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EMERALD ISLE SEISMIC SURVEY

PURPOSE

During the period March 5 through 24, a refractive seismic survey was performed within Section 27, T 23 N, R 18 W. This section lies due south and is adjacent to the Mining Division's Emerald Isle operations. Section 27 is completely blanketed by alluvium except for a small knoll of basement (pre-Cambrian granite) exposed at the eastern margin of the section.

This work was performed to provide data on the subsurface expressions of the basement rocks and the overlying Gila Conglomerate (fanglomerate). Such information could greatly assist evaluating the section's mineral potential by depicting the most favorable drilling locations.

The mineralization encountered in the Emerald Isle pit is present as a copper silicate (chrysocholla) cementing the unsorted cobbles and boulders comprising the Gila Conglomerate. The isopach maps of the pit area indicate that the mineralization appears to have favored a zone characterized by channeling in the underlying basement, which was later filled with rubble designated as the Gila Conglomerate. If similar environments of such "cut and fill" structure are present in Section 27, they would be the most likely areas to encounter similar mineralization.

At best, seismic data provide an indirect guide to mineralization since they differentiate only between rock units which transmit compressional waves at different velocities, and do not measure any mineralization parameters.

EQUIPMENT

For this work a Bison Seismograph, Model 1575, was selected. This instrument has signal enhancement capabilities which make it particularly effective where wide separations exist between geophone and energy source.

The seismic signal received by the geophone and displayed on a cathode ray tube can be stored electronically. This signal is modified at the operators discretion by adding one or a succession of seismic signals resulting from repeated energy imputs. At wide separations the seismic energy becomes significantly attenuated and may not be noticeably greater than the random background noise present. Without the enhancement capability, little useful information could be obtained from the data. With enhancement, successive energy imputs (such as repeated explosive discharges or, as in this survey, successive 8-foot drops of a one ton weight) will arrive at the geophone at identical times and the displayed seismic signal will experience growth in amplitude beginning at the instant the first arrival of seismic energy reaches the geophone. Conversely, the random background noise which reaches the geophone out of phase will tend to cancel itself.

The weight drop was fabricated out of an ancient hoist truck and a rectangular "lump" of cast iron. The weight was raised through a pulley at the top of the hoist by a rope which was looped around a power-driven cat head situated to the rear of the truck's cab. An inertia switch, which makes contact the moment of impact, was bolted onto a small plate welded to the side of the weight. This switch was connected to the seismograph by a long cable which was supplied in 250- and 500-foot lengths. The closing of the inertia switch signals the start of the measurement of the time necessary for the energy of impact to reach the seismograph. This time, measured in milliseconds, was visually digitized at the top of the cathode display.

FIELD TECHNIQUES

The seismic surveying was accomplished along six lines trending east-west across the section. Line 1 was along the north end of the section, and several feet south of the north quarter corner. The eastern end of the seismic survey line is 1430 feet west of the eastern section line. The remaining five lines are parallel to Line 1 and are spaced at 1000-foot intervals to the south. All lines begin due south of station 0+00 W on Line 1 with the exception of Line 3 which was offset three hundred feet to the west due to the presence of the basement exposure near station 0+00 W on Line 3.

The initial work consisted of obtaining seismic data along 2000-foot profiles. These profiles ran from 0+00 W to 20+00 W on Lines 1, 2 and 4 through 6; and from 3+00 W through 23+00 W on Line 3. These first profiles are designated as "A" profiles. A series of "B" profiles were performed on Lines 1 through 4. Each of the "B" profiles are 3000 feet in length, and were offset 1000 feet to the west of the "A" profiles. The data were collected between stations 30+00 W and 60+00 W. The data collected from the "A" and "B" profiles indicated that more information was needed between the two lines, so a series of 2000-foot "C" profiles were run between stations 10+00 W and 30+00 W along Lines 1, 2 and 3.

