CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

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REFRACTION SEISMIC SURVEY
HAVASU LAKE

PROPOSED ARIZONA STATE HIGHWAY
CAUSEWAY

for

ENGINEERS TESTING LABORATORIES INC.

April - May 1965

by

HEINRICHS GEOEXPLORATION COMPANY
P. O. Box 5671 Tucson, Arizona

TABLE OF CONTENTS

Index Map Page

Introduction---------- 1

Conclusions & Recommendations---------- 1

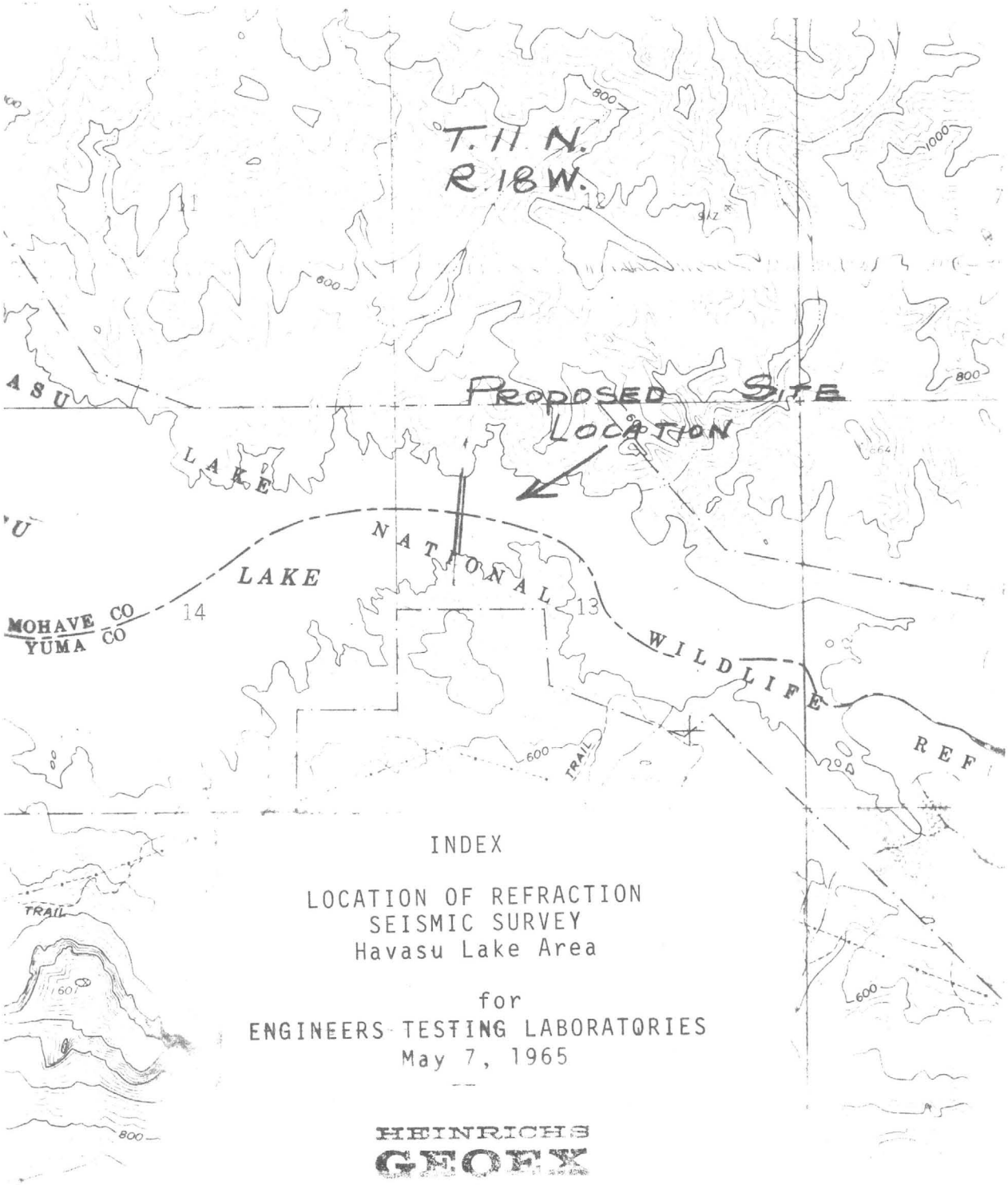
Procedures---------- 2

Seismographs (Polaroid Copies)

Setup 1
Setup 2
Setup 3
Setup 4
Setup 5

In Map Pocket

Composite Map



INDEX

LOCATION OF REFRACTION
SEISMIC SURVEY
Havasu Lake Area

for
ENGINEERS TESTING LABORATORIES
May 7, 1965

HEINRICHS
GEOFEX

INTRODUCTION

At the request of Mr. S. Brech and Mr. J. E. Warne of Engineers Testing Laboratories of Phoenix, Arizona, Heinrichs Geoexploration Company conducted a refraction seismic survey across the eastern extremity of Havasu Lake in the northwest quarter of Section 13, T 11 N, R 18 W Mohave and Yuma Counties, Arizona.

Personnel involved in the field work were E. Grover Heinrichs, Chris S. Ludwig and J. P. Matthews, Jr. of Heinrichs GEOEX and S. Brech and J. Willow of Engineers Testing Labs.

The purpose of the survey was to determine the depth to bedrock and shape of the channel and the thickness of the existing mud flat material.

Serious physical problems were encountered on the initial effort to make the survey in the middle of April. These were due to the low level of the lake and the inability of the resultant mud flat to support a man. The mud flat also prevented access to the area by boat, therefore the first seismic profile was confined to the south shore line.

During the first week in May a more dense blanket of sandy material washed over the mud flat and the level of the lake rose sufficiently to permit cautious negotiation of the site with the help of a styrafoam raft and life preservers. Even so, personnel acquiring the field data occasionally sank up to the arm pits in the mud and silt while using added pieces of styrafoam for support and movement through the mud.

CONCLUSIONS AND RECOMMENDATIONS

Based on the assumption (which should be verified by some drilling) that the zone underlying the mud, silt, sand and clay layer having a velocity of from 4,000 ft. per second to 9,000 ft. per second is either consolidated channel fill or weathered gneiss (water saturated); it is our conclusion that this zone would support a causeway or roadway.

The thicker zone of water, mud and silt appears to be on the north shore having a depth of 47 ft. from the water level as of May 3, 1965. No seismic profile was run on the north shore; however, by visual examination the rock appears to be the same

as on the south shore and for abutment purposes, conditions on either side (shore) should be adequate.

PROCEDURES

Six hundred feet of twelve (trace) channel cable was laid out on each setup and twelve geophones were spread along the line, spaced as indicated in the composite map. At least two shots were made at each cable setup. One at the center of the layout or one shot at either end of the cable. This procedure permitted an average apparent velocity to be computed and also two depths to be computed at either end of the layout.

In initial shots one half stick of 40% dynamite was used. This proved inadequate for good energy return and later shots required two or four sticks, except shot five in which twelve sticks were used to get the maximum depth of the channel.

Various adverse conditions which might have otherwise precluded successful application or prohibited reasonable progress of the survey were surmounted by the use of special underwater geophones, hookup gear and wet suits.

Seismic equipment used to conduct the survey was an Electro Tech Porta-Seis EVS-12.

Respectfully submitted,
HEINRICHS GEOEXPLORATION COMPANY

Chris S. Ludwig

Chris S. Ludwig, Sr. Geophysicist.

E. Grover Heinrichs

E. Grover Heinrichs
Vice President

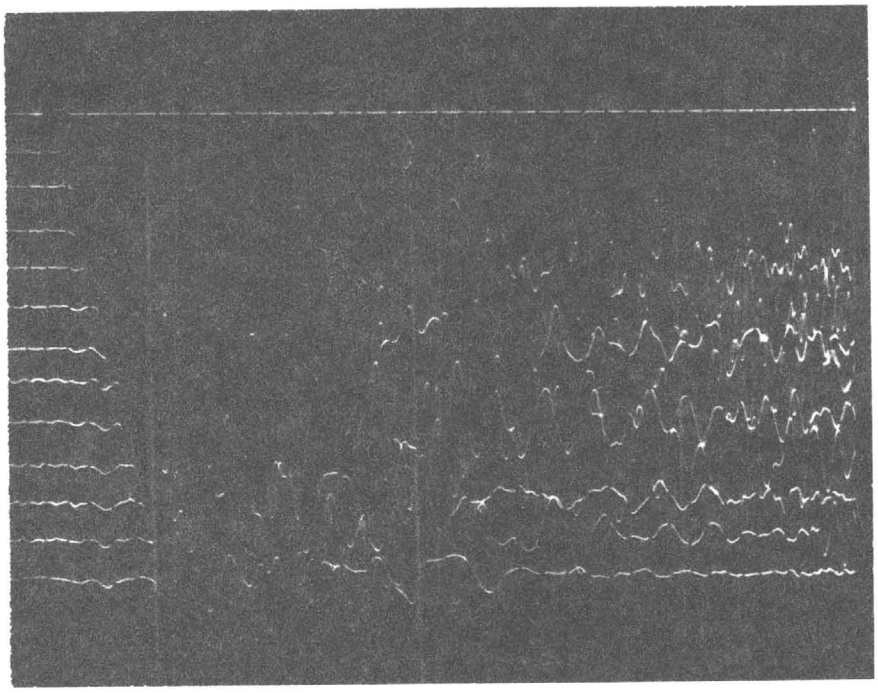
Approved: Walter E. Heinrichs, Jr.

Walter E. Heinrichs, Jr.
President & General Manager

Registered Professional Engineer (Mining)
CERTIFICATE EXPIRES
WALTER E. HEINRICHS, JR.
DEC. 31, 1965
ARIZONA, U.S.A.

