

Construction Design Solutions

Consulting Civil, Structural, Highway & Drainage Engineers

Drainage Assessment



Development :

Former Goodfellows School Development,
Spalding Common
Lincolnshire

Client :

Country Court Care Ltd.

CDS Project Reference : 2014.5563

October 2016

Prepared By:

Construction Design Solutions, 78 Wollaton Road, Beeston, Nottinghamshire, NG9 2NZ
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Storm Drainage

The existing site is a former school house and separate dwelling with large gardens to the North.

There are storm collection points on and around the existing buildings in the form of rainwater pipes and gullies. The former playground has a concrete 'slot' type drain along the southern boundary of the site.

None of the storm collection points are able to be traced. It appears that all storm water runs to soakaway systems. By today's standards, these existing soakaways will no doubt be of insufficient capacity.

Discussions with the Local Authority suggest that typically, storm drainage is dealt with by way of soakaways in the local vicinity.

There is no evidence to suggest that the adopted foul system was once 'combined' as is the case in many urban developments.

A ground investigation has been completed and percolation values calculated for two locations within the site. To the north, the better percolation values are found with $K = 5.33 \times 10^{-5}$ m/s. This is an acceptable value for consideration of SUDS systems. However, the site constraints include an easement for the adjacent railway. As such, soakaways cannot be located within that zone.

Water table levels indicate that water will be struck at 1.7 - 2.0m typically, and as such, any storm systems will need to be sited above this level to prevent floating.

Our initial estimates for storage required in a soakaway structure is 85m cubed. This is based upon the design criteria of a 1/100 year storm with 30% climate change. However, as a suitable location is not available for a standard soakaway in the south of the site, CDS propose that deep bore soakaways be investigated as a means of discharge. The Geotechnical Engineer has advised that this is likely to be successful, given the bore hole results for the development.

Whilst the site is deemed suitable for ground percolation in some form, further testing for the deep bore option will need to be completed and the associated storage volume clarified thereafter.

The underground positive drainage system will be designed in accordance with BS EN752. Pipes will not surcharge for a 1 in 2 year design storm and will not flood for a 1 in 30 year design storm.

In an exceedance event over and above the design storm criteria, local topography will be set below the floor level and will allow overland flows to run off site without disruption or loss of amenity to any personnel.

Foul Drainage

Foul drainage will be collected in a positive underground gravity drainage system and exit the site using the existing outfall pipes to Anglian Water Manhole ref 3402.

A peak foul flow calculation is enclosed within Appendix 2.

The existing foul sewer within the development will have an easement. The width of this will need to be clarified when Anglian Water approval is sought for the development.

The new connection will require an Indirect Section 106 application. The lead contractor is responsible for this application.

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Appendix 1 - Existing Site Topo Survey & Drainage Survey

Abbreviations

[illegible]

Survey Control

Station	Entrance	Exit	Level
21	52,156.843	3,043.746	3,027
22	52,152.112	3,033.551	2,828
23	52,125.029	3,044.452	2,440
24	52,145.037	3,032.234	3,150
27	52,206.538	3,048.577	2,700

Grid & Datum

Grid:	Grid Size:	Grid Type:	Grid Color:
Ballast:	Ballast Type:	Ballast Power:	Ballast Voltage:

General Notes:

1. Do not scale into driving. All dimensions must be corroborated on site. If in doubt ask.
2. All dimensions are in meters.

instyle Architecture



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[illegible]

