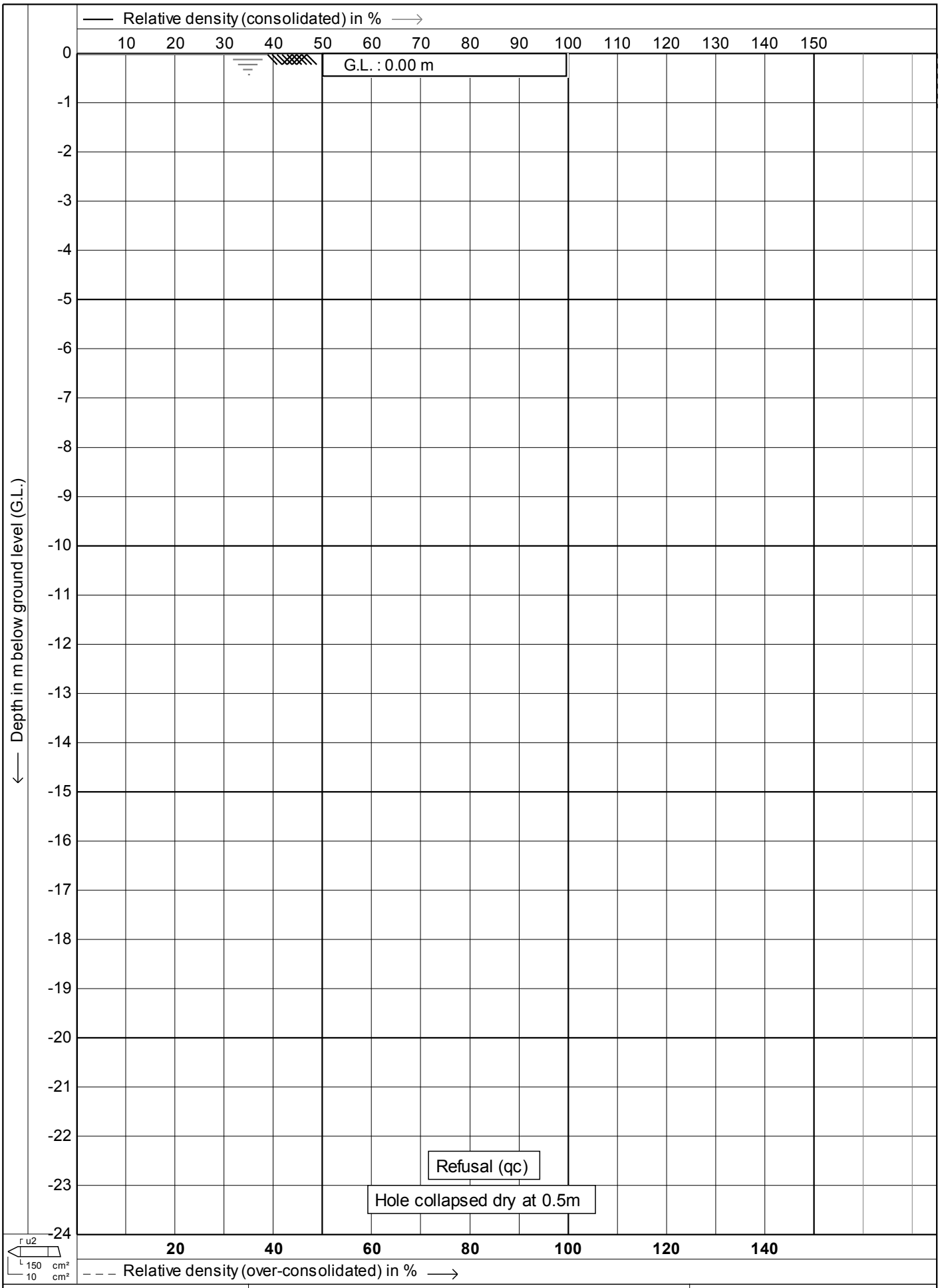


PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

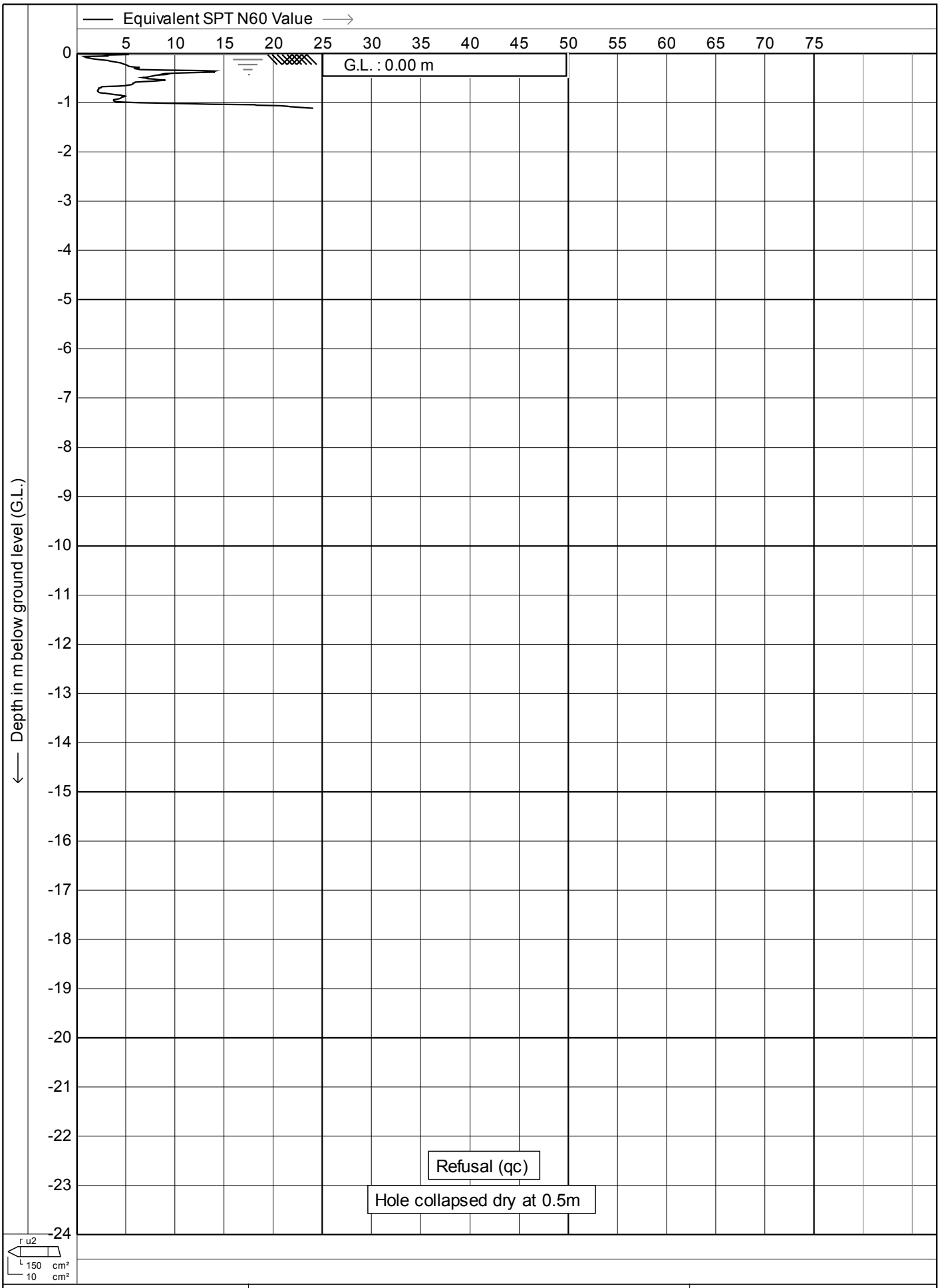
Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

11/14

1.42



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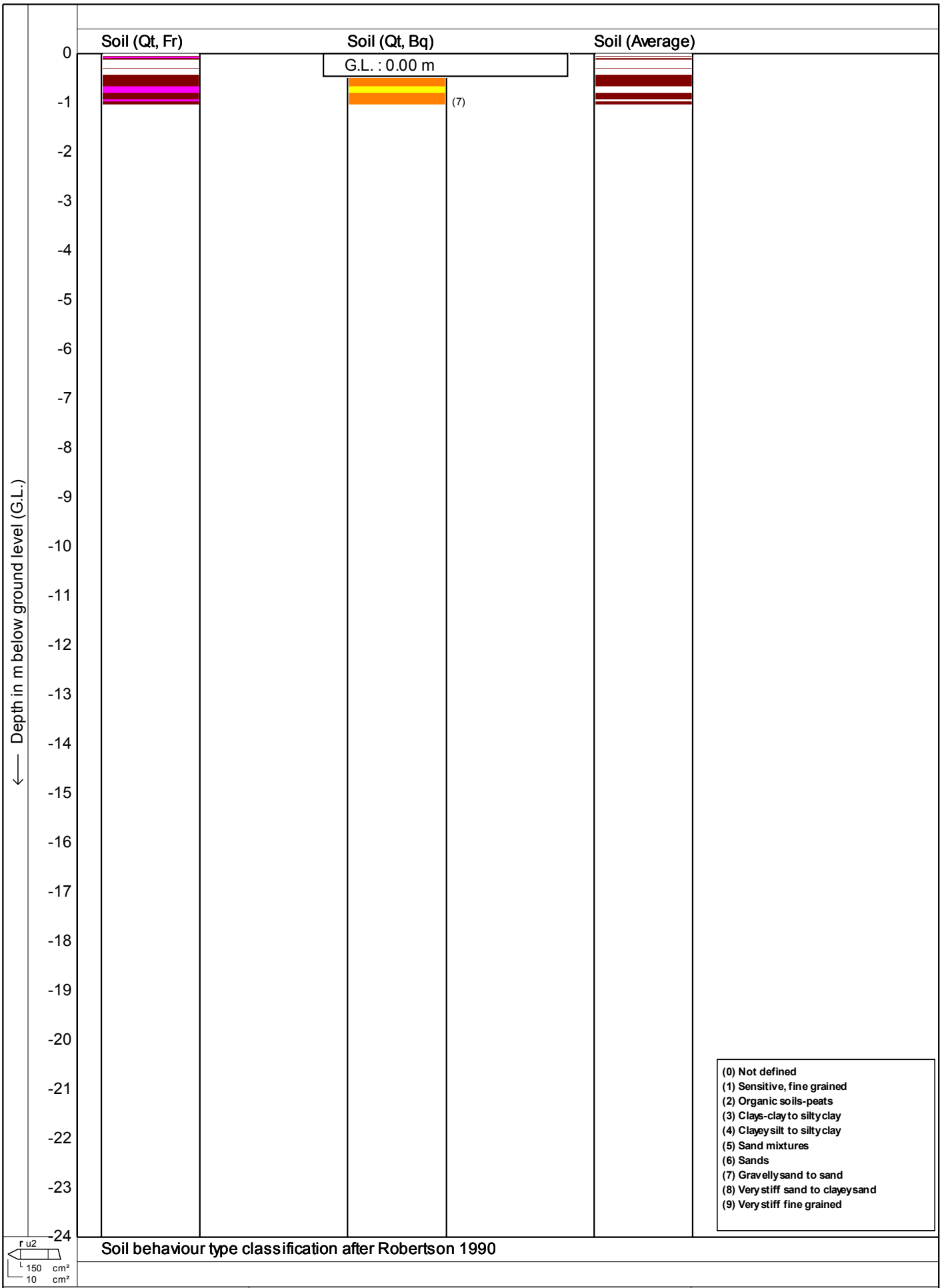
Project no. : **05TT17**

CPT no. : **09**

12/14

1.42



Soil behaviour type classification after Robertson 1990

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Project no. : **05TT17**

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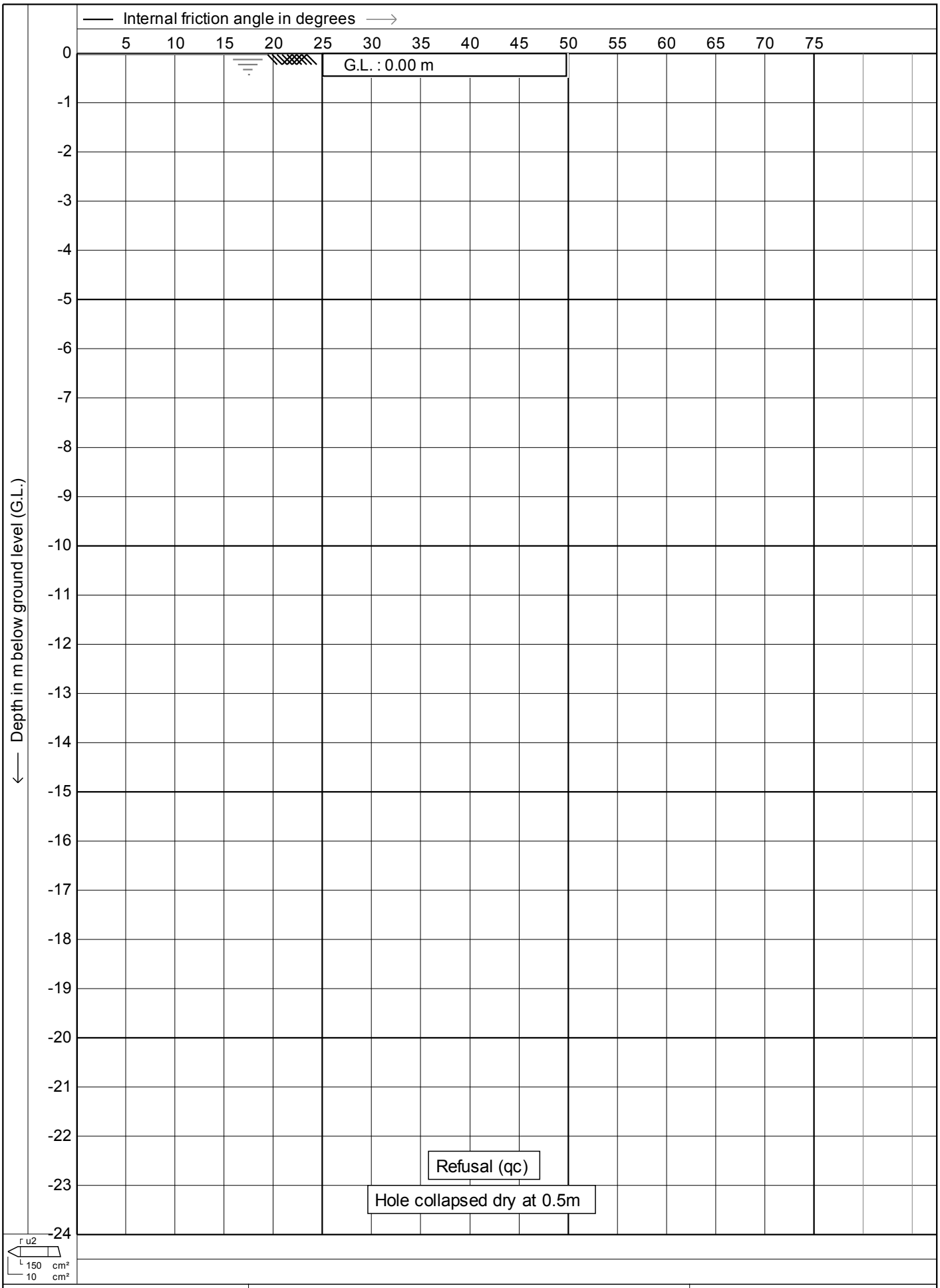
1.42



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Project no.	: **05TT17**
CPT no.	: **09**

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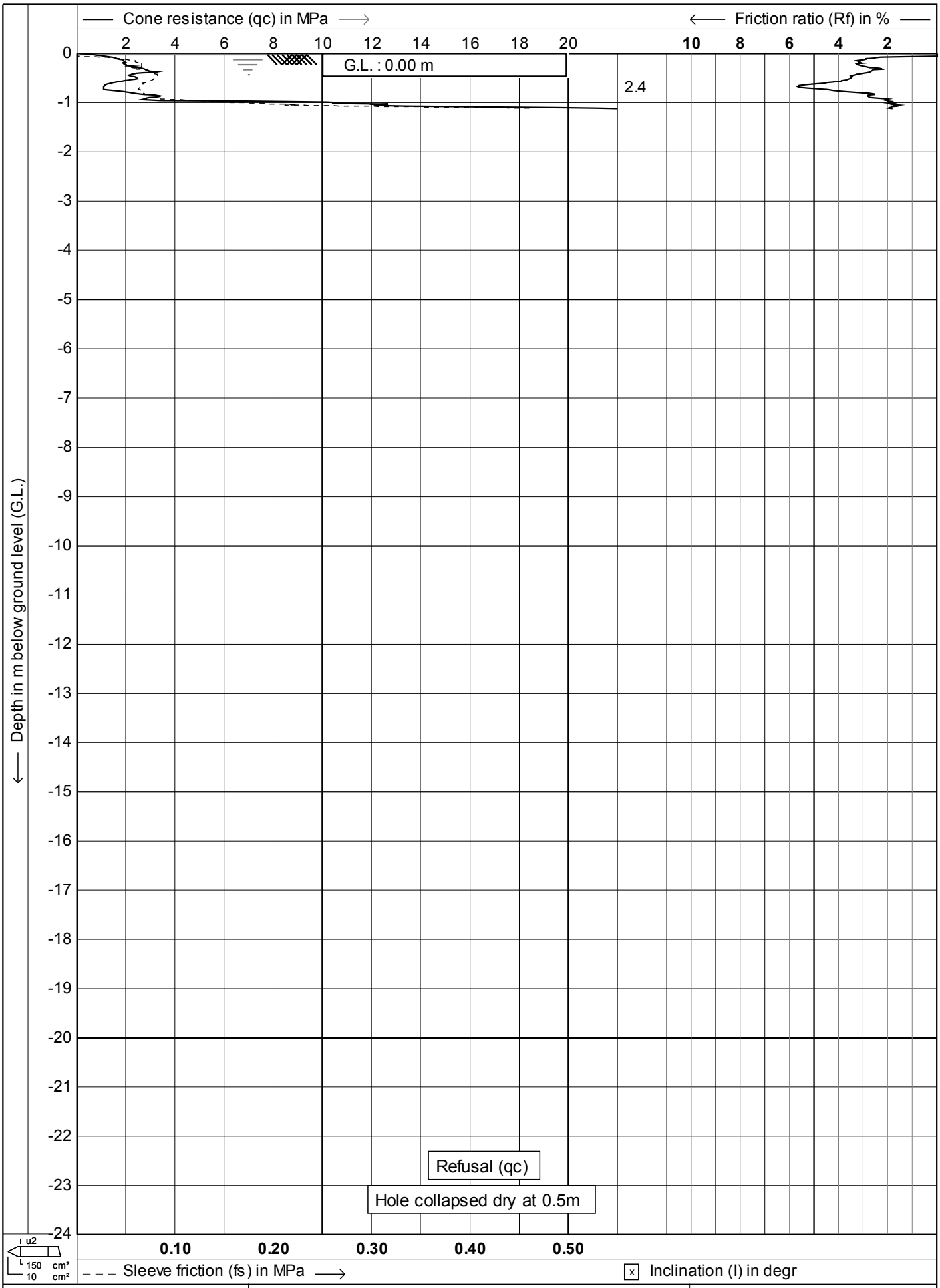

PERRY GEOTECH

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Position: **0, 0 RD**

Date : **5-11-2013**

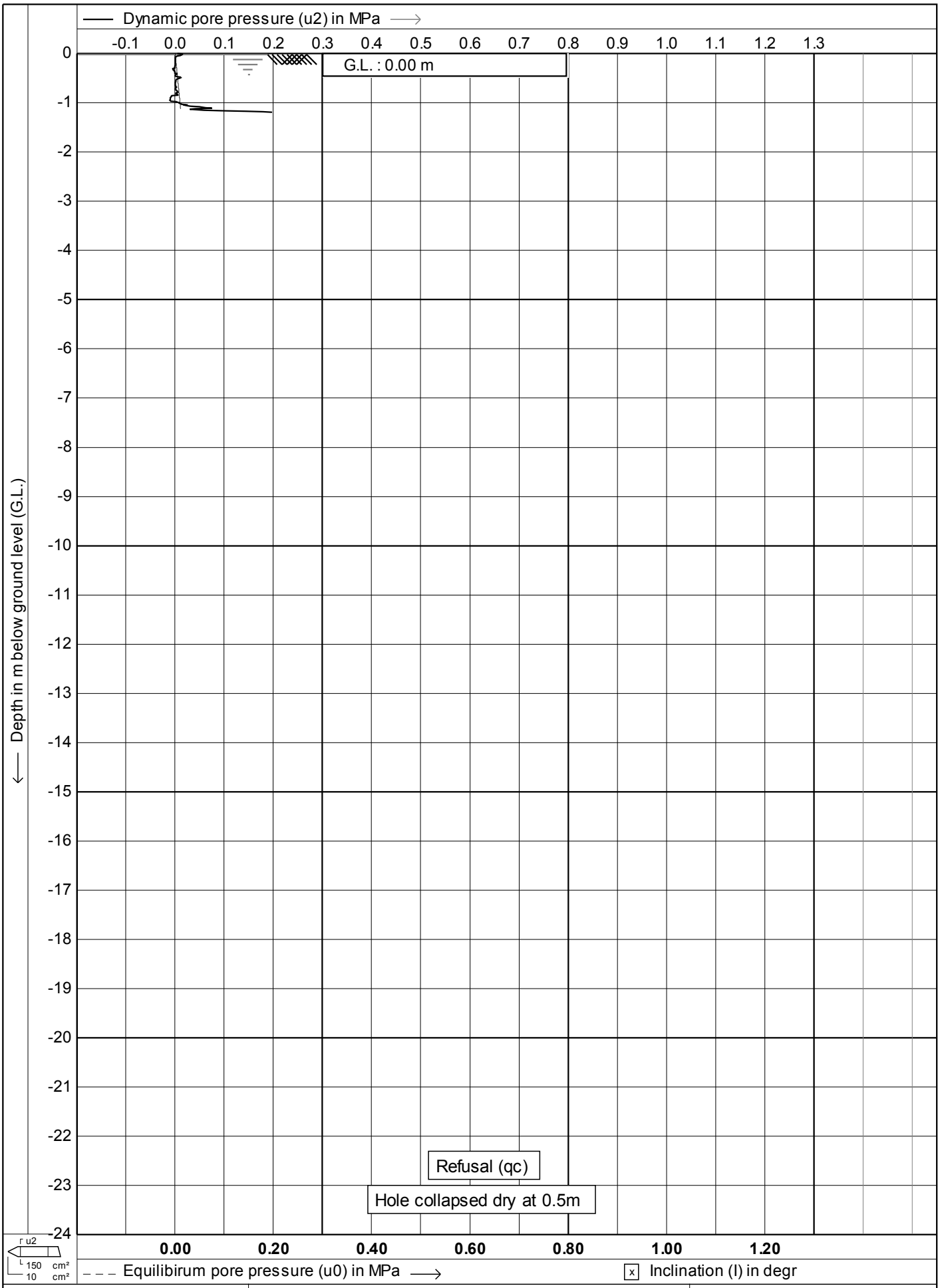
Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **09a**

1/14

1.42



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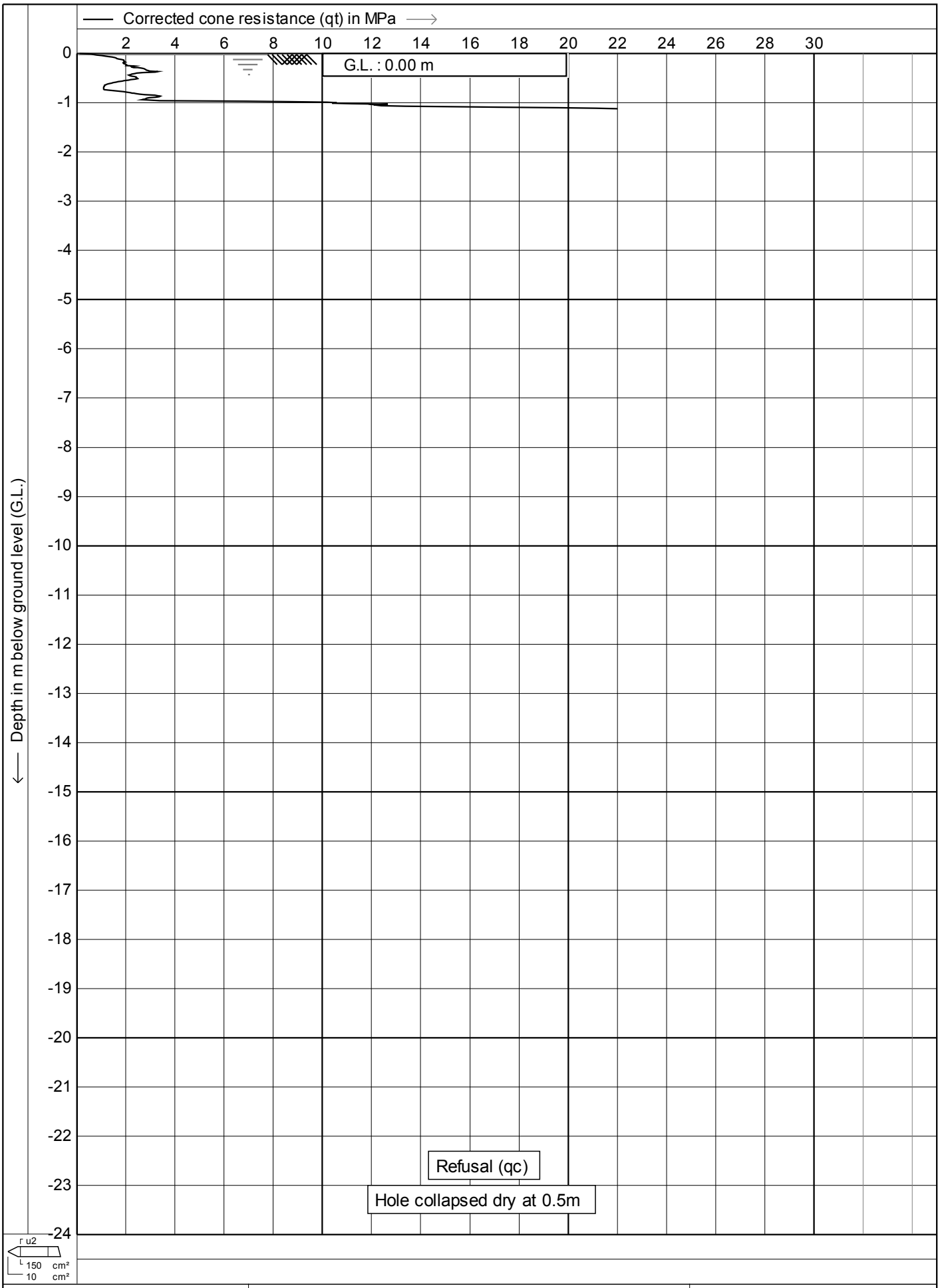

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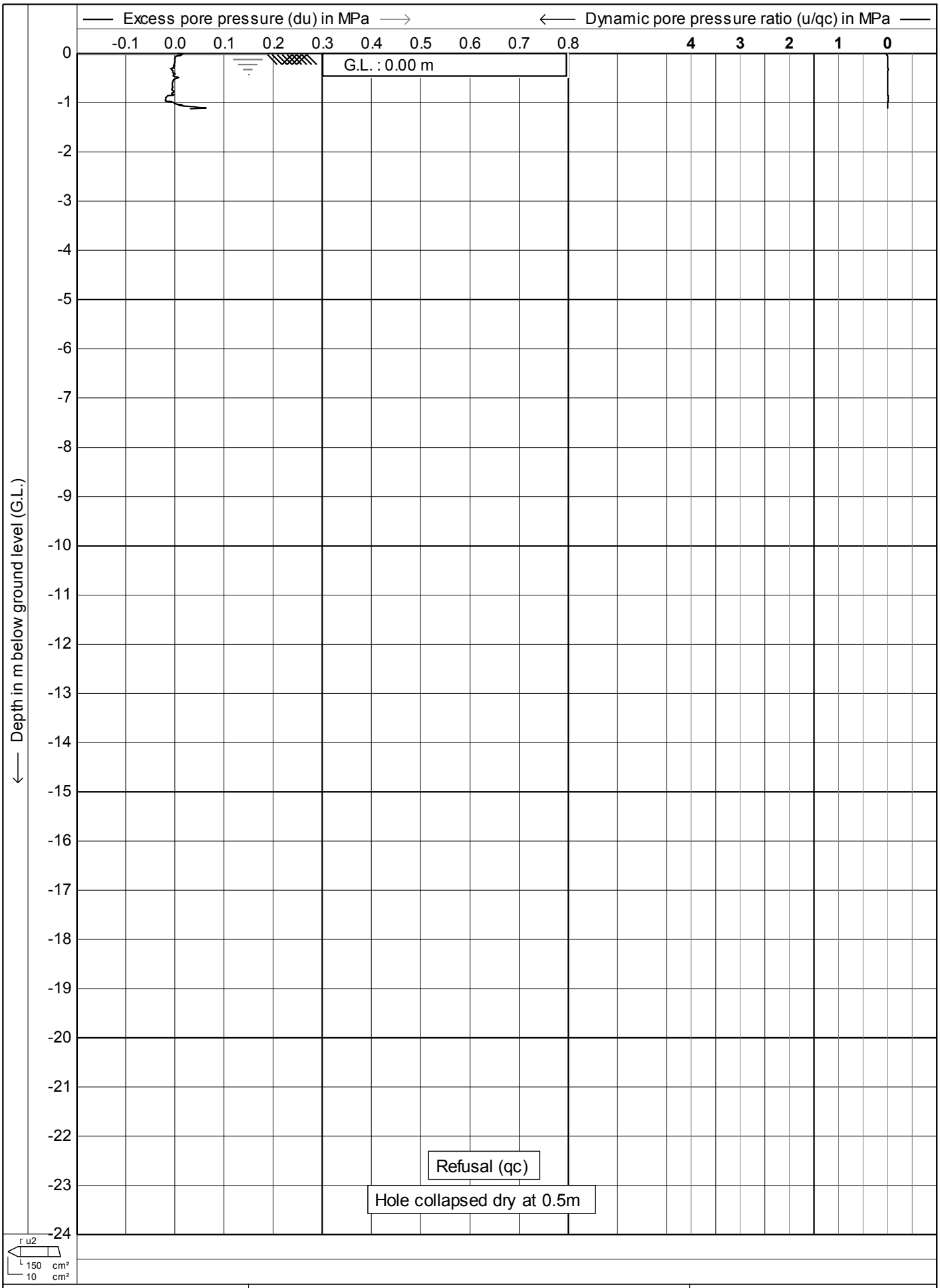

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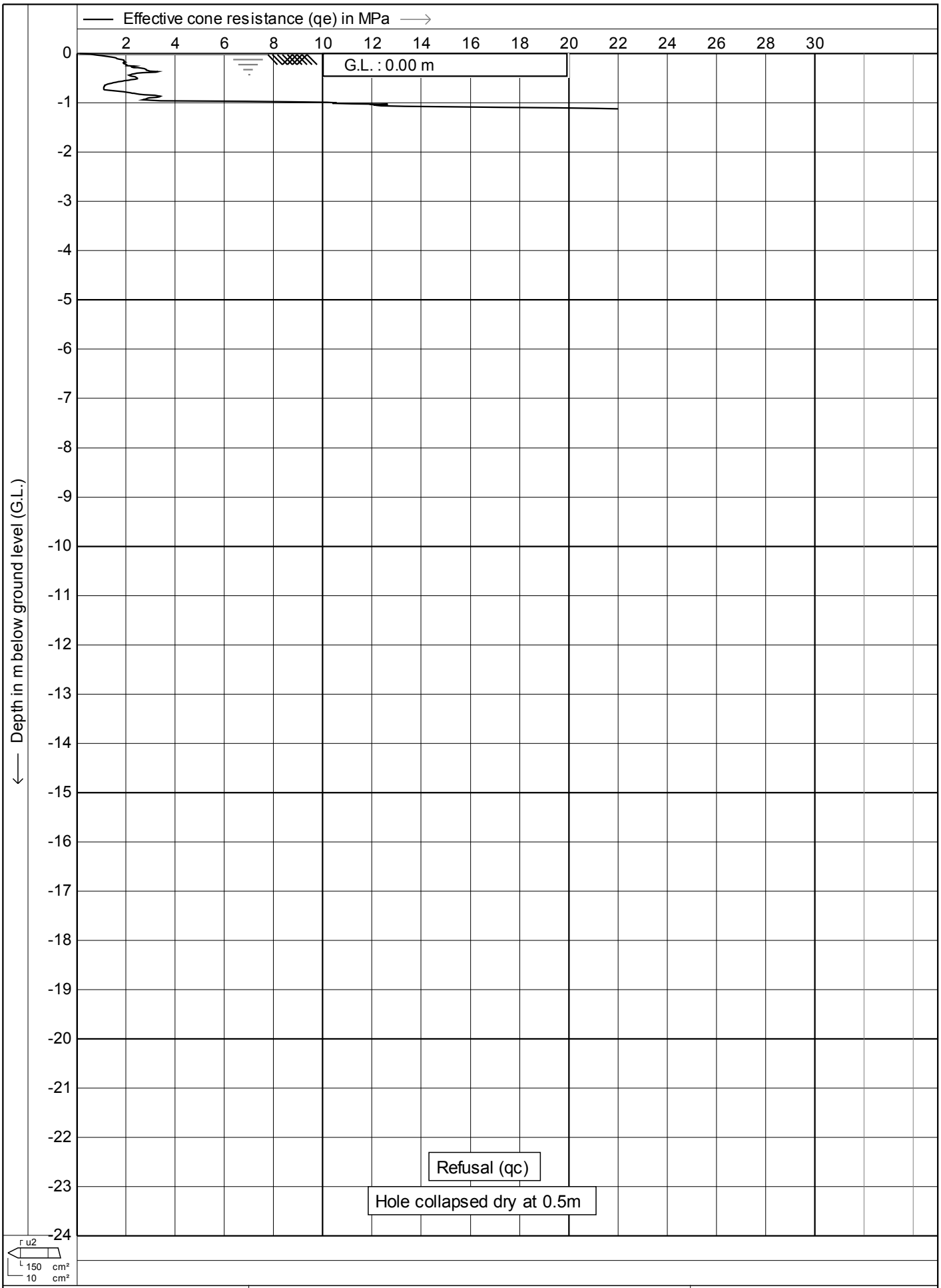
Project no.	: **05TT17**
CPT no.	: **09a** **4/14**

1.42



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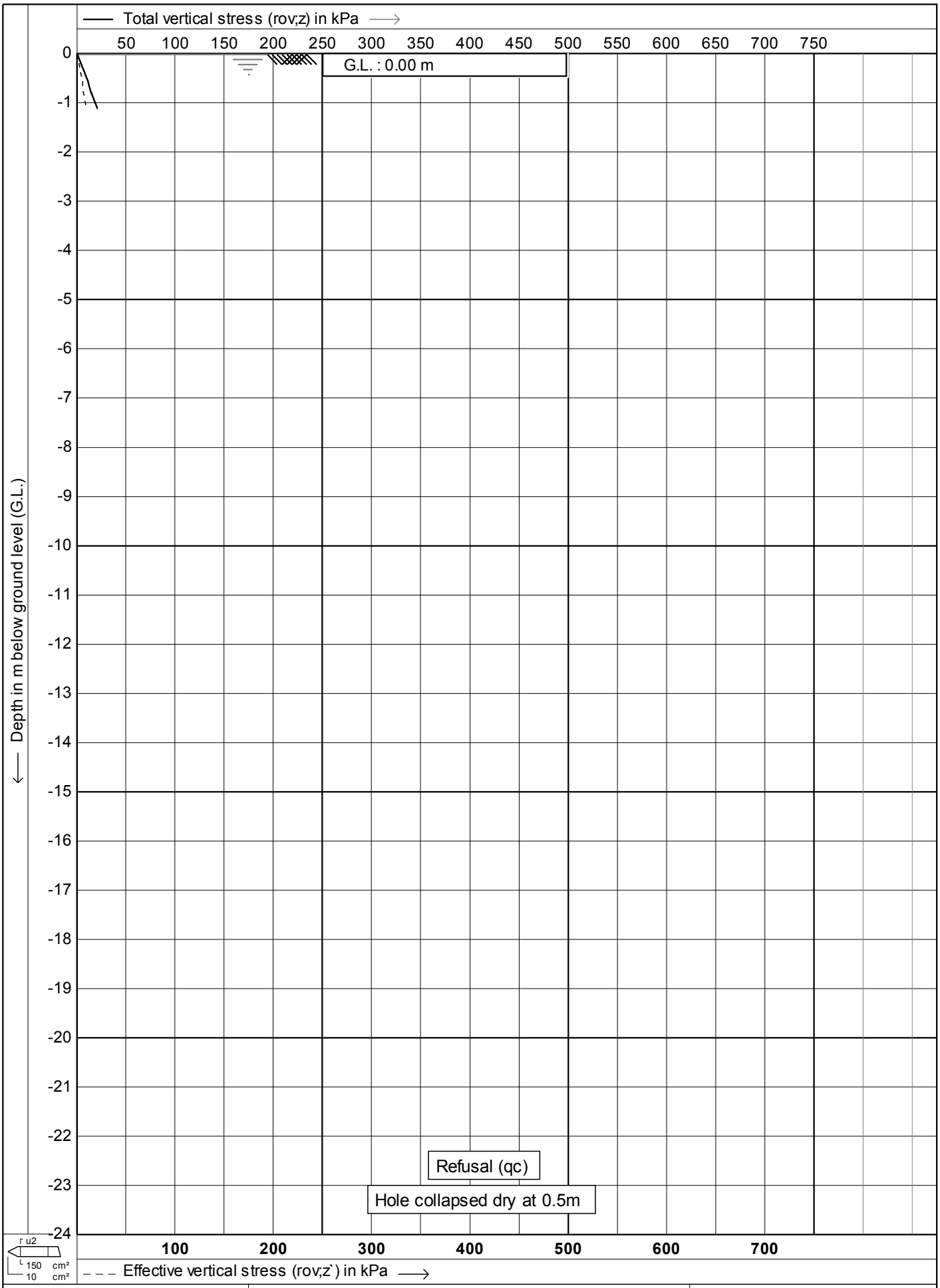

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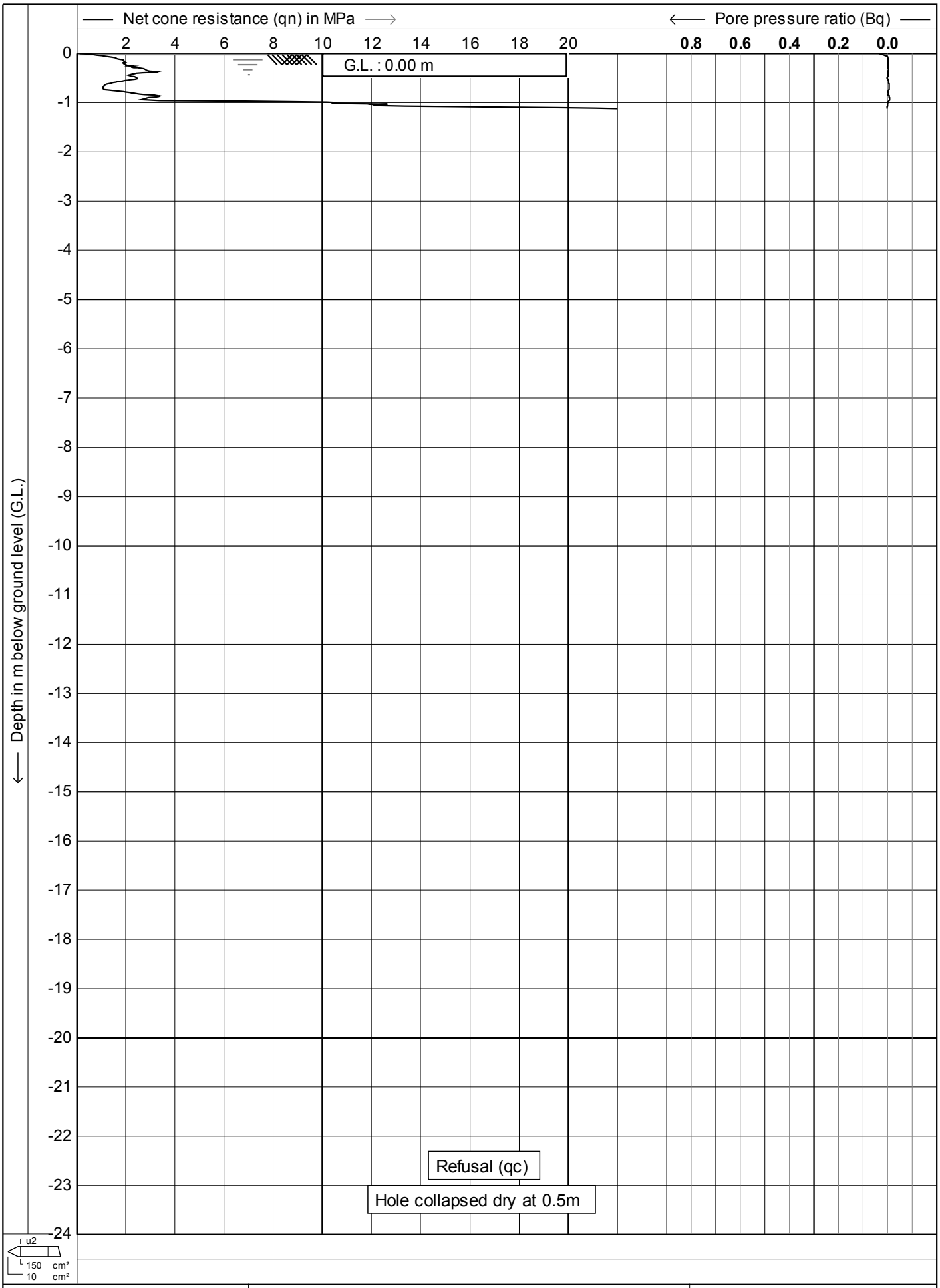
Project no.	: **05TT17**
CPT no.	: **09a** **6/14**

1.42



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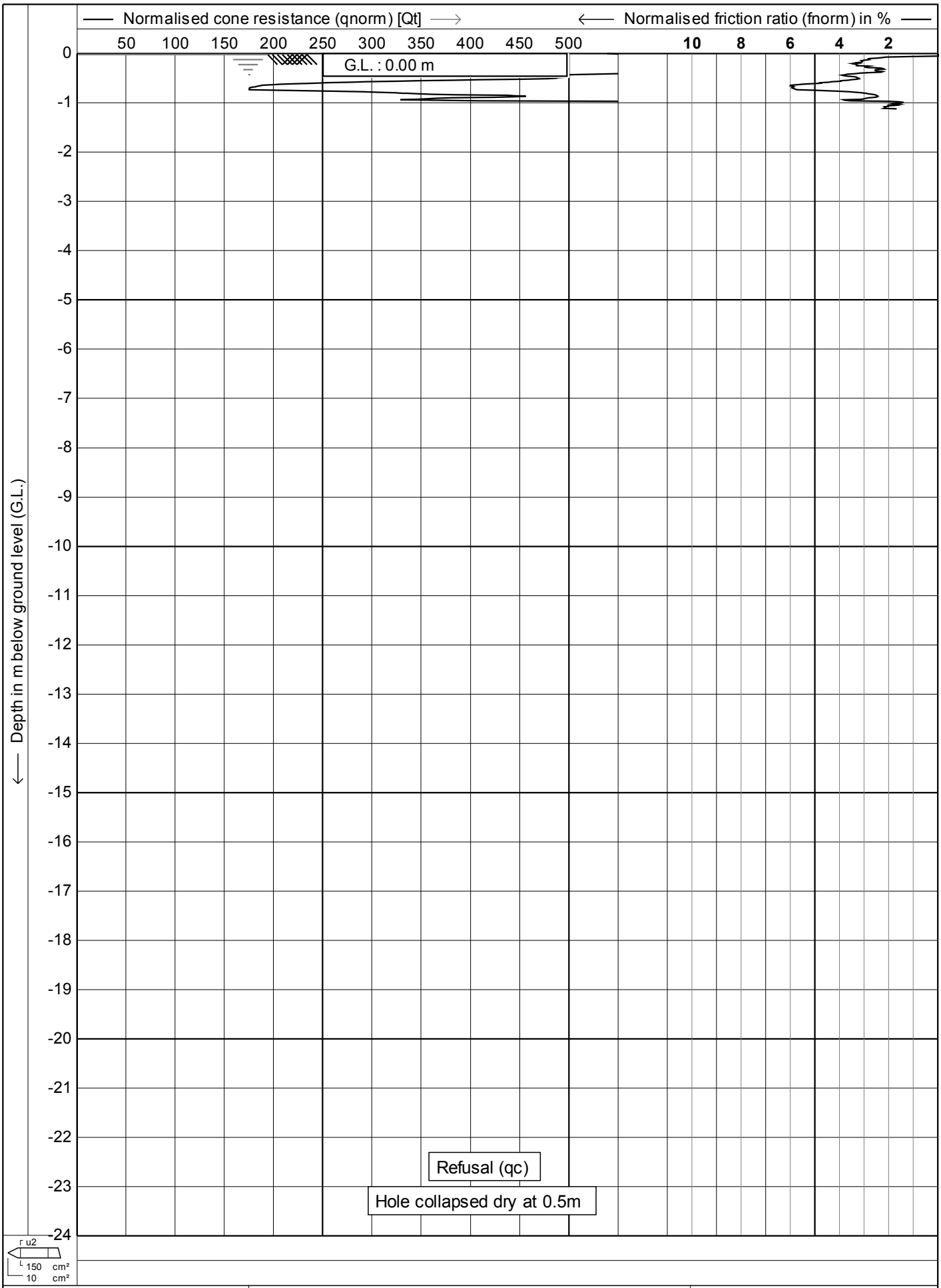
Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **09a** **7/14**

1.42



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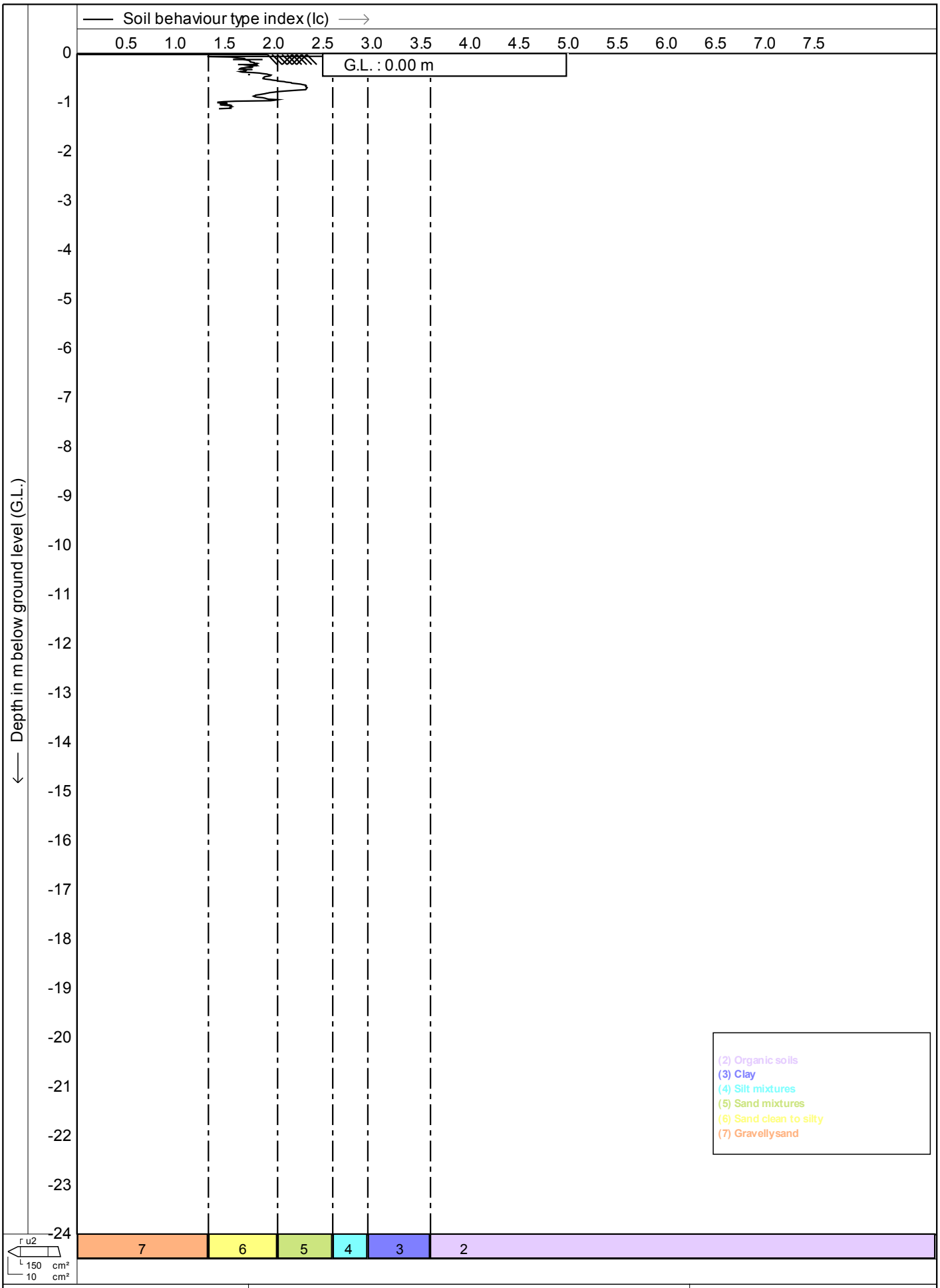
1.42



PERRY GEOTECH

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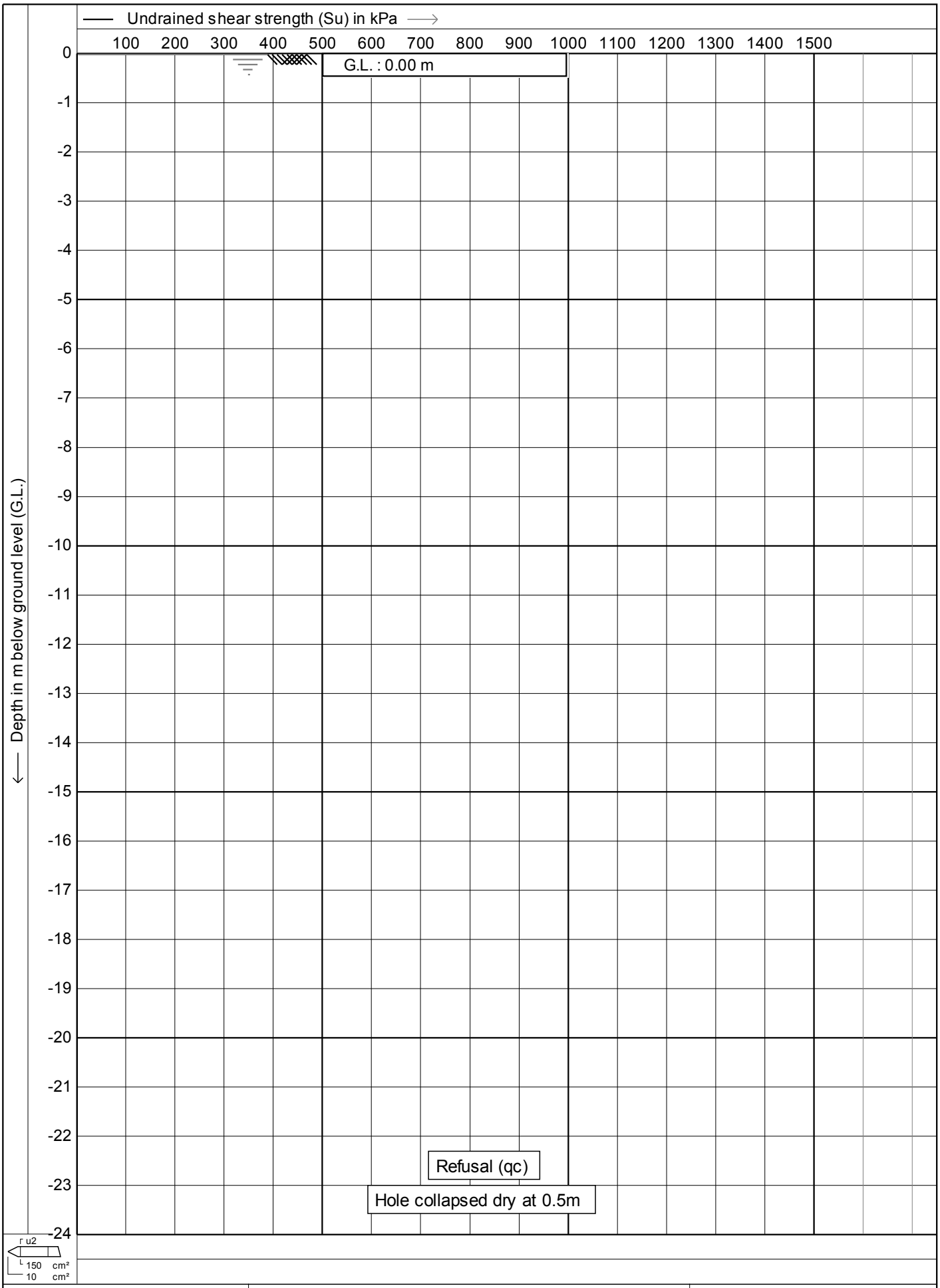

