TR20-165-173

21. Examination of proposed cemetery sites, Kingston

W.C. Cromer

Rapid urban development in the Channel district together with the imminent closure of the Cornelian Bay Cemetery has prompted the Kingborough Council to investigate possible lawn cemetery sites in the Kingborough Municipality. The council has requested geological advice on the suitability of two proposed sites (fig. 48). *Site A* [230415]*, 2.5 km from Kingston, is situated on agricultural land west of Whitewater Creek. *Site B* [242403], 2 km south of the town, is a lightly wooded undeveloped council property on the western slopes of Boronia Hill, with Coffee Creek flowing through its marshy southern end.

Both sites have an area of approximately 15 ha and are readily accessible. Water supplies for lawns are available. Both are acceptable on aesthetic grounds and are compatible with planned extensions to the urban area.

The district has been mapped by Moore (1968, 1971) and Leaman (1973*a*) and two proposed cemetery sites have been previously described (Moore 1973, Leaman 1974). Leaman (1973*b*) has discussed the geological requirements for cemetery sites, the primary criteria including the presence of soil or easily excavable material to a depth of at least 2.75 m (for double graves), and which must be above the water table. Other secondary criteria include provision for adequate drainage, and acceptability on health grounds.

GEOLOGY

Site A. The geology of this site is complex and mapping is difficult because of lack of outcrop. Geological boundaries depicted in Figure 49 are based mainly on soil types and are to be regarded as only approximate.

Most of the north-eastern section of the site is probably underlain by Jurassic dolerite as large boulders of dolerite occur in the area. Boulders of both dolerite and basalt are found at the extreme northern end of the property. Tertiary basalt occurs north of the property and is exposed in road cuttings on the nearby Southern Expressway. Both rock types produce grey-brown clayey soil. The south-western half of the site is covered by grey sandy loam, on Permian Malbina Sandstone (Leaman, 1973*a*) which occurs in the more elevated western corner of the block, and clayey Lower Triassic quartz sandstone which occurs in the south-east.

The faulted boundary between the two rock types probably corresponds with a pronounced break of slope which trends north and bisects the southern half of the site.

A NW-trending band of Tertiary(?) clay overlies the Triassic sandstone. The clay is exposed in a small creek fed by a spring which divides the property and probably approximates the dolerite/sediment contact. The clay is white to grey-blue, and contains large dolerite boulders, and angular quartzite cobbles derived from the Permian sediments. It is overlain by a brown iron-rich, pisolitic clayey soil about one metre thick.

Five test pits were excavated by back-hoe on this site (fig. 49). All pits revealed clayey soils about one metre thick overlying impermeable clay (table 1). The clay represents bedrock (dolerite or clayey sandstone) in advanced stages of weathering. Seepages were recorded in each excavation, their position generally coinciding with the soil/clay interface. The seepages represent a shallow temporary perched water table, which is the result

*All locations in this report lie in the AMG 100 kilometre square EN.

