REDEVELOPMENT OF THE ROYAL OAK, BRECK ROAD, POULTON-LE-FYLDE.

DRAINAGE STRATEGY REPORT

HAMILTON TECHNICAL SERVICES
1 CHILTERN AVE, EUXTON, CHORLEY, LANCS, PR7 6NU

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C-0912

Document Control Sheet

Redevelopment of the Royal Oak, Breck Road, Poulton-le-Fylde, Lancs.
Drainage Strategy Report

Job	Date	Issue	Copy
C0912	18th Dec 2019	1	

Originator……..G Hamilton… …….

Checker……G Hamilton…… ..……..

Approver……G Hamilton…… …..……..

Contents

1. Introduction

1.1. Hamilton Technical Services have been commissioned by Carter Zub Architecture, to prepare a Drainage Strategy Report, in support of a planning application for new residential properties at the former Royal Oak Public House, Breck Road, to replace former buildings with apartments with associated parking, access and landscaping.

1.2. The site comprises an area of land on the southeast side of Breck Road at its junction with Station Road. The location of the site is illustrated in **Figure 1** appended to this report.

1.3. The national grid reference for the site is 335079E, 439833N.

1.4. It is understood that permission is being sought to build a block of apartments along with associated parking, access and landscaping. A development sketch plan is attached to this report as **Figure 2.**

2. Description of the existing site.

2.1. The site is bounded to the northwest by Breck Road and local government offices. To the northeast the site is bounded by Station Road and residential properties. To the south the site is bounded by residential properties.

2.2. Consultation of Environment Agency Flood maps, through their website, shows that the site lies in Flood Zone 1 and well outside Flood Zones 2 + 3. This places the site at no significant risk of flooding from rivers or the sea.

2.3. Further consultation of the Environment Agency maps showing the risks of flooding from Surface Water or reservoir failure, shows that the site is not at risk of flooding from these sources.

2.4. The site is presently occupied by a main building, front parking area and rear landscaped garden and patio areas. The site is presently served by a network of combined drains carrying both foul effluent and rainwater to the public combined sewer in Breck Road.

2.5. Consideration has been given to the suitability of the ground for the employment of soak-aways to disperse surface water run-off from the development. However the site is restricted by adjacent buildings and retaining walls and there is insufficient space to locate soak-aways a minimum of 5 meters from nearby structures. Consultation of the British Geological Society maps shows the site to be on “Till, Devensian-Diamicton”, overlying Mudstone. Consultation of the Cranfield Institute Soilscapes maps shows the area to have a topsoil layer that is “slowly permeable, seasonally wet, loamy clayey soils with impeded drainage”.

2.6. For these reasons the use of soak-aways has been excluded. There are no watercourses or surface water drains within or adjacent to the site, to which surface water could be discharged. There is a public combined water sewer located in Station Road to the northeast of the site to which it is proposed foul and surface water run-off will be discharged.

2.7. The site was occupied by the former Royal Oak hostelry for many decades and the buildings and car park were serviced by a system of combined drains, carrying both foul and surface water run-off to the public combined sewer in Station Road. A plan showing the main collector drains is attached as **Figure 3** of this report.

2.8. A series of calculations have been completed to ascertain the existing rates of surface water discharge from the site. A sample of these calculations is contained in **Appendix 1** of this report. A plan showing the surface water catchment areas used in these simulations is attached as **Figure 4** of this report. These calculations show the rate of discharge during a 1 in 2 Yr storm to be 18.7 l/s, rising to 32.9 l/s during a 1 in 30 Yr event and to 39.4 l/s during a 1 in 100 Yr event.

3. Proposals for Redevelopment

3.1. The redevelopment of the site will consist of the initial demolition of the existing buildings and hard standings on site. The construction of the new apartments, a revised access leading from Station Road close to the eastern edge of the site, along with provision of parking to the rear of the buildings and landscaped areas along the site frontages.

3.2. The site is not, as discussed in 2.5, 2.6 and 2.7 above, suitable for the use of soak-aways and with no watercourses or surface water drainage systems on or adjacent to the site, the surface water run-off from the site will have to be discharged to the public combined sewer network as presently occurs.

3.3. In line with best SUDS practice the rate of off-site discharges will be limited to as close to brownfield run-off rates as possible. The simulation calculations shown in **Appendix 1** indicate the site area indicates that the existing site will have a rate of run-off of at least 18.7 l/s and based on this figure it has been decided to limit future discharge rates to a maximum of 10.0 l/s in all storm scenarios, by means of a controlling Hydro-brake unit, placed in the last surface water chamber on the site.

3.4. A new separate drainage system will be installed for both foul and surface water run-off from the new dwellings. Foul drainage will be discharge to the public combined sewer located in Station Road. Surface water flows will be controlled and attenuated before being combined with the foul discharge and discharged to the public combined water sewer.

3.5. A plan showing the proposed drainage systems is attached as **Figure 5** of this report. A series of run-off simulation calculations have been completed for the surface water drainage system and a selection of these calculations are appended to this report as **Appendix 2**. A plan showing the contributing catchment areas is attached as **Figure 6** of this report.

3.6. The calculations show that the flows generated by storms of up to a 1 in 100 Yr event, of 600 minutes duration and inclusive of a climate changes allowance of 35% will be contained within the chambers, attenuation tank and pipework of the proposed drainage system. There will be no surface flooding from the new drainage during these events and therefore no on site or off site flooding will be caused by the new development.

3.7. The designed surface water drainage system will discharge a maximum flow of 7.7 l/s during a 1 in 2 Yr event, 9.8 l/s during a 1 in 30 Yr event and 9.8 l/s during a 1 in 100 Yr event. These figures represent a reduction in discharge rates of 59%, 70% and 75% respectively.

4. Maintenance

4.1 The drainage serving the new development will remain in private ownership of the site and all future owners or occupants. On completion of the development a suitably qualified maintenance company will be contracted to carry out all site inspections and maintenance of the drainage systems.

The foul and surface drains and chambers will be inspected at six month intervals and all deleterious materials will be removed and any repairs or maintenance required will be carried out by a suitably qualified contractor.

The maintenance inspections and repairs or cleaning of the drainage systems will be funded through an annual maintenance fee levied on each apartment and collected by the owners of the properties.

5. Conclusions

Based on the above principals and proposals it will be possible to design and construct suitable systems of foul and surface water drainage that are sustainable and that will prevent any increased risk of flooding on or out with the development site.

