



TEST CERTIFICATE

Newark Road Peterborough
 t: 01733 566566
 e: admin@groundengineering.co.uk

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
 Wet Sieving Method

Client: Ground Engineering Ltd
 Client Address: Newark Road
 Peterborough
 PE1 5UA

Certificate Number: PL7512-1/27/710-2
 Client Reference: C15387
 Lab Job Number: PL7512-1
 Date Sampled: Unknown
 Date Received: 23.06.2021
 Date Tested: 14.07.2021

Contact: James Davies
 Site Name: Begbroke Science Park
 Site Address: Kidlington

Certificate of Sampling: N/A
 Sampling Certificate No.: N/A
 Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7512-1/27
 Client Reference: U1

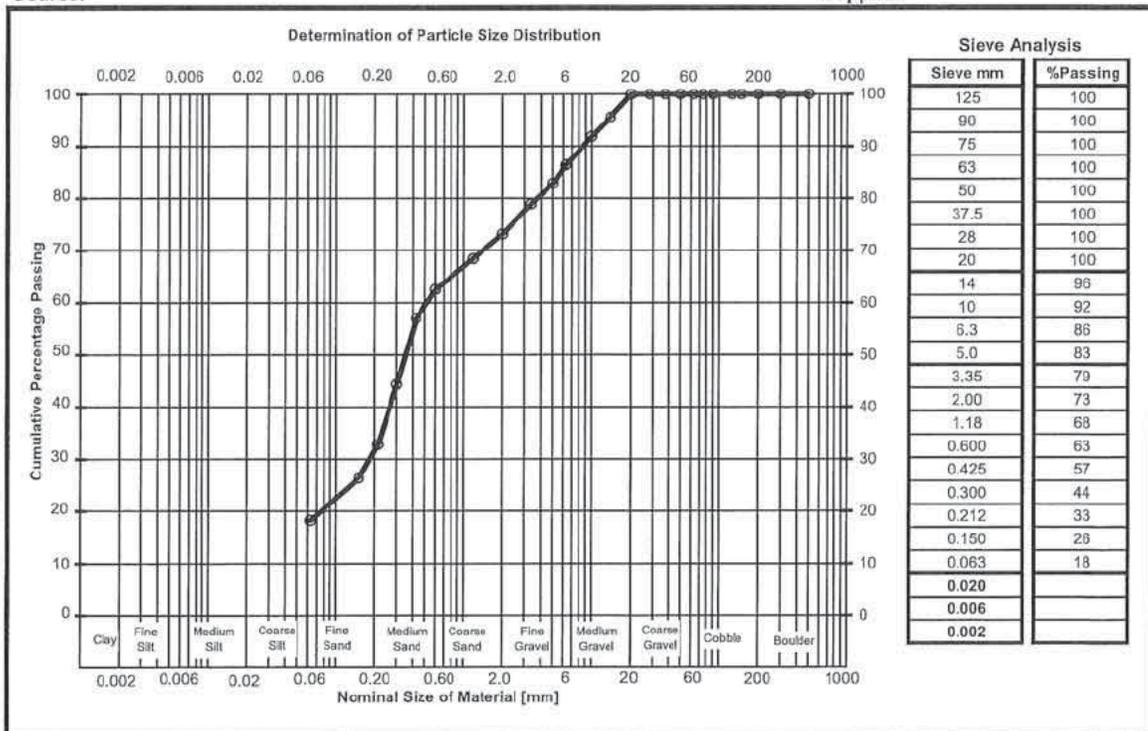
Pre-treatment for organic material: N/A

Sample Description:

Orange-brown slightly clayey slightly silty gravelly SAND with occasional roots <3mm in diameter. Gravel consists of sub-angular to rounded flint sandstone and ironstone.

Material Specification: Not Required
 Location: BH3
 Source:

Depth Top: 1.70m
 Depth Base: 1.90m
 Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed: [Redacted]

for and on behalf of Ground Engineering Ltd

Date Reported: 19.07.2021 Page 1 of 1
 Form Number: GELab/C/709-2 Version 56

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Registered in England & Wales
 Registration Number: 6929574
 Reg Office: Ground Engineering Ltd
 Newark Rd, Peterborough PE1 5UA



TEST CERTIFICATE

Newark Road Peterborough
t: 01733 566566
e: admin@groundengineering.co.uk

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7512-1/46/710-2
Client Reference: C15387
Lab Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 14.07.2021
Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

Contact: James Davies
Site Name: Begbroke Science Park
Site Address: Kidlington

TEST RESULTS

Laboratory Reference: PL7512-1/46
Client Reference: U1

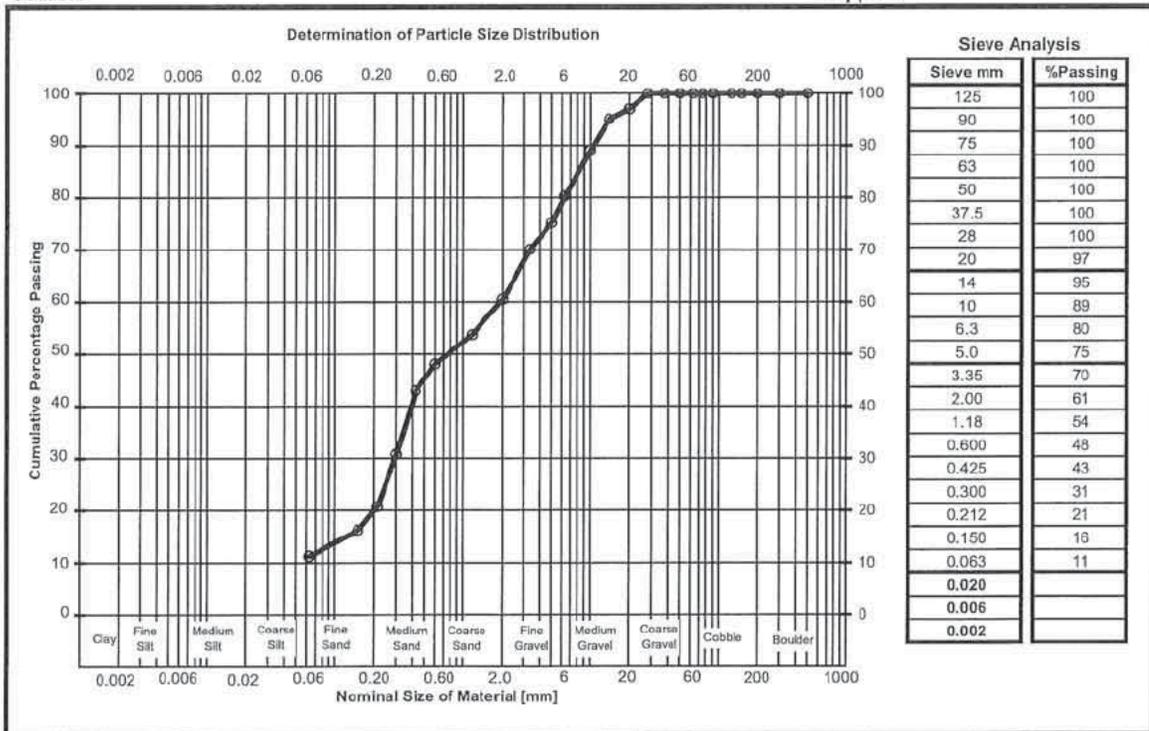
Pre-treatment for organic material: N/A

Sample Description:

Brown light brown slightly clayey slightly silty SAND and GRAVEL with occasional roots <2mm in diameter.
Gravel consists of angular to rounded flint siltstone sandstone and ironstone.

Material Specification: Not Required
Location: BH4
Source:

Depth Top: 1.20m
Depth Base: 2.20m
Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed: [Redacted]

for and on behalf of Ground Engineering Ltd

Date Reported: 19.07.2021 Page 1 of 1
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Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7512-1/54/710-2
Client Reference: C15387
Lab Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 14.07.2021

Contact: James Davies
Site Name: Begbroke Science Park
Site Address: Kidlington

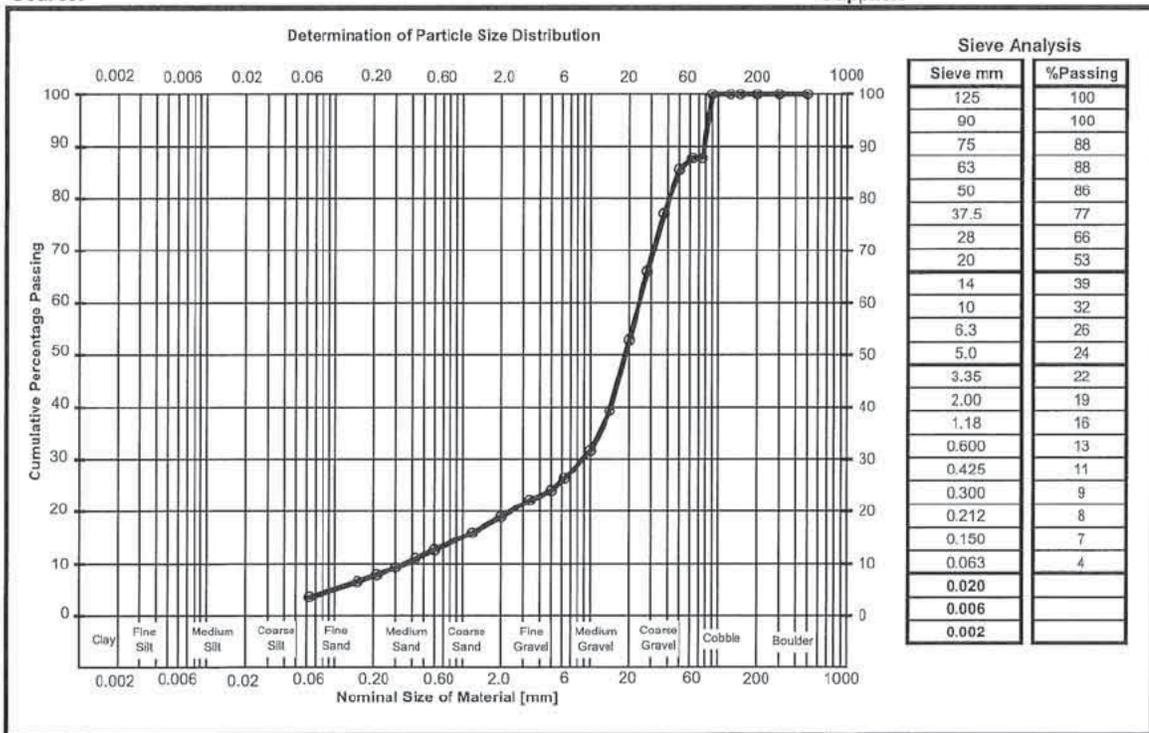
Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

TEST RESULTS Laboratory Reference: PL7512-1/54 Pre-treatment for organic material: N/A
Client Reference: B5

Sample Description: Orange-brown slightly clayey slightly silty sandy Gravel. Gravel consists of sub-angular to sub-rounded limestone sandstone and flint.

