GATHRIGHT DAM SITE

GEOPHYSICAL STUDIES

MAY 1971

DEPARTMENT OF THE ARMY
Missouri River Division, Corps of Engineers
DIVISION LABORATORY
OMAHA, NEBRASKA

GEOPHYSICAL REPORT
GATHRIGHT DAMSITE
LEFT ABUTMENT

GENERAL

1. Requesting Agency: This work was conducted at the request of the Norfolk District under Work Order GAR 71-5, dated 10 October 1970, with the Missouri River Division Laboratory.

2. Dates of Survey. Field work was accomplished February 1-11, and March 8-12, 1971.

3. Location: Gathright Dam site is located approximately 10 miles north of Covington, Virginia on the Jackson River.

4. Geophysical Method: The geophysical method employed in this survey was seismic refraction wave front, and conventional surface seismic refraction.

PURPOSE

The purpose of the investigation was to attempt to detect and delineate solution cavities in the left abutment limestone beds, some of which had been located by exploratory borings. The geophysical work was conducted in a semi-experimental manner in hopes of developing a technique which could determine the general quality of the rock and if possible, detect specific cavities.

FIELD SURVEY DATA

1. Equipment and Personnel. Equipment used were Electro-Tech ER-75 and Geospace GT-2B 12 channel portable refraction seismographs. The field work was conducted under the supervision of Mr. Raymond Roberts, MRD, Division Geophysicist with the assistance of Messrs. Nolan Mitchell and Robert Bruhn

of the MRD Laboratory; John Bowman, Norfolk District Geologist, and Ronald Buck and Lt. Thomas Sandow of the Norfolk District.

Mr. E. J. Deklotz is Director of the Missouri River Division Laboratory which operates under Mr. J. F. Redlinger, Chief, Geology, Soils and Materials Branch, Missouri River Division.

2. Coverage: Five drill holes were shot to develop wave front diagrams. Several surface refraction lines were spread over known cavities to determine if resonant "ringing" effects could be observed and to obtain seismic velocity and strike and dip of the beds.

3. Geology: The left abutment of Gathright Dam site is composed of limestone beds which are cherty to sandy in some areas, and contain numerous cavities. The cavities are generally open but are occasionally clay filled. Near the proposed axis of the dam the beds dip upstream on the flank of an anticline that plunges into the abutment. A shear zone passes through the area slightly upstream from the proposed dam axis and is approximately parallel to the axis of the anticline.

INTERPRETATION

1. The surface seismic refraction lines which were spread to detect cavities by resonant "ringing" were not successful. The background noise and difficult coupling between geophone and soil rendered the technique very questionable at this site.

2. Wave Front Method

a. Theory: A wave front diagram is a two dimensional cross section of the subsurface rock velocity characteristics. By symmetry and assuming a homogeneous substrata, it can be shown that a shot detonated at a particular

depth in a drill hole and recorded on the surface will be the same as if the shot were detonated at the surface at the drill hole and recorded at an imaginary point equal to the shot depth beneath the geophone.

After a number of shots have been made and the travel times recorded at the imaginary points, a velocity contour map can be constructed. If the material is homogeneous the time contours will appear as a series of concentric arcs originating at the drill collar. If the material is not homogeneous the contours become close spaced where the velocity decreases and wider spaced where the velocity increases.

b. Interpretation of lithologic contacts and possible cavities are indicated on the separate wave front plots included as Plates 2 through 5. General qualitative indications are that the rock on the left abutment is less solutionized in the area near the face and bounded by drill holes 800-801 and 803.

RECOMMENDATIONS

1. Anomalies indicated on the wave front should be drilled out to establish a confidence level for areal definition and vertical dimensions of the postulated cavities. These bore holes should also be inspected with a down hole television camera to obtain information on configuration and extent of fracturing.

2. Additional information can be obtained at this site if holes drilled for future exploration work are also shot for wave fronts. Care should be taken to keep the holes open - possibly to the extent of inserting 3-inch diameter sections of plastic pipe. These sections of pipe could then be retrieved as the explosive charges are detonated at successively shallower depths.

