JN1246 Wrexham 2024	
	
Raised western landscape	East to west across site
	
Monitoring Well WLS3 decommissioning	Monitoring Well WLS3 decommissioning

Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical



APPENDIX D

Laboratory Test Methods and Results



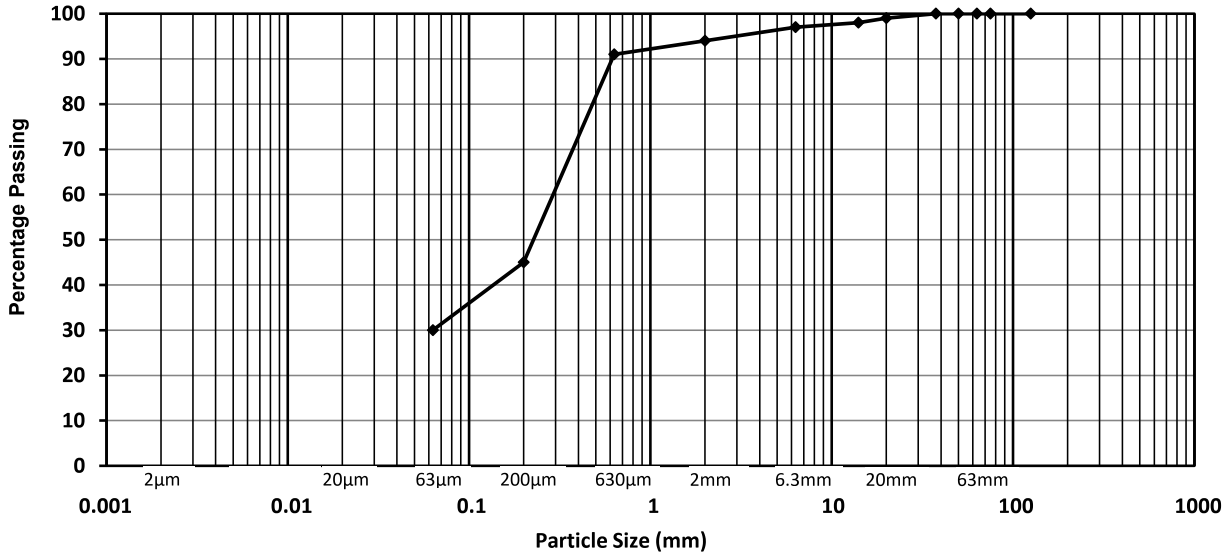
D

Southern Testing
Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8LU
ST Consult

Particle Size Distribution - Grading

Project Name	Tesco, Wrexham			Project No.	JN1246
Client	Glanville Consultants Limited	Project Engineer	CW	Location ID	WLS9
				Depth (m)	4.45
Visual Description of Sample: Dark brown clayey/silty gravelly fine and medium SAND. Gravel consists of fine to coarse subangular to well rounded sandstone.				Sample Type	Small Bag
				Date Issued	06-Jun-24
				Tested By	RL
				Checked By	RL

Particle Size Distribution Chart



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			
30%				65%			6%			0%

Particle Size	% Passing
125mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
20mm	99
14mm	98
6.3mm	97
2mm	94
630µm	91
200µm	45
63µm	30

Coefficient of Uniformity D60/D10	>4.65

Comment:

Test Method:

Wet & Dry Grading: BS EN ISO 17892-4:2016 cl. 5.2

Southern Testing
Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8LU
ST Consult

Particle Size Distribution - Grading

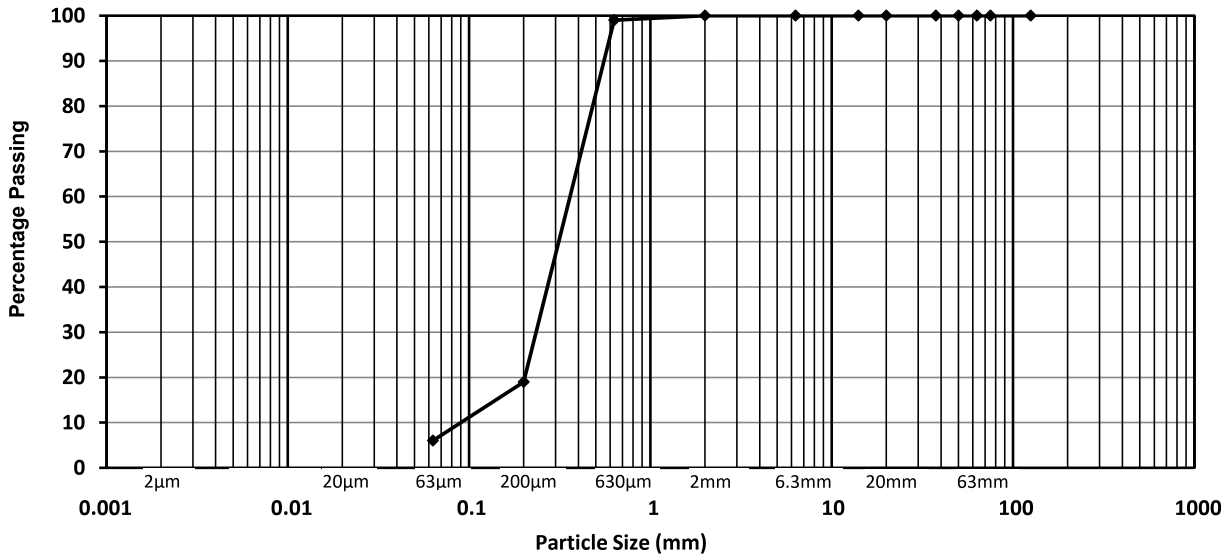
Project Name	Tesco, Wrexham		
Client	Glanville Consultants Limited	Project Engineer	CW

Project No.	JN1246
Location ID	WLS11
Depth (m)	2.50
Sample Type	Small Bag
Date Issued	06-Jun-24
Tested By	RL
Checked By	RL

Visual Description of Sample:

Brown clayey/silty fine and medium SAND.

Particle Size Distribution Chart



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			
6%				94%			0%			0%

Particle Size	% Passing
125mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
20mm	100
14mm	100
6.3mm	100
2mm	100
630µm	99
200µm	19
63µm	6

Coefficient of Uniformity D60/D10	3.87

Comment:

Test Method:

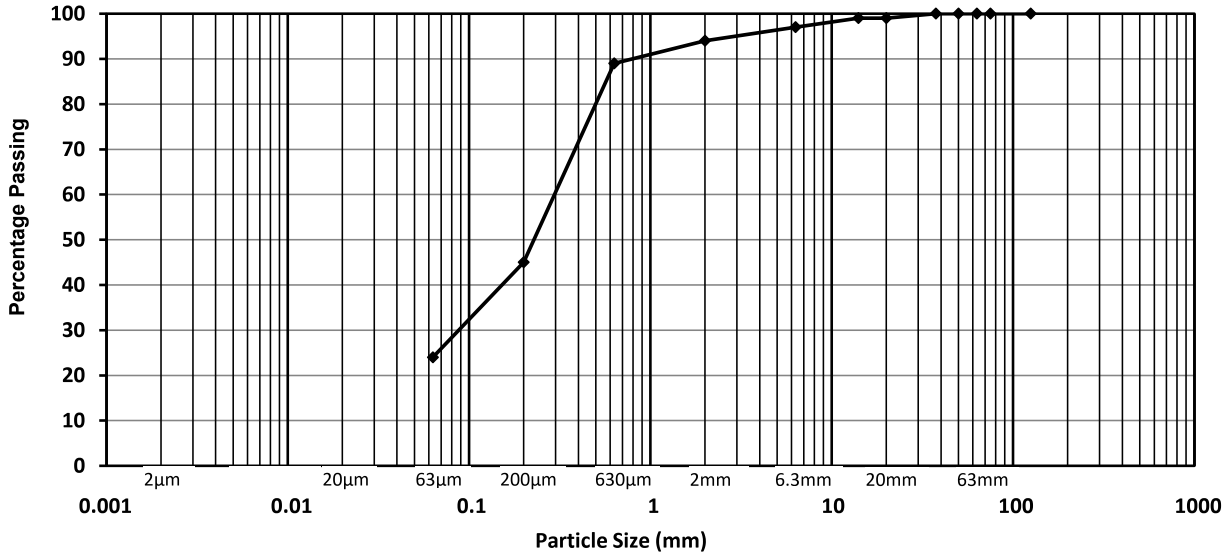
Wet & Dry Grading: BS EN ISO 17892-4:2016 cl. 5.2

Southern Testing
Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8LU
ST Consult

Particle Size Distribution - Grading

Project Name	Tesco, Wrexham			Project No.	JN1246
Client	Glanville Consultants Limited	Project Engineer	CW	Location ID	WLS12
				Depth (m)	1.50
Visual Description of Sample: Dark brown clayey/silty gravelly fine and medium SAND. Gravel consists of fine to coarse subangular to well rounded sandstone.				Sample Type	Small Bag
				Date Issued	06-Jun-24
				Tested By	RL
				Checked By	RL

Particle Size Distribution Chart



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
	SILT			SAND			GRAVEL			
24%				69%			6%			0%

Particle Size	% Passing
125mm	100
75mm	100
63mm	100
50mm	100
37.5mm	100
20mm	99
14mm	99
6.3mm	97
2mm	94
630µm	89
200µm	45
63µm	24

Coefficient of Uniformity D60/D10	>4.72

Comment:

Test Method:

Wet & Dry Grading: BS EN ISO 17892-4:2016 cl. 5.2

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022, cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022, cl 5.2 and 6

