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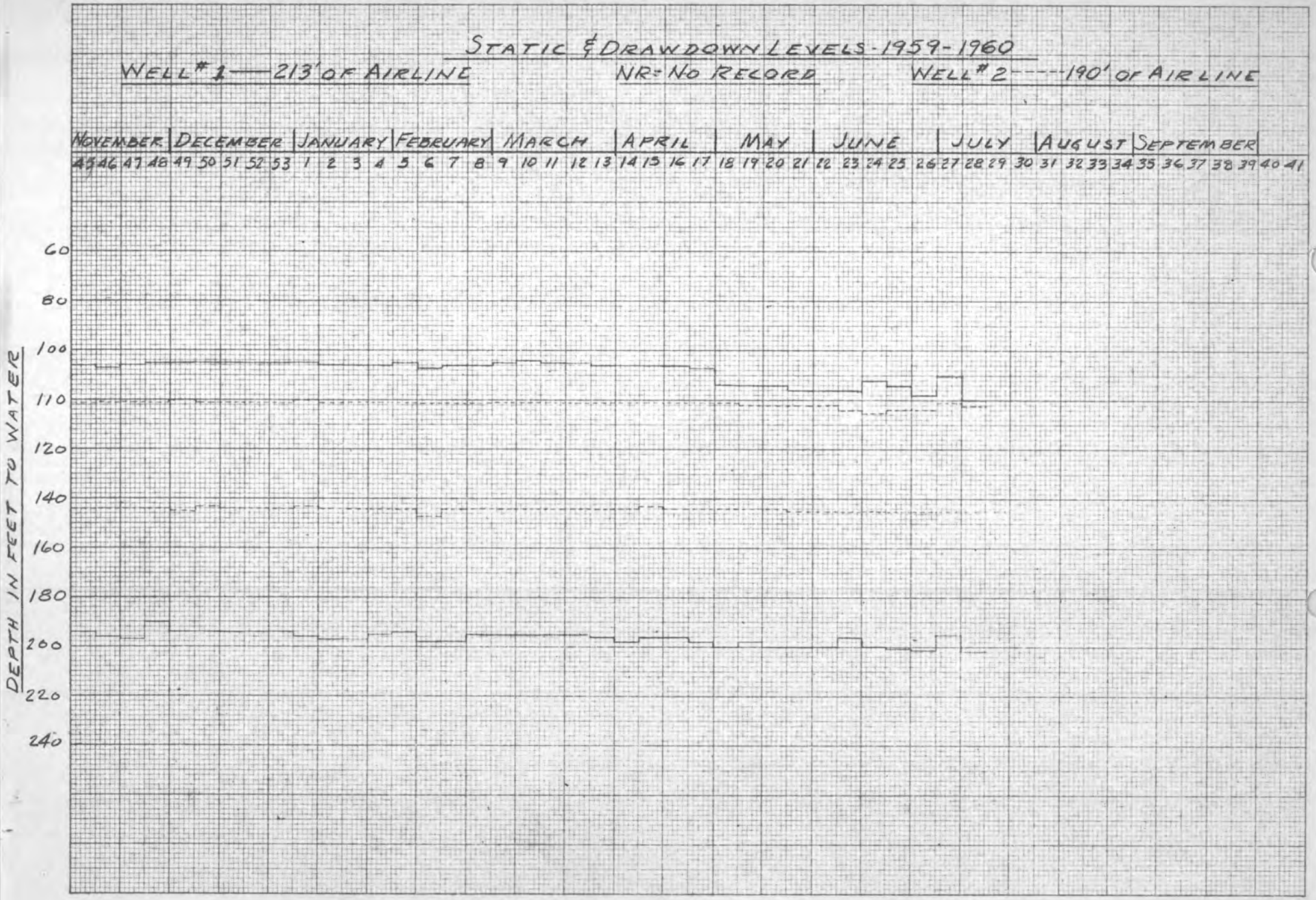
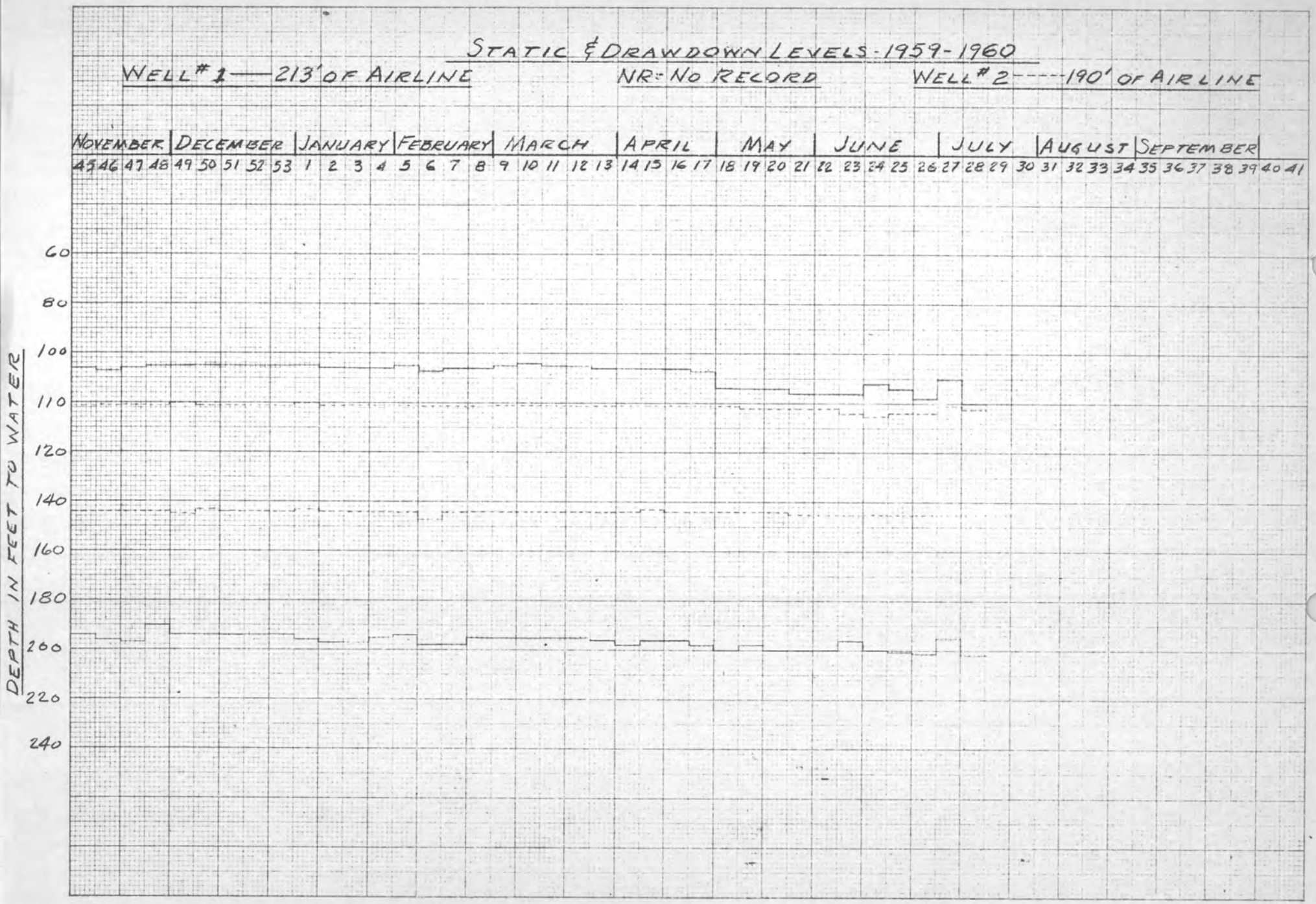
K+E 10 X 10 TO THE CM. 359-14
KEUFFEL & ESSER CO.

STATIC & DRAWDOWN LEVELS - 1959-1960

WELL #1 —— 213' OF AIRLINE NR = NO RECORD WELL #2 ----- 190' OF AIRLINE




STATIC & DRAWDOWN LEVELS - 1959-1960
WELL # 1 —— 213' OF AIRLINE
NR = NO RECORD
WELL # 2 ---- 190' OF AIRLINE
NOVEMBER
DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
45 46 47 48 49 50 51 52 53 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41
DEPTH IN FEET TO WATER
60
80
100
110
120
140
160
180
200
220
240

DATA ON WELLS AND PUMP IRRIGATION

AGRICULTURAL ENGINEERING DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
TUCSON, ARIZONA

UNIVERSITY OF ARIZONA

NAME: Hughes Aircraft Co. well#1 ADDRESS:

WELL: Location NW NW Sec. 29 Twp. 15S R. 14 E

Use, domestic, stock, or irrigation ..... acres

Type Drilled Casing 352'-16" #10 stare pipe 8-9 cuts/ft 346-150'

Perforations

Drilled by CW Pistor Date: Apr. 1952

29

2595 [illegible]

LOG

FROM Feet	TO Feet	MATERIAL	FROM Feet	TO Feet	MATERIAL
0	6	Fill	254	265	Cemented sand
6	10	Sandy clay- topsoil	265	330	Sticky red clay
10	30	White caliche	330	348	Cemented sand
30	50	Red caliche	348	400	Sticky red clay
50	60	White caliche			
60	75	Red caliche			
72	82	Sandy clay			
82	92	Hard sandy clay			
92	126	Red sandy clay			
126	140	Sticky Red clay			
140	154	Cemented sand			
154	156	Loose sand			
156	180	Sticky red clay			
180	186	Cemented sand			
186	254	Sticky red clay			

2520

2430

WATER LEVEL: Depth from surface when drilled 84 feet. Date

Present depth to water ..... feet. Date

Notes on fluctuation of water level

PUMP: Make Peerless Type Turbine Size

Diam. of bowls ..... Number of stages

Diam. of column 8" Diam. discharge 8" Diam. suction 8"

Rated capacity in G. P. M. 550 at 190' feet head, at ..... R. P. M.

Amount of discharge ..... G. P. M. measured by means of

Test. Drawdown ..... feet when pumping 500-525 G. P. M. Total lift 170' feet

ENGINE OR MOTOR: Make U.S. Type Elec. Motor Size 40 H. P.

Drive: direct-connected D-C belted ..... or geared

Fuel consumption or power input 440V 3Φ 60 cycle

Description of installation

[illegible]

DATA O[illegible] WELLS AND PUMP [illegible]RIGATION

AGRICULTURAL ENGINEERING DEPARTMENT

AGRICULTURAL EXPERIMENT STATION
TUCSON, ARIZONA

UNIVERSITY OF ARIZONA

NAME: HUGHE[illegible] [illegible]CRAFT CO[illegible]Y #2 **ADDRESS:** [illegible]st of [illegible] [illegible]

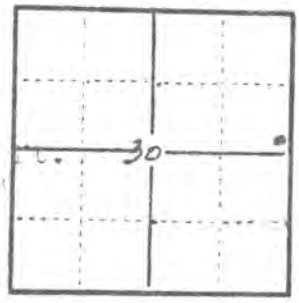
WELL: Location ..... Sec. 30, Twp. [illegible], R. [illegible]

Use, domestic, stock, or irrigation [illegible] acres

Type 14" [illegible] Casing stove-pipe

Perforations [illegible]

Drilled by [illegible] Date: [illegible]



[illegible] Top [illegible]

LOG

FROM Feet	TO Feet	MATERIAL	FROM Feet	TO Feet	MATERIAL
0	20	white caliche	[illegible]	[illegible]	[illegible]
20	34	red caliche	[illegible]	[illegible]	[illegible]
34	60	white caliche			
60	120	red sandy clay - struck wtr-80'			
120	130	red sandy clay			
130	140	Cemented sand			
140	180	red sticky clay			
180	195	sand, gravel and clay			
195	[illegible]	red sticky clay			
[illegible]	[illegible]	sandy red clay - fine sand			
340	[illegible]	cemented sand			
350	380	sticky red clay			
380	398	sticky red clay			
398	425	sticky red clay			
425	445	Packed sand (very fine sand)			

WATER LEVEL: Depth from surface when drilled [illegible]' feet. Date .....

Present depth to water [illegible]' feet. Date .....

Notes on fluctuation of water level none

test pumping - 180 gpm at 413' pumping level

PUMP: Make ..... Type ..... Size .....

Diam. of bowls ..... Number of stages .....

Diam. of column ..... Diam. discharge ..... Diam. suction .....

Rated capacity in G. P. M. ..... at ..... feet head, at ..... R. P. M.

Amount of discharge ..... G. P. M. measured by means of .....

Drawdown ..... feet when pumping ..... G. P. M. Total lift ..... feet

ENGINE OR MOTOR: Make ..... Type ..... Size ..... H. P.

Drive: direct-connected ..... belted ....., or geared .....

Fuel consumption or power input .....

Description of installation .....

[illegible]

Date: 10-14-54 (Signed) [illegible]

SEE OTHER SIDE FOR MISCELLANEOUS DATA

DATA ON WELLS AND PUMP IRRIGATION

AGRICULTURAL ENGINEERING DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
TUCSON, ARIZONA

UNIVERSITY OF ARIZONA

NAME: HUGHES AIRCRAFT CO. #3 SUNDT ADDRESS: NE of plant near RRspur

WELL: Location NE NE Sec. 29 Twp. 15S R. 14E

Use, domestic, stock, or irrigation ..... acres

Type ..... Casing 14" casing

Perforations .....

Drilled by R. Gustelum CWP Date: Oct. 1954

LOG

FROM	TO	MATERIAL	FROM	TO	MATERIAL
Feet 0	Feet 10	White caliche	Feet 190	Feet 205	Sand and gravel
10	15	Clay and boulders	205	280	Red sticky clay
15	30	Red caliche	280	295	Cemented sand
30	50	Red sandy clay	295	310	Sticky red clay
50	55	Sand	310	360	Sandy red clay
55	65	Red sandy clay	360	400	Cemented sand
65	75	Sand and gravel			
75	85	Red sand and clay			
85	105	Red clay			
105	135	Red sand-clay-struck water at 110'			
135	145	Loose sand			
145	160	Cemented sand			
160	174	Red sand and gravel			
174	180	Sticky red clay			
180	190	Cemented sand			

WATER LEVEL: Depth from surface when drilled 101 feet. Date Oct. 1954

Present depth to water ..... feet. Date .....

Notes on fluctuation of water level .....

2579

PUMP: Make ..... Type ..... Size .....

Diam. of bowls ..... Number of stages .....

Diam. of column ..... Diam. discharge ..... Diam. suction .....

Rated capacity in G. P. M. ..... at ..... feet head, at ..... R. P. M.

Amount of discharge ..... G. P. M. measured by means of .....

Drawdown ..... feet when pumping ..... G. P. M. Total lift ..... feet

ENGINE OR MOTOR: Make ..... Type ..... Size ..... H. P.

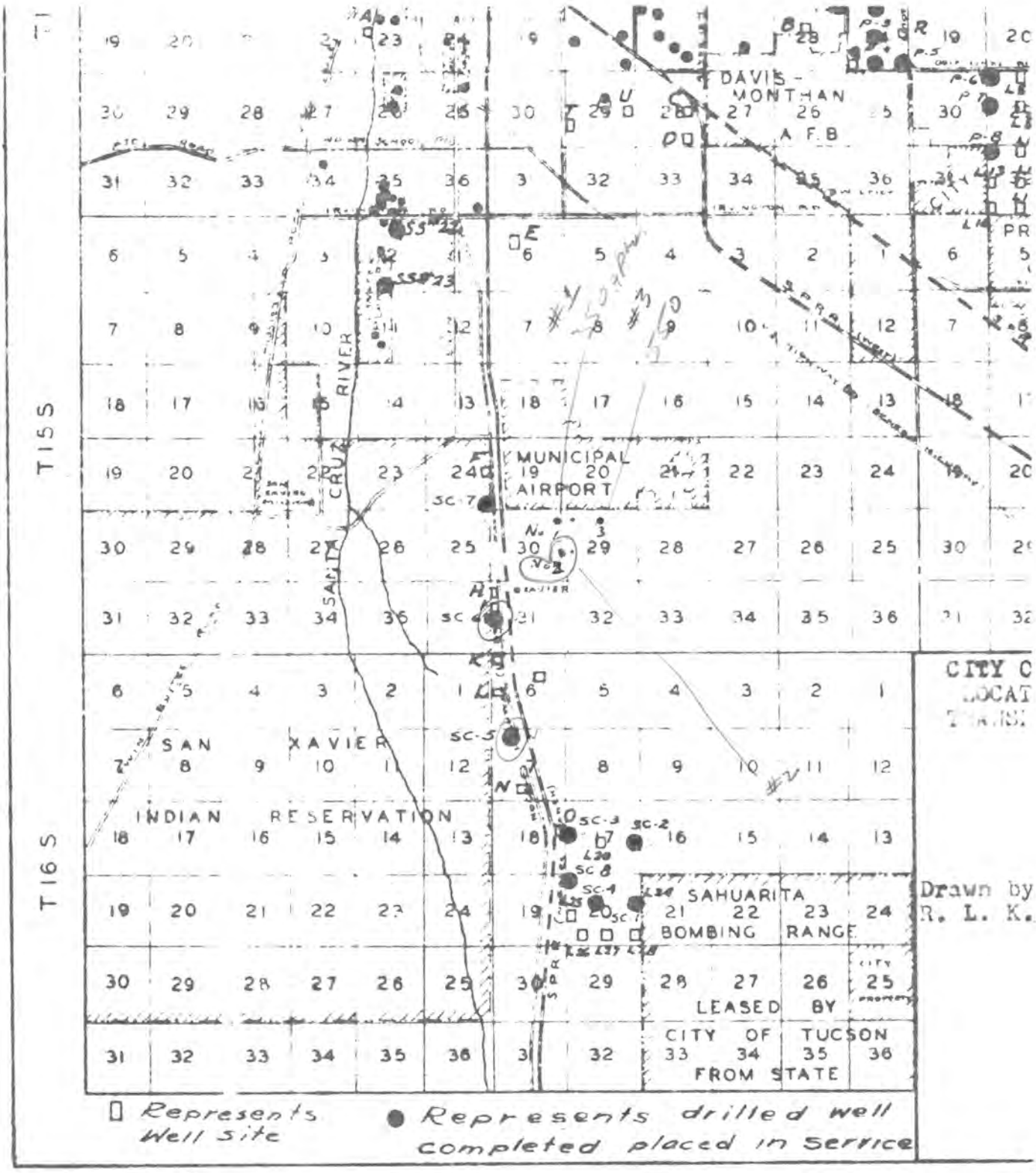
Drive: direct-connected ..... belted ..... or geared .....

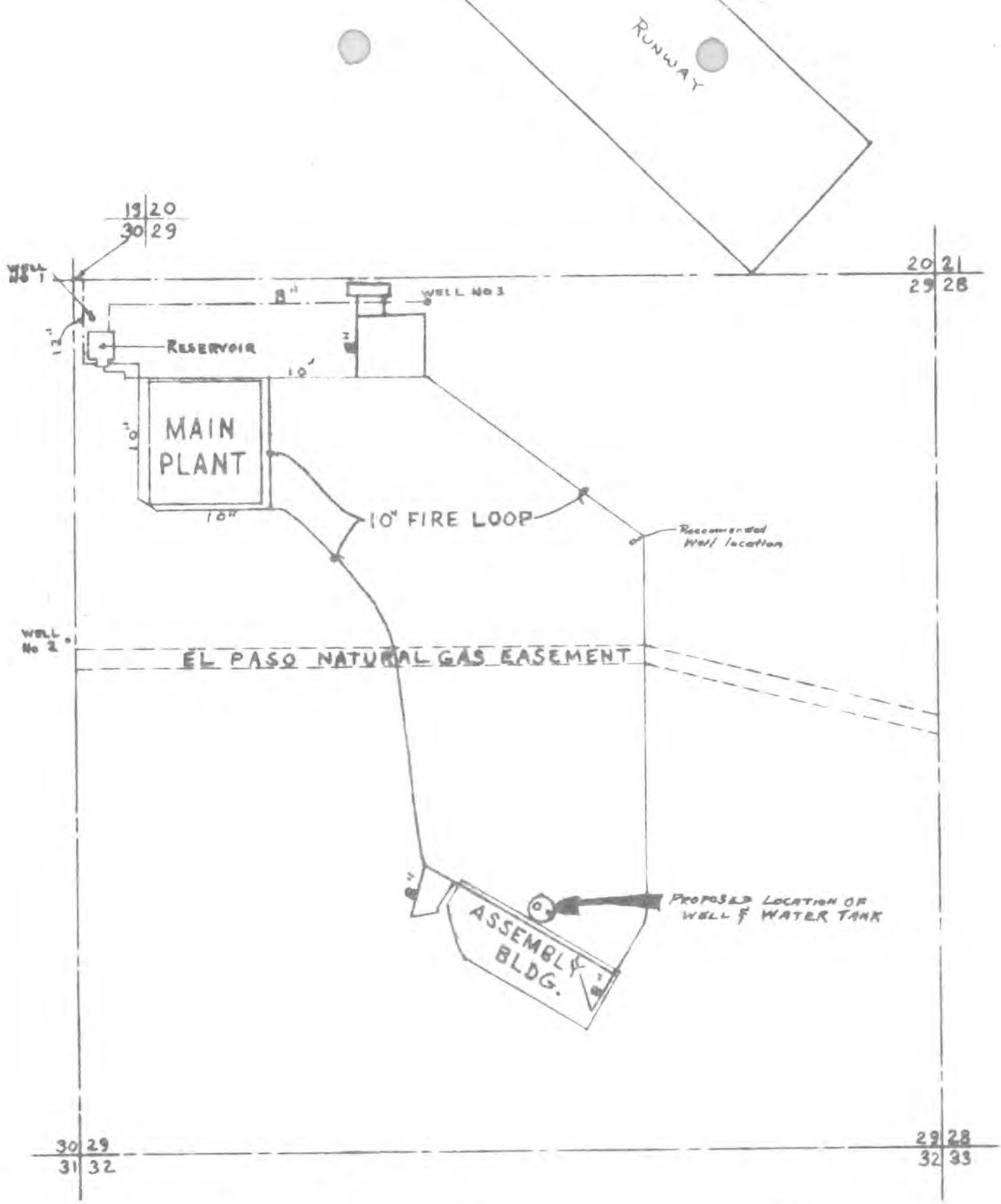
Fuel consumption or power input .....

Description of installation .....

Date: 7/5/56 (Signed) CWP

SEE OTHER SIDE FOR MISCELLANEOUS DATA MCF


T15S
T16S
DAVIS-MONTHAN A.F.B
SANTA CRUZ RIVER
MUNICIPAL AIRPORT
SAN XAVIER INDIAN RESERVATION
SAHUARITA BOMBING RANGE
LEASED BY CITY OF TUCSON FROM STATE
SC-1
SC-2
SC-3
SC-4
SC-5
SC-7
SC-8
Drawn by R. L. K.
Represents Well Site
Represents drilled well completed placed in service



ENCL. 'B' RECOMMENDED WELL LOCATION

TAYLOR, McFARLAND-JOHNSON

August 10, 1960

Mr. Don Lyons, Plant Staff Engineer
Hughs Aircraft Company
Department 5920
P. O. Box 11337
Emery Park Station
Tucson, Arizona

Re: 5920/1405

Dear Mr. Lyons:

The resistivity method we propose to apply to your problem will utilize direct current between 90 minimum and 500 volts maximum, from a bank of dry cell radio type "B" batteries at an average of 225 volts. This charge is put into the ground at two current electrodes which are either groups of usually stainless steel rods driven into the ground about two feet, or aluminum foil buried in shallow pits. These are wetted with an electrolite solution. Potential is then measured across non-polarizing porous pots that occupy two other central electrode positions and the resultant apparent resistivity computed.

A standard "Wenner" grounded electrode configuration is used in which equal "a" spacings are expanded from 10' - 15' to 1,000' maximum. See accompanying sketch. A five man crew is required--a geophysicist and four assistants who move the electrodes. Maximum distance for wire laid out along any spread would be 3,000 ft., consisting of 2 lengths 1,500' each and 2 more lengths 500' each extended along a straight line in 2 directions from the center of the layout.

A maximum 500 volts D.C. is used, manually alternated plus (+) and minus (-) with minor transients at switching on and off. There is approximately 1500 milliamps at maximum voltage or less. There is no interference with radio communications as there is no radio frequency energy. Current is always continuously fully grounded.

Briefly, this type survey simply measures the average resistance in varying layers of material in the earth including water table.

Very truly yours,

Walter E. Heinrichs, Jr.

WEH:jh
cc: 3 extra enclosed
Rus Taylor

1/9/61

#8

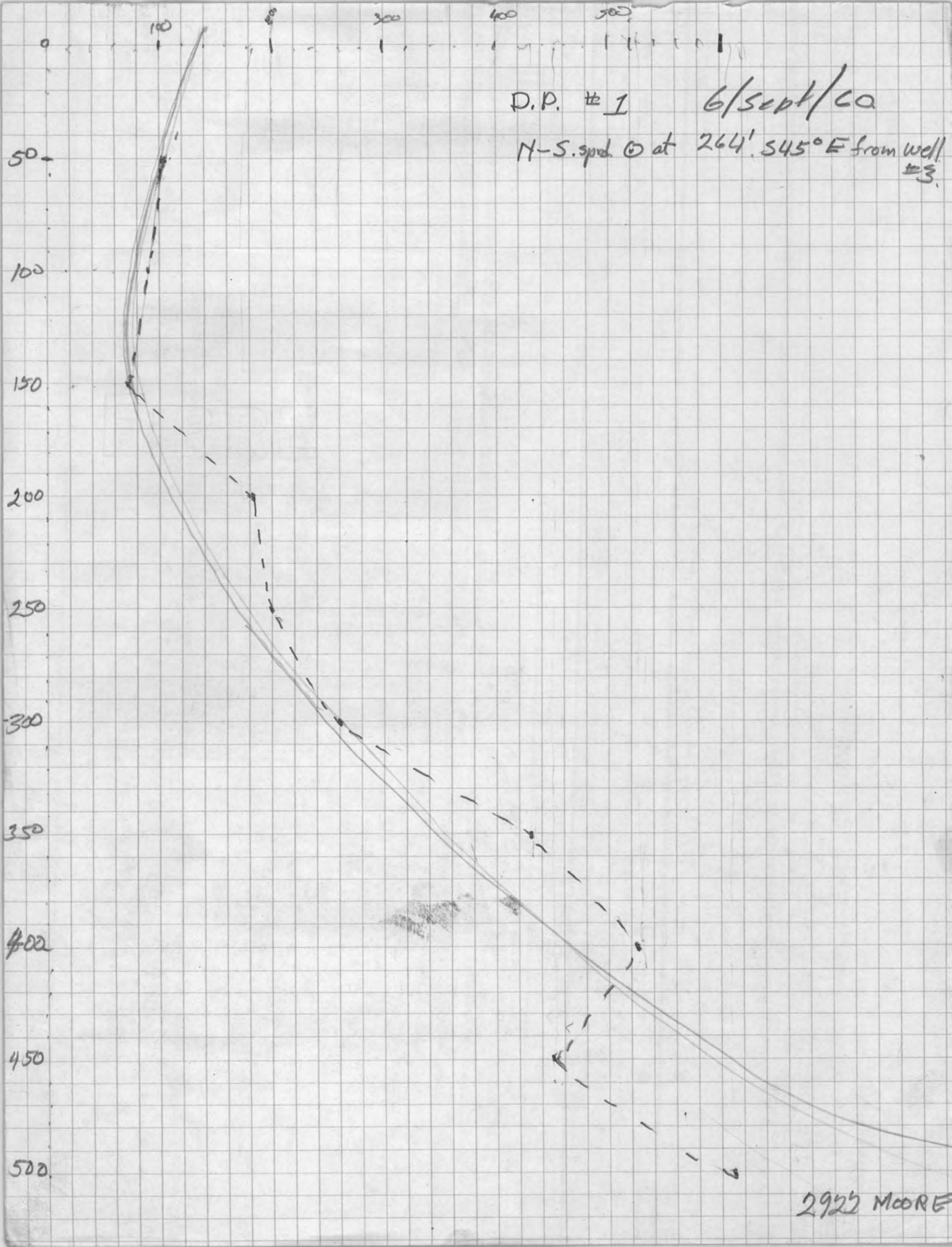
Static - 84.14' Sept 25, '58
(from hole in top plate,
+ 1.65 surface)

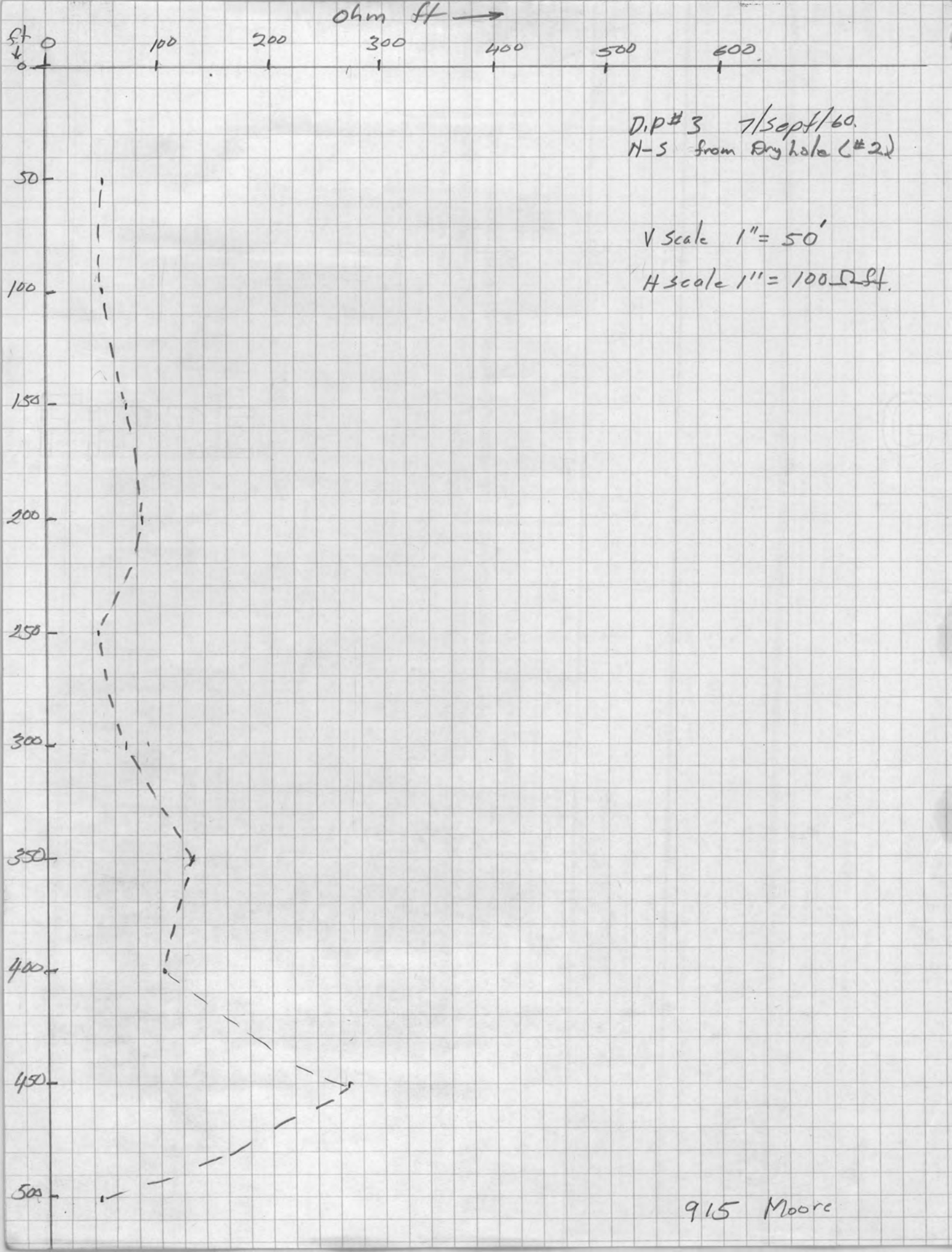
504' deep - 14" total depth.

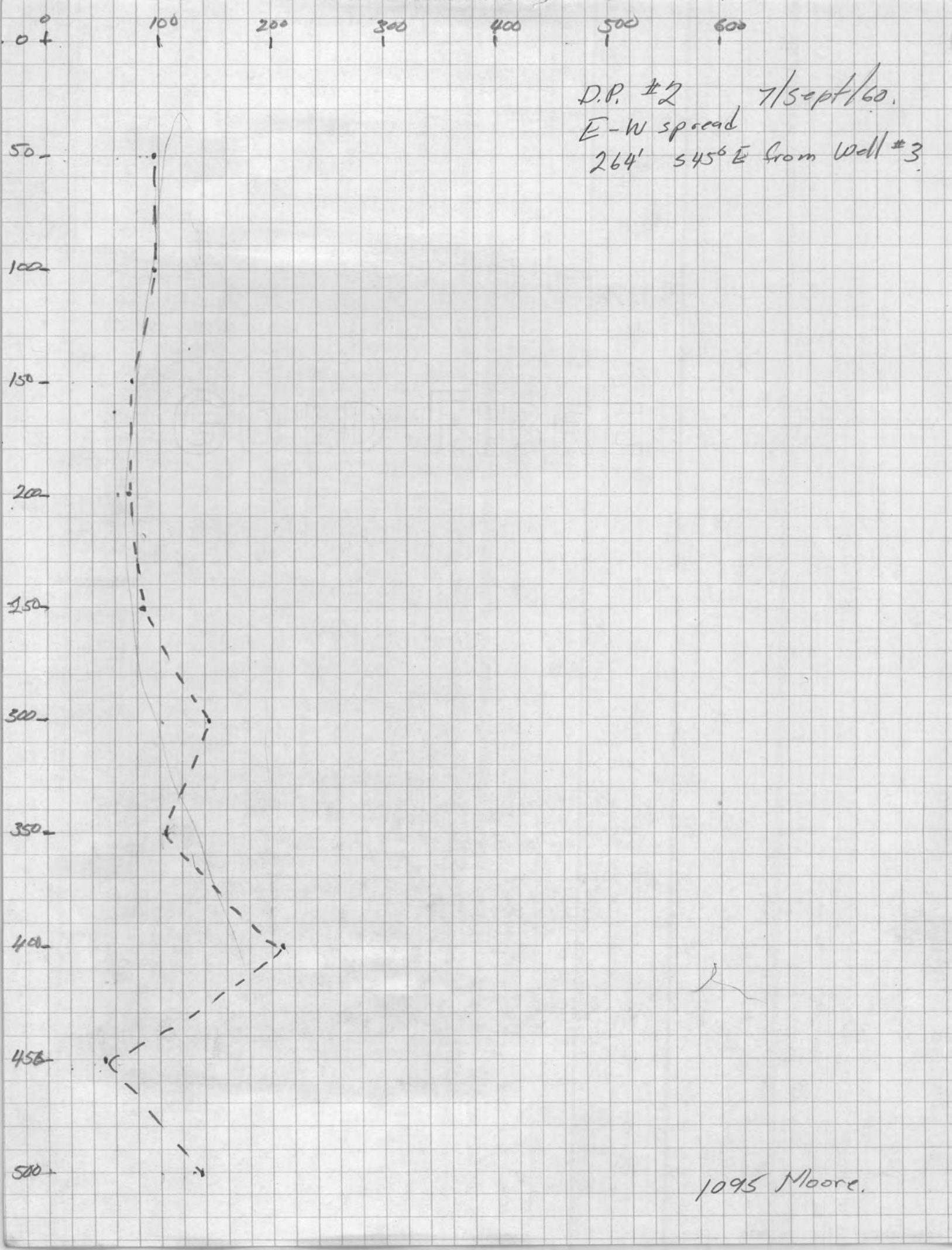
draw down 160' = 130 gpm.