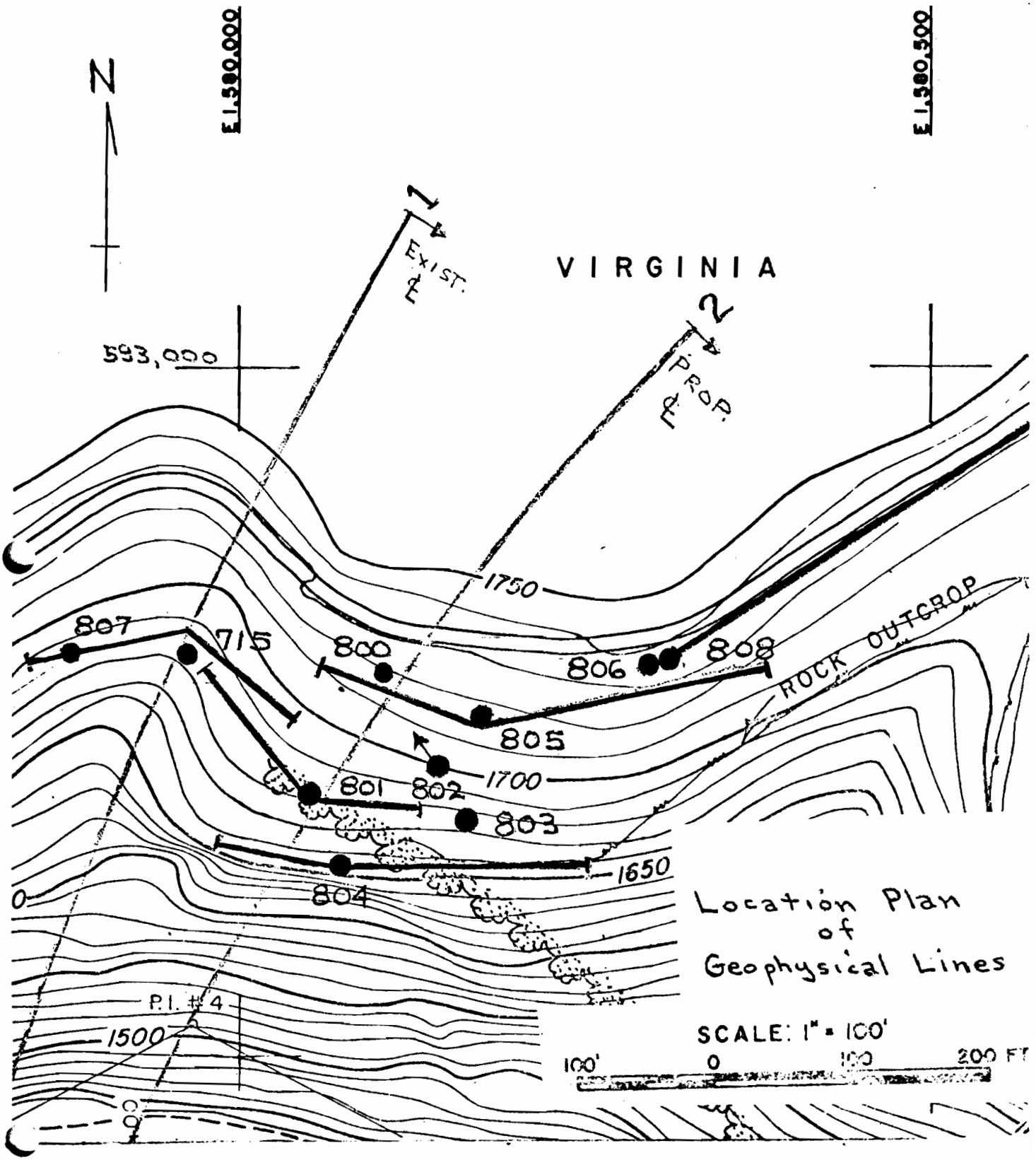
