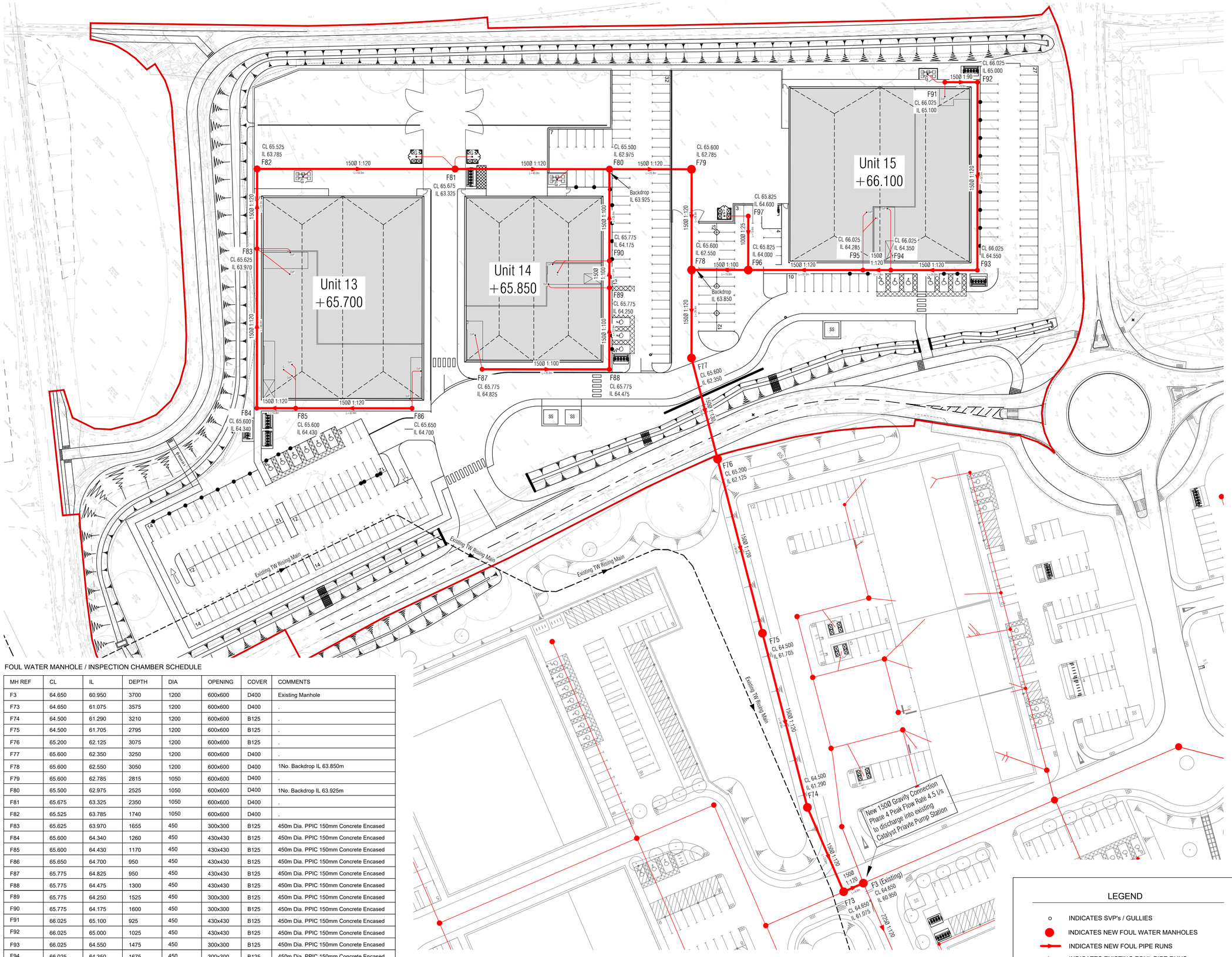
A1



FW Drainage Layout 1:500

FOUL WATER MANHOLE / INSPECTION CHAMBER SCHEDULE

MH REF	CL	IL	DEPTH	DIA	OPENING	COVER	COMMENTS
F3	64.650	60.950	3700	1200	600x600	D400	Existing Manhole
F73	64.650	61.075	3575	1200	600x600	D400	.
F74	64.500	61.290	3210	1200	600x600	B125	.
F75	64.500	61.705	2795	1200	600x600	B125	.
F76	65.200	62.125	3075	1200	600x600	B125	.
F77	65.600	62.350	3250	1200	600x600	D400	.
F78	65.600	62.550	3050	1200	600x600	D400	1No. Backdrop IL 63.850m
F79	65.600	62.785	2815	1050	600x600	D400	.
F80	65.500	62.975	2525	1050	600x600	D400	1No. Backdrop IL 63.925m
F81	65.675	63.325	2350	1050	600x600	D400	.
F82	65.525	63.785	1740	1050	600x600	D400	.
F83	65.625	63.970	1655	450	300x300	B125	450m Dia. PPIC 150mm Concrete Encased
F84	65.600	64.340	1260	450	430x430	B125	450m Dia. PPIC 150mm Concrete Encased
F85	65.600	64.430	1170	450	430x430	B125	450m Dia. PPIC 150mm Concrete Encased
F86	65.650	64.700	950	450	430x430	B125	450m Dia. PPIC 150mm Concrete Encased
F87	65.775	64.825	950	450	430x430	B125	450m Dia. PPIC 150mm Concrete Encased
F88	65.775	64.475	1300	450	430x430	B125	450m Dia. PPIC 150mm Concrete Encased
F89	65.775	64.250	1525	450	300x300	B125	450m Dia. PPIC 150mm Concrete Encased
F90	65.775	64.175	1600	450	300x300	B125	450m Dia. PPIC 150mm Concrete Encased
F91	66.025	65.100	925	450	430x430	B125	450m Dia. PPIC 150mm Concrete Encased
F92	66.025	65.000	1025	450	430x430	B125	450m Dia. PPIC 150mm Concrete Encased
F93	66.025	64.550	1475	450	300x300	B125	450m Dia. PPIC 150mm Concrete Encased
F94	66.025	64.350	1675	450	300x300	B125	450m Dia. PPIC 150mm Concrete Encased
F95	66.025	64.285	1740	450	300x300	B125	450m Dia. PPIC 150mm Concrete Encased
F96	65.825	64.000	1825	1050	600x600	D400	.
F97	65.825	64.600	1225	450	430x430	D400	450m Dia. PPIC 150mm Concrete Encased