The field procedure consisted of acquiring all data from east to west along lines. The geophone and seismograph were positioned at the east end and the weight drop stations were established at 100-foot intervals towards the west end of the lines. At the completion of these "normal" profiles, the seismograph/geophone equipment would switch ends with the weight drop and a "reverse" profile would be run; with the weight drop working towards the seismograph/geophone station. At the end of the reverse profile the weight drop was 100 feet east of the geophone. Additional seismic data would then be obtained by establishing 20- and 10-foot stations over the final 100 feet. The impacts would be accomplished by hitting a metal plate, set on the ground, with a sledge hammer. The close-proximity data were taken to obtain velocity measurements of the loosely consolidated surface alluvium.

In addition to the visual display of the travel time between impact and first seismic arrival at the geophone, a strip chart record was made of the seismic trace (including time break) at each station. These records were of much value later in the more precise determinations of the time breaks (time from impact to arrival of seismic energy at geophone). The time breaks along the profiles were plotted against distance (geophone/weight drop separations) and velocity curves (straight lines) were constructed through the points. The intersection of velocity curves indicate the points where the energy enters a medium of different density such as a contact between two dissimilar rock types. These graphs were used to locate the contacts and to indicate the general topographic character of the top of the basement. In addition, a tentative identification of fault zones encountered was made from these data. Following the interpretative work of constructing the curves, simple calculations resulted in depth measurements to contacts, and approximate fault displacements.

