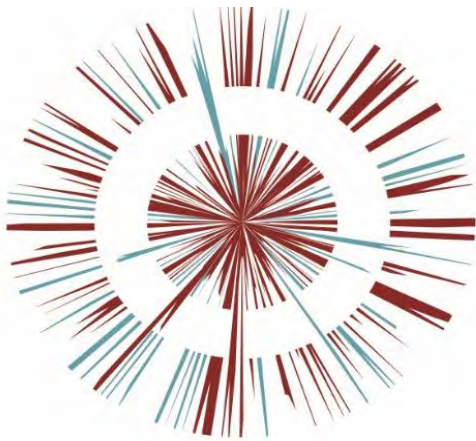




OMEGA ZONE 8, ST HELENS

Omega St Helens Ltd / T. J. Morris Limited



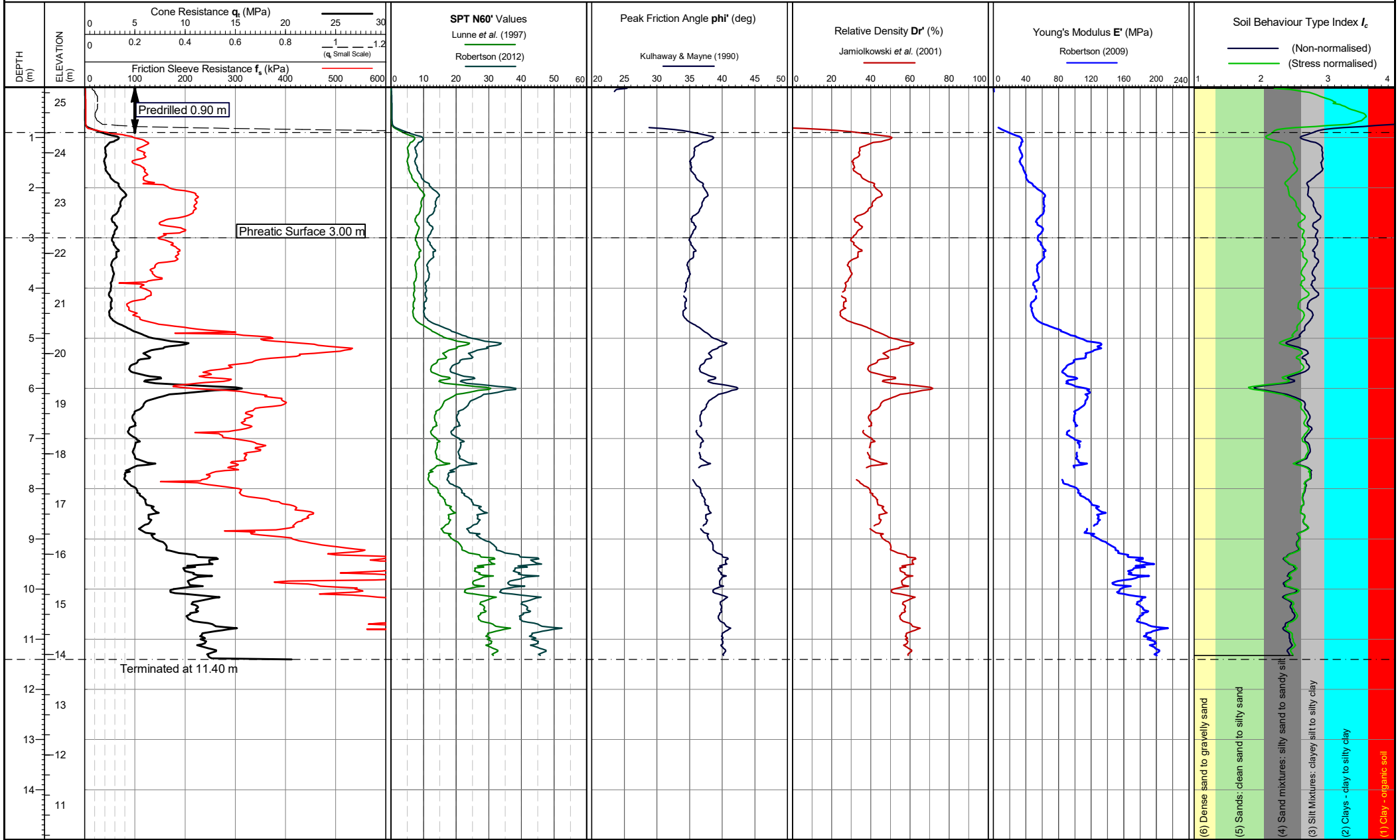
Ground Investigation Report
& Remediation Strategy
Appendix D Part 5
OPP DOC. 2.9

APPENDIX E STANDARD INTERPRETATION RESULTS - SET 2

EQUIVALENT SPT N60
PEAK FRICTION ANGLE
RELATIVE DENSITY
YOUNG'S MODULUS

LIST OF FIGURES:

Location ID	Pages included
CPT8A01	1
CPT8A02	1
CPT8A03	1
CPT8A04	1
CPT8A05	1
CPT8A06	1
CPT8A07	1
CPT8A08A	1
CPT8A09	1
CPT8A10	1
CPT8A11	1
CPT8B01	1
CPT8B02	1
CPT8B03	1
CPTP8A01	1
CPTP8A02	1
CPTP8A03	1
CPTP8A04A	1
CPTP8B01	1



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 10:10:00

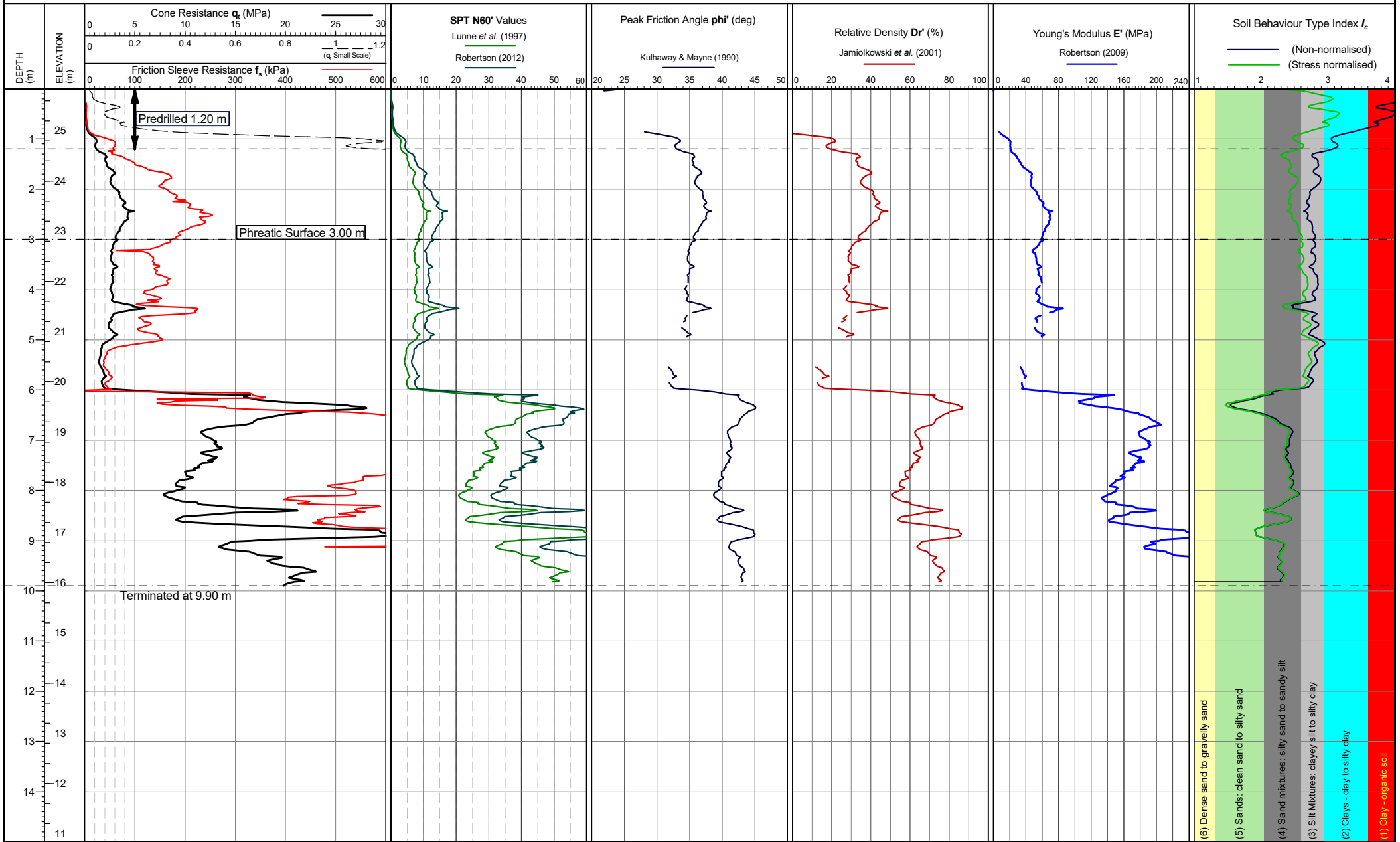
Location: Cheshire, UK
Coordinates: 354708.317, 390661.294
Elevation: 25.306
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A01



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 10:50:00

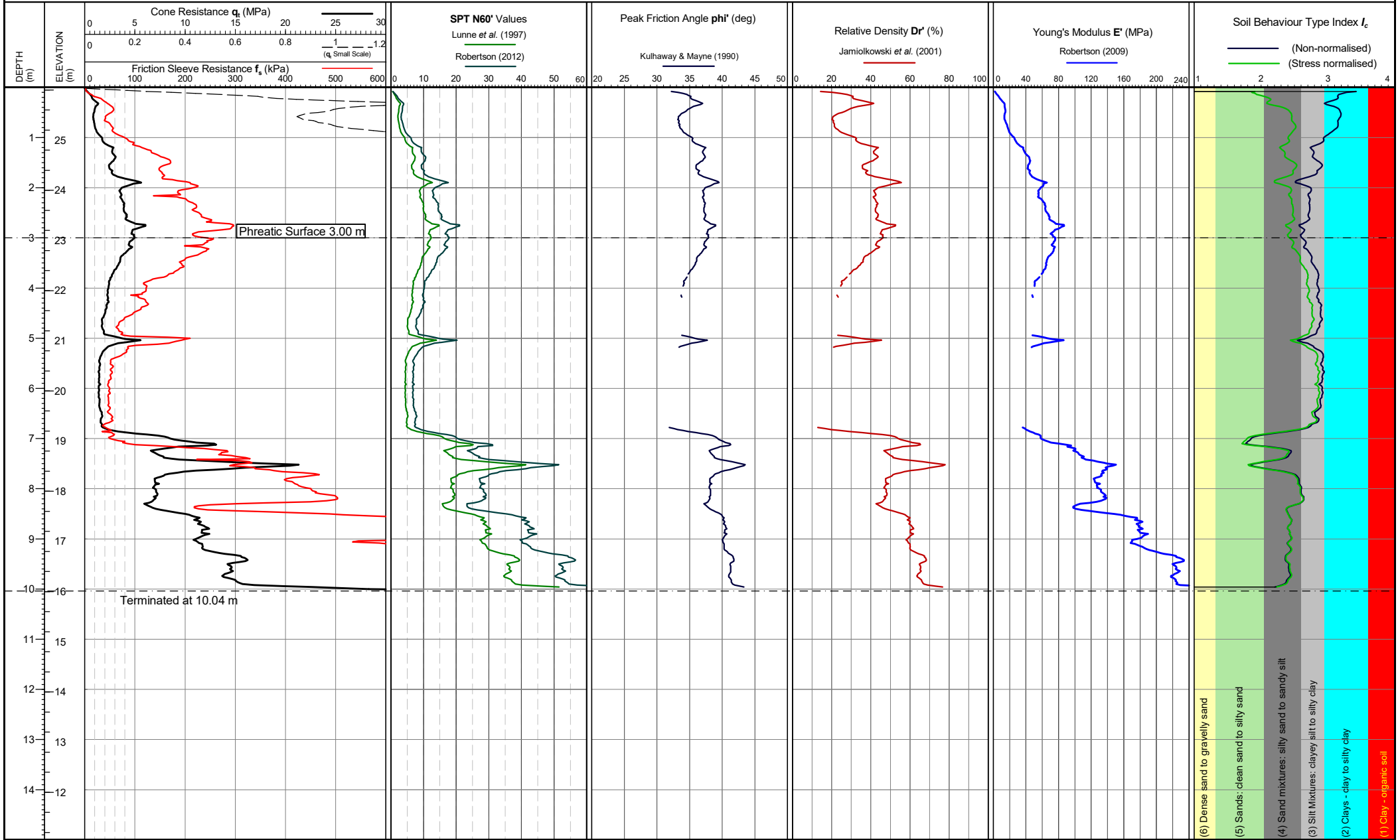
Location: Cheshire, UK
Coordinates: 354749.627, 390698.494
Elevation: 25.837
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A02