PERRY GEOTECH

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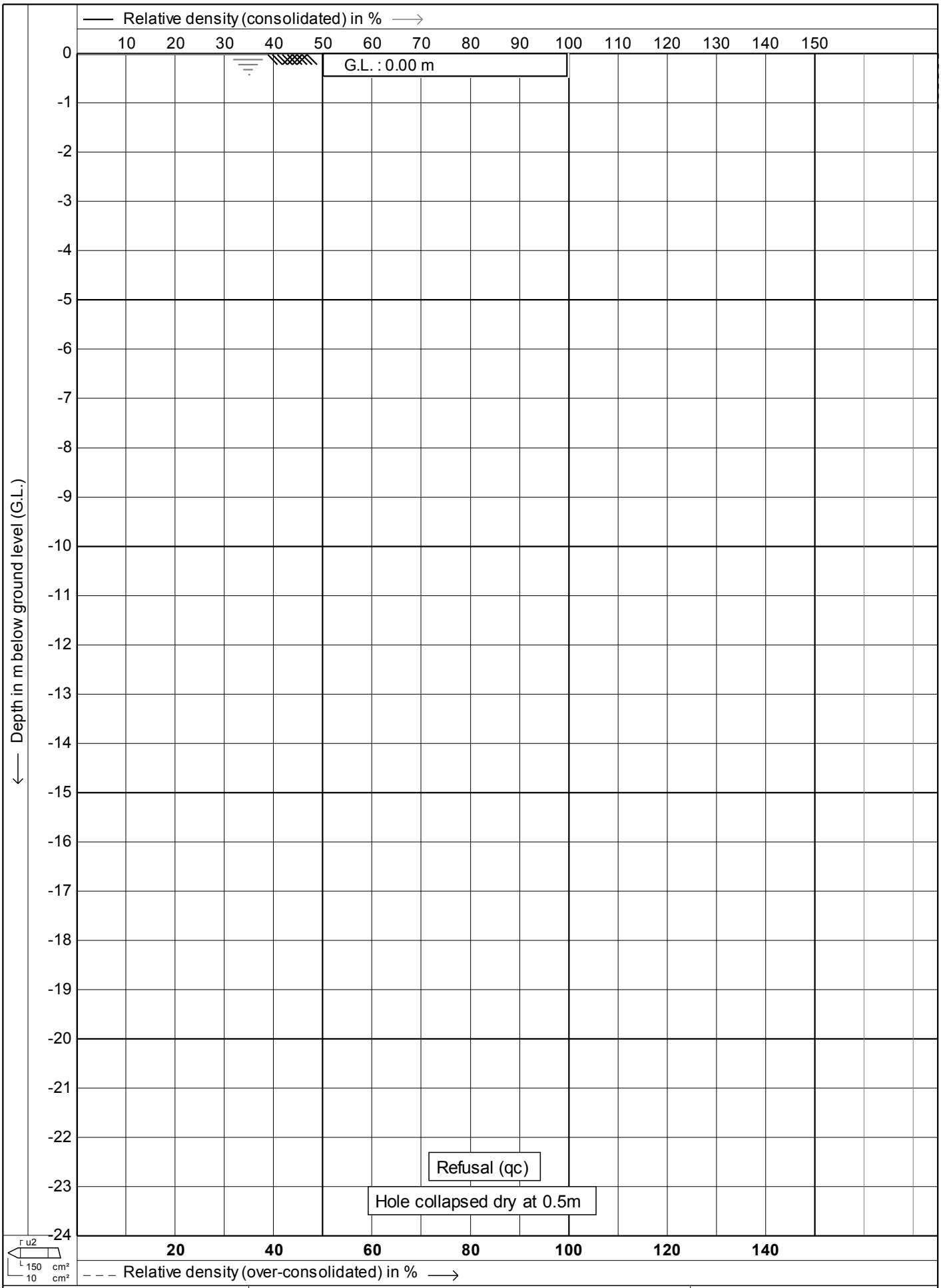
CPT no.	: **09a** **10/14**

1.42



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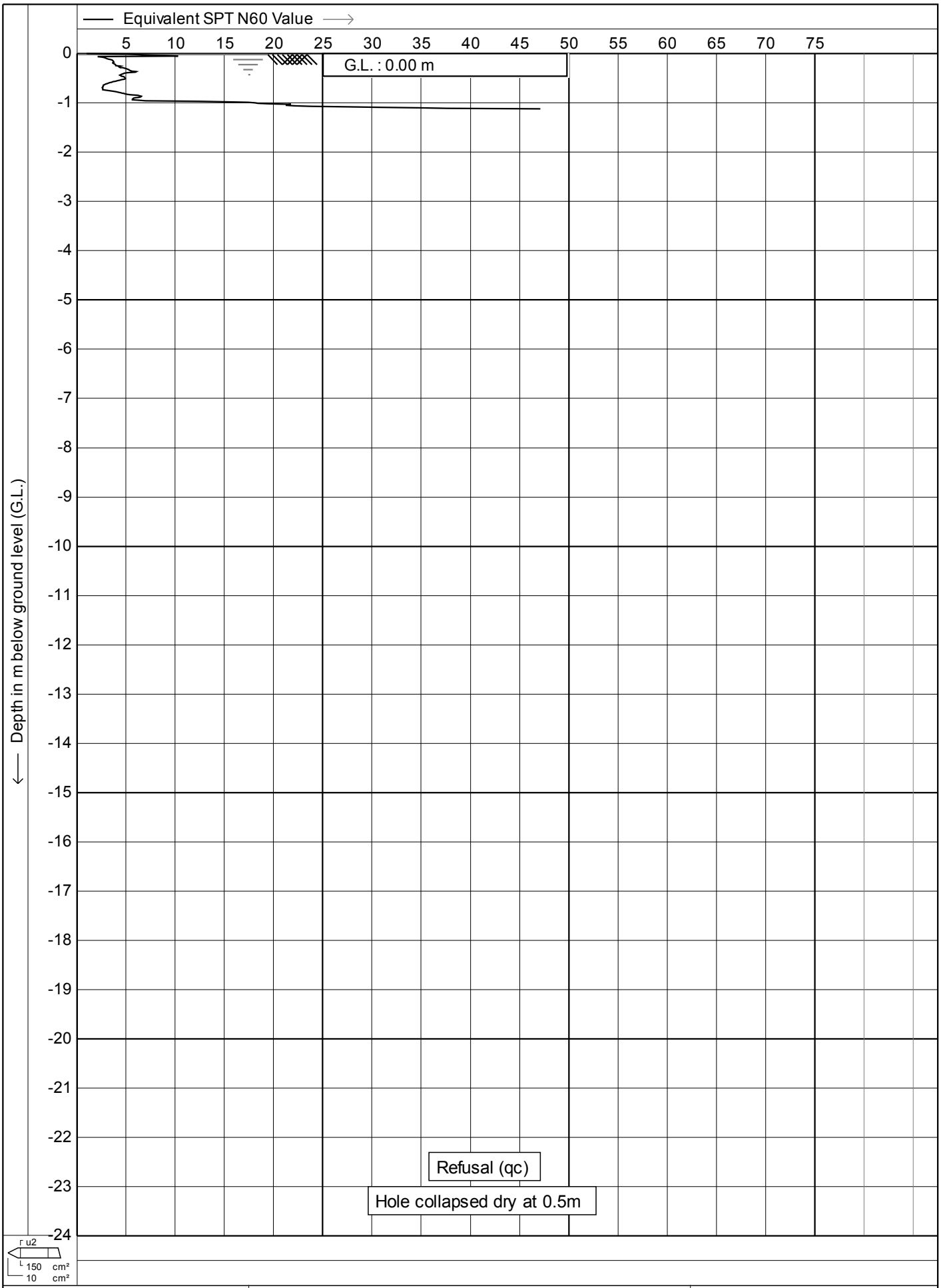
11/14

1.42



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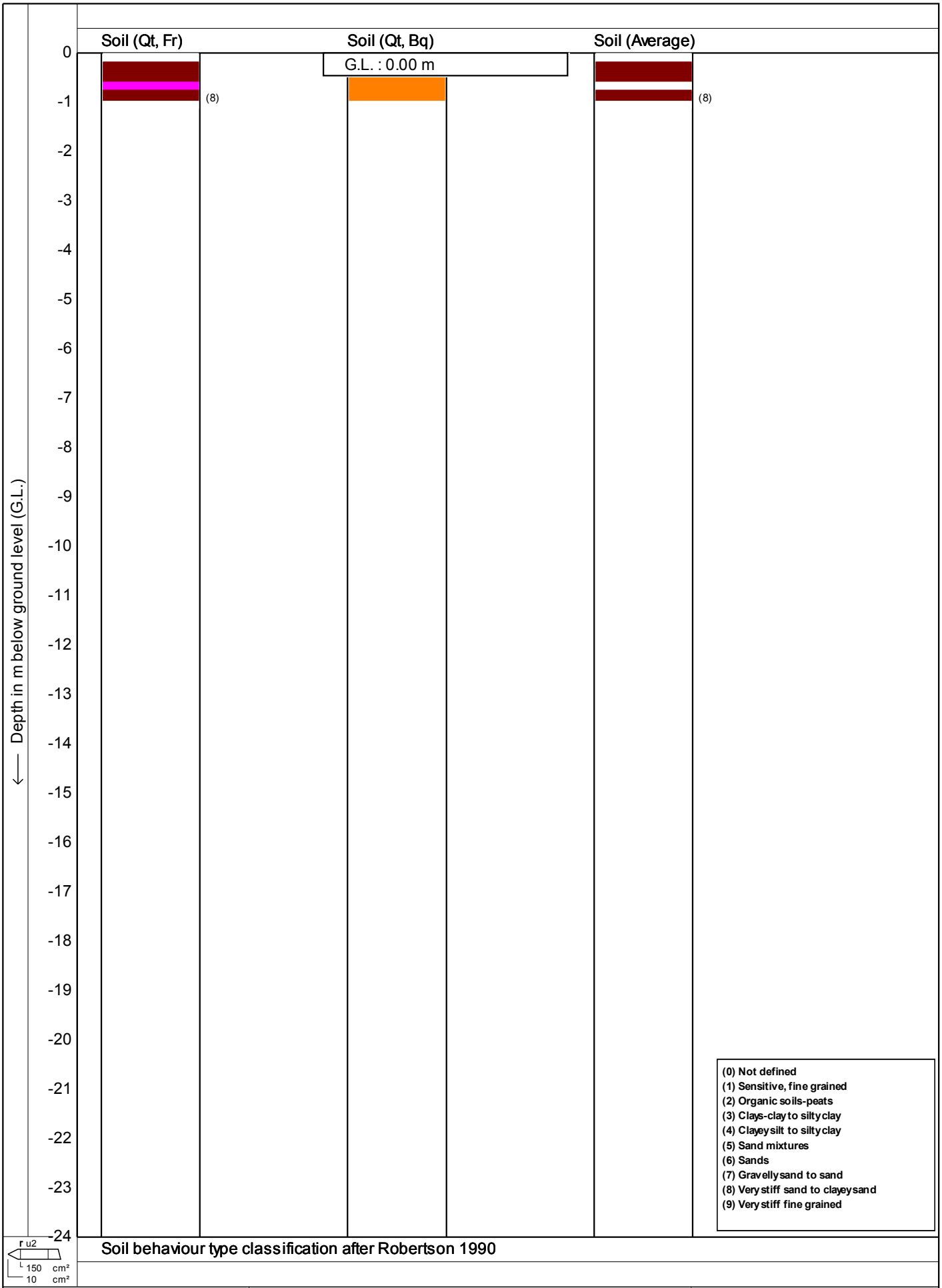

Soil behaviour type classification after Robertson 1990

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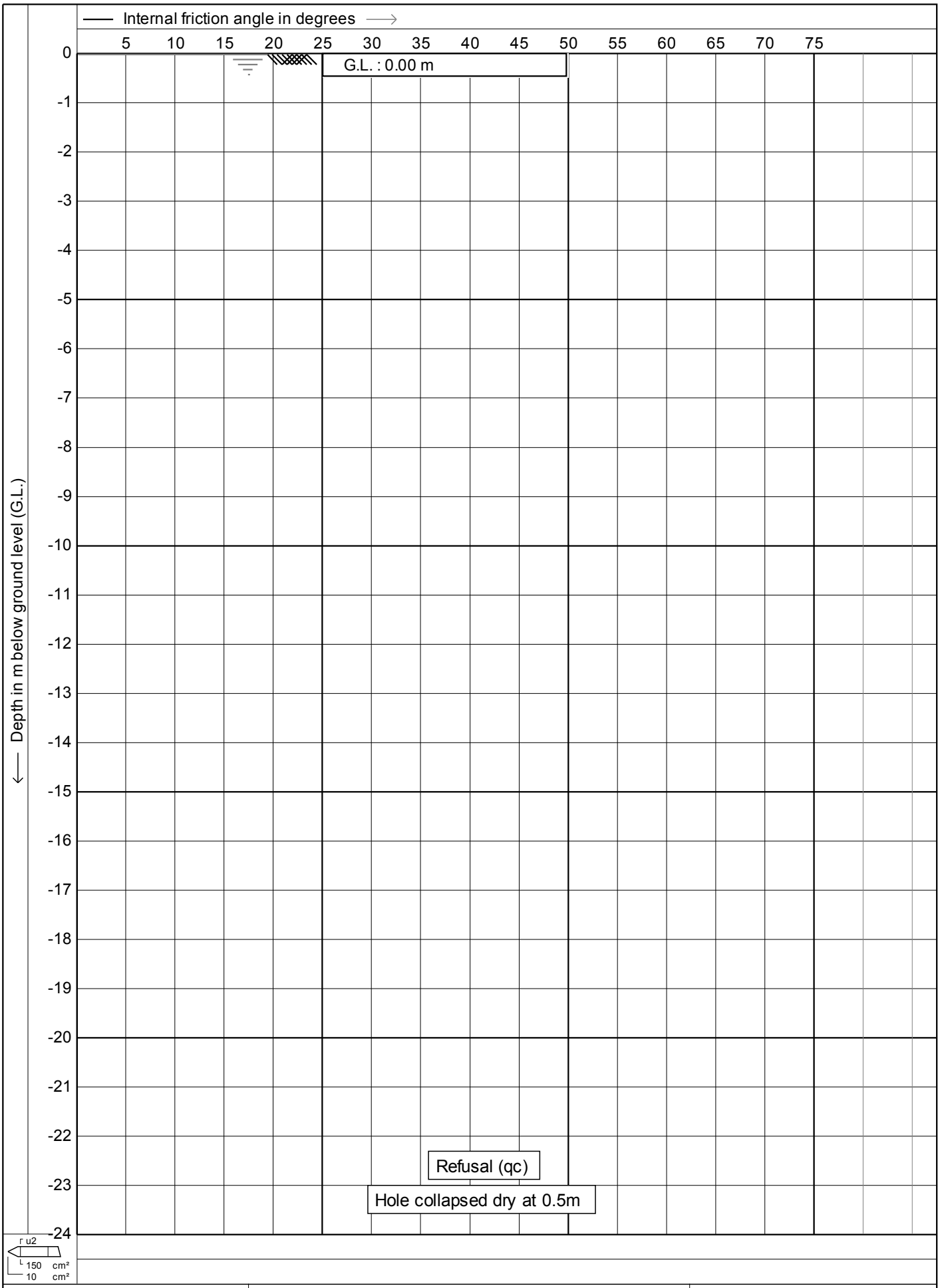

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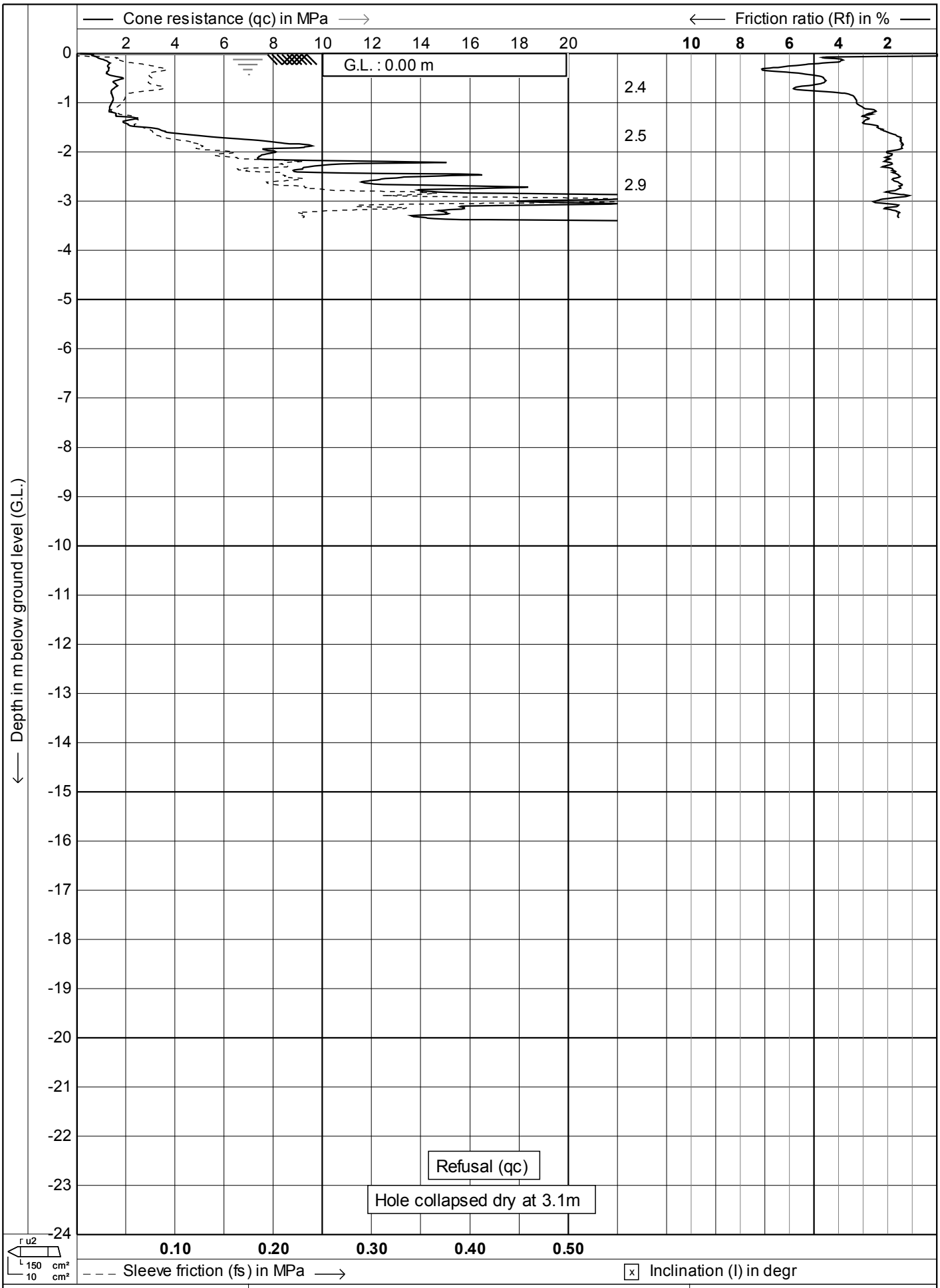

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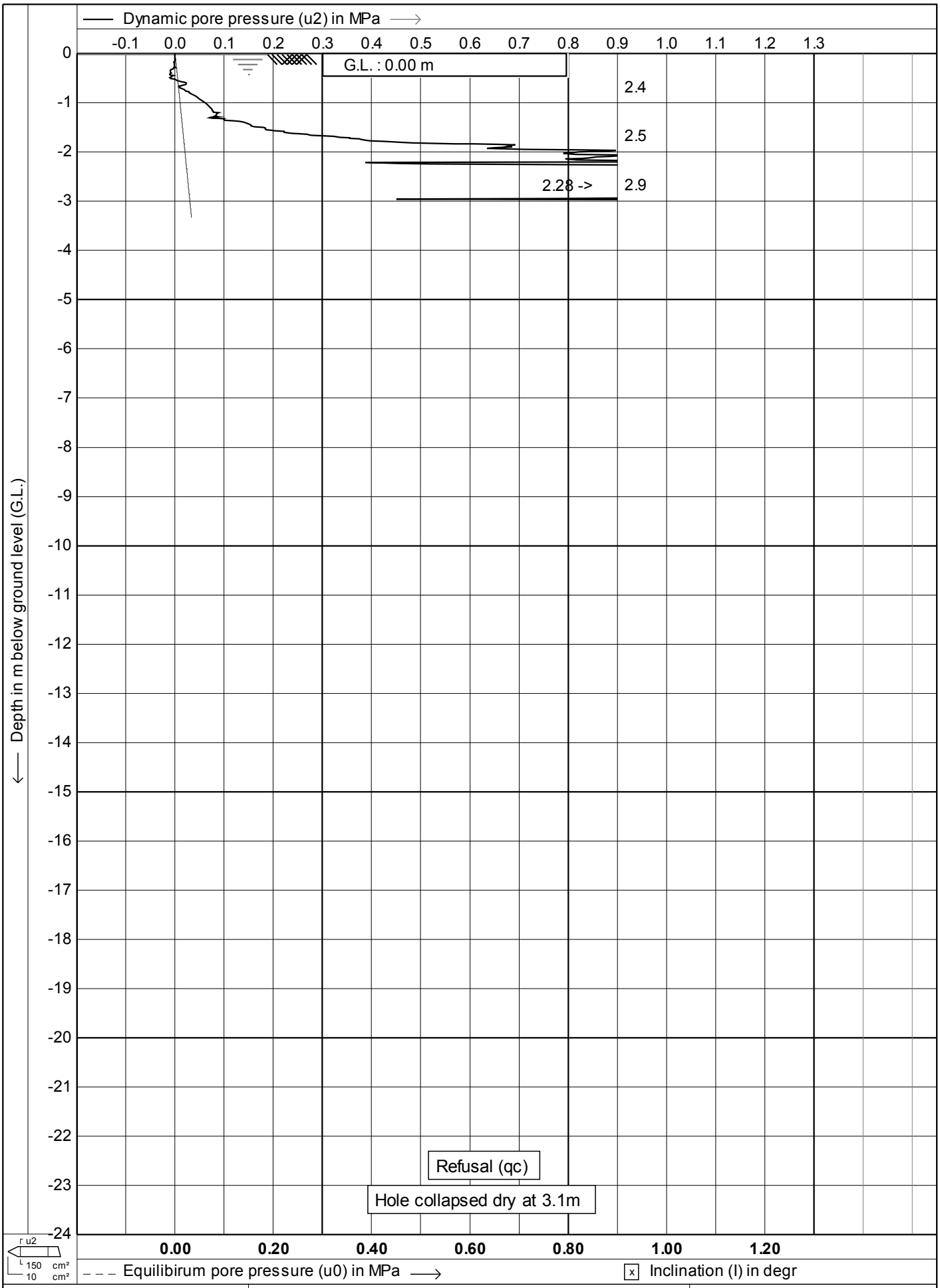
Project no. : **05TT17**

CPT no. : **10**

1/14

1.42



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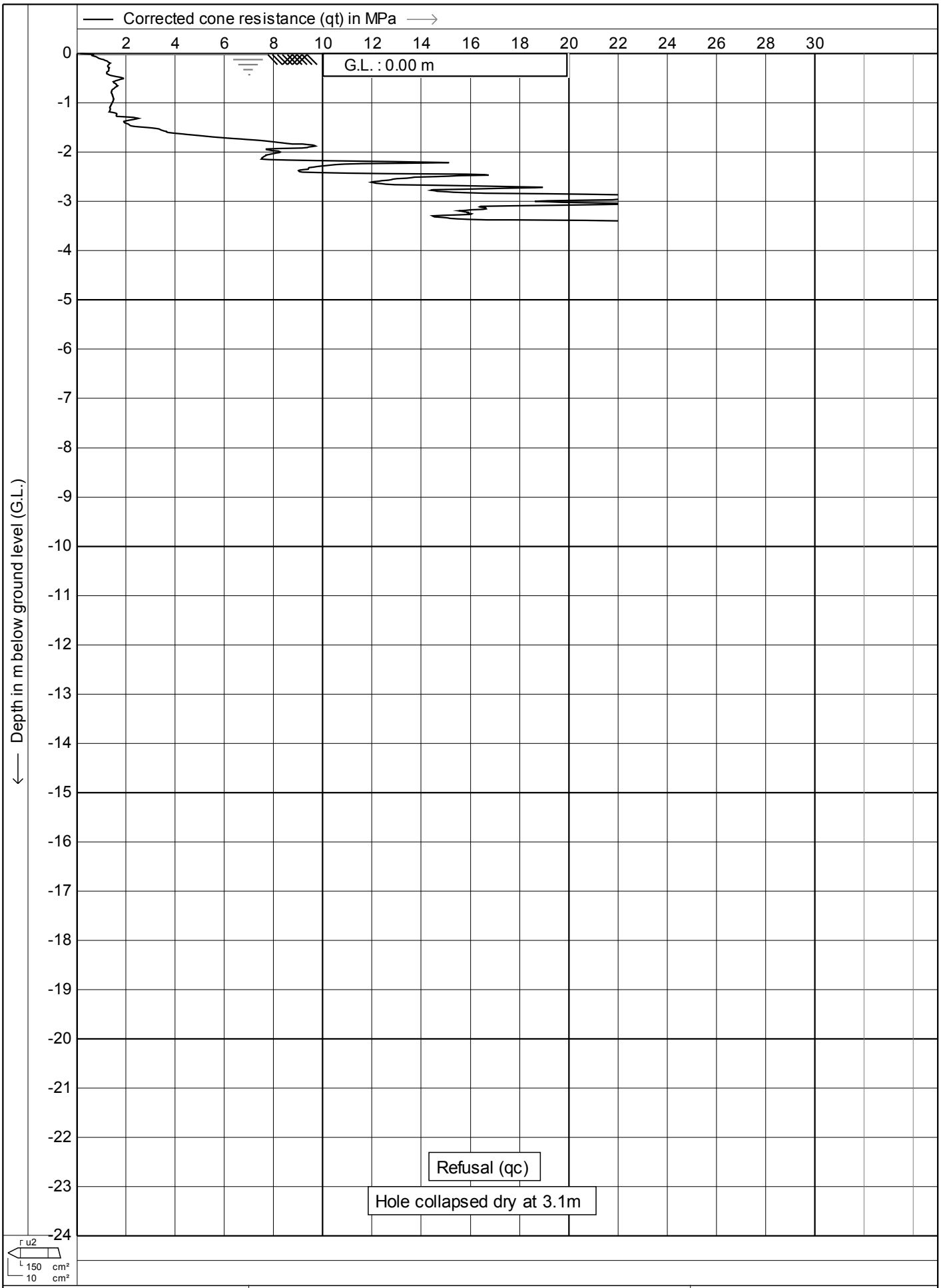

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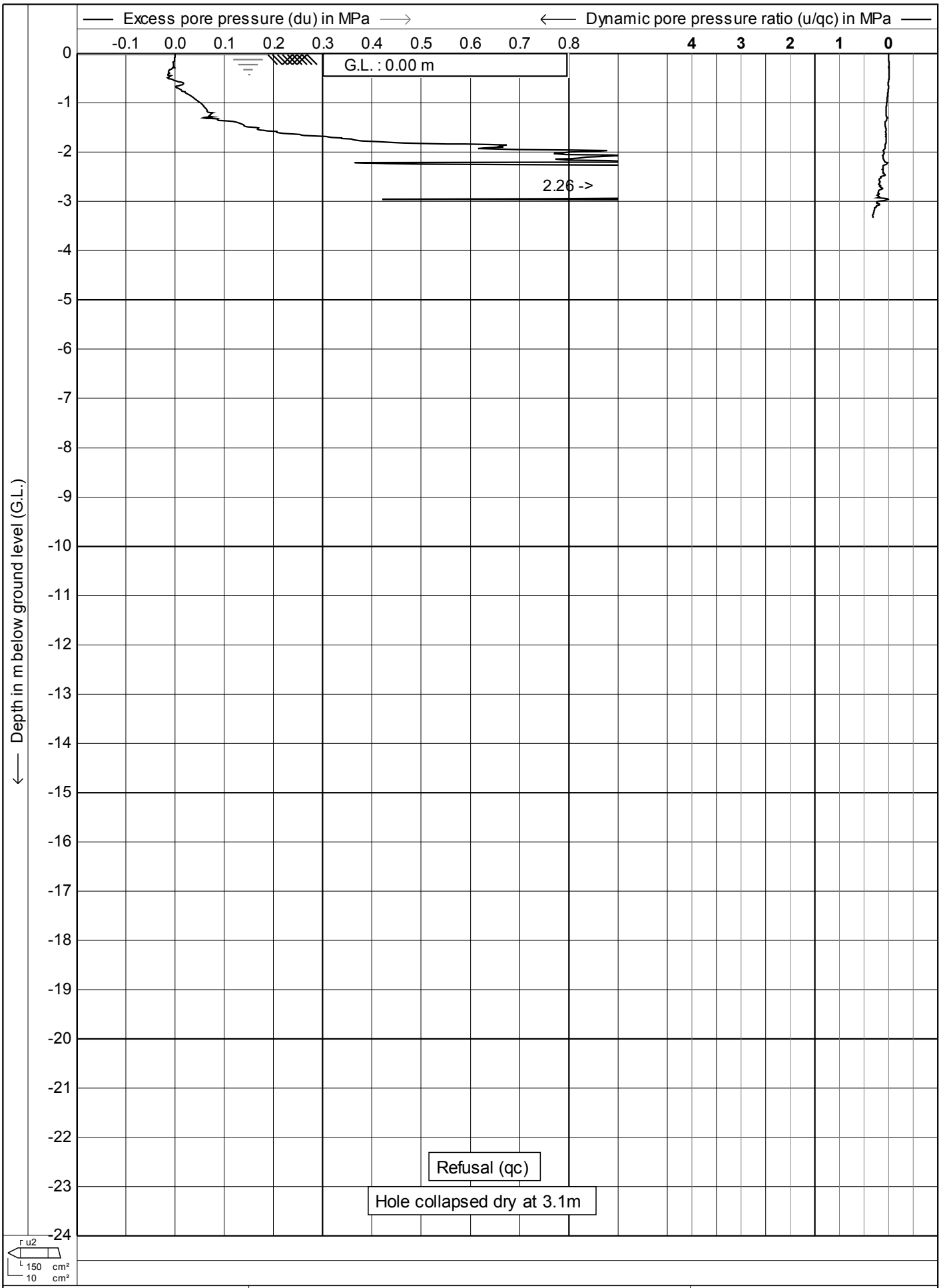

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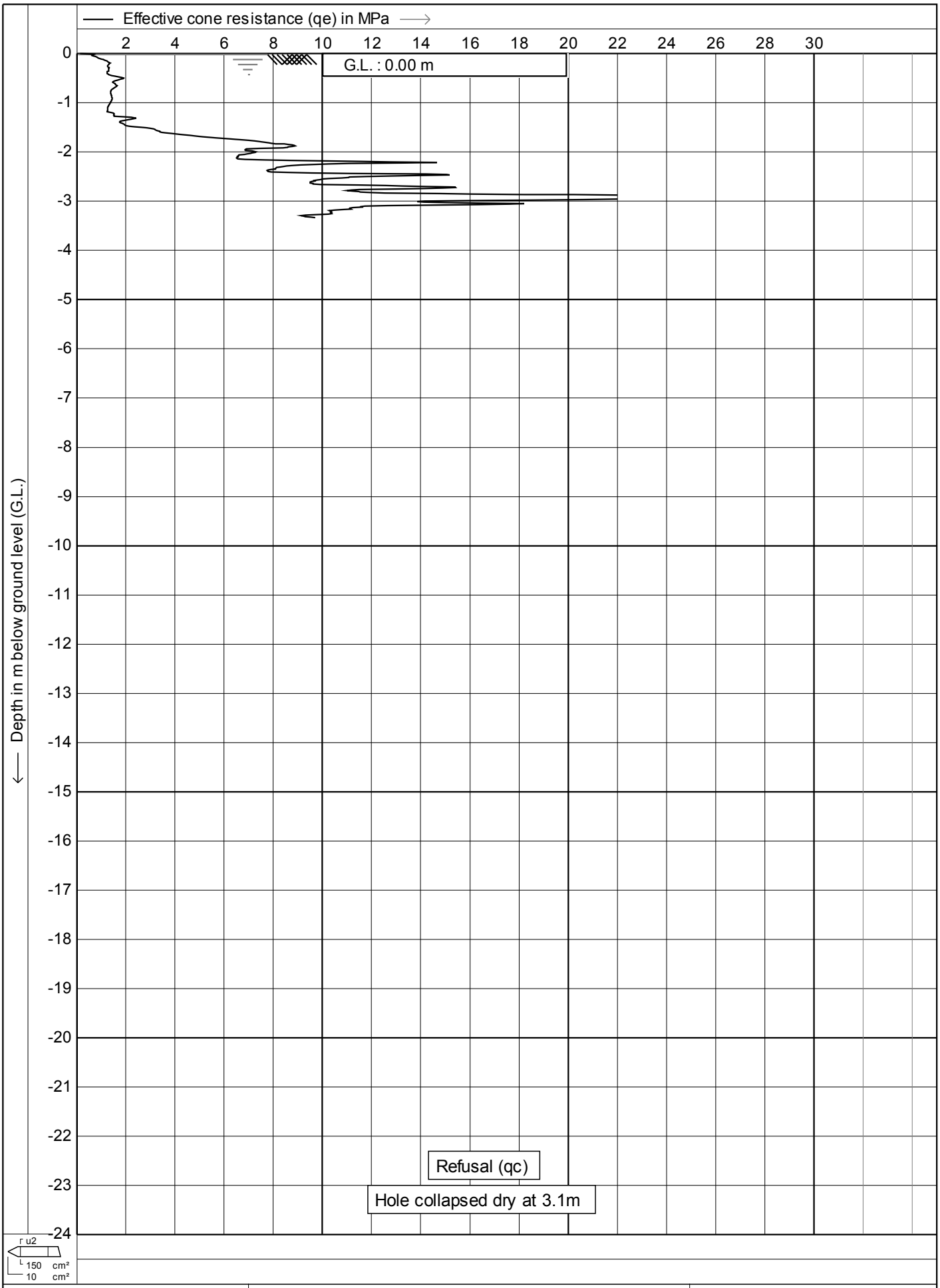

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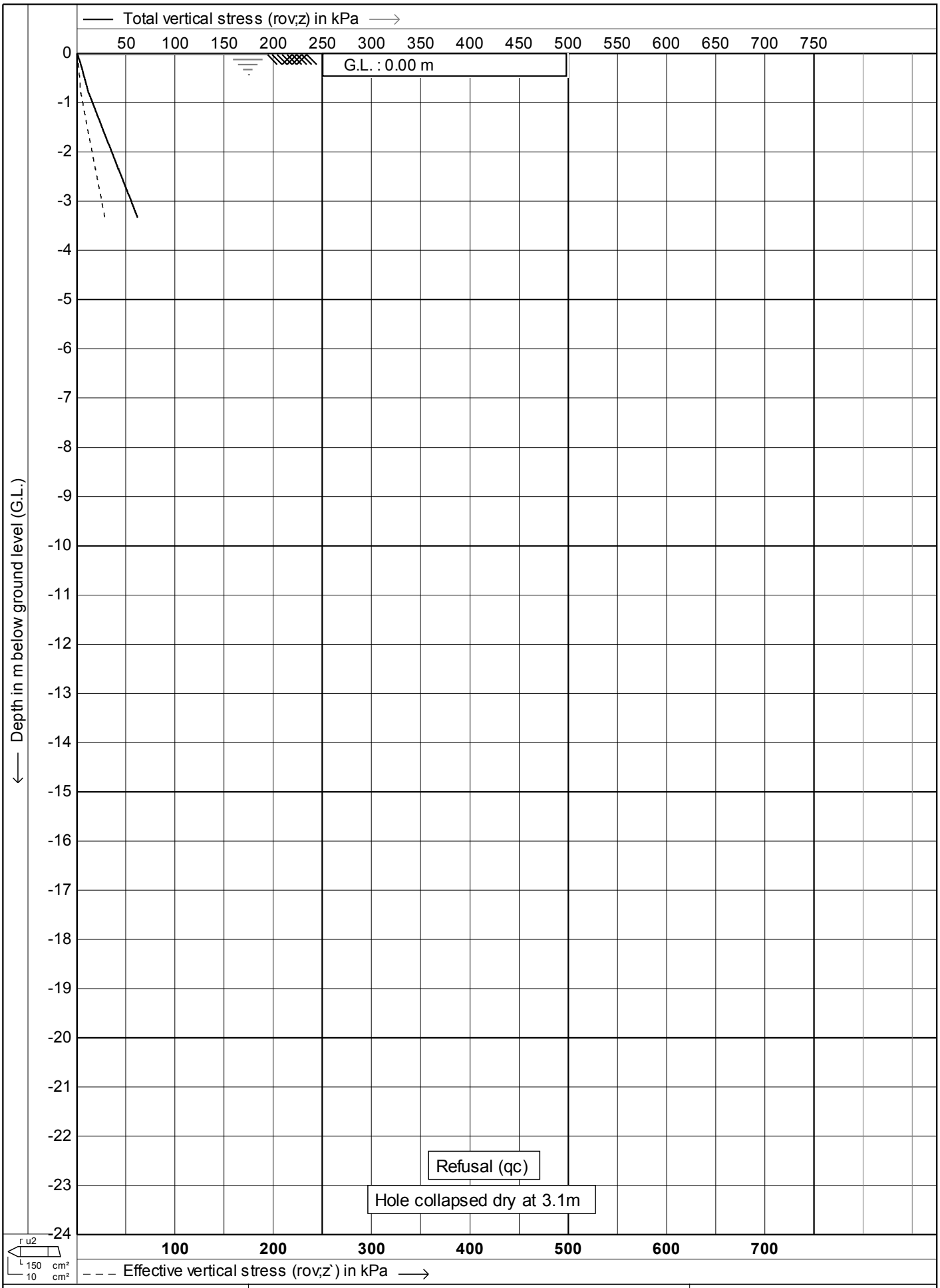

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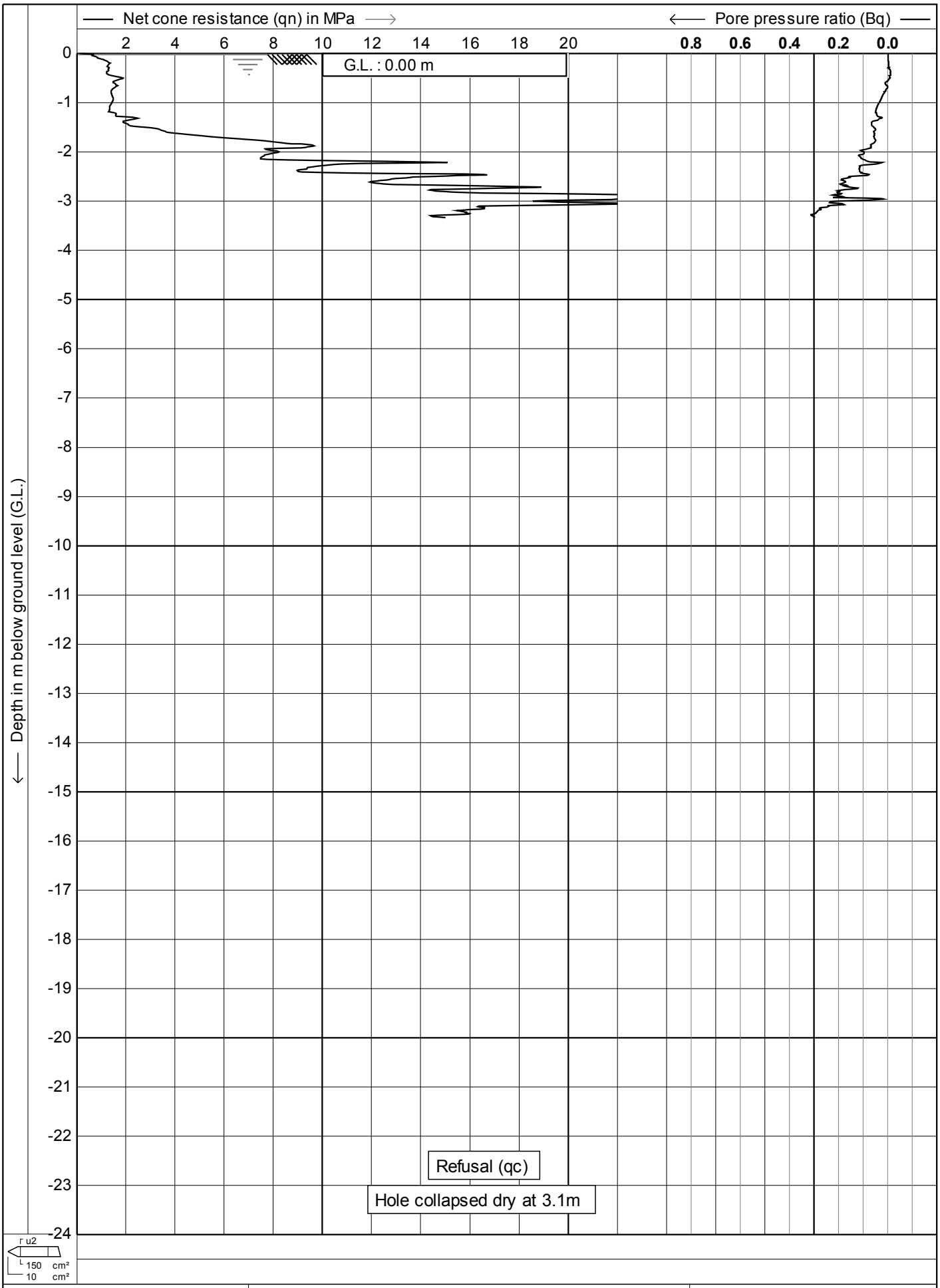

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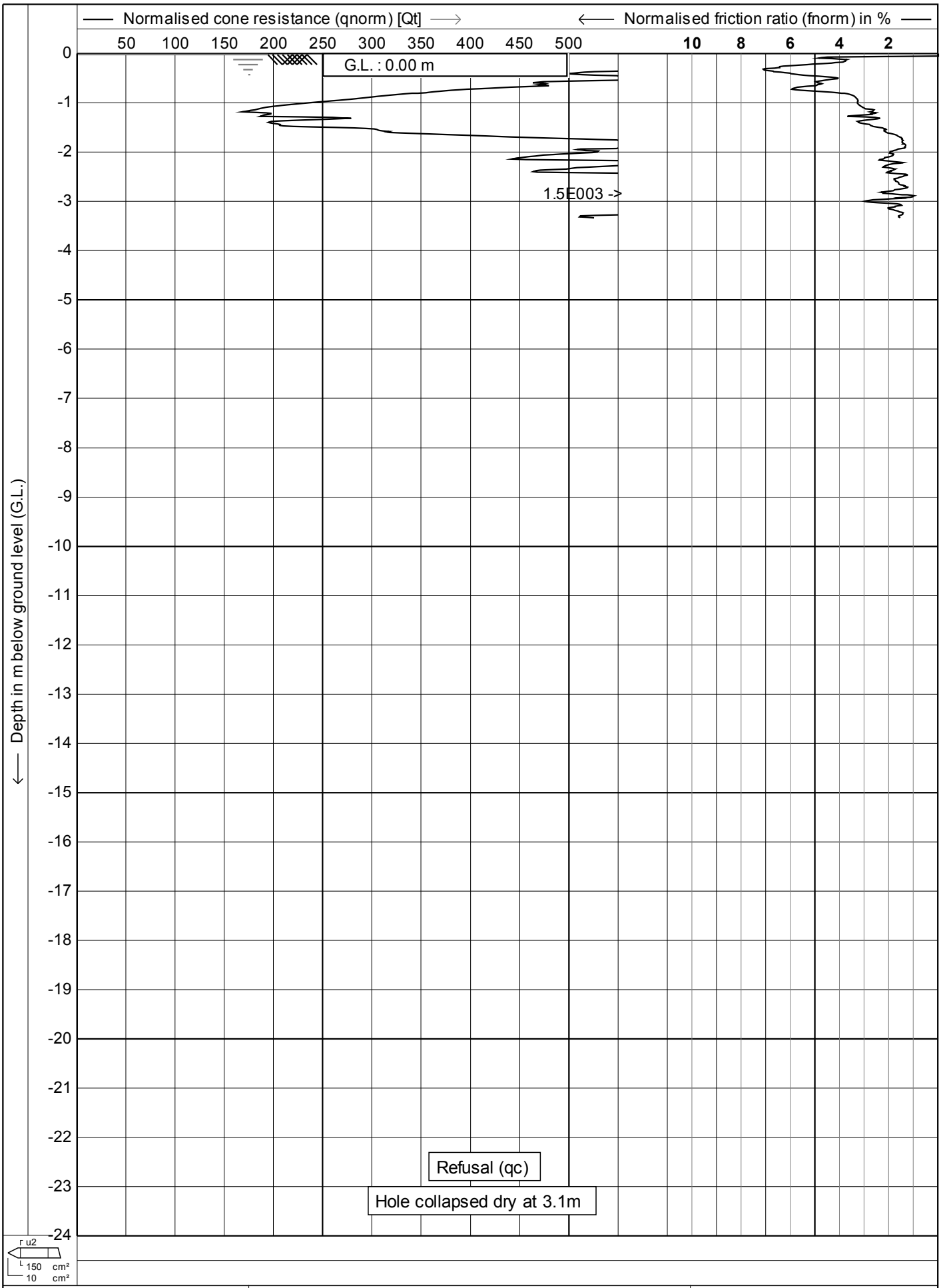
7/14

1.42



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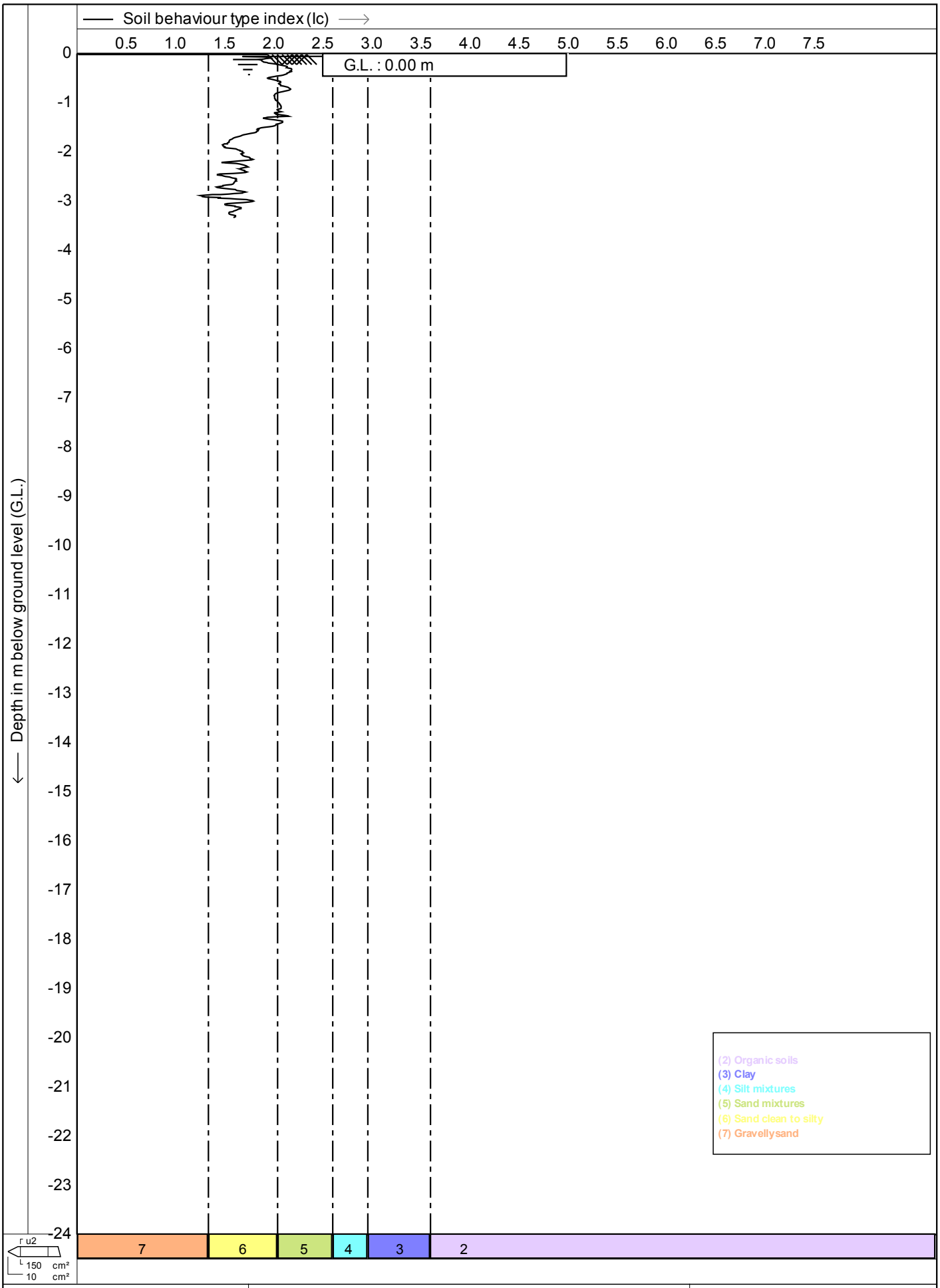

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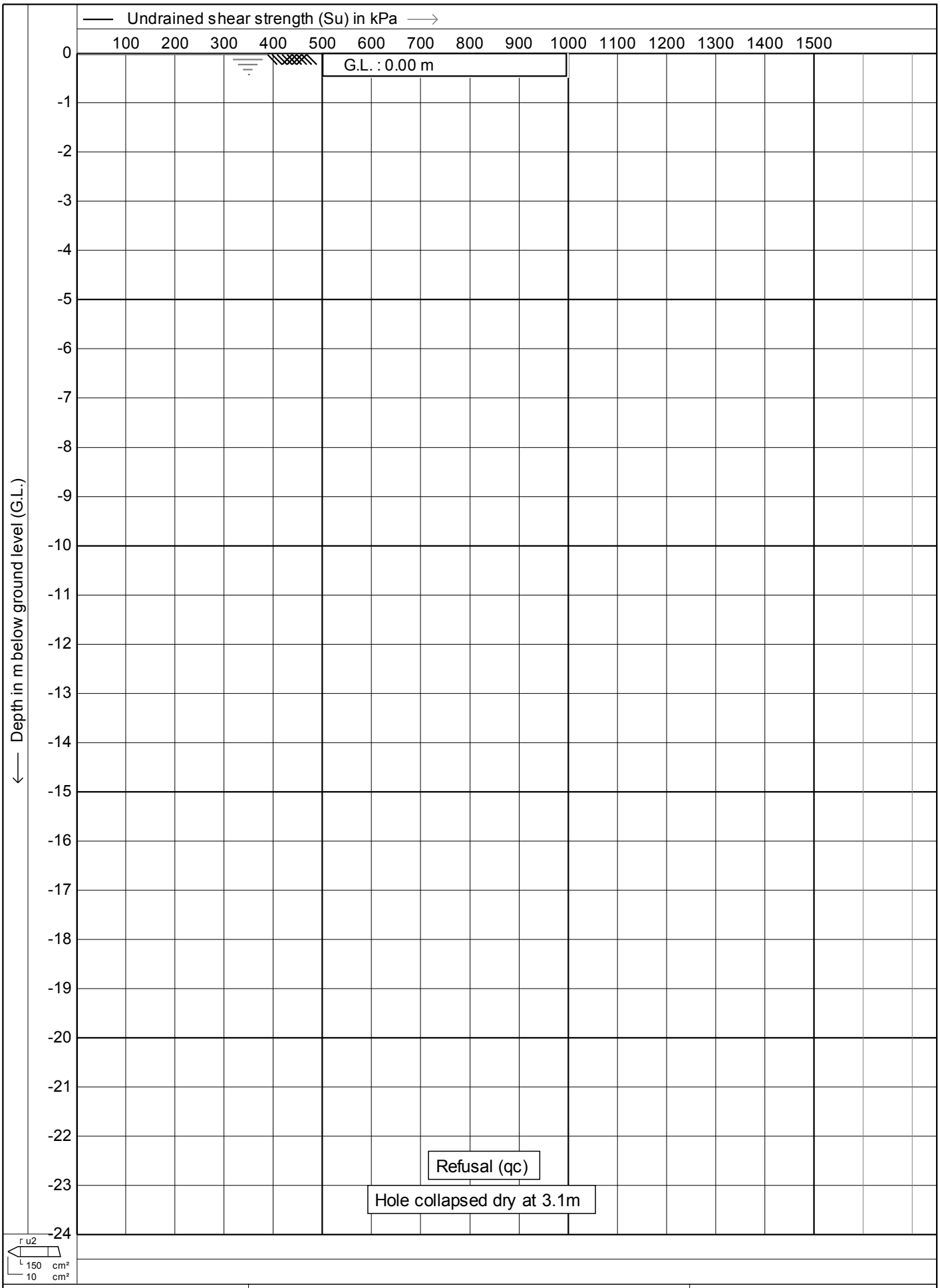
9/14

1.42



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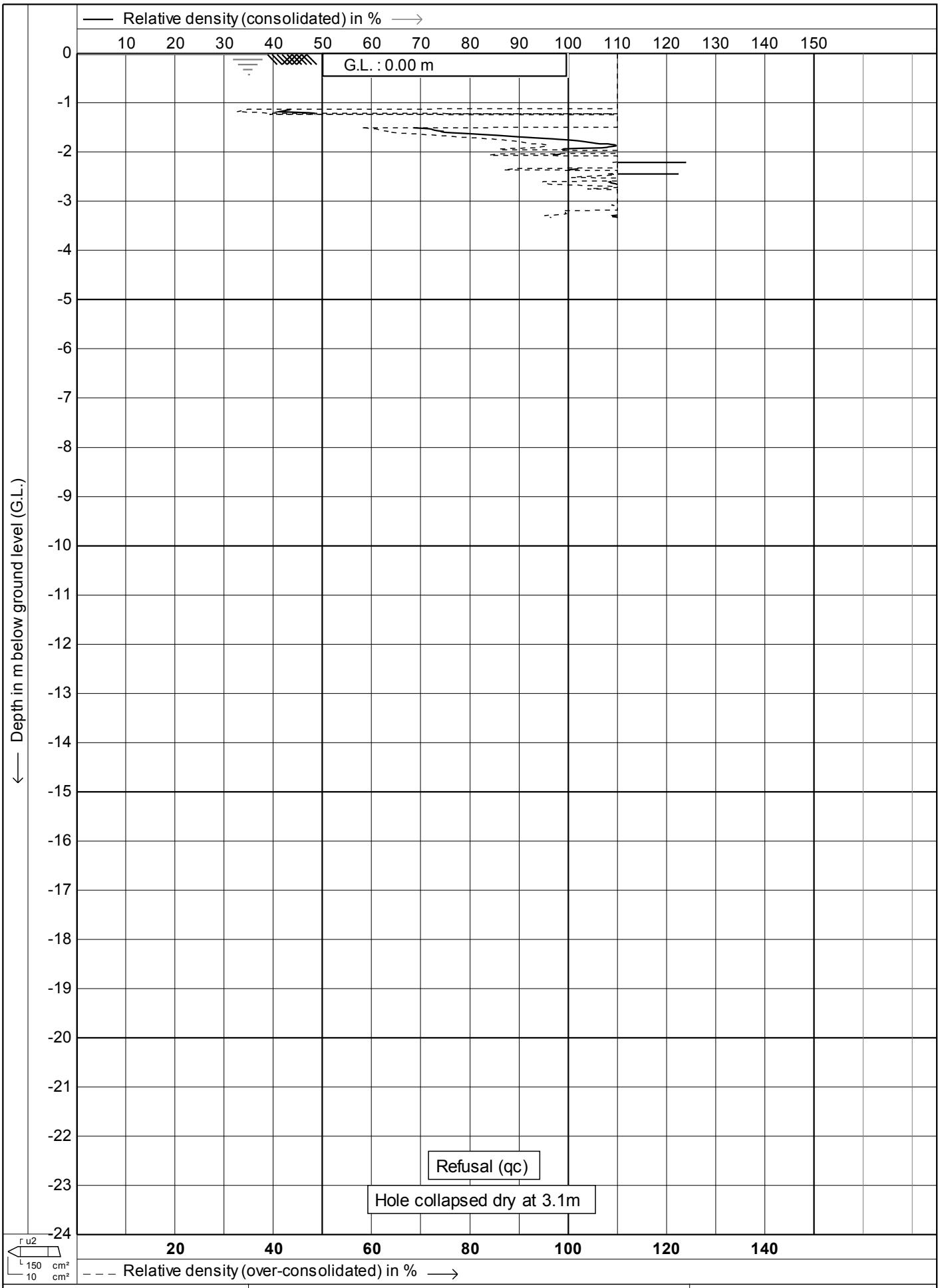