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

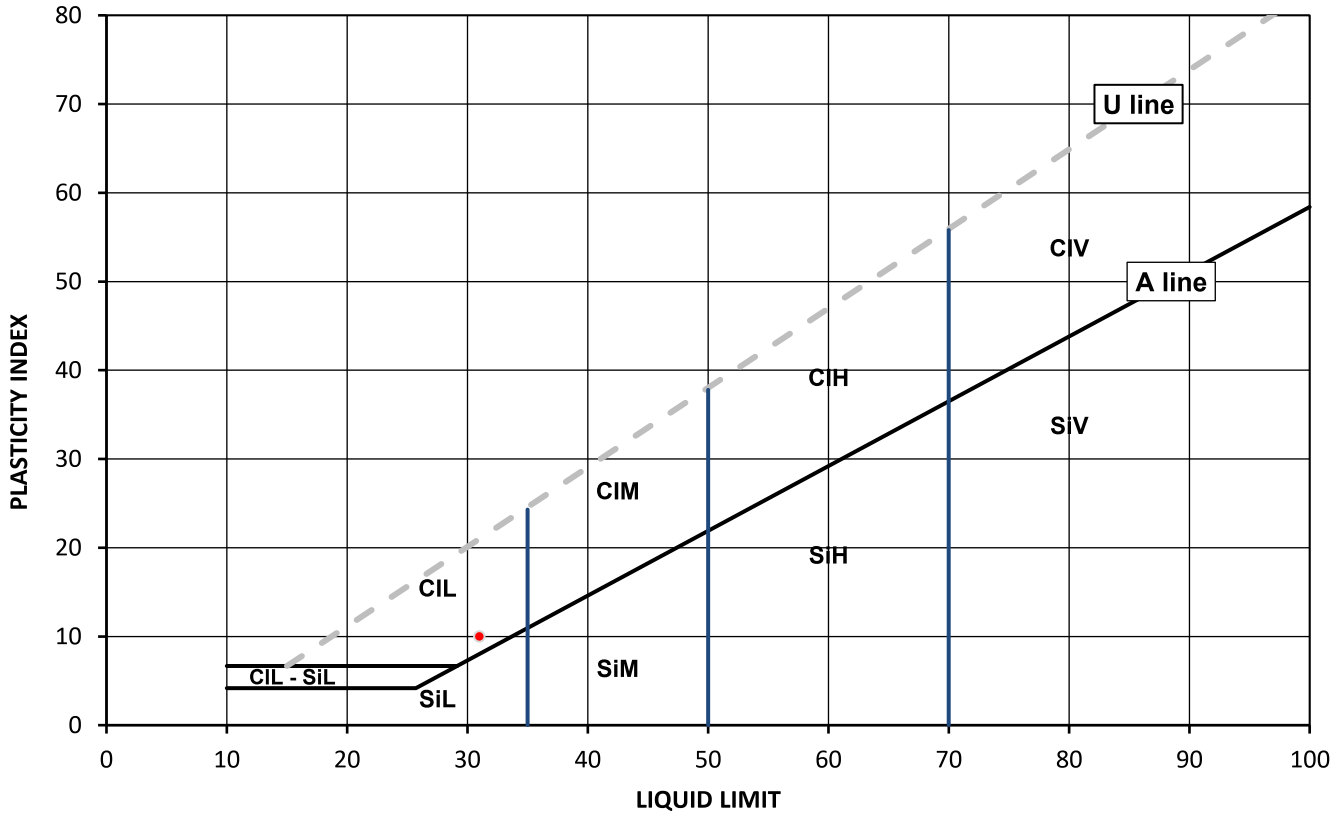
Client:	ST Consult Ltd	Client Reference:	JN1246
Client Address:	Twigden Barns, Brixworth Road, Creaton, Northamptonshire, NN6 8NN	Job Number:	24-022539-1
		Date Sampled:	Not Given
		Date Received:	31/05/2024
Contact:	Chris Nolan	Date Tested:	07/06/2024
Site Address:	Wrexham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	214537	Depth Top [m]:	1.50
Hole No.:	WLS9	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Brown gravelly very sandy silty CLAY		
Sample Preparation:	Tested after washing to remove >0.425mm; The water content in the sample was increased		
Cone Type:	80g/30deg		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
13.4	31	21	10	-0.80	1.80	50



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014; # Non accredited

Remarks: Sample tested under Red Lab condition.

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed: Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 20/06/2024

GF 337.13

TEST CERTIFICATE

DETERMINATION OF LIQUID AND PLASTIC LIMITS

Tested in Accordance with: BS EN ISO 17892-12:2018+A2:2022, cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022, cl 5.2 and 6

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

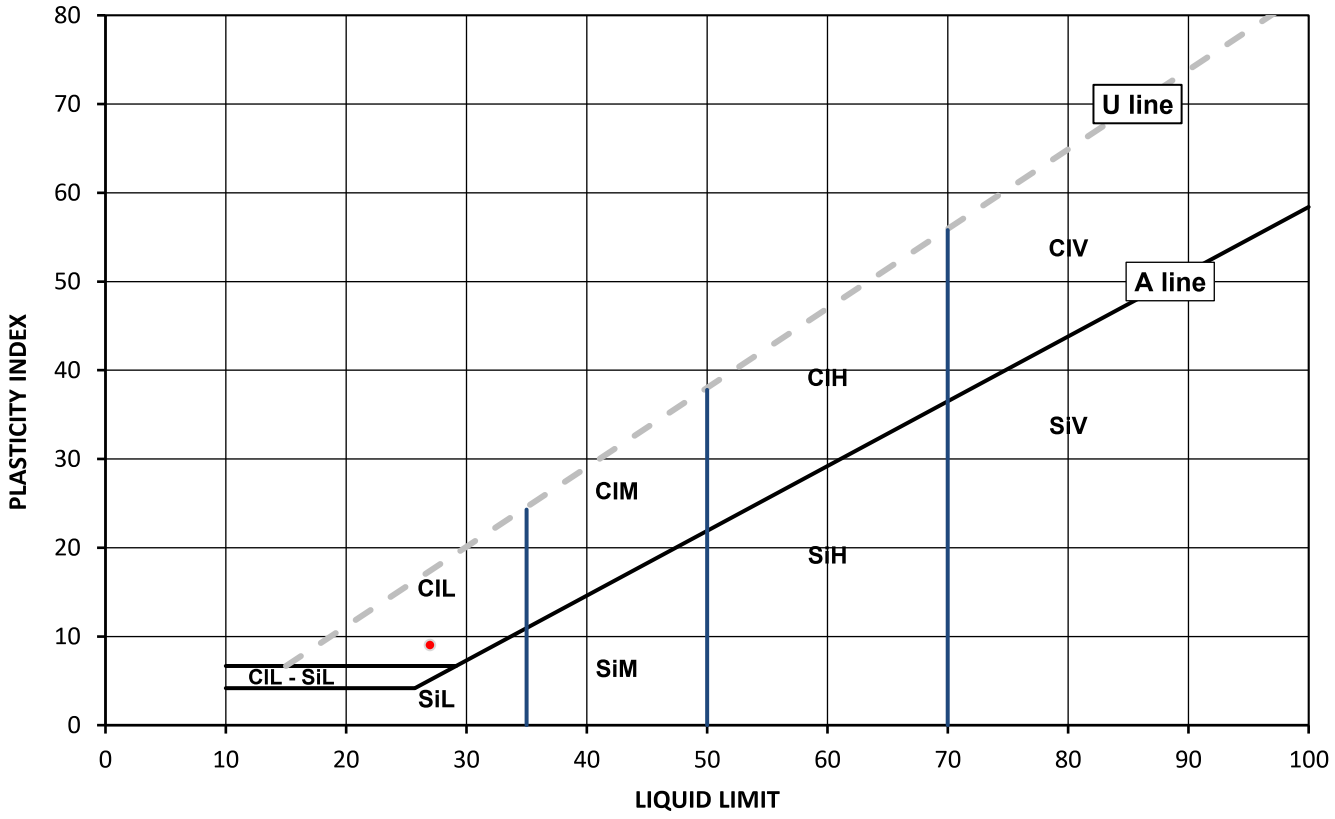
Client:	ST Consult Ltd	Client Reference:	JN1246
Client Address:	Twigden Barns, Brixworth Road, Creaton, Northamptonshire, NN6 8NN	Job Number:	24-022539-1
		Date Sampled:	Not Given
		Date Received:	31/05/2024
Contact:	Chris Nolan	Date Tested:	07/06/2024
Site Address:	Wrexham	Sampled By:	Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	214538	Depth Top [m]:	1.00
Hole No.:	WLS11	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	B
Sample Description:	Brown gravelly very sandy silty CLAY		
Sample Preparation:	Tested after washing to remove >0.425mm; The water content in the sample was increased		
Cone Type:	80g/30deg		

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	Liquidity Index [IL] % #	Consistency Index [IC] % #	% Passing 425µm BS Test Sieve
7.4	27	18	9	-1.22	2.22	61



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Water Content by BS EN 17892-1: 2014; # Non accredited

Remarks: Sample tested under Red Lab condition.

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed: Monika Siewior

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 20/06/2024

GF 337.13

SUMMARY REPORT

SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Client: ST Consult Ltd

Client Address: Twigden Barns, Brixworth Road, Creaton, Northamptonshire, NN6 8NN

Contact: Chris Nolan

Site Address: Wrexham

BS EN ISO 17892-12:2018+A2:2022 cl 5.3 and 5.5, Fall Cone Method, 4 Pt Test, BS 1377-2:2022, cl 5.2 and 6. W by BS EN ISO 17892-1:2014+A1:2022.