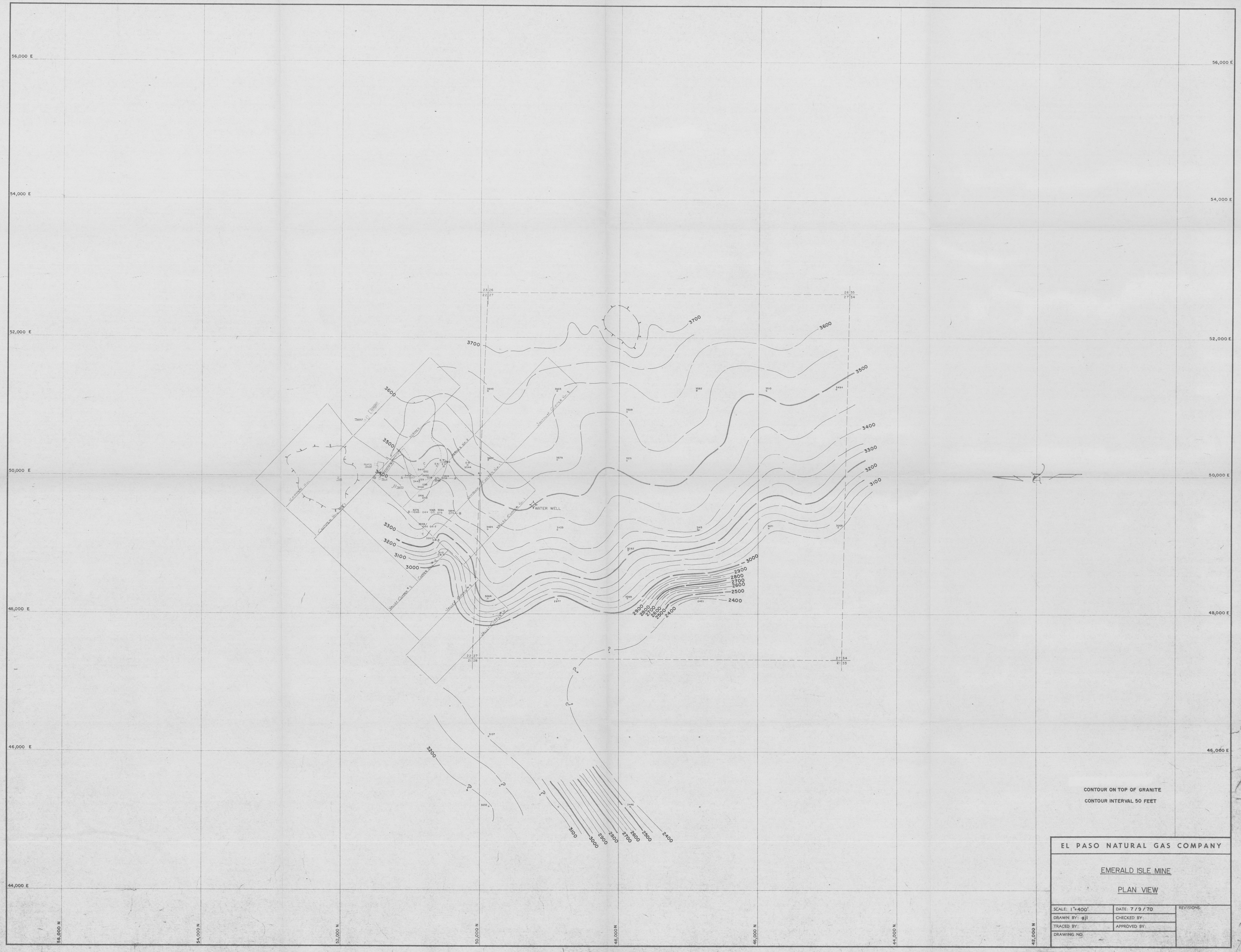
EVALUATION OF DATA

Depth determinations, in refractive seismic work, are made beneath the geophone stations. In this survey the geophone was placed at the east and west ends of the "A", "B" and "C" profiles; so data were obtained at stations 0+00 W, 10+00 W, 20+00 W, 30+00 W, 50+00 W and 60+00 W. The data on the "A" profile of Line 3 were obtained at 3+00 W and 23+00 W due to the offset to the west.

The seismic data provided sufficient depth information on the top of the basement to permit a contour map to be drawn of this surface. The contouring indicates an irregular surface sloping to the west, with an abrupt increase in slope near the western portion of the section. The break in slope occurs along a northwestern trend. Between 23+00 W and 30+00 W, on Line 3, the gradient is about 45 degrees. Of special interest are three zones of channeling in the basement, two of which lie adjacent to a basement high, expressed by the granite knob at the eastern margin of the section. These zones suggest a similar environment to that found in the pit area.

Evidence of apparent fault displacements were found on several profiles, but similar seismic data can be expected by erosional depressions filled with low velocity material. Strengthening the fault displacement interpretation is the strong northwestern trend between the "displacements" noted on lines 4, 5 and 6. This lineation is conformable to the regional trend in displacements which can be expected to occur in this area.

