SHIELDS WILSON
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STRUCTURAL AND CIVIL ENGINEERING

PRELIMINARY DRAINAGE STRATEGY REPORT

UPON

PROPOSED RESIDENTIAL DEVELOPMENT

BARBERS DROVE NORTH

CROWLAND

PROJECT No: SW 20-102

DOCUMENT REF: SW 20-102-REP-01 rev C



Mr Patrick Burke

Burmor Construction

burmor construction

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1. INTRODUCTION

Under the instruction of Burmor Construction, the following drainage strategy report has been prepared for a proposed residential development of 41 dwellings off Barbers Drove North, Crowland.

The strategy is based upon David Turnock Architects Site Plan drawing 2483/AL0205.

The object of this report is to clarify the design philosophies followed whilst preparing the proposed surface & foul water drainage arrangements for the site and to outline the proposed solution in sufficient detail for all relevant parties to be able to comment. This assessment also demonstrates that the proposals are within the guidance contained within the National Planning Policy Framework (NPPF)

This report has been prepared for the named client above and should not be relied upon by any other parties, expect the client and their specialist third party advisors, without the express written permission of Shields Wilson Limited.

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2. LOCATION & SITE DESCRIPTION

See Appendix A for a site Location plan and the proposed architectural site layout plan.

The Site layout is illustrated on David Turnock Architects drawing 2483/AL0205.

2.1. Site Location

The site is approximately 1.3 hectares in size and is located North of James Road Crowland and accessed off Barbers Drove North.



2.2. Site Description

The proposed site is currently a grazing paddock sitting to the rear of a large detached dwelling accessed off Barbers Drove North.

The site is bound to the South West by Barbers Drove North, to the South East by James Road, to the North West by Dwellings and a large empty field and to the North East by the North Level IDB drain Greenbank Drain.

The site is a greenfield site used for grazing purposes and historically as agricultural land.

The topographical survey undertaken by MFM, drawing number 16170272-BR-CROW-3D-TOPO, illustrates that the current site levels vary from 1.3m – 1.7m AOD. Generally levels are lower in the Southern half of the site.

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2.3. Site Geology

The British Geological survey maps indicate the site to be underlain by Oxford Clay Formation, with superficial Tidal flat deposits of clay and silt.

A detailed Ground investigation has been undertaken by Ground Engineering, report No. C15122.

The report indicates explorations encountered deposits of sandy silty clay with silty marine sand below.

Despite the granular nature of the underlying ground conditions the report indicates that the infiltrations rates are generally poor. The ground water table was encountered at 2.0m below ground level.

Extracted borehole logs and BGS information are contained within Appendix B.

3. Flood Risk

A site-specific flood risk assessment has been prepared by Ellingham consulting Ltd. Report reference ECL0020.

The flood risk assessment has identified that a minimum floor level of 2.3m AOD is required.

4. SURFACE WATER

4.1. Existing Surface Water

The surrounding existing Highways and residential developments are served by a series of adopted Public Anglian Water sewers and the IDB drainage system.

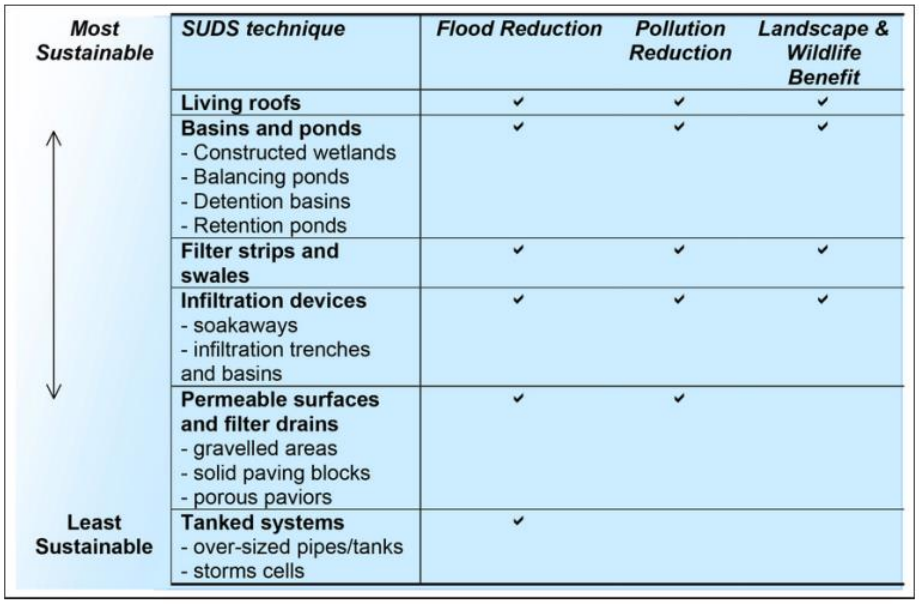
The site currently stands as a greenfield site with no active drainage system. The surface water run-off is served by the drain shared with James Road to the South East boundary and the IDB Greenbank Drain to the North East Boundary.

A copy of the Anglian water asset map is contained within Appendix C.

4.2. SuDS Considerations

The SuDS hierarchy has been given consideration during the design of the proposed surface water drainage system. As Highlighted previously within this report, it has been established that the sites geotechnical characteristics of poor infiltration rates and relatively high water table do not lend themselves to the use of an infiltration strategy for draining impermeable surfaces.

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Most Sustainable	SUDS technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
	Living roofs	✔	✔	✔
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✔	✔	✔
	Filter strips and swales	✔	✔	✔
	Infiltration devices - soakaways - infiltration trenches and basins	✔	✔	✔
	Permeable surfaces and filter drains - gravelled areas - solid paving blocks - porous paviors	✔	✔	
Least Sustainable	**Tanked systems** - over-sized pipes/tanks - storms cells	✔		

The following table outlines considerations given for the proposed development following the hierarchy of SuDS within the CIRIA SuDS manual, as extracted above.

SUDS Technique	**Commentary**	**Suitability**
Infiltration by Soakaway	The underlying soil conditions do not lend themselves to an infiltration system for the impermeable surfaces such as highways and roofs with a development density of this rate.	No
Green Roofs	Green roofs are not considered suitable for traditional style dwellings, and considered uneconomical for housing.	No
Permeable Paving	Whilst infiltration techniques are not suitable for large collections of surface water from roofs and highways, the conditions are suitable for the use of permeable surfacing to the shared private drives and parking spaces.\ This will be aided by the necessity to build up the levels on the site for the flood risk, and the sub-base construction of the permeable drives will be provided plenty of attenuated storage via suitable open graded crushed rock sub-base. The underlying ground conditions are not suitable for the use of a permeable surface for the adopted Highway as the CBR values are below 3%.	Yes

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Attenuation and discharge to surface water sewer	Initial conversations with North Level IDB engineer John Stubley indicate that a restricted flow discharge to the Greenbank IDB drain to the North boundary of the site would be acceptable. The discharge rates would need to be restricted to Qbar or greenfield run-off rates to be acceptable to the IDB and LLFA in accordance with current guidance.	Yes
Swales	The proposed block plan has included a hybrid swale/filter drain running the length of the site adjacent the adopted highway. Highway surface water will drain directly to this feature.	No
Detention Basins	There is area of shared public amenity space adjacent James Road and the IDB drain. This space could be utilised to locate an attenuation basin.	Yes
Ponds & Wetlands	The central POS for the site has been utilised to provide a flow through attenuation feature, which will have its base detailed with filter stone and reed planting, with wild flower planting to some of the banks to provide a visual, ecologically beneficial and aesthetically pleasing feature for the residences as well as serving a vital function for the drainage system.	No

4.3. Surface Water drainage proposals

As indicated in the SuDS review above initial discussions were had with North Level IDB engineer John Stubley to establish the viability of discharging the proposed system into the Greenbank drain. It was indicated to us that this would be a viable and acceptable route for the surface water from the development.

Initial plans were also sent for review and preliminary comment from local Highways officer Jon Sharpe who commented that they welcomed the inclusion of filter drains as a method of surface water collection and provision of suitable treatment train.

Further conversations have taken place with Martin Nash at LCC highways and Dean Whitehead of LCC LLFA.and the system proposed now reflect these comments.

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The natural topography on the site would preclude traditional gravity draining techniques due to the flat nature. However the minimum Floor level specified within the FRA generally raises the levels on site between 0.6m – 1.0m this has provided sufficient fall and cover for a gravity drainage system.

It is proposed to utilise a system of SuDS and traditional features to collect the surface water run-off, which will then be discharged into the main carrier drain running beneath the adopted highway.

The adopted Highways will be drained utilising a filter drain/swale running alongside, to be detailed in accordance with the Lincolnshire Highways Estate road specification. This will provide a suitable treatment train and slowing of the run-off from the highway. In accordance with guidance within the CIRIA SuDS manual.

The dwelling roof runoff water will be collected via. Downpipe and gutters, and will be discharged into a system of adopted Anglian water drains running underneath the swale/filterdrain.