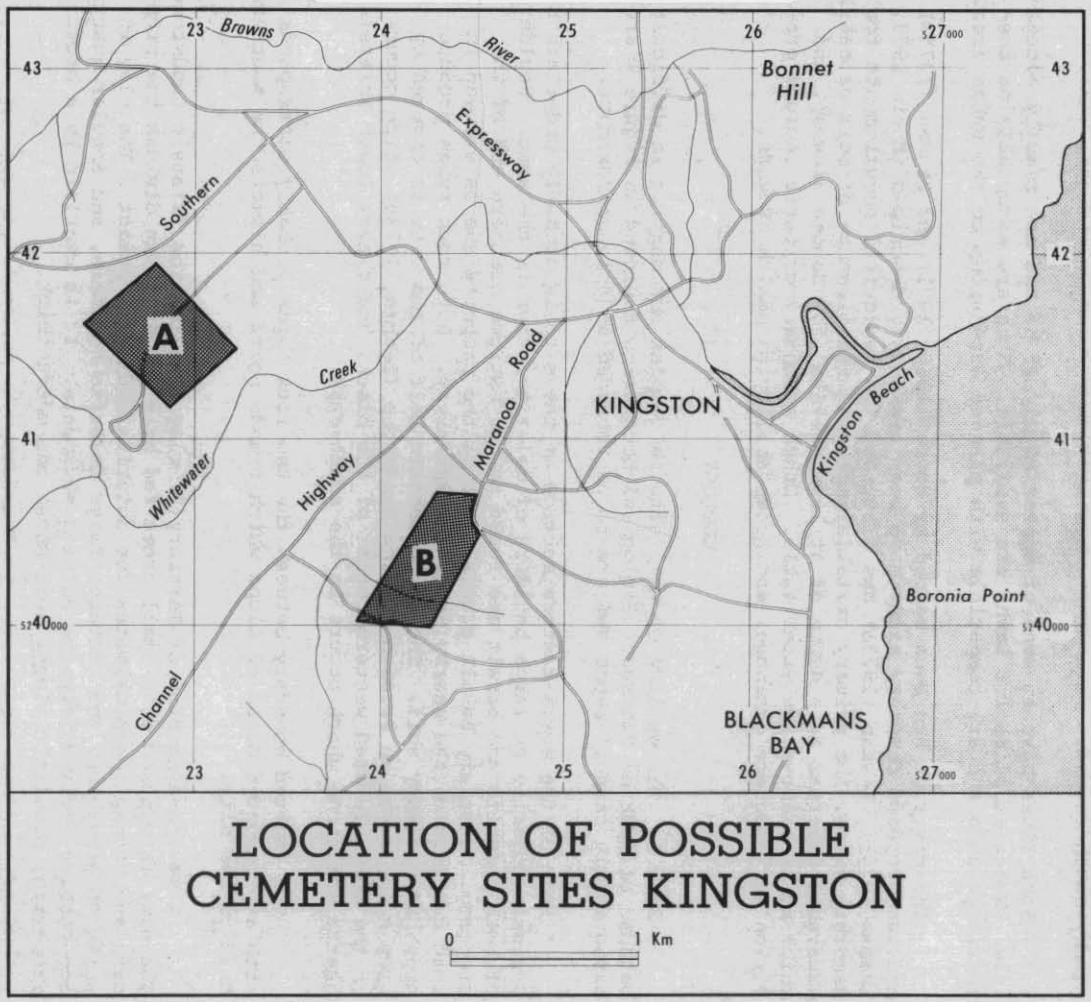

5 cm
Browns
River
Bonnet Hill
Expressway
Southern
Creek
Whitewater
Highway
Maranoa Road
KINGSTON
Kingston Beach
Boronia Point
BLACKMANS BAY
Channel
A
B
23
24
25
26
27000
43
42
41
40000
LOCATION OF POSSIBLE CEMETERY SITES KINGSTON
0
1 Km

Figure 48.

