

TR16-97-105

17. Devonport-Port Sorell gravity survey.

D.E. Leaman

Two regional gravity surveys have previously been carried out in the area; Longman and Leaman (1971), present a very general coverage of the whole area while Leaman *et al.* (1973) give a more detailed outline of the eastern part of the area, near Port Sorell. These two surveys revealed some large negative anomalies and since it is proposed to examine groundwater potential of the area it was decided to improve the gravity coverage in order to define the structures in greater detail. The negative anomalies are related to Tertiary sedimentary and volcanic rocks and since these rocks have the greatest water-yielding potential it is necessary to know the extent and thickness of the deposits.

A series of resistivity depth probes was also undertaken at the time of the gravity survey but difficulties arising from ground resistance, and from interpretation have precluded their use as a control on the gravity interpretation. As no correlation can be made from most of the resistivity depth probes all control on the gravity interpretation is derived from the series of boreholes drilled for oil (Burns, 1964; Gee and Legge, 1973).

GRAVITY SURVEY

The initial regional coverage of Longman and Leaman (1971) was accurate to about ± 0.3 mgal in the Bouguer anomaly. The degree of accuracy was largely due to the use of barometric height determinations; there was no terrain correction. The subsequent survey of Leaman *et al.* (1973) was of comparable reliability but was terrain corrected to a radius of 19 km.

Local base for both surveys was station 6751.0571 on the Frankford Highway at the junction with Bakers Beach Road. The principal tie station within the area is 6751.0586 at the centre of the Sassafras, E. Harford road junctions. Observed gravity at 6751.0586 is 980271.14 mgal. Additional observations coded 7151.4000+ have been made within previous coverage. Stations coded 7151.1300+ are part of the Tamar survey of Leaman *et al.* (1973). All stations, including those of Longman and Leaman (1971) have been terrain corrected. The station distribution is shown in Figure 26.

Worden meter no. 273 with scale factor of 0.1008 mgal/division was used for all the surveys. Stations are located to within 50 m and heights to within 2 m.

GEOLOGY

The geological sketch map of the area (fig. 27) is based on mapping by Burns (1963) and Gee and Legge (1971). No attempt has been made to indicate the detail of the Cainozoic succession although interbedded basalts, clays and sands are present. Details of the various boreholes are summarised below and complete logs are given by Burns (1964) and Gee and Legge (1973). The principal 'basement' rock appears to be dolerite which is intruded, at least in the eastern part of the area, at a fairly low level in Permian rocks which overlie Cambrian(?) slate and quartzite.

Burns (1964) considered that the Tertiary series occupied a double lead system with a major N-S lead from the coast through Wesley Vale and a secondary minor lead from the area south-east of East Devonport running parallel to the coast to join the major lead near Northdown. He was not aware of the outlet, although this must lie between Northdown and Pardoe Point. The channel was believed to be post-faulting and erosional in nature.

