



Tasmania Department Of Resources and Energy

Division of Mines and Mineral Resources — Report 1991/06

Drilling for groundwater at Safety Cove, Port Arthur

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Abstract

Twenty holes drilled in the Safety Cove area showed that useful quantities of groundwater could be obtained.

INTRODUCTION

This study aimed to investigate the possibility of obtaining sufficient groundwater in the Safety Cove area, south of Port Arthur township, to help supplement the lack of water during peak periods at the Port Arthur Historic Village.

TOPOGRAPHY

The area investigated, centred around EN693218 (fig. 1), covers approximately one square kilometre of the coastal area between Briggs Point and Rileys Reef and westwards towards Basket Bay. The land rises in elevation from three metres above sea level near Safety Cove to about 50 metres.

RESULTS OF INVESTIGATION

Twenty investigation holes were drilled over an area of approximately one square kilometre (Appendix 1). Not all holes were investigated fully, as the augered material in some looked unsuitable to yield any worthwhile quantities of water. The holes at higher elevations seemed to be drilled into perched water tables (i.e. holes 20–21, also possibly 16); although these holes are considerably higher in elevation than most other holes, the depth to the water table is approximately the same as in the holes at sea level. The logs of the holes are given in Appendix 2.

Screens were installed and pumped in ten of the holes (3, 5, 8, 10, 14, 15, 16, 17, 18, 20). Water from holes 5, 10, 14, 15 and 16 was sampled for complete water analysis (Appendix 3).

Sand samples were collected from holes 5, 14, 15, 16 and 17 for grain size analysis. Sand from all of the holes, with the exception of Hole 17, contained quantities of heavy minerals; the composition of heavy mineral concentrates for holes 14, 18 and 20 is shown in Table 1.

Table 1.
COMPOSITION OF HEAVY MINERAL
CONCENTRATES, SAFETY COVE
(Approximate %)

Reg. No. Borehole No.	400320 BH18	400321 BH20	400324 BH14
Ilmenite	45	35	50
Magnetite	5	tr	5
Rutile	5	5	10
Leucoxene	5	5	5
Hematite	5	10	tr
Pyrite	5	5	-
Chromite	tr	tr	tr
Zircon	10	10	15
Tourmaline	tr	tr	tr
Pyroxene	10	25	5
Garnet	5	tr	tr
Quartz and lithics	5	tr	10
Siderite	tr	5	-

CONCLUSION

There are useful quantities of good water in the areas near holes 4 and 5. Good quantities of water also occur in the areas around holes 10 and 14, especially near hole 10. Indications are that the area west of hole 5 could also give good results, and this area needs further investigation.

[26 March 1991]