Goodfellows School
Spalding
Lincolnshire

Title

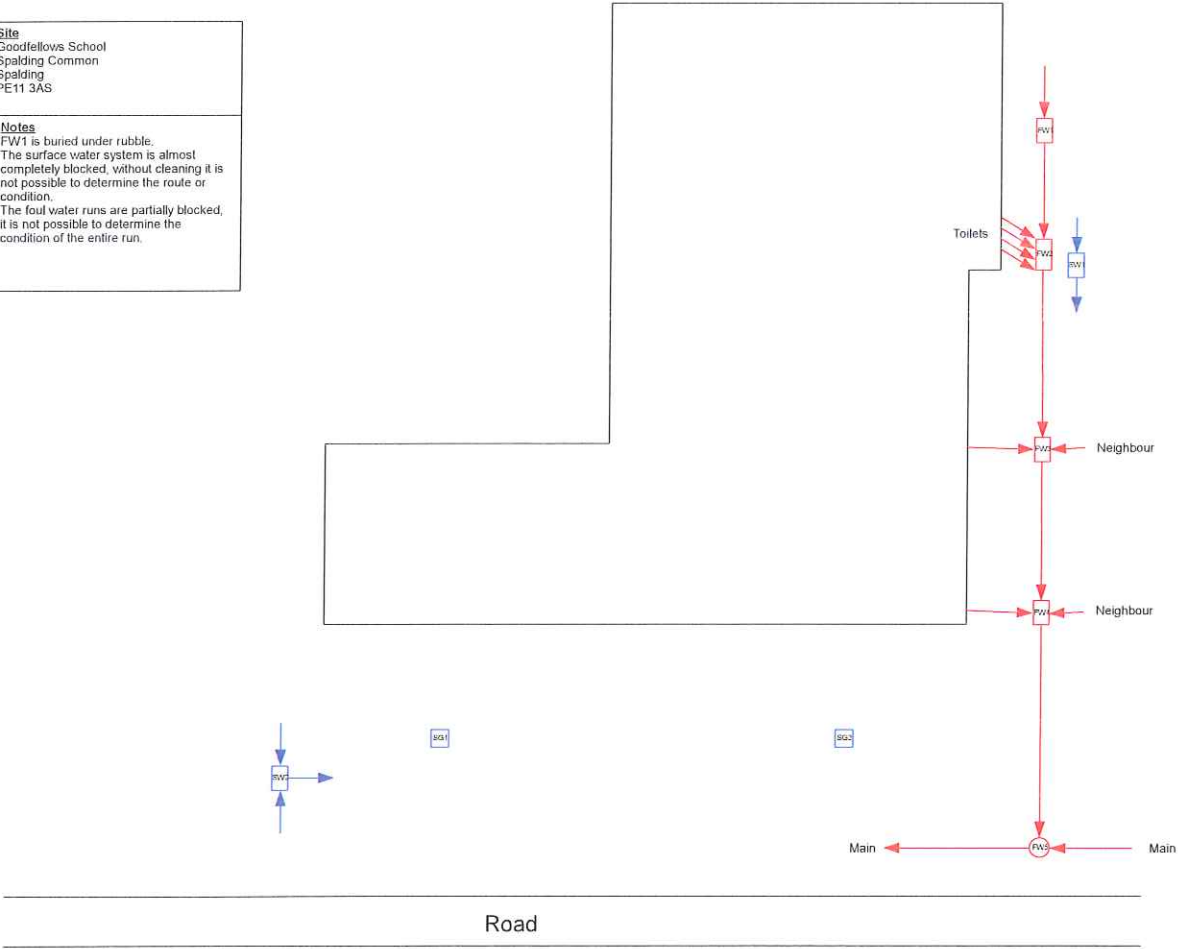
Topographical Survey

Scale
Plotting Scale: 1:500
Drawing Number: 102

Author: LS	CAD: LS	Checker: CM	Rev: -
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[illegible]

Customer Wynbrook	Site Goodfellows School Spalding Common Spalding PE11 3AS
Survey Date 24.04.2015	
Invert Depths FW1 – Buried. FW2 – 750mm. FW3 – 1050mm. FW4 – 1110mm. FW5 – 2000mm. SW1 – 450mm. SW2 – Blocked.	Notes FW1 is buried under rubble. The surface water system is almost completely blocked, without cleaning it is not possible to determine the route or condition. The foul water runs are partially blocked, it is not possible to determine the condition of the entire run.
FW= Foul Water SW= Surface Water SG= Surface Gully	



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Appendix 2 - Existing Site Drainage Notes - CDS

BH2 from AG ground investigation.
Soakaway testing yields $k = 5.33 \times 10^{-5}$ m/s.