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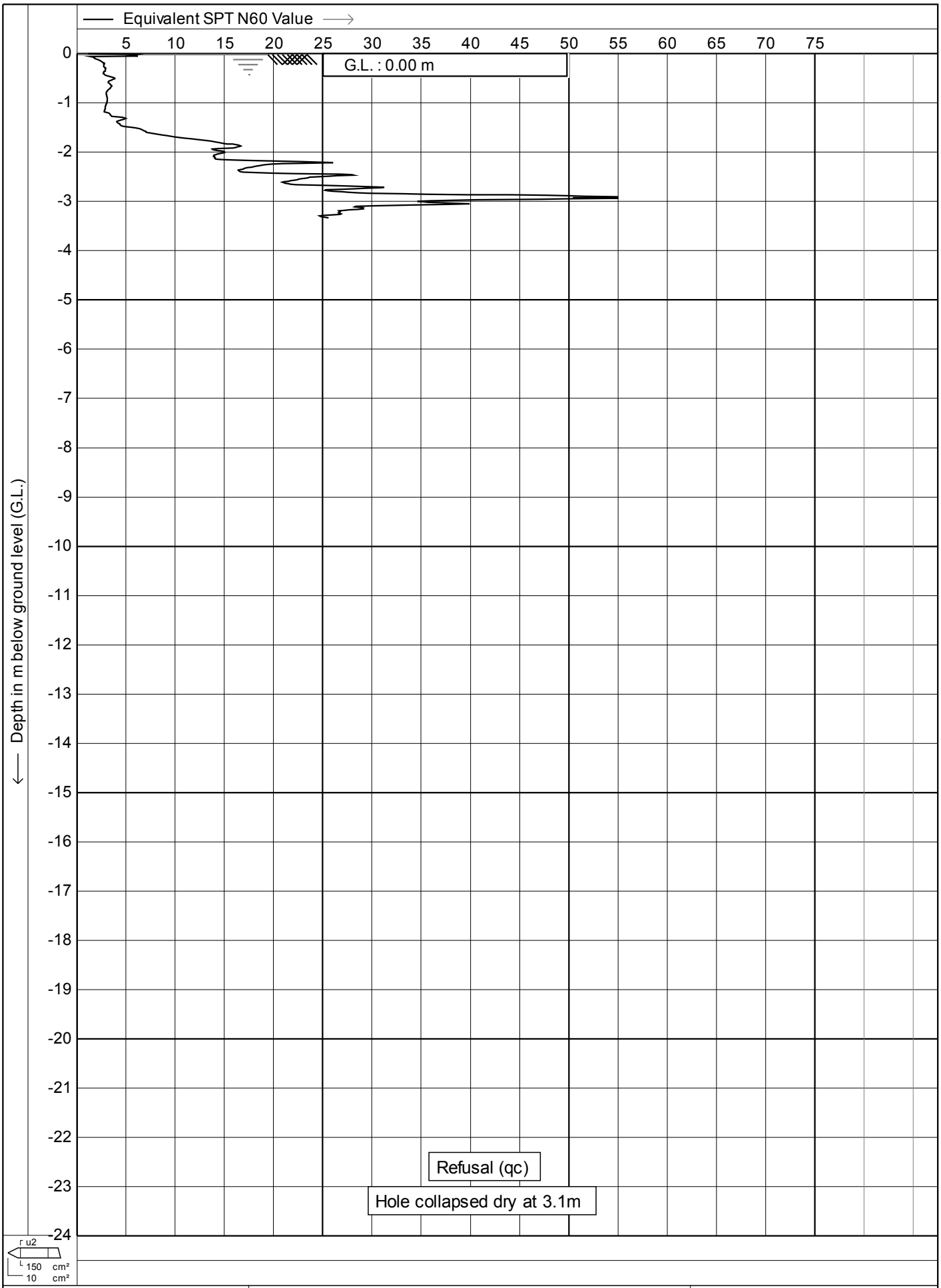

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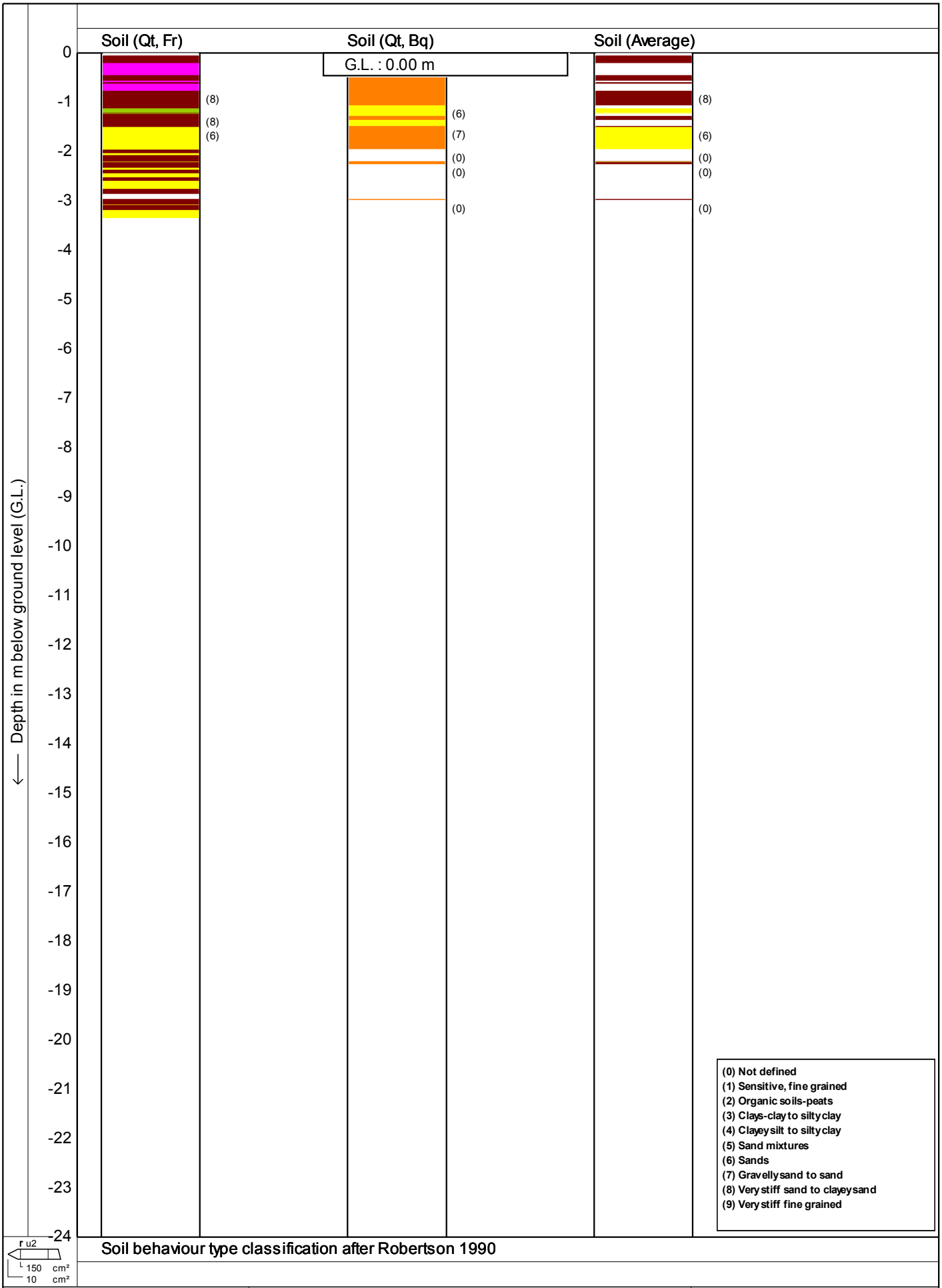

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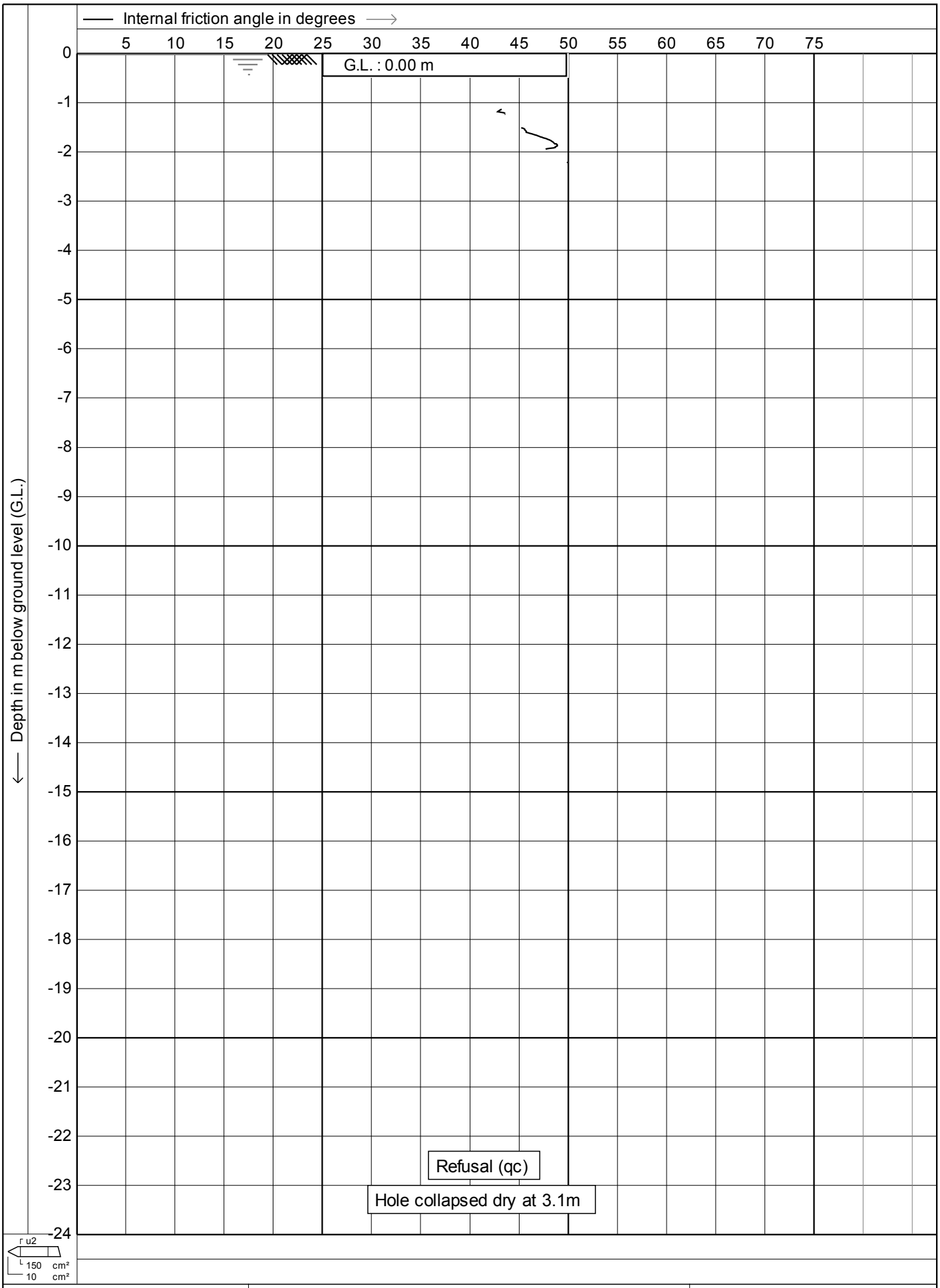

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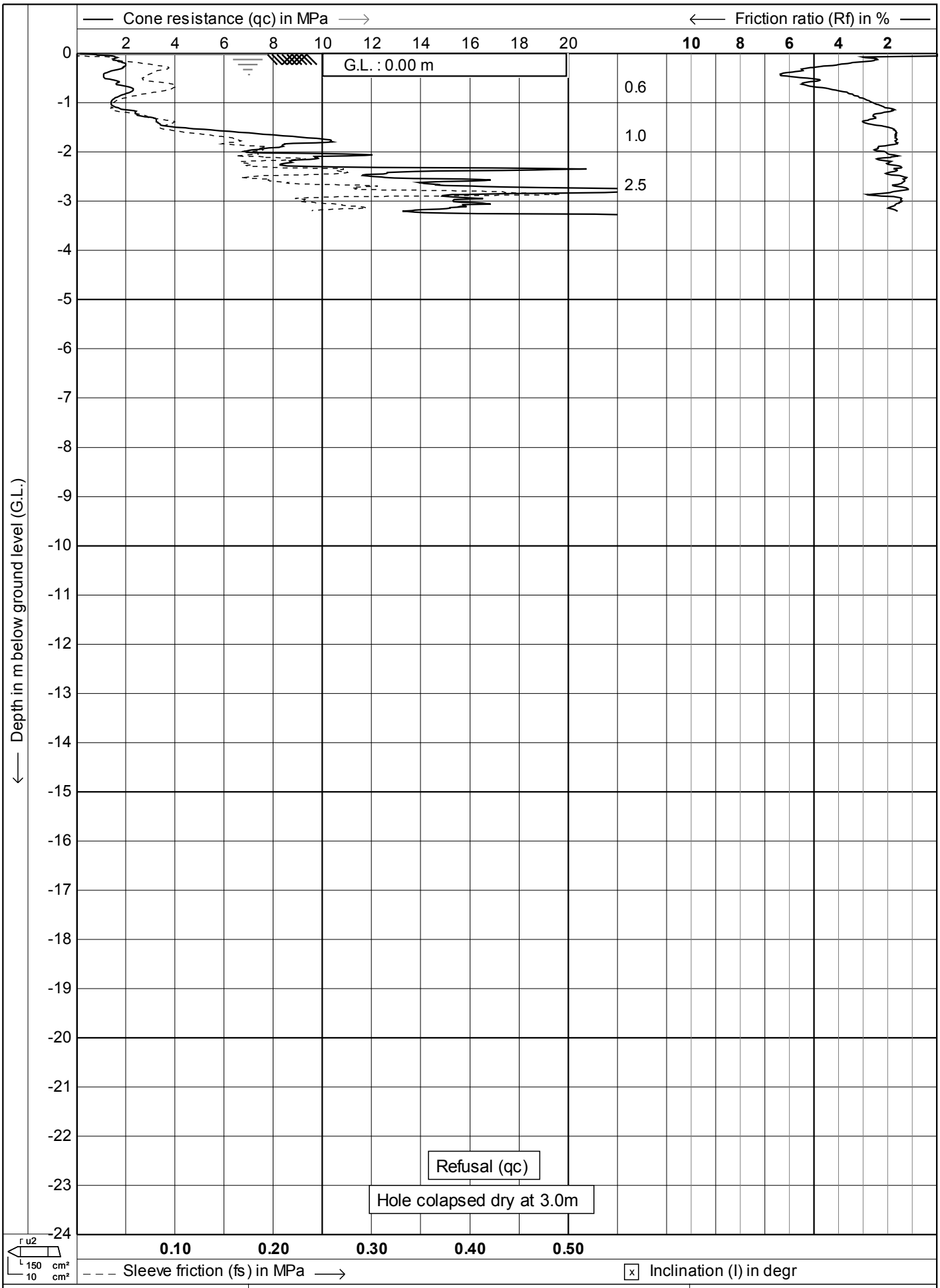


PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

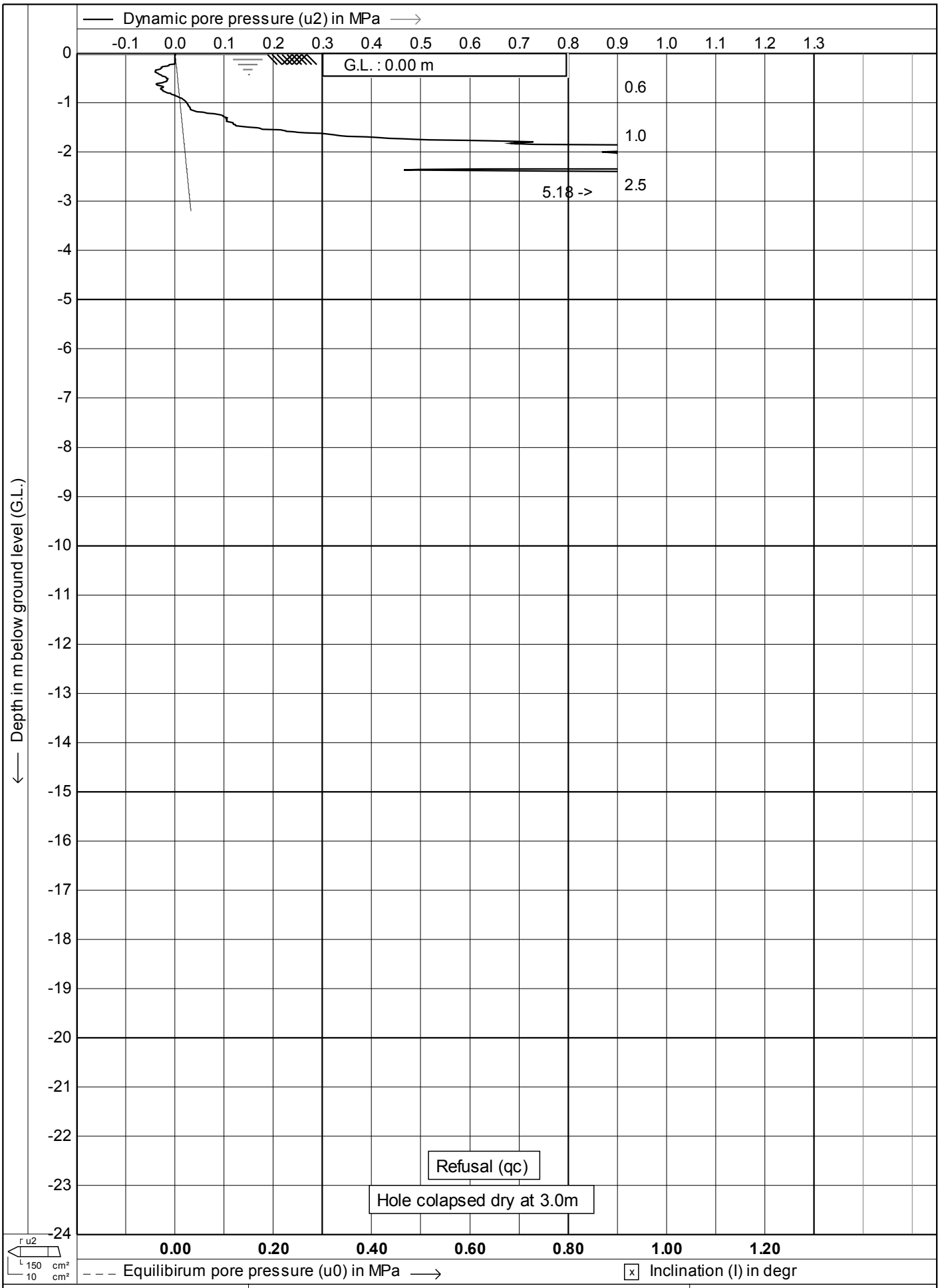
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **10a** **1/14**

1.42



PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

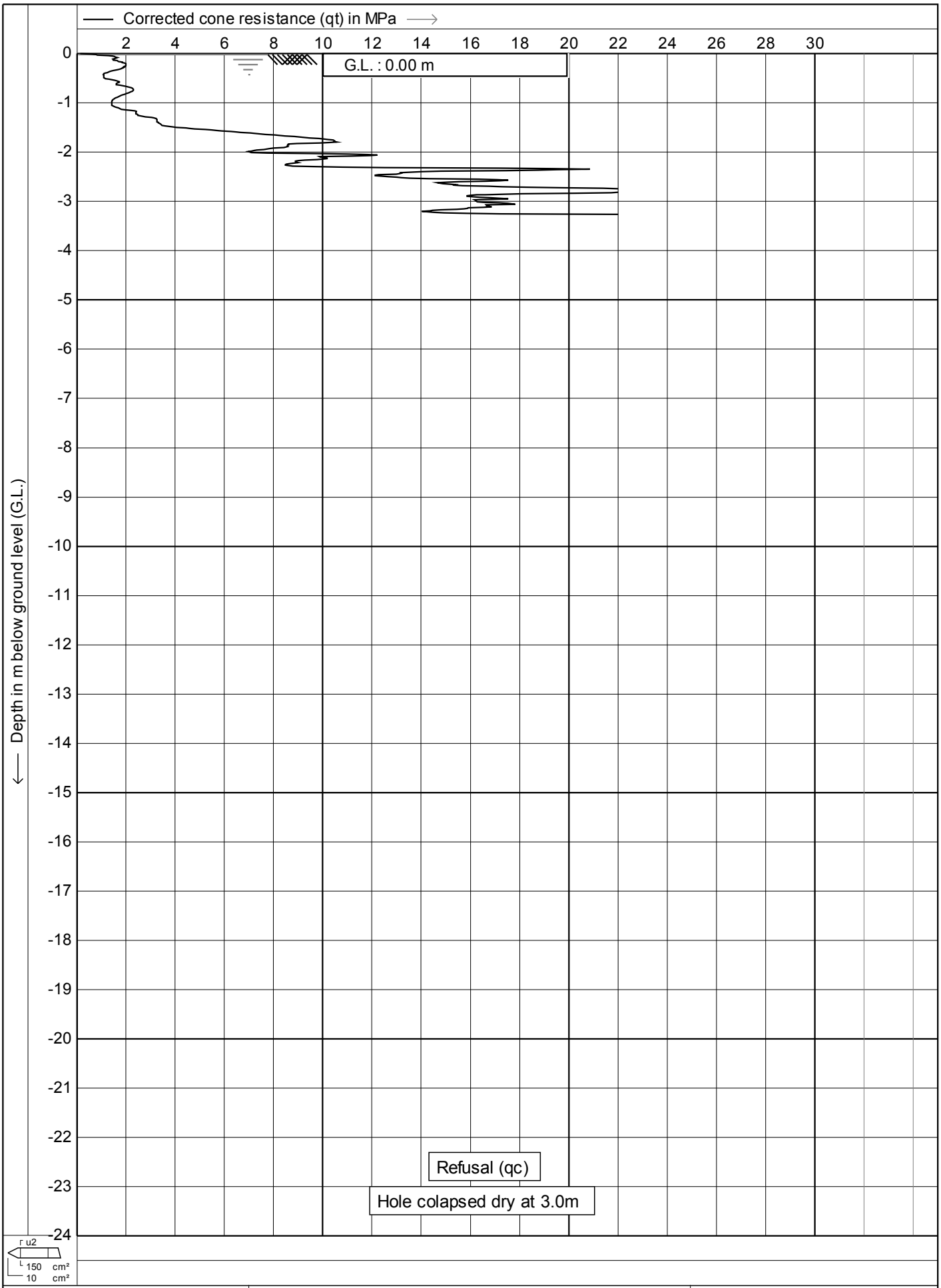
Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **10a**

1.42



PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

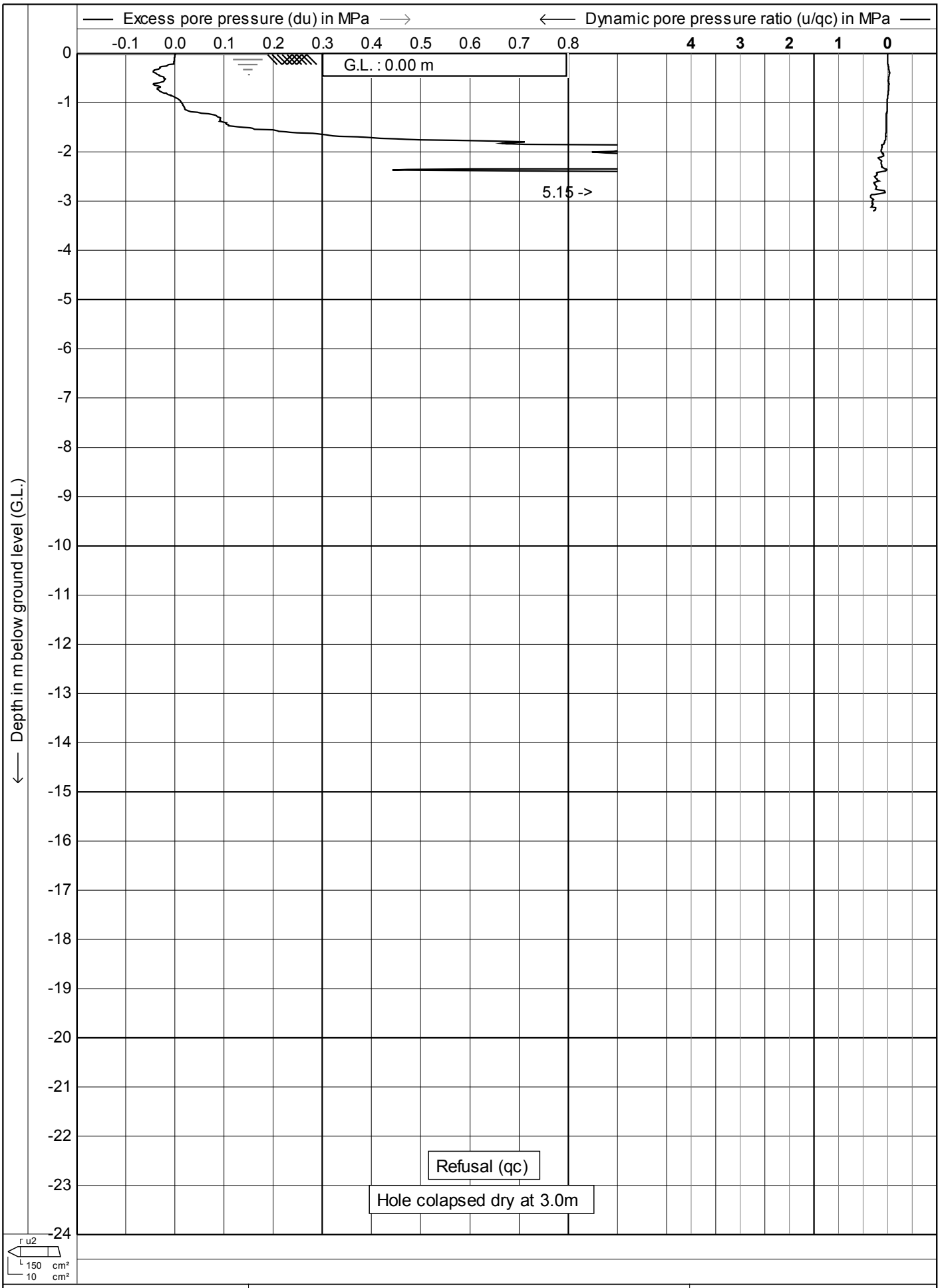
Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **10a** **3/14**

1.42



PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

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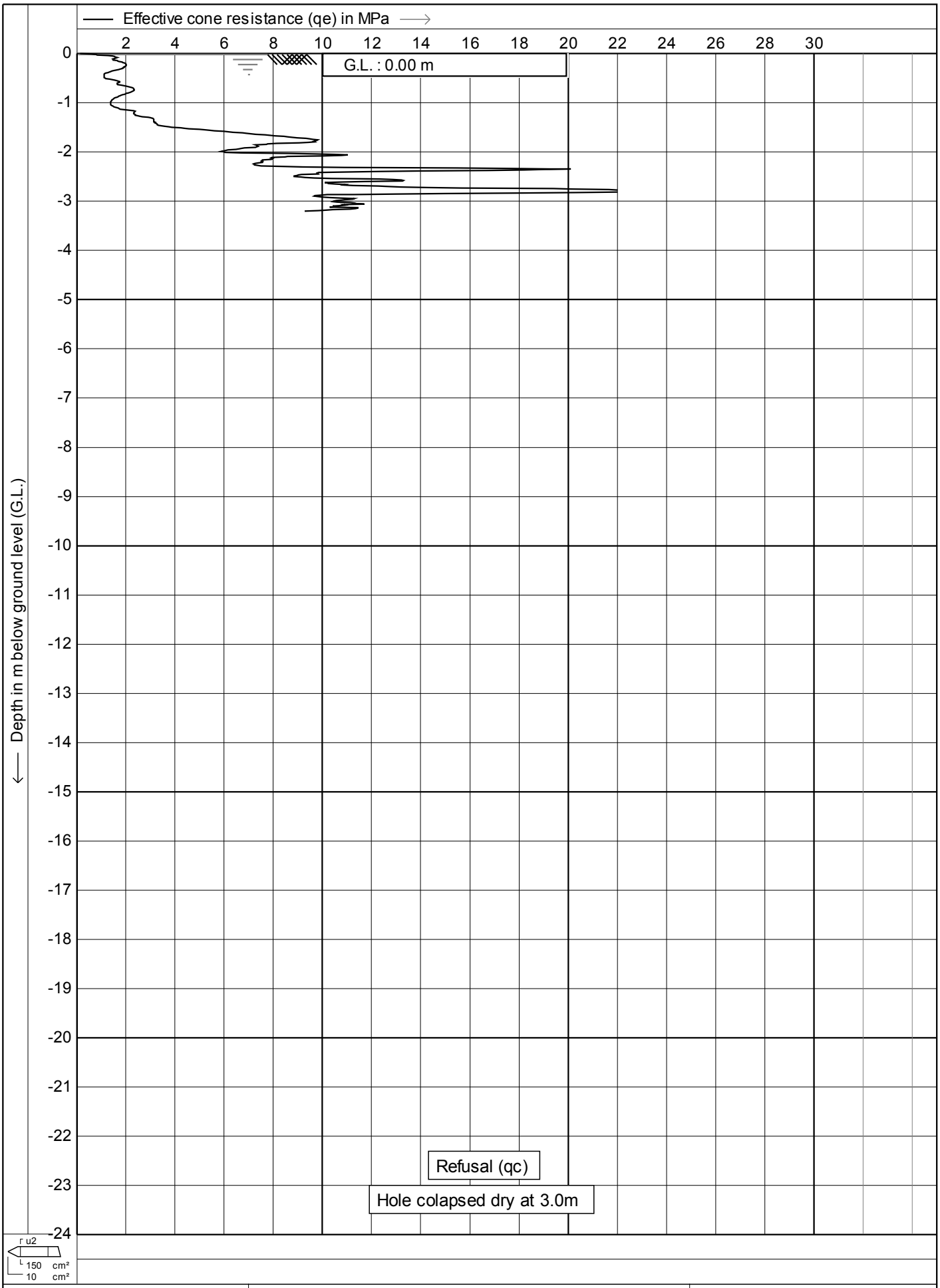
Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **10a** **4/14**

1.42



PERRY GEOTECH

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Project : **Site Investigation**

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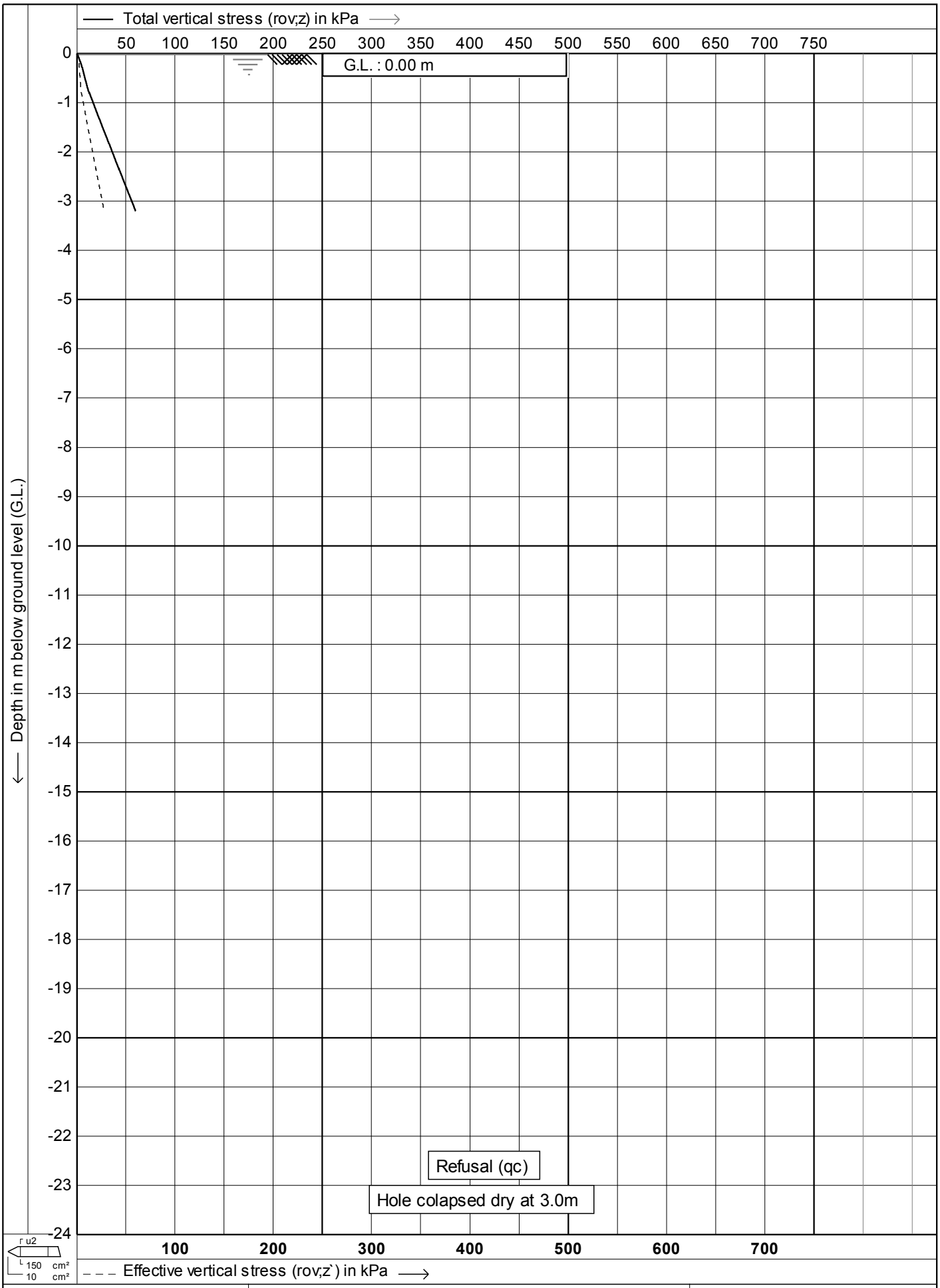
Project no.	: **05TT17**
CPT no.	: **10a** **5/14**

1.42



Test according A.S.T.M. Standard D 5778-12

PERRY GEOTECH

Project : **Site Investigation**

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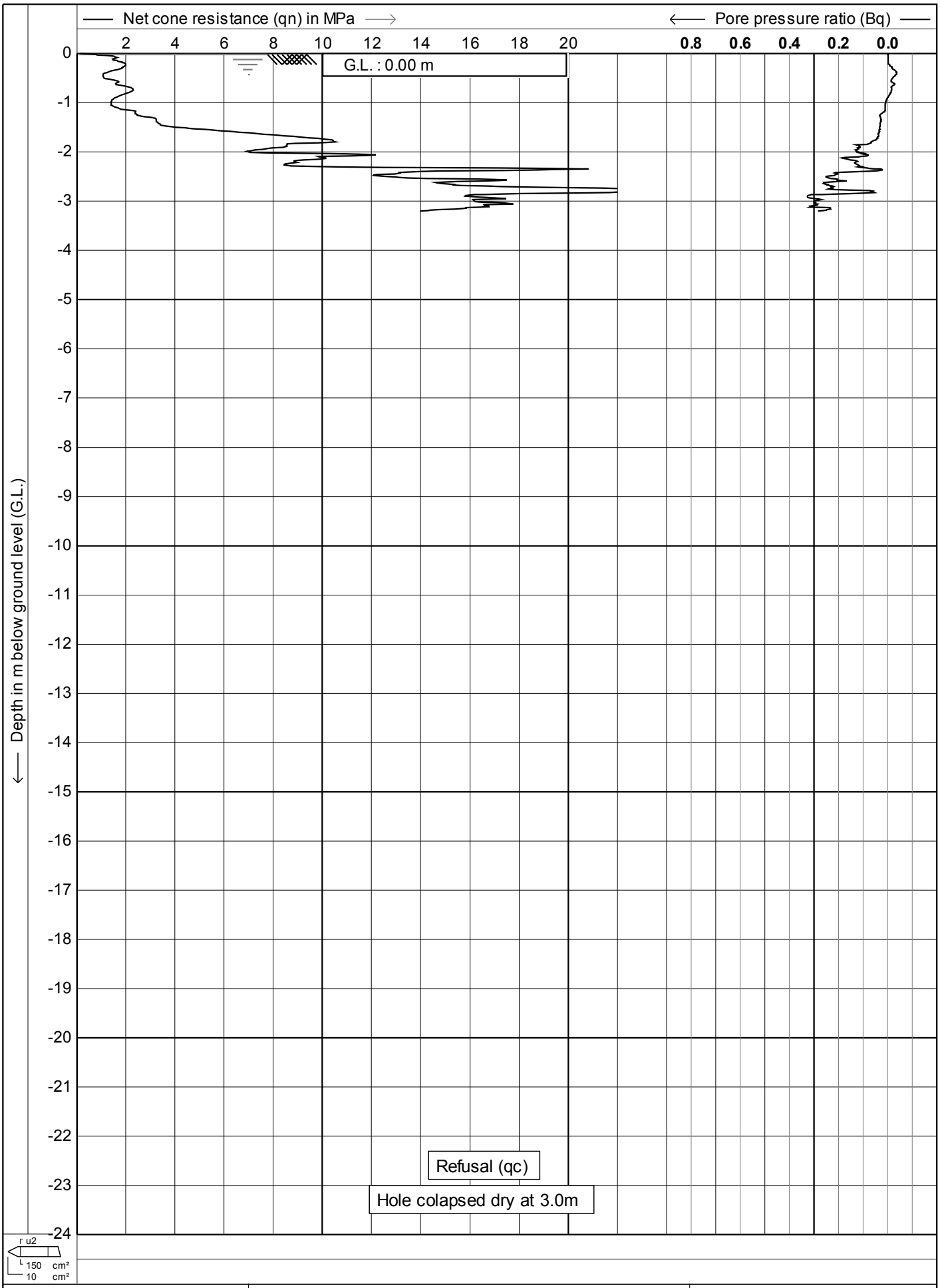
CPT no.	: **10a**

1.42



PERRY GEOTECH

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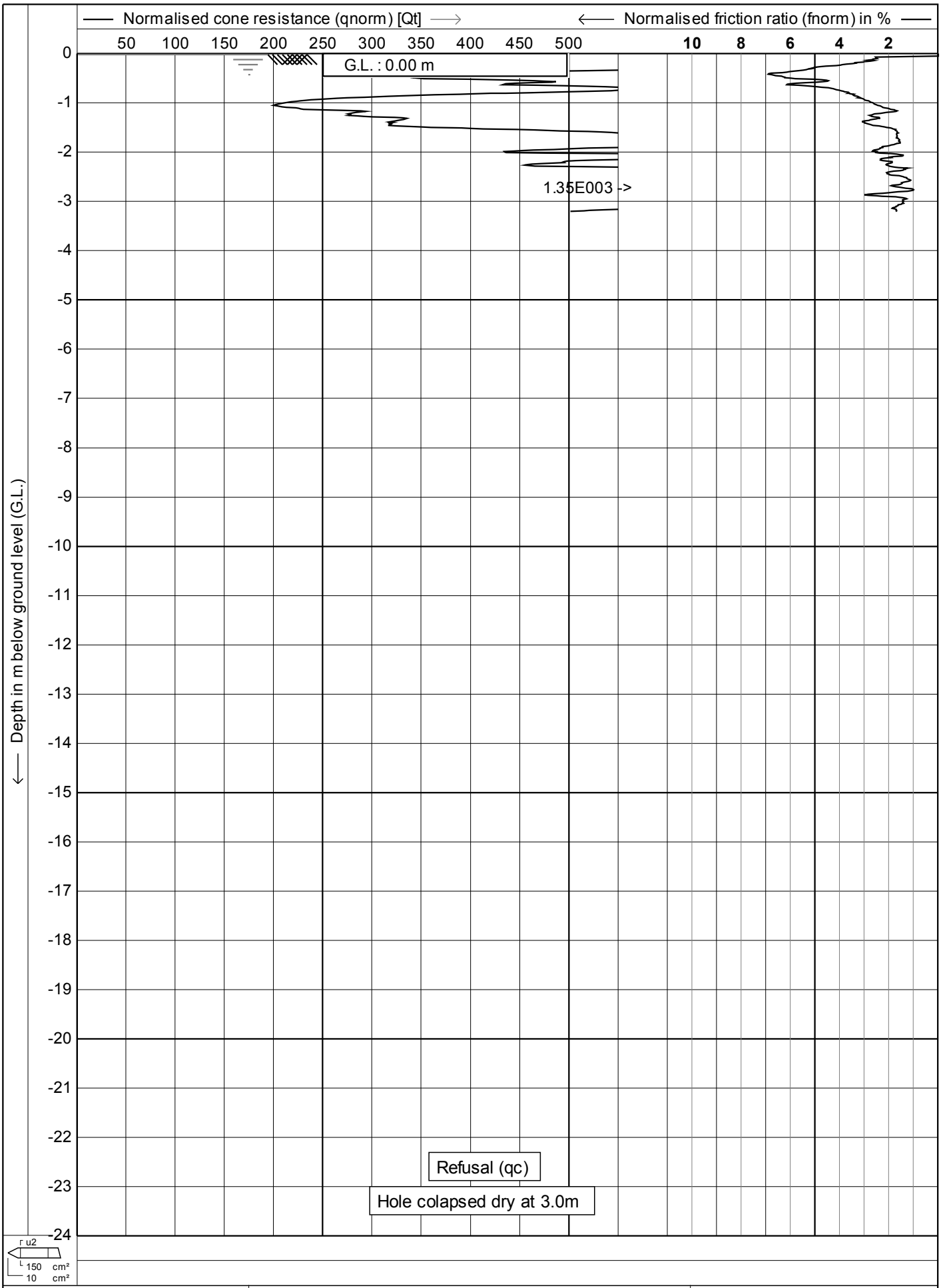
Project no.	: **05TT17**
CPT no.	: **10a** **7/14**

1.42



PERRY GEOTECH

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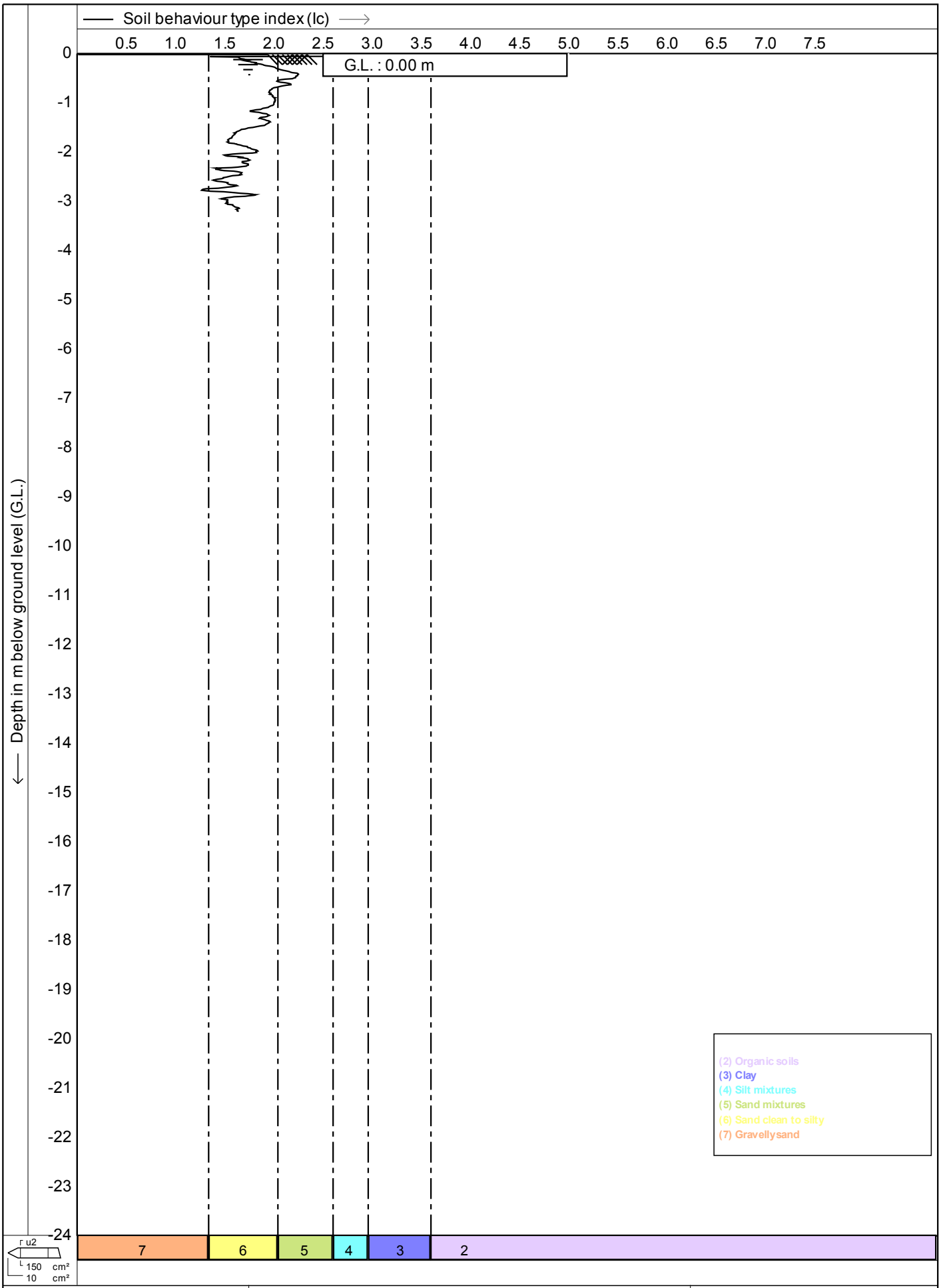
Project no.	: **05TT17**
CPT no.	: **10a** **8/14**

1.42



PERRY GEOTECH

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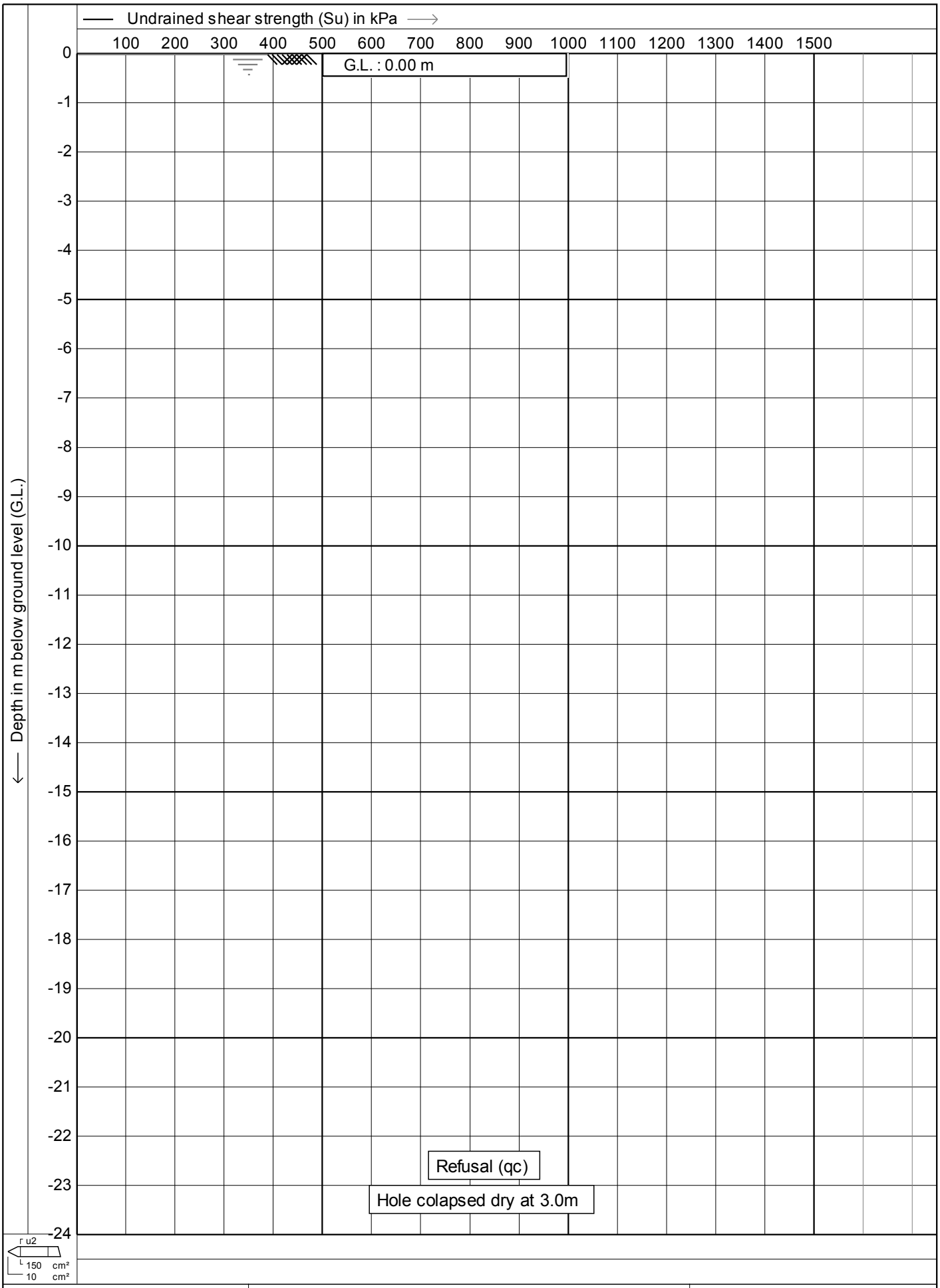
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **10a** **9/14**

1.42



PERRY GEOTECH

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Project no.	: **05TT17**
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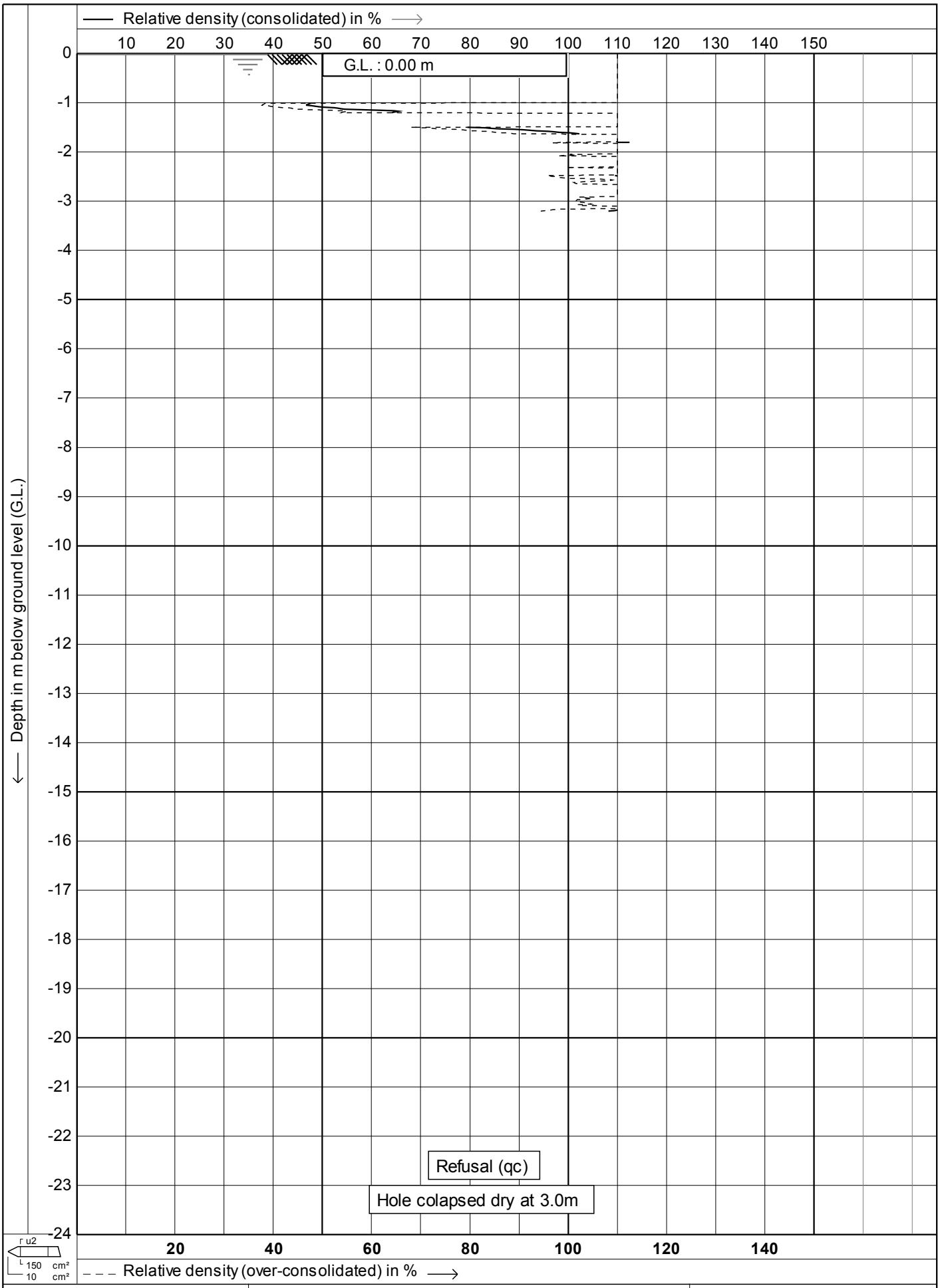
1.42