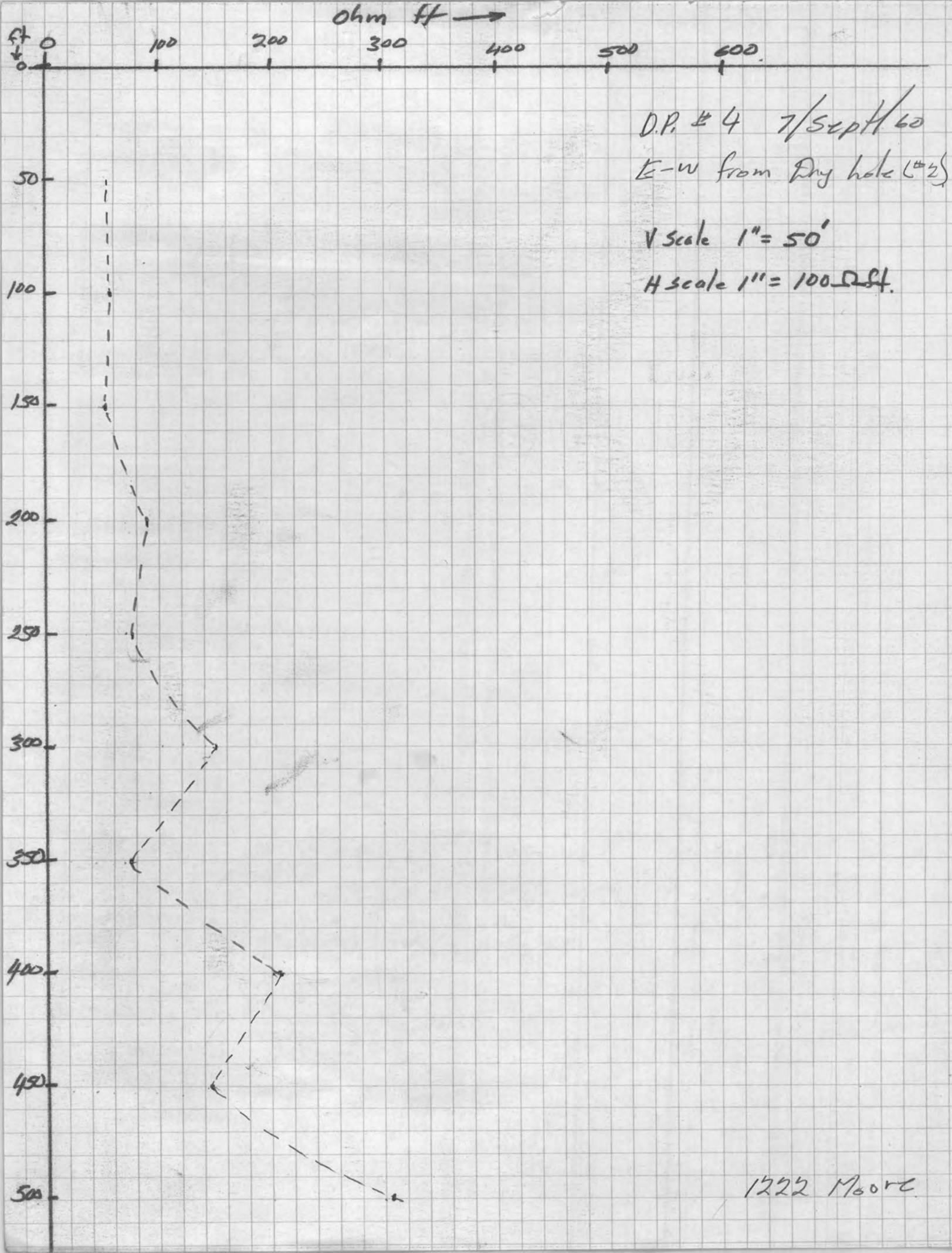
84
244'

More H2O, see draw down.


D.P. #1 6/Sept/CO
N-S. spd. ⊙ at 264'. S45°E from well #3.
0
100
200
300
400
500
50
100
150
200
250
300
350
400
450
500
2922 MOORE

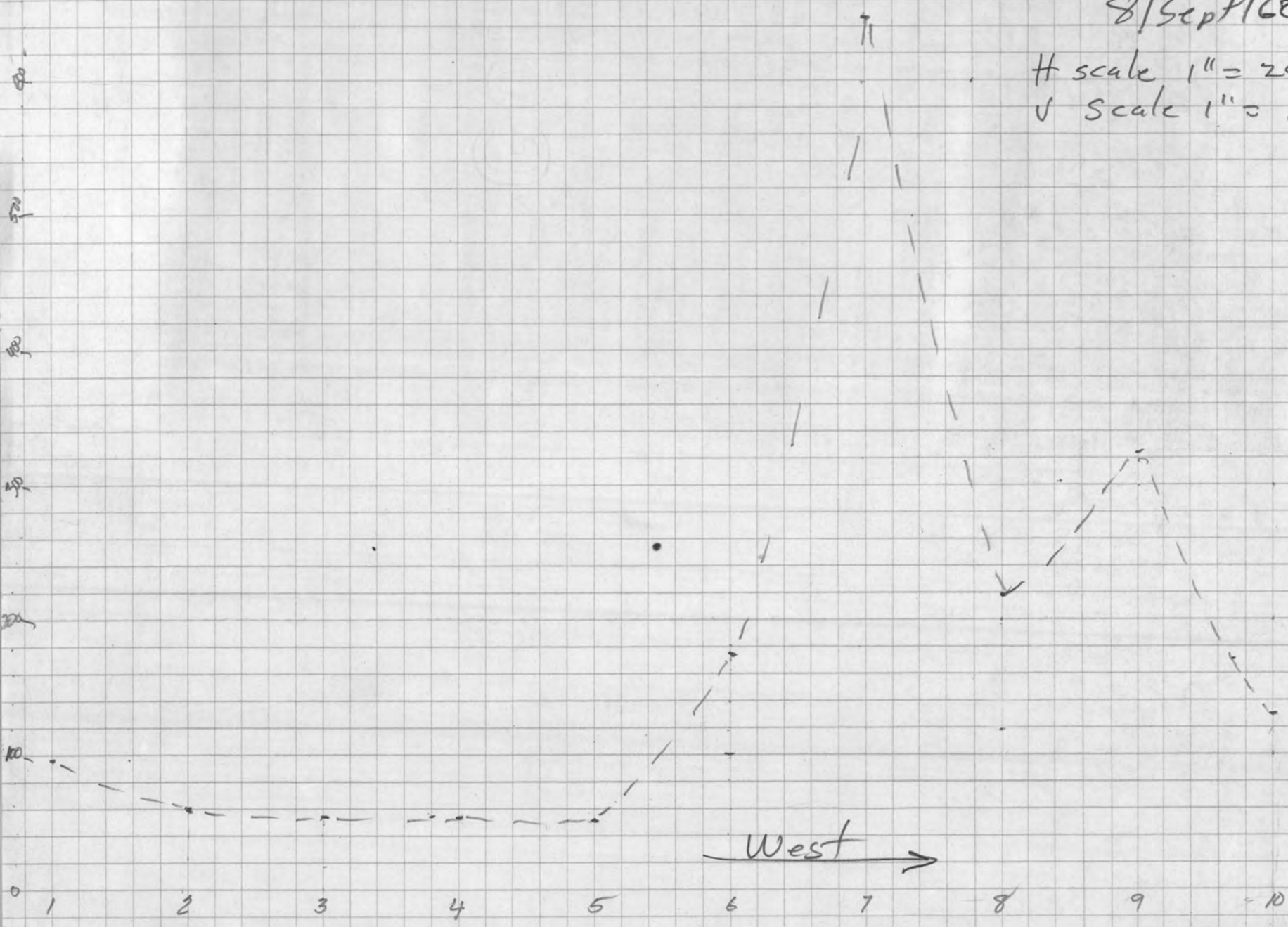

ohm ft →
ft ↓
0
100
200
300
400
500
600
50
100
150
200
250
300
350
400
450
500
D.P # 3 7/sept/60.
N-S from Dry hole (#2)
V Scale 1" = 50'
H scale 1" = 100 Ω ft.
915 Moore


0
100
200
300
400
500
600
D.P. #2 7/Sept/60.
E-W spread
264' S45°E from Well #3
50
100
150
200
250
300
350
400
450
500
1095 Moore.


Ohm ft →
ft ↓
0
100
200
300
400
500
600
50
100
150
200
250
300
350
400
450
500
D.P. # 4 7/Sept/60
E-W from Dry hole (#2)
V Scale 1" = 50'
H scale 1" = 100 Ω ft.
1222 Moore

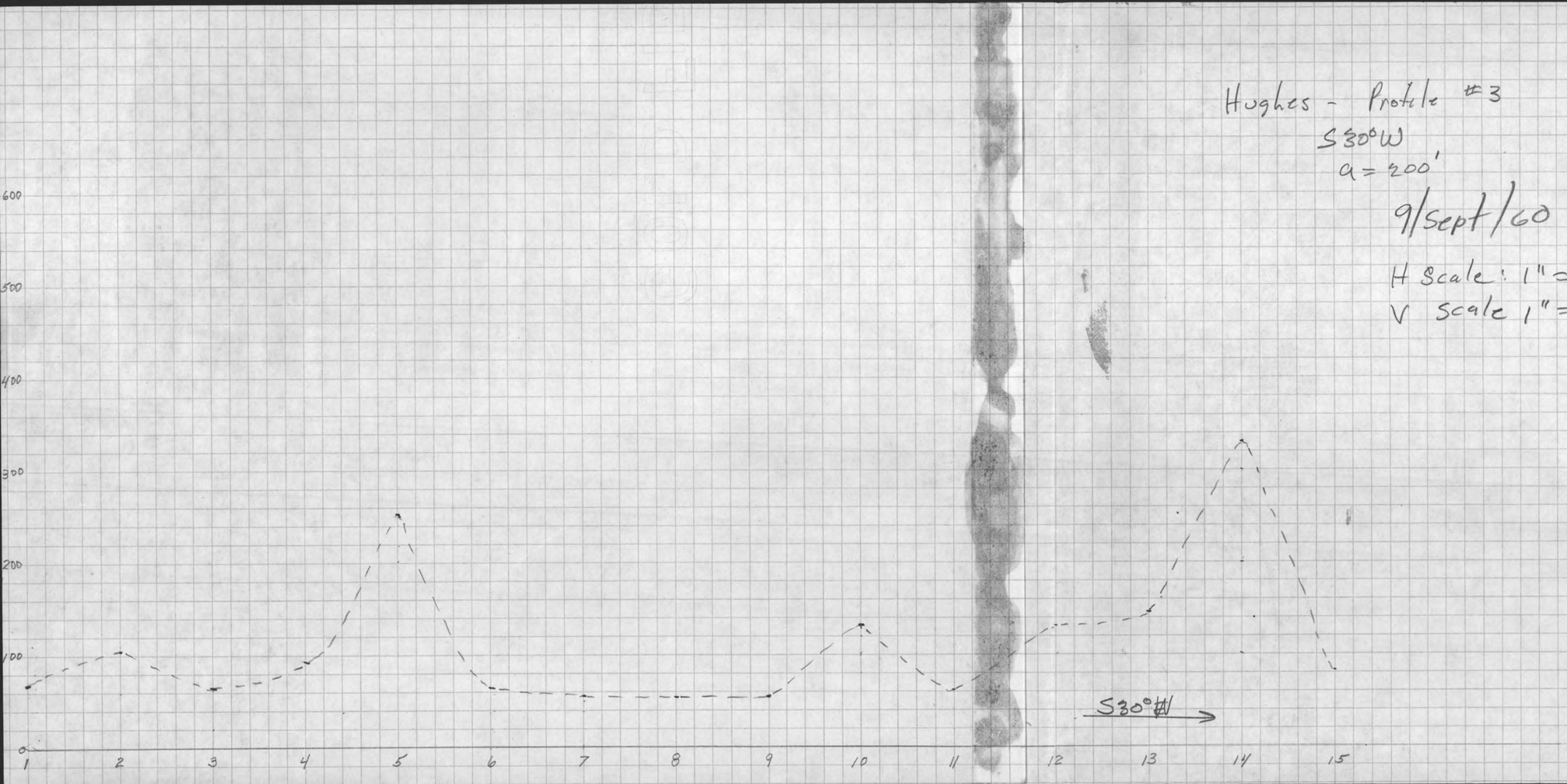
Hughes
Resistivity Profile #2
a = 200'
E-W
8/Sept/60

H scale 1" = 200 ft
V scale 1" = 100 Ω ft

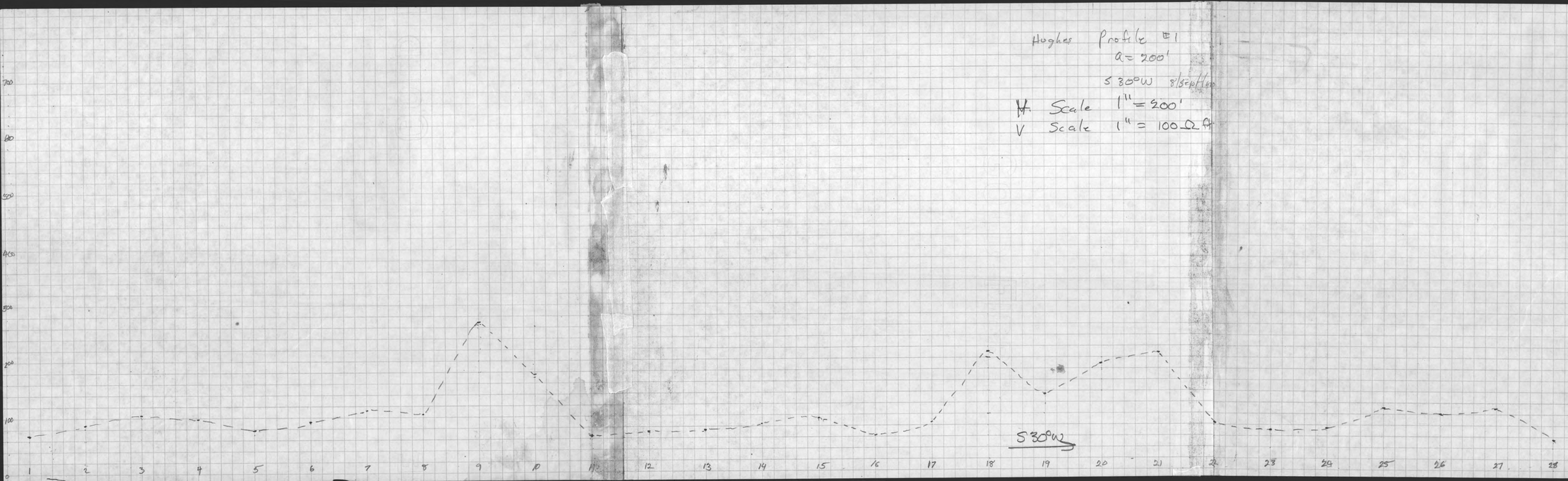


Hughes - Profile #3
S 30° W
a = 200'
9/Sept/60

H Scale: 1" = 200'
V Scale 1" = 100 Ω ft



Hughes Profile #1
a = 200'
S 30°W 8/Sept/60
H. Scale 1" = 200'
V Scale 1" = 100 Ω ft



REPORT ON RESISITIVITY SURVEYS

HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT NO. 44

for

Taylor, McFarland and Johnson

September 13, 1960

by

Heinrichs Geoexploration Company

P.O. Box 5671 Tucson, Arizona

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Resistivity Depth Probe 3	8
Resistivity Depth Probe 4	9
Resistivity Profile 1	10
Resistivity Profile 2	11
Resistivity Profile 3	12
Resistivity Profile 4	13

REPORT ON RESISITIVITY SURVEYS - HUGHES AIRCRAFT COMPANY

INTRODUCTION

At the request of the firm of Taylor, McFarland and Johnson of Tucson, Arizona, contractors to the Hughes Aircraft Company, operators of U.S.A.F. Plant No. 44, Heinrichs Geoexploration Company conducted resistivity surveys on the plant property, located south of Tucson, Arizona, on September 6, 1960 through September 9, 1960. These surveys consisted of four (4) depth probe measurements and four (4) profiles.

CONCLUSIONS & RECOMMENDATIONS

The resistivity surveys indicate marked lateral formational changes which probably control the flow of ground water.

These formational changes are probably directly related to the clay or silt content or the cementing agent of the sand aquifer.

Water "channels" or rather, more porous and/or permeable zones, probably strike in a north-west south-east direction and pinch and swell to some degree laterally.

It is recommended that further drilling for water be confined to the areas delineated as resistivity lows on the interpretation map.

A suggested possible well site location is indicated on the interpretation map.

OBJECTIVE

The purpose of these surveys was to appraise the relative favorability of various potential, or considered, locations for a new, supplemental water well and, if possible, the reason for the weaker production from the abandoned well.

PROCEDURE

Depth probes No. 1 and No. 2 were made across the producing well, originally No. 3. Depth probes No. 3 and No. 4 were made across the abandoned well, originally No. 2. Profile No. 1 was 6200 feet in length, S 30° W from a point about 1000 feet N 55° E of Well No. 3 to a point at the road about 2700 feet south of the abandoned well. Profile No. 2 was run due west 2400 feet from a point about 3350 feet S 26° E of Well No. 3. Profile No. 3 was 3400 feet in length, parallel to and about 800 feet southeast of Profile No. 1, from a point about 200 feet N 30° E of the disposal pit. Profile No. 4 was 3400 feet in length, through and starting at a point about 1800 feet north of the abandoned well.

Depth probes at the two locations were made using a standard expanding Wenner configuration. Expansions were made in 50 foot intervals from 50 to 500 feet, theoretically providing

apparent relative depth information from 0 to approximately 500 feet.

Profiles were made using a standard Wenner configuration with a 200 foot electrode spacing, theoretically providing relative apparent information to, or at, approximately a depth of 200 feet.

Results obtained from these surveys are considered to be reasonably conclusive and it is possible to make fairly definite recommendations for well locations.

METHODS AND INTERPRETATION

Results of the depth probes indicated pronounced lateral changes in resistivity at both locations, and that a possible resistivity interface exists at a depth of 150 to 200 feet in the case of Probes No. 1 and No. 2 at Well No. 3, and at 100 to 150 feet in the case of Probes No. 3 and No. 4 at the abandoned well. Depth probes do not yield conclusive interpretable information where marked lateral physical, and therefore resistivity, changes occur. Partially for this reason, but mainly to obtain maximum information,an alternate method of profiling at a constant electrode spacing of 200 feet was used in the rest of the work. The results produced by profiling were more conclusive and interpretable, making it possible to delineate and map the boundaries of the lateral resistivity changes. By running profiles through the three well locations,

where knowledge of the subsurface formations exist, it was concluded that a low value of resistivity probably corresponds to a "water channel" or aquifer containing a more available volume of water, while a high value of resistivity probably is related to a "tighter" or more cemented, less porous and/or permeable formation. Carrying this interpretation to the profiles through unknown areas, it has been possible to make the foregoing recommendations for location of a well.

Examination of the driller's logs of the three wells drilled tentatively supports the results. In the case of both the producing wells, "loose sand" and more sand and gravel without clay was reported, possibly indicating a cleaner or more well-washed aquifers or zones, while in the case of the abandoned well more clayey sand and fine sand was encountered and no "loose sand" or gravel was reported.

Respectfully submitted,

HEINRICHS GEOEXPLORATION COMPANY

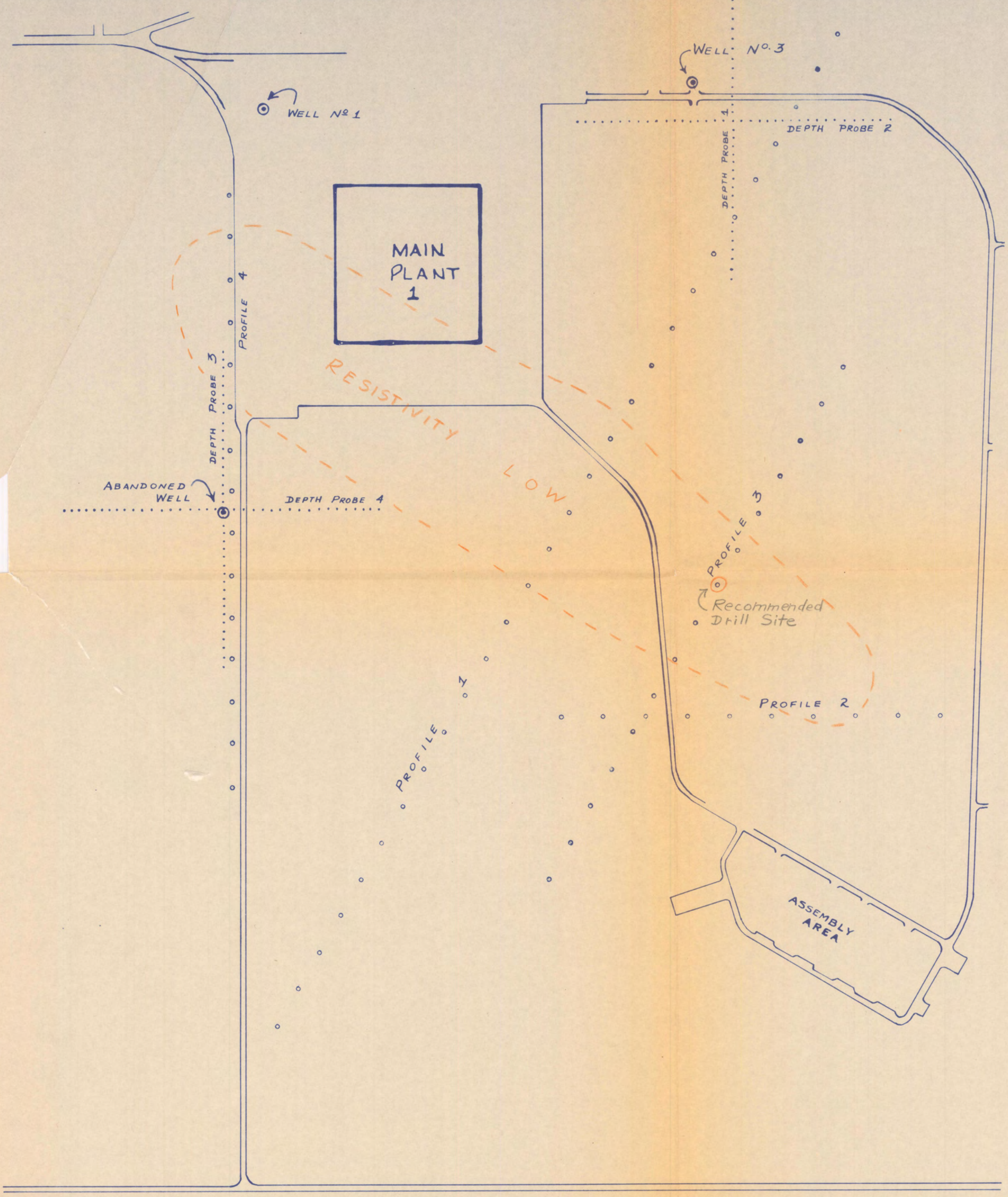
Franklin A. Seward Jr.

Franklin A. Seward Jr.
Geophysical Engineer

Approved by:

Walter E. Heinrichs Jr., Pres.
Heinrichs Geoexploration Company
P.O. Box 5671, Tucson, Arizona

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 1960
ARIZONA, U.S.A.



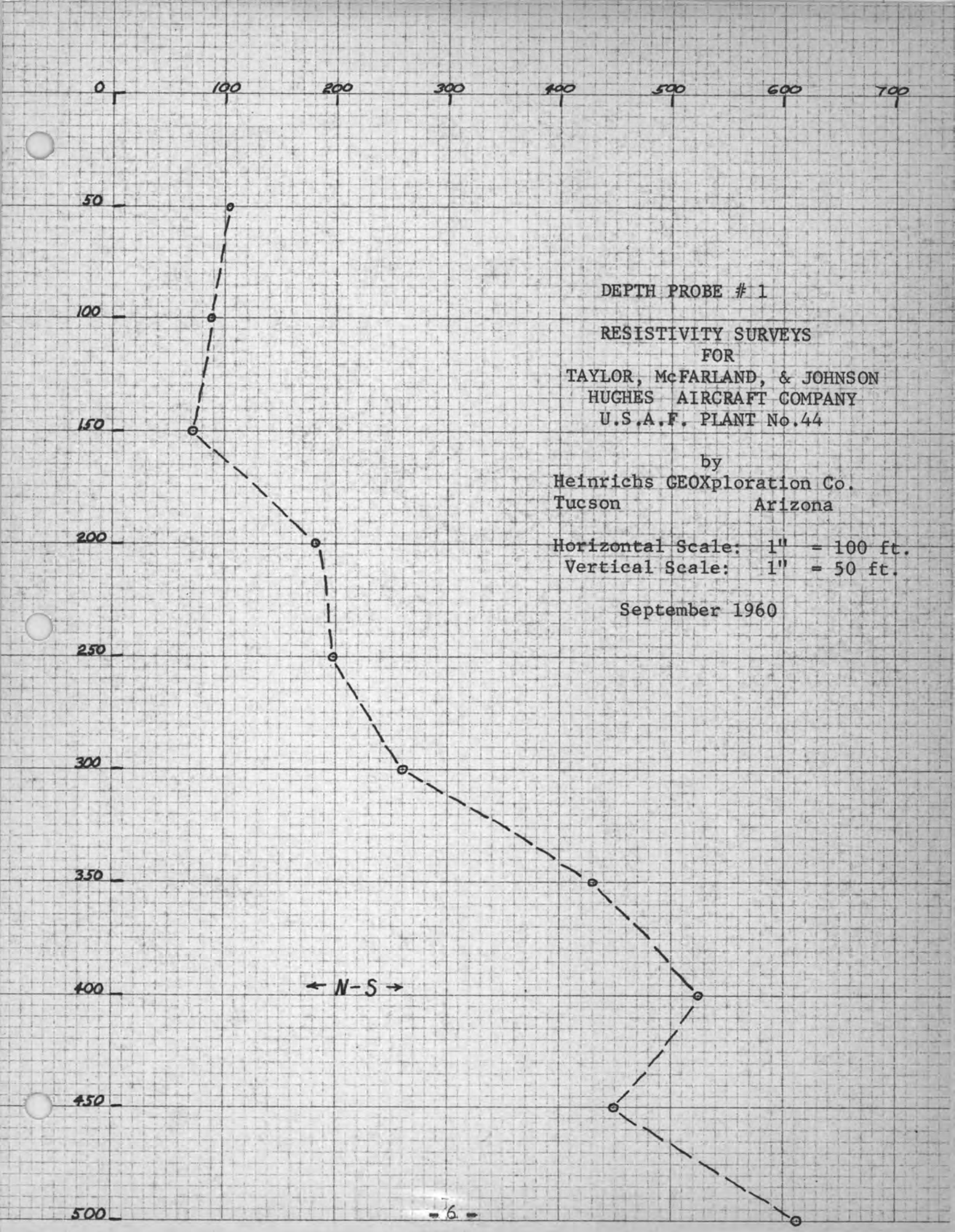
Scale: 1"=400'

LOCATION AND INTERPRETATION

RESISTIVITY SURVEYS
for
TAYLOR, McFARLAND, & JOHNSON

HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No.44

by
Heinrichs GEOEXploration Co.
P.O.Box 5671 Tucson, Arizona
September 1960



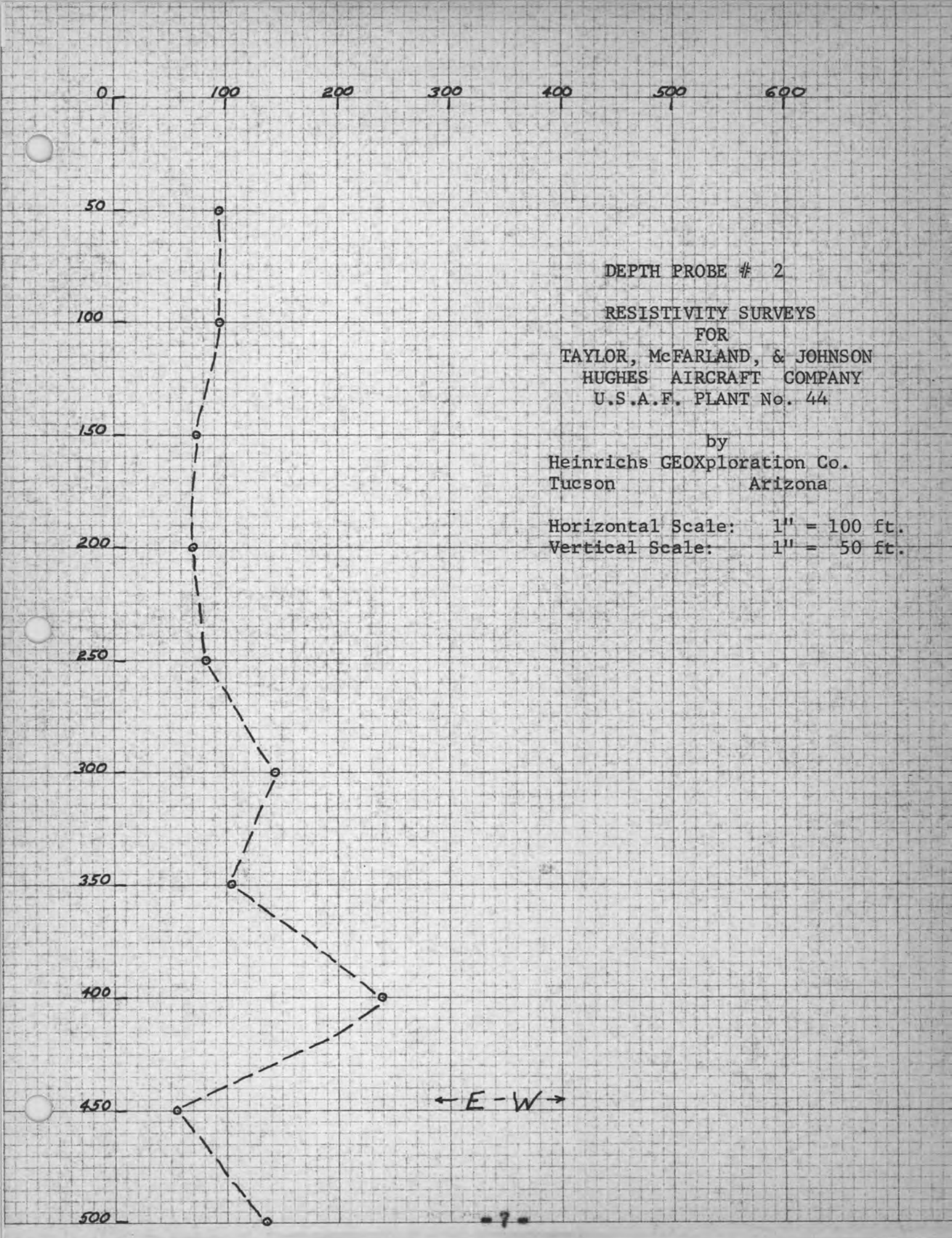
DEPTH PROBE # 1

RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No.44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960

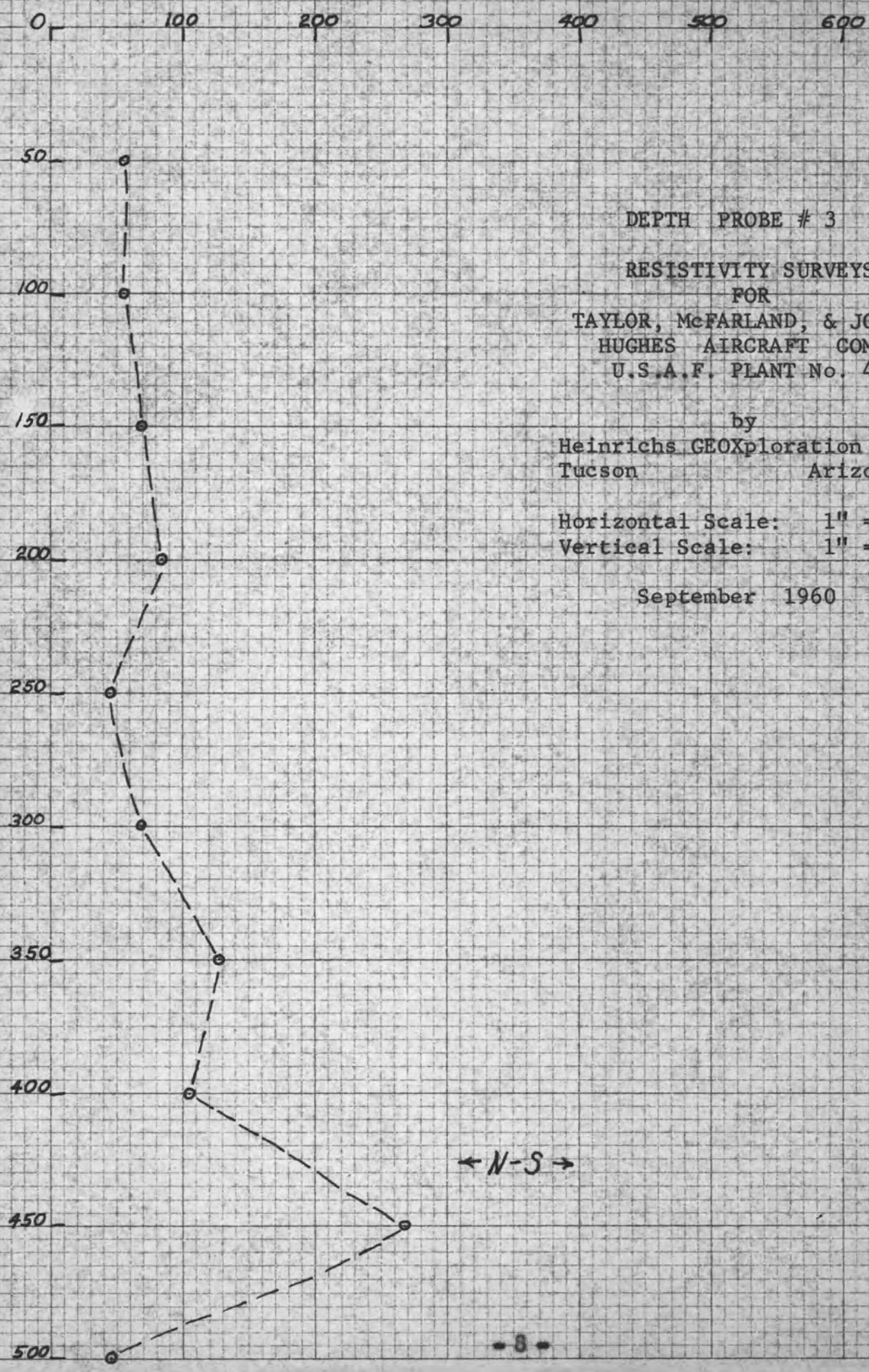


DEPTH PROBE # 2

RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.