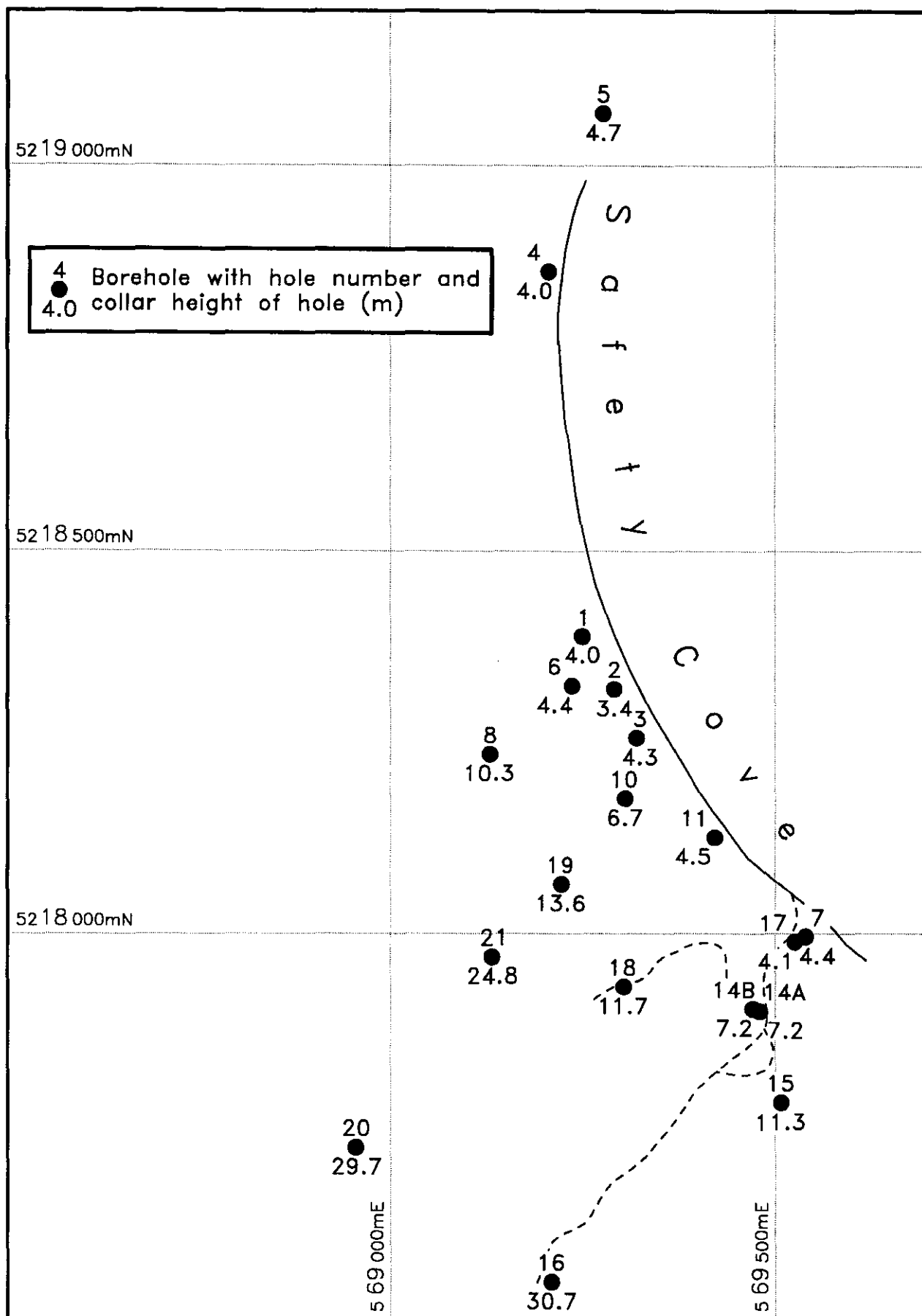
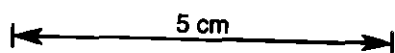


Figure 1



Location of drill holes, Safety Cove area

APPENDIX 1

Locations of boreholes

Borehole	Easting	Northing	Collar height (m)
1	569288	5218390	4.0
2	569290	5218317	3.4
3	569319	5218254	4.3
4	569203	5218861	4.0
5	569274	5219067	4.7
6	569232	5218321	4.4
7	569538	5217994	4.4
8	569129	5218234	10.3
10	569304	5218173	6.7
11	569420	5218125	4.5
14A	569475	5217898	7.2
14B	569472	5217900	7.2
15	569509	5217782	11.3
16	569210	5217550	30.7
17	569526	5217988	4.1
18	569302	5217932	11.7
19	569221	5218064	13.6
20	568952	5217725	29.7
21	569133	5217968	24.8

APPENDIX 2

Logs of boreholes, Safety Cove

Hole 1

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
3.4	8.7	180

Medium grey sand, fine to approximately 8 m, then clay or organic layer.

Hole 2

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
2.4 (collapsed)	8.7	-

Medium grey sand to 4.5 m, medium brown sand coarser than above to 8.5 m, clay or organic layer to 8.7 m.

Hole 3

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
2.0 (collapsed)	8.7	250

Well graded fine to medium grey sand to 5.5 m, finer sand to 8.5 m, then stiff grey clay to 8.7 m.

No. 10 screen installed to 10.5 m, pumped for one hour at 6 L/min (80 gph). On completion of pumping screen full of sand.

Hole 4

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
3.5	8.7	200

Medium grained grey-brown sand continuous through hole.

Hole 5

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
4.1	8.7	190

Medium to light brown sand above water table at 4.1 m, then slightly coarser. A 1.5 m No. 15 screen was installed to 6 metres. Pumped for one hour at 36 L/min (480 gph). Almost immediate recovery. Water sample BH5 collected.

Hole 6

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
1.5	6.0	180

Fine to medium light grey sand, some clayey lenses. Dark brown organic layer at six metres.