Figures;

Figure 1 – Site Location Plan
Figure 2 – Site Development Plan
Figure 3 – Existing Drainage Plan
Figure 4 _ Existing SW Catchment Plan
Figure 5 – Proposed Site Drainage Plan
Figure 6 – Proposed SW Catchments Plan

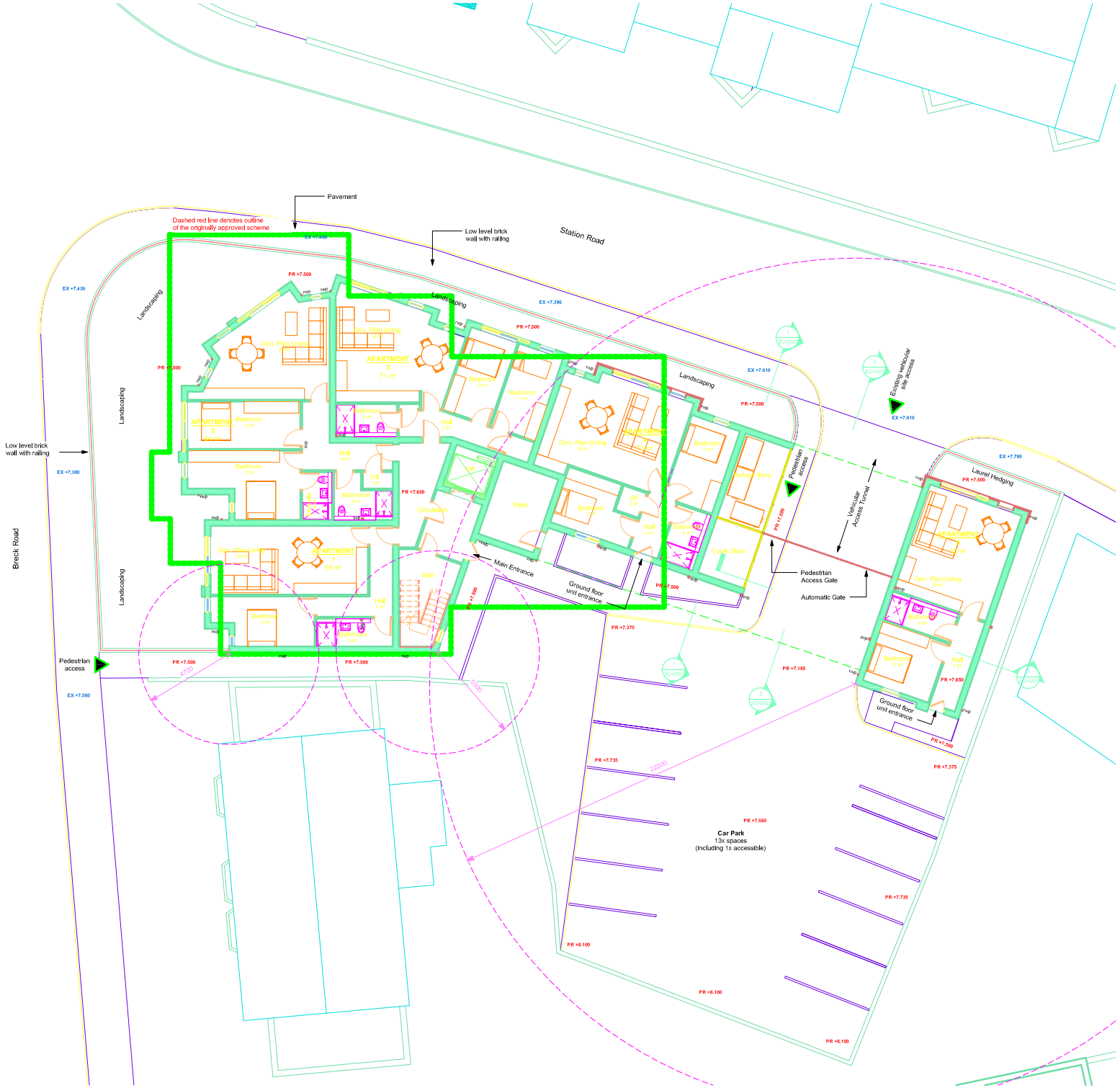
Appendix 1 – Existing SW Run-off Simulation Calculations
Appendix 2 _ Proposed SW Run-off Simulation Calculations

project Royal Oak	drawing title Site Location Plan
location The Royal Oak, Breck Road, Poulton	dwg purpose PLANNING
client Royal Oak	

CARTER-ZUB
BUILDING CONSULTANCY

1 Site Location Plan

1 : 1250



NOTES

DO NOT SCALE. IT IS ESSENTIAL THAT THIS DRAWING IS READ IN CONJUNCTION WITH THE SPECIFICATION & THAT ALL WORKS ARE INCLUDED FOR. THE CONTRACTOR MUST VISIT SITE, SO AS TO SATISFY HIMSELF TO LOCAL CONDITIONS, ACCESS ETC., & TO INCLUDE FOR THESE IN HIS COST FOR THESE WORKS. THE CONTRACTOR IS RESPONSIBLE FOR THE VERIFICATION OF ALL DIMENSIONS , LEVELS ETC., ON SITE.

Apartment Schedule

Name	Number	Area	Comments
APARTMENT	1	59 m²	1x bed, 2x person
APARTMENT	2	84 m²	2x bed, 4x person
APARTMENT	3	71 m²	2x bed, 3x person
APARTMENT	4	72 m²	2x bed, 3x person
APARTMENT	5	55 m²	1x bed, 2x person
APARTMENT	6	60 m²	2x bed, 3x person
APARTMENT	7	83 m²	2x bed, 4x person
APARTMENT	8	71 m²	2x bed, 3x person
DUPLEX	9	84 m²	2x bed, 4x person
DUPLEX	10	83 m²	2x bed, 4x person
DUPLEX	11	81 m²	2x bed, 4x person
DUPLEX	12	81 m²	2x bed, 4x person
DUPLEX	13	86 m²	2x bed, 4x person
APARTMENT	14	60 m²	1x bed, 2x person
APARTMENT	15	83 m²	2x bed, 4x person
APARTMENT	16	71 m²	2x bed, 3x person