June 10, 1965
P. O. Box 5671
Tucson, Arizona

#1
S.P.
1-B



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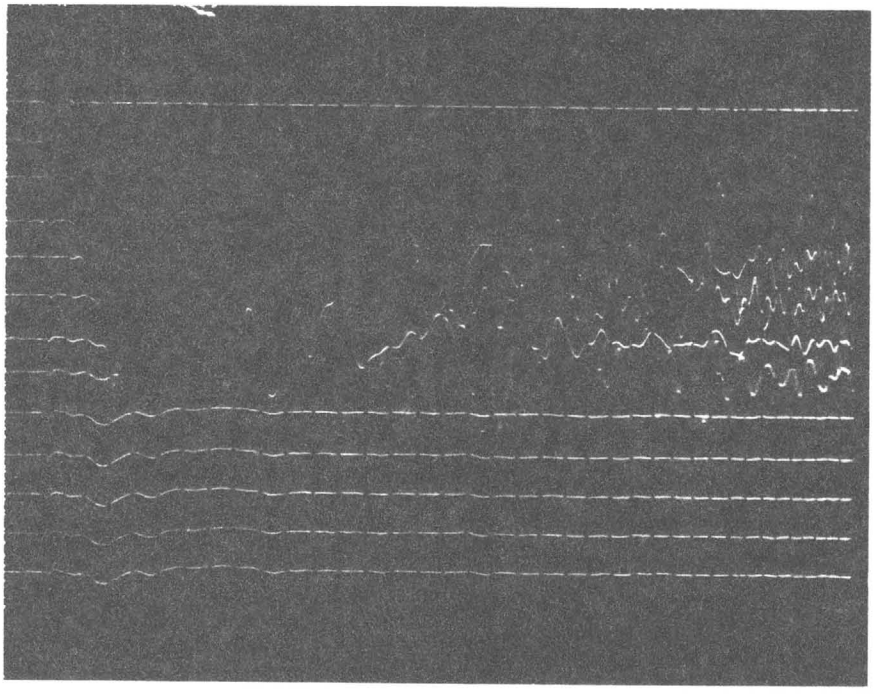

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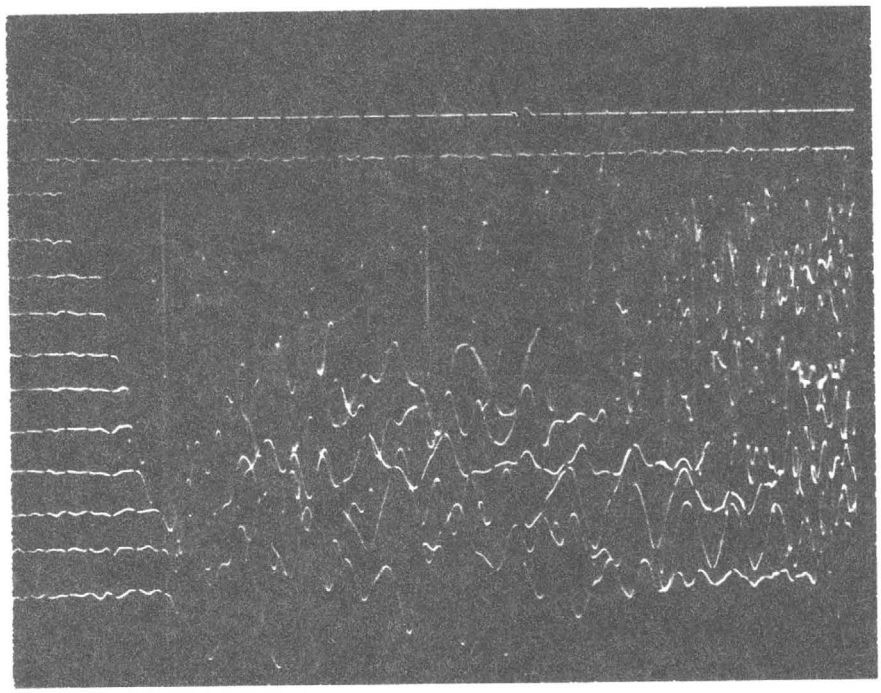

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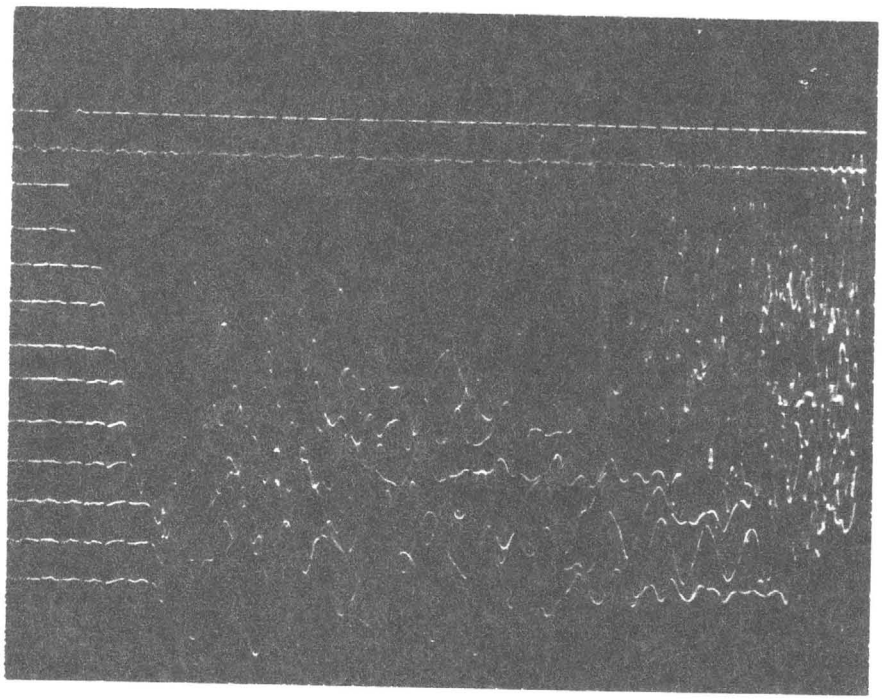

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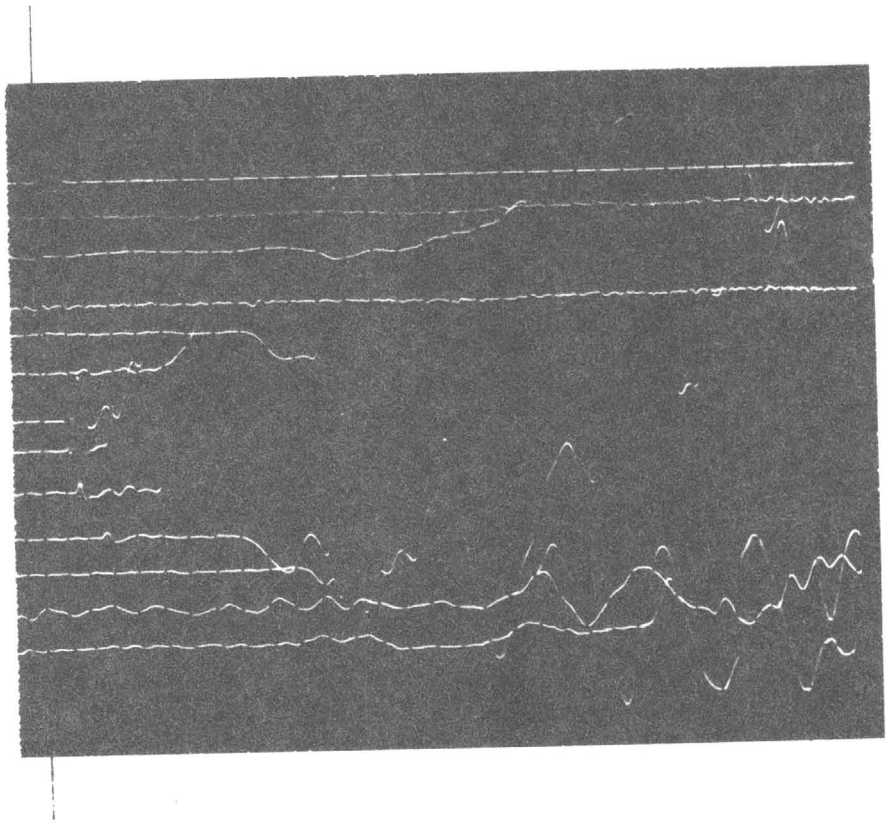

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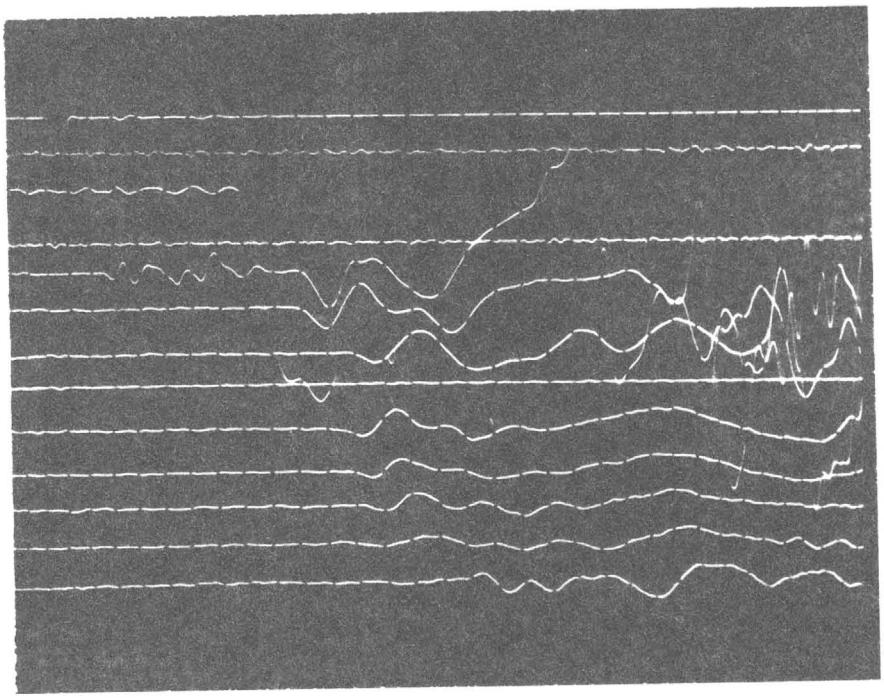

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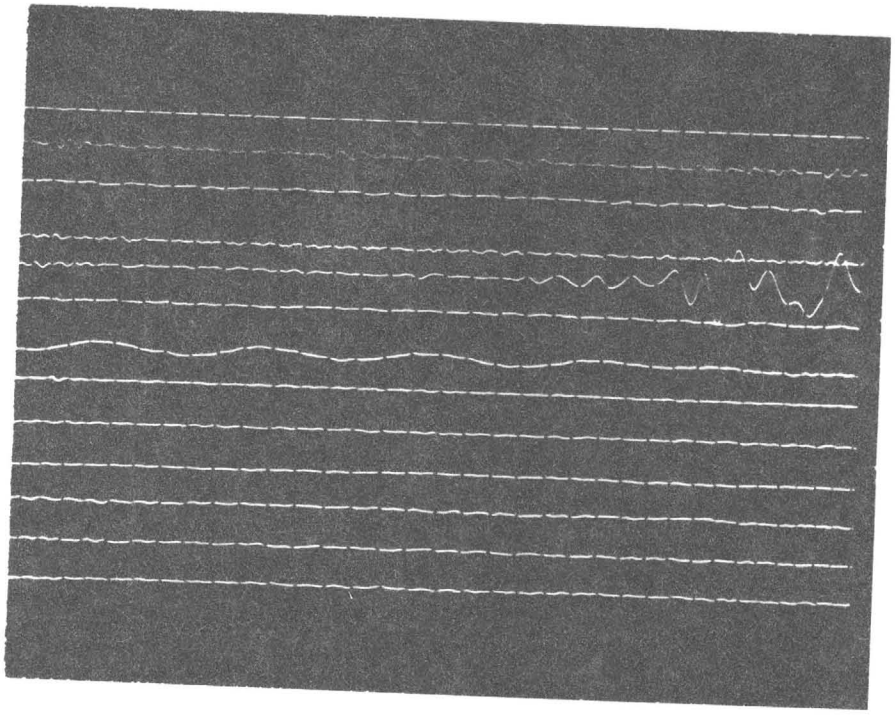

