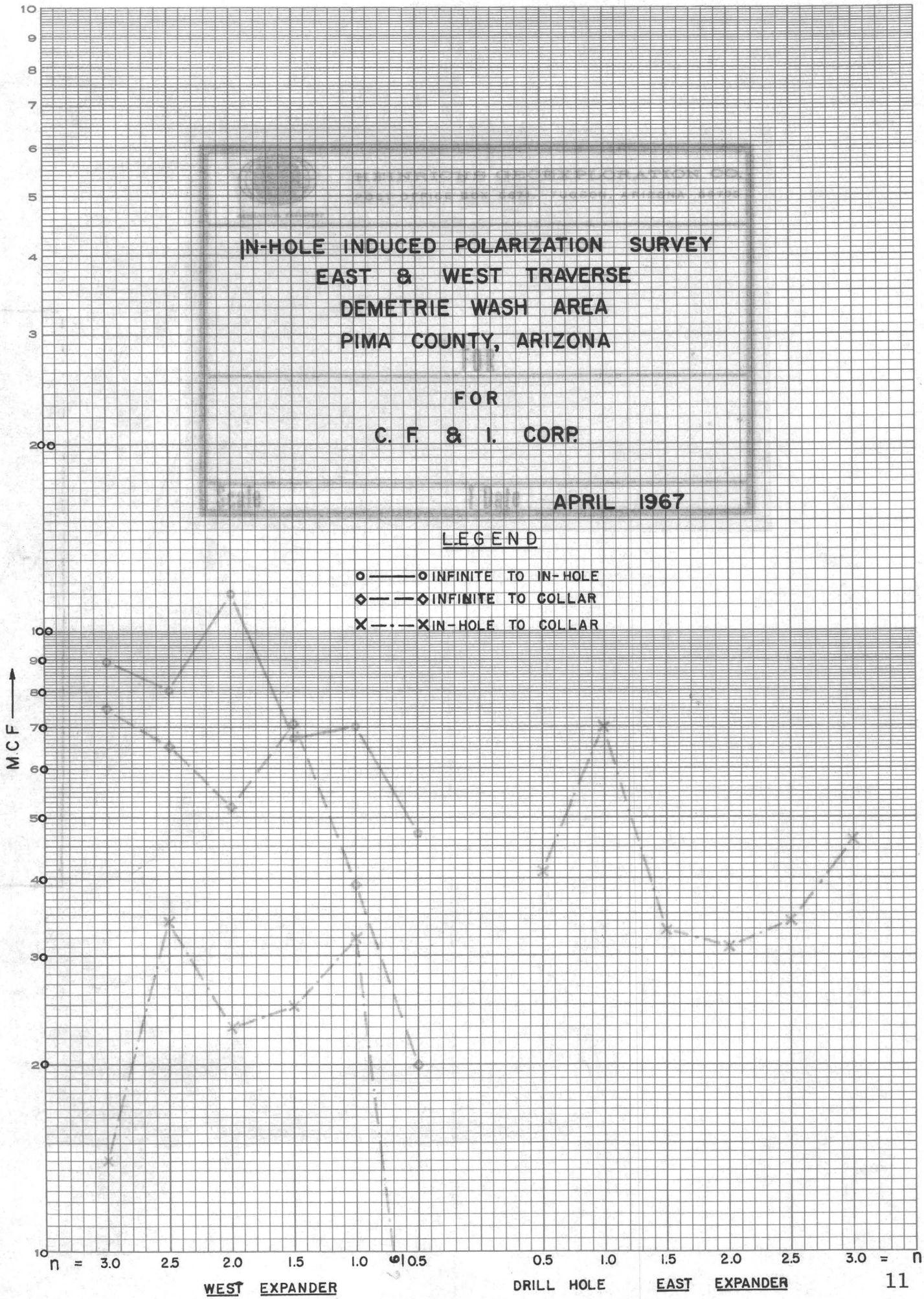
NO. 340R-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH

MCF



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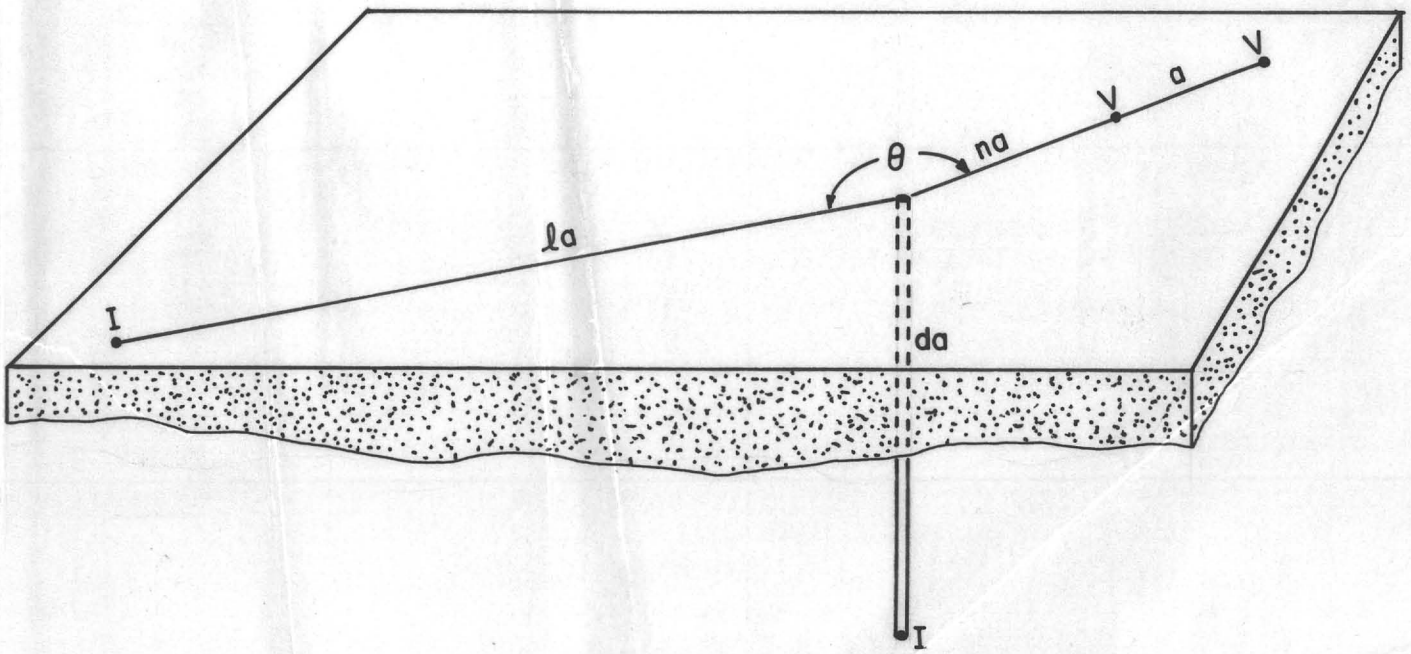
GEOMETRY & GENERAL APPARENT RESISTIVITY EQUATION

FOR

IN-HOLE INDUCED POLARIZATION SURVEY



$$\rho_a/2\pi = \left| \frac{aV}{I} \left[\frac{1}{\sqrt{n^2+d^2}} - \frac{1}{\sqrt{(n+1)^2+d^2}} - \frac{1}{\sqrt{n^2+\ell^2-2n\ell\cos\theta}} + \frac{1}{\sqrt{(n+1)^2+\ell^2-2(n+1)\ell\cos\theta}} \right]^{-1} \right|$$

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 5671, TUCSON, ARIZONA, 85703
Phone: 602/623-0578 Cable: GEOEX, Tucson
geophysical engineers
vancouver
sydney

IN-HOLE INDUCED POLARIZATION SURVEY
DEMETRIE WASH AREA
PIMA COUNTY, ARIZONA

For

C. F. & I. Corporation

March - April, 1967

By

Heinrichs Geoexploration Company
P. O. Box 5671 Tucson, Arizona 85703
Phone: 623-0578 Area Code: 602

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
CONCLUSIONS AND RECOMMENDATIONS	2
INTERPRETATION	3
GEOMETRY AND GENERAL APPARENT RESISTIVITY EQUATION	5
NORTH AND SOUTH TRAVERSE PLOTS	
Resistivity	6
PFE	7
MCF	8
EAST AND WEST TRAVERSE PLOTS	
Resistivity	9
PFE	10
MCF	11
BASIS OF I.P. METHOD	1a

IN MAP POCKET: (1 Piece)

In-Hole Induced Polarization Location Plan

INTRODUCTION

At the request of Mr. James Brooks of C. F. & I. Corporation, Pueblo, Colorado, Heinrichs Geoexploration Company of Tucson, Arizona, conducted and completed an in-hole induced polarization survey in the Demetrie Wash Area, Pima County, Arizona during the interim March 31 to April 5, 1967.

A current electrode was placed 1,000 feet below surface in diamond drill hole DCM-3. It was hoped that the probe could be placed about 1,300 feet below surface but a caved spot at about 1,000 feet prevented further access. An "infinite" current electrode was placed about 2.5 miles east of the drill hole. Also, another current electrode was placed about 50 feet from the collar of the hole (to avoid the casing). This gave three possible pairs of electrodes to send current through: in-hole to infinite, collar to infinite and in-hole to collar.

Readings were taken on a 1,000 foot dipole in 500 foot steps starting 500 feet from the collar out to 3,000 feet measuring from near receiving electrode on north, south, east, and west traverses using each of the three current electrode pairs for every station. The basic geometry and apparent resistivity equation for this system is shown on page 5.

The induced polarization data were taken with the dual frequency technique using 0.05 and 3.0 cycles per second sending frequencies. The data are plotted on semi-logarithmic graph paper with the horizontal scale representing the number of 1,000 foot dipole lengths separating the collar from the receiving dipole (the "n" interval). The vertical scale represents the I.P. parameter involved: apparent resistivity, percent frequency effect (PFE) and metallic conduction factor (MCF).

The object of this survey was to determine if any stronger concentrations of sulfides occur in the vicinity of the drill hole than have already been intersected; and to map the sulfide distribution near the hole.

Geoex personnel involved in the field work on this project were Paul Head, geophysicist, Rex Montierth, geophysical crew chief, William Hurley, receiver operator, and Brian Terrell, technical assistant. Field supervision, report, and interpretation were by Chris S. Ludwig, senior geophysicist.