Gross Internal Area

Area
1359 m²

rev	date	(init)	description
P1	20/12/19		Issued for Planning

project: Royal Oak

location: The Royal Oak, Breck Road, Poulton

client: Royal Oak

drawing title: Ground Floor and Site Plan

drwg purpose: CONSTRUCTION

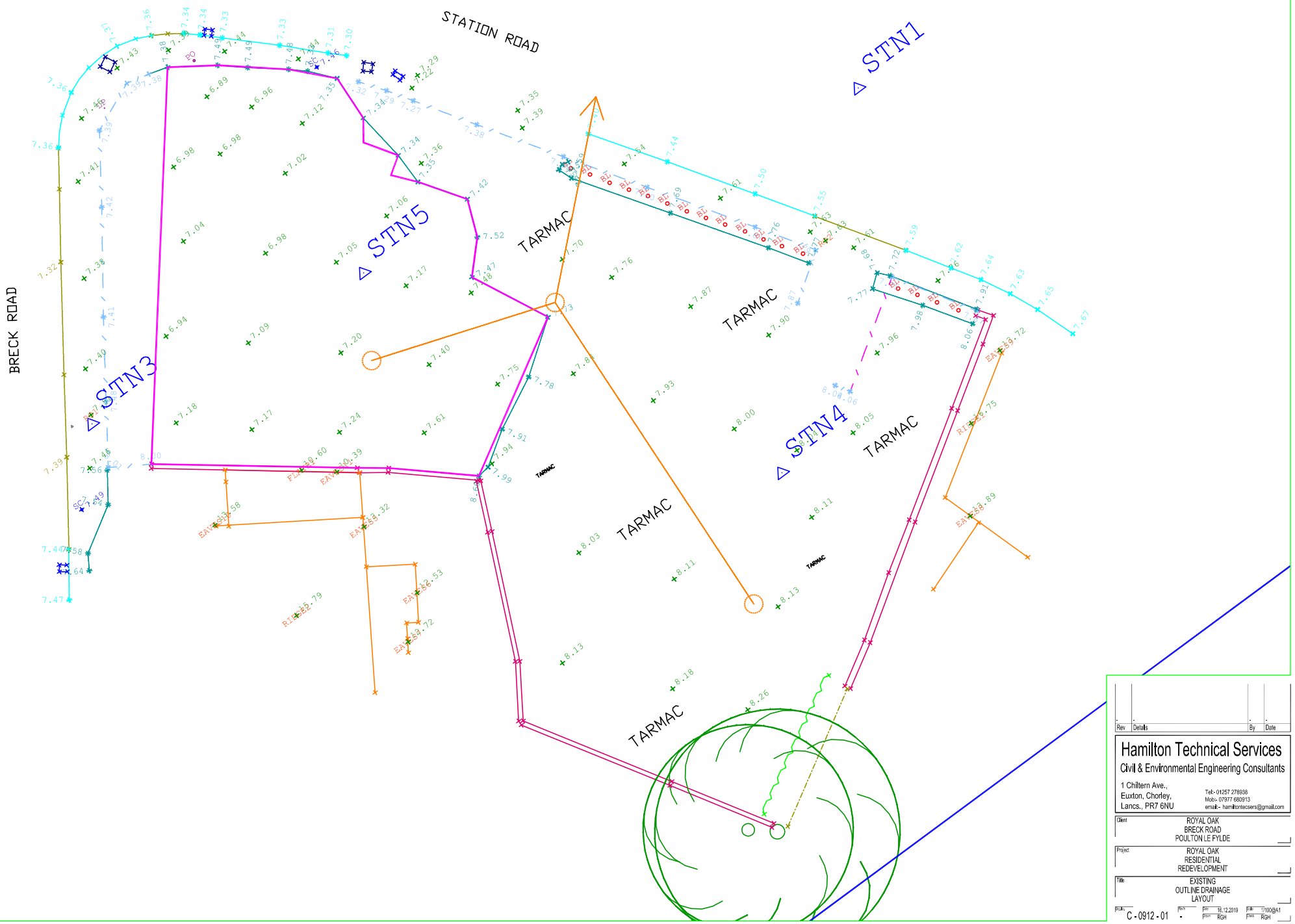
scale: 1 : 100 @ sheet size A1

rev date: 20/12/19

Project Number / job number: GA-0001

drawing number: P1

revision



Rev	Details	By	Date
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Hamilton Technical Services
Civil & Environmental Engineering Consultants

1 Chiltern Ave.,
Euxton, Chorley,
Lancs., PR7 6NU
Tel:- 01257 278938
Mob:- 07977 680913
email:- hamiltontecsers@gmail.com

Client: ROYAL OAK
BRECK ROAD
POULTON LE FYLDE

Project: ROYAL OAK
RESIDENTIAL
REDEVELOPMENT

Title: EXISTING
OUTLINE DRAINAGE
LAYOUT

Proj. No. C - 0912 - 01
Rev. -
Date 16.12.2019
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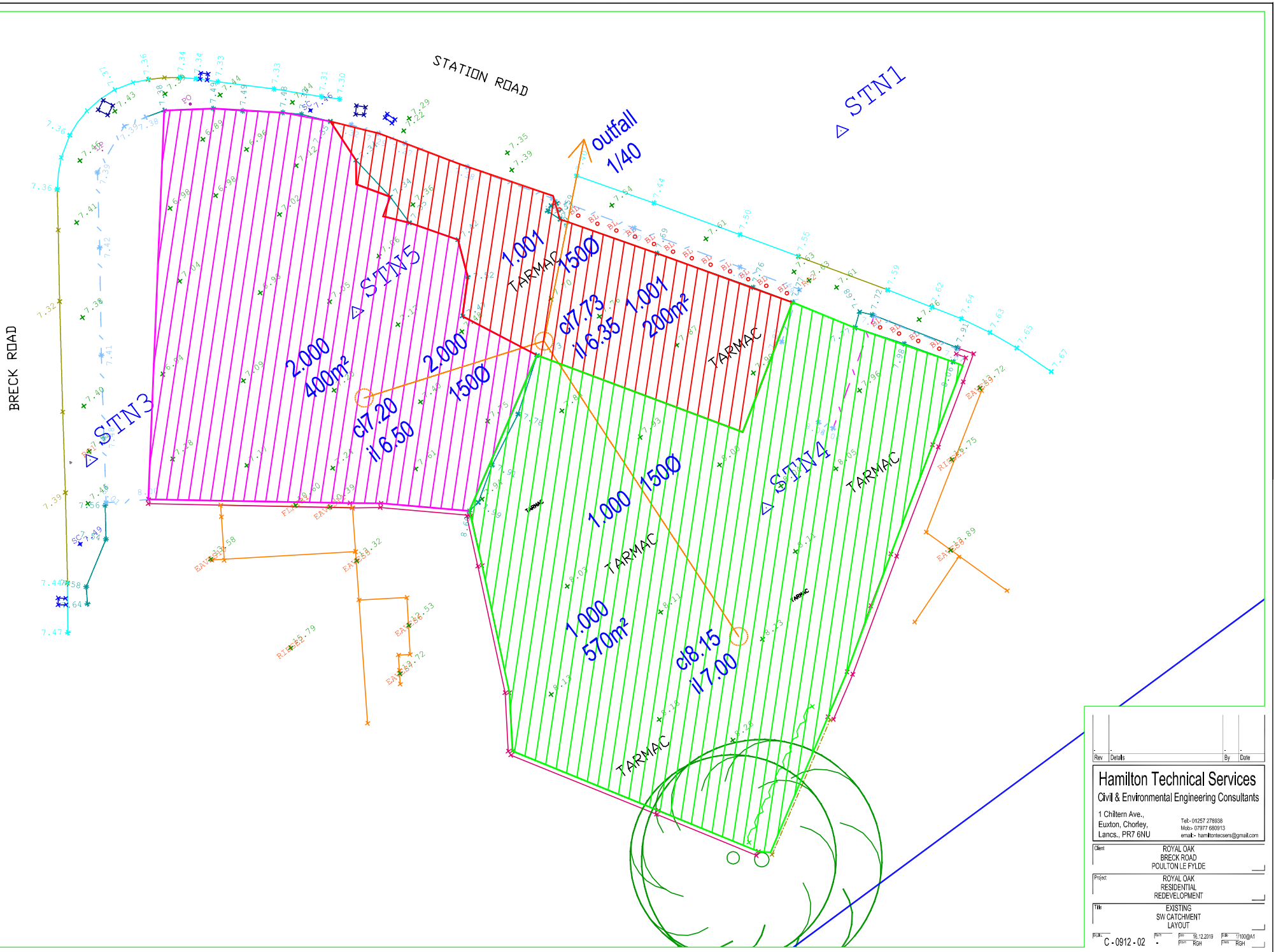