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 01/10/2019 09:34:00

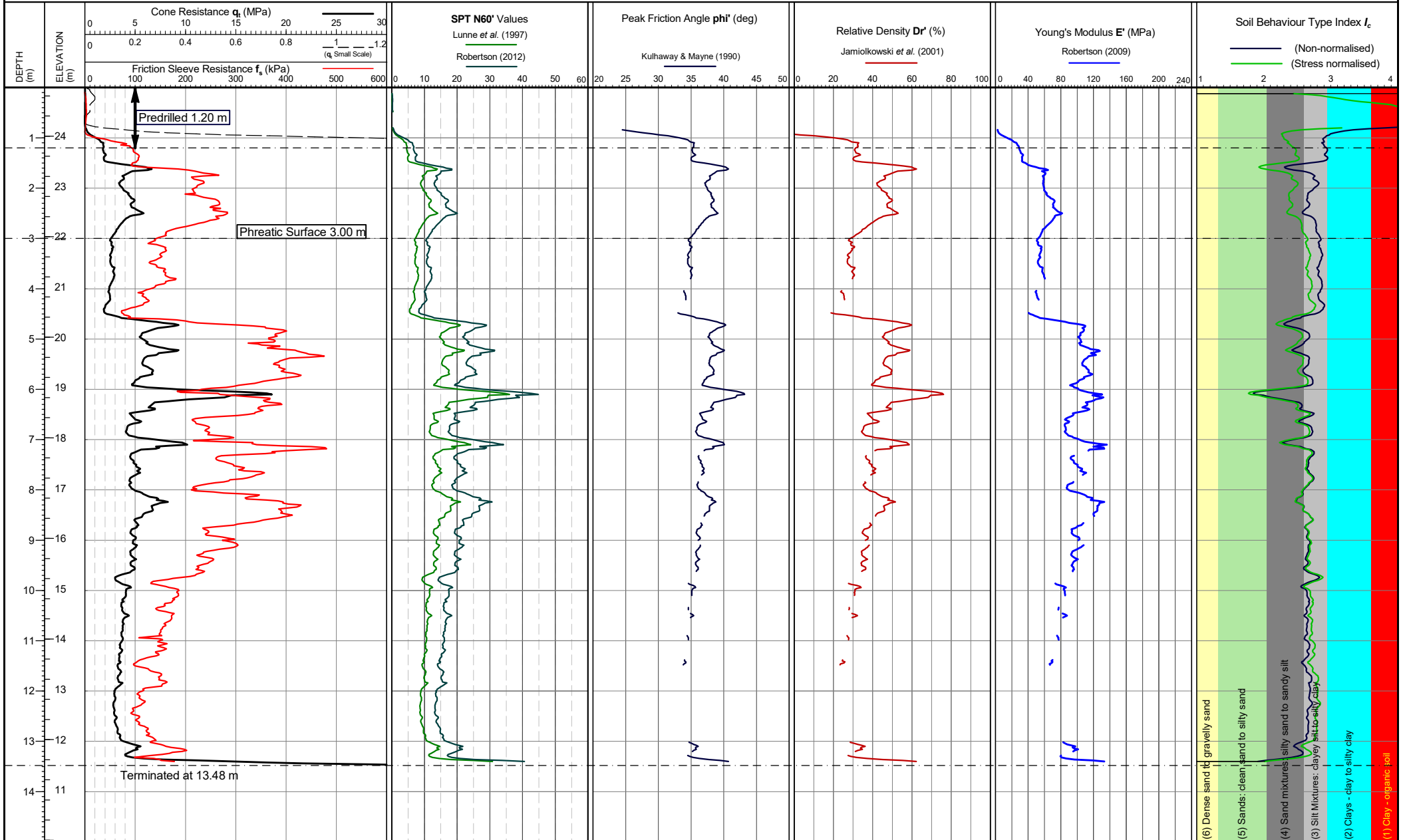
Location: Cheshire, UK
Coordinates: 354779.753, 390751.32
Elevation: 26.051
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A03



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 12:35:00

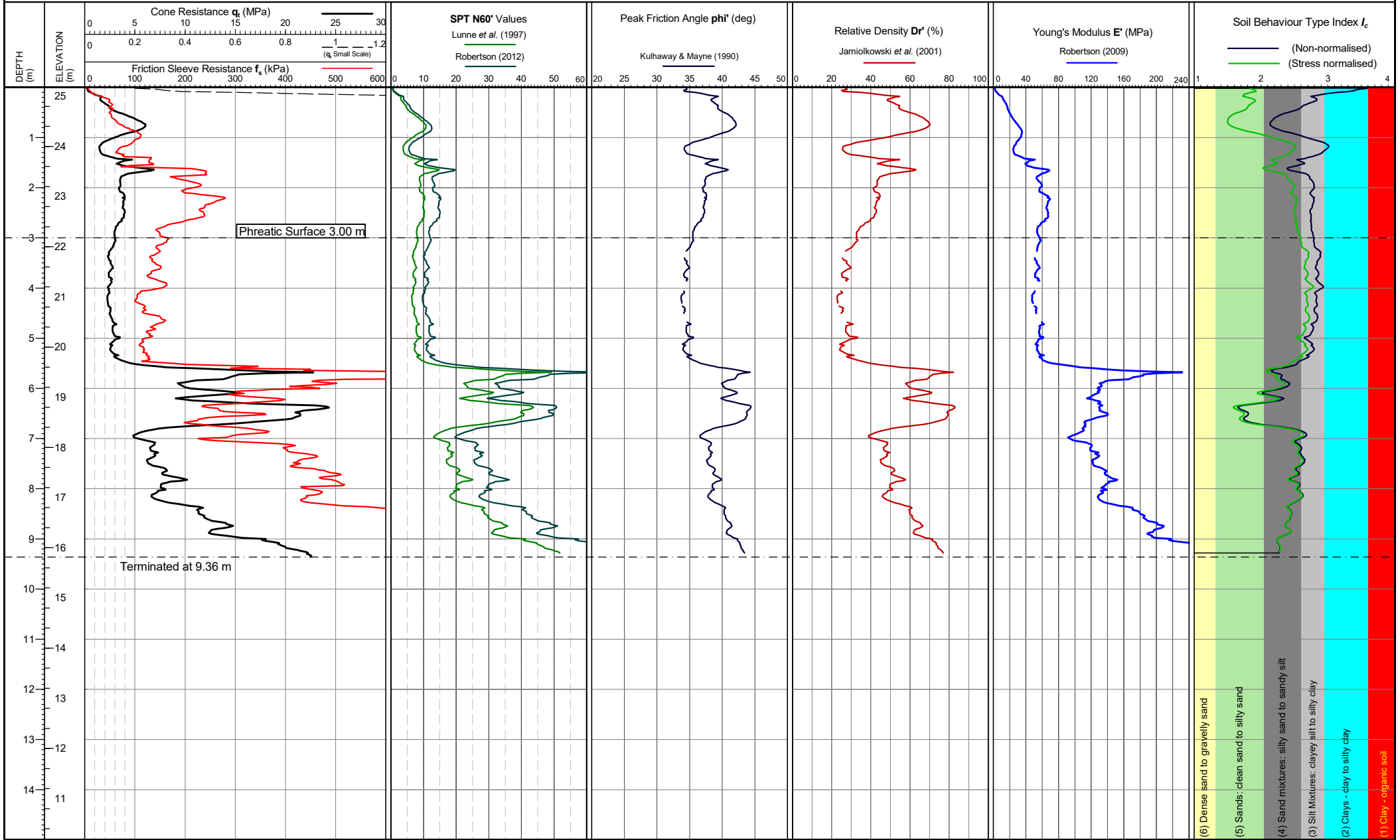
Location: Cheshire, UK
Coordinates: 354795.81, 390589.233
Elevation: 24.965
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A04



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 13:15:00

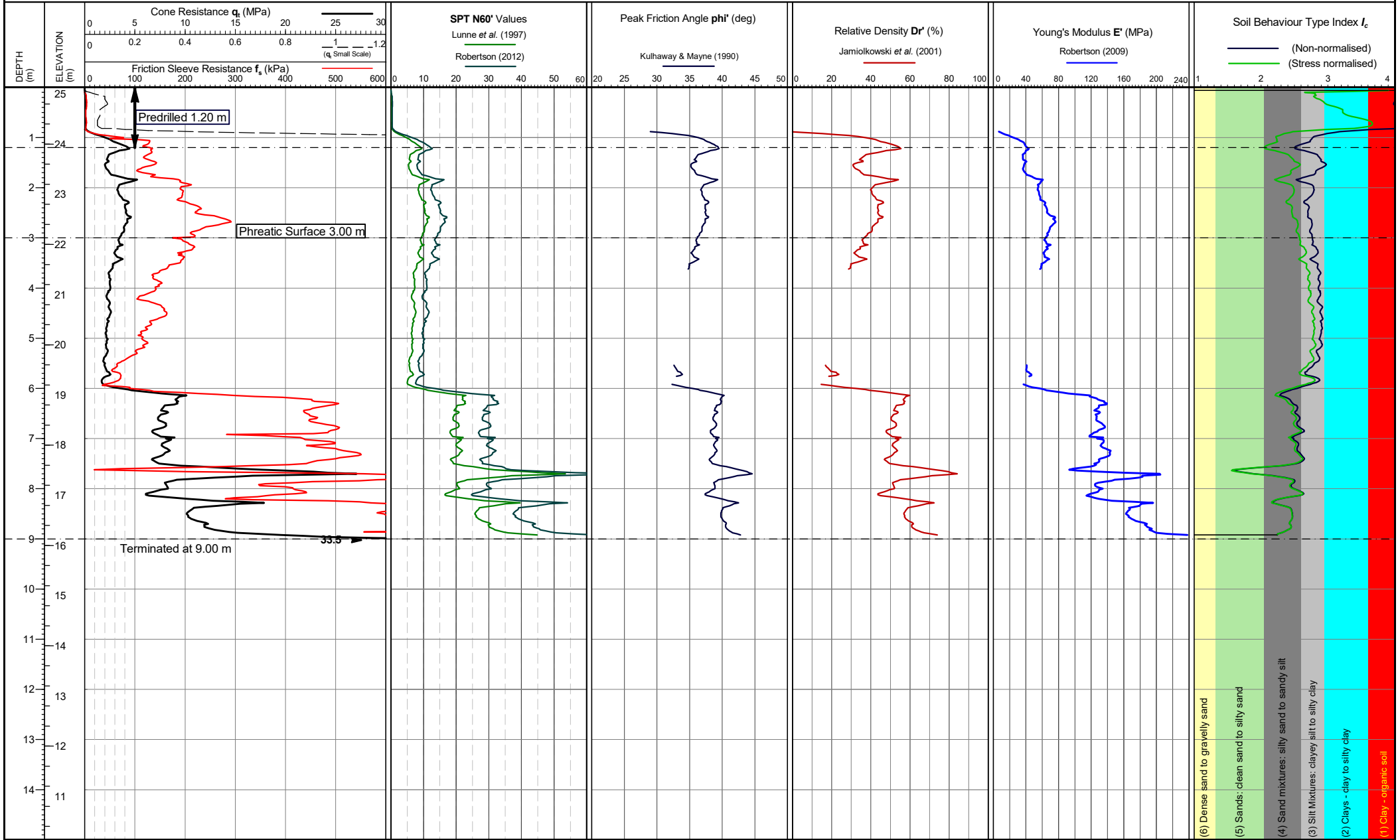
Location: Cheshire, UK
Coordinates: 354841.806, 390645.089
Elevation: 25.177
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A05



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 12:02:00

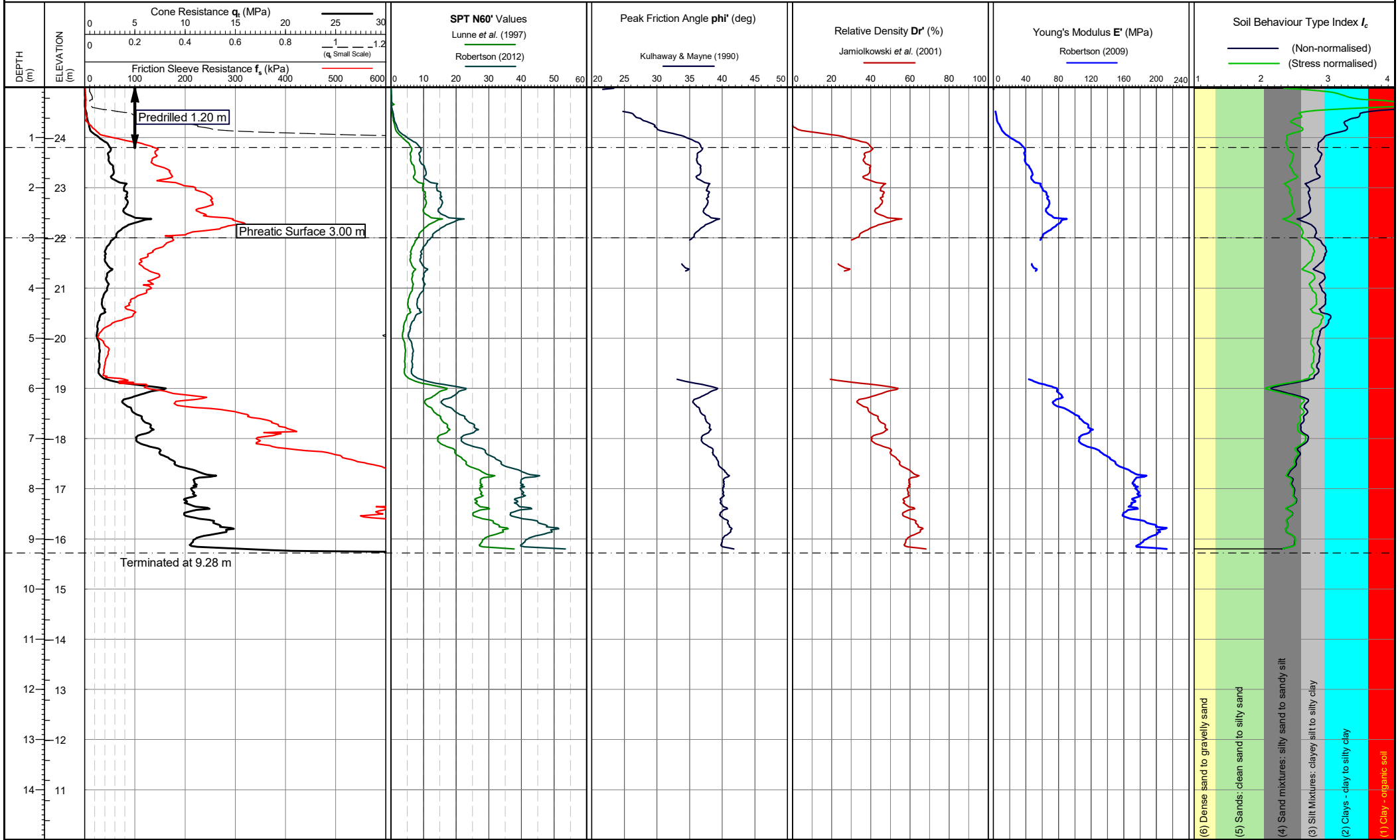
Location: Cheshire, UK
Coordinates: 354865.15, 390675.865
Elevation: 25.131
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A06