DRAINAGE NOTES

1. This drawing is to be read in conjunction with all relevant Architects and Bailey Johnson Hayes drawings and specifications.
2. Do not scale. Work only to figured dimensions.
3. All dimensions and condition of existing drainage to have invert levels confirmed on site prior to commencement of work.
4. Proposed Site & Finishes Plan from Cornish Architects:-
   Drawing Ref: 23022 - TP - 002 Rev -
   Topographical Survey by MK Surveys:
   Drawing Ref: 33239 Rev 1
5. All works to Adopted Sewers to be carried out in accordance with the requirements of Sewers for Adoption in the Sewerage Sector Guidance v2.2 (2022) and the Adopting authority requirements.
6. All private drainage is to be constructed in accordance with the Building Regulations as current at construction.
7. Drains to be 'Hepworth Supersleeve' or similar approved Laid in Class S Bedding to BS 882 1983: Table 4, or to BS 8301 1985: Appendix D. 450mm Diameter Drains and above are to be Hepworth Concrete Pipes Class H or similar approved drains within the site may be different main accordance with Sewerage Sector Guidance v2.2 (2022).
8. All trenches within trafficked areas to be backfilled with 75mm down graded stone fill, placed and compacted in 150mm layers. All pipes in Roadways / Parking, less than 900mm deep to pipe crown to be encased in concrete and flexible joints provided at 3000mm centres.
9. All drains to have Class S granular bed and surround, except where:
   a) Cover beneath roads or hardstanding is less than 900mm to Pipe Crown or,
   b) Cover beneath landscaping is less than 600mm in which case Class Z (Concrete) bedding / surround is required.
10. All Manholes greater than 1.5m to soffit to be constructed in Precast Concrete Rings to BS 5911: Part 1. Rings to be bedded in sealant strips unless otherwise noted in Manhole Schedule.
11. Manholes in footpaths or landscaped areas to be backfilled with 40mm down graded stone fill, compacted in layers not exceeding 150mm thick. All manholes beneath roads and parking areas to be cased in minimum 150mm concrete surround.
12. All connections to rain water pipes to be provided with Rodding access.
13. All road gullies to be Hepworth Road Gullies, Ref 214 RGR4 with 150mm diameter outlets or similar approved. Gullies to be encased in minimum 150mm concrete.
14. Drains under buildings and within 300mm of the underside of floor slab to be encased in 150mm concrete. Casing to incorporate flexible fibre board joints at spacing's as recommended by the pipe manufacturer. Drains under buildings
15. Architect is to provide final rain water pipe positions for construction.
16. All Pipes to enter manhole with Soffits Level unless otherwise stated. See manhole details drawings for further clarity of connections.

LEGEND

- INDICATES SVP's / GULLIES
- INDICATES NEW FOUL WATER MANHOLES
- INDICATES NEW FOUL PIPE RUNS
- INDICATES EXISTING FOUL PIPE RUNS
- INDICATES EXISTING RISING MAIN

ALL PIPES CONNECTED DIRECTY INTO GULLIES TO BE 150MM DIAMETER

SCALE

10m 5m 0 10m 20m 30m

Scale 1:500 @A1

TOWN PLANNING

Rev	Date	Revision Description
D	09.05.24	Issued for Planning Submission
C	26.04.24	Vegetation retained + Ditches updated
B	19.04.24	Issued for Planning Submission

Revision Schedule

Project Title
Catalyst Bicester Phase 4,
Wendlebury Road, Bicester

Client
ALBION LAND

Drawing Title
FW Drainage Layout

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL

Scale	1:500 @A1
Date	03.04.24
Drawn	JNG

Drawing Number
S1502-03 D

A1

KEY:

INDICATES DIRECTION OF OVERLAND FLOW

Extent of flooding in 100 yr + 40% event 25mm Deep (5m³)

Unit 13 +65.700

Unit 14 +65.850

Unit 15 +66.100

65.3m

Existing Watercourse Discharges to the Langford Brook

Exceedance Flow Route Plan 1:500

SCALE

10m 5m 0 10m 20m 30m

Scale 1:500 @A1

TOWN PLANNING

Rev	Date	Revision Description
C	09.05.24	Issued for Planning Submission
B	26.04.24	Vegetation retained + Ditches updated
A	19.04.24	Issued for Planning Submission

Revision Schedule

Project Title

Catalyst Bicester Phase 4, Wendlebury Road, Bicester

Client

ALBION LAND

Drawing Title

Exceedance Flow Route Plan

BAILEY JOHNSON HAYES
Consulting Engineers
ST.ALBANS: Suite 4, Phoenix House, 63 Campfield Rd, ST.ALBANS, Herts AL1 5FL

Scale	1:500 @A1
Date	18.04.24
Drawn	JNG

Drawing Number

S1502-05 C

APPENDIX H

Storage Estimates & Hydraulic Modelling Results

By Bailey Johnson Hayes (March 24)

hr wallingford

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	James Griffiths
Site name:	Unit 13, Catalyst
Site location:	Bicester

This is an estimation of the storage volume requirements that are needed to meet normal
best practice criteria in line with Environment Agency guidance "Rainfall runoff management
for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and
the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design
of drainage systems. It is recommended that hydraulic modelling software is used to calculate
volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.88478° N
Longitude:	1.1698° W
Reference:	1180499709
Date:	Apr 03 2024 10:48

Site characteristics

Total site area (ha):	1
Significant public open space (ha):	0
Area positively drained (ha):	1
Impermeable area (ha):	0.75
Percentage of drained area that is impermeable (%):	75
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	100
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	100
Compliance factor for rainwater harvesting system (%):	100
Net site area for storage volume design (ha):	1
Net impermable area for storage volume design (ha):	0.78
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	3
SPR:	0.1	0.37

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63.07
Rainfall 100 yrs 12 hrs:	--	73.78
FEH / FSR conversion factor:	1.09	0.96
SAAR (mm):	617	619
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	0.14	2.49
Q_{BAR} for net site area (l/s):	0.14	2.49

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.0
Volume control approach	Flow control to max of 2 l/s/ha or Qbar
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2.5

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2.5	2.5
1 in 30 years (l/s):	2.5	2.5
1 in 100 year (l/s):	2.5	2.5

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	627	577
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	627	577

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	James Griffiths
Site name:	Unit 14, Catalyst
Site location:	Bicester

This is an estimation of the storage volume requirements that are needed to meet normal
best practice criteria in line with Environment Agency guidance "Rainfall runoff management
for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and
the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design
of drainage systems. It is recommended that hydraulic modelling software is used to calculate
volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.88478° N
Longitude:	1.1698° W
Reference:	3914195661
Date:	Apr 03 2024 10:50

Site characteristics

Total site area (ha):	0.65
Significant public open space (ha):	0
Area positively drained (ha):	0.65
Impermeable area (ha):	0.65
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	100
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	100
Compliance factor for rainwater harvesting system (%):	100
Net site area for storage volume design (ha):	0.65
Net impermable area for storage volume design (ha):	0.65
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	3
SPR:	0.1	0.37

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63.07
Rainfall 100 yrs 12 hrs:	--	73.78
FEH / FSR conversion factor:	1.09	0.96
SAAR (mm):	617	619
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	0.09	1.62
Q_{BAR} for net site area (l/s):	0.09	1.62

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.0
Volume control approach	Flow control to max of 2 l/s/ha or Qbar
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	1.6

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	1.6	1.6
1 in 30 years (l/s):	1.6	1.6
1 in 100 year (l/s):	1.6	1.6

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	571	484
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	571	484

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	James Griffiths
Site name:	Unit 15, Catalyst
Site location:	Bicester

This is an estimation of the storage volume requirements that are needed to meet normal
best practice criteria in line with Environment Agency guidance "Rainfall runoff management
for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and
the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design
of drainage systems. It is recommended that hydraulic modelling software is used to calculate
volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.88478° N
Longitude:	1.1698° W
Reference:	3444501643
Date:	Apr 03 2024 10:52