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Civil & Environmental Engineering Consultants
1 Chiltern Ave.,
Euxton, Chorley,
Lancs., PR7 6NU
Tel:- 01257 278938
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email:- hamiltontecsers@gmail.com

Rev | Details | By | Date

Client: ROYAL OAK
BRECK ROAD
POULTON LE FYLDE

Project: ROYAL OAK
RESIDENTIAL
REDEVELOPMENT

Title: EXISTING
SW CATCHMENT
LAYOUT

Proj. No. C - 0912 - 02
Rev -
Date 16.12.2019
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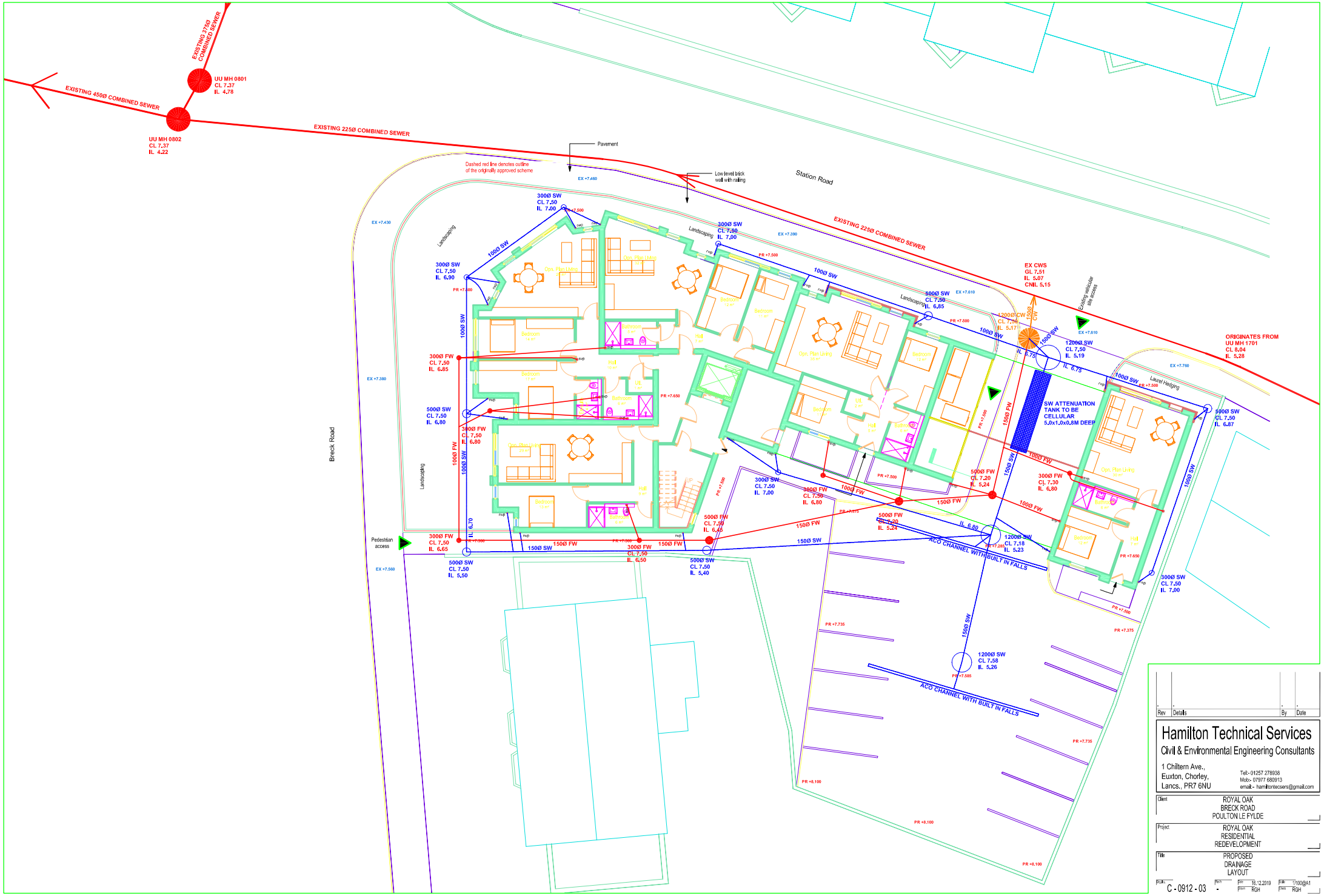
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EXISTING 450Ø COMBINED SEWER
UU MH 0801
CL 7.37
IL 4.78
UU MH 0802
CL 7.37
IL 4.22
EXISTING 225Ø COMBINED SEWER
Pavement
Dashed red line denotes outline of the originally approved scheme
Low level brick wall with railing
Station Road
Breck Road
Landscaping
Pedestrian access
EX CWS
GL 7.51
IL 5.07
CNIL 5.15
ORIGINATES FROM
UU MH 1701
CL 8.04
IL 5.28
SW ATTENUATION TANK TO BE CELLULAR 5.0x1.0x0.8M DEEP
ACO CHANNEL WITH BUILT IN FALLS
Hamilton Technical Services
Civil & Environmental Engineering Consultants
1 Chiltern Ave.,
Euxton, Chorley,
Lancs., PR7 6NU
Tel:- 01257 278938
Mob:- 07977 680913
email:- hamiltontecsers@gmail.com
ROYAL OAK
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DRAINAGE
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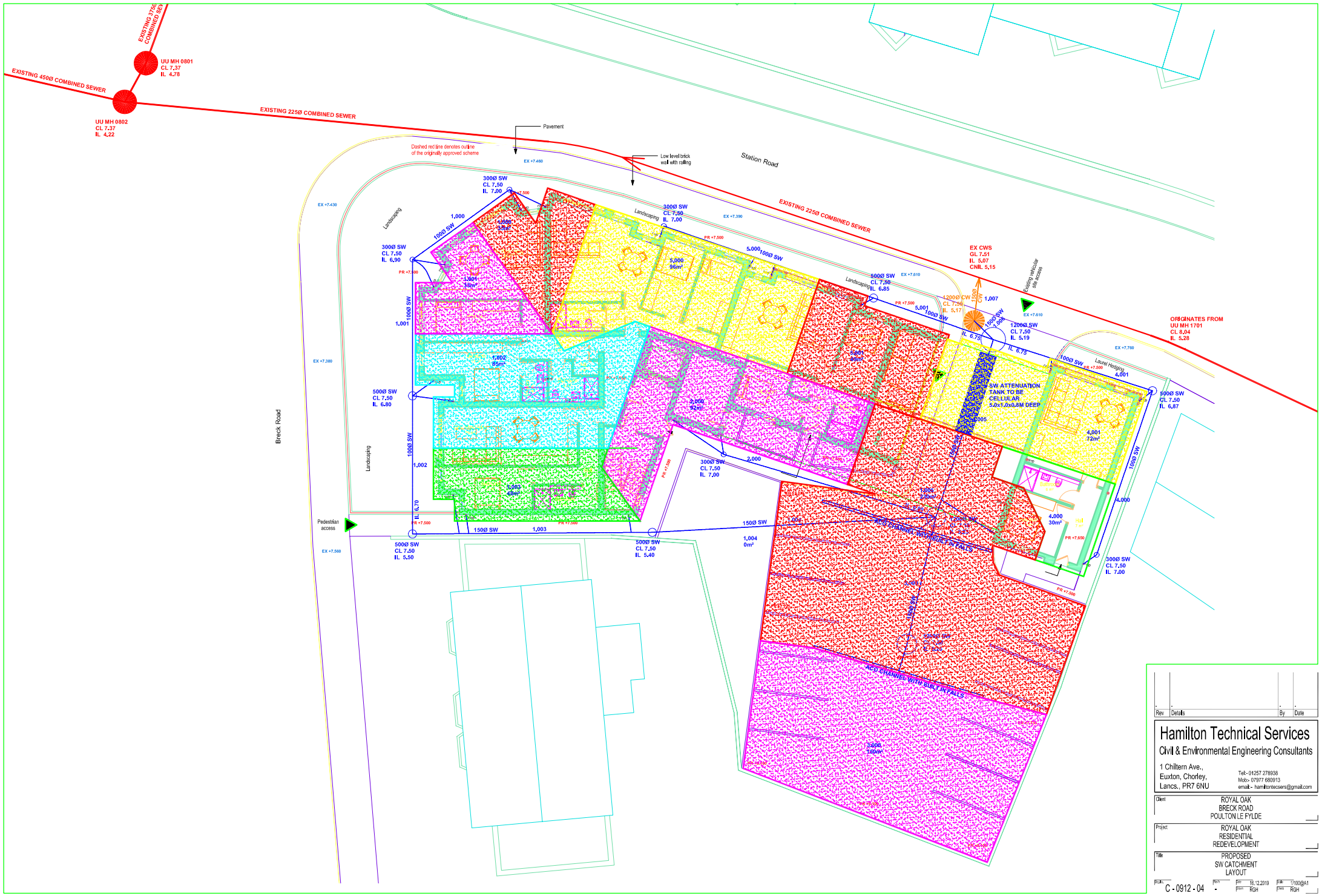
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ACO CHANNEL WITH BUILT IN FALLS
Landscaping
Laurel Hedging
Pedestrian access
Existing vehicular site access
Hamilton Technical Services
Civil & Environmental Engineering Consultants
1 Chiltern Ave.,
Euxton, Chorley,
Lancs., PR7 6NU
Tel:- 01257 278938
Mob:- 07977 680913
email:- hamiltontecsers@gmail.com
Client
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POULTON LE FYLDE
Project
ROYAL OAK
RESIDENTIAL
REDEVELOPMENT
Title
PROPOSED
SW CATCHMENT
LAYOUT
Rev
Details
By
Date
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Rev -
16.12.2019
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Land at Royal Oak, Breck Road, Poulton le Fylde.

