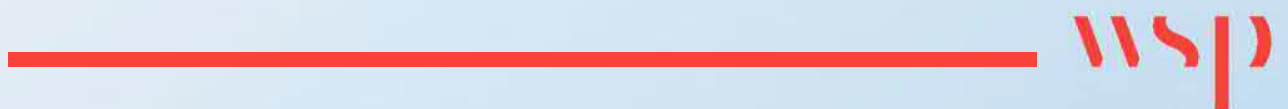


Appendix D

UNITED UTILITIES SEWER RECORDS





WSP

**3 white rose office park
millshaw park lane,
leeds,
ls11 0dl**

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: Omega 8
Our Ref: UUPS-ORD-135906
Date: 13/11/2019**

Dear Sirs

Location: Omega Business park

I acknowledge with thanks your request dated 13/11/2019 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

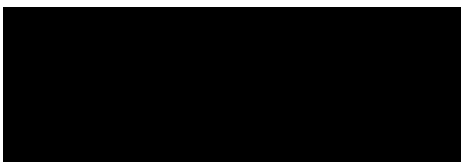
The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



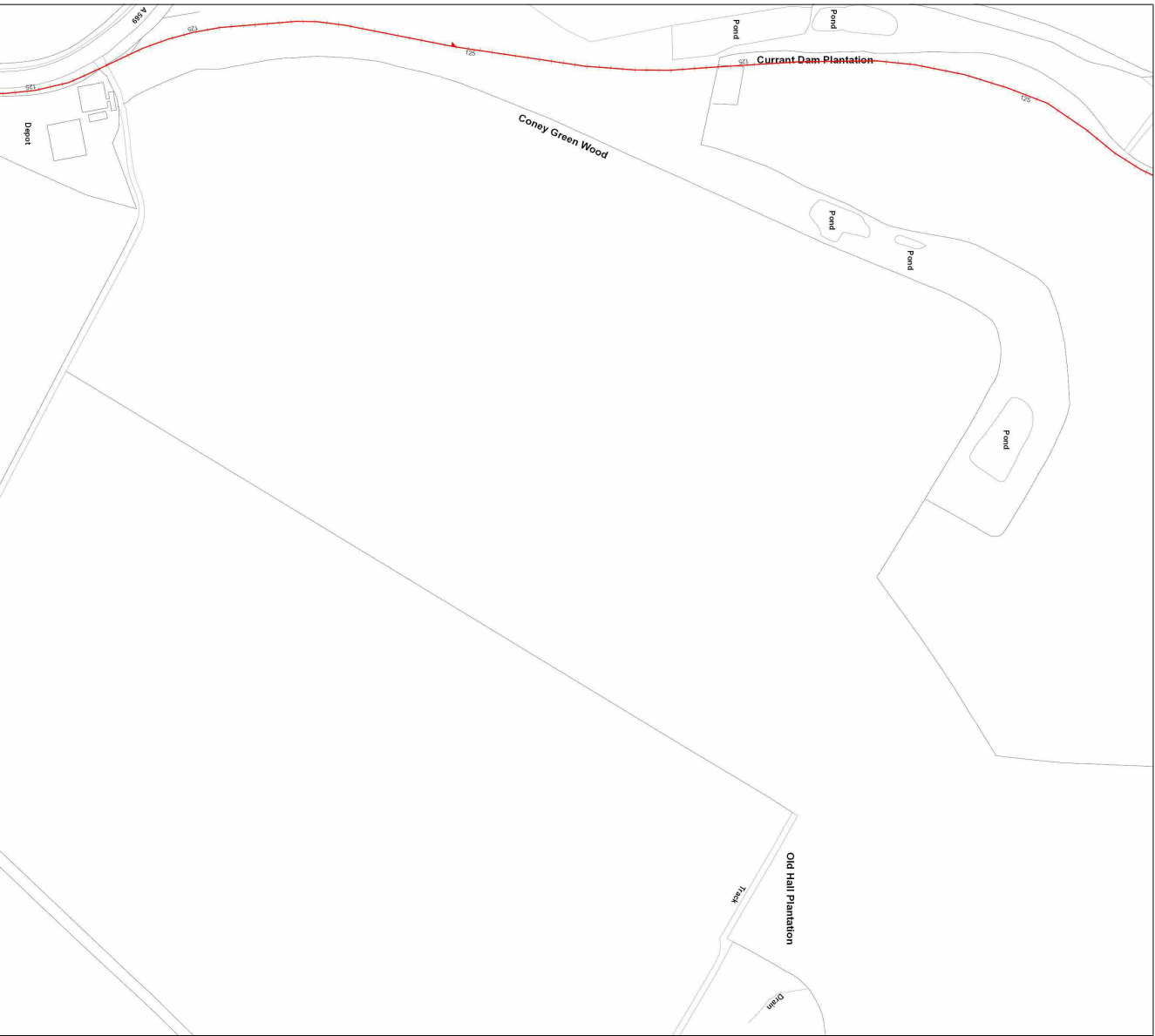
Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited ("UUWL").

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Notes: Crown Right, Road, Street, Railway, Water, Manhole, Length, Date

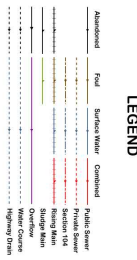
LEGEND

- Abandoned
- Public Sewer
- Private Sewer
- Section 154
- Stage 154
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- Stage 917
- Stage 9



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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All point assets follow the standard colour convention:

- [illegible]

MANHOLE FUNCTION

- | SEWER SHAPE | |
|-------------|---------------|
| SW | Surface Water |
| CO | Combined |
| OV | Overflow |
| CI | Circular |
| EG | Egg |
| OV | Oval |
| FT | Flat Top |
| RE | Rectangular |
| SQ | Square |
| TR | Triangular |
| AP | Arch |
| BS | Bent |
| HO | Household |
| UN | Unspecified |

SEWER SHAPE

- | SEWER MATERIAL | |
|----------------|-------------------------------|
| AC | Asbestos Cement |
| BR | Brick |
| PE | Polyethylene |
| RP | Reinforced Plastic Manhole |
| CO | Concrete |
| CS | Cast |
| CSB | Concrete Segment Box |
| CSU | Concrete Segment Unreinforced |
| CC | Concrete Box Culvert |
| PC | Precast/Sheet Composite |
| GR | Grass Reinforced Plastic |
| DI | Ductile Iron |
| PVC | Polyvinyl Chloride |
| CI | Cast Iron |
| SI | Sheet Iron |
| ST | Steel |
| VC | Unreinforced Clay |
| PP | Polypropylene |
| PI | Pitch Pipe |
| MC | Masonry, Coursed |
| MR | Masonry, Random |
| U | Unspecified |

Address or Site Reference:

business park,

OS sheet SJ5490SE

Scale: 1:1250 Date: 13/11/2019

Sheet: 8 of 15

Printed by: Property Searches

SEWER RECORDS





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Photo	Cover	Flare	Invert	Blur X	Blur Y	Shapo	MM	Length	Grid
Photo	Cover	Flare	Invert	Blur X	Blur Y	Shapo	MM	Length	Grid

LEGEND

Abandoned	Foal	Surface Water	Overland

All point assets follow the standard colour convention:

red = combined
brown = foul
purple = overflow
blue = surface water

- [illegible]

MANHOLE FUNCTION

FO	Fold
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Triangular
EG	Egg	AR	Arch
OV	Oval	BA	Banell
FT	Flat Top	HD	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIALS

AC	Acetabular Cement
BR	Black
PE	Polyethylene
RP	Refractive Index Mismatch
CO	Concrete
CSB	Concrete Segment Base
CSU	Concrete Segment Underlayment
CC	Concrete Base Culet
PSC	Polymer Steel Composite
GRG	Glass Reinforced Plastic
DI	Dilatation
PVC	Polyvinyl Chloride
CI	Cast Iron
SI	Steel Splice
ST	Steel
VC	Vitrified Clay
PP	Polypropylene
PF	Polyester Fibre
MAR	Marine
MM	Memory Foam
U	Unspecified

Address or Site Reference:

business park,

OS sheet S.J5590SW
Number:

