Drainage Design
Fleet House
Upnor Road
Lower Upnor
ME2 4UP

Fleet House

20th March 2024

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1. Introduction

The following drainage design report has been produced to discharge Condition 15 of planning permission MC/22/2813 at Fleet House, Upnor Road, Lower Upnor, ME2 4UP.

Condition 15 states:

No development shall take place until a scheme showing details of the disposal of surface water, based on sustainable drainage principles, including details of the design, implementation, maintenance, and management of the surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority in consultation with the Lead Local Flood Authority.

i. *Details of the design of the scheme (in conjunction with the landscaping plan where applicable).*
ii. *A timetable for its implementation (including phased implementation).*
iii. *Operational maintenance and management plan including access requirements for each sustainable drainage component.*
iv. *Proposed arrangements for future adoption by any public body, statutory undertaker or management company.*

The development shall be undertaken in accordance with the agreed scheme.

Reason: To manage surface water during and post construction and for the lifetime of the development as outlined at Paragraph 165 of NPPF.

2. Site Characteristics

Location - The site is situated between Upnor Road and Galleon Way, Figure 1.

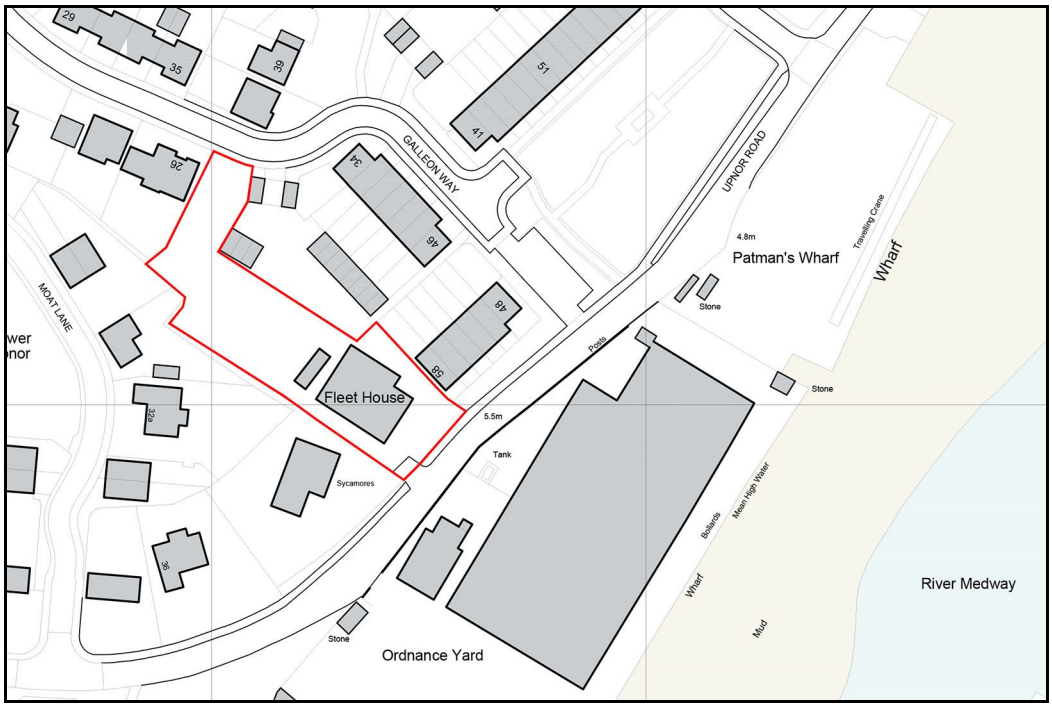


Figure 1. Site Location.

Topography - A topographical survey has been undertaken. Contours have been derived from Lidar data, Figure 2. The site slopes towards Upnor Road.