CONCLUSIONS AND RECOMMENDATIONS

In general, the induced polarization work indicates sulfide concentrations in the range 0.5 to 1.5% total sulfides by volume (about 1 to 3% by weight) in the zone from around 500 to 1,500 feet below surface in the vicinity of the drill hole. This is in accordance with brief visual inspection of the core as to sulfide content.

No significant anomalous concentration of sulfides were seen on any of the four traverses although the SW quadrant shows a minor increase with depth and away from the hole and the NE quadrant shows a minor decrease.

The resistivities show a relatively uniform bedrock below a somewhat conductive overburden except for a marked flexure about 1,000 feet north of the drill hole. This flexure probably represents the fault zone or contact suggested by the different material seen in Superior Oil's drill hole to the north.

We recommend if any of your other drill holes suggest proximity to mineralization that they be similarly tested for sulfide concentrations not intersected. Or, if important sulfide has been seen in your drilling, the in-hole survey could give some idea of its extent.

If this area is still of interest after drilling to date, detailed deep penetration surface I.P. coverage is recommended: 1,000 to 1,500 foot dipoles on 1/4 mile line spacing. Because of your area's favorable relation to nearby major producers we believe it should be thoroughly prospected before letting it go.

INTERPRETATION

For more details on I.P. and interpretation, see the Basis of Induced Polarization Method included in this report.

Resistivity on the north and west traverses show a definite increase with "n" suggestive of shallower alluvium in that direction. The south and east traverses show little or no increase with "n" suggesting deepening alluvium in those directions.

The north expander at "n"=1, shows a high on the in-hole to infinite array and an equivalent low on the collar to infinite array while the in-hole to collar array curve is quite smooth. This apparent discrepancy is actually rather typical of apparent resistivity work when crossing conductivity discontinuities because of the strong dependence of anomaly shape on the array used.

The PFE's show an increase with "n" on the north, south and west traverses for all three current arrays. This is due both to the general increase in sulfide content with depth and to an electromagnetic coupling interference effect which increases as the distance between sending and receiving dipoles is increased. This coupling effect made it impossible to obtain meaningful PFE readings on the east traverse for the in-hole to infinite and collar to infinite arrays because the receiver dipole was within the sending array making for extremely good mutual coupling. The collar to in-hole array was not bothered by this coupling and the PFE's show no significant variation to the east.

The MCF's give the most information about the actual bulk total sulfide content and from them the estimate of 0.5 to 1.5% total sulfide by volume was made.

The three sending arrays have different penetrating and resolution factors. The in-hole to infinite has the best penetration with the collar to infinite next and collar to in-hole least. However, the in-hole to collar should have the best resolution with the two infinite arrays being somewhat poorer.

Respectfully submitted,

HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig

Chris S. Ludwig
Senior Geophysicist

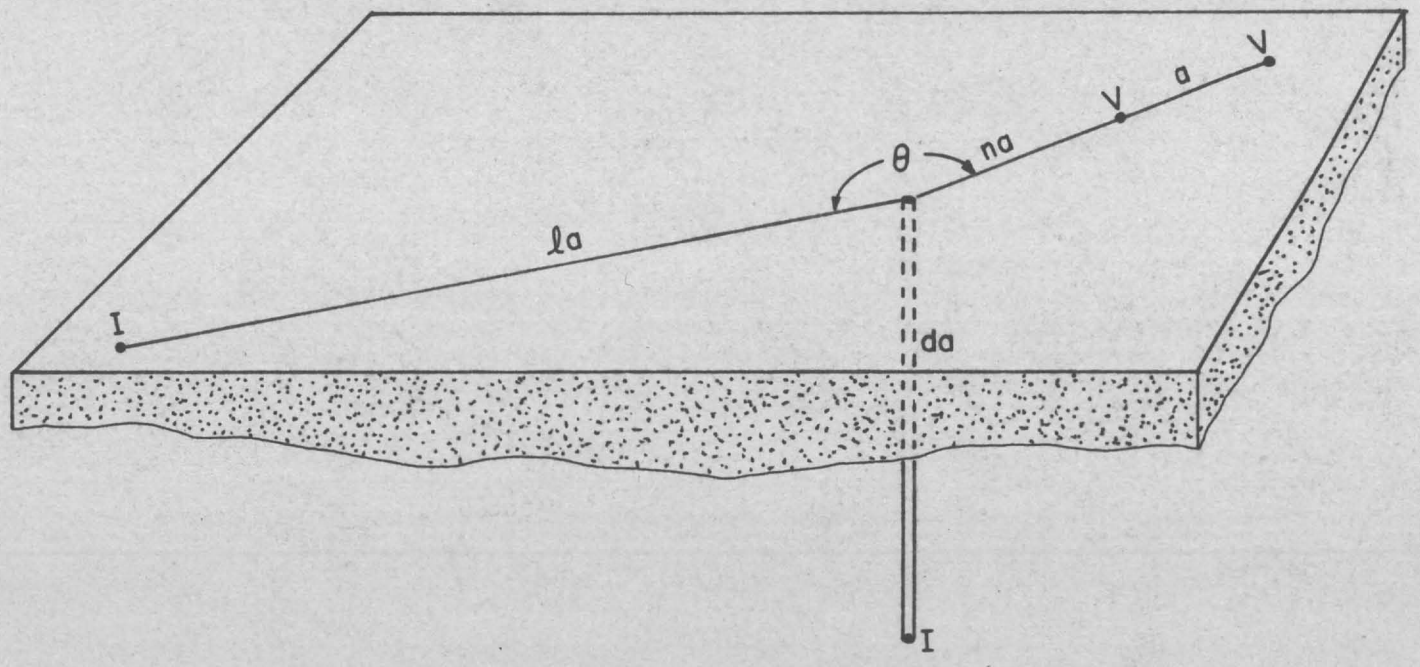
APPROVED: W. E. Heinrichs Jr.
Walter E. Heinrichs, Jr.
President & General Manager

April 27, 1967
Tucson, Arizona

GEOMETRY & GENERAL APPARENT RESISTIVITY EQUATION

FOR

IN-HOLE INDUCED POLARIZATION SURVEY



$$\rho_a/2\pi = \left| \frac{aV}{I} \left[\frac{1}{\sqrt{n^2+d^2}} - \frac{1}{\sqrt{(n+1)^2+d^2}} - \frac{1}{\sqrt{n^2+\ell^2-2n\ell\cos\theta}} + \frac{1}{\sqrt{(n+1)^2+\ell^2-2(n+1)\ell\cos\theta}} \right]^{-1} \right|$$

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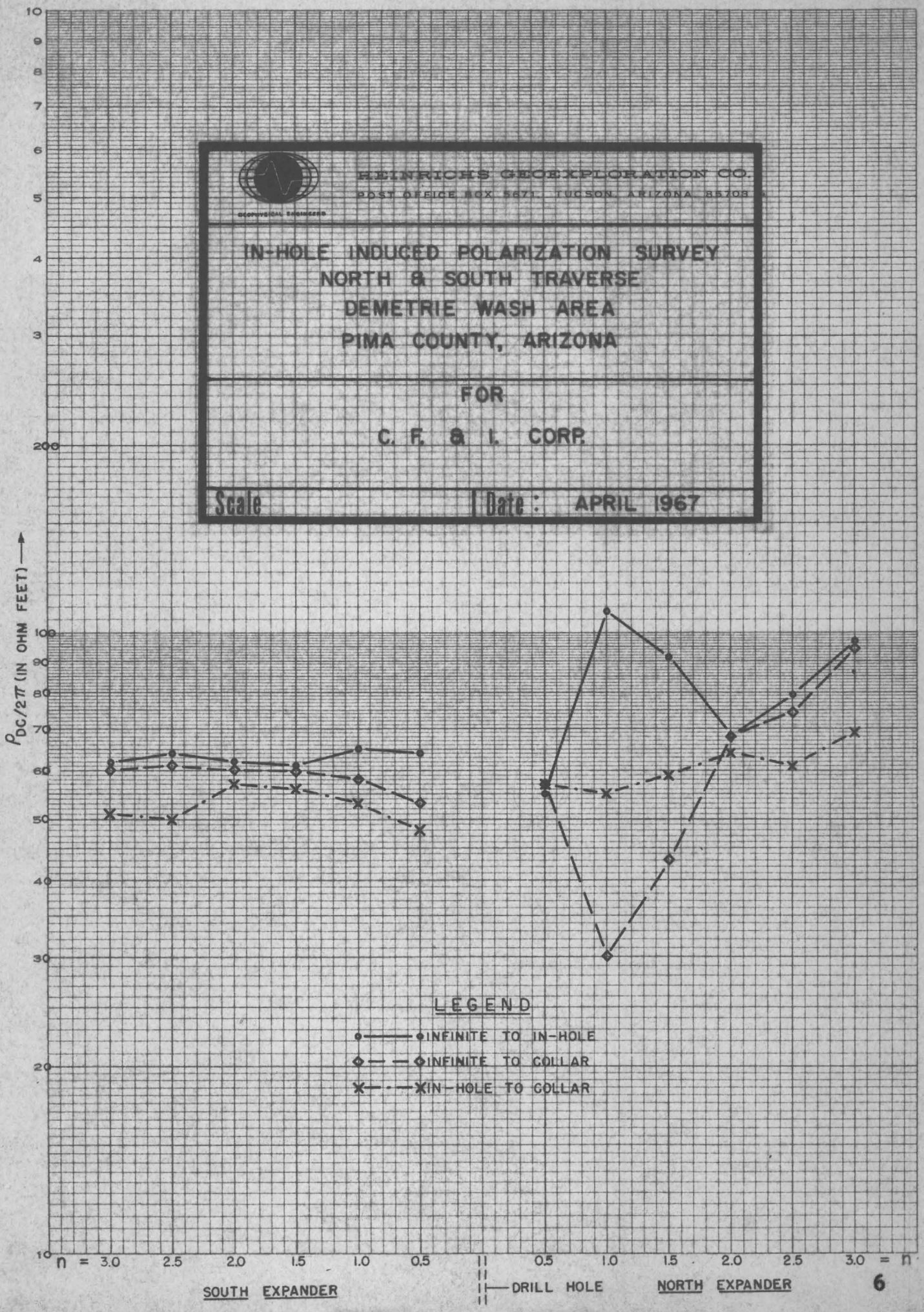
TUCSON, ARIZONA
BOX 5671, TUCSON, ARIZONA, 85703.
PHONE: (AREA CODE 602) 623-0578