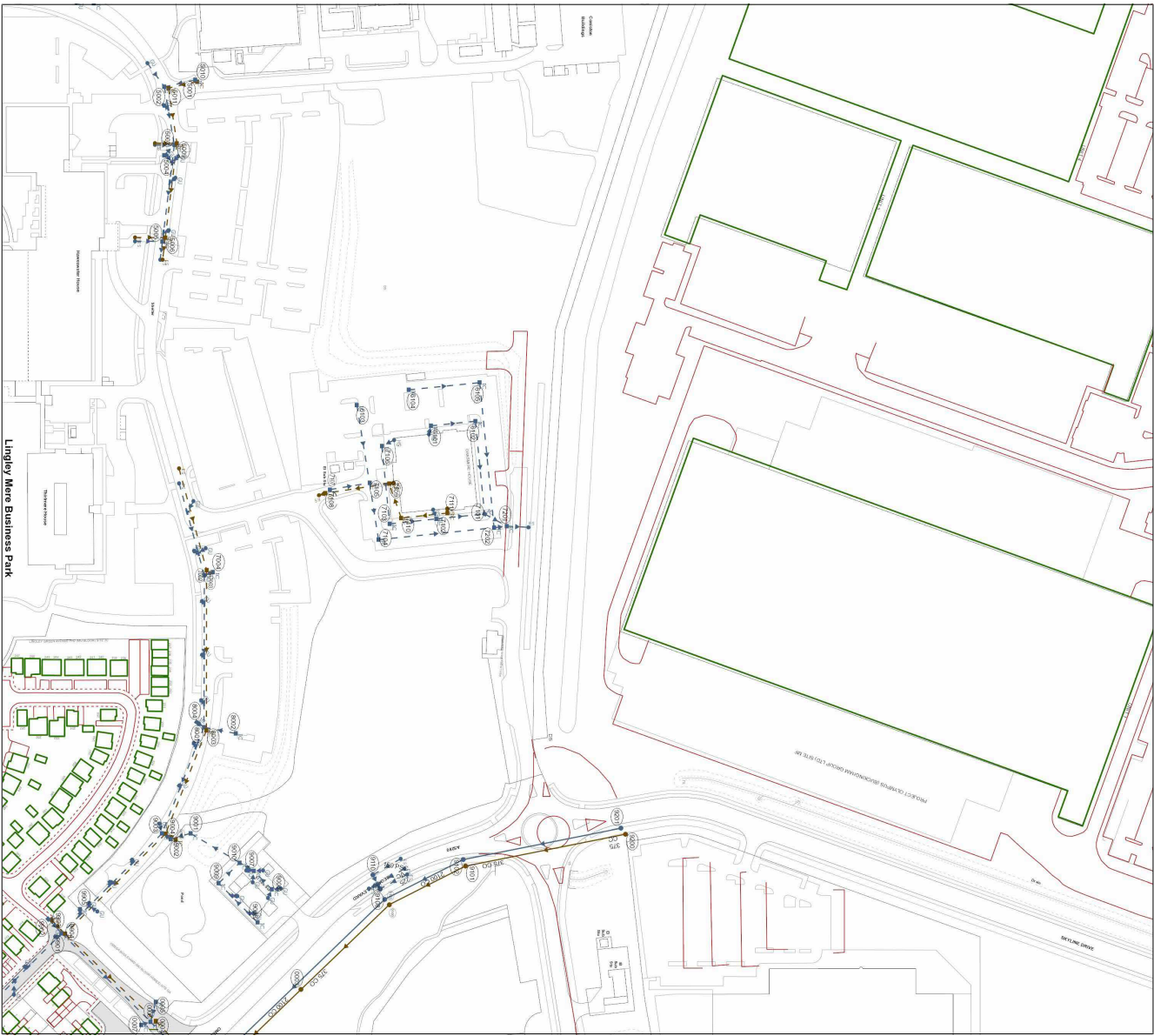
Number: Date: 13/11/2019
Scale: 1:1250
Nodes: 0

Sheet: 11 of 15

Printed by: Property Searches

SEWER
RECORDS
 **United**
Utilities





The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Manhole	Chain	Level	Depth	Shape	Material	Size	Notes
1000	1000	1000	1000	1000	1000	1000	1000
1001	1001	1001	1001	1001	1001	1001	1001
1002	1002	1002	1002	1002	1002	1002	1002
1003	1003	1003	1003	1003	1003	1003	1003
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1009	1009	1009	1009	1009	1009	1009	1009
1010	1010	1010	1010	1010	1010	1010	1010
1011	1011	1011	1011	1011	1011	1011	1011
1012	1012	1012	1012	1012	1012	1012	1012
1013	1013	1013	1013	1013	1013	1013	1013
1014	1014	1014	1014	1014	1014	1014	1014
1015	1015	1015	1015	1015	1015	1015	1015
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1017	1017	1017	1017	1017	1017	1017	1017
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LEGEND

Abandoned

Field

Surface Water

Combined

Public Sewer

Private Sewer

Section 154

Storage Silos

Overflow

Water Control

Signage Station

At point search below the standard colour convention:

Manhole

Valve

Change of Characteristic

MANHOLE FUNCTION

CI

CS

CV

CO

OV

SEWER MATERIAL

AC

BR

PE

CP

CC

CCU

CCS

CCP

CCD

CCF

CCG

CCH

CCI

CCJ

CCK

CCL

CCM

CCN

CCO

CCP

CCQ

CCR

CCS

CCU

CCV

CCW

CCX

CCY

CCZ

CC1

CC2

CC3

CC4

CC5

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CC7

CC8

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SEWER RECORDS

OS sheet

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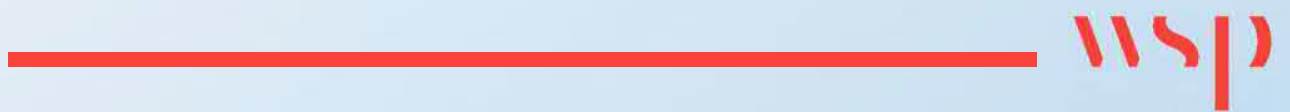
Nodes:

Sheet:

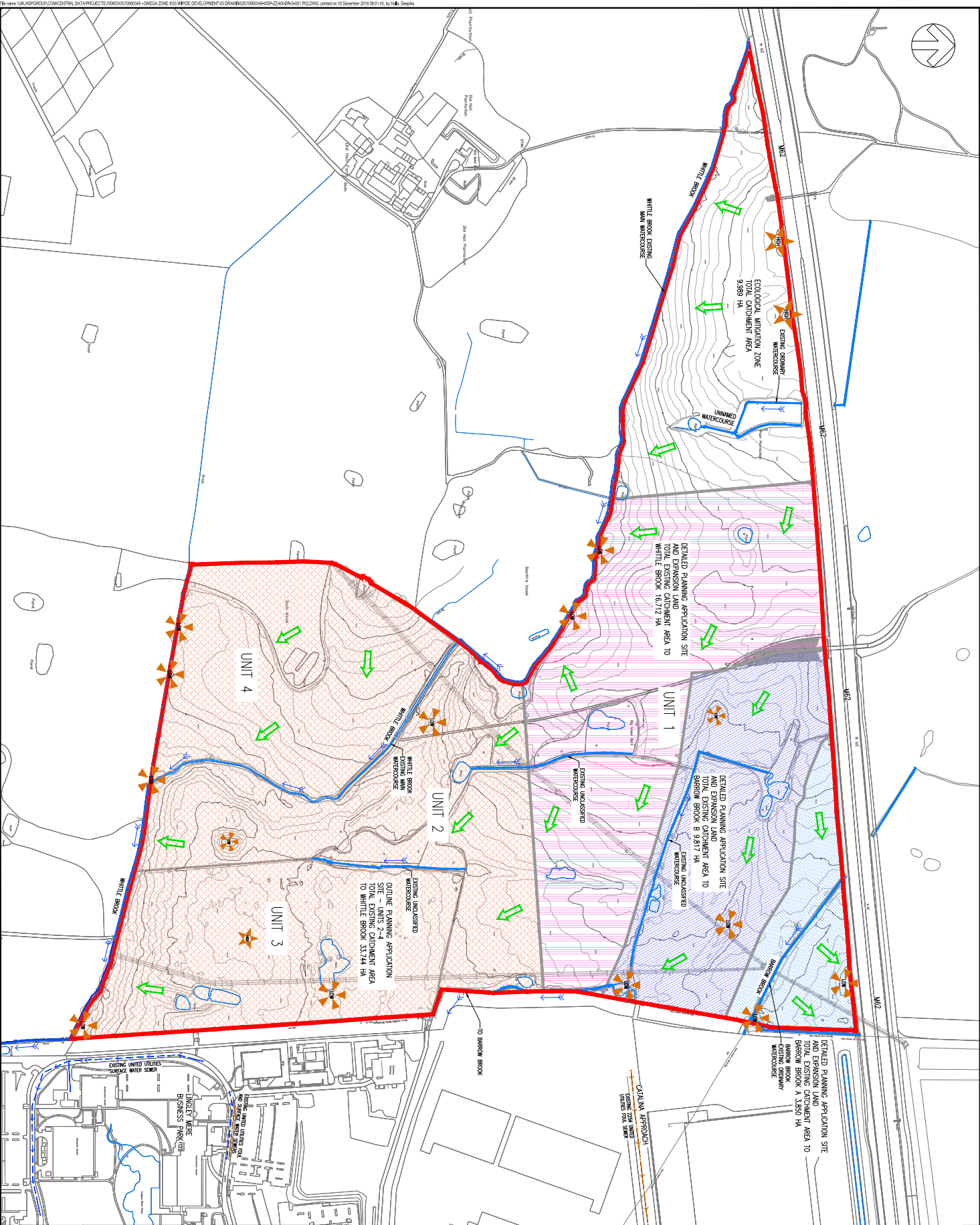
Printed by:

Appendix E

CATCHMENT AREA PLAN







DO NOT SCALE

NOTES

1. ALL DIMENSIONS ARE SHOWN IN METRES AND ALL LEVELS ARE SHOWN IN METRES UNLESS NOTED OTHERWISE.
2. THIS PLANNING IS IN THE DEVELOPMENT STAGE AND IS SUBJECT TO CHANGE.
3. THIS PLANNING IS BASED ON THE FOLLOWING INFORMATION:
 - TOPOGRAPHICAL SURVEY REF 32181.01 BY WILCOX
 - SITE WATERMAIN REF 4150-CA-00-08-4-03-10_ZONE 8 WESTERPA-343
 - BY CONDITIONS DATED OCTOBER 2018
 - UNITS 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Appendix F

MICRODRAINAGE CALCULATION RESULTS





Appendix F.1

GREENFIELD RUNOFF CALCULATIONS





WSP Group Ltd		Page 1
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Date 03/12/2019 10:39	Designed by ukdxv006	
File	Checked by	
XP Solutions	Source Control 2018.1	
<u>IH 124 Mean Annual Flood</u> Input Return Period (years) 1 SAAR (mm) 851 Urban 0.000 Area (ha) 74.112 Soil 0.470 Region Number Region 10 Results l / s QBAR Rural 430.6 QBAR Urban 430.6 Q1 year 374.6 Q1 year 374.6 Q2 years 401.1 Q5 years 512.4 Q10 years 594.3 Q20 years 677.0 Q25 years 706.2 Q30 years 730.1 Q50 years 796.6 Q100 years 895.7 Q200 years 1016.3 Q250 years 1055.0 Q1000 years 1309.1		
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Appendix F.2