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 11:31:00

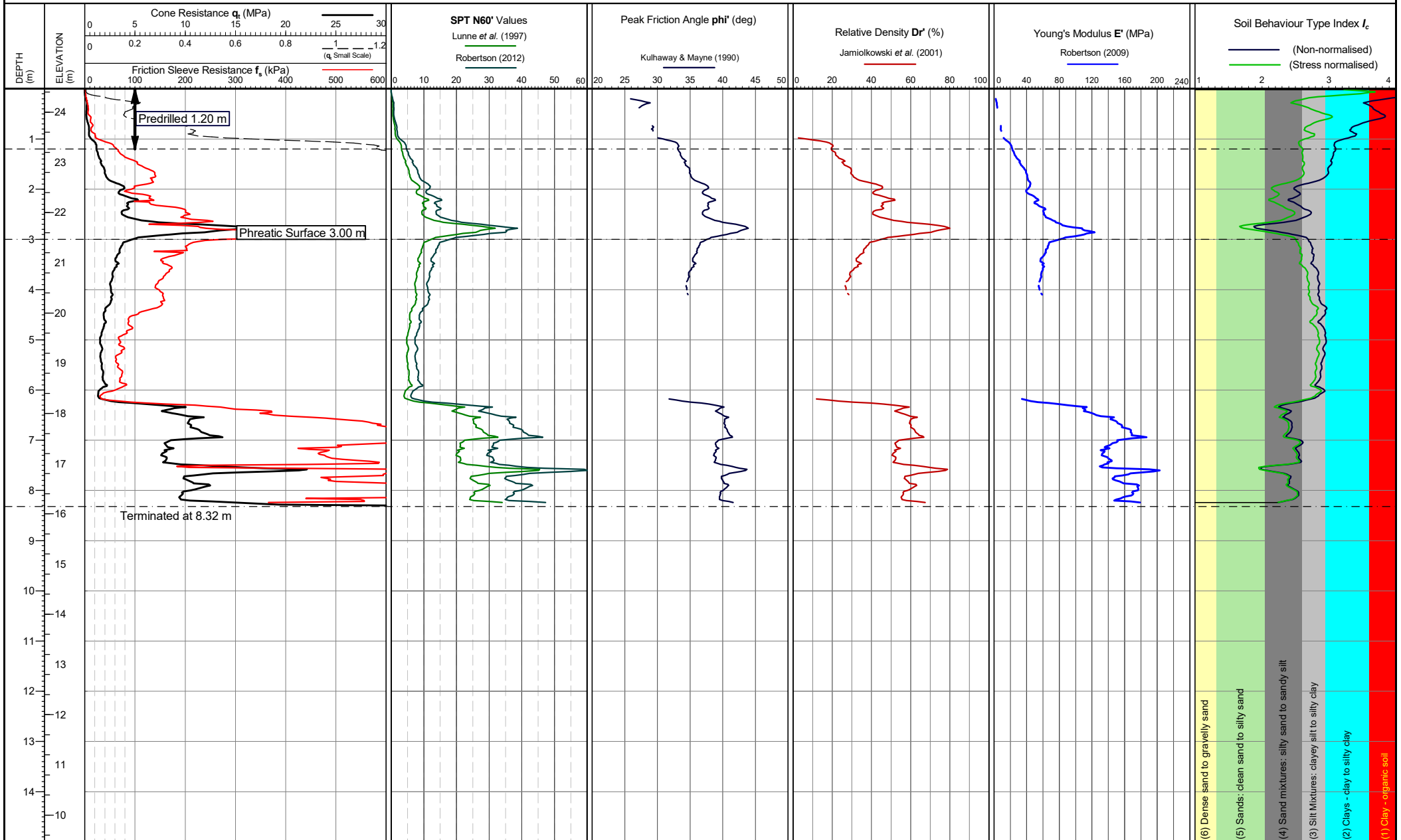
Location: Cheshire, UK
Coordinates: 354896.233, 390722.399
Elevation: 25.016
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A07



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 13:47:00

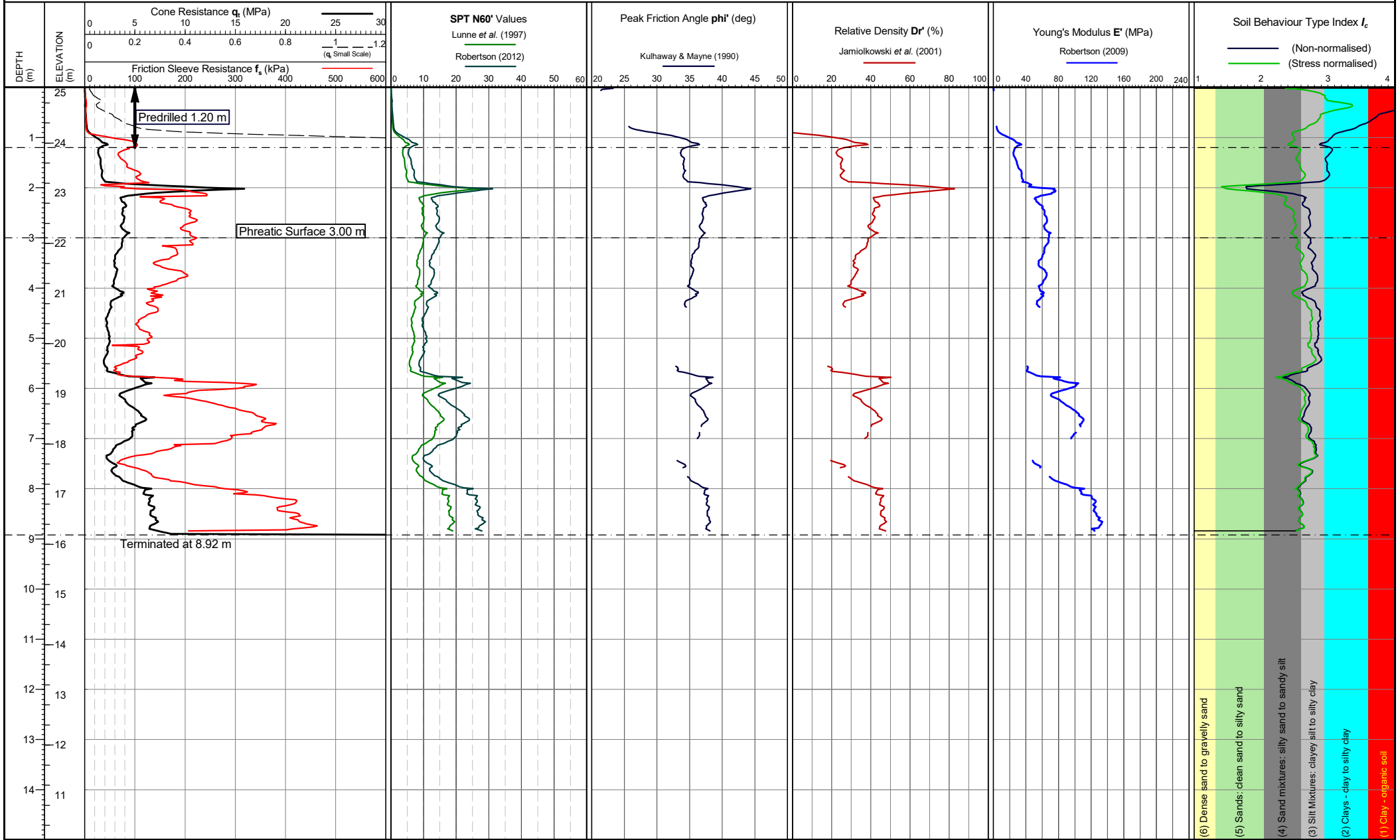
Location: Cheshire, UK
Coordinates: 354931.435, 390765.13
Elevation: 24.466
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A08A



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 15:28:00

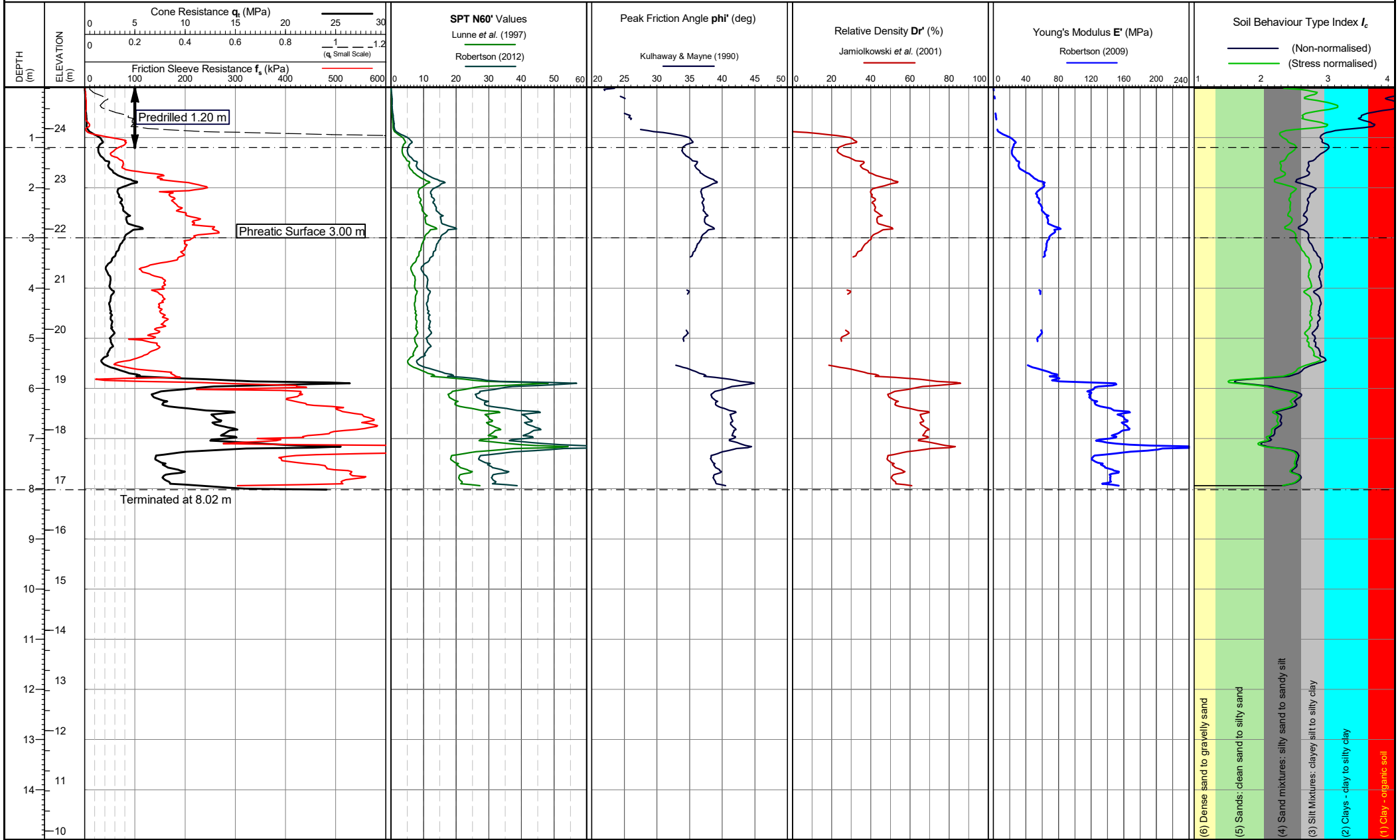
Location: Cheshire, UK
Coordinates: 354951.213, 390611.664
Elevation: 25.109
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player
Lankelma Project Ref: P-107284-10

TEST ID: CPT8A09
Page 1 of 1

- (6) Dense sand to gravelly sand
- (5) Sands: clean sand to silty sand
- (4) Sand mixtures: silty sand to sandy silt
- (3) Silt Mixtures: clayey silt to silty clay
- (2) Clays - clay to silty clay
- (1) Clay - organic soil



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 15:02:00

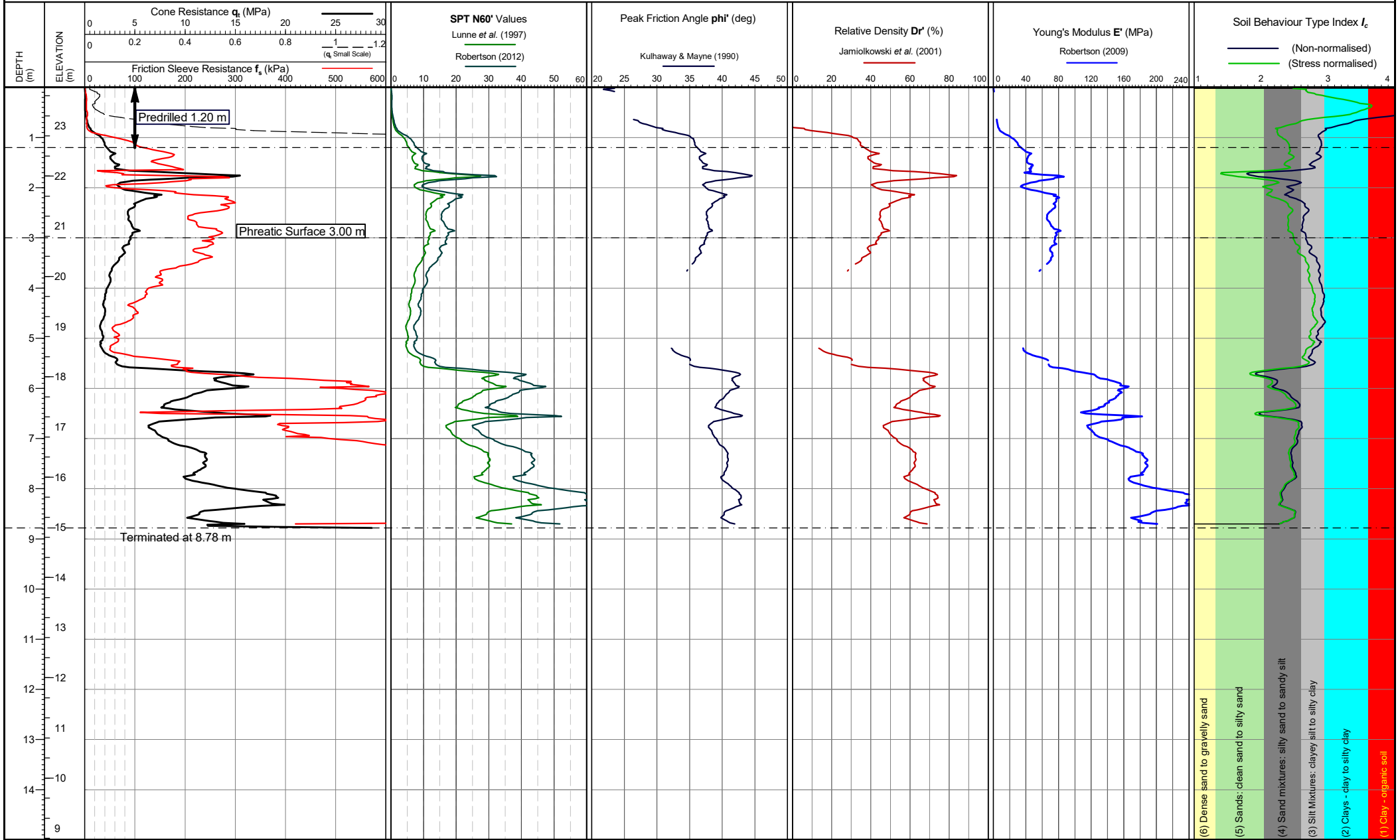
Location: Cheshire, UK
Coordinates: 354985.423, 390646.749
Elevation: 24.824
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A10