Client Reference: JN1246
Job Number: 24-022539-1
Date Sampled: Not Given
Date Received: 31/05/2024
Date Tested: 07/06/2024
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	W	Liquid & Plastic Limit							Density		
		Reference	Depth Top m	Depth Base m	Type			%	% Passing 425um %	WL* %	Correlation Factor	Wp %	Ip %	Cone type	Sample Preparation	bulk Mg/m3	dry Mg/m3	PD Mg/m3
214537	WLS9	Not Given	1.50	Not Given	B	Brown gravelly very sandy silty CLAY	Atterberg 4 Point	13.4	50	31	-	21	10	80g/30 deg	W / I			
214538	WLS11	Not Given	1.00	Not Given	B	Brown gravelly very sandy silty CLAY	Atterberg 4 Point	7.4	61	27	-	18	9	80g/30 deg	W / I			

Note: # Non accredited; NP - Non plastic; N - Tested in natural condition, R - Tested after >0,425mm removed by hand, W - Tested after washing to remove >425mm; I - The water content in the sample was increased , D - The water content in the sample was decreased; * - One point liquid limit corrected as per the report Correlation Factor by Clayton C.R.I and Jukes A.W (1978)

Comments: Sample tested under Red Lab condition

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

Signed:

Monika Siewior
Reporting Specialist
for and on behalf of i2 Analytical Ltd

Date Reported: 20/06/2024 **GF 362.15**

ST Consult Ltd
Twigden Barns
Brixworth Road
Creaton
Northamptonshire
NN6 8NN

t: 01604 500020

e: cnolan@stconsult.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 24-022613

Project / Site name:	Wrexham	**Samples received on:**	31/05/2024
Your job number:	JN1246	**Samples instructed on/ Analysis started on:**	31/05/2024
Your order number:		**Analysis completed by:**	10/06/2024
Report Issue Number:	1	**Report issued on:**	11/06/2024
Samples Analysed:	8 soil samples		

Signed: Izabela Wójcik

Izabela Wójcik
Senior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 24-022613
Project / Site name: Wrexham

Lab Sample Number				214966	214967	214968	214969	214970
Sample Reference				S1	WLS10	WLS9	WLS13	WLS12
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.05	0.06	3.00	3.45
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	7.2	0.53	0.06	6.4	4.6
Total mass of sample received	kg	0.1	NONE	1	0.9	1	0.9	1.2
Asbestos								
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	KWB	-	-	-	-
General Inorganics								
pH (L099)	pH Units	N/A	MCERTS	5.9	-	-	7	6.7
Total Sulphate as SO_4	%	0.005	MCERTS	-	-	-	0.007	0.008
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	-	-	-	6.5	8.7
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	3.26	4.35
Total Sulphur	mg/kg	50	MCERTS	-	-	-	< 50	61
Total Sulphur	%	0.005	MCERTS	-	-	-	< 0.005	0.006
Organic Matter (automated)	%	0.1	MCERTS	0.8	-	-	-	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.27	< 0.05	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	0.14	0.08	-	-
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.56	0.37	-	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.29	0.08	-	-
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.34	0.15	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.12	-	-
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.54	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	1.61	1.35	-	-
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	5.1	-	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	-	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	-	-	-	-
Chromium (III)	mg/kg	1	NONE	8.8	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	8.8	-	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14	-	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	27	-	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	-	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	8.5	-	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	41	-	-	-	-

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 24-022613
Project / Site name: Wrexham

Lab Sample Number				214966	214967	214968	214969	214970
Sample Reference				S1	WLS10	WLS9	WLS13	WLS12
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.80	0.05	0.06	3.00	3.45
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPHCWG - Aliphatic >C5 - C6 HS_1D_AL	mg/kg	0.02	NONE	< 0.020	-	-	-	-
TPHCWG - Aliphatic >C6 - C8 HS_1D_AL	mg/kg	0.02	NONE	< 0.020	-	-	-	-
TPHCWG - Aliphatic >C8 - C10 HS_1D_AL	mg/kg	0.05	NONE	< 0.050	-	-	-	-
TPHCWG - Aliphatic >C10 - C12 EH_CU_1D_AL	mg/kg	1	MCERTS	< 1.0	-	-	-	-
TPHCWG - Aliphatic >C12 - C16 EH_CU_1D_AL	mg/kg	2	MCERTS	< 2.0	-	-	-	-
TPHCWG - Aliphatic >C16 - C21 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	-	-	-	-
TPHCWG - Aliphatic >C21 - C35 EH_CU_1D_AL	mg/kg	8	MCERTS	< 8.0	-	-	-	-
TPHCWG - Aliphatic >C5 - C35 EH_CU+HS_1D_AL	mg/kg	10	NONE	< 10	-	-	-	-
TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.01	NONE	< 0.010	-	-	-	-
TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.01	NONE	< 0.010	-	-	-	-
TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.05	NONE	< 0.050	-	-	-	-
TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	< 1.0	-	-	-	-
TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	< 2.0	-	-	-	-
TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	-	-	-	-
TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	< 10	-	-	-	-
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR	mg/kg	10	NONE	< 10	-	-	-	-
VOCs								
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	-	-	-	-
Benzene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
Toluene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
o-Xylene	µg/kg	5	MCERTS	< 5.0	-	-	-	-
Miscellaneous Organics								
Coal Tar		N/A	NONE	-	Not Identified	Not Identified	-	-
Total Residue	mg/kg	10	NONE	-	2700	4700	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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Analytical Report Number: 24-022613
Project / Site name: Wrexham

Lab Sample Number				214971	214972	214973
Sample Reference				WLS10	S1	WLS12
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				3.45	0.30	0.10
Date Sampled				Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Stone Content	%	0.1	NONE	< 0.1	39.4	16.5
Moisture Content	%	0.01	NONE	13	6.7	12
Total mass of sample received	kg	0.1	NONE	1.1	1	0.9
Asbestos						
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	-	-	-
General Inorganics						
pH (L099)	pH Units	N/A	MCERTS	5.2	7.9	7.8
Total Sulphate as SO_4	%	0.005	MCERTS	0.024	0.017	0.025
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	47	5.1	27
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	23.5	2.54	13.5
Total Sulphur	mg/kg	50	MCERTS	110	100	300
Total Sulphur	%	0.005	MCERTS	0.011	0.01	0.03
Organic Matter (automated)	%	0.1	MCERTS	-	-	-
Speciated PAHs						
Naphthalene	mg/kg	0.05	MCERTS	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-
Fluorene	mg/kg	0.05	MCERTS	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-
Anthracene	mg/kg	0.05	MCERTS	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-
Pyrene	mg/kg	0.05	MCERTS	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-
Chrysene	mg/kg	0.05	MCERTS	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-
Total PAH						
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	-	-	-
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	-
Chromium (hexavalent)	mg/kg	1.8	MCERTS	-	-	-
Chromium (III)	mg/kg	1	NONE	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	-

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 24-022613
Project / Site name: Wrexham

Lab Sample Number				214971	214972	214973
Sample Reference				WLS10	S1	WLS12
Sample Number				None Supplied	None Supplied	None Supplied
Depth (m)				3.45	0.30	0.10
Date Sampled				Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**			
Petroleum Hydrocarbons						
TPHCWG - Aliphatic >C5 - C6 HS_1D_AL	mg/kg	0.02	NONE	-	-	-
TPHCWG - Aliphatic >C6 - C8 HS_1D_AL	mg/kg	0.02	NONE	-	-	-
TPHCWG - Aliphatic >C8 - C10 HS_1D_AL	mg/kg	0.05	NONE	-	-	-
TPHCWG - Aliphatic >C10 - C12 EH_CU_1D_AL	mg/kg	1	MCERTS	-	-	-
TPHCWG - Aliphatic >C12 - C16 EH_CU_1D_AL	mg/kg	2	MCERTS	-	-	-
TPHCWG - Aliphatic >C16 - C21 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-
TPHCWG - Aliphatic >C21 - C35 EH_CU_1D_AL	mg/kg	8	MCERTS	-	-	-
TPHCWG - Aliphatic >C5 - C35 EH_CU+HS_1D_AL	mg/kg	10	NONE	-	-	-
TPHCWG - Aromatic >EC5 - EC7 HS_1D_AR	mg/kg	0.01	NONE	-	-	-
TPHCWG - Aromatic >EC7 - EC8 HS_1D_AR	mg/kg	0.01	NONE	-	-	-
TPHCWG - Aromatic >EC8 - EC10 HS_1D_AR	mg/kg	0.05	NONE	-	-	-
TPHCWG - Aromatic >EC10 - EC12 EH_CU_1D_AR	mg/kg	1	MCERTS	-	-	-
TPHCWG - Aromatic >EC12 - EC16 EH_CU_1D_AR	mg/kg	2	MCERTS	-	-	-
TPHCWG - Aromatic >EC16 - EC21 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-
TPHCWG - Aromatic >EC21 - EC35 EH_CU_1D_AR	mg/kg	10	MCERTS	-	-	-
TPHCWG - Aromatic >EC5 - EC35 EH_CU+HS_1D_AR	mg/kg	10	NONE	-	-	-
VOCs						
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-	-	-
Benzene	µg/kg	5	MCERTS	-	-	-
Toluene	µg/kg	5	MCERTS	-	-	-
Ethylbenzene	µg/kg	5	MCERTS	-	-	-
p & m-Xylene	µg/kg	5	MCERTS	-	-	-
o-Xylene	µg/kg	5	MCERTS	-	-	-
Miscellaneous Organics						
Coal Tar		N/A	NONE	-	-	-
Total Residue	mg/kg	10	NONE	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 24-022613
Project / Site name: Wrexham

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
214966	S1	None Supplied	1.8	Brown sand
214967	WLS10	None Supplied	0.05	Non Soil. *b
214968	WLS9	None Supplied	0.06	Non Soil. *b
214969	WLS13	None Supplied	3	Brown sand
214970	WLS12	None Supplied	3.45	Brown sand
214971	WLS10	None Supplied	3.45	Brown clay and sand
214972	S1	None Supplied	0.3	Brown loam and sand with vegetation and stones
214973	WLS12	None Supplied	0.1	Brown loam and sand with vegetation and stones

Analytical Report Number : 24-022613
Project / Site name: Wrexham

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Coal Tar in soil	In-house method by GC-MS, by calculation of discrete polyaromatic content	In-house method by calculation	L064B	D	NONE
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS with carbon banding aliphatic and aromatic	In-house method	L076B/L088	D/W	MCERTS
Chromium III in soil	In-house method by calculation from total Cr and Cr VI	In-house method by calculation	L080	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080	W	MCERTS

Analytical Report Number : 24-022613
Project / Site name: Wrexham

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

*b - Unaccredited sample matrix.