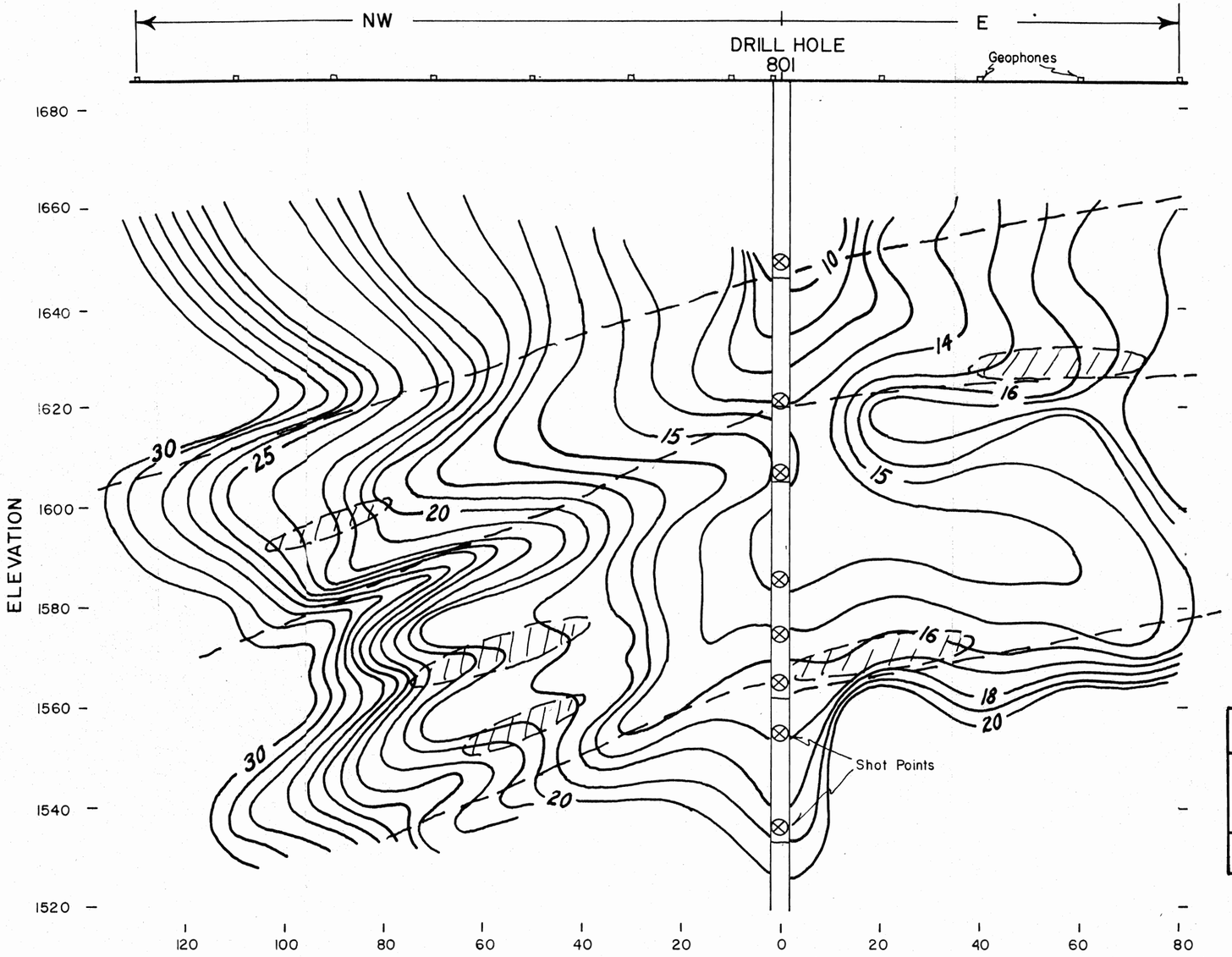