Material Specification: Not Required
Location: TP1
Source:

Depth Top: 3.50m
Depth Base: 3.70m
Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed: [Redacted Signature]

for and on behalf of Ground Engineering Ltd

Date Reported: 19.07.2021 Page 1 of 1
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Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7512-1/55/710-2
Client Reference: C15387
Lab Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 14.07.2021

Contact: James Davies
Site Name: Begbroke Science Park
Site Address: Kidlington

Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

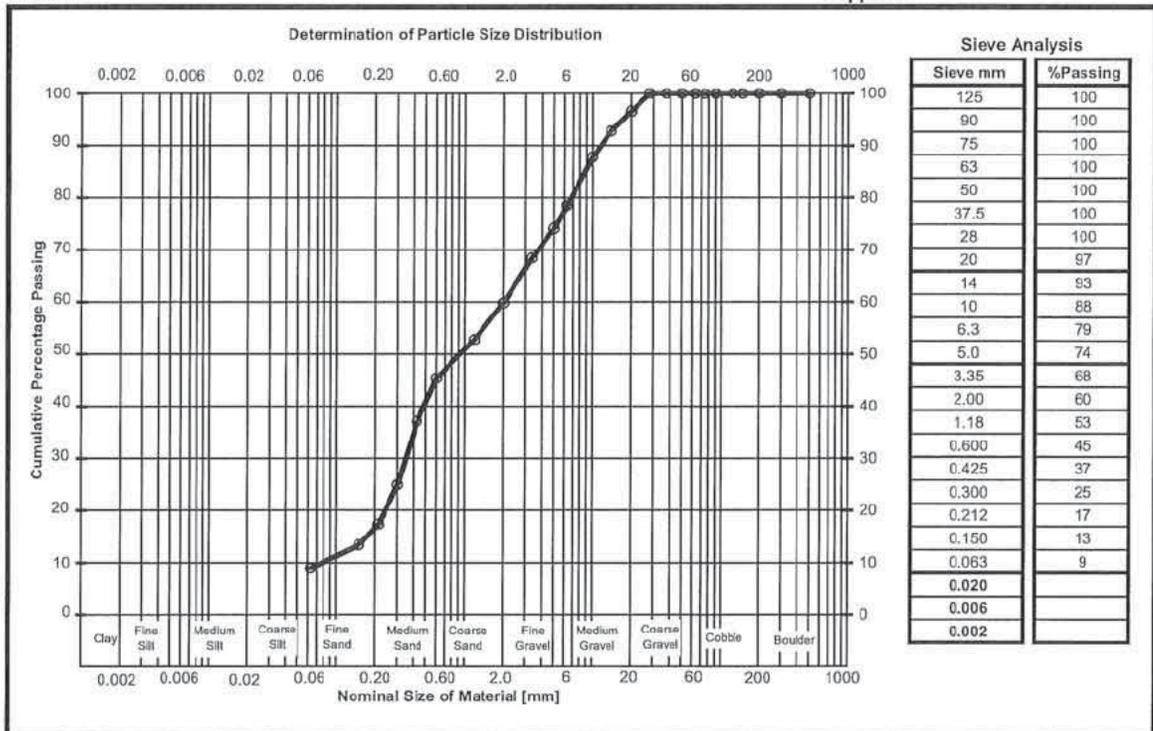
TEST RESULTS

Laboratory Reference: PL7512-1/55
Client Reference: B4
Pre-treatment for organic material: N/A
Brown clayey silty SAND and GRAVEL. Gravel consists of angular to sub-rounded flint and sandstone.

Sample Description:

Material Specification: Not Required
Location: TP2
Source:

Depth Top: 2.10m
Depth Base: 2.30m
Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed: [Redacted]

for and on behalf of Ground Engineering Ltd

Date Reported: 19.07.2021 Page 1 of 1
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Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7512-1/56/710-2
Client Reference: C15387
Lab Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 14.07.2021

Contact: James Davies
Site Name: Begbroke Science Park
Site Address: Kidlington

Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7512-1/56
Client Reference: B4

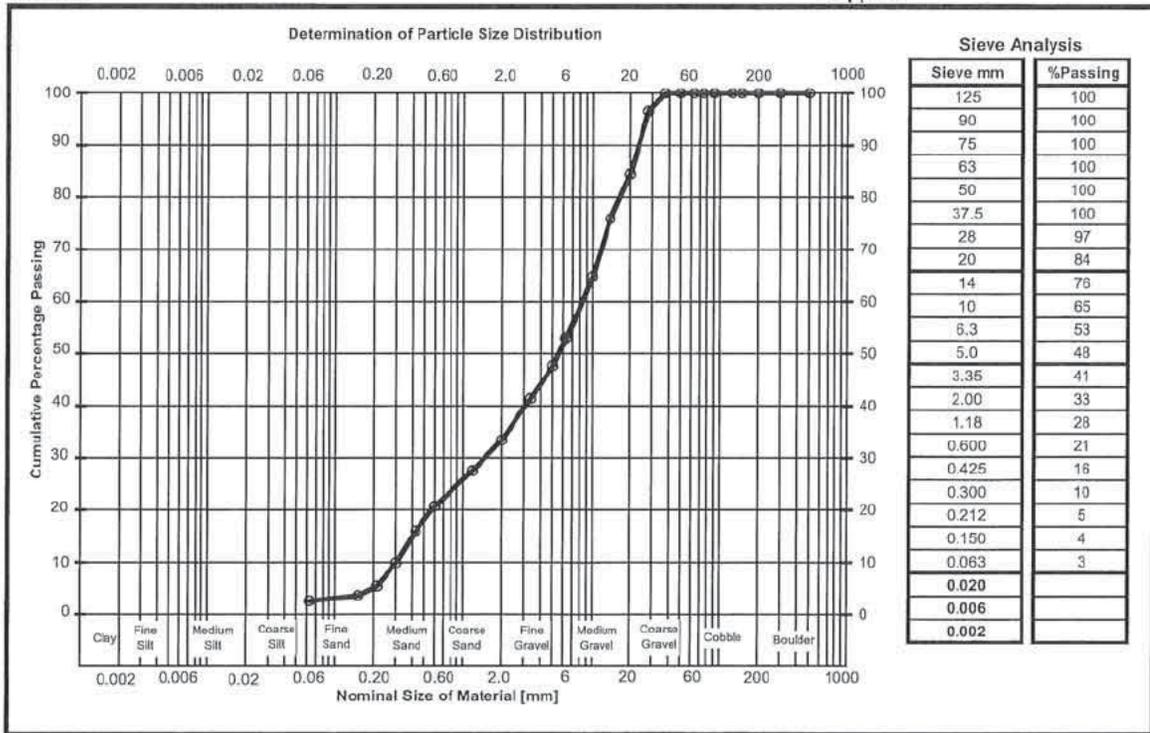
Pre-treatment for organic material: N/A

Sample Description:

Brown slightly clayey silty SAND and GRAVEL. Gravel consists of sub-angular to sub-rounded sandstone and flint.

Material Specification: Not Required
Location: TP5
Source:

Depth Top: 3.70m
Depth Base: 4.00m
Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed: [Redacted]

for and on behalf of Ground Engineering Ltd

Date Reported: 19.07.2021 Page 1 of 1
Form Number: GELab/C/709-2 Version 56

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TEST CERTIFICATE

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t: 01733 586566
e: admin@groundengineering.co.uk

Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7512-1/57/710-2
Client Reference: C15387
Lab Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 14.07.2021

Contact: James Davies
Site Name: Begbroke Science Park
Site Address: Kidlington

Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7512-1/57
Client Reference: B2

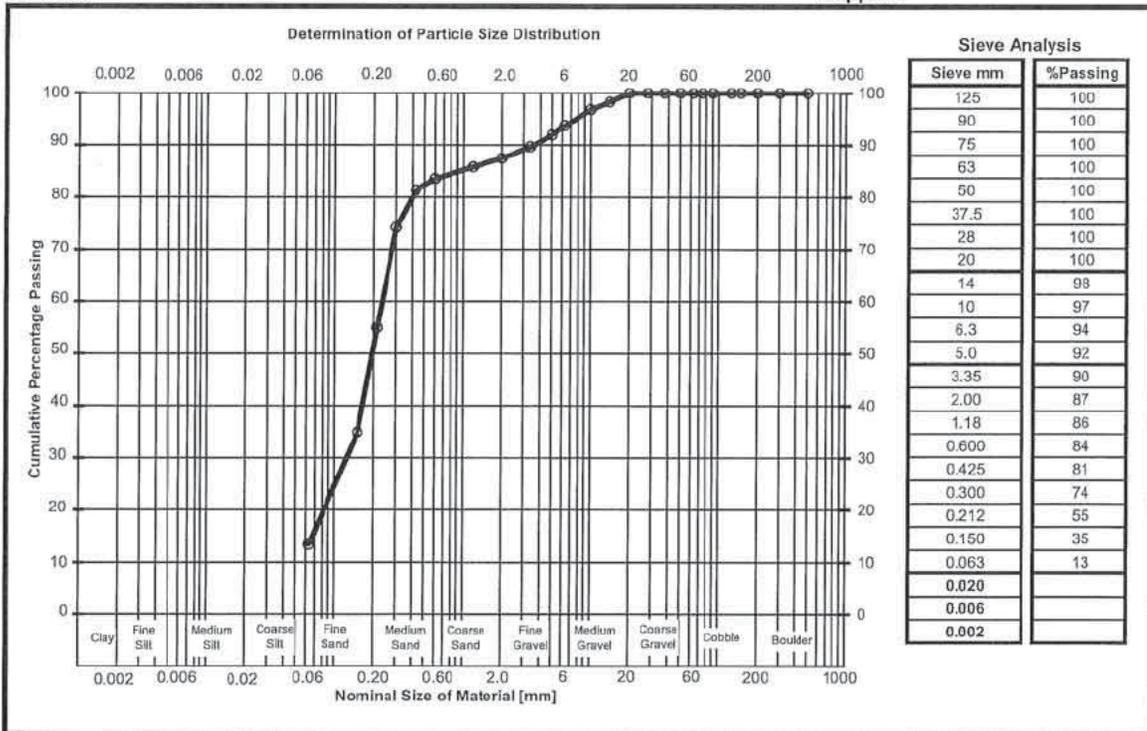
Pre-treatment for organic material: N/A

Sample Description:

Orange-brown silty gravelly SAND with rare roots <1mm in diameter. Gravel consists of sub-angular to rounded flint and sandstone.

Material Specification: Not Required
Location: TP6
Source:

Depth Top: 1.70m
Depth Base: 2.00m
Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed: [Redacted]

for and on behalf of Ground Engineering Ltd

Date Reported: 19.07.2021 Page 1 of 1
Form Number: GELab/C/709-2 Version 56

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Determination of Particle Size Distribution

Tested in Accordance with BS 1377-2: 1990: Clause 9.2
Wet Sieving Method

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
PE1 5UA

Certificate Number: PL7512-1/58/710-2
Client Reference: C15387
Lab Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 14.07.2021

Contact: James Davies
Site Name: Begbroke Science Park
Site Address: Kidlington

Certificate of Sampling: N/A
Sampling Certificate No.: N/A
Sampled By: Client

TEST RESULTS

Laboratory Reference: PL7512-1/58
Client Reference: B4

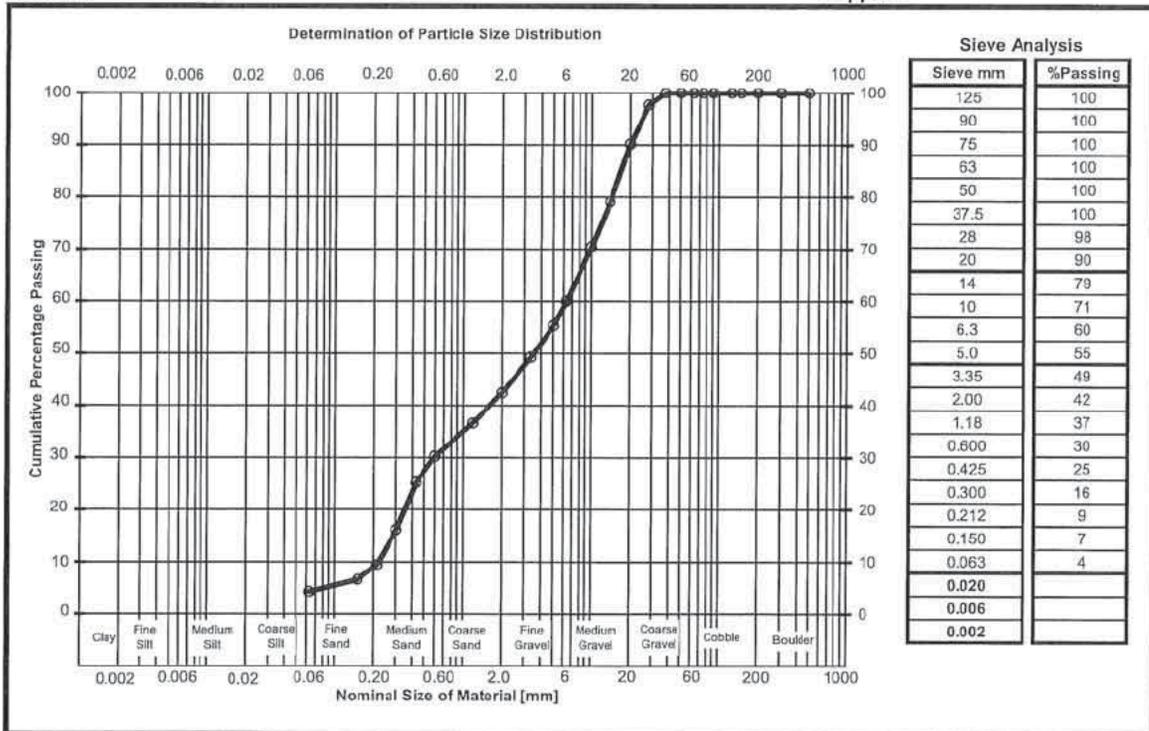
Pre-treatment for organic material: N/A

Sample Description:

Brown slightly clayey slightly silty SAND and GRAVEL with rare fossils and roots <1mm in diameter. Gravel consists of sub-angular to rounded sandstone and flint.