OUTLINE PLANNING APPLICATION SITE STORAGE CALCULATIONS





WSP Group Ltd			Page 1		
					
Date 04/12/2019 16:56 File 191204 Unit 2.srcx XP Solutions			Designed by ukdxv006 Checked by Source Control 2018.1		
Summary of Results for 100 year Return Period (+40%)					
St or m Event	Max Level (m)	Max Depth (m)	Max Cont r ol (l / s)	Max Vol ume (m³)	St at us
15 mi n Summer	97.338	0.338	33.3	2196.0	O K
30 mi n Summer	97.446	0.446	40.0	2899.5	O K
60 mi n Summer	97.560	0.560	40.7	3639.1	O K
120 mi n Summer	97.673	0.673	42.8	4377.4	O K
180 mi n Summer	97.735	0.735	44.7	4774.5	O K
240 mi n Summer	97.773	0.773	45.9	5021.3	O K
360 mi n Summer	97.819	0.819	47.2	5326.6	O K
480 mi n Summer	97.847	0.847	48.0	5504.4	O K
600 mi n Summer	97.862	0.862	48.5	5603.6	O K
720 mi n Summer	97.869	0.869	48.7	5651.4	O K
960 mi n Summer	97.873	0.873	48.8	5674.0	O K
1440 mi n Summer	97.871	0.871	48.7	5664.6	O K
2160 mi n Summer	97.856	0.856	48.3	5561.3	O K
2880 mi n Summer	97.830	0.830	47.6	5397.1	O K
4320 mi n Summer	97.771	0.771	45.8	5009.2	O K
5760 mi n Summer	97.710	0.710	44.0	4614.4	O K
7200 mi n Summer	97.653	0.653	42.2	4242.8	O K
8640 mi n Summer	97.599	0.599	40.7	3895.9	O K
10080 mi n Summer	97.546	0.546	40.7	3546.5	O K
15 mi n W nt er	97.378	0.378	36.5	2460.0	O K
30 mi n W nt er	97.500	0.500	40.7	3251.0	O K
60 mi n W nt er	97.628	0.628	41.4	4084.3	O K
120 mi n W nt er	97.756	0.756	45.4	4914.6	O K
180 mi n W nt er	97.825	0.825	47.4	5365.2	O K
240 mi n W nt er	97.869	0.869	48.6	5647.8	O K
360 mi n W nt er	97.924	0.924	50.2	6003.1	O K
480 mi n W nt er	97.956	0.956	51.0	6216.4	O K
600 mi n W nt er	97.976	0.976	51.6	6343.3	O K
720 mi n W nt er	97.987	0.987	51.8	6414.8	O K
960 mi n W nt er	97.993	0.993	52.0	6455.0	O K
St or m Event	Rai n (mm / hr)	Fl ooded Vol ume (m³)	Di schar ge Vol ume (m³)	Ti me- Peak (mi ns)	
15 mi n Summer	131.495	0.0	1521.0	27	
30 mi n Summer	87.293	0.0	2067.8	41	
60 mi n Summer	55.250	0.0	3291.5	70	
120 mi n Summer	33.773	0.0	4023.7	130	
180 mi n Summer	24.968	0.0	4447.2	188	
240 mi n Summer	20.019	0.0	4735.1	248	
360 mi n Summer	14.622	0.0	5139.8	366	
480 mi n Summer	11.697	0.0	5425.7	484	
600 mi n Summer	9.830	0.0	5634.9	602	
720 mi n Summer	8.524	0.0	5790.9	720	
960 mi n Summer	6.801	0.0	5987.9	844	
1440 mi n Summer	4.939	0.0	6058.0	1088	
2160 mi n Summer	3.580	0.0	8332.3	1488	
2880 mi n Summer	2.846	0.0	8747.8	1904	
4320 mi n Summer	2.056	0.0	9158.5	2724	
5760 mi n Summer	1.631	0.0	10476.0	3520	
7200 mi n Summer	1.362	0.0	10904.5	4320	
8640 mi n Summer	1.175	0.0	11230.5	5104	
10080 mi n Summer	1.037	0.0	11443.0	5848	
15 mi n W nt er	131.495	0.0	1725.6	26	
30 mi n W nt er	87.293	0.0	2321.5	41	
60 mi n W nt er	55.250	0.0	3692.8	70	
120 mi n W nt er	33.773	0.0	4501.4	128	
180 mi n W nt er	24.968	0.0	4965.3	186	
240 mi n W nt er	20.019	0.0	5278.0	242	
360 mi n W nt er	14.622	0.0	5711.5	358	
480 mi n W nt er	11.697	0.0	6010.7	474	
600 mi n W nt er	9.830	0.0	6222.6	586	
720 mi n W nt er	8.524	0.0	6373.2	698	
960 mi n W nt er	6.801	0.0	6542.0	912	
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Summary of Results for 100 year Return Period (+40%)

St or m Event	Max Level (m)	Max Depth (m)	Max Cont r ol (l / s)	Max Vol ume (m³)	St at us
1440 mi n W n t e r	97.982	0.982	51.7	6380.2	O K
2160 mi n W n t e r	97.953	0.953	51.0	6197.4	O K
2880 mi n W n t e r	97.912	0.912	49.8	5930.2	O K
4320 mi n W n t e r	97.820	0.820	47.3	5331.5	O K
5760 mi n W n t e r	97.731	0.731	44.6	4749.0	O K
7200 mi n W n t e r	97.648	0.648	42.0	4213.8	O K
8640 mi n W n t e r	97.570	0.570	40.7	3704.9	O K
10080 mi n W n t e r	97.493	0.493	40.7	3203.0	O K

St or m Event	Rai n (mm/ hr)	Fl ooded Vol ume (m³)	Di schar ge Vol ume (m³)	Ti me- Peak (mi ns)
1440 mi n W n t e r	4.939	0.0	6519.1	1144
2160 mi n W n t e r	3.580	0.0	9324.8	1604
2880 mi n W n t e r	2.846	0.0	9778.6	2052
4320 mi n W n t e r	2.056	0.0	10173.9	2940
5760 mi n W n t e r	1.631	0.0	11738.9	3760
7200 mi n W n t e r	1.362	0.0	12222.7	4608
8640 mi n W n t e r	1.175	0.0	12595.9	5368
10080 mi n W n t e r	1.037	0.0	12850.7	6048

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Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 97.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	6500.0	1.000	6500.0

Crown Vortex Valve® Outflow Control

Design Head (m)	1.000	Vortex Valve® Type	R2 SW Chl y	Invert Level (m)	97.000
Design Flow (l/s)	52.3	Diameter (mm)	281		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.9	1.200	57.2	3.000	90.4	7.000	138.1
0.200	18.2	1.400	61.8	3.500	97.6	7.500	142.9
0.300	29.6	1.600	66.0	4.000	104.4	8.000	147.6
0.400	37.9	1.800	70.0	4.500	110.7	8.500	152.2
0.500	40.7	2.000	73.8	5.000	116.7	9.000	156.6
0.600	40.4	2.200	77.4	5.500	122.4	9.500	160.9
0.800	46.7	2.400	80.9	6.000	127.8		
1.000	52.2	2.600	84.2	6.500	133.1		

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Summary of Results for 100 year Return Period (+40%)						
St or m Event	Max Level (m)	Max Depth (m)	Max Cont r ol (l / s)	Max Vol ume (m³)	St at us	
15 mi n Summer	97.338	0.338	24.2	1520.6	O K	
30 mi n Summer	97.447	0.447	25.8	2010.1	O K	
60 mi n Summer	97.561	0.561	27.1	2523.8	O K	
120 mi n Summer	97.674	0.674	29.7	3033.1	O K	
180 mi n Summer	97.735	0.735	31.0	3307.2	O K	
240 mi n Summer	97.773	0.773	31.8	3477.0	O K	
360 mi n Summer	97.819	0.819	32.8	3686.5	O K	
480 mi n Summer	97.846	0.846	33.3	3807.7	O K	
600 mi n Summer	97.861	0.861	33.6	3874.4	O K	
720 mi n Summer	97.868	0.868	33.7	3905.7	O K	
960 mi n Summer	97.871	0.871	33.8	3917.7	O K	
1440 mi n Summer	97.868	0.868	33.7	3905.0	O K	
2160 mi n Summer	97.850	0.850	33.4	3825.9	O K	
2880 mi n Summer	97.824	0.824	32.8	3706.7	O K	
4320 mi n Summer	97.763	0.763	31.6	3431.8	O K	
5760 mi n Summer	97.702	0.702	30.3	3157.1	O K	
7200 mi n Summer	97.645	0.645	29.1	2902.9	O K	
8640 mi n Summer	97.594	0.594	27.9	2672.0	O K	
10080 mi n Summer	97.548	0.548	26.8	2464.8	O K	
15 mi n W nt er	97.379	0.379	25.5	1704.1	O K	
30 mi n W nt er	97.501	0.501	25.8	2254.8	O K	
60 mi n W nt er	97.629	0.629	28.7	2830.8	O K	
120 mi n W nt er	97.757	0.757	31.5	3405.3	O K	
180 mi n W nt er	97.826	0.826	32.9	3716.8	O K	
240 mi n W nt er	97.869	0.869	33.7	3911.9	O K	
360 mi n W nt er	97.924	0.924	34.8	4156.4	O K	
480 mi n W nt er	97.956	0.956	35.4	4302.6	O K	
600 mi n W nt er	97.975	0.975	35.7	4389.0	O K	
720 mi n W nt er	97.986	0.986	35.9	4437.1	O K	
960 mi n W nt er	97.992	0.992	36.0	4462.4	O K	
St or m Event	Rai n (mm / hr)	Fl ooded Vol ume (m³)	Di schar ge Vol ume (m³)	Ti me- Peak (mi ns)		
15 mi n Summer	131.495	0.0	1117.7	26		
30 mi n Summer	87.293	0.0	1495.3	41		
60 mi n Summer	55.250	0.0	2329.9	70		
120 mi n Summer	33.773	0.0	2841.5	130		
180 mi n Summer	24.968	0.0	3136.7	188		
240 mi n Summer	20.019	0.0	3336.9	248		
360 mi n Summer	14.622	0.0	3617.1	366		
480 mi n Summer	11.697	0.0	3813.0	484		
600 mi n Summer	9.830	0.0	3954.2	602		
720 mi n Summer	8.524	0.0	4057.0	720		
960 mi n Summer	6.801	0.0	4178.4	846		
1440 mi n Summer	4.939	0.0	4185.6	1090		
2160 mi n Summer	3.580	0.0	5822.7	1492		
2880 mi n Summer	2.846	0.0	6117.4	1904		
4320 mi n Summer	2.056	0.0	6402.5	2724		
5760 mi n Summer	1.631	0.0	7280.8	3520		
7200 mi n Summer	1.362	0.0	7583.2	4320		
8640 mi n Summer	1.175	0.0	7817.5	5104		
10080 mi n Summer	1.037	0.0	7977.5	5856		
15 mi n W nt er	131.495	0.0	1261.6	26		
30 mi n W nt er	87.293	0.0	1659.7	41		
60 mi n W nt er	55.250	0.0	2610.3	70		
120 mi n W nt er	33.773	0.0	3174.1	128		
180 mi n W nt er	24.968	0.0	3496.4	184		
240 mi n W nt er	20.019	0.0	3712.4	242		
360 mi n W nt er	14.622	0.0	4009.4	358		
480 mi n W nt er	11.697	0.0	4210.5	474		
600 mi n W nt er	9.830	0.0	4348.8	586		
720 mi n W nt er	8.524	0.0	4442.7	698		
960 mi n W nt er	6.801	0.0	4534.6	912		
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Summary of Results for 100 year Return Period (+40%)