5 cm

DEVONPORT - PORT SORELL GRAVITY SURVEY

0 1 2 3 4 5 Km

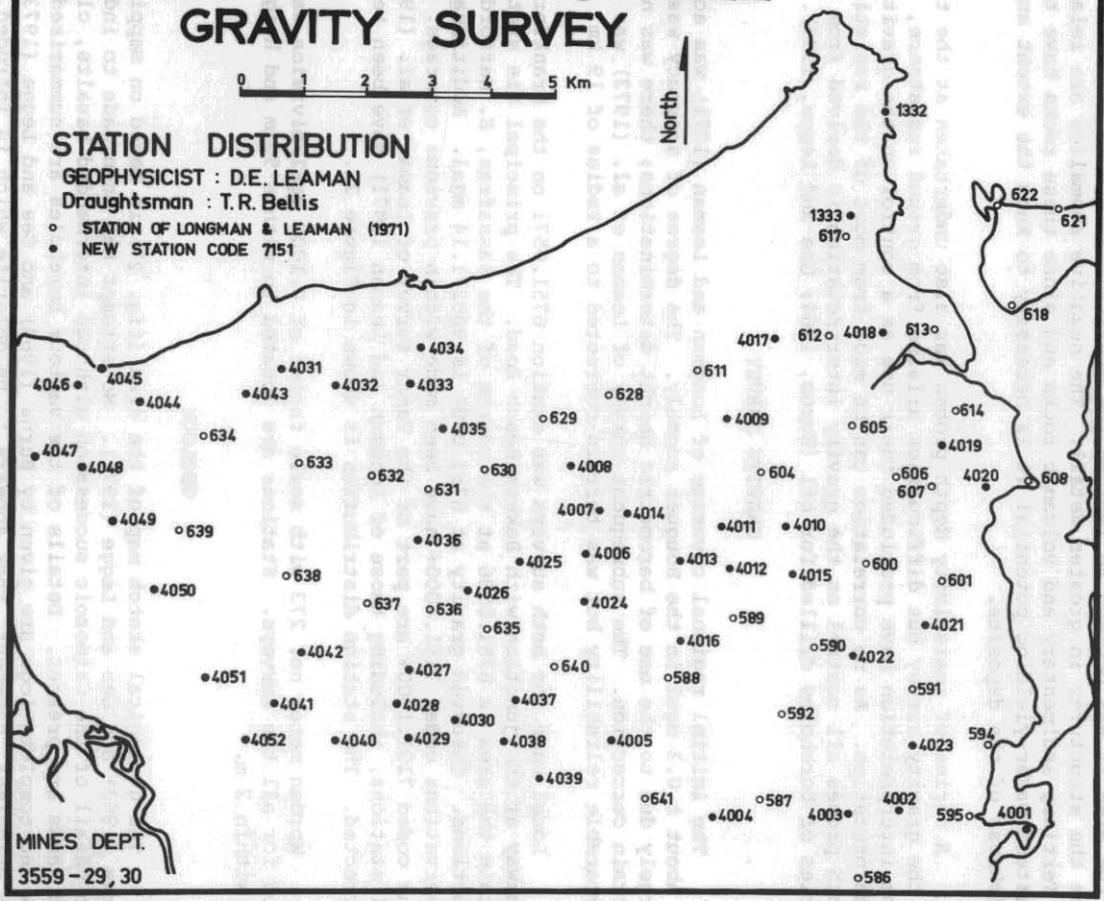
North

STATION DISTRIBUTION

GEOPHYSICIST : D.E. LEAMAN

Draughtsman : T.R. Bellis

- STATION OF LONGMAN & LEAMAN (1971)
- NEW STATION CODE 7151



MINES DEPT.
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Figure 26.