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Rob Ashcroft
Date of test: 01/10/2019 14:19:00

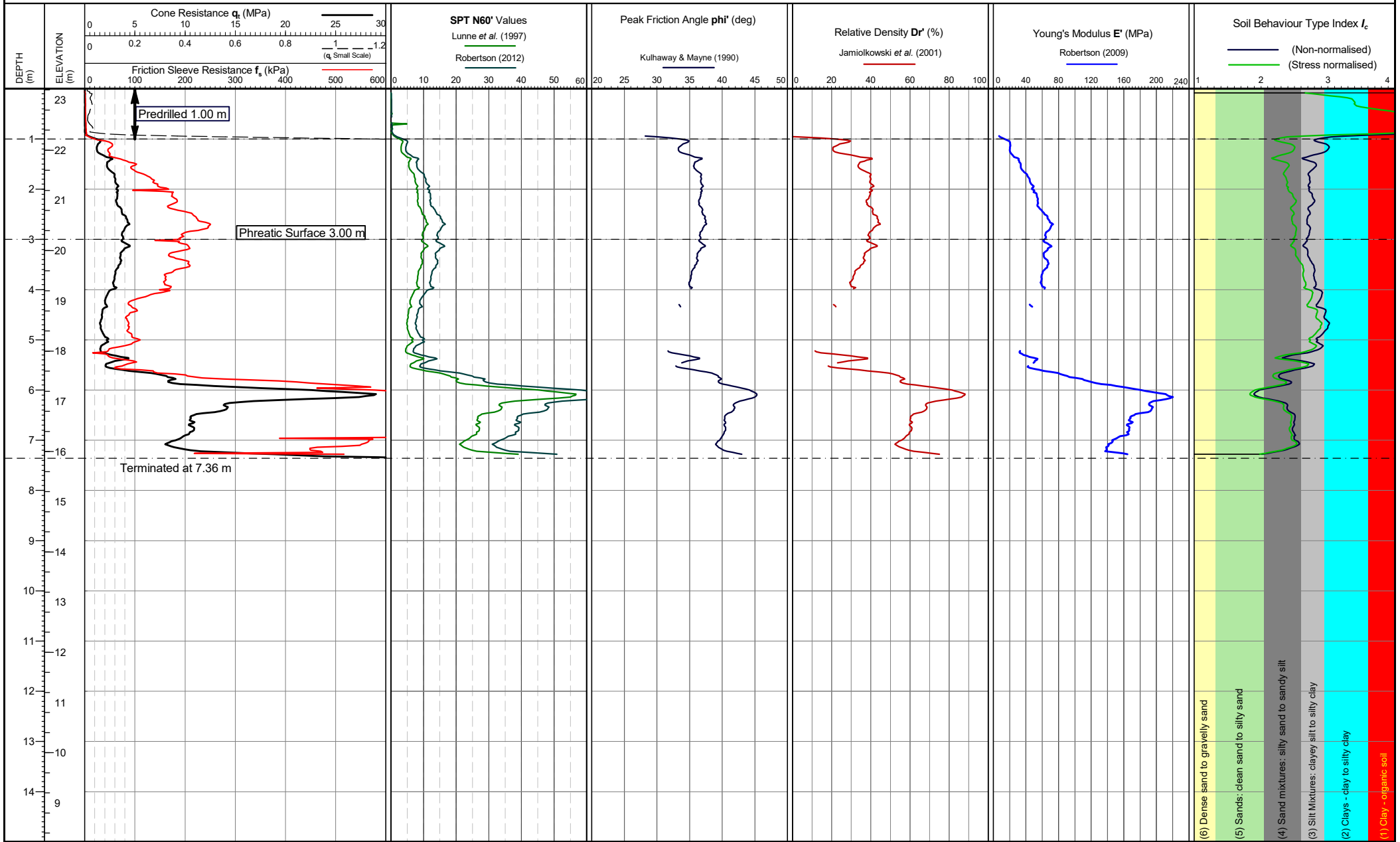
Location: Cheshire, UK
Coordinates: 355020.646, 390689.418
Elevation: 23.768
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8A11



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 25/09/2019 10:23:00

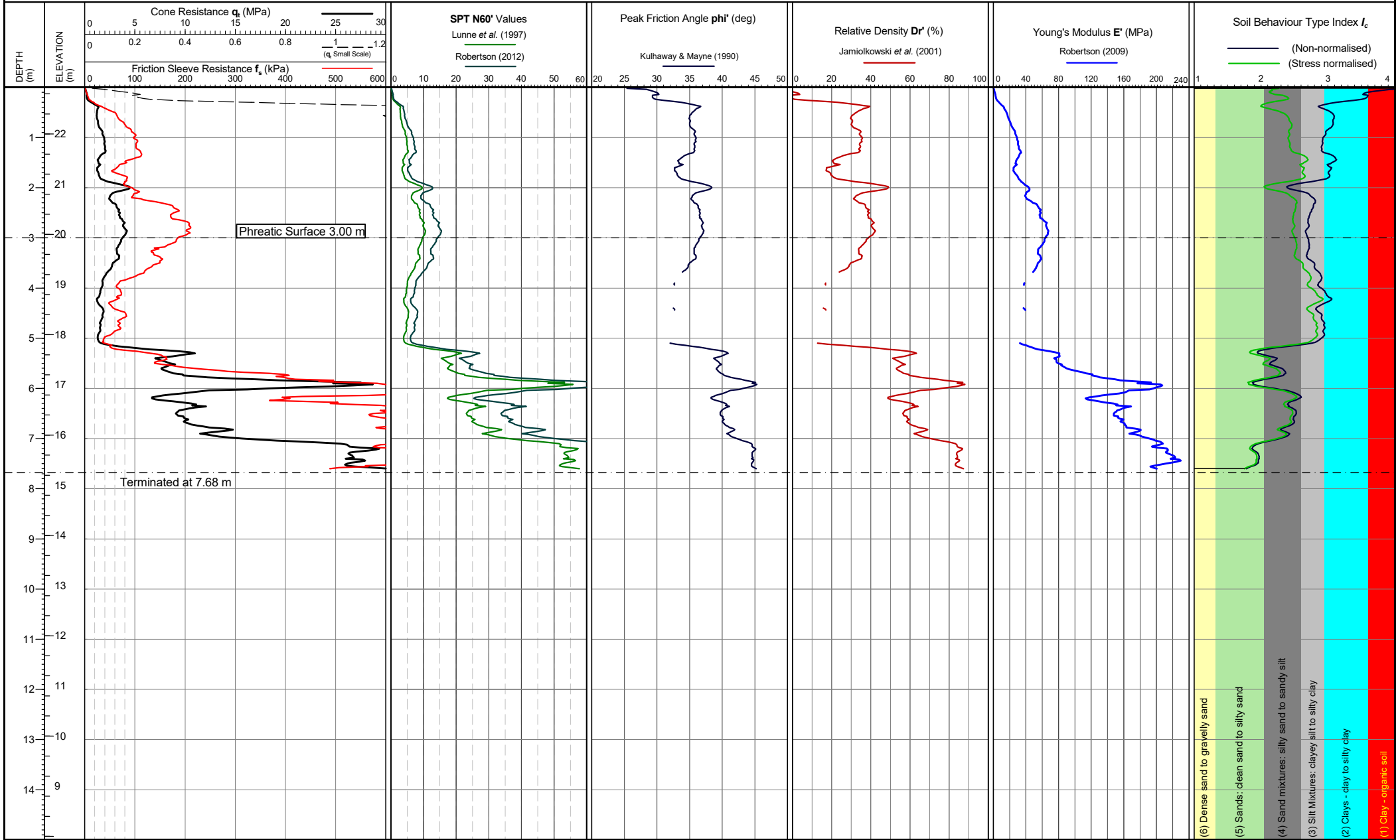
Location: Cheshire, UK
Coordinates: 355083.729, 390736.585
Elevation: 23.224
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8B01



Cone area (mm²): 1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 25/09/2019 09:52:00

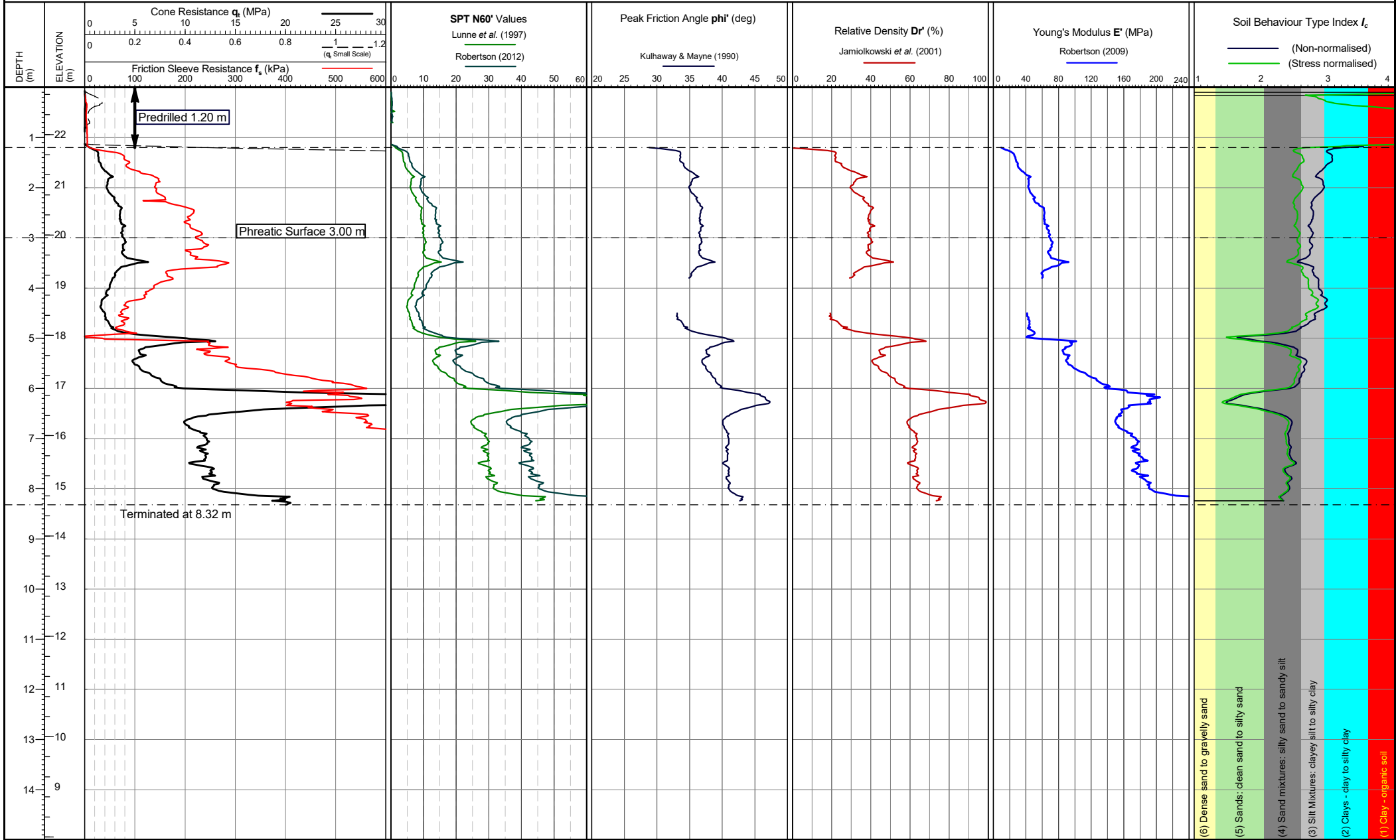
Location: Cheshire, UK
Coordinates: 355139.955, 390794.903
Elevation: 22.93
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player
Lankelma Project Ref: P-107284-10

TEST ID: CPT8B02
Page 1 of 1

- (6) Dense sand to gravelly sand
- (5) Sands: clean sand to silty sand
- (4) Sand mixtures: silty sand to sandy silt
- (3) Silt Mixtures: clayey silt to silty clay
- (2) Clays - clay to silty clay
- (1) Clay - organic soil



