

1977/39. Investigation of the stability of land at Legana Beach Road, Legana.

C.J. Knights

The stability of a block belonging to A. Rosevear at Legana Beach Road was examined. The land [EQ038228] is situated between two developed blocks on the lower side of Legana Beach Road, and extends from the road to the foreshore reserve. A complex of landslip features occur in the vicinity of the site and it has been zoned as unsuitable for building.

GEOLOGY

Geologically, the area is underlain by sand, sandstone and clay of Tertiary age. These are overlain by Quaternary gravel and sand. East of the land under investigation, the steep foreshore reserve has many active landslips which extend back into residents' gardens. At several locations, old landslip scars run through the gardens and extend back as far as the road.

A complex of landslip features which have the appearance of being relatively recent occur on Rosevear's block (fig. 1). Ponding behind a heaved toe area marks the north-easterly scar. The other scars show defined steepes and flats. Landslip features indicated on Figure 1 are not distinct, but merge into each other.

DRILLING

Three holes were auger drilled. The logs of the holes are given below.

Bore Hole 1. Located on upper flat, 6.2 m below road level.

Depth (m)	Description
0-0.9	Fine grey sand over laminated light fawn plastic clay close to its plastic limit.
0.9-1.8	Clay, as above.
1.8-2.7	Fine, wet sand and clay over very plastic pale white and pink clay, over stiff plastic red-brown clay with sand laminae.
2.7-3.6	Fairly soft wet grey sandy clay over moist orange sandy clay.
3.6-4.5	Moist orange sand and grey plastic clay.
4.5-5.5	Plastic brown and red-brown clay, marginally dryer than PL.
5.5-6.4	Stiff brown plastic clay with grey laminae.
6.4-7.3	Stiff grey and brown plastic clay. Overnight collapse to 3 m. Water rose to 1.8 m (August 1977).

Bore Hole 2. Located on lower flat, 12.8 m below road level.

Depth (m)	Description
0-0.9	Stiff white-grey clay with sand particles.
0.9-1.8	Stiff grey plastic clay with ironstone pieces.
1.8-2.7	Stiff plastic clay.
2.7-3.6	Stiff plastic clay with oxidised laminae.
3.6-4.5	Grey plastic clay with dark grey laminae. Softer drilling.
4.5-5.5	Stiff grey plastic clay with orange laminae. Softer drilling.