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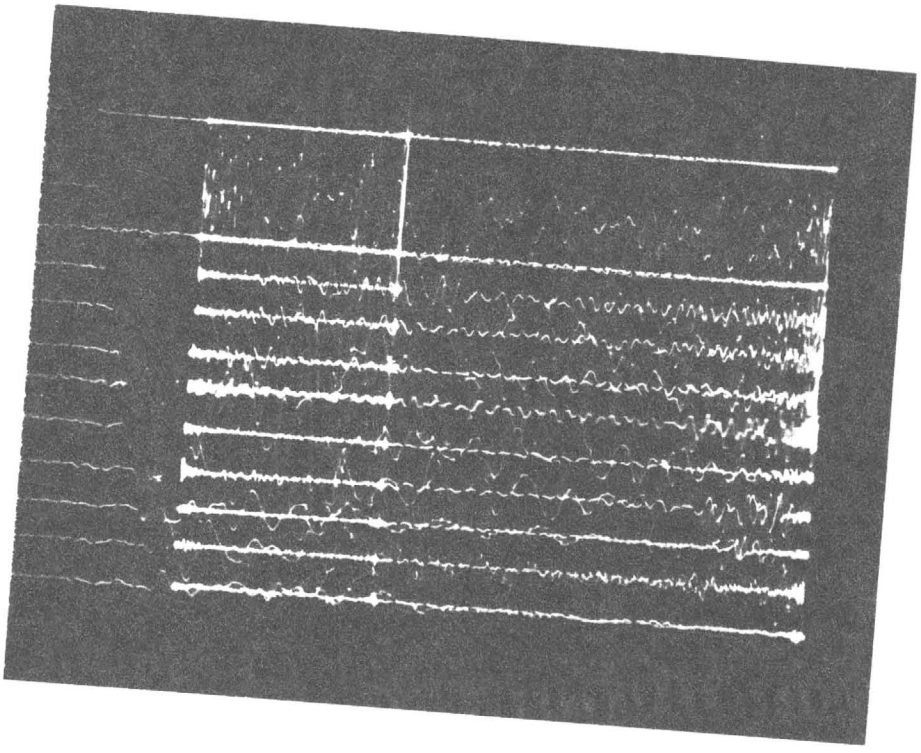

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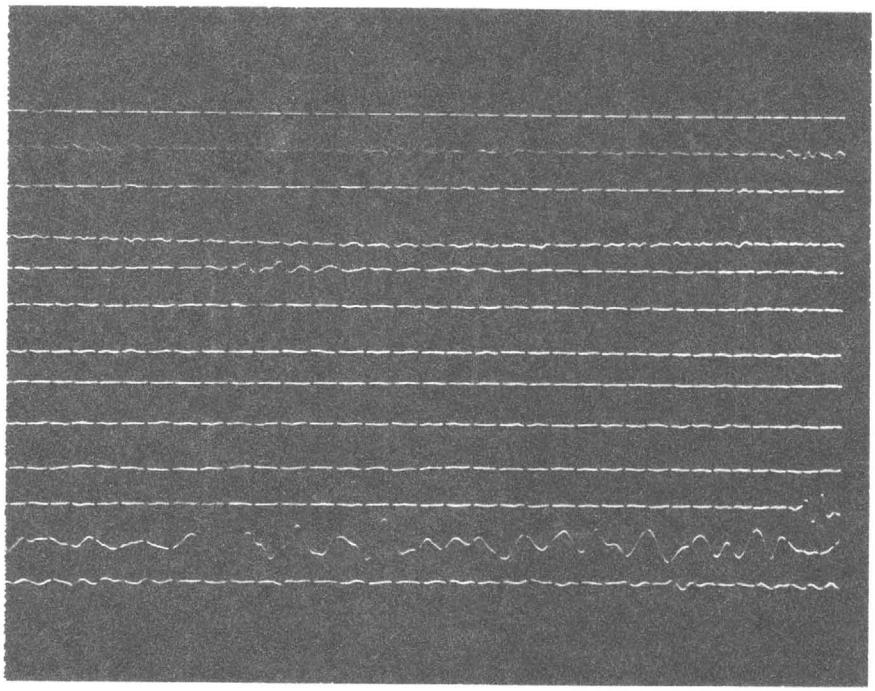

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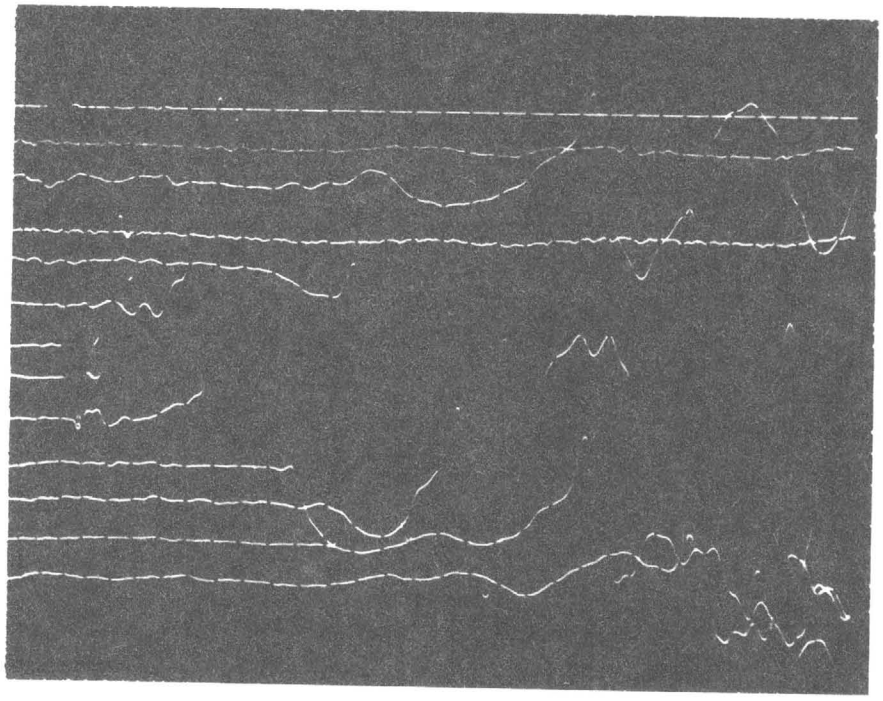
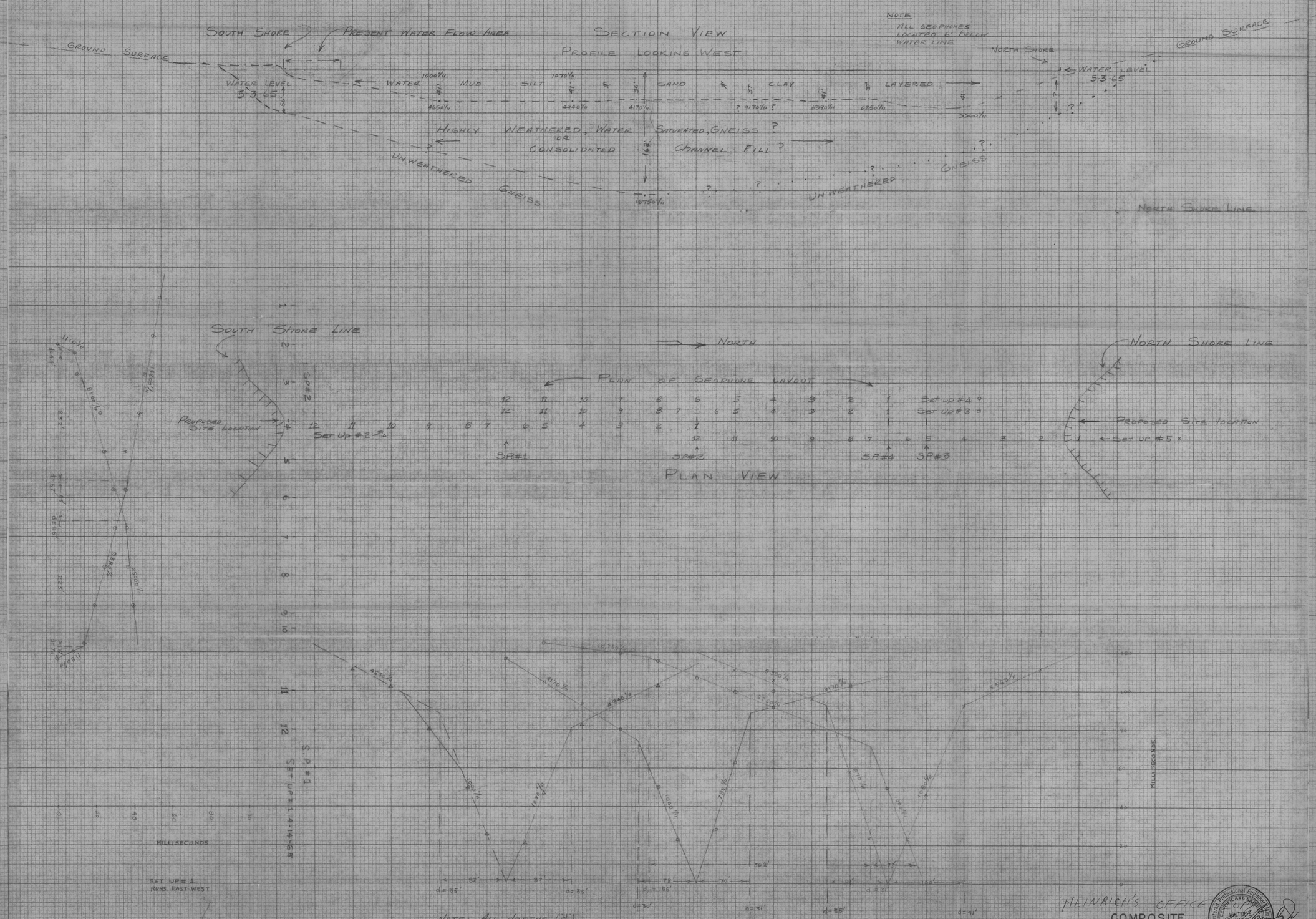




NOTE: ALL depths ("d") have an added 6'0" as the geophones were located 6'0" below the water level.

SET UP #2 △
SET UP #3 □
SET UP #4 ○
SET UP #5 ×
RUN NORTH-SOUTH

HEINRICH'S OFFICE
COMPOSITE

HEINRICHS GEOEXPLORATION COMPANY
P.O. Box 5671 Tucson, Arizona

REFRACTION SEISMIC SURVEY
HAVASU LAKE PROPOSED CAUSEWAY
FOR
ENGINEERS TESTING LAB
ARIZONA STATE HIGHWAY DEPT.