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 25/09/2019 11:09:00

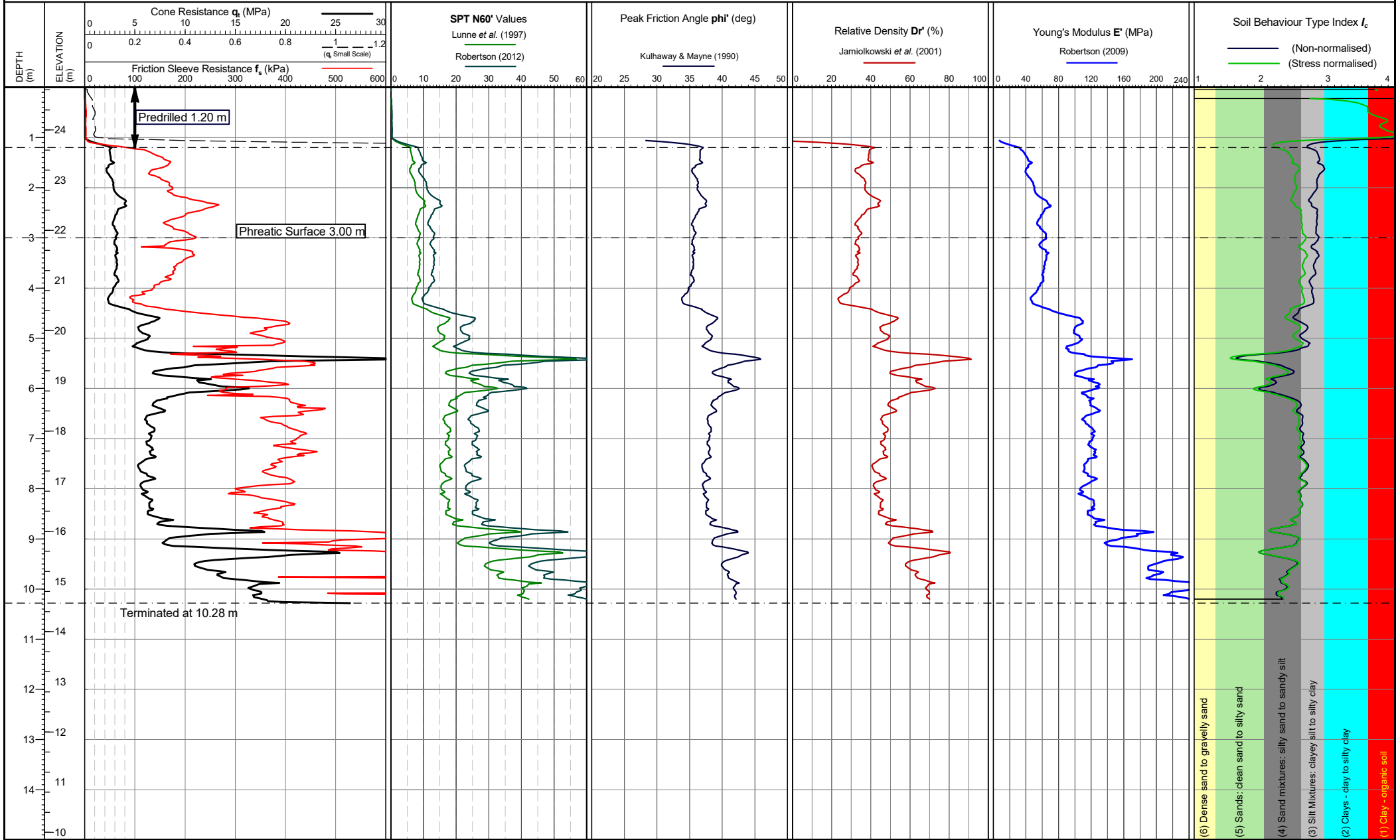
Location: Cheshire, UK
Coordinates: 355143.117, 390638.942
Elevation: 22.942
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPT8B03



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 27/09/2019 11:09:00

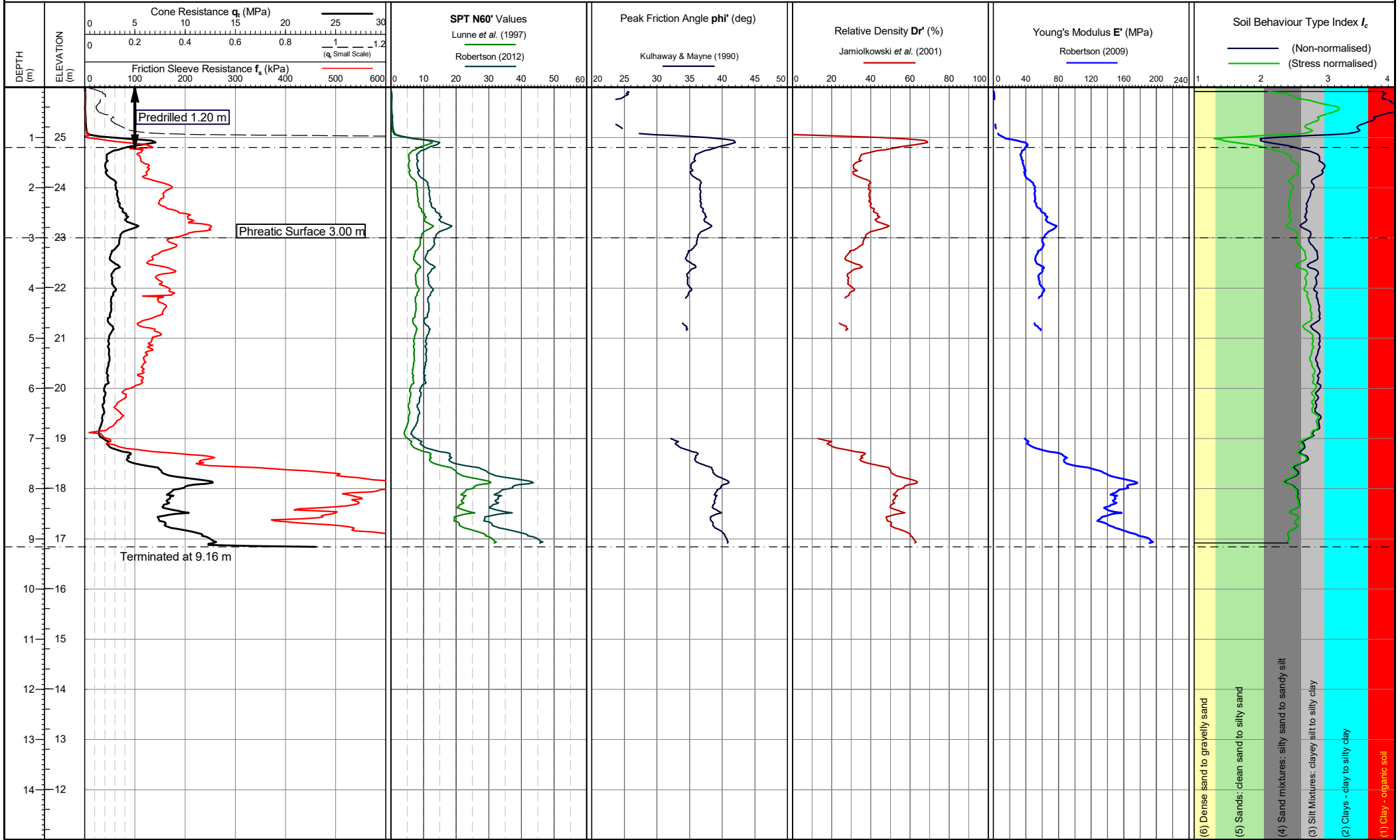
Location: Cheshire, UK
Coordinates: 354747.865, 390623.751
Elevation: 24.849
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPTP8A01



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 27/09/2019 10:21:00

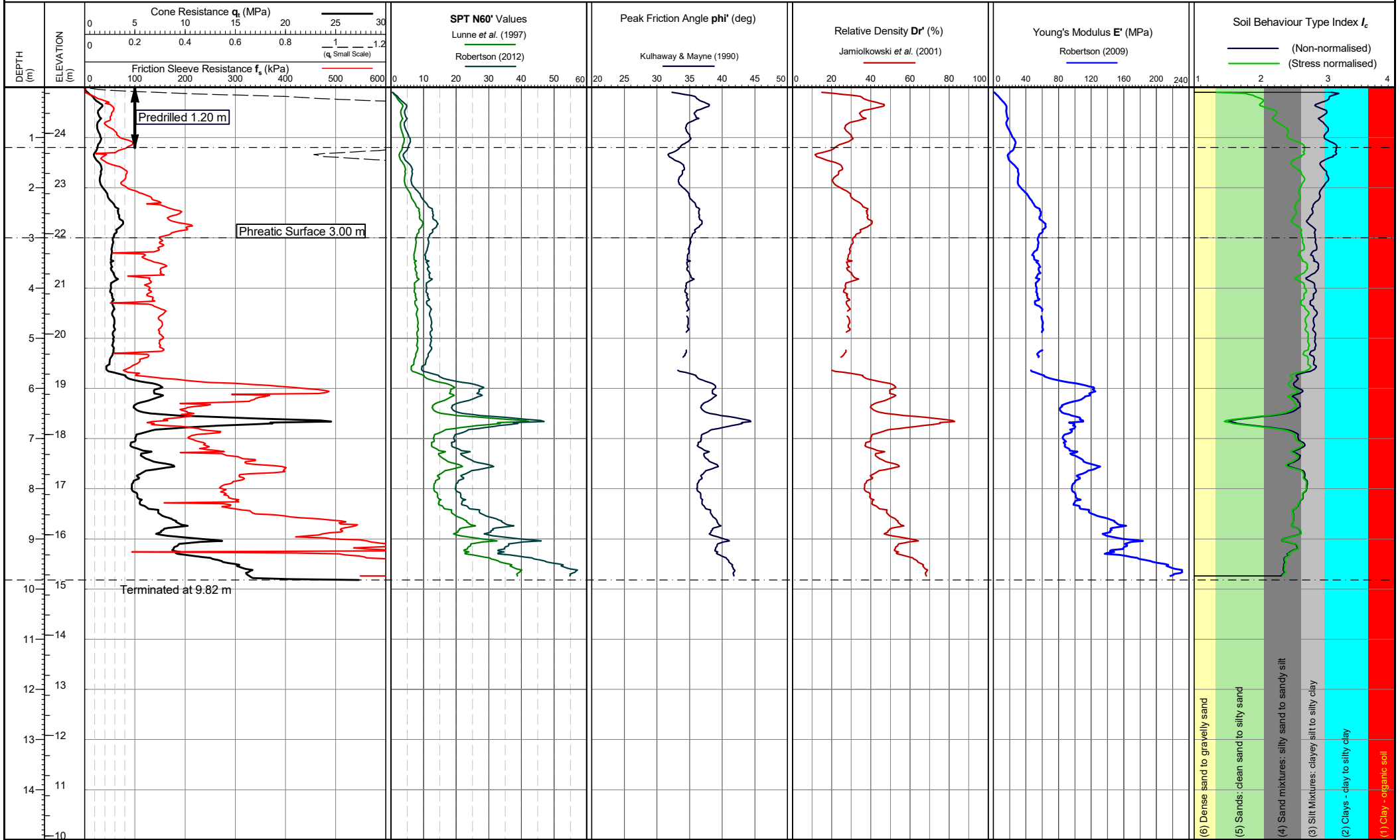
Location: Cheshire, UK
Coordinates: 354823.054, 390713.37
Elevation: 25.991
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPTP8A02



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 27/09/2019 09:34:00

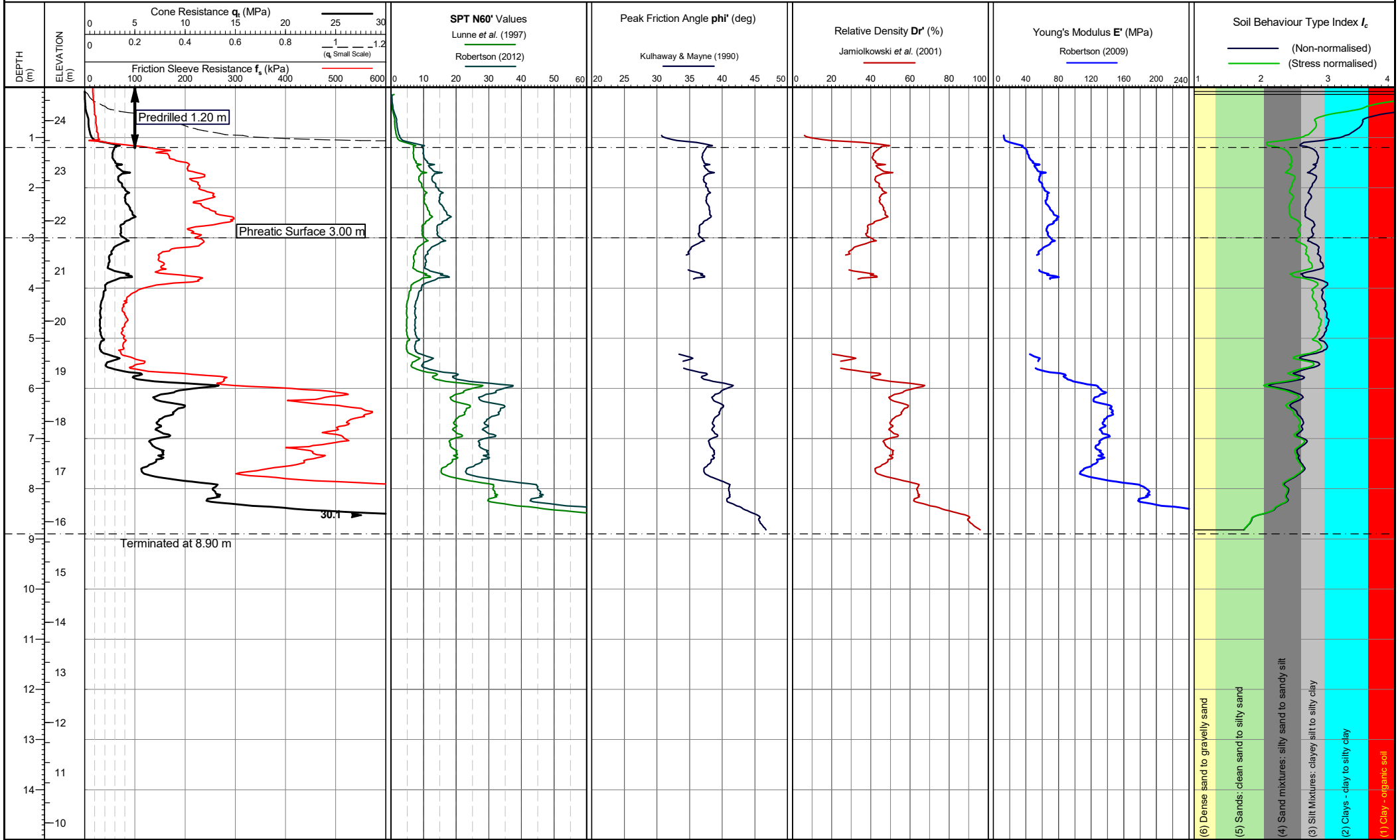
Location: Cheshire, UK
Coordinates: 354899.346, 390640.026
Elevation: 24.918
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPTP8A03



Cone area (mm²): 1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 27/09/2019 08:57:00

