1980/32. Feasibility refraction survey, Moulting Lagoon Sand Reserve

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Abstract

A test refraction survey has been undertaken on a proposed Lands Department sand reserve. Velocities of 300-1400 m/s are associated with dry sand or dry cemented sand, while velocities of 1500-2000 m/s are associated with wet sand or clay. The deposit is thin, patchy and marked property and section variations have been recorded. Bedrock velocities exceed 2500 m/s. Drilling results have confirmed the general thrust of the interpretation.

INTRODUCTION

A number of sand pits have been worked in the area between Bicheno and Coles Bay. Most have been shallow, scraping operations which have left unsightly surface scars. In an attempt to reduce the environmental impact of such operations, the Lands Department is seeking to restrict all operators to a single zone if a suitable deposit can be found. Such a deposit would need proving by drilling and sampling - methods unsuited to areal exploration. Consequently a test area has been probed seismically in order to evaluate the potential use of the refraction method for wider exploration. The site, as shown in Figure 1, is located adjacent to Coles Bay Road at FP025512.

SURVEY

Several reciprocal spreads with a total span of 55 m were fired in the area. Geophone spacing was generally five metres, although one spread used one and three metre spacings in order to examine the surface layer.

Layer velocities could be grouped as follows:

(1) 300- 600 m/s
(2) 750-1100 m/s
(3) 1200-1500 m/s
(4) 1800-2000 m/s
(5) 2300-3000 m/s
(6) >3000 m/s

All layers are erratic and clearly very variable in thickness. All time-distance plots are complex and reflect an irregular profile, especially in respect of layers 2, 3 and 4. These 'layers' are not universal and may be variations. The lack of continuity prohibits any attempt at correlation.

Spreads have been located on track lines or level ground between pits and thus do not readily correlate with hole sites on a regular grid (see fig. 1). Spreads have avoided pit edges in order to minimise terrain and interpretational problems. Geophones were placed in surface sand and surface velocities of less than 500 m/s were common. Low and uncertain velocities and poor coupling are the prime sources of error.

INTERPRETATION

Most pits are very shallow, but some stratigraphy is indicated. The desirable white sand overlies discoloured and partly cemented sand. The cement is iron oxide or siderite. These materials may be correlated directly

with layers 1 and 2 (∿500 m/s, ∿1000 m/s respectively). No reliable attempt can be made at distinguishing these layers due to coupling problems and inaccurate first layer specification.

Layer 3 (∿1400 m/s) has been interpreted as wet sand and layer 4 (∿1800 m/s) as clay. Layers 5 and 6 are considered to represent bedrock in various conditions.

The limit of easy working of the sand is the water table and the interpretation tabulation given below lists the depth of this surface (interface between layers 2 and 3). Alternatively the presence of clay will curtail operations. Thus, where layer 3 appears to be absent, the interface between 2 and 4 is stated. The table also shows the depth to clay or water encountered in test back-hoe pits at each pegged site. The sites discussed are those for which the refraction spreads can be directly correlated with a test pit.

Site	Refraction							Test pit	
	V_2	$^2/_3$	V_3	$^3/_4$	V_4	$^4/_5$	V_5	Clay	Water
2	700	2.2	1500	-	-	6.6	2500	0.7	nd
6	800	2.2	1500	-	-	-	2500	1.5	nd
11	-	-	1300	3.7	-	-	2400	>2.7	nd
16	900	-	-	1.7	1800	-	2300	1.6	1.6
19	750	2.4	1400	-	-	-	2500	2.0	nd
20	1100	-	-	3.4	2000	-	-	2.8	nd
21	1000	-	-	2.6	2000	-	2400	2.6	nd
26	900	-	-	3.4	2000	-	-	2.4	nd
30	-	-	1400	-	-	1.1	2500	0.9	nd
31	700	1.4	1200	-	-	7.8	2600	1.6	2.7

(Velocity = V m/s, V_2 = velocity of layer 2, $^2/_3$ = depth in metres to layer interface; Test pit - depths in metres).

The overall correlation is quite good but there are some significant discrepancies. These may be due to unassessed contributions from the slow surface layer or to marked changes in the position of the clay or water surfaces and hence the precise form of the layer model (2/3, 2/4, 3/5 *etc.*) The general trends established in the test pit data are observed in the spread coverage, although the interpreted depths agree within 0.5 m in only about 60% of cases.

EVALUATION AND CONCLUSIONS

The refraction method can certainly identify the sand deposits and indicate with fair reliability the overall thickness. The most reliable estimates are derived if clay (layer 4) is present. The most desired sand has a velocity less than 1000 m/s.