Existing manhole appears to be storm only. No downstream trace shown on surveys. possibly runs to soakaway.

Existing foul manhole with multiple toilet inlets. Not picked up on topo survey.

Survey shows all local foul connecting to MH 3401

BH3 from AG ground investigation.
Soakaway testing yields $k = 3.02 \times 10^{-7}$ m/s.

Existing storm manholes.
Heavily silted - unable to find bottom with pole. Possible soakaway.

SPALDING COMMON

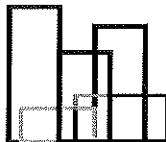
Existing foul manhole.
Believed to be AW foul manhole ref 3402.

Existing manhole.
Heavily silted - Likely to be highway drain

Existing storm manhole.
Heavily silted - unable to find bottom with pole. Possible soakaway.

Existing foul manhole.
Believed to be AW foul manhole ref 3401.

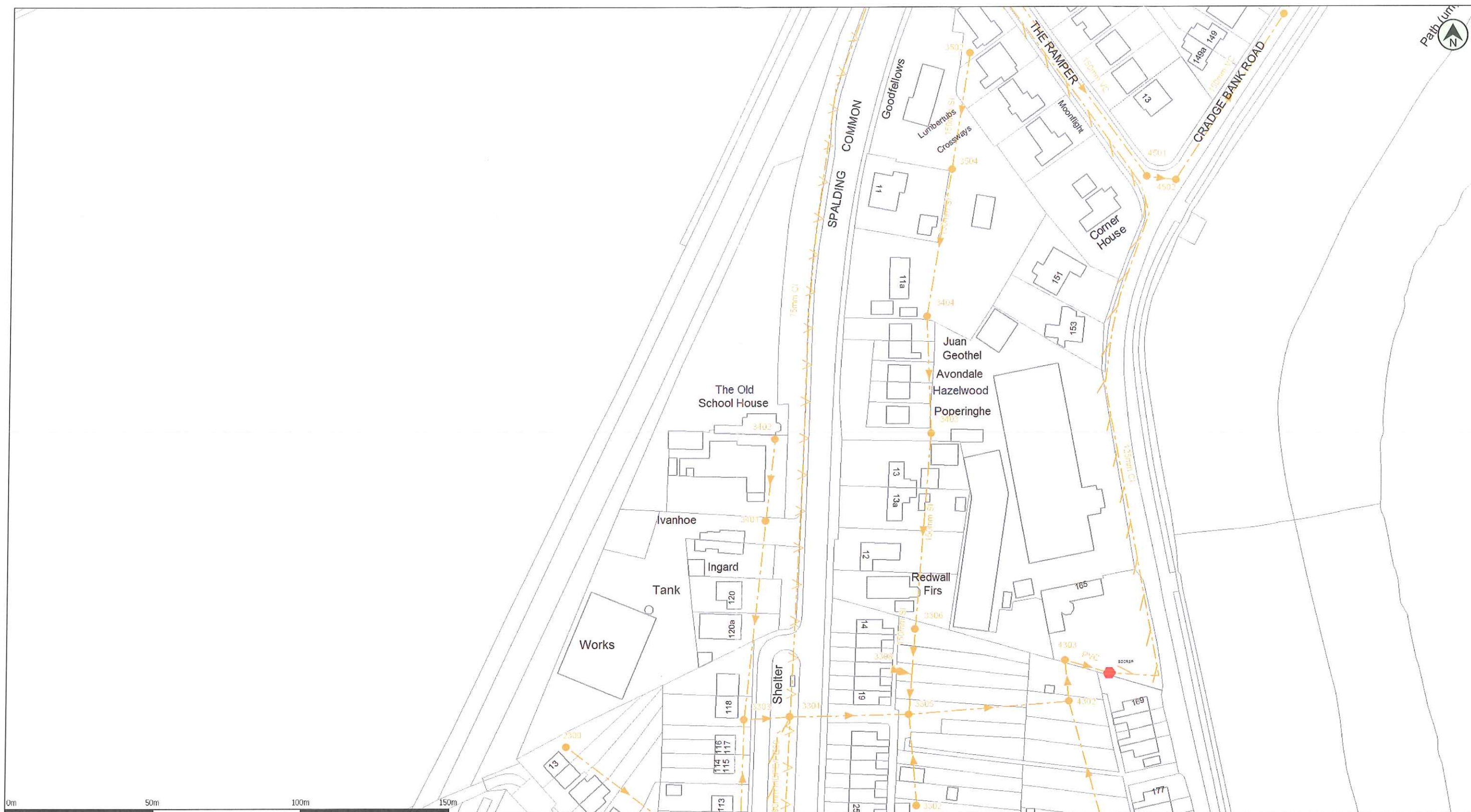
Existing foul sewer

Rev.	By	Date	Details	Chkd
Drawing Status			Information	
				
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Client Country Court Care				
Project Proposed Care Home Spalding Common				
Title Existing Drainage Notes				
Scale (A3) 1/500		Drawn by. SN		Drg. No. 2014.5563.SK01
Date. Jun 2015		Checked by.		

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Appendix 3 - Anglian Water Sewer Records



(c) Crown Copyright and database rights 2014 Ordnance Survey 100022432 Date: 20/05/15 Scale: 1:1250 Map Centre: 523306,320448 Data updated: 01/05/15 Our Ref: 141997 - 1 Wastewater Plan A3

This plan is provided by Anglian Water pursuant its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. The plan is produced by Anglian Water Services Limited from Ordnance Survey © Crown Copyright, 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer	---
Surface Sewer	---
Combined Sewer	---
Final Effluent	---
Rising Main	---
Private Sewer	---
Decommissioned Sewer	---
(Colour denotes effluent type)	
Outfall	---
(Colour denotes effluent type)	
Inlet	---
(Colour denotes effluent type)	
Manhole	---
(Colour denotes effluent type)	
Sewage Treatment Works	---
Pumping Station	---

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Appendix 4 - Proposed Site Layout - Architect's Plan