RESISTIVITY



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PFE

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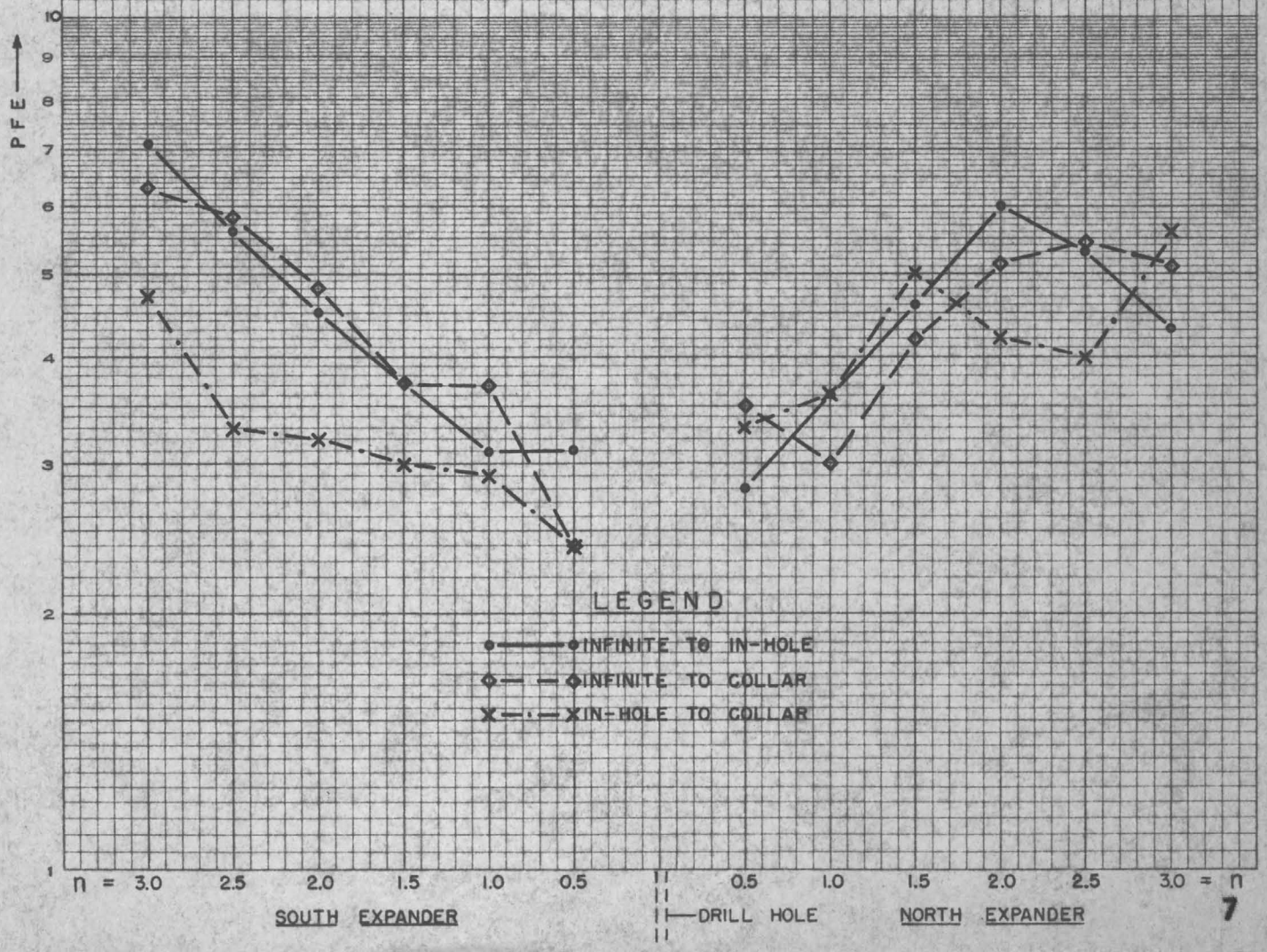
GEOPHYSICAL ENGINEERS

IN-HOLE INDUCED POLARIZATION SURVEY
NORTH & SOUTH TRAVERSE
DEMETRIE WASH AREA
PIMA COUNTY, ARIZONA

FOR

C. F. & I. CORP.

Scale | Date: APRIL 1967



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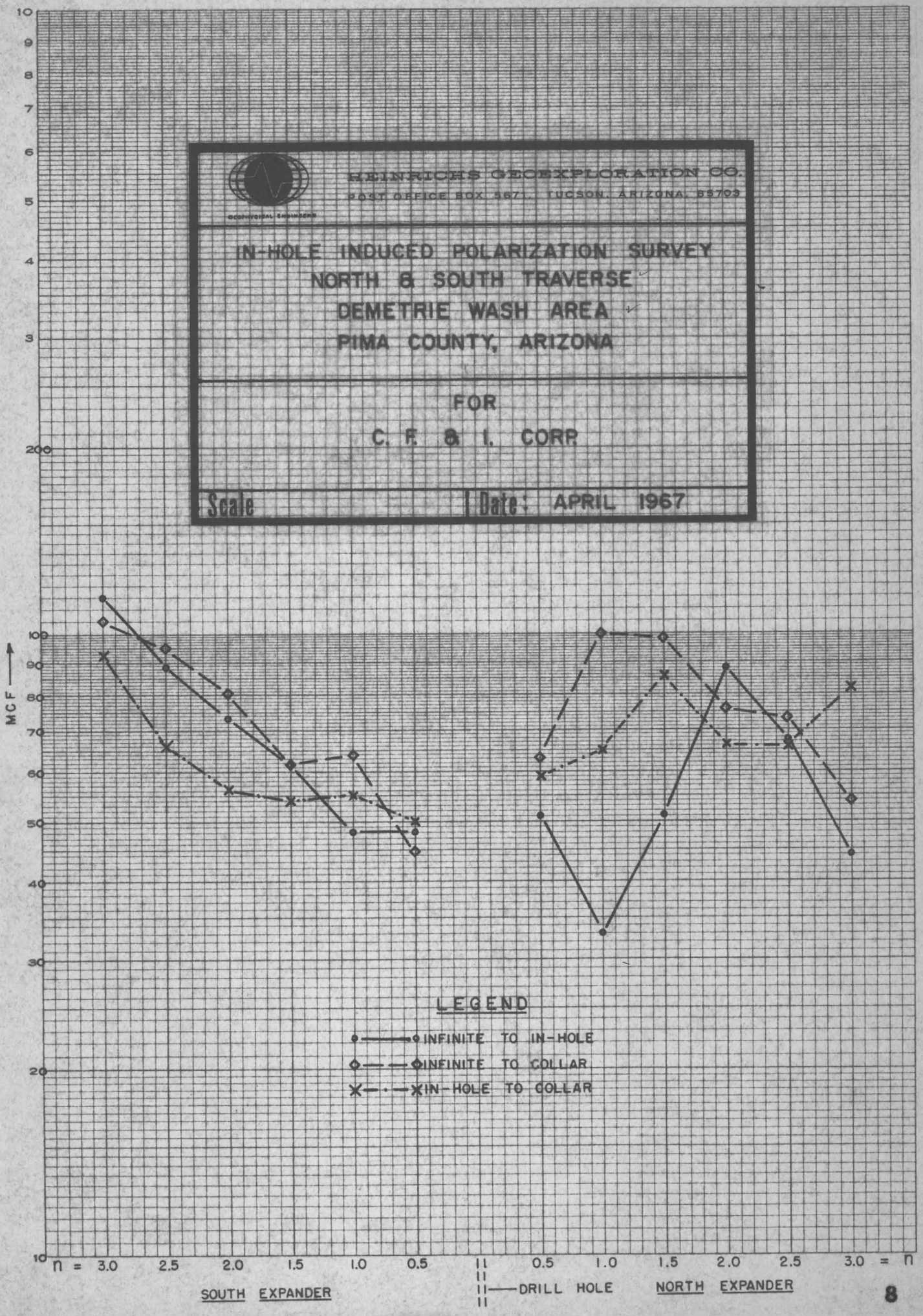
MCF
HEINRICHS GEOEXPLORATION CO.
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GEOPHYSICAL ENGINEERS
IN-HOLE INDUCED POLARIZATION SURVEY
NORTH & SOUTH TRAVERSE
DEMETRIE WASH AREA
PIMA COUNTY, ARIZONA
FOR
C. F. & I. CORP.
Scale
Date: APRIL 1967
MCF
LEGEND
INFINITE TO IN-HOLE
INFINITE TO COLLAR
IN-HOLE TO COLLAR
n = 3.0 2.5 2.0 1.5 1.0 0.5 0.5 1.0 1.5 2.0 2.5 3.0 = n
SOUTH EXPANDER
DRILL HOLE
NORTH EXPANDER
EUGENE DIETZGEN CO.
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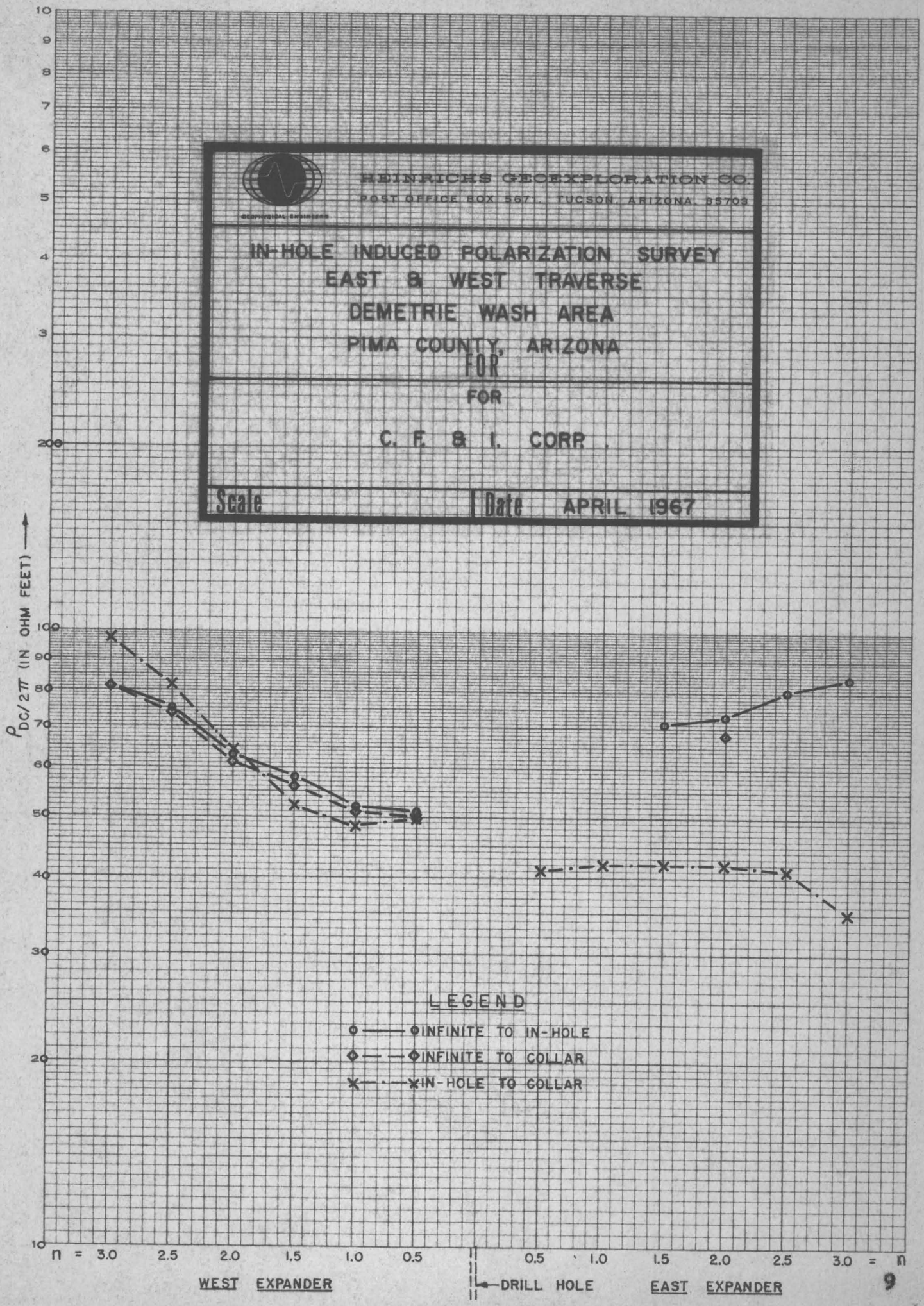
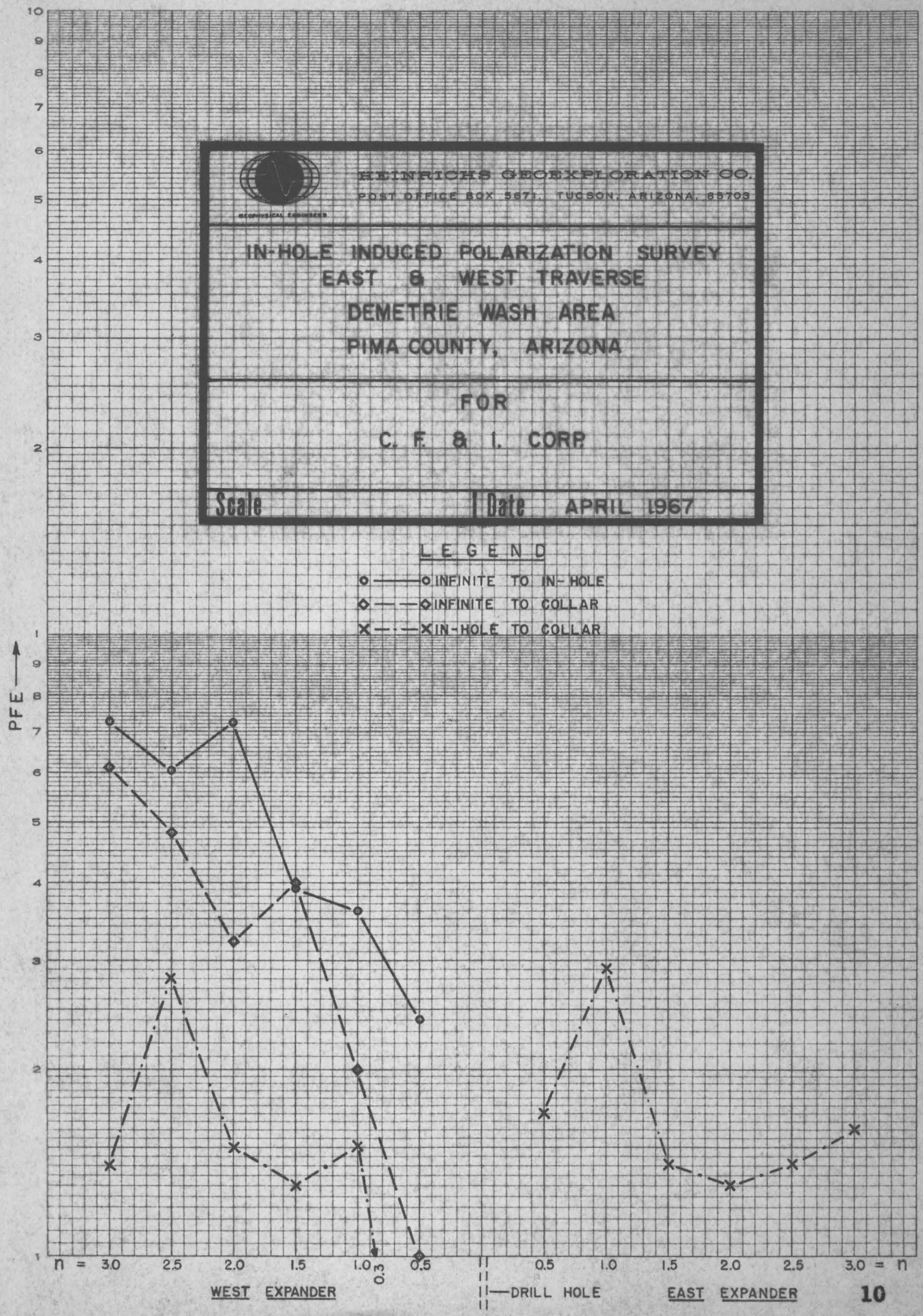
NO. 340R-L210 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH

RESISTIVITY



PFE



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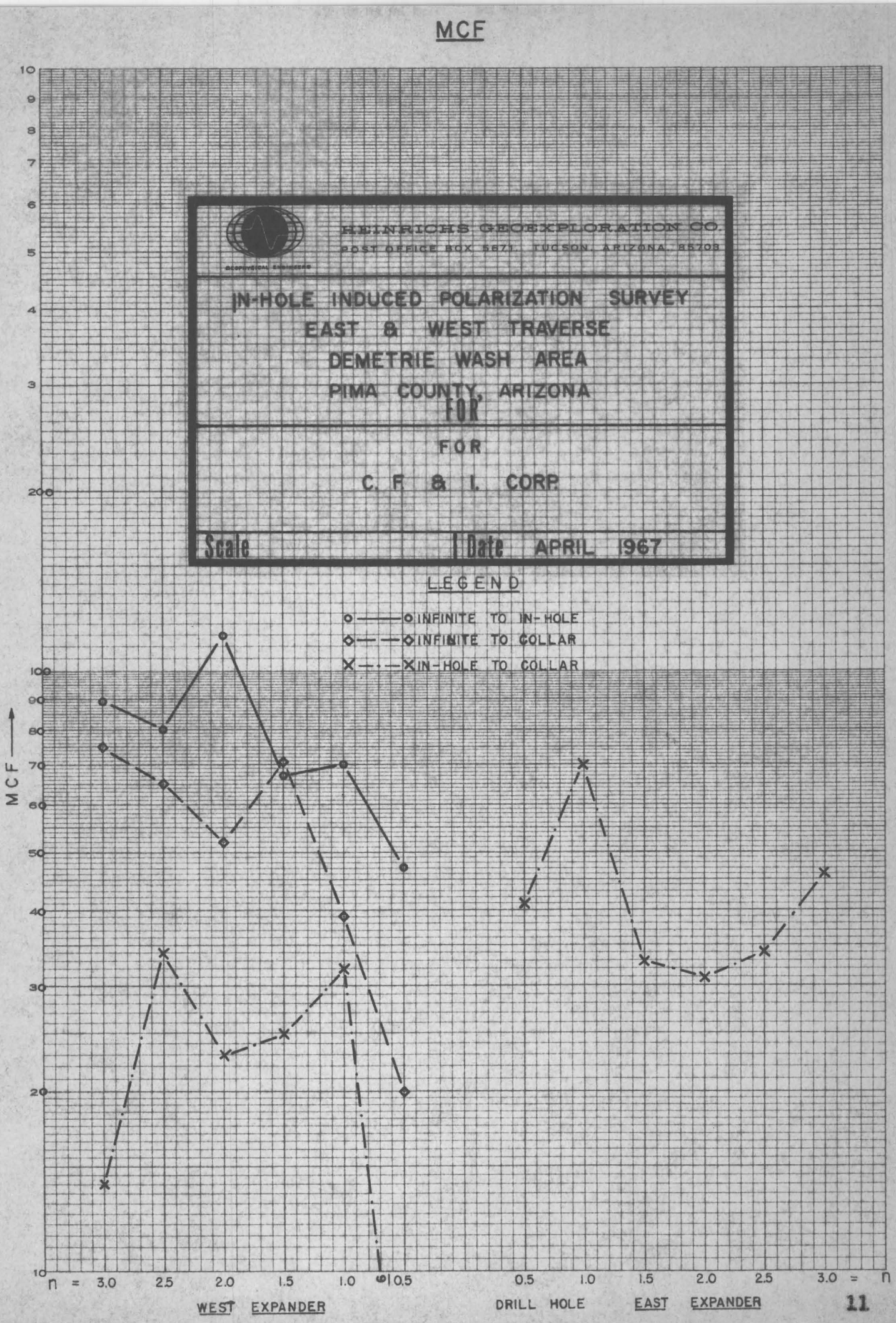
2 CYCLES X 10 DIVISIONS PER INCH