The carrier drain beneath the swale will be an adopted Anglian water sewer and will run generally North-Eastward towards the discharge into the IDB Greenbank drain. The root zone and top surface of the swale will be adopted by highways.

Prior to outfall there will be a flow restriction device in the form of a hydro brake. The sites greenfield run-off rate will be unsuitably low due to the size of the site and as such a practical minimum of 5l/s will be utilised. This is generally accepted as the minimum acceptable in fenland areas due to the flat sites and systems generating very small orifice sizes for smaller flow values. It is also the preferred minimum of Anglian water who we propose will adopt the flow restriction device and take responsibility for on going maintenance.

Prior to the flow restriction device there will be a requirement for attenuation to be provided within the system to provide the necessary storage volumes.

The attenuation volumes will be provided by the proposed flow through SUDS feature central to the site and a secondary offline dry detention basin adjacent the hydrobrake.

The design proposals are illustrated on our arrangement and key details drawings SW20-102/100, 101 & 102, included within Appendix E.

The system has been modelled utilising Causeway Flow drainage design and simulation software. The calculation inputs and outputs are included within Appendix E.

The calculations demonstrate that the attenuated run-off volume is stored and completely contained below surface for the 1 in 100 year storm event within a 40% climate change and 10% urban creep allowance.

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There are additional robustness built into the design in that the capacity of storage provided by the filter drains of approximately 14m³ has not been incorporated into the model. And all the peremeable driveways will have a minimum of 250mm depth of voided type 3 OGCR sub-base providing significant additional volumes.

To ensure that the high-water table on the site will not effect the attenuation features no infiltration has been considered. This complies with the requirements of adoptable standards for these features.

5. Foul Water

5.1. Existing Foul Water drainage

The existing foul water drainage serving the dwellings adjacent the site discharge into the public foul sewer within Barbers Drove North, which then runs Northward towards the system running along Peterborough road.

The Anglian water asset map is contained with Appendix C.

5.2. Foul Water drainage proposals

The proposed dwellings will have private buried pipe foul water network. There will be an adopted main sewer beneath the adopted highway conveying the foul water South-Westward towards an outfall into the existing Anglian Water network along Barbers Drove North.

The design proposals are illustrated on our drawings SW20-102/100 & 101, included within Appendix D.

Pipes and gradients are to be sized using a peak flow calculated in accordance with Codes for adoption, 4000 l/dwelling./day, considering all 41 plots as individual private dwellings.

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6. Management & Mainteanance strategy

The proposed systems contain the following assets which are all require to be in reasonable working order for the systems to function as a whole and operate as anticipated within the design models.

Permeable block paved drives and parking
Gutters, downpipes and other building rainwater goods
Buried pipe networks and chambers, surface and foul water
Hydrobrake Flow restriction deice
Flow through basin feature
Detention Basin

The private drive and parking space areas should be constructed utilising a permeable paving system and will be conveyed into the ownership of the private dwelling owners whose responsibility their maintenance will be.

Building rainwater goods and buried pipe networks immediately around properties will also be private and fall under the ownership and responsibility of the private dwelling owners.

The Highways surface and the root zone and top surface of the Filter drains will be constructed to Lincolnshire Highways adoptable standards and will be offered for adoption under Section 38 of the Highways Act.

The main carrier sewers under the filter drain/swale and adoptable highway, the flow through basin and the detention basin will all be built to the standards and requirements of the CIRIA SuDS manual and Codes for adoption and be offered to Anglian Water Services Ltd for adoption under Section 104 of the Drainage Act.

The scope/nature of inspection and maintenance is such that various facilities and structures are inspected and maintained at yearly intervals, as well as after or during use and/or heavy storm events, in order that they continue to perform effectively.

The maintenance schedule for the foul water system, should as a minimum consist of annual inspections and 5 yearly rodding/jetting should no issue be encountered.

The maintenance schedule for the surface water system will comprise the following activities in accordance with the CIRIA publication C753 (The SuDS Manual)

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Activity	Frequency	Typical Tasks
Routine/regular maintenance (including inspections and monitoring)	Monthly	• Litter/debris removal • Grass cutting (in season) • Inspection and clearance of gullies and drainage channels • Inspection of pumping station
Occasional maintenance	Annually	• Silt removal from catchpits/gullies • Pipe drainage every 3-5 years: suction sweeping (to Water Jetting Association standards) and CCTV where necessary
Remedial maintenance	As required (tasks to repair problems due to damage or vandalism	• Silt removal • Inlet/outlet repair • Erosion repairs • System rehabilitation following a pollution event • Pump failure

On completion of the above, ensure the drainage system is running freely and cleanly. If not, repeat maintenance activities. Written records should be kept of all maintenance work carried out.

7. Conclusions & Summary

As illustrated by our design proposals on drawings SW20-102/100,101 & 102 and the information outlined within this report, it is demonstrable that a viable and robust surface & foul water scheme that comply with the requirements of National Planning Guidance can be provided for the proposed residential development.

Under the proposals outlined within the report, all the drainage features will be either adopted or under private house holder ownership and as such have suitable management and on-going maintenance.

For and on behalf of **SHIELDS WILSON LIMITED**

A P Wilson CEng MIStructE **rev C July 2021**

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APPENDIX A – Location & Site Layout plan

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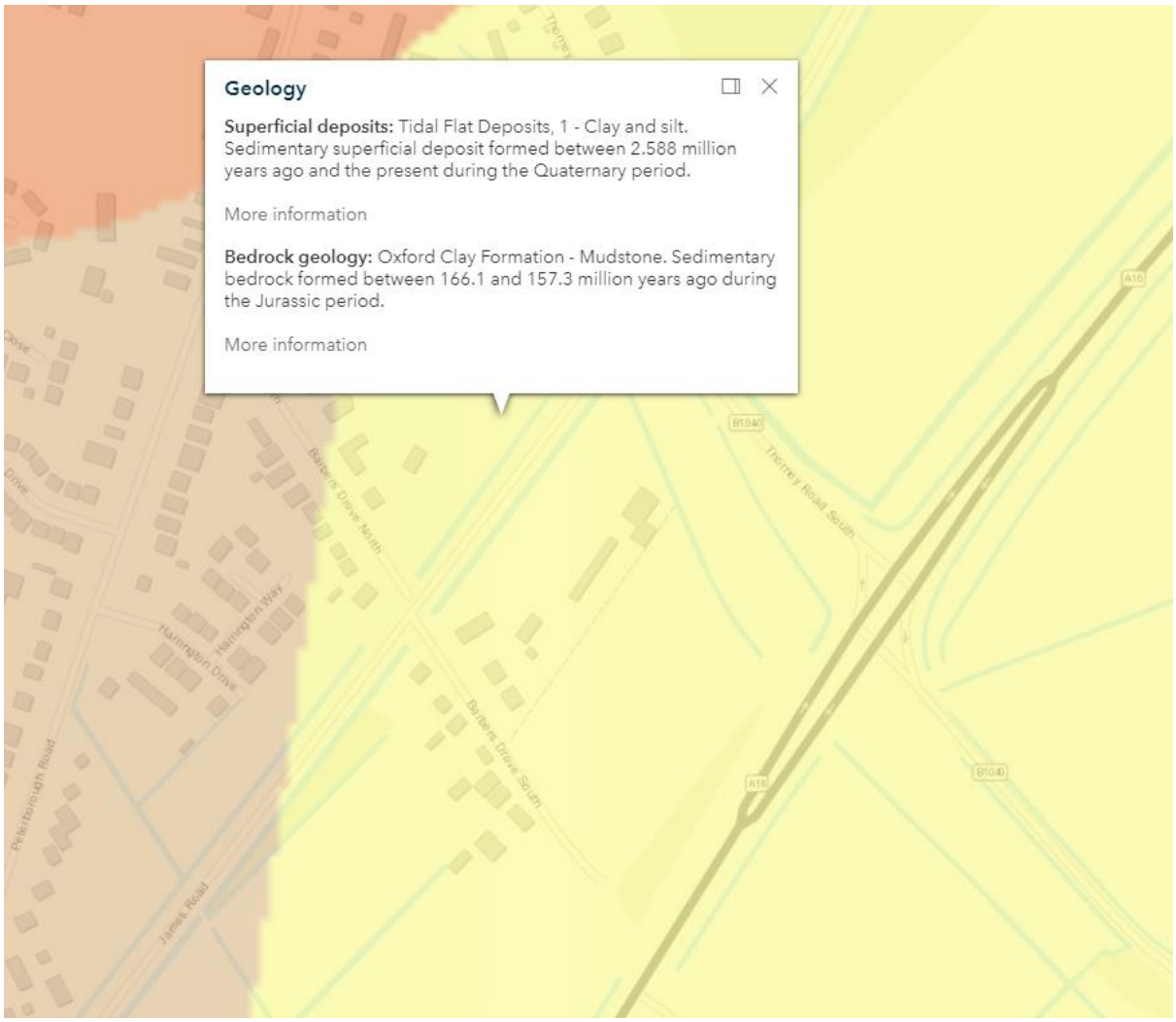
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APPENDIX B - Geology

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Extract British Geological Society maps

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GROUND ENGINEERING LIMITED
Tel: 01733-568568
www.groundengineering.co.uk

Site: BARBER'S DROVE, CROWLAND

TRIAL PIT TP1

Date: 06/08/20

Pit Size: 1.70m L x 0.60m W x 2.05m D.