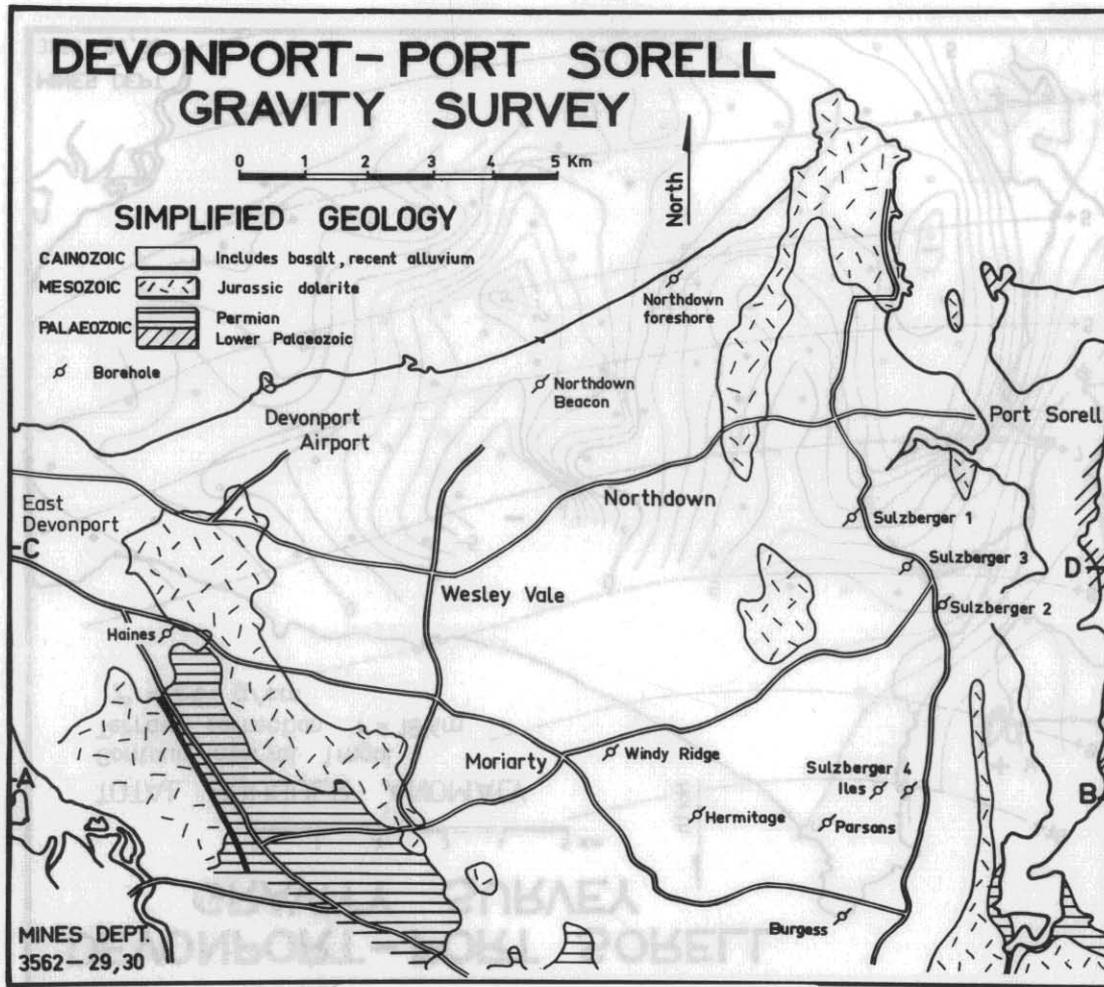