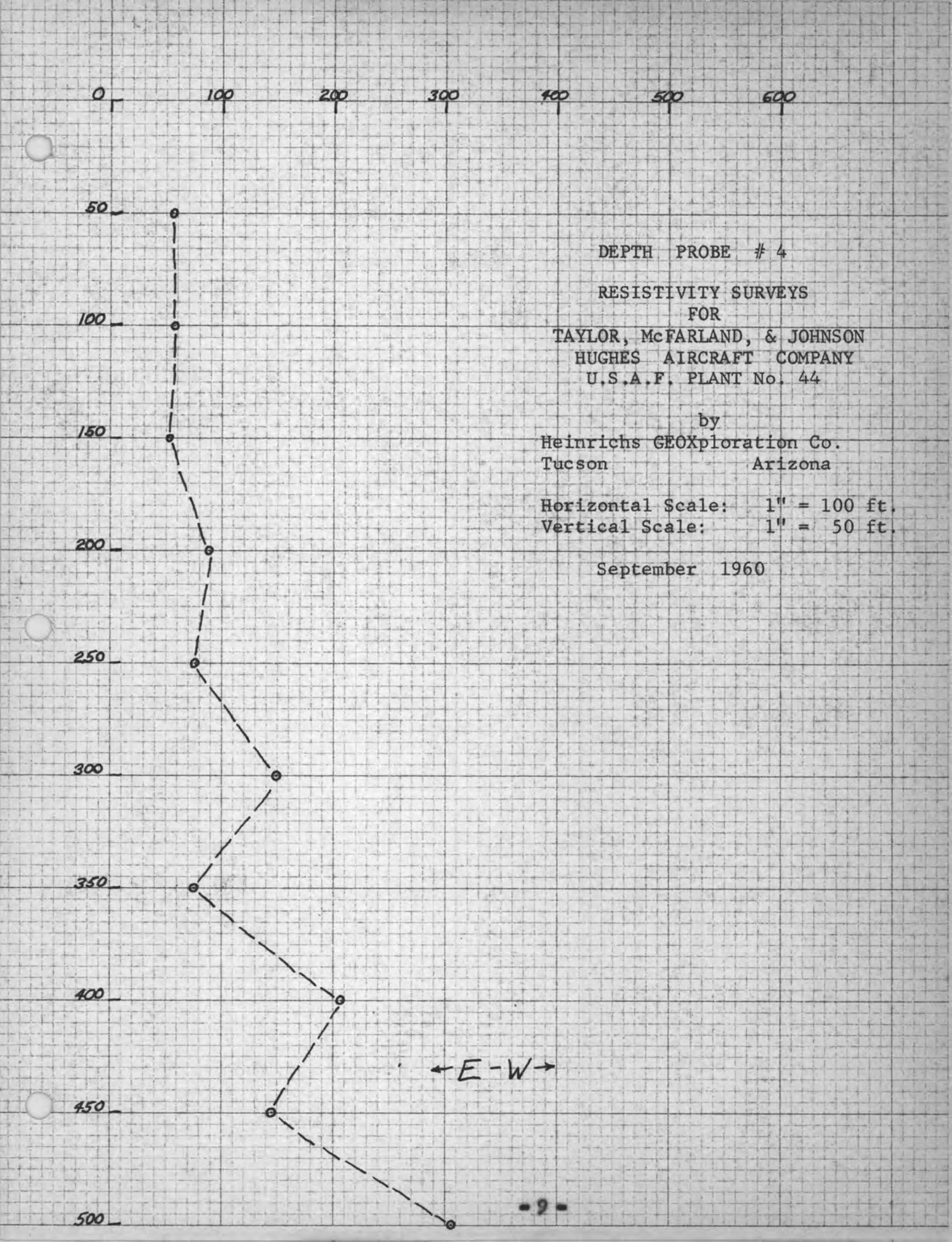
DEPTH PROBE # 3

RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960



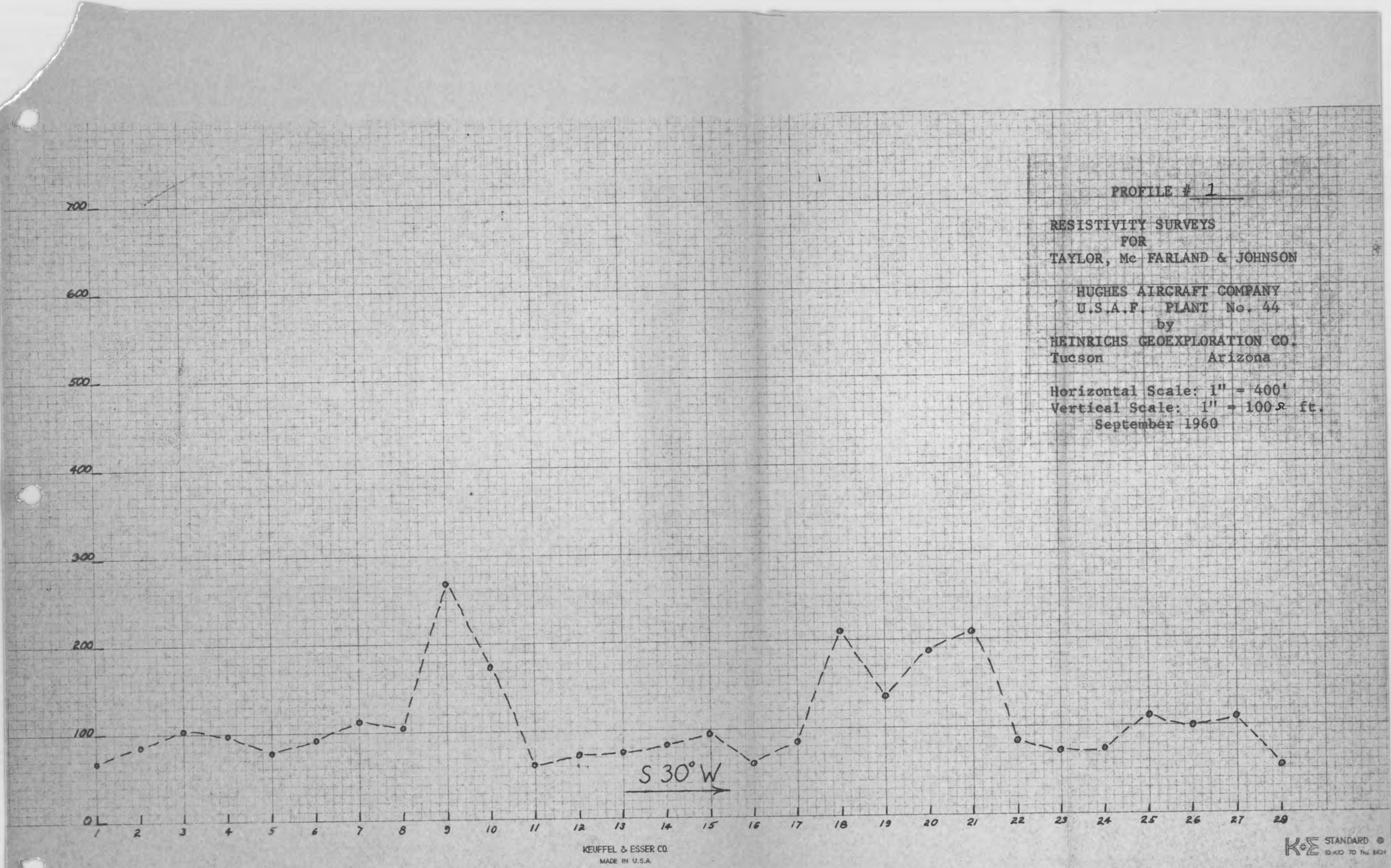
DEPTH PROBE # 4

RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960


PROFILE # 1
RESISTIVITY SURVEYS
FOR
TAYLOR, Mc FARLAND & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona
Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100 Ω ft.
September 1960
700
600
500
400
300
200
100
0
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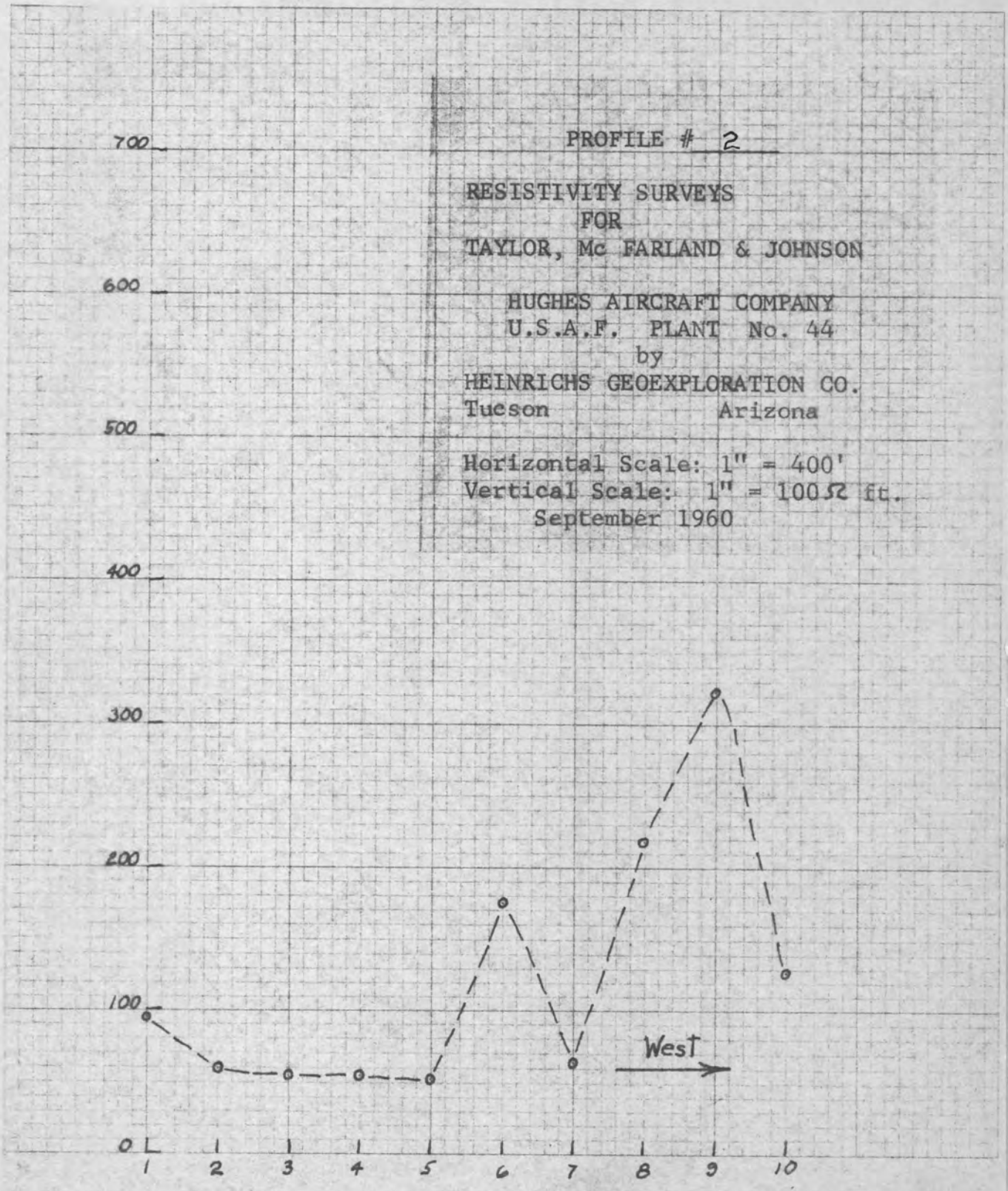
PROFILE # 2
RESISTIVITY SURVEYS
FOR
TAYLOR, Mc FARLAND & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona
Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100Ω ft.
September 1960
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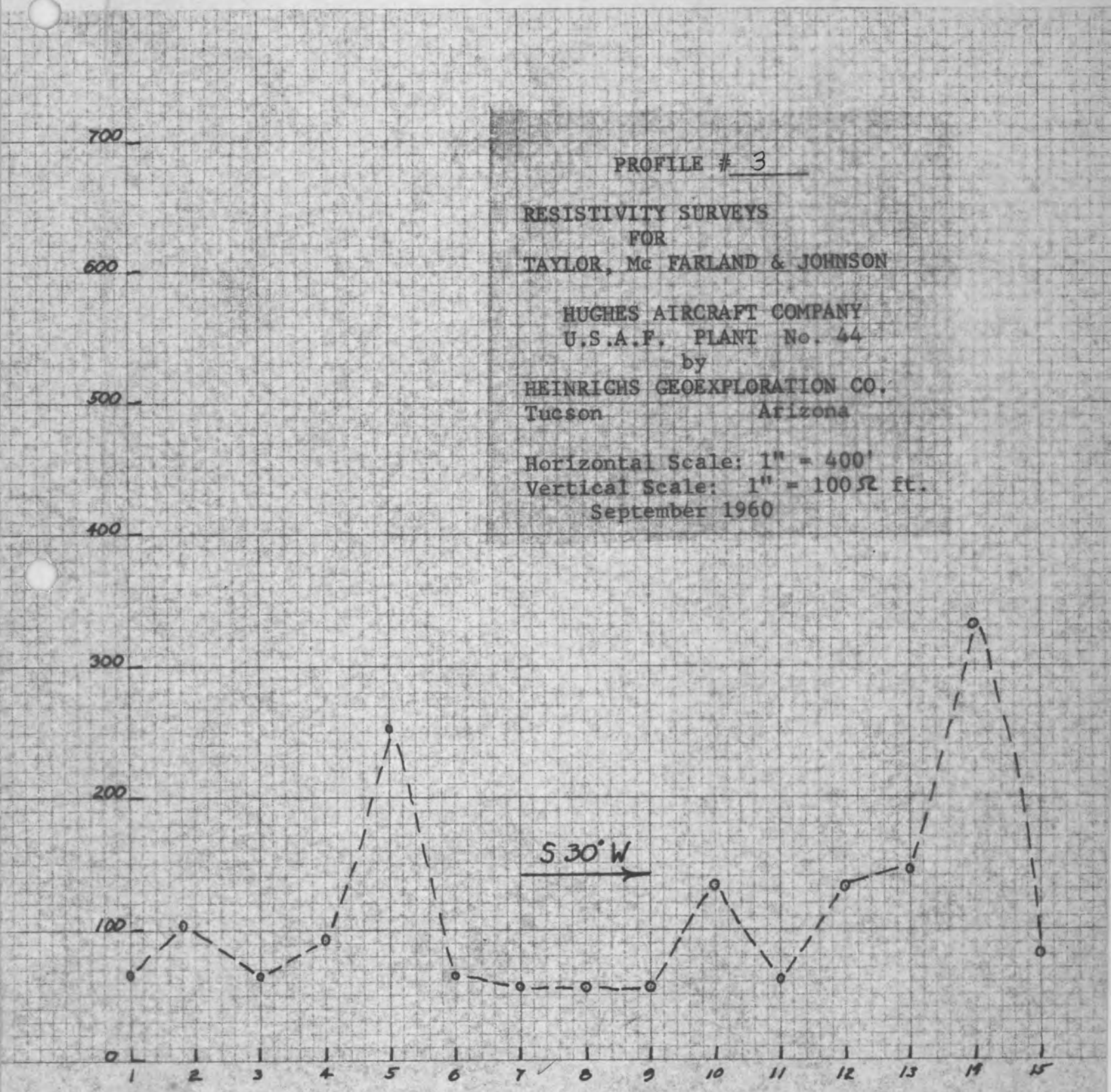
PROFILE # 3
RESISTIVITY SURVEYS
FOR
TAYLOR, Mc FARLAND & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona
Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100 Ω ft.
September 1960
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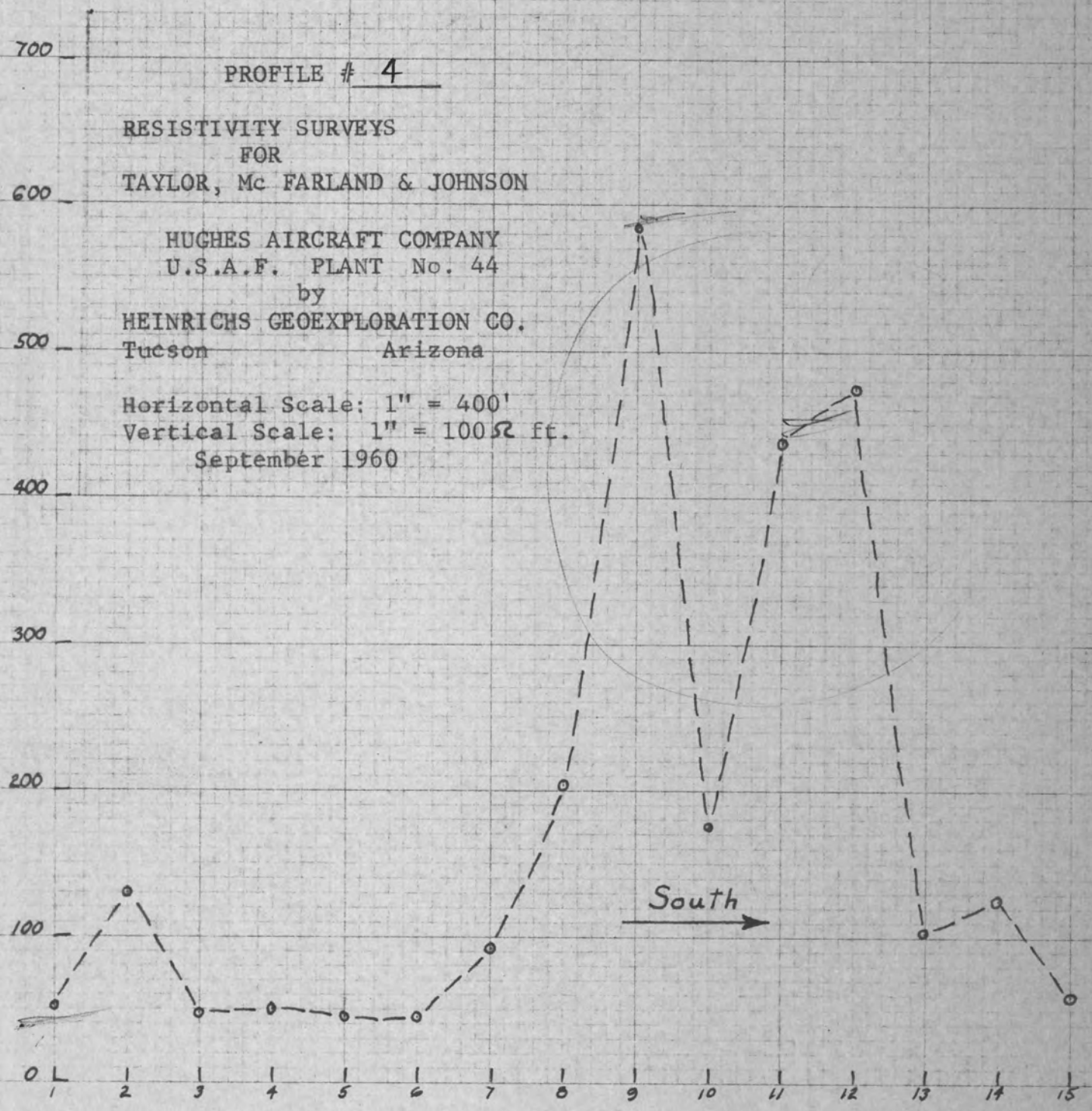
PROFILE # 4
RESISTIVITY SURVEYS
FOR
TAYLOR, Mc FARLAND & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona
Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100Ω ft.
September 1960
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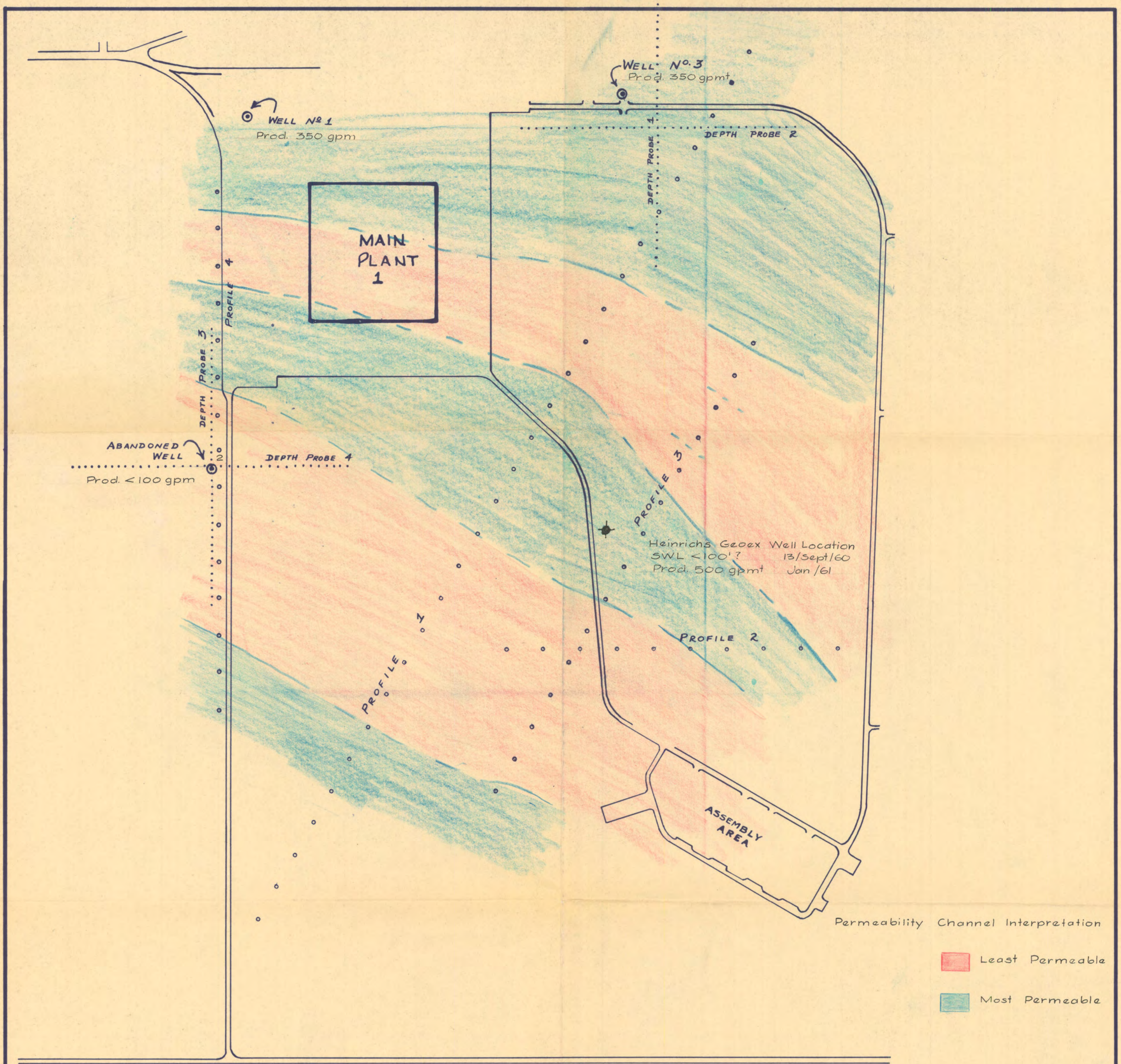

Scale: 1"=400'

RESISTIVITY SURVEYS
for
TAYLOR, McFARLAND, & JOHNSON

HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No.44

by
Heinrichs GEOEXploration Co.
P.O.Box 5671 Tucson, Arizona
September 1960

8/18/60

CONFIDENTIAL !!

To be returned and receipt obtained from Ed Spaulding at Hughes.

mmk

DISPOSAL OF WASTE WATER AT TUCSON PLANT OF HUGHES AIRCRAFT COMPANY

By
Leonard C. Halpenny

Water Development Corporation
CONSULTANTS IN GROUND-WATER HYDROLOGY
3938 SANTA BARBARA AVE.
TUCSON, ARIZONA

Water Development Corporation

CONSULTANTS IN GROUND-WATER HYDROLOGY

3938 SANTA BARBARA AVE.
TUCSON, ARIZONA

PHONE: EAST 6-1133
CABLE: WADEVCO, TUCSON

October 1, 1958

Mr. E. E. Turner
Plant Engineer
Hughes Aircraft Co.
Tucson, Arizona

Dear Mr. Turner:

Transmitted herewith for your consideration is the report requested in connection with my recent investigation of the problem of disposal of waste water presently being discharged from the storm sewer at the Hughes Tucson Plant. It is believed that the water can be disposed of without great expense and without danger of pollution or contamination of other water supplies in the neighborhood. Specifically, all of the water from the plating shop can be discharged to the sanitary sewer system. The remainder of the water now entering the storm sewer is predominantly waste from cooling operations. Part of this can be salvaged by inaugurating a program of recirculation; the balance can be injected back into the ground if it is sufficiently free of suspended sediment, oil and soap.

Please accept my thanks for the splendid cooperation provided by yourself and members of your staff, especially by Mr. E. K. Spaulding. Mr. Richard Evans of Infilco also provided valuable assistance, including arranging for the analysis of two 5-gallon water samples.

Respectfully submitted

WATER DEVELOPMENT CORPORATION

Leonard C. Halpenny

Leonard C. Halpenny, President

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
LEONARD C.
HALPENNY
DEC. 31, 1958
ARIZONA, U.S.A.

Registered Geologist
CERTIFICATE EXPIRES
LEONARD C.
HALPENNY
DEC. 31, 1958
ARIZONA, U.S.A.

WATER DEVELOPMENT CORPORATION
TUCSON, ARIZONA

DISPOSAL OF WASTE WATER AT TUCSON PLANT OF HUGHES AIRCRAFT COMPANY

BY

Leonard C. Halpenny
Consultant in Ground-Water Hydrology

Tucson, Arizona
October 1, 1958

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DISPOSAL OF WASTE WATER AT TUCSON PLANT OF HUGHES AIRCRAFT COMPANY

BY

Leonard C. Halpenny

INTRODUCTION

On September 12, 1958, the author of this report was invited by officials of Hughes Aircraft Company to discuss with them a problem of waste-water disposal at the Tucson Plant. Arrangements were made to conduct an investigation of the entire problem of waste-water disposal and to submit a report with recommendations. This report was prepared following the investigation and is submitted in accordance with the terms of the work agreement.

The Hughes Tucson Plant is in the valley of the Santa Cruz River, and occupies the NW 1/4 sec. 29, T. 15S., R. 14E., Pima County, Arizona. The property north and northwest of the plant is occupied by the Tucson Municipal Airport. A part of the Hughes facility is a tract of undeveloped land occupying nearly a square mile immediately west of the Plant. A narrow strip of land owned by the City of Tucson lies immediately to the west of this undeveloped land, and is bounded on the western side by the San Xavier Indian Reservation.

Part of the water used at the Hughes Plant is directed into the Sanitary District sewer, and becomes part of the waste treated at the City Sewage Disposal Plant north of Tucson. The remaining waste water is collected in a storm sewer which empties into a natural drainage channel at the west side of the Hughes Plant. The water follows this small wash westward to the Santa Cruz River, crossing enroute the unused land west of the plant, the narrow strip of City of Tucson land, and about 2 1/2 miles of the Indian Reservation. Both the City and the Bureau of Indian Affairs

have requested that Hughes Aircraft Company stop the waste water from crossing their lands.

The present investigation was directed toward determining the most feasible and economical method of disposing of the storm-sewer waste water.

WATER SUPPLY

The Santa Cruz River valley is occupied by a considerable thickness of alluvial fill consisting of gravel, sand, silt, clay, and caliche. The more permeable members of this fill yield water readily to wells, and contain the principal water supply of the region. Three wells have been drilled at the Hughes Plant, two of which were successfully completed as production wells. The third did not yield water at a rate sufficient to warrant installing a pump. The water is slightly hard and the average content of dissolved solids is slightly more than 300 ppm (parts per million). Tables 1, 2, and 3 contain data relating to the three wells, and figure 1 shows their location.

According to records obtained at the Hughes Plant, the combined production of the two active wells for the 12-month period ending June 30, 1958, was 212 million gallons. The month of greatest pumping was July, when 23 million gallons was produced. Lowest pumping occurred in December, when 14 1/2 million gallons was produced. The 12-month rate of withdrawal averaged 403 gpm (gallons per minute), or 580,000 gpd (gallons per day). Peak monthly demand was 760,000 gpd, and minimum monthly demand was 480,000 gpd. 17.7/MO

According to graphs of hourly pumpage for the 7-day period ending September 15, 1958, Well No. 1 was operated an average of 14 1/2 hours per day, and Well No. 2 was operated an average of 4 hours per day. These graphs indicate that both wells are lowering the pumping water level nearly to the bottom of the suction pipes, and consideration probably should be given soon to the need for lowering the pump settings.

WASTE WATER

According to an analysis made by Mr. E. K. Spaulding, engineer at the Hughes Plant, an average of about 100,000 gpd is consumed on the premises. This, when subtracted from the average quantity of 580,000 gpd pumped from the wells, leaves 480,000 gpd to be disposed of as waste. During the 12-month period ending June 30, 1958, about 44.5 million gallons was run into the sanitary sewer. The 12-month rate averaged 83 gpm, or 120,000 gpd. The remaining water entered the storm sewer and was discharged into the natural drainage channel west of the Plant. On a 12-month basis, the average load on the storm sewer was 250 gpm, or 360,000 gpd. In addition, the storm sewer collects and discharges water falling as rain on the roof of the Hughes Plant, but this factor is not of direct concern in the present analysis.

Sources of waste water

Not including rainfall, there are three sources of the water that enters the storm sewer. Cooling water, from the air-conditioning unit and from several heat exchangers, is discharged to the storm sewer. Wash water from the floor of the metal-plating shop is discharged continuously to the storm sewer. Plating-shop waste waters that contain chromium and cyanide are collected in 4,500-gallon tanks, treated to remove the toxicity, and are discharged to the sewer in slugs when a batch of treated water is dumped.

Chemical character of water discharged to storm sewer

The plant layout makes it difficult to isolate the combined cooling water effluent for chemical analysis, but this water can be expected to be similar to the water produced from the wells. It is probably more highly concentrated than the well water owing to evaporation, and the relative proportion of calcium and bicarbonate can be expected to be lower, owing to precipitation of calcium bicarbonate during the time the water is passing over the cooling towers.

The metal-plating shop has a raised wooden floor above the concrete floor of the building. Water flows across the concrete floor continuously as a safety measure, to remove any liquids which spill or drip onto the floor. This water is likely to contain in minute amounts some heavy metals such as cadmium or copper. The pH of this wash water can be expected to be altered from that of the well-water supply, and the sodium and sulfate content can be expected to be higher.

In compliance with State Board of Health requirements, the waste waters containing cyanide and chromium are collected in tanks and treated to remove their toxicity. The cyanide is broken down by treatment with chlorine, first to the cyanate form and second to complete separation of the carbon and nitrogen molecules. The chromium is treated, mainly with ferrous sulfate, to reduce the hexavalent form to the trivalent form. This form is relatively insoluble at a high pH, and it precipitates in a non-toxic form in the sludge resulting from the treatment. Each 4,500-gallon batch that is treated is tested before being discharged, to detect and avoid any possibility of residual toxicity. The treatment process includes agitation during the addition of chemicals and until the reactions are completed, following which agitation is stopped and sludge settles to the bottom of the tank. When a tank is dumped, the sludge is discharged to the storm sewer along with the treated water. The water is highly colored from the ferrous sulfate that was added. The presence of this water of unpleasing appearance is part of the reason that the City of Tucson and the Bureau of Indian Affairs object to the combined waste water entering or crossing their lands.

Table 4 lists analyses of water from the storm sewer, made by various organizations at various times. The occasional detection of chromium in this water is explainable by the fact that the precipitated chromium is in the sludge that is carried down the ditch with the treated and diluted water. The analyses do not indicate that the chromium, when present, is in the toxic hexavalent form, although it is conceivable that the pH could become lower as the water moves down the ditch and thereby permit the resolution of minute quantities of chromium. Two of the analyses indicate that very small amounts of cyanide remained in the water or the sludge.

Quantities of water discharged to storm sewer

The average quantity of cooling water discharged to the storm sewer at the present time is estimated to be 120 to 125 gpm. Plans are presently awaiting approval for recirculation of the water from the cooling operations sufficient to reduce the amount discharged to the storm sewer to the following rates:

Day shift	100gpm
Swing shift	80
Graveyard shift	75
Average daily	85gpm

The average quantity presently discharged after flowing across the plating-shop floor is 160 gpm.

At the present time there are 8 to 10 batches of treated waste dumped daily, each containing slightly less than 4,500 gallons. This rate is equivalent to a continuous discharge of about 28gpm.

The sum of all the wastes, as estimated above, is about 310 gpm. During the 24-hour period ending at noon on September 16, 1958, the average discharge was 311 gpm, with an instantaneous peak of 610 gpm and a minimum of 200 gpm.

POSSIBILITIES CONSIDERED FOR WASTE DISPOSAL

The problem of elimination of the storm-sewer waste water has been discussed for the past several years, and many plans have been considered. Most of the proposals were rejected by outsiders, mainly on the basis of their lack of knowledge of the true chemical character of the waste water, and from fear that deleterious ions in toxic quantities might appear intermittently and might be missed during collection or analyses of a water sample. Among the proposals that were considered are the following:

1. To use the water for irrigation of crops, either on the Indian Reservation or on section 30 (Hughes land). Apparently nobody was willing to risk using the water for this purpose, and the suggestion was not further considered.

2. To spread all of the water on section 30 and evaporate it, either from ponds or by means of a sprinkler system. This was rejected as being against the principal of water conservation, and was considered only in the event that no better alternative could be devised.

3. To establish a complete treatment plant to handle the water from the plating shop. This would be expensive, and is not considered as a possibility unless required on the basis of eliminating toxicity. The treated water, when separated from the sludge, could be put into the ground.

4. To put all or part of the storm sewer water into the sanitary sewer. Analysis of peak discharges and average discharge by Mr. Spaulding of Hughes indicated that the capacity of the present line is sufficient to carry all the water, but under these circumstances at the times of instantaneous peak loads the water would rise about 2 feet in the manholes.

City officials are concerned that the water from the plating shop is of such chemical character that it would adversely affect the bacterial action in the City Sewage Plant, but further studies indicate that the instantaneous concentrations in this water under the very worst combination of circumstances would be less than 1/5th of the limits of tolerance for the plant. Thus, it is feasible to discharge all waste and sludge from the plating shop into the sanitary sewer without the remotest possibility of this action causing a disruption of operation of the Sewage Plant.

5. To pond the water and/or clarify it by treatment to settle out the suspended sediments, and then recharge it to the ground-water reservoir through one or more recharge wells. This is feasible provided the water after settling is found not to be toxic in any way. Water recharged west of the Hughes Plant would move underground toward the north-northwest, in the general direction of the Santa Cruz River. Probably much of the water would be intercepted in the cones of depression surrounding the Hughes Well No. 1 and the City of Tucson Well No. SC-7, which is a few feet north of the drainage channel presently carrying waste water, on the City-owned strip of land in the western part of section 30 (see figure 1). The presence of this municipal water-supply well so near the Hughes waste ditch is the reason for the concern

expressed by City officials. On September 23, 1958, the Assistant City Water Engineer stated to the author of this report that the City would not object to recharging of the Hughes waste water, provided first that assurance was given that no possibility of toxicity exists, and second that the City be granted an opportunity to check at any time the quality of the water being recharged. It is recommended that the City be given such an opportunity if and when ground-water recharge is undertaken.