Ground Level:

Samples and In-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.10	D1			MADE GROUND - Stiff, dark brown, slightly gravelly, silty CLAY. Gravel is sub-angular to rounded quartz, quartzite and flint.			
0.10	ES1						
0.10	V1	(80)				0.30	
0.40	D2			Firm, brown, orange brown and grey, sandy CLAY.			
0.40	V2	(42)					
0.50-0.80	B1			(TIDAL FLAT DEPOSIT)			
						0.80	
0.90	D3			Orange brown, very silty SAND. Sand is fine grained.			
1.20	D4			(MARINE SAND)			
1.45	D5					1.50	
1.60	D6			Grey and orange brown, silty SAND. Sand is fine grained.			
				(MARINE SAND)			
2.05	D7		▼1/2			2.05	
				Pit completed at 2.05m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to 1.45m depth
2. Pit sides unstable below 1.90m depth
3. Groundwater met at 2.05m depth
4. Water stood at 2.05m depth on completion

Project No 15122

Scale 1:25

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SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Barber's Drove, Crowland
Client: Burmor Construction

Project No: C15122
Sheet No: 1/2

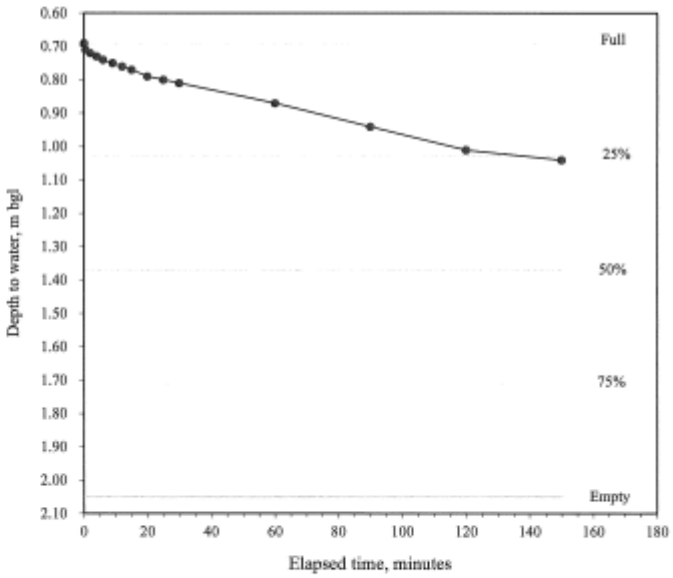
Trial Pit: TP1 FIRST FILLING
Depth: 2.05
Length: 1.70
Width: 0.60

Description of Stratum under test: Blue grey and orange brown mottled silty SAND.

Depth to water prior to test: 2.05 (Seepage)
(below ground level)

Elapsed Time min	Depth to Water m
0	0.69
1	0.71
2	0.72
4	0.73
6	0.74
9	0.75
12	0.76
15	0.77
20	0.79
25	0.80
30	0.81
60	0.87
90	0.94
120	1.01
150	1.04

DEPTH TO WATER vs ELAPSED TIME



f = (V75-V25)/A50(T75-T25)
V75-V25 = 0.694
A50 = 4.148
T75-T25 = 1570

ExtrapolatedSoil Infiltration Rate f = **1.78E-06** m/s

All dimensions given in metres

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GROUND ENGINEERING LIMITED
Tel: 01733-566566
www.groundengineering.co.uk

Site: BARBER'S DROVE, CROWLAND

TRIAL PIT TP2

Date: 06/08/20

Pit Size: 1.70m L x 0.60m W x 2.45m D.

Ground Level:

Samples and In-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.05	V1	(90)		MADE GROUND - Stiff, dark brown, slightly gravelly, silty, organic CLAY. Gravel is angular to sub-rounded quartz, quartzite and flint.			
0.15	D1						
0.15	ES1					0.35	
0.40	D2			Firm, grey, brown and dark brown, sandy, silty CLAY. (TIDAL FLAT DEPOSIT)			
0.40	V2	(62)				0.50	
0.50-0.80	B1			Medium dense, light brown and orange brown, very silty SAND. Sand is fine grained.			
0.60	D3						
0.90-1.35	MP1	100					
1.20	D4			(MARINE SAND)			
						1.55	
1.60	D5			Grey and orange brown, silty SAND.			
2.00	D6			(MARINE SAND)			
2.45	D7		▼2			2.45	
				Pit completed at 2.45m depth			

KEY
- D - Disturbed Sample
- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▼ - Water Strike
- ▼ - Water Rise
- ▼c - Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to 1.20m depth
2. Groundwater seepage at 2.45m depth
3. Pit sides stable
4. Water stood at 2.45m depth on completion

Project No 15122

Scale 1:25

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SOAKAWAY TEST RESULTS

BRE DIGEST 365 - SOIL INFILTRATION RATE

Project: Barber's Drove, Crowland
Client: Burmor Construction

Project No: C15122
Sheet No: 1/2

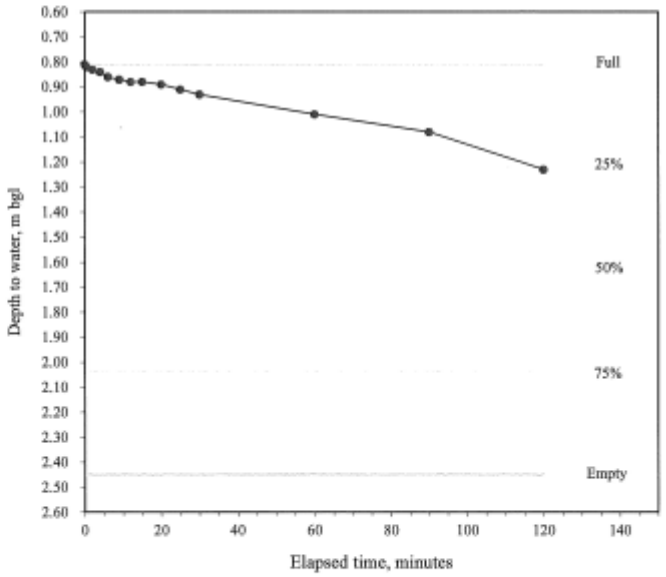
Trial Pit: TP2 FIRST FILLING
Depth: 2.45
Length: 1.70
Width: 0.60

Description of Stratum under test: Blue grey and orange brown mottled silty SAND.

Depth to water prior to test: 2.45 (Seepage)
(below ground level)

Elapsed Time min	Depth to Water m
0	0.81
1	0.82
2	0.83
4	0.84
6	0.86
9	0.87
12	0.88
15	0.88
20	0.89
25	0.91
30	0.93
60	1.01
90	1.08
120	1.23

DEPTH TO WATER vs ELAPSED TIME



f = (V75-V25)/A50(T75-T25)
V75-V25 = 0.836
A50 = 4.792
T75-T25 = 383

Extrapolated Soil Infiltration Rate f = **7.60E-06** m/s

All dimensions given in metres

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GROUND ENGINEERING LIMITED
Tel: 01733-566566
www.groundengineering.co.uk

Site: BARBER'S DROVE, CROWLAND

TRIAL PIT TP5

Date: 06/08/20

Pit Size: 1.70m L x 0.60m W x 2.90m D.