St or m Event	Max Level (m)	Max Depth (m)	Max Cont r ol (l / s)	Max Vol ume (m³)	St at us
1440 mi n W n t e r	97. 979	0. 979	35. 8	4405. 8	O K
2160 mi n W n t e r	97. 950	0. 950	35. 3	4273. 9	O K
2880 mi n W n t e r	97. 908	0. 908	34. 5	4085. 2	O K
4320 mi n W n t e r	97. 815	0. 815	32. 7	3668. 3	O K
5760 mi n W n t e r	97. 726	0. 726	30. 8	3267. 5	O K
7200 mi n W n t e r	97. 646	0. 646	29. 1	2906. 3	O K
8640 mi n W n t e r	97. 574	0. 574	27. 4	2583. 7	O K
10080 mi n W n t e r	97. 509	0. 509	25. 8	2291. 1	O K

St or m Event	Rai n (mm/ hr)	Fl ooded Vol ume (m³)	Di schar ge Vol ume (m³)	Ti me- Peak (mi ns)
1440 mi n W n t e r	4. 939	0. 0	4481. 9	1144
2160 mi n W n t e r	3. 580	0. 0	6513. 7	1604
2880 mi n W n t e r	2. 846	0. 0	6834. 2	2052
4320 mi n W n t e r	2. 056	0. 0	7103. 9	2940
5760 mi n W n t e r	1. 631	0. 0	8156. 9	3760
7200 mi n W n t e r	1. 362	0. 0	8497. 5	4608
8640 mi n W n t e r	1. 175	0. 0	8764. 4	5368
10080 mi n W n t e r	1. 037	0. 0	8953. 8	6160

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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)	19.500	Shortest Storm (mins)	15
Ratio R	0.376	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 6.247

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From	To:	From	To:	From	To:
0	4	4	8	8	12
	2.247		2.000		2.000

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Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 97.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	4500.0	1.000	4500.0

Crown Vortex Valve® Outflow Control

Design Head (m)	1.000	Vortex Valve® Type	R2 SW Only	Invert Level (m)	97.000
Design Flow (l/s)	36.2	Diameter (mm)	234		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.7	1.200	39.6	3.000	62.7	7.000	95.8
0.200	14.6	1.400	42.8	3.500	67.7	7.500	99.1
0.300	22.3	1.600	45.8	4.000	72.4	8.000	102.4
0.400	25.8	1.800	48.6	4.500	76.8	8.500	105.5
0.500	25.6	2.000	51.2	5.000	80.9	9.000	108.6
0.600	28.0	2.200	53.7	5.500	84.9	9.500	111.6
0.800	32.4	2.400	56.1	6.000	88.7		
1.000	36.2	2.600	58.4	6.500	92.3		

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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	97.331	0.331	24.5	1555.5	OK
30 min Summer	97.437	0.437	26.6	2055.7	OK
60 min Summer	97.549	0.549	27.5	2582.4	OK
120 min Summer	97.661	0.661	30.2	3104.7	OK
180 min Summer	97.721	0.721	31.5	3386.5	OK
240 min Summer	97.758	0.758	32.3	3561.6	OK
360 min Summer	97.804	0.804	33.3	3778.1	OK
480 min Summer	97.831	0.831	33.8	3904.2	OK
600 min Summer	97.846	0.846	34.1	3974.5	OK
720 min Summer	97.853	0.853	34.3	4008.6	OK
960 min Summer	97.856	0.856	34.3	4022.5	OK
1440 min Summer	97.853	0.853	34.3	4011.3	OK
2160 min Summer	97.837	0.837	34.0	3933.2	OK
2880 min Summer	97.811	0.811	33.4	3813.5	OK
4320 min Summer	97.752	0.752	32.2	3535.2	OK
5760 min Summer	97.693	0.693	30.9	3255.3	OK
7200 min Summer	97.637	0.637	29.6	2995.7	OK
8640 min Summer	97.587	0.587	28.5	2759.1	OK
10080 min Summer	97.542	0.542	27.3	2545.8	OK
15 min Winter	97.371	0.371	26.0	1742.9	OK
30 min Winter	97.491	0.491	26.6	2306.3	OK
60 min Winter	97.616	0.616	29.1	2896.6	OK
120 min Winter	97.742	0.742	32.0	3486.3	OK
180 min Winter	97.810	0.810	33.4	3806.5	OK
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	131.495	0.0	1129.6	30	
30 min Summer	87.293	0.0	1515.9	45	
60 min Summer	55.250	0.0	2374.2	74	
120 min Summer	33.773	0.0	2896.0	132	
180 min Summer	24.968	0.0	3197.0	192	
240 min Summer	20.019	0.0	3400.9	250	
360 min Summer	14.622	0.0	3686.0	368	
480 min Summer	11.697	0.0	3885.2	486	
600 min Summer	9.830	0.0	4028.7	604	
720 min Summer	8.524	0.0	4133.0	722	
960 min Summer	6.801	0.0	4256.0	856	
1440 min Summer	4.939	0.0	4263.2	1094	
2160 min Summer	3.580	0.0	5950.8	1492	
2880 min Summer	2.846	0.0	6249.5	1908	
4320 min Summer	2.056	0.0	6534.0	2728	
5760 min Summer	1.631	0.0	7452.7	3520	
7200 min Summer	1.362	0.0	7761.3	4328	
8640 min Summer	1.175	0.0	7999.5	5104	
10080 min Summer	1.037	0.0	8160.2	5856	
15 min Winter	131.495	0.0	1276.2	30	
30 min Winter	87.293	0.0	1685.1	44	
60 min Winter	55.250	0.0	2660.3	74	
120 min Winter	33.773	0.0	3235.3	130	
180 min Winter	24.968	0.0	3563.6	188	
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Summary of Results for 100 year Return Period (+40%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
240 min Winter	97.853	0.853	34.3	4007.3	OK
360 min Winter	97.906	0.906	35.3	4259.9	OK
480 min Winter	97.939	0.939	36.0	4411.7	OK
600 min Winter	97.958	0.958	36.3	4501.9	OK
720 min Winter	97.969	0.969	36.5	4552.8	OK
960 min Winter	97.975	0.975	36.7	4581.2	OK
1440 min Winter	97.963	0.963	36.4	4525.0	OK
2160 min Winter	97.935	0.935	35.9	4393.4	OK
2880 min Winter	97.894	0.894	35.1	4203.0	OK
4320 min Winter	97.804	0.804	33.3	3779.5	OK
5760 min Winter	97.717	0.717	31.4	3370.2	OK
7200 min Winter	97.638	0.638	29.7	3000.4	OK
8640 min Winter	97.568	0.568	28.0	2668.0	OK
10080 min Winter	97.503	0.503	26.6	2363.3	OK
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
240 min Winter	20.019	0.0	3783.7	246	
360 min Winter	14.622	0.0	4085.9	360	
480 min Winter	11.697	0.0	4290.3	476	
600 min Winter	9.830	0.0	4430.9	590	
720 min Winter	8.524	0.0	4526.4	700	
960 min Winter	6.801	0.0	4619.9	916	
1440 min Winter	4.939	0.0	4564.5	1150	
2160 min Winter	3.580	0.0	6656.8	1608	
2880 min Winter	2.846	0.0	6981.5	2056	
4320 min Winter	2.056	0.0	7248.5	2944	
5760 min Winter	1.631	0.0	8349.7	3800	
7200 min Winter	1.362	0.0	8697.4	4608	
8640 min Winter	1.175	0.0	8968.9	5376	
10080 min Winter	1.037	0.0	9159.8	6160	
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<u>Rainfall Details</u> <table><tr><td>Rainfall Model</td><td>FSR</td><td>Winter Storms</td><td>Yes</td></tr><tr><td>Return Period (years)</td><td>100</td><td>Ov (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Ov (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>19.500</td><td>Shortest Storm (mins)</td><td>15</td></tr><tr><td>Ratio R</td><td>0.376</td><td>Longest Storm (mins)</td><td>10080</td></tr><tr><td>Summer Storms</td><td>Yes</td><td>Climate Change %</td><td>+40</td></tr></table> <u>Time Area Diagram</u> Total Area (ha) 6.398 <table><tr><td>Time (mins)</td><td>Area</td><td>Time (mins)</td><td>Area</td><td>Time (mins)</td><td>Area</td><td>Time (mins)</td><td>Area</td></tr><tr><td>From</td><td>To: (ha)</td><td>From</td><td>To: (ha)</td><td>From</td><td>To: (ha)</td><td>From</td><td>To: (ha)</td></tr><tr><td>0</td><td>4 1.600</td><td>4</td><td>8 1.600</td><td>8</td><td>12 1.600</td><td>12</td><td>16 1.598</td></tr></table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Ov (Summer)	0.750	Region	England and Wales	Ov (Winter)	0.840	M5-60 (mm)	19.500	Shortest Storm (mins)	15	Ratio R	0.376	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	From	To: (ha)	From	To: (ha)	From	To: (ha)	From	To: (ha)	0	4 1.600	4	8 1.600	8	12 1.600	12	16 1.598
Rainfall Model	FSR	Winter Storms	Yes																																															
Return Period (years)	100	Ov (Summer)	0.750																																															
Region	England and Wales	Ov (Winter)	0.840																																															
M5-60 (mm)	19.500	Shortest Storm (mins)	15																																															
Ratio R	0.376	Longest Storm (mins)	10080																																															
Summer Storms	Yes	Climate Change %	+40																																															
Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area																																											
From	To: (ha)	From	To: (ha)	From	To: (ha)	From	To: (ha)																																											
0	4 1.600	4	8 1.600	8	12 1.600	12	16 1.598																																											
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WSP Group Ltd		Page 4																																																																																													
																																																																																															