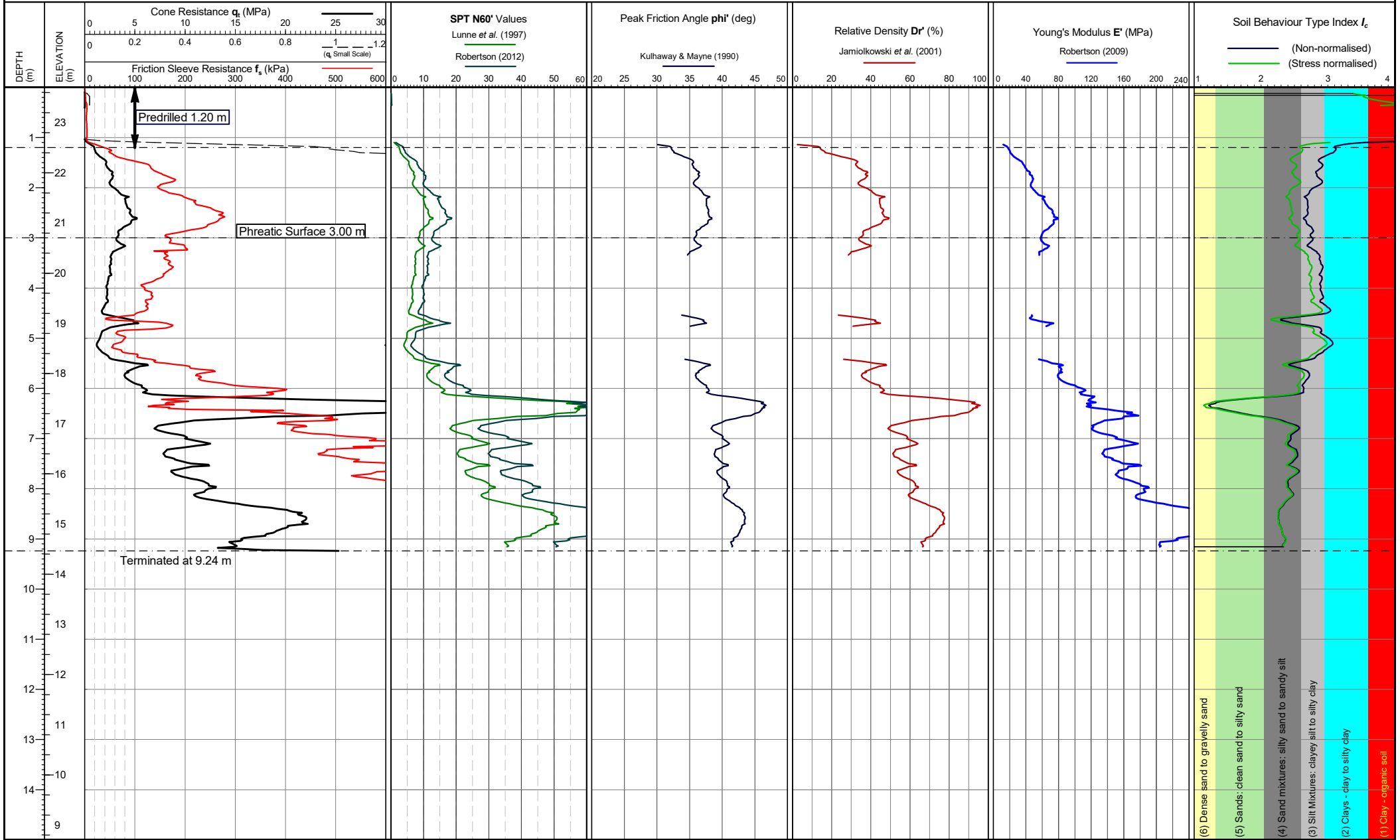
Location: Cheshire, UK
Coordinates: 354929.8, 390762.8
Elevation: 24.66
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

Lankelma Project Ref: P-107284-10

TEST ID: CPTP8A04A



Cone area (mm²):1500
Cone ID: S15-CFIPT.1768
Operator: Phillip Case
Date of test: 25/09/2019 12:39:00

Location: Cheshire, UK
Coordinates: 355075.308, 390661.689
Elevation: 23.704
Coordinate system:

Both drained and undrained parameters are calculated for mixed SBTs = I_c 2.40-2.70. See report section 'Drained and Undrained Behaviour' for discussion.
See report section 'Interpretive Data' for methods and discussion of parameter evaluation.

Date of plot: 03-01-20
Checked by: Chris Player

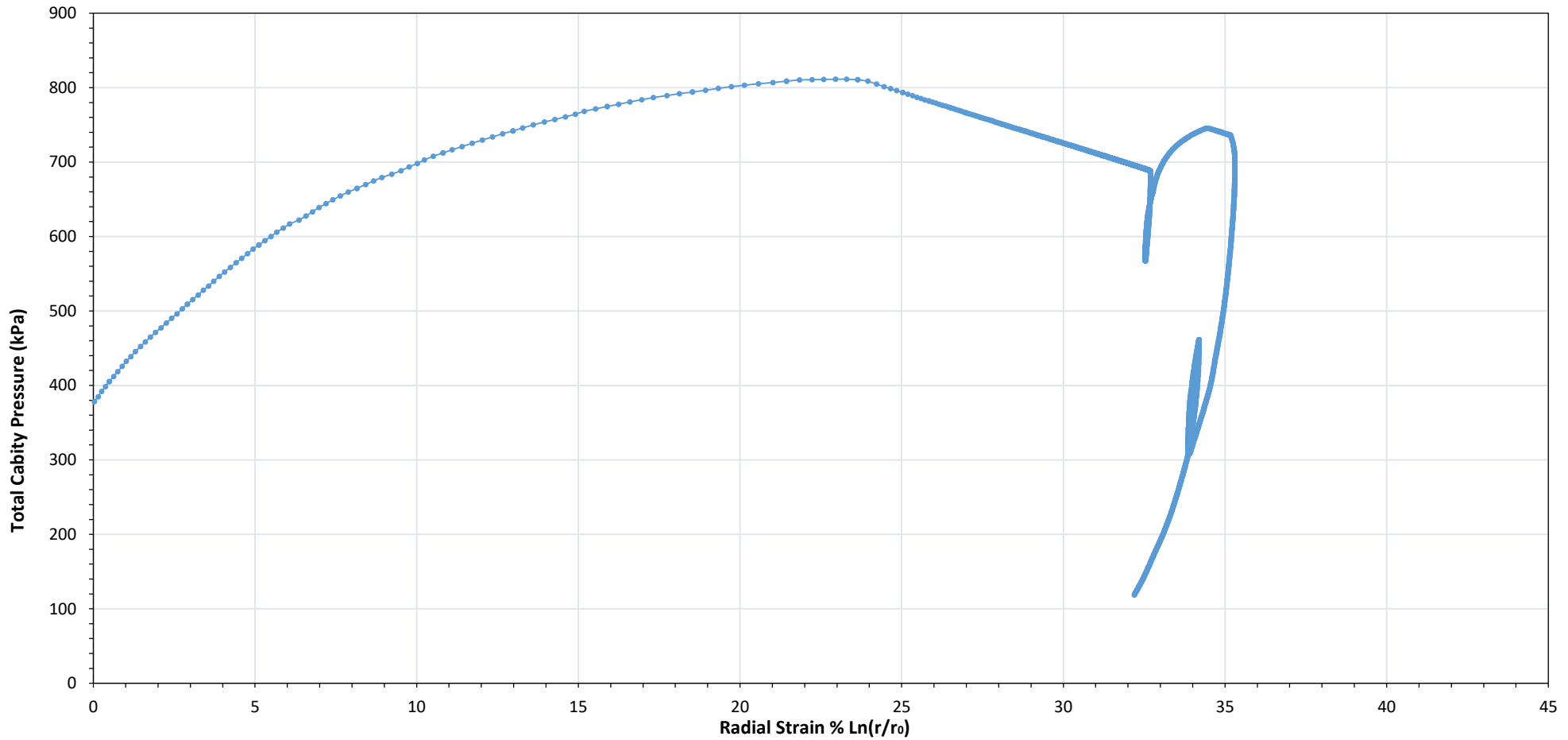
Lankelma Project Ref: P-107284-10

TEST ID: CPTP8B01

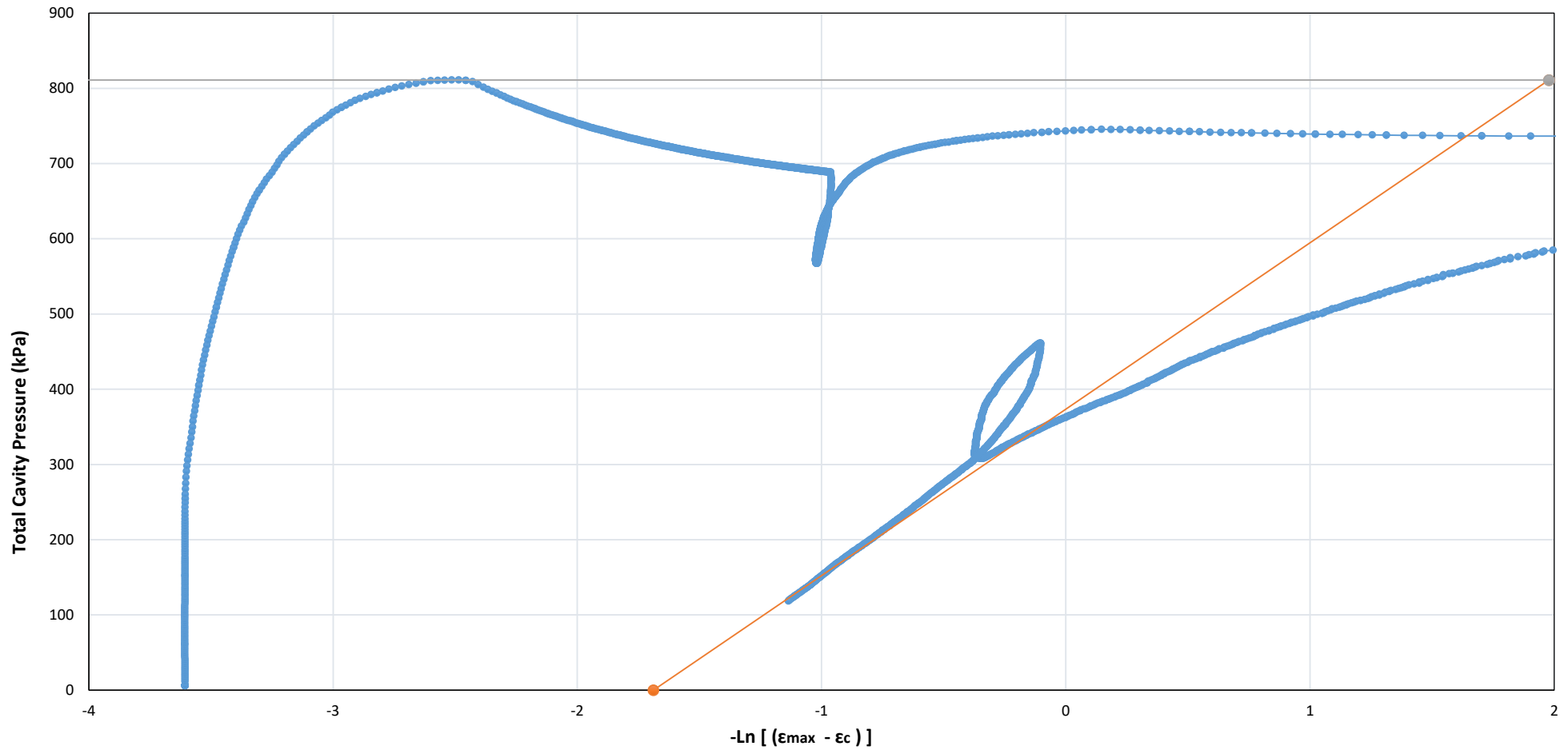
APPENDIX F PRESSUREMETER TEST RESULTS**LIST OF FIGURES:**

Location ID	Depth (m)
CPTP8A01	2.00
CPTP8A01	4.00
CPTP8A03	3.00
CPTP8A03	6.42
CPTP8A04A	2.50
CPTP8A04A	4.50
CPTP8B01	2.75
CPTP8B01	3.50
CPTP8B01	4.20
CPTP8B01	5.50

Pressuremeter Test - Total Pressure with Radial Strain



Project Ref: 107284	Test Engineer: JH	Unload-reload Loops: 2	Location ID: CTP8A01
Client: Geotechnics	Date: 27/09/2019	Drainage behaviour: Undrained	Depth: 2 m
Client Ref:		Test type: FDPM	Comments:
Location: Warrington, UK		Duration: 42 mins	