Ground Level:

Samples and In-situ Tests			(Date) Water	Description of Strata	Legend	Depth m	O.D. Level m
Depth m	Type	Result					
0.10	D1			MADE GROUND - Sandy TOPSOIL.		0.02	
0.10	ES1			MADE GROUND - Light brown, silty SAND AND GRAVEL. Gravel is sub-angular to rounded limestone.		0.15	
0.30	D2			MADE GROUND - Firm, dark brown, slightly gravelly, silty, organic CLAY. Gravel is sub-angular and sub-rounded quartz, quartzite, flint, coal, ash and brick fragments.			
0.30	ES2						
0.30	V1	(50)					
0.50-0.80	B1					0.80	
0.85	V2	(47)		Firm, grey and brown, sandy, silty CLAY.			
0.90	D3			(TIDAL FLAT DEPOSIT)		1.10	
1.20	D4			Grey, light brown and orange brown, very silty SAND. Sand is fine grained.			
1.50	D5						
2.00	D6			(MARINE SAND)		2.50	
				Grey, light brown and orange brown, silty SAND. Sand is fine grained.			
			▽	(MARINE SAND)			
2.90	D7		▼c			2.90	
				Pit completed at 2.90m depth			

KEY
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- B - Bulk Sample
- U - Undisturbed Sample
- R - Root Sample
- W - Water Sample
- ES - Environmental Sample
- ▽ Water Strike
- ▼ Water Rise
- ▼c Level on completion
- MP - Mackintosh Probe
- P( ) - Hand Penetrometer Cohesion ( ) kPa
- V - Vane Shear Test Cohesion ( ) kPa

REMARKS
1. Live roots observed to 1.40m depth
2. Groundwater met at 2.80m depth
3. Pit sides unstable below 1.40m depth
4. Water stood at 2.90m depth

Project No 15122

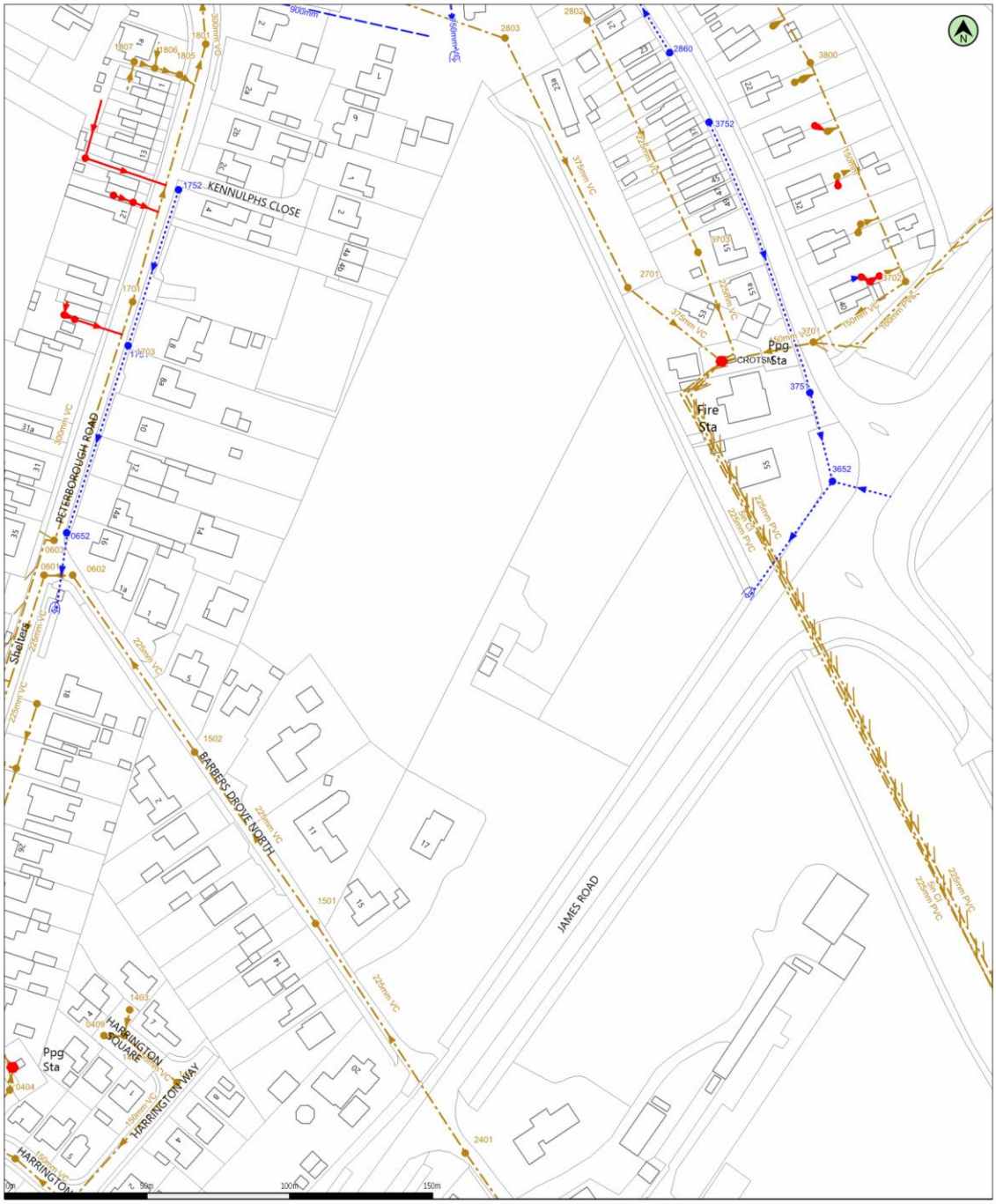
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APPENDIX C – Anglian Water Services Asset map

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Data updated: 01/07/20

Scale: 1:1250
Map Centre: 524232,309628

Date: 27/07/20
Our Ref: 419910 - 1

Wastewater Plan A3
Powered by digdat

Foul Sewer
Surface Sewer
Combined Sewer
Final Effluent
Rising Main*
Private Sewer*
Decommissioned Sewer*

Outfall*
Inlet*
Manhole*

Sewage Treatment Works
Public Pumping Station
Decommissioned Pumping Station

*(Colour denotes effluent type)

adam@shieldswilson.co.uk
17 Barbers Drove N

love every drop anglianwater

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. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2020 Ordnance Survey 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.

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Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0404	F	1.379	-1.157	2.536
0407	F	1.476	-0.934	2.41
0409	F	1.619	-0.627	2.246
0601	F	2.44	-1.29	3.73
0602	F	2.18	-1.3	3.48
0603	F	2.44	0.22	2.22
1401	F	1.537	-0.387	1.924
1402	F	1.573	-0.569	2.142
1403	F	-	0.65	-
1501	F	1.83	-0.89	2.72
1502	F	1.97	-1.07	3.04
1701	F	2.44	-0.08	2.52
1801	F	2.94	-0.19	3.13
1805	F	-	-	-
1806	F	-	-	-
1807	F	-	-	-
2401	F	1.66	-0.55	2.21
2701	F	2.519	-0.92	3.439
2802	F	2.49	0.54	1.95
2803	F	2.31	-0.56	2.87
3701	F	2.69	-0.622	3.312
3702	F	2.11	-0.26	2.37
3703	F	2.16	-0.17	2.33
3800	F	1.665	0.395	1.27
0652	S	2.34	0.98	1.36
1751	S	2.39	1.35	1.04
1752	S	2.62	1.83	0.79
2860	S	2.68	2.11	0.57
3652	S	1.85	0.77	1.08
3751	S	2.76	1.45	1.31
3752	S	2.65	2.17	0.48

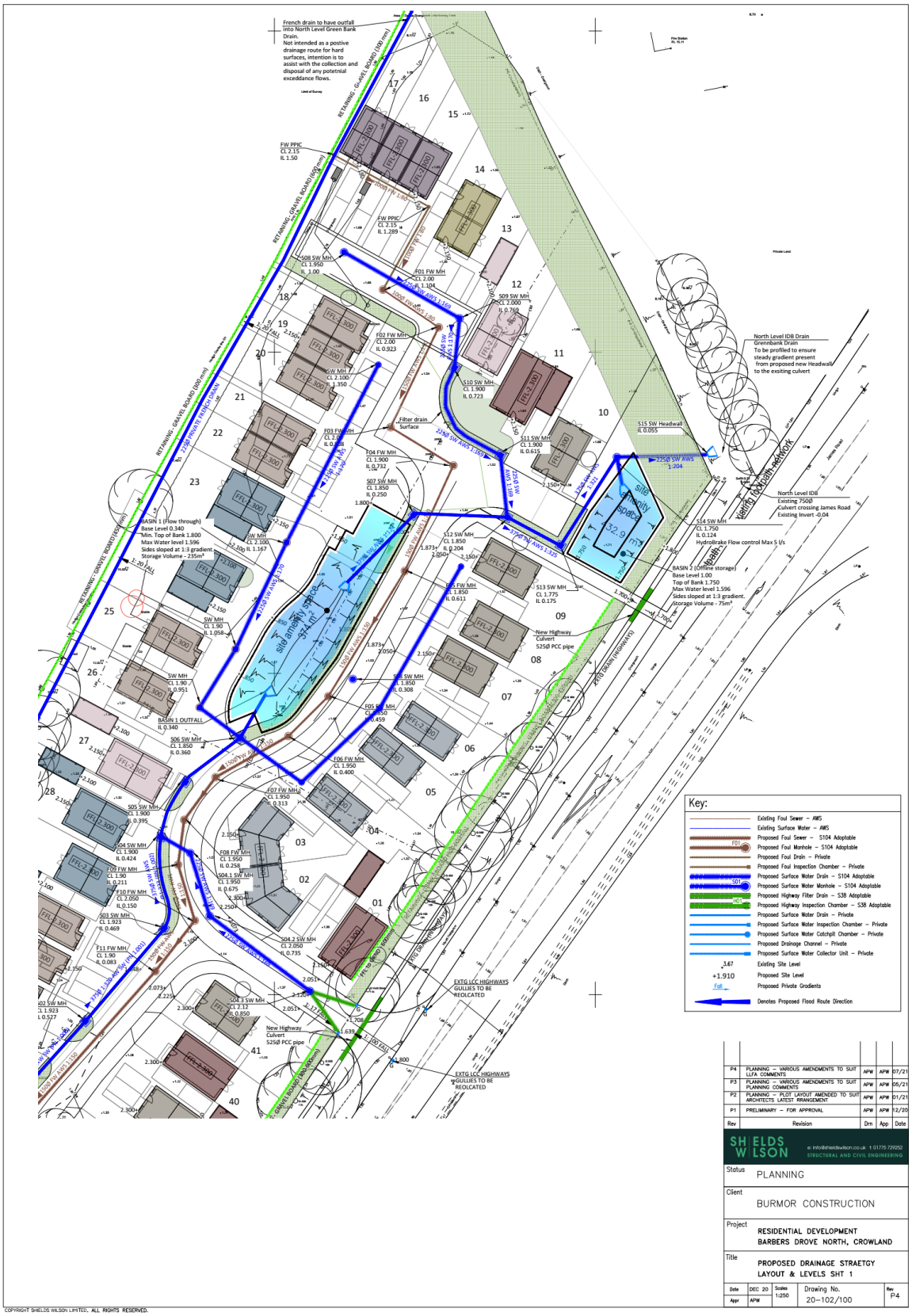
Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Our Ref: 419910 - 1