Site characteristics

Total site area (ha):	0.85
Significant public open space (ha):	0
Area positively drained (ha):	0.85
Impermeable area (ha):	0.75
Percentage of drained area that is impermeable (%):	88
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	100
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	100
Compliance factor for rainwater harvesting system (%):	100
Net site area for storage volume design (ha):	0.85
Net impermable area for storage volume design (ha):	0.76
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	3
SPR:	0.1	0.37

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63.07
Rainfall 100 yrs 12 hrs:	--	73.78
FEH / FSR conversion factor:	1.09	0.96
SAAR (mm):	617	619
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	0.12	2.11
Q_{BAR} for net site area (l/s):	0.12	2.11

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.0
Volume control approach	Flow control to max of 2 l/s/ha or Qbar
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2.1

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2.1	2.1
1 in 30 years (l/s):	2.1	2.1
1 in 100 year (l/s):	2.1	2.1

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	646	581
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	646	581

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	22.500	0.150	150.0	0.065	15.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	22.500	0.075	300.0	0.120	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	9.000	0.300	30.0	0.200	15.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	63.750	0.255	250.0	0.055	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	33.750	0.225	150.0	0.070	15.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	9.000	0.045	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	15.000	0.075	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	35.000	0.350	100.0	0.060	15.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	30.000	0.300	100.0	0.060	15.00	0.0	0.600	o	150	Pipe/Conduit	
1.005	15.000	0.075	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.000	35.000	0.350	100.0	0.060	15.00	0.0	0.600	o	150	Pipe/Conduit	
7.000	35.000	0.350	100.0	0.060	15.00	0.0	0.600	o	150	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)
1.000	70.00	15.35	64.650	0.065	0.0	0.0	0.0	1.07	42.4	16.4
1.001	70.00	15.77	64.500	0.185	0.0	0.0	0.0	0.90	63.8	46.8
2.000	70.00	15.05	64.825	0.200	0.0	0.0	0.0	2.88	203.7	50.6
2.001	70.00	15.11	64.475	0.200	0.0	0.0	0.0	1.57	111.1	50.6
1.002	70.00	16.70	64.425	0.440	0.0	0.0	0.0	1.14	126.1	111.2
3.000	70.00	15.53	64.545	0.070	0.0	0.0	0.0	1.07	42.4	17.7
1.003	70.00	16.80	64.095	0.510	0.0	0.0	0.0	1.43	228.1	128.9
1.004	70.00	16.98	64.050	0.510	0.0	0.0	0.0	1.43	228.1	128.9
4.000	70.00	15.58	64.550	0.060	0.0	0.0	0.0	1.00	17.8	15.2
5.000	70.00	15.50	64.500	0.060	0.0	0.0	0.0	1.00	17.8	15.2
1.005	70.00	17.15	63.975	0.630	0.0	0.0	0.0	1.43	228.1	159.2
6.000	70.00	15.58	64.550	0.060	0.0	0.0	0.0	1.00	17.8	15.2
7.000	70.00	15.58	64.550	0.060	0.0	0.0	0.0	1.00	17.8	15.2

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)	Section Type	Auto Design
1.006	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.007	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	150	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)
1.006	70.00	17.27	63.900	0.750	0.0	0.0	0.0	1.43	228.1	189.6
1.007	70.00	17.35	63.850	0.750	0.0	0.0	0.0	1.00	17.8«	189.6

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.065	0.065	0.065
1.001	-	-	100	0.120	0.120	0.120
2.000	-	-	100	0.200	0.200	0.200
2.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.055	0.055	0.055
3.000	-	-	100	0.070	0.070	0.070
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.060	0.060	0.060
5.000	-	-	100	0.060	0.060	0.060
1.005	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.060	0.060	0.060
7.000	-	-	100	0.060	0.060	0.060
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.750	0.750	0.750

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	Watercourse	65.500	63.800	0.000	0	0

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S8, DS/PN: 1.007, Volume (m³): 3.8

Unit Reference	MD-SHE-0072-2500-1200-2500
Design Head (m)	1.200
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	63.850
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.5	Kick-Flo®	0.644	1.9
Flush-Flo™	0.318	2.3	Mean Flow over Head Range	-	2.1

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	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.2	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Storage Structures for Storm

Porous Car Park Manhole: S6, DS/PN: 1.005

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	65.0
Membrane Percolation (mm/hr)	1000	Length (m)	16.1
Max Percolation (l/s)	290.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.40	Evaporation (mm/day)	3
Invert Level (m)	64.400	Cap Volume Depth (m)	0.700

Porous Car Park Manhole: S7, DS/PN: 1.006

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	70.0
Membrane Percolation (mm/hr)	1000	Length (m)	16.1
Max Percolation (l/s)	313.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.40	Evaporation (mm/day)	3
Invert Level (m)	64.400	Cap Volume Depth (m)	0.700

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S1	1.046	0.847	0.000	1.893
1.001	S2	1.216	1.500	0.000	2.716
2.000	ACO	0.087	0.578	0.000	0.665
2.001	PI 1	1.329	0.263	0.000	1.592
1.002	S3	1.825	6.892	0.000	8.717
3.000	S9	1.165	1.291	0.000	2.456
1.003	S4	2.118	1.217	0.000	3.335
1.004	S5	2.183	2.171	0.000	4.354
4.000	IC1	0.131	0.603	0.000	0.734
5.000	IC2	0.139	0.514	0.000	0.653
1.005	S6	2.004	2.171	293.020	297.195
6.000	IC3	0.131	0.603	0.000	0.734
7.000	IC4	0.131	0.603	0.000	0.734
1.006	S7	2.111	1.376	315.560	319.047
1.007	S8	2.398	0.076	0.000	2.474
Total		18.015	20.704	608.580	647.299

