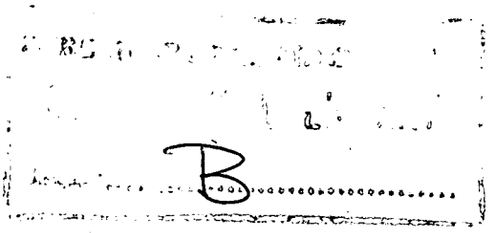
COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF SUPPLY AND SHIPPING.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

REPORT No.1948/42.

(GEOPHYSICAL REPORT NO. 4)



.....

REPORT

ON

GRAVIMETRIC SURVEY OF RESERVOIR SITE

MYPONGA, SOUTH AUSTRALIA

C. H. ZELMAN

GEOPHYSICIST

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF SUPPLY AND DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

REPORT NO. 1948/42

(GEOPHYSICAL REPORT NO. 4.)

.....

REPORT

ON

GRAVIMETRIC SURVEY OF RESERVOIR SITE MYPONGA, SOUTH AUSTRALIA.

C. H. ZELMAN

GEOPHYSICIST.

REPORT

ON

GRAVIMETRIC SURVEY OF RESERVOIR SITE

MYPONGA, SOUTH AUSTRALIA

CONTENTS

		Page
I	INTRODUCTION	1
II	GEOLOGY	1
III	THE METHOD AND OPERATIONS	1
IV	RESULTS AND INTERPRETATION	2
V	DRILLING RECOMMENDATIONS	3
VI	CONCLUSION	3

LIST OF PLATES

PLATE 1	Plan of Gravity Survey of Myponga Dam Site	G. 31-1
PLATE 2	Surface and Gravity Profiles of Myponga Dam Site	G. 31-2

GRAVIMETRIC SURVEY OF A RESERVOIR SITE, MYPONGA, SOUTH AUSTRALIA.

I. INTRODUCTION

The gravity survey covered by this report was undertaken at the request of the South Australian Department of Mines as part of the investigation of a proposed reservoir site at Myponga, South Australia. Myponga is about 40 miles south of Adelaide and the proposed reservoir would serve Yankalilla and other neighbouring towns which at present have no reticulated water supply.

II. GEOLOGY

As part of the investigation into the suitability of the site, a preliminary geological survey was made by officers of the South Australian Department of Mines. This examination showed that although the proposed weir would be on impervious Precambrian slates, the reservoir would be crossed by porous beds of Tertiary grits and sandstones overlying the Precambrian rocks for a portion of the area to be submerged. It was suspected that the Tertiary sediments filled an old valley and it was feared that if this valley was of considerable depth, it would allow serious leakage from the reservoir into lower creeks to the south west. However, before initiating a drilling programme it was recommended that geophysical methods be applied to see whether or not such methods could indicate the thickness of the Tertiary sediments, and so guide the drilling to the deepest parts of the suspected valley.

III. THE METHOD AND OPERATIONS

The survey was carried out during May, 1948 by officers of the Bureau of Mineral Resources, Geology and Geophysics (Department of Supply and Development) using a Heiland gravity meter.

As the Tertiary sediments were known to be lighter than the Precambrian rocks, an increase in thickness of the Tertiary sediments would result in a corresponding decrease in the value of "g". Therefore the gravity method was considered to be a suitable one to use.

Three roughly parallel traverses crossing the area occupied by the Teritary sediments were read. If a Tertiary filled valley did in fact exist, then these traverses would have crossed it.

The terrain was hilly and corrections for the change of "g" with elevation were quite large compared with the anomalies. There were no contour maps of the area available for use in calculating terrain corrections and no such corrections were made. However, changes in slope over the area were not great and terrain corrections would be very small compared to the elevation corrections.

Figures for the densities of the various rocks in the area were supplied by the South Australian Department of Mines and are listed below.

/2..

APPARENT SPECIFIC GRAVITIES

Sample Number	Apparent Specific Gravities	Remarks
	Precambrian	
399	2.70	(1) Silty slate
400	2.39	(2) Slate
401	2.41	(3) Quartzite
	Tertiary	
402	2.26	(4) Grit (Compact, silicified)
403	1.80	(5) Fine grained sandstone

Because the specimens tested were few in number and taken from surface outcrops subject to weathering, they cannot be regarded as truly representative of the Precambrian or Tertiary rocks as a whole. The table above shows values for Precambrian rocks ranging from 2.39 to 2.70 and for Tertiary from 1.80 to 2.26. Hence these determinations cannot serve other than to indicate in a general way that the Tertiary rocks are less dense than the Precambrian rocks.