Sample Deviation Report

Analytical Report Number : 24-022613
Project / Site name: Wrexham

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
S1	N/A	S	214966	ab	Asbestos identification in Soil	A001B	a
S1	N/A	S	214966	ab	BTEX and/or Volatile organic compounds in soil	L073B	ab
S1	N/A	S	214966	ab	Chromium III in soil	L080	a
S1	N/A	S	214966	ab	Hexavalent chromium in soil	L080	a
S1	N/A	S	214966	ab	Metals in soil by ICP-OES	L038B	a
S1	N/A	S	214966	ab	Organic matter (Automated) in soil	L009B	a
S1	N/A	S	214966	ab	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	ab
S1	N/A	S	214966	ab	Total petroleum hydrocarbons with carbon banding by GC-FID/GC-MS HS in soil	L076B/L088	ab
S1	N/A	S	214966	ab	pH in soil (automated)	L099	a
S1	N/A	S	214972	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
S1	N/A	S	214972	a	Total Sulphur in soil	L038B	a
S1	N/A	S	214972	a	Total sulphate (as SO4 in soil)	L038B	a
S1	N/A	S	214972	a	pH in soil (automated)	L099	a
WLS10	N/A	S	214967	ab	Coal Tar in soil	L064B	ab
WLS10	N/A	S	214967	ab	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	ab
WLS10	N/A	S	214971	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WLS10	N/A	S	214971	a	Total Sulphur in soil	L038B	a
WLS10	N/A	S	214971	a	Total sulphate (as SO4 in soil)	L038B	a
WLS10	N/A	S	214971	a	pH in soil (automated)	L099	a
WLS12	N/A	S	214970	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WLS12	N/A	S	214970	a	Total Sulphur in soil	L038B	a
WLS12	N/A	S	214970	a	Total sulphate (as SO4 in soil)	L038B	a
WLS12	N/A	S	214970	a	pH in soil (automated)	L099	a
WLS12	N/A	S	214973	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WLS12	N/A	S	214973	a	Total Sulphur in soil	L038B	a
WLS12	N/A	S	214973	a	Total sulphate (as SO4 in soil)	L038B	a
WLS12	N/A	S	214973	a	pH in soil (automated)	L099	a
WLS13	N/A	S	214969	a	Sulphate, water soluble, in soil (16hr extraction)	L038B	a
WLS13	N/A	S	214969	a	Total Sulphur in soil	L038B	a
WLS13	N/A	S	214969	a	Total sulphate (as SO4 in soil)	L038B	a
WLS13	N/A	S	214969	a	pH in soil (automated)	L099	a
WLS9	N/A	S	214968	ab	Coal Tar in soil	L064B	ab
WLS9	N/A	S	214968	ab	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	ab

Southern Testing
Environmental & Geotechnical

ST Consult
Environmental & Geotechnical



Head Office
East Grinstead
Tel: 01342 333100
enquiries@southerntesting.co.uk

ST Consult Midlands
Northampton
Tel: 01604 500020
creaton@stconsult.co.uk

ST Consult Thames Valley
Hannington
Tel: 01635 800 950
hannington@stconsult.co.uk

ST Consult North West
Warrington
Tel: 01925 661 735
warrington@stconsult.co.uk

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Appendix B

Drainage Calculations

PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	79.640	77.210	2.280	Open Manhole	1200
S1.001	o	150	S2	78.950	76.995	1.805	Open Manhole	1200
S1.002	o	150	S4	78.740	76.853	1.737	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	20.157	144.0	S2	78.950	77.070	1.730	Open Manhole	1200
S1.001	9.600	143.3	S4	78.740	76.928	1.662	Open Manhole	1200
S1.002	1.657	138.1	S	78.700	76.841	1.709	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.065	0.065	0.065
1.001	User	-	100	0.064	0.064	0.064
1.002	User	-	100	0.038	0.038	0.038
				Total	Total	Total
				0.167	0.167	0.167

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	5
FEH Rainfall Version	1999
Site Location	GB 334300 350550 SJ 34300 50550
C (1km)	-0.025
D1 (1km)	0.336
D2 (1km)	0.382
D3 (1km)	0.320
E (1km)	0.287
F (1km)	2.415
Summer Storms	Yes
Winter Storms	No
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 334300 350550 SJ 34300 50550
C (1km)	-0.025
D1 (1km)	0.336
D2 (1km)	0.382
D3 (1km)	0.320
E (1km)	0.287
F (1km)	2.415
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	2	+0%	30/15 Summer	100/15 Summer		
S1.001	S2	15 Winter	2	+0%	2/15 Summer	100/15 Summer		
S1.002	S4	15 Winter	2	+0%	2/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	77.307	-0.053	0.000	0.72		10.0	OK	4
S1.001	S2	77.234	0.089	0.000	1.34		17.6	SURCHARGED	4
S1.002	S4	77.112	0.109	0.000	2.06		22.3	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 334300 350550 SJ 34300 50550
C (1km)	-0.025
D1 (1km)	0.336
D2 (1km)	0.382
D3 (1km)	0.320
E (1km)	0.287
F (1km)	2.415
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
S1.001	S2	15 Winter	30	+0%	2/15 Summer	100/15 Summer		
S1.002	S4	15 Winter	30	+0%	2/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	78.458	1.098	0.000	1.46		20.3	SURCHARGED	4
S1.001	S2	78.179	1.034	0.000	2.89		37.9	SURCHARGED	4
S1.002	S4	77.614	0.611	0.000	4.51		48.9	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 334300 350550 SJ 34300 50550
C (1km)	-0.025
D1 (1km)	0.336
D2 (1km)	0.382
D3 (1km)	0.320
E (1km)	0.287
F (1km)	2.415
Cv (Summer)	0.750
Cv (Winter)	0.840

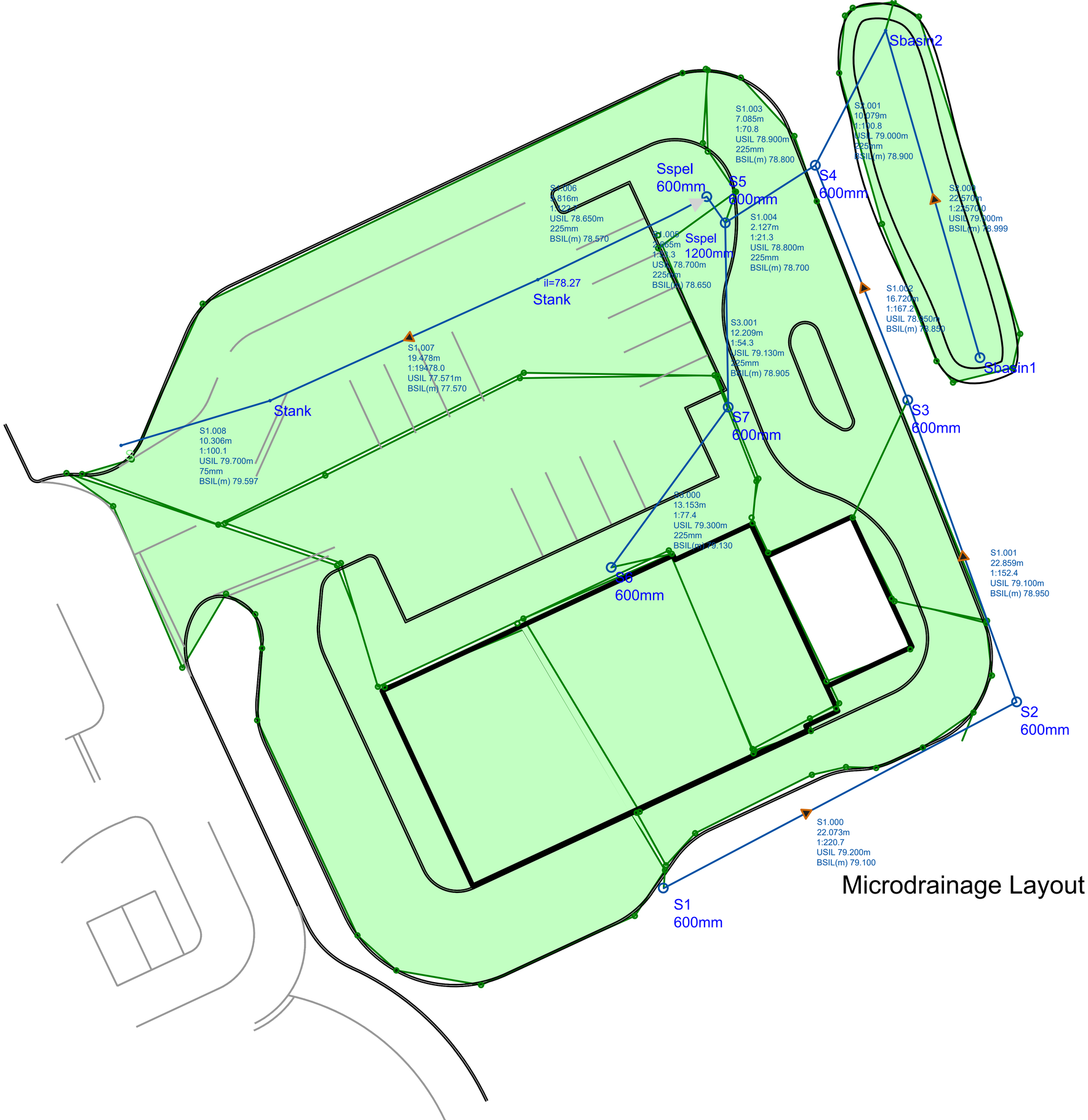
Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	100	+40%	30/15 Summer	100/15 Summer		
S1.001	S2	15 Winter	100	+40%	2/15 Summer	100/15 Summer		
S1.002	S4	15 Summer	100	+40%	2/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	79.643	2.283	2.992	2.21		30.8	FLOOD	4
S1.001	S2	78.957	1.812	7.400	4.16		54.6	FLOOD	4
S1.002	S4	78.317	1.314	0.000	6.55		71.1	SURCHARGED	