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	30 minute 2 year Summer I+0%	65.575	64.707	0.000	0.059	5.7	OK
1.001	S2	30 minute 2 year Summer I+0%	65.575	64.640	0.000	0.384	20.7	OK
2.000	ACO	30 minute 2 year Summer I+0%	65.375	64.896	0.000	0.010	17.4	OK
2.001	PI 1	30 minute 2 year Summer I+0%	65.650	64.621	0.000	0.188	17.3	OK
1.002	S3	30 minute 2 year Summer I+0%	65.700	64.615	0.000	1.142	41.3	OK
3.000	S9	30 minute 2 year Summer I+0%	65.575	64.608	0.000	0.066	6.1	OK
1.003	S4	120 minute 2 year Summer I+0%	65.575	64.579	0.000	6.658	33.7	SURCHARGED
1.004	S5	120 minute 2 year Summer I+0%	65.575	64.572	0.000	1.948	33.6	SURCHARGED
4.000	IC1	30 minute 2 year Summer I+0%	65.375	64.606	0.000	0.008	5.2	OK
5.000	IC2	30 minute 2 year Summer I+0%	65.375	64.557	0.000	0.008	5.2	OK
1.005	S6	480 minute 2 year Winter I+0%	65.375	64.534	0.000	59.729	6.7	SURCHARGED
6.000	IC3	30 minute 2 year Summer I+0%	65.375	64.606	0.000	0.008	5.2	OK
7.000	IC4	30 minute 2 year Summer I+0%	65.375	64.606	0.000	0.008	5.2	OK
1.006	S7	480 minute 2 year Winter I+0%	65.375	64.531	0.000	62.982	2.7	SURCHARGED
1.007	S8	480 minute 2 year Winter I+0%	65.525	64.556	0.000	2.380	2.3	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	30 minute 30 year Summer I+0%	65.575	64.940	0.000	0.322	14.1	SURCHARGED
1.001	S2	30 minute 30 year Summer I+0%	65.575	64.915	0.000	1.310	47.4	SURCHARGED
2.000	ACO	60 minute 30 year Summer I+0%	65.375	64.953	0.000	0.020	37.9	OK
2.001	PI 1	120 minute 30 year Summer I+0%	65.650	64.938	0.000	0.978	28.7	SURCHARGED
1.002	S3	180 minute 30 year Summer I+0%	65.700	64.894	0.000	2.428	49.1	SURCHARGED
3.000	S9	240 minute 30 year Summer I+0%	65.575	64.822	0.000	0.308	6.7	SURCHARGED
1.003	S4	240 minute 30 year Summer I+0%	65.575	64.813	0.000	9.204	47.1	SURCHARGED
1.004	S5	240 minute 30 year Summer I+0%	65.575	64.720	0.000	2.169	47.0	SURCHARGED
4.000	IC1	600 minute 30 year Winter I+0%	65.375	64.715	0.000	0.025	2.1	SURCHARGED
5.000	IC2	600 minute 30 year Winter I+0%	65.375	64.715	0.000	0.033	2.0	SURCHARGED
1.005	S6	600 minute 30 year Winter I+0%	65.375	64.713	0.000	135.529	9.8	SURCHARGED
6.000	IC3	600 minute 30 year Winter I+0%	65.375	64.712	0.000	0.025	2.1	SURCHARGED
7.000	IC4	600 minute 30 year Winter I+0%	65.375	64.712	0.000	0.025	2.1	SURCHARGED
1.006	S7	600 minute 30 year Winter I+0%	65.375	64.710	0.000	144.462	2.8	SURCHARGED
1.007	S8	600 minute 30 year Winter I+0%	65.525	64.735	0.000	2.636	2.3	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	30 minute 99 year Summer I+0%	65.575	65.096	0.000	0.499	17.9	SURCHARGED
1.001	S2	30 minute 99 year Summer I+0%	65.575	65.066	0.000	1.482	65.1	SURCHARGED
2.000	ACO	30 minute 99 year Summer I+0%	65.375	65.203	0.000	0.059	55.5	FLOOD RISK
2.001	PI 1	15 minute 99 year Summer I+0%	65.650	65.043	0.000	1.189	62.5	SURCHARGED
1.002	S3	240 minute 99 year Summer I+0%	65.700	64.978	0.000	2.549	52.6	SURCHARGED
3.000	S9	360 minute 99 year Summer I+0%	65.575	64.909	0.000	0.406	6.7	SURCHARGED
1.003	S4	360 minute 99 year Summer I+0%	65.575	64.900	0.000	9.328	47.8	SURCHARGED
1.004	S5	720 minute 99 year Winter I+0%	65.575	64.833	0.000	2.330	18.6	SURCHARGED
4.000	IC1	30 minute 99 year Summer I+0%	65.375	64.851	0.000	0.047	15.1	SURCHARGED
5.000	IC2	720 minute 99 year Winter I+0%	65.375	64.833	0.000	0.052	2.3	SURCHARGED
1.005	S6	720 minute 99 year Winter I+0%	65.375	64.832	0.000	185.340	10.8	SURCHARGED
6.000	IC3	720 minute 99 year Winter I+0%	65.375	64.830	0.000	0.044	2.3	SURCHARGED
7.000	IC4	720 minute 99 year Winter I+0%	65.375	64.830	0.000	0.044	2.3	SURCHARGED
1.006	S7	720 minute 99 year Winter I+0%	65.375	64.829	0.000	198.026	2.9	SURCHARGED
1.007	S8	720 minute 99 year Winter I+0%	65.525	64.853	0.000	2.805	2.3	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S1	30 minute 100 year Summer I+40%	65.575	65.449	0.000	0.898	27.1	FLOOD RISK
1.001	S2	30 minute 100 year Summer I+40%	65.575	65.412	0.000	1.873	89.1	FLOOD RISK
2.000	ACO	30 minute 100 year Summer I+40%	65.375	65.380	5.049	5.118	75.6	FLOOD
2.001	PI 1	30 minute 100 year Summer I+40%	65.650	65.289	0.000	1.493	75.6	SURCHARGED
1.002	S3	30 minute 100 year Summer I+40%	65.700	65.212	0.000	2.882	158.2	SURCHARGED
3.000	S9	480 minute 100 year Summer I+40%	65.575	65.086	0.000	0.606	7.6	SURCHARGED
1.003	S4	480 minute 100 year Summer I+40%	65.575	65.076	0.000	9.580	54.9	SURCHARGED
1.004	S5	960 minute 100 year Winter I+40%	65.575	65.057	0.000	2.651	21.7	SURCHARGED
4.000	IC1	30 minute 100 year Summer I+40%	65.375	65.189	0.000	0.101	21.1	FLOOD RISK
5.000	IC2	30 minute 100 year Summer I+40%	65.375	65.120	0.000	0.098	21.2	FLOOD RISK
1.005	S6	960 minute 100 year Winter I+40%	65.375	65.057	0.000	279.689	12.4	SURCHARGED
6.000	IC3	30 minute 100 year Summer I+40%	65.375	65.055	0.000	0.080	21.4	SURCHARGED
7.000	IC4	30 minute 100 year Summer I+40%	65.375	65.055	0.000	0.080	21.4	SURCHARGED
1.006	S7	960 minute 100 year Winter I+40%	65.375	65.053	0.000	299.503	2.9	SURCHARGED
1.007	S8	960 minute 100 year Winter I+40%	65.525	65.077	0.000	3.126	2.5	SURCHARGED

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	15.000	0.100	150.0	0.045	15.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	24.000	0.300	80.0	0.085	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	42.000	0.140	300.0	0.140	15.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	55.500	0.185	300.0	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	7.500	0.050	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	6.125	0.175	35.0	0.110	15.00	0.0	0.600	o	300	Pipe/Conduit	
3.001	5.250	0.150	35.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	25.000	0.250	100.0	0.050	15.00	0.0	0.600	o	150	Pipe/Conduit	
5.000	22.500	0.225	100.0	0.050	15.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	7.500	0.050	150.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	17.500	0.175	100.0	0.130	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.005	7.500	0.075	100.0	0.000	0.00	0.0	0.600	o	225	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)
1.000	70.00	15.23	64.750	0.045	0.0	0.0	0.0	1.07	42.4	11.4
1.001	70.00	15.46	64.575	0.130	0.0	0.0	0.0	1.76	124.4	32.9
2.000	70.00	15.78	64.650	0.140	0.0	0.0	0.0	0.90	63.8	35.4
2.001	70.00	16.80	64.460	0.180	0.0	0.0	0.0	0.90	63.8	45.5
1.002	70.00	16.89	64.200	0.310	0.0	0.0	0.0	1.48	163.1	78.4
3.000	70.00	15.04	64.575	0.110	0.0	0.0	0.0	2.67	188.5	27.8
3.001	70.00	15.07	64.350	0.110	0.0	0.0	0.0	2.67	188.5	27.8
4.000	70.00	15.41	64.450	0.050	0.0	0.0	0.0	1.00	17.8	12.6
5.000	70.00	15.37	64.425	0.050	0.0	0.0	0.0	1.00	17.8	12.6
3.002	70.00	15.50	64.200	0.210	0.0	0.0	0.0	1.48	163.1	53.1
1.003	70.00	16.93	64.150	0.520	0.0	0.0	0.0	1.81	200.1	131.4
1.004	70.00	17.09	64.100	0.650	0.0	0.0	0.0	1.81	200.1	164.3
1.005	70.00	17.19	63.925	0.650	0.0	0.0	0.0	1.31	52.0«	164.3