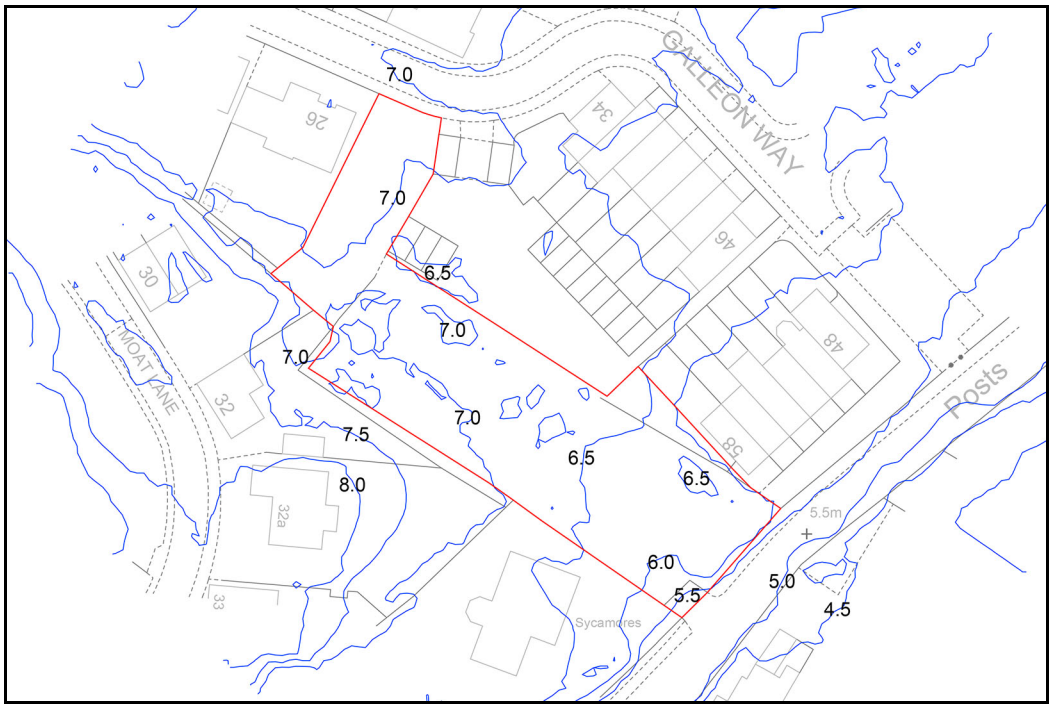


Figure 2. Topography.

Geology and Soils - The bedrock geology consists of the Thanet Formation, sand, silt and clay. There are no superficial deposits recorded at the site.

Soils are classified as freely draining soils draining to local groundwater and rivers.

A borehole sunk at Upchat Road, 260m southwest of the site, indicates Made Ground to a depth of 2m.

A borehole sunk 300m northeast of the site, indicates Made Ground to a depth of 4m.

Groundwater - A borehole sunk 300m northeast of the site, indicates a standing groundwater level 5.5m below ground level.

Watercourses - The River Medway is 80m to the southeast of the site.

Site Investigation - Site investigation was carried out in October 2022 by R. CARR Geotechnical Services.

The Phase 2 Report on Subsoil Investigations Revised August 2023 states:

7. Discussion/Recommendations

7.1 The investigation has revealed that the majority of the site is underlain by Fill material extending to depths in the order of 3.1m to 4.5m. Below the base of superficial site surfacing the Fill was of a clean appearance, containing scarce evidence of foreign or biodegradable matter. The soil was visually difficult to distinguish from natural occurring Thanet Sand deposits and probably represents reject silty sand historically quarried in the local area. However, low penetration values recorded by the in-situ soil strength tests confirmed the identity of the Fill and did not significantly increase until the naturally occurring Thanet Sand was penetrated.

7.2 Groundwater seepages were encountered in three of the boreholes at a depth of around 3.5m. The hydrogeology of the site may however be susceptible to seasonal variations and also possibly to tidal fluctuations of the nearby River Medway.

Revised Risk Assessment

7.5 The results of the contamination tests have revealed elevated concentrations of Lead that could present a risk to human health and plant life within the superficial site surfacing material. It is likely that Lead contamination may exist elsewhere on the site. Although not injurious to human health, slightly excessive concentrations of Zinc may also present a risk to plants. Remediation will therefore be necessary in areas of proposed garden.

7.6 A low risk has been identified to groundwater as excessive contamination is not widespread across the site and is confined within the superficial soil layer.