SCALE: 1" = 50'	CONTOUR INTERVAL:	REVISIONS
	DATA BY: EGH, CSL, JPM	
DATE: 5-5-65	SHEET OF	
DRAWN BY: EGH	DRAWING NO.:	FILE:

HEINRICHS GEOEX
GEOPHYSICAL ENGINEERS
TUCSON, ARIZONA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

MONKEYS HEAD QUADRANGLE
ARIZONA
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 PARKER DAM 15' QUADRANGLE

(CROSS ROADS)

Mapped, edited, and published by the Geological Survey

Control by USGS and USC&GS

Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1955. Field check 1959

Polyconic projection. 1927 North American datum
10,000-foot grid based on Arizona coordinate system, west zone
1000-meter Universal Transverse Mercator grid ticks,
zone 11, shown in blue

Unchecked elevations are shown in brown

15°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1959

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER 25, COLORADO OR WASHINGTON 25, D. C.
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

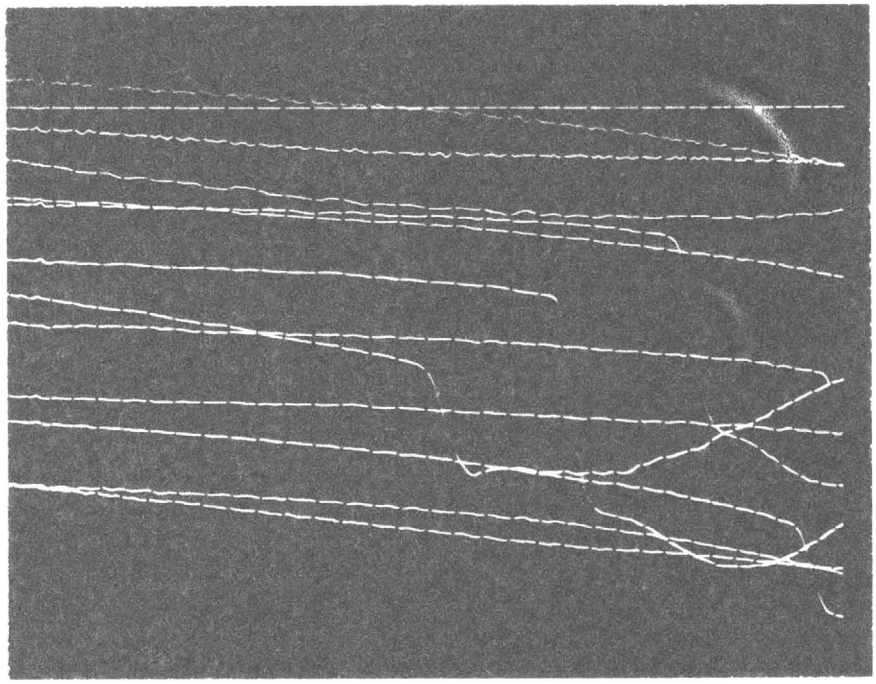
ARIZONA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Light-duty ——— Unimproved dirt - - - - -

MONKEYS HEAD, ARIZ.
SE/4 PARKER DAM 15' QUADRANGLE
N3415—W11400/7.5

1959



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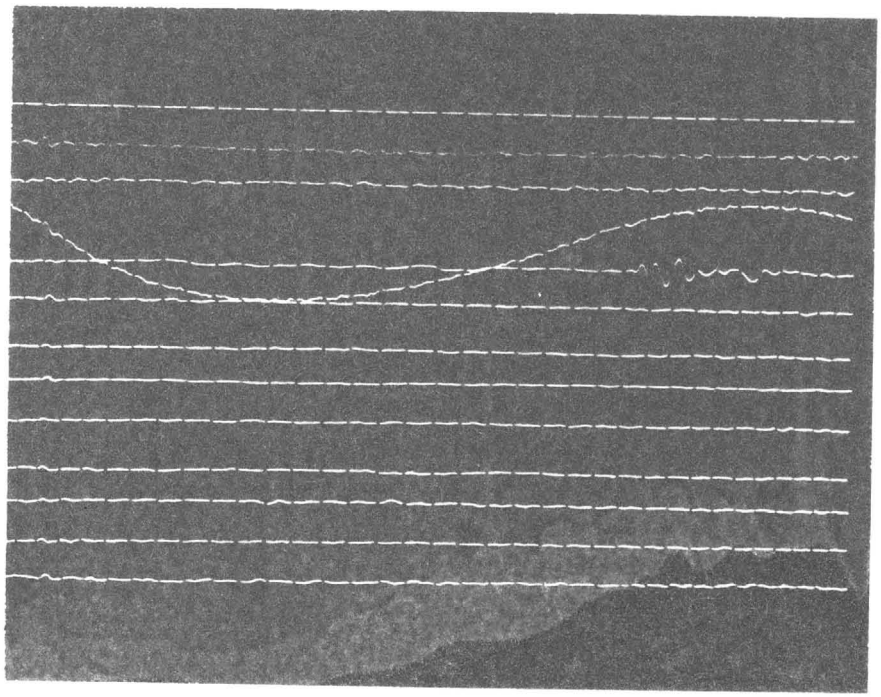

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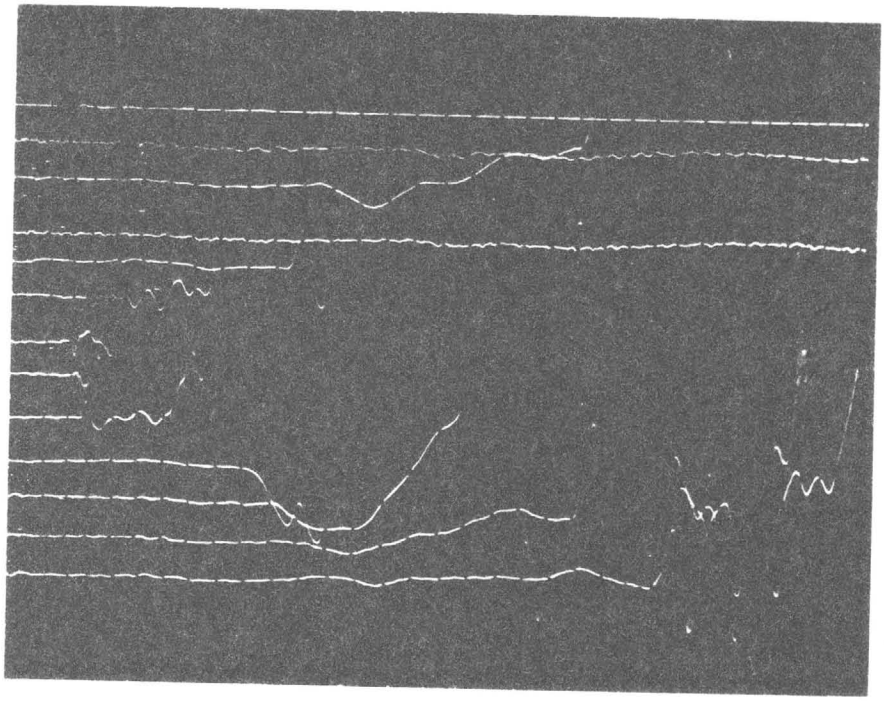

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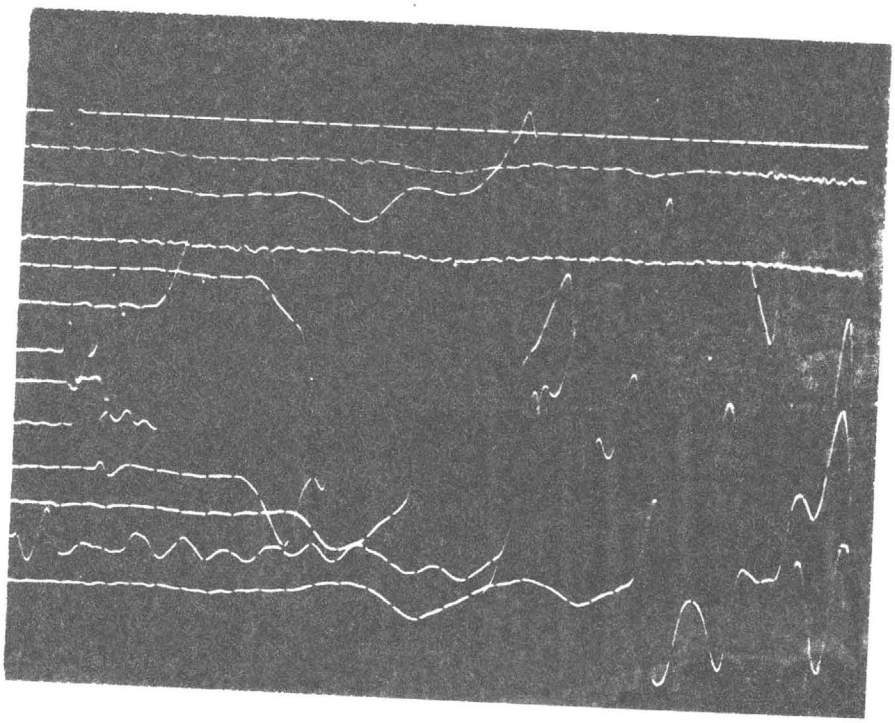
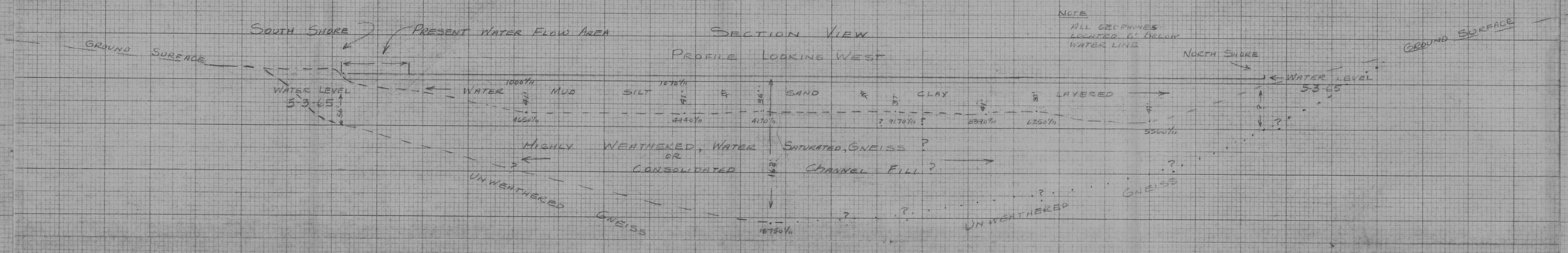
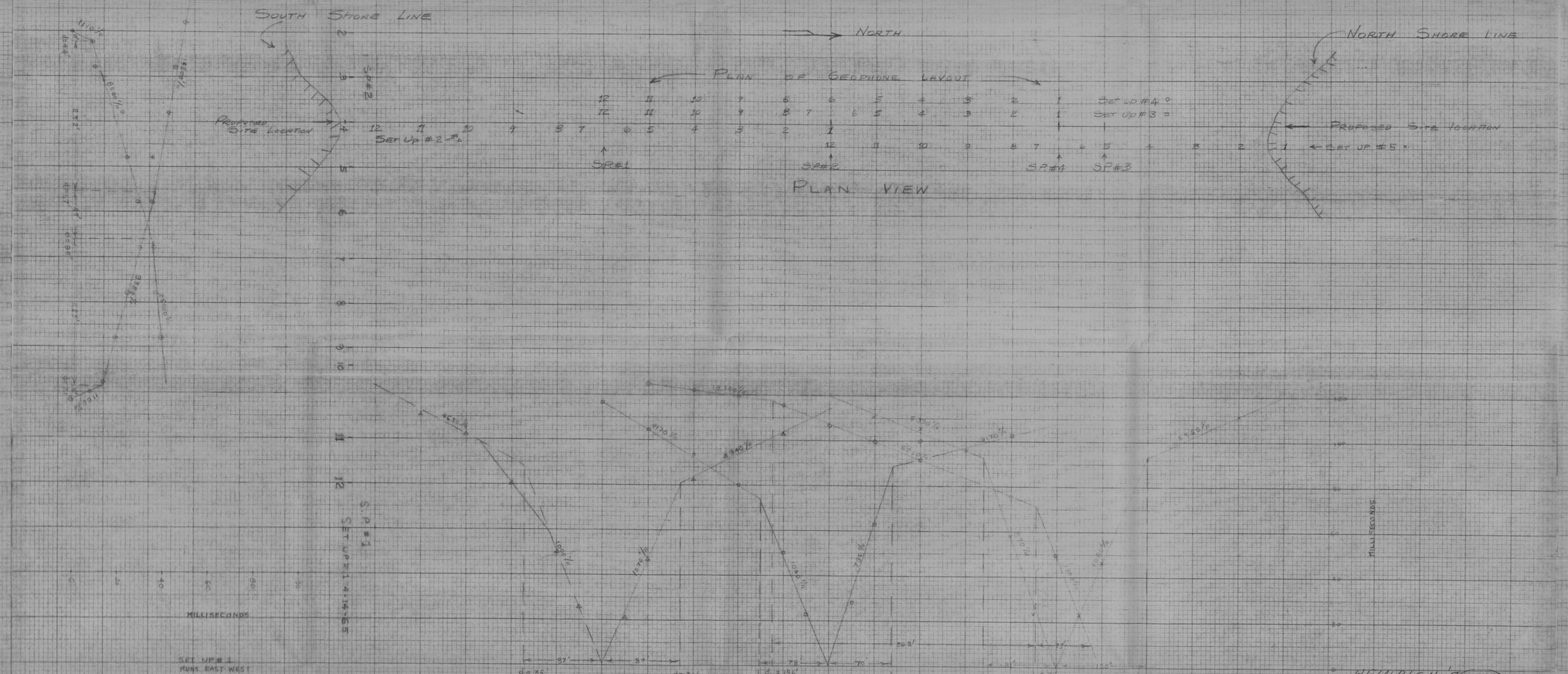