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.045	0.045	0.045
1.001	-	-	100	0.085	0.085	0.085
2.000	-	-	100	0.140	0.140	0.140
2.001	-	-	100	0.040	0.040	0.040
1.002	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.110	0.110	0.110
3.001	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.050	0.050	0.050
5.000	-	-	100	0.050	0.050	0.050
3.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.130	0.130	0.130
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.650	0.650	0.650

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)
1.005	Watercourse	65.500	63.850	0.000	0	0

Online Controls for Storm

Complex Manhole: S14, DS/PN: 1.005, Volume (m³): 7.0

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0056-1600-1275-1600
Design Head (m)	1.275
Design Flow (l/s)	1.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	56
Invert Level (m)	63.925
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.275	1.6	Kick-Flo®	0.504	1.1
Flush-Flo™	0.250	1.3	Mean Flow over Head Range	-	1.3

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	1.1	1.200	1.6	3.000	2.4	7.000	3.5
0.200	1.3	1.400	1.7	3.500	2.5	7.500	3.6
0.300	1.3	1.600	1.8	4.000	2.7	8.000	3.7
0.400	1.2	1.800	1.9	4.500	2.9	8.500	3.8
0.500	1.1	2.000	2.0	5.000	3.0	9.000	3.9
0.600	1.1	2.200	2.0	5.500	3.1	9.500	4.0
0.800	1.3	2.400	2.1	6.000	3.3		
1.000	1.4	2.600	2.2	6.500	3.4		

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 65.200

Storage Structures for Storm

Complex Manhole: TANK, DS/PN: 1.004

Cellular Storage

Invert Level (m) 64.100 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	320.0	0.0	0.401	0.0	0.0
0.400	320.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	16.1
Membrane Percolation (mm/hr)	1000	Length (m)	90.0
Max Percolation (l/s)	402.5	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.40	Evaporation (mm/day)	3
Invert Level (m)	64.500	Cap Volume Depth (m)	0.700

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	S10	1.103	0.549	0.000	1.651
1.001	S11	1.301	1.606	0.000	2.907
2.000	S15	1.131	2.884	0.000	4.015
2.001	PI 2	1.402	3.833	0.000	5.235
1.002	S12	1.968	0.679	0.000	2.647
3.000	ACO	0.151	0.375	0.000	0.526
3.001	PI 3	1.301	0.281	0.000	1.582
4.000	IC5	0.175	0.426	0.000	0.601
5.000	IC6	0.159	0.382	0.000	0.541
3.002	S16	1.753	0.679	0.000	2.433
1.003	S13	1.825	0.411	0.000	2.236
1.004	TANK	1.499	1.767	527.421	530.687
1.005	S14	5.280	0.262	0.000	5.543
Total		19.048	14.135	527.421	560.604

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S10	30 minute 2 year Summer I+0%	65.725	64.798	0.000	0.049	3.9	OK
1.001	S11	15 minute 2 year Summer I+0%	65.725	64.650	0.000	0.082	15.4	OK
2.000	S15	30 minute 2 year Summer I+0%	65.650	64.742	0.000	0.098	12.2	OK
2.001	PI 2	30 minute 2 year Summer I+0%	65.700	64.565	0.000	0.160	15.9	OK
1.002	S12	720 minute 2 year Winter I+0%	65.575	64.491	0.000	2.285	5.0	OK
3.000	ACO	30 minute 2 year Summer I+0%	65.525	64.636	0.000	0.009	9.6	OK
3.001	PI 3	720 minute 2 year Winter I+0%	65.500	64.491	0.000	0.182	1.8	OK
4.000	IC5	30 minute 2 year Summer I+0%	65.550	64.501	0.000	0.007	4.4	OK
5.000	IC6	720 minute 2 year Winter I+0%	65.425	64.492	0.000	0.010	0.8	OK
3.002	S16	720 minute 2 year Winter I+0%	65.425	64.491	0.000	1.302	3.4	OK
1.003	S13	720 minute 2 year Winter I+0%	65.425	64.491	0.000	1.609	8.2	OK
1.004	TANK	720 minute 2 year Winter I+0%	65.425	64.491	0.000	119.687	1.5	SURCHARGED
1.005	S14	720 minute 2 year Winter I+0%	66.000	64.490	0.000	3.187	1.3	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S10	30 minute 30 year Summer I+0%	65.725	64.825	0.000	0.079	9.1	OK
1.001	S11	960 minute 30 year Winter I+0%	65.725	64.738	0.000	0.276	3.1	OK
2.000	S15	30 minute 30 year Summer I+0%	65.650	64.795	0.000	0.159	28.2	OK
2.001	PI 2	960 minute 30 year Winter I+0%	65.700	64.738	0.000	1.798	4.3	OK
1.002	S12	960 minute 30 year Winter I+0%	65.575	64.738	0.000	5.980	7.4	SURCHARGED
3.000	ACO	960 minute 30 year Winter I+0%	65.525	64.738	0.000	0.025	2.6	OK
3.001	PI 3	960 minute 30 year Winter I+0%	65.500	64.738	0.000	0.743	2.6	SURCHARGED
4.000	IC5	960 minute 30 year Winter I+0%	65.550	64.739	0.000	0.045	1.2	SURCHARGED
5.000	IC6	960 minute 30 year Winter I+0%	65.425	64.739	0.000	0.049	1.2	SURCHARGED
3.002	S16	960 minute 30 year Winter I+0%	65.425	64.738	0.000	1.852	5.0	SURCHARGED
1.003	S13	960 minute 30 year Winter I+0%	65.425	64.738	0.000	2.193	12.5	SURCHARGED
1.004	TANK	960 minute 30 year Winter I+0%	65.425	64.738	0.000	260.607	1.5	SURCHARGED
1.005	S14	960 minute 30 year Winter I+0%	66.000	64.738	0.000	3.824	1.3	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S10	960 minute 99 year Winter I+0%	65.725	64.894	0.000	0.158	1.4	OK
1.001	S11	960 minute 99 year Winter I+0%	65.725	64.894	0.000	0.819	4.0	SURCHARGED
2.000	S15	960 minute 99 year Winter I+0%	65.650	64.894	0.000	0.271	4.3	OK
2.001	PI 2	960 minute 99 year Winter I+0%	65.700	64.894	0.000	3.233	5.5	SURCHARGED
1.002	S12	960 minute 99 year Winter I+0%	65.575	64.894	0.000	6.422	9.4	SURCHARGED
3.000	ACO	960 minute 99 year Winter I+0%	65.525	64.894	0.000	0.050	3.4	SURCHARGED
3.001	PI 3	960 minute 99 year Winter I+0%	65.500	64.894	0.000	0.984	3.3	SURCHARGED
4.000	IC5	960 minute 99 year Winter I+0%	65.550	64.895	0.000	0.070	1.5	SURCHARGED
5.000	IC6	960 minute 99 year Winter I+0%	65.425	64.895	0.000	0.074	1.5	SURCHARGED
3.002	S16	960 minute 99 year Winter I+0%	65.425	64.894	0.000	2.075	6.4	SURCHARGED
1.003	S13	960 minute 99 year Winter I+0%	65.425	64.894	0.000	2.416	15.7	SURCHARGED
1.004	TANK	960 minute 99 year Winter I+0%	65.425	64.894	0.000	351.143	1.6	SURCHARGED
1.005	S14	960 minute 99 year Winter I+0%	66.000	64.894	0.000	4.220	1.4	SURCHARGED