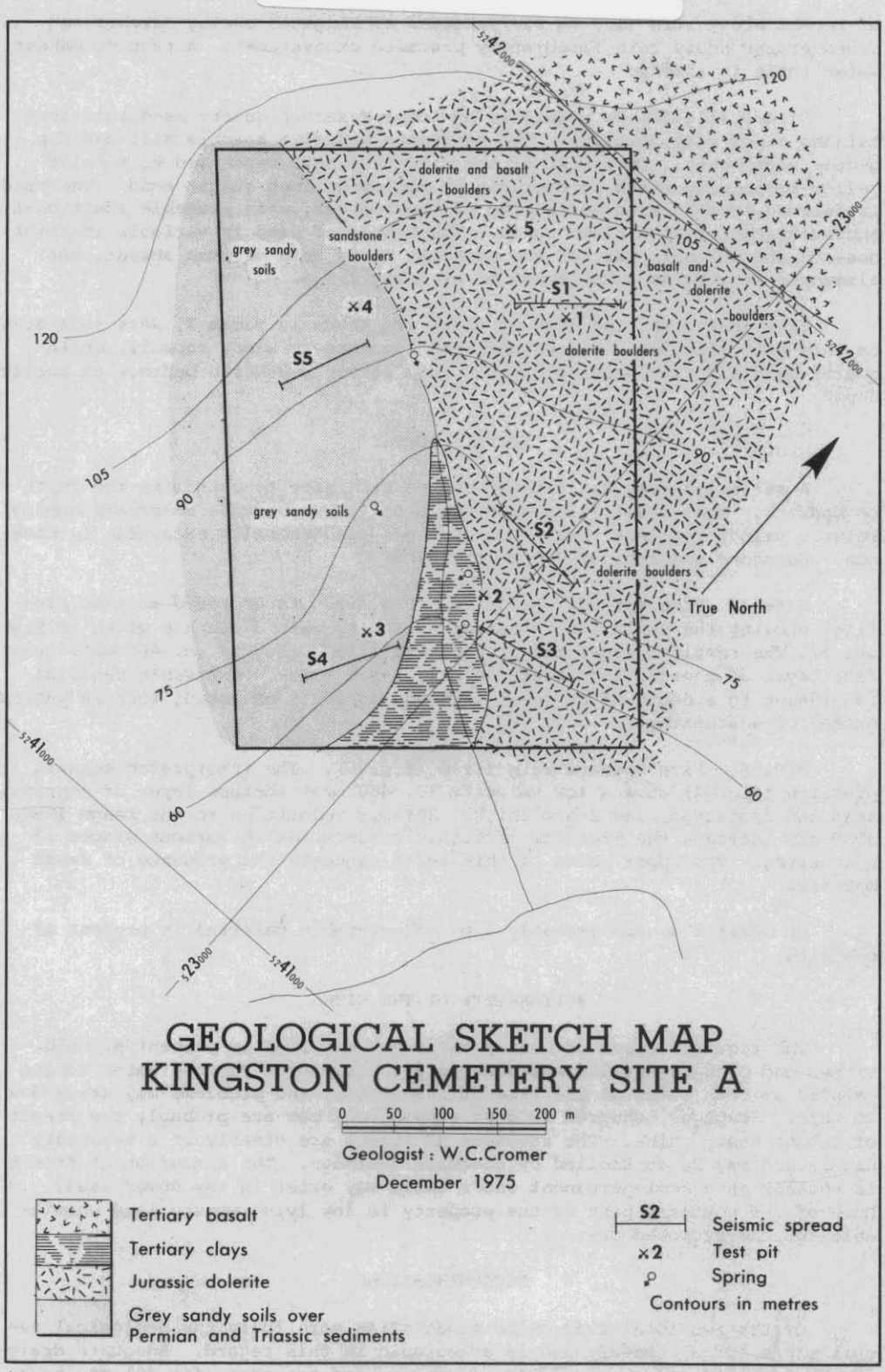

5 cm
dolerite and basalt boulders
sandstone boulders
grey sandy soils
basalt and dolerite boulders
dolerite boulders
grey sandy soils
dolerite boulders
S1
S2
S3
S4
S5
×1
×2
×3
×4
×5
True North
120
105
90
75
60
GEOLOGICAL SKETCH MAP
KINGSTON CEMETERY SITE A
0 50 100 150 200 m
Geologist : W.C.Cromer
December 1975
Tertiary basalt
Tertiary clays
Jurassic dolerite
Grey sandy soils over
Permian and Triassic sediments
S2 Seismic spread
×2 Test pit
Spring
Contours in metres

Figure 49.

of recent heavy rain (150 mm was recorded at Kingston during October and November and heavy rain immediately preceded excavation). A true permanent water table is absent.

Site B (fig. 50) is underlain by Lower Triassic quartz sandstone containing minor clay horizons. The sediments underlie Boronia Hill and dip gently south-west. Over most of the site they have weathered to a stiff yellow-brown clay which is overlain by medium-grained quartz sand. The sand is derived from *in situ* weathering of the bedrock, with probable additional accumulations of wind blown sands. The veneer of sand is variable in thickness: on the northern part of the property it is thin or even absent, but elsewhere it attains a thickness of at least 2.5 m.

Five test pits, the logs of which are given in Table 2, were excavated on this site (fig. 50). The established sequence is sandy topsoil, white quartz sand and clay grading rapidly into partly weathered bedrock at shallow depth.

SEISMIC SURVEY

A seismic survey was carried out on each site to determine the depth to bedrock. The results also have practical value because materials having seismic velocities less than about 2000 m/s are generally excavable by backhoe. Geophone spacings of 7.6 m were used.