Appendix 1

Existing Site SW Run-off Simulation Calculations

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.109	4-8	0.008

Total Area Contributing (ha) = 0.117

Total Pipe Volume (m³) = 0.770

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	20.600	0.650	31.7	0.057	4.00	0.0	0.600	o	150
2.000	11.000	0.150	73.3	0.040	4.00	0.0	0.600	o	150
1.001	12.000	0.300	40.0	0.020	0.00	0.0	0.600	o	150

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)
1.000	0.00	4.19	7.000	0.057	0.0	0.0	0.0	1.79	31.7	0.0
2.000	0.00	4.16	6.500	0.040	0.0	0.0	0.0	1.18	20.8	0.0
1.001	0.00	4.32	6.350	0.117	0.0	0.0	0.0	1.60	28.2	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.001	SEWER	7.400	6.050	6.050	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	15
Ratio R	0.350		

Summary of Results for 15 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.058	-0.092	0.000	0.32	0.0	9.4	OK
2.000	2	6.562	-0.088	0.000	0.35	0.0	6.6	OK
1.001	3	6.446	-0.054	0.000	0.73	0.0	18.7	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.109	4-8	0.008

Total Area Contributing (ha) = 0.117

Total Pipe Volume (m³) = 0.770

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	20.600	0.650	31.7	0.057	4.00	0.0	0.600	o	150
2.000	11.000	0.150	73.3	0.040	4.00	0.0	0.600	o	150
1.001	12.000	0.300	40.0	0.020	0.00	0.0	0.600	o	150

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)
1.000	0.00	4.19	7.000	0.057	0.0	0.0	0.0	1.79	31.7	0.0
2.000	0.00	4.16	6.500	0.040	0.0	0.0	0.0	1.18	20.8	0.0
1.001	0.00	4.32	6.350	0.117	0.0	0.0	0.0	1.60	28.2	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.001	SEWER	7.400	6.050	6.050	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	15
Ratio R	0.350		

Summary of Results for 15 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.084	-0.066	0.000	0.60	0.0	17.8	OK
2.000	2	6.744	0.094	0.000	0.62	0.0	11.6	SURCHARGED
1.001	3	6.697	0.197	0.000	1.29	0.0	32.9	SURCHARGED

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.109	4-8	0.008

Total Area Contributing (ha) = 0.117

Total Pipe Volume (m³) = 0.770

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	20.600	0.650	31.7	0.057	4.00	0.0	0.600	o	150
2.000	11.000	0.150	73.3	0.040	4.00	0.0	0.600	o	150
1.001	12.000	0.300	40.0	0.020	0.00	0.0	0.600	o	150

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)
1.000	0.00	4.19	7.000	0.057	0.0	0.0	0.0	1.79	31.7	0.0
2.000	0.00	4.16	6.500	0.040	0.0	0.0	0.0	1.18	20.8	0.0
1.001	0.00	4.32	6.350	0.117	0.0	0.0	0.0	1.60	28.2	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.001	SEWER	7.400	6.050	6.050	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	15
Ratio R	0.350		

Summary of Results for 15 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.202	0.052	0.000	0.72	0.0	21.4	SURCHARGED
2.000	2	6.995	0.345	0.000	0.75	0.0	13.9	SURCHARGED
1.001	3	6.917	0.417	0.000	1.54	0.0	39.4	SURCHARGED

Land at Royal Oak, Breck Road, Poulton le Fylde.