PERRY GEOTECH

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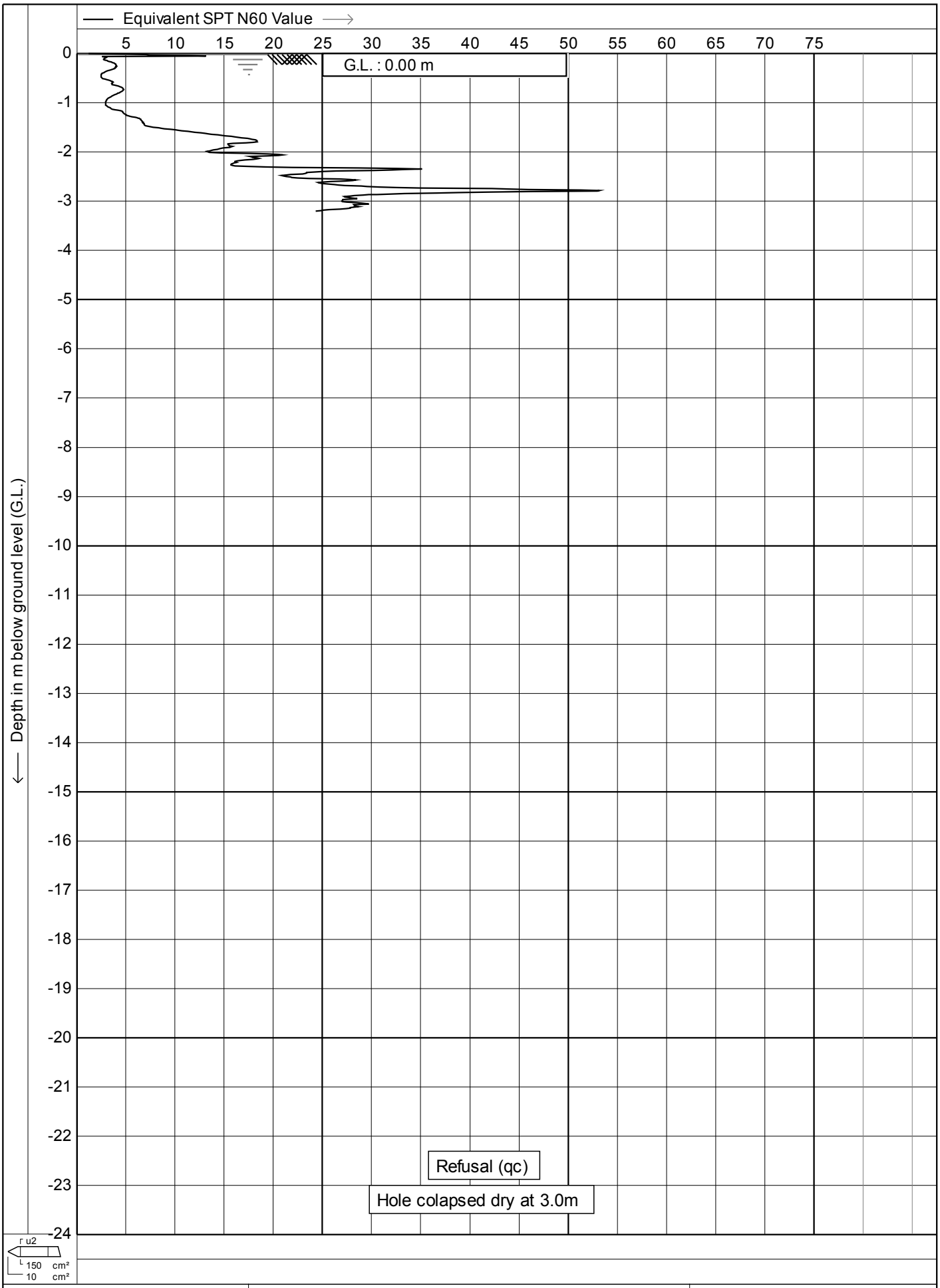

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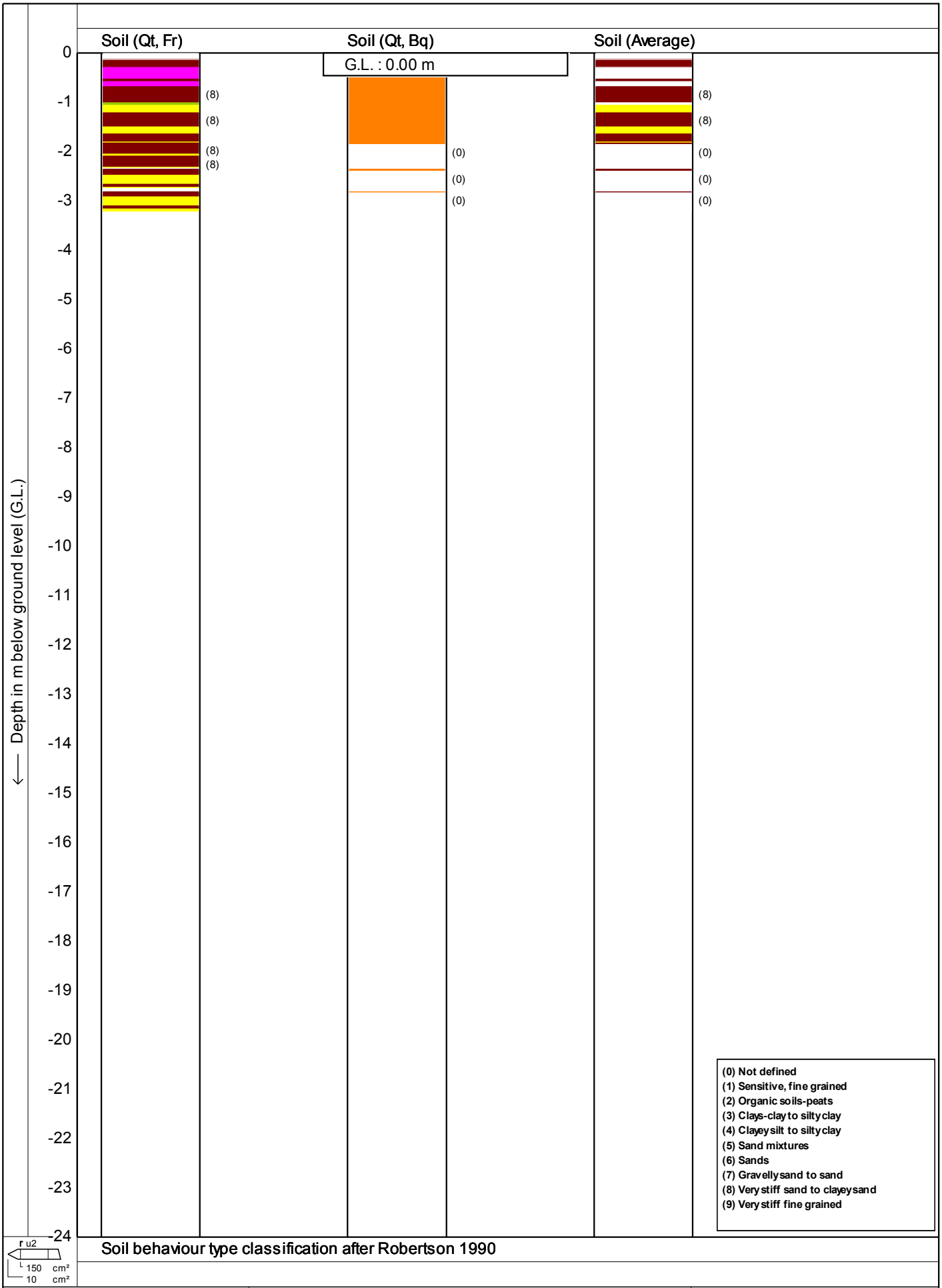
1.42



Soil behaviour type classification after Robertson 1990

PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

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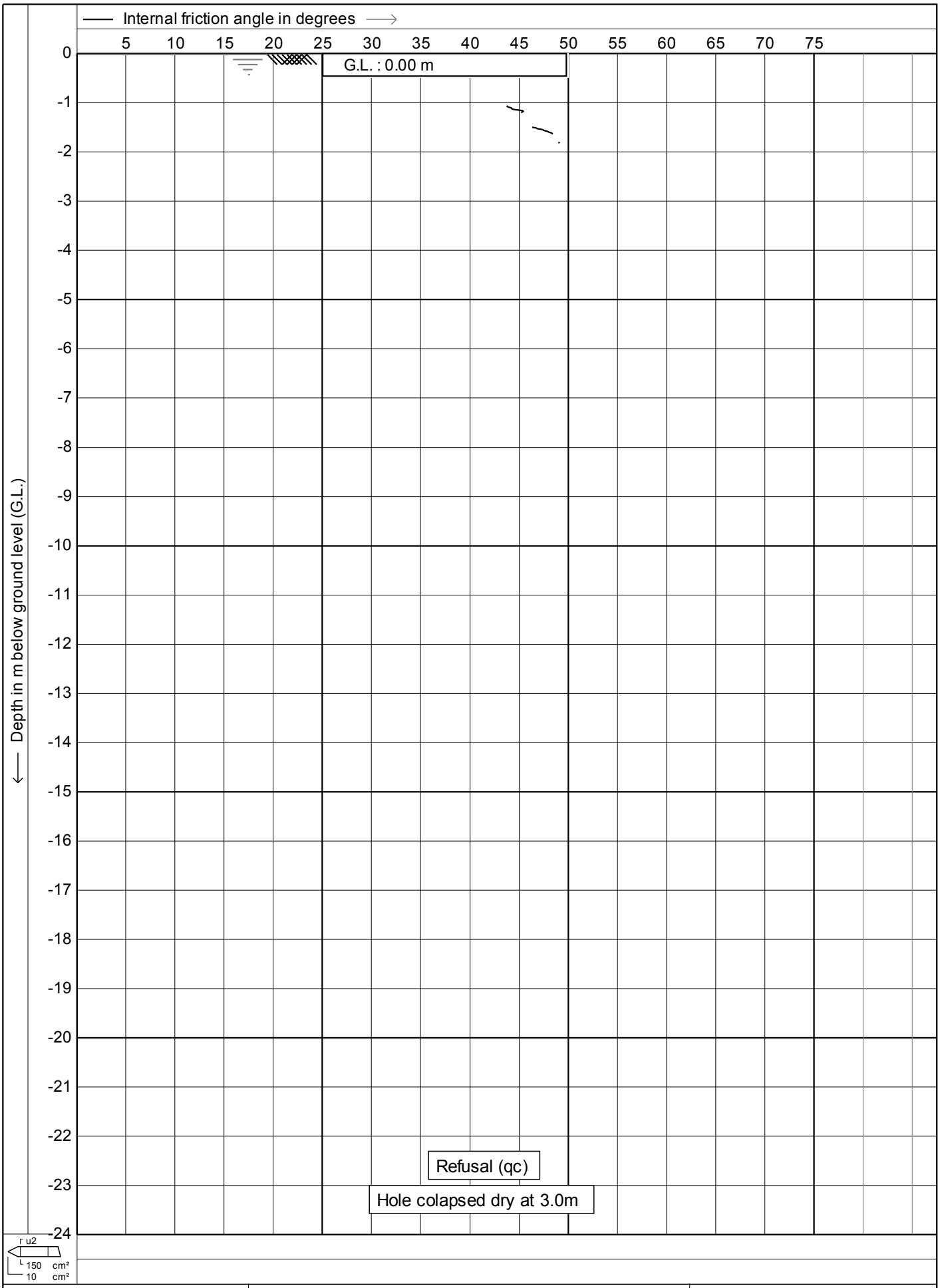
Project no. : **05TT17**

CPT no. : **10a**

1.42



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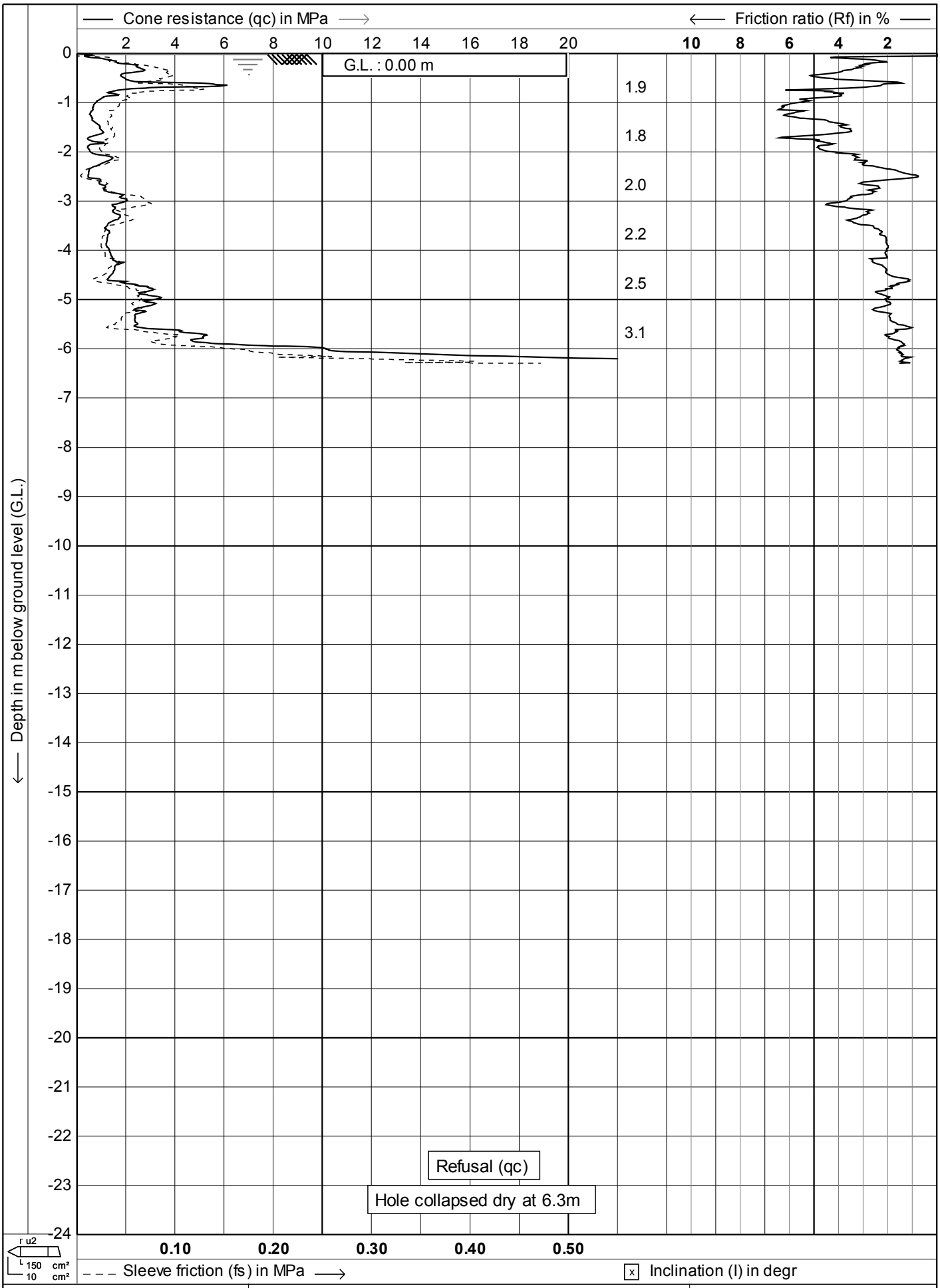
CPT no.	: **10a** **14/14**

1.42



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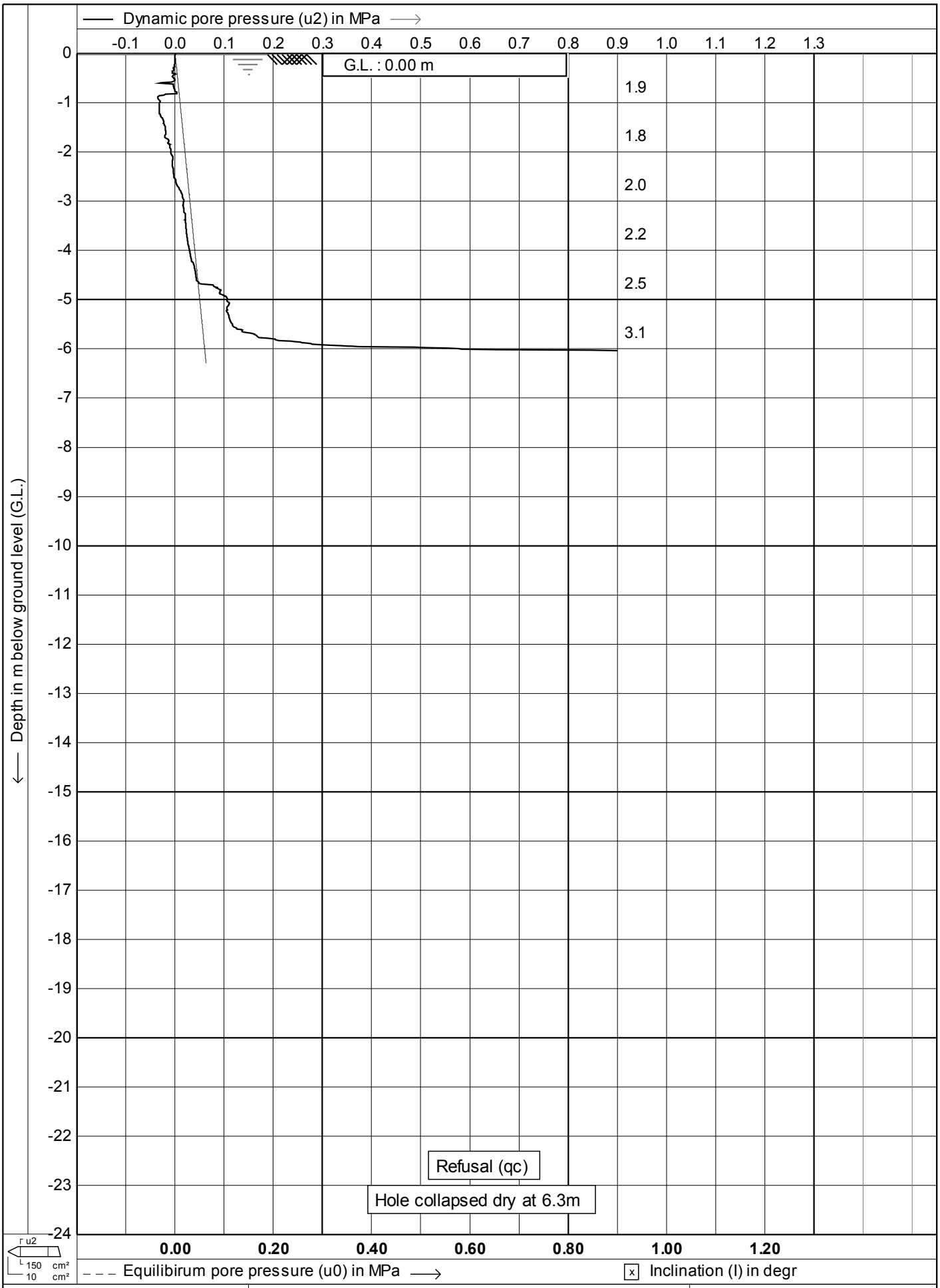
Project no. : **05TT17**

CPT no. : **11**

1/14



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CPT no.	: **11**

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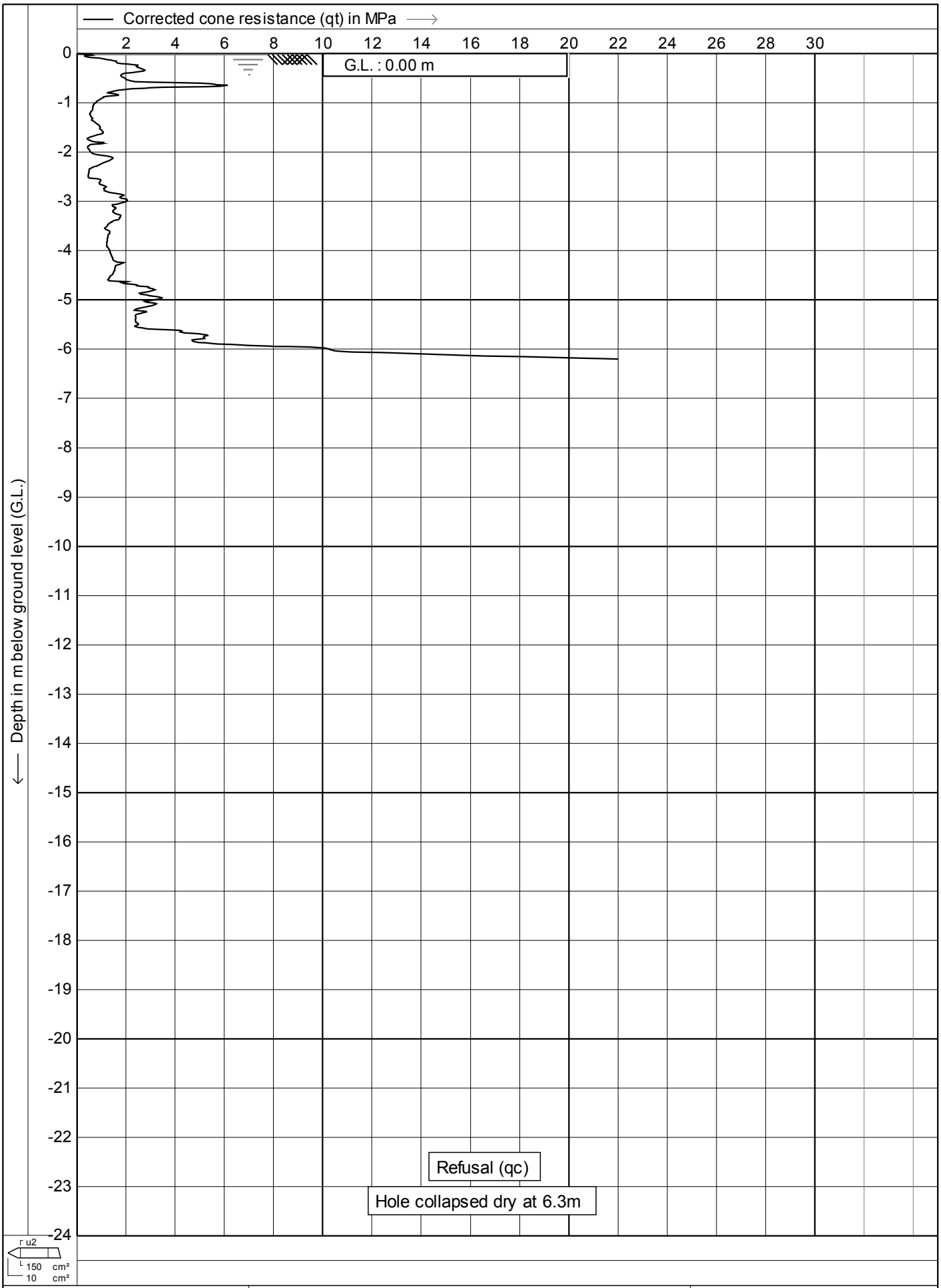

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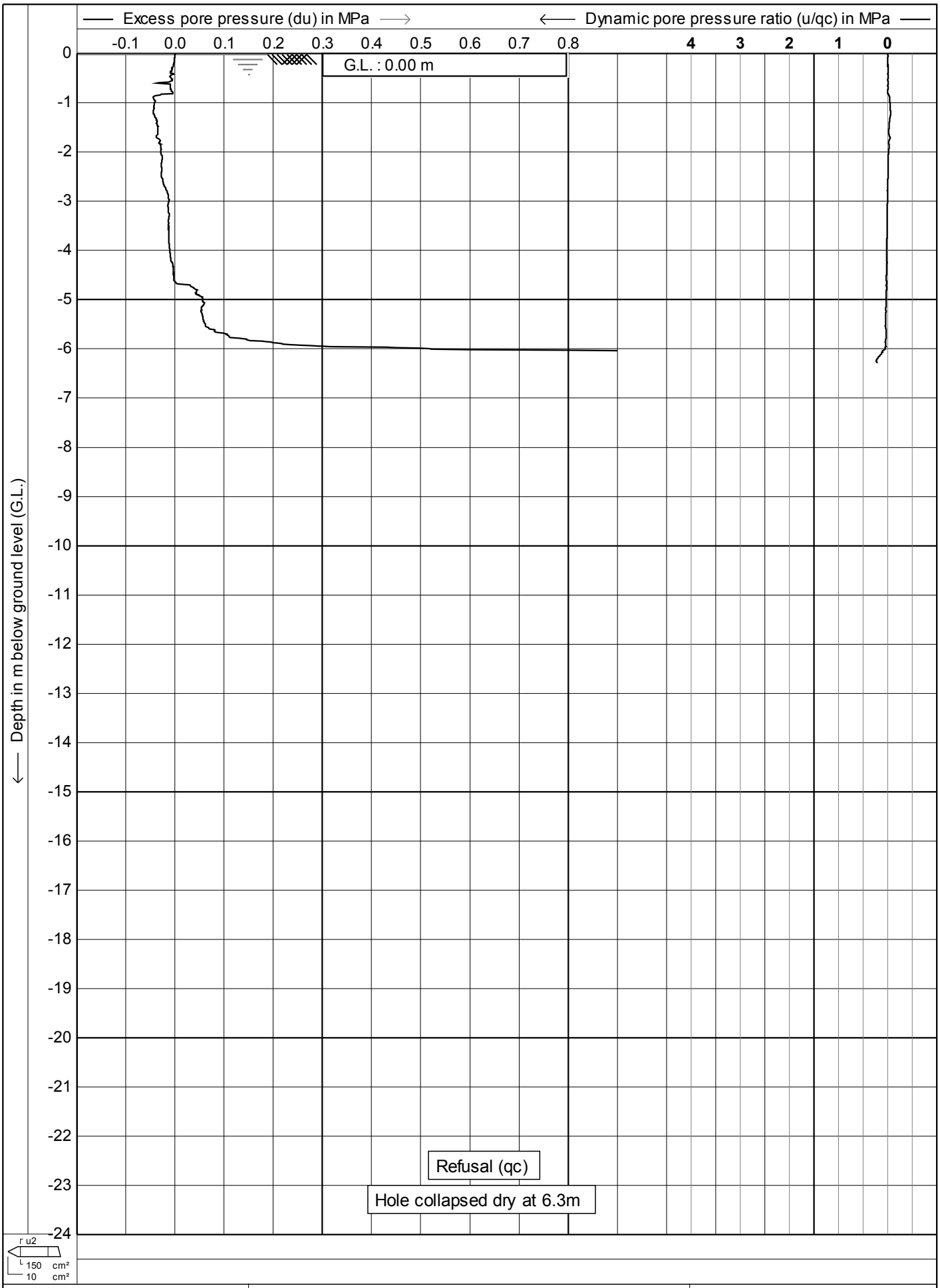

PERRY GEOTECH

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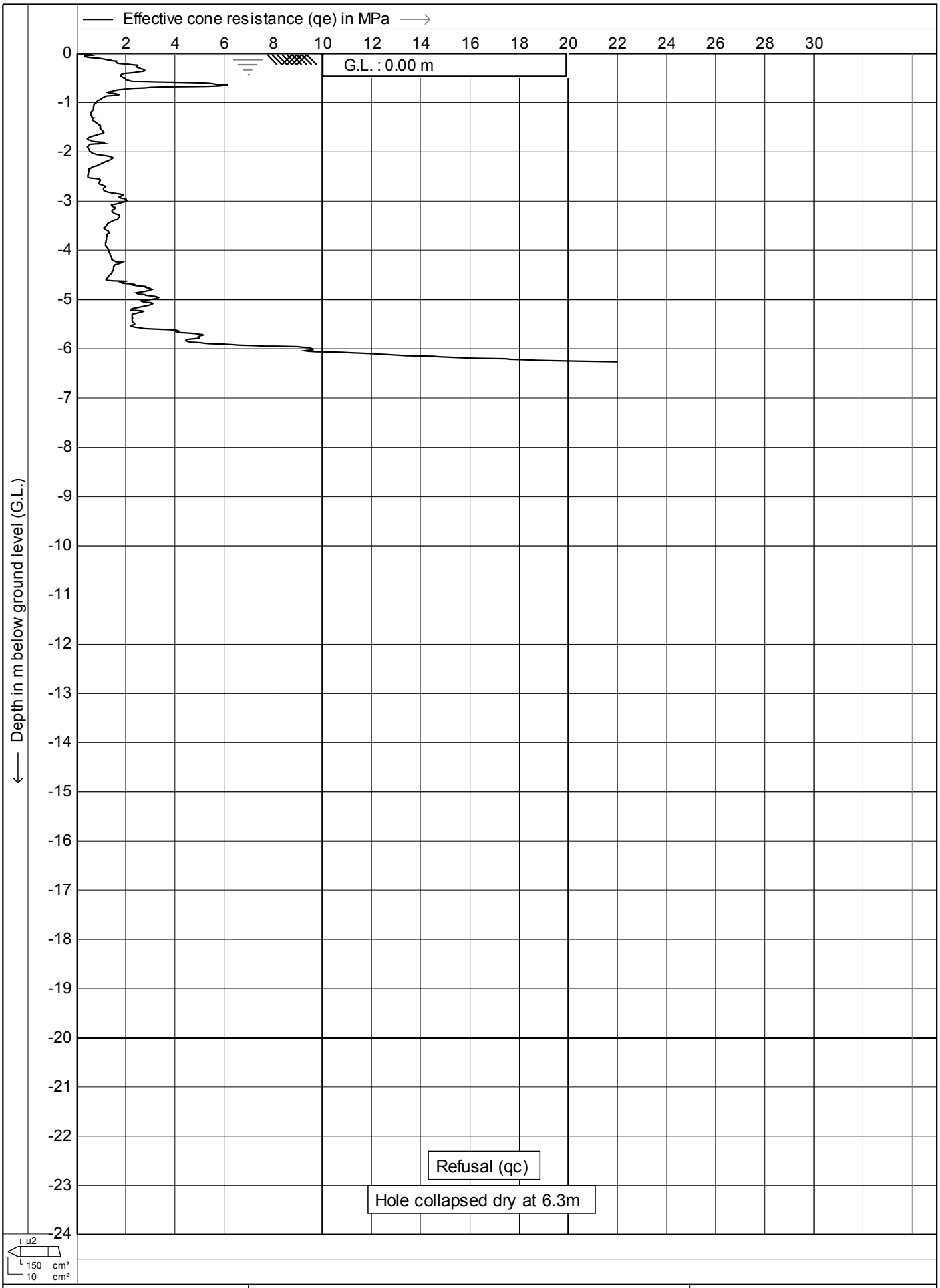

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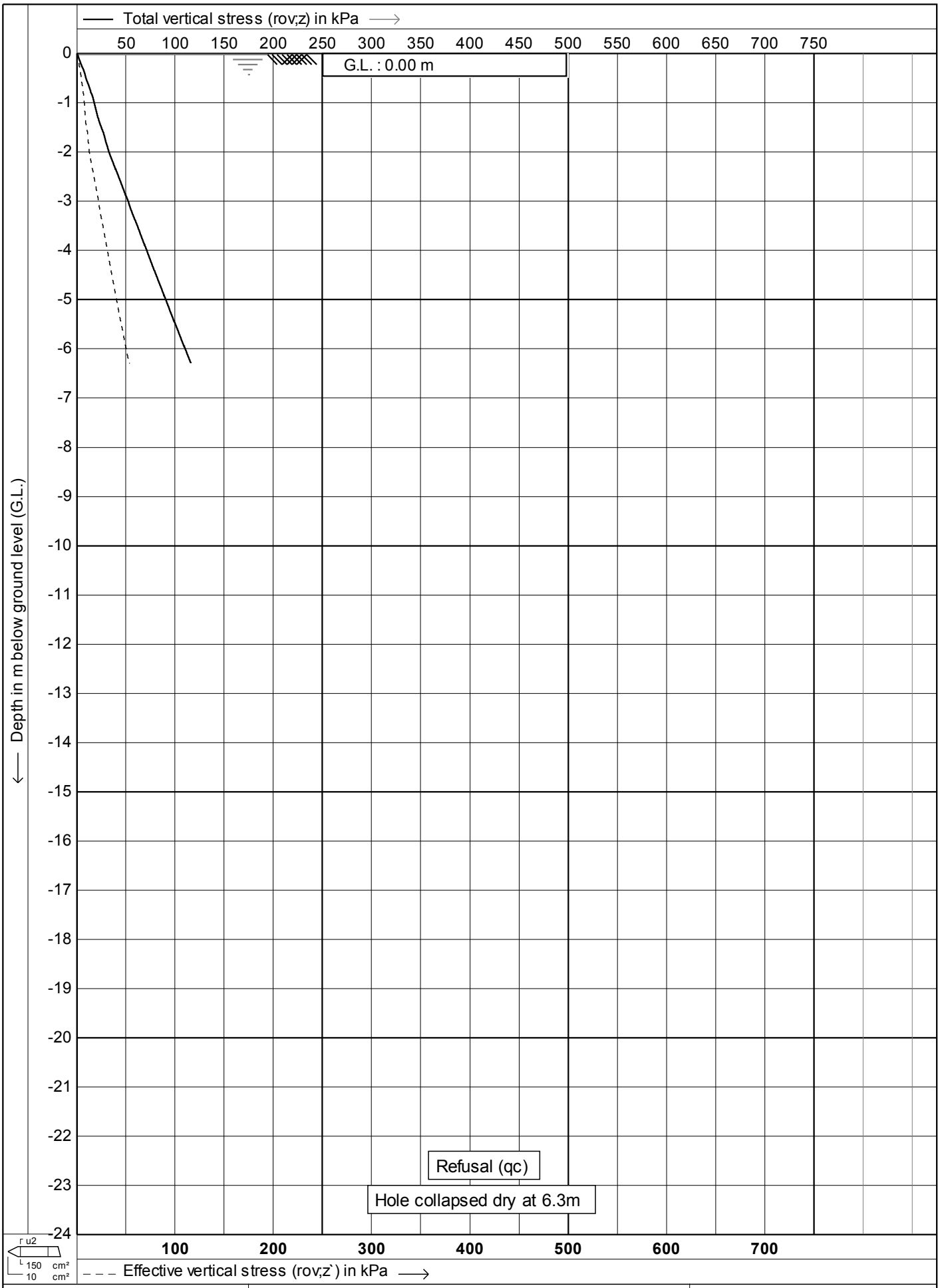

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PERRY GEOTECH

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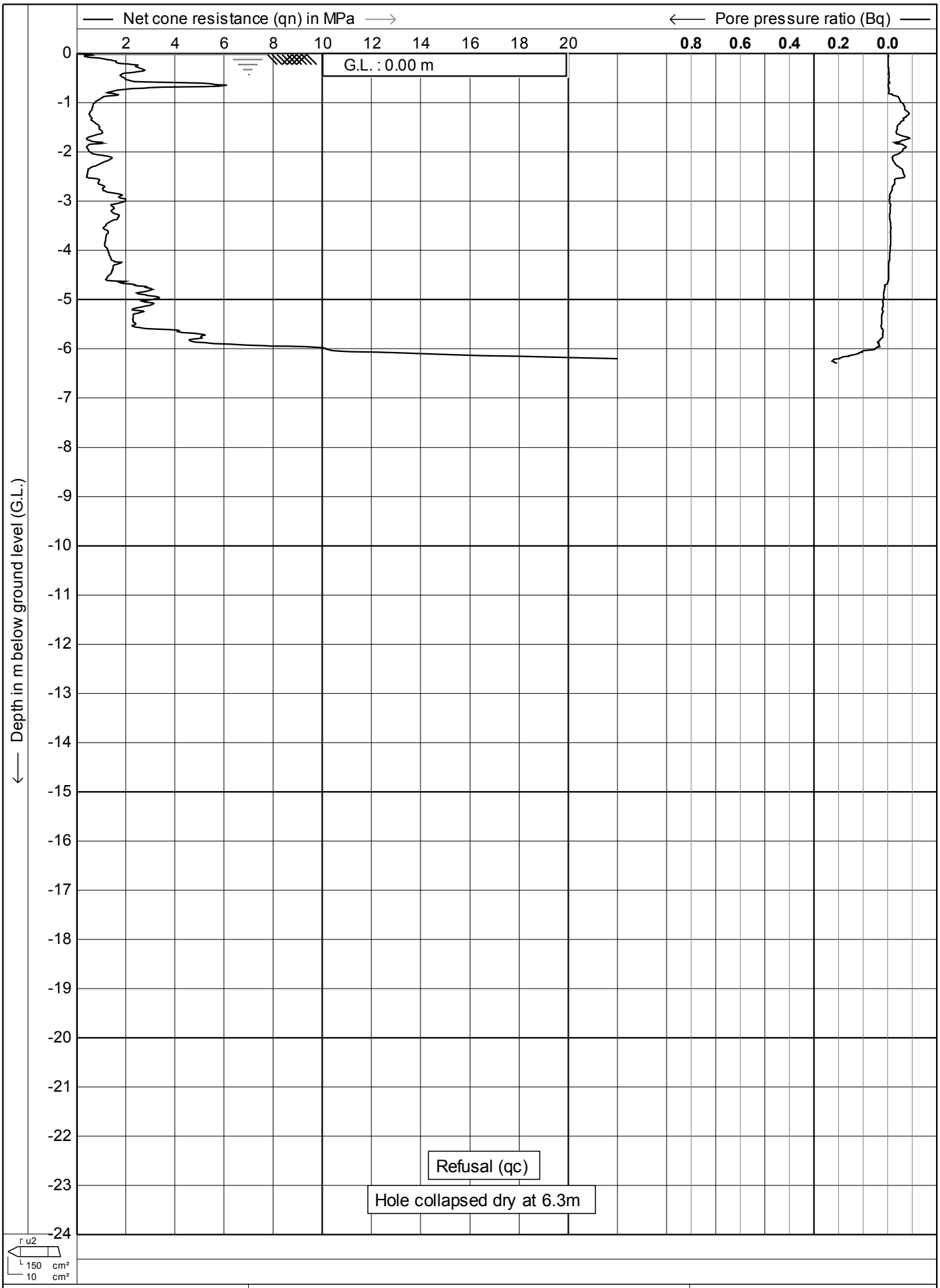

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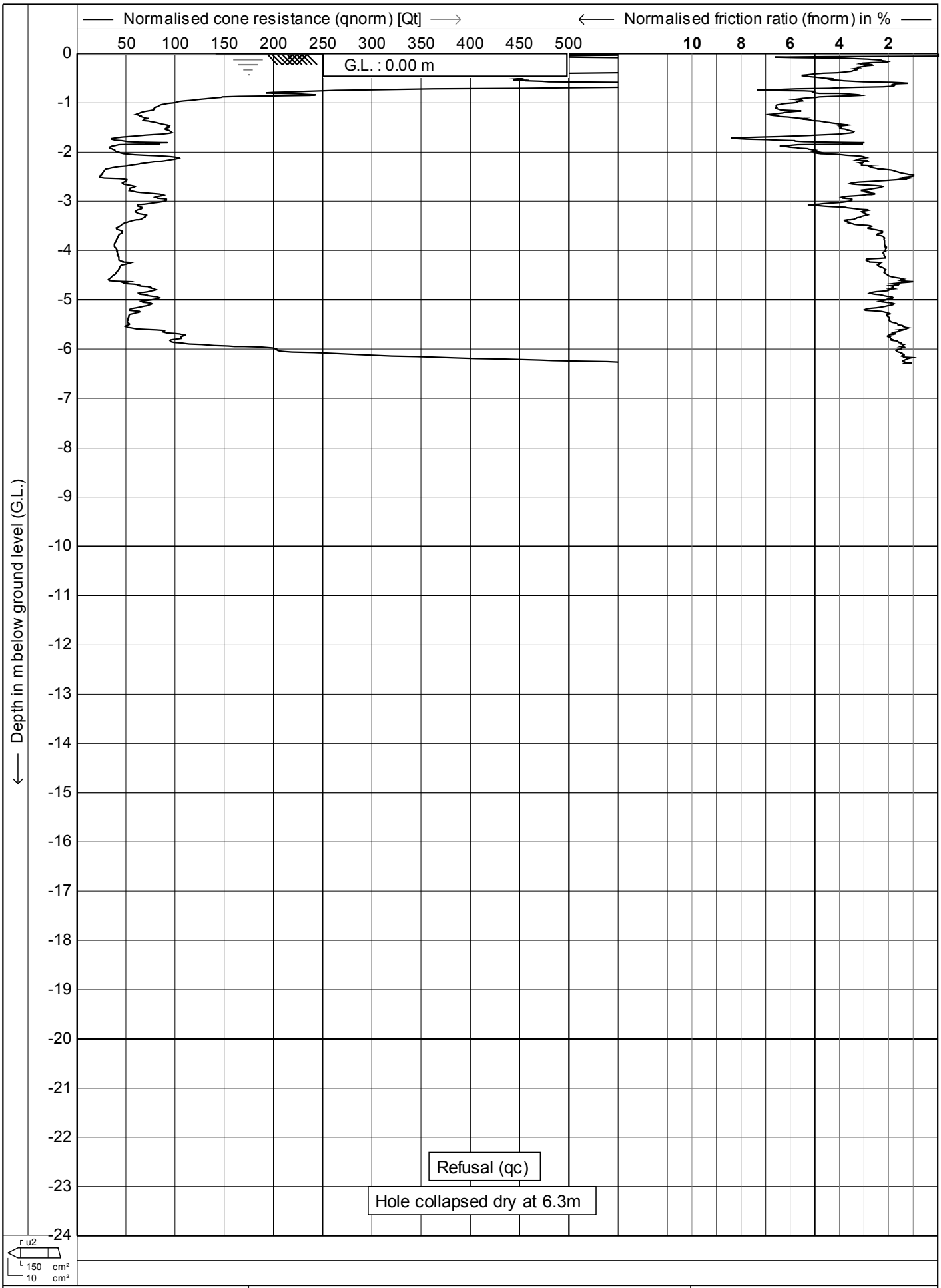
7/14

1.42



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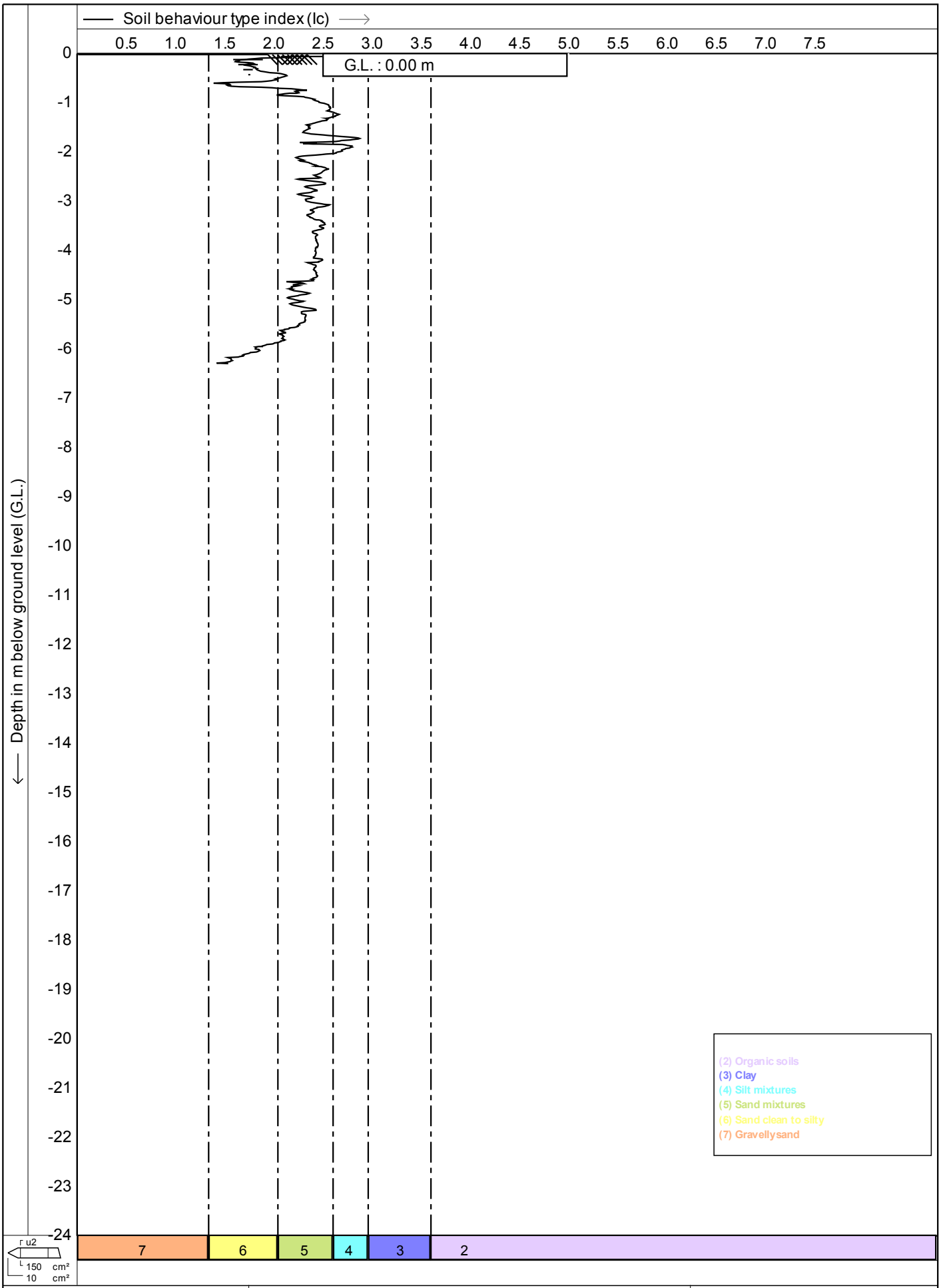

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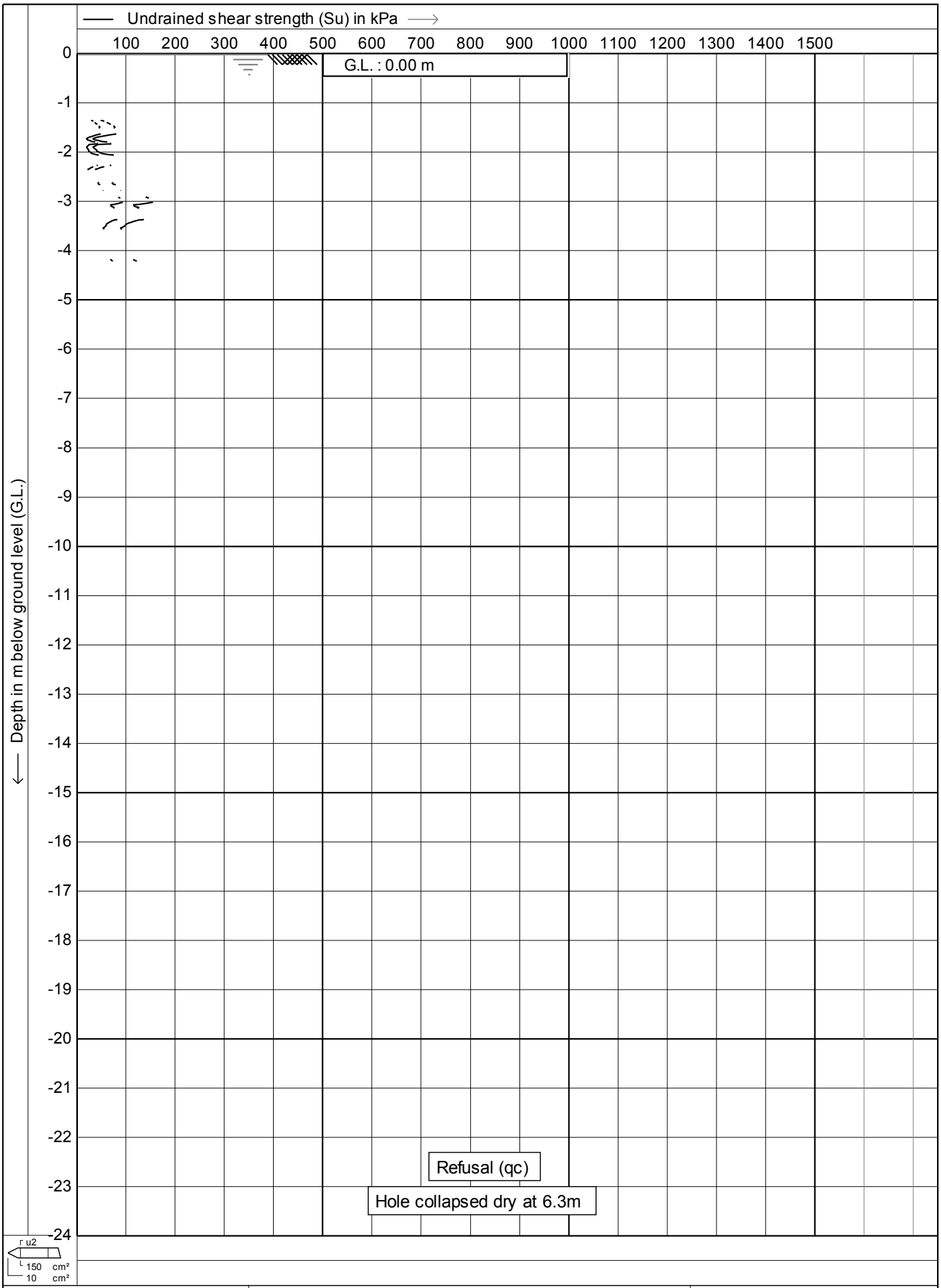

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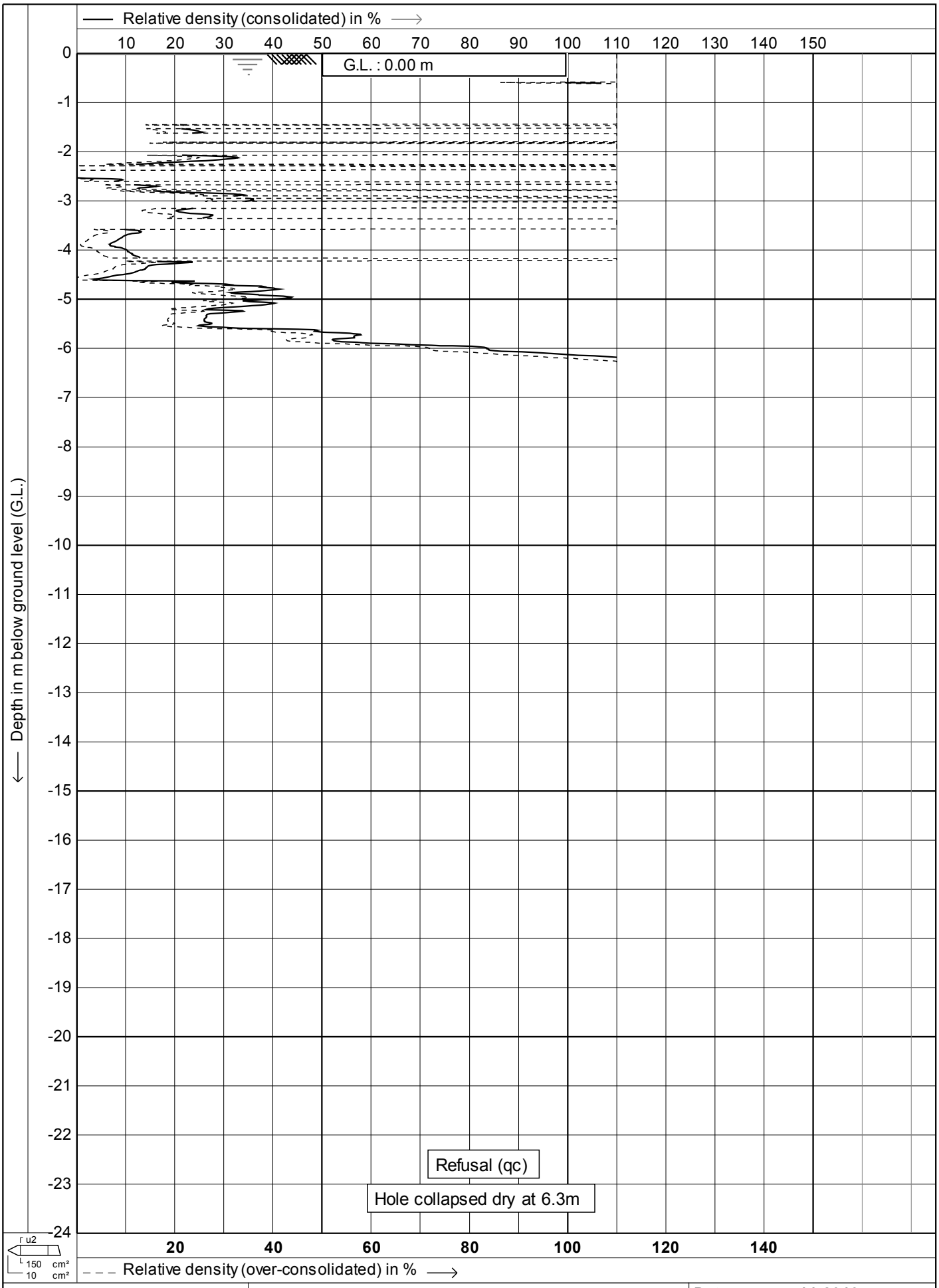
10/14