Site A. Five spreads were fired (fig. 49). Interpreted seismic profiles showing the variation of seismic velocity with depth are given in Figure 52. The results reveal the presence of a low velocity (*c.* 460 m/s) surface layer of topsoil and fractured clay 2-5 m thick. Excavable material is present to a depth of at least 15 m and consists of parent rock in various stages of weathering.

Site B. Five spreads were fired (fig. 50). The interpreted seismic profiles (fig. 51) show a low velocity (*c.* 460 m/s) surface layer of topsoil, sand and fractured clay 2-5 m thick. Seismic velocities in the range 1990-3065 m/s indicate the presence of Triassic sandstone in various stages of weathering. The upper value of this range suggests the presence of fresh material.

At least 3 m, and probably 5 m, of excavable material is present at the site.

SUITABILITY OF THE SITES

The required depth of easily excavable material is present at both sites, and each is equally suitable in this respect. Perched water tables existed at both sites at the time of inspection, and problems may arise due to this. Seepages occurred in most excavations but are probably the result of recent heavy rains. The seepages at Site A are clearly of a temporary nature and may be controlled by adequate drainage. The situation at Site B is unclear as a semi-permanent water table may exist in the cover sands. Much of the southern part of the property is low lying marshy land unsuitable for the proposed use.

RECOMMENDATIONS

Of the two localities, Site A satisfies more fully the geological requirements for a cemetery and is acceptable in this regard. Adequate drainage is required and the presence of springs and seepages (fig. 49) may be a problem . Health factors may have to be considered.