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XP Solutions		Source Control 2019.1																																																																																													
Model Details Storage is Online Cover Level (m) 100.000 Tank or Pond Structure Invert Level (m) 97.000 <table><tr><td>Depth (m)</td><td>Area (m²)</td><td>Depth (m)</td><td>Area (m²)</td></tr><tr><td>0.000</td><td>4700.0</td><td>1.000</td><td>4700.0</td></tr></table> Crown Vortex Valve® Outflow Control <table><tr><td>Design Head (m)</td><td>1.000</td><td>Vortex Valve® Type</td><td>R2 SW Only</td><td>Invert Level (m)</td><td>97.000</td></tr><tr><td>Design Flow (l/s)</td><td>37.1</td><td>Diameter (mm)</td><td>237</td><td></td><td></td></tr></table> <table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>5.8</td><td>1.200</td><td>40.7</td><td>3.000</td><td>64.3</td><td>7.000</td><td>98.2</td></tr><tr><td>0.200</td><td>14.8</td><td>1.400</td><td>43.9</td><td>3.500</td><td>69.5</td><td>7.500</td><td>101.7</td></tr><tr><td>0.300</td><td>22.7</td><td>1.600</td><td>47.0</td><td>4.000</td><td>74.3</td><td>8.000</td><td>105.0</td></tr><tr><td>0.400</td><td>26.5</td><td>1.800</td><td>49.8</td><td>4.500</td><td>78.8</td><td>8.500</td><td>108.2</td></tr><tr><td>0.500</td><td>26.3</td><td>2.000</td><td>52.5</td><td>5.000</td><td>83.0</td><td>9.000</td><td>111.4</td></tr><tr><td>0.600</td><td>28.8</td><td>2.200</td><td>55.1</td><td>5.500</td><td>87.1</td><td>9.500</td><td>114.4</td></tr><tr><td>0.800</td><td>33.2</td><td>2.400</td><td>57.5</td><td>6.000</td><td>90.9</td><td></td><td></td></tr><tr><td>1.000</td><td>37.1</td><td>2.600</td><td>59.9</td><td>6.500</td><td>94.7</td><td></td><td></td></tr></table>				Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	4700.0	1.000	4700.0	Design Head (m)	1.000	Vortex Valve® Type	R2 SW Only	Invert Level (m)	97.000	Design Flow (l/s)	37.1	Diameter (mm)	237			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	5.8	1.200	40.7	3.000	64.3	7.000	98.2	0.200	14.8	1.400	43.9	3.500	69.5	7.500	101.7	0.300	22.7	1.600	47.0	4.000	74.3	8.000	105.0	0.400	26.5	1.800	49.8	4.500	78.8	8.500	108.2	0.500	26.3	2.000	52.5	5.000	83.0	9.000	111.4	0.600	28.8	2.200	55.1	5.500	87.1	9.500	114.4	0.800	33.2	2.400	57.5	6.000	90.9			1.000	37.1	2.600	59.9	6.500	94.7		
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Appendix F.3

DETAILED PLANNING APPLICATION SITE HYDRAULIC CALCULATIONS





Area to north watercourse

ICP SUDS

ICP SUDS Input (FSR Method)

Return Period (Years)
Area (ha)
SAAR (mm)
Soil
Growth Curve

Partly Urbanised Catchment (QBAR)

Urban
Region

Results

QBAR rural (l/s)

QBAR urban (l/s)

Return Period Flood

	Region	QBAR (l/s)	Q (1yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
IH 124	Region 1	16.7	14.2	14.2	31.6	41.5
ICP SUDS	Region 2	16.7	14.6	14.6	31.8	44.0
ADAS 345	Region 3	16.7	14.4	14.4	29.4	34.8
FEH	Region 4	16.7	13.9	13.9	32.8	43.0
ReFH2	Region 5	16.7	14.6	14.6	40.2	59.6
Greenfield Volume	Region 6/Region 7	16.7	14.2	14.2	38.0	53.4
Greenfield Volume (ReFH2)	Region 8	16.7	13.1	13.1	31.9	40.5
	Region 9	16.7	14.7	14.7	29.5	36.5
	Region 10	16.7	14.6	14.6	28.4	34.8

Enter Return Period between 1 and 1000

Area to south watercourse

Rural Runoff Calculator

Micro Drainage

ICP SUDS

ICP SUDS Input (FSR Method)

Return Period (Years)

Area (ha)

SAAR (mm)

Soil

Growth Curve

Partly Urbanised Catchment (QBAR)

Urban

Region

Results

QBAR rural (l/s)

QBAR urban (l/s)

Return Period Flood

	Region	QBAR (l/s)	Q (1yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
IH 124						
ICP SUDS	Region 1	98.3	83.5	83.5	185.7	243.8
	Region 2	98.3	85.5	85.5	186.5	258.5
ADAS 345	Region 3	98.3	84.5	84.5	172.8	204.4
FEH	Region 4	98.3	81.6	81.6	192.6	252.6
	Region 5	98.3	85.5	85.5	236.1	349.9
ReFH2	Region 6/Region 7	98.3	83.5	83.5	222.8	313.6
	Region 8	98.3	76.7	76.7	187.4	237.9
Greenfield Volume	Region 9	98.3	86.5	86.5	173.3	214.3
Greenfield Volume (ReFH2)	Region 10	98.3	85.5	85.5	166.7	204.4

OK Cancel Help

Enter Return Period between 1 and 1000

W A Fairhurst & Partners		Page 1
11 Woodside Terrace Glasgow G3 7XQ	Omega Zone 8 St. Helens New Distribution HUB	
Date 12/12/2019 12:39 File Northern swale higher dischar...	Designed by NS Checked by MH	
Micro Drainage Network 2018.1		
<u>Simulation Criteria for Storm</u> 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 Coefficient 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 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FSR Profile Type Summer Return Period (years) 100 Cv (Summer) 0.750 Region England and Wales Cv (Winter) 0.840 M5-60 (mm) 19.100 Storm Duration (mins) 30 Ratio R 0.403		
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11 Woodside Terrace Glasgow G3 7XQ	Omega Zone 8 St. Helens New Distribution HUB	
Date 12/12/2019 12:39	Designed by NS	
File Northern swale higher dischar...	Checked by MH	
Micro Drainage	Network 2018.1	
Online Controls for Storm		
Hydro-Brake® Optimum Manhole: S10, DS/PN: S12.036, Volume (m³): 339.3		
Unit Reference MD-SHE-0178-1670-1374-1670		
Design Head (m)1.374		
Design Flow (l/s)16.7		
Flush-Flo™Calculated		
ObjectiveMinimise upstream storage		
ApplicationSurface		
Sump AvailableYes		
Diameter (mm)178		
Invert Level (m)21.226		
Minimum Outlet Pipe Diameter (mm)225		
Suggested Manhole Diameter (mm)1500		
Control PointsHead (m)Flow (l/s)		
Design Point (Calculated)1.37416.7		
Flush-Flo™0.40916.7		
Kick-Flo®0.89913.7		
Mean Flow over Head Range-14.4		
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated		
Depth (m)Flow (l/s)Depth (m)Flow (l/s)Depth (m)Flow (l/s)Depth (m)Flow (l/s)		
0.1006.31.20015.73.00024.27.00036.4		
0.20015.31.40016.83.50026.17.50037.7		
0.30016.41.60018.04.00027.88.00038.9		
0.40016.71.80019.04.50029.48.50040.0		
0.50016.62.00020.05.00031.09.00041.1		
0.60016.32.20020.95.50032.49.50042.2		
0.80015.12.40021.86.00033.8		
1.00014.42.60022.66.50035.2		
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11 Woodside Terrace Glasgow G3 7XQ		Omega Zone 8 St. Helens New Distribution HUB	
Date 12/12/2019 12:39		Designed by NS	
File Northern swale higher dischar...		Checked by MH	
Micro Drainage		Network 2018.1	



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 * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	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	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.402
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	0.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S12.000	S28	15 Winter	100	+40%					23.359
S12.001	S28-1	15 Winter	100	+40%					23.359
S12.002	S28-2	15 Winter	100	+40%					23.358
S12.003	S28-3	15 Winter	100	+40%					23.358
S12.004	S28-4	15 Winter	100	+40%					23.356
S12.005	S28-5	15 Winter	100	+40%					23.355
S12.006	S28-6	15 Winter	100	+40%					23.353
S12.007	S28-7	15 Winter	100	+40%					23.351
S12.008	S28-8	15 Winter	100	+40%					23.349
S12.009	S28-9	15 Winter	100	+40%					23.347
S12.010	S28-10	15 Winter	100	+40%					23.345
S12.011	S28-11	15 Winter	100	+40%					23.343
S12.012	S28-12	15 Winter	100	+40%					23.342
S12.013	S28-13	15 Winter	100	+40%					23.340
S12.014	S28-14	15 Winter	100	+40%					23.338
S12.015	S28-15	15 Winter	100	+40%					23.336
S12.016	S28-16	15 Winter	100	+40%					23.334
S12.017	S28-17	15 Winter	100	+40%					23.333
S12.018	S28-18	15 Winter	100	+40%					23.331
S12.019	S28-19	15 Winter	100	+40%					23.329