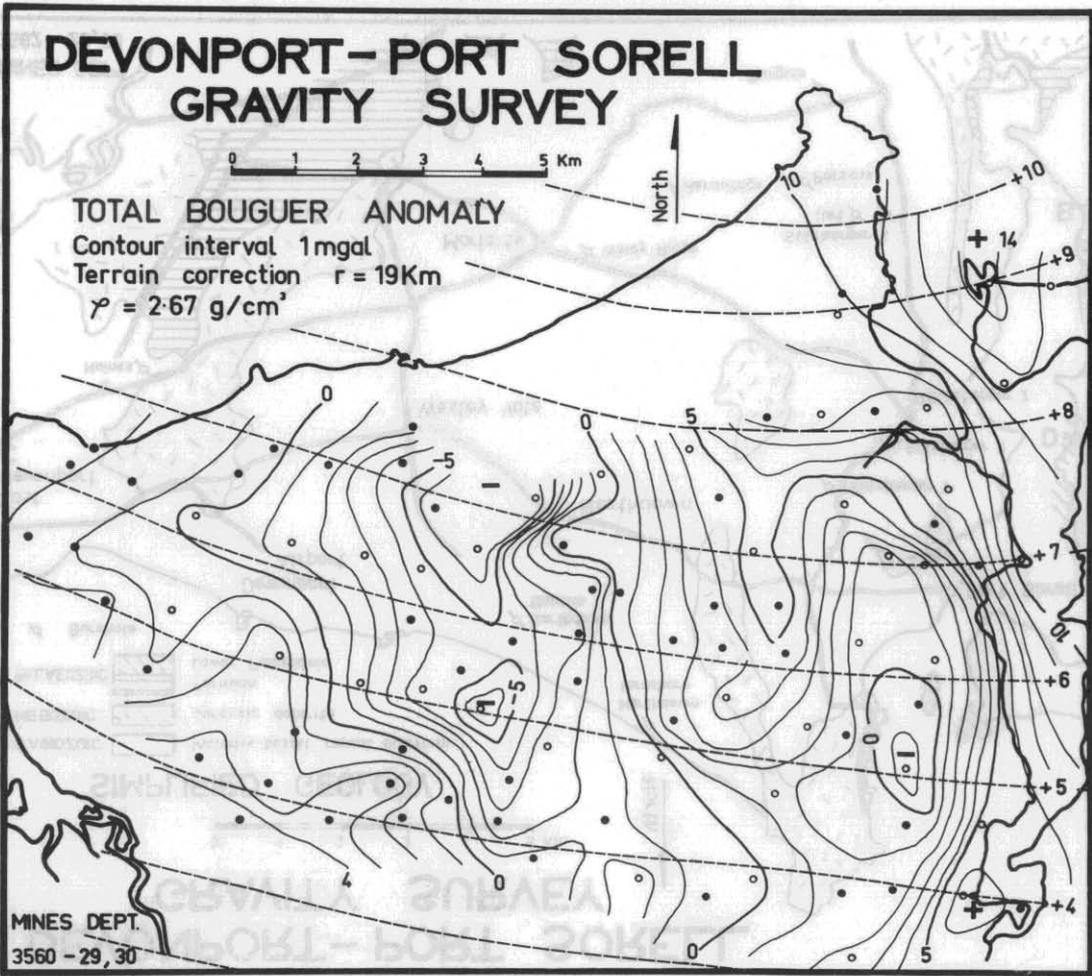


