COMMONWEALTH OF AUSTRALIA
MINISTRY OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

REPORT 1948/81
(GEOPHYSICAL SERIES 1948/15)

GRAVITY SURVEY OF BROWN COAL DEPOSITS, MORWELL, VICTORIA

JANUARY - FEBRUARY, 1948

by

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C O N T E N T S

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INTRODUCTION.

In November, 1943, an investigation was carried out by the Geophysical Section of the Mineral Resources Survey on portions of the Latrobe Valley Brown Coalfield near Morwell and Traralgon, and the results were forwarded to the State Electricity Commission in Report No.1944/41 entitled "Preliminary Geophysical Survey, Morwell Brown Coalfield, Victoria." This investigation was confined to tests by the electrical resistivity method and was carried out at the request of the Commission to see whether or not this method could prove useful in determining the depth to coal. At the same time the possibility of a gravity survey was discussed, and it was agreed that, as soon as staff and suitable equipment were available, the Mineral Resources Survey or its successor, the Bureau of Mineral Resources, Geology and Geophysics, would carry out tests with this exploration method.

It was not, however, until January 1948, that staff and equipment were available to commence the gravity tests. A party comprising a Geophysical Officer from the Bureau, and four University students carried out field work during January and February, using a Humble-Truman gravimeter. Later, a substantial number of the readings were repeated with a more modern type of gravity meter, and a few new stations established. The results were subjected to a preliminary investigation soon after the completion of the field work, but it was evident that a much more detailed study would be required before an interpretation could be completed. Owing to staff shortages and urgent commitments on other projects, it became necessary to postpone the completion of the office investigations and they were not resumed until late in the year.

Before the geophysical test was started, discussions took place between technical officers of the Commission and of the Bureau with a view to selecting an area for testing on which the results could be related to some of the known geological structures, and on which information useful to the Commission might be obtained. An area was selected in the Parish of Hazelwood, to the south of the town of Morwell. The area is approximately triangular in shape, and is bounded on the east by the Ridge Road, on the west by the Morwell River, and extends from the intersection of these two to approximately one mile north of the Hazelwood Railway Siding. The northern portion of the area had been explored in some detail by drilling, but on the southern portion only scout drilling had been carried out with drill holes on a one mile grid.

It was on this southern portion that it was thought that the gravity survey could be of direct assistance to the Commission in correlating the information between the scout bores.

During the field work close contact was maintained between the field party and officers of the Commission engaged in exploring the coal deposits. The co-operation of the Commission in providing facilities for carrying out the survey was greatly appreciated.

GEOLOGY.

The Geology of the area has been described by H. Herman ("Brown Coals of Victoria" - Bulletin No.45 of the Geological Survey of Victoria) and A. B. Edwards in his paper "The Composition of Victorian Brown Coals".

Edwards' interpretation is that the Latrobe Valley is actually a graben in which the Tertiary coal measures were deposited. Smaller faults have caused two major formations. These are the Morwell dome and the Traralgon trough. In the Morwell dome there are three thick coal seams totalling over 1000 feet. In descending order these are the Yallourn, Morwell I and Morwell II seams. They have been warped into a dome by converging fault movements and in the central part erosion has removed the Yallourn seam and some of the Morwell I seam. The Traralgon trough is an area between Morwell and Loy Yang and in it the uppermost coal seam is covered by several hundred feet of sediments.

The main Geological feature of the area covered by the gravity tests is a fault whose strike is approximately north-east--south-west and which appears to closely follow the Ridge Road. The coal measures are folded into a monocline over this fault (Morwell Monocline).

To the west, decomposed basalt was struck in many of the bores at depths which varied considerably. In bore 111 it was reached at 21 feet while bore 110, 1 mile to the east, went through 472 feet of coal in two seams before reaching the decomposed basalt at 609 feet.

The Morwell I seam varies greatly in thickness in this area. There was no coal found in bore 111, whereas bore 276 passed through 537 feet of this seam. This is probably not a true indication of coal thickness because it appears likely that the coal is dipping steeply at this point and that the bore did not intersect the seam at right angles. However, there appears to be a general increase in thickness to the north and east.

The Yallourn seam is intersected again in bores in the north-east corner of the area and also east of the fault which coincides with the Ridge Road, where down-faulting has protected the seam from erosion.

METHOD USED.

The survey was commenced using a Humble-Truman Gravity Meter. A party comprising four University students, who were employed for vacational work by the Bureau, did the actual field work and whatever surveying was necessary. Using this instrument the party occupied a total of 191 gravity stations.