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11 Woodside Terrace Glasgow G3 7XQ			Omega Zone 8 St. Helens New Distribution HUB					
Date 12/12/2019 12:39 File Northern swale higher dischar...			Designed by NS Checked by MH					
Micro Drainage			Network 2018.1					
Summary of Critical Results by Maximum Level (Rank 1) for Storm								
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S12.020	S28-20	15 Winter	100	+40%				
S12.021	S28-21	15 Winter	100	+40%				
S12.022	S28-22	15 Winter	100	+40%				
S12.023	S28-23	15 Winter	100	+40%				
S12.024	S28-24	15 Winter	100	+40%				
S12.025	S28-25	15 Winter	100	+40%				
S12.026	S28-26	15 Winter	100	+40%				
S12.027	S28-27	15 Winter	100	+40%				
S12.028	S28-28	15 Winter	100	+40%				
S12.029	S28-29	15 Winter	100	+40%				
S12.030	S28-30	15 Winter	100	+40%				
S12.031	S28-31	15 Winter	100	+40%				
S12.032	S28-32	15 Winter	100	+40%				
S12.033	S10	360 Winter	100	+40%				
S12.034	S10	480 Winter	100	+40%	100/480 Winter	100/360 Winter		
S13.000	S31	15 Winter	100	+40%				
S13.001	S31-1	15 Winter	100	+40%				
S13.002	S31-2	15 Winter	100	+40%				
S13.003	S31-3	15 Winter	100	+40%				
S13.004	S31-4	15 Winter	100	+40%				
S13.005	S31-5	15 Winter	100	+40%				
S13.006	S31-6	15 Winter	100	+40%				
S13.007	S31-7	15 Winter	100	+40%				
S13.008	S31-8	15 Winter	100	+40%				
S13.009	S31-9	15 Winter	100	+40%				
S13.010	S31-10	15 Winter	100	+40%				
S13.011	S31-11	15 Winter	100	+40%				
S13.012	S31-12	15 Winter	100	+40%				
S13.013	S31-13	15 Winter	100	+40%				
S13.014	S31-14	15 Winter	100	+40%				
S13.015	S31-15	15 Winter	100	+40%				
S13.016	S31-16	15 Winter	100	+40%				
S13.017	S31-17	15 Winter	100	+40%				
S13.018	S31-18	15 Winter	100	+40%				
S13.019	S31-19	15 Winter	100	+40%				
S13.020	S31-20	15 Winter	100	+40%				
S13.021	S31-21	15 Winter	100	+40%				
S13.022	S31-22	15 Winter	100	+40%				
S13.023	S31-23	15 Winter	100	+40%				
S13.024	S31-24	15 Winter	100	+40%				
S13.025	S31-25	15 Winter	100	+40%				
S13.026	S31-26	15 Winter	100	+40%				
S13.027	S31-27	15 Winter	100	+40%				
S13.028	S31-28	15 Winter	100	+40%				
S13.029	S31-29	15 Winter	100	+40%				
S13.030	S32	15 Winter	100	+40%				
S12.035	S31	480 Winter	100	+40%				
S14.000	S31	15 Winter	100	+40%	100/15 Summer			
S14.001	S11	15 Winter	100	+40%	100/15 Summer			
S12.036	S10	480 Winter	100	+40%	100/15 Summer			
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11 Woodside Terrace Glasgow G3 7XQ				Omega Zone 8 St. Helens New Distribution HUB					
Date 12/12/2019 12:39 File Northern swale higher dischar...				Designed by NS Checked by MH					
Micro Drainage				Network 2018.1					
Summary of Critical Results by Maximum Level (Rank 1) for Storm									
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
S12.020	S28-20	23.327	-0.649	0.000	0.31		163.7	OK	
S12.021	S28-21	23.324	-0.653	0.000	0.33		171.1	OK	
S12.022	S28-22	23.321	-0.657	0.000	0.34		178.2	OK	
S12.023	S28-23	23.318	-0.662	0.000	0.35		185.0	OK	
S12.024	S28-24	23.315	-0.666	0.000	0.36		191.6	OK	
S12.025	S28-25	23.311	-0.672	0.000	0.38		197.9	OK	
S12.026	S28-26	23.306	-0.678	0.000	0.39		203.8	OK	
S12.027	S28-27	23.300	-0.685	0.000	0.40		209.3	OK	
S12.028	S28-28	23.294	-0.692	0.000	0.41		214.5	OK	
S12.029	S28-29	23.287	-0.700	0.000	0.42		219.3	OK	
S12.030	S28-30	23.279	-0.710	0.000	0.42		220.4	OK	
S12.031	S28-31	23.276	-0.713	0.000	0.42		222.4	OK	
S12.032	S28-32	23.274	-0.715	0.000	0.43		224.4	OK	
S12.033	S10	22.611	-0.133	0.000	0.06		45.6	OK	
S12.034	S10	22.600	0.000	0.000	0.02		107.9	FLOOD	1
S13.000	S31	23.679	-0.271	0.000	0.04		8.3	OK	
S13.001	S31-1	23.679	-0.271	0.000	0.06		13.5	OK	
S13.002	S31-2	23.678	-0.272	0.000	0.09		19.1	OK	
S13.003	S31-3	23.677	-0.273	0.000	0.11		24.7	OK	
S13.004	S31-4	23.675	-0.275	0.000	0.14		30.1	OK	
S13.005	S31-5	23.674	-0.276	0.000	0.16		36.1	OK	
S13.006	S31-6	23.672	-0.278	0.000	0.19		42.0	OK	
S13.007	S31-7	23.669	-0.281	0.000	0.22		47.7	OK	
S13.008	S31-8	23.666	-0.284	0.000	0.24		53.4	OK	
S13.009	S31-9	23.663	-0.287	0.000	0.27		58.9	OK	
S13.010	S31-10	23.660	-0.290	0.000	0.29		64.3	OK	
S13.011	S31-11	23.656	-0.294	0.000	0.31		69.5	OK	
S13.012	S31-12	23.651	-0.299	0.000	0.34		74.6	OK	
S13.013	S31-13	23.646	-0.304	0.000	0.36		79.5	OK	
S13.014	S31-14	23.641	-0.309	0.000	0.38		84.3	OK	
S13.015	S31-15	23.636	-0.314	0.000	0.40		89.0	OK	
S13.016	S31-16	23.630	-0.320	0.000	0.42		93.5	OK	
S13.017	S31-17	23.625	-0.325	0.000	0.45		98.5	OK	
S13.018	S31-18	23.619	-0.331	0.000	0.47		103.6	OK	
S13.019	S31-19	23.613	-0.337	0.000	0.49		108.3	OK	
S13.020	S31-20	23.606	-0.344	0.000	0.51		112.9	OK	
S13.021	S31-21	23.599	-0.351	0.000	0.53		117.3	OK	
S13.022	S31-22	23.592	-0.358	0.000	0.55		121.7	OK	
S13.023	S31-23	23.584	-0.366	0.000	0.57		126.1	OK	
S13.024	S31-24	23.576	-0.374	0.000	0.59		130.4	OK	
S13.025	S31-25	23.567	-0.383	0.000	0.61		134.8	OK	
S13.026	S31-26	23.559	-0.391	0.000	0.63		139.1	OK	
S13.027	S31-27	23.550	-0.400	0.000	0.37		140.3	OK	
S13.028	S31-28	23.546	-0.404	0.000	0.27		140.6	OK	
S13.029	S31-29	23.545	-0.405	0.000	0.33		141.6	OK	
S13.030	S32	22.930	-0.295	0.000	0.50		139.0	OK	
S12.035	S31	22.589	-0.011	0.000	0.00		14.6	OK	
S14.000	S31	23.880	0.080	0.000	1.06		160.2	SURCHARGED	
S14.001	S11	22.578	0.116	0.000	1.08		298.0	SURCHARGED	
S12.036	S10	22.560	0.734	0.000	0.05		16.7	SURCHARGED	
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11 Woodside Terrace Glasgow G3 7XQ					Omega Zone 8 St. Helens New Distribution HUB								
Date 12/12/2019 11:51					Designed by NS								
File CAR PARK WITH CELL STORAGE.MDX					Checked by MH								
Micro Drainage					Network 2018.1								
STORM SEWER DESIGN by the Modified Rational Method													
Design Criteria for Storm													
Pipe Sizes STANDARD Manhole Sizes STANDARD													
FSR Rainfall Model - England and Wales													
Return Period (years)				100				PIMP (%)				100	
M5-60 (mm)				19.200				Add Flow / Climate Change (%)				40	
Ratio R				0.403				Minimum Backdrop Height (m)				0.200	
Maximum Rainfall (mm/hr)				50				Maximum Backdrop Height (m)				1.500	
Maximum Time of Concentration (mins)				30				Min Design Depth for Optimisation (m)				1.200	
Foul Sewage (l/s/ha)				0.000				Min Vel for Auto Design only (m/s)				1.00	
Volumetric Runoff Coeff.				0.750				Min Slope for Optimisation (1:X)				500	
Designed with Level Soffits													
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)	HYD SECT	DIA (mm)	Section Type	Auto Design		
S4.000	2.634	0.000	0.0	0.115	4.00	0.0	0.600	o	525	Pipe/Conduit			
S4.001	11.504	0.017	676.7	0.047	0.00	0.0	0.600	o	675	Pipe/Conduit			
S4.002	64.086	0.092	700.0	0.511	0.00	0.0	0.600	o	750	Pipe/Conduit			
S5.000	41.103	0.624	65.9	0.328	4.00	0.0	0.600	o	300	Pipe/Conduit			
S6.000	43.927	0.322	136.4	0.104	4.00	0.0	0.600	o	300	Pipe/Conduit			
S6.001	67.786	0.302	224.5	0.329	0.00	0.0	0.600	o	450	Pipe/Conduit			
S5.001	37.249	0.447	83.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit			
S4.003	91.552	0.131	700.0	0.161	0.00	0.0	0.600	o	750	Pipe/Conduit			
S4.004	30.769	0.022	1400.0	0.207	0.00	0.0	0.600	o	750	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)			
S4.000	50.00	4.20	22.071	0.115	0.0	0.0	6.2	0.22	46.6	21.8			
S4.001	50.00	4.40	22.071	0.162	0.0	0.0	8.8	1.00	357.8	30.7			
S4.002	50.00	5.41	22.071	0.673	0.0	0.0	36.5	1.05	463.9	127.6			
S5.000	50.00	4.35	23.500	0.328	0.0	0.0	17.7	1.94	137.1	62.1			
S6.000	50.00	4.54	23.500	0.104	0.0	0.0	5.6	1.34	95.0	19.7			
S6.001	50.00	5.38	23.028	0.434	0.0	0.0	23.5	1.35	215.2	82.2			
S5.001	50.00	5.66	22.726	0.761	0.0	0.0	41.2	2.23	354.4	144.3			
S4.003	50.00	7.11	21.979	1.596	0.0	0.0	86.4	1.05	463.9	302.5			
S4.004	50.00	7.81	21.848	1.802	0.0	0.0	97.6	0.74	326.5«	341.7			
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11 Woodside Terrace Glasgow G3 7XQ	Omega Zone 8 St. Helens New Distribution HUB	
Date 12/12/2019 11:51 File CAR PARK WITH CELL STORAGE.MDX	Designed by NS Checked by MH	
Micro Drainage Network 2018.1		