Material Specification: Not Required
Location: TP6
Source:

Depth Top: 3.40m
Depth Base: 3.60m
Supplier:



Comments:

Approved Signatory: M. Hartnup - Laboratory Manager

Signed: [Redacted Signature]

for and on behalf of Ground Engineering Ltd

Date Reported: 19.07.2021 Page 1 of 1
Form Number: GELab/C/709-2 Version 56

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Registered in England & Wales
Registration Number: 6929574
Reg Office: Ground Engineering Ltd
Newark Rd, Peterborough PE1 5UA

TEST CERTIFICATE**Determination of Uniaxial Compression Strength**

I.S.R.M. Suggested Methods 1981

Newark Road Peterborough

t: 01733 566566

e: admin@groundengineering.co.uk

Client: Ground Engineering Ltd
 Client Newark Road
 Address: Peterborough
 Cambs
 Postcode: PE1 5UA
 Contact: James Davies
 Site Name: Begbroke Science Park
 Site Address: Kidlington

Certificate Number: PL7512-1/5/408
 Client Reference Number: **C15387**
 Date Sampled: Unknown
 Date Received: 23.06.2021
 Date Tested: 21.07.2021
 Sampling Certificate No.: N/A
 Certificate of Sampling: N/A
 Sampled By: Client

Test Results:

Lab Reference PL7512-1/5
 Location: **BH1**
 Sample Description: Light grey dark grey LIMESTONE.

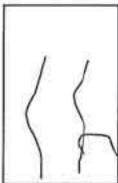
Sample Reference: **C1**
 Depth (m): **8.20 - 8.60**

Laboratory Temperature (°C): 22.0
 Testing Equipment: ELE AQR 2000

Specimen Details

Height (mm): 169.5
 Diameter (mm): 86.3
 Method of Preparation : I.S.R.M. Suggested Methods 1981

Applied Rate of Stress (kN/sec): **4.0**
 Bulk Density (Mg/m³): **2.48**
 Moisture Content (%): **N/A**
 Dry Density (Mg/m³): **N/A**

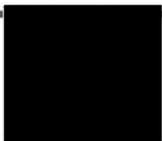
Failure Sketch

Mode of Failure: Axial

Variations from Standard: Specimen with length and diameter ratio outside 2.5-3.0 recommendation.

Stress Rate	4.0	kN/sec
Failure Time	0.48	Min/Sec
Uniaxial Compressive Strength	18.38	MN/m ²

Approved Signatory: M.Hartnup - Laboratory Manager
 L.Petch - Team Leader

Signed: 

for and on behalf of
 Ground Engineering Ltd

Date Reported: 21/07/2021

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 Newark Rd, Peterborough
 PE1 5UA

TEST CERTIFICATE

Newark Road Peterborough

t: 01733 566566

e: admin@groundengineering.co.uk

Determination of Uniaxial Compression Strength

I.S.R.M. Suggested Methods 1981

Client: Ground Engineering Ltd
 Client Newark Road
 Address: Peterborough
 Cambs
 Postcode: PE1 5UA
 Contact: James Davies
 Site Name: Begbroke Science Park
 Site Address: Kidlington

Certificate Number: PL7512-1/17/408
 Client Reference Number: **C15387**
 Date Sampled: Unknown
 Date Received: 23.06.2021
 Date Tested: 21.07.2021
 Sampling Certificate No.: N/A
 Certificate of Sampling: N/A
 Sampled By: Client

Test Results:

Lab Reference PL7512-1/17
 Location: **BH1**
 Sample Description: Light grey dark grey LIMESTONE.

Sample Reference: **C9**
 Depth (m): **19.80 - 20.20**

Laboratory Temperature (°C): 22.0
 Testing Equipment: ELE AQR 2000

Specimen Details

Height (mm): 177.6
 Diameter (mm): 86.5
 Method of Preparation : I.S.R.M. Suggested Methods 1981

Applied Rate of Stress (kN/sec): **4.0**
 Bulk Density (Mg/m³): **2.39**
 Moisture Content (%): **N/A**
 Dry Density (Mg/m³): **N/A**

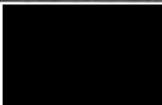
Failure Sketch

Mode of Failure: Axial

Variations from Standard: Specimen with length and diameter ratio outside 2.5-3.0 recommendation.

Stress Rate	4.0	kN/sec
Failure Time	0.58	Min/Sec
Uniaxial Compressive Strength	25.49	MN/m ²

Approved Signatory: M.Hartnup - Laboratory Manager
 L.Petch - Team Leader

Signed: 

Date Reported: 21/07/2021

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for and on behalf of
 Ground Engineering Ltd

Registered in England and Wales
 Reg No. 6929574
 Reg Office: Ground Engineering Ltd
 Newark Rd, Peterborough
 PE1 5UA

TEST CERTIFICATE**Determination of Uniaxial Compression Strength**

I.S.R.M. Suggested Methods 1981

Newark Road Peterborough

t: 01733 566566

e: admin@groundengineering.co.uk

Client: Ground Engineering Ltd
 Client Newark Road
 Address: Peterborough
 Cambs
 Postcode: PE1 5UA
 Contact: James Davies
 Site Name: Begbroke Science Park
 Site Address: Kidlington

Certificate Number: PL7512-1/33/408
 Client Reference Number: **C15387**
 Date Sampled: Unknown
 Date Received: 23.06.2021
 Date Tested: 21.07.2021
 Sampling Certificate No.: N/A
 Certificate of Sampling: N/A
 Sampled By: Client

Test Results:

Lab Reference PL7512-1/33
 Location: **BH3**
 Sample Grey dark grey LIMESTONE.
 Description:

Sample Reference: **C2**
 Depth (m): **9.00 - 9.40**

Laboratory Temperature (°C): 22.0
 Testing Equipment: ELE AQR 2000

Specimen Details

Height (mm): 188.4
 Diameter (mm): 86.4
 Method of Preparation : I.S.R.M. Suggested Methods 1981

Applied Rate of Stress (kN/sec): **4.0**
 Bulk Density (Mg/m³): **2.41**
 Moisture Content (%): **N/A**
 Dry Density (Mg/m³): **N/A**

Failure Sketch

Mode of Failure: Axial

Variations from Standard: Specimen with length and diameter ratio outside 2.5-3.0 recommendation.

Stress Rate	4.0	kN/sec
Failure Time	0.47	Min/Sec
Uniaxial Compressive Strength	17.31	MN/m ²

Approved M.Hartnup - Laboratory Manager
 Signatory: L.Petch - Team Leader

Signed:



Date Reported: 21/07/2021

for and on behalf of
 Ground Engineering Ltd

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 Reg No. 6929574
 Reg Office: Ground Engineering Ltd
 Newark Rd, Peterborough
 PE1 5UA

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Determination of Uniaxial Compression Strength

I.S.R.M. Suggested Methods 1981

Client: Ground Engineering Ltd
 Client Newark Road
 Address: Peterborough
 Cambs
 Postcode: PE1 5UA
 Contact: James Davies
 Site Name: Begbroke Science Park
 Site Address: Kidlington

Certificate Number: PL7512-1/42/408
 Client Reference Number: **C15387**
 Date Sampled: Unknown
 Date Received: 23.06.2021
 Date Tested: 21.07.2021
 Sampling Certificate No.: N/A
 Certificate of Sampling: N/A
 Sampled By: Client

Test Results:

Lab Reference PL7512-1/42
 Location: **BH3**
 Sample Light grey LIMESTONE.
 Description:

Sample Reference: **C7**
 Depth (m): **17.10 - 17.50**

Laboratory Temperature (^oC): 22.0
 Testing Equipment: ELE AQR 2000

Specimen Details

Height (mm): 190.7
 Diameter (mm): 86.5
 Method of Preparation : I.S.R.M. Suggested Methods 1981

Applied Rate of Stress (kN/sec): **4.0**
 Bulk Density (Mg/m³): **2.52**
 Moisture Content (%): **N/A**
 Dry Density (Mg/m³): **N/A**

Failure Sketch

Mode of Failure: Axial

Variations from Standard: Specimen with length and diameter ratio outside 2.5-3.0 recommendation.

Stress Rate	4.0	kN/sec
Failure Time	1.14	Min/Sec
Uniaxial Compressive Strength	44.02	MN/m ²

Approved M.Hartnup - Laboratory Manager
 Signatory: L.Petch - Team Leader

Signed:

Date Reported: 21/07/2021

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 Reg Office: Ground Engineering Ltd
 Newark Rd, Peterborough
 PE1 5UA

TEST CERTIFICATE

Determination of Point Load Test Index

Newark Road, Peterborough,
PE1 5UA
Tel:01733 566566
admin@groundengineering.co.uk

Tested in Accordance with Broch & Franklin (1972) & ISRM (1985) Methodology

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
Cams
PE1 5UA
Contact: James Davies

Certificate Number: PL7512-1/1/400

Client Reference: C15387
Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 16.07.2021

Site Name: Begbroke Science Park
Site Address: Kidlington

Certificate of Sampling: N/A
Sampled By: Client

Test Results: Laboratory Reference:

Lab Reference	Sample Reference	Depth (m)	Description	Test Type	Is(50)	UCS (MN/m ²)
PL7512-1/6	BH1 C2	8.75 - 9.25	Dark grey shelly LIMESTONE.	Axial	0.69	10
PL7512-1/6	BH1 C2	8.75 - 9.25	Light grey LIMESTONE.	Irregular	2.34	35
PL7512-1/7	BH1 C3	10.80 - 11.20	Grey dark grey light grey LIMESTONE.	Axial	0.87	13
PL7512-1/9	BH1 C4	11.90 - 12.30	Grey light grey LIMESTONE.	Axial	3.76	56
PL7512-1/15	BH1 C8	18.30 - 18.70	Light grey light brown LIMESTONE.	Axial	3.61	54
PL7512-1/16	BH1 C9	18.70 - 19.40	Light grey light brown LIMESTONE.	Axial	1.23	18
PL7512-1/22	BH2 C1	8.20 - 8.40	Grey dark grey slightly shelly LIMESTONE.	Axial	4.16	62
PL7512-1/23	BH2 C2	8.70 - 9.00	Grey dark grey LIMESTONE.	Axial	4.37	66
PL7512-1/24	BH2 C2	9.40 - 9.70	Grey light grey LIMESTONE.	Axial	1.12	17
PL7512-1/25	BH2 C2	10.00 - 10.20	Light grey dark grey LIMESTONE.	Axial	3.61	54
PL7512-1/31	BH3 C1	7.50 - 8.00	Grey dark grey LIMESTONE.	Axial	2.35	35
PL7512-1/32	BH3 C1	8.30 - 8.70	Grey shelly LIMESTONE.	Axial	1.78	27
PL7512-1/34	BH3 C2	9.60 - 10.20	Grey dark grey light grey LIMESTONE.	Axial	0.52	7.8
PL7512-1/36	BH3 C3	11.10 - 11.20	Grey light grey LIMESTONE.	Axial	3.95	59
PL7512-1/37	BH3 C4	12.00 - 12.10	Grey dark grey light grey LIMESTONE>	Axial	0.91	14