Hole 7

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
2.6	8.7	-

Greyish-brown sand to water table, medium to fine sand to 8 m, organic clay 8.0–8.7 m.

Hole 8

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
4.6	8.7	170

Yellow to brown sand 4.5–4.8 m. Dark brown sand, medium size, saturated to 7.5 m; dark grey fine sand 7.5–8.5 m; dark grey clay 8.5–8.7 m.

Pumped for one hour at 36 L/min (480 gph). No. 10 screen, 1.5 x 50 mm.

Hole 9

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
1.4	2.2	720

Coarse sand or shells to 2 m, then light brown clay.

Hole 10

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
5.0	7.2	310

0–1 m soil profile; 1–3 m light brown fine sand; 3–5 m darker brown coarse sand; 5–7.2 m medium to dark brown coarse sand.

A 1.5 m No. 15 screen was installed to 7.2 m; pumped for one hour at 36 L/min (480 gph). Water clear after 5 minutes, no sand recovered in pump test. 1.5 m of water still in riser pipe at end of test.

Hole 11

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
2.5	5.8	290

Light brown fine sand to water table, then fine light grey sand to 5.9 m and grey clay.

Hole 12

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
-	-	-

Drilled to refusal at 2.5 m, only damp grey sand.

Hole 13

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
1.0	8.7	100

Fine grey sand with clay lenses.

Hole 14

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
1.9	7.9	190

0–9 m topsoil; 0.9–3.4 m medium grey, fine-medium sand; 3.4–6.1 m as above with considerable black grains, possibly ilmenite; 6.1–7.9 m slightly coarser, possibly grey to brown organic layer.

Samples taken for grain size analysis and heavy minerals. A 1.5 m No. 15 x 50 mm screen installed to 6.5 m and 3 hour pump and recovery test conducted at a flow of 20 L/min (240 gph). Drawdown 5.32 m. See pump test results (fig. 2). Water sample collected for analysis. Observation hole 14A drilled three metres away.

Hole 15

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
1.8	8.8	-

Log about same as Hole 14, not as much heavy mineral obvious except at 3.4 m. No. 15 screen installed; pumped from the top at 10 L/min (140 gph), very good recovery.

Hole 16

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
2.7	7.9	-

0–0.6 m topsoil; 0.6–4.3 m medium grey sand, ilmenite at 3.4 m; 4.3–4.8 m organic layer, ilmenite at 4.6 m; 4.8–6.0 m light brown medium sand; 6.0–7.9 m as above with clay layer at 7.9 m.

No. 15 screen installed to 5.5 m and pumped for 30 minutes at 10 L/min (144 gph), slow recovery.

Hole 17

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
2.3	7	-

Grey to brown sand to water table; medium to fine sand to 6.5 m; sandy clay 6.5–7 m. Pumped for one hour with suction from top at 68 L/min (90 gph). Screen set at 5 metres. Screen then installed to 7 m and pumped at only 30 L/min (40 gph).

Hole 18

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
1.2	7.0	210

Samples collected at 1.5 m, 3.3 m, 5.1 m, 7.0 m for grain sizing material below water table. Medium to fine greyish sand, no visible variation in grain size or colour. Organic or clay layer at 6.8 m.

No. 15 screen installed and pumped for 20 minutes at 68 L/min (90 gph), water dirty in colour. Heavy mineral samples taken.

Hole 19

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
6.5	7.2	-

0–6.5 m material similar to Hole 10, medium to dark brown sand, grain size medium. 6.5–7.2 m sand greyish in colour, medium grain size.

Hole 20

<i>SWL (m)</i>	<i>TD (m)</i>	<i>TDS (mg/l)</i>
5.0	7.8	-

0–1 m topsoil and reddish-brown sand; 1–5 m medium brown sand, medium grain size, some clay particles present; 5–7.8 m similar to above, slightly clayey.

No. 18 screen installed to 7 m, pumped for one hour at 68 L/min (90 gph). Sample collected for heavy minerals.