Owing to the large number of roads and fences in the area, very few traverses were actually surveyed. In general they were laid out along roads, fences or a line of bore-holes and located on a map, thus saving a considerable amount of time.

During the course of this survey it was found that the Ridge Road was subject to seismic disturbances. An irregular oscillation of up to 15 scale divisions occurred in the gravimeter and made work impossible on some days.

Later a Western Gravimeter was taken to the area and 57 old stations and 9 new stations were occupied. The limiting sensitivity of the Humble-Truman gravimeter is ± 0.1 milligal,

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whereas that of the Western is ± 0.02 milligal, so more accurate results were obtained on the second trip.

The two sets of results were considered together and the Humble-Truman readings corrected to bring them in line with the Western readings which were taken as correct. A gravity contour plan was then drawn from the results (G.39-1).

To assist in the preliminary interpretation of the results, a contour map was prepared showing the variations in thickness of the coal to the bottom of the Morwell No.1 Seam, and this was compared with the gravity contour plan. The reason for this approach was that it was believed that the gravity results would be influenced to a large degree by variations in the thickness of this seam, and any correlation between the coal thickness contours and the gravity results would prove very useful in correlating between the scout bores.

There was a fair correlation between the two, and it was evident that in a general way the gravity results indicated the geological structure of the area. However, the gravity changes were too large to be directly correlated with variations in coal thickness, and, in fact, only half the gravity change could be ascribed to this cause. It seemed a reasonable assumption that that part of the gravity change which was not accounted for by variation in coal thickness was due to variations in the depth to the basement rocks.

A number of geological sections were drawn, making use of bore information on the sections, and assuming a basement topography which was consistent with the geological structure of the coal seams. Gravity changes were calculated for these sections, and the sections were modified until the calculated gravity profiles fitted reasonably well with the observed profiles. The geological sections which were most consistent with the observed gravity changes were then used as a basis for interpreting the remainder of the gravity results.

INTERPRETATION OF RESULTS.

The main advantage of the gravity results obtained in this survey was that they could be used to construct geological sections and thus assist in the correlation of information obtained from boring. Three such sections were drawn at right angles to the gravity contours.

The first of these went through bores 245, 276 and 127 (G.39-2). The calculated gravity profile did not fit the observed curve very well in the vicinity of the fault running along the Ridge Road, but showed the same gravity gradient going west from the fault. The section drawn shows a gradual thinning of the coal seam (Morwell I seam) towards the west.

The second section, through Bore 110 (G.39-3) shows that both the Morwell I and Morwell II (or Hazelwood) seams cut out fairly rapidly towards the west.

The third section (through Bore 112)(G.39-4) indicates that the coal seams are dipping more steeply still at this stage; that the Morwell I seam cuts out east of bore 112; and that the coal intersected in this bore was Morwell II seam with possibly another thin seam underlying it.

These results gave information necessary for the interpolation between bores on these and other sections. Section N, through bores 111, 110 and 109 on the State Electricity Commission of Victoria Brown Coal Investigation plan titled "Latrobe Valley, Sections along Lines of Boreholes Running East and West", will be considered first.

From the section on plate G.39-3, it is seen that the two seams intersected in Bore 110 are the Morwell I and Morwell II seams. These thin fairly rapidly to the west and have entirely cut out

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before reaching Bore 111. To the east of Bore 110, the coal seams are down-folded and the Yallourn seam reappears and is the thick seam found in Bore 109.

Along Section M, at Bore 98, the Morwell I seam has thinned to 20' and the 110' of coal is Morwell II.

Along Section O, the gravity results indicate that there is the full thickness of coal (including the Yallourn seam) present at Bore 113 and, therefore, this coal must be below the bottom of the bore. The 107' of coal in Bore 112 is believed to be the Morwell II seam.

On the corresponding State Electricity Commission plan showing "Sections Along Lines of Boreholes Running North and South", a similar interpretation can be made.

On Section 3, the 107' of Morwell II seam at Bore 112 has cut out before Bore 111.

Along Section 4, the gravity results indicate that the information on Bore 98 has been interpreted incorrectly. The results indicate that the 20' of coal is Morwell I seam, which has thinned considerably, and the 110' is Morwell II. These seams would then correspond with 364' of Morwell I and 108' of Morwell II at Bore 110. At Bore 36, the upper seam appears to be Yallourn and the lower seam Morwell I.