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Microdrainage Layout

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	26.875	0.100	268.8	0.052	5.00	0.0		0.060	→|o|→		Filter Drain	
S1.001	21.610	0.150	144.1	0.012	0.00	0.0		0.060	→|o|→		Filter Drain	
S1.002	16.720	0.100	167.2	0.032	0.00	0.0		0.060	→|o|→		Filter Drain	
S2.000	22.570	0.001	22570.0	0.000	5.00	0.0		0.060	→_/		Pond/Tank	
S2.001	10.079	0.100	100.8	0.015	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.003	7.085	0.100	70.8	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S3.000	13.153	0.170	77.4	0.014	5.00	0.0	0.600		o	225	Pipe/Conduit	
S3.001	12.209	0.225	54.3	0.047	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.004	2.127	0.100	21.3	0.057	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.005	2.665	0.050	53.3	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.006	9.816	0.080	122.7	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
S1.007	19.478	0.001	19478.0	0.000	0.00	0.0		0.500	→[↓]		Cellular Storage	
S1.008	10.306	0.103	100.1	0.000	0.00	0.0	0.600		o	75	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	7.70	79.200	0.052	0.0	0.0	0.0	0.17	35.0	7.0
S1.001	50.00	9.42	79.100	0.064	0.0	0.0	0.0	0.21	35.6	8.6
S1.002	50.00	10.84	78.950	0.096	0.0	0.0	0.0	0.20	34.1	12.9
S2.000	50.00	13.72	79.000	0.000	0.0	0.0	0.0	0.04	76.3	0.0
S2.001	50.00	13.85	79.000	0.015	0.0	0.0	0.0	1.30	51.8	2.1
S1.003	50.00	13.92	78.900	0.111	0.0	0.0	0.0	1.56	61.9	15.0
S3.000	50.00	5.15	79.300	0.014	0.0	0.0	0.0	1.49	59.2	1.9
S3.001	50.00	5.26	79.130	0.061	0.0	0.0	0.0	1.78	70.8	8.3
S1.004	50.00	13.93	78.800	0.228	0.0	0.0	0.0	2.85	113.3	30.9
S1.005	50.00	13.96	78.700	0.228	0.0	0.0	0.0	1.80	71.4	30.9
S1.006	50.00	14.10	78.650	0.228	0.0	0.0	0.0	1.18	46.9	30.9
S1.007	50.00	30.00	77.571	0.228	0.0	0.0	0.0	0.01	104.3	30.9
S1.008	50.00	30.00	79.700	0.228	0.0	0.0	0.0	0.63	2.8«	30.9

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	→|o|→		S1	79.900	79.200	0.000	Open Manhole	600
S1.001	→|o|→		S2	79.850	79.100	0.000	Open Manhole	600
S1.002	→|o|→		S3	79.720	78.950	0.000	Open Manhole	600
S2.000	→_/		Sbasin1	79.301	79.000	0.000	Junction	
S2.001	o	225	Sbasin2	79.300	79.000	0.075	Open Manhole	100
S1.003	o	225	S4	79.920	78.900	0.795	Open Manhole	600
S3.000	o	225	S6	79.950	79.300	0.425	Open Manhole	600
S3.001	o	225	S7	79.850	79.130	0.495	Open Manhole	600
S1.004	o	225	S5	79.950	78.800	0.925	Open Manhole	600
S1.005	o	225	Sspel	80.000	78.700	1.075	Open Manhole	600
S1.006	o	225	Sspel	80.000	78.650	1.125	Open Manhole	1200
S1.007	→[↓]		Stank	79.780	77.571	1.008	Open Manhole	100
S1.008	o	75	Stank	79.780	79.700	0.005	Open Manhole	100

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	26.875	268.8	S2	79.850	79.100	0.050	Open Manhole	600
S1.001	21.610	144.1	S3	79.720	78.950	0.020	Open Manhole	600
S1.002	16.720	167.2	S4	79.920	78.850	0.300	Open Manhole	600
S2.000	22.570	22570.0	Sbasin2	79.300	78.999	0.000	Open Manhole	100
S2.001	10.079	100.8	S4	79.920	78.900	0.795	Open Manhole	600
S1.003	7.085	70.8	S5	79.950	78.800	0.925	Open Manhole	600
S3.000	13.153	77.4	S7	79.850	79.130	0.495	Open Manhole	600
S3.001	12.209	54.3	S5	79.950	78.905	0.820	Open Manhole	600
S1.004	2.127	21.3	Sspel	80.000	78.700	1.075	Open Manhole	600
S1.005	2.665	53.3	Sspel	80.000	78.650	1.125	Open Manhole	1200
S1.006	9.816	122.7	Stank	79.780	78.570	0.985	Open Manhole	100
S1.007	19.478	19478.0	Stank	79.780	77.570	1.009	Open Manhole	100
S1.008	10.306	100.1	S	80.000	79.597	0.328	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.052	0.052	0.052
1.001	User	-	100	0.012	0.012	0.012
1.002	User	-	100	0.032	0.032	0.032
2.000	-	-	100	0.000	0.000	0.000
2.001	User	-	100	0.015	0.015	0.015
1.003	-	-	100	0.000	0.000	0.000
3.000	User	-	100	0.014	0.014	0.014
3.001	User	-	100	0.047	0.047	0.047
1.004	User	-	100	0.057	0.057	0.057
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.228	0.228	0.228

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 333992 350361 SJ 33992 50361	Cv (Winter)	0.840
Data Type	Point	Storm Duration (mins)	30

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Storage Structures for Storm

Filter Drain Pipe: S1.000

Manning's N	0.060	Trench Length (m)	26.9
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.200
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	268.8
Invert Level (m)	79.200	Cap Volume Depth (m)	0.000
Trench Width (m)	0.9	Cap Infiltration Depth (m)	0.000

Filter Drain Pipe: S1.001

Manning's N	0.060	Trench Length (m)	21.6
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	144.1
Invert Level (m)	79.100	Cap Volume Depth (m)	0.900
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000

Filter Drain Pipe: S1.002

Manning's N	0.060	Trench Length (m)	16.7
Infiltration Coefficient Base (m/hr)	0.00000	Pipe Diameter (m)	0.150
Infiltration Coefficient Side (m/hr)	0.00000	Pipe Depth above Invert (m)	0.000
Safety Factor	2.0	Number of Pipes	1
Porosity	0.30	Slope (1:X)	167.2
Invert Level (m)	78.950	Cap Volume Depth (m)	0.000
Trench Width (m)	0.7	Cap Infiltration Depth (m)	0.000

Tank or Pond Pipe: S2.000

Manning's N 0.060 Invert Level (m) 79.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	102.0	0.300	163.0

Porous Car Park Manhole: Sspel, DS/PN: S1.006

Infiltration Coefficient Base (m/hr)	0.03880	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.5
Max Percolation (l/s)	17.4	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	79.400	Cap Volume Depth (m)	0.400

Cellular Storage Pipe: S1.007

Manning's N	0.500	Infiltration Coefficient Side (m/hr)	0.03888
Invert Level (m)	77.571	Safety Factor	5.0
Infiltration Coefficient Base (m/hr)	0.03888	Porosity	0.95

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	195.0	230.0	1.200	195.0	254.3	1.201	0.0	254.3

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Point
FEH Rainfall Version	2013	Cv (Summer)	0.750
Site Location	GB 333992 350361 SJ 33992 50361	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	2	+0%					79.354	-0.546
S1.001	S2	15 Winter	2	+0%					79.253	-0.597
S1.002	S3	30 Winter	2	+0%					79.129	-0.591
S2.000	Sbasin1	960 Summer	2	+0%					79.016	-0.285
S2.001	Sbasin2	1440 Summer	2	+0%					79.011	-0.214
S1.003	S4	30 Winter	2	+0%	30/15 Winter				78.967	-0.158
S3.000	S6	15 Winter	2	+0%	100/15 Winter				79.329	-0.196
S3.001	S7	15 Winter	2	+0%	100/15 Summer				79.185	-0.170
S1.004	S5	15 Winter	2	+0%	30/15 Summer				78.902	-0.123
S1.005	Sspel	15 Winter	2	+0%	30/15 Summer				78.825	-0.100
S1.006	Sspel	15 Winter	2	+0%	30/15 Summer				78.759	-0.116
S1.007	Stank	1440 Winter	2	+0%	100/1440 Winter				77.855	-0.917
S1.008	Stank	960 Winter	2	+0%					77.845	-1.930

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.19		6.7	OK	
S1.001	S2	0.000	0.20		7.2	OK	
S1.002	S3	0.000	0.24		8.2	OK	
S2.000	Sbasin1	0.000	0.02		5.1	FLOOD RISK*	
S2.001	Sbasin2	0.000	0.01		0.4	FLOOD RISK	
S1.003	S4	0.000	0.19		8.6	OK	
S3.000	S6	0.000	0.04		2.1	OK	
S3.001	S7	0.000	0.14		8.2	OK	
S1.004	S5	0.000	0.42		18.6	OK	
S1.005	Sspel	0.000	0.59		18.5	OK	
S1.006	Sspel	0.000	0.48		18.5	OK	

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.007	Stank	0.000	0.01		3.3	OK	
S1.008	Stank	0.000	0.00		0.0	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH Data Type	Point
FEH Rainfall Version		2013 Cv (Summer)	0.750
Site Location	GB 333992 350361 SJ 33992 50361	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	15 Winter	30	+0%					79.527	-0.373
S1.001	S2	15 Winter	30	+0%					79.424	-0.426
S1.002	S3	30 Winter	30	+0%					79.339	-0.381
S2.000	Sbasin1	30 Winter	30	+0%					79.019	-0.282
S2.001	Sbasin2	15 Winter	30	+0%					79.023	-0.202
S1.003	S4	15 Winter	30	+0%	30/15 Winter				79.128	0.003
S3.000	S6	15 Winter	30	+0%	100/15 Winter				79.347	-0.178
S3.001	S7	15 Winter	30	+0%	100/15 Summer				79.227	-0.128
S1.004	S5	15 Winter	30	+0%	30/15 Summer				79.121	0.096
S1.005	Sspel	15 Winter	30	+0%	30/15 Summer				79.009	0.084
S1.006	Sspel	15 Winter	30	+0%	30/15 Summer				78.899	0.024
S1.007	Stank	1440 Winter	30	+0%	100/1440 Winter				78.207	-0.565
S1.008	Stank	1440 Winter	30	+0%					78.207	-1.568