All concerned realize that ground-water recharge by use of input wells requires that the water must be free of suspended sediment. This could be accomplished by constructing a stilling pond if the sediments settle out naturally within a relatively short time. If clarification is not feasible by natural settling, a mechanical clarifier unit will be required. An input well can take partially clear water for short periods if it is backwashed occasionally by pumping. This has been demonstrated, for example, in the High Plains area of northwest Texas, where a number of recharge wells are operated to receive input water 23 hours per day and to discharge by pumping 1 hour per day. This keeps the wells clean enough to continue indefinitely for recharge use.

SUGGESTED COURSE OF ACTION

Plating-shop waste water

It is recommended that all water from the plating-shop operations be discharged into the sanitary sewer. Calculations of the worst possible set of circumstances with respect to content of chromium are set forth as follows:

A. Average load of City Sewage Plant is 12 million gpd. Minimum discharge from all sources could be at an instantaneous low of 3,500 gpm, less than half of the average daily rate.

B. Assume that a batch of 4,500 gallons of waste is dumped, and that it has an average concentration of 0.3 ppm of chromium. The rate of dumping is one batch in 20 minutes, or about 225 gpm. This water in moving

through the sewer can be expected to spread out to a 40-minute flow under expected worst conditions (barring stoppage of the line), which would bring the average rate of discharge down to about 110 gpm. This, mixed with 3,500 gpm of other sewage water, would dilute the chromium about 30 times, reducing the content to about 0.01 ppm.

Under average conditions, the batch would contain perhaps 0.1 ppm of precipitated chromium in the sludge, the flow would spread to a period of 60 minutes or more, and dilution would be with 7,000 gpm of other sewage. Thus, on the average, the chromium content contributed from Hughes at the City Sewage Plant would be about .001 ppm.

It is conceivable that the steady flow of water across the floor of the plating shop could be reduced to a lower rate without impairing the efficiency or safety of the shop. This would save water and would reduce the load on the sanitary sewer.

Cooling water

It is recommended that the conservation measures now planned with respect to recirculation of cooling water should be placed in operation. Assuming that this will be done, that the average daily rate of residual discharge to the storm sewer will thenceforth be of the order of 85 gpm, and that this water will be free of suspended sediment, the discharged water could be placed back underground. It is possible that the abandoned well (No. 3, see Table 3) can take up to 85 gpm if the water is put in under pressure. If this well cannot accept 85 gpm on a continuous basis, or if the quantity to be recharged is larger than now anticipated, it will be necessary to drill another well.

Recharge wells

Well No. 3

The data presently available indicate that Well No. 3, when tested in 1954, yielded 130 gpm with a drawdown of 160 feet.

On the basis of this information, at the present static level the well can be expected to receive and recharge by gravity, on a continuous basis, about 68 gpm. On the basis of a second test in 1954, when 180 gpm was pumped with a drawdown of 339 feet, the well could receive by gravity and recharge 45 gpm. Using a mean figure of 55 gpm that would enter by gravity under existing conditions of development, 85 gpm theoretically could be injected with an input head of 53 feet, or 23 pounds per square inch.

This well indicated a yield performance only 1/7th to 1/20th, respectively, of that of Wells No. 1 and 2. Apparently the water-bearing units are less permeable at Well No. 3 than at either Well No. 1 or Well No. 2. It is possible, however, that the performance of the well can be improved with further development. The following course of treatment is suggested as a relatively inexpensive experimental method to increase the yield and hence the rate of input.

Stage 1

Obtain approximately 250 pounds of dry ice. Open one package (25 pounds), break it with a hammer into pieces about 2 or 3 inches across, and drop the pieces into the well. Keep adding dry ice from succeeding 25-pound packages until the well spouts water into the air. Wait about 30 minutes and repeat the process. Keep up this surging process until the supply of dry ice is used up.

Stage 2

Clean out the well with a bailer to total depth. Install a turbine test pump that has a capacity of 200 gpm with a lift of 400 feet. Install an airline and observe the water level at 5-minute intervals when pumping and when the level is rising after pumping is completed. Operate the pump as follows:

Surge 2 hours, then pump at 50 gpm for 6 hours;
Surge 2 hours, then pump at 75 gpm for 6 hours;
Surge 2 hours, then pump at 100 gpm for 6 hours;
Surge 2 hours, then pump at 125 gpm for 6 hours;
Surge 2 hours, then pump at 150 gpm for 6 hours;
Surge 2 hours, then pump at 175 gpm (if possible) for 24 hours. Following this treatment and after the pump is removed, again clean out the well with a bailer to total depth.

New well

If a second recharge well is required, it could be located at the edge of the drainage channel at the point where the storm sewer ends. On the basis of the logs of Wells 1 and 3, the new well should be drilled to a total depth of at least 450 feet and not more than 500 feet. The diameter should be 14 inches. The well should be drilled open hole to total depth with the exception of a joint of surface casing, cemented from top to bottom. The hole can be kept open by use of a light drilling mud, which can be made on the site as the hole progresses by adding Baroid mud and Aquagel in small quantities by hand. The well should be cased with 8-inch diameter seamless pipe, pre-perforated at the site with an acetylene cutting torch. The pipe used can be threaded and collared, or plain-end with the successive joints arc-welded together. The bottom end of the hole should be sealed closed with a wooden plug or with cement. Then the annular space between casing and wall (about 3 inches) should be filled with pea gravel, adding gravel until it reaches the surface.

The mud will enter the casing and can be removed by bailing. The gravel is likely to subside in the well during bailing, and more should be added. After the well has been thoroughly cleaned by bailing, it should be further developed by use of a test pump, following a schedule similar to that suggested for Well No. 3. More gravel should be added outside the casing if required. Following the test pumping, the well should be cleaned again with a bailer and it will then be ready to receive input water.

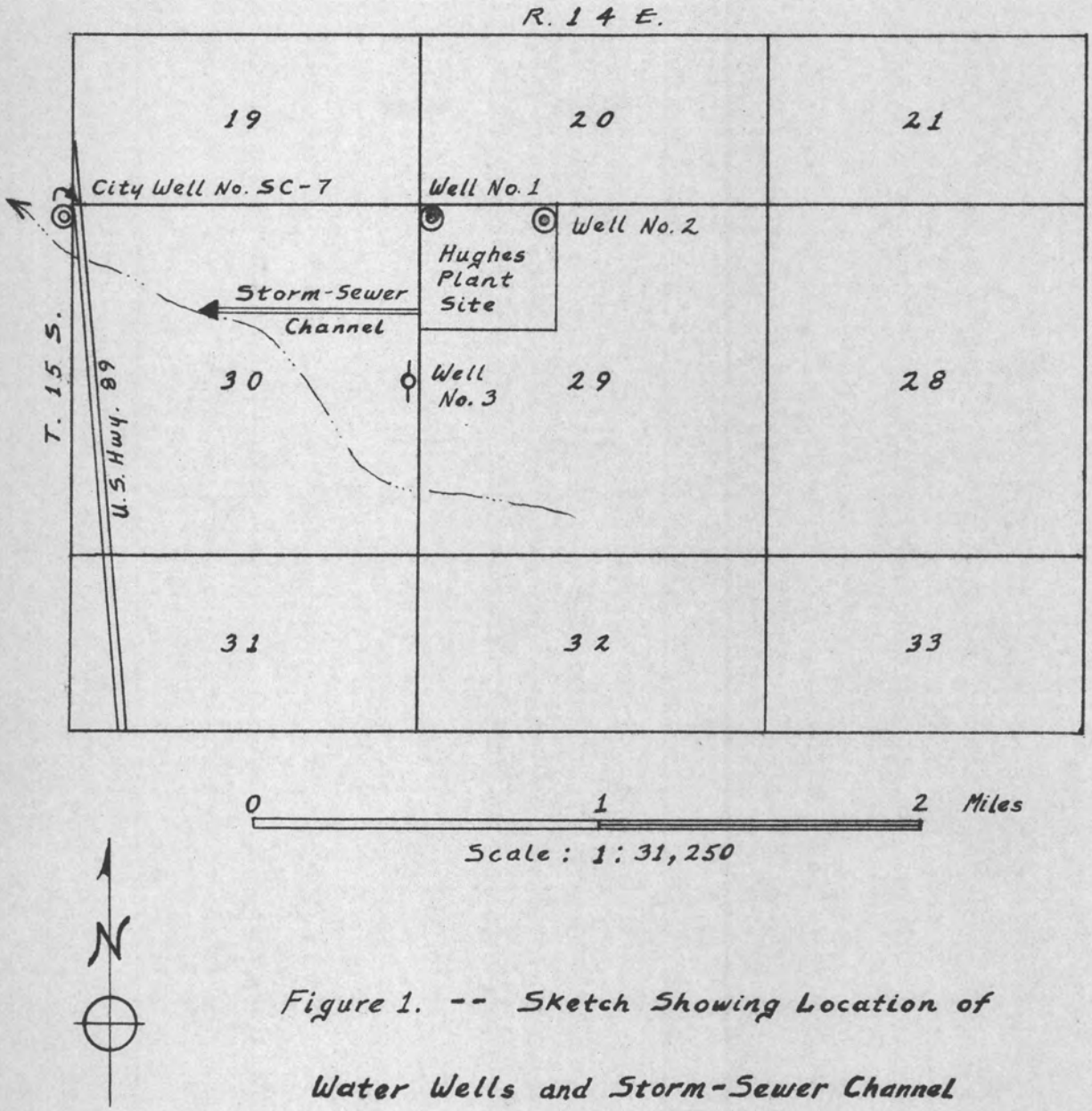


Figure 1. -- Sketch Showing Location of Water Wells and Storm-Sewer Channel Hughes Aircraft Company Plant Tucson, Arizona

Table 1. - Record of Well No. 1 at Hughes Plant, Tucson, Arizona.

Location: NW 1/4 NW 1/4 sec. 29, T. 15S., R. 14E.

Date drilled: March-April 1952. Driller: Carl Pistor.

Depth: 400 ft.

Casing record: 16-in., 10-gauge double stovepipe, 0-346 ft., perforated 8 to 9 cuts per ft. from 150 to 346 ft.

Pump: Turbine, set at approximately ~~210~~ 225 ft.

Static water level when drilled: 85 ft.

Pumping water level when drilled: 185 ft. when pumping 700 gpm.

Present static water level (from weekly graph): 105 ft.

Present pumping water level (from weekly graph): 205 ft.

Specific capacity: 7 gpm/ft.

Table 2. - Record of Well No. 2 at Hughes Plant, Tucson, Arizona.

Location: NE 1/4 NW 1/4 sec. 29, T. 15S., R. 14E.

Date drilled: October 1954. Driller: Carl Pistor.

Depth: 400 ft.

Casing record: 14-in., 10-gauge double stovepipe, 0-380 ft., perforated 10 cuts per ft. from 110 to 380 ft.

Pump: Turbine, set at approximately ~~150~~ 180 ft.

Static water level when drilled: 101 ft.

Pumping water level when drilled: 139 ft. when pumping 800 gpm.

Present static water level (from weekly graph): 109 ft.

Present pumping water level (from weekly graph): 148 ft.

Specific capacity: 21 gpm/ft.

Table 3. - Record of Well No. 3 at Hughes Plant, Tucson, Arizona.

Location: E 1/4-cor., sec. 30, T. 15S., R. 14E.

Date drilled: July 1954. Driller: Carl Pistor.

Depth: 504 ft.

Casing record: 14-in., 10-gauge double stovepipe, 0-501 ft., perforated from 75 to 480 ft.

Pump: None.

Static water level when drilled: 74 ft.

Pumping water level when drilled: 234 ft. when pumping 130 gpm; 413 ft. when pumping 180 gpm.

Present static water level (measured Sept. 25, 1958): 84.14 ft.

Specific capacity: 0.81 gpm/ft.

Table 4. - Analyses of water from storm-sewer waste ditch
Hughes Plant, Tucson, Arizona

Item	Analysis No. 1	Analysis No. 2	Analysis No. 3	Analysis No. 4	Analysis No. 5
Date sample collected	7-20-57	3-27-58	2-5-58	9-23-58	9-23-58
Analyzed for	City of Tucson	City of Tucson	Univ. of Ariz.	Water Devel. Corp.	Water Devel. Corp.
Analyzed by	Comm. Lab.	Comm. Lab.	Univ. of Ariz.	Ariz. Testing Lab.	Ariz. Testing Lab.
Silica (SiO_2), ppm	23.2	12.8	----	----	----
Aluminum oxide (Al_2O_3), ppm	Trace	Trace	----	----	----
Iron oxide (Fe_2O_3), ppm	Trace	Trace	----	----	----
Calcium (Ca), ppm	44.8	126.5	47	----	----
Magnesium (Mg), ppm	12.6	11.2	2	----	----
Sodium and Potassium (Na+K), ppm	57.3	35	159	----	----
Carbonate (CO_3), ppm	0	0	0	----	----
Bicarbonate (HCO_3), ppm	202.6	148.9	310	----	----
Sulfate (SO_4), ppm	58.4	124.7	68	----	----
Chloride (Cl), ppm	44	132	107	----	----
Boron (B), ppm	.1	.2	----	----	----
Nitrate (NO_3), ppm	.3	----	----	----	----
Fluoride (F), ppm	.7	0	.2	----	----
Phenol	0	.01	----	----	----
Cyanide	0	.1	----	Nil	.01
Manganese	.01	.001	----	Nil	Nil
Copper	.19	.1	----	.2	Nil
Cadmium	0	.1	----	----	----
Silver	.01	.1	----	----	----
Chromium (Cr), ppm	.038	.002	----	.1	Nil
Nickel (Ni), ppm	.02	.1	----	----	----
Iron (Fe), ppm	.19	.075	---	.1	.1
Total dissolved solids, ppm	442.9	591.1	693	----	----
Total hardness as $CaCO_3$, ppm	164.0	362.2	----	----	----
pH	7.5	7.6	----	----	----

INFILCO

cc: H.B. Gustafson
Tucson Lab. (2)
File

February 23, 1959

Re: Hughes Aircraft
Tucson, Arizona

R. Evans (4)

Sample Nos: 16057-T Pretreated Waste; 16058-T Outlet of Sewer

Raw Waste Characteristics: 16057-T (Pretreated Waste)

pH = 11.4, P = 300, M = 342, Turb = 50, Total Solids = 3046, Susp. Solids = 142 ppm

Raw Waste Characteristics. 16058-T Outlet of Sewer

pH = 7.4, P = 0, M = 160, Turb = 18, Total Solids = 182, Susp. Solids = 19, Hi = none, Cu = 2.5 ppm

Coagulation Data: 16058-T (outlet of Sewer)

100 ml Samples; Stirred 10 mins at 50 RPM. Settled 5 mins. At room Temp

Test	Lime ppm	Alum ppm	Act'd Silica ppm	Separan NP-10 ppm	Coag	Sett	Clar	pH	Turb	SVR	% SV	Note
* 1	110(1)	17(2)			G	VG	G	9.5	5	0X	<1	All Tests made week of 11-20-58 by B.L. Laubscher
2	110(1)	17(2)			G	VG	G	9.4	4	1X	0.5	
3	100(2)		5(1)		VG	VG	G	9.7	3	0X	<1	
4	100(2)		5(1)		VG	Ex	G	9.7	2	1X	0.6	
5	100				F-G	VG	P	9.4	54	0X	<1	
6	100				G	VG	F	9.4	23	1X	0.3	
7	100(2)		2(1)		VG	VG	P	9.6	14	1X	0.3	
8	100(1)			2(2)	F	VG	F	9.7	24	1X	0.3	
9	110(2)	17(1)			G	G	F-G	9.5	20	0X	<1	
10	100(1)		5(2)		VG	VG	F	9.7	17	1X	<1	
11	100(1)	34(2)			G	VG	G	9.2	8	1X	1	
12	110(2)	17(3)	2(1)		VG	VG	F	—	22	0X	<1	
13	110(2)	17(3)	2(1)		—	—	—	—	9	1X	<1	

* Numbers in parentheses indicate order of addition

Re: Hughes Aircraft
Tucson, Arizona

February 23, 1959

Subsidence Data: (16058-T Outlet of Sewer)

200 ml Samples; 4X Sludge Returns. Stirred 10 mins. at 50 RPM. Room Temp

Height of Liquid: $2\frac{15}{16}$ inches

Chemical Dosage: 110 ppm Lime, 17 ppm Alum added in that order

Time (Minutes)	Subsidence (Inches)		% SV
1/4	5/8		
1/2	$1\frac{1}{4}$		
1	$2\frac{1}{2}$	Majority of floc down	
2	$2\frac{13}{16}$		
5	$2\frac{13}{16}$		
10	$2\frac{13}{16}$		0.7

Characteristic of Supernatant:

pH = 8.6, P = 6, M = 124, Turb = 8, Color = 3, Susp. Solids = 6, Cu = 1.8 ppm

Subsidence Data: (16058-T Outlet of Sewer)

200 ml Samples; 4 X Sludge Returns. Stirred 10 mins. at 50 RPM. Room Temp.

Height of Liquid: $3\frac{1}{16}$ inches

Chemical Dosage: 5 ppm Act'd Silica, 100 ppm Lime added in that order

Time (Minutes)	Subsidence (Inches)		% SV
1/4	1		
1/2	$2\frac{1}{4}$	Majority of floc down	
1	$2\frac{15}{16}$		
2	$2\frac{15}{16}$		
5	$2\frac{15}{16}$		
10	$2\frac{15}{16}$		0.7

Characteristics of Supernatant:

pH = 8.7, P = 16, M = 120, Turb = 22, Color = 4, Susp. Solids = 16, Cu = 1.9 ppm

Sample Nos. 16057-T and 16058-T

The following tests and subsidence data were made on a mixture of 5 volumes 16058-T and 1 volume 16057-T

Coagulation Data:

100 ml Samples; Stirred 10 mins. at 50 RPM. Settled 5 mins. At Room Temp.

Test	Lime ppm	Alum ppm	Act'd Silica ppm	Separan NP-10 ppm	Coag	Sett	Clar	pH	Turb	Color	SVR	% SV
1	100				F-G	F-G	F	9.0	67	8	0X	0.1
* 2	100(2)		5(1)		G	VG	G	9.2	12	4	0X	0.3
3	110(2)	17(1)			G	G	F-G	9.2	20	2	0X	0.3
4	100(2)		2(1)		G	VG	G	9.2	8	2	0X	0.4
5	100(1)			0.5(2)	F	G	VP	9.2	155	11	0X	0.2
6	110(2)	17(1)			G	G	G	9.2	15	3	1X	0.6

* Numbers in parentheses indicate order of addition.

Subsidence Data:

200 ml Samples; 2X Sludge Returns. Stirred 10 mins. at 50 RPM. Room Temp.

Height of Liquid: 3 inches. Chemical Dosage: 17 ppm Alum, 110 ppm Lime added in that order

Time (Minutes)	Subsidence (Inches)	% SV
1/4	1/2	
1/2	7/8	
1	1 12/16	
2	2 13/16	
5	2 13/16	
10	2 13/16	0.7

Characteristics of Supernatant:

pH = 9.3, P = 14, M = 48, Turb = 13, Color = 3, Susp. Solids = 32, Cu = 1.5 ppm

February 23, 1959

Re: Hughes Aircraft
Tucson, Arizona

Sample Nos. 16057-T and 16058-T

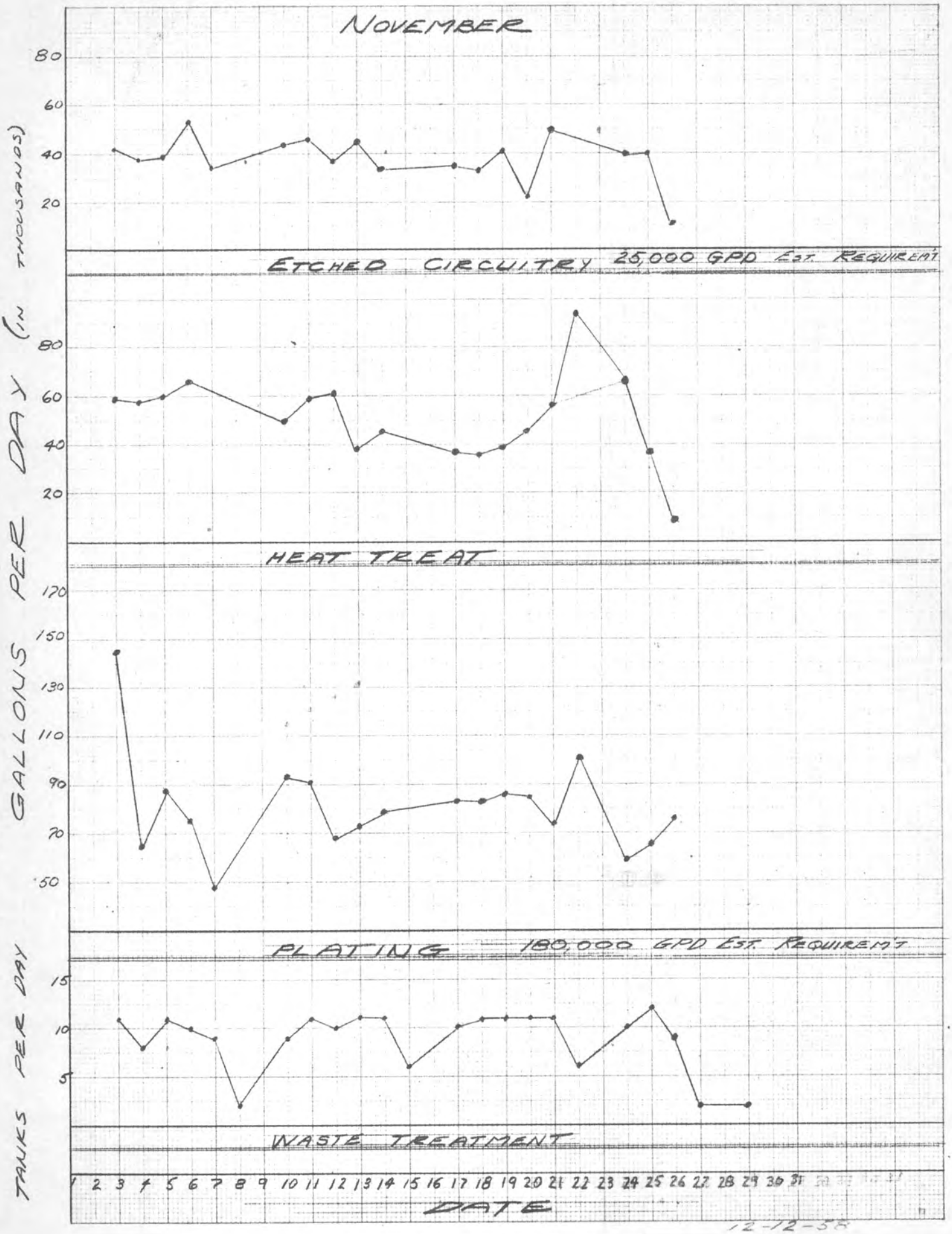
Subsidence Data: (On mixture of 5 volumes 16058-T and 1 volume 16057-T)
200ml Samples; 2X Sludge Returns. Stirred 10 mins. at 50 RPM. Room Temp.
Height of Liquid: $3\frac{7}{16}$ inches
Chemical Dosage: 2ppm Acid Silica, 100 ppm Lime added in that order

Time (Minutes)	Subsidence (Inches)		% S.V
1/4	$\frac{5}{8}$		
1/2	$1\frac{1}{8}$		
1	$2\frac{10}{16}$	Majority of floc down	
2	$2\frac{15}{16}$		
5	$2\frac{15}{16}$		
10	$2\frac{15}{16}$		0.6

Characteristics of Supernatant:
pH = 9.2, P = 16, M = 42, Turb = 22, Susp. Solids = 20, Color = 3, Cu = 1.6 ppm