MCF
HEINRICHS GEOEXPLORATION CO.
POST OFFICE BOX 5671, TUCSON, ARIZONA 85703
GEOPHYSICAL ENGINEERS
IN-HOLE INDUCED POLARIZATION SURVEY
EAST & WEST TRAVERSE
DEMETRIE WASH AREA
PIMA COUNTY, ARIZONA
FOR
FOR
C. F. & I. CORP.
Scale
Date APRIL 1967
LEGEND
INFINITE TO IN-HOLE
INFINITE TO COLLAR
IN-HOLE TO COLLAR
MCF
n = 3.0 2.5 2.0 1.5 1.0 0.5 0.5 1.0 1.5 2.0 2.5 3.0 = n
WEST EXPANDER
DRILL HOLE
EAST EXPANDER
EUGENE DIETZGEN CO.
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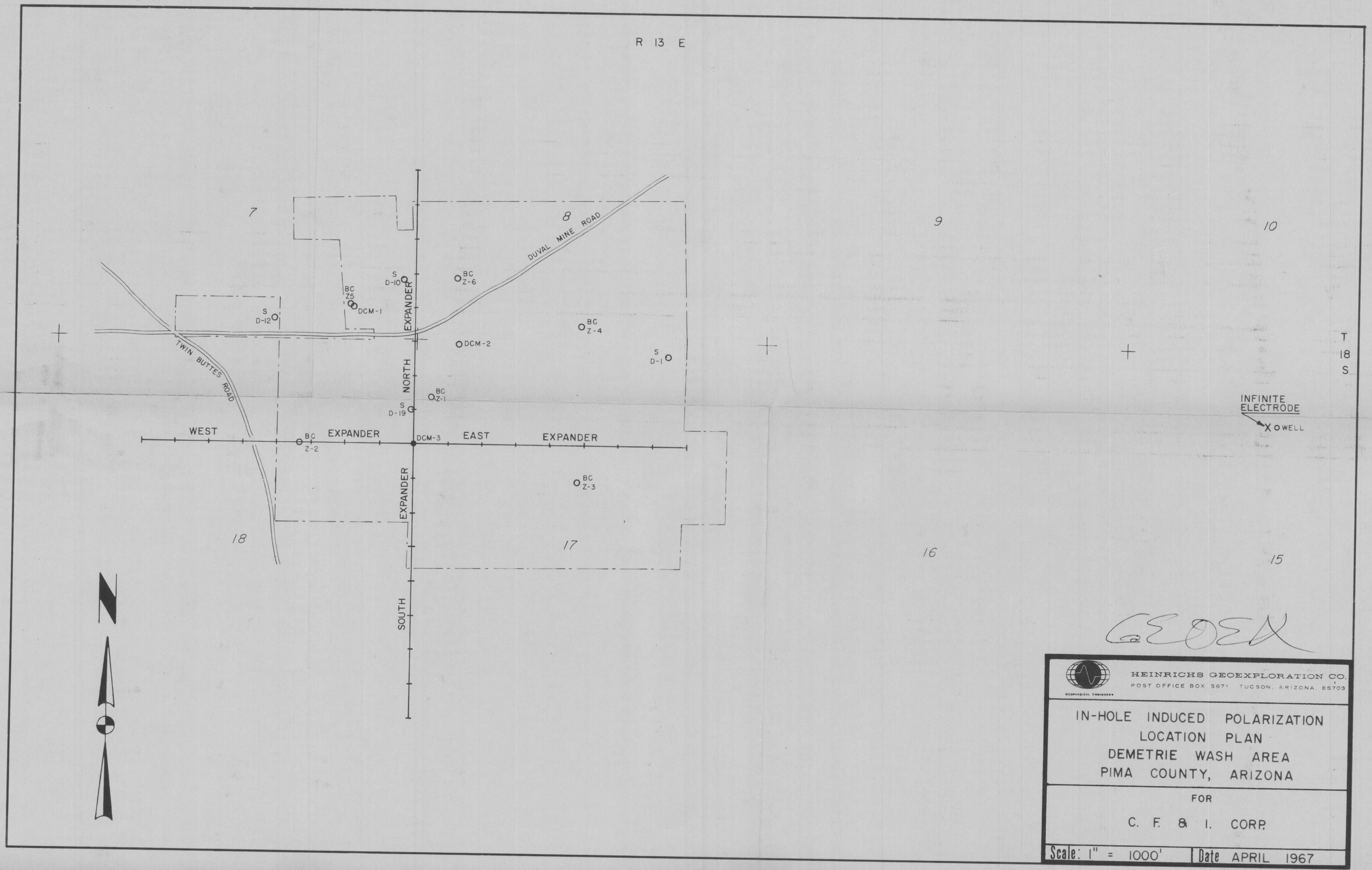
SEMI-LOGARITHMIC
2 CYCLES X 10 DIVISIONS PER INCH


R 13 E
T 18 S
7
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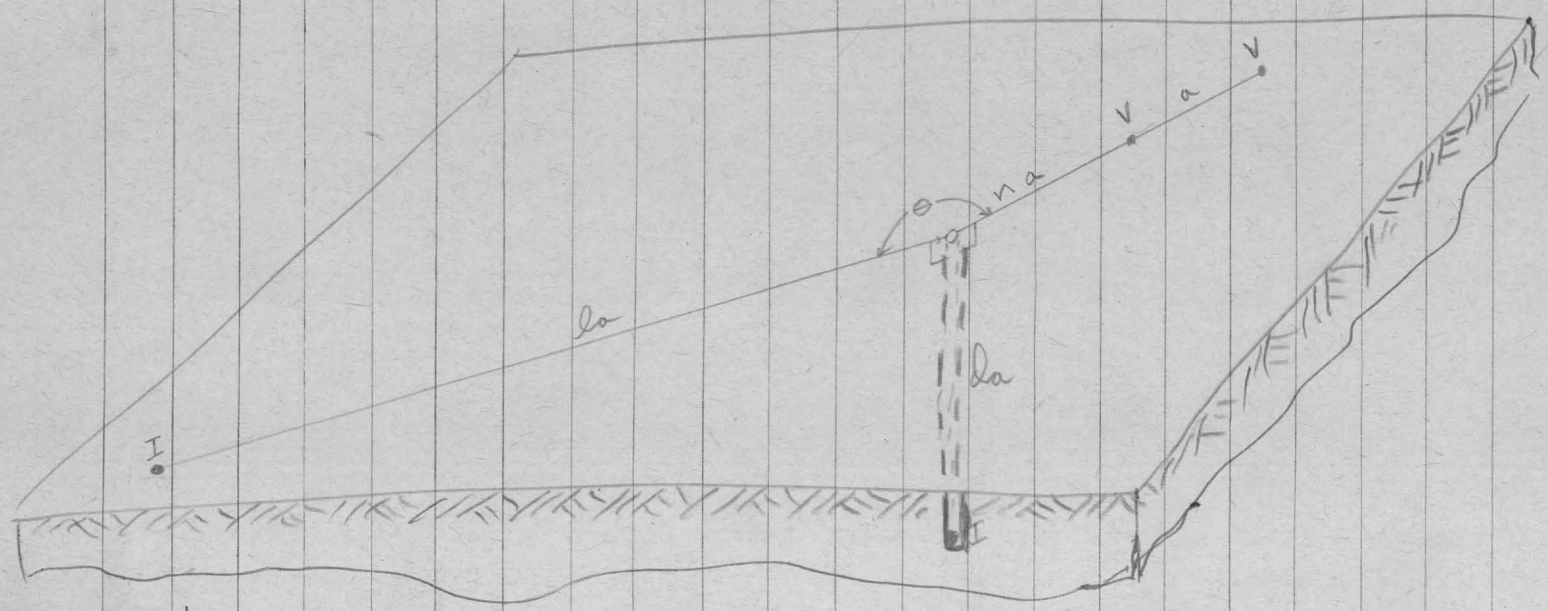
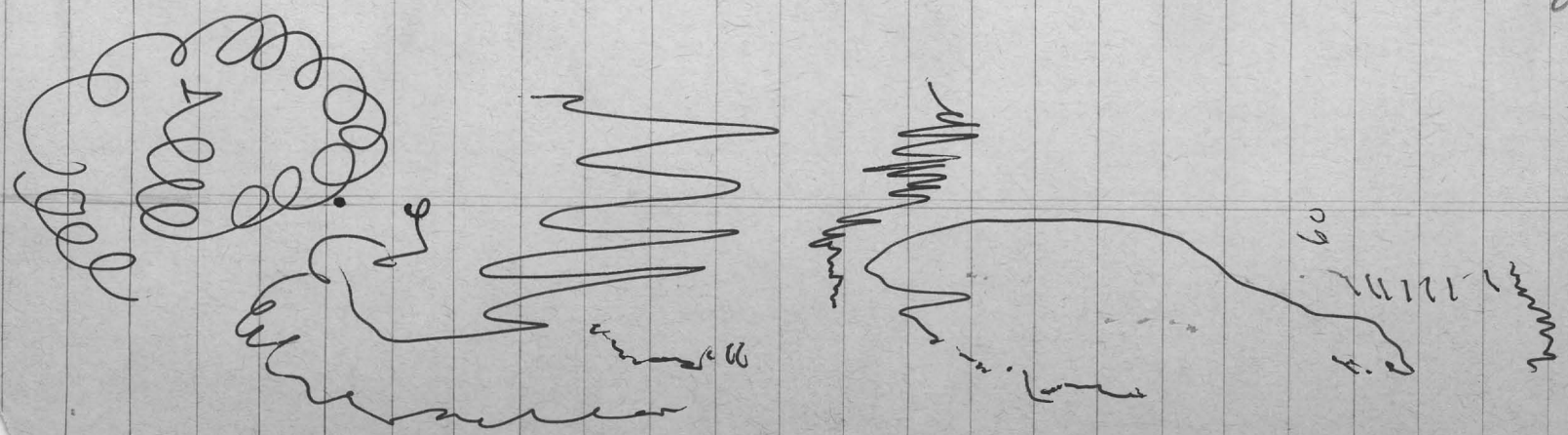
16
15
DUVAL MINE ROAD
TWIN BUTTES ROAD
WEST
EXPANDER
EAST
EXPANDER
NORTH
EXPANDER
SOUTH
EXPANDER
DCM-3
DCM-1
DCM-2
BC Z5
S D-10
BC Z-6
S D-12
BC Z-4
S D-1
BC Z-1
S D-19
BC Z-2
BC Z-3
INFINITE ELECTRODE
X WELL
N
GEOEX
HEINRICHS GEOEXPLORATION CO.
GEOPHYSICAL ENGINEERS
POST OFFICE BOX 5671 TUCSON, ARIZONA, 85703
IN-HOLE INDUCED POLARIZATION
LOCATION PLAN
DEMETRIE WASH AREA
PIMA COUNTY, ARIZONA
FOR
C. F. & I. CORP.
Scale: 1" = 1000'
Date APRIL 1967