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.45		15.6	OK	
S1.001	S2	0.000	0.45		15.9	OK	
S1.002	S3	0.000	0.55		18.7	OK	
S2.000	Sbasin1	0.000	0.00		0.4	FLOOD RISK*	
S2.001	Sbasin2	0.000	0.02		0.8	FLOOD RISK	
S1.003	S4	0.000	0.40		17.6	SURCHARGED	
S3.000	S6	0.000	0.10		5.0	OK	
S3.001	S7	0.000	0.39		23.6	OK	
S1.004	S5	0.000	1.05		46.8	SURCHARGED	
S1.005	Sspel	0.000	1.48		46.7	SURCHARGED	
S1.006	Sspel	0.000	1.19		46.5	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.007	Stank	0.000	0.01		4.3	OK	
S1.008	Stank	0.000	0.00		0.0	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 0.750
Site Location	GB 333992 350361 SJ 33992 50361		Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
S1.000	S1	30 Winter	100	+40%					79.819	-0.081
S1.001	S2	30 Winter	100	+40%					79.770	-0.080
S1.002	S3	30 Winter	100	+40%					79.698	-0.022
S2.000	Sbasin1	30 Winter	100	+40%					79.098	-0.203
S2.001	Sbasin2	30 Winter	100	+40%					79.098	-0.127
S1.003	S4	15 Winter	100	+40%	30/15 Winter				79.334	0.209
S3.000	S6	15 Winter	100	+40%	100/15 Winter				79.536	0.011
S3.001	S7	15 Winter	100	+40%	100/15 Summer				79.519	0.164
S1.004	S5	15 Winter	100	+40%	30/15 Summer				79.395	0.370
S1.005	Sspel	15 Winter	100	+40%	30/15 Summer				79.193	0.268
S1.006	Sspel	15 Winter	100	+40%	30/15 Summer				78.992	0.117
S1.007	Stank	1440 Winter	100	+40%	100/1440 Winter				78.926	0.154
S1.008	Stank	1440 Winter	100	+40%					78.926	-0.849

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.000	0.68		23.6	FLOOD RISK	
S1.001	S2	0.000	0.76		27.0	FLOOD RISK	
S1.002	S3	0.000	1.03		34.8	FLOOD RISK	
S2.000	Sbasin1	0.000	0.03		6.7	FLOOD RISK*	
S2.001	Sbasin2	0.000	0.32		13.6	FLOOD RISK	
S1.003	S4	0.000	0.79		35.2	SURCHARGED	
S3.000	S6	0.000	0.20		10.1	SURCHARGED	
S3.001	S7	0.000	0.72		43.8	SURCHARGED	
S1.004	S5	0.000	1.40		62.5	SURCHARGED	
S1.005	Sspel	0.000	1.97		62.1	SURCHARGED	
S1.006	Sspel	0.000	1.60		62.4	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.007	Stank	0.000	0.03		7.6	SURCHARGED	
S1.008	Stank	0.000	0.00		0.0	OK	

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Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FEH	Data Type Point
FEH Rainfall Version		2013	Cv (Summer) 0.750
Site Location	GB 333992 350361 SJ 33992 50361		Cv (Winter) 0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1000
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	1000	+0%	1000/15 Summer	1000/15 Summer			79.901
S1.001	S2	30 Winter	1000	+0%					79.848
S1.002	S3	30 Winter	1000	+0%	1000/30 Summer	1000/30 Summer			79.721
S2.000	Sbasin1	30 Winter	1000	+0%					79.140
S2.001	Sbasin2	30 Winter	1000	+0%					79.140
S1.003	S4	15 Winter	1000	+0%	1000/15 Summer				79.390
S3.000	S6	15 Winter	1000	+0%	1000/15 Summer				79.669
S3.001	S7	15 Winter	1000	+0%	1000/15 Summer				79.650
S1.004	S5	15 Winter	1000	+0%	1000/15 Summer				79.478
S1.005	Sspel	1440 Winter	1000	+0%	1000/15 Summer				79.329
S1.006	Sspel	1440 Winter	1000	+0%	1000/15 Summer				79.423
S1.007	Stank	960 Winter	1000	+0%	1000/960 Winter				79.775
S1.008	Stank	960 Winter	1000	+0%	1000/960 Winter	1000/960 Winter			79.780

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.001	1.331	0.81		28.1	FLOOD	4
S1.001	S2	-0.002	0.000	0.91		32.4	FLOOD RISK	
S1.002	S3	0.001	0.992	1.16		39.5	FLOOD	2
S2.000	Sbasin1	-0.161	0.000	0.04		10.8	FLOOD RISK*	
S2.001	Sbasin2	-0.085	0.000	0.50		21.8	FLOOD RISK	
S1.003	S4	0.265	0.000	0.86		38.2	SURCHARGED	
S3.000	S6	0.144	0.000	0.24		12.0	FLOOD RISK	
S3.001	S7	0.295	0.000	0.85		51.7	FLOOD RISK	
S1.004	S5	0.453	0.000	1.49		66.5	SURCHARGED	
S1.005	Sspel	0.404	0.000	0.56		17.5	SURCHARGED	
S1.006	Sspel	0.548	0.000	0.39		15.1	SURCHARGED	

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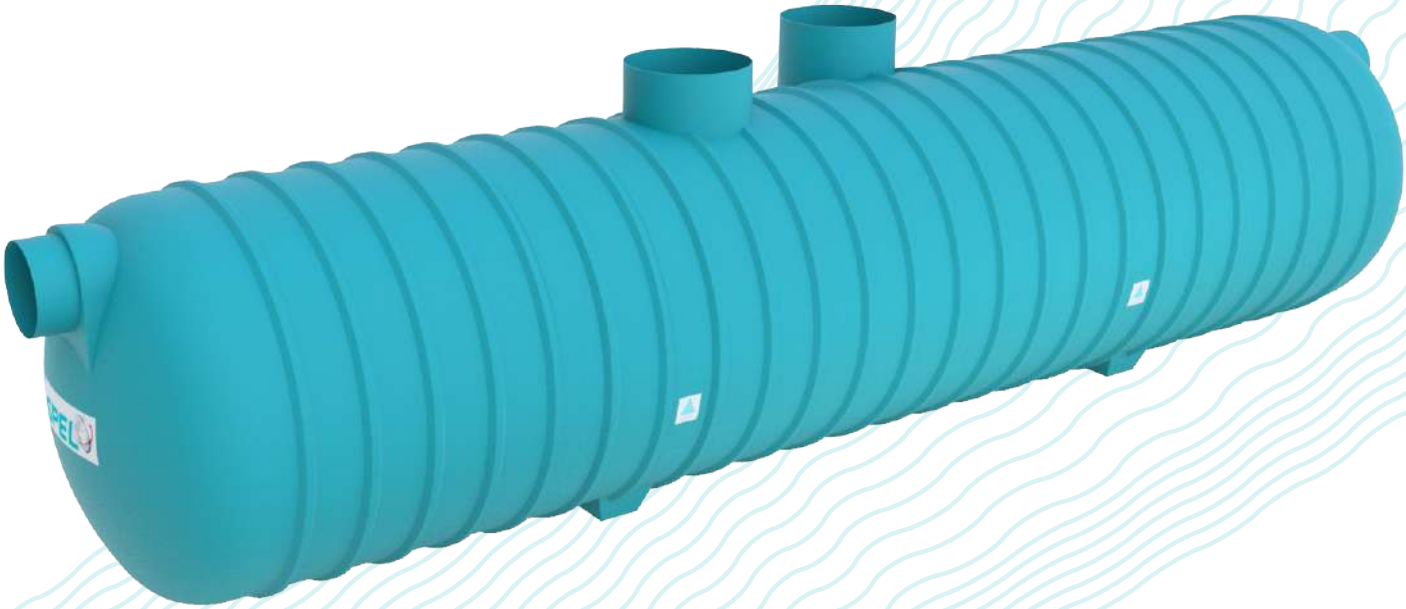
Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.007	Stank	1.003	0.000	0.04		10.8	FLOOD RISK	
S1.008	Stank	0.005	0.002	0.19		0.5	FLOOD	1

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Appendix C

Product Details



SPEL Stormceptor

ESR (Enhanced Silt Retention)

SuDS Compliant ESR Range

spelproducts.co.uk

SPEL Stormceptor ESR Range
By-Pass System

The **total** treatment solution for SuDS

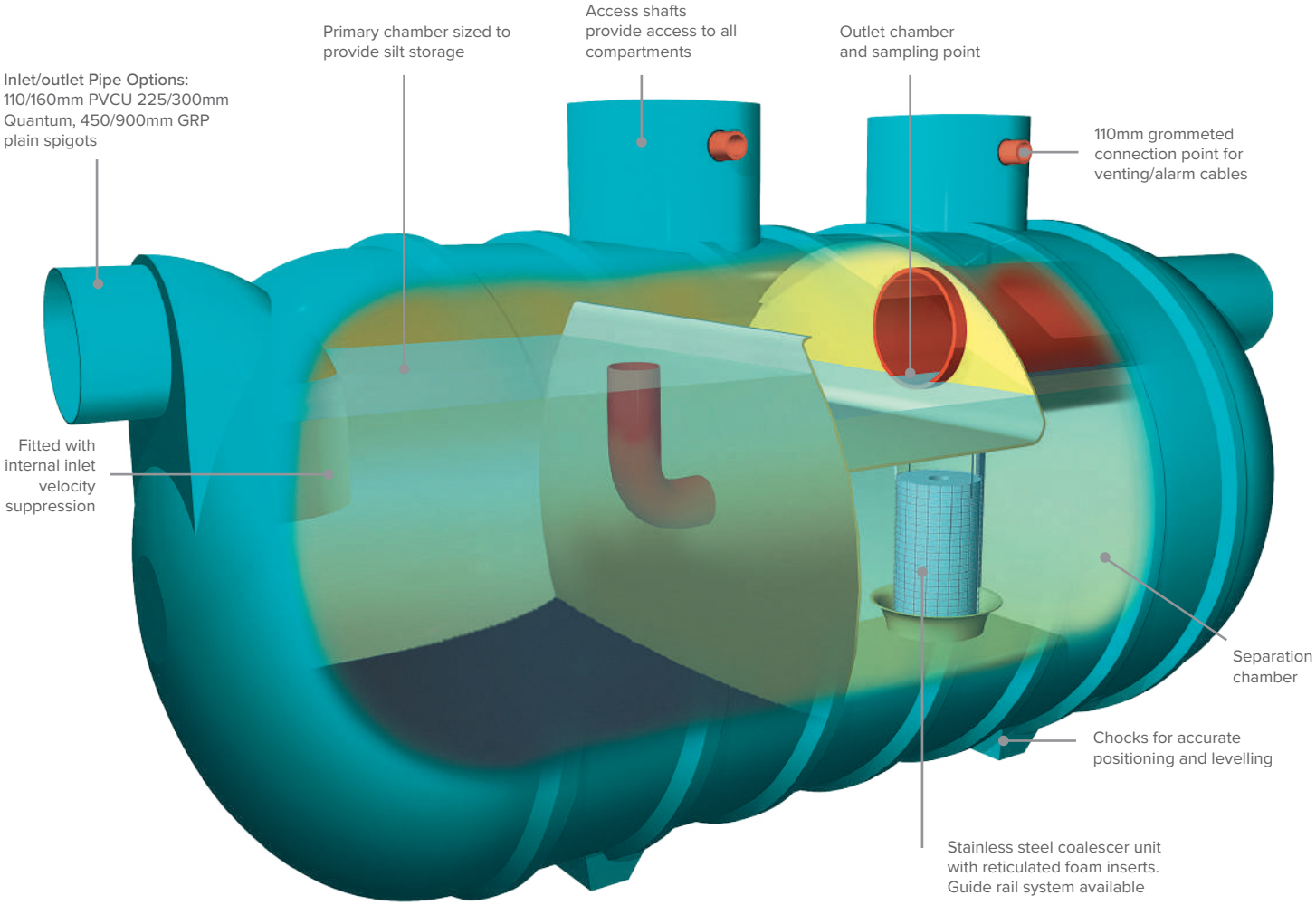
The new SPEL ESR System is fully certified to meet the CIRIA SuDS Mitigation Index. It has been tested by WRc (for TSS and Metals) to the British Water Code of Practice for Manufactured Treatment Devices. This unit is also compliant to the British and European Standard BS EN 858.