It was hoped that the seismic data would indicate the alluvium/Gila contact as well as that between the Gila and basement. Unfortunately, the seismic records do not clearly differentiate between the well consolidated alluvium and Gila. Without this information, the amount of Gila present at any point in Section 27 is purely conjecture. The total isopach map showing the thickness of material overlying the basement is of some use, but cannot be considered an index of the presence or absence of Gila.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WATER WELL
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3600
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
CONTOUR ON TOP OF GRANITE
CONTOUR INTERVAL 50 FEET
EL PASO NATURAL GAS COMPANY
EMERALD ISLE MINE
PLAN VIEW
SCALE: 1"=400'
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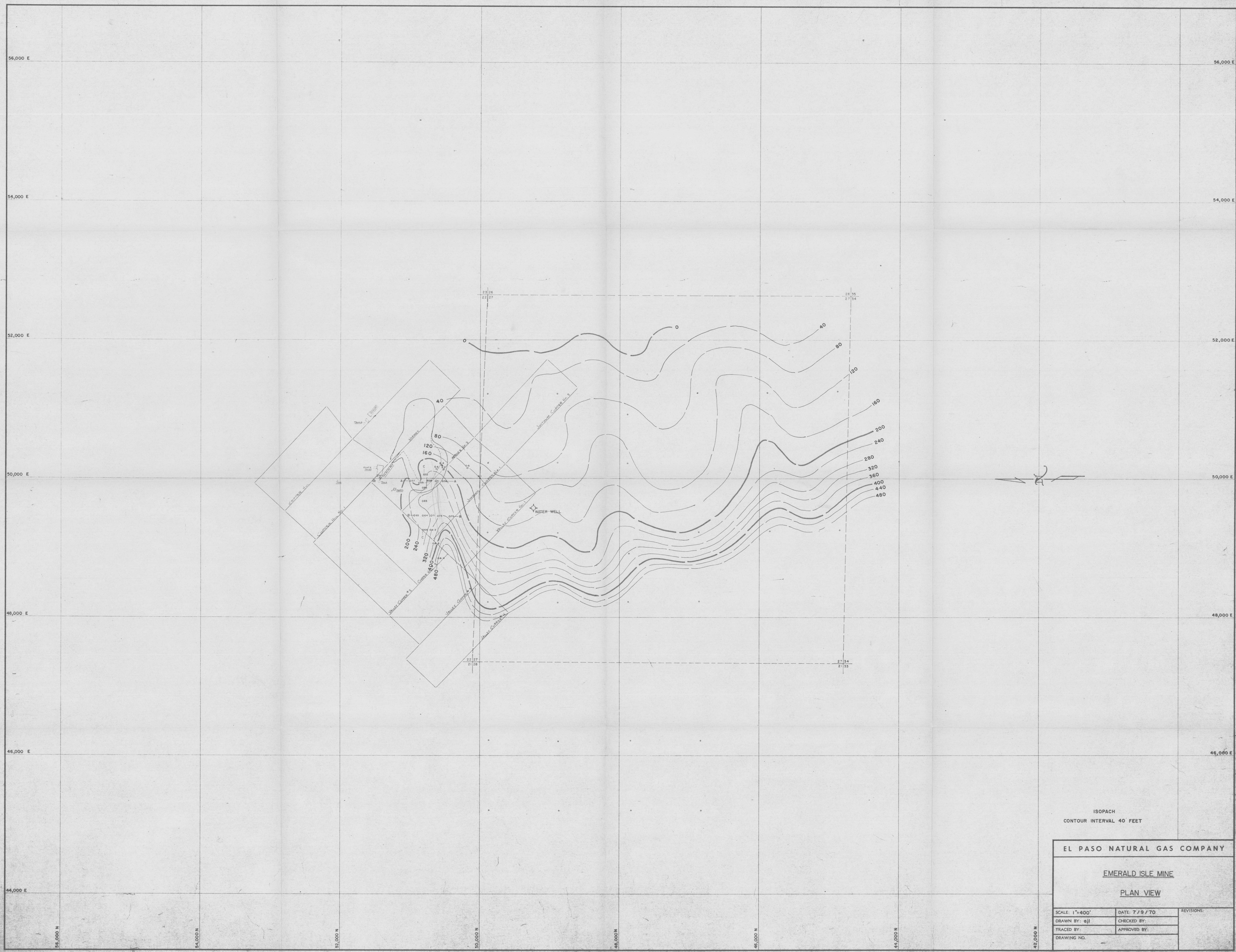
CHECKED BY:
TRACED BY:
APPROVED BY:
DRAWING NO.
REVISIONS:


ISOPACH
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PLAN VIEW
SCALE: 1"=400'
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CHECKED BY:
TRACED BY:
APPROVED BY:
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REVISIONS:
WATER WELL
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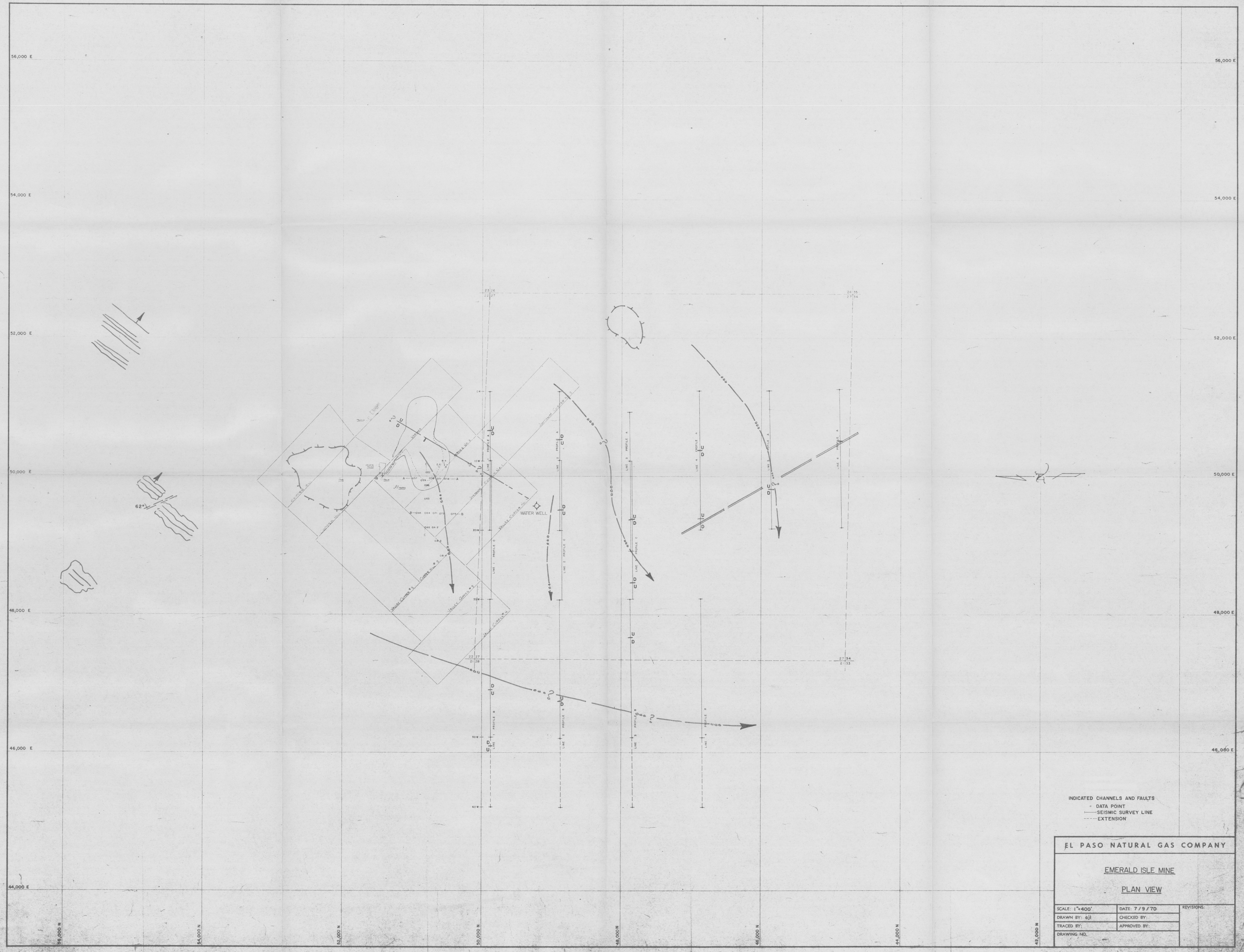
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44,000 N
42,000 N
62°
WATER WELL
INDICATED CHANNELS AND FAULTS
DATA POINT
SEISMIC SURVEY LINE
EXTENSION
EL PASO NATURAL GAS COMPANY
EMERALD ISLE MINE
PLAN VIEW
SCALE: 1"=400'
DATE: 7/9/70
REVISIONS:
DRAWN BY: ajl
CHECKED BY:
TRACED BY:
APPROVED BY:
DRAWING NO.