Comments: U C S (MN/m²) value has been calculated using a K factor, = 15

Approved Signatory: [x] M. Hartnup Laboratory Manager
[] L. Petch Team Leader

Signed:



for and on behalf of Ground Engineering Ltd

Date Reported: 19 July 2021 Page 1 of 2
Form Number: Form Number GELab/C/401 Issue 2

Registered in England & Wales
Registration Number 692574
Reg Office Ground Engineering Ltd
Newark Rd Peterborough PE1 5UA

TEST CERTIFICATE

Determination of Point Load Test Index

Newark Road, Peterborough,
PE1 5UA
Tel:01733 566566
admin@groundengineering.co.uk

Tested in Accordance with Broch & Franklin (1972) & ISRM (1985) Methodology

Client: Ground Engineering Ltd
Client Address: Newark Road
Peterborough
Cambs
PE1 5UA
Contact: James Davies
Site Name: Begbroke Science Park
Site Address: Kidlington

Certificate Number: PL7512-1/1/400
Client Reference: C15387
Job Number: PL7512-1
Date Sampled: Unknown
Date Received: 23.06.2021
Date Tested: 16.07.2021
Certificate of Sampling: N/A
Sampled By: Client

Test Results: Laboratory Reference:

Lab Reference	Sample Reference	Depth (m)	Description	Test Type	Is(50)	UCS (MN/m ²)
PL7512-1/40	BH3 C6	15.50 - 15.80	Grey light grey LIMESTONE.	Axial	3.46	52
PL7512-1/43	BH3 C8	17.70 - 18.10	Grey light grey LIMESTONE.	Axial	2.18	33
PL7512-1/44	BH3 C8	18.10 - 18.60	Light brown grey LIMESTONE.	Axial	0.77	11
PL7512-1/50	BH4 C2	8.20 - 8.50	Light grey LIMESTONE.	Axial	6.17	92
PL7512-1/51	BH1 C8	8.70 - 9.00	Grey dark grey shelly LIMESTONE.	Axial	3.20	48
PL7512-1/52	BH1 C9	9.00 - 9.50	Grey light grey LIMESTONE.	Axial	1.03	15
PL7512-1/53	BH2 C1	9.75 - 10.00	Grey dark grey light grey LIMESTONE.	Axial	0.57	8.6
PL7512-1/45	BH2 C2	18.90 - 19.10	Dark grey LIMESTONE.	Diametral	1.68	25
PL7512-1/45	BH2 C2	18.90 - 19.10	Dark grey LIMESTONE.	Irregular	1.55	23

Comments: U C S (MN/m²) value has been calculated using a K factor, = 15

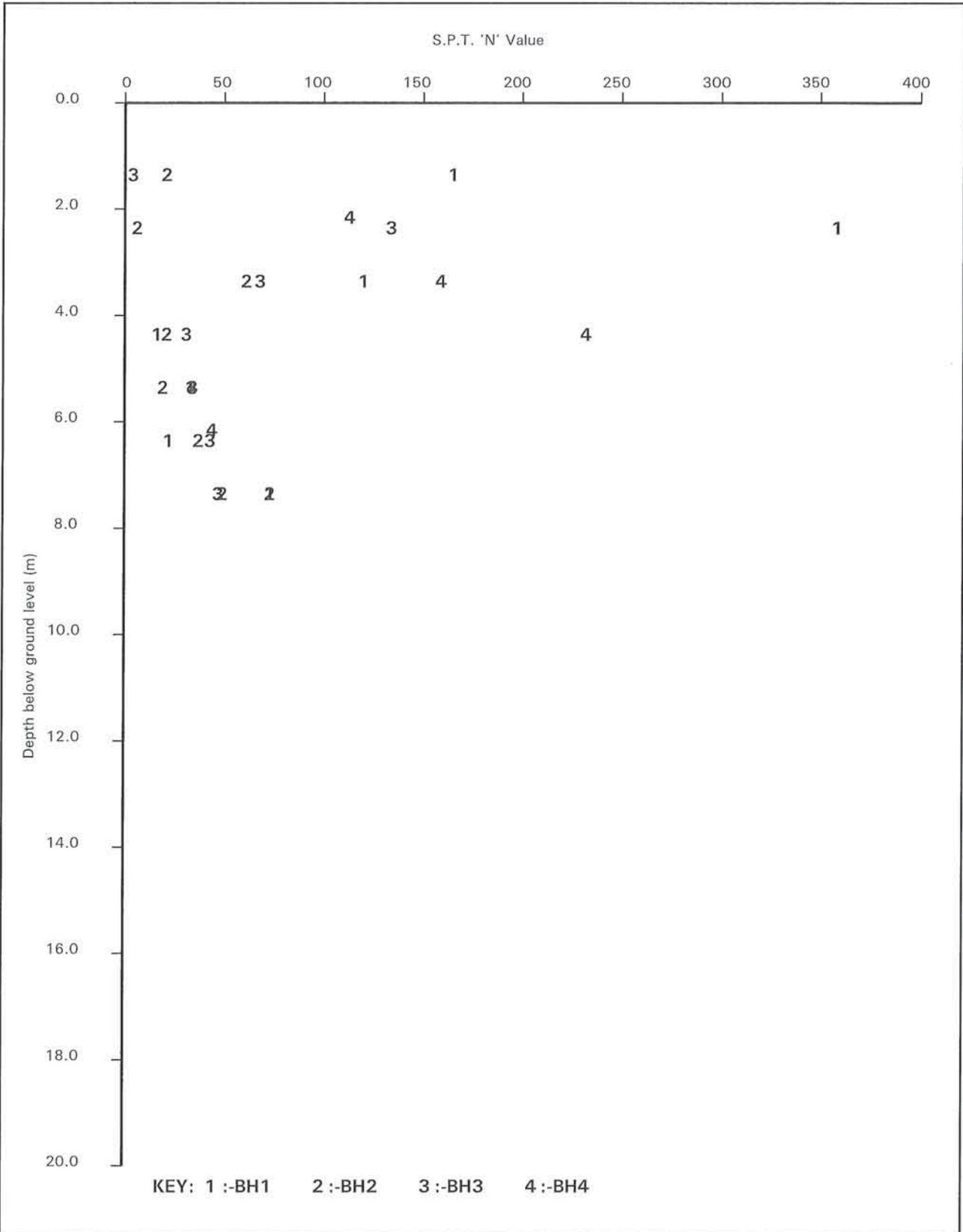
Approved Signatory: [x] M. Hartnup Laboratory Manager
[] L. Petch Team Leader

Signed: 

for and on behalf of Ground Engineering Ltd

Date Reported: 19 July 2021 Page 2 of 2
Form Number: Form Number GELab/C/401 Issue 2

Registered in England & Wales
Registration Number 692574
Reg Office Ground Engineering Ltd
Newark Rd Peterborough PE1 5UA



S.P.T. 'N' Value vs Depth below ground level (m).