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	S10	1440 minute 100 year Winter I+40%	65.725	65.200	0.000	0.503	1.4	SURCHARGED
1.001	S11	1440 minute 100 year Winter I+40%	65.725	65.200	0.000	1.250	3.9	SURCHARGED
2.000	S15	1440 minute 100 year Winter I+40%	65.650	65.200	0.000	0.616	4.3	SURCHARGED
2.001	PI 2	1440 minute 100 year Winter I+40%	65.700	65.200	0.000	3.715	5.5	SURCHARGED
1.002	S12	1440 minute 100 year Winter I+40%	65.575	65.200	0.000	6.863	9.2	SURCHARGED
3.000	ACO	1440 minute 100 year Winter I+40%	65.525	65.200	0.000	0.099	3.3	SURCHARGED
3.001	PI 3	1440 minute 100 year Winter I+40%	65.500	65.200	0.000	1.330	3.3	SURCHARGED
4.000	IC5	1440 minute 100 year Winter I+40%	65.550	65.200	0.000	0.119	1.5	SURCHARGED
5.000	IC6	1440 minute 100 year Winter I+40%	65.425	65.200	0.000	0.123	1.5	FLOOD RISK
3.002	S16	1440 minute 100 year Winter I+40%	65.425	65.200	0.000	2.512	6.2	FLOOD RISK
1.003	S13	1440 minute 100 year Winter I+40%	65.425	65.200	0.000	2.854	15.4	FLOOD RISK
1.004	TANK	1440 minute 100 year Winter I+40%	65.425	65.199	0.000	528.635	1.7	FLOOD RISK
1.005	S14	1440 minute 100 year Winter I+40%	66.000	65.200	0.000	4.998	1.6	SURCHARGED

STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	22.500	0.225	100.0	0.010	15.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	24.750	0.165	150.0	0.120	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	63.000	0.420	150.0	0.055	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	50.000	0.500	100.0	0.055	15.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	60.000	0.300	200.0	0.125	15.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	10.000	0.050	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	7.500	0.075	100.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.002	12.000	0.060	200.0	0.120	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	13.000	0.065	200.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	60.000	0.200	300.0	0.185	15.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.002	5.000	0.050	100.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	27.500	0.550	50.0	0.080	15.00	0.0	0.600	o	150	Pipe/Conduit	
4.003	15.000	0.150	100.0	0.000	0.00	0.0	0.600	o	300	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)
1.000	70.00	15.37	65.075	0.010	0.0	0.0	0.0	1.00	17.8	2.5
1.001	70.00	15.70	64.700	0.130	0.0	0.0	0.0	1.28	90.6	32.9
1.002	70.00	16.51	64.535	0.185	0.0	0.0	0.0	1.28	90.6	46.8
2.000	70.00	15.83	64.900	0.055	0.0	0.0	0.0	1.00	17.8	13.9
3.000	70.00	16.09	64.525	0.125	0.0	0.0	0.0	0.92	36.6	31.6
3.001	70.00	16.27	64.225	0.125	0.0	0.0	0.0	0.92	36.6	31.6
2.001	70.00	16.34	64.175	0.180	0.0	0.0	0.0	1.81	200.1	45.5
2.002	70.00	16.49	64.100	0.300	0.0	0.0	0.0	1.28	141.1	75.8
1.003	70.00	16.68	64.040	0.485	0.0	0.0	0.0	1.28	141.1	122.6
4.000	70.00	16.11	64.475	0.185	0.0	0.0	0.0	0.90	63.8	46.8
4.001	70.00	16.16	64.275	0.185	0.0	0.0	0.0	1.57	111.1	46.8
4.002	70.00	16.21	64.175	0.185	0.0	0.0	0.0	1.57	111.1	46.8
5.000	70.00	15.32	64.675	0.080	0.0	0.0	0.0	1.43	25.2	20.2
4.003	70.00	16.37	64.125	0.265	0.0	0.0	0.0	1.57	111.1	67.0

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)	Section Type	Auto Design
1.004	7.500	0.075	100.0	0.000	0.00	0.0	0.600	o	225	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)
1.004	70.00	16.78	63.975	0.750	0.0	0.0	0.0	1.31	52.0«	189.6

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.010	0.010	0.010
1.001	-	-	100	0.120	0.120	0.120
1.002	-	-	100	0.055	0.055	0.055
2.000	-	-	100	0.055	0.055	0.055
3.000	-	-	100	0.125	0.125	0.125
3.001	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.120	0.120	0.120
1.003	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.185	0.185	0.185
4.001	-	-	100	0.000	0.000	0.000
4.002	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.080	0.080	0.080
4.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.750	0.750	0.750

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)
1.004	Watercourse	65.500	63.900	0.000	0	0

Online Controls for Storm

Complex Manhole: S20, DS/PN: 1.004, Volume (m³): 5.2

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0063-2100-1425-2100
Design Head (m)	1.425
Design Flow (l/s)	2.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	63
Invert Level (m)	63.975
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.425	2.1	Kick-Flo®	0.565	1.4
Flush-Flo™	0.277	1.7	Mean Flow over Head Range	-	1.7

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	1.4	1.200	1.9	3.000	3.0	7.000	4.4
0.200	1.7	1.400	2.1	3.500	3.2	7.500	4.5
0.300	1.7	1.600	2.2	4.000	3.4	8.000	4.7
0.400	1.7	1.800	2.3	4.500	3.6	8.500	4.8
0.500	1.5	2.000	2.4	5.000	3.7	9.000	4.9
0.600	1.4	2.200	2.6	5.500	3.9	9.500	5.1
0.800	1.6	2.400	2.7	6.000	4.1		
1.000	1.8	2.600	2.8	6.500	4.2		

Weir

Discharge Coef 0.544 Width (m) 1.800 Invert Level (m) 65.400

Storage Structures for Storm

Complex Manhole: TANK, DS/PN: 2.002

Cellular Storage

Invert Level (m) 64.100 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	200.0	0.0	0.401	0.0	0.0
0.400	200.0	0.0			

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	16.1
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	447.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.40	Evaporation (mm/day)	3
Invert Level (m)	64.500	Cap Volume Depth (m)	0.700

Porous Car Park Manhole: IC7, DS/PN: 5.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	40.0
Max Percolation (l/s)	111.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.40	Evaporation (mm/day)	3
Invert Level (m)	65.025	Cap Volume Depth (m)	0.425