SPEL's ESR range is a total treatment system removing Hydrocarbons, Total Suspended Solids (TSS) and Metals (particulate). It's a highly efficient, single unit, water quality SuDS component.

SPEL ESR Stormceptor Certified Mitigation Index

TSS	0.8
Metals	0.6
Hydrocarbons	0.9*

**H R Wallingford test results to BS EN 858*



SPEL Stormceptor ESR Range
By-Pass System



Surface Water Treatment Device Performance Declaration

Testing carried out according to British Water Code of Practice

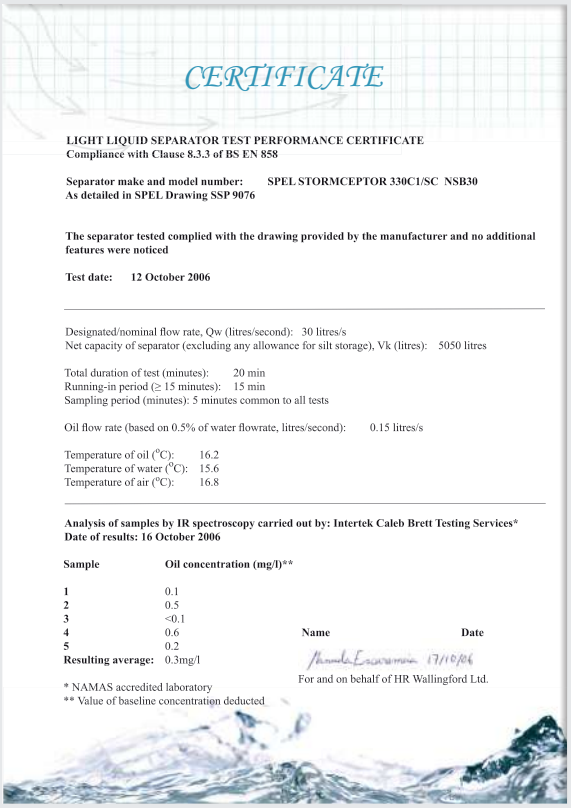
Product Details	Description
Manufacturer	SPEL Products
Treatment Device Name/Model	Stormceptor Type 210 C1/SC
General description	Class 1 By-pass Separator with Silt Capacity
Envisaged application	Treatment of Surface Water Run-off
Pollutant(s) captured	Suspended Solids

Test	Value	Unit
Treatment device capacity	3200	litres
Sediment Storage capacity	1000	litres
Treatment Flow rate	10	l/s
Connected Area	1,333	m²
Pollution retention flow rate	10	l/s

Parameter	Value	Unit
Maximum capacity flow rate	100	l/s
Device head loss (at treatment flowrate)	0.15	m
Device head loss (at maximum capacity treatment flowrate)	-	m
TSS capture and retention efficiency (Milisil W4 test sediment)	**82**	**%**
Zinc capture efficiency (if tested)	Not tested for dissolved metals	%
Zinc retention efficiency (if tested)	Not tested for dissolved metals	%
Copper capture efficiency (if tested)	Not tested for dissolved metals	%
Copper retention efficiency (if tested)	Not tested for dissolved metals	%
Dissolved Metals reduction	0.0	%
Particulate metals reduction*	61.5*	%
Total Metals reduction*	61.5*	%
Total Metals Mitigation Index	0.615*	-

* Extrapolated value in accordance with British Water How to Guide: Applying the CIRIA The SuDS Manual (C753) Simple Index Approach to Proprietary / Manufactured Stormwater Treatment Devices. Version 7, Section 4.3, (2021- under pre-publication review).

Certificates of compliance from WRc and HR Wallingford for the SPEL Stormceptor ESR Range



CERTIFICATE

LIGHT LIQUID SEPARATOR TEST PERFORMANCE CERTIFICATE
Compliance with Clause 8.3.3 of BS EN 858

Separator make and model number: SPEL STORMCEPTOR 330C1/SC NSB30
As detailed in SPEL Drawing SSP 9076

The separator tested complied with the drawing provided by the manufacturer and no additional features were noticed

Test date: 12 October 2006

Designated/nominal flow rate, Qw (litres/second): 30 litres/s
Net capacity of separator (excluding any allowance for silt storage), Vk (litres): 5050 litres

Total duration of test (minutes): 20 min
Running-in period (≥ 15 minutes): 15 min
Sampling period (minutes): 5 minutes common to all tests

Oil flow rate (based on 0.5% of water flowrate, litres/second): 0.15 litres/s

Temperature of oil (°C): 16.2
Temperature of water (°C): 15.6
Temperature of air (°C): 16.8

Analysis of samples by IR spectroscopy carried out by: Intertek Caleb Brett Testing Services*
Date of results: 16 October 2006

Sample	Oil concentration (mg/l)**
1	0.1
2	0.5
3	<0.1
4	0.6
5	0.2
Resulting average:	0.3mg/l

Name Date

For and on behalf of HR Wallingford Ltd.

* NAMAS accredited laboratory
** Value of baseline concentration deducted



SPEL's Head of Technical Development alongside the WRc testing officer.

Research and Development

Research and development is at the heart of what we do at SPEL, our passion as Zero Pollution Ambassadors is to be at the cutting edge of clean surface water technology.

Months of rigorous testing has resulted in the new SPEL Stormceptor ESR Range.


Quality Assured Company
BS EN ISO 9001
Design & Manufacture

Protecting our environment for over 45 years

The SuDS Manual is leading good practise in drainage design, SPEL are endorsing this with the release of the new SPEL Stormceptor ESR range.

Total Suspended Solids (TSS)	Metals	Hydrocarbons
0.8	0.6	0.9*

**H R Wallingford test results to BS EN 858*

Added to these class-leading Mitigation Indices, the ESR range benefits from:

- British/European Standard BS EN 858-1 2002 certification.
- The SPEL 25 year shell Warranty.
- 50 year+ life expectancy.
- ISO9001 quality assurance.
- ISO14001 committed to environmental improvement

26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
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 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]

26.3 Indicative SuDS mitigation indices for discharges to surface waters

	Mitigation Indices		
Type of SuDS component	TSS	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4[2]	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond[4]	0.7[3]	0.7	0.5
Wetland	0.8[3]	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 frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.		

Tables from The SuDS Manual (C753), p568-569
For reference notes, please see the full manual: https://www.ciria.org/Memberships/The_SuDs_Manual_C753_Chapters.aspx