1.42



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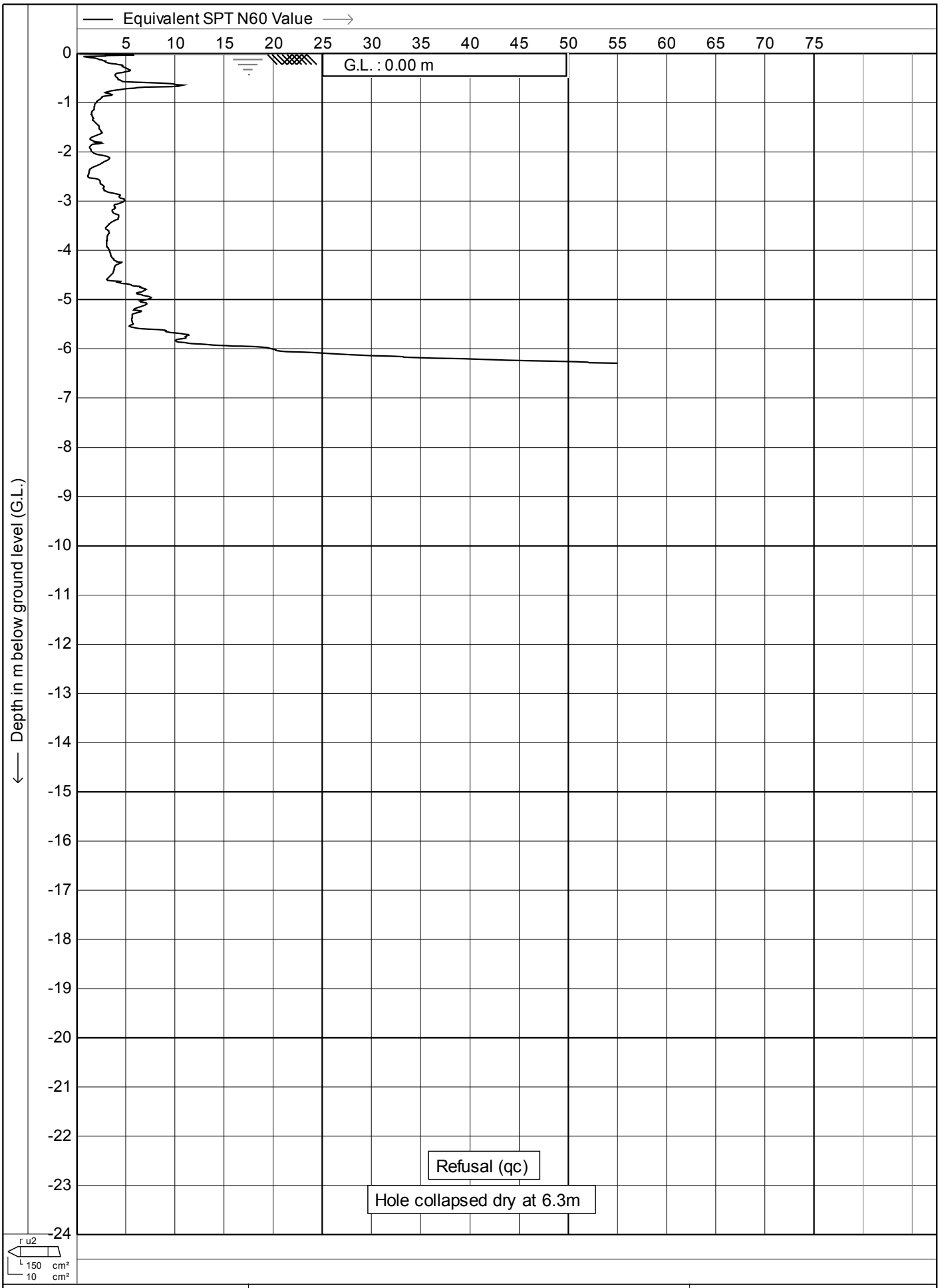

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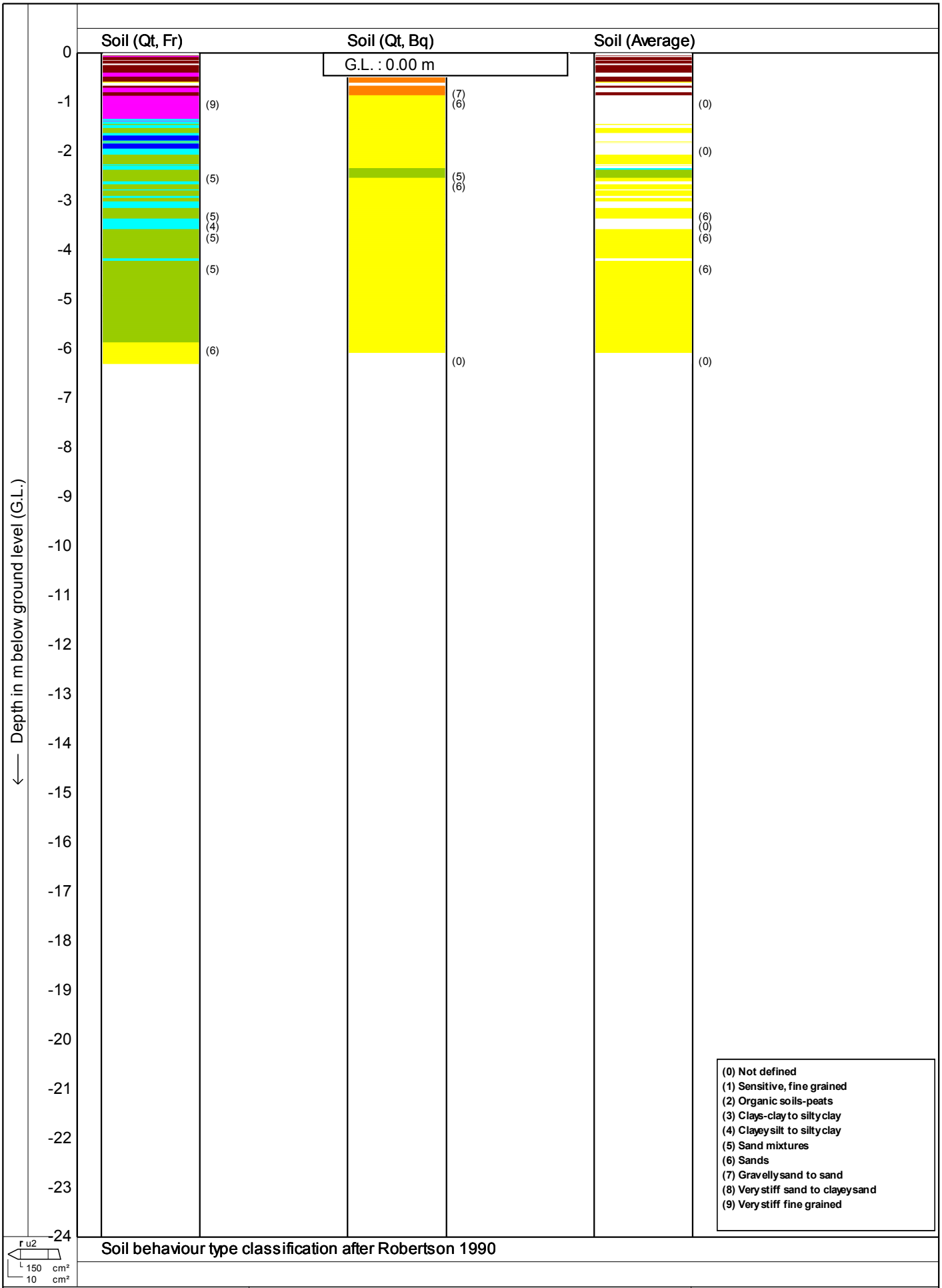

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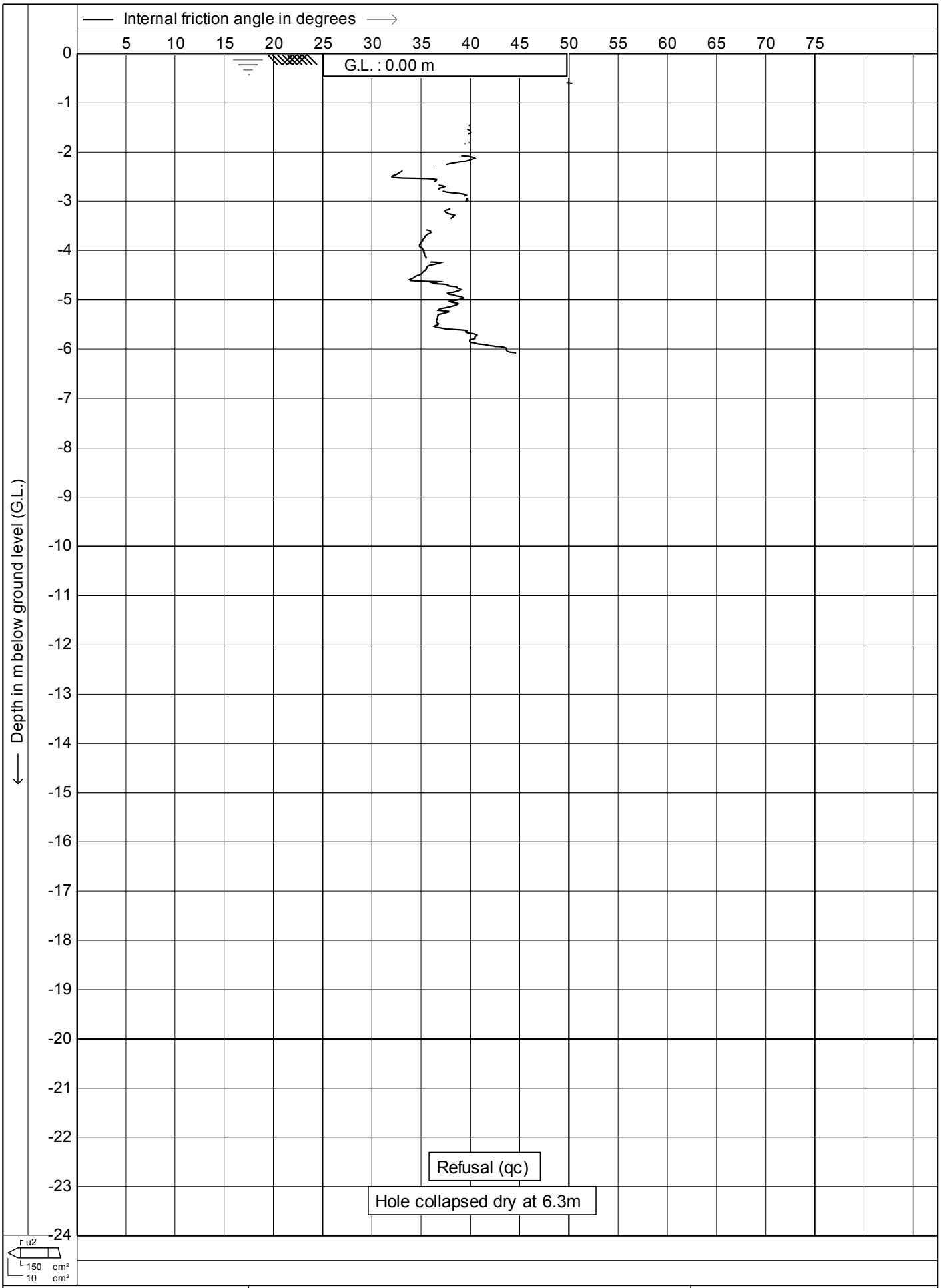

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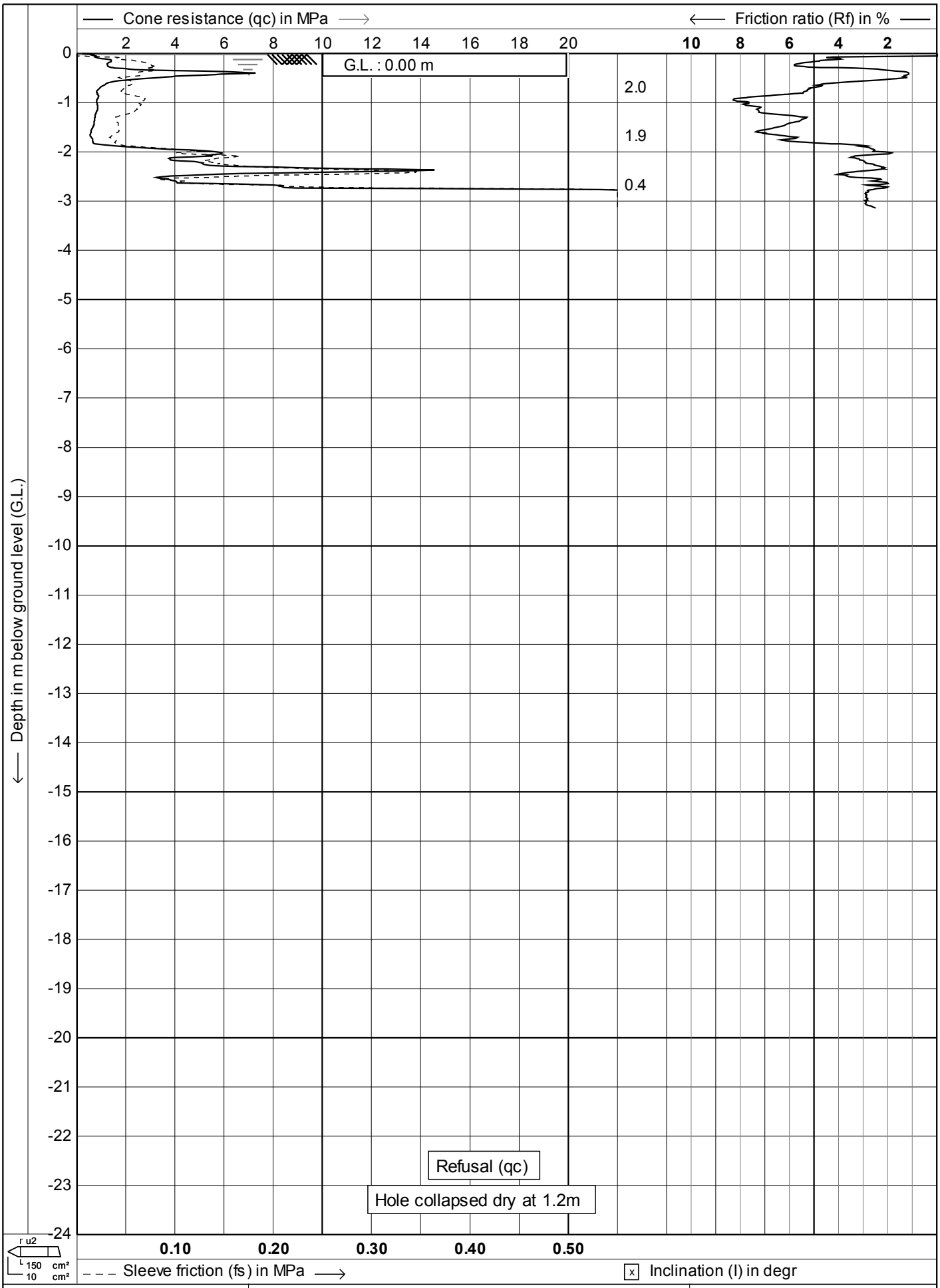

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1/14

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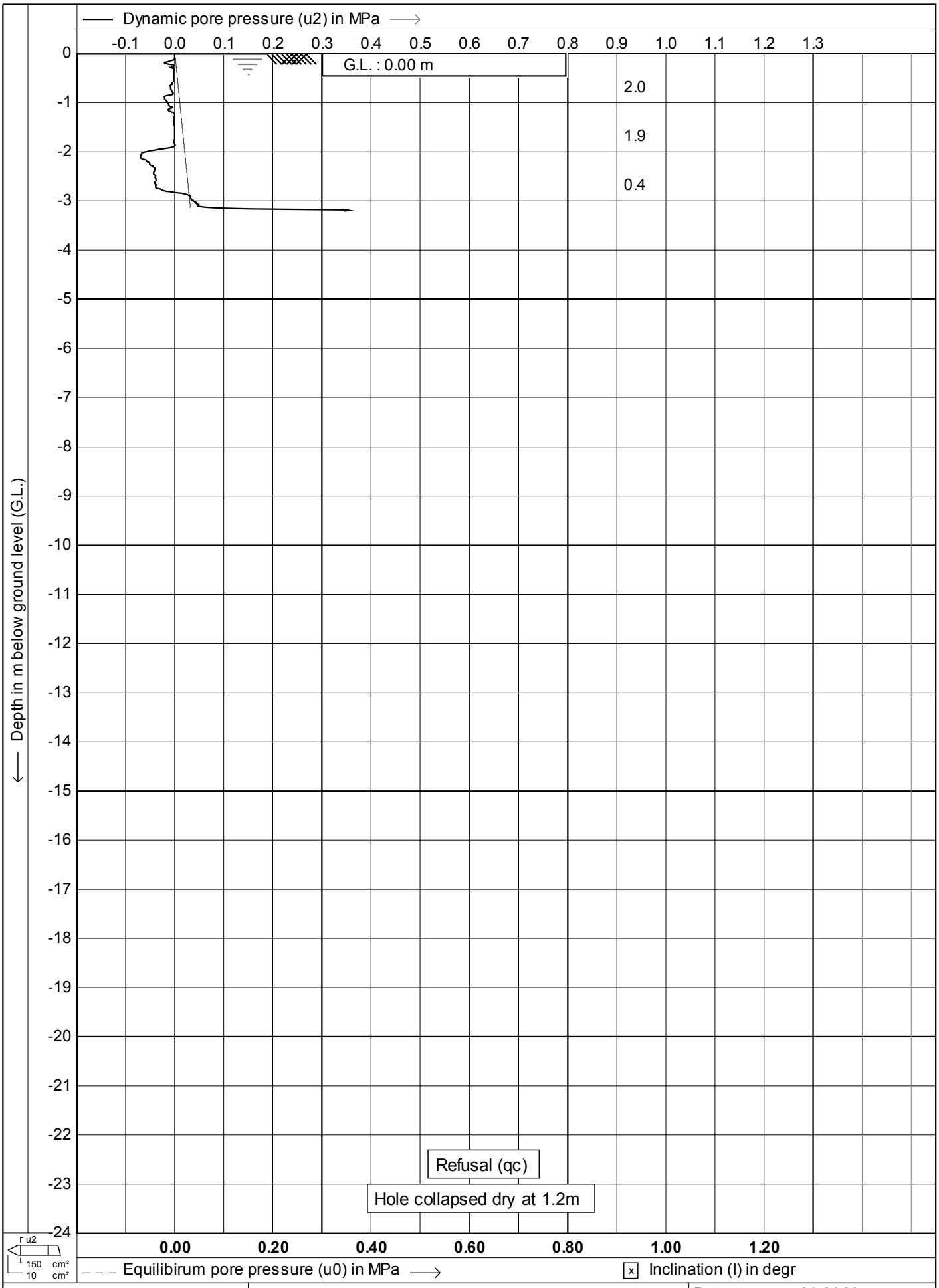

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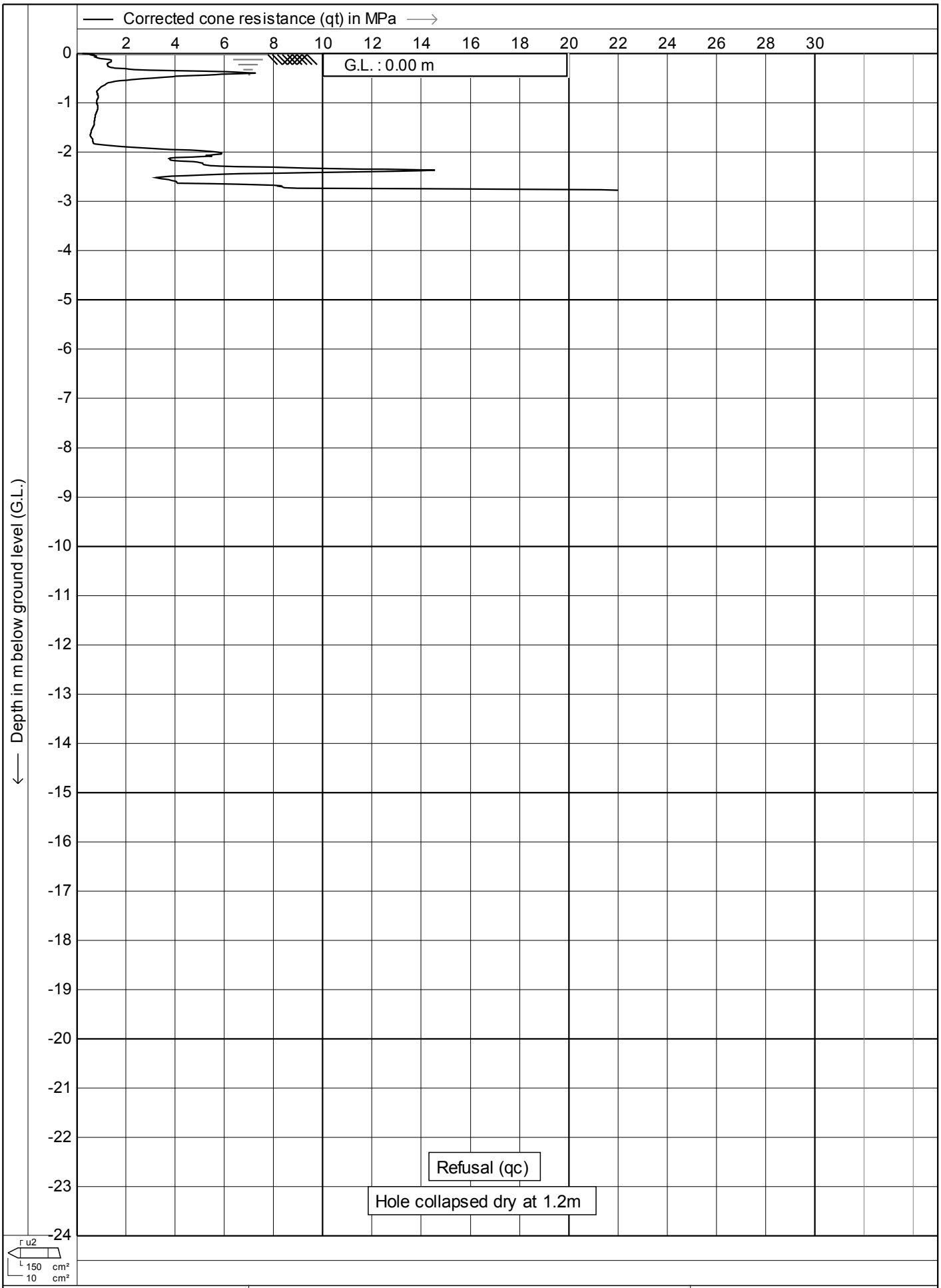

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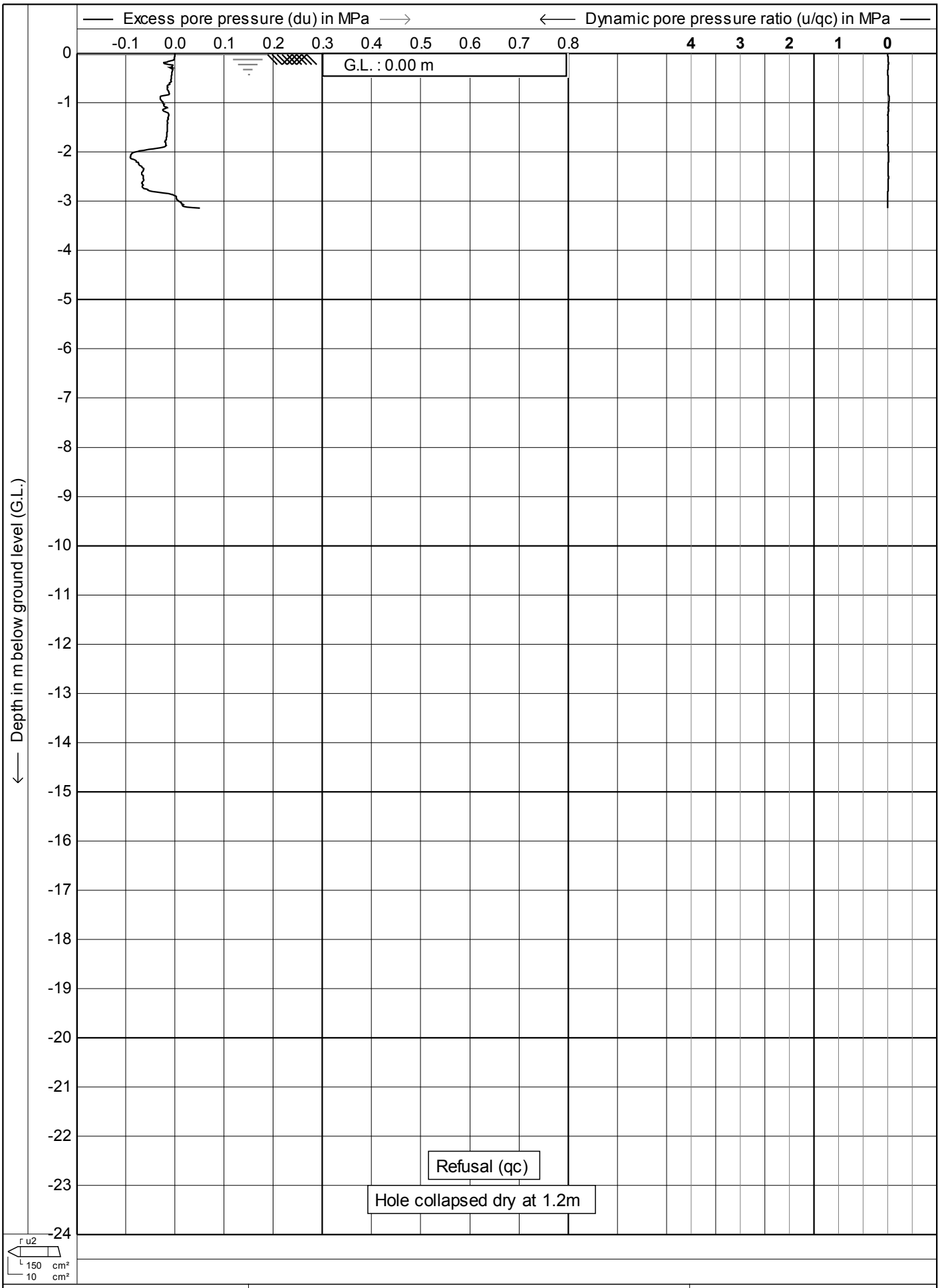

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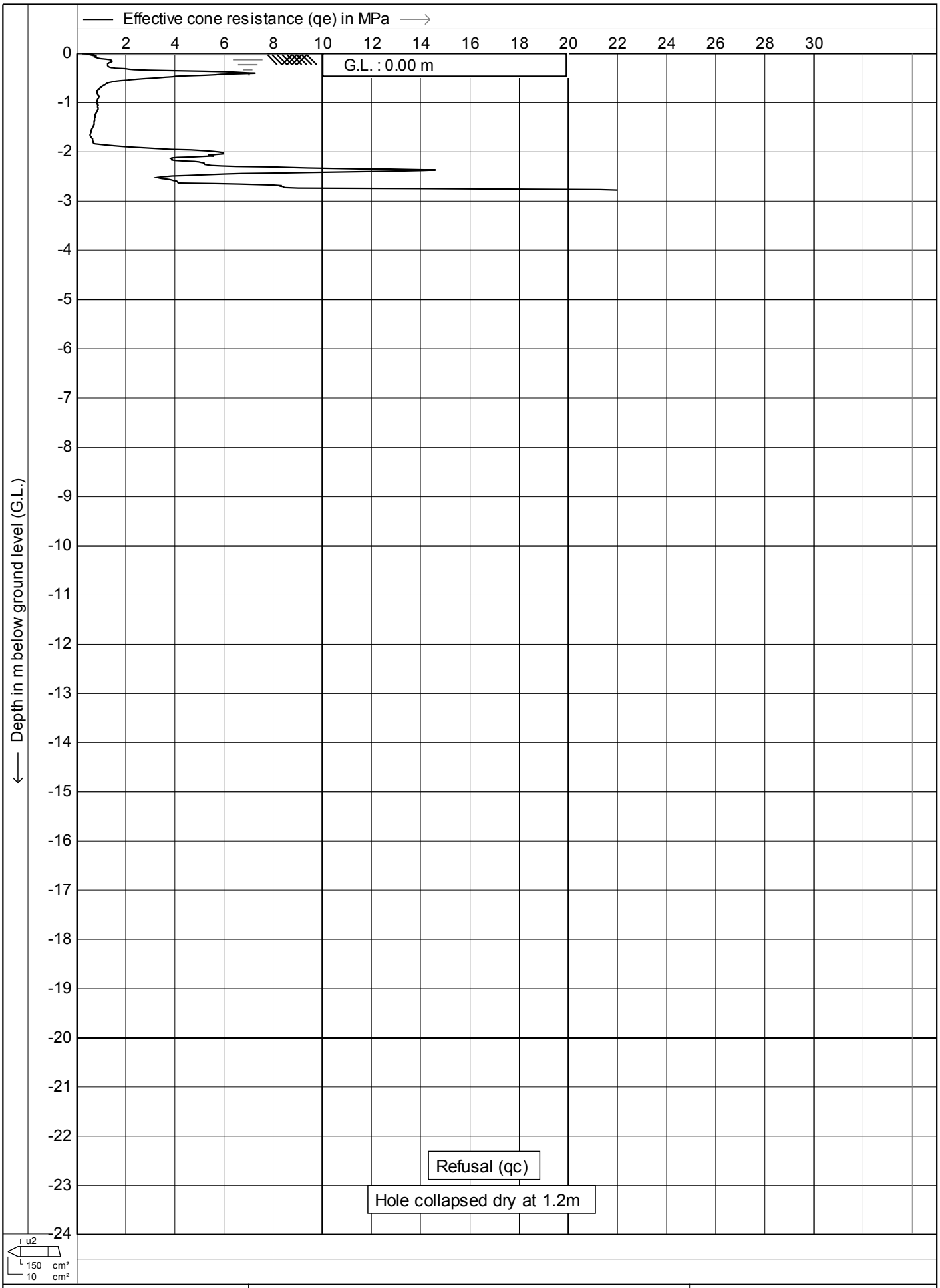

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CPT no.	: **12**

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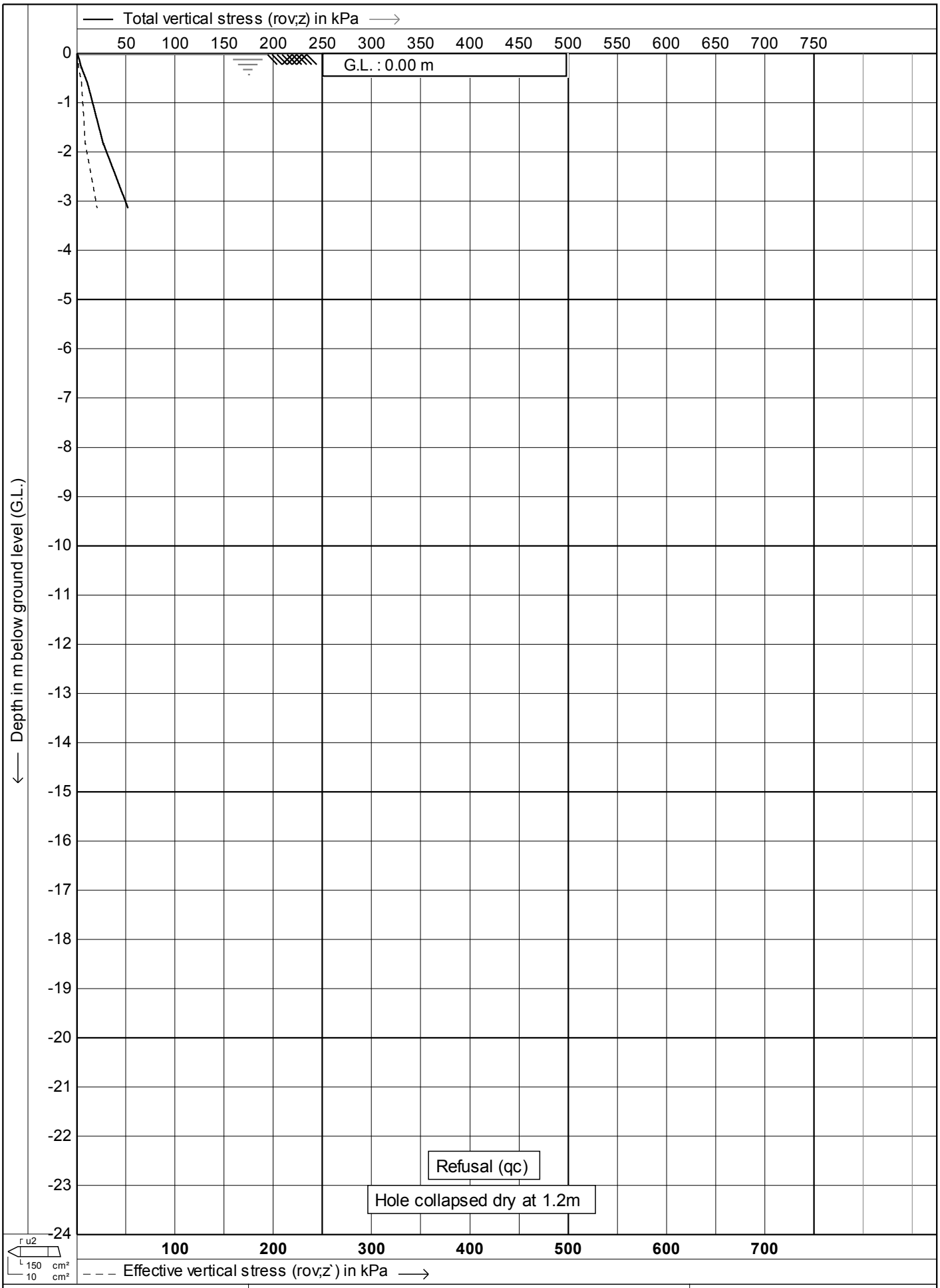

Test according A.S.T.M. Standard D 5778-12

PERRY GEOTECH

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **12**

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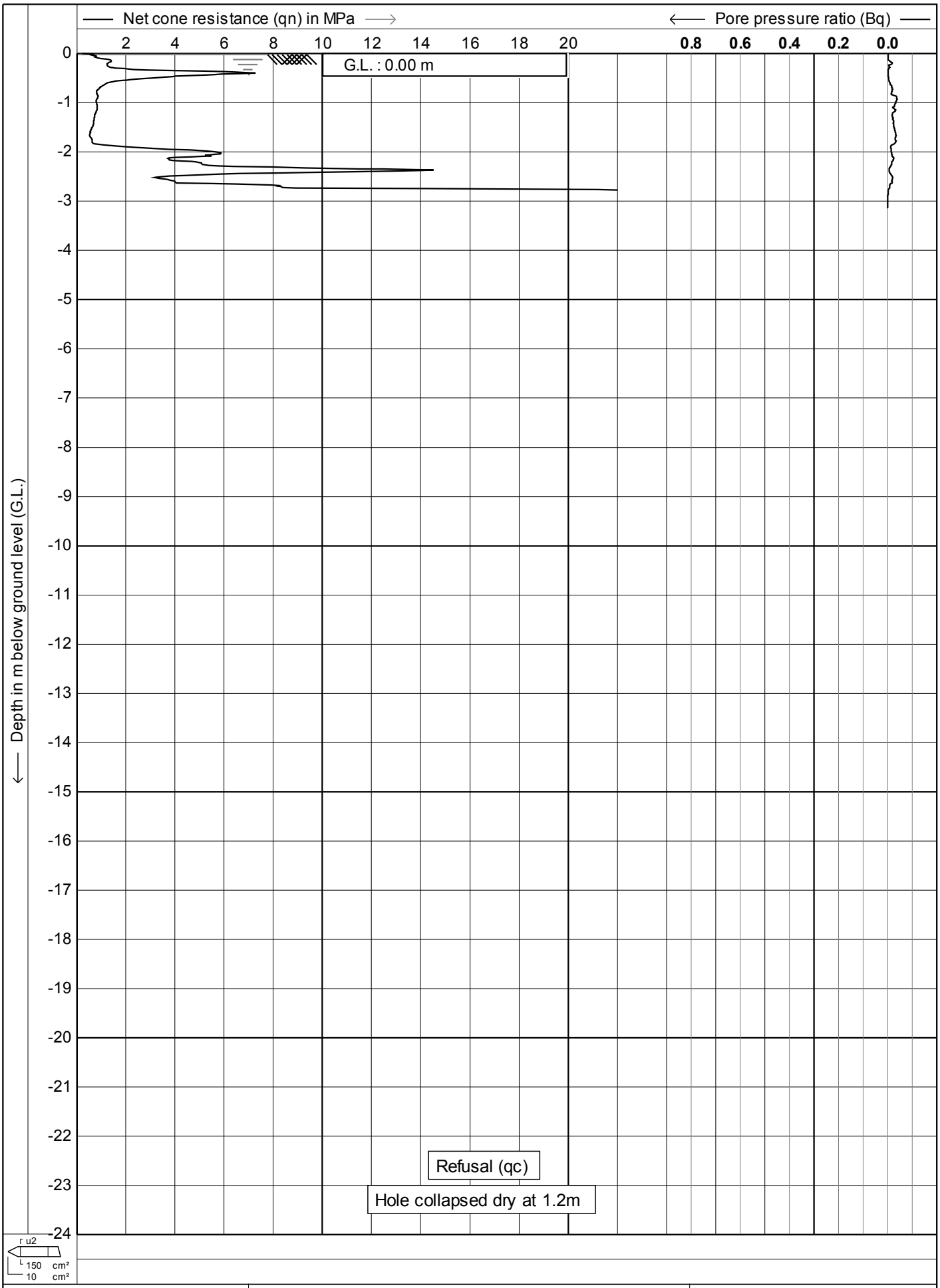


PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

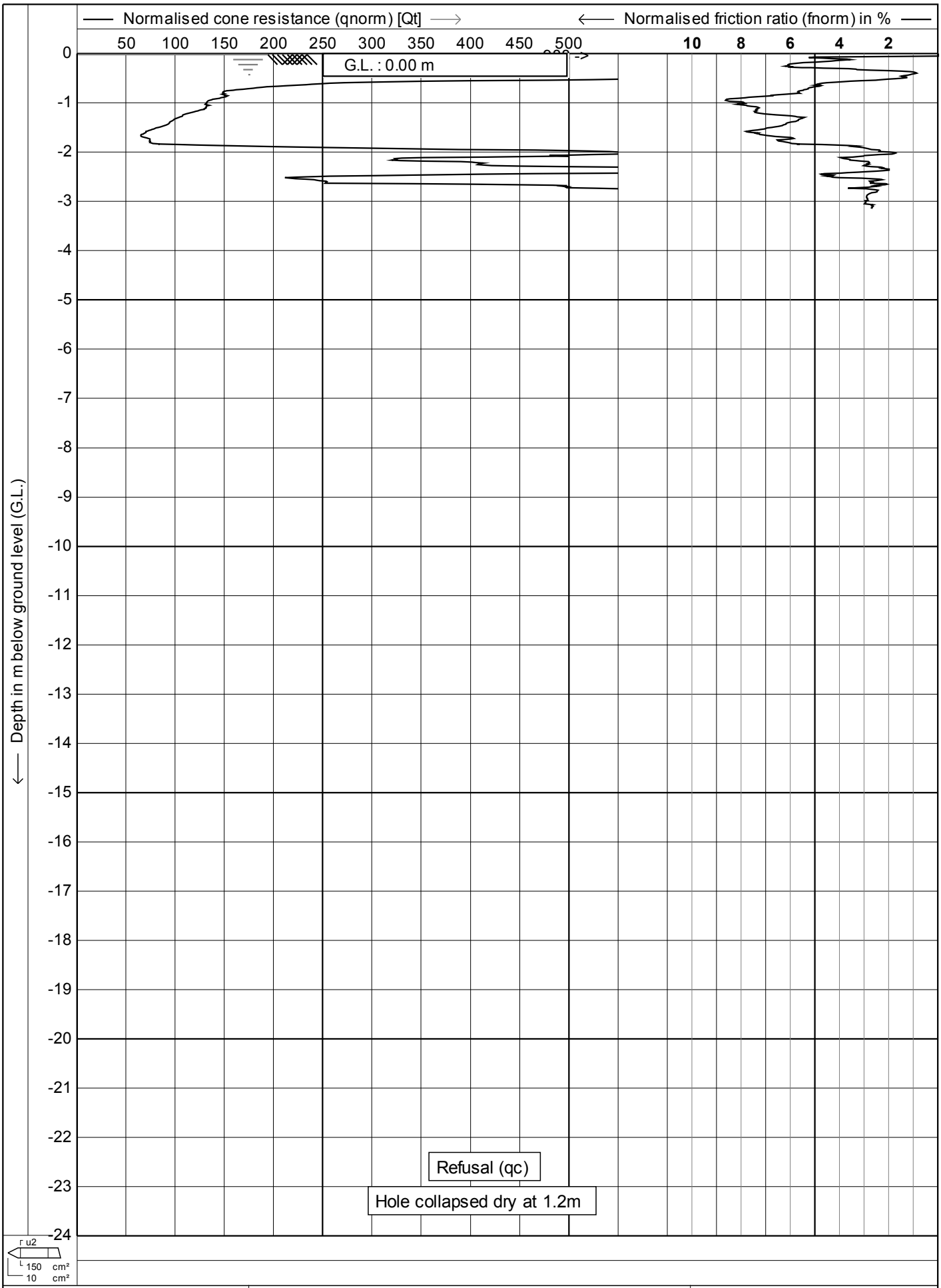
Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **12**

7/14

1.42



PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **12**

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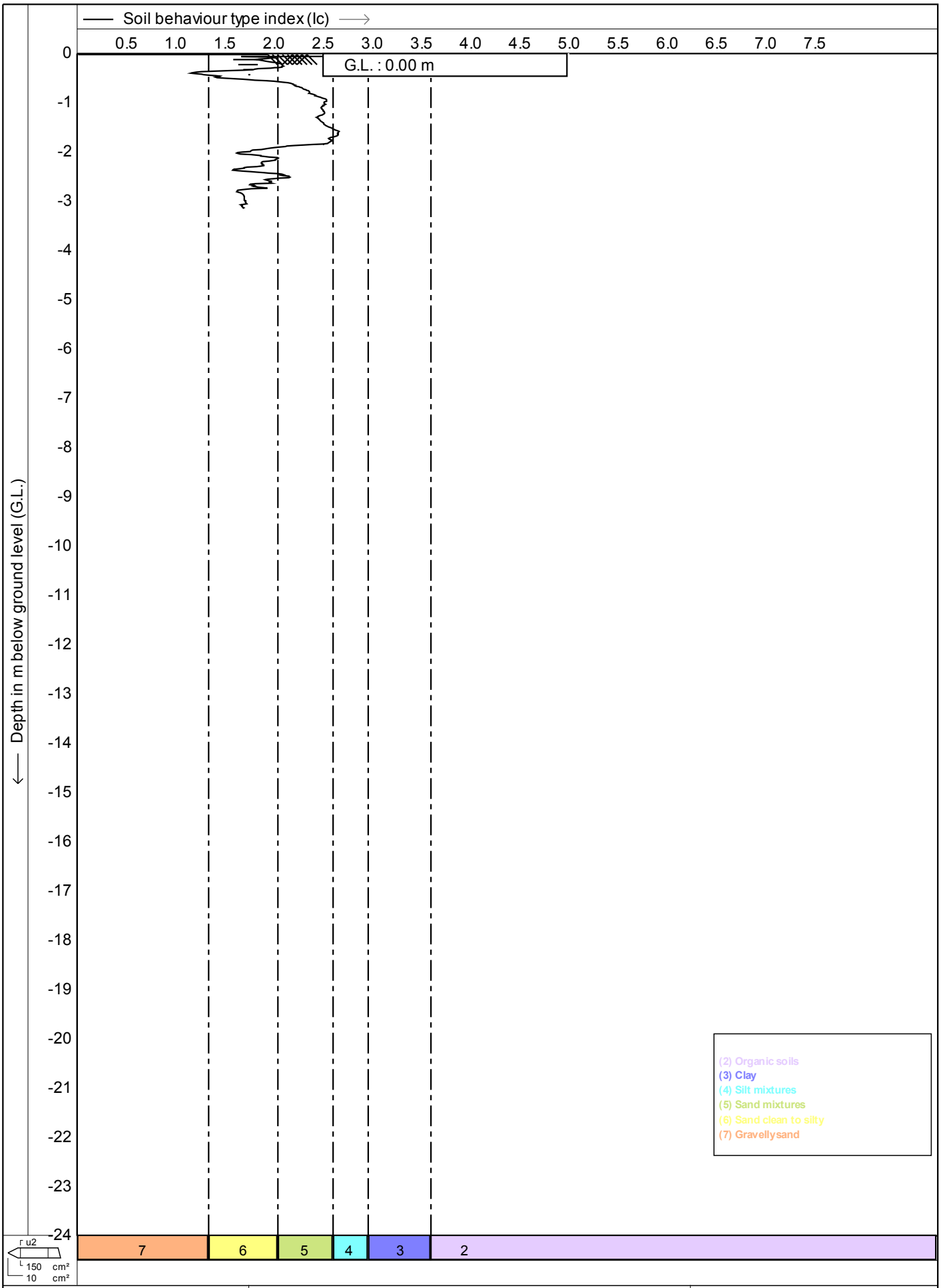

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Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **12**

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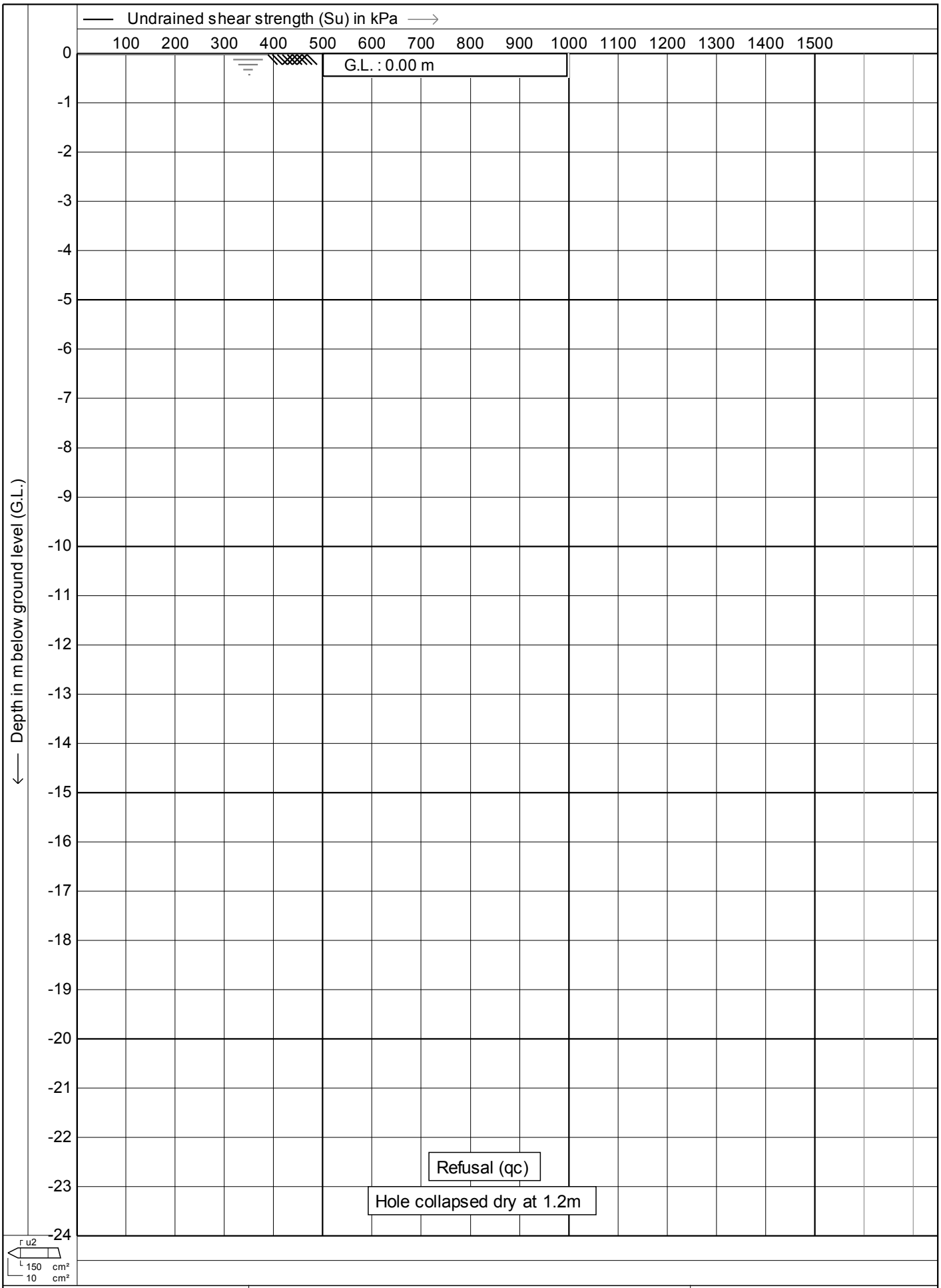
1.42



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Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **12**

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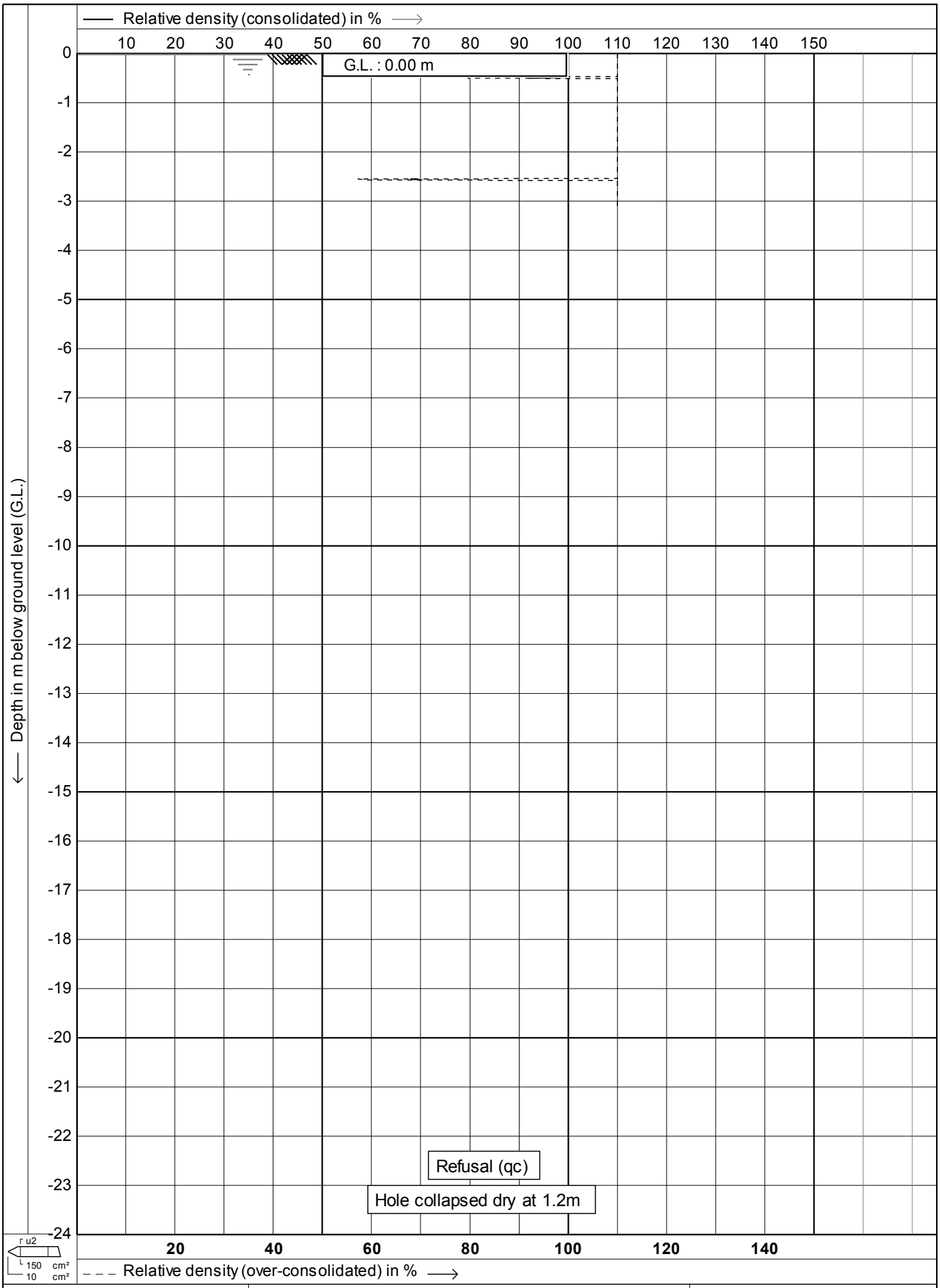

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	Project : **Site Investigation**	Cone no. : **C10CFIIP.C13184**
	Location: **Ngataringa Rd - Devonport - Auckland**	Project no. : **05TT17**
	Position: **0, 0 RD**	CPT no. : **12** **11/14**