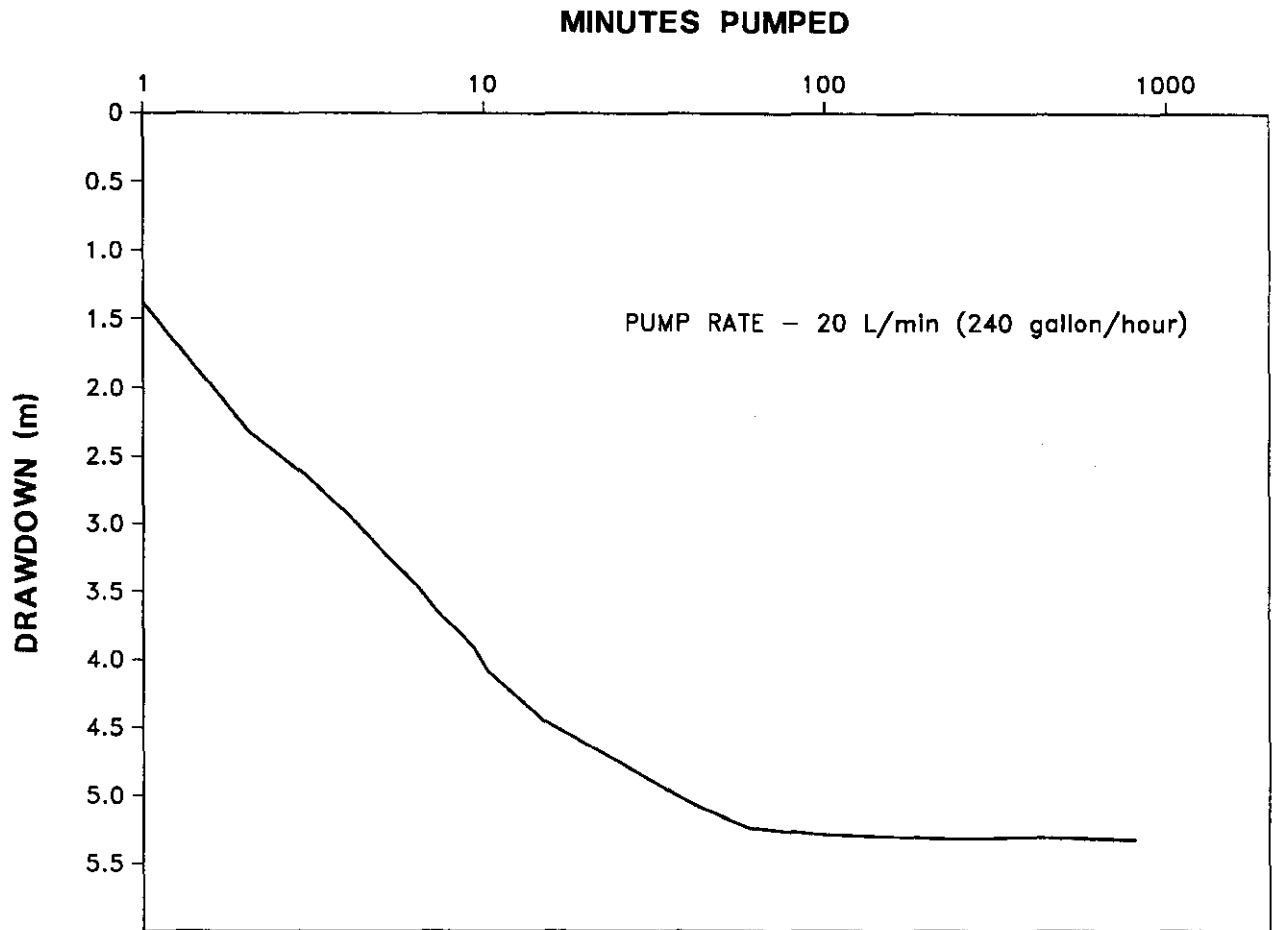


Figure 2

Drawdown curve for pump test, Hole 14, Safety Cove

APPENDIX 3

Analyses of water samples

Sample No.	840068	874643	860057	874644	860058	874878
Borehole	BH5	BH10	BH14	BH14	BH15	BH16
pH	5.7	6.4	6.0	5.7	5.6	5.6
Cond (µs/cm)	280	590	310	380	320	1060
Item (mg/L)						
CO ₃	Nil	Nil	Nil	Nil	Nil	Nil
HCO ₃	5.7	41	14.0	15.5	19.5	9.7
Cl	65	135	80	81	77	270
SO ₄	13.0	22	15.5	10.5	13.5	34
SiO ₂	15.5					
Ca	4.4	9.8	3.3	3.8	3.2	6.7
Mg	6.6	12.0	5.5	6.4	5.8	18
Fe	<0.1	<0.1	<0.1	<0.1	0.3	<0.1
Al	<0.2	<0.2	0.2	<0.2	0.3	<0.2
K	11.0	49	3.6	3.4	4.1	6.5
Na	31	100	54	74	53	150
TDS	190	310	190	200	210	620
Permanent Hardness	33	11.0	20	20	18.0	83
Temporary Hardness	4.7	34	11.5	13.0	16.0	7.9
Alkalinity (as CaCO ₃)	4.7	34	11.5	13.0	16.0	7.9