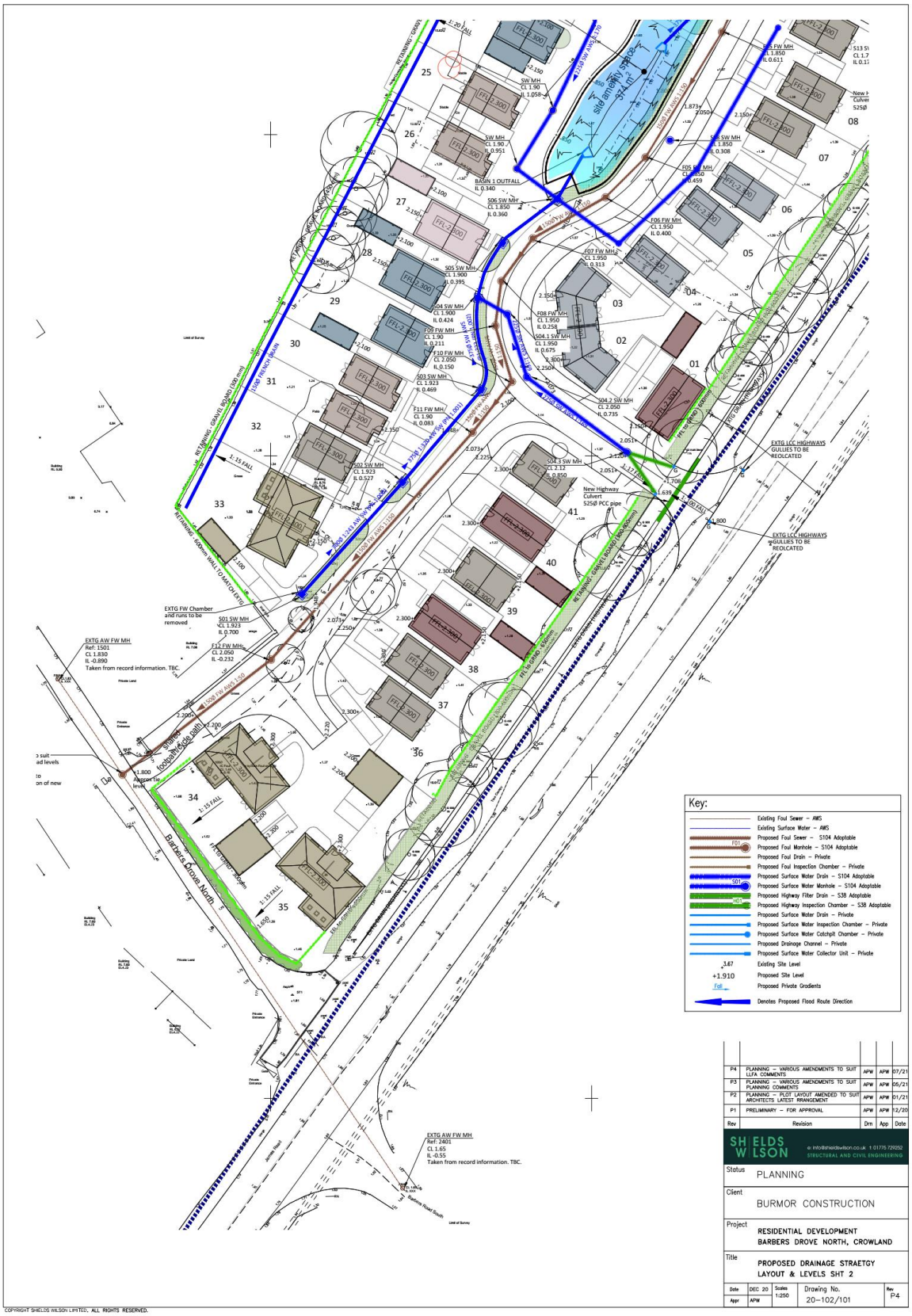
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APPENDIX D – Proposed Drainage Arrangement Drawings

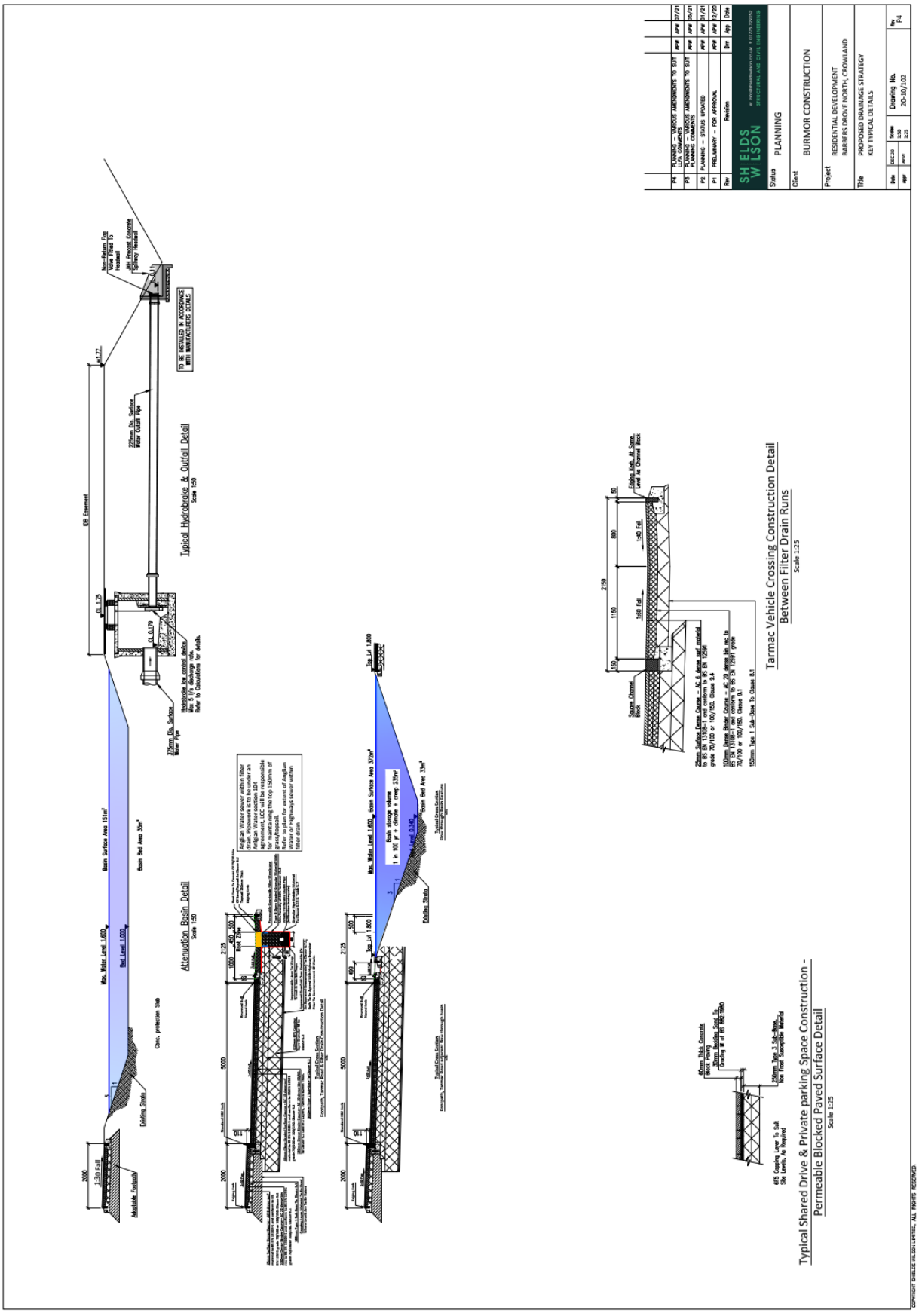
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VISIBILITY SPLAYS IN ACCRODANCE WITH THE SSD REQUIREMENTS SETOUT WITHIN table 2.10 CD 109
10m Radius
10m Radius
4500
4500
4400
215m
215m
P3 PLANNING – UPDATED TO CURRENT LAYOUT APW APW 06/21
P2 PLANNING – STATUS UPDATED APW APW 01/21
P1 PRELIMINARY – FOR APPROVAL APW APW 08/20
Rev Revision Drn App Date
SHIELDS WILSON
e: info@shieldswilson.co.uk t: 01775 729252
STRUCTURAL AND CIVIL ENGINEERING
Status PLANNING
Client BURMOR CONSTRUCTION
Project RESIDENTIAL DEVELOPMENT BARBERS DROVE NORTH, CROWLAND
Title PROPOSED LAYOUT ILLUSTRATING VISIBLITY SPLAY
Date Nov 20
Appr APW
Scales 1:500
Drawing No. 20–102/103
Rev P3
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APPENDIX E – Surface Water model Calculations