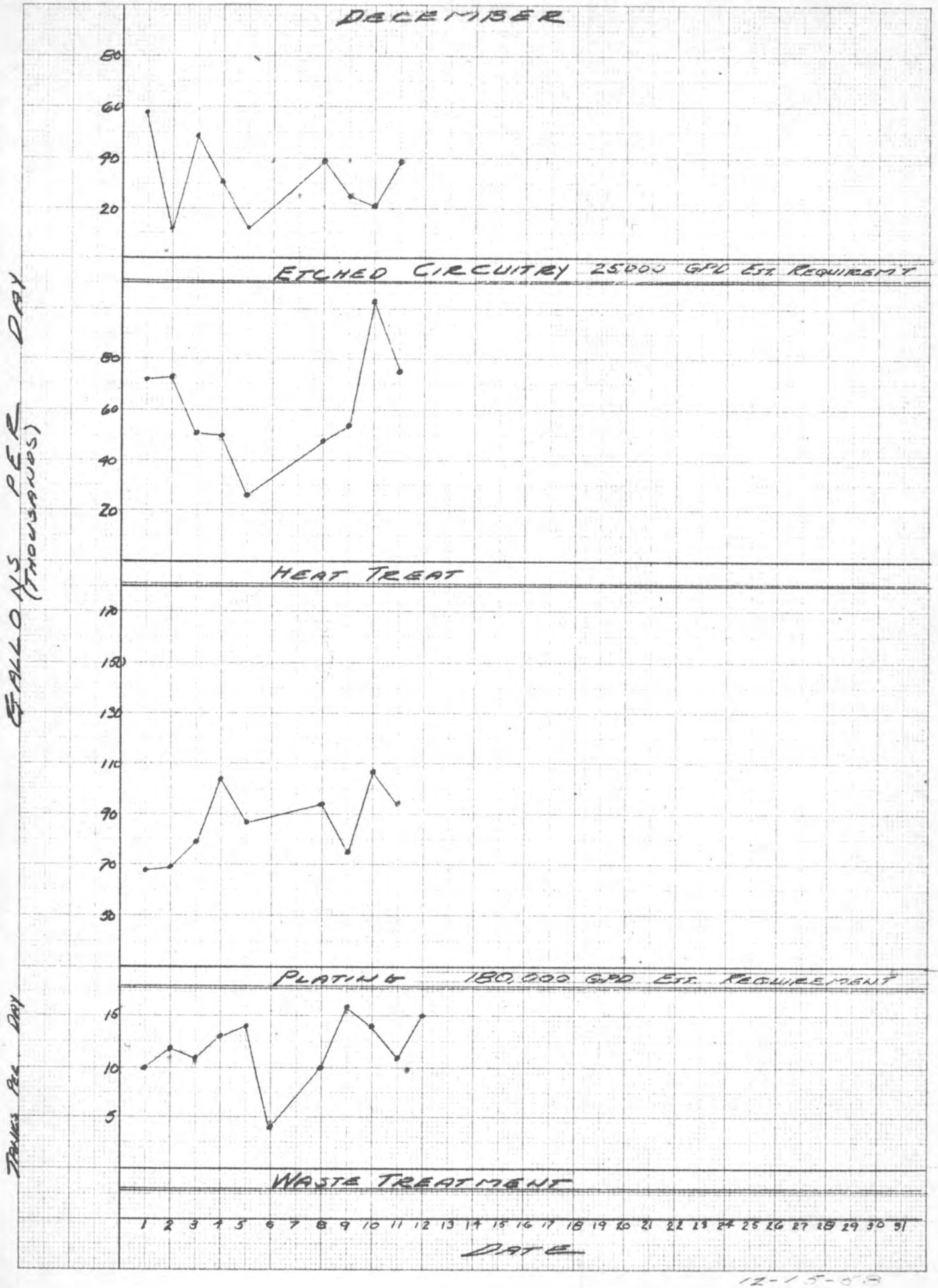
C. H. Newsome

WATER SURVEY — PROCESS AREAS



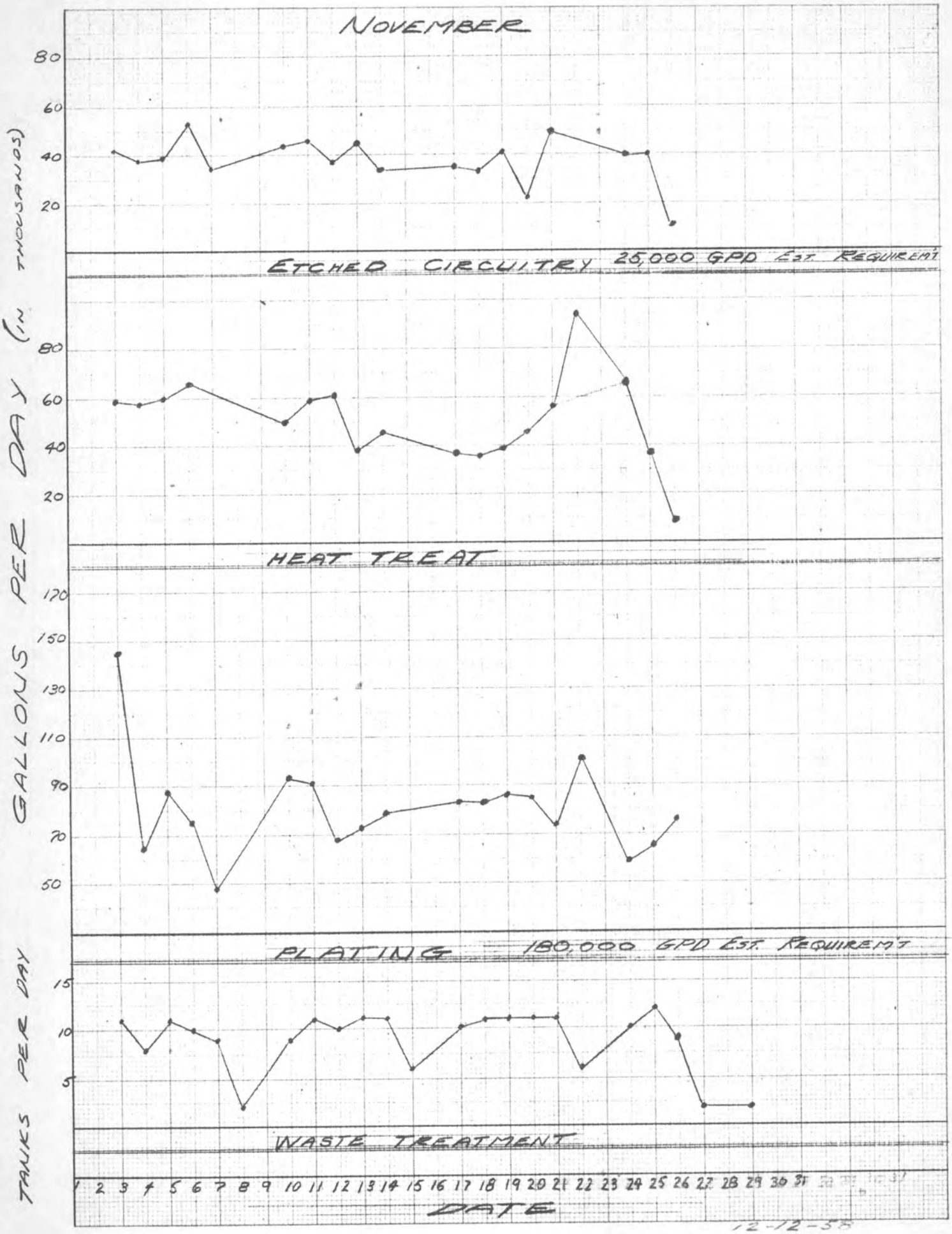
12-12-58
EJK

WATER SURVEY — PROCESS AREAS



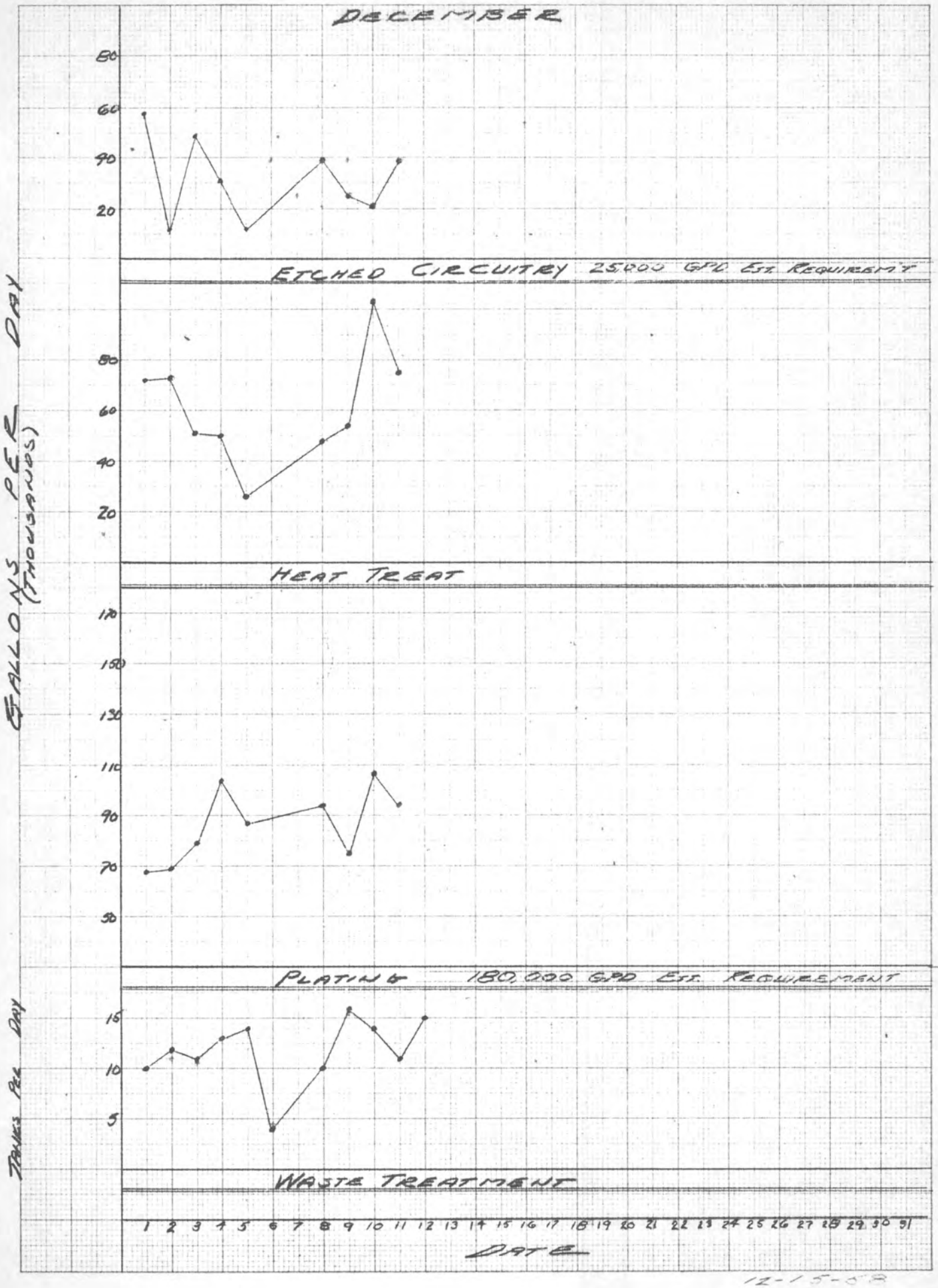
12-15-68

WATER SURVEY — PROCESS AREAS

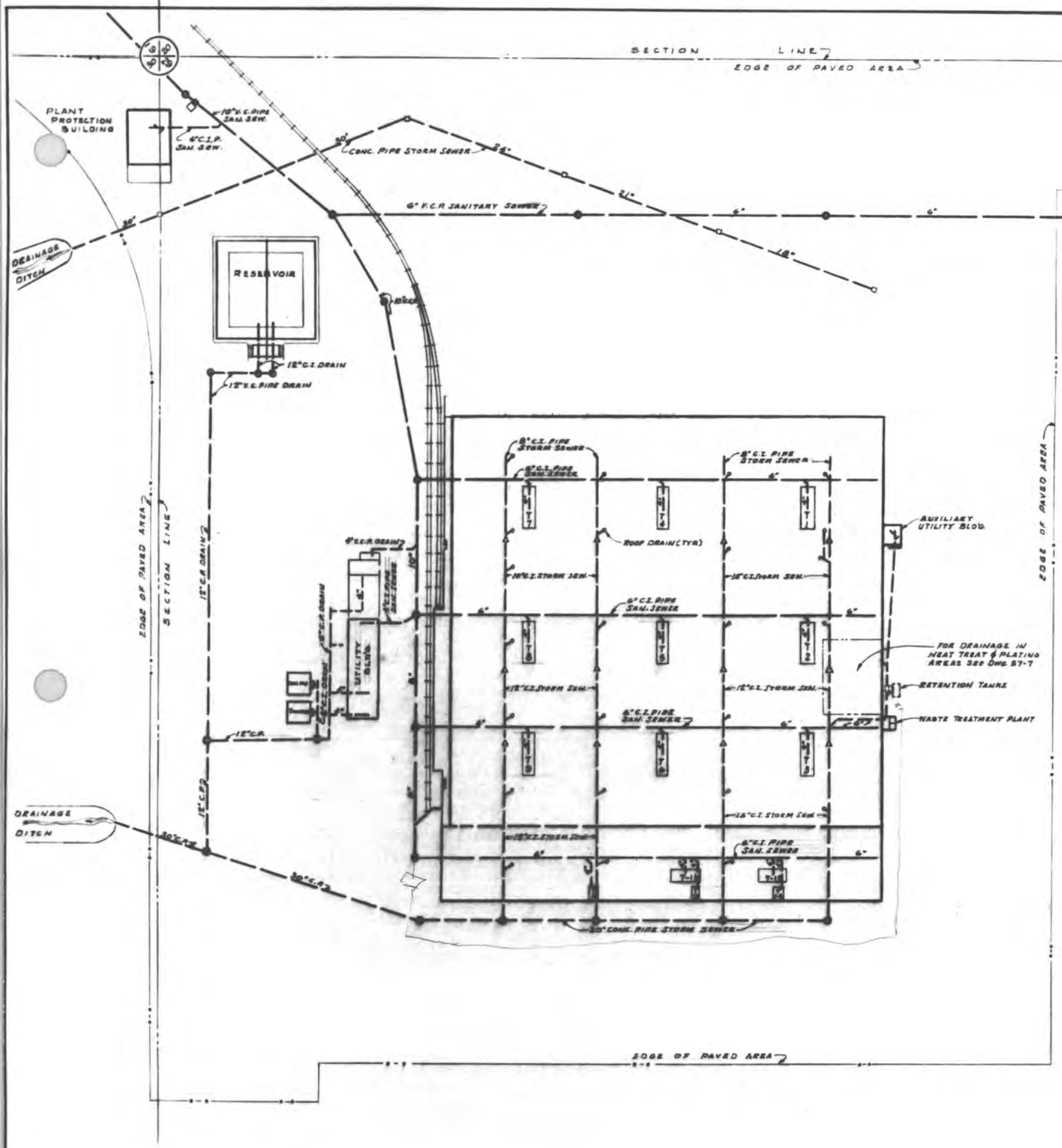


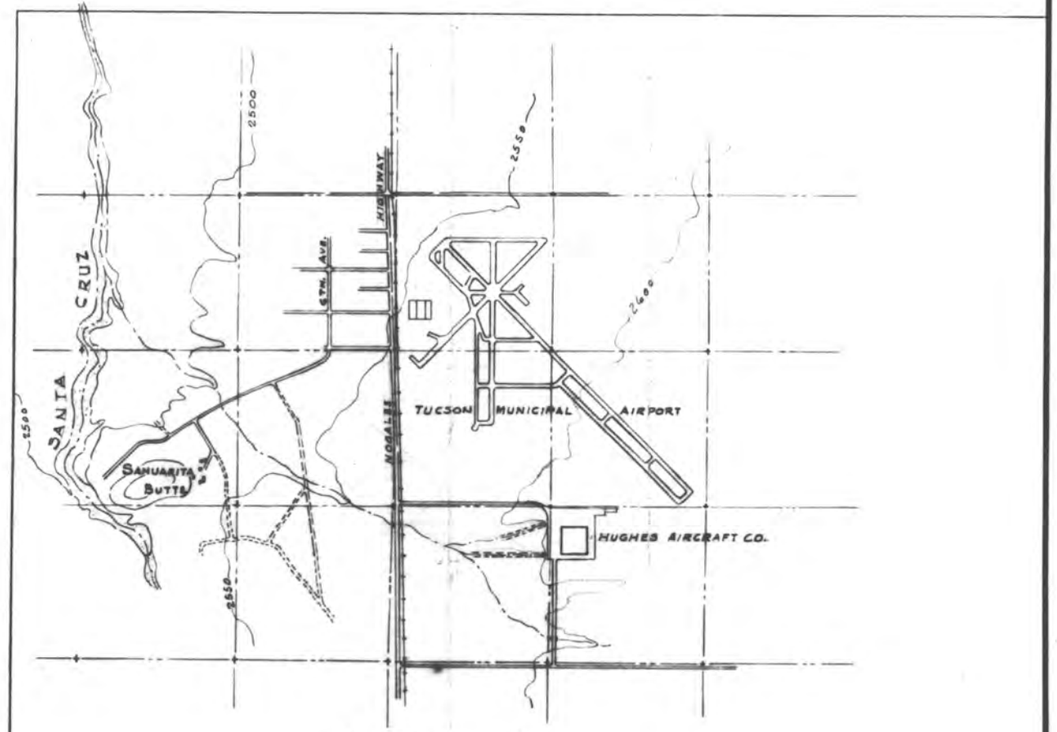
12-12-55
EJV

WATER SURVEY — PROCESS AREAS



12-15-58
EJV





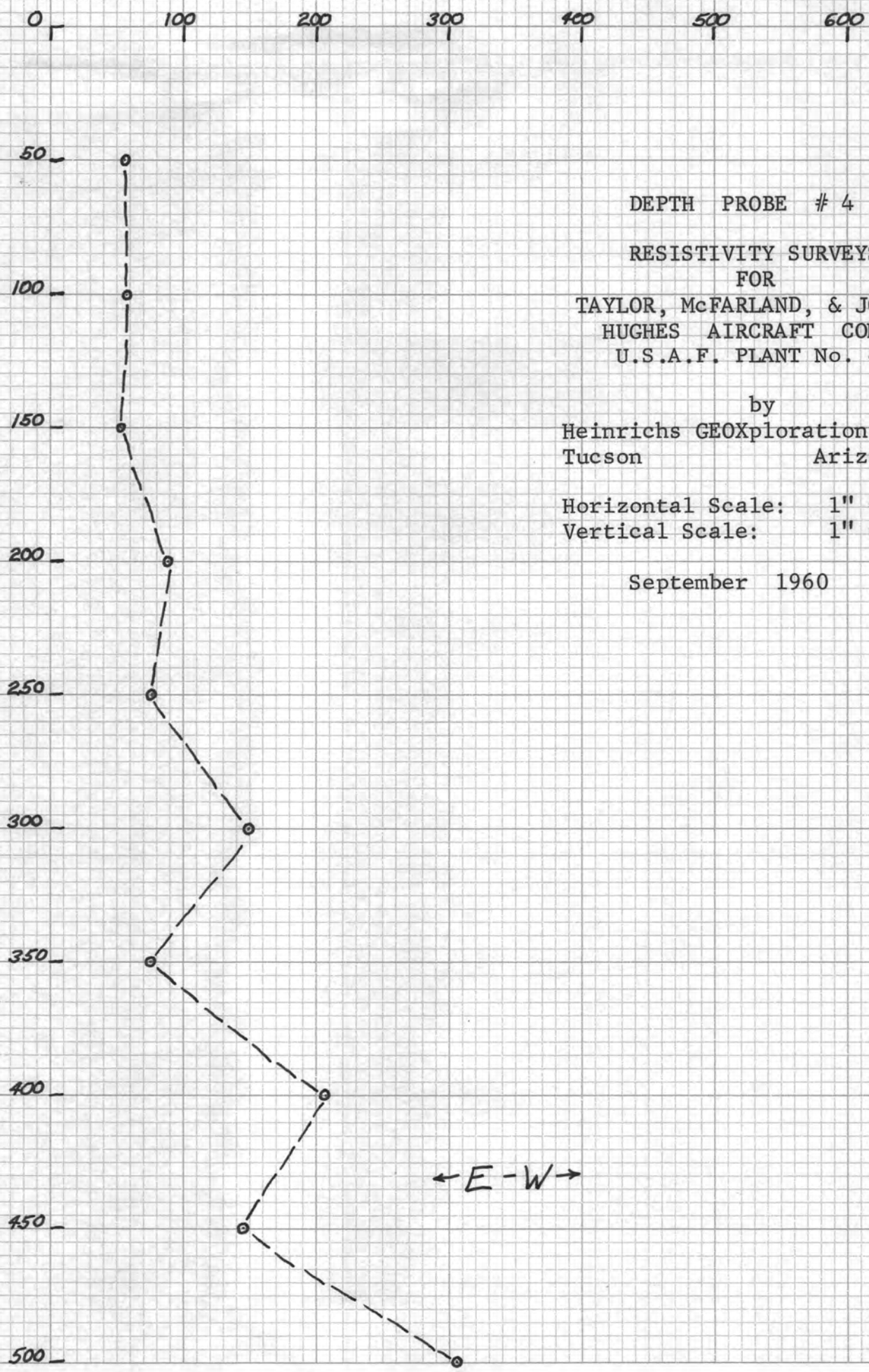
LOCATION MAP
SCALE: 1" = 2640'

HUGHES AIRCRAFT CO.
PLANT ENGINEERING DEPT.
TUCSON ARIZONA

DRAINAGE SYSTEMS

DESIGNED BY:		SCALE: NONE
DRAWN BY: F.D. HARRISON	1-9-58	DRAWING NO.
TRACED BY:		A10-83-1
CHECKED BY:		
APPROVED BY:		
APPROVED BY:		
REV. NO.		

FORM HAC 7-379



DEPTH PROBE # 4

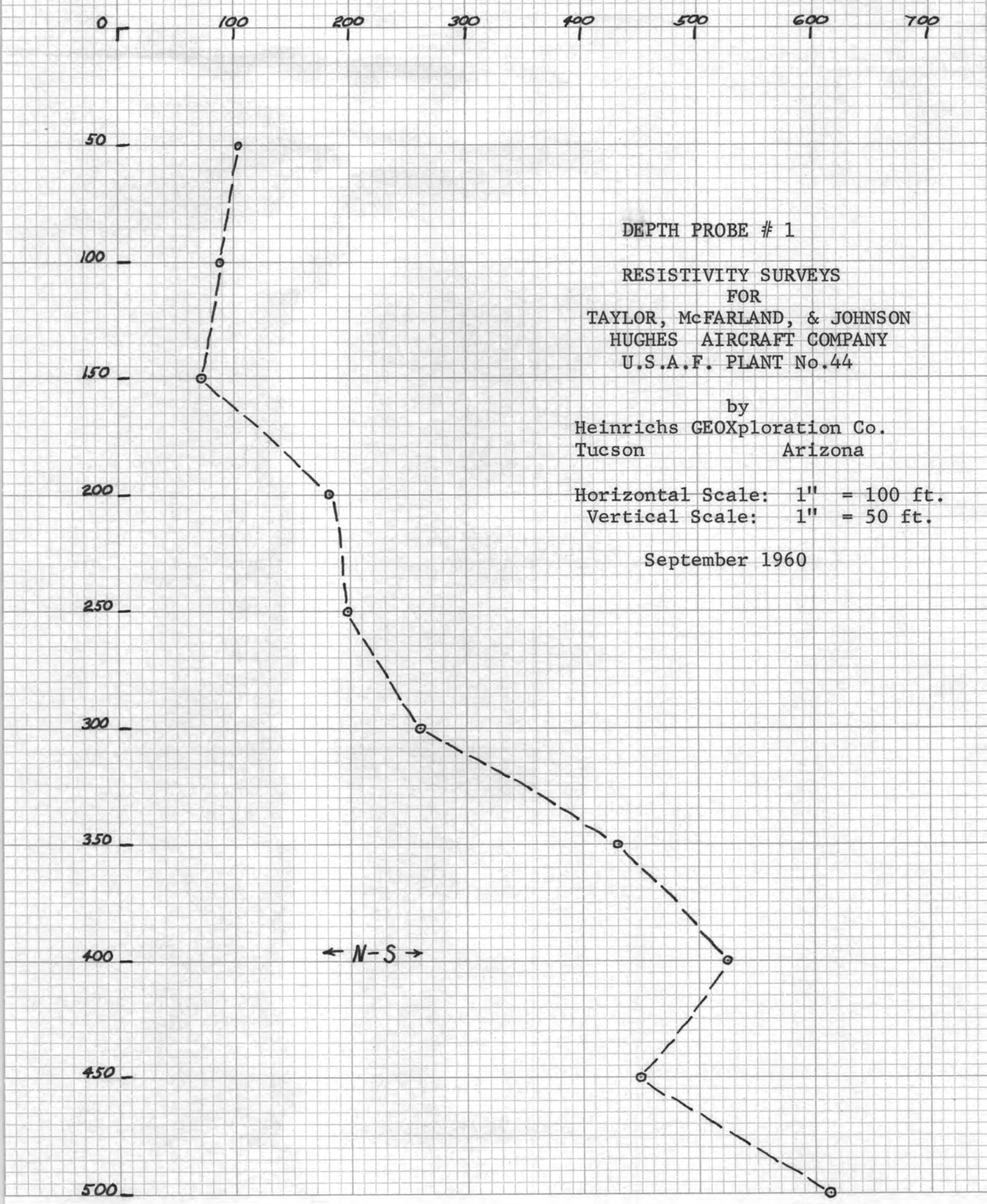
RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960

KEUFFEL & ESSER CO.
MADE IN U.S.A.



DEPTH PROBE # 1

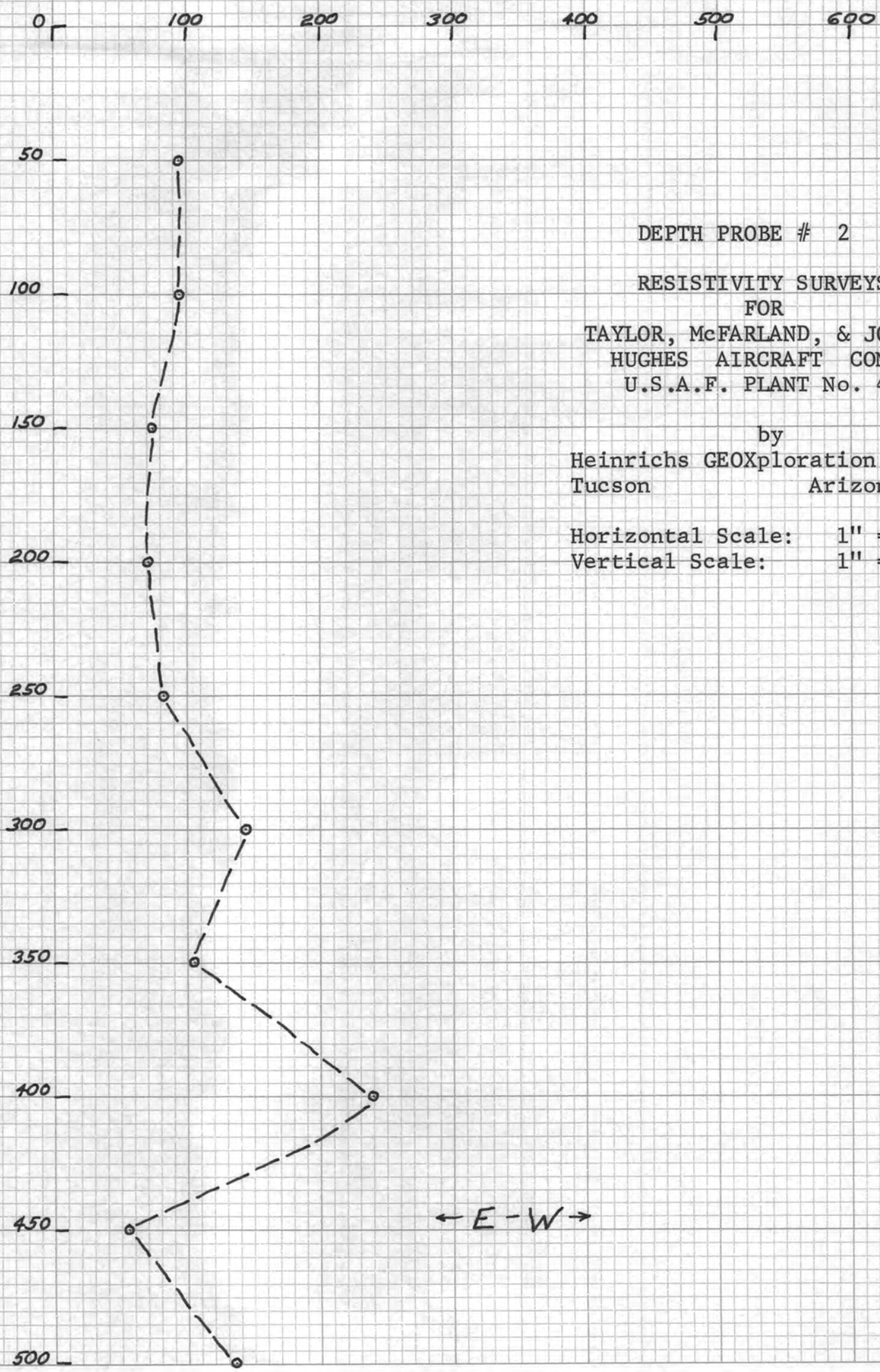
RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No.44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960

KEUFFEL & ESSER CO.
MADE IN U.S.A.



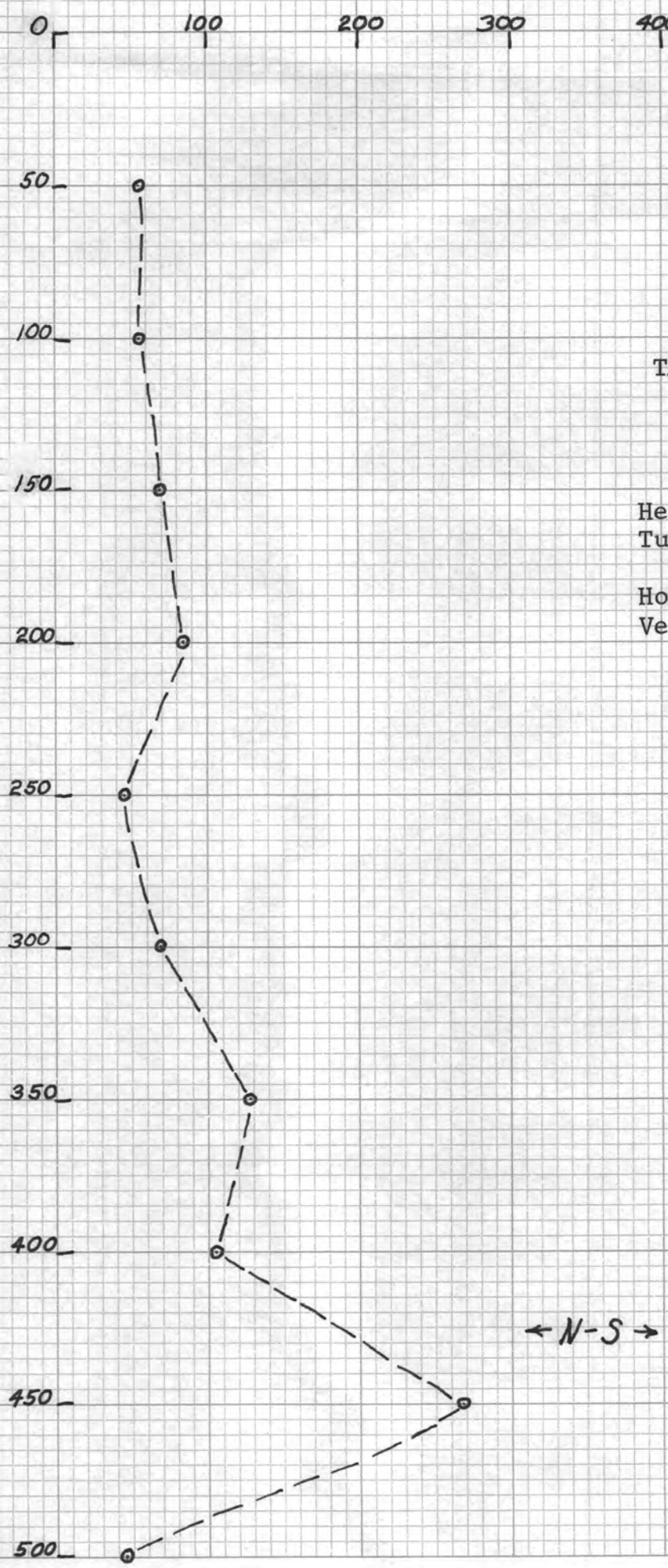
DEPTH PROBE # 2

RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

K+E STANDARD ® CROSS SECTION
10×10 TO THE INCH



DEPTH PROBE # 3

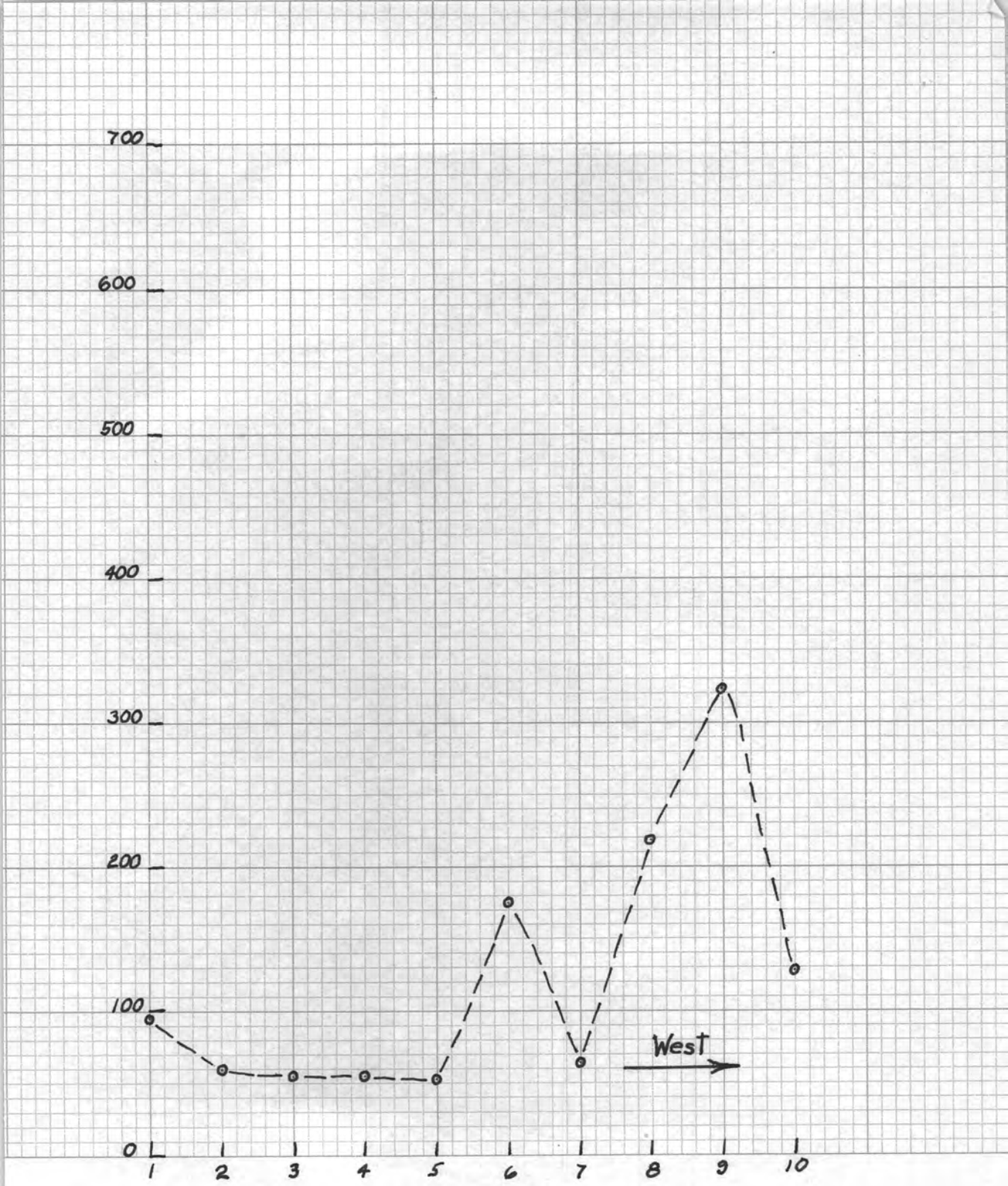
RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960

K+E STANDARD ® CROSS SECTION
10×10 TO THE INCH

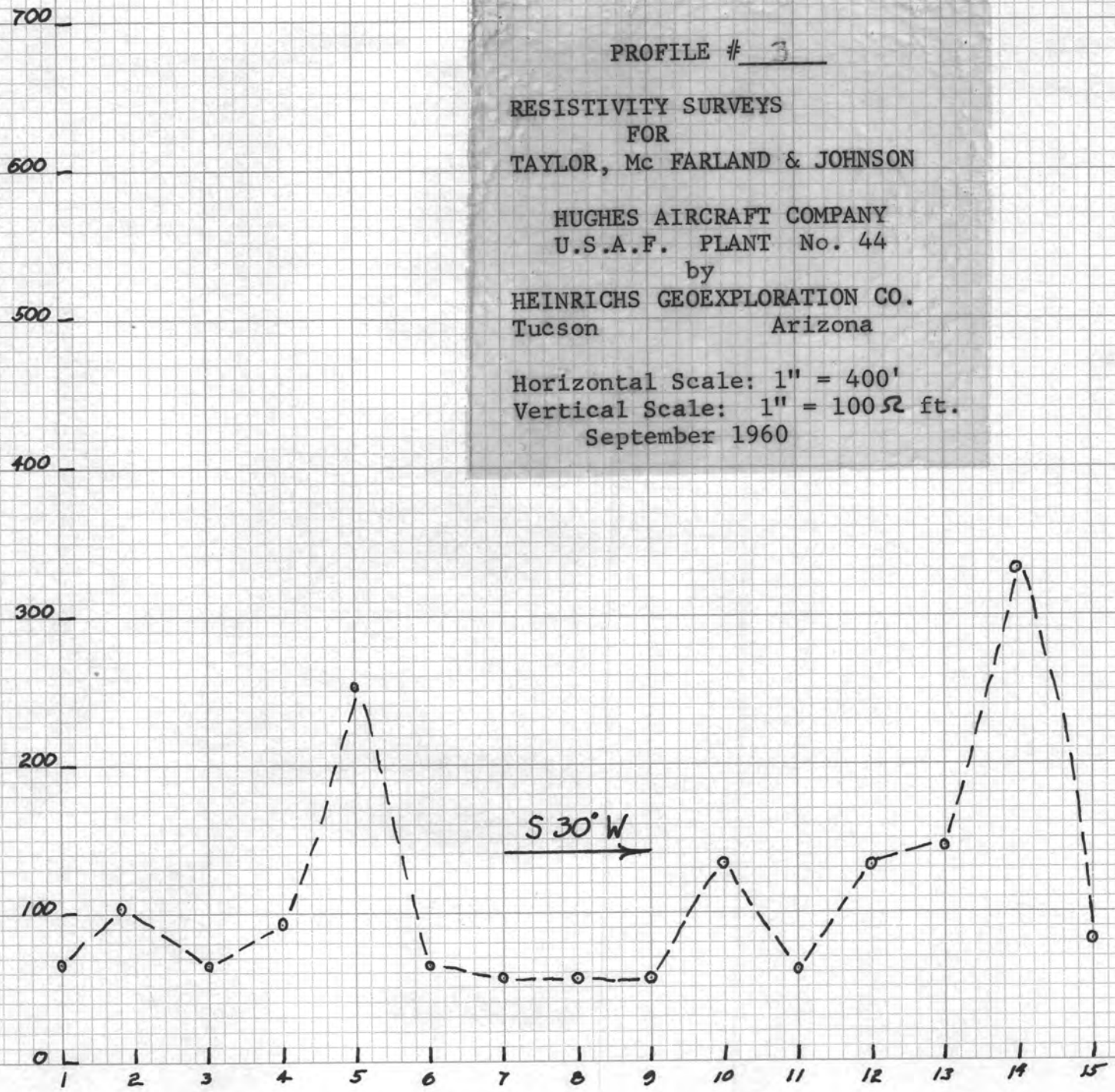

700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
West

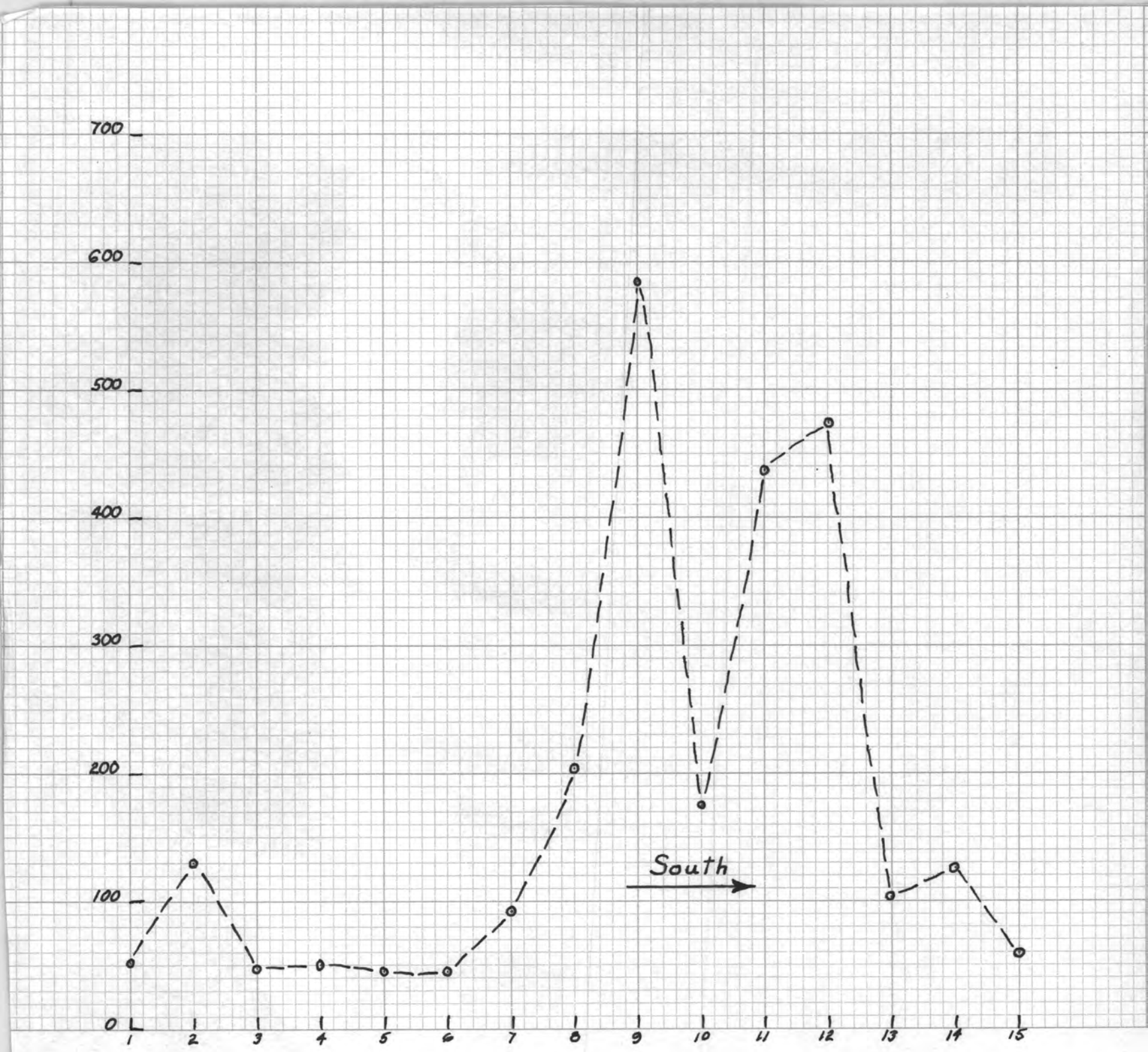
PROFILE # 3

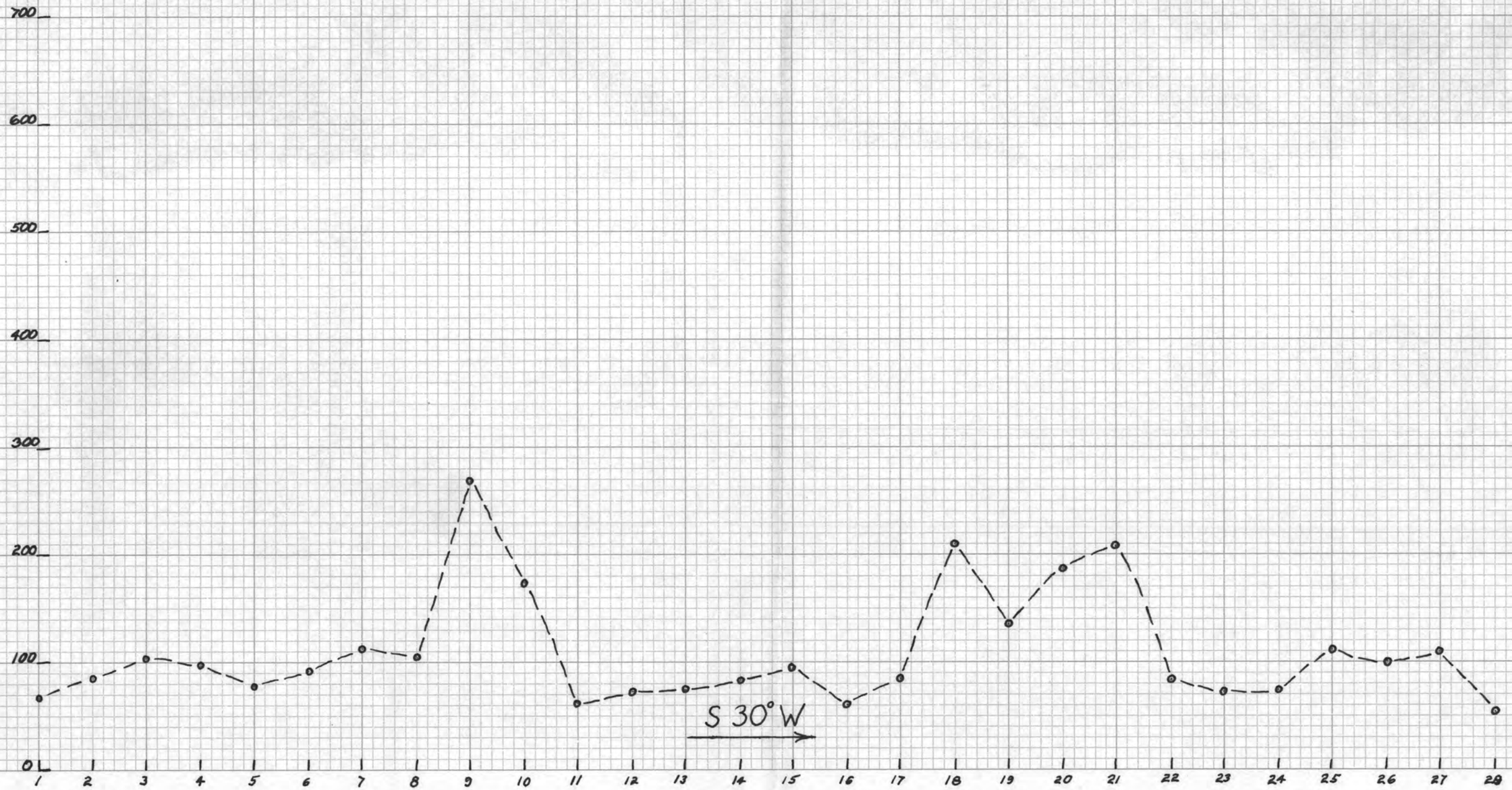
RESISTIVITY SURVEYS
FOR
TAYLOR, Mc FARLAND & JOHNSON

HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona

Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100 Ω ft.
September 1960




700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
South



KEUFFEL & ESSER CO.
MADE IN U.S.A.