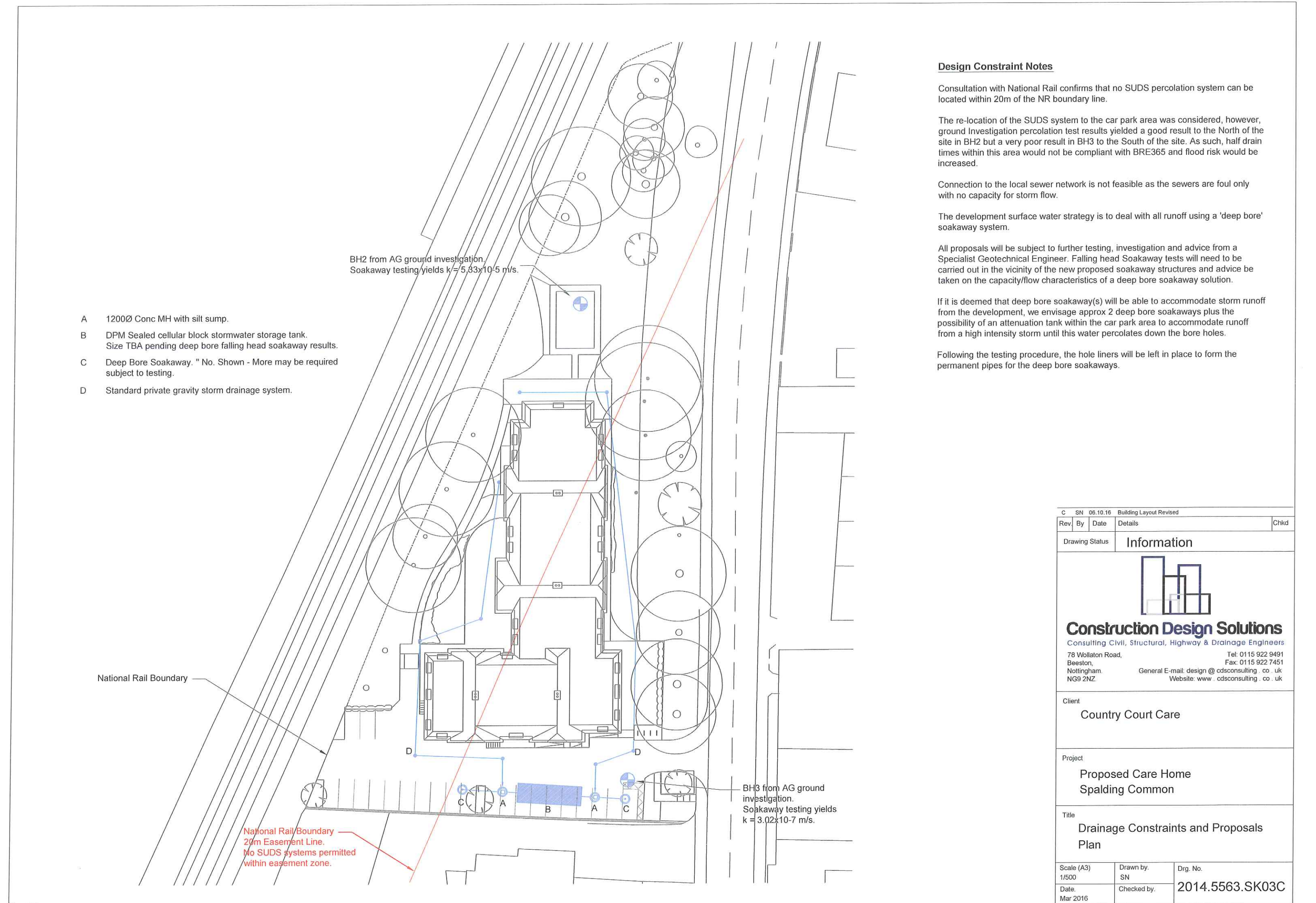
Key:



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Appendix 5 - CDS Proposed Drainage Philosophy Sketch



- A 1200Ø Conc MH with silt sump.
- B DPM Sealed cellular block stormwater storage tank. Size TBA pending deep bore falling head soakaway results.
- C Deep Bore Soakaway. " No. Shown - More may be required subject to testing.
- D Standard private gravity storm drainage system.

Design Constraint Notes

Consultation with National Rail confirms that no SUDS percolation system can be located within 20m of the NR boundary line.

The re-location of the SUDS system to the car park area was considered, however, ground investigation percolation test results yielded a good result to the North of the site in BH2 but a very poor result in BH3 to the South of the site. As such, half drain times within this area would not be compliant with BRE365 and flood risk would be increased.

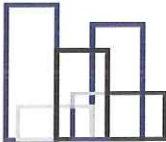
Connection to the local sewer network is not feasible as the sewers are foul only with no capacity for storm flow.

The development surface water strategy is to deal with all runoff using a 'deep bore' soakaway system.

All proposals will be subject to further testing, investigation and advice from a Specialist Geotechnical Engineer. Falling head Soakaway tests will need to be carried out in the vicinity of the new proposed soakaway structures and advice be taken on the capacity/flow characteristics of a deep bore soakaway solution.

If it is deemed that deep bore soakaway(s) will be able to accommodate storm runoff from the development, we envisage approx 2 deep bore soakaways plus the possibility of an attenuation tank within the car park area to accommodate runoff from a high intensity storm until this water percolates down the bore holes.