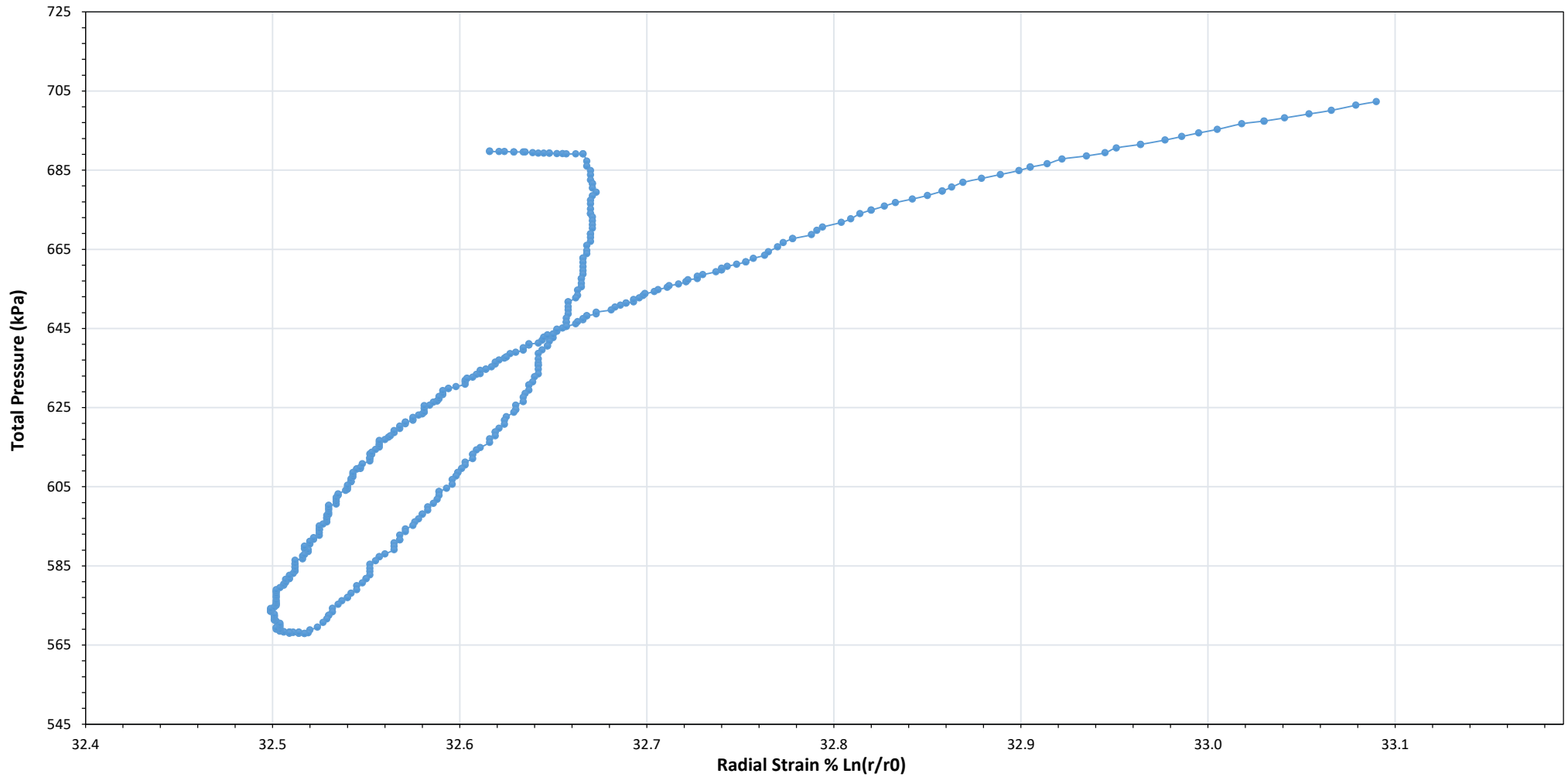


Project Ref: 107284
Client: Geotechnics
Client Ref:
Location: Warrington, UK

Shear strength S_u : 111 kPa
Drainage behaviour: Undrained

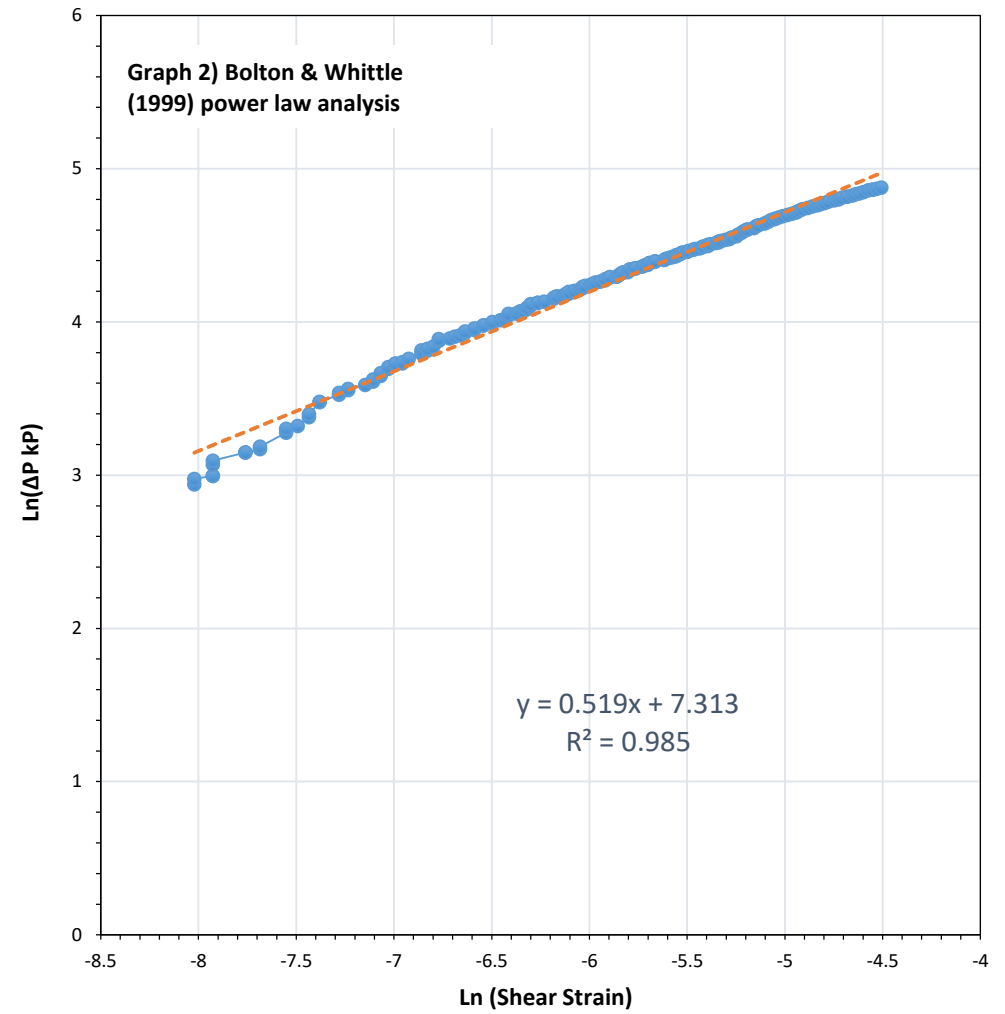
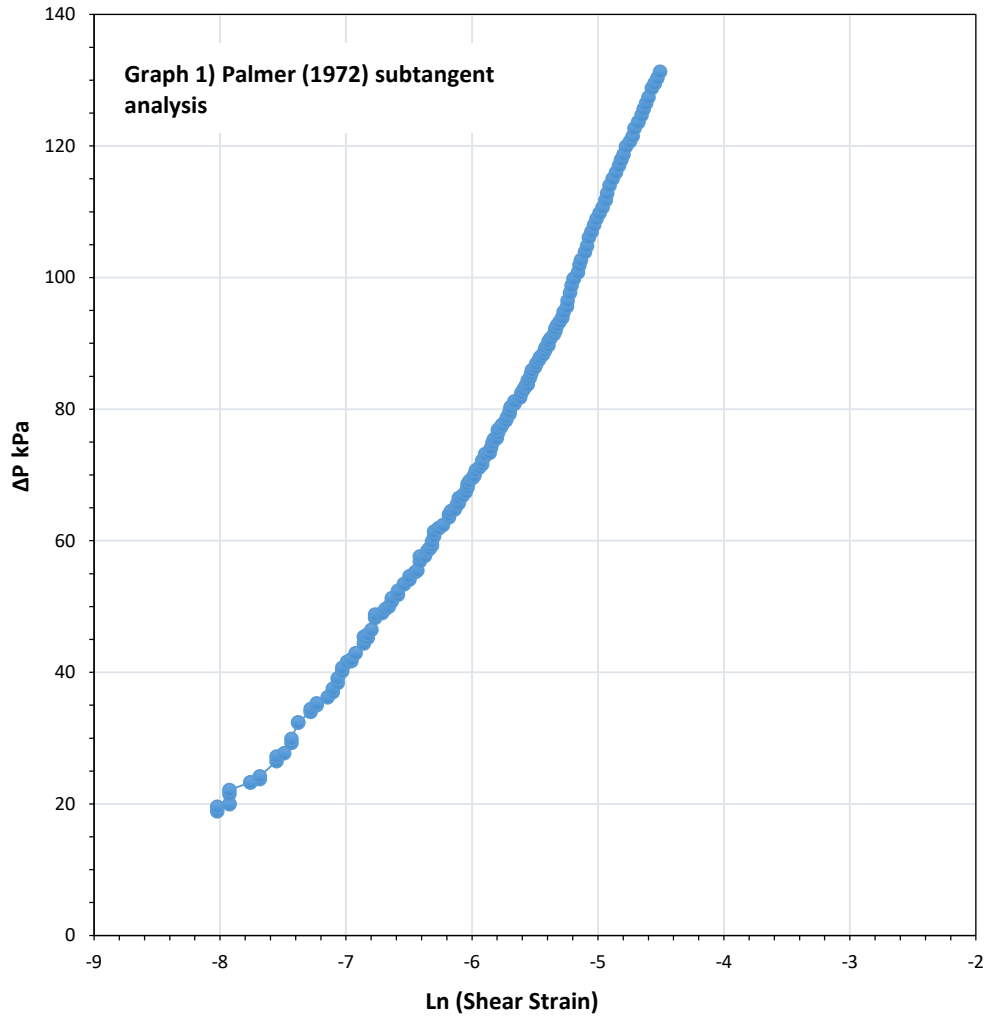
Location ID: CTP8A01
Depth: 2 m
Comments:

Loop 1 Total Pressure with Radial Cavity Strain



Project Ref: 107284	Drainage behaviour: Undrained	Shear modulus Gur: 2499.2 MPa	Location ID: CTP8A01
Client: Geotechnics	Test type: FDPM	Cavity strain range: 0.09 %	Depth: 2 m
Client Ref:	Loop duration: 7.2 mins	Comments:	
Location: Warrington, UK			

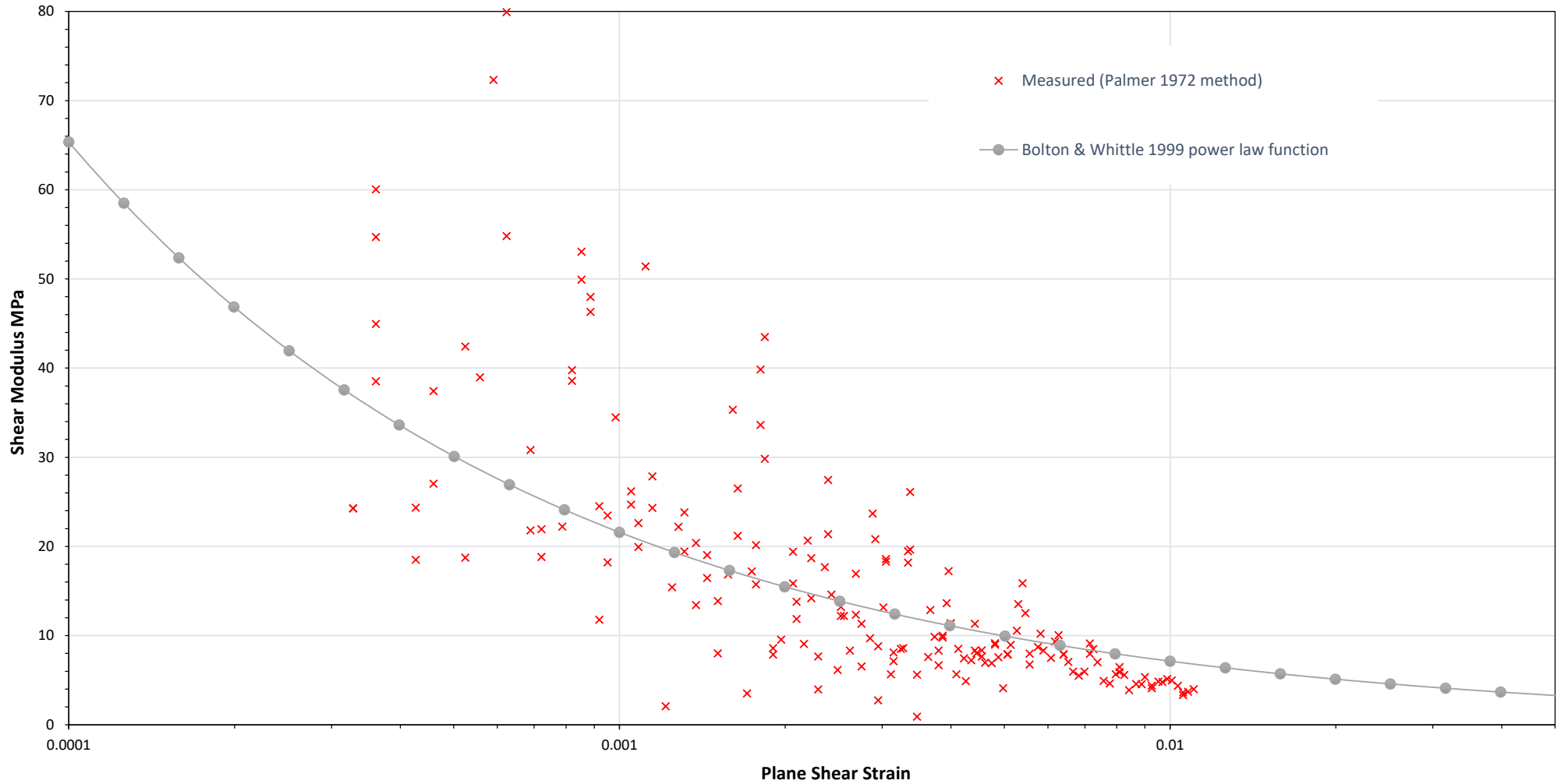
Loop 1 Non-Linear Stress-Strain Analysis



Project Ref: 107284	Obtained Power Law Parameters (right hand side graph)	Location ID: CPTP8A01
Client: Geotechnics	Non-linearity exponent (β) (gradient): 0.519	Depth: 2 m
Client Ref:	Intercept (η): 1.5 MPa	Comments:
Location: Warrington, UK	Shear stress constant α ($\beta \cdot \eta$): 0.779 MPa	