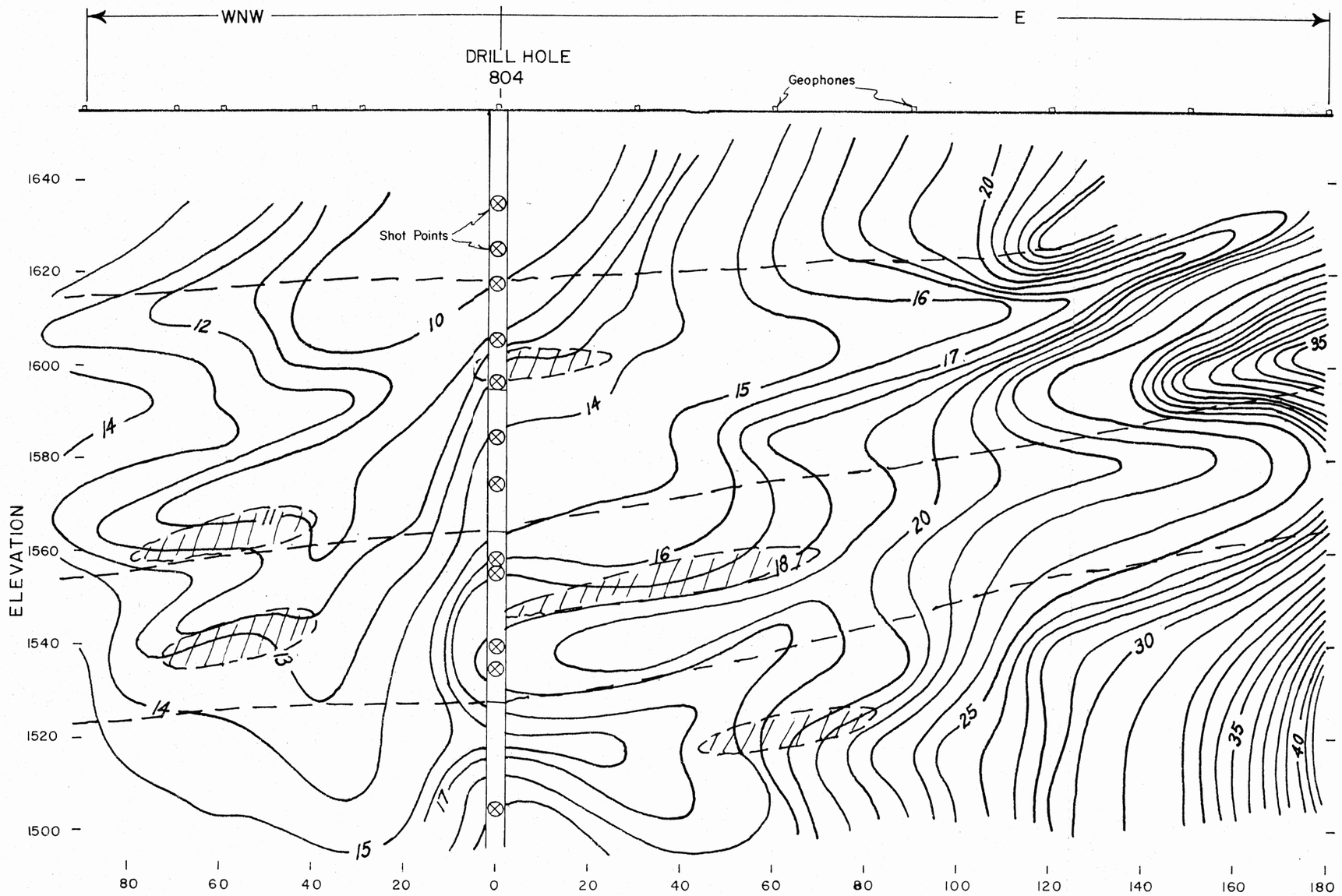