SITE

BEGBROKE SCIENCE PARK, KIDLINGTON

CLIENT

OXFORD UNIVERSITY DEVELOPMENT

Contract Number 15387

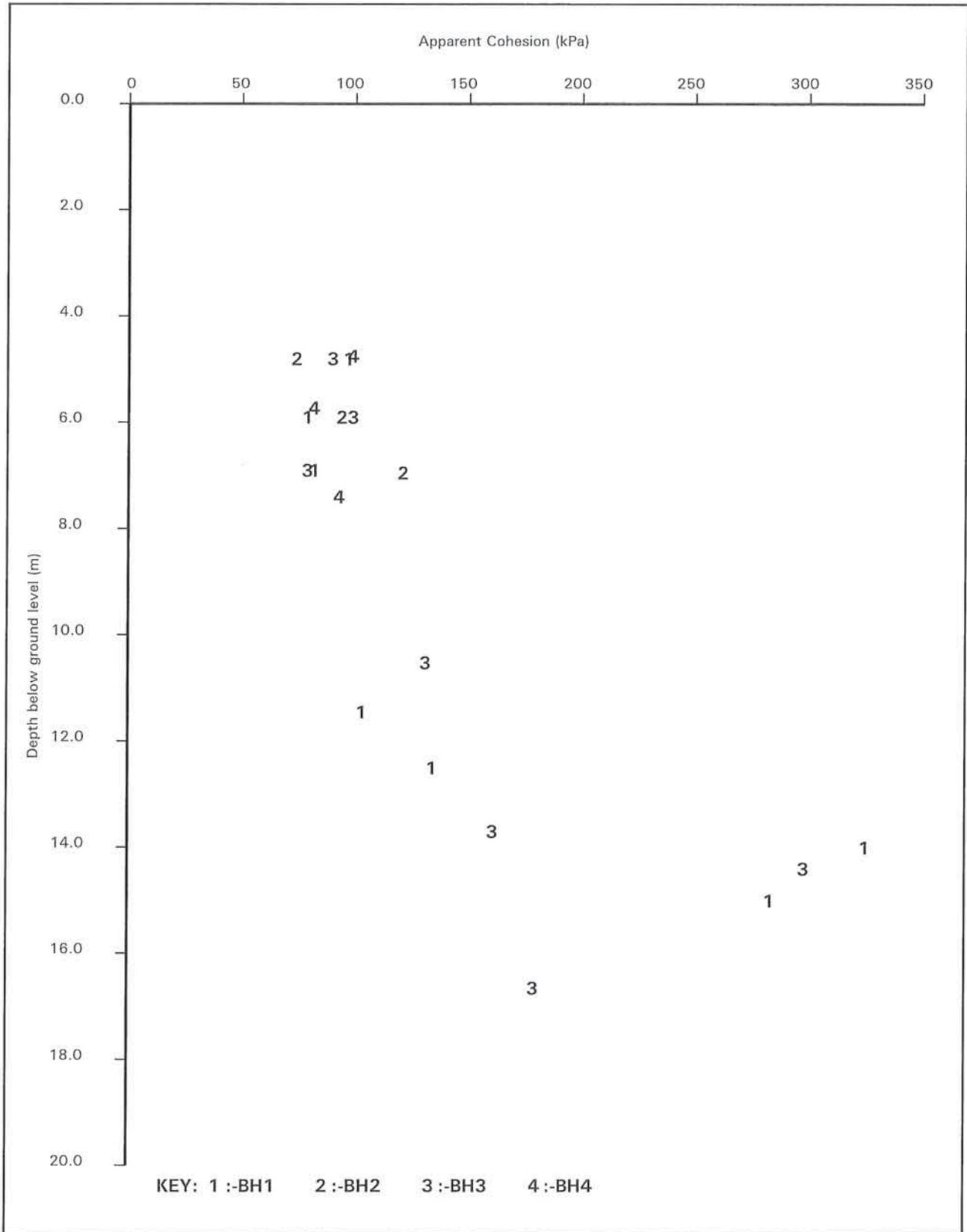
GROUND ENGINEERING

L I M I T E D

Tel: 01733-566566
www.groundengineering.co.uk

Date 20/07/21

Figure 1

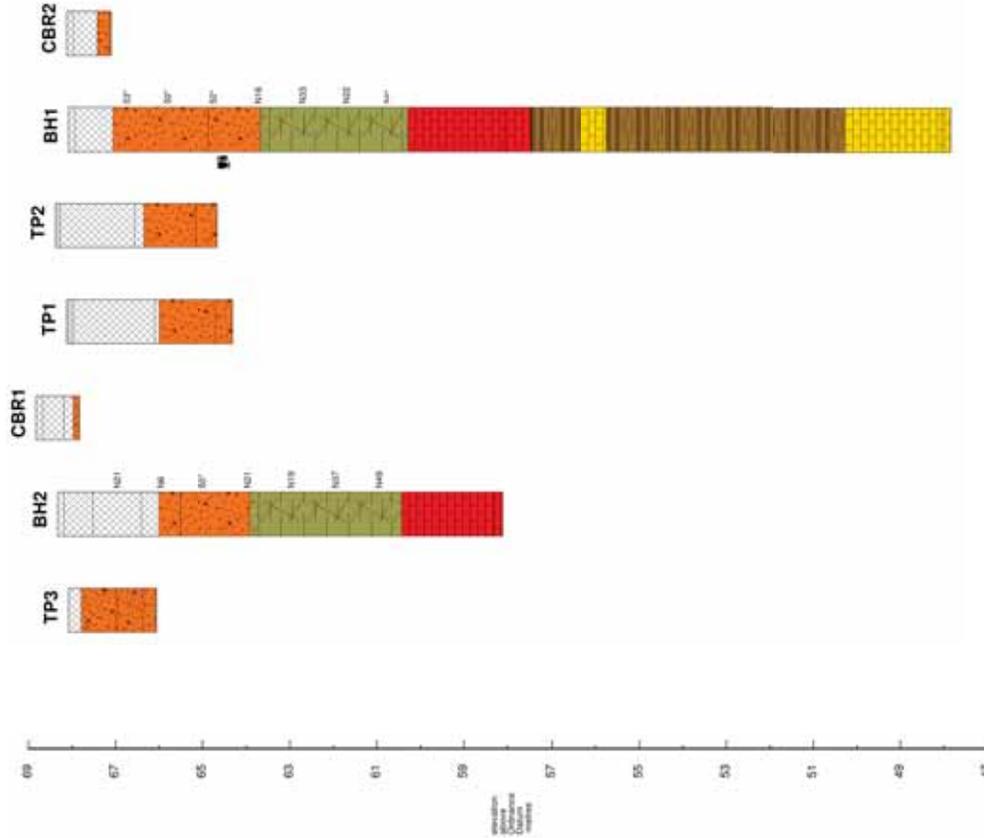


Apparent Cohesion (kPa) vs Depth below ground level (m).

SITE		BEBROKE SCIENCE PARK, KIDLINGTON	
CLIENT	OXFORD UNIVERSITY DEVELOPMENT	Contract Number	15387
GROUND ENGINEERING L I M I T E D	Tel: 01733-566566 www.groundengineering.co.uk	Date	19/07/21
		Figure	2

SOUTH-WEST

NORTH-EAST



Project : Begbroke Science Park, Kidlington
Client : Oxford University Development

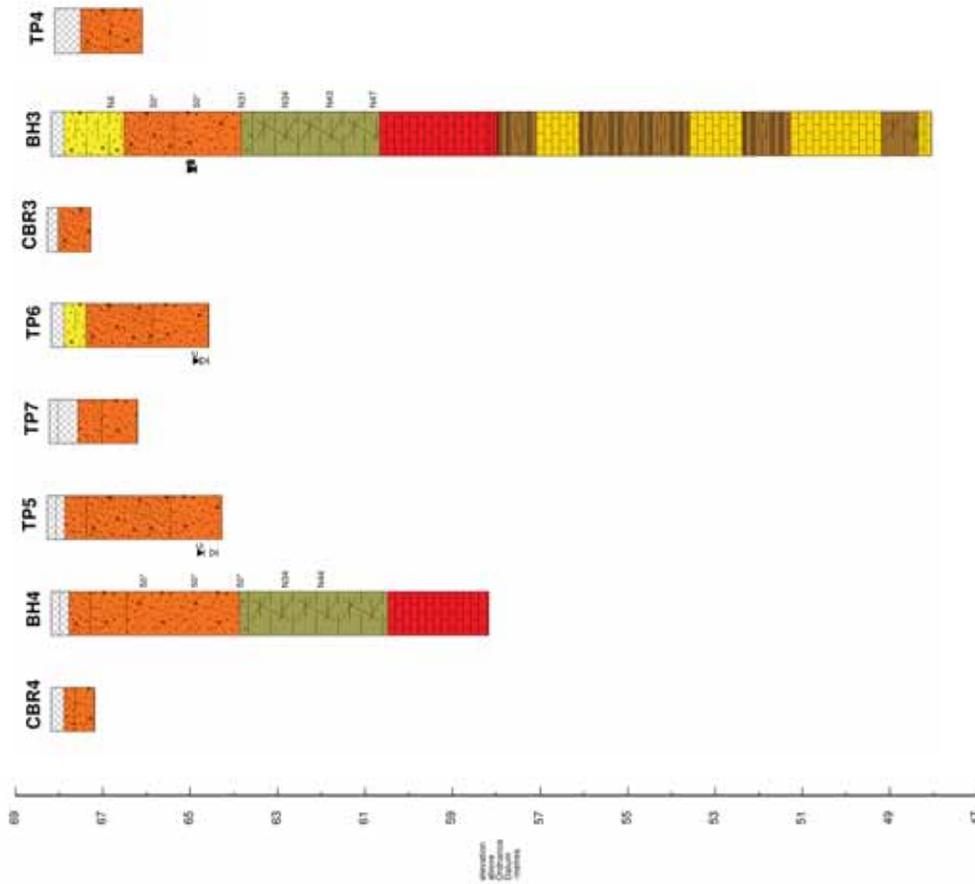
GROUND ENGINEERING LIMITED
 Tel: 01733 566566

SOIL PROFILE
Fig No. 3

Project No
C15387
Vertical Scale 1:100

SOUTH-WEST

NORTH-EAST



KEY TO LEGENDS

- MADE GROUND
- Localised clay layer of SUMMERTOWN - RADLEY SAND AND GRAVEL MEMBER
- Coarse-grained SUMMERTOWN - RADLEY SAND AND GRAVEL MEMBER
- KELLAWAYS CLAY MEMBER
- CORNBRASSH FORMATION
- Clay layers of FOREST MARBLE FORMATION
- Limestone layers of FOREST MARBLE FORMATION
- Groundwater Encountered
- Groundwater Rise
- Level on Completion
- Level Casing Withdrawn
- Standpipe Level

Project : Begbroke Science Park, Kidlington
Client : Oxford University Development

GROUND ENGINEERING LIMITED
 Tel: 01733 566566

SOIL PROFILE
Fig No. 3.1

Project No C15387
Vertical Scale 1:100

Appendix 4

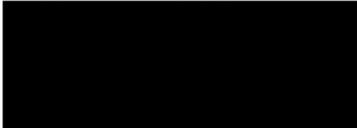
Chemical Test Results



Amended Report

Report No.:	21-21947-2	Date of Re-Issue:	16-Jul-2021
Initial Date of Issue:	05-Jul-2021		
Client	Ground Engineering Limited		
Client Address:	Newark Road Peterborough Cambridgeshire PE1 5UA		
Contact(s):	James Davies		
Project	C15387 Begbroke Science Park, Kidlington		
Quotation No.:	Q20-22175	Date Received:	28-Jun-2021
Order No.:	C15387	Date Instructed:	28-Jun-2021
No. of Samples:	17		
Turnaround (Wkdays):	15	Results Due:	16-Jul-2021
Date Approved:	16-Jul-2021		

Approved By:



Details: Glynn Harvey, Technical Manager

Bulk Identification Certificate

Client: Ground Engineering Limited

Site Address:

Date Sampled: 22-Jun-2021

Date Received: 28-Jun-2021

Your Ref.:

Project:

Job Number:

No Samples:

Date Reported:

C15387 Begbroke Science
Park, Kidlington
21-21947

05-Jul-2021

Sample No.	Sample ID	Sample Ref.	Description	Top (m)	Bottom (m)	SOP	Accred.	Laboratory	Material	Result
1229473	ACM		TP5	0.20	0.40	2185	U	DURHAM	Cement	Chrysotile

The in-house procedure SOP2185 is in accordance with the requirements of Appendix 2 of the Analyst Guide (HSG 248).

The results relate only to items tested as supplied by the client.

Comments and interpretations are beyond the scope of UKAS accreditation.

Samples associated with asbestos in building surveys are retained for six months (HSG 264 refers)

Results - Soil

Project: C15387 Begbroke Science Park, Kidlington

Determindand	Accred.	Chemtest Job No.:		Chemtest Sample ID.:		21-21947		21-21947		21-21947		21-21947		21-21947		21-21947		
		SOP	Units	LOD	Client Sample ID.:	Sample Location:	Sample Type:	Top Depth (m):	Bottom Depth (m):	Date Sampled:	Asbestos Lab:	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947
pH	M	2010		4.0														
Moisture	N	2030	%	0.020														
Stones and Removed Materials	N	2030	%	0.020														
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40														
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010														
Cyanide (Free)	M	2300	mg/kg	0.50														
Cyanide (Total)	M	2300	mg/kg	0.50														
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50														
Arsenic	M	2450	mg/kg	1.0														
Cadmium	M	2450	mg/kg	0.10														
Chromium	M	2450	mg/kg	1.0														
Copper	M	2450	mg/kg	0.50														
Mercury	M	2450	mg/kg	0.10														
Nickel	M	2450	mg/kg	0.50														
Lead	M	2450	mg/kg	0.50														
Selenium	M	2450	mg/kg	0.20														
Zinc	M	2450	mg/kg	0.50														
Chromium (Hexavalent)	N	2490	mg/kg	0.50														
Organic Matter	M	2625	%	0.40														
Acenaphthene	M	2700	mg/kg	0.10														
Acenaphthylene	M	2700	mg/kg	0.10														
Anthracene	M	2700	mg/kg	0.10														
Benzo[a]anthracene	M	2700	mg/kg	0.10														
Benzo[a]pyrene	M	2700	mg/kg	0.10														
Benzo[b]fluoranthene	M	2700	mg/kg	0.10														
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10														
Benzo[k]fluoranthene	M	2700	mg/kg	0.10														
Chrysene	M	2700	mg/kg	0.10														
Dibenz[a,h]Anthracene	M	2700	mg/kg	0.10														
Fluoranthene	M	2700	mg/kg	0.10														
Fluorene	M	2700	mg/kg	0.10														
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10														
Naphthalene	M	2700	mg/kg	0.10														
Phenanthrene	M	2700	mg/kg	0.10														
Pyrene	M	2700	mg/kg	0.10														
Total Of 16 PAHs	M	2700	mg/kg	2.0														
Total Phenols	M	2920	mg/kg	0.10														