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	RE	1.046	0.376	0.000	1.423
1.001	S17	1.470	1.665	0.000	3.135
1.002	S18	1.629	4.363	0.000	5.992
2.000	S21	1.074	0.861	0.000	1.935
3.000	S23	1.301	2.338	0.000	3.639
3.001	S24	1.640	0.347	0.000	1.987
2.001	S22	2.183	0.679	0.000	2.862
2.002	TANK	2.290	1.176	526.863	530.330
1.003	S19	2.662	1.287	0.000	3.949
4.000	S25	1.216	4.156	0.000	5.372
4.001	S26	1.442	0.269	0.000	1.711
4.002	PI 4	1.696	0.269	0.000	1.965
5.000	IC7	1.131	0.465	68.000	69.596
4.003	S27	1.810	0.970	0.000	2.780
1.004	S20	2.899	0.271	0.000	3.170

Volume Summary (Static)

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
Total		25.489	19.492	594.863	639.844

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
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
Return Period(s) (years) 2, 30, 99, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	RE	30 minute 2 year Summer I+0%	66.000	65.097	0.000	0.019	0.9	OK
1.001	S17	15 minute 2 year Summer I+0%	66.000	64.797	0.000	0.104	18.1	OK
1.002	S18	15 minute 2 year Summer I+0%	65.975	64.648	0.000	0.287	25.2	OK
2.000	S21	30 minute 2 year Summer I+0%	65.850	64.953	0.000	0.055	4.8	OK
3.000	S23	30 minute 2 year Summer I+0%	65.675	64.610	0.000	0.091	10.8	OK
3.001	S24	600 minute 2 year Winter I+0%	65.675	64.570	0.000	2.102	2.1	SURCHARGED
2.001	S22	600 minute 2 year Winter I+0%	65.700	64.570	0.000	1.062	2.9	SURCHARGED
2.002	TANK	600 minute 2 year Winter I+0%	65.700	64.570	0.000	122.359	1.4	SURCHARGED
1.003	S19	600 minute 2 year Winter I+0%	65.900	64.570	0.000	5.009	1.4	SURCHARGED
4.000	S25	30 minute 2 year Summer I+0%	65.550	64.590	0.000	0.125	15.8	OK
4.001	S26	600 minute 2 year Winter I+0%	65.550	64.570	0.000	3.040	3.3	OK
4.002	PI 4	600 minute 2 year Winter I+0%	65.675	64.570	0.000	0.704	3.3	SURCHARGED
5.000	IC7	30 minute 2 year Summer I+0%	65.675	64.730	0.000	0.056	7.0	OK
4.003	S27	600 minute 2 year Winter I+0%	65.725	64.570	0.000	1.075	4.7	SURCHARGED
1.004	S20	600 minute 2 year Winter I+0%	66.000	64.569	0.000	3.101	1.7	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	RE	30 minute 30 year Summer I+0%	66.000	65.109	0.000	0.033	2.0	OK
1.001	S17	15 minute 30 year Summer I+0%	66.000	64.899	0.000	0.229	55.0	OK
1.002	S18	15 minute 30 year Summer I+0%	65.975	64.831	0.000	1.532	70.6	OK
2.000	S21	30 minute 30 year Summer I+0%	65.850	64.987	0.000	0.093	11.1	OK
3.000	S23	960 minute 30 year Winter I+0%	65.675	64.820	0.000	0.328	2.9	SURCHARGED
3.001	S24	960 minute 30 year Winter I+0%	65.675	64.819	0.000	3.004	2.9	SURCHARGED
2.001	S22	960 minute 30 year Winter I+0%	65.700	64.819	0.000	1.846	4.1	SURCHARGED
2.002	TANK	960 minute 30 year Winter I+0%	65.700	64.819	0.000	283.014	1.6	SURCHARGED
1.003	S19	960 minute 30 year Winter I+0%	65.900	64.819	0.000	6.617	1.6	SURCHARGED
4.000	S25	60 minute 30 year Summer I+0%	65.550	65.024	0.000	0.615	33.2	SURCHARGED
4.001	S26	60 minute 30 year Summer I+0%	65.550	64.942	0.000	4.905	33.1	SURCHARGED
4.002	PI 4	60 minute 30 year Summer I+0%	65.675	64.860	0.000	1.038	33.1	SURCHARGED
5.000	IC7	30 minute 30 year Summer I+0%	65.675	64.974	0.000	0.332	15.6	SURCHARGED
4.003	S27	960 minute 30 year Winter I+0%	65.725	64.819	0.000	1.510	5.9	SURCHARGED
1.004	S20	960 minute 30 year Winter I+0%	66.000	64.818	0.000	3.457	1.7	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	RE	15 minute 99 year Summer I+0%	66.000	65.118	0.000	0.043	2.5	OK
1.001	S17	15 minute 99 year Summer I+0%	66.000	65.114	0.000	0.760	62.4	SURCHARGED
1.002	S18	15 minute 99 year Summer I+0%	65.975	65.004	0.000	2.175	85.4	SURCHARGED
2.000	S21	30 minute 99 year Summer I+0%	65.850	65.005	0.000	0.113	14.4	OK
3.000	S23	960 minute 99 year Winter I+0%	65.675	64.984	0.000	0.513	3.7	SURCHARGED
3.001	S24	960 minute 99 year Winter I+0%	65.675	64.982	0.000	3.189	3.6	SURCHARGED
2.001	S22	960 minute 99 year Winter I+0%	65.700	64.982	0.000	2.330	5.2	SURCHARGED
2.002	TANK	960 minute 99 year Winter I+0%	65.700	64.982	0.000	388.332	2.6	SURCHARGED
1.003	S19	960 minute 99 year Winter I+0%	65.900	64.988	0.000	6.889	2.2	SURCHARGED
4.000	S25	120 minute 99 year Summer I+0%	65.550	65.123	0.000	0.727	33.7	SURCHARGED
4.001	S26	120 minute 99 year Summer I+0%	65.550	65.043	0.000	5.020	33.6	SURCHARGED
4.002	PI 4	960 minute 99 year Winter I+0%	65.675	64.984	0.000	1.178	5.4	SURCHARGED
5.000	IC7	30 minute 99 year Summer I+0%	65.675	65.041	0.000	3.044	16.7	SURCHARGED
4.003	S27	960 minute 99 year Winter I+0%	65.725	64.985	0.000	1.701	7.7	SURCHARGED
1.004	S20	960 minute 99 year Winter I+0%	66.000	64.989	0.000	3.701	1.8	SURCHARGED

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	2013
Site Location	GB 457460 221065 SP 57460 21065
Data Type	Point
Cv (Summer)	0.900
Cv (Winter)	0.900