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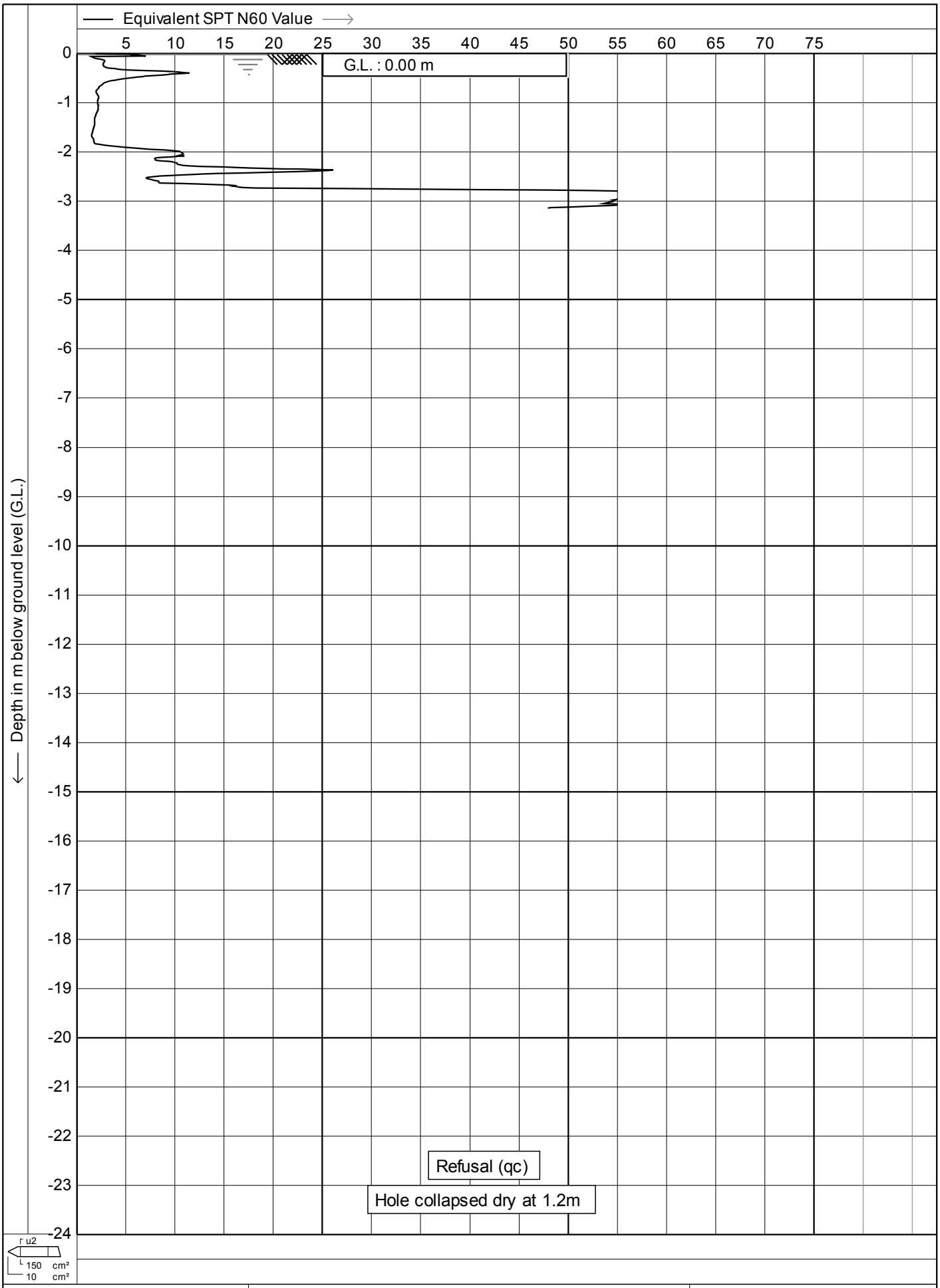

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Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **12**

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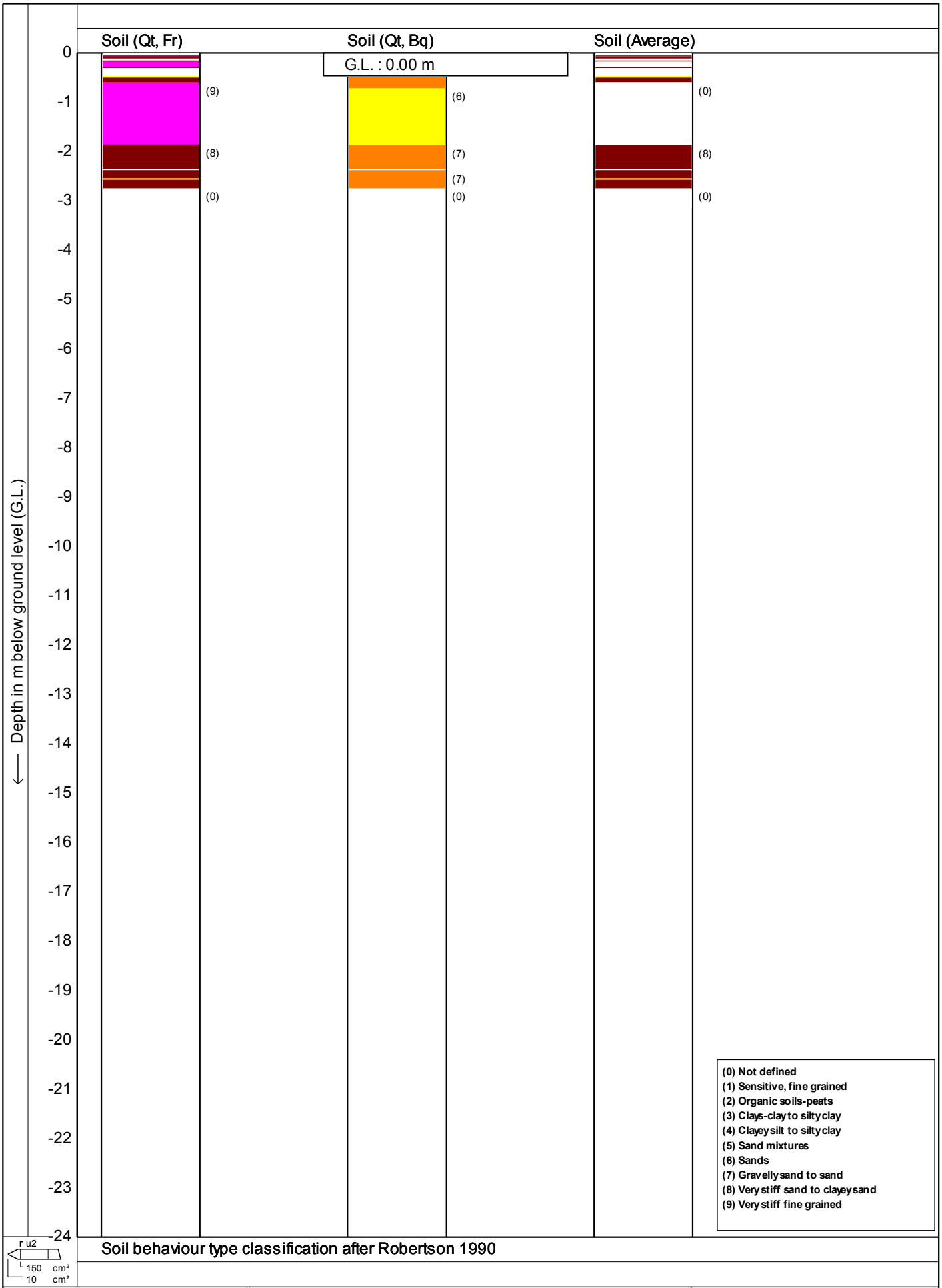

Soil behaviour type classification after Robertson 1990

PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **12**

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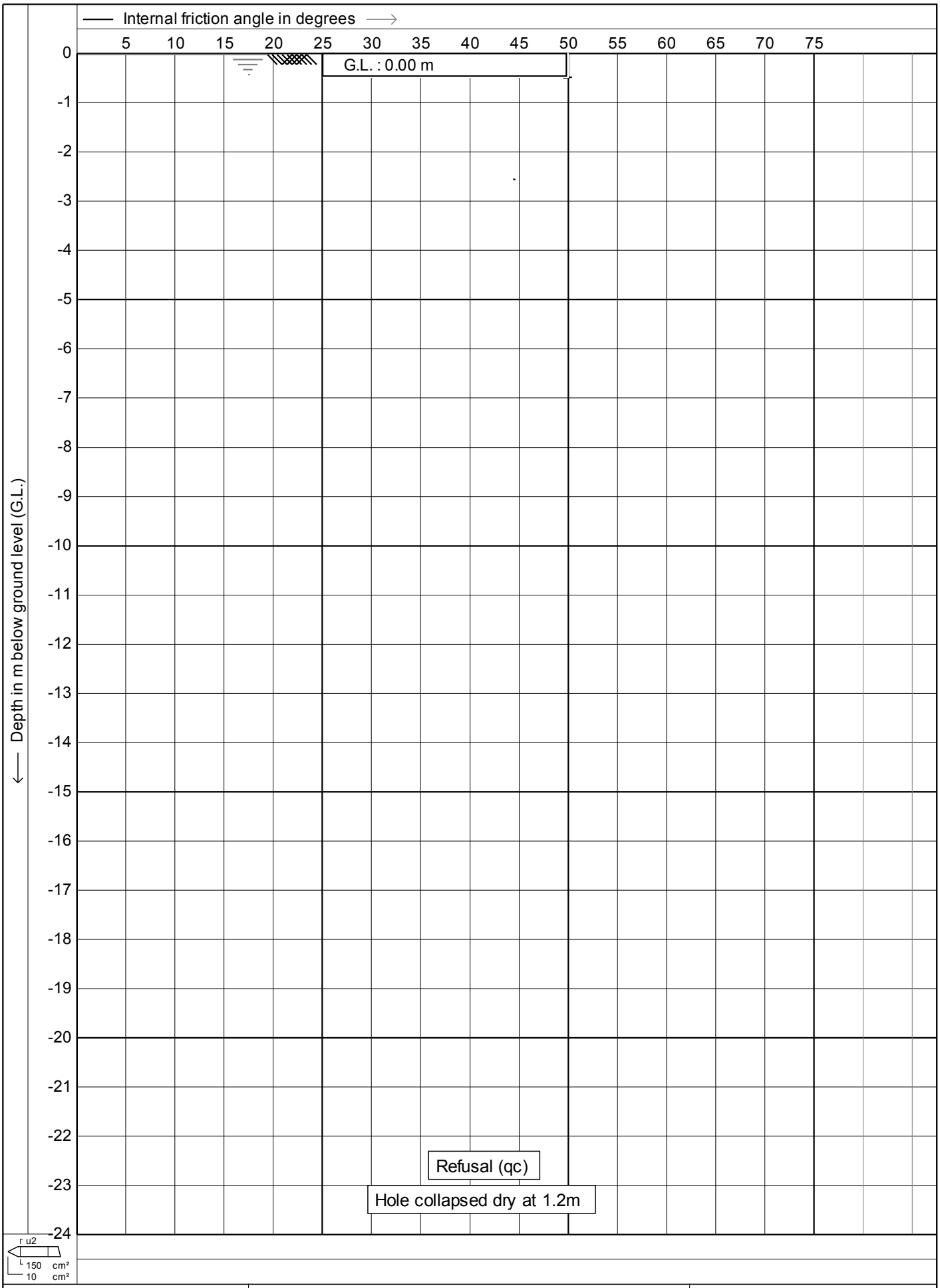

PERRY GEOTECH

Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date	: **5-11-2013**
Cone no.	: **C10CFIIP.C13184**
Project no.	: **05TT17**
CPT no.	: **12**

1.42

Appendix C: Laboratory test results

GEOTECHNICS
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w. www.geotechnics.co.nz

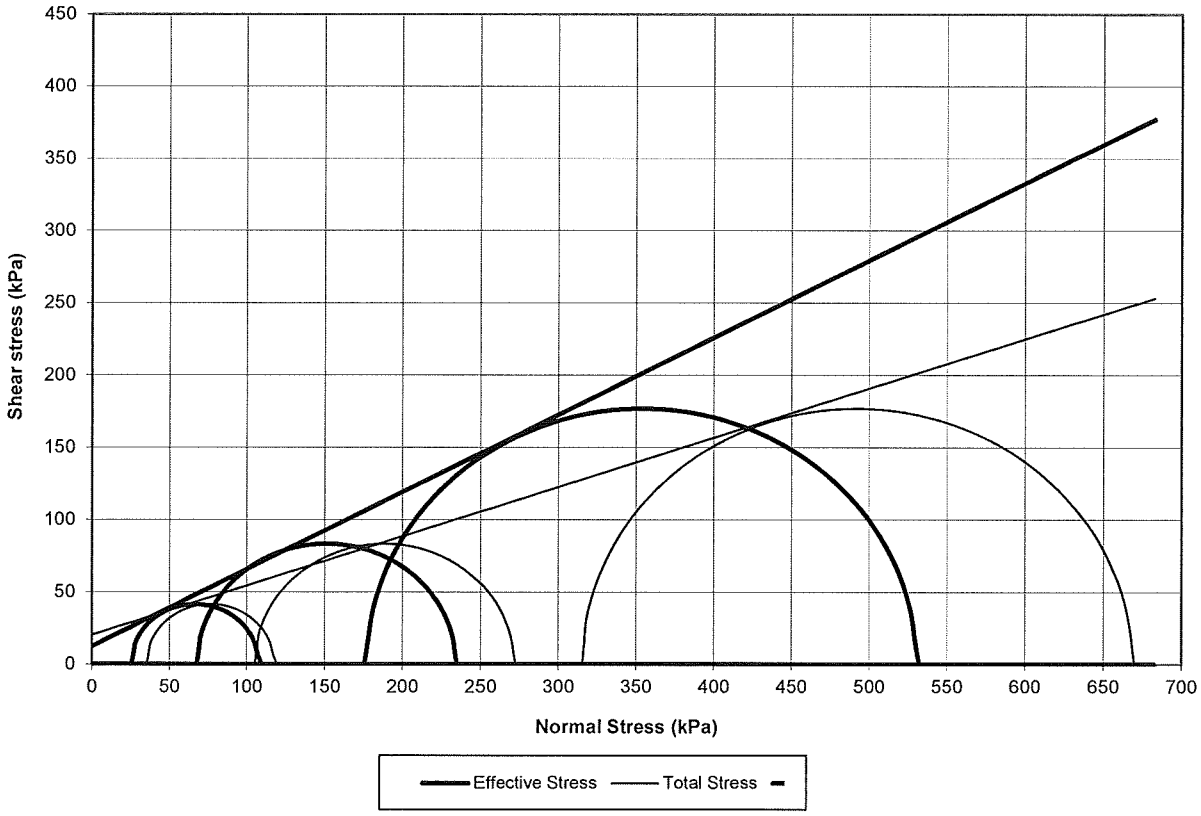
Form No.:	TP1
Form Date:	July 2003

P:\616193\616193.0010\WorkingMaterial\PT-2\PT-2.xl

Plate No.: Page of
Site: 7~37 Ngataringa Rd, Devonport Your Ref No.: 29452 Job No.: 616193.001
Test pit/Bh No.: BH07A Sample No.: PT-2 Depth: 2.09 -- 2.24 (m)
Test method used: BS1377:Part 8:1990:Clause 5 Saturation BS1377:Part 8:1990:Clause 6 Consolidation
BS1377:Part 8:1990:Clause 7 Consolidated-undrained triaxial compression test with pore pressure measurement

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST (3 STAGES)

MOHR CIRCLES OF TOTAL AND EFFECTIVE STRESSES



Initial Sample Height:	151.55	mm	Initial Water Content:	27.3	%
Initial Sample Diameter:	73.04	mm	Initial Bulk Density:	1.93	t/m³
Initial B Value:	2	%	Initial Dry Density:	1.52	t/m³
B Value before Consolidation:	96	%	Final Water Content:	26.6	%

	Consolidation Stage			Failure Values				
	Cell Pressure (kPa)	Back Pressure (kPa)	Eff. Consol. Stress	Deviator Stress (kPa)	Pore Pressure Change During Shearing δμ(kPa)	Effective Principal Stress (kPa) Major σ1'	Minor σ3'	Vertical Strain (%)
STAGE 1	435	400	35	82.86	10	107.86	25.00	1.71
STAGE 2	505	400	105	166.54	37.2	234.34	67.80	2.97
STAGE 3	715	400	315	353.74	138.2	530.54	176.80	4.10

		Total			Effective	
Angle of Frictional Resistance:	ϕ =	19	°	ϕ' =	28	°
Cohesion:	c =	20	kPa	c' =	12	kPa
Linear Regression Coefficient:	r =	0.998		r =	1.000	

Sample History: Undisturbed core trimmed at natural water content.

Soil description: SILT, with some clay and minor sand, firm, orange brown with light grey, brown, white and dark grey, medium to high plasticity, slightly dilatant.

Failure Mode: Planar / Plastic **Test Speed:** 0.028 (mm/min)

Test Remarks: The sample was saturated by increments of cell pressure and back pressure.
Failure for each stage was determined by the maximum effective stress ratio. Strength parameters have been derived by using a linear regression fitting method.

Entered by: Date: 26/11/13 Checked by: MM Date: 27/11/13

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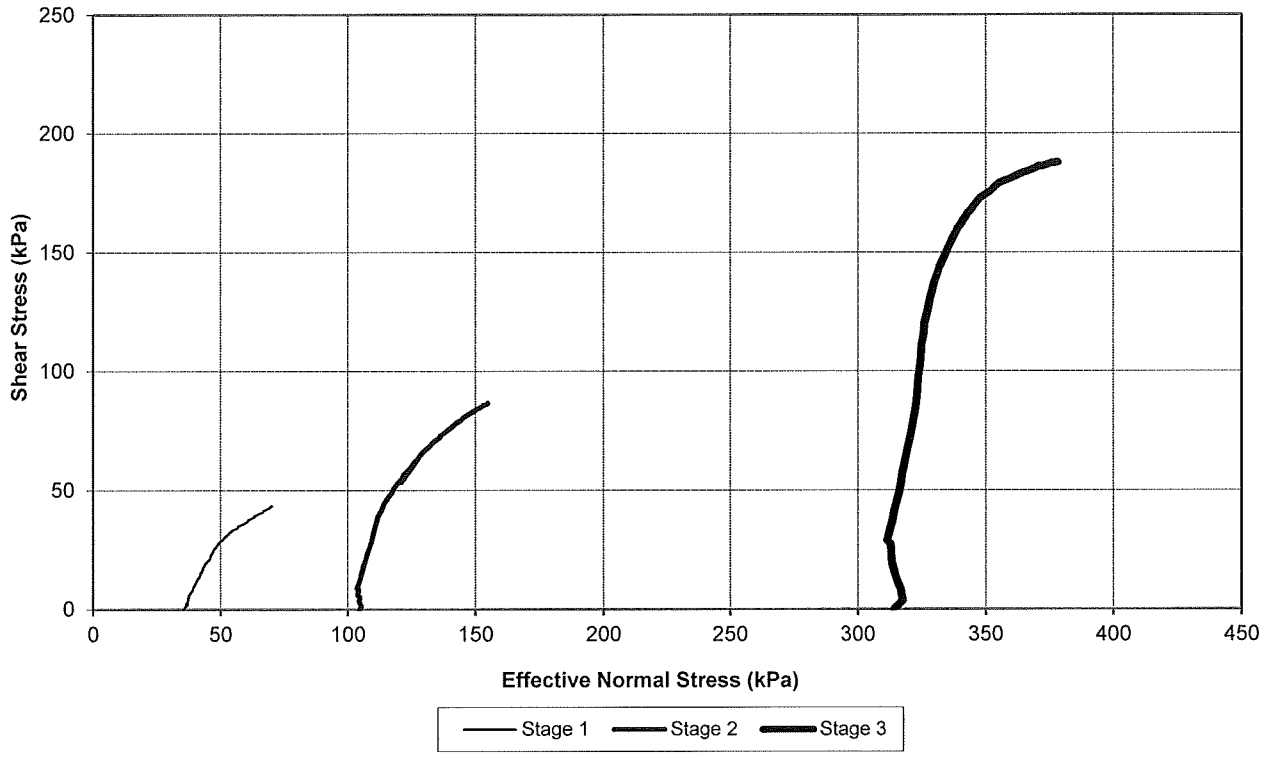
Form No.:	TG2
Form Date:	July 2003

P:\616193\616193.0010\WorkingMaterial\PT-2\PT-2.xlsx

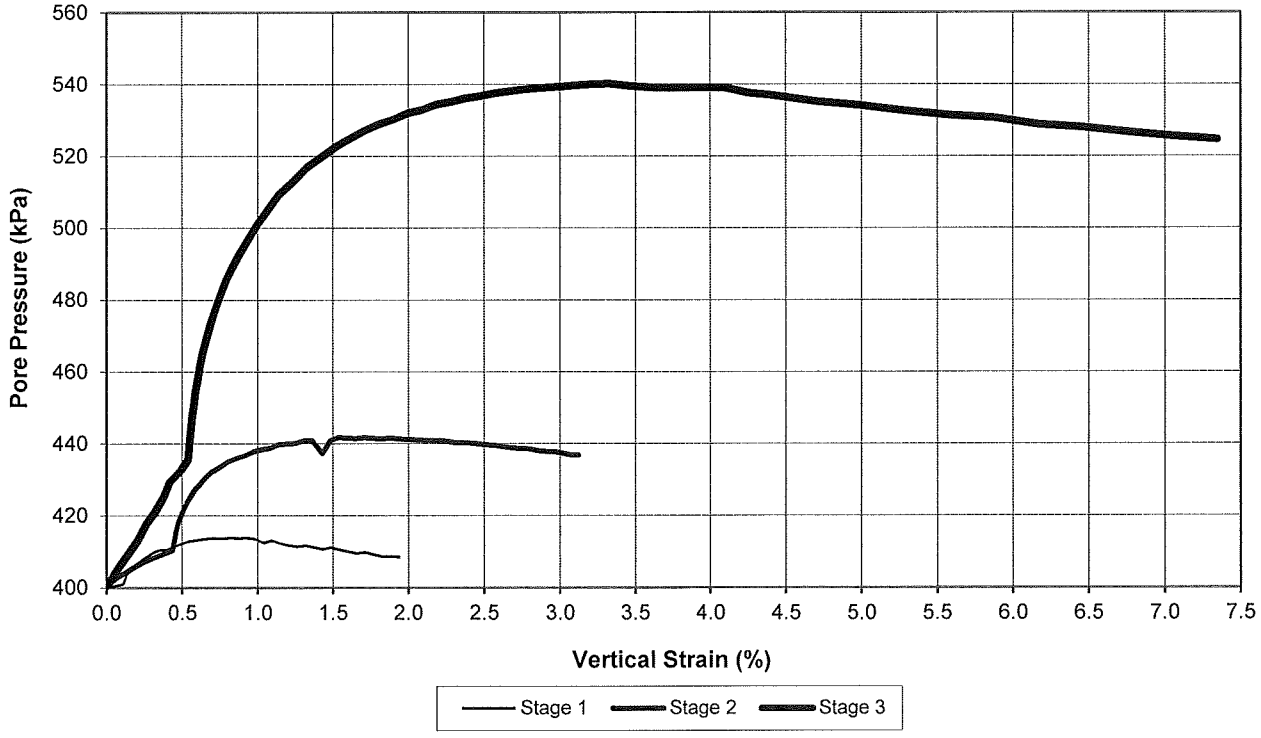
Plate No.: Page of
Site: 7~37 Ngataringa Rd, D Your Ref No.: 29452 Job No.: 616193.001
Test pit/Bh No.: BH07A Sample No.: PT-2 Depth: 2.09 -- 2.24 (m)

GRAPHS

STRESS PATH



PORE PRESSURE Vs VERTICAL STRAIN



Entered by: Date: 28/11/13 Checked by: MPL Date: 29/11/13

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Form No.:	TG1-1
Form Date:	July 2003
P:\616193\616193.0010\WorkingMaterial\PT-2\PT-2.xlsx	

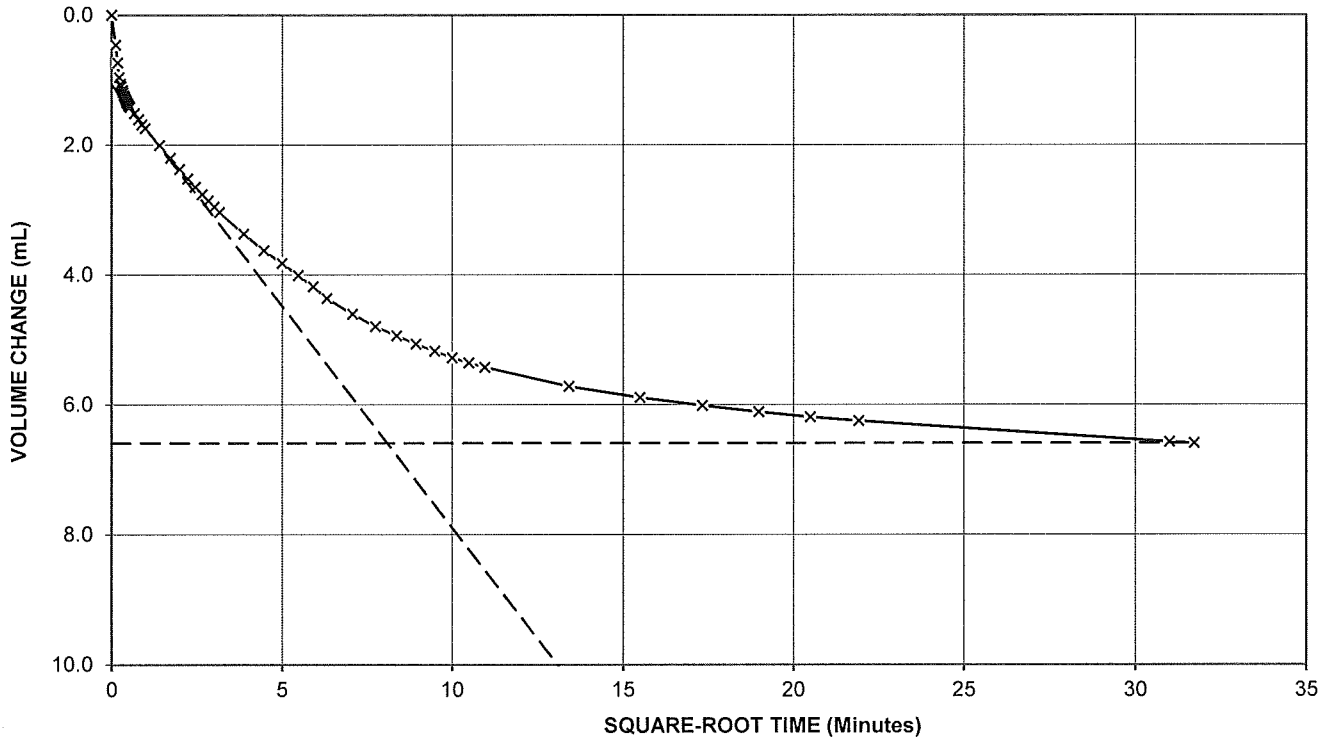
Plate No.: Page of

Site: 7~37 Ngataringa Rd, D Your Ref No.: 29452 Job No.: 616193.001

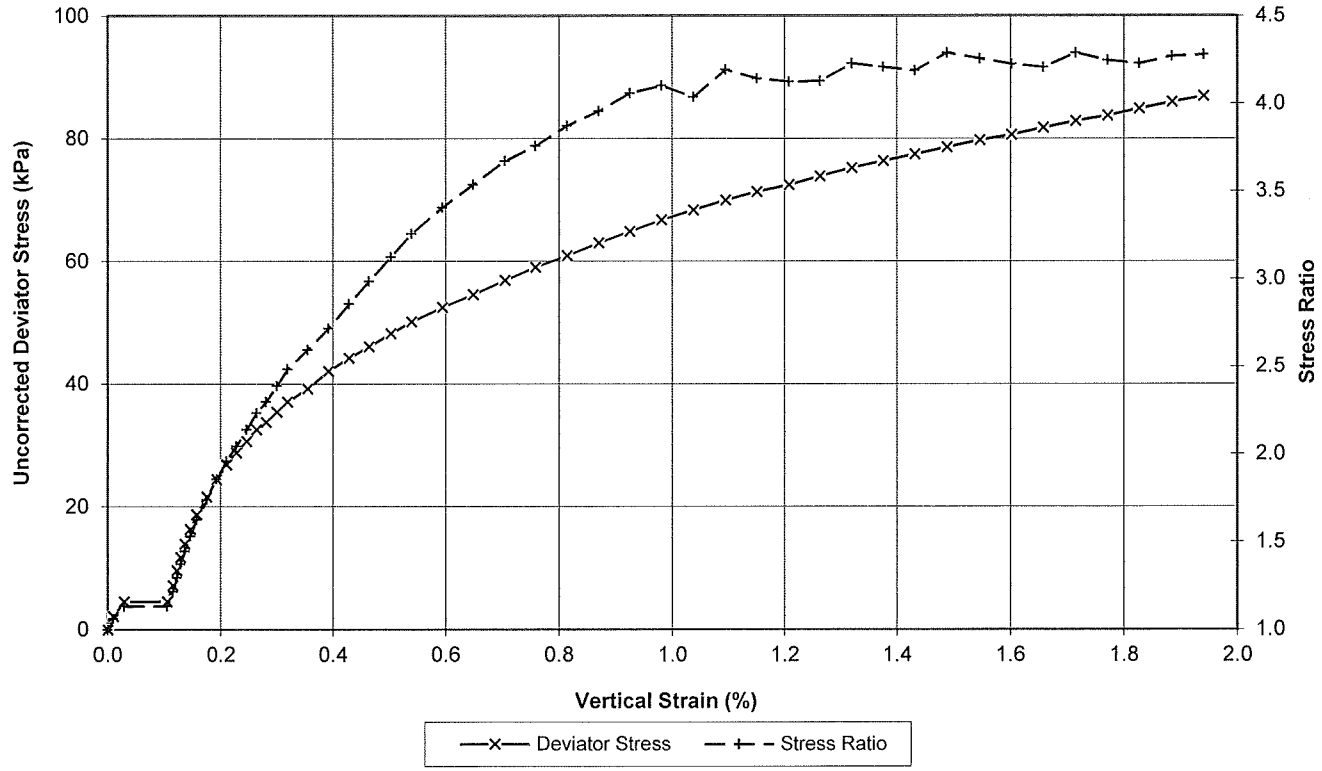
Test pit/Bh No.: BH07A Sample No.: PT-2 Depth: 2.09 -- 2.24 (m)

STAGE 1 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



Entered by: Date: 26/11/13 Checked by: MPL Date: 27/11/13

GEOTECHNICS
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Auckland 1023, New Zealand
p. +64 9 356 3510
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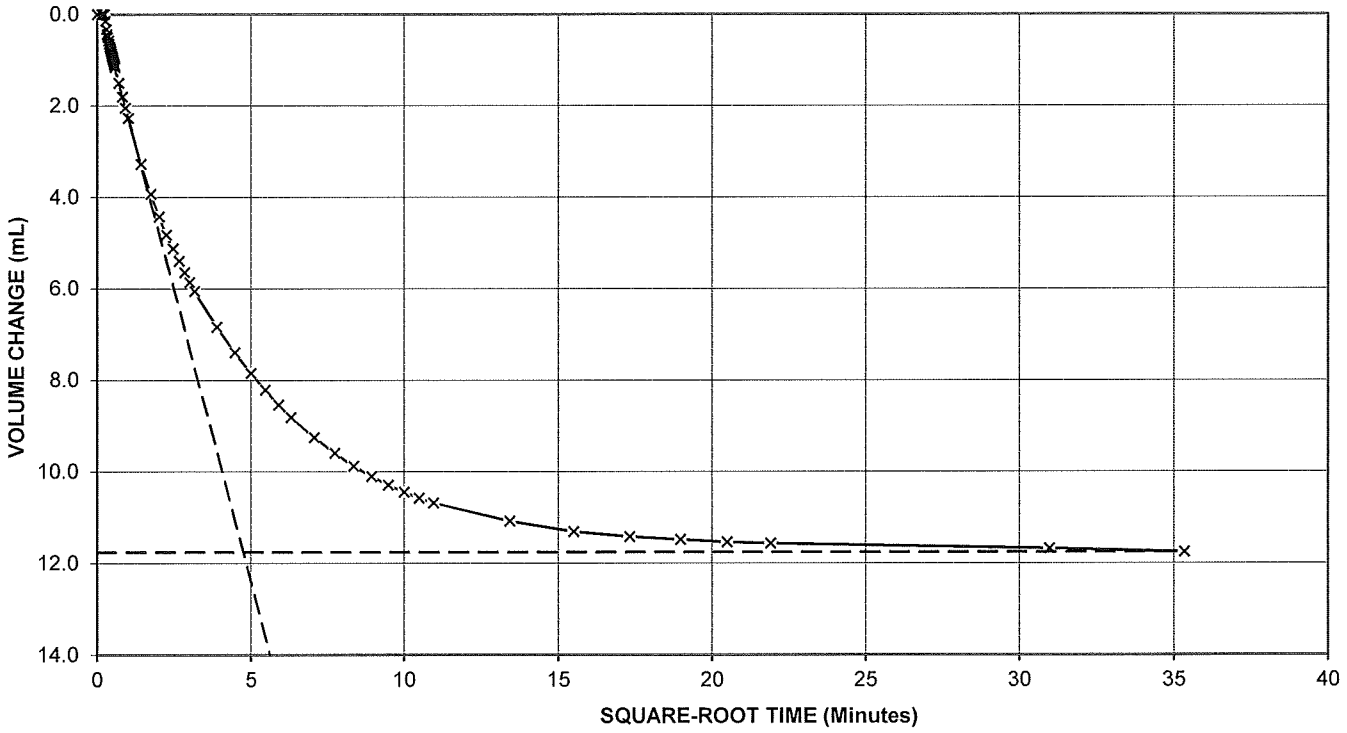
Form No.:	TG1-2
Form Date:	July 2003
P:\616193\616193.0010\WorkingMaterial\PT-2\PT-2.xlsx	

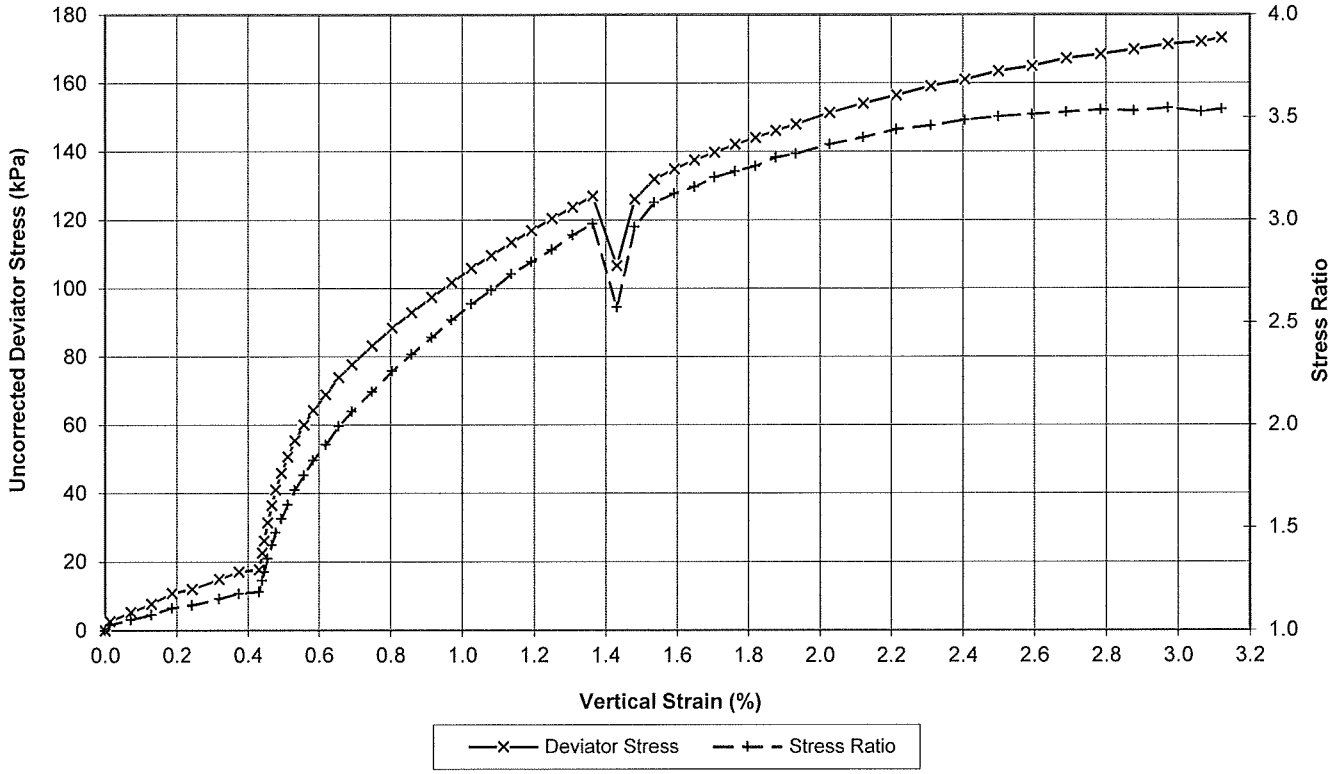
Plate No.: Page of
Site: 7~37 Ngataringa Rd, E Your Ref No.: 29452 Job No.: 616193.001
Test pit/Bh No.: BH07A Sample No.: PT-2 Depth: 2.09 -- 2.24 (m)

STAGE 2 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



Entered by: Date: 26/11/13 Checked by: MPL Date: 27/11/13

Appendix D: Investigation coordinates

	Mt Eden Circuit 2000		Auckland 1946	NZTM Projection	
Investigation ID	Northing (mN)	Easting (mE)	RL (m)	Northing (mN)	Easting (mE)
BH01	806919.18	402279.86	25.5	5923893.373	1759629.799
BH02	806843.27	402302.81	14.23	5923817.051	1759651.345
BH03	806890.73	402418.18	16.06	5923862.375	1759767.573
BH04	806897.8	402475.96	11.31	5923868.377	1759825.474
BH06	806991.56	402499.65	14.15	5923961.686	1759850.891
BH07	806942.99	402391.05	20.39	5923915.127	1759741.411
BH07A	806941.44	402392.98	20.29	5923913.542	1759743.312
BH08	807035.81	402557.64	17.34	5924004.859	1759909.688
CPT01	806920.24	402284	25.47	5923894.357	1759633.958
CPT02	806893.95	402296.64	22.81	5923867.837	1759646.111
CPT03	806843.54	402306.87	14.19	5923817.246	1759655.409
CPT04	806861.78	402381.49	16.12	5923834.106	1759730.354
CPT05	806883.99	402419.11	15.58	5923855.619	1759768.378
CPT06	806896.51	402471.76	11.31	5923867.165	1759821.251
CPT07	806933.39	402509.6	11.78	5923903.341	1759859.766
CPT08	806992.12	402500.74	14.09	5923962.225	1759851.991
CPT09	806955.85	402481.6	12.77	5923926.314	1759832.185
CPT10	806950.25	402383.57	20.6	5923922.524	1759734.067
CPT11	806945.14	402409.99	18.51	5923916.927	1759760.388
CPT12	806997.57	402588.72	9.3	5923966.051	1759940.058
HA01	806932.88	402336.32	25.48	5923906.029	1759686.503
HA02	806894.09	402297.68	22.82	5923867.958	1759647.154
HA03	806854.26	402358.13	15.8	5923827.019	1759706.859
HA04	807005.98	402470.64	21.5	5923976.639	1759822.151

APPENDIX E

Tree Health,
Andrew Barrell, Consultant Arborist (2015)

Andrew Barrell
CONSULTANT ARBORIST

17 November 2015

Richard Turner
Mitchell Partnerships Limited
Via email: Richard.Turner@mitchellpartnerships.co.nz
Cc: Pierre Malan, Tonkin and Taylor, PMalan@tonkintaylor.co.nz

RE: tree health issues at 7-37 Ngataringa Road, Devonport

Introduction

1. I have been engaged by Richard Turner of Mitchell Partnerships Ltd (on behalf of the site owner, Ryman Healthcare Ltd) to provide arboricultural comments relating to potential adverse impacts on trees that may be affected by the proposed construction of a retirement village at 7-37 Ngataringa Road, Devonport.

2. Of particular interest are the effects that may arise from possible changes in ground water levels and also disruption to the health and stability of retained trees arising from excavations in close proximity to their root zone areas.

3. I met with Pierre Malan of Tonkin and Taylor Ltd on site on 13 November 2015 to discuss and clarify potential ground water issues with regard to health effects on retained trees.

Assessment – *water table effects*

4. During this site meeting Mr. Malan indicated that the geotechnical groundwater model showed groundwater typically more than 3m below ground level. In summer in particular, groundwater is often more than 6m below ground surface. His expectation is that no ground water would generally be present within 3m of the surface where trees are located based on the inferred geological conditions and abovementioned measurements.

5. Trees generally have the majority of their functional roots located in the top 200 – 400mm of soil. This depth will be dependent upon site conditions to a certain degree but it is very unusual to find functioning roots more than 1m below ground level. Roots need air to percolate to them as they need oxygen to function therefore the deeper they are the less effective they become. The bulk (if not all) of any life-sustaining biological processes occur within this upper soil level and depend on water percolation from the surface and retention of that moisture within the soil structure. In other words, the critical aspect here is that roots are dependent on water moving downwards as opposed to water moving upwards (i.e. from a water table several metres below ground).

6. I find it difficult to understand how changes to water levels typically located more than 3m below ground surface will have any effect whatsoever on roots located in the first half metre of soil. Furthermore, observation around the coastal margins of the Auckland region (and other land that has suffered significant slips) indicates that vegetation survives perfectly well on cliff faces where the face is being constantly eroded (or has recently fallen away), sometimes in tens of metres below the functional root zone area.

7. This may be over-simplifying the matter but if the water table is located below the functional root zone area it will be irrelevant if that water table is 3m below the root zone area or 300m below; it is still beyond the reach of roots and therefore I think it would be reasonable to assume the distance is irrelevant, as will be the effect upon the roots above. If the roots cannot reach the water, they cannot reach the water, regardless of how far away it is.

8. The only possible problem I can foresee is if the water table rises to the top half metre of soil profile and results in the ground becoming waterlogged. I believe this is highly unlikely.

Assessment – *works in root zone*

9. With regards to the proposed excavations in the vicinity of retained trees, the site plans indicate that such excavations will only encroach to the outer edge of the drip line of these trees.

10. The majority of the trees along the northern boundary are pohutukawa with a handful of other species (mainly ash – *Fraxinus* species) scattered in between. The pohutukawa trees appeared to be in reasonably good health at the time of my site visit however some of the ash trees showed signs of poor health including sparse canopy cover and an abundance of dead wood.

11. I believe the pohutukawa will be able to tolerate the anticipated level of root zone disturbance, given their current good health, the amount of viable root zone being retained and the natural resilience of the species in general.

12. The ash trees may not be so resilient however it is impossible to tell from a single site inspection whether or not the trees are actually declining in health or improving from some previous stress event. On that basis the only realistic option is to ensure that the root zone of these trees is made as healthy as possible with regard to providing the most favourable environment for ongoing root development and improvement.

Conclusions

13. I do not consider the anticipated changes to ground water levels will have any adverse effect on retained trees given the relatively large distances between viable / functional root areas and measured depths of ground water.

14. Any adverse effects arising from root zone disturbances during excavations can be effectively managed by employment of appropriate levels of arboricultural supervision during the actual excavations along with effective amelioration of the remaining root zone areas for the duration of the project.

15. Such root zone amelioration will serve to improve tree health in general and also help to buffer any adverse health effects that may eventuate from peripheral root damage that may occur during construction works.

Recommendations

16. All works in the vicinity of retained trees are to be managed where appropriate by an arboricultural specialist to ensure any root damage is minimised as much as reasonably possible.

17. The root zone area of all retained trees should be fenced off prior to commencement of excavations or other works that may encroach into root zone areas.

18. A layer of wood chip mulch should be placed over the entire root zone area of all trees which are to be retained. This layer should be at least 100mm deep and it should be applied as soon as reasonably possible – the sooner it is applied, the sooner the underlying root zone will start to improve and the sooner the trees will be better placed to accommodate any impending physiological stress.

19. This mulch layer is to be maintained for the duration of works, as is the protective fencing.

Andrew Barrell
CONSULTANT ARBORIST

Please feel free to contact me if you wish to discuss any of the above comments.

Regards

Andy

Andrew Barrell
CONSULTANT ARBORIST

P 09 422 5001 M 021 0515 825 E andybarrell@xtra.co.nz W www.andybarrell.co.nz

APPENDIX F

Ground Contamination Desk Study Assessment Report, Tonkin & Taylor (2013)

REPORT

Ryman Healthcare Limited

Ground Contamination Desk Study Assessment
7-37 Ngataringa Road, Narrowneck

Report prepared for:

Ryman Healthcare Limited

Report prepared by:

Tonkin & Taylor Ltd

Distribution:

Ryman Healthcare Limited	copies
Tonkin & Taylor Ltd (FILE)	1 copy

November 2013

T&T Ref: 29452.001

Table of contents

1 Introduction

Tonkin & Taylor Ltd (T&T) has been commissioned by Ryman Healthcare Ltd to undertake a pre-purchase ground contamination desk study assessment for 7 Ngataringa Road, Narrowneck, Auckland referred to below as the site, Figure 1).

This report was undertaken in accordance with our proposal of 26 July 2013 and your instruction to proceed of 1 November 2013.

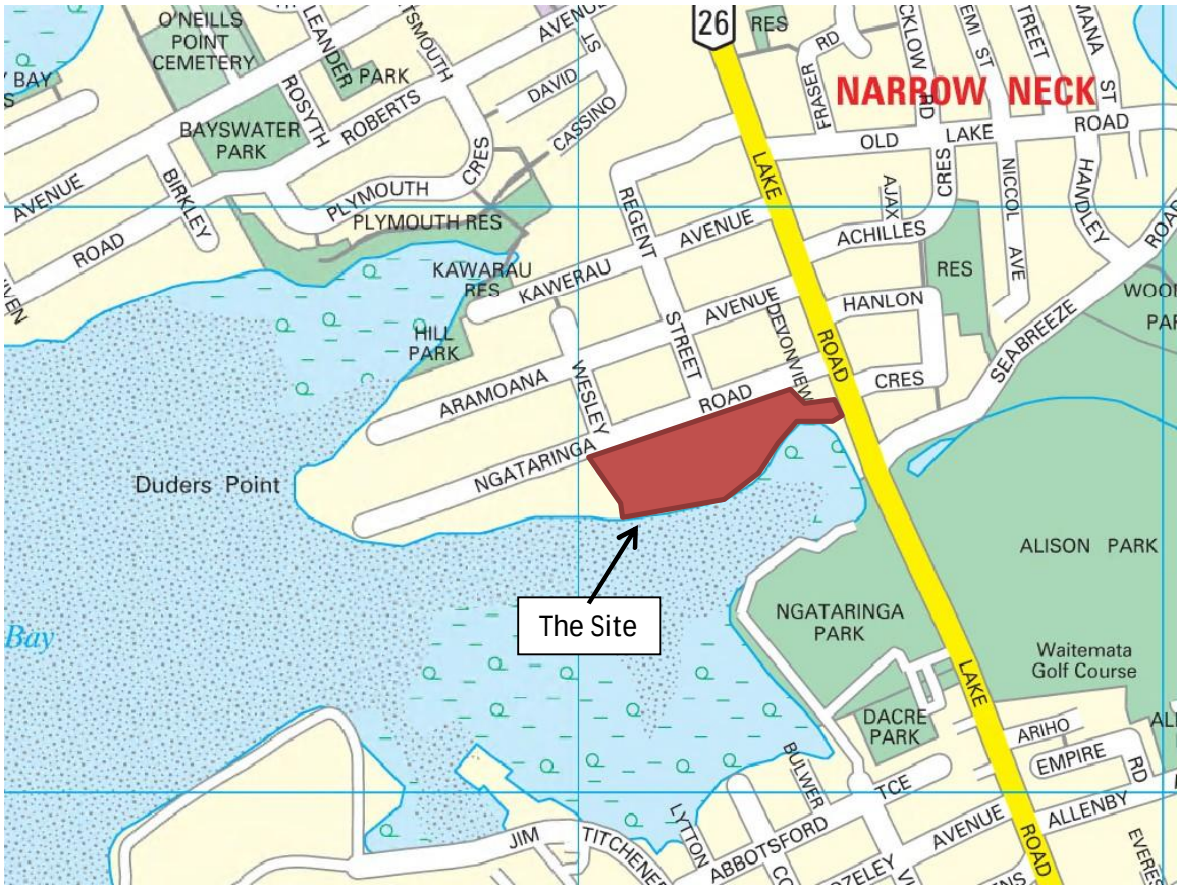


Figure 1: Site Location (source: Terraview, 2013).

1.1 Background

We understand that Ryman Healthcare Ltd is proposing to redevelop the site as a retirement village. Current conceptual plans indicate that the proposed redevelopment will comprise apartment style buildings. The development will also include landscaping and paved access ways. Conceptual development plans are included in Appendix A.

1.2 Objective and scope of work

The objectives of this report are to:

- Assess the potential for historic onsite activities to have resulted in ground contamination at the site; and
- Make a preliminary assessment of potential ground contamination-related cost implications for the proposed development.

To achieve this, the following scope of work was undertaken:

- Review of the Auckland Council property file;
- Review of historical aerial photographs from the Tonkin & Taylor library, Auckland Council website and Google Earth;
- Review of historical certificates of title;
- Liaison with Auckland Council regarding pollution incidents at the site;
- A site walkover inspection;
- Collection of soil samples from 25 locations across the site, with 37 samples scheduled for analysis (including four duplicate samples for QA/QC purposes) for a range of metals, polycyclic aromatic hydrocarbons (PAH) and asbestos; and
- Preparation of this report documenting our findings and commenting on the potential for ground contamination at the site, in the context of the proposed development.

This report has been prepared in general accordance with national guidance and standards for conducting ground contamination-related desk study investigations in New Zealand. This includes compliance with the general format described in the Ministry for the Environment (MfE) Contaminated Land Management Guideline No. 1 "*Reporting on Contaminated Sites in New Zealand*".

This report was conducted concurrently with a preliminary geotechnical investigation undertaken by T&T[1].

[1] T&T, 2013. Ryman Healthcare Ltd. 7-37 Ngataringa Road, Devonport. Geotechnical Investigation Report:

2 Site description

2.1 Location and legal description

The site address and legal description is provided in Table 1 below.

Table 1: Property description

Address	Legal Description	Certificate of Title	Area (approximate)
7-37 Ngataringa Road	Lot 4 DP20927	547720	0.14 ha
	Lot 5 DP20927	547719	4.1 ha

The total site area is some 4.2 hectares and it is irregular in shape. The site location and layout are shown on Figures 1 and 2 respectively.

The site is located within a residential setting, bound by Ngataringa Road to the north, Lake Road to the east and residential properties to the west. The southern boundary of the site is bound by mangroves bordering the Waitemata Harbour at Ngataringa Bay.

The site is zoned Residential 4B.

2.2 Site condition

Site walkover inspections were undertaken on 5 August and 8 November 2013 by a T&T contaminated land specialist. The initial inspection was undertaken as part of a scoping exercise prior to the assessment being undertaken. The second more detailed inspection was undertaken during surface soil sampling. The purpose of the inspections was to gather general information on topography and land use (both on site and the surrounding area) as well as making observations for evidence of potential ground contamination. Relevant observations made at the time of the inspections are summarised below. The site layout is shown on Figure 2 and selected photographs are included as Photographs 1 to 6 in Appendix B.

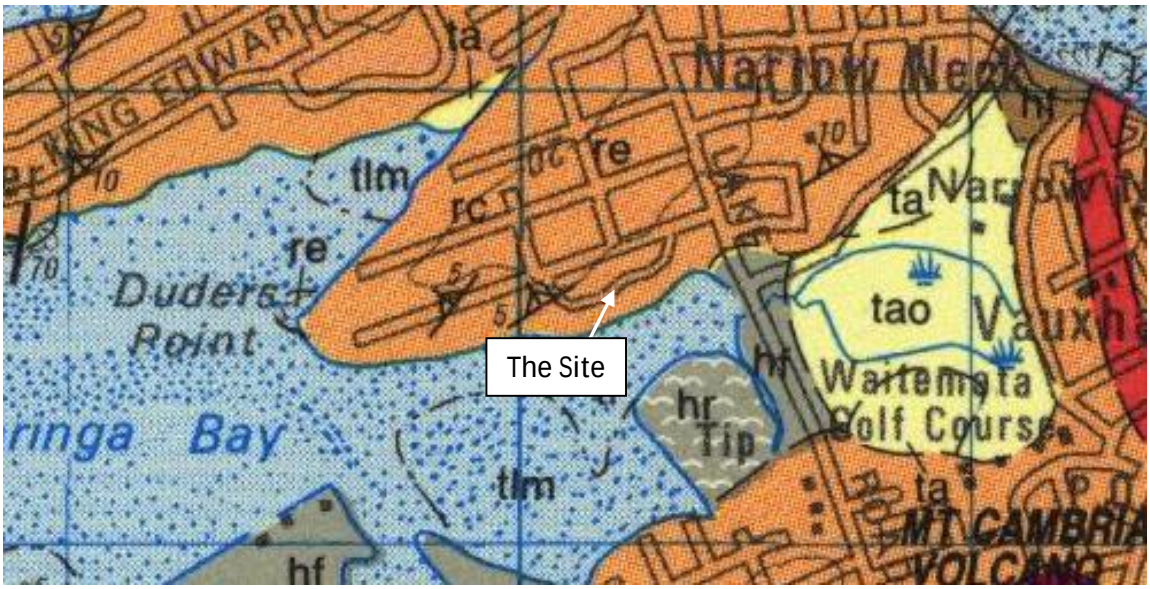
The site is currently unoccupied and contains the following features:

- The site is flat to moderately steeply undulating with an overall slope down to the south towards Ngataringa Bay. A series of flat terraces separate sloped areas at the site (Photographs 1 to 4).
- Several areas were identified across the site with topography suggestive of the presence of fill (Photograph 3). However, anecdotal evidence (conversations with local residents) suggests that these areas are likely to represent disturbance associated with historic cutting and filling of site soils rather than the importation of fill material.
- The majority of the site is covered in grass with occasional native and exotic trees, particularly along the northern boundary of the site adjacent to Ngataringa Road (Photographs 1 to 3). The southern portion of the site, adjacent to Ngataringa Bay, is covered in dense native shrubs and trees (Photograph 4). Vegetation typically appeared to be in good condition. However, several small bare soil areas were identified across the site. These areas are most likely the result of poor turf management and desiccation of existing vegetation.
- A rectangular building with weatherboard cladding and aluminium roofing and two small sheds are present on Lot 4 DP20927 (. The external areas of the property are grassed.

- An asphalt paved access way, referred to as "Wakakura Crescent" crosses through the site (Photographs 1 and 2). Vehicle access is prevented by locked gates at either end of the accessway. Sealed vehicle parking areas are located near the middle of the southern site boundary (Photographs 5) and in the north-western portion of the site. Sealed foot paths are located in the western, southern and eastern portions of the site.
- A number of onsite manholes were observed adjacent to the footpath in the southern portion of the site.
- Two concrete pads, which were observed to be in a fair condition, were noted in the eastern portion of the site (these are likely to relate to a former site workshop and storage shed area, as discussed in Section 3.3).
- A small electrical transformer is located near the middle of the northern site boundary on the road reserve area (offsite) (Photograph 6).
- No obvious discolouration or staining of site surfaces was observed.