CF & I



$$\frac{\rho_a}{2\pi} = \left| \frac{aV}{I} \left[\frac{1}{\sqrt{n^2+d^2}} - \frac{1}{\sqrt{(n+1)^2+d^2}} - \frac{1}{\sqrt{n^2+l^2-2nl\cos\theta}} + \frac{1}{\sqrt{(n+1)^2+l^2-2(n+1)l\cos\theta}} \right]^{-1} \right|$$

Geometry & General Apparent Resistivity Equation for In-Hole Induced Polarization Survey



		WX				EX			
				$\infty \to H$					
			P_{02}/P_{01}	PFE	MCF				
.5	2.98	51.15/3	51	2.4	47	—	—	—	—
1.0	3.93	40.05/3	52	3.6	69	—	—	—	—
1.5	5.62	30.75/3	58	3.9	67	38/3	71	—	—
2.0	7.88	23.95/3	63	7.2	114	28/3	73	—	—
2.5	10.92	20.72/3	75	6.0	80	22/3	80	—	—
3.0	14.3	16.9/3	81	7.2	89	17.6/3	84	—	—
				$\infty \to C$					
.5	0.75	202/3	50	1.0	20	—	—	—	—
1.0	2.00	76.0/3	51	2.0	39	—	—	—	—
1.5	3.75	44.4/3	56	4.0	71	—	—	—	—
2.0	6.04	30.25/3	61	3.2	52	33.5/3	68	—	—
2.5	8.90	25.1/3	74	4.8	65	—	—	—	—
3.0	12.24	19.93/3	81	6.1	75	—	—	—	—
				$H \to C$					
.5	1.007	446/9	50	0.3	6	370/9	41	1.7	41
1.0	4.16	102.5/9	47	1.5	32	90.5/9	42	2.9	69
1.5	12.0	38.7/9	52	1.3	25	31.25/9	42	1.4	33
2.0	28.0	20.7/9	64	1.5	23	13.61/9	42	1.3	31
2.5	56.8	12.99/9	82	2.8	34	6.48/9	41	1.4	34
3.0	103.5	8.5/9	98	1.4	14	3.08/9	35	1.6	46

$n = 0.5 \rightarrow 3.0$ $\quad d = 1$

$a = 1000'$

$l = 12.6$

$\infty - H$

168	159.25	162.25	175
75.6	12.6	37.85	101
243.6	171.85	200.1	276

$$\frac{e_q}{2\pi} = \frac{1000V}{I}\left[\frac{1}{\sqrt{n^2+1}} - \frac{1}{\sqrt{(n+1)^2+1}} - \frac{1}{\sqrt{n^2+159+25.2n}} + \frac{1}{\sqrt{(n+1)^2+159+25.2(n+1)}}\right]^{-1}$$

$n = 0.5$

$$\frac{1000V}{I}\left[.894 - .554 - 0.076 + 0.071\right]$$

.894
.559
.335

.5	$\boxed{2.98}$
1	3.93
1.5	5.62
2	7.88
2.5	10.92
3.0	$\boxed{14.3}$

3.0 $\quad .3162 - .2424 - 0.0691 + 0.0602$

.3162
.2463
.0699

.2424
39
.2463

.0691
.0602
.0089

∞ - hole

$a = 1000'$ $\qquad \theta = 90°$

$l = 1$ $\qquad \cos\theta = 0$

$l = 12.6$ $\qquad l^2 = 159$

$n = 0.5$

1

1.5

2

2.5

3

$$\frac{e_a}{2\pi} = \frac{1000V}{I}\left[\frac{1}{\sqrt{n^2+1}} - \frac{1}{\sqrt{(n+1)^2+1}} - \frac{1}{\sqrt{n^2+159}} + \frac{1}{\sqrt{(n+1)^2+159}}\right]^{-1}$$

.595 $\quad n = \frac{1}{2}$ $\quad \left[\frac{1}{\sqrt{1.25}} - \frac{1}{\sqrt{3.25}} - \frac{1}{\sqrt{159.25}} + \frac{1}{\sqrt{161.25}}\right]^{-1}$

.894 $\quad$ .554 $\quad$ .079 $\quad$ .079

$.336^{-1}$

$\frac{1000V}{I}$ $\boxed{2.97}$

.386 $\quad n = 1$ $\quad \left[\frac{1}{\sqrt{2}} - \frac{1}{\sqrt{5}} - \frac{1}{\sqrt{160}} + \frac{1}{\sqrt{163}}\right]^{-1}$ $\quad .259^{-1} = \boxed{3.86}$

.707 $\quad$ .447 $\quad$ .079 $\quad$ .078

.366 $\quad n = 1\frac{1}{2}$ $\quad \frac{1}{\sqrt{3.25}} - \frac{1}{\sqrt{7.25}} - \frac{1}{\sqrt{162.25}} + \frac{1}{\sqrt{165.25}}$ $\quad .182^{-1} = \boxed{5.50}$

.554 $\quad$ .371 $\quad$ .078 $\quad$ .077

.385 $\quad n = 2$ $\quad \frac{1}{\sqrt{5}} - \frac{1}{\sqrt{10}} - \frac{1}{\sqrt{163}} + \frac{1}{\sqrt{168}}$ $\quad .130^{-1}$ $\quad \boxed{7.69}$

.447 $\quad$ .316 $\quad$ .078 $\quad$ .077

.427 $\quad n = 2.5$ $\quad \frac{1}{\sqrt{7.25}} - \frac{1}{\sqrt{13.25}} - \frac{1}{\sqrt{165.25}} + \frac{1}{\sqrt{171.25}}$ $\quad .094^{-1}$ $\quad \boxed{10.63}$

.371 $\quad$ .275 $\quad$ .078 $\quad$ .076

.463 $\quad n = 3$ $\quad \frac{1}{\sqrt{10}} - \frac{1}{\sqrt{17}} - \frac{1}{\sqrt{168}} + \frac{1}{\sqrt{175}}$ $\quad .0721^{-1}$ $\quad \boxed{13.89}$

.3162 $\quad$ .2425 $\quad$ .0772 $\quad$ .0756

.2441 $\quad$ .2441

.0721

.8333
.16
.5317
.0833
.16
.0417

$a = 1000'$ $\theta = 90°$

$d = 0$ $\cos\theta = 0$ $\infty - C$

$l = 12.6$ $l^2 = 159$

$n = 0.5 \rightarrow 3.0$

$$e_a/2\pi = \frac{1000V}{I}\left[\frac{1}{n(n+1)} - \frac{1}{\sqrt{n^2+l^2}} + \frac{1}{\sqrt{(n+1)^2+l^2}}\right]$$

.1667 .1142

n	
½	0.75
1	2.00
1½	3.75
2	6.04
2½	8.90
3	12.24

$$\frac{1}{\sqrt{x}} = \sqrt{x^{-1}}$$

H − C

$a = 1000$ $\theta = 90°$

$d = 1$ $\cos\theta = 0$

$l = 0$

$n = 0.5 - 3.0$

$$e_a/2\pi = \frac{aV}{I}\left[\frac{1}{\sqrt{n^2+1}} - \frac{1}{\sqrt{(n+1)^2+1}} - \frac{1}{n(n+1)}\right]^{-1} = \left|\frac{aV}{I}(-1.007)\right|$$

	.8944	.5547	1.333	
0.5				
1.0	.7071	.4472	.5000	$\left\|\frac{aV}{I}(-4.16)\right\|$
1.5	.5547	.3714	.2667	12.0
2.0	.4472	.3162	.1667	28.0
2.5	.3714	.2747	.1143	56.8
3.0	.3162	.2425	.0833	103.5

$\frac{\rho_a}{2\pi} = \frac{1000V}{I}(G.F.)$ $\infty \rightarrow H$

		NX	$\rho_a/2\pi$	PFE	MCF	SX	$\rho_a/2\pi$	PFE	MCF
½	2.94	56.2/3	55	2.8	51	65.1/3	64	3.1	48
1	3.86	112/4	108	3.6	33	50.2/3	65	3.1	48
1½	5.50	66.15/4	91	4.6	51	33.15/3	61	3.7	61
2	7.69	26.5/3	68	6.0	88	24.1/3	62	4.5	73
2½	10.63	22.43/3	79	5.3	67	18.04/3	64	5.6	88
3	13.89	20.96/3	97	4.3	44	13.35/3	62	7.1	114