K+E STANDARD ® CROSS
10×10 TO THE INCH

150 - 175 ✓
345 - 380

25'
20'
10'
10
10'
55'
5
135'

all Out

150 - 175 ✓ $\frac{3}{16}$"
345 - 380 ✓ — $\frac{1}{8}$"

~~385 - 400~~
~~410 - 415~~

---

175 - 195 ✓
245 - 255 ✓
265 - 275 ✓
285 - 295 ✓
~~345 - 400~~ ✓

1/6/60

Welfer. Co.

370'

Where is casing 12" Max pump & heads.

750 gpm.

2 Jan '61 - cased to 272'

3 " " - "

1st hit H_2O at shallow.

5 " " - drilled to 380'

355-375 Very fine sand

375-380 Sand & small gravel caved.

cased to 384'

trouble keeping casing straight.

lower well not hold sand says driller

may need screen.

put pump at 200'

Ed Spaulding

Dave.

Jet - etc

Copied from drillers log 6/Jan/61.

325 – 40	sandy clay streaks fine small gravel
340 – 45	clay
345 – 55	sdy clay w fine sd strks.
52	lots fine sand running in
355 – 70	very fine sand.
370 – 73	clay
373 – 80	sd – small gravel
	heaved up in hole
	384' pipe in hole
380 – 85	clay
385 – 400	sdy clay some small gravel
	Clay – stickey streaks
	some fine sand.
400 – 405	clay – 400 ft pipe in hole

Res. PROFILE #3 S30W FROM
DISPOSAL PIT

	V0	I 140			SP	
1. N.	-1.0	130 - 111			-7.0	
	+11.9	100				
R.	+12.8 25.7	111 481	.0534	67		
	+6.0	120				
2. N.	+8.9	114			+1.0	
	+11.9	110				
R.	+10.3 37.1	110 454	.0817	103		
	+13.0	140				
3. N.	+14.9	141			+8.0	
	+1.6	151				
R.	-0.5 30	151 583	.0515	65		
	+28.3	223				
4. N.	+29.0	229			+15.5	
	-2.8	205				
R.	-3.4 63.5	209 866	.0733	92		
	-27.7	181				
5. N.	-27.0	183			-35.2	Spot 20' NE of Pipeline
	+44.7	174				
R.	+44.5 143.9	178 716	.2010	252		
	+24.3	261				
6. N.	+27.3	273			+15.8	
	-1.2	268				
R.	-3.3 56.1	273 1075	.0521	65		
	+12.4	240				
7. N.	+13.8	244			+3.0	
	+9.0	225				
R.	+7.5 42.7	227 936	.0456	57		
	+12.6	314				
8. N.	+15.1	321			+2.0	Pot 20' NE Sec Fence
	+13.0	275				
R.	+11.6 52.3	271 1184	.0442	56		
	+8.4	212				
9. N.	+9.0	221			-1.0	7' SE Edge Rd
	+11.3	229				
R.	+11.3 40.0	230 892	.0448	56		
	+16.2	96				
10. N.	+17.0	110			+12.2	
	-6.3	113				
R.	-6.5 46.0	118 437	.1053	132		
	+18.0	250				
11. N.	+19.3	253			+7.0	Cross spread #2
	+8.5	285				
R.	+6.8 52.6	287 1075	.0489	61		
	-9.0	168				
12. N.	-9.0	170			-18.5	30' west of P.L.
	+27.0	175				
R.	+27.4 72.4	179 692	.1046	131		
	+28.2	170				
13. N.	+29.7	169			+27.5	
	-9.9	175				
R.	-10.5 78.3	166 680	.1151	145		
	-29.0	159				
14. N.	-27.2	157			-36.8	Top
	+45.8	122				
R.	+45.0 147.0	109 547	.2687	331		
	-0.6	82				
15. N.	+1.4	80		81	-4.4	
	+10.5	79				
R.	+8.0 20.5	79 320	.0641			

Hughes Res. PROFILE #2 E & W.

	V.	I.			S.P.
	+8.2	70			
1. N	+7.9	64			+4.2
	-2.7	72			
R	-2.6 21.4	70	276 .0775	97.3	-
	+3.2	155			
2. N	+3.	152			-4.
	+11	145			
R.	+11.2 28.4	142 594 .0478		60.0	
	+14.0	180			
3 N	+13.5	182			+5
	+1.0	168			
R	+1.9 30.4	171 701 .0434		54.5.	
	+12	128			
4 N	+9.5	100			+5.
	0	130			
R	0 21.5	130 488 .0441		55.4	
	0	249			
5 N	0	260			-11
	+20.1	230			
R	+20.1 40.2	232 971 .0414		52.0.	
	+43	239			
6 N	+42.8	241			+32.5
	-23.3	228			
R	-22.8 131.9	236 944 .1397		175.5	
	-38.8	85			
7 N	-38.5	84			-42. lowest pot of road
	+46.2	80			
R	+46.3 169.8	81 330 .5145		646	
	+25	118			
8 N	+26	118			+22
	-14.6	113			
R	-15.2 80.4	112 461 .1744		219	
	+44.8	151			
9. N	+45.3	150			+39.5
	-29.9	141			
R	-30.2 149.7	141 583 .2568		323	
	-5.5	111			
10 N	-6	110			-11.5 30' w of power line
	+16.2	110			
R	+17.5 45.2	110 441 .1025		129	

Hughes. D.P #3 N-S by Dry hole. 7/Sept/60.

			V	I	V/I av.	V/I 2πa	S.P.	S.R	PR
			78.7	275					
314	50	M	78.7	275			+39	1000	950
			8.2	265					
		R	8.5	265	0.1612	50.6			1200
			19.5	205					
628	100	M	19	205			+2	1800	1200
			12	187					
		R	13	190	0.0807	50.7			1000
			32	258					
942	150	M	31	258			+16.5	1300	1000
			4.5	235					
		R	4.8	229	0.0738	69.5		3000	10
			15	150					
1256	200	M	15	150			+10	3000	1000
			4	135					
		R	-4	138	0.0663	83.3			
			11	200					
1570	250	M	10	200			+4.5	1900	750
			-1	189					
		R	0	190	0.0282	443			
			12	211					
1884	300	M	12	212			+7	1800	700
			-3.2	198					
		R	-3	198	0.0369	69.5			
			12.5	172					
2198	350	M	12.5	170			+9.	2200	1100
			-6.6	157					
		R	-6.7	157	.0584	128			
			-3	125					
2512	400	M	-4	122			-6	4000	400
			+6	115					
		R	+7	115	.0419	105			
			-12	163					
2826	450	M	-13.5	160			-16	3750	480
			+16	145					
		R	+16.5	143	.0949	268			
			+2.2	147					
3140	500	M	+4	148			+2	2300	700
			+1.5	132					
		R	0.5	130	.0147	46.2			
				557	.015				

8.2 557 8.2

58
711

3140
314
2826

Hughes

D.P # 4 E-W by Dry hole

7/Sept/60

Sta		V	I			$2\pi a \frac{V}{I}$	S.P.	SR	PR
		87.3	392						
50	M	88.2	400				+17	750	550
		46.5	350						
	R	47	352	1494	.1801	56.6			
		20	185						
100	M	20	185				+3	1900	1000
		14	182						
	R	14	185	737	.0923	58.0			
		3.5	220						
150	M	3.5	228				-10	1300	500
		21	212						
	R	22	220	880	.0568	53.5			
		-7.5	240						
200	M	-8	240				-18	1200	500
		26	234						
	R	26.7	238	952	.0716	89.9		~~4000~~	~~700~~
		-2.0	116						
250	M	-2.2	115				-6	4000	700
		8.6	102						
	R	+8.5	100	453	.0492	77.2			
		-9	123						
300	M	-9	122				-12	4000	900
		14.5	112						
	R	14.3	112	592	.0791	149.0			
		-2.5	168						
350	M	-2.5	170				-6	2000	850
		8.8	162						
	R	9	162	662	.0344	75.6		~~1750~~	~~1200~~
		-12.0	189						
400	M	-12.2	191				-16	1750	1200
		18.3	178						
	R	18.8	180	738	.0831	208.7			
		-6.5	175						
450	M	-6	178				-9	1900	925
		12	168						
	R	11.5	172	693	.0519	146.7			
		-11	140						
500	M	-11	140				-12.5	3000	700
		14.6	118						
	R	14.5	125	523	.0977	306.8			

Hughes — Resist. Profile # 1 — 8/Sept/60

S 30° E from NE Cor

a = 200'.

Sta	V	I			S.P
	7.5	240			
1 N	7.2	240			-6
	18	245			
R	+19	250	.0542	68	
	12.5	150			
2 N	13	152			+3
	8	148			
R	7.5 41	148	.598 .0686	86.3	
	-5	212			
3 N	-4	212			-18
	+31.5	222			
R	+32 72.5	225	871 .0833	104.5	
	+9	145			
4 N	+8	138			-3
	+15	160			
R	+15 47	160	603 .0779	98	
	+1	90			
5 N	-0.5	85			-7
	+10.5	99			
R	+11.2 23.2	98	372 .0624	78.5	
	+6	95			
6 N	+6	90			0
	+8	98			
R	+7.5 22.5	95	378 .0728	91.5	
	-2.5	90			
7 N	-3.5	85			-9.5
	+13	95			
R	+13.5 30.5	93	363 .0896	112.6	
	+29.5	170			
8 N	+23	165			+13
	-5.8	208			
R	-5 58.3	210	698 .0835	105	
	-23	190			
9 N	-23	190			-30
	+37	191			
R	+37 120	190	561 .2145	269	
	-8.3	88			
10 N	-8.5	85			-12
	+15	84			
R	+15 46.8	81	338 .1385	174	
	+17	215			
11 N	+17	214			+6
	+2.5	186			
R	+3 39.5	185	900 .0494	62	
	+16.5	192			
12 N	+16	196			+2.5
	+8.8	215			
R	+9.5 50.8	220	823 .0618	71.5	
	+12	310			
13 N	+12.5	325			-7.5
	+26.2	342			
R	+27.5 78.2	360	137 .0585	73.5	
	+15	370			
14 N	+15	380			-11.5
	+35.5	392			
R	+37.5 103.0	416	1558 .0662	83	

Resis Profile # 1 8/sept/60
~~Spre~~ Page #2

EL PASO GAS on pipeline

		N	I		
		-4	225		
15	N	-4	227		-18
		+30.6	235		
	R	+30.5 69.1	238 925 .0747	93.8	
		+16	168		
16	N	+16.5	165		+9
		+0.2	168		
	R	0 32.7	170 671 .0487	61.2	
		+26	208		
17	N	+24.5	200		+12
		-4	218		
	R	-3.7 58.2	220 846 .0688	86.4	
		-16	140		
18	N	-16.2	138		-25
		+31.4	145		
	R	+31.5 95.1	145 568 .1674	210	
		-4.1	81		
19	N	+5.8	76		-10
		+12.0	81		
	R	+12.5 34.4	80 318 .1082	136	
		+21.2	102		
20	N	+22	102		+14.6
		-8.5	102		
	R	-9.5 61.2	102 408 .1500	188	
		-10.3	100		
21	N	-12.5	100		-19
		+21.6	103		
	R	+22.9 67.3	102 405 .1662	209	
		+8	69		
22	N	+7.8	60		+3.7
		+0.8	70		
	R	0	70 264 .0659	82.8	
		+3.8	198		
23	N	+4.1	205		-8.1
		+18.1	188		
	R	+18.4 44.4	188 779 .0570	71.6	
		+24.8	207		
24	N	+25	211		+11.2
		0	213		
	R	0 49.8	213 844 .0590	74.1	
		-2.5	65		
25	N	-2.2	65		-7.2
		+8.9	60		
	R	+8.6 22.2	61 251 .0884	111	
		+19.9	180		
26	N	~~[illegible]~~ +20.0	~~[illegible]~~ 174		+10.5
		-5	134		
	R	-4.9 49.8	135 623 .0799	100	
		-7.8	180		
27	N	-7.5	180		-17.5
		+31.3	260		
	R	+31.5	270 890 .0878	110	
		~~[illegible]~~ +0.6	171		
28	N	0	162		-7.8
		+12.2	125		
	R	~~[illegible]~~ +12.3 25.1	~~[illegible]~~ 125 583 .0431	54	

Hughes D.P #1 6/Sept 60.
264' S 45° E from well

			V	I	V/I av.	N-S. x 2πa Ω ft.	S.P.	BR.	PR.
			79.5	190					
	50	N	94.5	235	.329	103	+ 17.5	800Ω	800Ω
			38.5	170					
		R	57	225					
628	100	N	47	170					
			59	250			+24	800	900
			9	165					
		R	3	190	.141	89			
942	150	N	21	170					
			22.5	190			+9	450	900
			3.0	152					
		R	5.0	170	.076	72		~~750~~	~~700~~
1256	200	N	31.5	165					
			35	210			+25	750	700
			-17.4	150					
		R	-17	172 697	.145	182		~~650~~	~~700~~
1570	250	N	+31.7	180					
			+34.5	260		174 206	+25	650	700
			-20	170					
		R	-19	210	.127	199		7	
1884	300	N	31	185					
			32	230			+27	725	700
			-23.5	170					
		R	-22.5	205 790	.138	260			
2198	350	N	41	185					
			43.2	225			+40	1000	750
			-35	175					
		R	-35	200 785	.196	431			
2512	400	N	39	160					
			40	200			+36	1500	650
			-34	160					
		R	34	183 703	.209	525			
2826	450	N	32	180					
			33	210			+30.5	1275	500
			-27.5	175					
		R	-28	192 757	.159	449			
3140	500	N	29.5	143					
			30	150			+28.5	2200	525
			26.2	135					
		R	26.8	148 576	.195	612			

Hughes. DP # 2 E-W 7/Sept/60

264' S45°W from well

			V	I	$\frac{V}{I}$ av	$\frac{V}{I}$ 2 ≥ a	S.P.	SR	PR
314	50	N	27 +28.	138 140	.303	95.1	-15.	3000	1000
		R.	53 +55	128 132.					
628	100	N	11 +11	140 142.	.152	95.5	-11	3000	1200
		R.	29 +31	125. 132.					
942	150	N	23. 23	295 295	.0789	74.3	-1.	1000	1000.
		R	21 23	265 285					
1256	200	N	11 12	245 265	.0567	71.2	-4.5	1300	1000
		R.	15 17	215 245					
1570	250	N	19 20	210 230.	.0526	82.6	+11.	3000	1000
		R	-3.5 -3	205. 220					
1884	300	N	24 25.	250 262	.0762	144	+17.5	2500	1000
		R	-11 -11.	210 210.					
2198	350	N	19 +20.	250 300	.0482	106	+13.5	500	1200
		R	-8 -6.5	250 309					
increasing, 2512	400	N	21 21.8	190 238	.0956	240	+17.	1800	800
		R	-14.5 -14	158 160					
2826	450	N	+1 +2	255 280	.0179	50.6	-3.5	500	850
		R.	+8 +8	260 265					
3140	500	N	15 +15.	280 300	.0433	136	+11	1000	850
		R	-7 -7	245 260					

Res. PROFILE #4 S. Edge of
Road BY Fire STATION Running on W. Edge of Road

Sta	V	I				S.P	
	+17.5	415					
1. N.	+16.5	400				0	Normal current steady 350-400 from 350 Reverse
	+4.0	100					
R.	+10.8	270	1185	.0412	52.		
	-9.8	162					
2. N.	-9.5	160				-15.2	
	+20.6	130					
R.	+20.5	60.4 132	584	.1634	130		
	+29.3	451					
3. N.	+30.3	469				+12.1	
	+4.7	446					
R	+5.0	458	1824	.0380	48.7		
	+10.8	450					
4. N.	+11.9	477				-7.3	electrodes 100' from Sta 4 at sewer ditch
	+23.8	420					
R.	+25.4	71.9 452	1799	.0400	50.		
	+17.8	471					
5. N.	+19.3	490				+2.0	
	+16.3	478					
R.	+16.3	69.7 486	1925	.0362	45.		
	+20.5	402					
6. N.	+21.5	418				+7.5	
	+8.3	415					
R.	+8.0	58.3 425	1660	.0351	44.		
	-15.5	350					
7. N.	-14.8	367				-26.1	
	+37.8	361					
R.	+38.0	106.1 370	1448	.0733	92.		
	-36.7	248					
8. N.	-36.1	267				-48.7	12' EAST OF DRY WELL
	+51.1	282					
R.	+51.2	175.1 287	1084	.1615	203.		
	+70.0	148					
9. N.	+71.0	142				+66.7	ON PIPE LINE
	-60.0	128					
R.	-59.8	260.8 142	560	.4657	585		
	+31.8	174					
10. N.	+32.7	176				+25.0	
	-17.0	181					
R.	-17.7	992 181	712	.1393	175.		
	-37.6	124					
11. N.	-37.0	125				-45.0	
	+53.8	135					
R.	+52.7	181.1 135	519	.3489	438.		
	+40.0	100					
12. N.	+40.0	100				+33.8	
	-27.0	78					
R.	-28.5	135.5 80	358	.3785	475.		
	+28.0	182					
13. N.	+29.0	190				+16.0	
	-1.5	186					
R.	-3.2	190	750	.0823	103		
	+18.9	130					
14. N.	+21.0	140				+11.0	
	-5.8	86					
R.	-4.0	49.7 138	494	.1006	126		

OVER

1/16/61

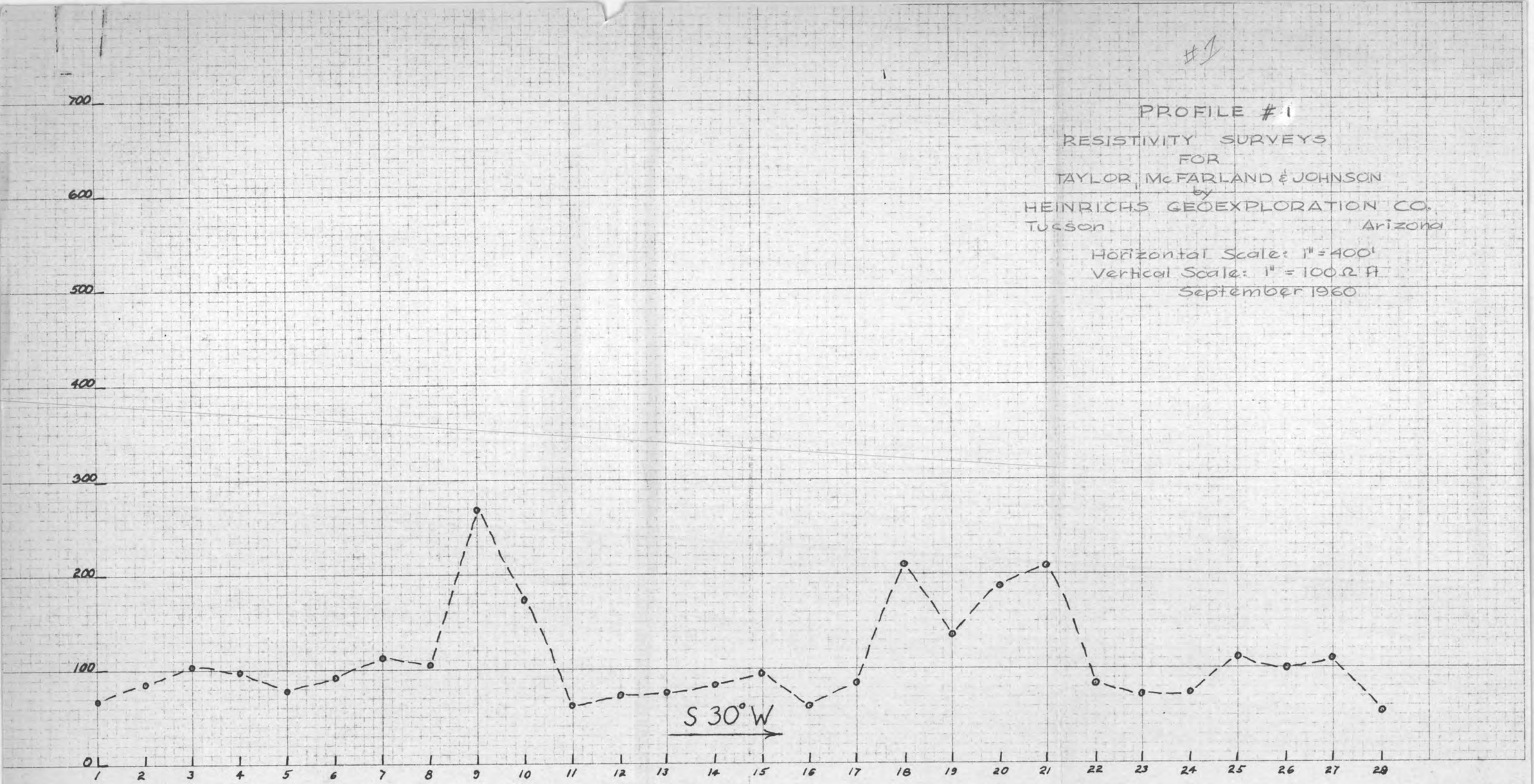
Bryan Kent & Mac. of T.M.S.

#1

PROFILE #1

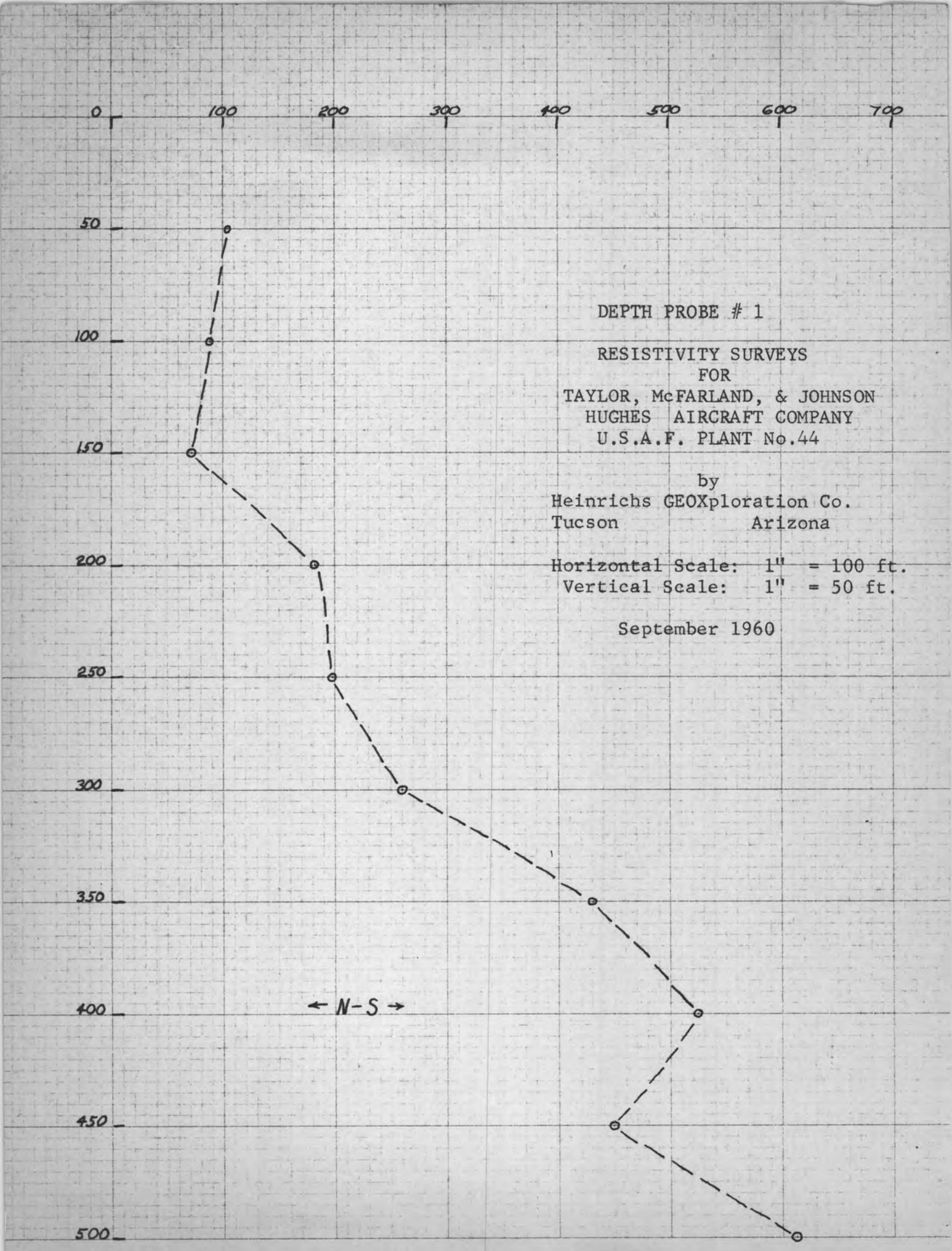
RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND & JOHNSON
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona

Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100 Ω ft
September 1960



KEUFFEL & ESSER CO.
MADE IN U.S.A.

K+E STANDARD CROSS
10 X 10 TO THE INCH



DEPTH PROBE # 1

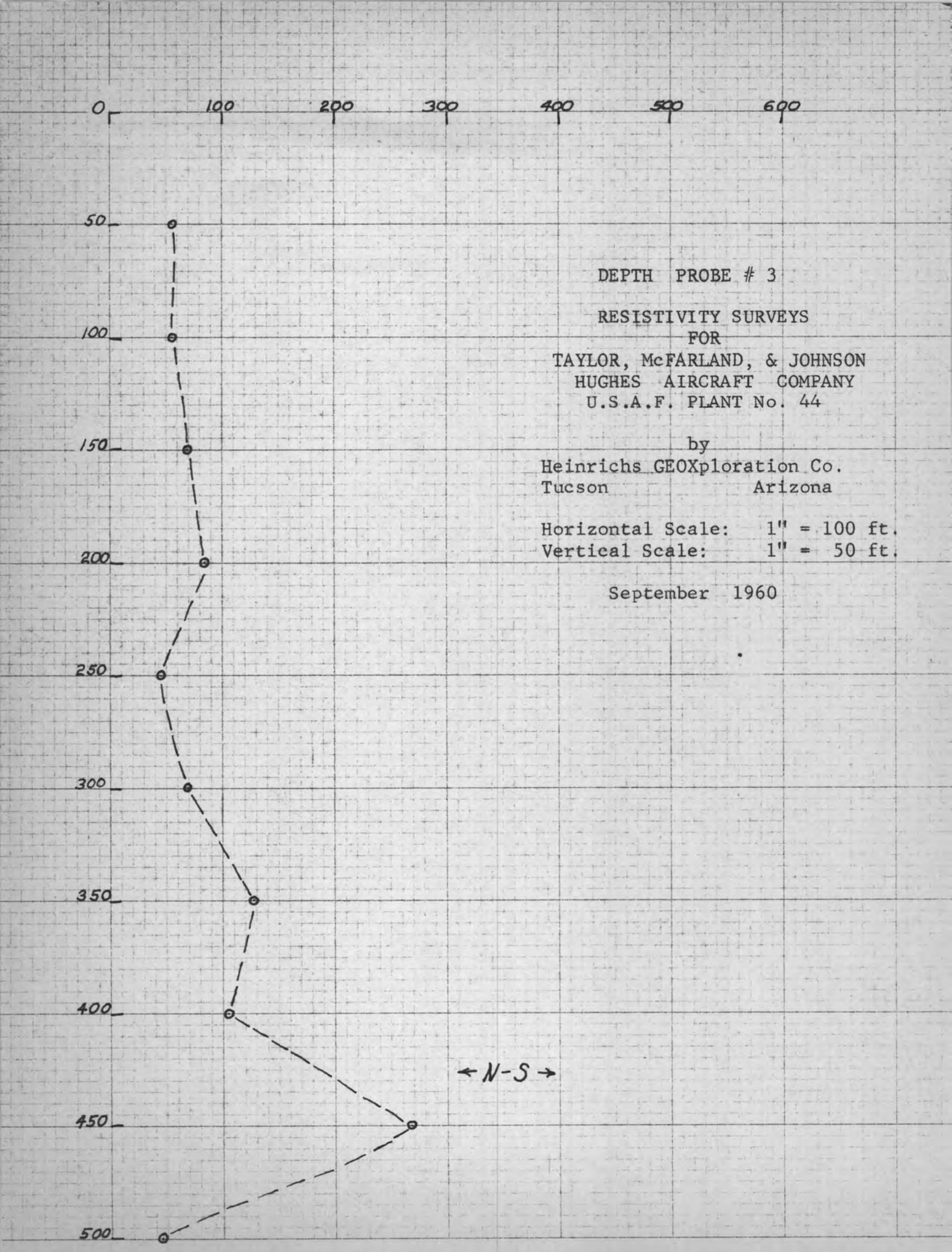
RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No.44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960

KEUFFEL & ESSER CO.
MADE IN U.S.A.



DEPTH PROBE # 3

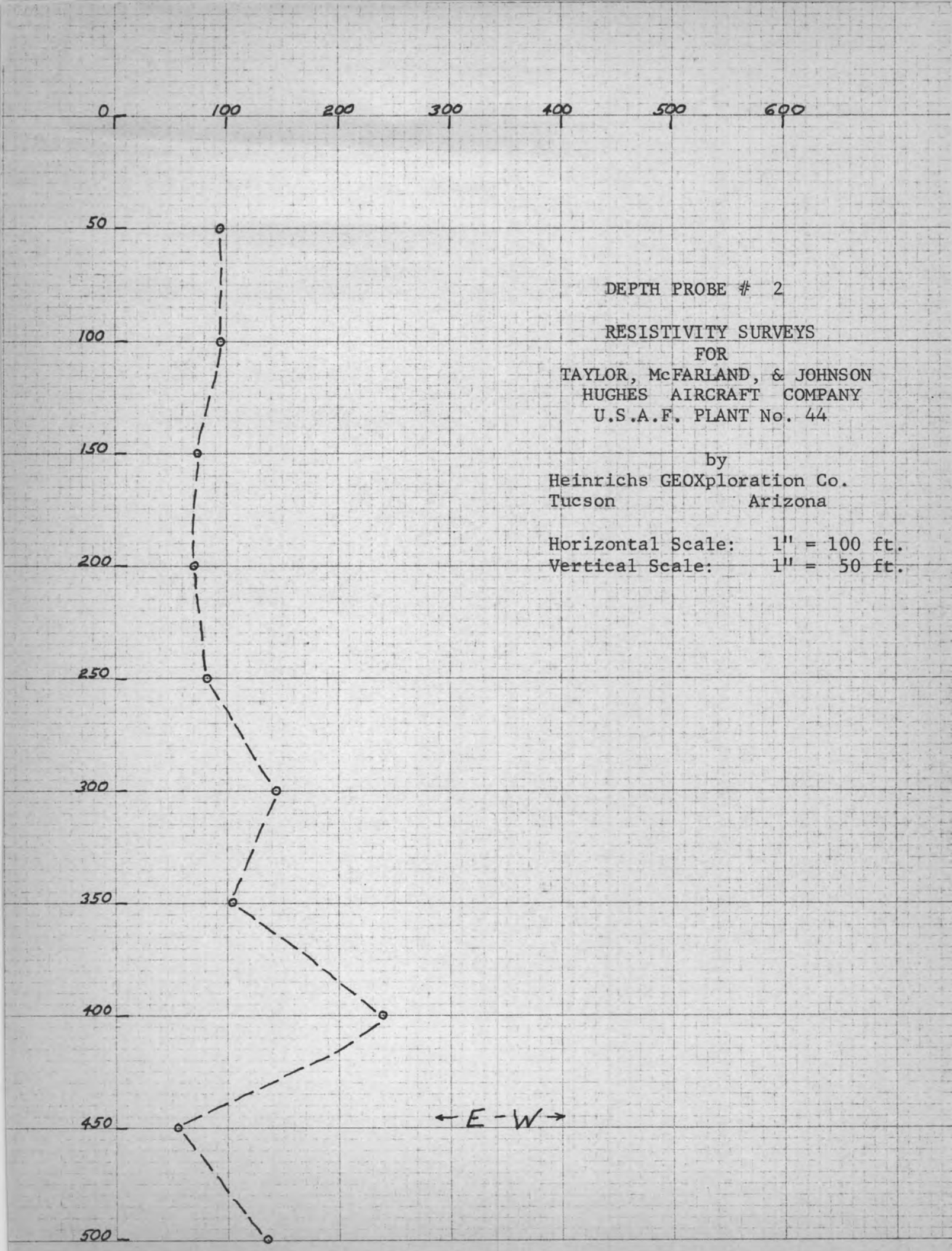
RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960