2.3 Geology

The geological map of the area[2] indicates that the majority of the site is underlain by greenish grey, alternating muddy sandstone and mudstone, with occasional interbedded lenses of grit of the East Coast Bays Formation (see Map 1 below). The geological map indicates that the south eastern corner of the site is underlain by construction fill material comprising recompacted clay to gravel sized materials which may include demolition debris. However, our aerial photograph review outlined in Section 3.2 found no evidence of this area being filled given the filling apparently commenced after the naval buildings were constructed on this portion of the site.



Map 1: Published geology of the Narrowneck area (source: Kermode, 1992) as per footnote

A geotechnical investigation was undertaken by T&T concurrently to this ground contamination investigation[1]. A summary of the geological conditions encountered is outlined in Section 2.5 of the geotechnical report.

[2] Kermode, L.O. 1992. Geology of the Auckland urban area, Sheet R11. Scale 1:50,000. Institute of Geological and Nuclear Sciences geological map 2.1 sheet + 63p. Institute of Geological and Nuclear Sciences Ltd., Lower Hutt, New Zealand.

2.4 Hydrogeology and hydrology

Based on topography and observations made during the geotechnical investigation, groundwater is anticipated at 2 to 5m depth below existing ground level and is likely to flow in a southerly direction and discharge to Ngataringa Bay located directly south of the site. Groundwater use in the vicinity of the site has not been assessed as part of this investigation.

3 Site history

Historical information relating to the site has been collected from a variety of sources including current and historical certificates of title, historic aerial photographs, and the Auckland Council property file and contamination enquiry. This history focuses on on-site activities, except for the aerial photograph review where comments are also provided on readily observable surrounding land use. The information reviewed is summarised in the following sections.

3.1 Site ownership

We reviewed current and historic certificates of titles, which indicated the following with respect to ownership and use of the site:

- The oldest evidence of land ownership was a proclamation issued for the site in 1953 to Her Majesty the Queen; and
- The site was transferred to current site owners Whai Rawa Property Holdings LP in 2013.

Copies of the certificates of title are provided in Appendix D.

3.2 Historic aerial photographs

Historic aerial photographs were obtained from the T&T, the Auckland Council database and Google Earth. Relevant features of the site and surrounds are summarised from each aerial photograph in Table 3 below.

Table 3: Summary of aerial photograph review

Aerial photograph (date and source)	Key points identified	Surrounding land features
1950 Photograph (T&T Library, 1915/34)	The 1950 aerial photograph shows that the majority of the site is vacant land, with the exception of three buildings, and a circular structure (kiln?) located in the south eastern half of the site (see Figure 2 for historical locations and Appendix C for the historic aerial photograph). The centre of the site appears to be undergoing earthworks at the time the photograph was taken. No access ways were observed on the aerial photograph.	The surrounding land use is residential. Ngataringa Bay is present directly south of the site.
1959 Photograph (Auckland Council)	The 1959 photograph shows eleven rectangular buildings on the site that appear to be used as housing units (see Figure 2 for historical locations). A paved access way (Wakakura Crescent) intersects the housing units. Paved driveways/pathways leading from the access way to each unit are also evident. A paved pathway enters the site from Lake Road and runs east to west. The	The surrounding land features appear to remain unchanged since the 1950 aerial photograph.

Aerial photograph (date and source)	Key points identified	Surrounding land features
	southern boundary of the site is covered in bush. The remainder of the site appears grassed.	
1963 Photograph (T&T Library 3232/53)	No changes to the site are apparent from the 1959 aerial photograph.	The surrounding land features appear to remain unchanged since the 1963 aerial photograph.
1972 Photograph (T&T Library, 4599/13)	No changes to the site are apparent from the 1963 aerial photograph.	The surrounding land features appear to remain largely unchanged since the 1959 aerial photograph, with the exception of what appear to be reclamation activities occurring along the southern boundary of Ngataringa Bay approximately 500m south of the site.
1980 Photograph (T&T Library, SN5783M/15)	No changes to the site are apparent from the 1972 aerial photograph.	The surrounding land features appear to remain largely unchanged since the 1972 aerial photograph, however the reclamation activities are now within 150m of the site.
1996 Photograph (Auckland Council)	A small structure (shed?) is apparent in the eastern half of the site adjacent to the paved pathway (see Figure 2). Two paved car parking areas have been constructed in between two of the housing blocks adjacent to the western boundary of the site and to the south of a housing block in the middle of the site (see Figure 2). No other apparent changes to the site have occurred since the 1980 aerial photograph.	The surrounding land features appear to remain largely unchanged since the 1980 aerial photograph, however the reclaimed land is now grassed and appears to be used for recreational activities.
2006 Photograph (Auckland Council)	All of the buildings observed at the site in the 1996 aerial photograph have now been demolished. The site is predominately grassed, however the paved access way, some paved pathways and the car parking areas remain.	The surrounding land features appear to remain largely unchanged since the 1996 aerial photograph.
2008 Photograph (Auckland Council)	No changes to the site are apparent from the 2006 aerial photograph.	The surrounding land features appear to remain largely unchanged since the 2006 aerial photograph.
2010 Photograph (Auckland Council)	With the exception of the construction of a new driveway and parking area from Lake Road, no changes to the site are apparent from the 2008 aerial photograph.	The surrounding land features appear to remain largely unchanged since the 2008 aerial photograph.

Aerial photograph (date and source)	Key points identified	Surrounding land features
2013 Google Earth	No changes to the site are apparent from the 2010 aerial photograph.	The surrounding land features appear to remain largely unchanged since the 2010 aerial photograph.

3.3 Council property file review

The property file for 7 Ngataringa Road, Narrowneck was obtained from Auckland Council and reviewed on 22 July 2013 to identify potential on site sources of contamination. Relevant information obtained from the property file review is summarised as follows:

- A building consent was issued in 1974 for the construction of a storage shed adjacent to the caretakers lodge at the "Ngataringa flats". A plan in the consent documentation shows that a workshop and store are located adjacent to 87 Wakakura Crescent (refer Figure 2); and
- Correspondence to the Minister of Defence referred to the proposed removal of navy flats in 2000.

3.4 Council contamination enquiry

An Auckland Council contamination enquiry was obtained and reviewed on 26 July 2013. The letter response is presented in Appendix E. No pollution incidents relating to the site were recorded. However, the contamination enquiry identified that the property at 27 Lake Road, located immediately to the south of the subject site, may have been subject to historic filling/importation of unverified-origin material. The location of this property corresponds to the area of reclamation identified in the aerial photograph review (refer to Section 3.2) and a former landfill identified in the resource consent records provided with the council contamination enquiry. The resource consent records are summarised in Table 4.

Table 4: Ground contamination-related resource consents

Location	Type of consent	Activity description	Holder	Status
29 Lake Road	Landfill Discharge	Discharge of contaminants from a landfill via seepage to ground.	Auckland Council	Occurring
29 Lake Road	Landfill Discharge	To discharge leachate to the basal materials under the landfill	Auckland Council	Occurring

The former landfill is located approximately 190 m south-west of the site, across the inlet of Ngataringa Bay, at a slightly lower elevation from the site. As such, we consider that leachate and landfill gas discharges (if any) are unlikely to significantly affect the subject site.

3.5 Historic investigations

3.5.1 Opus Consultants Archaeological Assessment 2010

Opus Consultants were commissioned by the New Zealand Defence Force (NZDF) in 2010 to carry out an archaeological assessment at the site. The report indicates that two recorded archaeological sites are within the bounds of 7-37 Ngataringa Road.

The New Zealand Archaeological Association's (NZAA) *ARCHSITE* database was searched to establish the location and extent of the recorded archaeological sites at 7-37 Ngataringa Rd Information regarding the archaeological features are summarised in Table 5 below.

Table **5** – Summary information on archaeological sites from NZAA site record forms.

NZAA ID	Site Type	Site Name	NZTM Easting	NZTM Northing	Updated
R11/1795	Historic Brickworks	Duder Brickworks	1759857	5923907	2001
R11/2181	Midden	-	1759827	5923867	2001

Historical information contained within the archaeological report indicates that the site was initially purchased by Mr Thomas Duder in 1847 and subsequently used to graze stock. The Duder Brickworks (R11/1795) were constructed in 1875 when the land was leased to a brick maker. The brick maker erected a shed on the site and proceeded to manufacture bricks by hand in wooden moulds. In 1890, new facilities were opened which included two kilns with a capacity of 20,000 bricks each. A brickworks building and three brick during sheds were also constructed at this time. Power was sourced through a steam engine and boiler until 1924 where an electric motor was installed. The site continued to be used as a brickworks until 1942, when the navy occupied the brickworks and demolished the chimney and brick drying sheds, using the bricks and timber to construct ammunition stores. It is unclear from the report whether this ammunition store was located on or offsite. The brickworks and kilns were progressively demolished between 1944 and 1955 during preparatory land development for the naval residential units.

An archaeological survey of the former Duder Brickworks area was undertaken by Packington-Hall in 1992, which concluded that the archaeological condition of the Duder Brickworks was very poor. The results of a resistivity survey undertaken as part of the wider study suggests that there may be intact subsurface remains located within the main area of the site including brick rubble and possibly subsurface portions of one or more of the kilns.

Some archaeological features (including the wooden piles of the original brickworks wharf, demolition materials from the former brickworks and midden deposits) remain in the lower area of the site, adjacent to the coastal escarpment.

The archaeological area (the *archaeological exclusion* zone[3]) is shown on Figures 2 and 3. The full archaeological report is included in Appendix F.

[3] For the purposes of this investigation, the *archaeological exclusion zone* is defined as the area of the site where archaeological features have been identified. No intrusive works have been undertaken within the area, with the exception of two topsoil samples obtained for analytical ground contamination testing.

4 Potential for contamination

The historical review indicates that the eastern end of the site was used as a brickworks from 1875 to 1942. The brickworks operation included two kilns and was powered by a steam engine until 1924 and then electricity. Post 1942, the former brickworks was demolished and eleven naval residential buildings and ancillary buildings constructed. The site appears to have been largely used for the same activity until prior to 2006. The naval buildings were demolished prior to 2006. The site is now vacant and used for recreational purposes with remnant asphalt foot paths and concrete pads present across the site.

Some of the above activities have potential to contaminate the ground. The identified potentially contaminating activities are shown on Table 6 below. Table 6 also summarises the potential contaminants associated with each of the activities and likely extent of contamination.

The archaeological report also indicated that an ammunition store may have been present on the site, however it is unclear from the site history information where the store was located or whether it actually existed on the site. Therefore, the ammunition store has not been included in Table 5 below.

Table 6: Potentially contaminating activities

Land use/activity	Potential contaminants	Magnitude, possible extent and likelihood of contamination	HAIL Activity reference (see Note 1)
Former brick works and ancillary buildings	Metals (including boron and mercury), polyaromatic hydrocarbons (PAHs) derived from burning of coal to fire steam engine/kilns	The historical archaeological reports indicated that a former brick works occupied the site between 1875 and 1942. The reports show the brick works to be located in the south-eastern half of the site (as shown on Figures 2 and 3). The report indicates that some subsurface structures still remain in this area. If contamination is present, then it would most likely be localised to the immediate vicinity of the former brick works, although disposal of coal ash may possibly have been undertaken across a wider area.	Yes Activity I – intentional or accidental release of a hazardous substance

Land use/activity	Potential contaminants	Magnitude, possible extent and likelihood of contamination	HAIL Activity reference (see Note 1)
Filling	Area outside archaeological exclusion zone Unknown but a broad range of contaminants possible depending on whether offsite material was sourced. If sourced from industrial areas then typical contaminants include metals and polyaromatic hydrocarbons (PAHs). Archaeological exclusion zone Metals and PAH	Area outside archaeological exclusion zone Observations made from the review of the 1950 aerial photograph and during the site walkover assessment suggest that historical earthworks have been undertaken across the site, particularly along the middle of the site where a series of flat terraces separate sloped areas. Fill is most likely to be present in this area but could also be present elsewhere on site. Observations made during the geotechnical investigation (refer Section 6.2.1) indicates that the fill comprises reworked East Coast Bays sediments, however it is unclear whether these sediments have been sourced from on or offsite. Archaeological exclusion zone The archaeological reports summarised in Section 3.5.1, suggest that historic subsurface remains of the former brickworks exist within the area defined on Figures 2 and 3. Contamination (if present), is likely to be contained to the extent of the fill materials.	Yes Activity I – Intentional or accidental release of a hazardous substance
Storage of chemicals	Unknown but a broad range of contaminants possible, including; hydrocarbons and solvents	Site history information suggests that a former workshop and store was located adjacent to the eastern boundary of the site (near the Lake Road entrance). If present, contamination would likely be localised to surface soils in the immediate vicinity of the buildings.	Yes Activity A17 – Storage tanks or drums for fuel, chemicals or liquid waste.
Lead and asbestos from demolished buildings	Lead and asbestos containing material (ACM)	All naval buildings that were historically present on the site were constructed before the 1960s and as such may have had lead paint and asbestos containing materials (ACM) on or within them. Thus there is potential for lead paint flecks and ACM to have contaminated the site during demolition. Any such contamination would be present in surface soil and could be distributed across the site.	Yes Activity I – Intentional or accidental release of a hazardous substance

Note 1 - The HAIL is a list of activities and industries compiled by the Ministry for the Environment that are likely to cause land contamination resulting from hazardous substance use, storage or disposal.

5 Regulatory Framework

The key legislation and planning controls around contaminated sites in Auckland include:

- Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (the NES Soil);
- The Auckland City District Plan (Auckland City Isthmus Section) (the District Plan);
- The Auckland Council Regional Plan: Air, Land and Water (the Regional Plan); and
- The proposed Auckland Unitary Plan (the Unitary Plan).

5.1 NES

The NES Soil came into effect on 01 January 2012. The NES Soil relates to soil disturbance, sampling soil, fuel systems removal, subdivision and land use change activities.

If an activity or industry described in the Ministry for the Environment's (MfE) Hazardous Activities and Industries List (HAIL) is being, or has been, undertaken on a site, the NES Soil applies and consent may be required if one of the five activities detailed above takes place on the site.

The NES (Soil) now prevails over the rules in the District Plan, except where the rules permit or restrict effects that are not dealt with in the NES.

The District Plan does not include any contaminated land rules that address effects not dealt with by the NES (Soil) and so the District Plan provisions have not been considered further.

5.2 Regional Plan

The Regional Plan includes a series of rules related to contaminated sites. The ALW Plan was notified for submissions on 23 October 2001. The Regional Plan became fully operative on 30 September 2013.

The relevant Permitted Activity (PA) rules can be briefly summarised as follows:

- Small scale earthworks on land containing contaminants are a permitted activity under Rule 5.5.40 provided (among other things) the volume of earthworks open at any one time is less than 200 m^3 and works are completed within one month. This rule is principally to allow the installation of services, or similar minor works, without the need for consent. The other requirements include advising Council of works, implementation of appropriate stormwater and erosion controls, and appropriate off-site soil disposal.
- Rule 5.5.41 states that if soil concentrations, or the 95% upper confidence limit (UCL) of soil concentrations, are below the relevant guidelines for the current land use (or proposed land use, if change is planned) and the land does not contain separate phase hydrocarbons, then a resource consent is not required for the site. If soil contaminant concentrations exceed these relevant acceptance criteria or separate phase is present, then a consent for the ongoing discharge of contaminants and/or for any land disturbance activity is required (Rules 5.5.43 through 5.5.45).
- Rule 4.5.49 states that the discharge of contaminants into air from earthworks is a permitted activity, subject to conditions (a) to (c) of Rule 4.5.1. Rule 4.5.1 requires that there shall be no discharge into air of hazardous air pollutants that may cause adverse effects on human health, ecosystems or property, including noxious, dangerous, offensive or objectionable odour, dust, particulate, smoke or ash.

5.3 Proposed Auckland Unitary Plan

The Proposed Auckland Unitary Plan (PAUP) was notified on 30 September 2013. The rules relating to contaminated land are identified as having immediate legal effect. The contaminated land rules are set out in Part 3 Chapter H Section 4.5. These provisions need to be considered in addition to the provisions set out in the operative Regional Plan.

The permitted activity rules relevant to this project in the Unitary Plan and the corresponding rule in the Regional Plan are summarised in Table 7 below:

Table 7: Unitary Plan permitted activity rules

Unitary Plan (Chapter H)	Regional Plan	Purpose of rule
4.5.2.1.1 (Activity table line 1)	5.5.40	Disturbance of land
4.5.2.1.3 (Activity table line 3)	5.5.41	Long term discharges

- To be a permitted activity for disturbance of land, the controls in Rule 4.5.2.1.1 of the Unitary Plan must be complied with. The controls include:
  - advising Council prior to commencing the work;
  - implementing appropriate stormwater and erosion controls;
  - No separate phase liquids; and
  - Discharged water to have no more than minor adverse effects on the environment.

  There is no restriction on the volume of soil to be disturbed on the land or duration of land disturbance. If the Unitary Plan requirements cannot be met, then a resource consent for land disturbance is required as a controlled activity under Rule 4.5.2.1.1 (Activity Table line 6). To be a controlled activity the controls identified in Rule 4.5.2.2.2 must be complied with. A detailed site investigation and remedial action plan are required to support the consent application.

To be a permitted activity for the long term discharges, the controls in Rule 4.5.2.1.3 must be complied with. The concentrations/acceptance criteria are generally similar to Rule 5.5.41 of the Regional Plan. If soil contaminant concentrations exceed the target soil concentrations or separate phase is present, then a consent for the ongoing discharge of contaminants is required.

6 Recent Intrusive Investigations

6.1 Investigation methodology

The ground contamination desk study identified four potentially contaminating activities on the site.

The investigation comprised (refer to Figure 3 for sample locations)

- Collection of thirteen surface soil samples taken during the site walkover assessment on 8 November 2013 (S1 to S13). These were taken from across the site, targeted to assess potential surface contamination from the former naval buildings;
- Collection of soil samples on 13 November 2013 from ten hand auger boreholes advanced across the site to approximately 1m below ground level (HA1 to HA10). These were targeted to assess potential contamination within fill materials;
- Collection of two additional surface soil samples on 13 November 2013 (HA11 and HA12) within the *Archaeological Exclusion Zone.*
- Collection of two fill samples from geotechnical boreholes (BH05 (45) and BH05 (46)).

Sampling of Lot 4 DP20927 was not able to be undertaken due to access constraints at the time of sampling. However, the site history indicates that this portion of the site has been used for residential purposes since at least 1959. In addition, the PAUP identifies the area of former brickworks as Historic Heritage Place # 831. It is described as being *Duders' Brickworks and Jetty site* and is a category B feature. This site is also identified on the New Zealand Archaeological Association Database (NZAA ID R11/1795). In addition, the NZAA also identifies another archaeological site located within the general reserve area as being indigenous midden deposits (NZAA ID R11/2181).

Under the PAUP, any total or substantial demolition or destruction of the site itself requires resource consent from Auckland Council as a non-complying activity. Any application for resource consent for a scheduled historic heritage place must also be accompanied by a heritage impact assessment.

In addition, as the site is also noted on the New Zealand Archaeological Association Database, approval from the Historic Places Trust is also necessary before works can be undertaken.

This *Archaeological Exclusion Area* is shown on Figures 2 and 3. To adhere to the regional plan rules no intrusive investigation works were undertaken within the *Archaeological Exclusion Area,* however two surface samples were collected from within this area to test topsoil conditions.

Surface soil samples were collected using a trowel, while deeper samples were collected directly from the hand auger boreholes from the surface, 0.25m, 0.5m and 1m depth intervals. Samples were collected either directly from the trowel or the hand auger using a freshly gloved hand. Each sample was placed immediately into a laboratory supplied sample container in general accordance with MfE sampling protocols. The sampling equipment was decontaminated between sample locations using clean water and Decon 90 (a phosphate-free detergent) rinses. The samples were shipped in a chilled container to RJ Hill Laboratories, Hamilton under chain of custody documentation.

A total of thirty-three samples were analysed for a range of metals, polycyclic aromatic hydrocarbons (PAHs) and asbestos containing materials (ACM) including:

- Fifteen topsoil samples for metals (incl. boron) and PAHs;
- Thirteen fill samples for metals (incl. boron and mercury) and PAHs;
- Five natural soil samples for metals (incl. boron and mercury) and PAHs; and

- Four QA/QC samples for metals (incl. boron and mercury) and PAHs.

For evaluating the carcinogenic PAH compounds, benzo(a)pyrene equivalent (B(a)P eq.) values have been calculated. B(a)P is the most studied PAH compound and the B(a)P eq. value represents an estimate of the cumulative effects of seven common carcinogenic PAH species listed by the USEPA.

A summary of results can be found in Appendix G with full laboratory transcripts in Appendix H.

6.2 Investigation Results

6.2.1 Ground conditions

The subsurface geologic profile of the proposed site is generally in agreement with the published geology of the region stated in Section 2.3. The proposed site is predominantly underlain by rock of the East Coast Bays Formation (ECBF) mantled by ECBF residual soils. Ground conditions encountered during the ground contamination assessment were generally consistent with those described in Section 2.5 of the geotechnical report[1].

However, fill, inferred to be associated with the construction of naval barracks at the site in 1955, was encountered in areas identified as previous building platforms. The fill forms flat building platforms on the site.

No olfactory or visual evidence of potential contamination was observed in the soil.

Groundwater conditions encountered during the works are discussed in Section 2.4.

6.2.2 Data quality

A quality assurance and quality control (QA/QC) program was implemented as part of field procedures. This included:

- Sampling equipment decontaminated between sampling locations;
- Preservation of samples with ice during transport from the field to the laboratory;
- Transportation of samples with accompanying Chain of Custody documentation;
- Compliance with sample holding times; and
- Duplicate sampling and testing at four locations.

A quantitative measure of the precision of the results was undertaken independently of the laboratory for one site by calculating the RPD values for a duplicate pair of samples. The RPD value was calculated using the following equation.

$$RPD := \frac{\left(C_0 - C_s\right)\cdot 100\%}{\frac{\left(C_0 + C_s\right)}{2}}$$

where Co = concentration obtained from the original sample

Cs = concentration obtained from the split or duplicate sample

Table 8 presents the QA/QC analytical results.

Table 8: Summary of QA/QC data

Sample ID	As	B	Cd	Cr	Cu	Pb	Hg	Ni	Zn	PAHs
S7	2	< 20	< 0.10	12	10	-	18	5	27	-
QC1	< 2	< 20	< 0.10	13	9	-	17	5	28	-
Relative % Difference	NC	NC	NC	8	11	-	2	0	4	-
S13	4	< 20	0.12	27	18	-	29	31	62	-
QC2	4	< 20	< 0.10	29	18	-	29	34	64	-
Relative % Difference	0	NC	NC	7	0	-	0	9	3	-
HA2 (0.25)	< 2	< 20	< 0.10	13	5	< 0.10	4.5	6	10	< LOR
Dup 1	< 2	< 20	< 0.10	10	3	< 0.10	2.8	4	5	< LOR
Relative % Difference	NC	NC	NC	26	50	NC	47	40	67	NC
HA9 (0.25)	4	< 20	0.14	34	29	< 0.10	63	48	186	< LOR
Dup 2	3	< 20	0.14	31	32	< 0.10	40	57	136	< LOR
Relative % Difference	29	NC	NC	9	10	NC	45	17	31	NC

NC – RPD not calculated due to primary and/or duplicate sample result less than the laboratory limit of reporting

< LOR – indicates contaminant concentration less than laboratory limit of reporting

Bold values exceed the acceptable RPD range

It is typically considered acceptable (refer to MfE Guideline No. 5) if an RPD range of less than 30% to 50 % is achieved for soil samples. As shown in Table 8, the metal concentrations in the four duplicate samples reported RPD's within these limits with one exception. Lead in one duplicate sample pair (HA2 0.25 and Dup1) recorded an RPD value of 67%. This elevated RPD value is considered to reflect the heterogeneous nature of the fill soils at the site. PAHs were not reported above the laboratory limit of reporting in either of the duplicate sample pairs analysed.

In summary we consider that the QA/QC results show that the appropriate procedures have been adopted in relation to this assessment. In addition, the results indicate that the variability in the investigation data generally falls within accepted levels of uncertainty and is therefore considered suitable for interpretation.

6.2.3 Assessment criteria

To assess human health risks, environmental risks and potential soil disposal costs, the soil analytical results have been assessed against the following criteria:

- Published background concentrations for Auckland described in the Auckland Regional Council Technical Publication 153 – *Background concentrations of inorganic elements in soils from the Auckland Region.* This data is also generally used as a basis for criteria for disposal of soil to cleanfill sites. These are referred to as the default cleanfill disposal criteria. In this instance the background range for volcanic soils has been adopted
- The NES Soil requires soil results to be assessed against published background concentrations and soil contaminant standards (SCS) that define an adequate level of protection for human health. Future use of the site is proposed to be consistent with the

NES Soil SCS exposure scenario for high density residential land use, hence, SCS for that type of land use has been used to evaluate site data;

- Permitted activity (PA) soil acceptance criteria set out in the Regional Plan; and
- PA Soil acceptance criteria set out in the Unitary Plan.

The various assessment criteria based on the above are displayed with the soil results in Table 1 in Appendix G.

6.2.4 Discussion of results

A summary of results can be found in Appendix G with full laboratory transcripts in Appendix H.

Comparison of the soil laboratory results with the assessment criteria gave the following results:

- All soil sampled yielded results which comply with the NES (Soil) human health criteria for high density residential land use. These findings indicate that the site conditions are highly unlikely to present a risk to human health under the proposed development.
- With one exception, all soils sampled yielded results which comply with the Regional/Unitary Plan environmental criteria. A single exceedance of lead was reported in a topsoil sample collected from the south western half of the site (270mg/kg from S8, compared against the Regional Plan/Unitary Plan criterion of 250mg/kg). S8 was taken as part of a general grid across the wider site. The gridded surface samples (14no.) have been used to calculate 95% Upper Confidence Limits (95% UCL) for lead, in accordance with the provisions of the Regional/Unitary Plan. The estimated 95% UCL for lead is 81.4mg/kg, which complies with the relevant Regional/Unitary Plan environmental criteria. These findings indicate that the site conditions are highly unlikely to present a risk to the environment under the proposed development.
- Results from twenty two topsoil and fill soil samples exceeded the background range for non-volcanic soils (local cleanfill criteria) for metals (copper, lead, nickel, zinc) and B(a)P equivalent. However, in the majority of cases the concentrations were reported to only marginally exceed the background concentrations. These findings indicate that surplus topsoil generated from site development works may not be acceptable for disposal as cleanfill.
- Results from all five natural soil samples tested reported concentrations below the background range for non-volcanic soils for metals and PAHs. These findings indicate that surplus natural soils generated from site development works are likely to be able to be disposed of as cleanfill.
- Asbestos was not detected in the two samples tested for ACM (evidence of ACM fragments was not observed in any of the soil samples taken).

7 Development implications

7.1 Human health and environmental risks

The results of the desk study review have identified a number of potential contaminating activities including a former brick works, the use of fill on the site, the potential for localised contamination associated with historic naval housing units and a chemical store. The archaeological report also indicated that an ammunition store may have been present on the site, however it is unclear from the site history information where the store was located or whether it actually existed on the site.

An assessment of soil contamination was undertaken across the majority of the site, with the exception of the *Archaeological Exclusion Area* identified on Figures 2 and 3.

The results of this assessment have not identified significant contamination in terms of potential risk to human health and/or the environment.

Testing of soil from within the exclusion area would be required to assess the levels of contamination associated with the historic brickworks activity.

7.2 Potential cost implications

The results of the desk study and contamination testing indicate that ground contamination is unlikely to present a practical constraint to the proposed development of the site, subject to appropriate management of any potential contamination identified within the *Archaeological Exclusion Area.*

7.2.1 Area of site outside the archaeological exclusion zone

The results of the desk study and testing indicate that soils in this area of the site are likely to be suitable for re-use on site in terms of ground contamination.

Metals (copper, lead, nickel and zinc) and B(a)P equivalent are marginally elevated above background within the topsoil and fill materials. Therefore, should removal of soils from the site be required, then the laboratory results indicate the following disposal locations:

- Topsoil – managed fill;
- Fill – managed fill;
- Natural soils –cleanfill (non-volcanic background).

The indicative costs for disposal at managed fill are between $20 and $36/tonne, plus transport costs and GST. Retaining soils on site would minimise costs. If disposal off site is required, then it would be prudent to carry out further testing to delineate the extent of fill materials to minimise costs.

Natural soils underlying any fill materials are likely to be suitable for disposal to cleanfill.

7.2.2 Area of site within the archaeological exclusion zone

The *Archaeological Exclusion Area* (former brick works) shown on Figures 2 and 3, could potentially have metal and hydrocarbon contamination in the subsurface soils and within fill materials, which could have the following additional cost implications if development extends into this area:

- Reasonable best case – no significant contamination identified (no additional cost implications other than surface soils and fill which would likely need to go to managed fill).

- Reasonable worst case – contamination above human health guidelines in surface and subsurface soils, requiring removal from site to landfill to protect human health (and replaced with uncontaminated soils either from elsewhere on site, or imported). At this stage the volumes of soil to be removed from this area are not known, however for the purposes of pre-purchase costing it could be assumed that a minimum of 600mm of surface soils would need to be removed to landfill from the *Archaeological Exclusion Area* and replaced with uncontaminated soils. If additional excavation is required (eg to form a basement) then a reasonable worst case assumption would be that all the excavated materials would need to be removed to landfill.

The indicative costs for disposal to landfill are $30/tonne to $45/tonne, plus transport costs and GST.

7.3 Regulatory implications

7.3.1 NES implications

Potentially contaminating land uses included on the HAIL have been carried out on the site, as detailed in Section 4, and so the NES Soil will apply. The NES Soil has rules for soil disturbance, sampling soil, fuel systems removal, subdivision and land use change.

The soil disturbance rules are applicable to the proposed works. In terms of the land use change rules, the site has been used for residential purposes for much of the last 70 years (after 1942, up until 2006) and is zoned residential. Post demolition in 2006, the site has been used informally as recreational land. The rules are unclear on whether this situation should be classified as a change of land use or not, however, it appears likely at this stage that the need for a consent under the NES will be captured by the soil disturbance rules anyway.

Thus, the need for a consent under the NES will be in part dependent on the volume of earthworks and off-site disposal proposed for the development, plus the levels of contamination within the *Archaeological Exclusion Area*. Therefore, it would be prudent at this stage to assume that contamination above guideline values is present within the *Archaeological Exclusion Area* and that a restricted discretionary consent under the NES will be required for the proposed development. More detailed assessment of the NES consenting requirements should be undertaken once the earthworks design has been progressed and levels of contamination within the *Archaeological Exclusion Area* is known.

7.3.2 Regional Plan

As indicated in Section 5.2, the Regional Plan includes a series of rules related to contaminated sites. For the contamination identified at the site to be a Permitted Activity (PA), the proposed development works will need to comply with Rule 5.5.40 or Rule 5.5.41.

The results of laboratory soil testing are generally below the Regional Plan criteria. A single exceedance has been reported at location S8 in the south-western corner of the site, however the 95% UCL for lead is estimated to be 81.4mg/kg, which is below the Regional Plan environmental criteria of 250mg/kg.

Therefore, the development of the majority of the site (with the exception of the *Archaeological Exclusion Area*) is indicated to be a Permitted Activity providing the controls specified in rule 5.5.41 can be met. The consenting requirements for the *Archaeological Exclusion Area* will depend upon the results of more detailed investigation, although at his stage it would be prudent to assume that a controlled activity consent will be required for this area.

7.3.3 Unitary Plan

As indicated in Section 6.2.4, soil concentrations are generally below the unitary plan criteria, with the exception of the single lead exceedence at location S8 (south-western corner of the site). However, the 95% UCL for lead is estimated to be 81.4mg/kg which is well under the Unitary Plan environmental criteria of 250mg/kg.

There is no restriction on the volume of soil that can be disturbed on the land or duration of disturbance. Therefore, the proposed development across the majority of the site (with the exception of the archaeological exclusion area) is indicated to be a PA providing the controls specified in rule 4.5.2.1.1 are met. The consenting requirements for the *Archaeological Exclusion Area* will depend upon the results of more detailed investigation, although at his stage it would be prudent to assume that a controlled activity consent was required for this area.

8 Conclusions

We understand that Ryman Healthcare Ltd propose to purchase the subject property, located at 7-37 Ngataringa Road, Narrowneck for the redevelopment of the site as a retirement village. Current conceptual plans indicate that the proposed redevelopment will comprise apartment style buildings. The development will also include landscaping and paved access ways.

This ground contamination desk study assessment was undertaken to establish the potential for historical onsite activity to have resulted in ground contamination at the site.

Based on our historical review, the eastern end of the site was used as a brickworks from 1875 to 1942. The remainder of the site appeared to be used for pastoral purposes at this time. The brickworks operation included two kilns that were originally powered by a steam engine until 1924 and then electricity. Post 1942, the former brickworks was demolished and eleven naval residential buildings and ancillary buildings were constructed. The site appears to have been largely used for the same activity until prior to 2006 when the naval buildings were demolished. The site is now vacant and used for recreational purposes with remnant asphalt foot paths and concrete pads present across the site.

This assessment has identified a number of historic activities that had the potential to cause contamination of the site. Of particular note are the following activities:

- Former brick works and ancillary buildings (engines and kilns);
- Filling within the *archaeological exclusion area*;
- Storage of chemicals; and
- Lead and asbestos from demolished buildings.

The results of soil testing carried out on the site to date, which addresses the potential contamination sources outside of the *archaeological exclusion zone* do not indicate a significant risk to human health for the proposed development. Soil testing would be required within the *archaeological exclusion zone* and Lot 4 DP 20927 (which was unable to be sampled due to access constraints) to assess the potential risks to human health.

In terms of the regulatory framework, the ground contamination desk study assessment and limited soil testing indicates that consent under the NES Soil will likely be required, dependent on the volumes of earthworks and re-use of materials on site for development works across the wider site. Additional consents maybe required, under the provisions of both the regional and district council plans, if development works extend into the *archaeological exclusion zone.* Further assessment of consenting requirements will be required once additional testing is completed and earthworks design for the development is undertaken.

9 Applicability

This report has been prepared for the benefit of Ryman Healthcare Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Recommendations and opinions in this report are based on data from the sample locations. The nature and continuity of soil away from these locations are inferred and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	pp 
.....	.....
Courtney Fagan	John Leeves
Environmental Geologist	Project Director

cf

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Appendix A: Conceptual development plans

VERIFY ALL DIMENSIONS BEFORE STARTING WORK

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100mm
ORIGINAL SCALE
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A 24/045/13 ISSUED

AMENDMENTS

RYMAN HEALTHCARE LTD

DEVONPORT

AERIAL PHOTO

S01 A0-010 A

Work Number | Sheet Number | Amendment

Scale: 1 : 750 at A1 (1 : 1500 at A3)
PDF Name: DEV - RCT _ S01 _ A0-010 _ A

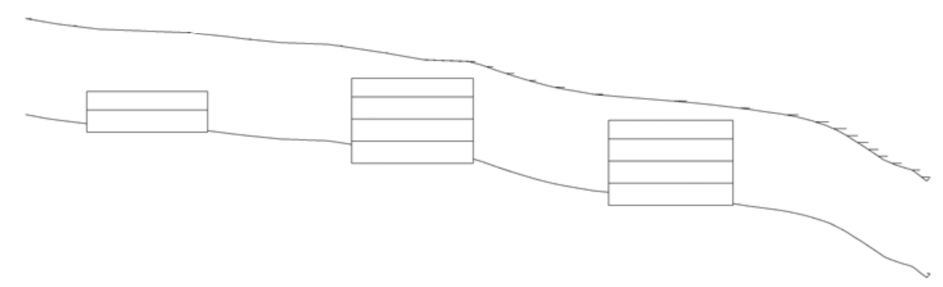
Project Number: DEV - RCT

Stage Number

92 Russley Road
PO BOX 771
CHRISTCHURCH
PH 64 - 3 - 366 4065
NEW ZEALAND
FAX 64 - 3 - 366 4861

VERIFY ALL DIMENSIONS BEFORE STARTING WORK

1 Level 2
1 : 1000



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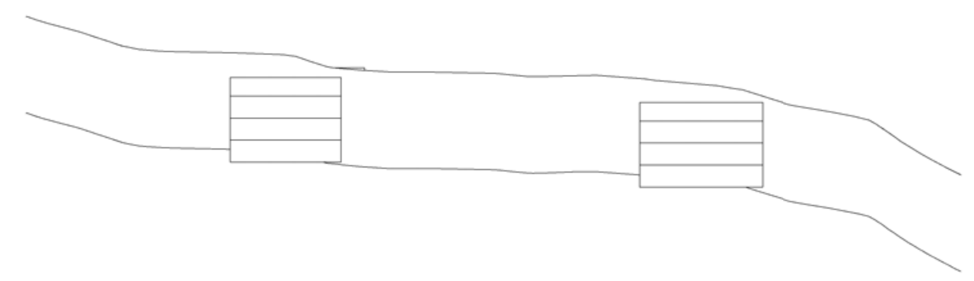

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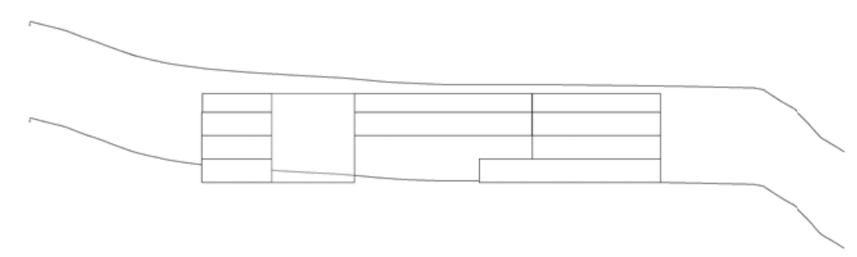

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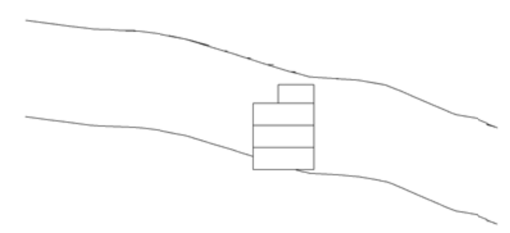

11 Section 10
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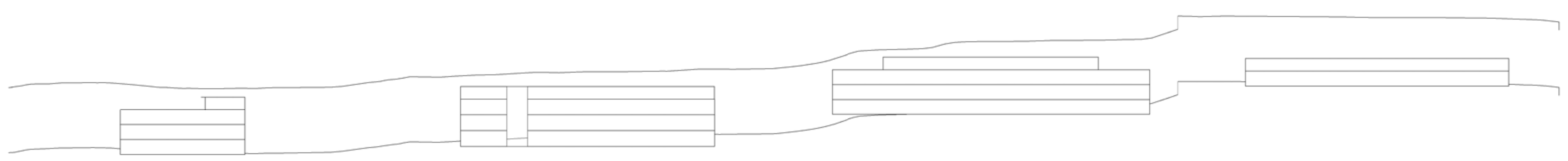
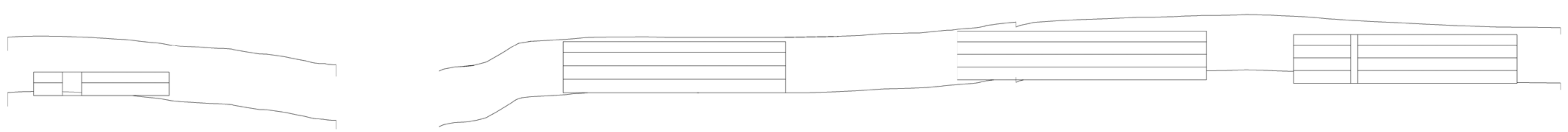


12 Section 11
A0-010 1 : 1000



13 Section 12
A0-010 1 : 1000

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AMENDMENTS

RYMAN
HEALTHCARE LTD

DEVONPORT

Site Sections

A0-013

1 : 1000
DEV
A0-013
DEV-

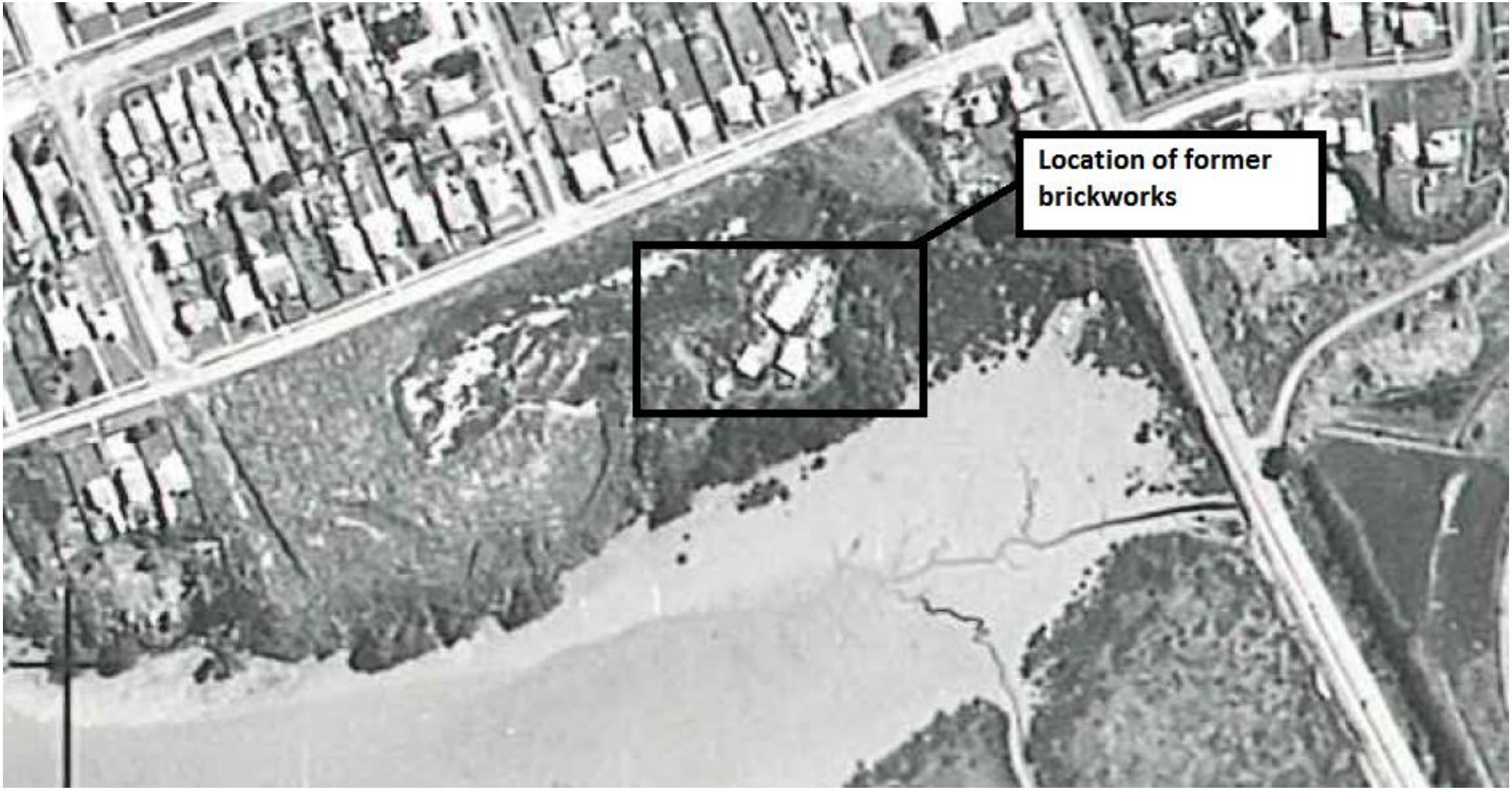
LEVEL 11, CLARENDON TOWERS | CNR WORCESTER ST & OXFORD TCE
P O BOX 771 | CHRISTCHURCH | NEW ZEALAND
PH 64 - 3 - 366 4069 | FAX 64 - 3 - 366 4861

Appendix B: Site photographs

Photograph 1 *Date: 05/08/2013* *Eastern portion of the site, looking east along Wakakura Crescent.*	
Photograph 2 *Date: 5/08/2013* *Northern portion of the site, looking north-west.*	
Photograph 3 *Date: 5/08/2013* *Middle of site looking north-east. Topography suggestive of filling.*	

Photograph 4 *Date: 5/08/2013* *Western portion of the site, looking south-west towards Ngaringata Bay.*	
Photograph 5 *Date: 5/08/2013* *Vehicle parking area and minor rubbish dumping in southern portion of site, looking north-west.*	
Photograph 6 *Date: 5/08/2013* *Electrical transformer located near the middle of the northern site boundary on the road reserve (offsite).*	

Appendix C: 1950 Aerial Photograph


Location of former brickworks

Appendix D: Certificates of title

terranet
property information online

terralink
INTERNATIONAL

Terranet Document Ordering Service

Historic Title: 547719

Billing Code: 29452.001
Terralink Reference: 1048637/1

Processed: 17 July 2013

Sourced from www.terranet.co.nz a service provided by Terralink International Limited. For queries about this document or this service please call 0508 483 772 or email tdo@terralink.co.nz.

TERRALINK TRUSTED DATA

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Historical Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**547719**
Land Registration District	**North Auckland**
Date Issued	25 March 2011

Prior References
PROC 13742

Estate	Fee Simple
Area	4.1089 hectares more or less
Legal Description	Lot 5 Deposited Plan 20927
Purpose	Buildings of the General Government

Original Proprietors
Her Majesty the Queen

Interests

9296184.1 Transfer to Whai Rawa Property Holdings LP - 1.2.2013 at 4:43 pm
Subject to Part IVA Conservation Act 1987 (but sections 24(2A), 24A, and 24AA of that Act do not apply)
Subject to Section 11 Crown Minerals Act 1991

terranet
property information online

terralink
INTERNATIONAL

Terranet Document Ordering Service

Historic Title: PROC13742

Billing Code: 29452.001
Terralink Reference: 1048695/1

Processed: 17 July 2013

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TERRALINK TRUSTED DATA

PROC 13742

Proc 13742. [illegible] 98

GN 13742 Gazette Notice
Cpy - 01/01, Pgs - 002, 06/04/11, 13:10
DocID: 512498810

PARTICULARS ENTERED IN THE REGISTER-BOOK
VOL. 988 FOLIO 195 and on Mtge 353560
THE 5th DAY OF February 1953
AT 10. O'CLOCK.

13352-1553 [illegible] P60
Assistant Land Registrar

XRP_0031700

To L.T.S 24 MAR
From L.T.S

Advise Min of Works (Auck)
L/D 18 21/4/53 The Manager
CT. 988/195 } B. N.Z. }
Mtge 353560 } Auckland. } Dupes mailed 6/5/53.
Robert Penman. Mtgor.
L/D 54 21/4/53

29036
127 A 10-5

Recorded on D.P. 20927
J.H. [illegible]

8725284.1 - Certificate pursuant to Section 226 Resource Management Act 1991. 25.3.2011 @ 7.00am

Z. E[illegible]
for RGL

8725284.2 - CFR 547719 issued for Lot 5 DP 20927 (4.1089ha) and CFR 547720 issued for Lot 4 DP 20927 (0.1426ha) - 25.3.2011 @ 7.00am

Z. E[illegible]
for RGL

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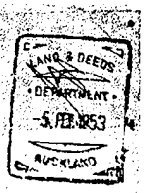

[Extract from *N.Z. Gazette* No. 1, 15 January 1953, page 9]

Bond Taken for Buildings of the General Government in the Borough of Devonport

[L.S.] C. W. M. NORRIE, Governor-General

A PROCLAMATION

PURSUANT to the Public Works Act 1928, I, Lieutenant-General Sir Charles Willoughby Moke Norrie, the Governor-General of New Zealand, hereby proclaim and declare that the land described in the Schedule hereto is hereby taken for buildings of the General Government; and I also declare that this Proclamation shall take effect on and after the 19th day of January 1953.

SCHEDULE

APPROXIMATE area of the piece of land taken: 10 acres 2 roods 0·88 perch.

988/195

Being Lots 4 and 5, D.P. 20927, being part Allotment 3, Section 1, Parish of Takapuna, situated in the Borough of Devonport, and being the whole of the land comprised and described in certificate of title, Volume 988, folio 195 (Auckland Land Registry).

Given under the hand of His Excellency the Governor-General, and issued under the Seal of New Zealand, this 22nd day of December 1952.

W. S. GOOSMAN, Minister of Works.

GOD SAVE THE QUEEN!

(P.W. 23/368/39; D.O. 8/13/86/0/1)

R. E. OWEN, Government Printer, Wellington.

Appendix E: Auckland Council Contamination Enquiry

Auckland Council
Te Kaunihera o Tāmaki Makaurau

23 July 2013

Tonkin & Taylor
PO Box 5271
Wellesley Street
Auckland

Attention: Courtney Fagan

Dear Courtney

Site Contamination Enquiry – 7 Ngataringa Road, Devonport

This letter is in response to your enquiry requesting available site contamination information for the above site. The following details are based on information available from the former Auckland Regional Council records system and information currently held by the Auckland Council Natural Resources and Specialist Input Unit. The details provided below exclude any property information held by the former district/city councils.

No pollution incident files regarding spills/contamination were found for the above site. The general catchment file and site visit file for the catchment (5-01 and 5-01-SV, respectively) were not searched. These files contain pollution incidents where the source of pollution was not traced to a particular site, site visits where no follow-up correspondence was required and some information from archived files.

If the above site is coastal or beside a river, it is possible that historic, unconsented reclamation may have occurred. The Auckland Council, Natural Resources and Specialist Input, Coastal Team may be able to provide further information.

The records reviewed as part of this Site Contamination Enquiry search do not identify individual horticultural sites in the region. However, there is a possibility that horticultural activities may have occurred at the site. The local Auckland Council customer service centre, specific to the area of the site may be able to provide relevant information where former horticultural sites have been mapped.

If you are concerned that a historic land use (such as filling) may have caused the underlying soils to become contaminated, it is recommended that you obtain an independent environmental assessment of the site. Staff from the Auckland Council Earthworks and Contaminated Land Team can provide advice on the results of any evaluation in terms of site remediation and/or potential consent requirements.

We have identified that the following site (within 200 metres of the area searched) may have been subject to historic filling / importation of unverified-origin material. Please note that this information is indicative only and our database of such sites is incomplete.

INDICATIVE ONLY	**Please contact Contaminated Land (Environmental Services)**
PROPERTY INFO:	27 Lake Road, Devonport, Lot 2 DP 94976, Lot 2 DP 76084
SITE ID:	10
SITE NAME:	Devonport (Ngataringa/Dacre Park)

The former Auckland Regional Council and current Natural Resources and Specialist Input Unit databases were searched for records of landfill, bore, air discharge, industrial and trade process consents, contaminated site discharge consents, and environmental assessments within approximately 200 metres of the site. Relevant details of the identified consents are appended to this letter (Attachment A).

The details provided are in accordance with the obligation to make information publicly available upon request. While the Auckland Council has carried out the search using its best practical endeavours, it does not warrant its completeness or accuracy and disclaims any responsibility or liability in respect of the information. If you or any other person wishes to act or to rely on this information, or make any financial commitment based upon it, it is recommended that you seek appropriate technical and/or professional advice.

In addition, it is recommended that you contact the local customer service centre of the Auckland Council, specific to the site being investigated: 1 The Strand, Takapuna as they also may hold files with relevant information.

I trust that this answers your query. If you wish to discuss the matter further, please contact Andrew Kalbarczyk on 301 0101. Should you wish to request any of the files listed above for viewing, please contact the Auckland Council Call Centre on 301 0101 and note you are requesting former Auckland Regional Council records (the records department requires three working days' notice to ensure files will be available).

Please note: the Auckland Council cost recovers officer's time for all site enquiries. A basic enquiry takes approximately 0.5-1.5 hours to search the files and databases in which information is held. As such an invoice for the time involved in this enquiry will follow shortly.

Yours sincerely

pp.

David Hampson
Team Leader - Earthworks and Contaminated Land
Natural Resources and Specialist Input

Attachment A

ACTIVITY DESCRIPTION:	Construction of a 50 mm dia. bore to approx. 10m depth. Installation of steel casing to approx. 6.5m and PVC screen from approx. 9m to 10m. Gravel packs are to be cemented in place with bentonite.
ACTIVITY ID:	7
ACTIVITY STATUS:	Drilled
ACTIVITY TYPE:	Bore
CONSENT HOLDER:	Auckland Regional Council
CONSENT NUMBER:	9751
CONSENT STATUS:	Expired
DATE CREATE:	22/07/2013 7:14:56 p.m.
EXPIRY DATE:	19940329
FILE REFERENCE:	14/17/887
GRANTED DATE:	19930329
LOC TYPE:	Point
PROCESSING OFFICER:	Andrew Millar
PROPERTY ADDRESS:	29 Lake Road Devonport North Shore
PURPOSE:	Authorize the construction of a bore for the extraction of groundwater for water quality monitoring.
REVIEW DATE:	Null
SITE DESCRIPTION:	DEVONPORT LANDFILL, LAKE ROAD, DEVONPORT,
SITE NAME:	Null
WORKS DESCRIPTION:	Construction of a 50 mm dia. bore BH1 to approx. 10m depth. Installation of steel casing to approx. 6.5m and PVC screen from approx. 9m to 10m. Gravel packs are to be cemented in place with bentonite.

ACTIVITY DESCRIPTION:	Null
ACTIVITY ID:	21921
ACTIVITY STATUS:	Decommissioned/Backfilled
ACTIVITY TYPE:	Bore
CONSENT HOLDER:	Auckland Regional Council
CONSENT NUMBER:	9752
CONSENT STATUS:	Expired
DATE CREATE:	22/07/2013 7:14:56 p.m.
EXPIRY DATE:	19940329
FILE REFERENCE:	14/17/888
GRANTED DATE:	19930329
LOC TYPE:	Point
PROCESSING OFFICER:	Andrew Millar
PROPERTY ADDRESS:	29 Lake Road Devonport North Shore
PURPOSE:	Authorize the construction of a bore for the extraction of groundwater for water quality monitoring. Associated with bore codes 8 and 5147
REVIEW DATE:	Null
SITE DESCRIPTION:	Null
SITE NAME:	Lake Rd, Devonport
WORKS DESCRIPTION:	Construction of a 50 mm dia. bore BH2 to approx. 14m depth. Installation of steel casing to approx. 13m and PVC screen from approx. 13 m to 14m. Gravel packs are to be sealed in position with

	bentonite.