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Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	10	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.500
Ratio-R	0.400	Preferred Cover Depth (m)	0.800
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
S01	0.125	5.00	1.923	1200	1.223
S02	0.043	5.00	1.923	1200	1.396
S03	0.072	5.00	1.923	1200	1.454
S04	0.022	5.00	1.900	1200	1.476
S05	0.008	5.00	1.900	1200	1.505
S06	0.049	5.00	1.850	1200	1.490
S07	0.080	5.00	1.850	1200	1.600
S08	0.022	5.00	1.900	1200	0.900
S09	0.035	5.00	1.900	1200	1.131
S10	0.010	5.00	1.900	1200	1.177
S11	0.057	5.00	1.900	1200	1.285
S12	0.000	5.00	1.775	1350	1.571
S13	0.000	5.00	1.850	1350	1.675
S14	0.000	5.00	1.750	1500	1.626
S15	0.000	5.00	1.600	1200	1.545
Basin 1	0.043	5.00	1.800	1	1.460
Basin 2	0.000	5.00	1.750	1	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S01	S02	23.770	0.600	0.700	0.602	0.098	242.6	300	5.39	68.0
1.001	S02	S03	18.600	0.600	0.527	0.469	0.058	320.7	375	5.70	66.4
1.002	S03	S04	14.540	0.600	0.469	0.424	0.045	323.1	375	5.94	65.1
1.003	S04	S05	9.260	0.600	0.424	0.395	0.029	319.3	375	6.10	64.4
1.004	S05	S06	11.330	0.600	0.395	0.360	0.035	323.7	375	6.29	63.5
1.005	S06	Basin 1	6.300	0.600	0.360	0.340	0.020	315.0	375	6.39	63.0
1.006	Basin 1	S07	11.150	0.600	0.340	0.250	0.090	123.9	375	6.50	62.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	71.0	25.3	0.923	1.021	0.125	0.0	123	0.922
1.001	1.006	111.1	33.2	1.021	1.079	0.168	0.0	140	0.883
1.002	1.002	110.7	46.6	1.079	1.101	0.240	0.0	170	0.960
1.003	1.008	111.4	50.3	1.101	1.130	0.262	0.0	177	0.984
1.004	1.001	110.6	51.1	1.130	1.115	0.270	0.0	179	0.982
1.005	1.015	112.1	59.9	1.115	1.085	0.319	0.0	195	1.032
1.006	1.626	179.6	67.4	1.085	1.225	0.362	0.0	159	1.513

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	S07	S12	14.345	0.600	0.250	0.204	0.046	315.0	375	6.74	61.4
2.000	S08	S09	39.100	0.600	1.000	0.769	0.231	169.3	225	5.65	66.6
2.001	S09	S10	7.710	0.600	0.769	0.723	0.046	169.0	225	5.78	66.0
2.002	S10	S11	18.252	0.600	0.723	0.615	0.108	169.0	225	6.08	64.4
2.003	S11	S12	9.675	0.600	0.615	0.558	0.057	169.0	225	6.24	63.7
1.008	S12	S13	9.410	0.600	0.204	0.175	0.029	324.5	375	6.90	60.7
1.009	S13	S14	16.350	0.600	0.175	0.124	0.051	320.6	375	7.17	59.6
1.010	S14	S15	14.080	0.600	0.124	0.055	0.069	204.1	225	7.42	58.6
3.000	Basin 2	S14	4.400	0.600	0.750	0.706	0.044	100.0	225	5.06	69.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.007	1.015	112.1	80.9	1.225	1.196	0.442	0.0	237	1.102
2.000	1.002	39.8	4.4	0.675	0.906	0.022	0.0	51	0.665
2.001	1.003	39.9	11.2	0.906	0.952	0.057	0.0	81	0.863
2.002	1.003	39.9	12.9	0.952	1.060	0.067	0.0	87	0.895
2.003	1.003	39.9	23.5	1.060	0.992	0.124	0.0	124	1.043
1.008	1.000	110.5	102.5	1.196	1.300	0.566	0.0	287	1.130
1.009	1.006	111.1	100.6	1.300	1.251	0.566	0.0	281	1.134
1.010	0.911	36.2	98.9	1.401	1.320	0.566	0.0	225	0.928
3.000	1.307	52.0	0.0	0.775	0.819	0.000	0.0	0	0.000

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	23.770	242.6	300	Circular	1.923	0.700	0.923	1.923	0.602	1.021
1.001	18.600	320.7	375	Circular	1.923	0.527	1.021	1.923	0.469	1.079
1.002	14.540	323.1	375	Circular	1.923	0.469	1.079	1.900	0.424	1.101
1.003	9.260	319.3	375	Circular	1.900	0.424	1.101	1.900	0.395	1.130
1.004	11.330	323.7	375	Circular	1.900	0.395	1.130	1.850	0.360	1.115
1.005	6.300	315.0	375	Circular	1.850	0.360	1.115	1.800	0.340	1.085
1.006	11.150	123.9	375	Circular	1.800	0.340	1.085	1.850	0.250	1.225
1.007	14.345	315.0	375	Circular	1.850	0.250	1.225	1.775	0.204	1.196
2.000	39.100	169.3	225	Circular	1.900	1.000	0.675	1.900	0.769	0.906
2.001	7.710	169.0	225	Circular	1.900	0.769	0.906	1.900	0.723	0.952

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S01	1200	Manhole	Adoptable	S02	1200	Manhole	Adoptable
1.001	S02	1200	Manhole	Adoptable	S03	1200	Manhole	Adoptable
1.002	S03	1200	Manhole	Adoptable	S04	1200	Manhole	Adoptable
1.003	S04	1200	Manhole	Adoptable	S05	1200	Manhole	Adoptable
1.004	S05	1200	Manhole	Adoptable	S06	1200	Manhole	Adoptable
1.005	S06	1200	Manhole	Adoptable	Basin 1	1	Manhole	Adoptable
1.006	Basin 1	1	Manhole	Adoptable	S07	1200	Manhole	Adoptable
1.007	S07	1200	Manhole	Adoptable	S12	1350	Manhole	Adoptable
2.000	S08	1200	Manhole	Adoptable	S09	1200	Manhole	Adoptable
2.001	S09	1200	Manhole	Adoptable	S10	1200	Manhole	Adoptable

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.002	18.252	169.0	225	Circular	1.900	0.723	0.952	1.900	0.615	1.060
2.003	9.675	169.0	225	Circular	1.900	0.615	1.060	1.775	0.558	0.992
1.008	9.410	324.5	375	Circular	1.775	0.204	1.196	1.850	0.175	1.300
1.009	16.350	320.6	375	Circular	1.850	0.175	1.300	1.750	0.124	1.251
1.010	14.080	204.1	225	Circular	1.750	0.124	1.401	1.600	0.055	1.320
3.000	4.400	100.0	225	Circular	1.750	0.750	0.775	1.750	0.706	0.819

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.002	S10	1200	Manhole	Adoptable	S11	1200	Manhole	Adoptable
2.003	S11	1200	Manhole	Adoptable	S12	1350	Manhole	Adoptable
1.008	S12	1350	Manhole	Adoptable	S13	1350	Manhole	Adoptable
1.009	S13	1350	Manhole	Adoptable	S14	1500	Manhole	Adoptable
1.010	S14	1500	Manhole	Adoptable	S15	1200	Manhole	Adoptable
3.000	Basin 2	1	Manhole	Adoptable	S14	1500	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S01	1.923	1.223	1200	0	1.000	0.700	300
S02	1.923	1.396	1200	1	1.000	0.602	300
				0	1.001	0.527	375
S03	1.923	1.454	1200	1	1.001	0.469	375
				0	1.002	0.469	375
S04	1.900	1.476	1200	1	1.002	0.424	375
				0	1.003	0.424	375
S05	1.900	1.505	1200	1	1.003	0.395	375
				0	1.004	0.395	375
S06	1.850	1.490	1200	1	1.004	0.360	375
				0	1.005	0.360	375
S07	1.850	1.600	1200	1	1.006	0.250	375
				0	1.007	0.250	375