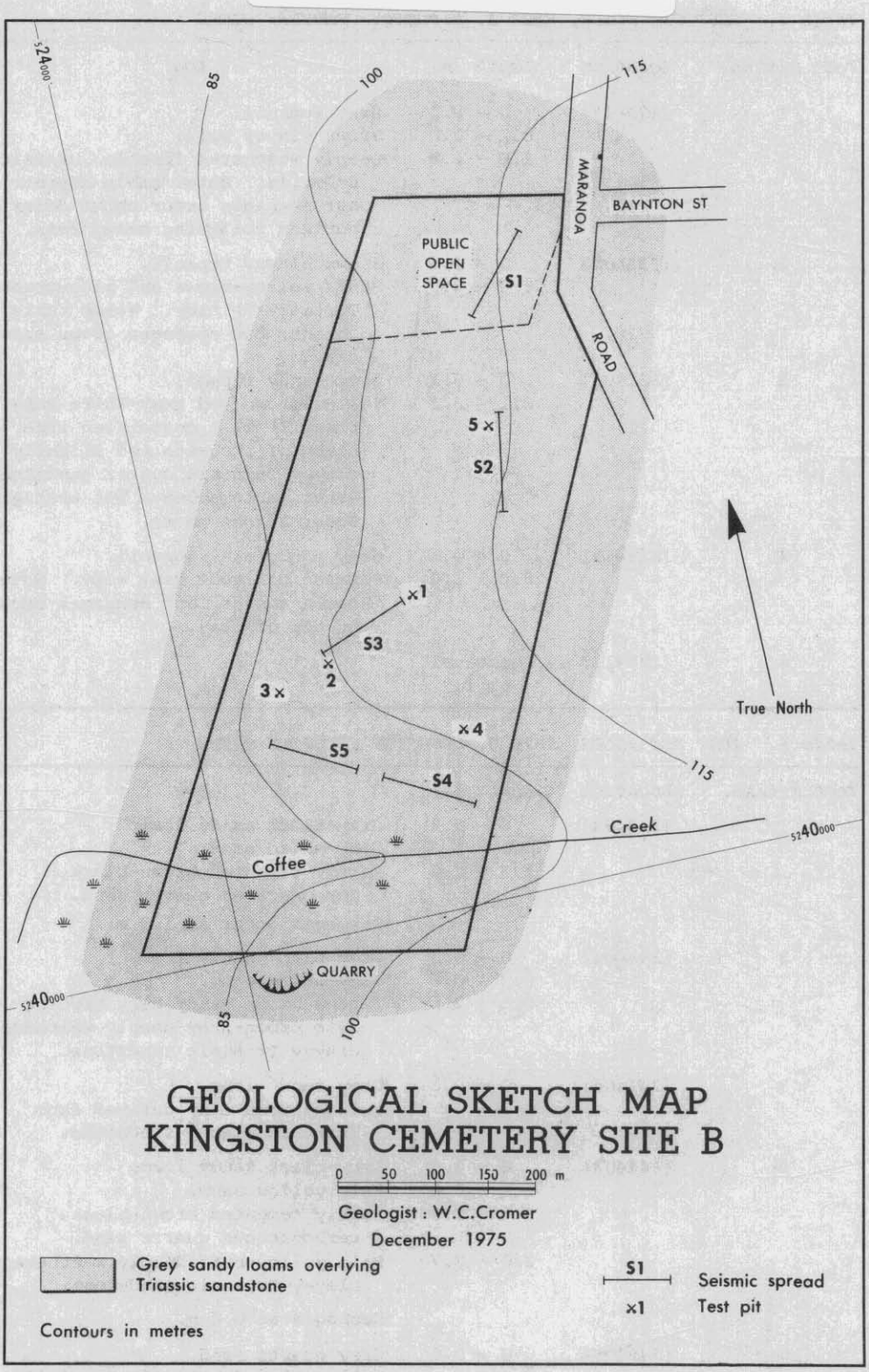

5 cm
5240000
85
100
115
MARANOA
BAYNTON ST
PUBLIC
OPEN
SPACE
S1
ROAD
5 x
S2
x1
S3
x
2
3 x
x4
S5
S4
True North
115
Creek
5240000
Coffee
QUARRY
5240000
85
100
GEOLOGICAL SKETCH MAP
KINGSTON CEMETERY SITE B
0 50 100 150 200 m
Geologist : W.C.Cromer
December 1975
Grey sandy loams overlying
Triassic sandstone
S1
Seismic spread
x1
Test pit
Contours in metres

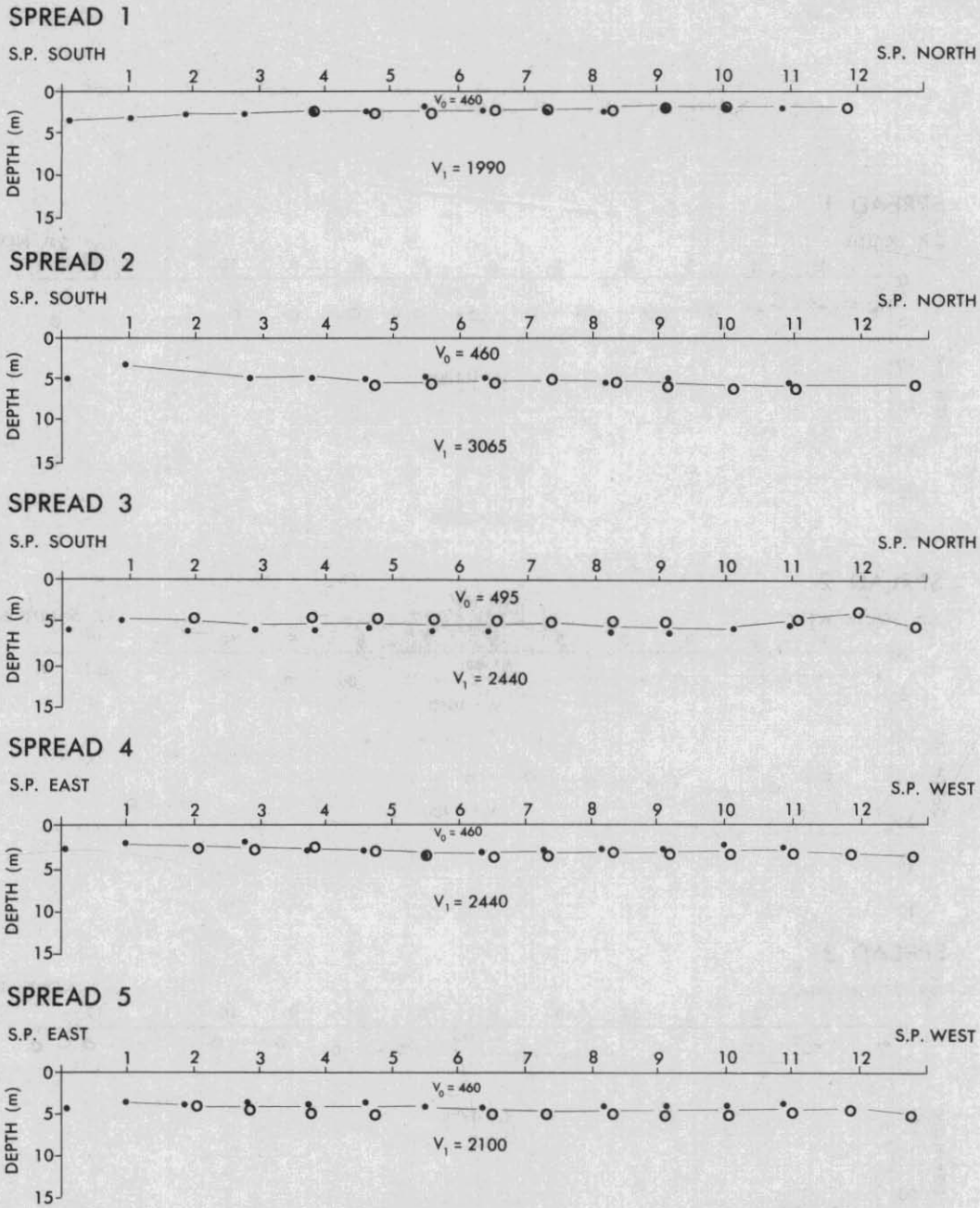
Figure 50.