7.7 The investigation has revealed significant quantities of made ground beneath the site surface, though the infill material is of natural derivation with no biodegradable matter. TOC was within 0.3% below the superficial soil layer and only marginal traces of TPH were detected locally within the superficial soil. A low risk is therefore considered applicable to the site from emissions of ground gases.

Remediation Method Statement

7.9 It is recommended that in areas of proposed garden the Fill material should be excavated to a depth of 600mm below finished site level and replaced with clean soil. The cover layer should include a capping of at least 300mm of imported topsoil which has been tested in order to ensure that it is free from contamination. Photographs of the reduced site levels should be retained as evidence that this procedure has been undertaken and for inclusion within a Closure Report for the site. Remediation of garden

areas could only be undertaken following the removal of site surfacing, with the subsequent placement of imported topsoil during the latter stages of the development.

Infiltration to ground has been discounted for the following reasons:

- Significant depths of fill.
- The recommendation that garden areas should be remediated.

Rainfall Data - Point rainfall data has been obtained from the Flood Estimation Handbook (FEH) Web Service. The FEH 2022 XML rainfall data has been used in the surface water drainage design. This provides rainfall data for return periods greater than 2 years.

Climate Change - The Environment Agency provides peak rainfall climate change allowances by management catchment. The Medway Management Catchment peak rainfall allowances for the 2050s and 2070s are shown in Table 1.

Annual Exceedance Event	Central Allowance	Upper End Allowance
2050s		
3.3%	20%	35%
1%	20%	45%
2070s		
3.3%	20%	35%
1%	20%	40%

Table 1. Peak rainfall allowances.

The surface water calculations include increases of 20% and 45% in peak rainfall intensity for the sizing of structures.

Existing Site - The existing site covers 0.18ha. It is a brownfield site. The site is covered with 1,280m^2 of impermeable materials consisting of 270m^2 of roof area and 1,010m^2 of paved area, Figure 3. The peak rate of runoff and volume of runoff for the critical storm duration for the existing site, is shown in Table 2.

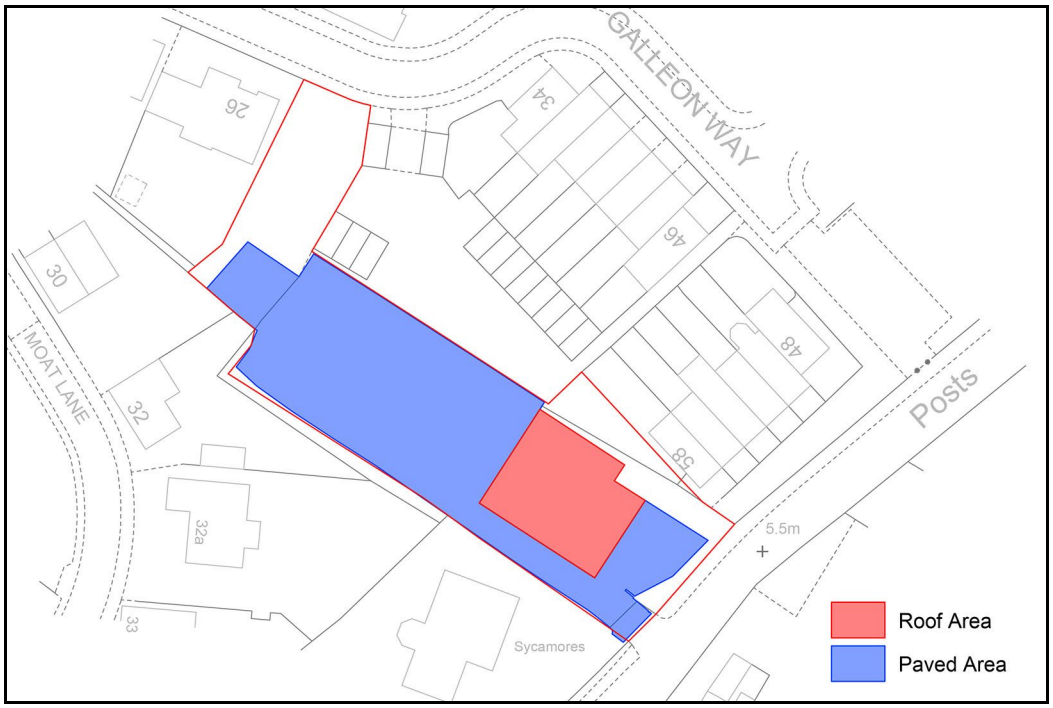


Figure 3. Existing impermeable areas.