Online Controls for Storm

Non Return Valve Manhole: S5, DS/PN: S4.001, Volume (m³): 2.2

Hydro-Brake® Optimum Manhole: S6, DS/PN: S4.005, Volume (m³): 19.6

Unit Reference	MD-SHE-0291-5830-2674-5830
Design Head (m)	2.674
Design Flow (l/s)	58.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	291
Invert Level (m)	21.819
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.674	58.2
Flush-Flo™	0.775	58.3
Kick-Flo®	1.678	46.5
Mean Flow over Head Range	-	50.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	9.0	1.200	56.3	3.000	61.6	7.000	92.9
0.200	30.0	1.400	53.9	3.500	66.3	7.500	96.1
0.300	50.1	1.600	49.3	4.000	70.8	8.000	99.1
0.400	54.1	1.800	48.1	4.500	74.9	8.500	102.1
0.500	56.3	2.000	50.6	5.000	78.9	9.000	105.0
0.600	57.6	2.200	53.0	5.500	82.6	9.500	107.8
0.800	58.3	2.400	55.3	6.000	86.2		
1.000	57.6	2.600	57.5	6.500	89.6		

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11 Woodside Terrace Glasgow G3 7XQ	Omega Zone 8 St. Helens New Distribution HUB	
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11 Woodside Terrace
Glasgow
G3 7XQ

Omega Zone 8
St. Helens
New Distribution HUB

Date 12/12/2019 11:51
File CAR PARK WITH CELL STORAGE.MDX

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Micro Drainage

Network 2018.1

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 Coefficient 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 2

Number of Online Controls 2

Number of Time/Area Diagrams 0

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR

Ratio R 0.404

Region England and Wales Cv (Summer) 0.750

M5-60 (mm) 19.200

Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 0.0

Analysis Timestep 2.5

Second Increment (Extended)

DTS Status ON

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080

Return Period(s) (years) 100

Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S4.000	S4	360 Winter	100	+40%					22.356
S4.001	S5	360 Winter	100	+40%					22.369
S4.002	S3	15 Winter	100	+40%	100/15 Summer				22.971
S5.000	S4	15 Winter	100	+40%	100/15 Summer				24.741
S6.000	S5	15 Winter	100	+40%	100/15 Summer				24.125
S6.001	S6	15 Winter	100	+40%	100/15 Summer				24.008
S5.001	S5	15 Winter	100	+40%	100/15 Summer				23.629
S4.003	S4	15 Winter	100	+40%	100/15 Summer				22.930
S4.004	S5	120 Winter	100	+40%	100/120 Winter				22.636
S4.005	S6	120 Winter	100	+40%	100/120 Winter				22.742

Surcharged Flooded

Pipe

US/MH

Depth

Volume

Flow / Overflow

Pipe

Level

PN

Name

(m)

(m³)

Cap.

(l/s)

(l/s)

Status

Exceeded

S4.000

S4

-0.240

0.000

0.12

20.3

OK

S4.001

S5

-0.377

0.000

0.11

19.5

OK

S4.002

S3

0.150

0.000

0.58

233.3

SURCHARGED

S5.000

S4

0.941

0.000

1.41

180.4

SURCHARGED

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

PN	Surcharged		Flooded		Pipe		Level Exceeded
	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	
S6.000	S5	0.325	0.000	0.67		59.5	SURCHARGED
S6.001	S6	0.529	0.000	1.15		229.2	SURCHARGED
S5.001	S5	0.453	0.000	1.25		390.4	SURCHARGED
S4.003	S4	0.201	0.000	1.51		634.8	SURCHARGED
S4.004	S5	0.038	0.000	0.42		99.9	SURCHARGED
S4.005	S6	0.173	0.000	0.16		58.1	SURCHARGED

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11 Woodside Terrace Glasgow G3 7XQ					Omega Zone 8 St. Helens New distribution HUB																																																																																																																																																																																														
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<u>STORM SEWER DESIGN by the Modified Rational Method</u> <u>Design Criteria for Storm</u> Pipe Sizes STANDARD Manhole Sizes STANDARD FSR Rainfall Model - England and Wales <table><tr><td>Return Period (years)</td><td>100</td><td>PIMP (%)</td><td>100</td></tr><tr><td>M5-60 (mm)</td><td>19.100</td><td>Add Flow / Climate Change (%)</td><td>40</td></tr><tr><td>Ratio R</td><td>0.403</td><td>Minimum Backdrop Height (m)</td><td>0.200</td></tr><tr><td>Maximum Rainfall (mm/hr)</td><td>50</td><td>Maximum Backdrop Height (m)</td><td>1.500</td></tr><tr><td>Maximum Time of Concentration (mins)</td><td>30</td><td>Min Design Depth for Optimisation (m)</td><td>1.200</td></tr><tr><td>Foul Sewage (l/s/ha)</td><td>0.000</td><td>Min Vel for Auto Design only (m/s)</td><td>1.00</td></tr><tr><td>Volumetric Runoff Coeff.</td><td>0.750</td><td>Min Slope for Optimisation (1:X)</td><td>500</td></tr></table> Designed with Level Soffits												Return Period (years)	100	PIMP (%)	100	M5-60 (mm)	19.100	Add Flow / Climate Change (%)	40	Ratio R	0.403	Minimum Backdrop Height (m)	0.200	Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500	Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200	Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00	Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500																																																																																																																																																												
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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S6.000	9.963	1.792	5.6	0.187	4.00	0.0	0.600	o	600	Pipe/Conduit	
S1.003	63.465	0.127	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S7.000	4.604	1.549	3.0	0.178	4.00	0.0	0.600	o	600	Pipe/Conduit	
S1.004	29.520	0.059	500.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S8.000	28.794	1.778	16.2	0.215	4.00	0.0	0.600	o	600	Pipe/Conduit	
S1.005	95.845	0.126	763.7	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S1.006	80.485	0.115	700.0	0.000	0.00	0.0	0.600	o	750	Pipe/Conduit	
S9.000	71.825	0.479	150.0	0.536	4.00	0.0	0.600	ooo	300	Triple Pipe	
S9.001	55.293	0.130	425.3	1.993	0.00	0.0	0.600	o	975	Pipe/Conduit	
S10.000	22.679	0.358	63.4	0.424	4.00	0.0	0.600	o	600	Pipe/Conduit	
S11.000	34.743	0.836	41.6	0.226	4.00	0.0	0.600	o	525	Pipe/Conduit	
S9.002	59.007	0.130	453.9	0.000	0.00	0.0	0.600	o	975	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)
S6.000	50.00	4.02	23.119	0.187	0.0	0.0	10.1	10.37	2932.3	35.5
S1.003	50.00	8.57	21.327	2.235	0.0	0.0	121.0	1.24	549.9	423.6
S7.000	50.00	4.01	23.102	0.178	0.0	0.0	9.6	14.19	4011.7	33.7
S1.004	50.00	8.97	21.200	2.412	0.0	0.0	130.7	1.24	549.9	457.3
S8.000	50.00	4.08	22.919	0.215	0.0	0.0	11.6	6.07	1716.6	40.8
S1.005	50.00	10.56	21.141	2.627	0.0	0.0	142.3	1.00	443.9	498.0
S1.006	50.00	11.84	21.015	2.627	0.0	0.0	142.3	1.05	463.9	498.0
S9.000	50.00	4.93	22.493	0.536	0.0	0.0	29.0	1.28	271.7	101.6
S9.001	50.00	5.51	22.014	2.529	0.0	0.0	137.0	1.59	1187.0	479.5
S10.000	50.00	4.12	22.600	0.424	0.0	0.0	22.9	3.06	865.7	80.3
S11.000	50.00	4.17	23.413	0.226	0.0	0.0	12.2	3.48	753.7	42.8
S9.002	50.00	6.15	21.884	3.179	0.0	0.0	172.2	1.54	1148.8	602.6