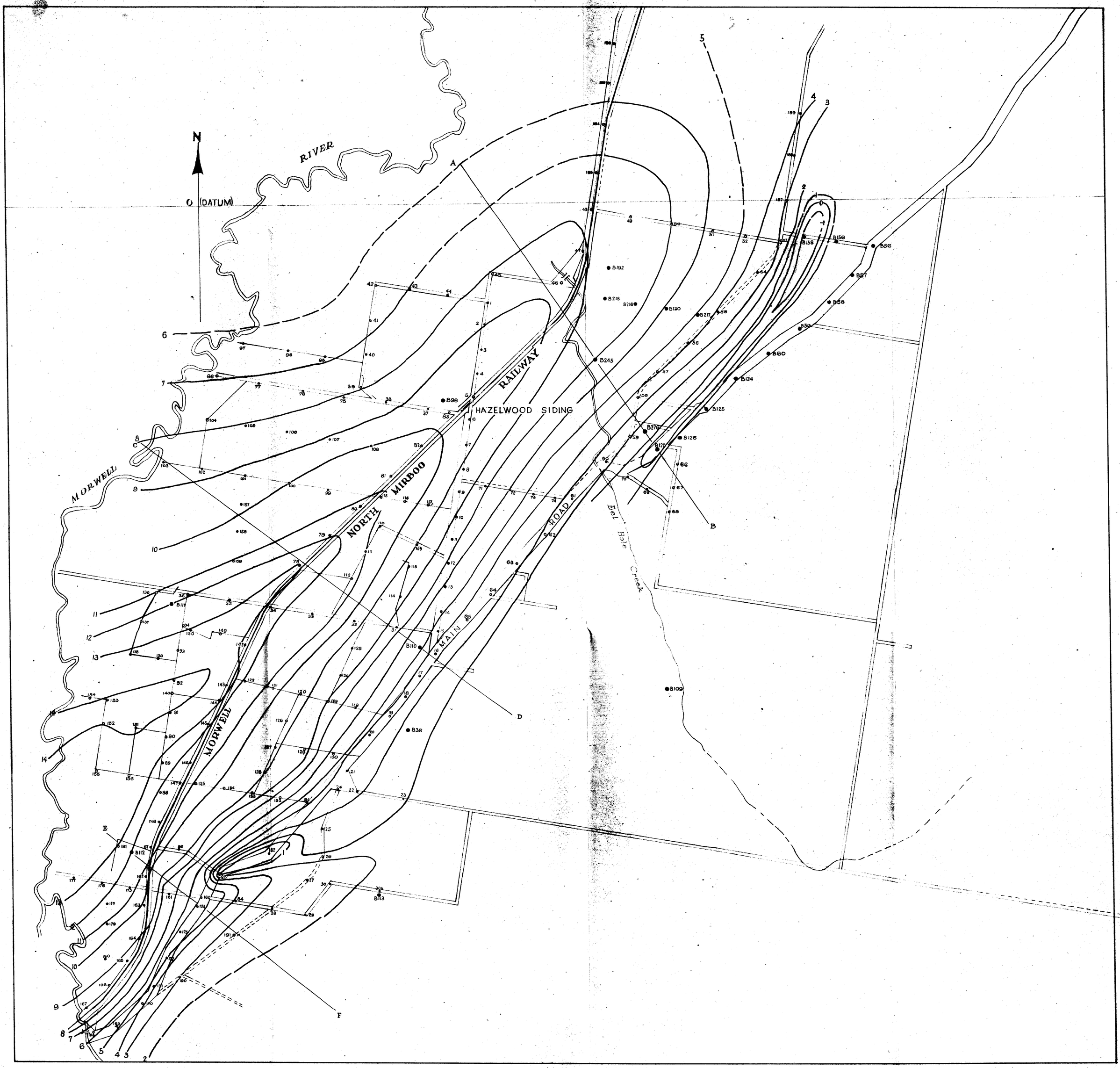
CONCLUSIONS.

It appears that, for this problem, the gravity method is of more use than electrical resistivity methods. The interpretation was hampered by lack of information concerning the basement. It is proposed to resume gravity work at Morwell shortly and by doing a larger scale survey instead of detailed work, it is possible that some useful information about the basement and thickness of sediments in the Latrobe Valley may be obtained. Even the work that was done over a very limited area during this survey tends to show some indications of a larger structural pattern.

(R. F. THYER)
SUPERINTENDING GEOPHYSICIST.

(L. W. WILLIAMS)
GEOPHYSICIST.

MELBOURNE,
1948.