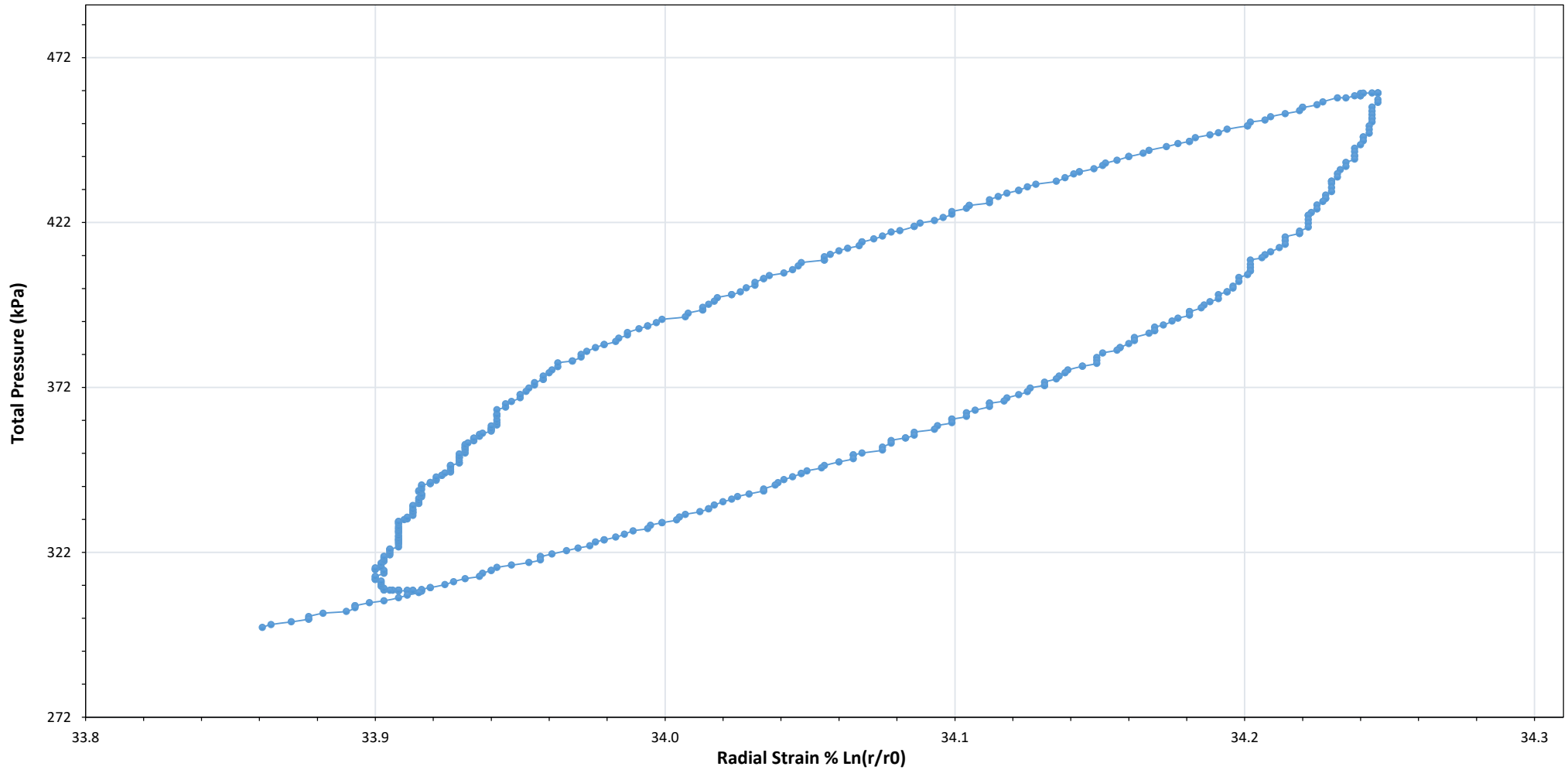


Loop 1 Non-Linear Analysis - Secant Shear Modulus with Plane Shear Strain



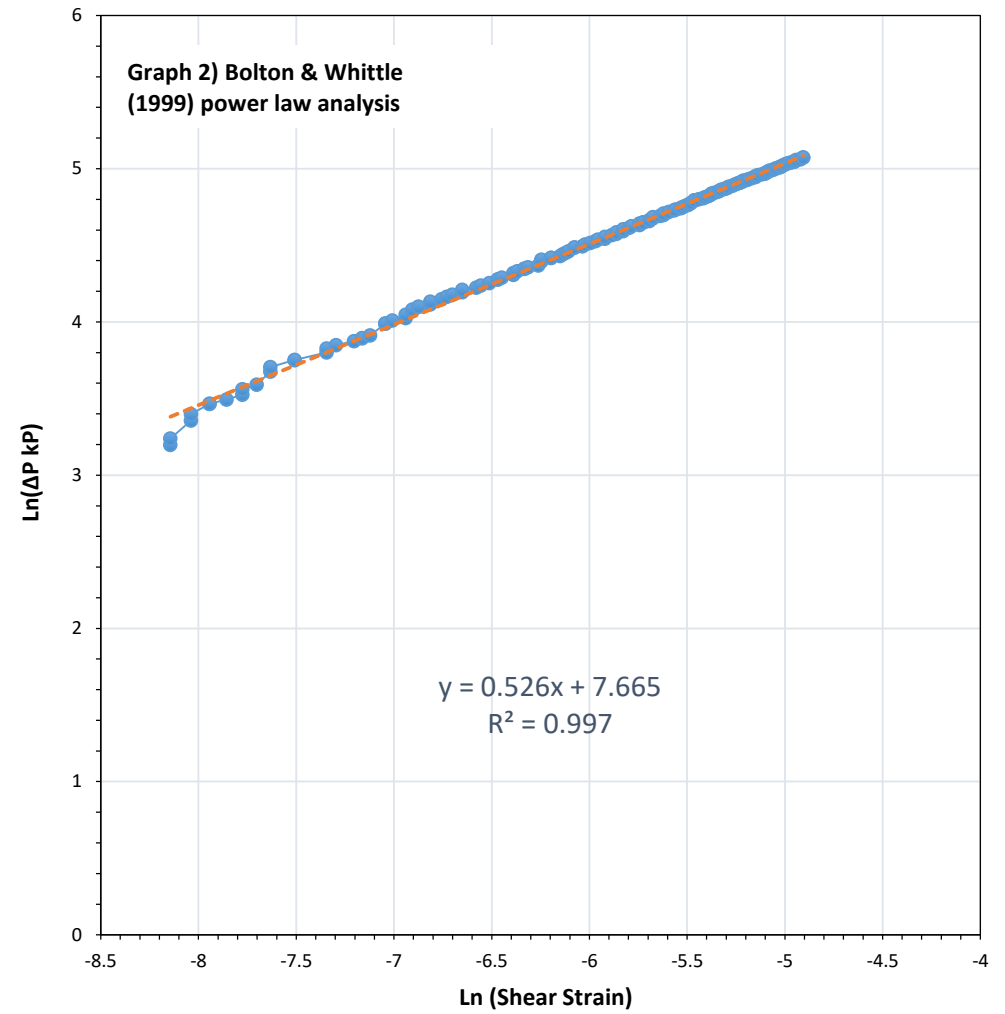
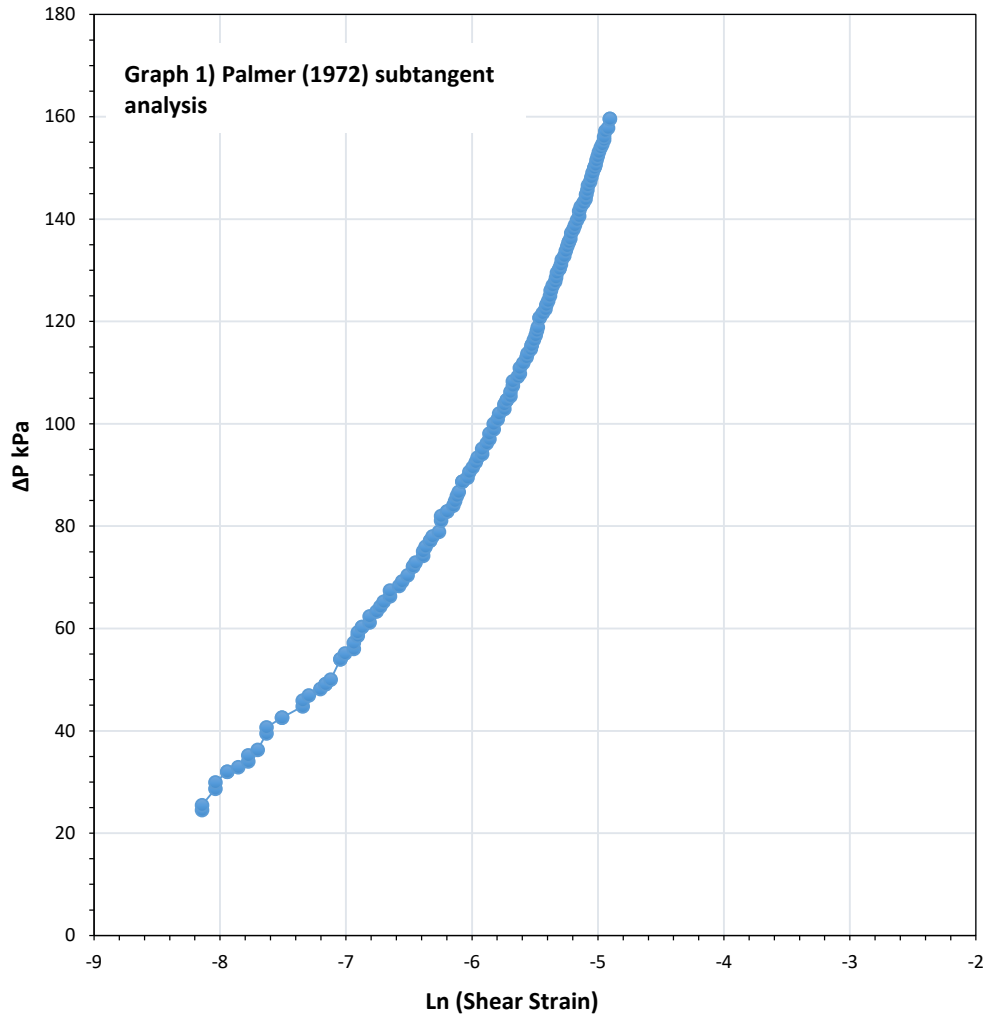
Project Ref: 107284	Bolton & Whittle 1999 power law parameters applied	Location ID: CPTP8A01
Client: Geotechnics	Non-linearity exponent (β): 0.519	Depth: 2 m
Client Ref:	Intercept (η): 1.5 MPa	Comments:
Location: Warrington, UK	Shear stress constant $\alpha = (\beta \cdot \eta)$: 0.779 MPa	

Loop 2 Total Pressure with Radial Cavity Strain



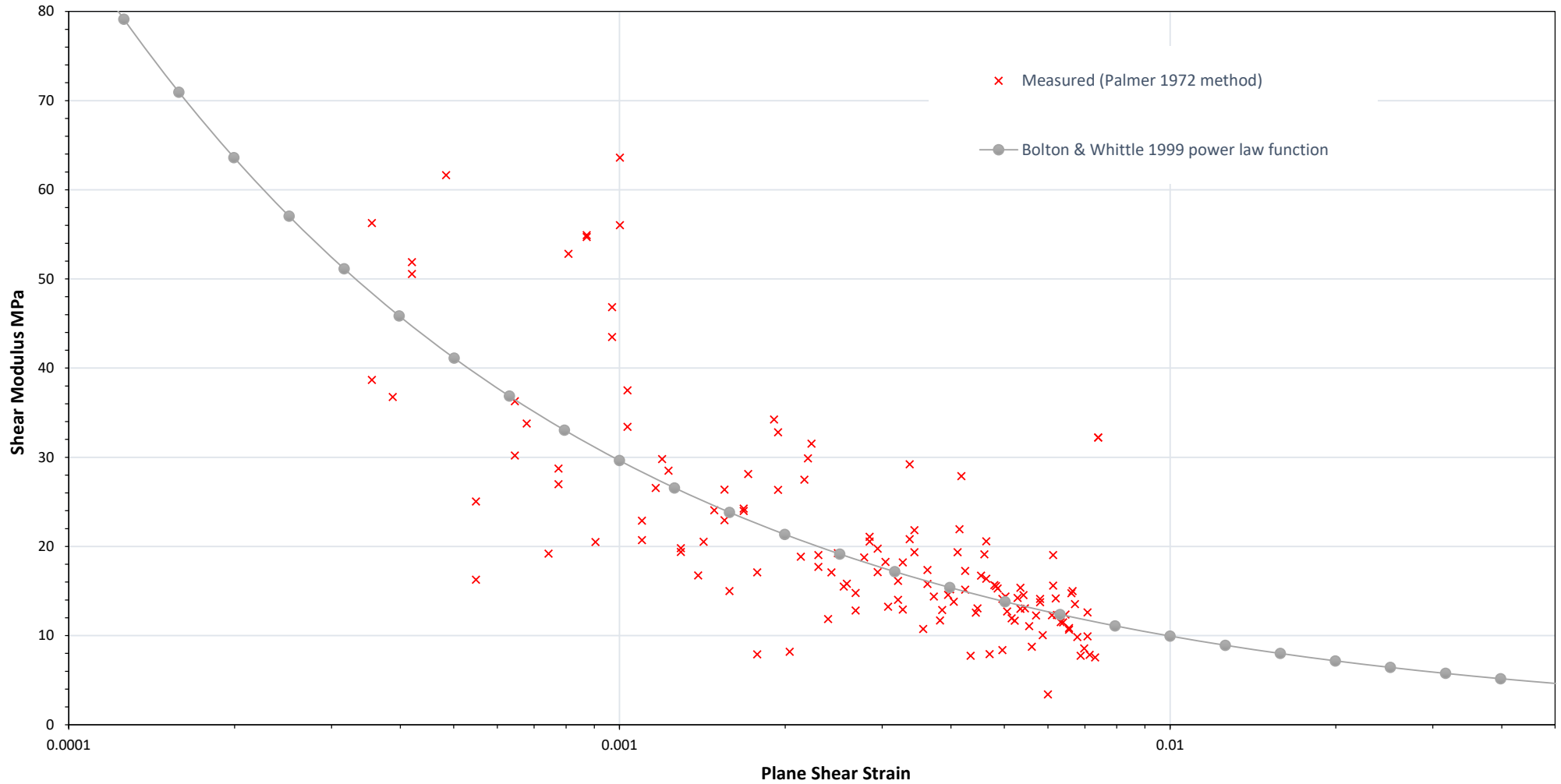
Project Ref: 107284	Drainage behaviour: Undrained	Shear modulus G_{ur}: 2065.4 MPa	Location ID: CPTP8A01
Client: Geotechnics	Test type: FDPM	Cavity strain range: 0.21 %	Depth: 2 m
Client Ref:	Loop duration: 7.4 mins		Comments:
Location: Warrington, UK			

Loop 2 Non-Linear Stress-Strain Analysis



Project Ref: 107284	Obtained Power Law Parameters (right hand side graph)	Location ID: CPTP8A01
Client: Geotechnics	Non-linearity exponent (β) (gradient): 0.526	Depth: 2 m
Client Ref:	Intercept (η): 2.132 MPa	Comments:
Location: Warrington, UK	Shear stress constant α ($\beta \cdot \eta$): 1.121 MPa	

Loop 2 Non-Linear Analysis - Secant Shear Modulus with Plane Shear Strain



Project Ref: 107284	<u>Bolton & Whittle 1999 power law parameters applied</u>	Location ID: CPTP8A01
Client: Geotechnics	Non-linearity exponent (β): 0.526	Depth: 2 m
Client Ref:	Intercept (η): 2.132 MPa	Comments:
Location: Warrington, UK	Shear stress constant $\alpha = (\beta \cdot \eta)$: 1.121 MPa	