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Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S08	1.900	0.900	1200	0	2.000	1.000	225
S09	1.900	1.131	1200	1	2.000	0.769	225
				0	2.001	0.769	225
S10	1.900	1.177	1200	1	2.001	0.723	225
				0	2.002	0.723	225
S11	1.900	1.285	1200	1	2.002	0.615	225
				0	2.003	0.615	225
S12	1.775	1.571	1350	1	2.003	0.558	225
				2	1.007	0.204	375
				0	1.008	0.204	375
S13	1.850	1.675	1350	1	1.008	0.175	375
				0	1.009	0.175	375
S14	1.750	1.626	1500	1	3.000	0.706	225
				2	1.009	0.124	375
				0	1.010	0.124	225
S15	1.600	1.545	1200	1	1.010	0.055	225
Basin 1	1.800	1.460	1	1	1.005	0.340	375
				0	1.006	0.340	375
Basin 2	1.750	1.000	1	0	3.000	0.750	225

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	10.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	2 year (l/s)	2.8
Summer CV	0.750	30 year (l/s)	7.9
Winter CV	0.840	100 year (l/s)	11.1
Analysis Speed	Normal	Check Discharge Volume	✓
Skip Steady State	x	100 year +40% 360 minute (m³)	350

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Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	10	10	0
100	40	10	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.55
Greenfield Method	IH124	Growth Factor 100 year	3.56
Positively Drained Area (ha)	1.200	Betterment (%)	0
SAAR (mm)	554	QBar	2.6
Soil Index	3	Q 2 year (l/s)	2.3
SPR	0.37	Q 30 year (l/s)	6.7
Region	5	Q 100 year (l/s)	9.3
Growth Factor 2 year	0.89		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	40
Positively Drained Area (ha)	1.200	Storm Duration (mins)	360
Soil Index	3	Betterment (%)	0
SPR	0.37	PR	0.334
CWI	83.556	Runoff Volume (m^3)	350

Node S14 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	0.124	Product Number	CTL-SHE-0095-5000-1700-5000
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node Basin 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	0.340
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	32.8	0.0	1.460	372.0	0.0

Node Basin 2 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	0.750
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m^2)	Inf Area (m^2)	Depth (m)	Area (m^2)	Inf Area (m^2)
0.000	35.0	0.0	1.000	151.4	0.0

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Node S02 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	1.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.602	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	450

Node S03 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	1.001
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.469	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	450

Node S04 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	1.002
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.424	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	450

Node S05 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	1.003
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.395	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	450

Node S06 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	1.004
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.360	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	450

Node S11 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	2.002
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.615	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	450

Node S13 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Link	1.008
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	0.175	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)		Diameter (mm)	450

Other (defaults)

Entry Loss (manhole)	0.250	Entry Loss (junction)	0.000	Apply Recommended Losses	✓
Exit Loss (manhole)	0.250	Exit Loss (junction)	0.000	Flood Risk (m)	0.300

Link Loss Overrides

Link	Exit Loss
1.006	1.000
3.000	1.000

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Approval Settings

Node Size	✓	Minimum Full Bore Velocity (m/s)	
Node Losses	✓	Maximum Full Bore Velocity (m/s)	3.000
Link Size	✓	Proportional Velocity	✓
Minimum Diameter (mm)	150	Return Period (years)	
Link Length	✓	Minimum Proportional Velocity (m/s)	0.750
Maximum Length (m)	100.000	Maximum Proportional Velocity (m/s)	3.000
Coordinates	✓	Surcharged Depth	✓
Accuracy (m)	1.000	Return Period (years)	
Crossings	✓	Maximum Surcharged Depth (m)	0.100
Cover Depth	✓	Flooding	✓
Minimum Cover Depth (m)		Return Period (years)	30
Maximum Cover Depth (m)	3.000	Time to Half Empty	x
Backdrops	✓	Discharge Rates	✓
Minimum Backdrop Height (m)		Discharge Volume	✓
Maximum Backdrop Height (m)	1.500	100 year 360 minute (m^3)	
Full Bore Velocity	✓		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	141.566	40.058
2 year 15 minute winter	99.345	40.058
2 year 30 minute summer	91.753	25.963
2 year 30 minute winter	64.388	25.963
2 year 60 minute summer	61.301	16.200
2 year 60 minute winter	40.727	16.200
2 year 120 minute summer	37.449	9.897
2 year 120 minute winter	24.880	9.897
2 year 180 minute summer	28.672	7.378
2 year 180 minute winter	18.637	7.378
2 year 240 minute summer	22.636	5.982
2 year 240 minute winter	15.039	5.982
2 year 360 minute summer	17.235	4.435
2 year 360 minute winter	11.203	4.435
2 year 480 minute summer	13.550	3.581
2 year 480 minute winter	9.003	3.581
2 year 600 minute summer	11.088	3.033
2 year 600 minute winter	7.576	3.033
2 year 720 minute summer	9.878	2.647
2 year 720 minute winter	6.639	2.647
2 year 960 minute summer	8.113	2.136
2 year 960 minute winter	5.374	2.136
2 year 1440 minute summer	5.891	1.579
2 year 1440 minute winter	3.959	1.579
30 year +10% CC +10% A 15 minute summer	295.577	83.638
30 year +10% CC +10% A 15 minute winter	207.423	83.638
30 year +10% CC +10% A 30 minute summer	192.422	54.449
30 year +10% CC +10% A 30 minute winter	135.033	54.449
30 year +10% CC +10% A 60 minute summer	128.248	33.892
30 year +10% CC +10% A 60 minute winter	85.205	33.892
30 year +10% CC +10% A 120 minute summer	77.482	20.476
30 year +10% CC +10% A 120 minute winter	51.477	20.476
30 year +10% CC +10% A 180 minute summer	58.628	15.087

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Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +10% CC +10% A 180 minute winter	38.110	15.087
30 year +10% CC +10% A 240 minute summer	45.764	12.094
30 year +10% CC +10% A 240 minute winter	30.405	12.094
30 year +10% CC +10% A 360 minute summer	34.344	8.838
30 year +10% CC +10% A 360 minute winter	22.324	8.838
30 year +10% CC +10% A 480 minute summer	26.756	7.071
30 year +10% CC +10% A 480 minute winter	17.776	7.071
30 year +10% CC +10% A 600 minute summer	21.731	5.944
30 year +10% CC +10% A 600 minute winter	14.848	5.944
30 year +10% CC +10% A 720 minute summer	19.238	5.156
30 year +10% CC +10% A 720 minute winter	12.929	5.156
30 year +10% CC +10% A 960 minute summer	15.636	4.117
30 year +10% CC +10% A 960 minute winter	10.358	4.117
30 year +10% CC +10% A 1440 minute summer	11.177	2.995
30 year +10% CC +10% A 1440 minute winter	7.511	2.995
100 year +40% CC +10% A 15 minute summer	488.233	138.153
100 year +40% CC +10% A 15 minute winter	342.620	138.153
100 year +40% CC +10% A 30 minute summer	320.551	90.705
100 year +40% CC +10% A 30 minute winter	224.948	90.705
100 year +40% CC +10% A 60 minute summer	214.603	56.713
100 year +40% CC +10% A 60 minute winter	142.577	56.713
100 year +40% CC +10% A 120 minute summer	129.587	34.246
100 year +40% CC +10% A 120 minute winter	86.094	34.246
100 year +40% CC +10% A 180 minute summer	97.729	25.149
100 year +40% CC +10% A 180 minute winter	63.526	25.149
100 year +40% CC +10% A 240 minute summer	75.977	20.078
100 year +40% CC +10% A 240 minute winter	50.477	20.078
100 year +40% CC +10% A 360 minute summer	56.677	14.585
100 year +40% CC +10% A 360 minute winter	36.841	14.585
100 year +40% CC +10% A 480 minute summer	43.979	11.622
100 year +40% CC +10% A 480 minute winter	29.219	11.622
100 year +40% CC +10% A 600 minute summer	35.604	9.738
100 year +40% CC +10% A 600 minute winter	24.327	9.738
100 year +40% CC +10% A 720 minute summer	31.433	8.424
100 year +40% CC +10% A 720 minute winter	21.125	8.424
100 year +40% CC +10% A 960 minute summer	25.432	6.697
100 year +40% CC +10% A 960 minute winter	16.847	6.697
100 year +40% CC +10% A 1440 minute summer	18.055	4.839
100 year +40% CC +10% A 1440 minute winter	12.134	4.839