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NOTE
For sections along A-B, C-D, E-F See plate numbers G39-2, G39-3 and G39-4.

Geophysicist

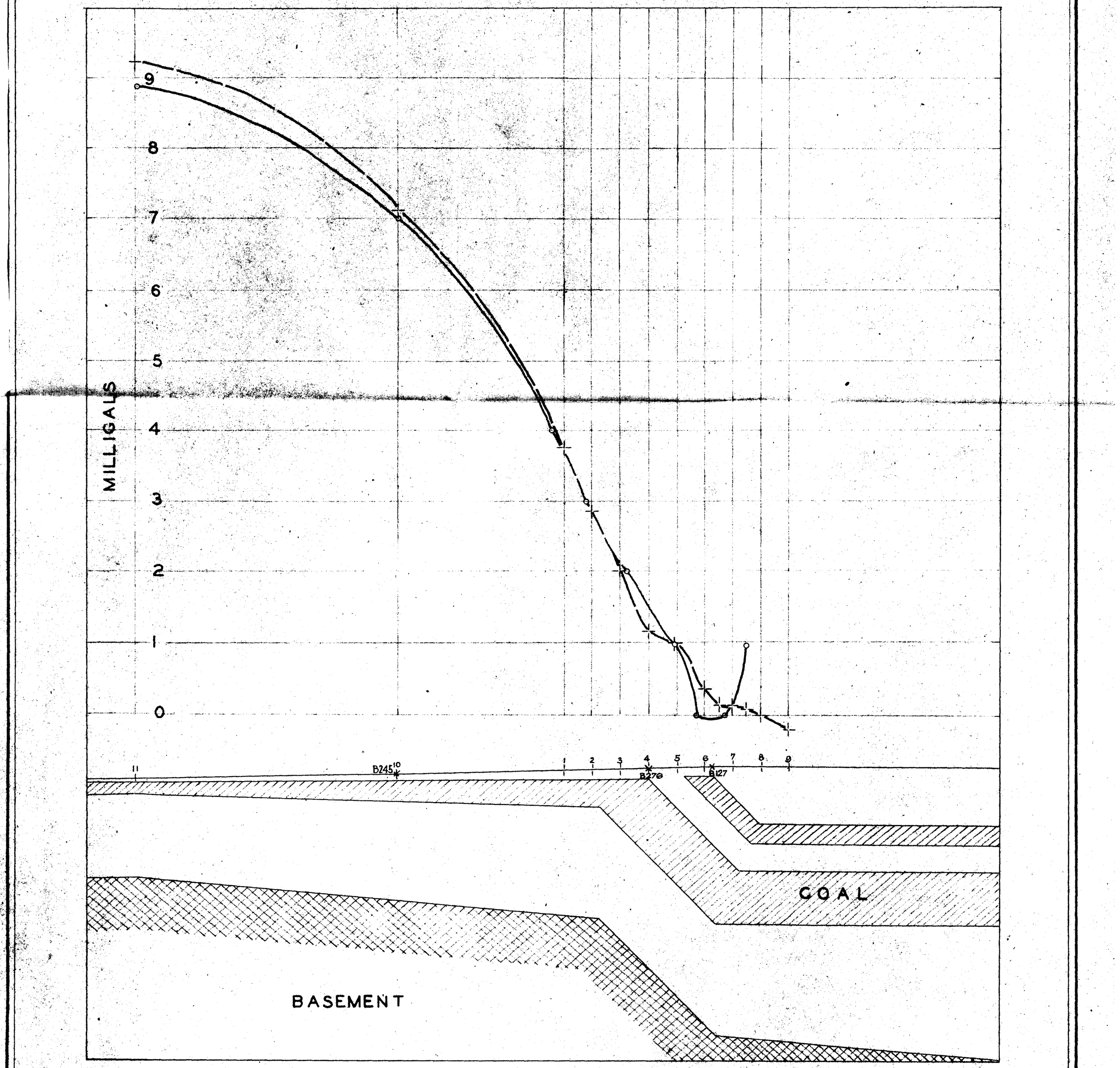
SCALE

0 1000 2,000 3,000 4,000 5,000

MORWELL GRAVITY SURVEY

SHEWING GRAVITY CONTOURS & STATION LOCATIONS IN PARISH OF HAZELWOOD.