Note: All depths (d) have an added 6.0' as the geophones were located 6.0' below the water level.

SET UP #2 △
SET UP #3 □
SET UP #4 □
SET UP #5 ×
RUN NORTH-SOUTH

HEINRICHS GEOEXPLORATION COMPANY

OFFICE COPY

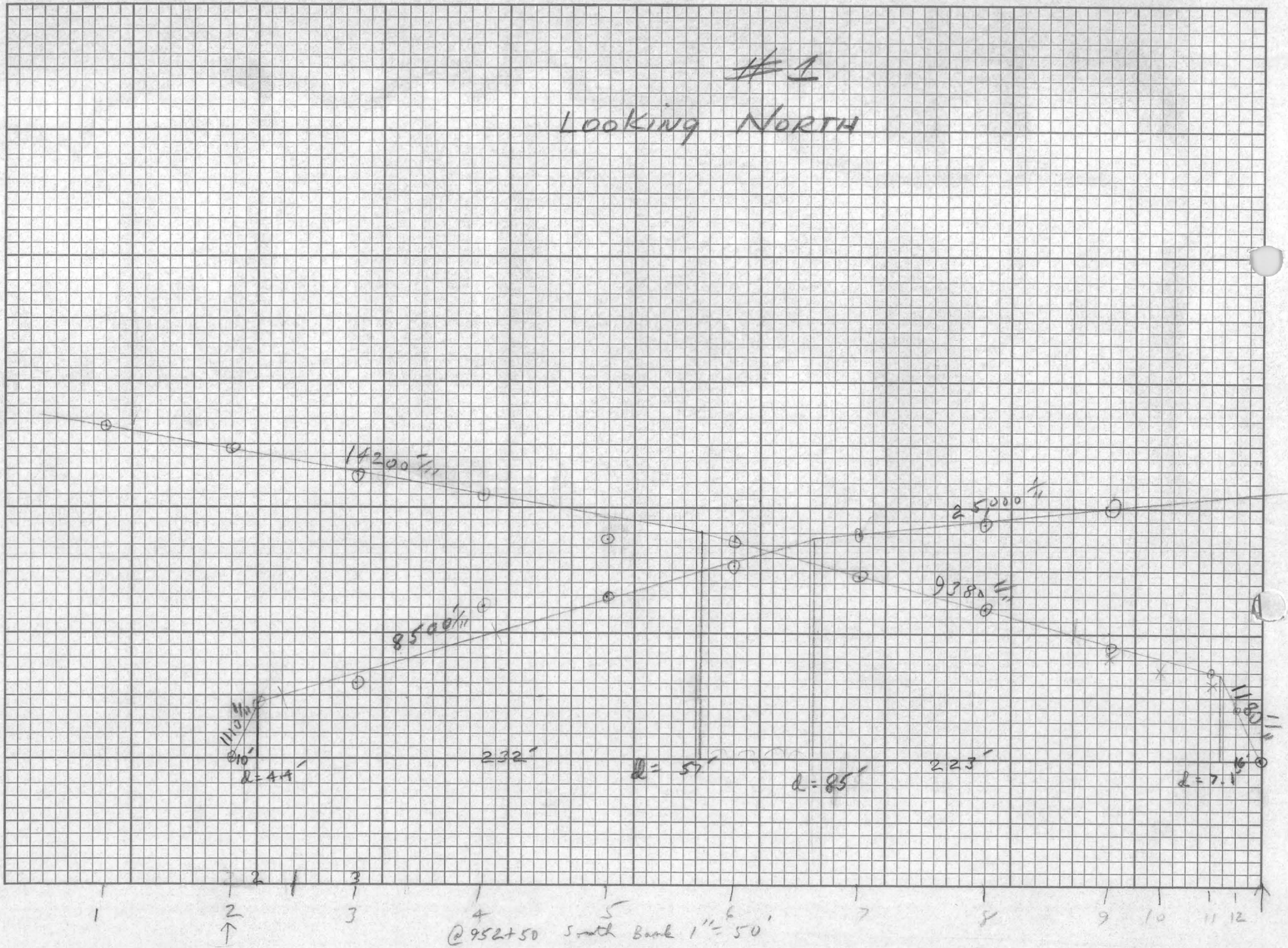
COMPOSITE

HEINRICHS GEOEXPLORATION COMPANY
P.O. Box 5671 Tucson, Arizona

REFRACTION SEISMIC SURVEY
HAVASU LAKE PROPOSED CAUSEWAY
YUMA & MOHAVE COUNTIES
FOR
ENGINEERS TESTING LAB
ARIZONA STATE HIGHWAY DEPT.

SCALE: 1" = 50'	CONTOUR INTERVAL:	REVISIONS	
	DATA BY: E.G.H., C.S.L., J.P.M.		
DATE: 5-5-65	SHEET OF		
DRAWN BY: E.G.H.	DRAWING NO.:	FILE:	

K+E 10 X 10 TO THE INCH KEUFFEL & ESSER CO. 359-5DG MADE IN U.S.A.



K+E 10 X 10 TO THE INCH KEUFFEL & ESSER CO. 359-5DG MADE IN U.S.A.

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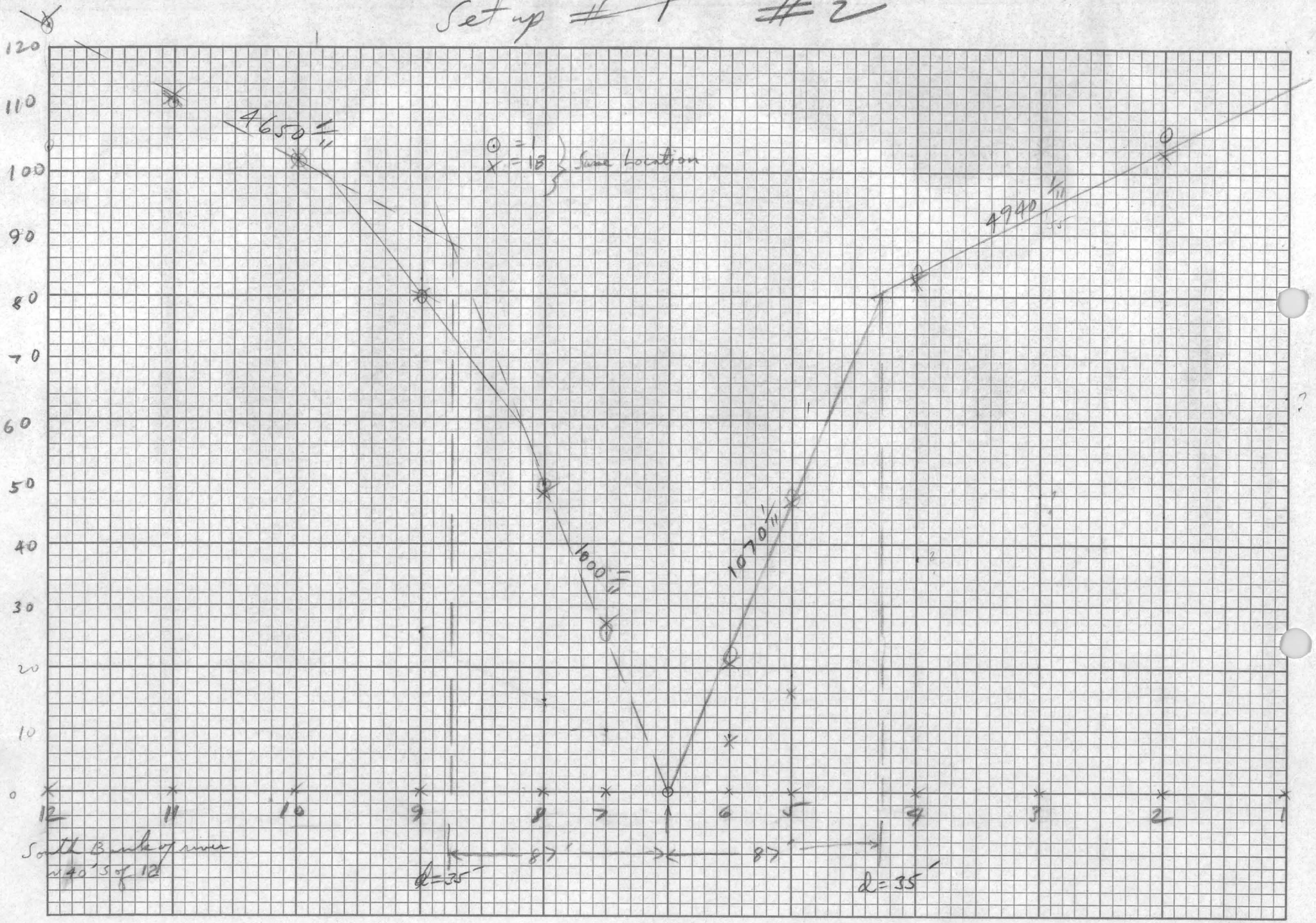
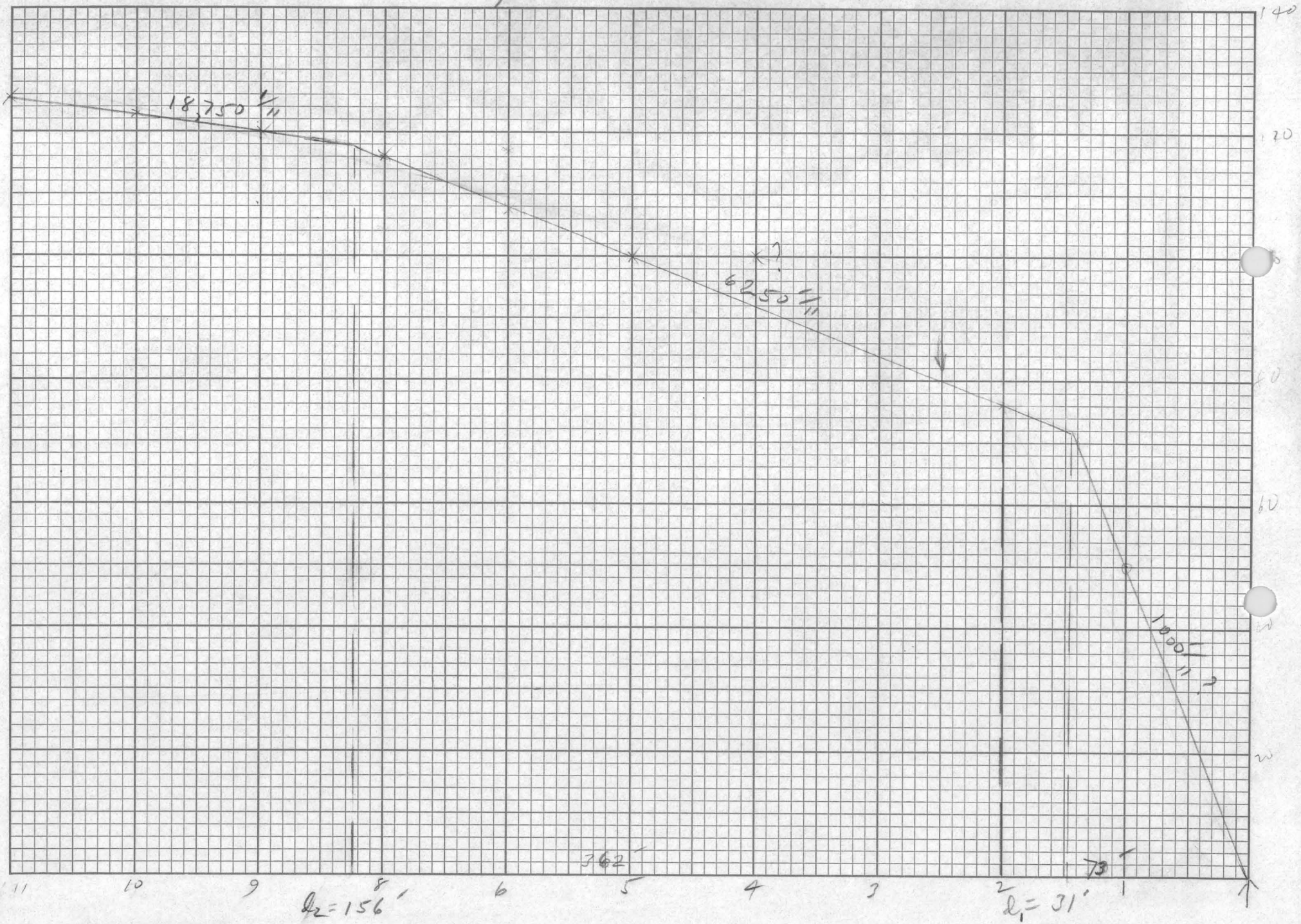