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
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
Return Period(s) (years)	2, 30, 99, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Flooded Volume (m³)	Maximum Vol (m³)	Pipe Flow (l/s)	Status
1.000	RE	15 minute 100 year Summer I+40%	66.000	65.612	0.000	0.602	9.0	SURCHARGED
1.001	S17	15 minute 100 year Summer I+40%	66.000	65.621	0.000	1.413	83.4	SURCHARGED
1.002	S18	15 minute 100 year Summer I+40%	65.975	65.436	0.000	2.678	115.2	SURCHARGED
2.000	S21	1440 minute 100 year Winter I+40%	65.850	65.377	0.000	0.534	1.7	SURCHARGED
3.000	S23	1440 minute 100 year Winter I+40%	65.675	65.378	0.000	0.959	3.7	FLOOD RISK
3.001	S24	1440 minute 100 year Winter I+40%	65.675	65.376	0.000	3.634	3.7	FLOOD RISK
2.001	S22	1440 minute 100 year Winter I+40%	65.700	65.375	0.000	2.919	5.3	SURCHARGED
2.002	TANK	1440 minute 100 year Winter I+40%	65.700	65.375	0.000	529.361	2.0	SURCHARGED
1.003	S19	1440 minute 100 year Winter I+40%	65.900	65.374	0.000	7.442	2.7	SURCHARGED
4.000	S25	1440 minute 100 year Winter I+40%	65.550	65.375	0.000	1.012	5.5	FLOOD RISK
4.001	S26	1440 minute 100 year Winter I+40%	65.550	65.374	0.000	5.394	5.5	FLOOD RISK
4.002	PI 4	1440 minute 100 year Winter I+40%	65.675	65.374	0.000	1.619	5.5	SURCHARGED
5.000	IC7	1440 minute 100 year Winter I+40%	65.675	65.372	0.000	56.271	2.4	SURCHARGED
4.003	S27	1440 minute 100 year Winter I+40%	65.725	65.374	0.000	2.140	7.8	SURCHARGED
1.004	S20	1440 minute 100 year Winter I+40%	66.000	65.374	0.000	4.252	2.1	SURCHARGED

APPENDIX J

Estimated FW Flow Calculations

By Bailey Johnson Hayes (March 24)

S1358/240326/WB/JG

BAILEY JOHNSON HAYES CONSULTING ENGINEERS

Catalyst Bicester (DL + Phases 1-4)
Estimated FW Flows, Rising Main & Storage Calculations

Calculations by: James Griffiths Checked by: Bill Bailey

Estimated FW Domestic Flows:-

David Lloyd:-

- Private agreement to provide an allowance of **3.0 litres/sec** (DWF) and **20.0 litres/sec** Peak (6 DWF).

Phase 1:-

• Units 1-3 –	GF Commercial (GIA)	= 2,379m²	@300 litres/day/100m²	= 7,137 l/day
	FF Office (GIA)	= 1,201m²	@750 litres/day/100m²	= 9,008 l/day
• Unit 4 –	GF Commercial (GIA)	= 1,584m²	@300 litres/day/100m²	= 4,752 l/day
	FF Office (GIA)	= 446m²	@750 litres/day/100m²	= 3,345 l/day
			Total	**= 24,242 l/day**

Average DWF = 24,242 litres/day + 10% Infiltration = **0.309 litres/sec (1 DWF)**
Peak DWF = Equivalent to 37 Dwellings = **1.852 litres/sec (6 DWF)**

Phase 2:-

• Unit 5 –	GF Commercial (GIA)	= 1,547m²	@300 litres/day/100m²	= 4,641 l/day
	FF Office (GIA)	= 706m²	@750 litres/day/100m²	= 5,295 l/day
• Unit 6 –	GF Commercial (GIA)	= 1,925m²	@300 litres/day/100m²	= 5,775 l/day
	FF Office (GIA)	= 877m²	@750 litres/day/100m²	= 6,578 l/day
• Unit 7 –	GF Commercial (GIA)	= 1,925m²	@300 litres/day/100m²	= 5,775 l/day
	FF Office (GIA)	= 877m²	@750 litres/day/100m²	= 6,578 l/day
• Unit 8 –	GF Commercial (GIA)	= 2,517m²	@300 litres/day/100m²	= 7,551 l/day
	FF Office (GIA)	= 1,128m²	@750 litres/day/100m²	= 8,460 l/day
			Total	**= 50,653 l/day**

Average DWF = 50,653 litres/day + 10% Infiltration = **0.645 litres/sec (1 DWF)**
Peak DWF = Equivalent to 76 Dwellings = **3.869 litres/sec (6 DWF)**

Phase 3:-

• Unit 9 –	GF Commercial (GIA)	= 2,234m²	@300 litres/day/100m²	= 6,702 l/day
	FF Office (GIA)	= 958m²	@750 litres/day/100m²	= 7,185 l/day
• Unit 10 –	GF Commercial (GIA)	= 1,139m²	@300 litres/day/100m²	= 3,417 l/day
	FF Office (GIA)	= 380m²	@750 litres/day/100m²	= 2,850 l/day
• Unit 11 –	GF Commercial (GIA)	= 1,190m²	@300 litres/day/100m²	= 3,570 l/day
	FF Office (GIA)	= 397m²	@750 litres/day/100m²	= 2,978 l/day
• Unit 12 –	GF Commercial (GIA)	= 2,728m²	@300 litres/day/100m²	= 8,184 l/day
	FF Office (GIA)	= 1,169m²	@750 litres/day/100m²	= 8,768 l/day
			Total	**= 43,654 l/day**

Average DWF = 43,654 litres/day + 10% Infiltration = **0.556 litres/sec (1 DWF)**
Peak DWF = Equivalent to 65 Dwellings = **3.335 l/sec (6 DWF)**

Phase 4:-

• Unit 13 –	GF Commercial (GIA)	= 2,493m^2	@300 litres/day/100m^2	= 7,479 l/day
	FF+SF Office (GIA)	= 2,081m^2	@750 litres/day/100m^2	= 15,608 l/day
• Unit 14 –	GF Commercial (GIA)	= 1,693m^2	@300 litres/day/100m^2	= 5,079 l/day
	FF+SF Office (GIA)	= 1,431m^2	@750 litres/day/100m^2	= 10,733 l/day
• Unit 15 –	GF Commercial (GIA)	= 2,411m^2	@300 litres/day/100m^2	= 7,233 l/day
	FF+SF Office (GIA)	= 1,757m^2	@750 litres/day/100m^2	= 13,178 l/day
			Total	**= 59,310 l/day**

Average DWF = 59,310 litres/day + 10% Infiltration = **0.755 litres/sec (1 DWF)**
Peak DWF = Equivalent to 89 Dwellings = **4.531 l/sec (6 DWF)**

Phases 1-4:-

Average DWF = 177,859 litres/day + 10% Infiltration = **2.264 litres/sec (1 DWF)**
Peak DWF = Equivalent to 267 Dwellings = **13.6 l/sec (6 DWF)**

Phases 1-4 + David Lloyd:-

Average DWF = 437,059 litres/day + 10% Infiltration = **5.564 litres/sec (1 DWF)**
Peak DWF = Equivalent to 679 Dwellings = **33.6 l/sec (6 DWF)**

Existing Pump Main Design:-

Length of Rising Main = 940.80m
Discharge Point of Rising Main = 65.800m
Diameter of Rising Main = 160mm Outside Diameter (140.3mm Internal Bore)
Rising Main Material = PE100
Rising Main Strength Class = SDR17
Pump Duty = 30 l/sec

Storage within Wet Well & Offline Tank :-

Storage available within wet well between H.L.A and upper limit level:-

Chamber Diameter = 1.800m
Upper Limit Level = 63.150m
High Level Alarm 60.650m
Storge available in Wet Well = 6.36m^3
Storge available in Offline Tank = 3No. 2.5m Diameter 14m Long Tanks = 206m^3
Total Storage provided = 212.36m^3 + Upstream storage

Total storage required = 24 hours of flows* = 250 m^3 < 212.36m^3 + Upstream storage - Considered OK.
*Full 24 hour provision made for Phases 1-4. 1hr of peak emergency storage for David Lloyd.