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Results for 2 year Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S01	10	0.816	0.116	22.8	0.2501	0.0000	OK
120 minute winter	S02	118	0.799	0.272	9.7	0.6199	0.0000	OK
120 minute winter	S03	118	0.799	0.330	13.3	0.7670	0.0000	OK
120 minute winter	S04	118	0.799	0.375	12.9	1.2388	0.0000	SURCHARGED
120 minute winter	S05	118	0.799	0.404	12.2	1.0817	0.0000	SURCHARGED
120 minute winter	S06	118	0.799	0.439	14.1	1.5411	0.0000	SURCHARGED
120 minute winter	S07	118	0.800	0.550	7.5	0.8966	0.0000	SURCHARGED
15 minute winter	S08	11	1.047	0.047	4.0	0.0647	0.0000	OK
15 minute winter	S09	11	0.848	0.079	10.3	0.1144	0.0000	OK
15 minute winter	S10	11	0.806	0.083	11.7	0.1010	0.0000	OK
120 minute winter	S11	118	0.799	0.184	7.2	0.9340	0.0000	OK
120 minute winter	S12	114	0.800	0.596	10.2	0.8522	0.0000	SURCHARGED
120 minute winter	S13	118	0.799	0.624	8.2	2.4367	0.0000	SURCHARGED
120 minute winter	S14	118	0.799	0.675	6.3	1.1928	0.0000	SURCHARGED
60 minute winter	S15	32	0.108	0.053	4.6	0.0000	0.0000	OK
120 minute winter	Basin 1	116	0.799	0.459	19.7	39.7259	0.0000	SURCHARGED
120 minute winter	Basin 2	116	0.799	0.049	1.9	1.8679	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S01	1.000	S02	22.2	0.901	0.313	0.5893	
120 minute winter	S02	1.001	S03	9.2	0.515	0.083	1.7542	
120 minute winter	S03	1.002	S04	11.7	0.582	0.105	1.5491	
120 minute winter	S04	1.003	S05	11.7	0.576	0.105	1.0210	
120 minute winter	S05	1.004	S06	11.3	0.499	0.102	1.2497	
120 minute winter	S06	1.005	Basin 1	13.0	0.737	0.116	0.6949	
120 minute winter	S07	1.007	S12	5.6	0.408	0.050	1.5822	
15 minute winter	S08	2.000	S09	3.9	0.425	0.097	0.3619	
15 minute winter	S09	2.001	S10	10.0	0.777	0.252	0.0995	
15 minute winter	S10	2.002	S11	11.8	0.677	0.296	0.3184	
120 minute winter	S11	2.003	S12	7.2	0.757	0.181	0.3607	
120 minute winter	S12	1.008	S13	8.2	0.446	0.074	1.0379	
120 minute winter	S13	1.009	S14	6.3	0.341	0.057	1.8034	
120 minute winter	S14	1.010	S15	4.6	0.628	0.126	0.1022	90.8
120 minute winter	Basin 1	1.006	S07	-5.3	0.501	-0.029	1.2298	
120 minute winter	Basin 2	3.000	S14	-1.9	-0.268	-0.037	0.0482	

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Results for 30 year +10% CC +10% A Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	S01	236	1.214	0.514	9.8	1.1597	0.0000	SURCHARGED
240 minute winter	S02	236	1.214	0.687	12.5	2.3146	0.0000	SURCHARGED
240 minute winter	S03	236	1.214	0.745	17.4	2.4316	0.0000	SURCHARGED
240 minute winter	S04	236	1.214	0.790	18.5	4.4420	0.0000	SURCHARGED
240 minute winter	S05	236	1.214	0.819	18.1	3.3058	0.0000	SURCHARGED
240 minute winter	S06	236	1.214	0.854	21.1	4.2894	0.0000	SURCHARGED
240 minute winter	S07	236	1.215	0.965	9.0	1.6215	0.0000	SURCHARGED
240 minute winter	S08	236	1.215	0.215	1.7	0.3004	0.0000	OK
240 minute winter	S09	236	1.214	0.445	4.4	0.6550	0.0000	SURCHARGED
240 minute winter	S10	236	1.214	0.491	4.6	0.6013	0.0000	SURCHARGED
240 minute winter	S11	236	1.214	0.599	8.6	4.7226	0.0000	SURCHARGED
240 minute winter	S12	236	1.214	1.010	15.9	1.4449	0.0000	SURCHARGED
240 minute winter	S13	236	1.214	1.039	15.7	4.7886	0.0000	SURCHARGED
240 minute winter	S14	236	1.215	1.091	14.9	1.9269	0.0000	SURCHARGED
120 minute winter	S15	44	0.108	0.053	4.6	0.0000	0.0000	OK
240 minute winter	Basin 1	236	1.214	0.874	23.6	117.7853	0.0000	SURCHARGED
240 minute winter	Basin 2	236	1.214	0.464	10.4	28.7978	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	S01	1.000	S02	9.1	0.615	0.128	1.6739	
240 minute winter	S02	1.001	S03	11.8	0.448	0.106	2.0515	
240 minute winter	S03	1.002	S04	16.8	0.483	0.152	1.6037	
240 minute winter	S04	1.003	S05	17.5	0.476	0.157	1.0214	
240 minute winter	S05	1.004	S06	17.3	0.453	0.157	1.2497	
240 minute winter	S06	1.005	Basin 1	20.2	0.718	0.180	0.6949	
240 minute winter	S07	1.007	S12	8.7	0.390	0.078	1.5822	
240 minute winter	S08	2.000	S09	1.7	0.333	0.043	1.5415	
240 minute winter	S09	2.001	S10	3.9	0.585	0.097	0.3066	
240 minute winter	S10	2.002	S11	4.3	0.485	0.107	0.7259	
240 minute winter	S11	2.003	S12	7.3	0.685	0.182	0.3848	
240 minute winter	S12	1.008	S13	15.7	0.428	0.142	1.0379	
240 minute winter	S13	1.009	S14	14.9	0.319	0.134	1.8034	
240 minute winter	S14	1.010	S15	4.6	0.628	0.126	0.1022	109.8
240 minute winter	Basin 1	1.006	S07	6.8	0.501	0.038	1.2298	
240 minute winter	Basin 2	3.000	S14	-10.4	-0.518	-0.200	0.1750	

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Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.85%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	S01	352	1.596	0.896	11.8	2.0207	0.0000	SURCHARGED
360 minute winter	S02	352	1.596	1.069	15.6	4.1013	0.0000	SURCHARGED
360 minute winter	S03	352	1.596	1.127	21.8	4.0298	0.0000	SURCHARGED
360 minute winter	S04	352	1.596	1.172	23.3	7.4346	0.0000	SURCHARGED
360 minute winter	S05	352	1.596	1.201	23.1	5.3506	0.0000	SURCHARGED
360 minute winter	S06	352	1.596	1.236	27.0	6.8052	0.0000	FLOOD RISK
360 minute winter	S07	352	1.596	1.346	7.7	2.2626	0.0000	FLOOD RISK
360 minute winter	S08	352	1.596	0.596	2.1	0.8343	0.0000	SURCHARGED
360 minute winter	S09	352	1.596	0.827	5.0	1.2164	0.0000	SURCHARGED
360 minute winter	S10	352	1.596	0.873	5.8	1.0685	0.0000	SURCHARGED
360 minute winter	S11	352	1.596	0.981	10.8	8.4774	0.0000	SURCHARGED
360 minute winter	S12	352	1.596	1.392	16.5	1.9914	0.0000	FLOOD RISK
360 minute winter	S13	352	1.596	1.421	16.4	6.9493	0.0000	FLOOD RISK
360 minute winter	S14	352	1.596	1.472	15.6	2.6006	0.0000	FLOOD RISK
360 minute winter	S15	352	0.109	0.054	4.6	0.0000	0.0000	OK
360 minute winter	Basin 1	352	1.596	1.256	30.7	224.8789	0.0000	FLOOD RISK
360 minute winter	Basin 2	352	1.596	0.846	11.5	71.2320	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	S01	1.000	S02	11.5	0.541	0.162	1.6739	
360 minute winter	S02	1.001	S03	15.0	0.388	0.135	2.0515	
360 minute winter	S03	1.002	S04	21.2	0.466	0.192	1.6037	
360 minute winter	S04	1.003	S05	22.3	0.492	0.200	1.0214	
360 minute winter	S05	1.004	S06	22.4	0.463	0.202	1.2497	
360 minute winter	S06	1.005	Basin 1	26.1	0.718	0.233	0.6949	
360 minute winter	S07	1.007	S12	7.5	0.422	0.067	1.5822	
360 minute winter	S08	2.000	S09	1.8	0.302	0.046	1.5550	
360 minute winter	S09	2.001	S10	4.9	0.544	0.122	0.3066	
360 minute winter	S10	2.002	S11	5.6	0.430	0.141	0.7259	
360 minute winter	S11	2.003	S12	9.6	0.588	0.242	0.3848	
360 minute winter	S12	1.008	S13	16.4	0.386	0.148	1.0379	
360 minute winter	S13	1.009	S14	15.6	0.252	0.141	1.8034	
360 minute winter	S14	1.010	S15	4.6	0.630	0.127	0.1029	153.5
360 minute winter	Basin 1	1.006	S07	5.8	0.478	0.032	1.2298	
360 minute winter	Basin 2	3.000	S14	-11.5	-0.441	-0.221	0.1750	

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