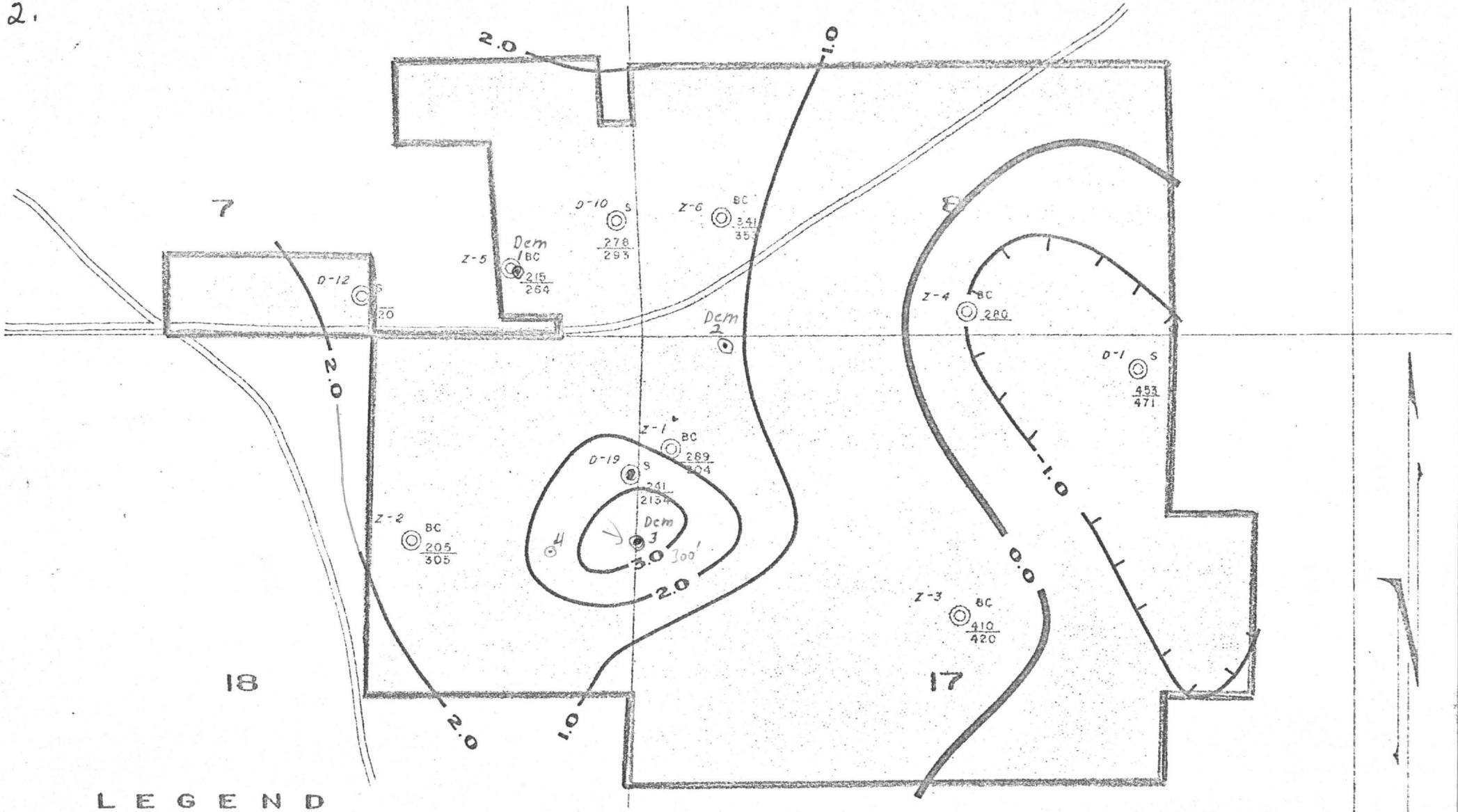
$\infty \rightarrow C$

		NX				SX			
½	0.75	225/3	56	3.5	63	211.5/3	53	2.4	45
1	2.00	52.15/3.5	30	3.0	100	87.25/3	58	3.7	64
1½	3.75	39.8/3.5	43	4.2	98	47.9/3	60	3.7	62
2	6.04	33.25/3	67	5.1	76	29.8/3	60	4.8	80
2½	8.90	24.9/3	74	5.4	73	20.65/3	61	5.8	95
3	12.24	23.05/3	94	5.1	54	14.76/3	60	6.3	105

$H \rightarrow C$

		NX				SX			
½	1.007	165.5/3	56	3.3	59	428.5/9	48	2.4	50
1	4.16	119.7/9	55	3.6	65	113.8/9	53	2.9	55
1½	12.0	44.0/9	59	5.0	85	41.8/9	56	3.0	54
2	28.0	20.47/9	64	4.2	66	18.28/9	57	3.2	56
2½	56.8	9.65/9	61	4.0	66	8.0/9	50	3.3	66
3	103.5	5.96/9	69	5.6	81	4.45/9	51	4.7	92

2.



LEGEND

S SUPERIOR DRILL HOLE

BC BEAR CREEK DRILL HOLE

410/420 DEPTH TO BEDROCK / TOTAL DEPTH

PERCENT FREQUENCY EFFECT
INDUCTIVE COUPLING CORRECTED
CONTOUR PLAN
3n Interval Separation
(Between Sender & Receiving Dipoles)
Electrode Array:

1000' — 3n = 3000' — 1000'

SENDER DIPOLE — RECEIVER DIPOLE

THE SUPERIOR OIL COMPANY
MINERALS DIVISION TUCSON, ARIZONA

INDUCED POLARIZATION SURVEY

DEMETRIE WASH

SCALE 1" = 1000'

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TWIN BUTTES QUADRANGLE
ARIZONA—PIMA CO.
15 MINUTE SERIES (TOPOGRAPHIC)

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, and USCE

Topography by planetable surveys 1938–39
Culture revision and field check 1957

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, central zone
1000-meter Universal Transverse Mercator grid ticks, zone 12, shown in blue

13°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1957

SCALE 1:62 500

1 ½ 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 50 FEET
DATUM IS MEAN SEA LEVEL

ARIZONA
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Unimproved dirt
U. S. Route — State Route

TWIN BUTTES, ARIZ.
N3145—W11100/15

1957

FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER 25, COLORADO OR WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT _____

LINE _____ HALF E SP. _____ DATE 4-4

SEND	sub hole	sub collar	hole collar	sub hole	sub collar	hole collar	sub hole	sub collar	hole collar	
RECEIVE	5-15	→	→	10-20	→	→	15-25			CAL
RANGE										
VOLTAGE										
CURRENT	3A		9A	3A		9A	3A	3A	9A	1A
SEND	sub hole	sub collar	hole collar	sub hole	sub collar	hole collar	sub hole	sub collar	hole collar	
RECEIVE	20-30	→	→	25-35	→	→	30-40	→	→	
RANGE										
VOLTAGE										
CURRENT	3A	3A	9A	3A		9A	3A		9A	

FREQUENCIES .05 3.0

SENDER NO. MK4 6644-5

OPERATOR MONTIERTH

RECEIVER NO.

OPERATOR HURLEY

COMMENTS:

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT _____

LINE _____ HALF E SP. _____ DATE _____

PAGE

SEND	∞-Hole	∞-Collar	Hole-Coll	∞-Hole	∞-Collar	Hole-Coll	∞-Hole	∞-Collar	Hole-Coll	
RECEIVE	5-15 →			10-20 →			15-25 →			
RANGE	3000		1600	1000		300	100		100	
DC 1			370-370			90-91	38-39		31-31.5	
DC 2			370-370			90-91	37-39		31-31.5	
DC 3			370-370			90-91	38-38		31-31.5	
DC 4										
DC 5										
DC 6										
DC 7										
DC 8										
DC AVG.			370			90.5			31.25	
AC 1	860		360	525		87	52.5		30.5	
AC 2			360			87	52.5		30.5	
AC AVG.			360			87.0			30.5	
S.P.	+1			+10					+3	
AC NOISE	.13			.15					.15	
POT RES.			1.7			2.9			1.4	

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT _____

LINE _____ HALF E SP. 89 DATE _____

PAGE

SEND	∞-Hole	∞-Colle	Hole-Colle	∞-Hole	∞-Colle	Hole-Colle	∞-Hole	∞-Colle	Hole-Colle	Col
RECEIVE	20-30	→	→	25-35	→	→	30-40	→	→	
RANGE	100	100	30	100		10	30		10	300
DC 1	08	34.5 32.5	13-14	22/22		6.3-6.6	17.5-17.7		3.0-3.2	99/99
DC 2			13.3-14	22/22		6.6-6.2			3.0-3.2	99/99
DC 3			13.4-14			6.6-6.6			3.0-3.0	99/99
DC 4			13.4-13.5			6.5-6.5			3.0-3.2	
DC 5			13.5-13.8			6.3-6.55			3.0-3.2	
DC 6						6.2-6.8				
DC 7										0.990
DC 8										
DC AVG.			13.61			6.48			3.08	
AC 1	30.7	35.5	13.4	23.8		6.3	19.8		3.0	97
AC 2	30.7	35.5	13.2	23.8		6.35	19.8		3.0	98
AC AVG.										
S.P.	+9			+8			-2			
AC NOISE	.125			.12			.1			
POT RES.			1.3			1.4			1.6	

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT _____

LINE ____ HALF 5 SP. ____ DATE 4-3

SEND	inf hole	inf collar	hole collar	inf hole	inf collar	hole collar	inf hole	inf collar	hole collar	
RECEIVE	5-15	→	→	10-20	→	→	15-25	→	→	CAL
RANGE										
VOLTAGE										
CURRENT	3A	3A	9A	3A	3A	9A	3A	3A	9A	1A
SEND	inf hole	inf collar	hole collar	inf hole	inf collar	hole collar	inf hole	inf collar	hole collar	
RECEIVE	20-30	→	→	25-35	→	→	30-40	→	→	
RANGE										
VOLTAGE										
CURRENT	3A	3A	9A	3A	3A	9A	3A	3A	9A	

FREQUENCIES 0.5 3.0

SENDER NO. MK4 6644 5

OPERATOR MONTIERTH

RECEIVER NO.

OPERATOR

COMMENTS:

5X 12600'

PAGE

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT CF&I
LINE ____ HALF ____ SP. ____ DATE 4/5/67

SEND	∞-L	∞-C	H-C	∞-H	∞-C	H-C	∞-H	∞-C	H-C	CXL
RECEIVE	5-15	→	→	10-20	→	→	15-25	→	→	H-C
RANGE	100	300	1000	100	300	300	100	100	100	300
DC 1	65.2	213	427	50.4	87.5	113.5	32.8	46.8	42.9	98
DC 2	65.2	210	429	50.1	87	114	33.9 P	49.0	40.6	98.5
DC 3	65.0	213	429	50.3	87.5	113.5	32.6	46.7	42.9	98.5
DC 4	65.2	210	428	50.1	87	114	33.8	49.1	40.6	98.5
DC 5	64.8						32.3		43.2	98.5
DC 6	65.5						33.8		40.7	
DC 7	64.8						32.2		43.0	
DC 8	65.5						34.2			
DC AVG.	65.1	211.5	428.5	50.2	87.25	113.8	33.15	47.9	41.8	98
AC 1	62.6	206	417	48.4	83.5	110	31.8	46.0	40.4	98
AC 2	63.0	205	416	48.4	84	110	31.8	46.0	40.4	
AC AVG.	62.8	205.5	416.5		83.75					
S.P.	+9	→	→	+14	→	→	+6	→	→	995
AC NOISE	.05	→	→	.05	→	→	.04	→	→	
POT RES.	3.1	2.4	2.4	3.1	3.7	2.9	3.7	3.7	3.0	