The method could be used in a step out manner from this test site, but the results must be treated with some caution, not used for reserve estimates and checked with occasional test pits.

Most errors appear to be related to inaccurate determinations of the velocity and thickness of the very slow surface materials. Unfortunately any attempt to resolve this problem must involve shorter spreads, and hence more spreads for a given coverage. This survey was undertaken

in a compromise manner, between surface precision and coverage, in order to find a reasonable and economical approach. With due regard to the cautions stated above, the method could be used to provide a rapid exploratory coverage.

[23 September 1980]

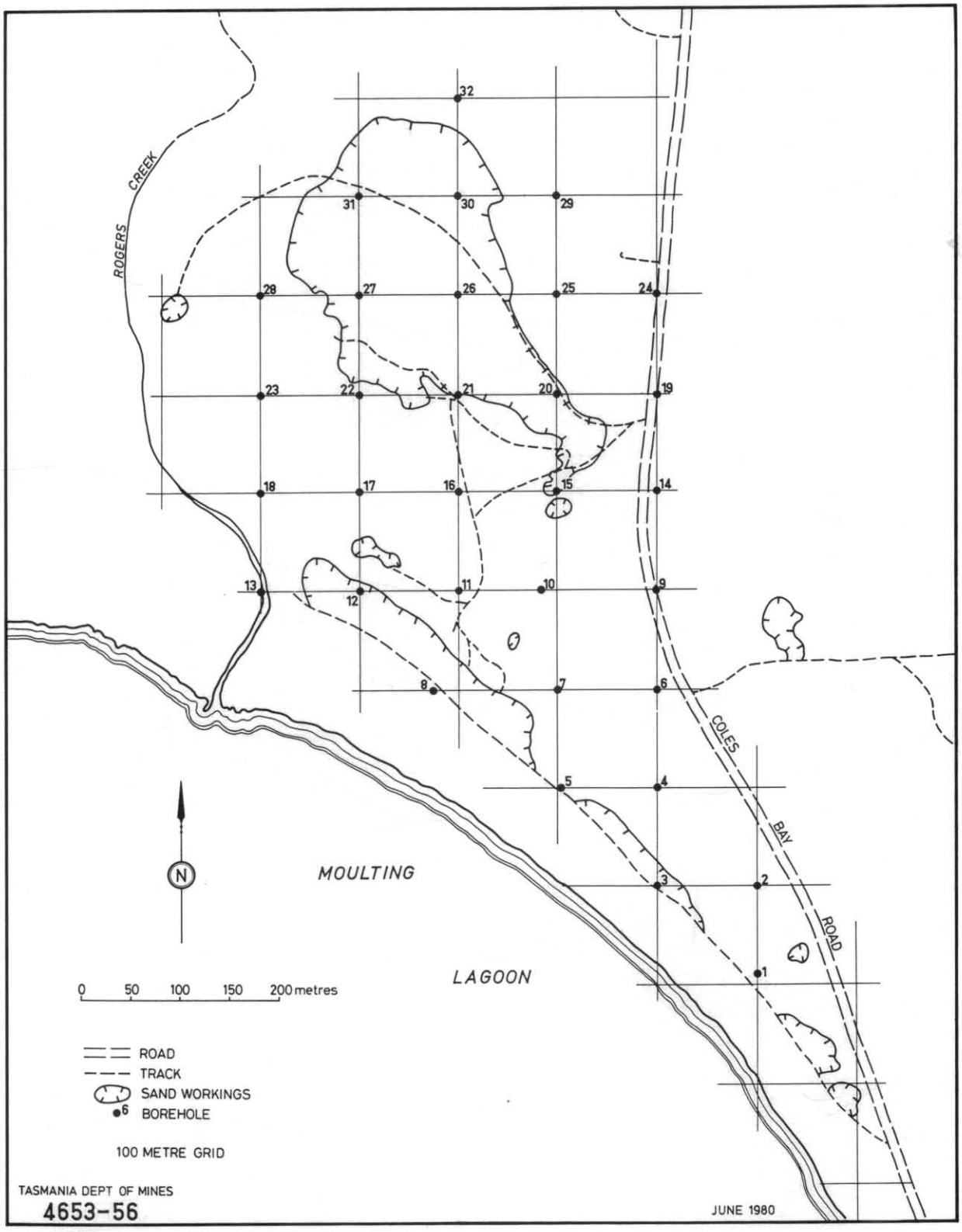

Figure 1. *Location of investigation area*

5 cm