G 39 - 1



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LEGEND

Observed Gravity

Calculated Gravity

Scale

Feet 0 500 1000 1500 2000 VERTICAL HORIZONTAL

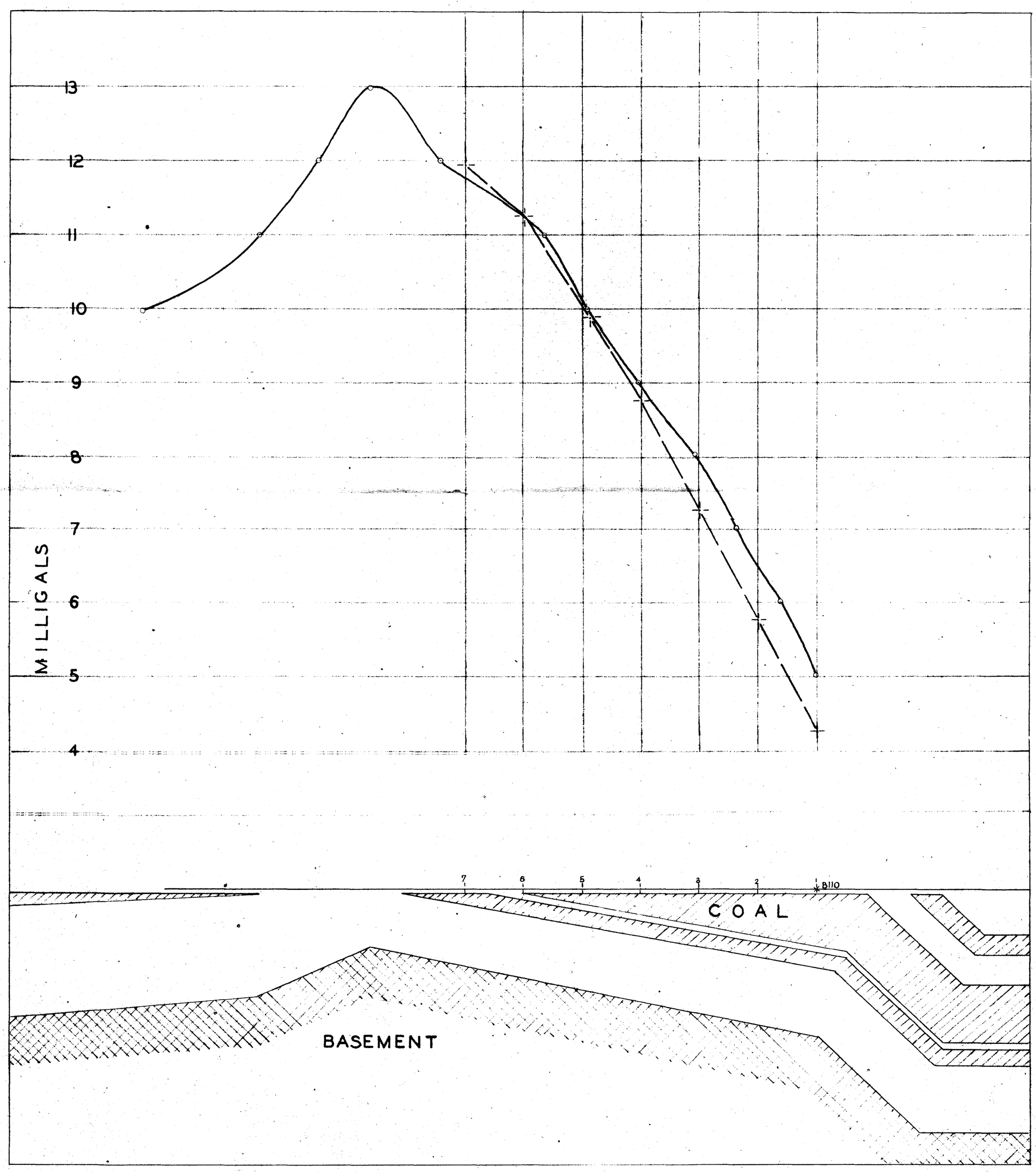
1

L. Williams
Geophysicist

MORWELL GRAVITY SURVEY

ASSUMED GEOLOGICAL SECTION THROUGH BORES 245, 276 ALONG LINE A-B SHEWING OBSERVED & CALCULATED GRAVITY PROFILES.