Figure 27.



100

Figure 28.

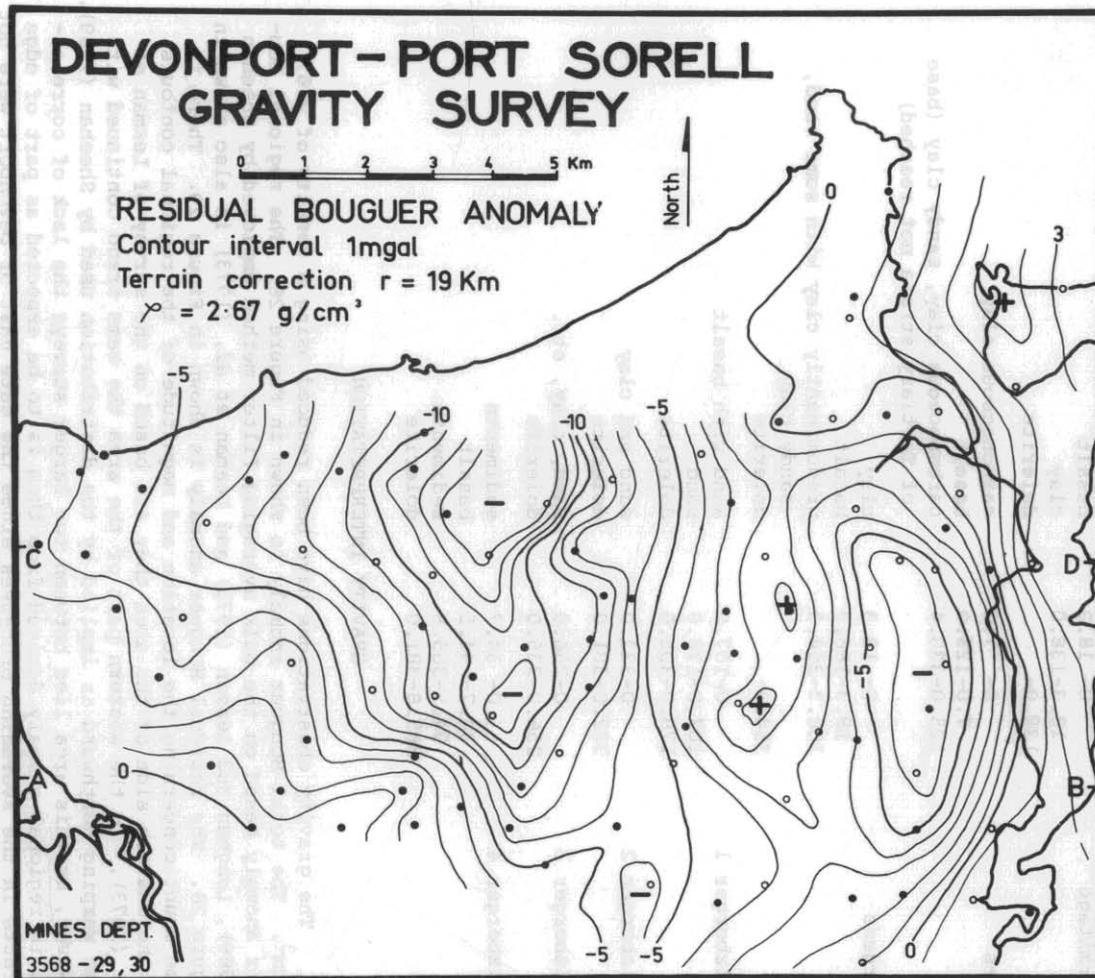


Figure 29.

No drill logs are available for the boreholes at Northdown Beacon and foreshore, although Burns (1964) states of the Northdown Beacon that it 'met bedrock at a shallow depth...'

Borehole	Depth (m)	Rock type
Parsons Bore	0- 18.3	clay and gravel
	18.3-115.8	basalt
	115.8-351.0	clay and sand
	351.0-	dolerite
Hermitage	0- 18.3	basalt
	18.3-138.0	clay
	138.0-	dolerite
Iles	0- 7.0	carbonaceous clay
	7.0-125.0	basalt
	125.0-338.4	carbonaceous clay, sandy clay (base of Tertiary strata not reached)
Burgess	0- 18.3	clay
	18.3-186.3	basalt
	186.3-354.3	predominantly clay with some sand, sandy clay
	354.3-	dolerite
Sulzberger 1	0-107.0	sand with basalt
	107.0-178.0	sand
	178.0-305.0	dolerite
Sulzberger 2	0-332.0	sand and clay
	332.0-381.0	dolerite
Sulzberger 3	0-256.0	sand, clay, etc.
	256.0-335.0	dolerite
Sulzberger 4	0- 34.7	sediments
	34.7- 94.5	basalt
	94.5-365.8	sediments
	365.8-381.0	dolerite

GRAVITY INTERPRETATION

The gravity observations have been reduced using a density of 2.67 g/cm³. The total Bouguer anomaly is shown in Figure 28. The regional Bouguer anomaly based on the bulk averaging filter method employed by Sheehan (1969), Longman and Leaman (1971) and Leaman *et al.* (1973) is also shown in Figure 28. The residual Bouguer anomaly is shown in Figure 29. There is some doubt concerning the location and magnitude of the regional contours. On the eastern side of the area they are based on the survey of Leaman *et al.* (1973). In the western part of the area the same trend continued with some warping northward as implied by the distribution used by Sheehan (1969). However, as this area lies between two larger surveys the lack of correlation in regional anomaly derived from them is to be expected as part of edge effects in the averaging processes since the data east of Devonport were not available at the time of Sheehan (1969). Further as this is a relatively small area anomalies within it may be affected by large local features in sub-Cainozoic materials. A significant positive anomaly occurs immediately east of Port Sorell and as it is related to Cambrian(?) rocks on a folded structure which 'thins' westward (see Leaman *et al.* 1973), this may lead to asymmetry in the Cainozoic-anomaly relationships.