ACTIVITY DESCRIPTION:	Null
ACTIVITY ID:	2908
ACTIVITY STATUS:	Occurring
ACTIVITY TYPE:	Landfill Discharge
CONSENT HOLDER:	Auckland Council
CONSENT NUMBER:	25921
CONSENT STATUS:	Issued
DATE CREATE:	22/07/2013 7:14:56 p.m.
EXPIRY DATE:	20221231
FILE REFERENCE:	7533
GRANTED DATE:	20020924
LOC TYPE:	Point
PROCESSING OFFICER:	__Lora Ross
PROPERTY ADDRESS:	29 Lake Road Devonport North Shore
PURPOSE:	(Renewal of Consent No. (91)7533) to discharge contaminants from a landfill via seepage to ground in accordance with Section 15 1(a) & 15 1(b) of the Resource Management Act 1991.
REVIEW DATE:	Null
SITE DESCRIPTION:	Null
SITE NAME:	Devonport Landfill (closed)
WORKS DESCRIPTION:	New BHs drilled. Check BHs used (URS) have the same design as original Bhs that were lost. ESL think not.

ACTIVITY DESCRIPTION:	Null
ACTIVITY ID:	2908
ACTIVITY STATUS:	Occurring
ACTIVITY TYPE:	Landfill Discharge
CONSENT HOLDER:	Auckland Regional Council
CONSENT NUMBER:	7627
CONSENT STATUS:	Replaced
DATE CREATE:	22/07/2013 7:14:56 p.m.
EXPIRY DATE:	20011231
FILE REFERENCE:	7533
GRANTED DATE:	19910801
LOC TYPE:	Point
PROCESSING OFFICER:	_Eddie Grogan
PROPERTY ADDRESS:	29 Lake Road Devonport North Shore
PURPOSE:	TO DISCHARGE LEACHATE TO THE BASAL MATERIALS UNDER THE LANDFILL
REVIEW DATE:	Null
SITE DESCRIPTION:	Null
SITE NAME:	Devonport Landfill (closed)
WORKS DESCRIPTION:	LEACHATE CUT-OFF TRENCHES

ACTIVITY DESCRIPTION:	Null
ACTIVITY ID:	5336
ACTIVITY STATUS:	Decommissioned/Backfilled
ACTIVITY TYPE:	Bore
CONSENT HOLDER:	ENVIROWASTE SERVICES LTD
CONSENT NUMBER:	15466
CONSENT STATUS:	Expired
DATE CREATE:	22/07/2013 7:14:56 p.m.
EXPIRY DATE:	19960917
FILE REFERENCE:	C512-12-1823
GRANTED DATE:	19960917
LOC TYPE:	Point
PROCESSING OFFICER:	_Gillian Crowcroft
PROPERTY ADDRESS:	29 Lake Road Devonport North Shore
PURPOSE:	Authorize the alteration or reconstruction of a piezometer.
REVIEW DATE:	Null
SITE DESCRIPTION:	DEVONPORT LANDFILL, LAKE ROAD, DEVONPORT
SITE NAME:	Null
WORKS DESCRIPTION:	Alteration or reconstruction of a 100mm dia. piezometer to approx 32m depth. Installation of PVC casing to approx 30m and PVC screen from approx. 30m to 31m if required.

ACTIVITY DESCRIPTION:	To authorise the construction of ten bores for investigation.
ACTIVITY ID:	23196
ACTIVITY STATUS:	Proposed
ACTIVITY TYPE:	Bore
CONSENT HOLDER:	North Shore City Council
CONSENT NUMBER:	36085
CONSENT STATUS:	Expired
DATE CREATE:	22/07/2013 7:14:56 p.m.
EXPIRY DATE:	20090731
FILE REFERENCE:	C512-12-4270*
GRANTED DATE:	20080801
LOC TYPE:	Area
PROCESSING OFFICER:	Reginald Samuel
PROPERTY ADDRESS:	29 Lake Road Devonport North Shore
PURPOSE:	To authorise the construction of ten bores
REVIEW DATE:	Null
SITE DESCRIPTION:	Null
SITE NAME:	29 lake road Devonport
WORKS DESCRIPTION:	The construction of ten 50mm diameter bores to a maximum depth of 8-14m. Installation of Steel and lockable casing material to an approximate depth of 0.5m. Proposed grouting to 0.5m.

Appendix F: Archaeological Report

Appendix 5

Archaeological Assessment

OPUS

Archaeological Assessment
Duder Brickworks, Devonport

Mary Barrett Glade Track Upgrade

Prepared for NZ Defence Force

Archaeological Assessment of R. Duder Brickworks (R11/1795), Devonport, Auckland

Mary Barrett Glade Track Upgrade

Prepared By

Nicholas Cable
Archaeologist

Reviewed By

Mica Plowman
Senior Archaeologist

Opus International Consultants Limited

Environmental
Opus House, Princes Street
Private Bag 3057, Waikato Mail Centre,
Hamilton 3240, New Zealand

Telephone: +64 7 838 9344

Facsimile: +64 7 838 9324

Date: 07/04/2010
Reference: 3-AR293.02
Status: Final

Executive Summary

The New Zealand Defence Force has commissioned Opus International Consultants (Opus) to carry out an archaeological assessment of the proposed upgrades to the Mary Barrett Glade Track in Devonport, Auckland.

The proposed works are located in the vicinity of the former R. & R. Duder Brickworks, a recorded historic archaeological site (R11/1795). The site is listed on the North Shore City Council Schedule of Archaeological Sites. Prehistoric shell midden (R11/2181) has also been recorded within the Mary Barrett Glade and in the general vicinity of the proposed track upgrade.

This report presents an assessment of potential impact on archaeological values in support of a Historic Places Trust (HPT) Archaeological Authority application.

The following recommendations are made:

1. *That an authority is sought and obtained under Section 11 of the Historic Places Act 1993 to modify potential subsurface remains associated with archaeological site R11/1795 (the Duder Brickworks) as well as any unrecorded subsurface remains located within the coastal margins of the Ngataringa Bay that may be potentially affected by the proposed project. This is a legal requirement.*
2. *That any archaeological mitigation required by the New Zealand Historic Places under an Authority granted in relation to the proposed remedial earthworks in the Mary Barrett Glade is carried out by a suitably qualified archaeologist.*
3. *That all intact structures associated with the Duder Brickworks (i.e. wharf, stone wall, brick clamp, should be avoided completely.*
4. *That strict provision is made in any Authority granted by the New Zealand Historic Places Trust for the ongoing protection of the remaining archaeological features within the Mary Barrett Glade, particularly as it relates to ongoing vegetation management of the coastal reserve.*
5. *An Authority should be sought immediately to avoid delays during construction. It should be noted that about 3 months should be allowed for the processing of authorities, which includes a statutory stand down period of 15 working days before an authority can be exercised).*
6. *Consultation with Ngati Paoa should begin immediately in order to complete the authority application.*

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1 INTRODUCTION:

1.1 Purpose of this Report

The New Zealand Defence Force (NZDF) has commissioned Opus International Consultants (Opus) to carry out an archaeological assessment of proposed remediation work to the Mary Barrett Glade Track in Devonport, Auckland.

The proposed works are located in the vicinity of the recorded historic archaeological site associated with the 19th century R. & R. Duder Brickworks (R11/1795). This site is listed on the North Shore City Council Schedule of Archaeological Sites. Prehistoric shell midden deposits (R11/2181) have also been recorded within the reserve and in the general vicinity of the proposed track upgrade.

The following report is based on a review of information relating to the recorded archaeological sites in the project area and immediate surrounds and a ground survey of the surviving visible archaeological remains located within the Mary Barrett Glade. This report presents an assessment of the potential impact on archaeological values in support of a Historic Places Trust (HPT) Archaeological Authority application. All recommendations are made in accordance with statutory requirements.

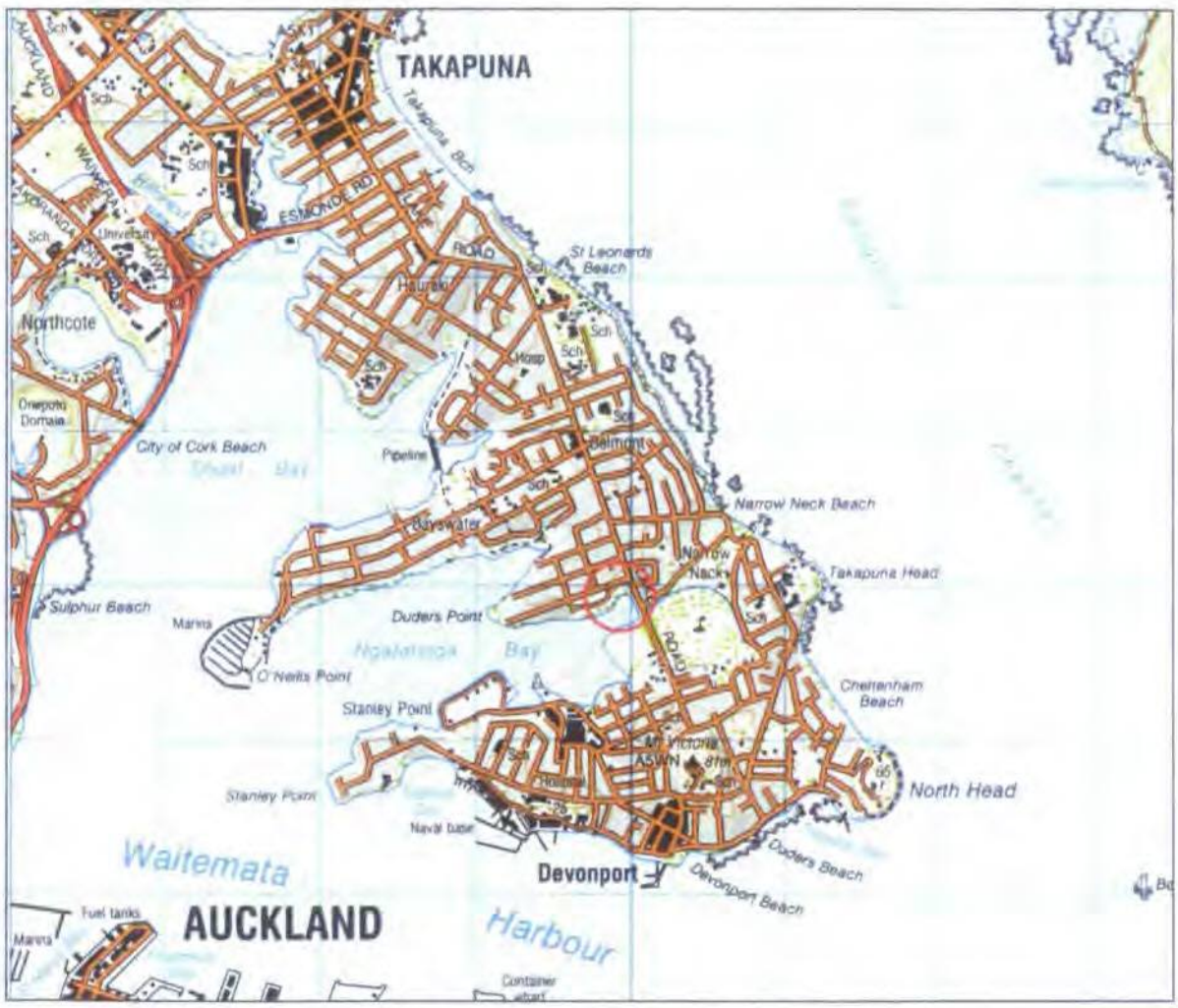

Figure 1. Location of Mary Barrett Glade (circled) in Devonport (NZTM 2000-BA32).

1.2 Relevant Legislation

The purpose of the Historic Places Act 1993 (HPA) is to promote the identification, protection, preservation and conservation of the historic and cultural heritage of New Zealand. The HPA provides blanket protection to all archaeological sites whether they are recorded or not. Protection and management of sites is managed by the archaeological authority process, which is administered by the New Zealand Historic Places Trust (NZHPT). It is illegal to destroy damage or modify archaeological sites without an authority to do so from the New Zealand Historic Places Trust.

An archaeological site is defined by the HPA 2(a)(i) and 2(b) as: 'any place in New Zealand that was associated with human activity that occurred before 1900, and is or may be able through investigation by archaeological methods to provide evidence relating to the history of New Zealand'. Authorities to modify archaeological sites can be applied for either under Section 11, in respect to a particular site or sites, or under Section 12, for all sites that may be present within a specified area.

In addition to any requirements under the HPA (1993), The Resource Management Act 1991 (RMA) provides guidelines and regulations for the sustainable management and protection of the natural and cultural environment. Section 6(e) & 6(f) of the 2003 amendment of the Act recognises matters of historic heritage as having national significance, and provides for the protection of such heritage from inappropriate development and use. Historic heritage is defined (s2) as historic heritage includes those natural and physical resources that contribute to an understanding and appreciation of New Zealand's history and cultures, this includes: historic sites, structures, places and areas; archaeological sites; and sites of significance to Maori.

1.3 Constraints and Limitations

This is a study of archaeological values and does not include an assessment of Maori values. An assessment of the cultural significance of an area can only be competently made by the affected tangata whenua. Consequently, no statements on the cultural significance of the project area are made nor are the views of tangata whenua expressed in this document. An assessment of recorded or potential archaeological values will not necessarily correlate with an assessment of cultural values.

The archaeological information presented in this report is derived from relevant published material, unpublished archaeological reports and site information recorded in the New Zealand Archaeological Association (NZAA) *Archsite* Database and the Auckland Regional Councils (ARC) Cultural Heritage Inventory (CHI).

It is important to note that the NZAA *Archsite* archaeological site location data should be regarded as a guide only. The coordinates for many of these sites were recorded using the Imperial map system and inaccuracies in location became inherent in the data when imperial grid references were converted to the metric system. As a result it is considered unlikely that sites will be located exactly where the recorded grid references place them, but it is generally accepted that the location of sites is within 100-200m of the area indicated by the *Archsite* data. In addition, it should be noted that the exact boundaries for many recorded sites are ill defined. The single point location coordinate provided by the *Archsite* Database for each archaeological site are often based on the visible surface expression of each site and in most cases should be regarded as indicative only and may not necessarily represent the true subsurface extent of the site.

Importantly, in any area where archaeological sites have been recorded in the general vicinity it is highly likely that unrecorded subsurface archaeological remains will also be present. The wider coastal area surrounding the project area has not been subject to systematic archaeological ground survey and/or assessment for cultural heritage sites, therefore the likelihood that additional unrecorded sites are

present within the study area cannot be discounted and consequently the general area must be treated as archaeologically sensitive until proven otherwise.

1.4 Project Background

The Mary Barrett Glade is an area of restored native bush approximately 30m wide and 400m long situated along a coastal escarpment forming the eastern extent of Ngataringa Bay and below the former Royal New Zealand Navy (RNZN) Wakakura housing estate located on Ngataringa Road in Devonport, Auckland (Snowsill 2010:1). In 1992 North Shore District Council sought permission to construct a public walkway along the escarpment. A loop walking track was created in the following year by Mrs Mabel Pollock, a local volunteer. Mrs Pollock also undertook extensive native re-vegetation work and coastal reclamation to improve the newly installed track and named the area the Mary Barrett Glade in memory of her daughter.

In 2009 concerns were raised by the Department of Conservation that the walkways in the Mary Barrett Glade did not meet national safety standards and the area was subsequently closed in 2009 (Snowsill 2010:1). The NZDF have reviewed various options to upgrade the reserve walkways to meet national safety standards. As part of this option review process an archaeological assessment of the Mary Barrett Glade was initiated to: relocate and record the surviving remains of the two recorded archaeological sites within the reserve (R11/1795/ Duder Brickworks & R11/2181 shell midden); to identify any further unrecorded archaeological sites; and to assess any potential impact that the proposed remedial work may have on the archaeological values of the reserve.

2 METHODOLOGY:

The New Zealand Archaeological Association's (NZAA) *Archsite* Database and the Auckland Regional Council's Cultural Heritage Inventory (CHI) were searched to establish the location and background of recorded archaeological sites or other cultural heritage sites within or in the immediate vicinity of the Mary Barrett Glade. Relevant background literature pertaining to the recorded traditional Maori and early European settlement of the area were reviewed and early (SO) survey plans, historic aerials and archaeological reports pertaining to the area were consulted (see references). The North Shore City District Plan was also consulted to identify significant archaeological and historic heritage features within the immediate vicinity of the project area and any relevant statutory protection mechanisms that may be in place for such features.

A pedestrian survey of the property and surrounding area was undertaken by Nick Cable and Mica Plowman of Opus on the 4th of April 2010. Particular attention was given to the relocation of the recorded archaeological sites in the reserve and to the most likely locations for visible evidence of unrecorded archaeological material, such as along the lower edge of the coastal escarpment/ foreshore and to areas of exposed earth where soil profiles were visible, such as erosion scarps. No subsurface testing was conducted as part of this assessment. The location of all sites was defined with a Garmin GPS and photographs of the sites and their location were taken.

3 PHYSICAL SETTING:

The Mary Barrett Glade is an area of restored native bush approximately 30m wide and 400m long situated along a steep coastal escarpment below the former Royal New Zealand Navy (RNZN) Wakakura housing estate located on Ngataringa Road, Devonport (Snowsill 2010:1). The coastal escarpment is located at the eastern most point of Ngataringa Bay, on the south-east side of Duder's Point (Figure 2).

The glade contains two principal walkways forming a loop track and a number of ancillary tracks between the walkways. The loop track consists of a lower track parallel to the coastline and an upper

Figure 2. Aerial photo illustrating Ngataringa Bay and the location of the Mary Barrett Glade below the former Royal New Zealand Navy (RNZN) Wakakura housing estate located on Ngataringa Road, Devonport.

track that follows a fence line along the edge of the escarpment. Above the escarpment is an open grassed area which formerly contained the Duder's Brickworks and Wakakura naval housing estate.

The geology of the general area consists of Miocene era sandstones and mudstones of the Waitemata Group (Snowsill 2010:4). Associated clays soils occur throughout the region and formed the basis of the 19th and 20th century heavy clay industry in Auckland (see Eaves 1990). The intertidal zone consists of more recent alluvial material and rubble from the former brickworks site (Snowsill 2010:4).

4 RECORDED ARCHAEOLOGICALSITES:

The New Zealand Archaeological Association's (NZAA) *Archsite* database and the ARC Council's Cultural Heritage Inventory (CHI) were searched to establish the location and background of recorded archaeological sites or other cultural heritage sites on or in the immediate vicinity of the Mary Barrett Glade where the proposed walking track upgrade works are to be undertaken.

The NZAA site file was examined for recorded archaeological sites within 1km of the project area (Figure 3). This provides for the identification of recorded sites that are located within the project area and those sites located in close proximity that might extend in the project area. It also provides a useful overview of the general patterning of archaeological site types in the wider locality.

There are two recorded sites located in the Mary Barrett Glade and four located in the general immediate vicinity of the reserve. These include: R11/1795 (Brickworks); R11/1943 (brickworks); R11/1944 (brickworks) and R11/ 2181, R11/968 and R11/969 (middens). The locations of these recorded archaeological sites are illustrated in Figure 3 and Table 1. The NZAA site record forms for the recorded sites within the reserve are appended to this report (Appendix 1).

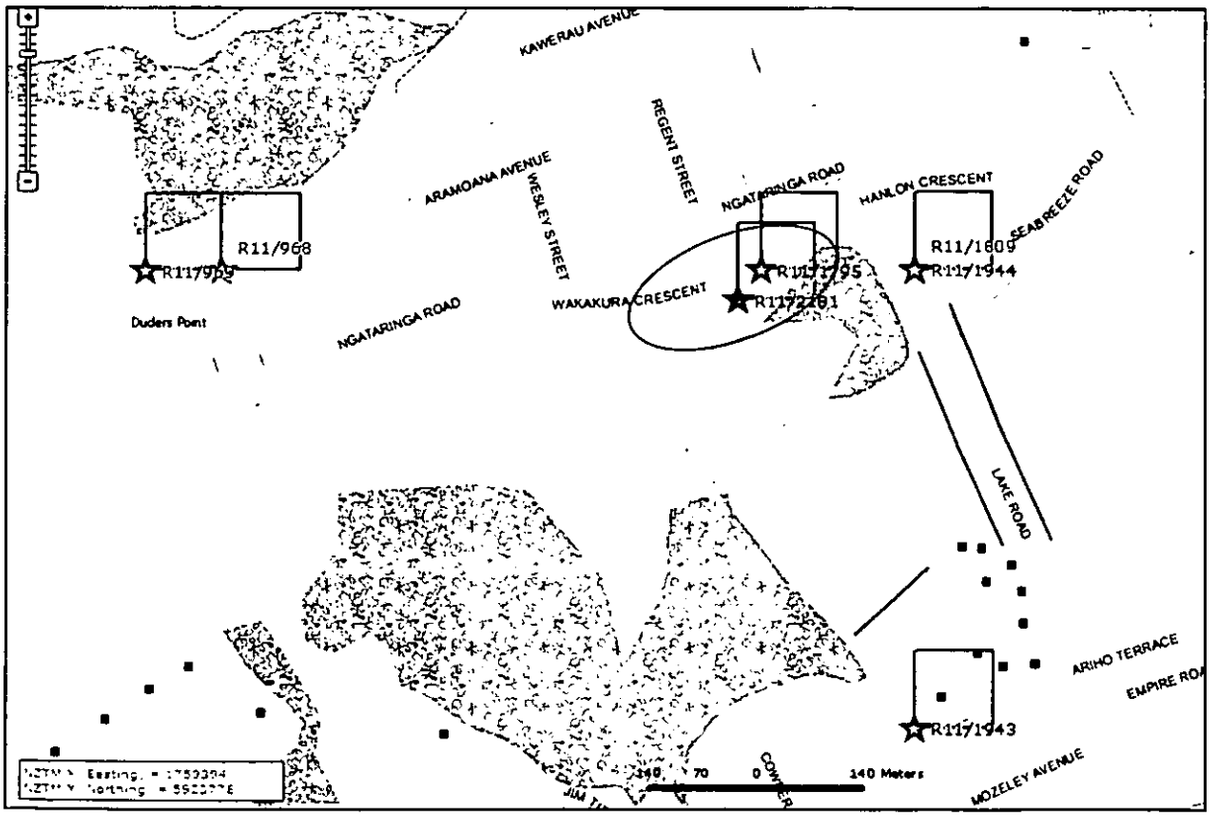

Figure 3. Map of recorded archaeological sites in the vicinity of the Mary Barrett Glade (© NZ Archaeological Association 2009). The glade is circled in red.

NZAA	Site Type	Site name	NZTM Easting	NZTM Northing	Last Updated
R11/968	Midden		1759157	5923906	2000
R11/969	Midden		1759057	5923906	1979
R11/1809	Historic Brickworks	Auckland Gas Company (duplicate)	1760057 (incorrect)	5923908 (incorrect)	1997
R11/1943	Historic Gas & Brickworks	Auckland Gas Company	1760059	5923308	1992
R11/1944	Historic Brickworks	Tiller & King Ltd	1760057	5923908	1997
R11/1795	Historic Brickworks	Duder Brickworks	1759857	5923907	2001
R11/2181	Midden		1759827	5923867	2001

Table 1. Summary information on archaeological sites from NZZA site record forms.

4.1 Recorded Archaeological Sites in the Vicinity of the Project Area

4.1.1 Historic Brickworks:

There are two historic brickworks recorded in the vicinity of the Mary Barrett Glade. These include the Auckland Gas Company Brickworks and Gasworks (R11/1943 and R11/1809) and the Tiller & King Brickworks (R11/1944).

Auckland Gas Company (R11/1943 and R11/1809)

The Auckland Gas Company is recorded as both R11/1943 and R11/1809, although the later is erroneously recorded to the north of the sites location. The site is located between Lake Road and Mozeley Avenue, approximately 500m south of the project area. Packington-Hall recorded surface remnants across much of the site, although no detailed archaeological investigation has been carried out to date. The company operated from 1885 up until 1970 (Eaves 1990:9).

Tiller and King Ltd (R11/1944)

A second brickworks, Tiller and King Ltd, was also located on the west side of Lake Road near Hanlon Crescent (R11/1944). This site is 200m east of the Duder Brickworks. Packington-Hall recorded this site on the basis of historical records and surface evidence of brick rubble along Hanlon Crescent. Given the extent of the residential development in the area, it is likely that any intact remains associated with this company are subsurface. Tiller and King Limited operated briefly from 1852 until 1863 (Eaves 1990:9).

4.1.2 Prehistoric Midden Sites (R11/969 & R11/969)

In addition to the historic material, there is also evidence of prehistoric Maori activity along the coastal escarpment on both the north and south sides of Duder's Point. Two shell midden deposits

have been recorded along the coastal bank on the north side of Duder's Point below Aramoana Ave (R11/968 and R11/969) in 1979. These middens are described as comprised predominantly of cockle and pipi shell, with charcoal and occasional evidence of fired clay balls. No further archaeological investigation has been carried out on these sites since they were initially recorded and it unknown where they are still extant. The sites are located approximately 550m north-west of the proposed project works.

4.2 Recorded Sites Located within the Mary Barrett Glade

4.2.1 R. & R. Duder Brickworks: R11/1795

The R. & R. Duder Brickworks (R11/1795) is located within the Mary Barrett Glade and above the coastal escarpment on the land previously occupied by the Wakakura naval housing estate. Packington-Hall recorded this site in 1992 following an intensive ground survey of the location and soil resistivity testing (see section 4.3 below). Packington-Hall found the physical remains of a wharf, a coastal stone retaining wall, scattered bricks and machinery parts, late-19th century domestic rubbish, a brick clamp under a large pohutakawa tree, various earthworks and possible subsurface evidence for the chimney and rectangular down-draft kiln on the grassed area above the glade (see Figs. 3-4).

The Duder Brickworks were known to have produced common and ornamental bricks, special bricks for chimney heads and basements and tiles for baker's ovens (Packington-Hall 1992:17). They made all kinds of pipes, including salt glazed inspection pipes and yard sinks, traps, garden edges and flowers pots. Handmade garden urns and terracotta garden chairs were also produced (Packington-Hall 1992:17-18).

Major projects associated with the Duder Brickworks include the pump house and chimney at Lake Pupuka in Takapuna and the Mt Victoria reservoir in Devonport (Packington-Hall 1992:18). The house at 31 Lake Road, adjacent to the Mary Barrett Glade, is also built entirely of Duder bricks (Packington-Hall 1992:18). It was built for Mr. P. Johnson, a part owner of the brickworks and relative of the Duder brothers.

4.2.2 Prehistoric Midden Site: R11/2181

R11/2181 comprises a series of four small shell midden located within the Mary Barrett Glade along the coastal bank on the southern side of Duder's Point, and to the west of the Duder Brickworks. The first of these is located on the top of the escarpment, along the upper track. The second is located nearby along the lower track. Both are described as containing fragmentary cockle and pipi shell eroding out of tree roots and undergrowth on the steep bank. Two further shell midden deposits are recorded as located along the lower track at the western edge of the brickworks site (see R11/1795). The first of these middens is recorded eroding out of the bank above the track near a modern concrete sump, while the second is recorded 15m to the east eroding out from under tree roots.

5 PREVIOUS ARCHAEOLGICAL RESEARCH:

The Duder Brickworks has been the subject of a previous archaeological study undertaken in 1992 by T. Packington-Hall as a research project for a paper on Archaeological Science at the University of Auckland. 1 This research paper included detailed historic research, photogrammetric mapping, intensive ground survey of the site remains, including: soil resistivity surveying and systematic surface collection of portable artefacts (1992:1). The background information provided in this assessment report is taken directly from this 1992 report. This report is provided in full in Appendix 2.

5.1 History of the Duder Brickworks (Packington-Hall 1992)

"The site on which the R. and R. Duder Brickworks was built is part of a block of land purchased by Mr Thomas Duder from the crown grantee, Mr William White, in 1847 for £50 (Land Transfer Office, 3A 2015, 52240C, 22/5/1847). The land was subsequently used to graze stock (Philson M. 1990:78).

In August 1875 Robert and Richard Duder obtained ownership of the land (Land Transfer Office, 3A 2015,52230C, 5/8/1875), and later in the year leased a few acres to a brick maker (Philson M. 1990:78). This brick maker erected a shed on the site and proceeded to hand manufacture bricks by hands in wooden moulds (Duder H. June 9 1967) on a small scale of about 600 bricks per day (Diamond, J. Dec 1983:26). The bricks were fired in "clamps", which consisted of layers of stacked bricks with straw fuel between each layer (Duder H. June 9 1967). After a few years of operation the brick maker left for the Coromandel gold rush and, as he owed rent on the property where his brickwork were situated the Duder brothers took the brick making business in lieu of payment (Duder H. June 9 1967).

Robert Duder subsequently hired a brick maker named Andrews on wages, and the small scale hand manufacture of bricks continued as previously (MacKay J. 1963).

During July 1890 new facilities were opened at the R. and R. Duder brickworks (Titchener P. Apr 1978, Mar 1979:11). The new brickworks were equipped with two kilns having a capacity of 20,000 bricks each (Cyclopedia of NZ 1902:533). One of these was a "beehive" down draught type (Brickell B. June 1991) approximately 15m in diameter, the other being a square down draught kiln approximately 15m long by 10m wide. A brickworks building approximately 45m long by 10m wide was also constructed at this time. Three brick drying sheds each 120ft long completes the structural inventory... [See Plate 1]

A 6hp Tangye steam engine and boiler...provided the motive power for the brickworks (Cyclopedia of NZ 1902:533).

Plate 1. 1924 Photograph of the R. & R. Duder Brickworks from Lake Road by H. Duder (© North Shore Libraries Image Collection D_GBB_0016). Visible structures include the chimney and jetty below (left), square kiln and drying sheds (centre).

The low rate of production of the brick making machine suggests that it may have been an earlier man-powered machine modified for steam motivation (Diamond J. 1983:26). No further detail is known about these machines...

Sometime prior to 1924 a Siemens alternating current electric motor was installed (Crum J. 14 July 1944), and this probably replaced the previous steam plant.

Sometime between 1934 and 1936 the 100ft high brick chimney collapsed in a storm, and as R. and R. Duder had been unable to operate the brickworks on an economic basis for many years prior (Crum J. 14 July 1944), it seems likely that the brickworks stopped production at this date.

Little modernisation apart from the installation of the electric motor prior to 1924 seems to have been undertaken. The brickworks machinery and buildings in [sic] used in the middle 1930s were those installed in 1890 (Crum J. July 1944).

...In May 1942 the Army occupied the brickworks and demolished the remaining part of the chimney, taking the 1000 bricks to Camp Takapuna. The Army also demolished the brick drying sheds at this time, using the 6000 to 7000 super feet of 9" x 1" timber to construct ammunition stores (King R. 9 Dec 1942).

In July 1944 the brickworks remained intact with the exception of the chimney and brick drying sheds. The 1890s brick and pipe manufacturing machine also remain on the site at this date (Crum J. 14 July 1944).

An aerial photograph taken in 1946 [Whites Aviation 1946 – Devonport X4066] *shows only the circular beehive kiln and brickworks building remaining on the site. The square kiln had been demolished between July 1944 and 1946.*

...In February 1953 the General Government acquired the R. and R. Duder brickworks property by proclamation under the Public Works Act.

An aerial photograph dated 1955 [Whites Aviation 1955 – Narrow Neck 36937] *shows the preparatory land development prior to the construction of Naval residential units, with the circular beehive kiln and the brickworks building no longer there."* (Packington-Hall 1992:18-21). [see Plates 2-3].

5.2 1992 Archaeological Survey of the Duder Brickworks (R11/1795) (Packington Hall)

In 1992 Packington-Hall undertook a comprehensive ground survey of the Duder Brickworks. This survey collated a range of information including: photogrammetric mapping, systematic surface collection of portable artefacts and soil resistivity survey (1992:1).

The surface collection of artefacts indicated a background distribution of structural and artefactual (i.e. bricks, pipes) material across the entire brickworks site, the coastal escarpment and along the shoreline immediately below (Packington-Hall 1992:8). This material was associated with industrial activity during the operation of the brickworks and the demolition and abandonment of the site between the 1930s and 1950s. At the extreme eastern end of the site was domestic debris associated with early domestic residential occupation above the escarpment from the 1870s onwards (Figure 4).

Intact structural features were found on a prominent platform at the base of the coastal escarpment above the high water mark and towards the eastern end of the site (Figure 5). These structures include a length of scoria seawall, the timber piles of the brickworks wharf, and the remains of a brick structure likely to be an early clamp (Packington-Hall 1992:9). Structural rubble was scattered across the western edge of the platform and along the foreshore below, including machine parts, concrete

footings and mortared bricks. Packington-Hall concluded that this structural rubble was demolition material from the 1890s buildings above the escarpment that was dumped down the slope when the site was cleared in the 1950s for the development of the naval housing facilities (Packington-Hall 1992:10). The lower walkway track of the Mary Barrett Glade traverses the coastal platform and continues eastwards along what Packington-Hall identifies as the original road that extended from the coastal platform to Lake Road. This road is visible in the early 20th century photographs of the brickworks illustrated in Plate 1.

Plate 2. c.1940s aerial photograph of the Duder Brickworks and quarry (White's Aviation 1916/32).

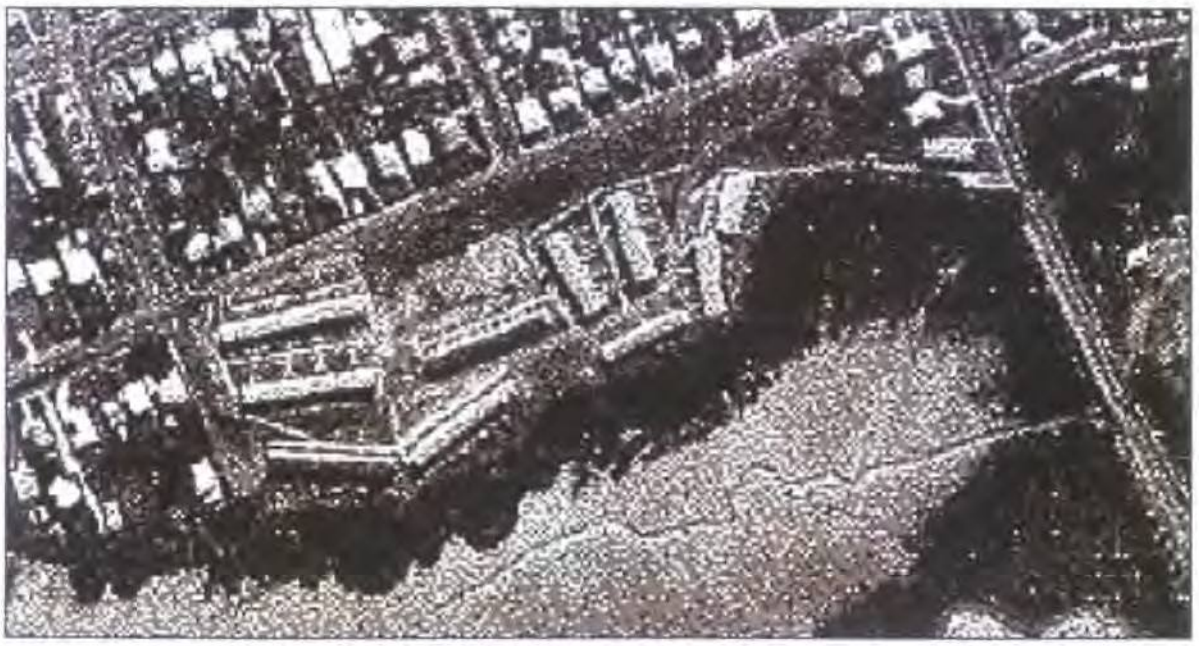

Plate 3. c.1950s aerial Photograph of Wakakura Naval Housing Estate (White's Aviation 4599/13).

In an attempt to locate evidence of subsurface structural features associated with the brickworks, Packington-Hall conducted a soil resistivity survey on the edge of the grassed area above the escarpment where two of the primary brickwork kilns (square and circular Kiln) were thought to be located on the basis of documentary evidence and aerial photography. Although no evidence of the circular kiln was found, the resistivity profiles indicated the possible location of the square kiln walls and a surrounding debris field (Packington-Hall 1992:15-16, Figure 4). However, no subsurface excavation were undertaken to verify the results of the resistivity survey.

Packington-Hall collated the results of his survey into a detailed site map of the entire property that included both the remaining Duder Brickwork structures and the naval housing blocks. This site map is illustrated in Figure 5. Currently, the upper edge of the coastal escarpment which divides the area occupied by the Duder Brickworks proper from the associated features located to the south on the coastal platform at the base of the escarpment is delineated by the current fence line which runs along the northern boundary of the Mary Barrett Glade and which also serves to demarcate the northern extent of the Mary Barrett Glade and associated walkways.

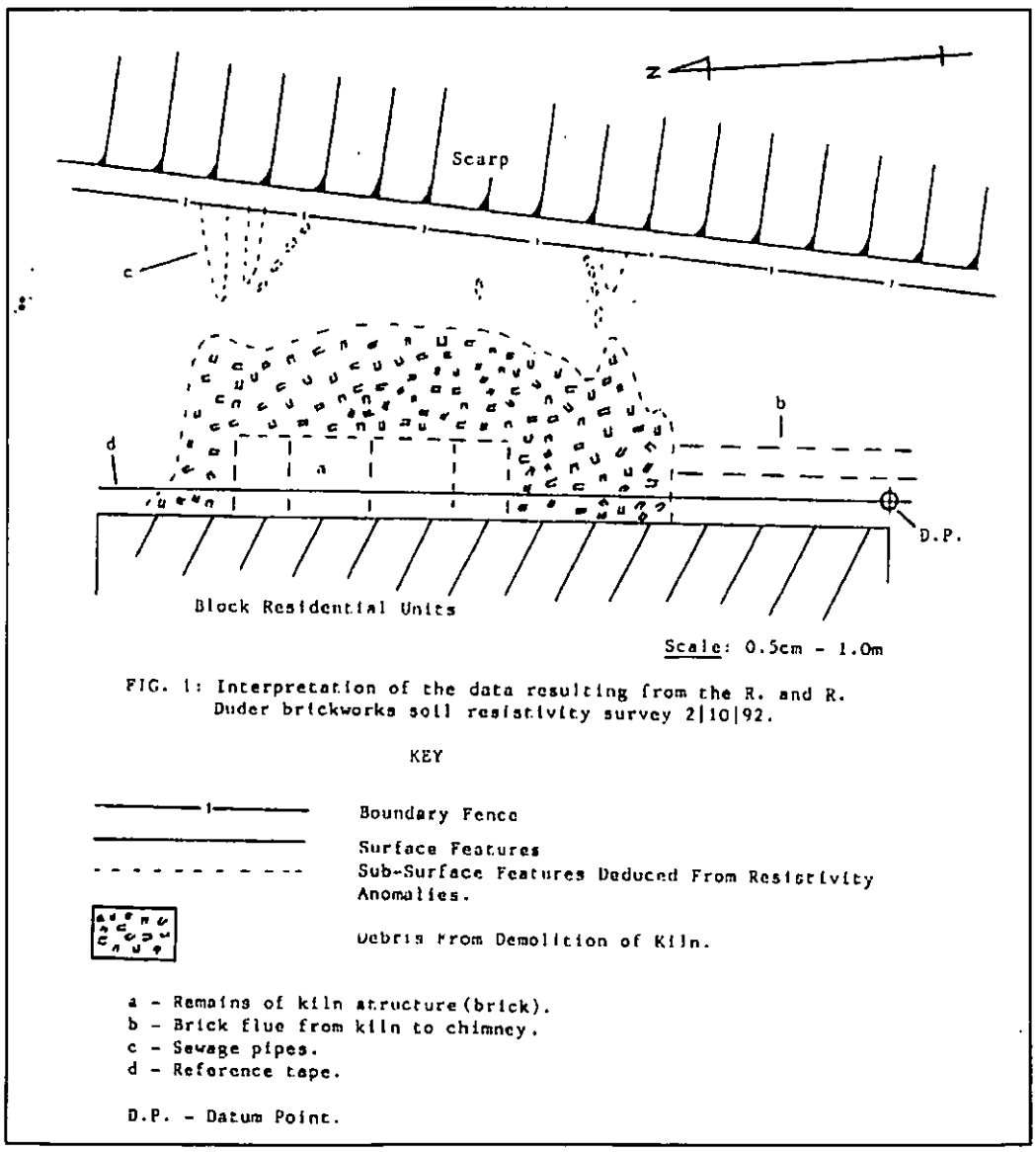

Figure 4. Results from Packington-Hall's resistivity survey (1992:15 Fig. 1).

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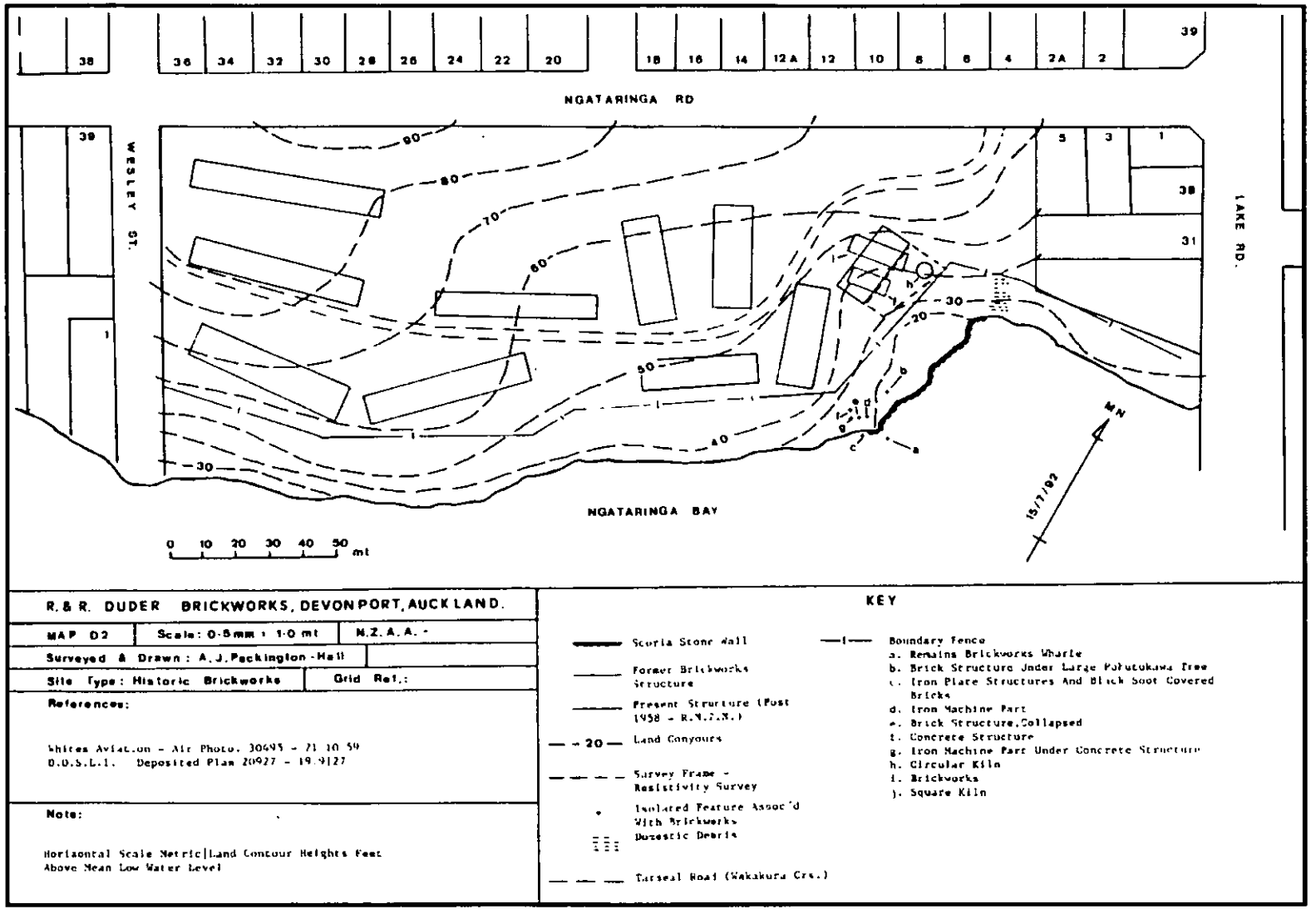

Figure 5. R11/1975. Plan of Duder Brickwork features identified by Packington-Hall (1992).

6 FIELD SURVEY (2010):

6.1 Survey Methods

A pedestrian site survey of the Mary Barrett Glade and immediate coastal surrounds was undertaken by archaeologists Nicholas Cable and Mica Plowman on the 27th March 2010. The survey was limited to the Mary Barrett Glade, defined as located between the boundary fence at the top of the escarpment and the high tide mark along the coast, and extending from the private properties along the west side of the escarpment to Lake Road, generally following the route of the existing walkways. The conditions for archaeological survey along the existing walkways were good, but ground visibility on the slopes of the coastal escarpment between the upper and lower walkway were limited by dense vegetation cover and associated ground cover.

The primary aim of this survey was to relocate the two recorded archaeological sites located in the Glade (Duder Brickworks R11/1795 and midden R11/2181) as well as any apparent unrecorded archaeological features and to provide an assessment of their current condition and any potential impact that may result from the proposed track upgrade. A photographic record was made of all features observed during the survey and their locations established using a handheld GPS unit.

6.2 Survey Results

6.2.1 Midden Deposits R11/2181

Four, small, discrete shell midden lenses were identified along the upper and lower walkways at the western end of the coastal escarpment and near the western extent of brick rubble associated with the Duder Brickworks. The location of the primary deposits is illustrated in Figure 6. In general, these lenses contained diffuse fragmented shell, little more than 1m across and 50-150mm thick and were either directly exposed in the walkway cuttings or in the face of the coastal escarpment. Dispersed, fragmentary amounts of shell were also visible along the floor of the lower coastal walkway in the vicinity of the primary exposures. These midden deposits comprised predominantly of cockle (*Austrovenus stutchburyi*) and pipi (*Paphies australis*) with lesser amounts of Cat's eyes (*Turbo smaragdus*) and mudsnails (*Amphibola crenata*) and generally resemble the descriptions of shell middens recorded elsewhere around Duder's Point.

Midden Deposit 1 (NZTM mE1759646 mN5923777)

This deposit comprises of a small cockle midden lens exposed in the side of a walkway cutting which leads down to the lower walkway at the western end of the escarpment (Plate 4). Directly below the lens was a small scatter of fragmentary shell in the middle of the track (Plate 5), presumably originating from the bank. This shell had been dispersed and damaged by foot traffic.

Midden Deposit 2 (NZTM mE1759657 mN5923781)

The second shell scatter was found approximately 10m further down slope from the first deposit and in the surface of an access track leading from the lower walkway to the neighbouring property (mE2670100 mN6485474) (Plate 6). The origin of this shell was not clear, but was presumably somewhere near the same source as the first midden. This deposit also consisted entirely of cockle shell.

Midden Deposit 3 (NZTM mE1759759 mN5923803)

This deposit comprised of two closely associated shell deposits located below the lower walking track and in the vicinity of a mature pohutakawa tree located on the coastal bank immediately above the high water mark of Ngataringa Bay. The first of these was located on the edge of the coastal escarpment and along the foreshore (Plate 7) and the second is located within the tree roots of the pohutakawa tree itself (Plate 8). Both deposits appear to represent secondary deposits that have eroded down slope overtime.

Midden Deposits 4 (NZTM mE1759832 mN5923849)

The fourth midden deposit was identified approximately 80m further east of deposit 3 on the lower walking track. This deposit is one of the two midden exposures recorded by Gardner in 2001 as R11/2181 (mE2670274 mN6485542) (Plate 9). Only the deposit recorded as located within the lower walkway cutting was located. As noted on the site record form, this midden is located adjacent to an old iron ploughshare at the edge of the track. The second midden deposit was not relocated as it was located upslope of the walkway under dense vegetation and was not visible from the track.

6.2.2 Duder Brickworks (NZTM mE1759903 mN5923886)

The iron ploughshare also marks the beginning of a 30m long concentration of brick rubble along the lower walkway. The rubble is clearly associated with the brickworks and has in places been incorporated into the walkway itself, or dumped along the bottom of the escarpment. It is assumed that much of the concentration of brick rubble was actually the handiwork of Mrs Pollock, who, it is said has cleared parts of the brickworks site and or brick debris to form the walkway.

The eastern extent of the concentrated brick rubble along the lower walkway marks the beginning of the main platform on which the brickworks features identified by Packington-Hall are located. The general impression of the site is that little has changed since 1992 when the site was initially surveyed and recorded.

Approximately 70m east of the iron ploughshare is a large pile of loose bricks below a mature pohutakawa tree, forming some kind of structure (Plate 10). This is the clamp identified by Packington-Hall (1992) and it is the most obvious feature along the walkway, despite being obscured by the tree.

Within the foreshore margins, immediately below and extending south from the edge of the main coastal platform are the wooden piles of the original brickworks wharf (Plate 12). On either side of the wharf runs a c.2m high scoria seawall, partially obscured at either end by dense vegetation (Plate 11). On the west side of the wharf is a concentration of structural rubble associated with the brickworks buildings, including concrete footings, iron cabinets and concrete machine mounts (Plates 13-16).

The material associated with the Duder Brickworks, which is located on the slopes of the coastal escarpment around and along the lower walkway (including the concentrated brick rubble) extends for approximately 100m. The lower walkway runs right through the site and continues along a fairly well formed track towards Lake Road. If Packington-Hall is correct, then this part of the walking track is actually an original road leading from the wharf to Lake Road. A second road ran from the wharf upslope to the brickworks site proper, on the grassed area above the escarpment. This area was not examined as it is not affected by the proposed remedial works.

A4

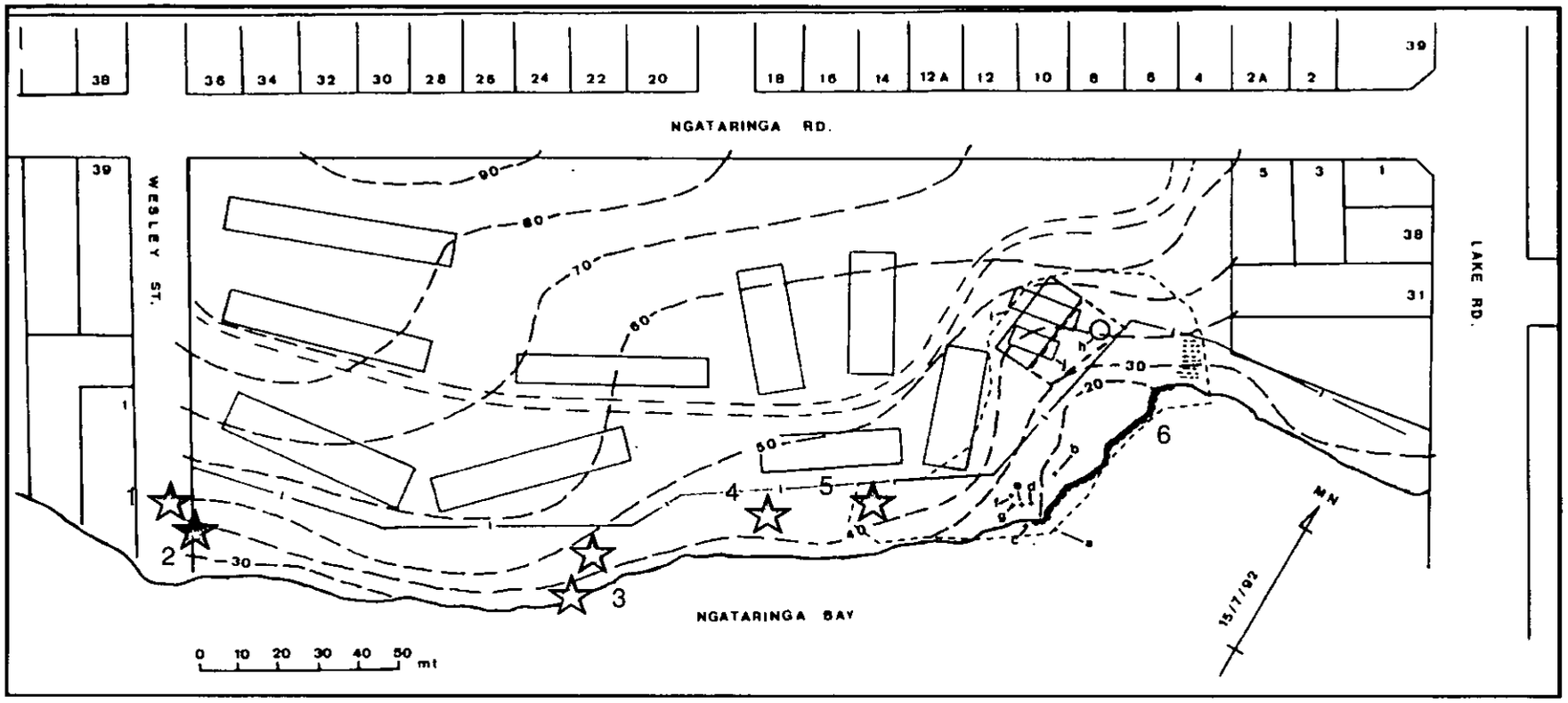

Figure 6. Packington-Hall's survey map, annotated with shell middens found by the author (1, 2, 3), those previously recorded by Gardner in 2001 (4 & 5) and the approximate extent of the brickworks site (6).

Plate 4. Midden deposit 1. Lens of shell exposed in the bank above the walkway track. Scale is 250mm.

Plate 5. Midden deposit 1. Shell scatter in walkway track below midden exposure #1. Scale is 250mm.

Plate 6. Midden deposit 2. Shell scatter on access track leading down to neighbouring property .

Plate 7. Midden deposit 3. Lens of shell midden in bank along the high water mark on the foreshore. In the vicinity of the large pohutakawa tree on the lower walkway. Scale is 250mm.

Plate 8. Midden deposit 3. Lens of shell midden under the large pohutakawa tree along the lower walkway. Scale is 250mm.

Plate 9. Midden deposit 5. Lens of shell, exposed in the bank above the walkway track. Next to an iron ploughshare. Scale is 250mm.

Plate 10. R11/1975. Large pile of bricks under pohutakawa tree – the clamp identified by Packington-Hall (1992).