N
E 1,580,000
E 1,580,500
593,000
VIRGINIA
1
EXIST. ℄
2
PROP. ℄
1750
1700
1650
1500
807
715
800
806
808
805
801
802
803
804
ROCK OUTCROP
P.I. #4
Location Plan
of
Geophysical Lines
SCALE: 1" = 100'
100'
0
100
200 FT

PLATE I



Contour Interval: 1 millisecond
Scale: Vertical & Horizontal
1 inch = 20 feet

U.S. ARMY CORPS OF ENGINEERS MISSOURI RIVER DIVISION		
WAVE FRONT DIAGRAM DRILL HOLE 801 GATHRIGHT		
PLATE NO. 2	DATE 3/25/71	DRAWN BY KDK

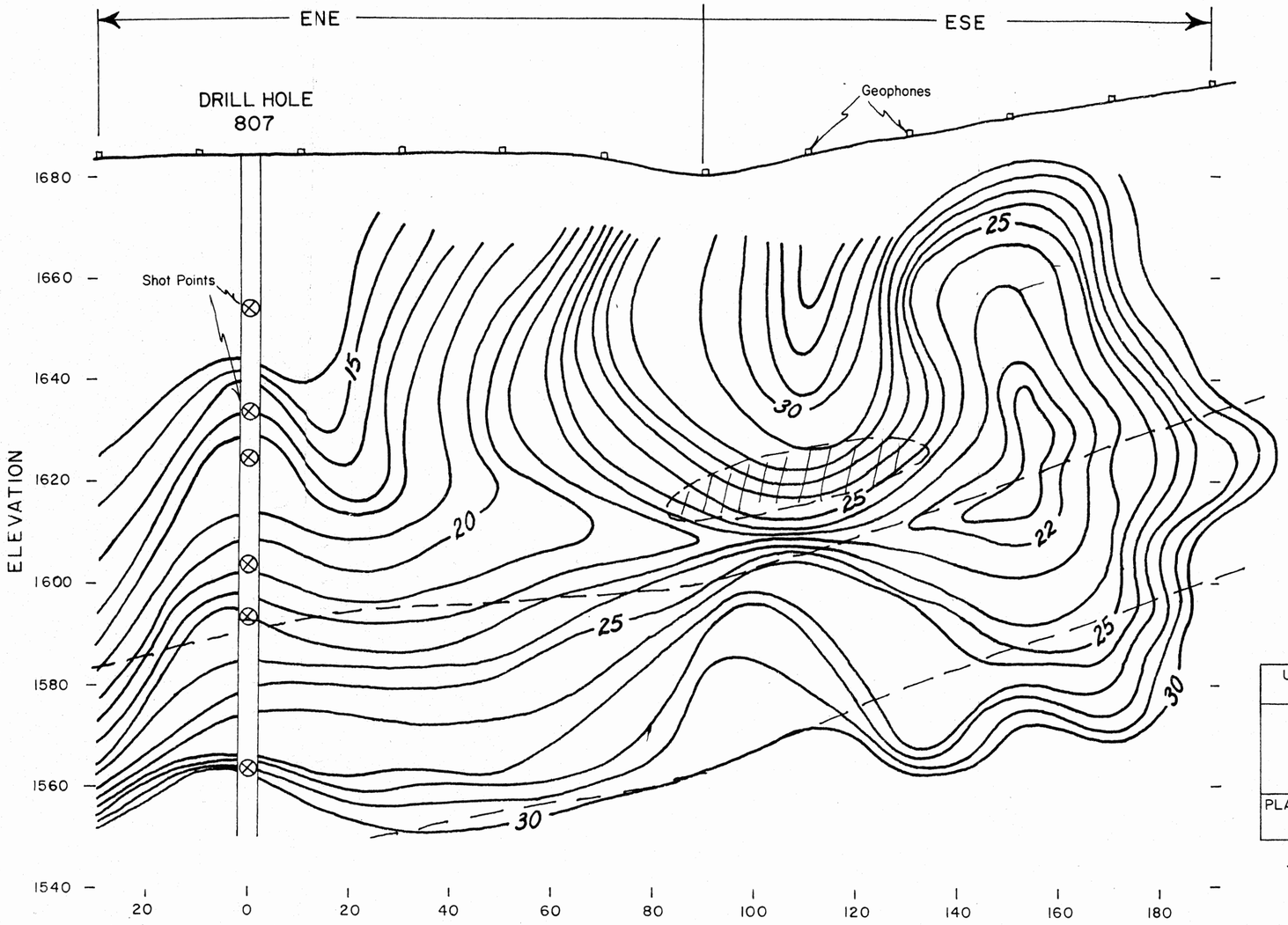


Contour Interval: 1 millisecond
Scale: Vertical & Horizontal
1 inch = 20 feet

U.S. ARMY CORPS OF ENGINEERS
MISSOURI RIVER DIVISION

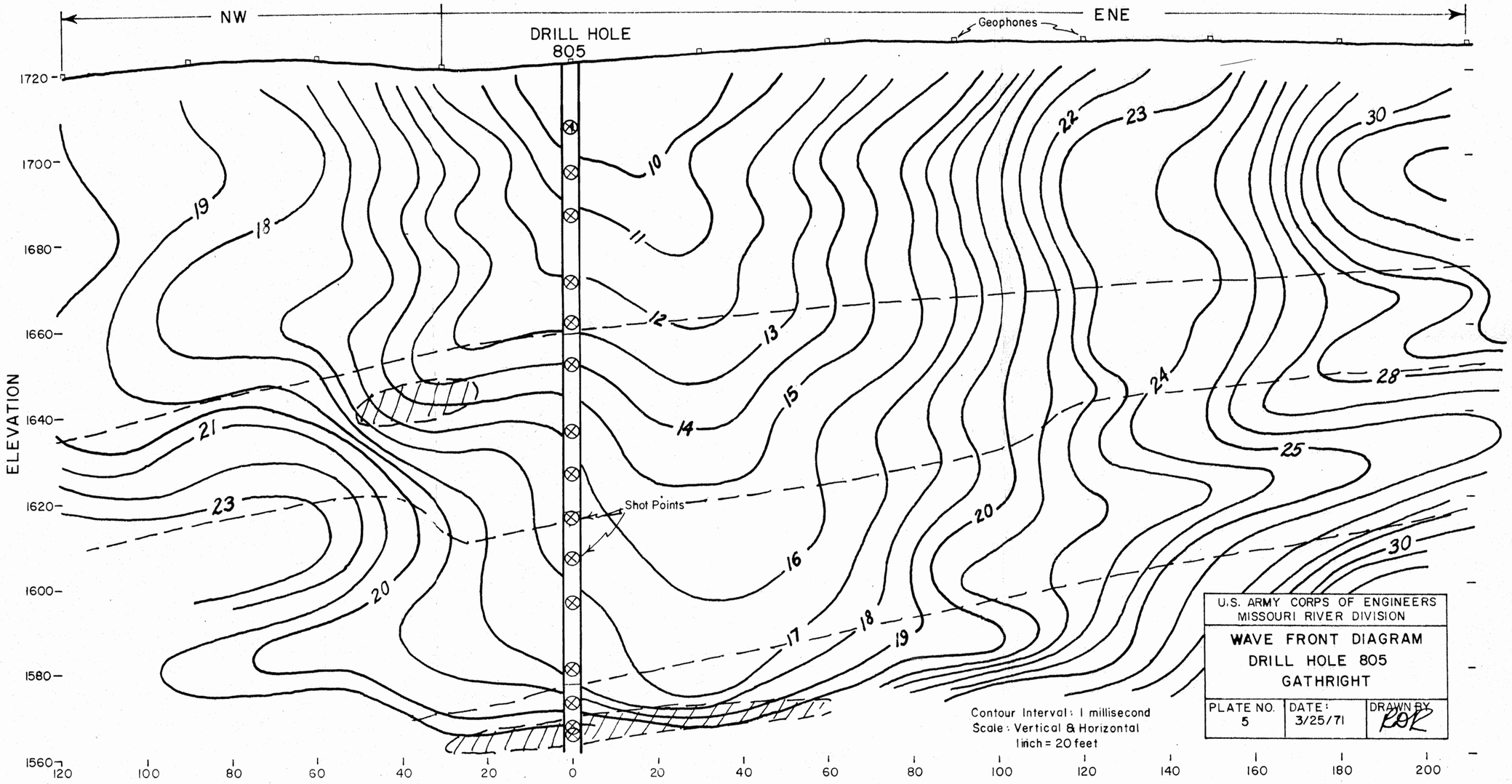
WAVE FRONT DIAGRAM
DRILL HOLE 804
GATHRIGHT