1" = 50'

K+E 10 X 10 TO THE INCH 359-5DG
KEUFFEL & ESSER CO. MADE IN U.S.A.

K+E 10 X 10 TO THE INCH KEUFFEL & ESSER CO. 359-5DG MADE IN U.S.A.

Set up #3 #4



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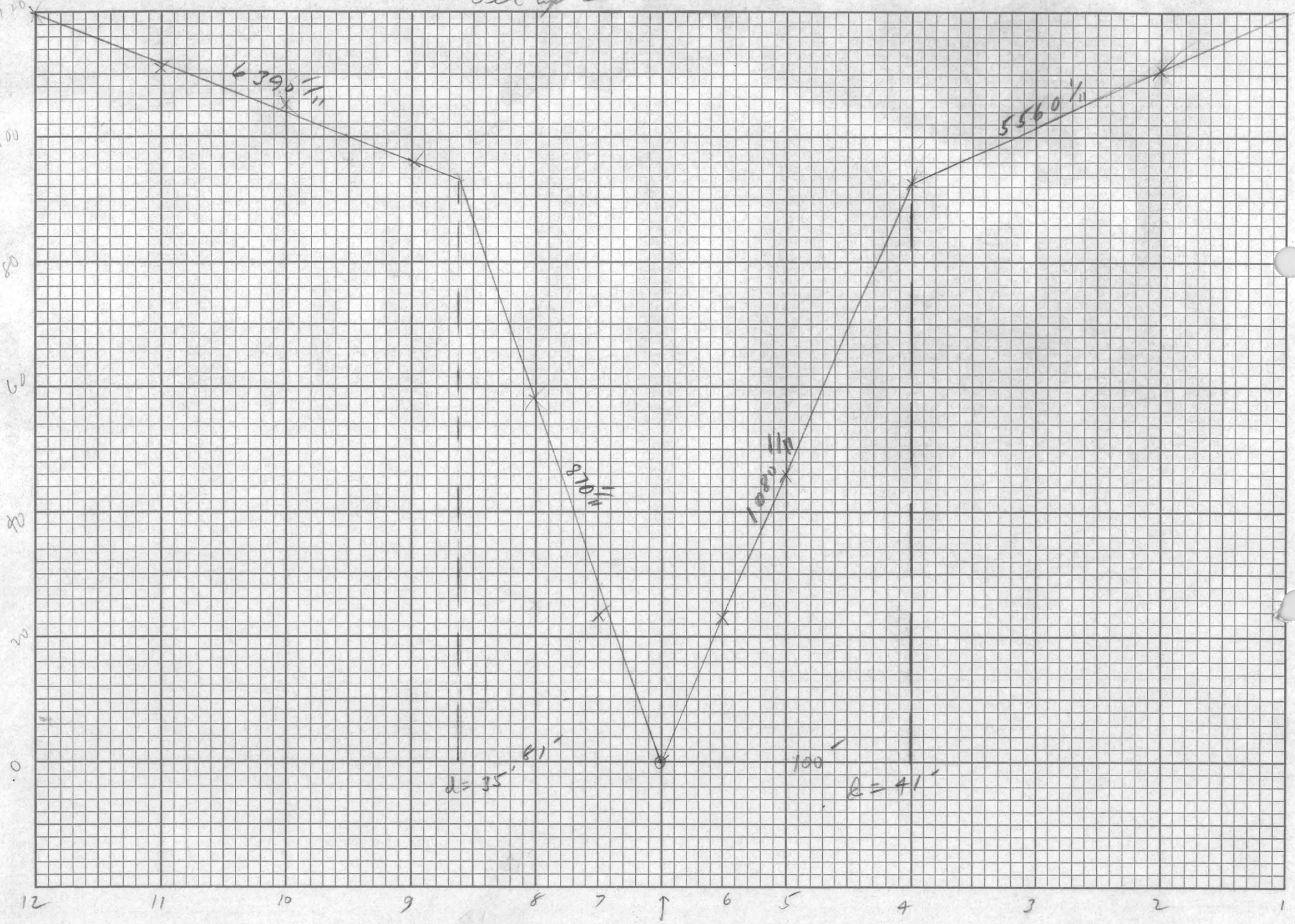
Set up # 4 #5



INDEX

LOCATION OF REFRACTION SEISMIC SURVEY
Havasu Lake Area

for

ENGINEERS TESTING LABORATORIES

May 7, 1965

HEINRICHS
GEOEX
GEOPHYSICAL ENGINEERS
TUCSON, ARIZONA

3 - 4 - 65

WARNE SANDY BERECH

Jim ~~Warren~~:
XXXX Engineers Testing Labs, Phoenix 264-4781

2 ft. water plus 2 - 3 ft. mud.

Bill Williams Havasu Lake

Bridge and Fill 200 ft. span.

State Highway - 1100 ft. wide.

Drill preliminary

Jetting and resistivity

coarse river run

Which side bridge versus fill

7 1/2" quads : Gene Wash or Monkey's Head

Motel at Havasu Lake

Havasu Lake Motel ? 135 miles Phx.

Parker

Needles & Dam 260 miles

Will send map and rock samples.

Tom Ellis quoted $300.00 WEH

3/4/65

Jim Warren 264-4781

Called: 2' Water +2-3 mud.

Engineers Testing Labs Phx

Bill Williams Havasu Lake

Bridge & fill 200' span

State Hwy. 1100' wide.

Drill pilim.

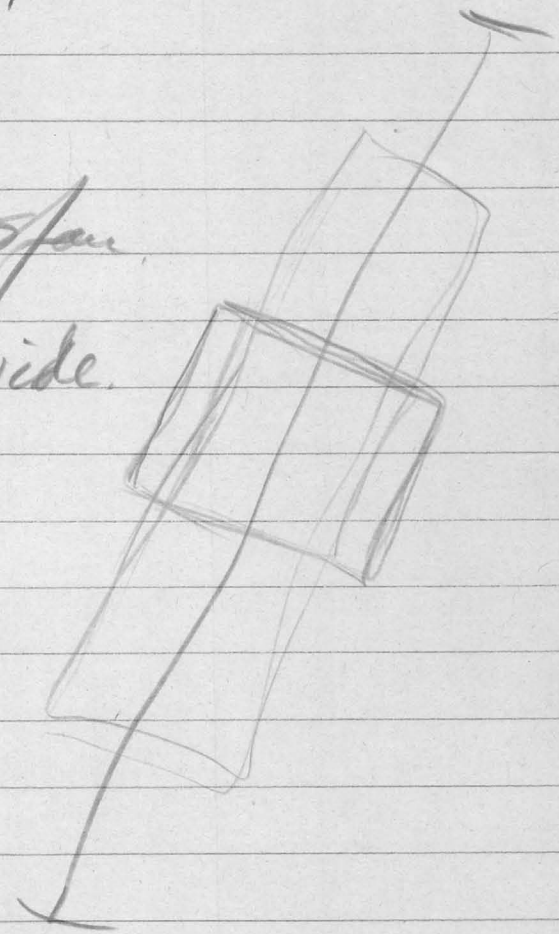
Jetting & resistivity,

cover river run.

which side bridge

7½' Quads: Gene Wash

or Monkeys Head.



Motel at Havasu Lake 135 Plx.
" Motel. mils

Paker.