APPENDIX 4

Grain size analyses

Hole 8

Depth: 8.7 m
Registered No.: 840079

Depth: 1.8 m
Registered No.: 840075

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
			+2360	0.13	0.13
			+1180	0.30	0.42
			+600	0.62	1.04
+600	0.08	0.08	+300	18.69	19.73
+300	26.19	26.26	+250	21.60	41.32
+250	30.97	57.23	+212	29.27	70.60
+212	28.12	85.35	+150	18.77	89.37
+150	12.69	98.04	+75	4.77	94.15
+75	1.22	99.26	+38	2.44	96.58
+38	0.13	99.39	-38	3.42	100.00
-38	0.61	100.00			

Hole 14

Depth: 3.3 m
Registered No.: 840076

Depth: 1.6 m
Registered No.: 851858

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.35	0.35	+600	0.51	0.51
+300	41.52	41.88	+300	9.24	9.75
+250	25.63	67.50	+250	13.99	23.74
+212	22.06	89.56	+212	38.42	62.16
+150	9.46	99.02	+150	30.41	92.58
+75	0.90	99.92	+75	5.34	97.91
+38	0.04	99.96	+38	0.51	98.43
-38	0.04	100.00	-38	1.57	100.00

Depth: 5.1 m
Registered No.: 840077

Depth: 2.5 m
Registered No.: 851859

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.21	0.21	+600	0.85	0.85
+300	36.29	36.50	+300	14.03	14.88
+250	27.36	63.86	+250	16.75	31.63
+212	23.60	87.45	+212	41.91	73.54
+150	11.02	98.47	+150	20.99	94.53
+75	1.29	99.76	+75	3.83	98.36
+38	0.03	99.79	+38	0.44	98.79
-38	0.21	100.00	-38	1.21	100.00

Depth: 6.9 m
Registered No.: 840078

Depth: 3.4 m
Registered No.: 851860

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.35	0.35	+600	0.36	0.36
+300	39.61	39.96	+300	11.55	11.91
+250	26.20	66.16	+250	17.47	29.39
+212	21.65	87.81	+212	37.30	66.69
+150	10.43	98.24	+150	24.30	90.99
+75	1.52	99.76	+75	5.92	96.91
+38	0.05	99.81	+38	1.02	97.93
-38	0.19	100.00	-38	2.07	100.00

Hole 14

Depth: 7.9 m
Registered No.: 851865

Depth: 4.3 m
Registered No.: 851861

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
			+600	1.36	1.36
			+300	16.72	18.08
			+250	18.89	36.97
+600	0.61	0.61	+212	28.27	65.25
+300	21.00	21.61	+150	21.84	87.09
+250	17.27	38.87	+75	5.12	92.21
+212	37.56	76.43	+38	2.27	94.47
+150	16.76	93.19	-38	5.53	100.00
+75	3.71	96.90			
+38	0.85	97.75			
-38	2.25	100.00			

Hole 15

Depth: 5.2 m
Registered No.: 851862

Depth: 1.6 m
Registered No.: 851866

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.46	0.46	+600	3.34	3.34
+300	23.62	24.08	+300	26.12	29.45
+250	19.12	43.20	+250	19.40	48.85
+212	32.17	75.37	+212	27.06	75.91
+150	16.97	92.34	+150	18.13	94.05
+75	4.29	96.63	+75	3.07	97.11
+38	1.23	97.86	+38	1.08	98.20
-38	2.14	100.00	-38	1.80	100.00

Depth: 6.1 m
Registered No.: 851863

Depth: 3.4 m
Registered No.: 851867

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.69	0.69	+600	0.15	0.15
+300	37.89	38.57	+300	5.18	5.32
+250	20.93	59.50	+250	20.90	26.23
+212	23.27	82.76	+212	41.88	68.10
+150	10.10	92.87	+150	22.24	90.35
+75	2.37	95.24	+75	5.62	95.97
+38	1.38	96.61	+38	1.14	97.11
-38	3.39	100.00	-38	2.89	100.00