Results - Soil

Project: C15387 Begbroke Science Park, Kidlington

Client: Ground Engineering Limited Quotation No.: Q20-22175	Chemtest Job No.:		21-21947	1229459	21-21947	1229461	21-21947	1229462	21-21947	1229463	21-21947	1229464	21-21947	1229465	21-21947	
	Chemtest Sample ID.:	Client Sample ID.:														
	D2/ES2	BH1	D2/ES2	BH2	BH3	BH4	D1/ES1	D2/ES2	D1/ES1	D1/ES1	D2/ES2	D2/ES2	D2/ES2	D4/ES4	D1/ES1	
	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
	0.20	0.20	0.20	0.10	0.70	0.10	1.20	0.70	0.10	0.10	0.40	0.40	0.60	0.60	0.10	
	Top Depth (m):	Bottom Depth (m):					1.50									
	Date Sampled:	Asbestos Lab:	22-Jun-2021	DURHAM	22-Jun-2021	DURHAM	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	
Determinand	Accred.	SOP	Units	LOD												
ACM Type	U	2192		N/A												
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Soil Colour	N	2040		N/A	Brown	Brown	Other	Stones and Roots	Stones	Brown	Brown	Stones and Roots	Brown	Stones and Roots	Brown	Stones, Roots and Wood
Other Material	N	2040		N/A	Stones and Roots	Stones										
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand
Total TPH >C6-C40	M	2670	mg/kg	10	< 10	2700	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C8	N	2680	mg/kg	1.0		< 1.0										
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0										
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0										
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0										
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0										
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0		< 1.0										
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0		41										
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0										
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		41										
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		< 1.0										
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		< 1.0										
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0										
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0										
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0										
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		99										
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0		2000										
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0										
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		2100										
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		2100										

Results - Soil

Project: C-15387 Begbroke Science Park, Kidlington

Determind	Accred.	Chemtest Job No.:		21-21947	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947	21-21947
		SOP	Units												
pH	M	2010	4.0	8.3	8.7	9.4	7.6	8.0	10.2	7.7	8.6	8.6	7.7	8.6	8.6
Moisture	N	2030	%	9.0	7.1	7.6	8.8	8.8	6.2	8.9	6.3	8.9	6.2	8.9	6.3
Stones and Removed Materials	N	2030	%	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020	< 0.020
Boron (Hot Water Soluble)	M	2120	mg/kg	0.63	< 0.40	0.55	0.57	0.49	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	< 0.010	< 0.010	0.27	< 0.010	< 0.010	0.21	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Free)	M	2300	mg/kg	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Cyanide (Total)	M	2300	mg/kg	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.70	0.83	12	0.76	1.4	1.0	0.55	1.2	1.2	0.55	1.2	1.2
Arsenic	M	2450	mg/kg	1.0	31	15	23	22	15	36	25	36	15	36	25
Cadmium	M	2450	mg/kg	0.10	< 0.10	0.17	0.19	0.17	0.12	0.19	0.18	0.19	0.12	0.19	0.18
Chromium	M	2450	mg/kg	1.0	22	6.8	20	18	6.7	28	11	28	6.7	28	11
Copper	M	2450	mg/kg	0.50	4.6	8.9	10	9.5	2.8	11	5.6	11	2.8	11	5.6
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50	33	6.4	15	14	5.6	20	8.8	20	5.6	20	8.8
Lead	M	2450	mg/kg	0.50	6.1	22	24	16	5.6	22	39	22	5.6	22	39
Selenium	M	2450	mg/kg	0.20	< 0.20	< 0.20	0.29	0.28	< 0.20	0.36	< 0.20	0.36	< 0.20	0.36	< 0.20
Zinc	M	2450	mg/kg	0.50	30	31	45	41	17	51	43	51	17	51	43
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	< 0.40	2.8	2.8	1.4	< 0.40	1.7	< 0.40	1.7	< 0.40	1.7	< 0.40
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	0.40	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	0.55	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	1.8	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzofluoranthracene	M	2700	mg/kg	0.10	< 0.10	8.1	0.11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzofluoranthrene	M	2700	mg/kg	0.10	< 0.10	10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzofluoranthrene	M	2700	mg/kg	0.10	< 0.10	14	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzofluoranthrene	M	2700	mg/kg	0.10	< 0.10	8.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzofluoranthrene	M	2700	mg/kg	0.10	< 0.10	5.7	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	10	0.12	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	2.7	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	16	0.36	< 0.10	< 0.10	< 0.10	0.16	< 0.10	< 0.10	< 0.10	0.16
Fluorene	M	2700	mg/kg	0.10	< 0.10	0.62	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	8.9	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Naphthalene	M	2700	mg/kg	0.10	< 0.10	0.18	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	6.1	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	16	0.29	< 0.10	< 0.10	< 0.10	0.13	< 0.10	< 0.10	< 0.10	0.13
Total Of 16 PAHs	M	2700	mg/kg	2.0	< 2.0	110	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols	M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: C-15387 Begbroke Science Park, Kidlington

Quotation No. : Q20-22175	Chemtest Job No.:		21-21947	1229468	21-21947	1229469	21-21947	1229470	21-21947	1229471	21-21947	1229472	21-21947	1229474	21-21947
	Chemtest Sample ID.:	Client Sample ID.:													
			D1/ES1	TP1	D1/ES1	TP2	D1/ES1	TP3	D1/ES1	TP4	D1/ES1	TP5	D1/ES1	TP6	TP7
			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			0.10	0.40	0.40	0.60	0.10	0.10	0.30	0.30	0.30	0.30	0.20	0.20	0.40
			22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021	22-Jun-2021
			DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD											
ACM Type	U	2192		N/A											
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Other	Brown	Other	Other
Other Material	N	2040		N/A	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones, Roots and Wood	Stones and Roots
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand
Total TPH >C6-C40	M	2670	mg/kg	10	50	850	46	40	25	26	25	25	26	26	51
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	20	20	20	20	20	20	20	20	20	20	20
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	20	20	20	20	20	20	20	20	20	20	20
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	39	39	39	39	39	39	39	39	39	39	39
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	510	510	510	510	510	510	510	510	510	510	510
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	550	550	550	550	550	550	550	550	550	550	550
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	570	570	570	570	570	570	570	570	570	570	570

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2185	Asbestos	Asbestos	Polarised light microscopy
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N-dimethyl-p-phenylenediamine.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6-C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8-C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5-C6, >C6-C8,>C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35- C44Aromatics: >C5-C7, >C7-C8, >C8- C10, >C10-C12, >C12-C16, >C16- C21, >C21- C35, >C35- C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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All water samples will be retained for 14 days from the date of receipt

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customerservices@chemtest.com



Final Report

Report No.: 21-22770-1
Initial Date of Issue: 11-Jul-2021
Client: Ground Engineering Limited
Client Address: Newark Road
Peterborough
Cambridgeshire
PE1 5UA
Contact(s): Admin
James Davies

Project: C15387 Begbroke Science Park,
Kidlington

Quotation No.:	Q20-22175	Date Received:	02-Jul-2021
Order No.:	C15387	Date Instructed:	05-Jul-2021
No. of Samples:	2		
Turnaround (Wkdays):	5	Results Due:	09-Jul-2021
Date Approved:	11-Jul-2021		

Approved By:



Details: Glynn Harvey, Technical Manager

Results - Water

Project: C:15387 Bedbrooke Science Park, Kidlington

Determind	Accred.	SOP		Top Depth (m):		Chemtest Job No.:		Chemtest Sample ID.:	
		Units	LOD	Units	LOD	21-22770	21-22770	1233378	1233379
pH	U	1010	N/A	7.6	7.7	W1	W1	BH1	BH3
Boron (Dissolved)	U	1455	µg/l	10.0	2100	WATER	WATER	3.61	3.27
Sulphate	U	1220	mg/l	1.0	160				
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050				
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050				
Sulphide	U	1325	mg/l	0.050	< 0.050				
Arsenic (Dissolved)	U	1455	µg/l	0.20	100				
Cadmium (Dissolved)	U	1455	µg/l	0.11	5.4				
Chromium (Dissolved)	U	1455	µg/l	0.50	200				
Copper (Dissolved)	U	1455	µg/l	0.50	560				
Mercury (Dissolved)	U	1455	µg/l	0.05	0.12				
Nickel (Dissolved)	U	1455	µg/l	0.50	320				
Lead (Dissolved)	U	1455	µg/l	0.50	410				
Selenium (Dissolved)	U	1455	µg/l	0.50	180				
Zinc (Dissolved)	U	1455	µg/l	2.5	820				
Acenaphthene	N	1700	µg/l	0.010	< 0.010				
Acenaphthylene	N	1700	µg/l	0.010	< 0.010				
Anthracene	N	1700	µg/l	0.010	< 0.010				
Benzo[a]anthracene	N	1700	µg/l	0.010	< 0.010				
Benzo[a]pyrene	N	1700	µg/l	0.010	< 0.010				
Benzo[b]fluoranthene	N	1700	µg/l	0.010	< 0.010				
Benzo[g,h,i]perylene	N	1700	µg/l	0.010	< 0.010				
Benzo[k]fluoranthene	N	1700	µg/l	0.010	< 0.010				
Chrysene	N	1700	µg/l	0.010	< 0.010				
Dibenz[a,h]Anthracene	N	1700	µg/l	0.010	< 0.010				
Fluoranthene	N	1700	µg/l	0.010	< 0.010				
Fluorene	N	1700	µg/l	0.010	< 0.010				
Indeno(1,2,3-c,d)Pyrene	N	1700	µg/l	0.010	< 0.010				
Naphthalene	N	1700	µg/l	0.010	< 0.010				
Phenanthrene	N	1700	µg/l	0.010	< 0.010				
Pyrene	N	1700	µg/l	0.010	< 0.010				
Total Of 16 PAH's	N	1700	µg/l	0.20	< 0.20				
Total Phenols	U	1920	mg/l	0.030	< 0.030				
Total Hardness as CaCO3	U	1270	mg/l	15	60000				
Aliphatic TPH >C5-C8	N	1675	µg/l	0.10	< 0.10				
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10				
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10				
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10				
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10				
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10				

Results - Water

Project: C15387 Bedbrooke Science Park, Kidlington

Client: Ground Engineering Limited	Chemtest Job No.:	21-22770	21-22770		
Quotation No.: Q20-22175	Chemtest Sample ID.:	1233378	1233379		
	Client Sample ID.:	W1	W1		
	Sample Location:	BH1	BH3		
	Sample Type:	WATER	WATER		
	Top Depth (m):	3.61	3.27		
Determinand	Accred.	SOP	Units	LOD	
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1325	Sulphide in Waters	Sulphides	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using N,N-dimethyl-pphenylenediamine.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5-C6, >C6-C8, >C8- C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35- C44Aromatics: >C5-C7, >C7-C8, >C8- C10, >C10-C12, >C12-C16, >C16- C21, >C21- C35, >C35- C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.

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Appendix 5

Classification of Aggressive Chemical Environment for Buried Concrete

TABLE C2 – AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE

(ACEC) CLASSIFICATION FOR BROWNFIELD LOCATIONS^a

Table C2 Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations ^a								
Sulfate and magnesium					Groundwater			ACEC Class for location
Design Sulfate Class for location	2:1 water/soil extract ^b		Groundwater		Total potential sulfate ^c	Static water	Mobile water	
1	2	3	4	5	6	7	8	9
	(SO ₄ mg/l)	(Mg mg/l)	(SO ₄ mg/l)	(Mg mg/l)	(SO ₄ %)	(pH) ^d	(pH) ^d	
DS-1	< 500		< 400		< 0.24	≥ 2.5		AC-1s
							> 6.5 ^d	AC-1
							5.5–6.5	AC-2z
							4.5–5.5	AC-3z
							2.5–4.5	AC-4z
DS-2	500–1500		400–1400		0.24–0.6	> 5.5		AC-1s
							> 6.5	AC-2
							2.5–5.5	AC-2s
							5.5–6.5	AC-3z
							4.5–5.5	AC-4z
							2.5–5.5	AC-5z
DS-3	1600–3000		1500–3000		0.7–1.2	> 5.5		AC-2s
							> 6.5	AC-3
							2.5–5.5	AC-3s
							5.5–6.5	AC-4
							2.5–5.5	AC-5
DS-4	3100–6000	≤ 1200	3100–6000	≤ 1000	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4
							2.5–5.5	AC-4s
							2.5–6.5	AC-5
DS-4m	3100–6000	> 1200 ^e	3100–6000	> 1000 ^e	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4m
							2.5–5.5	AC-4ms
							2.5–6.5	AC-5m
DS-5	> 6000	≤ 1200	> 6000	≤ 1000	> 2.4	> 5.5		AC-4s
							2.5–5.5	AC-5
DS-5m	> 6000	> 1200 ^e	> 6000	> 1000 ^e	> 2.4	> 5.5		AC-4ms
							2.5–5.5	AC-5m

Notes

- a Brownfield locations are those sites, or parts of sites, that might contain chemical residues produced by or associated with industrial production (Section C5.1.3).
- b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered from previous Digests (Box C7).
- c Applies only to locations where concrete will be exposed to sulfate ions (SO₄), which may result from the oxidation of sulfides such as pyrite, following ground disturbance (Appendix A1 and Box C8).
- d An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content (Section C5.1.3).
- e The limit on water-soluble magnesium does not apply to brackish groundwater (chloride content between 12 000 mg/l and 17 000 mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Seawater (chloride content about 18 000 mg/l) and stronger brines are not covered by this table.