Table 1. TEST PIT HOLES, SITE A, KINGSTON CEMETERY SITES

Test Pit No.	Location	Depth (m)	Log
1	[229417]	0 - 0.2	Grey topsoil.
		0.2 - 1.0	Brown clayey soil.
		1.0 - 2.8	Deeply weathered friable Jurassic dolerite. Water table absent. but seepages occur above dolerite horizon following heavy rain.
2	[231405]	0 - 0.4	Brown clayey topsoil.
		0.4 - 3.0	Stiff yellow-brown and blue-green Tertiary(?) clay. Water table absent, but seepages occur above clay.
3	[231404]	0 - 0.1	Grey sandy topsoil.
		0.1 - 2.5	Yellow-brown and grey-white Tertiary(?) clay containing rare slabs of iron-stained slightly clayey Triassic quartz sandstone. Water table absent, but seepages occur at one metre.
4	[229415]	0 - 0.8	Grey sandy clay topsoil.
		0.8 - 2.0	Permian derived? grey clay. Water table absent, but seepages occur at top of clay.
5	[228417]	Identical to 1.	

Table 2. TEST PIT HOLES, SITE B, KINGSTON CEMETERY SITES

Test Pit No.	Location	Depth (m)	Log
1	[243404]	0 - 0.2	Grey-black sandy loam.
		0.2 - 1.3	Grey-white sand.
		1.3 - 2.0	Partly cemented brown-black carbonaceous quartz sand.
			Seepages occur at 1.3 m.
2	[242404]	0 - 0.3	Grey-black sandy loam.
		0.3 - 0.8	Grey-white sand.
		0.8 - 2.5	Yellow-brown sandy clay grading into brown-grey deeply weathered clayey Triassic sandstone.
3	[241404]	0 - 0.3	Grey sandy loam.
		0.3 - -	Yellow-brown clay derived from Triassic clayey sandstone.
4	[244403]	0 - 0.2	Grey-black sandy loam.
		0.2 - 0.6	Pale yellow sand.
		0.6 - 2.0	Partly cemented brown-black carbonaceous quartz sand.
		2.0 - 2.7	Pale yellow-buff deeply weathered clayey Triassic sandstone.
			Seepages at 0.6 m.
5	[244405]	0 - 0.6	Grey quartz sand.
		0.6 - -	Yellow clay derived from underlying Triassic sediments.