CONTOUR ON TOP OF GILA

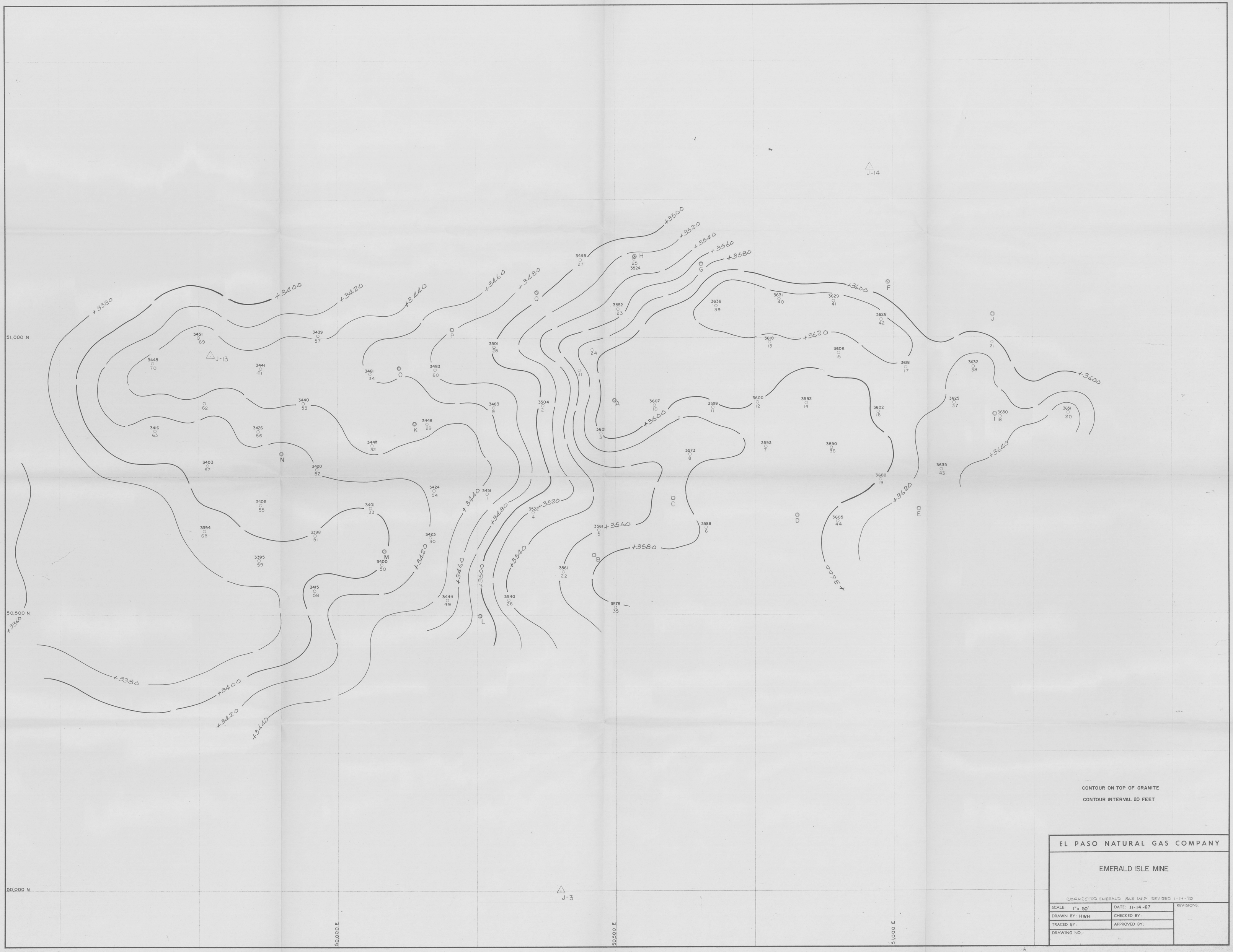
CONTOUR INTERVAL 20 FEET

EL PASO NATURAL GAS COMPANY

EMERALD ISLE MINE

CORRECTED EMERALD ISLE MAP REVISED 1-14-70

SCALE: 1" = 50'	DATE: 11-14-67	REVISIONS:
DRAWN BY: HWH	CHECKED BY:	
TRACED BY:	APPROVED BY:	
DRAWING NO.		