The following density values, and contrasts with the reduction density, have been employed throughout.

Tertiary sediments	2.00 g/cm ³	-0.67 g/cm ³
Tertiary basalt	2.87 g/cm ³	+0.20 g/cm ³
Jurassic dolerite	2.90 g/cm ³	+0.23 g/cm ³
Permian rocks	2.57 g/cm ³	-0.10 g/cm ³
Cambrian(?) rocks	2.75 g/cm ³	+0.08 g/cm ³
Precambrian basement	2.67 g/cm ³	0.00 g/cm ³

It should be noted that the figure quoted for basalt is a bulk estimate. The quality of the basaltic rocks of this area is variable and while some parts of the flows present may have densities as high as 3.20 g/cm³ other scoriaceous or weathered zones may be less than 2.60 g/cm³. The figures used for dolerite, Permian and Precambrian rocks are bulk averages based on known data (refer to earlier surveys), while that quoted for the Cambrian(?) rocks is also an estimate due to their great variability.

Two sketch profiles are shown in Figure 30. Lack of control is notably lacking in the Wesley Vale-Moriarty basin. In general, the calculated and observed profiles match reasonably well when all known geologic factors are considered. These are:

- (1) Cambrian sedimentary rocks thinning to the west.
- (2) Permian sedimentary rocks thickening westward or related upward transgression of dolerite sheet westward.
- (3) Fault controlled Tertiary basins.
- (4) Controlled thickness of Tertiary sediments in the Port Sorell basin.

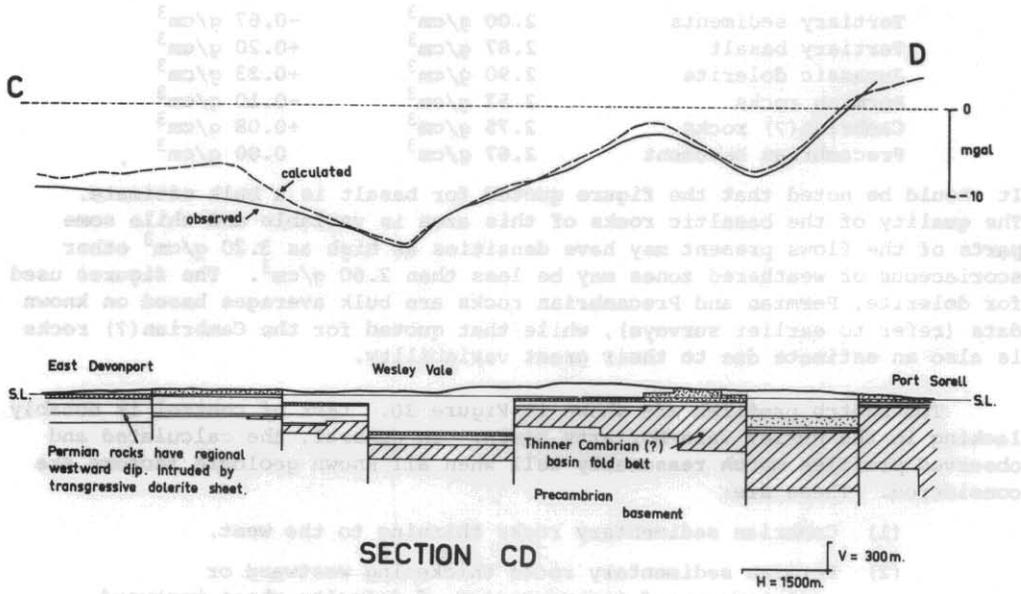
Inspection of the gradients indicates sharp, probably fault-produced escarpments. In calculating the profiles AB, CD no allowance has been made in the Wesley Vale-Moriarty basin for any basalt that may be present. Thus the estimated depth of 400-500 m could be too low. It should be noted that if the residual Bouguer anomaly is affected by an E-W local regional effect due to the Cambrian(?) basement, which hopefully has been fully corrected, then the Wesley Vale basin could be 100 m shallower. Until control points are available for the interpretation it should only be regarded as semi-quantitative and, in part, sketchy.