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

SX I.C. 89

PROJECT _____

LINE _____ HALF _____ SP. _____ DATE _____

PAGE

SEND	∞-H	∞-C	H-C	∞-H	∞-C	H-C	∞-H	∞-C	H-C	
RECEIVE	20-30	→	→	25-35	→	→	30-40	→	→	
RANGE	30	100	30	30	30	30	30	30	10	
DC 1	24.0	29.7	18.1	18.8	20.4	7.9	13.2	14.3	4.46	
DC 2	24.2	30.2	16.5	17.3	20.9	8.1	13.6	15.3	4.45	
DC 3	24.1	29.4	18.1	18.7	20.4	7.8	13.1	14.2	4.44	
DC 4	24.0	30.2	18.5	17.4	20.9	8.2	13.6	15.3	4.48	
DC 5	24.1	29.3	18.0	18.7		7.8	13.0	14.2	4.40	
DC 6		30.3	18.5			8.2	13.7	15.3	4.49	
DC 7							13.0		4.39	
DC 8									4.57	
DC AVG.	24.1	29.8	18.28	18.04	20.65	8.0	13.35	14.76	4.45	
AC 1	22.9	28.3	17.6	17.0	19.6	7.7	12.4	13.8	4.24	
AC 2	23.0	28.3	17.6	17.0	19.5	7.7	12.4	13.8	4.22	
AC AVG.										
S.P.	-7	→	→	-8	→	→	+4	→	→	
AC NOISE	.05	→	→	.04	→	→	.03	→	→	
POT RES.	4.5	4.8	3.2	5.6	5.8	3.3	7.1	6.3	4.7	

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT _____

LINE _____ HALF W SP. _____ DATE 4-4

SEND	~~inf hole~~	~~inf collar~~	~~hole collar~~	~~inf hole~~	~~inf collar~~	~~hole collar~~	~~inf hole~~	~~inf collar~~	~~hole collar~~	
RECEIVE	5-15	→	→	10-20	→	→	15-25	→	→	CAL
RANGE										
VOLTAGE										
CURRENT	3A	3A	9A	3A	3A	9A	3A	3A	9A	1A
SEND	~~inf hole~~	~~inf collar~~	~~hole collar~~	~~inf hole~~	~~inf collar~~	~~hole collar~~	~~inf hole~~	~~inf collar~~	~~hole collar~~	
RECEIVE	20-30	→	→	25-35	→	→	30-40	→	→	
RANGE										
VOLTAGE										
CURRENT	3A	3A	9A	3A	3A	9A	3A	3A	9A	

FREQUENCIES .05 3.0

SENDER NO. MK4 6645

OPERATOR MONTIERTH

RECEIVER NO.

OPERATOR HURLEY

COMMENTS:

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT _____
LINE _____ HALF W SP. _____ DATE _____

PAGE

SEND	∞-Hole	∞-Collar	Collar-Hole	∞-Hole	∞-Collar	Hole-Collar	∞-Hole	∞-Collar	Hole-Collar
RECEIVE	5-15	→	→	10-20	→	→	*15-25	→	→
RANGE	100	300	1000	100	100	300	100	100	100
DC 1	51-51.3	201-203	445-447	40-40.1	77-75	101-104	30.5-31	45-47.9	39.5-38.5
DC 2	51-51.3	201-203	445-447	40-40.1	77-75	101-104	30.5-31	44.5-44	38.5-38.5
DC 3	51-51.3	201-203	445-447	40-40.1	77.5-74.5	101-104	30.5-31	44.5-44.5	38.5-38.5
DC 4					77.5-74.5			44.5-44.5	39-38.5
DC 5									39-38.5
DC 6									
DC 7									
DC 8									
DC AVG.	51.15	202	446	40.05	76.0	102.5	30.75	44.4	38.7
AC 1	49.5	198	440	38.3	73.7	100	29.3	42.2	37.8
AC 2	49.5	198	440	38.3	73.8	100	29.3	42.3	37.8
AC AVG.					73.75			42.25	
S.P.	-1			+5			+1		
AC NOISE	.15			.13			.143		
POT RES.	*2.4	1.0	0.3	3.6	2.0	1.5	3.9	4.0	1.3

HEINRICHS GEOEXPLORATION CO.
I.P. RECEIVER NOTES

PROJECT _____
LINE _____ HALF W SP. _____ DATE _____

PAGE

SEND	∞-Hole	∞-Cells	Hole-Cell	∞-Hole	∞-Cells	Hole-Cell	∞-Hole	∞-Cells	Hole-Cells	Cal
RECEIVE	20-30 →			25-35 →			30-40 →			
RANGE	100	100	30	30	30	30	30	30	30	300
DC 1	24/23.9	30/30.5	21/20.4	20.6-20.5	25.2-25	13.4-13.2	[illegible]	20.5-19.1	8.7-8.4	100/100
DC 2	24/23.9	30.5/30	21/20.4	20.5-20.5	25.2-25	13.2-12.6	17.5-16.2	20.5-20	8.8-8.2	100/100
DC 3	24/23.9	30/30.5	21/20.4	20.7-20.7	25.2-25	13.2-12.8	16.9-17.-	20.3-19.5	8.8-8.2	100/100
DC 4		30/30.5		20.5-21.-		13.2-13.-	17.3-16.6	19.6-19.5	8.3-8.6	
DC 5				20.4-21.3		12.9-12.5	17.--17.	20.2-19.8	26	
DC 6				20.4-20.8		13.2-12.7	16.9-17	20.6-19.8	14 40	
DC 7				21-21						0.990
DC 8										
DC AVG.	23.95	30.25	20.7	20.72	25.1	12.99	16.9	19.93	8.50	
AC 1	22.1	29	20.2	19.3	23.7	12.5	15.6	18.6	8.3	99
AC 2	22.1	29	20.2	19.4	23.7	12.5	15.6	18.6	8.3	99
AC AVG.			20.2	19.35						
S.P.	-1			+2			+2			
AC NOISE	.14			.175			.18			
POT RES.	7.2	3.2	1.5	6.0	4.8	2.8	7.2	6.1	1.4	

Black = infinite
Blue = hole
Yellow = Collar

PAGE 1

HEINRICHS GEOEXPLORATION CO.

I. P. SENDER NOTES

PROJECT _____
LINE _____ HALF N SP. _____ DATE 4-3

SEND	infinite hole	infinite collar	hole collar	infinite hole	infinite collar	hole collar	infinite hole	inf collar	hole collar	
RECEIVE	5-15	→	→	10-20	→	→	15-25	→	→	CAL
RANGE										
VOLTAGE										
CURRENT	3 A	3 A	3 A	4 A	3 1/2 A	9 A	4 A	3 1/2 A	9 A	1 A
SEND	inf hole	inf collar	hole collar	inf hole	inf collar	hole collar	inf hole	inf collar	hole collar	
RECEIVE	20-30	→	→	25-35	→	→	30-40	→	→	
RANGE										
VOLTAGE										
CURRENT	3 A	3 A	9 A	3 A	3 A	9 A	3 A	3 A	9 A	

FREQUENCIES _____ _____
SENDER NO. MK4-6644S
OPERATOR MONTIERTH
RECEIVER NO.
OPERATOR

COMMENTS:

NX Black = ∞ Blue = Hole Yellow = Collar

PAGE

HEINRICHS GEOEXPLORATION CO.

5 in to SE DH

I.P. RECEIVER NOTES

PROJECT CF&I D.W.

LINE ____ HALF ____ SP. ____ DATE 4/3/6

SEND	∞-hole	∞-collar	hole-Coll	∞-h	∞-C	H-C	∞-h	∞-C	H-C	AL
RECEIVE	5-15	→	→	10-20	→	→	15-25			H-C
RANGE	100	300	300	300	100	300	100	100	100	300
DC 1	57.1	226	167	112	51.7	120	65.8	40.2	44.3	99
DC 2	55.4 1st	224	164	111.5	52.6	119	66.3	39.5	43.8	98.5
DC 3	57.1	226	167	112.5	51.7	120.5	66.0	40.1	44.6	99
DC 4	55.4	224	164	111.5	52.6	119	66.3	39.5	43.6	98.5
DC 5 1/126	54.9 57.8			113		120.5	66.1	40.1	44.3	99
DC 6 1/123	57.7			111			66.3		43.4	98.5
DC 7 1/122	54.6									
DC 8 1/122	57.6									
DC AVG.	54.6 56.7	225	165.5	112	52.15	119.7	66.15	39.8	44.0	98.75
AC 1	54.6?	220	162	109.5	51.3	117	64.1	38.7	42.5	100
AC 2	55.4	220	162	109.5	51.4	117	69.1	38.6	42.4	100
AC AVG.	55.5	220	162	109.5	51.35	117	64.1			100
S.P.	55.45	-2	→	+4	→	→	+5	→	→	
AC NOISE	.01	→	→	.05	→	→	.05	→	→	1.012
POT RES.	2.8	3.5	3.3	3.6	3.0	3.6	4.6	4.2	5.0	

NX 89-I.C.

HEINRICHS GEOEXPLORATION CO.

I.P. RECEIVER NOTES

PROJECT CFII

LINE ____ HALF ____ SP. RDO DATE 4/3/67

PAGE

SEND	∞-H	∞-C	H-C	∞-H	∞-C	H-C	∞-H	∞-C	H-C	
RECEIVE	20-30	→	→	25-35	→	RBR	30-40	→	→	
RANGE	100	100	30	30	100	30	30	30	10	
DC 1	27.9	32.9	20.4 20.5	22.4 22.5	25.0	10.1 9.1	23.7 23.4	21.6 21.6	5.65	
DC 2	25.0	33.8	21.0 20.9	22.1 22.2	24.7	8.9 10.3	22.5 22.7	20.4 20.2	6.26	
DC 3	28.1	32.7	20.4 20.2	22.3 22.9	24.3	10.1 10.2	23.4 23.7	21.7 21.3	6.12	
DC 4	24.8	33.9	20.7 20.5	22.2 22.6	25.0	9.1 9.1	22.7 22.7	20.2 20.5	5.82	
DC 5	28.0	32.6	19.9	22.7 22.8	24.7	8.9 9.1	23.8	21.4	5.87	
DC 6		33.8	20.0	22.3 22.2	25.5	10.4 10.3	22.8	20.3	6.13	
DC 7		32.6	20.1	22.5 22.6	24.9	10.1 9.1	23.6	21.8	6.32	
DC 8			20.7	22.2 22.2	25.5	9.2 9.2	22.2	20.6	5.52	
DC AVG.	26.5	33.25	20.47	22.43	24.9	9.65	23.05	20.96	5.96?	
AC 1	25.3	32.1	19.9	21.55	23.9	9.4	22.2	20.3	5.71	
AC 2	25.3	32.0	19.9	21.6	24.0	9.4	22.2	20.35	5.71	
AC AVG.		32.05								
S.P.	-1	→	→	+3	→	→	+5	→	→	
AC NOISE	.05	→	→	.05	→	→	.03	→	→	
POT RES.	6.0	5.1	4.2	5.3	5.4	4.0	5.1	4.3	5.6 ?	