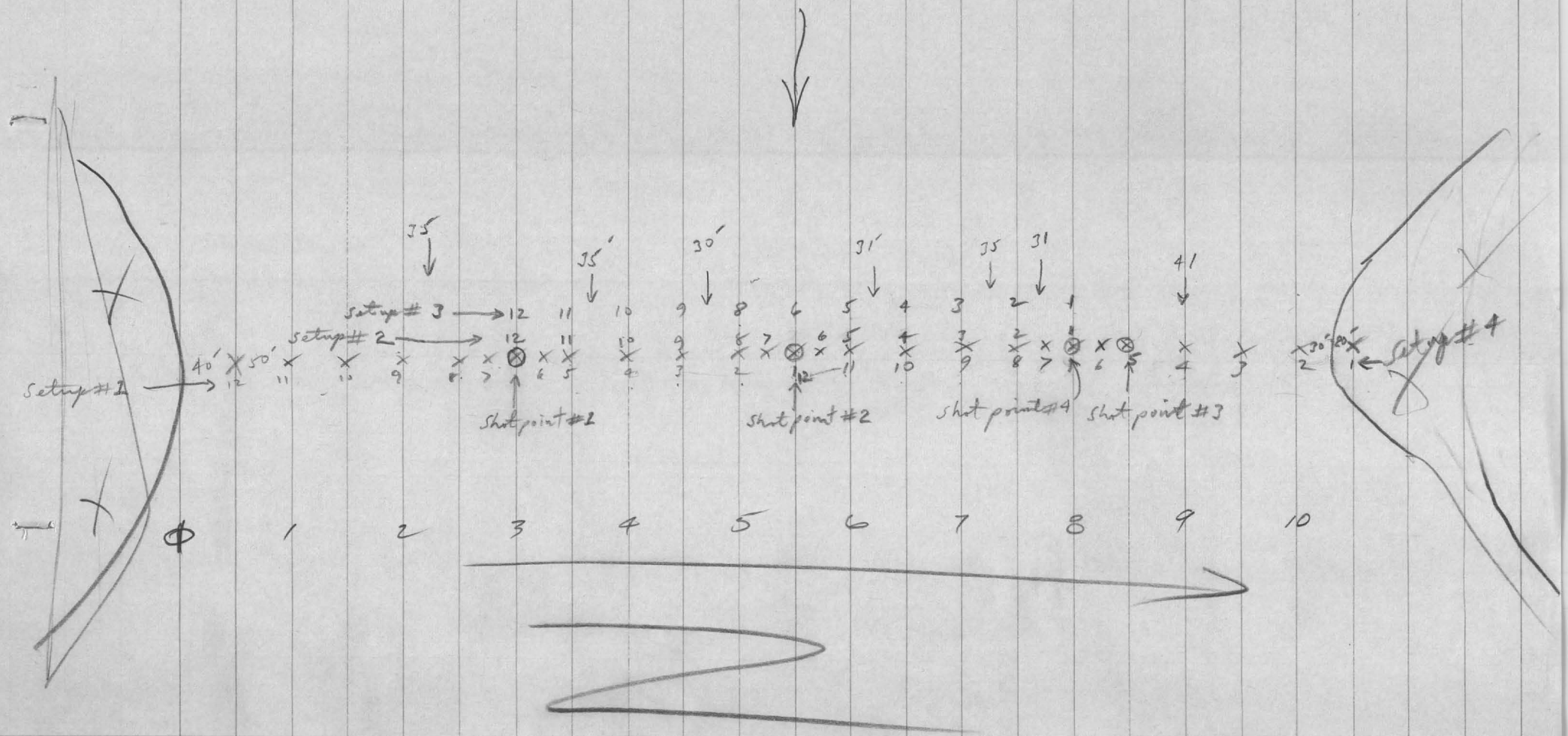
— 260 miles

Needles & Down.

Will send map &
rock samples.

Tom Ellis quoted $300.00

W.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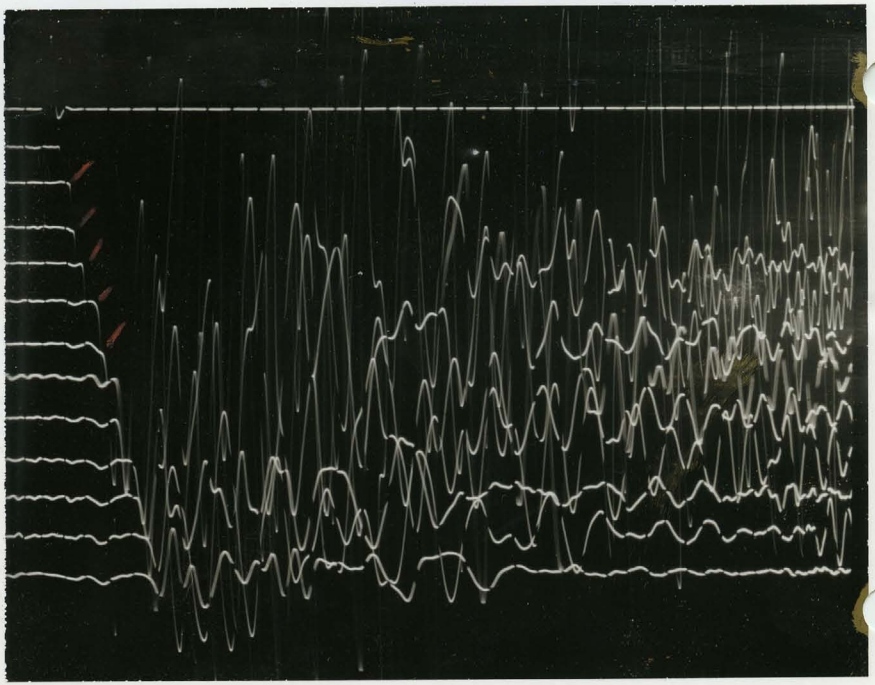

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WESTERN UNION

TELEGRAM

W. P. MARSHALL, PRESIDENT

SF-1201 (4-60)

SYMBOLS

DL = Day Letter

NL = Night Letter

LT = International Letter Telegram

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723A PST APR 14 65 LB001

DB015

D HSHE001 PD

WUX HSHE HOUSTON TEXAS 4-14-65 913AM CST

HEINRICHS GEOEXPLORATION CO

ATTN GROVER HEINRICHS

808 W GRANT ROAD

TUCSON ARIZONA

PHONE 623-0578

APR 1965 GEOEX

$	No 623-0578	To	
S	By	At 835	To Be
E			

PORTA SEIS [redacted] EQUIPMENT SHIPPED VIA CONTINENTAL AIRBILL #05-HOU-038528 4-13-65.

MANDREL IND. INC.

4/15/65

Grover at:
& Phil

Black Meadow Marina landing Motel
(North of Parker Dam) Parker, Calif. exch.
c/o Sandy Bereck of Engineers Testing Labs
264-4781 of Phx

Re: State Hwy Bill Williams Bridge.

W.

10:25

WESTERNUNION 4-14-65

ATTN: GROVER HEINRICHS

HOUSTON, TEXAS

PORTA SEIS EQUIPMENT SHIPPED VIA CONTINENTAL, AIR BILL NO. 05HOU038528X

4-13-65.

MANDREL INC.

Bereck out of town - talked to Warne
Phy 264-4781

when gear arrives call
Eng. Testing Labs - Collect

arrived

HEINRICHS GEOEXPLORATION COMPANY

806 WEST GRANT ROAD, TUCSON, ARIZONA, 85703. P.O. BOX 5671. PHONE: (AREA CODE 602) 623-0578

April 5, 1965

APR 1965 GEOEX

Engineers Testing Laboratories Inc.
2515 East Indian School Road
Phoenix, Arizona

Attn: Mr. J. E. Warne
Mr. S. Berech

Re: Proposed Seismic Study
Havasu Lake, Sec. 12, 4, T11N, R18W
Mohave & Yuma Counties, Arizona

Gentlemen:

To confirm our conversations of the past two weeks and particularly April 1, 1965, we are ready to proceed with the seismic survey during the week of April 5, 1965 on the following basis:

2 or 3 Man Seismic Crew & Equipment $200.00 - $250.00 per day
Expenses charged at our cost include:
Living expenses
Misc. supplies, dynamite, caps, reproductions, equipment rental, communications, etc.
Vehicle Rental & Travel Expenses: Tucson to Tucson @ $10.00 per day and .10¢ per mile
Standby for Weather and at client's request at one-half the daily rate
Office computation, compilation & interpretation per staff day @ $100.00 per day
Trespass liability problems will be borne by client.

Please indicate your understanding and agreement to the above by signing, dating, and returning the enclosed copy of this letter.

Very truly yours,
HEINRICHS GEOEXPLORATION COMPANY

E. Grover Heinrichs, Vice President

APPROVED:
ENGINEERS TESTING LABS. INC.

A. J. Berech
A. J. BERECH
6 APRIL 1965

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LANDING
NORTH 3-3250
NORTH 3-3450
Parker Dam, California

GLENN C. JACOBSON
Manager
P.O. Box 98
Parker Dam, California

ALBERT J. SHODEN
Ass't. Manager
P.O. Box 98
Parker Dam, California

HEINRICHS GEOEXPLORATION COMPANY
808 W. GRANT ROAD - P. O. BOX 5671 - TUCSON, ARIZONA 85703
Area Code 602 Phone ~~622-4202 or 623-4561~~ 623-0578

MESSAGE | REPLY

TO Mr. Verlon Boysen
Electro Technical Labs
5234 Glenmont Drive
P. O. Box 36306
Houston, Texas

DATE April 7, 1965

Dear Mr. Boysen:

Will or can the rental price on the used Porta-Seismograph be applicable on a purchase? What is the total price of the unit?

We would like a delay-timer to extend the range. Could this be adapted to the above unit? If so what would be the cost, time involved, etc.

Any further particulars you might provide will be most appreciated.

Thank you.

Walt.

SIGNED Walter E. Heinrichs, Jr.
President & General Manager

DATE

SIGNED

FORM AVAILABLE FROM GRAYARC CO., INC.
882 THIRD AVE., B'KLYN 32, N. Y.

DETACH THIS COPY — RETAIN FOR ANSWER. SEND WHITE AND PINK COPIES WITH CARBONS INTACT.

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NIGHT LETTER	X

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E

WESTERN UNION
TELEGRAM

W. P. MARSHALL, PRESIDENT

1207 (4-55)

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Check the class of service desired; otherwise the message will be sent at the full rate	
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LETTER TELEGRAM	
SHORE-SHIP	

NO. WDS.-CL. OF SVC.	PD. OR COLL.	CASH NO.	CHARGE TO THE ACCOUNT OF	TIME FILED
	PD		Engr. Testing Labs	4:00 p.m.

Send the following message, subject to the terms on back hereof, which are hereby agreed to

To Vern Boysen, Electro-Tech April 5, 1965 19

Street and No. 5234 Glenmont Drive

Care of or Apt. No. *Place* Houston, Texas Phone: 667-6561

PROCEED AS PER WIRE DATED APRIL 2, 1965

Ship three boxes film

GEOEX, Tucson

Confirmation copy mailed 4-5-65

Senders's name and address (For reference)

Sender's telephone number

ALL MESSAGES TAKEN BY THIS COMPANY ARE SUBJECT TO THE FOLLOWING TERMS:

To guard against mistakes or delays, the sender of a message should order it repeated, that is, telegraphed back to the originating office for comparison. For this, one-half the unrepeated message rate is charged in addition. Unless otherwise indicated on its face, this is an unrepeated message and paid for as such, in consideration whereof it is agreed between the sender of the message and the Telegraph Company as follows:

1. The Telegraph Company shall not be liable for mistakes or delays in the transmission or delivery, or for non-delivery, of any message received for transmission at the unrepeated-message rate beyond the sum of five hundred dollars; nor for mistakes or delays in the transmission or delivery, or for non-delivery, of any message received for transmission at the repeated-message rate beyond the sum of five thousand dollars, unless specially valued; nor in any case for delays arising from unavoidable interruption in the working of its lines.