Explanation of suffix symbols to ACEC Class

- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' have primarily to resist acid conditions and may be made with any of the cements in Table D2 on page 42.
- Suffix 'm' relates to the higher levels of magnesium in Design Sulfate Classes 4 and 5.

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APPENDIX 5 SUDS MANAGEMENT AND MAINTENANCE PLAN

BEGBROKE SCIENCE PARK SUDS OPERATIONAL MANAGEMENT AND MAINTENANCE PLAN

Project name **Begbroke Science Park**
 Project no. **1620011508**
 Recipient **Local Planning Authority (Cherwell District Council North Oxfordshire)**
 Document Ref **BBSP-RAMB-XX-XX-DN-C-000002**
 Version **P01**
 Date **17/12/2021**
 Prepared by **A Taleb**
 Checked by **L February**
 Approved by **L Sawyer**
 Description **Sustainable Urban Drainage Operational Management and Maintenance Plan**

CONTENTS

1.	Introduction	2
2.	Surface Water Drainage Design Philosophy	2
3.	SuDS Analysis and Treatment Train	3
4.	Sustainable Drainage Systems (SuDS) – Normal Function	6
5.	Management and Maintenance	6
6.	End of Life Maintenance	10

APPENDICES

Appendix 1
 Surface Water Drainage Drawing

1. Introduction

This Design Note has been produced to provide guidance on the management and maintenance of the Sustainable Drainage Systems (SuDS) proposed for the Begbroke Science Park, Begbroke Hill, Begbroke, Kidlington OX5 1PF. Furthermore, the report has been written in support of discharging the planning condition 16 (Ref. 18/00803/OUT). The Design Note should be read in conjunction with the proposed surface water drainage layout drawings (BBSP-RAMB-ZZ-00-DR-C-000101 and BBSP-RAMB-ZZ-00-DR-C-000103).

Planning condition 16 reads as follows;

Development shall not begin until a surface water drainage scheme for the site or part if separate reserved matters are submitted, based on sustainable drainage principles and an assessment of the hydrological and hydro-geological context of the development, has been submitted to and approved in writing by the Local Planning Authority. The scheme shall subsequently be implemented in accordance with the approved details before the development is completed. The scheme shall also include:

- a) *Discharge Rates*
- b) *Discharge Volumes*
- c) *SUDS (Soakaways)*
- d) *Maintenance and management of SUDS features (To include provision of a SuDS Management and Maintenance Plan)*
- e) *Infiltration in accordance with BRE365 (To include infiltration testing; seasonal monitoring and recording of groundwater levels)*
- f) *Detailed drainage layout with pipe numbers*
- g) *Network drainage calculations*
- h) *Phasing*
- i) *Flood Flow Routing in exceedance conditions (To include provision of a flood exceedance route plan)*

Reason - To ensure an acceptable drainage scheme is provided in relation to the proposed expansion and do ensure the proposals do not have a detrimental impact on the drainage systems currently in situ in the immediate locale.

The proposed drainage network is to be built to adoptable standards (but shall remain private), and a series of sustainable urban drainage features will convey surface water run-off from the development site for infiltration to ground.

2. Surface Water Drainage Design Philosophy

The surface water drainage strategy for the proposed development comprises infiltration to ground for surface water run-off generated by the proposed development including the Zone B – Academic Building, Zone C – Commercial Building, and the associated surface car park area. Surface water run-off is collected via several SuDS features (raingardens, permeable/porous paving and dry infiltration basin) from where run-off is conveyed via piped networks to nearby infiltration tanks. Infiltration tanks which may cause a point discharge are located greater than 5.0m from building foundations.

The proposed surface water management strategy has been developed in parallel with the Architectural and Landscaping Architects proposals. In producing this strategy, a feasibility assessment of viable

SuDS measures was undertaken to ensure that surface water is appropriately managed given the existing site constraints.

The principles of the strategy are as follows:

- **Raingardens** to collect surface water run-off from roof and external hardstanding areas prior to conveyance to a nearby geocellular tank for infiltration to ground.
- Footpath and parking bay areas will be laid with **permeable / porous pavements** (lined for attenuation and unlined for infiltration) and a series of perforated pipes surrounded by gravel. This system will provide the required treatment for the small flows entering the positive drainage system. Treatment measures to be confirmed sufficient in accordance with Ciria SuDS Manual (Chapter 26) at detailed design stage.
- Surface water run-off from external traffic areas conveyed via a linear drainage channel to an adjacent **filter drain** surrounded by gravel with a permeable membrane underneath. This system will provide the required treatment for the small flows entering the positive drainage system. Treatment measures to be confirmed sufficient in accordance with Ciria SuDS Manual (Chapter 26) at detailed design stage.
- The proposed surface water run-off from the development site is conveyed to the geocellular structures via the SuDS features noted above to provide **infiltration** to ground.
- **Petrol interceptors** are proposed to provide further pollution treatment for surface water run-off from services and delivery access areas.

The proposed surface water drainage strategy drawings are included in Appendix 1.

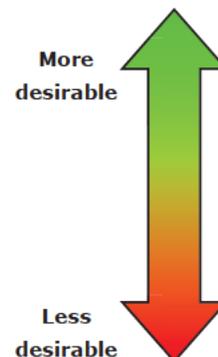
3. SuDS Analysis and Treatment Train

Good practice emphasises the need to ensure surface water run-off is managed close to its source. It highlights that developers should aim to achieve greenfield run-off from their site through the use of sustainable drainage techniques. This can also be aided by encouraging the retention of soft landscaping as opposed to hard, less permeable surfaces.

In line with the Lead Local Flood Authority guidance, SuDS features are used to achieve a betterment on the brownfield rates for the development site. The proposed surface water drainage strategy is for infiltration on site.

The following hierarchy for managing surface water applies:

- Water Reuse
- Living Roofs
- Basins and Ponds
- Infiltration Devices
- Permeable Surfaces
- Tank Systems



The surface water drainage strategy considers the SuDS hierarchy in developing the water management proposals and includes infiltration and permeable surfacing within the scheme. The surface water management features, water re-use, basins and ponds, were considered during the design development and discounted for the following reasons;

- Due to the compact nature of the development, water re-use was not considered feasible.
- There is limited opportunity within the landscaped areas for the provision of open SuDS features. Filter drains are proposed to provide treatment for run-off from impermeable areas before discharging to the infiltration drainage system.

Water pollution has been taken into account and methods of treatment chosen against criteria outlined in the Ciria SuDS Manual. Treatment measures are to be confirmed sufficient in accordance with Ciria SuDS Manual (Chapter 26) at detailed design stage. An outline using extracts from the document to allocate suitable pollution indices for the proposed land use is provided below:

1. Define pollution hazard indices, presented in Table 26.2 of the Ciria SuDS Manual:

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

Notes

- 1 Motorways and trunk roads should follow the guidance and risk assessment process set out in Highways Agency (2009).
- 2 These should only be used if considered appropriate as part of a detailed risk assessment – required for all these land use types (Table 4.3). When dealing with high hazard sites, the environmental regulator should first be consulted for pre-permitting advice. This will help determine the most appropriate approach to the development of a design solution.

Table 3.3. Pollution Hazard Indices

Extract from the Ciria SuDS Manual, Chapter 26

The pollution hazard for the site is low to medium. The previously described sustainable drainage systems are proposed to mitigate pollution discharging to the surface water system. Each sustainable drainage feature has associated pollution mitigation indices, as shown in the below table, reproduced from CIRIA C753 Table 26.3):

2. Determine SuDS Pollution Mitigation Indices

TABLE 26.4 Indicative SuDS mitigation indices for discharges to groundwater			
Characteristics of the material overlying the proposed infiltration surface, through which the runoff percolates¹	TSS	Metals	Hydrocarbons
A layer of dense vegetation underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.6 ⁴	0.5	0.6
A soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.3	0.3
Infiltration trench (where a suitable depth of filtration material is included that provides treatment, ie graded gravel with sufficient smaller particles but not single size coarse aggregate such as 20 mm gravel) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.4 ⁴	0.4	0.4
Constructed permeable pavement (where a suitable filtration layer is included that provides treatment, and including a geotextile at the base separating the foundation from the subgrade) underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.7	0.6	0.7
Bioretention underlain by a soil with good contaminant attenuation potential ² of at least 300 mm in depth ³	0.8 ⁴	0.8	0.8
Proprietary treatment systems ^{5, 6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area.		

Notes

- 1 All designs must include a minimum of 1 m unsaturated depth of aquifer material between the infiltration surface and the maximum likely groundwater level (as required in infiltration design – **Chapter 25**).
- 2 For example as recommended in Sniffer (2008a and 2008b), Scott Wilson (2010) or other appropriate guidance.
- 3 Alternative depths may be considered where it can be demonstrated that the combination of the proposed depth and soil characteristics will provide equivalent protection to the underlying groundwater – see note 1.
- 4 If significant volumes of sediment are allowed to enter an infiltration system, there will be a high risk of rapid clogging and subsequent system failure.
- 5 See **Chapter 14** for approaches to demonstrate product performance. Note: a British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: www.britishwater.co.uk/Publications/codes-of-practise.aspx
- 6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution, where there is a requirement to retrofit treatment. WAT-RM-08 (SEPA, 2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

Table 3.4. Pollution Mitigation Indices for Discharges to Ground Waters

Extract from the Ciria SuDS Manual, Chapter 26

The applicable indices following the methodology set out the Ciria SuDS Manual is highlighted with a red box.

As per CIRIA C753, a sufficient SuDS mitigation index should be provided to eliminate pollutants across all pollutant categories. For the majority of the drained area on site, which is roof, footpath and delivery zone this requirement is satisfied by the mitigation indices of all of the SuDS proposed for the development. It is proposed that all run-off will pass through at least one of the SuDS.

4. Sustainable Drainage Systems (SuDS) – Normal Function

SuDS generally mimic the natural drainage patterns of an undeveloped (greenfield) site, where surface water run-off should have as many opportunities as possible to soak into the ground, improving water quality and controlling outfall rates from the development. This reduces the impact and risk of flooding on downstream developments alongside providing additional benefits such as pollution control, increasing biodiversity and providing water-based amenity.

At the point of infiltration, it is intended for all surface water to have been treated using at least one method of water treatment with the final function via below ground infiltration tanks.

The SuDS features proposed for the development site will provide;

- A platform to capture surface water,
- A medium to attenuate, filter and treat surface water, and
- A means of conveying surface water.

5. Management and Maintenance

The final maintenance strategy for the specific SuDS features proposed at the development site will be dependent upon the specific products used within the installation of the features and therefore subject to Manufacturer's guidance.

The maintenance regime for SuDS features present on site can be divided into three categories:

1. Regular maintenance;
2. Occasional tasks, and
3. Remedial works

The frequency of regular maintenance will usually be monthly, the occasional tasks and remedial works should be conducted as required.

It is proposed that the Building Management team will be responsible for the maintenance of the proposed SuDS features. The table below describes the typical maintenance and management requirements of the proposed SuDS elements to the surface water drainage strategy in line with CIRIA C753: The SuDS Manual.