K+E STANDARD ® CROSS SECTION
10×10 TO THE INCH



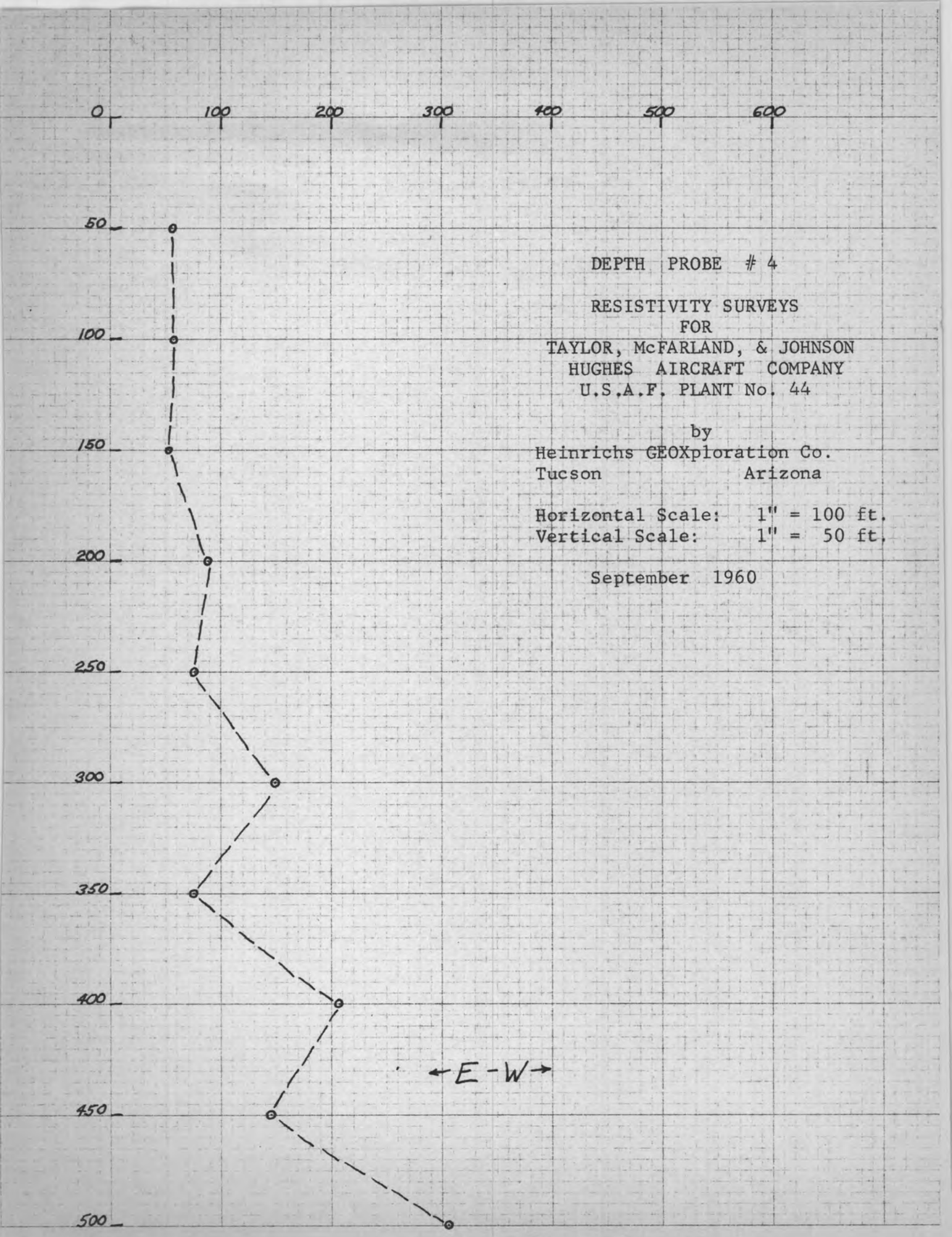
DEPTH PROBE # 2

RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

K+E STANDARD ® CROSS SECTION
10×10 TO THE INCH



DEPTH PROBE # 4

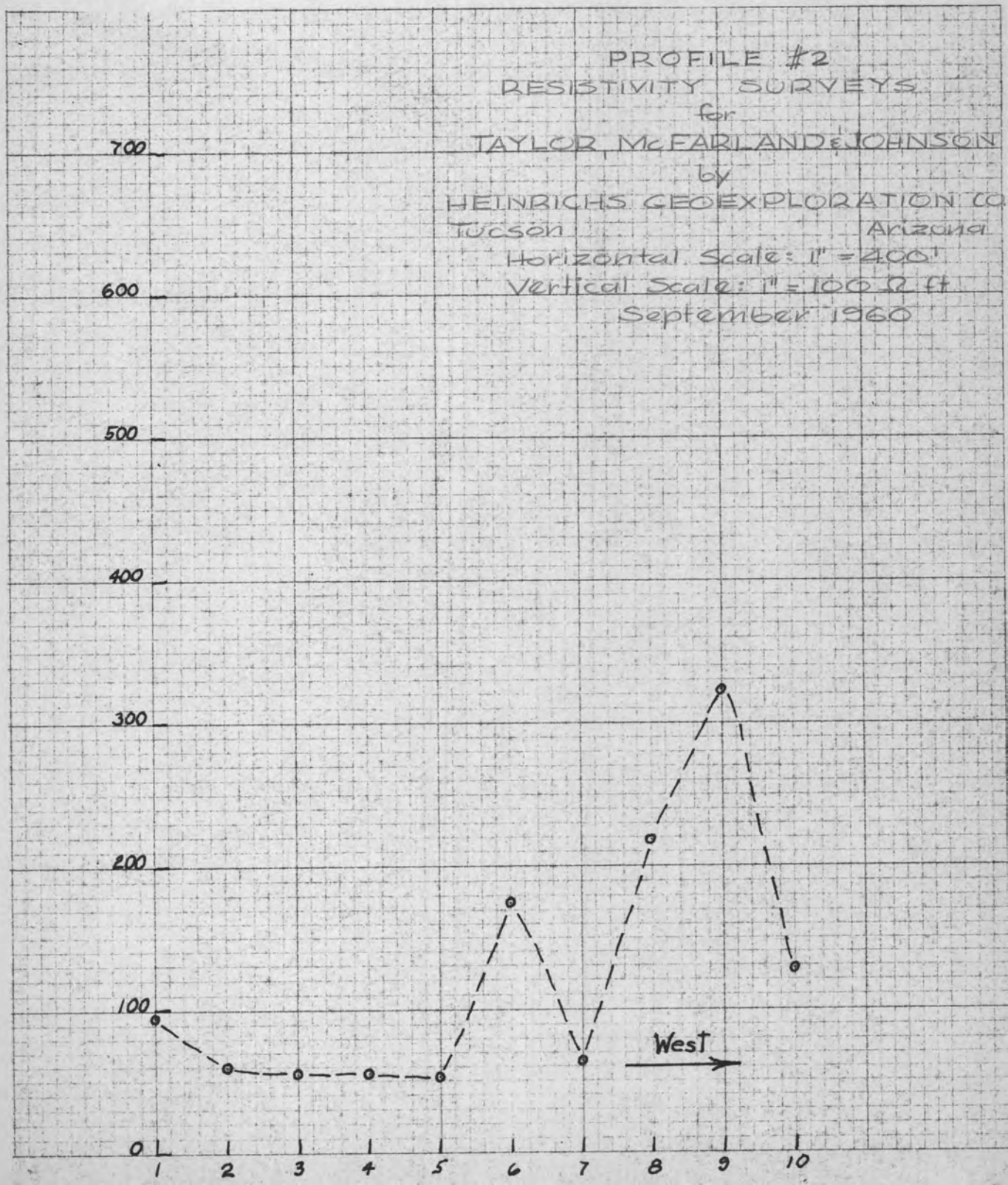
RESISTIVITY SURVEYS
FOR
TAYLOR, McFARLAND, & JOHNSON
HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44

by
Heinrichs GEOXploration Co.
Tucson Arizona

Horizontal Scale: 1" = 100 ft.
Vertical Scale: 1" = 50 ft.

September 1960

KEUFFEL & ESSER CO.
MADE IN U.S.A.


PROFILE #2
RESISTIVITY SURVEYS
for
TAYLOR, McFARLAND & JOHNSON
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona
Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100 Ω ft
September 1960
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
West

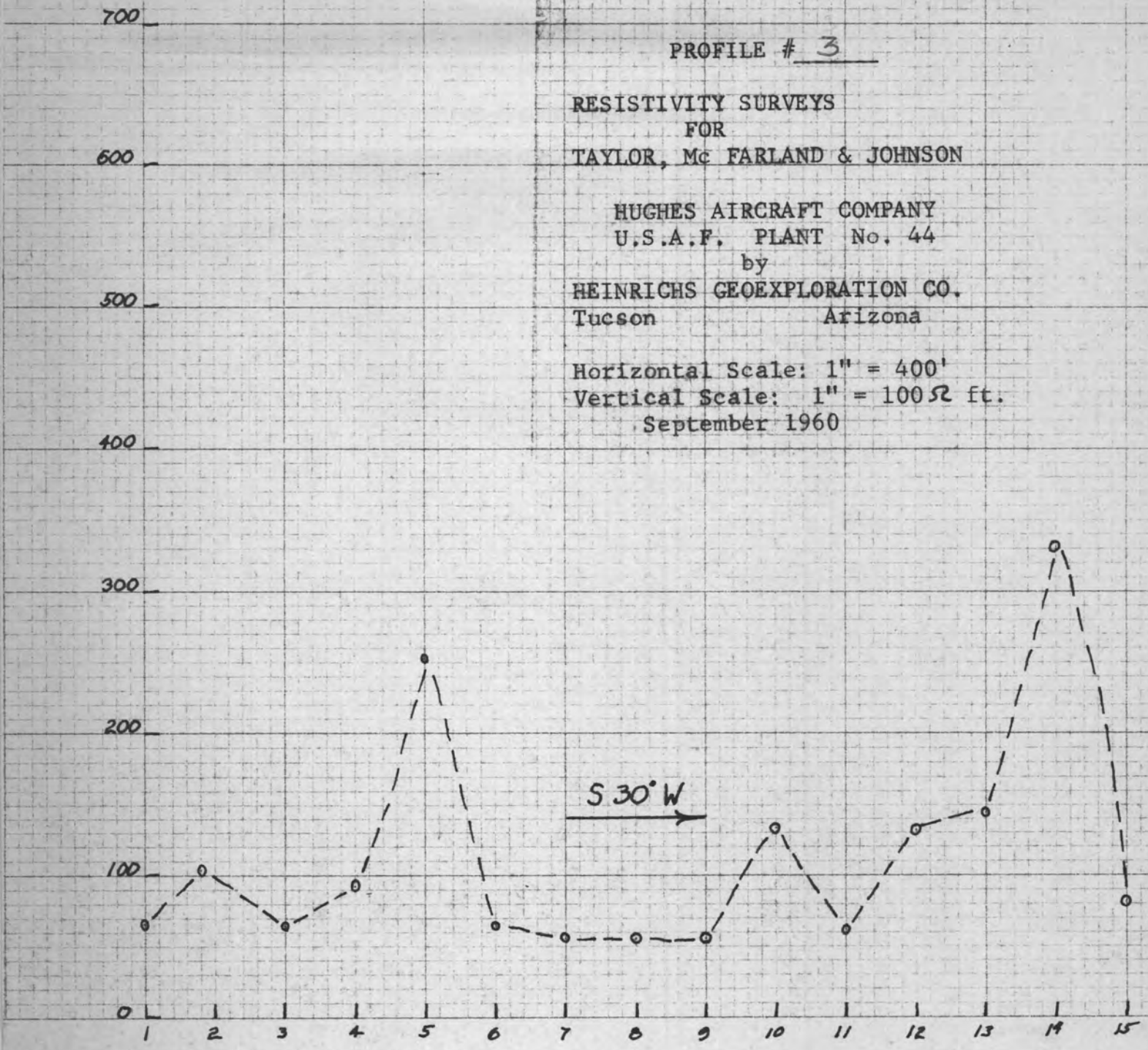
2

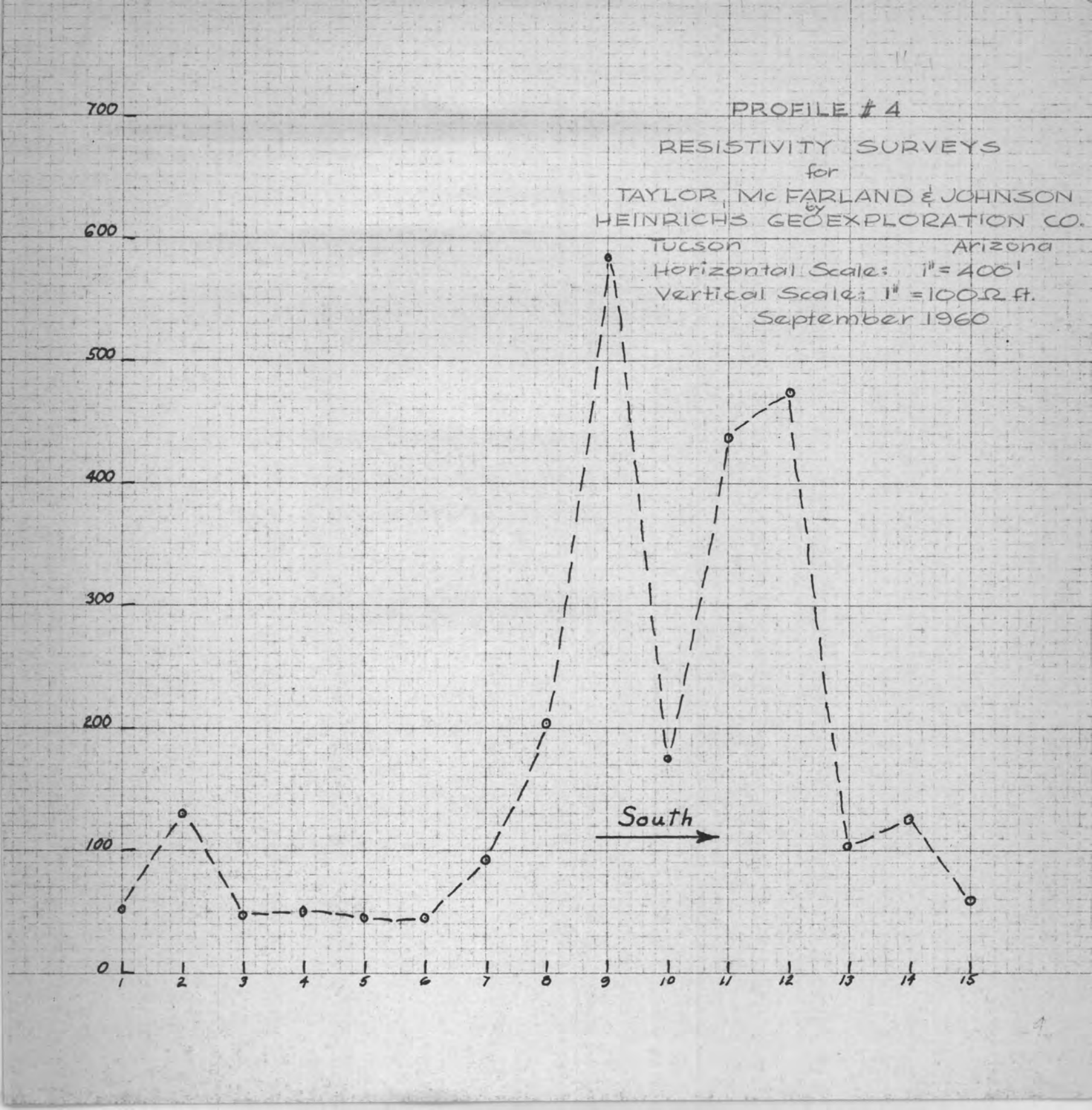
PROFILE # 3

RESISTIVITY SURVEYS
FOR
TAYLOR, Mc FARLAND & JOHNSON

HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT No. 44
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona

Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100 Ω ft.
September 1960




PROFILE # 4
RESISTIVITY SURVEYS
for
TAYLOR, McFARLAND & JOHNSON
by
HEINRICHS GEOEXPLORATION CO.
Tucson Arizona
Horizontal Scale: 1" = 400'
Vertical Scale: 1" = 100Ω ft.
September 1960
700
600
500
400
300
200
100
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
South

REPORT ON RESISITIVITY SURVEYS

HUGHES AIRCRAFT COMPANY
U.S.A.F. PLANT NO. 44

for

Taylor, McFarland and Johnson

September 13, 1960

by

Heinrichs Geoexploration Company

P.O. Box 5671 Tucson, Arizona

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REPORT ON RESISTIVITY SURVEYS - HUGHES AIRCRAFT COMPANY

INTRODUCTION

At the request of the firm of Taylor, McFarland and Johnson of Tucson, Arizona, contractors to the Hughes Aircraft Company, operators of U.S.A.F. Plant No. 44, Heinrichs Geoexploration Company conducted resistivity surveys on the plant property, located south of Tucson, Arizona, on September 6, 1960 through September 9, 1960. These surveys consisted of four (4) depth probe measurements and four (4) profiles.

CONCLUSIONS & RECOMMENDATIONS

The resistivity surveys indicate marked lateral formational changes which probably control the flow of ground water.

These formational changes are probably directly related to the clay or silt content or the cementing agent of the sand aquifer.

Water "channels" or rather, more porous and/or permeable zones, probably strike in a north-west south-east direction and pinch and swell to some degree laterally.

It is recommended that further drilling for water be confined to the areas delineated as resistivity lows on the interpretation map.

A suggested possible well site location is indicated on the interpretation map.

OBJECTIVE

The purpose of these surveys was to appraise the relative favorability of various potential, or considered, locations for a new, supplemental water well and, if possible, the reason for the weaker production from the abandoned well.

PROCEDURE

Depth probes No. 1 and No. 2 were made across the producing well, originally No. 3. Depth probes No. 3 and No. 4 were made across the abandoned well, originally No. 2. Profile No. 1 was 6200 feet in length, S 30° W from a point about 1000 feet N 55° E of Well No. 3 to a point at the road about 2700 feet south of the abandoned well. Profile No. 2 was run due west 2400 feet from a point about 3350 feet S 26° E of Well No. 3. Profile No. 3 was 3400 feet in length, parallel to and about 800 feet southeast of Profile No. 1, from a point about 200 feet N 30° E of the disposal pit. Profile No. 4 was 3400 feet in length, through and starting at a point about 1800 feet north of the abandoned well.

Depth probes at the two locations were made using a standard expanding Wenner configuration. Expansions were made in 50 foot intervals from 50 to 500 feet, theoretically providing

apparent relative depth information from 0 to approximately 300 feet.

Profiles were made using a standard Wenner configuration with a 200 foot electrode spacing, theoretically providing relative apparent information to, or at, approximately a depth of 200 feet.

Results obtained from these surveys are considered to be reasonably conclusive and it is possible to make fairly definite recommendations for well locations.

METHODS AND INTERPRETATION

Results of the depth probes indicated pronounced lateral changes in resistivity at both locations, and that a possible resistivity interface exists at a depth of 150 to 200 feet in the case of Probes No. 1 and No. 2 at Well No. 3, and at 100 to 130 feet in the case of Probes No. 3 and No. 4 at the abandoned well. Depth probes do not yield conclusive interpretable information where marked lateral physical, and therefore resistivity, changes occur. Partially for this reason, but mainly to obtain maximum information, an alternate method of profiling at a constant electrode spacing of 200 feet was used in the rest of the work. The results produced by profiling were more conclusive and interpretable, making it possible to delineate and map the boundaries of the lateral resistivity changes. By running profiles through the three well locations,

where knowledge of the subsurface formations exist, it was concluded that a low value of resistivity probably corresponds to a "water channel" or aquifer containing a more available volume of water, while a high value of resistivity probably is related to a "tighter" or more cemented, less porous and/or permeable formation. Carrying this interpretation to the profiles through unknown areas, it has been possible to make the foregoing recommendations for location of a well.

Examination of the driller's logs of the three wells drilled tentatively supports the results. In the case of both the producing wells, "loose sand" and more sand and gravel without clay was reported, possibly indicating a cleaner or more well-washed aquifers or zones, while in the case of the abandoned well more clayey sand and fine sand was encountered and no "loose sand" or gravel was reported.

Respectfully submitted,

HEINRICHS GEOEXPLORATION COMPANY

Franklin A. Seward Jr.

Franklin A. Seward Jr.
Geophysical Engineer

Approved by:

Walter E. Heinrichs Jr., Pres.
Heinrichs Geoexploration Company
P.O. Box 3671, Tucson, Arizona

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 1969
ARIZONA, U.S.A.

TABLE NO. 1

Tucson, Arizona, Investigation of 22nd Street Reservoir

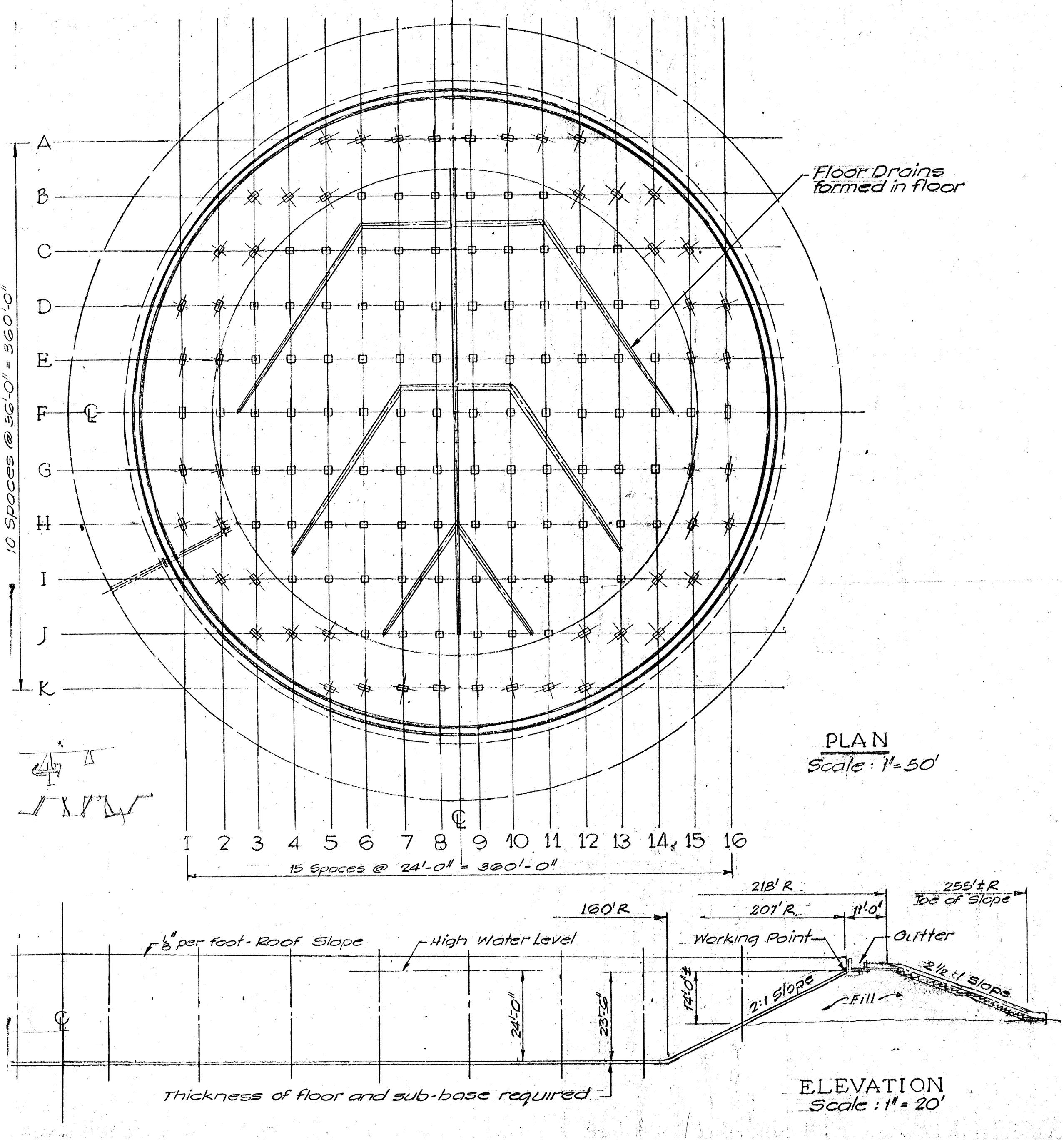
5/13/53

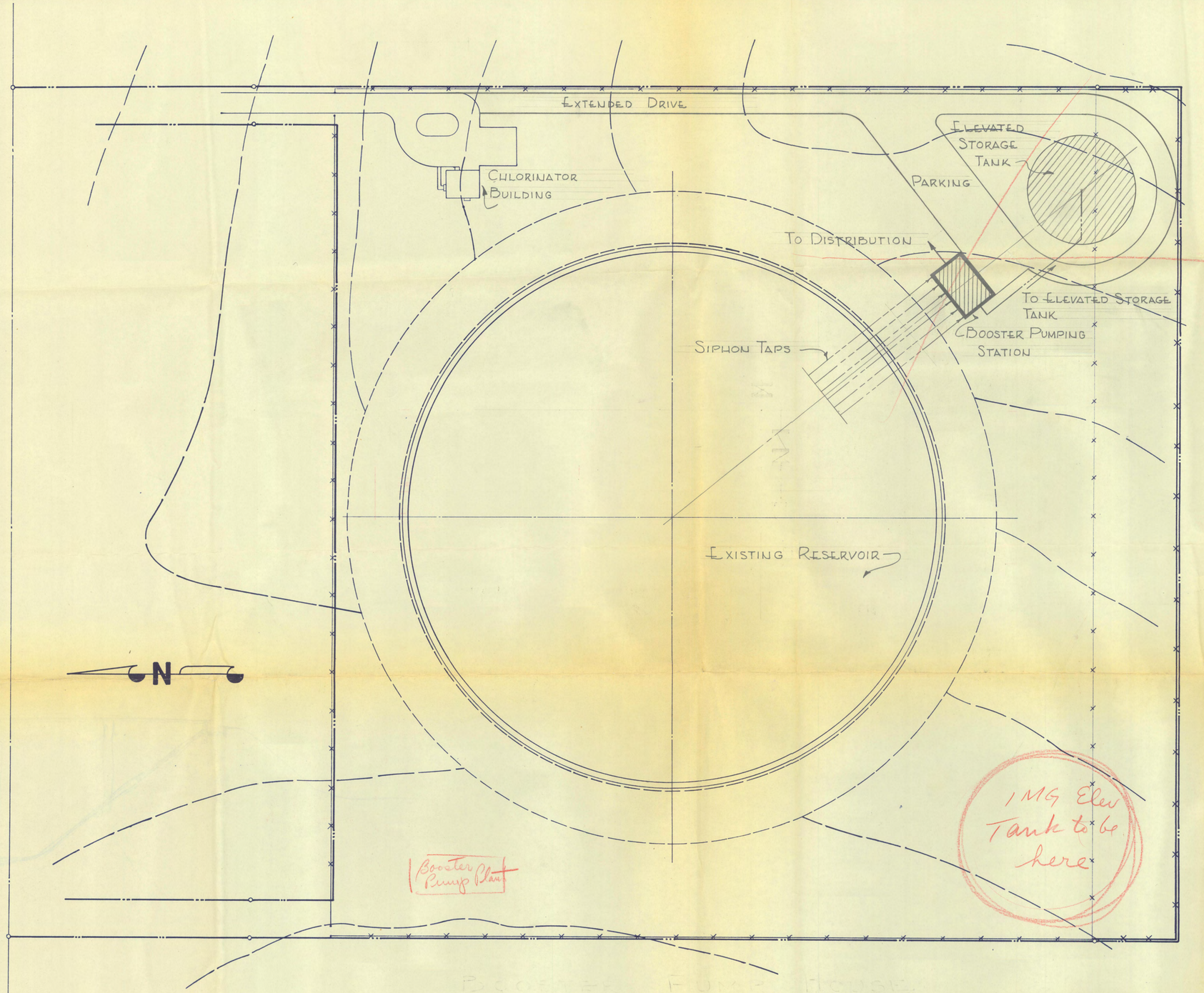
RESULTS OF TESTS MADE ON SUBGRADE SOILS BY ARIZONA TESTING LABORATORY

SOIL TEST HOLES

	1A*	1A**	1B	1C	2A	2B	2C	3A	3B	3C	4	5	6	7
Liquid Limit	50%	70%	46%	44%	47%	57%	52%	73%	74%	55%	49%	72%	61%	59%
Plastic Limit	21%	35%	18%	19%	18%	21%	18%	29%	29%	18%	17%	31%	32%	21%
Plasticity Index	29%	35%	28%	25%	29%	36%	34%	44%	45%	37%	32%	41%	29%	38%
Soil Classification	A-7(14)	A-7(17)	A-7(15)	A-7(11)	A-7(15)	A-7(14)	A-7(13)	A-7(20)	A-2(7)	A-7(14)	A-7(15)	A-7(17)	A-7(14)	A-7(16)
Density, Dry Wt./c.f.		95.37		98.7	101.6	86.11		97.0	98.7	94.1	107.9		82.9	
Moisture		15.72%		19.6%	18.9%	13.52%		13.1%	5.1%	17.7%	17.1%		12.6%	
Shrinkage Limit	21.2%	21.32% ~~18.98%~~			23.44% ~~18.63%~~			25.03%			19.86%	21.40%	24.08%	
Shrinkage Ratio	1.62	1.60			1.57			1.39			1.67	1.58	1.57	
Field Moisture Equivalent	36.7%	52.22%			37.22%			54.57%			34.26%	50.60%	55.51%	
Volumetric Change	25.1%	49.12%			21.63%			47.13%			24.05%	46.14%	49.35%	
Pass 200 Sieve	59%	64%	68%	57%	66%	57%	54%	75%	9%	58%	66%	66%	56%	64%
Hydrometer Analysis														
0.010 to 0.005mm	17%	20%			22%			20%			25%		20%	
0.005 to 0.001mm	10%	13%			19%			19%			18%		13%	
0.001mm & smaller	3%	3%			6%			6%			2%		7%	

* To depth of 20" below top of gunite
** From 20" to 31" below top of gunite

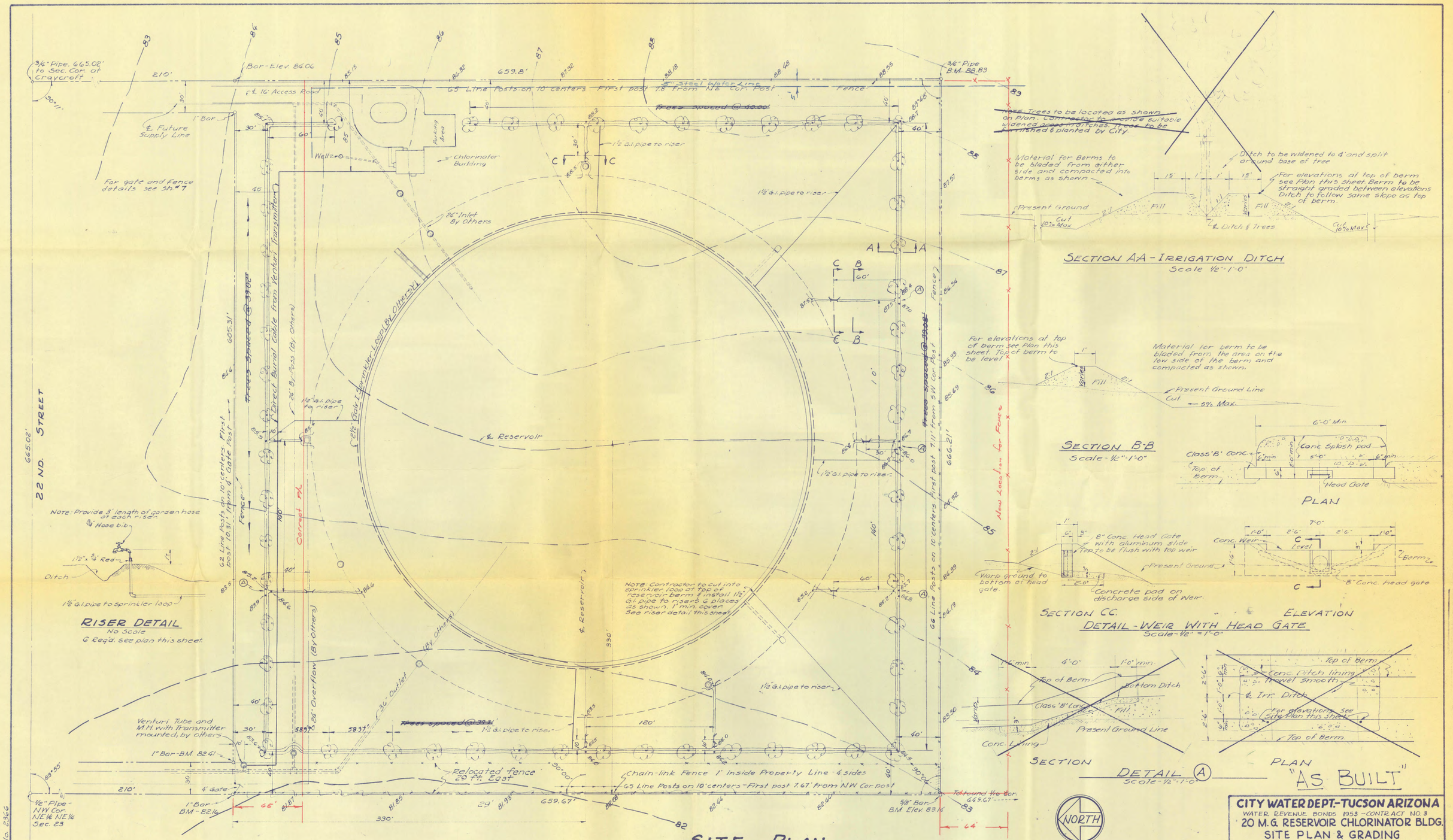

A
B
C
D
E
F
G
H
I
J
K
10 Spaces @ 36'-0" = 360'-0"
Floor Drains formed in floor
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
15 Spaces @ 24'-0" = 360'-0"
PLAN
Scale: 1" = 50'
218' R
255'± R
Toe of Slope
160' R
207' R
11'-0"
1/8" per foot - Roof Slope
High Water Level
Working Point
Gutter
2:1 Slope
2 1/2 : 1 Slope
Fill
24'-0"
23'-6"
14'-0"±
Thickness of floor and sub-base required
ELEVATION
Scale: 1" = 20'



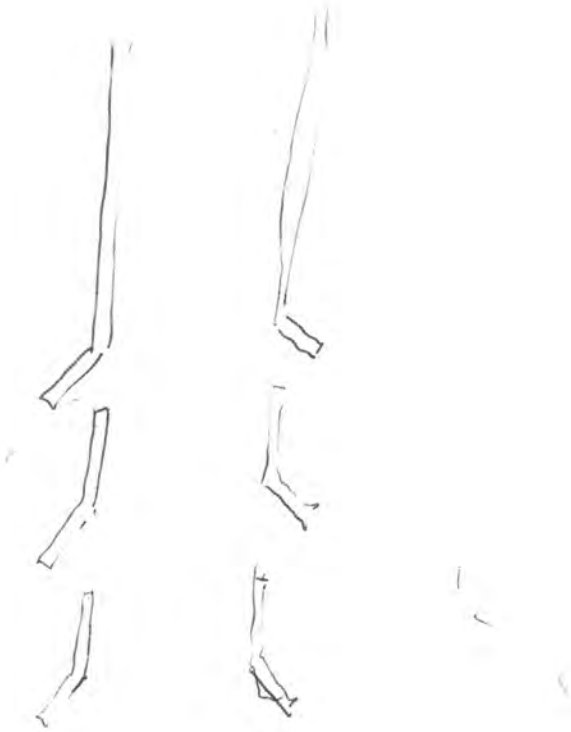
SCHEME "C"

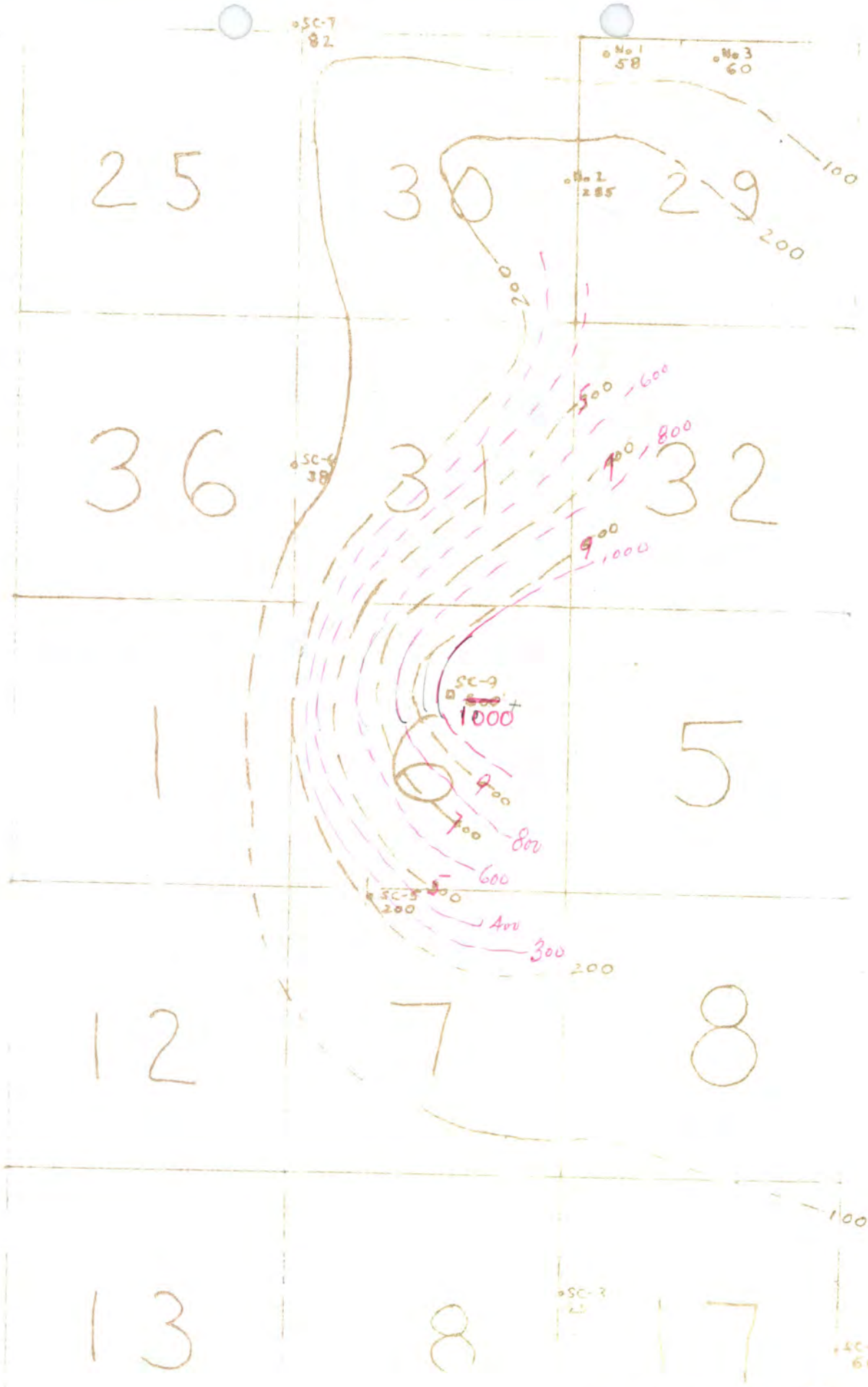
CITY OF TUCSON, ARIZONA
WATER WORKS IMPROVEMENT

SCALE: VERT. HORIZ. 1" = 40'-0"
DRAWN BY: JR
CHECKED BY:
DATE:
JOHANNESSEN, GIRAND & TAYLOR.