IV. RESULTS AND INTERPRETATION

A plan of the area is shown on the accompanying Plate 1. Profiles of the surface and of reduced gravity values along the three traverses are shown on Plate 2.

In the interpretation of the readings it is important to know the densities of the materials in the area. These densities may be determined by actual density measurements where good representative samples as from drill cores can be obtained; or the gravity readings may be analysed to determine the most probable value of the elevation correction factor, which is a function of the density. In the present survey the latter was the only course available, and by using stations along the traverses for this purpose, an elevation correction factor of 0.065 was selected as the most suitable. This factor corresponds to a density of 2.26 which probably represents a combined density of the Tertiary with some of the Precambrian beneath it. This is explained by the fact that the elevation correction attempts to reduce all readings to the one elevation, and the rocks above this elevation are, in places,,part Tertiary and part Precambrian.

The densest of the Tertiary specimens tested was a compact and silicified grit with an apparent specific gravity of 2.26, but to be consistent with the value adopted as being the most probable elevation factor the overall density of the Tertiary material would be less than this.

A wide range of elevation correction factors was tried before selecting the value of 0.065, and all produced higher reduced gravity values over the silty slates than over the quartzites. This was to be expected from the results of the actual density determinations which showed the silty slates to be denser

/3..

than the quartzites.

Basement rocks are exposed at both ends of each traverse, slates at one end and quartzites at the other. It is possible that variations in gravity recorded are due entirely to variations in density within the basement, and that the Tertiary cover is too thin and constant in thickness to produce any appreciable variations in gravity. However, an examination shows that over the Tertiary sediments the gravity profiles have a gently arched shape with a minor trough, marked by the hatched areas, crossing the three traverses at stations 45, 57 and 17 respectively. It is believed that this trough is due to a thickening of the Tertiary sediments and marks a minor valley in the basement rocks.

The gravity results seem to indicate that there is no general broad valley in the basement rocks nor any great thickness of Tertiary sediments. It is believed that the lowest elevation in the basement rocks along any given north-south section will be found in the centre of the minor valley referred to above. There is not sufficient evidence to show definitely in which direction this valley slopes, but the only practical point of importance is to prove that on at least one of the north-south sections the lowest elevation of the impervious rocks (that is in the centre of the valley) is above the proposed water level. It should be noted that the application of the elevation correction to the gravity readings in effect reduces these readings to what they would have been if read on a horizontal plane; so that the trough corresponds to an increase in thickness of the Tertiary sediments below the reference plane. Due to variations in surface elevations the greatest thickness of Tertiary would not necessarily be where this trough occurs, but the centre of the trough would correspond to the lowest elevation of the basement rocks.

The results on the most easterly traverse could be explained by assuming a slate-quartzite contact near Station 34 with a very thin covering of Tertiary sediments overlying quartzites between Stations 34 and 39, while to the north of Station 34 the slates are covered by a somewhat thicker Tertiary layer reaching its maximum depth at the centre of the supposed trough near Station 45.

A similar explanation could be offered for the gravity results on the other sections but it is evident that the uncertainty in density distribution within the basement rocks makes such attempts at explanation of doubtful value.

V. DRILLING RECOMMENDATIONS

It is recommended that in the initial stages of testing by boring, one bore be put down at Station 45 and that two or three be placed to straggle the strongest indication near Stations 16 and 17. The suggested positions are shown on Plate 1.

VI. CONCLUSIONS

It has been pointed out that the reason for this survey was to determine the existence or otherwise of a valley in the Precambrian rocks, filled with porous Tertiary sediments. As these Tertiary sediments are less dense than the Precambrian rocks beneath them, a considerable thickness of them would give rise to lower relative

/4...

gravity readings. If there was a wide Tertiary filled valley as suspected from the geological examination, it would probably be reflected in the gravity profiles as a broad trough. However, the profiles in general are somewhat arched with a small trough in each at stations 45, 57 and 17 respectively.

Hence it might be expected that there is no general broad Tertiary filled valley, and that it is probable that the Tertiary cover is not of great thickness. However, there may be a narrow valley through the area surveyed, and it is this valley which should be first investigated by boring.

C H Zelman.

(C. H. ZELMAN)
Geophysicist.

Melbourne.
9th July, 1948.

Plate I.

Myponga Creek

APPROXIMATE

Precambrian Slates

Tertiary Grits & Sandstones

RESERVOIR

MARGIN

HUNDRED OF MYPONGA

715

714

80

MAIN ROAD

To Myponga

To Yankalilla

Tertiary Grits & Sandstones

Precambrain Quartzites.