Following the testing procedure, the hole liners will be left in place to form the permanent pipes for the deep bore soakaways.

C SN 06.10.16 Building Layout Revised				
Rev.	By	Date	Details	Chkd
Drawing Status			Information	
 Construction Design Solutions Consulting Civil, Structural, Highway & Drainage Engineers 78 Wollaton Road, Beeston, Nottingham. NG9 2NZ Tel: 0115 922 9491 Fax: 0115 922 7451 General E-mail: design @ cdsconsulting . co . uk Website: www . cdsconsulting . co . uk				
Client				
Country Court Care				
Project				
Proposed Care Home Spalding Common				
Title				
Drainage Constraints and Proposals Plan				
Scale (A3) 1/500		Drawn by. SN	Drg. No.	
Date. Mar 2016		Checked by.	2014.5563.SK03C	

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Appendix 6 - Initial Storm SUDS Storage Estimate Calculations

Construction Design Solutions		Page 1
78 Wollaton Road Beeston Nottingham NG9 2NZ Tel. (0115) 922 9491	Spalding Common Initial Soakaway Volumes	
Date Jun 2015 File Initial Soakaway Vol 10...	Designed by SN Checked by	
Micro Drainage	Source Control 2015.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 158 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	100.317	0.317	4.4	45.1	O K
30 min Summer	100.406	0.406	4.5	57.9	O K
60 min Summer	100.477	0.477	4.6	68.0	O K
120 min Summer	100.507	0.507	4.7	72.3	O K
180 min Summer	100.499	0.499	4.7	71.1	O K
240 min Summer	100.484	0.484	4.6	68.9	O K
360 min Summer	100.448	0.448	4.6	63.9	O K
480 min Summer	100.415	0.415	4.6	59.2	O K
600 min Summer	100.384	0.384	4.5	54.7	O K
720 min Summer	100.353	0.353	4.5	50.3	O K
960 min Summer	100.297	0.297	4.4	42.3	O K
1440 min Summer	100.202	0.202	4.3	28.7	O K
2160 min Summer	100.105	0.105	4.1	15.0	O K
2880 min Summer	100.057	0.057	4.1	8.1	O K
4320 min Summer	100.039	0.039	3.2	5.5	O K
5760 min Summer	100.031	0.031	2.5	4.4	O K
7200 min Summer	100.026	0.026	2.1	3.7	O K
8640 min Summer	100.022	0.022	1.8	3.2	O K
10080 min Summer	100.020	0.020	1.6	2.8	O K
15 min Winter	100.358	0.358	4.5	51.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	121.269	0.0	24
30 min Summer	79.695	0.0	38
60 min Summer	49.937	0.0	66
120 min Summer	30.267	0.0	120
180 min Summer	22.297	0.0	150
240 min Summer	17.851	0.0	182
360 min Summer	12.957	0.0	250
480 min Summer	10.330	0.0	318
600 min Summer	8.659	0.0	386
720 min Summer	7.492	0.0	452
960 min Summer	5.959	0.0	582
1440 min Summer	4.309	0.0	828
2160 min Summer	3.110	0.0	1172
2880 min Summer	2.466	0.0	1480
4320 min Summer	1.775	0.0	2204
5760 min Summer	1.405	0.0	2936
7200 min Summer	1.171	0.0	3672
8640 min Summer	1.008	0.0	4400
10080 min Summer	0.889	0.0	5136
15 min Winter	121.269	0.0	25