CONCLUSIONS

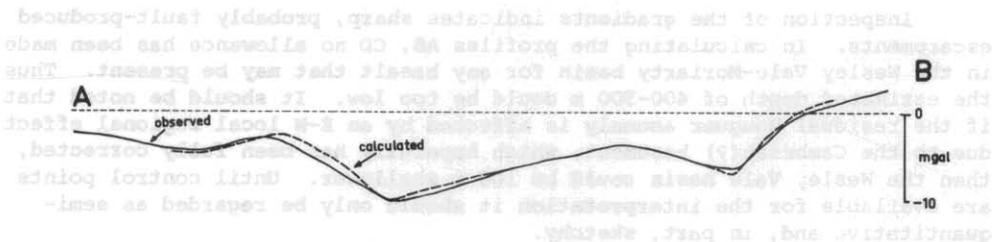
This survey confirms the presence of two deep basins between East Devonport and Port Sorell of which that at Port Sorell is 100 m shallower (c.350 m deep) than that at Wesley Vale. The two basins are only a short distance apart; if there is any connection between them it could only be in the form of a deep, narrow gorge. The Port Sorell basin was apparently land-locked.

The Wesley Vale-Moriarty lead is very much larger, has a slight western component to its trend and extends southward to Sassafras. The survey suggests an outlet to Bass Strait near Northdown Beacon. In this respect the survey has confirmed the views of Burns (1964). However the second lead proposed by him parallel to the coast near the airport does not exist.

The basins appear to be fault-controlled erosion troughs which have been subsequently filled with sediment. The steep gradients and the irregular nature of the basin boundaries suggest fault escarpments cut into by ravines.

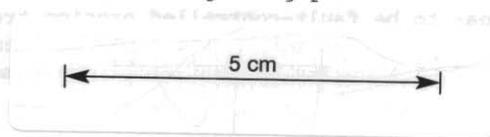


SECTION CD



SECTION AB

Figure 30. Devonport - Port Sorell gravity profiles.



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- LEAMAN, D.E.; SYMONDS, P.A.; SHIRLEY, J.E. 1973. Gravity survey of the Tamar region. *Bull.geol.Surv.Tasm.* 55.
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- SHEEHAN, M. 1969. *Gravity survey of the Sheffield area.* B.Sc. Thesis. University of Tasmania : Hobart.

CONCLUSION

Old filled channels have been definitely established away from the present course and it appears certain that the Scamander River once passed to the Tamar Sea at a point nearer Fairbairn than Scamander. In view of the limited equipment used for this survey and the general break-back of the curve on the underlying strata the depth estimates may be in error by 10%. To confirm the profile and establish the nature of base material remains work should be undertaken.

PART 3. SEISMIC SURVEY

The resistivity survey revealed a deep lead adjacent to the present course of the Scamander River. This has been examined by a seismic reflector survey in the region of the ridge between Scamander River and Tacon.

SURVEY DETAILS

A single 180 m spread was fired across the centre of the ridge area (between resistivity probes 43 and 64, figure 11). The dip angle was 15 m.

The seismic velocities recorded were:

- First layer: 1,200 m/sec (loose sand and gravel)
- Second layer: 1,900 m/sec (weathered slate etc.)
- Third layer: 2,000 m/sec (unweathered slate etc.)

The first layer decreased in thickness from over 10 m near depth probe 43 to only 20 m at depth probe 64.