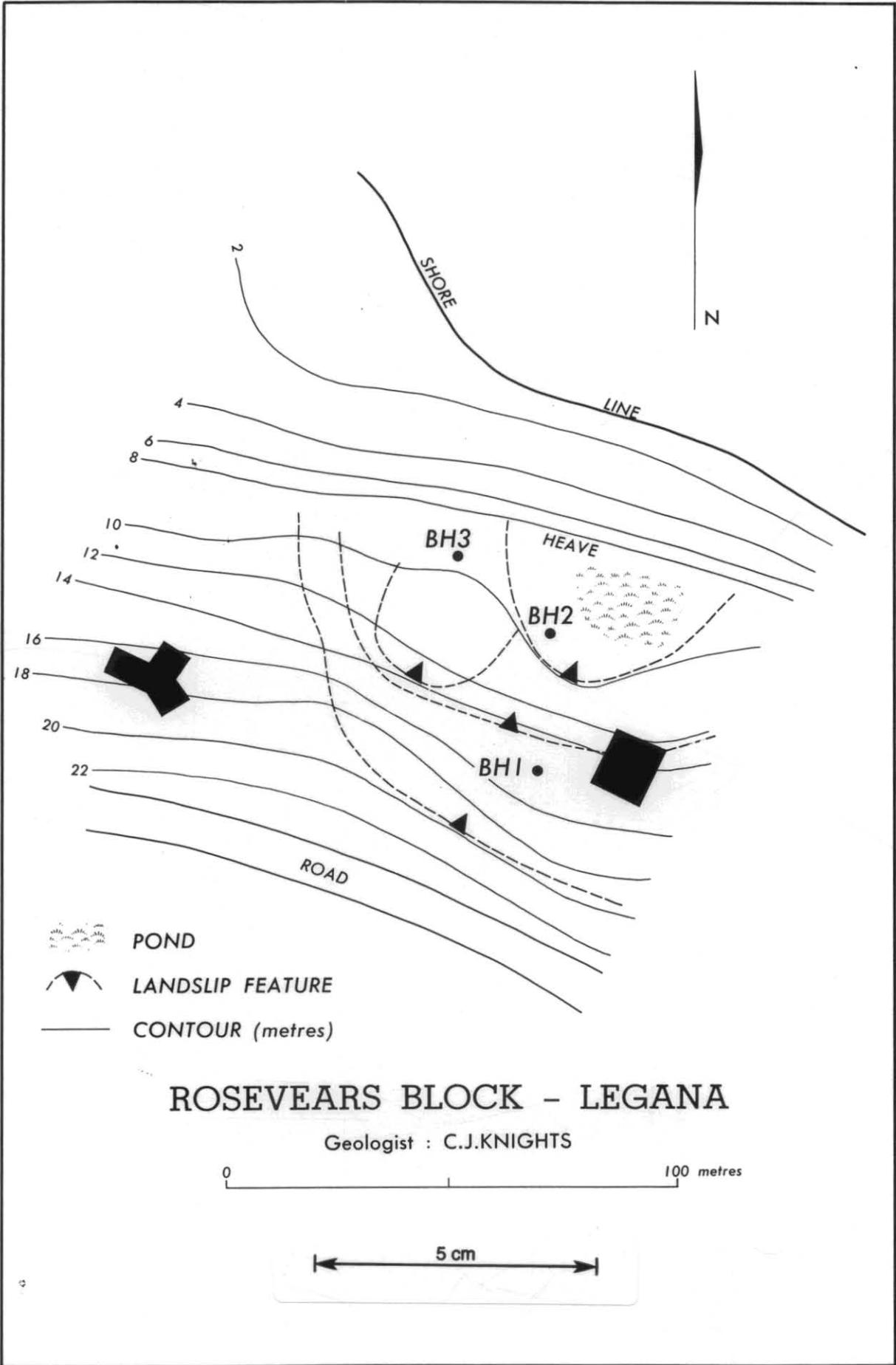


Figure 1.

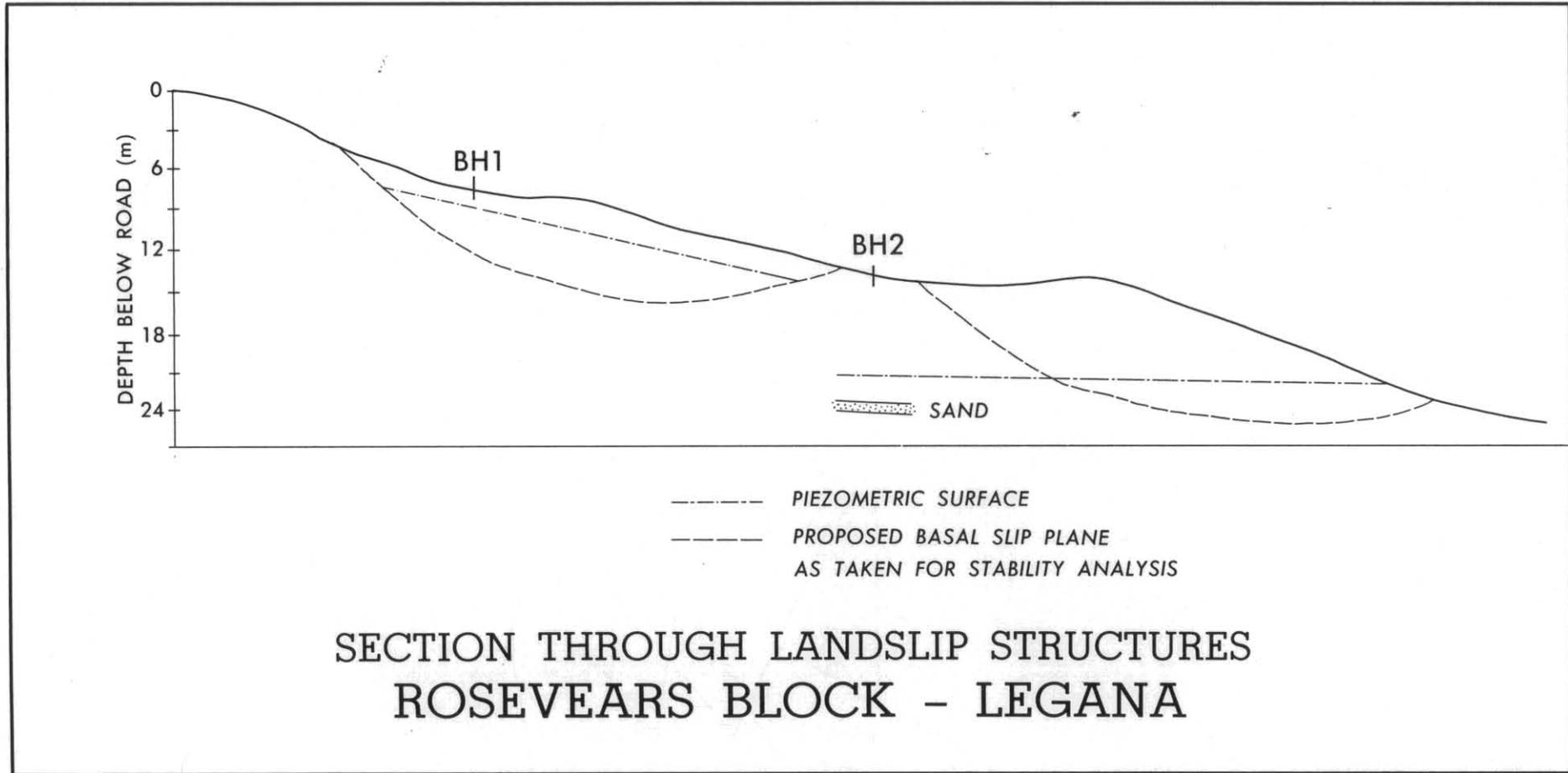
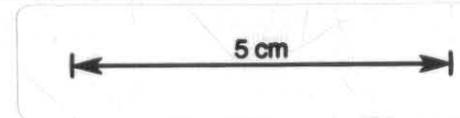