Appendix 2

Proposed SW Run-off Simulation Calculations

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m^3) = 1.614

STORM SEWER DESIGN by the Modified Rational Method

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)
1.000	7.330	0.100	73.3	0.003	4.00	0.0	0.600	o	100
1.001	8.350	0.100	83.5	0.003	0.00	0.0	0.600	o	100
1.002	8.460	0.100	84.6	0.009	0.00	0.0	0.600	o	100
1.003	14.690	0.100	146.9	0.005	0.00	0.0	0.600	o	150
1.004	17.400	0.170	102.4	0.000	0.00	0.0	0.600	o	150
2.000	13.560	0.200	67.8	0.009	4.00	0.0	0.600	o	100
3.000	7.990	0.030	266.3	0.015	4.00	0.0	0.600	o	150
1.005	11.410	0.040	285.3	0.023	0.00	0.0	0.600	o	150
4.000	10.620	0.130	81.7	0.003	4.00	0.0	0.600	o	100
4.001	10.240	0.120	85.3	0.007	0.00	0.0	0.600	o	100
5.000	13.580	0.150	90.5	0.010	4.00	0.0	0.600	o	100
5.001	7.770	0.100	77.7	0.005	0.00	0.0	0.600	o	100
1.006	1.640	0.020	82.0	0.000	0.00	0.0	0.600	o	150
1.007	2.660	0.020	133.0	0.000	0.00	0.0	0.600	o	150