G39-2



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LEGEND

Observed Gravity —o—

Calculated Gravity — + —

Scale

VERTICAL
HORIZONTAL

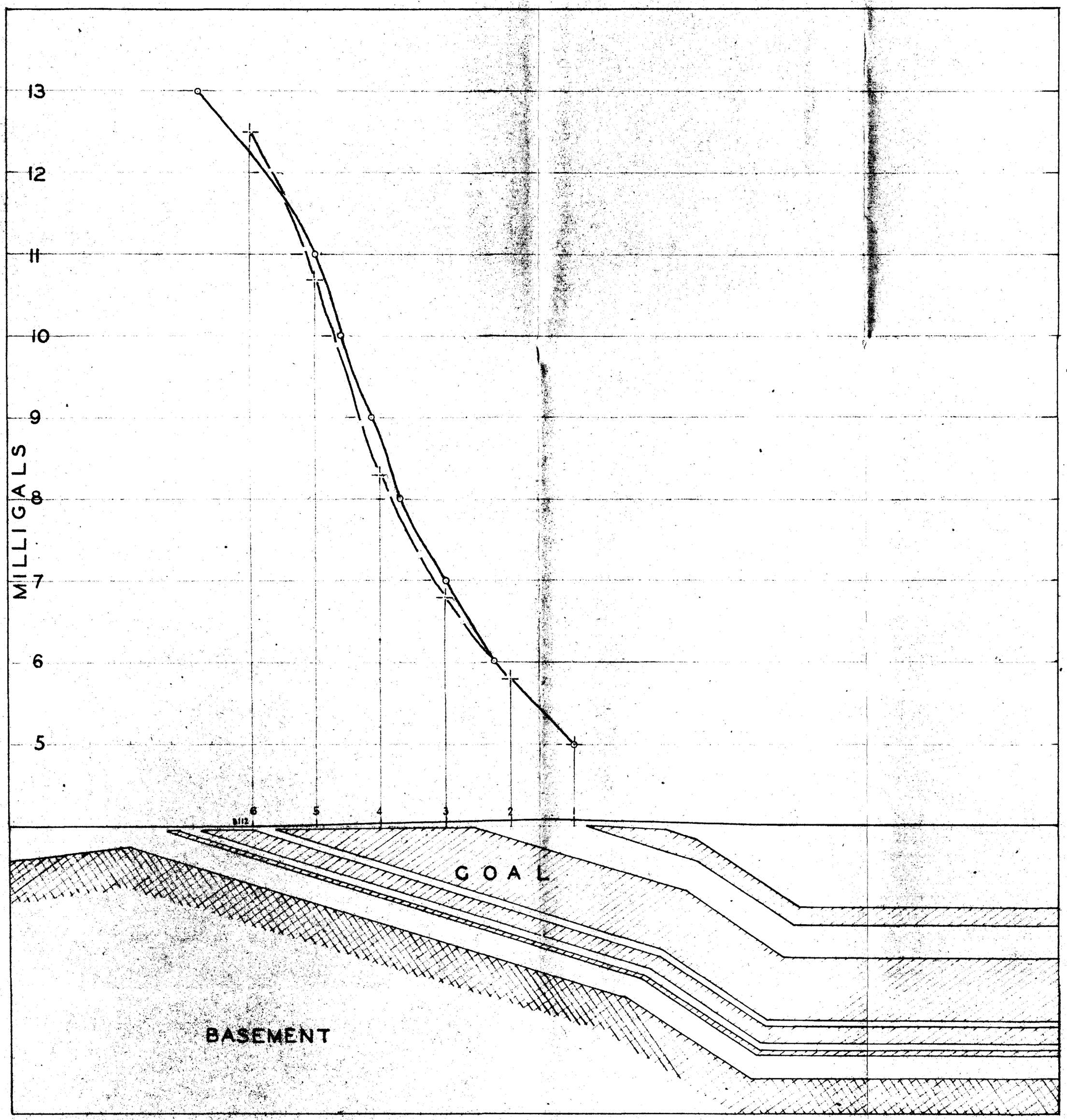
0 500 1000 1500 Feet

L.A. Williams
Geophysicist

MORWELL GRAVITY SURVEY

ASSUMED GEOLOGICAL SECTION THROUGH BORE 110, ALONG LINE C-D SHEWING OBSERVED & CALCULATED GRAVITY PROFILES

G39-3



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LEGEND

Observed Gravity —o—

Calculated Gravity ---+---

L.A. Williams
Geophysicist

Scale

FEET 0 500 1000 1500 2000 VERTICAL HORIZONTAL

MORWELL GRAVITY SURVEY

ASSUMED GEOLOGICAL SECTION THROUGH BORE 112 ALONG LINE E-F, SHEWING OBSERVED & CALCULATED GRAVITY PROFILES.

G39–4