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78 Wollaton Road Beeston Nottingham NG9 2NZ Tel. (0115) 922 9491		Spalding Common Initial Soakaway Volumes			
Date Jun 2015 File Initial Soakaway Vol 10...		Designed by SN Checked by			
Micro Drainage		Source Control 2015.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	100.461	0.461	4.6	65.6	O K
60 min Winter	100.545	0.545	4.7	77.7	O K
120 min Winter	100.590	0.590	4.8	84.0	O K
180 min Winter	100.581	0.581	4.8	82.8	O K
240 min Winter	100.561	0.561	4.7	80.0	O K
360 min Winter	100.513	0.513	4.7	73.1	O K
480 min Winter	100.464	0.464	4.6	66.1	O K
600 min Winter	100.416	0.416	4.6	59.3	O K
720 min Winter	100.370	0.370	4.5	52.7	O K
960 min Winter	100.285	0.285	4.4	40.6	O K
1440 min Winter	100.150	0.150	4.2	21.3	O K
2160 min Winter	100.049	0.049	4.0	7.0	O K
2880 min Winter	100.039	0.039	3.2	5.6	O K
4320 min Winter	100.028	0.028	2.3	4.0	O K
5760 min Winter	100.023	0.023	1.9	3.2	O K
7200 min Winter	100.019	0.019	1.5	2.6	O K
8640 min Winter	100.016	0.016	1.3	2.3	O K
10080 min Winter	100.014	0.014	1.2	2.0	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	79.695	0.0	38		
60 min Winter	49.937	0.0	66		
120 min Winter	30.267	0.0	120		
180 min Winter	22.297	0.0	170		
240 min Winter	17.851	0.0	194		
360 min Winter	12.957	0.0	270		
480 min Winter	10.330	0.0	346		
600 min Winter	8.659	0.0	418		
720 min Winter	7.492	0.0	488		
960 min Winter	5.959	0.0	620		
1440 min Winter	4.309	0.0	860		
2160 min Winter	3.110	0.0	1108		
2880 min Winter	2.466	0.0	1472		
4320 min Winter	1.775	0.0	2204		
5760 min Winter	1.405	0.0	2920		
7200 min Winter	1.171	0.0	3584		
8640 min Winter	1.008	0.0	4256		
10080 min Winter	0.889	0.0	5120		
©1982-2015 XP Solutions					

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78 Wollaton Road Beeston Nottingham NG9 2NZ Tel. (0115) 922 9491	Spalding Common Initial Soakaway Volumes	
Date Jun 2015 File Initial Soakaway Vol 10...	Designed by SN Checked by	
Micro Drainage	Source Control 2015.1	

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.220

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	(ha)	From:	To:	(ha)
0	4	0.073	4	8	0.073
			8	12	0.073

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78 Wollaton Road Beeston Nottingham NG9 2NZ Tel. (0115) 922 9491	Spalding Common Initial Soakaway Volumes	
Date Jun 2015 File Initial Soakaway Vol 10...	Designed by SN Checked by	
Micro Drainage	Source Control 2015.1	

Model Details

Storage is Online Cover Level (m) 102.000

Cellular Storage Structure

Invert Level (m) 100.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.19200 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.19200

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	150.0	150.0	0.900	0.0	190.0
0.800	150.0	190.0			

800mm DEEP CELLULAR SOAKAWAY
ASSUMED.