22 ND. STREET
3/4" Pipe. 665.02' to Sec. Cor. at Graycroft
Bar-Elev. 84.06
659.8'
3" Steel Water Line
68 Line Posts on 10 centers First post 18' from NE Cor. Post
Fence
3/4" Pipe B.M. 88.83
16' Access Road
1" Bar
℄ Future Supply Line
For gate and fence details see Sh. #7
Building Area
Chlorinator Building
1½" G.I. pipe to riser
Wall=0
26" Inlet By Others
℄ Reservoir
Direct Burial Cable from Venturi Transmitter
26" By-Pass (By Others)
2½" Galv. Sprinkler Loop (By Others)
62 Line Posts on 10' centers First post 10.31' from 4' Gate Post
Corner P.L.
Note: Provide 3' length of garden hose at each riser.
3/4" Hose bib
1½" x 3/4" Red.
Ditch
1½" G.I. pipe to sprinkler loop
RISER DETAIL
No Scale
6 Reqd. see plan this sheet
Note: Contractor to cut into sprinkler loop at top of reservoir berm & install 1½" G.I. pipe to risers 6 places as shown. 1' min. cover. See riser detail this sheet.
26" Over-Flow (By Others)
36" Outlet
Venturi Tube and M.T.H. with Transmitter mounted, by others
1" Bar-B.M. 82.41
Relocated fence 29' ft. East
Chain-link Fence 1' inside Property Line - 4 sides
65 Line Posts on 10' centers - First post 7.67' from N.W. Cor. post
1" Bar BM-82.16
1/2" Pipe - N.W. Cor. NE¼ NE¼ Sec. 23
4' Gate
Tel. found 1/2" Bar.
5/8" Bar B.M. Elev. 83.16
66 Line Posts on 10' centers First post 7.11' from SW Cor. Post
New Location for Fence
330'
210'
65'
64'
29'
120'
Material for Berms to be bladed from either side and compacted into berms as shown
Present Ground
Cut 10% Max
Fill
Ditch to be widened to 6' and split around base of tree
For elevations at top of berm see Plan this sheet. Berm to be straight graded between elevations. Ditch to follow same slope as top of berm.
℄ Ditch & Trees
SECTION AA - IRRIGATION DITCH
Scale 1/2" = 1'-0"
For elevations at top of berm see Plan this sheet. Top of berm to be level
Material for berm to be bladed from the area on the low side of the berm and compacted as shown.
Present Ground Line
Cut 5% Max.
SECTION B-B
Scale - 1/2" = 1'-0"
6'-0" Min.
Conc. Splash pad
Class 'B' Conc.
Top of Berm
Head Gate
PLAN
8" Conc. Head Gate with aluminum slide. Top to be flush with top weir
Warp ground to bottom of head gate.
Concrete pad on discharge side of Weir.
SECTION CC.
Conc. Weir
Level
Berm
8" Conc. head gate
ELEVATION
DETAIL - WEIR WITH HEAD GATE
Scale - 1/2" = 1'-0"
Top of Berm
Bottom Ditch
Class 'B' Conc.
Fill
Present Ground Line
Conc. Lining
SECTION
Conc. ditch lining
Trowel smooth
℄ Irr. Ditch
For elevations see Site Plan this sheet
PLAN
DETAIL (A)
Scale - 1/2" = 1'-0"
"AS BUILT"
NORTH
SITE PLAN
Scale - 1" = 40'
CITY WATER DEPT.-TUCSON ARIZONA
WATER REVENUE BONDS 1953 - CONTRACT NO. 3
20 M.G. RESERVOIR CHLORINATOR BLDG.
SITE PLAN & GRADING
DRAWN BY F.R.S. CHECKED BY J.R.F.
APPROVED: WATER DEPT. DATE
YOST AND GARDNER ENGINEERS
HEARD BLDG. PHOENIX, ARIZONA
APRIL 1953
17/27
Y&G Job No. 2366

1. Well





Isopach

depth to clay?? ZONE IV Formation

Clay (thickness?)? (presumed)

YOST AND GARDNER ENGINEERS

File Nov 3 1954
Subject
By

CITY OF TUCSON WATER DEPARTMENT

WELL NO.	SC-7
LOCATION	Near SW Cor Sec 19 T15S R14E
DRILLED BY	Roscoe Moss Co.
DEPTH	Drilled and cased 16" to 350 ft.
REMARKS	Perforated 114' to 338' with Mills Knife 245 ft. sand removed. Static level 57 ft.

DRILLER'S LOG

0-15	Caliche
15-32	Sand
32-114	Brown sandy clay - water at 57'
114-138	Sand and gravel
138-156	Yellow sandy clay
156-350	Brown sandy clay

Bowl

REPORT OF TEST PUMPING

WELL NO. SC-7
SUCTION LEVEL 167
METER 6½" Orifice in 10" OD Pipe
TESTED BY Roscoe Moss Co. 9/27/54 to 9/30/54

TIME	Piezo Meter	GPM	Air Line	Draw Down	Specific Capacity	Remarks
9/27/54						
7:00 AM			56			Static
7:05	Air		94			
7:15	Air		104			Heavy clay & sand
8:00	Air		107			
8:30	Air		106			Clearing - inc. speed
8:35	Air		122			Heavy with clay
9:30	Air		129			Heavy with clay
10:00	Air		131			Heavy with clay
10:30	Air		131			Stopped 5 min.
11:00	Air		135			Sand, little clay
11:30	Air		139			Very little sand
12:00	Air		139			Very little sand
12:30 PM	Air		139			x Sand & clay
1:00	Air		140			xx Sand & clay
1:30	25	845	103	47		Heavy with sand
2:00	25.5	855	103	47		Heavy with sand
3:00	26	860	105	49		xx Little sand
3:30	30	930	107	51		xx Little sand
4:00	32	960	101	45		
4:10	38	1050	112	56		
5:00	36.5	1025	112			
6:00	36.5	1025	115	59		Little sand, no clay
6:05			64			Static
9/28/54						
6:00 AM			56			Static
6:20	Air		120			Heavy clay & sand
6:30	29	920	103	47		Sand, little clay
6:45	30	930	105	49		Clear, little sand
7:00	Air		115			
7:10	32	960	113	57		
7:45	Air		135			Clear
8:15	Air		126			Clear
9:00	Air		115			Clear
9:20	Air		115			Clear
10:00	Air		115			Clear
10:30	Air		133			Clear
10:35	Air					Inc. Speed
11:05	Air		144			
11:15	Air					Dec. Speed
11:30	32		106	50	19.2	
11:32	Air					Inc. Speed
11:45	Air		147			
12:15	Air		149			
1:00	Air		152			

Page 2. Report of Test Pumping, Well No. SC-7

Time	Piezo Meter	GPM	Air Line	Draw Down	Specific Capacity	Remarks
1:35	Air		154			Clear in 4 min.
2:10	Air		154			
2:20	Air		256			Clear
2:35	20		94			
3:00	Air		119			
3:15	23	800	106	50	16	
3:25	23	800	106	50		x Much color
3:35	31	940	95	39	24	
4:00	29	910	95	39	23.5	
4:30	28	900	95	39	23	Clear
5:00	29	910	95	39	23	Clear
5:30	29	910	95	39	23	Stopped
5:35			59			Recovery
9/29/54						
6:15 AM			56			Static taped
6:30	36	1020	95	39	26	Clear in 2 min.
6:35	36	1025	99	43	24	
6:45	31	940	95	39	24	
7:05	31	940	96	40	23	
7:30	30	930	97	41	23	xxx
7:40	33	975	94	38	26	Clear in 5 min.
8:00	33	975	94	38	26	xxx
8:30	35	1000	93	37	27	xxx
9:00	34	990	94	38	26	xxx
9:15	35	1000	91	35	28	Clear in 3 min.
9:45	33	975	90	34	29	xxx
10:15	35	1000	90	34	29	xxx
11:00	37	1030	91	35	29	xxx
11:15	41	1090	94	38	29	Water cool
11:30	41	1090	95	39	28	xxxx
11:45	41	1090	94	38	29	
12:00	41	1090	95	39	28	xxxx
12:30	42.5	1105	95	39	28	Clear
1:00	42	1100	96	40	27	Clear
1:30	41	1090	96	40	27	Clear
2:00	41	1090	96	40	27	Clear
2:30	41	1090	96	40	27	Clear
3:00	41	1090	96	40	27	Clear
3:30	41	1090	97	41	26	Clear
4:00	41	1090	97	41	26	Clear
4:15	41	1090	97	41	26	Dec. Speed
4:45	27.5	890	87	31	29	Dec. Speed
5:15	12	580	73	17	34	Inc. Speed
5:30	71	1450	118	62	23	Air - stopped
5:35			59			Recovery
9/30/54						
7:00 AM			56			Static
7:25	64	1350	113	57	23.6	
7:45	62	1330	118	62	21.5	xxx
8:15	61	1320	113	57	23.2	xxx
8:45	62	1330	114	58	23.0	xxx
9:15	63	1340	118	62	21.6	xxx
9:20	65	1360	117	61	22.2	xxxx
10:10	62	1330	110	54	24.6	
	60	1315	112	56	23.5	xxx

Page 3. Report of Test Pumping, Well No. SC-7

Time	Piezo Meter	GPM	Air Line	Draw Down	Specific Capacity	Remarks
10:40	64	1350	111	55	24.5	xxx
11:05	65	1360	112	56	24.3	xxx
11:20	72	1450	115	59	24.6	xxx
11:30	73	1455	114	58	25.0	xxx
11:45	71	1445	116	60	24.2	xxx
12:15	73	1455	115	59	24.7	xxx
12:45	73	1455	117	61	29.3	xxx
1:16	72	1450	116	60	24.2	xxx
1:45	73	1455	116	60	24.2	xxx
2:30	71	1455	117	61	23.9	Dec. Speed
3:00	50	1200	103	47	25.5	Dec. Speed
3:30	36	1020	93	37	27.6	Dec. Speed
4:00	22	800	81	25	32.0	Dec. Speed
4:30	12	600	73	17	35.3	Inc. Speed
4:35	81		122			Air- Stopped
4:40			59			Recovery

(x) Indicates surge

Removed 50' sand after test

CITY OF TUCSON WATER DEPARTMENT

File Tucson 3
Subject 1954
By

WELL NO.	SC-6
LOCATION	Near W¼ Cor Sec 31 T15S R14E
DRILLED BY	Roscoe Moss Co. 8/12/54 to 8/27/54
DEPTH	Drilled & cased 16" to 350 ft.
REMARKS	Perforated 110' to 335' with Mills Knife 90 ft. sand removed. Static level 62 ft.

DRILLER'S LOG

0-4	Caliche
4-18	Sand
18-40	Brown sandy clay
40-47	Red sandy clay
47-78	Brown sandy clay
78-82	Sand
82-126	Brown sandy clay
126-142	Tight sand and gravel
142-164	Loose sand, gravel, boulders
164-350	Brown sandy clay & gravel

YOST AND GARDNER ENGINEERS

REPORT OF TEST PUMPING

WELL NO. SC-6
SUCTION LEVEL 167
METER 6½" & 8" Orifices in 10" O.D. Pipe
TESTED BY Roscoe Moss Co. 10/4/54 & 10/5/54

Time	Piezo Meter	GPM	Air Line	Draw Down	Specific Capacity	Remarks
10/4/54						6½" orifice
7:00 AM			63			Static-taped
8:00	12.5	600	71	8		Stopped
10:10			62			Restart
10:30	12.5	600	70	8	75	Sand & color
11:20	21	780	74	12	65	Sand & color
11:30	33	990	79	17	58	Sand & color
12:00	33	990	79	17	58	Sand & color
12:45PM	51	1210	84	22	55	Sand & color
1:20	64	1350	88	26	52	Sand & color
2:00	63	1350	87	25	54	Sand & color
2:30	63	1350	87	25	54	Sand & color
3:00	81	1530	91	29	53	Sand & color
3:30	81	1530	91	29	53	Clear - some sand
	Stopped 10 min. - changed to 8" orifice					
3:45	30	1700	93	31	55	much sand
4:15	30	1720	95	33	52	much sand
4:50	30	1720	95	33	52	much sand
5:30	31	1750	95	33	53	little sand
6:00	31	1750	95	33	53	clear
6:05			69			recovery
10/5/54						
6:00 AM			63			Static
6:30	31	1750	92	29	60	
6:45	42	2025	97	34	59	
7:00	42	2025	97	34	59	Murky
7:30	51	2230	101	38	58.6	Clear - little sand
8:00	51	2230	101	38	58.6	Clear - little sand x
8:30	51	2230	101	38	58.6	Clear - little sand
8:55	51	2230	101	38	58.6	Clear - little sand
9:30	68	2575	108	45	57	Clear - little sand
9:40	68	2575	109	46	56	Clear - little sand
10:00	75	2700	111	48	56	Clear - little sand
10:15	89	2940	117	54	54	Clear - little sand
11:00	88	2925	118	55	53	Slug of sand 10:45 x
11:30	78	2760	113	50	55	Clear - little sand
12:00	82	2820	115	52	54	Clear - little sand
12:30	80	2800	114	51	55	Clear - little sand
1:10	82	2830	115	52	57	Clear - little sand xx
1:45	83.5	2850				Clear - little sand
2:15	82	2830	115	52	57	Clear - little sand
2:30	84	2860	116	53	54	Reduced speed
3:15	68.5	2580	110	47	55	Almost no sand
3:48	51	2235	103	40	55.9	Almost no sand
4:20	31	1750	94	31	56.5	Almost no sand
4:50	24.5	1540	90	27	57	Inc. Speed
5:06	51	2235	102			Stopped

Page 2. Report of Test Pumping, Well No. SC-6

Time	Piezo Meter	GPM	Air Line	Draw Down	Specific Capacity	Remarks
5:09			73			
5:14			70			
5:21			70			

(x) Indicates surge

Laboratory Number [illegible] Book [illegible] Page [illegible]

AGRICULTURAL CHEMISTRY & SOILS
AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF ARIZONA
TUCSON

WATER SAMPLE

1. Name City of Tucson Water Dept. S Test & Gardner
2. Address 194 N. Mayer, Tucson, Arizona Date August 18, 1954
3. Source: Well, spring or surface water Well County Pima
4. **IMPORTANT:**
   Location of sampling NE¼ NW¼ SEC 7 TWP 16S R 14E
5. Depth of well 550 Depth to water level 42
6. Use, ~~domestic~~, stock or irrigation
7. Problem or question
   Complete analysis for City of Tucson
   Scrubbed B5

	0	
NW		NE
	7	
SW		SE

8. Analysis

	p.p.m.		p.p.m.
Carbonate	0	Calcium	90
Bicarbonate	181	Magnesium	4
Chloride	26	Sodium	37
Sulphate	130	Total salts	469
Fluoride	0.6	Sodium Calcium Ratio	0.41

Hardness, grains per gallon 14.13

9. **Comments and recommendations:**

Water Dept

File AUG 31 1954 195

Log of New Wells
Santa Cruz River
Basin - Water Res.
Bonds - 1953,
Well No. SC 5.

CITY OF TUCSON WATER DEPARTMENT

Well No.	SC-5
Location	Near N¼ Corner Sec 7 T16S R14E
Drilled by	Roscoe Moss Co. 7/17/54 to 8/5/54
Depth	Drilled & cased 16" to 550 feet
Remarks	Perforated 85' to 438' with Mills Knife 245 ft. sand removed static level 44' 44' to 156' - water; 156' to 550' - wet

Driller's Log

1-12	Clay
12-44	Sandy clay
44-180	Sandy Clay & large rock
180-200	Clay - very little sand
200-275	Brown sandy clay & ½" grave
275-320	Sandy clay - some gravel
320-380	Sand, gravel & clay
380-440	Large gravel & clay
440-550	Clay - little sand

REPORT OF TEST PUMPING

Well No. SC-5

Suction Level 148'

Meter 8" orifice in 10" O.D. Pipe $Q = 512\sqrt{h}$

Tested By Roscoe Moss Co. August 15-17, 1954

Time	Piezo Meter	G.P.M.	Air Line	Draw Down	Specific Capacity	Remarks
8/15/54						
7:30 AM			42			Static
7:45	10	1000	59	17		Little sand
8:15	10.5	1015	67	25	40	Cloudy
8:55	12	1075	73	31	35	Cloudy (x)
9:00	13	1125	68	26	43	No sand
9:15	13	1125	68	26	43	Inc. speed
9:25	16.5	1260	85	43	29	Some mud
9:40	15.5	1230	88	46	27	Murky
10:00	16	1250	87	45	28	Muddy
10:20	15.5	1230	87	45	27	Getting more mud (x)
10:30	17	1285	78	36	36	Muddy
10:35	17	1285	80	38	34	Stopped - 46 (x)
10:40	20.5	1410	80	38	37	Muddy
10:45	21.5	1445	95	53	27	Muddy (x)
11:25	20	1390	94	52	27	Muddy (x)
12:00	21	1430	93	51	28	Muddy (xx)
12:05 PM	22	1460	85	43	34	Clears for 30 sec after each surge
12:15	21.5	1445	88	46	31	Still very little sand
12:35	21.5	1445	88	46	31	xxx Inc. Speed
1:15						(about 5 min. heavy with mud)
1:40	20	1390	122	80	17	xxx
2:15	20.5	1410	120	78	18	Muddy xxx
2:30	18.5	1340	129	87	15	Stopped - recovered to 44xxx clear for about 60 sec.
3:00	23	1490	112	70	21	7 surges
3:15	22	1460	119	77	19	Still muddy
3:30	21.5		118			Decreased speed
4:00	8	880	92	50	17	Still muddy x
4:15	8.5		92			Still muddy
4:30	8		92			Still muddy
4:45	8		92			Stopped pump
after 30 sec.			56			
after 2 min.			53			
after 5 min.			52			
8/16/54			42			Static
9:00 AM	25	1560	93	51	30	Cloudy
10:00	22.5	1485	106	64	23	Less Cloudy
11:00	22	1460	108	66	22	Less Cloudy
12:00	21.5	1450	111	69	21	Less Cloudy
12:30 PM	13.5	1150	96	54	21	Decreased Speed
1:00	13.5	1150	95	53	22	Clear
1:30	13.5	1150	94	52	22	Trace of sand
2:00	13	1125	94	52	22	Clear & cool
2:30	13	1125	93	51	22	
3:30	12.5	1100	95	53	21	
4:00	12.5	1100	96	54	20	

Time	Piezo Meter	G.P.M.	Air Line	Draw Down	Specific Capacity	Remarks
4:15	12.5	1100	96	54	20	Surge
4:20	16	1250	98	56	22	
4:25	15.5	1225	99	57	21	
4:30	10	1000	90	48	21	
5:15	10	1000	89	47	21	
5:45	10	1000	89	47	21	
6:30	10	1000	89	47	21	
7:00	10	1000	90	48	21	
8:00	10	1000	90	48	21	
8:30	10.5	1000	91	49	20	
9:30	10.5	1000	92	50	20	
10:30	10.5	1000	91	49	20	
11:45	10	1000	91	49	20	
8/17/54						
12:30 AM	10	1000	91	49	20	
1:00	10.5	1000	92	50	20	
2:00	10.5	1000	92	50	20	
3:00	10.5	1000	92	50	20	
4:00	10.5	1000	92	50	20	
5:00	10.5	1000	92	50	20	
6:00	10.5	1000	92	50	20	Completed Test
after 1 min.			55			
after 5 min.			52			

(x) indicates surge

REPORT OF TEST PUMPING

Well No. SC-2

Suction Level 268

Meter 5" orifice in 10" O.D. Pipe

Tested By Roscoe Moss Co. 10/13/54 & 10/14/54

Time	Piezo Meter	GPM	Air Line	Draw Down	Specific Capacity	Remarks
10/13/54						
6:00 AM			106			Static
7:00			179	73		
8:15			175	69		(x) Milky
9:00			174	68		) Milky
10:00			174	68		(x) Milky
11:00			190	84		(x) Milky
12:00			188	82		Mud & sand
2:00 PM			189	83		Stopped
2:05			116			recovery
3:00						restart
4:00	est.	250	208	102		(x) Muddy
4:55	est.	240	206	100		stopped
5:00			125			recovery
10/14/54						
6:30 AM			130			Static
7:00	8	250	130	62		
7:30	8	250	134	74		(x)
8:30	9	265	198	89		(x)
9:15	7½	240	198	89		(x) Clear
9:35	7	230	189	80		Stopped
9:41			121			recovery

(x) indicates surge

R. B. McDonnell

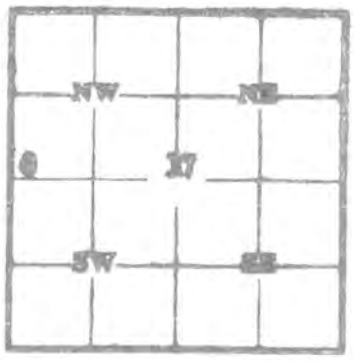
Laboratory Number [illegible] Book [illegible] Page [illegible]

AGRICULTURAL CHEMISTRY & SOILS
AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF ARIZONA
TUCSON

WATER SAMPLE

1. Name City of Tucson Water Dept. c/o Yost & Gardner Engineers Date Sept. 18, 19[illegible]
2. Address 194 North Mayer, Tucson County Pima
3. Source: Well, spring or surface water Well SC-2
4. IMPORTANT:
   Location of sampling E ½ SW. SEC 17, TWP [illegible], R [illegible]
5. Depth of well [illegible] Depth to water level [illegible]
6. Use, domestic, stock or irrigation Domestic
7. Problem or question
   Complete analysis for City of Tucson

NW		NE	
0		17	
SW		SE	



8. Analysis

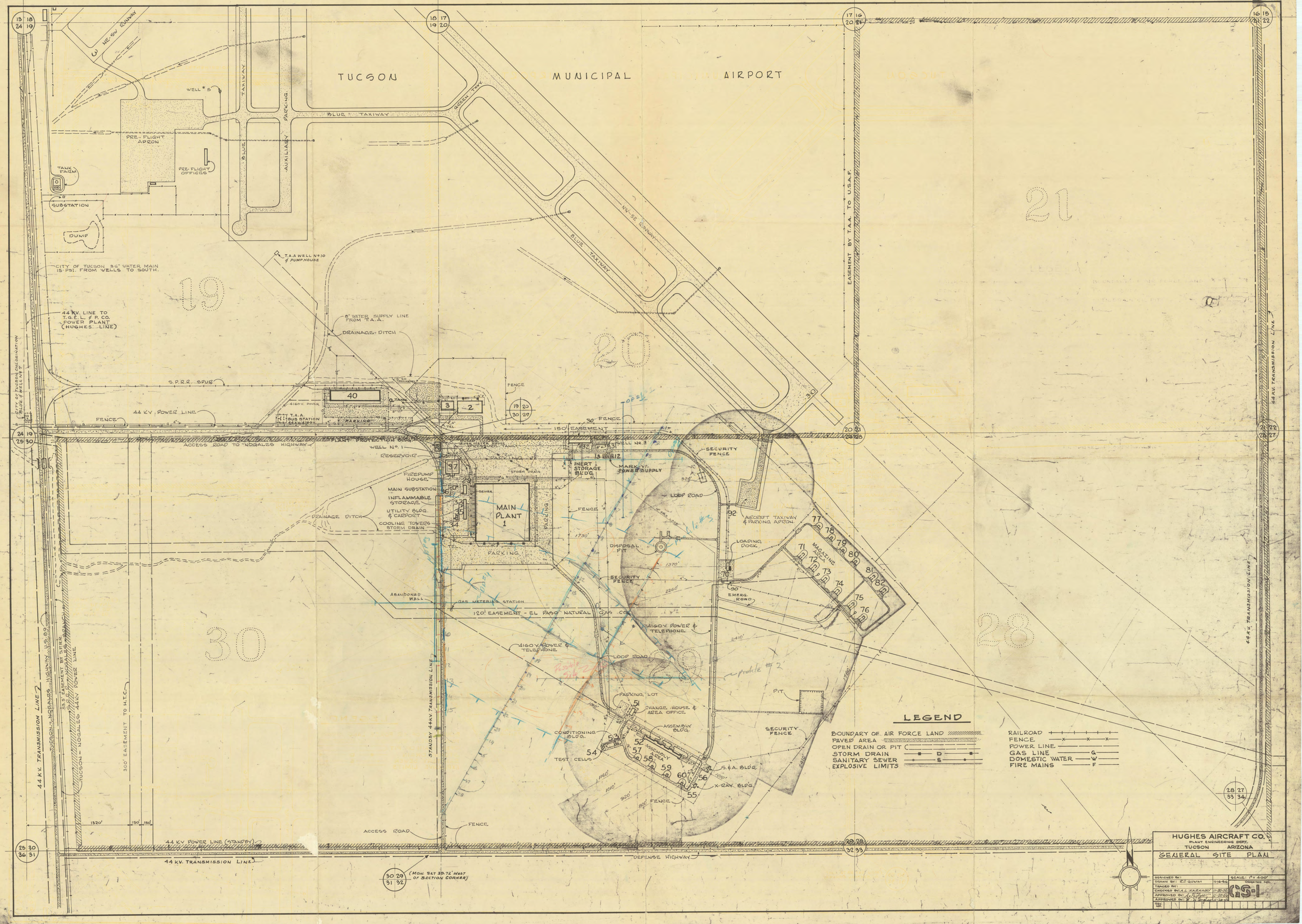
	p.p.m.		p.p.m.
Carbonate	[illegible]	Calcium	[illegible]
Bicarbonate	[illegible]	Magnesium	[illegible]
Chloride	[illegible]	Sodium	[illegible]
Sulphate	[illegible]	Total salts	[illegible]
Fluoride	[illegible]	Sodium: Calcium Ratio	[illegible]

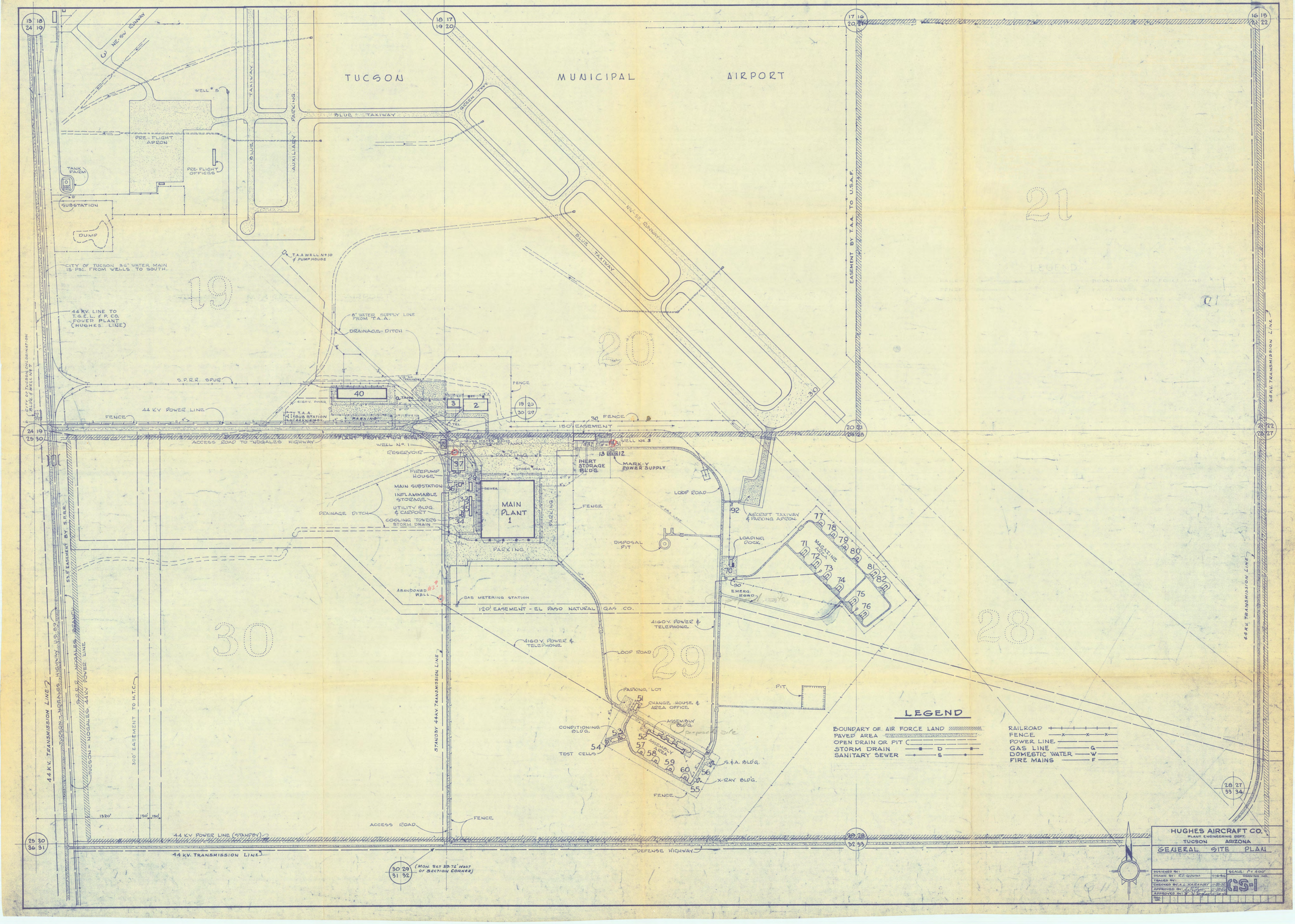
Hardness, grains per gallon 17.15

9. Comments and recommendations:

Wallace R. Fuller
Associate Biochemist

OCT 1954 RECEIVED


TUCSON MUNICIPAL AIRPORT
NE-SW RUNWAY
NW-SE RUNWAY
BLUE TAXIWAY
GREEN TXWY
AUXILIARY PARKING
PRE-FLIGHT APRON
PRE-FLIGHT OFFICES
TANK FARM
SUBSTATION
DUMP
WELL #5
T.A.A. WELL No 10 & PUMP HOUSE
CITY OF TUCSON 36" WATER MAIN 15 PSI. FROM WELLS TO SOUTH.
44 KV. LINE TO T.G.E.L. & P. CO. POWER PLANT (HUGHES LINE)
8" WATER SUPPLY LINE FROM T.A.A.
DRAINAGE DITCH
S.P.R.R. SPUR
44 KV POWER LINE
FENCE
ACCESS ROAD TO NOGALES HIGHWAY
PLANT PROTECTION BLDG.
WELL No. 1
RESERVOIR
FIREPUMP HOUSE
MAIN SUBSTATION
INFLAMMABLE STORAGE
UTILITY BLDG. & CARPORT
COOLING TOWERS STORM DRAIN
MAIN PLANT 1
PARKING
INERT STORAGE BLDG.
MARK V POWER SUPPLY
SECURITY FENCE
LOOP ROAD
AIRCRAFT TAXIWAY & PARKING APRON
LOADING DOCK
MAGAZINE AREA
EMERG. ROAD
DISPOSAL PIT
ABANDONED WELL
GAS METERING STATION
120' EASEMENT - EL PASO NATURAL GAS CO.
4160 V. POWER & TELEPHONE
PARKING LOT
CHANGE HOUSE & AREA OFFICE
ASSEMBLY BLDG.
CONDITIONING BLDG.
TEST CELLS
S.&A. BLDG.
X-RAY BLDG.
PIT
EASEMENT BY T.A.A. TO U.S.A.F.
44 KV. TRANSMISSION LINE
STANDBY 44 KV. TRANSMISSION LINE
300' EASEMENT TO H.T.C.
44 KV POWER LINE (STANDBY)
DEFENSE HIGHWAY
(MON. SET 39.72' WEST OF SECTION CORNER)
LEGEND
BOUNDARY OF AIR FORCE LAND
PAVED AREA
OPEN DRAIN OR PIT
STORM DRAIN
SANITARY SEWER
EXPLOSIVE LIMITS
RAILROAD
FENCE
POWER LINE
GAS LINE
DOMESTIC WATER
FIRE MAINS
HUGHES AIRCRAFT CO.
PLANT ENGINEERING DEPT.
TUCSON ARIZONA
GENERAL SITE PLAN
DESIGNED BY:
DRAWN BY: R.D. GUMM 11-16-56
TRACED BY:
CHECKED BY: A.L. NARAWAY 11-20-56
APPROVED BY:
APPROVED BY:
REV. NO.
SCALE: 1" = 400'
DRAWING NO.
C-S-1


TUCSON MUNICIPAL AIRPORT
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GREEN TAXIWAY
NW-SE RUNWAY
NE-SW RUNWAY
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GS-1
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