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11 Woodside Terrace Glasgow G3 7XQ					Omega Zone 8 St. Helens New distribution HUB						
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Micro Drainage					Network 2018.1						
Network Design Table for Storm											
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S12.000	22.770	0.354	64.3	0.387	4.00	0.0	0.600	o	600	Pipe/Conduit	
S13.000	34.395	0.968	35.5	0.258	4.00	0.0	0.600	o	525	Pipe/Conduit	
S9.003	57.256	0.130	440.4	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit	
S9.004	91.939	0.130	707.2	0.928	0.00	0.0	0.600	o	1050	Pipe/Conduit	
S14.000	48.181	0.345	139.7	0.314	4.00	0.0	0.600	o	525	Pipe/Conduit	
S15.000	20.599	0.128	161.0	0.199	4.00	0.0	0.600	o	525	Pipe/Conduit	
S9.005	89.688	0.176	511.0	0.344	0.00	0.0	0.600	o	1050	Pipe/Conduit	
S16.000	50.648	0.204	248.2	0.394	4.00	0.0	0.600	o	525	Pipe/Conduit	
S17.000	24.226	0.027	912.3	0.246	4.00	0.0	0.600	o	525	Pipe/Conduit	
S9.006	118.986	0.176	678.0	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit	
S18.000	49.165	0.062	797.7	0.392	4.00	0.0	0.600	o	525	Pipe/Conduit	
S19.000	70.753	0.207	342.1	0.124	4.00	0.0	0.600	o	525	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)	
S12.000	50.00	4.12	22.500	0.387	0.0	0.0	21.0	3.04	859.5	73.4	
S13.000	50.00	4.15	23.411	0.258	0.0	0.0	14.0	3.77	815.4	48.9	
S9.003	50.00	6.74	21.750	3.824	0.0	0.0	207.1	1.64	1416.2	724.9	
S9.004	50.00	7.93	21.620	4.752	0.0	0.0	257.4	1.29	1115.4	900.8	
S14.000	50.00	4.42	21.839	0.314	0.0	0.0	17.0	1.89	409.8	59.5	
S15.000	50.00	4.19	21.622	0.199	0.0	0.0	10.8	1.76	381.5	37.7	
S9.005	50.00	8.91	21.494	5.609	0.0	0.0	303.8	1.52	1314.0	1063.4	
S16.000	50.00	4.60	21.523	0.394	0.0	0.0	21.3	1.42	306.8	74.7	
S17.000	50.00	4.55	21.346	0.246	0.0	0.0	13.3	0.73	158.8	46.6	
S9.006	50.00	10.42	21.319	6.249	0.0	0.0	338.5	1.32	1139.4	1184.7	
S18.000	50.00	5.04	21.205	0.392	0.0	0.0	21.2	0.79	170.0	74.3	
S19.000	50.00	4.98	21.350	0.124	0.0	0.0	6.7	1.21	260.9	23.5	
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Micro Drainage						Network 2018.1					
Network Design Table for Storm											
PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S9.007	64.921	0.118	550.1	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit	
S9.008	60.999	0.125	486.9	0.000	0.00	0.0	0.600	o	1050	Pipe/Conduit	
S20.000	118.346	1.096	107.9	1.066	4.00	0.0	0.600	CA	600	CastSlot	
S21.000	74.818	0.346	216.0	0.508	4.00	0.0	0.600	CA	500	CastSlot	
S20.001	86.077	0.100	860.8	3.440	0.00	0.0	0.600	o	975	Pipe/Conduit	
S22.000	8.428	0.001	8428.3	0.000	4.00	0.0	0.600	oo	750	Double Pipe	
S1.007	49.648	0.331	150.0	1.500	0.00	0.0	0.600	o	450	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)	
S9.007	50.00	11.16	21.143	6.765	0.0	0.0	366.4	1.46	1266.0	1282.5	
S9.008	50.00	11.81	21.025	6.765	0.0	0.0	366.4	1.56	1346.5	1282.5	
S20.000	50.00	4.82	22.996	1.066	0.0	0.0	57.7	2.40	1008.3	202.0	
S21.000	50.00	4.89	22.246	0.508	0.0	0.0	27.5	1.40	331.2	96.3	
S20.001	50.00	6.18	21.000	5.014	0.0	0.0	271.6	1.11	831.7	950.5	
S22.000	50.00	4.48	22.310	0.000	0.0	0.0	0.0	0.29	260.5	0.0	
S1.007	50.00	12.34	20.900	15.906	0.0	0.0	861.6	1.66	263.6	3015.4	
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 Coefficient				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				17		
Number of Online Controls				5	Number of Time/Area Diagrams				0		
Number of Offline Controls				0	Number of Real Time Controls				0		
Synthetic Rainfall Details											
Rainfall Model				FSR	Profile Type				Summer		
Return Period (years)				100	Cv (Summer)				0.750		
Region				England and Wales	Cv (Winter)				0.840		
M5-60 (mm)				19.100	Storm Duration (mins)				30		
Ratio R				0.403							
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<u>Online Controls for Storm</u> <u>Non Return Valve Manhole: S3, DS/PN: S1.006, Volume (m³): 51.7</u> <u>Non Return Valve Manhole: S4, DS/PN: S9.001, Volume (m³): 21.2</u> <u>Non Return Valve Manhole: S7, DS/PN: S9.008, Volume (m³): 63.3</u> <u>Non Return Valve Manhole: S22, DS/PN: S20.001, Volume (m³): 74.5</u> <u>Pump Manhole: S5, DS/PN: S1.007, Volume (m³): 167.6</u> Invert Level (m) 20.900 <table><tr><th colspan="2">Depth (m) Flow (l/s)</th><th colspan="2">Depth (m) Flow (l/s)</th></tr><tr><td>0.001</td><td>40.0000</td><td>2.650</td><td>40.0000</td></tr></table>			Depth (m) Flow (l/s)		Depth (m) Flow (l/s)		0.001	40.0000	2.650	40.0000
Depth (m) Flow (l/s)		Depth (m) Flow (l/s)								
0.001	40.0000	2.650	40.0000							
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Micro Drainage	Network 2018.1	

Storage Structures for Storm

Cellular Storage Manhole: S3, DS/PN: S2.000

Invert Level (m) 22.919 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	37.0	37.0	1.032	0.0	64.4
1.031	37.0	64.4			

Cellular Storage Manhole: S6, DS/PN: S3.000

Invert Level (m) 23.119 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	37.0	37.0	1.032	0.0	64.4
1.031	37.0	64.4			

Cellular Storage Manhole: S7, DS/PN: S4.000

Invert Level (m) 22.910 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	15.0	15.0	1.041	0.0	38.0
1.040	15.0	38.0			

Cellular Storage Manhole: S11, DS/PN: S5.000

Invert Level (m) 23.119 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	15.0	15.0	1.032	0.0	38.0
1.031	15.0	38.0			

Cellular Storage Manhole: S16, DS/PN: S6.000

Invert Level (m) 23.119 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	24.0	24.0	1.032	0.0	48.8
1.031	24.0	48.8			

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Micro Drainage	Network 2018.1																																																																																											
<u>Cellular Storage Manhole: S201, DS/PN: S8.000</u> Invert Level (m) 22.919 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>27.0</td><td>27.0</td><td>1.032</td><td>0.0</td><td>52.4</td></tr><tr><td>1.031</td><td>27.0</td><td>52.4</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S5, DS/PN: S9.000</u> Invert Level (m) 22.493 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>39.0</td><td>39.0</td><td>1.378</td><td>0.0</td><td>66.8</td></tr><tr><td>1.377</td><td>39.0</td><td>66.8</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S95, DS/PN: S10.000</u> Invert Level (m) 22.600 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>20.0</td><td>20.0</td><td>0.701</td><td>0.0</td><td>44.0</td></tr><tr><td>0.700</td><td>20.0</td><td>44.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S79, DS/PN: S11.000</u> Invert Level (m) 23.413 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>16.0</td><td>16.0</td><td>0.538</td><td>0.0</td><td>39.2</td></tr><tr><td>0.537</td><td>16.0</td><td>39.2</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S9, DS/PN: S12.000</u> Invert Level (m) 22.500 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>18.0</td><td>18.0</td><td>0.769</td><td>0.0</td><td>41.6</td></tr><tr><td>0.768</td><td>18.0</td><td>41.6</td><td></td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	27.0	27.0	1.032	0.0	52.4	1.031	27.0	52.4				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	39.0	39.0	1.378	0.0	66.8	1.377	39.0	66.8				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	20.0	20.0	0.701	0.0	44.0	0.700	20.0	44.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	16.0	16.0	0.538	0.0	39.2	0.537	16.0	39.2				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	18.0	18.0	0.769	0.0	41.6	0.768	18.0	41.6			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																																							
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0.000	39.0	39.0	1.378	0.0	66.8																																																																																							
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0.000	20.0	20.0	0.701	0.0	44.0																																																																																							
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Micro Drainage	Network 2018.1																																																																																											
<u>Cellular Storage Manhole: S106, DS/PN: S13.000</u> Invert Level (m) 23.411 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>18.0</td><td>18.0</td><td>0.540</td><td>0.0</td><td>41.6</td></tr><tr><td>0.539</td><td>18.0</td><td>41.6</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S143, DS/PN: S14.000</u> Invert Level (m) 21.839 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>25.0</td><td>25.0</td><td>2.112</td><td>25.0</td><td>50.0</td></tr><tr><td>2.111</td><td>25.0</td><td>50.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S145, DS/PN: S15.000</u> Invert Level (m) 21.622 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>25.0</td><td>25.0</td><td>2.329</td><td>0.0</td><td>50.0</td></tr><tr><td>2.328</td><td>25.0</td><td>50.0</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S149, DS/PN: S18.000</u> Invert Level (m) 21.205 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>56.0</td><td>56.0</td><td>2.746</td><td>0.0</td><td>87.2</td></tr><tr><td>2.745</td><td>56.0</td><td>87.2</td><td></td><td></td><td></td></tr></table> <u>Cellular Storage Manhole: S156, DS/PN: S19.000</u> Invert Level (m) 21.350 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr><tr><td>0.000</td><td>54.0</td><td>54.0</td><td>2.601</td><td>0.0</td><td>84.8</td></tr><tr><td>2.600</td><td>54.0</td><td>84.8</td><td></td><td></td><td></td></tr></table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	18.0	18.0	0.540	0.0	41.6	0.539	18.0	41.6				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	25.0	25.0	2.112	25.0	50.0	2.111	25.0	50.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	25.0	25.0	2.329	0.0	50.0	2.328	25.0	50.0				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	56.0	56.0	2.746	0.0	87.2	2.745	56.0	87.2				Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	54.0	54.0	2.601	0.0	84.8	2.600	54.0	84.8			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																																							
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