N

MAG

TRUE

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GRAVITY SURVEY OF MYPONGA DAM AREA

Recommended Bore Sites ⊙2

Gravity Stations •27

Approximate Precambrian-Tertiary Contact Precambrian / Tertiary

SCALE 200 100 0 200 400 600 800 700 Feet

Topographical Survey and Geology by S.A.G. Dept of Mines.

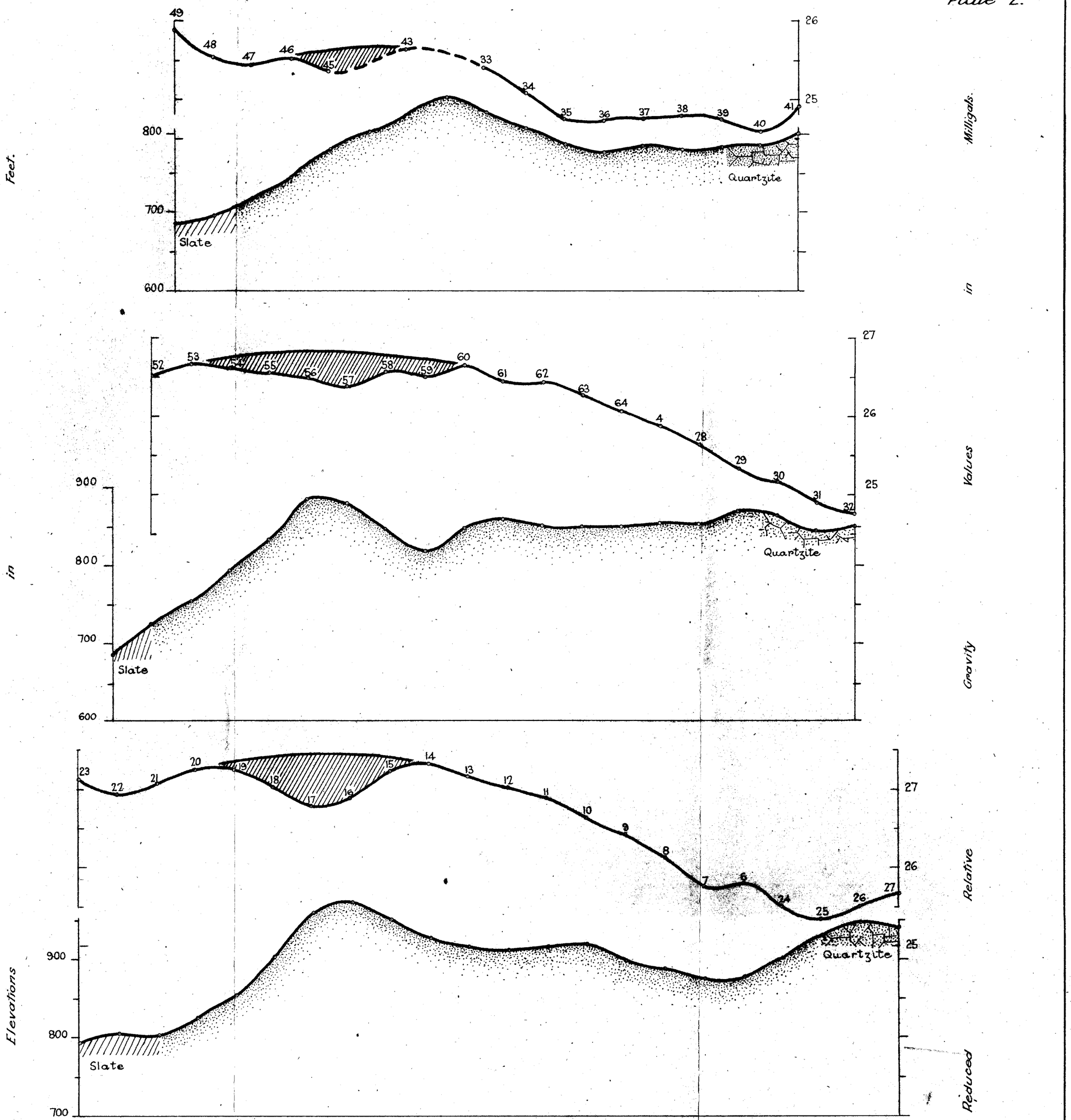
L. W. Zelman.
Geophysicist
21-6-48.

G31-1.

KAS 7.7.48.

G31-1

Plate 2.



BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

SURFACE & GRAVITY PROFILES OF MYPONGA DAM AREA

Reduced Relative Gravity profiles shewn thus:- 31 32

Surface profiles shewn thus:-

Elevation Correction Factor = 0·065.

C.A. Zelman.
Geophysicist
21-6-'48.

G31-2.

K.A.S. 13.7.48.

G31-2.