SEISMIC PROFILES, KINGSTON CEMETERY SITE B

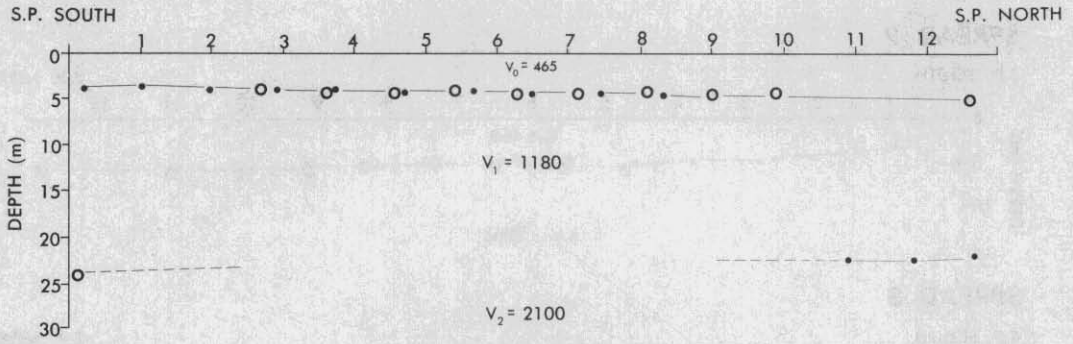
All velocities are in metres / second

$\frac{V}{H} = 1$

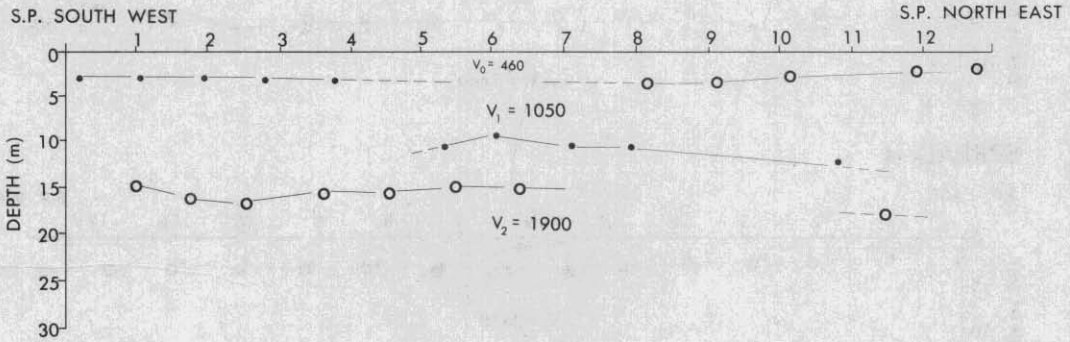
Figure 51.

5 cm

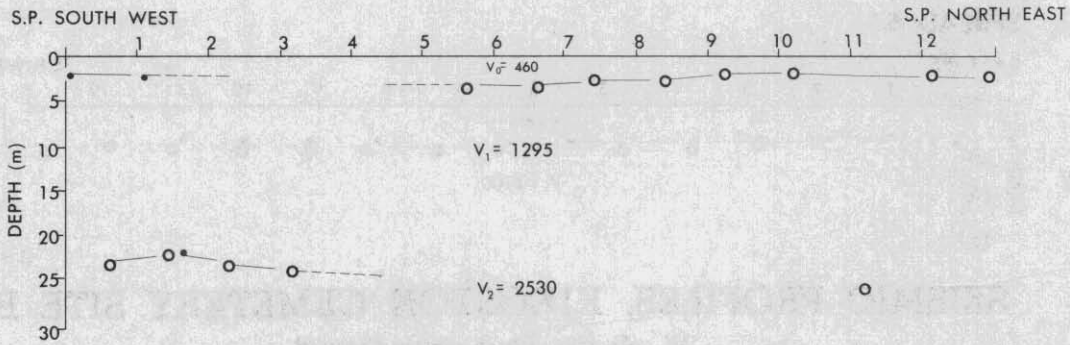
SPREAD 1

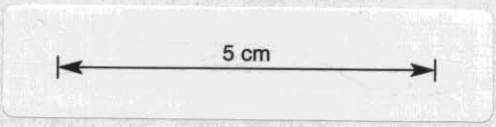


SPREAD 2



SPREAD 3





REFERENCES

LEAMAN, D.E. 1973*a*. 1:50 000 geological map series. Zone 7 Sheet 82 (8312S). Hobart. *Department of Mines, Tasmania*.