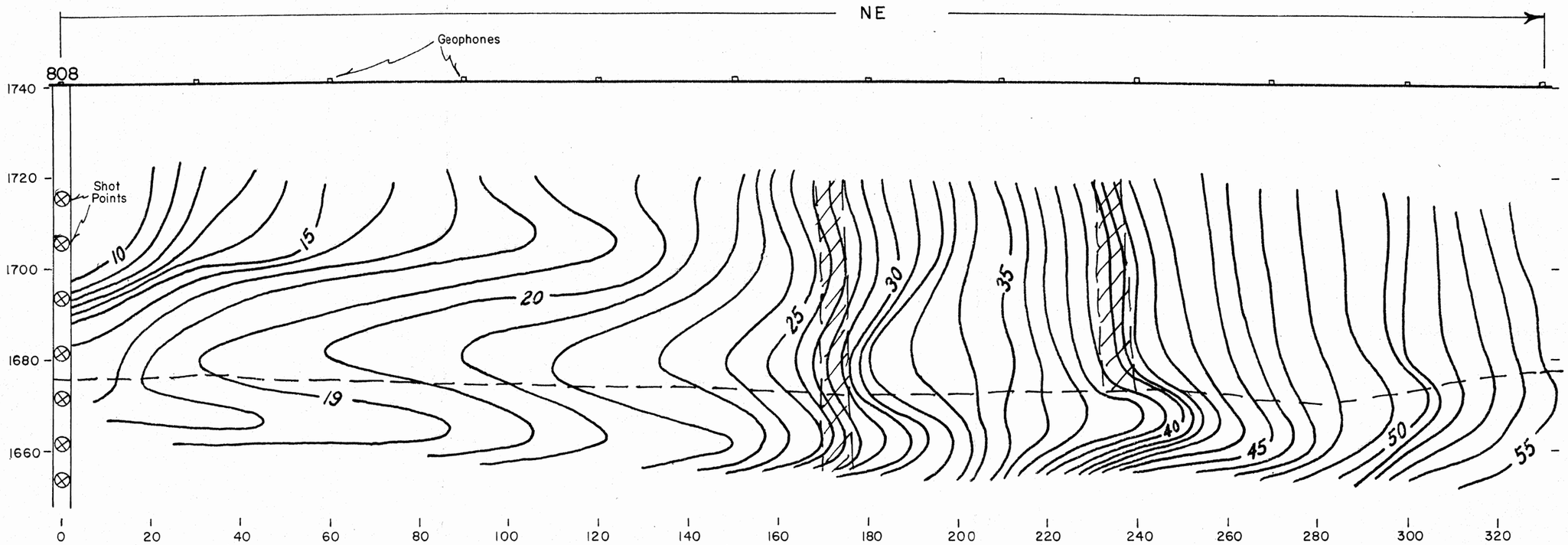
PLATE NO.	DATE	DRAWN BY
3	3/25/71	RDR



Contour Interval: 1 millisecond
Scale: Vertical & Horizontal
1 inch = 20 feet

U.S. ARMY CORPS OF ENGINEERS MISSOURI RIVER DIVISION		
WAVE FRONT DIAGRAM DRILL HOLE 807 GATHRIGHT		
PLATE NO. 4	DATE 3/25/71	DRAWN BY RDK


NW
ENE
DRILL HOLE
805
Geophones
Shot Points
ELEVATION
1720
1700
1680
1660
1640
1620
1600
1580
1560
120
100
80
60
40
20
0
20
40
60
80
100
120
140
160
180
200
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
28
30
Contour Interval: 1 millisecond
Scale: Vertical & Horizontal
1 inch = 20 feet
U.S. ARMY CORPS OF ENGINEERS
MISSOURI RIVER DIVISION
WAVE FRONT DIAGRAM
DRILL HOLE 805
GATHRIGHT
PLATE NO. 5
DATE: 3/25/71
DRAWN BY



Contour Interval: 1 millisecond
Scale: Vertical & Horizontal
1 inch = 20 feet

U.S. ARMY CORPS OF ENGINEERS MISSOURI RIVER DIVISION		
WAVE FRONT DIAGRAM DRILL HOLE 808 GATHRIGHT		
PLATE NO. 6	DATE 3/25/71	DRAWN BY: RDR