Figure 2.



Bore Hole 2. (continued)

<i>Depth (m)</i>	<i>Description</i>
5.5-6.4	Stiff grey plastic clay with orange laminae. Softer drilling.
6.4-9.0	Moist orange plastic sandy clay.
9.0-9.9	Moist orange plastic sandy clay.
9.9-10.7	Soft wet clayey sand and clay bands.
10.7	Hard band.

Bore Hole 3. Located on western flat, 12.2 m below road level.

<i>Depth (m)</i>	<i>Description</i>
0-0.9	Sandy, plastic, fawn clay.
0.9-2.7	Sandy orange brown clay with grey laminae. Stiff, may be a lithic sandstone which becomes clay when remoulded.
2.7-3.6	As above with ironstone pieces and nodules.
3.6-4.5	Stiff highly plastic blue clay with numerous red laminae.
4.5-5.5	Red to orange plastic clay with grey laminae, dryer than PL.
5.5-6.4	Stiff plastic orange and grey clay. Too hard to drill further.

STABILITY

Bore Hole 1

The top 4.5 m of material consists of variable layers of stiff clay, soft clay and moist to wet sand. Stiff clay occurs below this depth. Although no water was evident at the time of drilling, there was water in the hole and it had begun to collapse by the end of the day. On the following day, the hole was closed at 3 m and the water level was 1.8 below surface.

For stability analysis of the upper slip feature, the dimensions of the proposed slip plane were taken by fitting a semicircular arc to the topography and to the base of the soft zone in BH1. Other factors in the analysis were estimated from previous knowledge of Tamar clays.

Assumed factors are $C'_r = 0$, $\phi'_r = 13^\circ$, $\gamma_{sat} = 1.9 \text{ g/cm}^3$. With these inputs, the calculated factor of safety is 0.9.

Bore Hole 2

This hole was drilled through fairly stiff clay to a depth of 7 m where the clay became softer and more sandy. At 9.8 m soft wet sand was intercepted. Water rose to about 3 m above the base overnight and the hole became blocked near the surface.

Dimensions of the lower slip were chosen by assuming that the wet sand bed is horizontal and forms a basal slip surface and that the piezometric surface is also horizontal. Other factors were taken as above. The calculated factor of safety was 1.05.

There was insufficient information to analyse the western slip feature, but visual examination suggests that it is more stable than the other two.

DISCUSSION

The stability analyses are far from rigorous as there is insufficient drilling information for locating the slip planes with certainty. Rigorous analysis also requires soil testing to determine the values of c' and ϕ' .

However the analyses given are based on reasonable estimations of the factors involved. As a factor of safety of less than 1.0 indicates that the slip is actually moving, in the case of the upper slip it is evident that the analysis has slightly under-estimated the restraining factors.

Both safety factors are so close to 1.0 that they suggest stability is marginal. Safety factors of over 1.5 would be necessary before the re-zoning of this block could be considered.

[1 September 1977]