LEAMAN, D.E. 1973*b*. Proposed lawn cemetery, Milford, Pitt Water. *Tech.Rep. Dep.Mines Tasm.* 16:206-207.

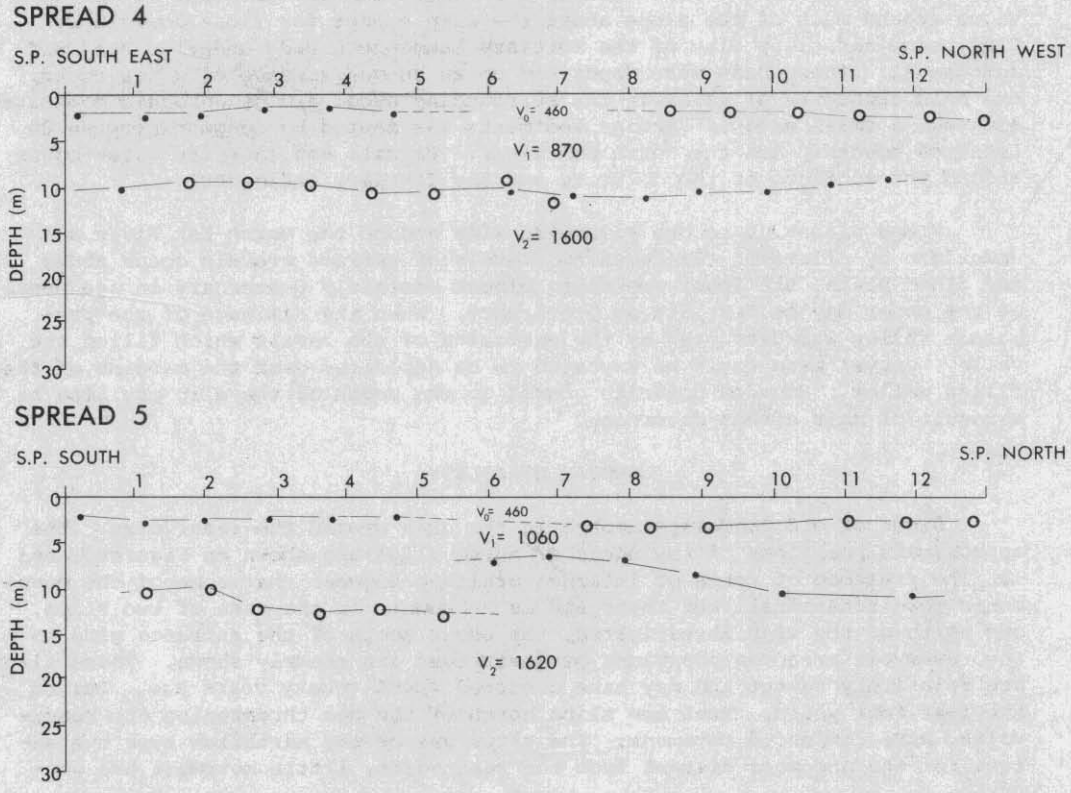
LEAMAN, D.E. 1974. Proposed lawn cemetery, Kingston. *Tech.Rep.Dep.Mines Tasm.* 17:139-143.

MOORE, W.R. 1968. Geological report on dam sites, Whitewater Creek, Kingston. *Tech.Rep.Dep.Mines Tasm.* 12:59-68.

MOORE, W.R. 1971. Whitewater Creek dam site, Kingston : subsurface investigations, 1969. *Tech.Rep.Dep.Mines Tasm.* 14:117-134.

MOORE, W.R. 1973. Proposed cemetery site, North West Bay. *Tech.Rep.Dep. Mines Tasm.* 15:116-117.

[3 December 1975]



SEISMIC PROFILES, KINGSTON CEMETERY SITE A

All velocities are in metres / second

$\frac{V}{H} = 1$

Figure 52.

5 cm