2. In any event the Telegraph Company shall not be liable for damages for mistakes or delays in the transmission or delivery, or for the non-delivery, of any message, whether caused by the negligence of its servants or otherwise, beyond the actual loss, not exceeding in any event the sum of five thousand dollars, at which amount the sender of each message represents that the message is valued, unless a greater value is stated in writing by the sender thereof at the time the message is tendered for transmission, and unless the repeated-message rate is paid or agreed to be paid and an additional charge equal to one-tenth of one per cent of the amount by which such valuation shall exceed five thousand dollars.

3. The Telegraph Company is hereby made the agent of the sender, without liability, to forward this message over the lines of any other company when necessary to reach its destination.

4. The applicable tariff charges on a message destined to any point in the continental United States listed in the Telegraph Company's Directory of Stations cover its delivery within the established city or community limits of the destination point. Beyond such limits and to points not listed in the Telegraph Company's Directory of Stations, the Telegraph Company does not undertake to make delivery but will endeavor to arrange for delivery by any available means as the agent of the sender, with the understanding that the sender authorizes the collection of any additional charge from the addressee and agrees to pay such additional charge if it is not collected from the addressee.

5. No responsibility attaches to the Telegraph Company concerning messages until the same are accepted at one of its transmitting offices; and if a message is sent to such office by one of the Telegraph Company's messengers, he acts for that purpose as the agent of the sender; except that when the Telegraph Company sends a messenger to pick up a message, the messenger in that instance acts as the agent of the Telegraph Company in accepting the message, the Telegraph Company assuming responsibility from the time of such acceptance.

6. The Telegraph Company will not be liable for damages or statutory penalties when the claim is not presented in writing to the Telegraph Company, (a) within ninety days after the message is filed with the Telegraph Company for transmission in the case of a message between points within the United States (except in the case of an intrastate message in Texas) or between a point in the United States on the one hand and a point in Alaska, Canada, Mexico, or St. Pierre-Miquelon Islands on the other hand, or between a point in the United States and a ship at sea or in the air, (b) within 95 days after the cause of action, if any, shall have accrued in the case of an intrastate message in Texas, and (c) within 180 days after the message is filed with the Telegraph Company for transmission in the case of a message between a point in the United States and a foreign or overseas point other than the points specified above in this paragraph; provided, however, that this condition shall not apply to claims for damages or overcharges within the purview of Section 415 of the Communications Act of 1934, as amended.

7. It is agreed that in any action by the Telegraph Company to recover the tolls for any message or messages the prompt and correct transmission and delivery thereof shall be presumed, subject to rebuttal by competent evidence.

8. Special terms governing the transmission of messages according to their classes, as enumerated below, shall apply to messages in each of such respective classes in addition to all the foregoing terms.

9. No employee of the Telegraph Company is authorized to vary the foregoing.

4-54

CLASSES OF SERVICE

DOMESTIC SERVICES

TELEGRAM

The fastest domestic service.

DAY LETTER (DL)

A deferred same-day service, at low rates.

NIGHT LETTER (NL)

Economical overnight service. Accepted up to 2 A. M. for delivery the following morning, at rates lower than the Telegram or Day Letter rates.

INTERNATIONAL SERVICES

FULL RATE (FR)

The fastest overseas service. May be written in code, cipher, or in any language expressed in Roman letters.

LETTER TELEGRAM (LT)

For overnight plain language messages, at half-rate. Minimum charge for 22 words applies.

SHIP RADIOGRAM

For messages to and from ships at sea.

April 5, 1965

Engineers Testing Laboratories Inc.
2515 East Indian School Road
Phoenix, Arizona

Attn: Mr. J. E. Warne
Mr. S. Berech

Re: Proposed Seismic Study
Havasu Lake, Sec. 12, 4, T11N, R18W
Mohave & Yuma Counties, Arizona

Gentlemen:

To confirm our conversations of the past two weeks and particularly April 1, 1965, we are ready to proceed with the seismic survey during the week of April 5, 1965 on the following basis:

2 or 3 Man Seismic Crew & Equipment $200.00 - $250.00 per day
Expenses charged at our cost include:
Living expenses
Misc. supplies, dynamite, caps, reproductions, equipment rental, communications, etc.
Vehicle Rental & Travel Expenses: Tucson to Tucson @ $10.00 per day and .10¢ per mile
Standby for Weather and at client's request at one-half the daily rate
Office computation, compilation & interpretation per staff day @ $100.00 per day
Trespass liability problems will be borne by client.

Please indicate your understanding and agreement to the above by signing, dating, and returning the enclosed copy of this letter.

Very truly yours,
HEINRICHS GEOEXPLORATION COMPANY

APPROVED:
ENGINEERS TESTING LABS. INC.

_____

E. Grover Heinrichs, Vice President

MADE IN U.S.A. U.S. PAT. NO. 3,013,354

6

MAY 65H

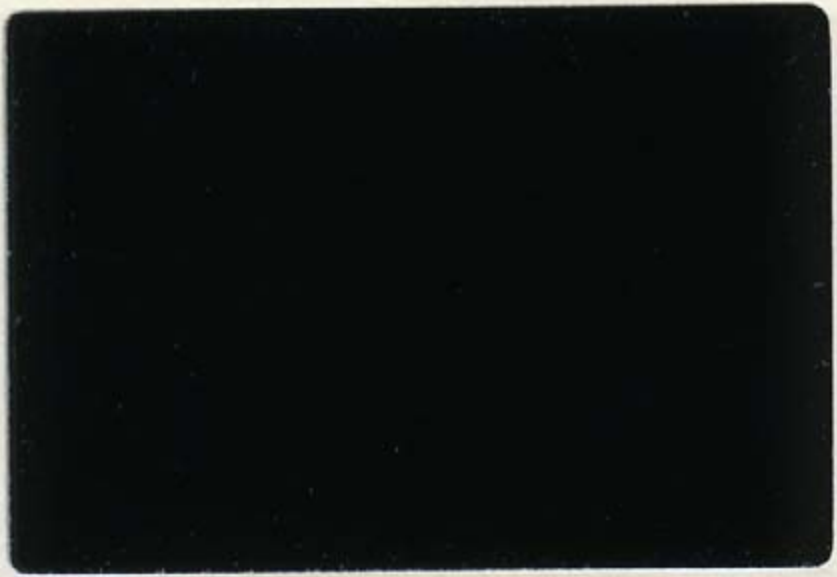
11

MAY 65H

MADE IN U.S.A. U.S. PAT. NO. 3,013,354

·15

MAY 65H



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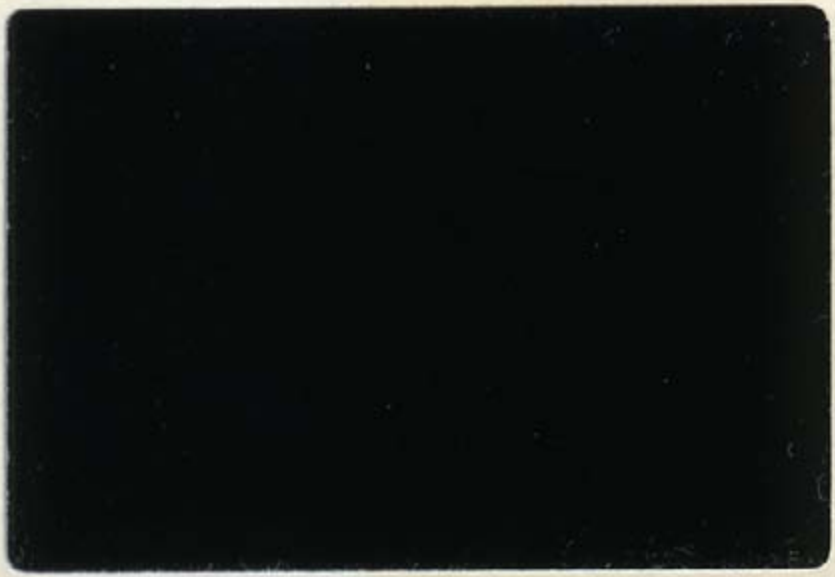
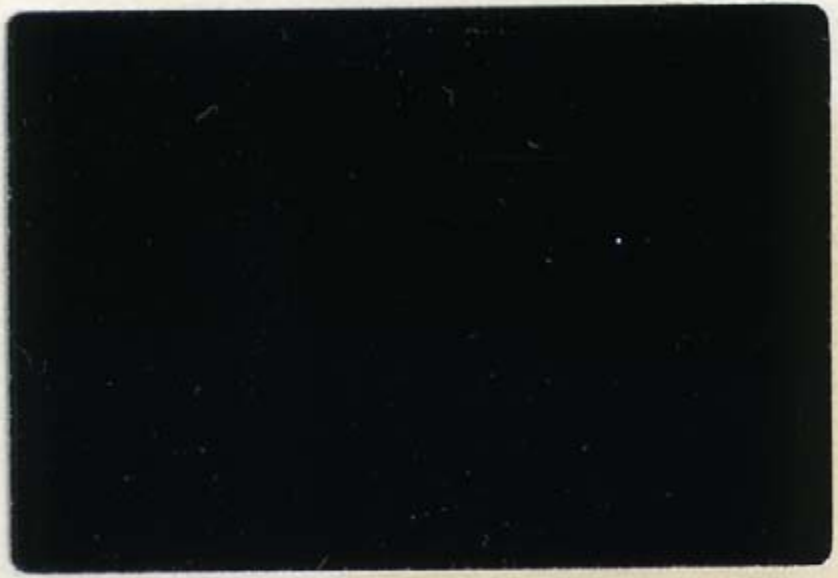
MAY 65H



MADE IN U.S.A. U.S. PAT. NO. 3,013,354

17

MAY 65H



450 = 236.74
440 = 221.32
430 = 187.09
G & SRM R17W
G & SRM R18W
ADOBE
N.3,750,000
E.3,584,000
582,000
PROJECT BOUNDARY
Boundary
RIVER
Line
N.3,748,000
N.3,746,000
N.3,744,000
N.3,742,000
N.3,740,000
E.3,590,000
E.3,592,000
DALEY No. 2
DALEY No. 3
BLUE
MONUMENT No. 2
S. BILL WILLIAMS
NEEDLES
YUMA COUNTY
B-176
Long. 114° 03'

3 - 4 - 65

Jim ~~Warren~~: WARNE
~~XXXX~~ Engineers Testing Labs, Phoenix 264-4781 Phone

2 ft. water plus 2 - 3 ft. mud.

Bill Williams Havasu Lake

Bridge and Fill 200 ft. span.

State Highway - 1100 ft. wide.

Drill preliminary

Jetting and resistivity

coarse river run

Which side bridge versus fill

7 1/2" quads : Gene Wash or Monkey's Head

Motel at Havasu Lake

Havasu Lake Motel ? 135 miles Phx.

Parker

Needles & Dam 260 miles

Will send map and rock samples.

Tom Ellis quoted $300.00 WEH