Roof 1300m²

EXTERNALS 900m²

$K = 5.33 \times 10^{-5} \text{ m/s} = 0.192 \text{ m/hr}$

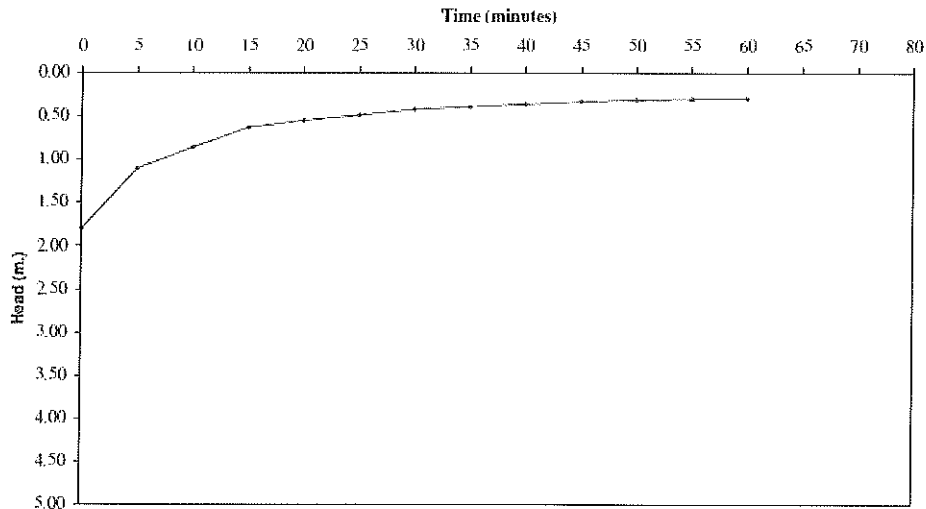
110042 + 30% CC

APPROXIMATE STORAGE Vol = 85m³

TBC AT FINAL DESIGN STAGE.

Borehole Permeability Test Results

ANALYTICAL GEOTECHNICS LTD



Falling Head Permeability	
Location	BH2
Effective depth	1.8m
Response length	1.8m
Diameter (average)	0.083m
Cross Sectional Area	0.0054m ²
Ho (initial head of water)	1.80m
F (intake factor)	6.91
T (time factor)	14.7min.
k (10 ⁻⁵)	5.33m/s

Site : Goodfellows School, Spalding

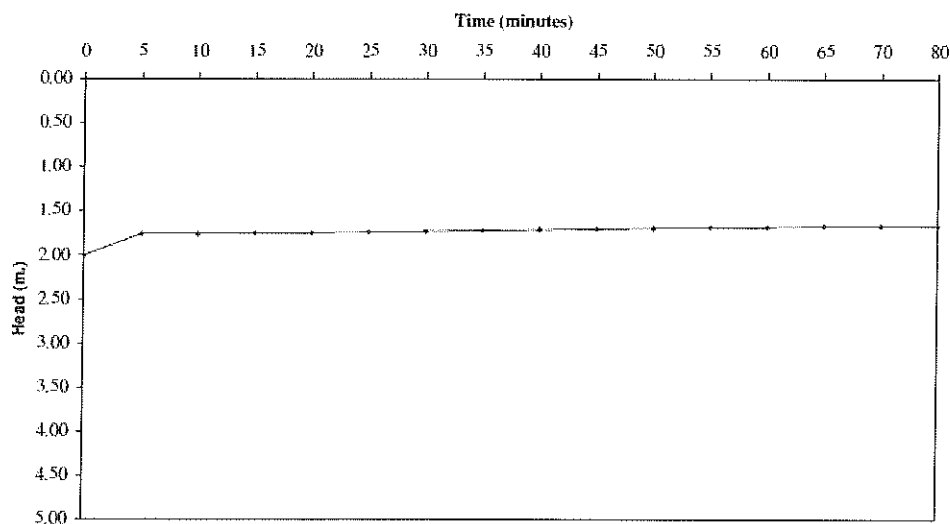
Date : 19th May, 2015

Weather : Showers.

Soil Type : FILL to 0.3m.; slightly sandy CLAY to 2.9m ;
gravely SAND to 5.0m.
Water standing at 1.70m.bgl. before test.

Borehole Permeability Test Results

ANALYTICAL GEOTECHNICS LTD



Falling Head Permeability	
Location	BH3
Effective depth	3.4m
Response length	2.0m
Diameter (average)	0.083m
Cross Sectional Area	0.0054m ²
Ho (initial head of water)	2.00m
F (intake factor)	7.47
T (time factor)	2400min.
k (10 ⁻⁷)	3.02m/s

Site : Goodfellows School, Spalding

Date : 19th May, 2015

Weather : Showers.

Soil Type : FILL to 0.3m.; slightly sandy CLAY to 2.9m ;
gravely SAND to 5.0m.
Water standing at 2.0m.bgl. before test



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