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)
1.000	0.00	4.14	7.000	0.003	0.0	0.0	0.0	0.90	7.1	0.0
1.001	0.00	4.30	6.900	0.006	0.0	0.0	0.0	0.84	6.6	0.0
1.002	0.00	4.47	6.800	0.015	0.0	0.0	0.0	0.84	6.6	0.0
1.003	0.00	4.77	5.500	0.020	0.0	0.0	0.0	0.83	14.6	0.0
1.004	0.00	5.06	5.400	0.020	0.0	0.0	0.0	0.99	17.5	0.0
2.000	0.00	4.24	7.000	0.009	0.0	0.0	0.0	0.94	7.4	0.0
3.000	0.00	4.22	5.260	0.015	0.0	0.0	0.0	0.61	10.8	0.0
1.005	0.00	5.38	5.230	0.067	0.0	0.0	0.0	0.59	10.4	0.0
4.000	0.00	4.21	7.000	0.003	0.0	0.0	0.0	0.85	6.7	0.0
4.001	0.00	4.41	6.870	0.010	0.0	0.0	0.0	0.83	6.5	0.0
5.000	0.00	4.28	7.000	0.010	0.0	0.0	0.0	0.81	6.4	0.0
5.001	0.00	4.43	6.850	0.015	0.0	0.0	0.0	0.87	6.9	0.0
1.006	0.00	5.40	5.190	0.092	0.0	0.0	0.0	1.11	19.6	0.0
1.007	0.00	5.46	5.170	0.092	0.0	0.0	0.0	0.87	15.4	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	15
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 15 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.018	-0.082	0.000	0.08	0.0	0.5	OK
1.001	2	6.925	-0.075	0.000	0.14	0.0	0.9	OK
1.002	3	6.840	-0.060	0.000	0.34	0.0	2.1	OK
1.003	4	5.546	-0.104	0.000	0.20	0.0	2.7	OK
1.004	5	5.481	-0.069	0.000	0.15	0.0	2.4	OK
2.000	6	7.031	-0.069	0.000	0.21	0.0	1.5	OK
3.000	7	5.474	0.064	0.000	0.18	0.0	1.7	SURCHARGED
1.005	8	5.472	0.092	0.000	0.67	0.0	6.3	SURCHARGED
4.000	9	7.019	-0.081	0.000	0.08	0.0	0.5	OK
4.001	10	6.903	-0.067	0.000	0.23	0.0	1.4	OK
5.000	11	7.036	-0.064	0.000	0.27	0.0	1.6	OK
5.001	12	6.892	-0.058	0.000	0.36	0.0	2.3	OK
1.006	13	5.450	0.110	0.000	0.72	0.0	7.8	SURCHARGED
1.007	14	5.264	-0.056	0.000	0.71	0.0	7.7	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 30 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.016	-0.084	0.000	0.06	0.0	0.4	OK
1.001	2	6.923	-0.077	0.000	0.12	0.0	0.7	OK
1.002	3	6.836	-0.064	0.000	0.28	0.0	1.7	OK
1.003	4	5.541	-0.109	0.000	0.17	0.0	2.3	OK
1.004	5	5.474	-0.076	0.000	0.13	0.0	2.1	OK
2.000	6	7.027	-0.073	0.000	0.16	0.0	1.1	OK
3.000	7	5.469	0.059	0.000	0.14	0.0	1.3	SURCHARGED
1.005	8	5.465	0.085	0.000	0.62	0.0	5.8	SURCHARGED
4.000	9	7.016	-0.084	0.000	0.06	0.0	0.4	OK
4.001	10	6.899	-0.071	0.000	0.19	0.0	1.2	OK
5.000	11	7.031	-0.069	0.000	0.21	0.0	1.2	OK
5.001	12	6.886	-0.064	0.000	0.29	0.0	1.8	OK
1.006	13	5.445	0.105	0.000	0.70	0.0	7.6	SURCHARGED
1.007	14	5.263	-0.057	0.000	0.70	0.0	7.6	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
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	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	60
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 60 minute 2 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.013	-0.087	0.000	0.04	0.0	0.3	OK
1.001	2	6.919	-0.081	0.000	0.08	0.0	0.5	OK
1.002	3	6.830	-0.070	0.000	0.20	0.0	1.2	OK
1.003	4	5.534	-0.116	0.000	0.12	0.0	1.6	OK
1.004	5	5.433	-0.117	0.000	0.10	0.0	1.6	OK
2.000	6	7.022	-0.078	0.000	0.11	0.0	0.8	OK
3.000	7	5.416	0.006	0.000	0.11	0.0	1.0	SURCHARGED
1.005	8	5.413	0.033	0.000	0.50	0.0	4.7	SURCHARGED
4.000	9	7.013	-0.087	0.000	0.04	0.0	0.3	OK
4.001	10	6.894	-0.076	0.000	0.13	0.0	0.8	OK
5.000	11	7.025	-0.075	0.000	0.14	0.0	0.8	OK
5.001	12	6.880	-0.070	0.000	0.20	0.0	1.2	OK
1.006	13	5.396	0.056	0.000	0.58	0.0	6.3	SURCHARGED
1.007	14	5.252	-0.068	0.000	0.58	0.0	6.3	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	15
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 15 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.030	-0.070	0.000	0.20	0.0	1.3	OK
1.001	2	6.945	-0.055	0.000	0.42	0.0	2.5	OK
1.002	3	6.897	-0.003	0.000	1.00	0.0	6.0	OK
1.003	4	6.322	0.672	0.000	0.40	0.0	5.4	SURCHARGED
1.004	5	6.313	0.763	0.000	0.22	0.0	3.6	SURCHARGED
2.000	6	7.053	-0.047	0.000	0.55	0.0	3.8	OK
3.000	7	6.308	0.898	0.000	0.31	0.0	2.9	SURCHARGED
1.005	8	6.304	0.924	0.000	1.50	0.0	14.1	SURCHARGED
4.000	9	7.030	-0.070	0.000	0.20	0.0	1.3	OK
4.001	10	6.932	-0.038	0.000	0.69	0.0	4.2	OK
5.000	11	7.062	-0.038	0.000	0.70	0.0	4.2	OK
5.001	12	6.933	-0.017	0.000	1.00	0.0	6.2	OK
1.006	13	6.280	0.940	0.000	0.90	0.0	9.8	SURCHARGED
1.007	14	5.281	-0.039	0.000	0.90	0.0	9.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 30 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.026	-0.074	0.000	0.15	0.0	1.0	OK
1.001	2	6.939	-0.061	0.000	0.32	0.0	1.9	OK
1.002	3	6.868	-0.032	0.000	0.79	0.0	4.8	OK
1.003	4	6.466	0.816	0.000	0.32	0.0	4.3	SURCHARGED
1.004	5	6.458	0.908	0.000	0.22	0.0	3.6	SURCHARGED
2.000	6	7.045	-0.055	0.000	0.41	0.0	2.9	OK
3.000	7	6.454	1.044	0.000	0.26	0.0	2.5	SURCHARGED
1.005	8	6.450	1.070	0.000	1.30	0.0	12.3	SURCHARGED
4.000	9	7.026	-0.074	0.000	0.15	0.0	1.0	OK
4.001	10	6.922	-0.048	0.000	0.52	0.0	3.2	OK
5.000	11	7.052	-0.048	0.000	0.53	0.0	3.2	OK
5.001	12	6.916	-0.034	0.000	0.77	0.0	4.8	OK
1.006	13	6.428	1.088	0.000	0.90	0.0	9.8	SURCHARGED
1.007	14	5.281	-0.039	0.000	0.90	0.0	9.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	60
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 60 minute 30 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.021	-0.079	0.000	0.10	0.0	0.6	OK
1.001	2	6.931	-0.069	0.000	0.21	0.0	1.3	OK
1.002	3	6.852	-0.048	0.000	0.53	0.0	3.2	OK
1.003	4	6.161	0.511	0.000	0.24	0.0	3.2	SURCHARGED
1.004	5	6.153	0.603	0.000	0.17	0.0	2.8	SURCHARGED
2.000	6	7.036	-0.064	0.000	0.28	0.0	1.9	OK
3.000	7	6.147	0.737	0.000	0.22	0.0	2.0	SURCHARGED
1.005	8	6.143	0.763	0.000	1.03	0.0	9.7	SURCHARGED
4.000	9	7.021	-0.079	0.000	0.10	0.0	0.6	OK
4.001	10	6.911	-0.059	0.000	0.35	0.0	2.1	OK
5.000	11	7.041	-0.059	0.000	0.36	0.0	2.1	OK
5.001	12	6.901	-0.049	0.000	0.51	0.0	3.2	OK
1.006	13	6.116	0.776	0.000	0.90	0.0	9.8	SURCHARGED
1.007	14	5.281	-0.039	0.000	0.90	0.0	9.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	15
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 15 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.034	-0.066	0.000	0.25	0.0	1.6	OK
1.001	2	6.980	-0.020	0.000	0.51	0.0	3.1	OK
1.002	3	6.971	0.071	0.000	1.25	0.0	7.5	SURCHARGED
1.003	4	6.961	1.311	0.000	0.42	0.0	5.6	SURCHARGED
1.004	5	6.953	1.403	0.000	0.27	0.0	4.5	SURCHARGED
2.000	6	7.062	-0.038	0.000	0.70	0.0	4.9	OK
3.000	7	6.951	1.541	0.000	0.38	0.0	3.6	SURCHARGED
1.005	8	6.946	1.566	0.000	1.82	0.0	17.2	SURCHARGED
4.000	9	7.035	-0.065	0.000	0.26	0.0	1.6	OK
4.001	10	6.944	-0.026	0.000	0.89	0.0	5.5	OK
5.000	11	7.100	0.000	0.000	0.84	0.0	5.0	SURCHARGED
5.001	12	6.992	0.042	0.000	1.20	0.0	7.5	SURCHARGED
1.006	13	6.921	1.581	0.000	0.90	0.0	9.8	SURCHARGED
1.007	14	5.281	-0.039	0.000	0.90	0.0	9.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 30 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.104	0.004	0.000	0.20	0.0	1.3	SURCHARGED
1.001	2	7.102	0.102	0.000	0.41	0.0	2.5	SURCHARGED
1.002	3	7.098	0.198	0.000	1.00	0.0	6.0	SURCHARGED
1.003	4	7.087	1.437	0.000	0.37	0.0	4.9	SURCHARGED
1.004	5	7.079	1.529	0.000	0.28	0.0	4.7	SURCHARGED
2.000	6	7.082	-0.018	0.000	0.54	0.0	3.8	OK
3.000	7	7.078	1.668	0.000	0.30	0.0	2.8	SURCHARGED
1.005	8	7.072	1.692	0.000	1.47	0.0	13.9	FLOOD RISK
4.000	9	7.057	-0.043	0.000	0.20	0.0	1.3	OK
4.001	10	7.054	0.084	0.000	0.68	0.0	4.2	SURCHARGED
5.000	11	7.069	-0.031	0.000	0.69	0.0	4.2	OK
5.001	12	7.058	0.108	0.000	1.00	0.0	6.3	SURCHARGED
1.006	13	7.046	1.706	0.000	0.90	0.0	9.8	SURCHARGED
1.007	14	5.281	-0.039	0.000	0.90	0.0	9.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	60
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 60 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.052	-0.048	0.000	0.13	0.0	0.8	OK
1.001	2	7.050	0.050	0.000	0.28	0.0	1.7	SURCHARGED
1.002	3	7.046	0.146	0.000	0.70	0.0	4.2	SURCHARGED
1.003	4	7.035	1.385	0.000	0.28	0.0	3.8	SURCHARGED
1.004	5	7.027	1.477	0.000	0.23	0.0	3.7	SURCHARGED
2.000	6	7.042	-0.058	0.000	0.36	0.0	2.5	OK
3.000	7	7.024	1.614	0.000	0.25	0.0	2.3	SURCHARGED
1.005	8	7.019	1.639	0.000	1.20	0.0	11.3	FLOOD RISK
4.000	9	7.024	-0.076	0.000	0.14	0.0	0.8	OK
4.001	10	7.002	0.032	0.000	0.46	0.0	2.8	SURCHARGED
5.000	11	7.048	-0.052	0.000	0.47	0.0	2.8	OK
5.001	12	7.005	0.055	0.000	0.68	0.0	4.2	SURCHARGED
1.006	13	6.993	1.653	0.000	0.90	0.0	9.8	SURCHARGED
1.007	14	5.281	-0.039	0.000	0.90	0.0	9.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	120
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 120 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.019	-0.081	0.000	0.08	0.0	0.5	OK
1.001	2	6.928	-0.072	0.000	0.18	0.0	1.1	OK
1.002	3	6.847	-0.053	0.000	0.44	0.0	2.7	OK
1.003	4	6.399	0.749	0.000	0.21	0.0	2.8	SURCHARGED
1.004	5	6.391	0.841	0.000	0.18	0.0	3.0	SURCHARGED
2.000	6	7.032	-0.068	0.000	0.23	0.0	1.6	OK
3.000	7	6.387	0.977	0.000	0.20	0.0	1.9	SURCHARGED
1.005	8	6.382	1.002	0.000	0.95	0.0	8.9	SURCHARGED
4.000	9	7.020	-0.080	0.000	0.09	0.0	0.5	OK
4.001	10	6.907	-0.063	0.000	0.29	0.0	1.8	OK
5.000	11	7.037	-0.063	0.000	0.30	0.0	1.8	OK
5.001	12	6.896	-0.054	0.000	0.43	0.0	2.7	OK
1.006	13	6.358	1.018	0.000	0.90	0.0	9.8	SURCHARGED
1.007	14	5.281	-0.039	0.000	0.90	0.0	9.8	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	240
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 240 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.014	-0.086	0.000	0.05	0.0	0.3	OK
1.001	2	6.922	-0.078	0.000	0.11	0.0	0.7	OK
1.002	3	6.835	-0.065	0.000	0.27	0.0	1.6	OK
1.003	4	5.606	-0.044	0.000	0.15	0.0	2.1	OK
1.004	5	5.598	0.048	0.000	0.12	0.0	2.0	SURCHARGED
2.000	6	7.025	-0.075	0.000	0.14	0.0	1.0	OK
3.000	7	5.593	0.183	0.000	0.16	0.0	1.5	SURCHARGED
1.005	8	5.589	0.209	0.000	0.71	0.0	6.7	SURCHARGED
4.000	9	7.015	-0.085	0.000	0.05	0.0	0.3	OK
4.001	10	6.898	-0.072	0.000	0.18	0.0	1.1	OK
5.000	11	7.028	-0.072	0.000	0.18	0.0	1.1	OK
5.001	12	6.884	-0.066	0.000	0.26	0.0	1.6	OK
1.006	13	5.564	0.224	0.000	0.83	0.0	9.1	SURCHARGED
1.007	14	5.275	-0.045	0.000	0.83	0.0	9.1	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	400
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 400 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.012	-0.088	0.000	0.03	0.0	0.2	OK
1.001	2	6.918	-0.082	0.000	0.07	0.0	0.4	OK
1.002	3	6.829	-0.071	0.000	0.18	0.0	1.1	OK
1.003	4	5.533	-0.117	0.000	0.11	0.0	1.5	OK
1.004	5	5.439	-0.111	0.000	0.09	0.0	1.5	OK
2.000	6	7.021	-0.079	0.000	0.10	0.0	0.7	OK
3.000	7	5.432	0.022	0.000	0.12	0.0	1.1	SURCHARGED
1.005	8	5.429	0.049	0.000	0.52	0.0	4.9	SURCHARGED
4.000	9	7.012	-0.088	0.000	0.04	0.0	0.2	OK
4.001	10	6.893	-0.077	0.000	0.12	0.0	0.7	OK
5.000	11	7.023	-0.077	0.000	0.12	0.0	0.7	OK
5.001	12	6.878	-0.072	0.000	0.18	0.0	1.1	OK
1.006	13	5.411	0.071	0.000	0.62	0.0	6.7	SURCHARGED
1.007	14	5.255	-0.065	0.000	0.62	0.0	6.7	OK