Depth: 7.0 m
Registered No.: 851864

Depth: 5.2 m
Registered No.: 851868

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	1.72	1.72	+600	0.61	0.61
+300	18.65	20.37	+300	12.52	13.13
+250	18.48	38.84	+250	21.20	34.33
+212	25.11	63.96	+212	34.61	68.94
+150	20.42	84.38	+150	21.20	90.15
+75	6.81	91.19	+75	5.13	95.27
+38	2.40	93.59	+38	1.86	97.13
-38	6.41	100.00	-38	2.87	100.00

Hole 15

Depth: 4.3 m (layer 0.5 m thick)
Registered No.: 851873

Depth: 7.0 m
Registered No.: 851869

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
			+600	0.54	0.54
			+300	7.19	7.74
+600	0.61	0.61	+250	13.39	21.12
+300	7.54	8.15	+212	37.05	58.17
+250	18.01	26.16	+150	21.25	79.42
+212	42.19	68.35	+75	9.70	89.12
+150	23.57	91.92	+38	4.32	93.44
+75	4.81	96.73	-38	6.56	100.00
+38	0.85	97.58			
-38	2.42	100.00			

Depth: 8.8 m
Registered No.: 851870

Depth: 4.6 m
Registered No.: 851874

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
			+600	1.17	1.17
+600	0.32	0.32	+300	19.81	20.98
+300	5.66	5.98	+250	17.43	38.41
+250	15.56	21.55	+212	37.17	75.58
+212	42.27	63.82	+150	16.27	91.84
+150	28.35	92.17	+75	4.09	95.93
+75	4.42	96.58	+38	1.14	97.07
+38	0.89	97.47	-38	2.93	100.00
-38	2.53	100.00			

Hole 16

Depth: 5.2 m
Registered No.: 851875

Depth: 1.6 m
Registered No.: 851871

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
			+600	0.13	0.13
+600	0.45	0.45	+300	16.90	17.03
+300	21.69	22.15	+250	21.02	38.05
+250	21.88	44.03	+212	38.83	76.87
+212	27.24	71.27	+150	15.05	91.92
+150	17.26	88.53	+75	3.47	95.39
+75	3.98	92.51	+38	1.75	97.15
+38	2.02	94.53	-38	2.85	100.00
-38	5.47	100.00			

Depth: 3.4 m
Registered No.: 851872

Depth: 6.1 m
Registered No.: 851876

Sieve size (µm)	Mass (%)	Cum. Mass (%)	Sieve size (µm)	Mass (%)	Cum. Mass (%)
			+600	0.16	0.16
+600	1.61	1.61	+300	39.93	40.09
+300	11.65	13.26	+250	15.92	56.01
+250	10.43	23.69	+212	26.68	82.69
+212	28.01	51.70	+150	11.47	94.15
+150	26.07	77.78	+75	2.57	96.72
+75	9.56	87.34	+38	0.73	97.45
+38	3.43	90.76	-38	2.55	100.00
-38	9.24	100.00			

Hole 16

Depth: 7.0 m
Registered No.: 851877

Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.45	0.45
+300	16.94	17.39
+250	23.96	41.35
+212	36.23	77.58
+150	16.31	93.88
+75	3.16	97.05
+38	0.84	97.89
-38	2.11	100.00

Depth: 7.9 m
Registered No.: 851878

Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.04	0.04
+300	29.74	29.78
+250	25.07	54.86
+212	28.89	83.75
+150	9.96	93.71
+75	1.56	95.27
+38	1.35	96.62
-38	3.38	100.00

Hole 17

Depth: 5.2 m
Registered No.: 851879

Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.21	0.21
+300	20.83	21.05
+250	26.40	47.45
+212	33.00	80.45
+150	17.40	97.86
+75	1.71	99.57
+38	0.13	99.70
-38	0.30	100.00

Depth: 7.0 m
Registered No.: 851880

Sieve size (µm)	Mass (%)	Cum. Mass (%)
+600	0.98	0.98
+300	14.19	15.18
+250	24.15	39.32
+212	33.30	72.62
+150	19.01	91.63
+75	4.78	96.41
+38	1.16	97.57
-38	2.43	100.00