SPEL Stormceptor ESR Range By-Pass System

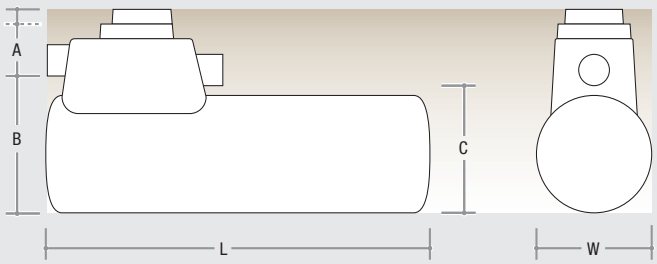
ESR Specification Chart

Model	Series	Treated Flow Rate - l/s	Maximum Flow	Catchment area (m^2)*	Oil storage (litres)	Silt capacity (litres)	Overall length* (mm) L	Overall diameter (mm)	Inlet Invert (mm) A	Base to Inlet (mm) B	Base to outlet (mm) C	Max in/ out pipe diameter** (mm)	Number of access shafts (dia. mm) 600	750	900	1200
ESR10/C1	200	10	100	1,333	150	1,000	2,920	1,225	560	1,350	1,300	300	-	1	-	-
ESR15/C1	200	15	150	2,000	225	1,500	4,237	1,225	560	1,350	1,300	300	-	1	-	-
ESR20/C1	300	20	200	2,665	300	2,000	3,200	1,875	700	1,450	1,350	450	2	-	-	-
ESR25/C1	300	25	250	3,333	375	2,500	3,540	1,875	700	1,450	1,350	450	2	-	-	-
ESR30/C1	300	30	300	4,000	450	3,000	4,420	1,875	700	1,450	1,350	450	-	1	1	-
ESR40/C1	300	40	400	5,333	600	4,000	5,760	1,875	740	1,410	1,310	450	1	1	-	-
ESR45/C1	300	45	450	6,000	675	4,500	6,570	1,875	740	1,410	1,310	450	1	1	-	-
ESR50/C1	300	50	500	6,665	750	5,000	7,060	1,875	740	1,410	1,310	450	1	1	-	-
ESR60/C1	400	60	600	8,000	900	6,000	4,400	2,700	950	2,100	2,000	600	1	-	1	-
ESR70/C1	400	70	700	9,333	1,050	7,000	5,250	2,700	950	2,100	2,000	600	1	-	1	-
ESR80/C1	400	80	800	10,665	1,200	8,000	6,170	2,700	950	2,100	2,000	600	1	-	1	-
ESR100/C1	400	100	1000	13,333	1,500	10,000	7,400	2,700	1,100	1,950	1,850	750	1	-	1	-
ESR125/C1	400	125	1250	16,665	1,875	12,500	9,050	2,700	1,100	1,950	1,850	750	1	-	1	-
ESR150/C1	400	150	1500	20,000	2,250	15,000	9,950	2,700	1,100	1,950	1,850	750	-	-	2	-
ESR160/C1	400	160	1600	21,333	2,400	16,000	11,830	2,700	1,250	1,800	1,700	750	1	1	1	-
ESR180/C1	500	180	1800	24,000	2,700	18,000	7,470	3,650	1,185	2,690	2,550	900	-	-	-	-
ESR200/C1	500	200	2000	26,665	3,000	20,000	8,530	3,650	1,185	2,690	2,355	1,200	-	-	-	-
ESR250/C1	500	250	2500	33,333	3,750	25,000	10,040	3,650	1,185	2,690	2,355	1,200	-	-	-	-
ESR300/C1	600	300	3000	40,000	4,500	30,000	10,310	4,150	1,325	2,850	2,675	1,200	-	-	-	-
ESR350/C1	600	350	3500	46,665	5,250	35,000	11,470	4,150	1,325	2,850	2,675	1,200	-	-	-	-
ESR400/C1	600	400	4000	53,333	6,000	40,000	12,690	4,150	1,325	2,850	2,675	1,200	-	-	-	-
ESR500/C1	600	500	5000	66,665	7,500	50,000	15,870	4,150	1,325	2,850	2,675	1,200	-	-	-	-
ESR600/C1	600	600	6000	80,000	9,000	60,000	18,260	4,150	1,325	2,850	2,675	1,200	-	-	-	-
ESR700/C1	600	700	7000	93,333	10,500	70,000	22,250	4,150	2,850	2,850	2,675	1,200	-	-	-	-

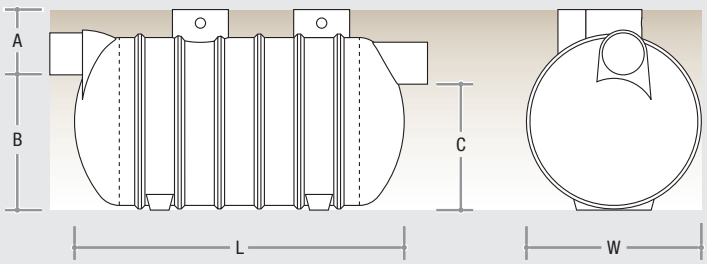
These catchment areas are based on the SuDS Manual requirement for By-Pass devices to treat the 1 in 1 year storm event (27mm).
***This dimension is for A-C inlet/outlet options, larger pipe sizes are available for D-I inlet/outlet options.*

200 Series ESR – Inside diameter 1200mm, outside diameter 1225mm.
300 series ESR – Inside diameter 1800mm, outside diameter 1875mm.
400 series ESR – Inside diameter 2600mm, outside diameter 2700mm.
500 series ESR – Inside diameter 3500mm, outside diameter 3650mm.
600 series ESR – Inside diameter 4000mm, outside diameter 4150mm.

200 series



300/400/500 & 600 series



Optional extras

SPEL coalescer unit guide rail systems

To facilitate easy insertion of coalescer units, the SPEL guide rail system manufactured in stainless steel can be incorporated into SPEL Puraceptors and class 1 Stormceptors.

Brackets fixed to the top and bottom of the coalescer unit simply engage the stainless steel guide rail fixed to the top of the stub access shaft. The coalescer unit is then lowered in the normal way, being guided at the correct angle into the conical base.

Lifting chains are available for the larger coalescer units and where extension shafts are fitted.

Extension guide rails can be incorporated into SPEL extension shafts to suit.

SPEL coalescer unit lifting, locating and locking system

The SPEL lifting, locating and locking system is manufactured in stainless steel and replaces the standard coalescer unit handle.

The locating/locking handle ensures the coalescer unit is seated and locked in its correct position after maintenance.



Above left:
Lifting, locating and locking system with guide rail system.

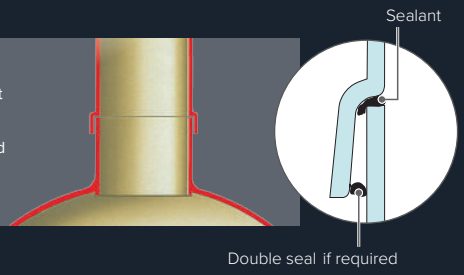
Above right:
The SPEL coalescer unit with lifting chain.

SPEL extension access shafts

Extension access shafts are available for deep invert applications.

Socket joint stub access shaft with extension shaft.

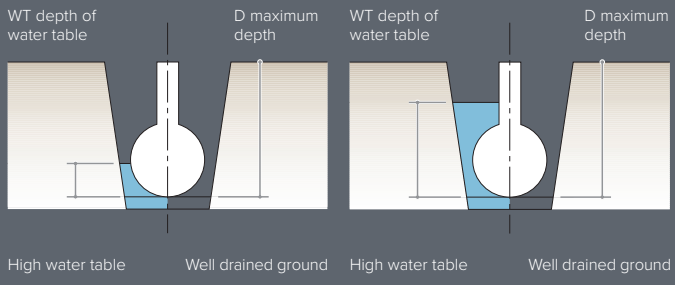
600mm, 750mm, 900mm and 1200mm diameter.



Tank shell specifications

The 'standard' specification is normally adequate for most installations but heavier specifications are available depending upon the burial depth and water table level, in winter. The concern is when the system is emptied completely and remains empty for a period of time.

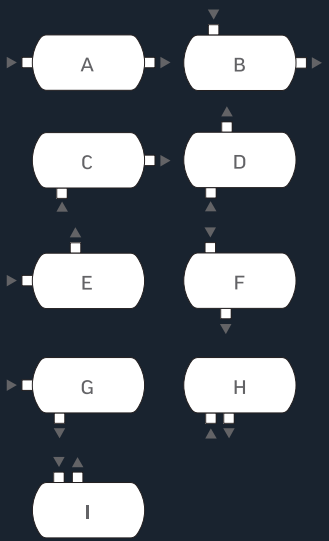
Standard tanks			Heavy tanks		
Series	WT (m)	D (m)	Series	WT (m)	D (m)
100/200	1.0	4.0	100/200	2.0	6.0
300	0.9	4.0	300	2.8	5.6
400	1.3	5.0	400	3.5	6.0
500	1.9	5.7	500	4.5	7.25
600	2.4	6.2	600	4.7	7.3



Based on installation in concrete with concrete surround
For pea gravel surround, see SPEL Data Manual p13.5

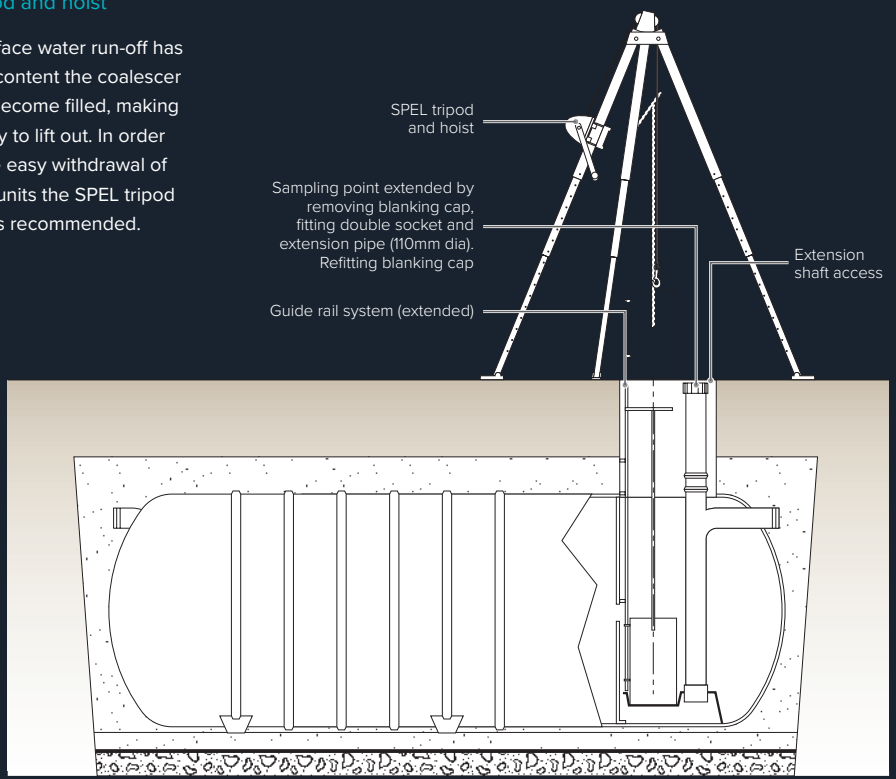
SPEL ESR Range – Inlet/outlet orientation

Dependent upon model and diameter of connections, these nine different orientations are available. However on the larger models it is important to check with our technical department.



SPEL tripod and hoist

Where surface water run-off has a high silt content the coalescer units can become filled, making them heavy to lift out. In order to facilitate easy withdrawal of coalescer units the SPEL tripod and hoist is recommended.



SPEL

Quality that protects the environment the **safest way**



The SPEL underground tanks have been designed with reference to BS EN 13121

SPEL Tank shells carry a 25 year Warranty and have a life expectancy of over 50 years

Rigorous quality control procedures at all stages of manufacture for each serial numbered tank, ISO 9001.

SPEL is an environmentally accredited company to ISO 14001.

Certificate No: FM 35174 UVDB/Achilles accredited – Supplier No. 88611.

Scan code with a QR reader to launch our website: spelproducts.co.uk

#ZeroPollutionAmbassadors

SPEL 10/21

SPEL spelproducts.co.uk
+44 (0)1743 445 200

SPEL Products
Lancaster Road
Shrewsbury, Shropshire
SY1 3NQ, England.

T. +44 (0)1743 445200
E. info@spelproducts.co.uk
E. sales@spelproducts.co.uk