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.078	4-8	0.014

Total Area Contributing (ha) = 0.092

Total Pipe Volume (m³) = 1.614

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.007	SEWER	7.510	5.150	5.150	1000	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Foul Sewage per hectare (l/s)	0.000
Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	35.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Run Time (mins)	1440
Manhole Headloss Coeff (Global)	0.500	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0		

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Winter
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	600
Ratio R	0.350		

Online Controls for Storm

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.006, Volume (m³): 2.9

Unit Reference	MD-SHE-0131-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	131
Invert Level (m)	5.190
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	10.0	Kick-Flo®	1.167	7.8
Flush-Flo™	0.569	9.8	Mean Flow over Head Range	-	8.7

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	4.7	1.200	7.9	3.000	12.1	7.000	18.1
0.200	8.3	1.400	8.5	3.500	13.0	7.500	18.7
0.300	9.2	1.600	9.0	4.000	13.9	8.000	19.3
0.400	9.6	1.800	9.5	4.500	14.7	8.500	19.9
0.500	9.8	2.000	10.0	5.000	15.4	9.000	20.5
0.600	9.8	2.200	10.5	5.500	16.2	9.500	21.0
0.800	9.6	2.400	10.9	6.000	16.8		
1.000	9.0	2.600	11.3	6.500	17.5		

Storage Structures for Storm

Cellular Storage Manhole: 13, DS/PN: 1.006

Invert Level (m) 5.190 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	5.0	0.0	0.800	5.0	0.0
0.400	5.0	0.0	0.801	0.0	0.0

Summary of Results for 600 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 200.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	1	7.011	-0.089	0.000	0.03	0.0	0.2	OK
1.001	2	6.915	-0.085	0.000	0.05	0.0	0.3	OK
1.002	3	6.824	-0.076	0.000	0.13	0.0	0.8	OK
1.003	4	5.528	-0.122	0.000	0.08	0.0	1.1	OK
1.004	5	5.425	-0.125	0.000	0.07	0.0	1.1	OK
2.000	6	7.017	-0.083	0.000	0.07	0.0	0.5	OK
3.000	7	5.364	-0.046	0.000	0.09	0.0	0.8	OK
1.005	8	5.361	-0.019	0.000	0.38	0.0	3.6	OK
4.000	9	7.011	-0.089	0.000	0.03	0.0	0.2	OK
4.001	10	6.890	-0.080	0.000	0.09	0.0	0.5	OK
5.000	11	7.020	-0.080	0.000	0.09	0.0	0.5	OK
5.001	12	6.874	-0.076	0.000	0.13	0.0	0.8	OK
1.006	13	5.348	0.008	0.000	0.46	0.0	4.9	SURCHARGED
1.007	14	5.241	-0.079	0.000	0.46	0.0	4.9	OK