CONTOUR ON TOP OF GRANITE

CONTOUR INTERVAL 20 FEET

EL PASO NATURAL GAS COMPANY

EMERALD ISLE MINE

CORRECTED EMERALD ISLE MAP REVISED 1-14-70

SCALE: 1" = 50'	DATE: 11-14-67	REVISIONS:
DRAWN BY: HWH	CHECKED BY:	
TRACED BY:	APPROVED BY:	
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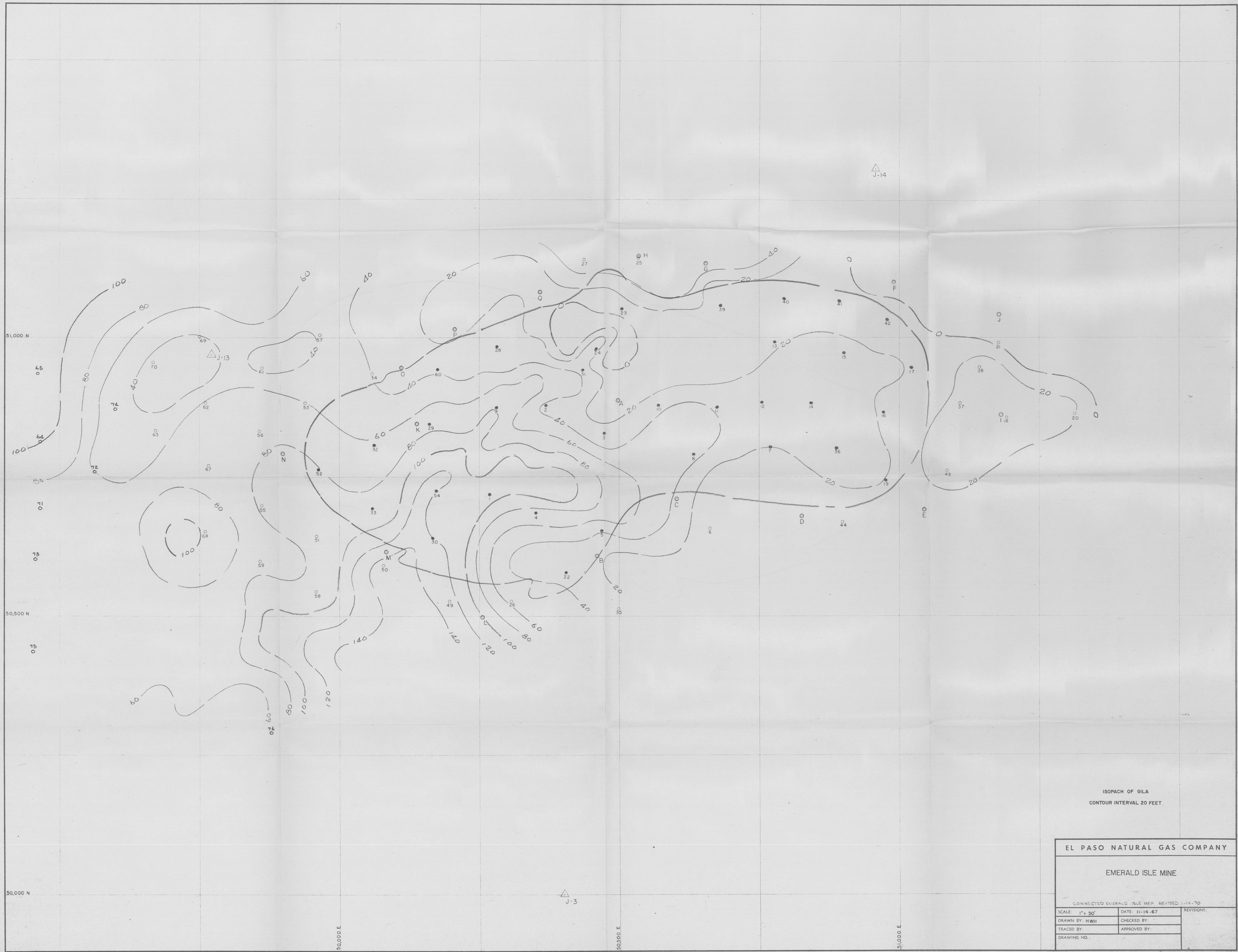
J-14
J-13
J-3
51,000 N
50,500 N
50,000 N
50,000 E
50,500 E
51,000 E
ISOPACH OF GILA
CONTOUR INTERVAL 20 FEET
EL PASO NATURAL GAS COMPANY
EMERALD ISLE MINE
CORRECTED EMERALD ISLE MAP REVISED 1-14-70
SCALE: 1" = 50'
DATE: 11-14-67
REVISIONS:
DRAWN BY: HWH
CHECKED BY:
TRACED BY:
APPROVED BY:
DRAWING NO.