TABLE 13.1 Operation and maintenance requirements for soakaways		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Table 2.1. Maintenance Requirements of Drainage Components (Soakaways)

Extract from the Ciria SuDS Manual, Chapter 13

TABLE 16.1 Operation and maintenance requirements for filter drains		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Table 2.2. Maintenance Requirements of Drainage Components (Filter Drains)

Extract from the Ciria SuDS Manual, Chapter 16

TABLE 18.3 Operation and maintenance requirements for bioretention systems		
Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
	Check operation of underdrains by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect inlets and outlets for blockage	Quarterly
Regular maintenance	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
	Replace any plants, to maintain planting density	As required
	Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
Occasional maintenance	Infill any holes or scour in the filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
Remedial actions	Remove and replace filter medium and vegetation above	As required but likely to be > 20 years

Table 2.3. Maintenance Requirements of Drainage Components (Bioretention Systems - Raingardens)

Extract from the Ciria SuDS Manual, Chapter 18

TABLE 20.15 Operation and maintenance requirements for pervious pavements		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Table 2.4. Maintenance Requirements of Drainage Components (Pervious Pavements)

Extract from the Ciria SuDS Manual, Chapter 20

In addition to the items listed above, the table below provides further guidance on type of operational and maintenance requirements that may be appropriate for the drainage features not included in the tables provided above.

Table 2.5: Drainage Maintenance Strategy

Drainage Feature	Regular Maintenance	Occasional/Remedial Maintenance	Monitoring
Drainage channels/Gullies	<p>Inspections will include gratings; covers including their locking bolts; sumps and sump buckets; exposed concrete surround and adjacent surfacing.</p> <p>Check for accumulation of debris and silt and cleaned as necessary</p>	<p>Channel cleaning will be by flushing with water or high pressure jetting (no boiling water or cleaning agent will be used). All silt buckets and sumps will be cleaned out replaced back into the units ensuring they are correctly fitted.</p>	<p>Inspect every 4 months or after large storm.</p>

Drainage Feature	Regular Maintenance	Occasional/Remedial Maintenance	Monitoring
Catchpit Manholes/Inspection Chambers	<p>Gratings, frames and all associated locking parts to be checked for damage.</p> <p>Exposed concrete and adjacent surfacing to be checked for cracking and general damage.</p> <p>Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures Check for accumulation of debris and silt and cleaned as necessary.</p> <p>Covers and frames to be checked for damage.</p> <p>Exposed concrete and adjacent surfacing to be checked for cracking and general damage.</p> <p>Check condition of inlet and outlet pipes, flow controls, baffles and isolation structures</p>	<p>All channel surfaces and joints will be checked and repaired as necessary.</p> <p>Repair/rehabilitation of inlets, outlet, overflows and vents, as required.</p> <p>Clean as necessary.</p> <p>All manhole and inspection chamber covers and frames to be replaced as necessary.</p> <p>Repair exposed concrete and surfacing as necessary</p> <p>Repair/rehabilitation of inlets, outlet, overflows and vents, as required.</p>	<p>Inspect every 6 months or after large storm.</p> <p>Inspect for evidence of poor operation; six monthly Inspect filter media and establish appropriate replacement frequencies; six monthly Inspect sediment accumulation rates and establish appropriate removal frequencies; monthly during the first half year of operation, then every six months</p>
Proprietary treatment system	<p>Remove litter and debris and inspect for sediment, oil and grease accumulation; six monthly Change the filter media; as recommended by manufacturer Remove sediment, oil, grease and floatables; as necessary – indicated by system inspections or immediately following significant spill</p>	<p>Replace malfunctioning parts or structures; as required</p>	

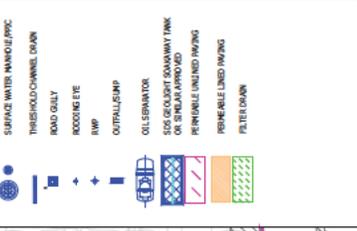
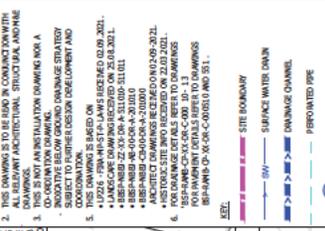
6. End of Life Maintenance

As part of their normal function many SuDS features are intended to act as a repository for potential pollutants such as sediment, hydrocarbons and heavy metals, thus improving the water quality of runoff. Certain pollutants, such as hydrocarbons, can be broken down via biodegradation. However, other pollutants, namely the particulate or sediment type, such as metals, remain trapped within elements of the sustainable drainage feature.

Current evidence does not conclude to what extent pollution entrapment within SuDS will occur or whether this can lead to the site becoming contaminated and therefore hazardous to human well-being. Furthermore, it is not yet known if certain sustainable drainage systems (or elements of them) will be classified as hazardous waste at the time of their disposal. For these reasons, it is proposed that at end-life, all SuDS are disposed of in accordance with the relevant rules, regulations and available guidance at the time. If required, at redevelopment stage, consultation with the Environment Agency should be sought and testing of materials and ground should be carried out.

APPENDIX 1
SURFACE WATER DRAINAGE DRAWING

1. THIS DRAWING IS NOT TO BE SCALED.
 2. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
 3. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
 4. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
 5. THIS DRAWING IS BASED ON THE FOLLOWING ASSUMPTIONS:
 • ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
 • ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
 • ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
 6. FOR DIMENSION DETAILS REFER TO DRAWINGS:
 BSSP-RAMB-ZC-XX-DR-C-00010 AND S1.



REV	DATE	DESCRIPTION
1	16/08/2021	ISSUE FOR PERMIT
2	20/08/2021	ISSUE FOR PERMIT
3	23/08/2021	ISSUE FOR PERMIT
4	26/08/2021	ISSUE FOR PERMIT
5	29/08/2021	ISSUE FOR PERMIT
6	31/08/2021	ISSUE FOR PERMIT
7	03/09/2021	ISSUE FOR PERMIT
8	06/09/2021	ISSUE FOR PERMIT
9	09/09/2021	ISSUE FOR PERMIT
10	12/09/2021	ISSUE FOR PERMIT
11	15/09/2021	ISSUE FOR PERMIT
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47	31/12/2021	ISSUE FOR PERMIT

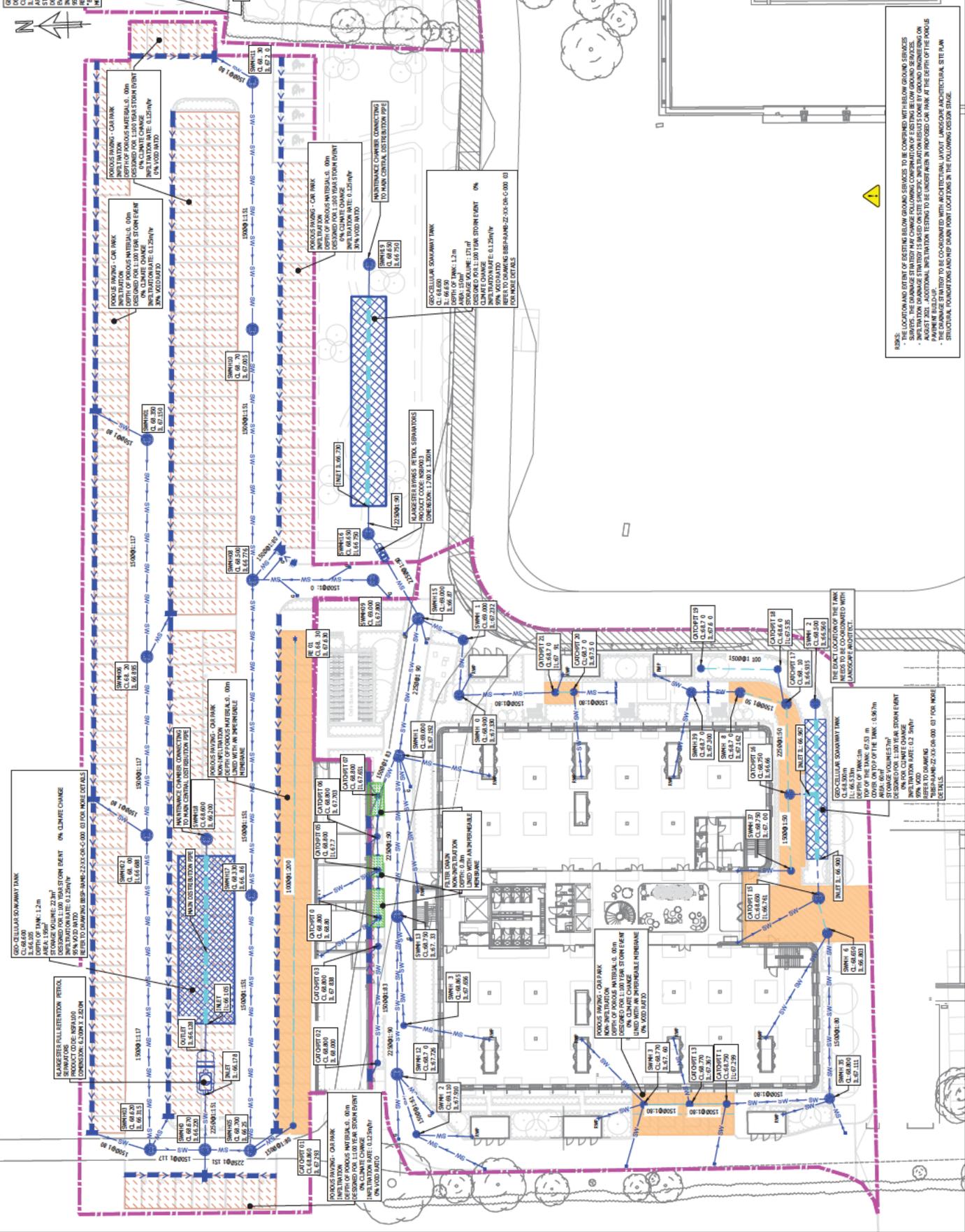
STAGE 3

BROOKFIELD
 100 BROOKFIELD DRIVE
 BROOKFIELD QLD 4108
 www.brookfield.com.au

ZONE C

INDICATIVE SURFACE WATER DRAINAGE LAYOUT

DATE: 16/08/2021
 DRAWN BY: [Name]
 CHECKED BY: [Name]
 PROJECT: BSSP-RAMB-ZC-XX-DR-C-00010
 SHEET: P02



NOTE: THE LOCATION AND EXTENT OF BESTING BELOW GROUND SERVICES TO BE CONFIRMED WITH BELOW GROUND SERVICES SUPPLIERS. THE DRAINAGE LAYOUT MAY CHANGE FOLLOWING CONFIRMATION OF EXISTING BELOW GROUND SERVICES. THE DRAINAGE LAYOUT IS BASED ON THE SPECIFIC INFILTRATION RATES BY GROUND PENETRATION ON PERMEABLE UNFINISHED PAVING. INFILTRATION RATES TO BE CONFIRMED IN THE FIELD ON CAR PARK AT THE SITE OF THE PUBLIC BUILDING. THE DRAINAGE LAYOUT IS BASED ON THE SPECIFIC INFILTRATION RATES BY GROUND PENETRATION ON PERMEABLE UNFINISHED PAVING. INFILTRATION RATES TO BE CONFIRMED IN THE FIELD ON CAR PARK AT THE SITE OF THE PUBLIC BUILDING. THE DRAINAGE LAYOUT IS BASED ON THE SPECIFIC INFILTRATION RATES BY GROUND PENETRATION ON PERMEABLE UNFINISHED PAVING. INFILTRATION RATES TO BE CONFIRMED IN THE FIELD ON CAR PARK AT THE SITE OF THE PUBLIC BUILDING.