Storm Return Period (years)	Peak Runoff (Q l/s)	Volume of Runoff 360 minute duration storm (m^3)
2	16	26
30	43	54
100	54	71
100 + 20%	65	85
100 + 45%	79	103

Table 2. Peak rate of runoff and volume of runoff from the existing site.

Greenfield Runoff Rate - The greenfield runoff rate for the critical storm duration for the site has been calculated using the IH124 method from the greenfield runoff rate estimation tool published online by HR Wallingford at uksuds.com. The peak runoff is shown in Table 3.

Return Period	Runoff Rate Q l/s per ha.
QBar	1.5
1	1.3
30	3.4
100	4.7

Table 3. Greenfield runoff rate for the site.

Sewer Record - The site is served by public foul and surface water sewers, Figure 4. The public sewer record is attached at Appendix A.

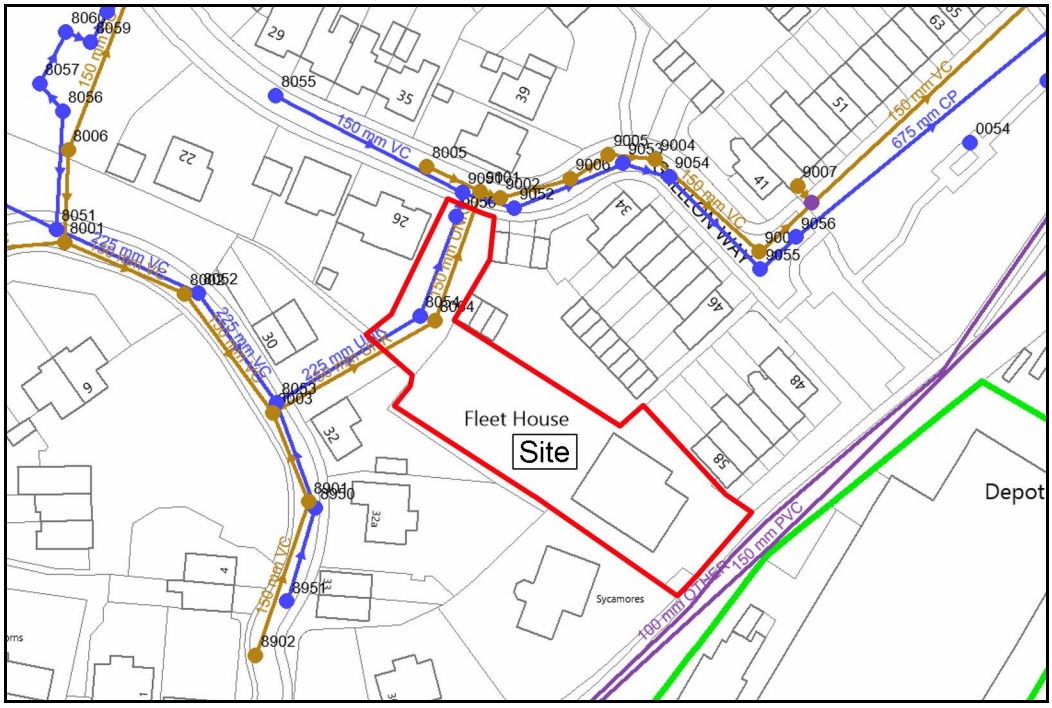


Figure 4. Public sewer record.

The sewers shown crossing the northern part of the site are no longer present.

Existing Drainage - A public surface water sewer enters the site at the northern end. Foul and surface water connections have been provided to the site along the rear of 48-58 Upnor Road, Figure 5. The existing drainage connection details are:

Public surface water sewer Galleon Way: Invert Level 5.76mAOD, depth 1.59m
Foul to the rear of 48-58 Upnor Road: Invert Level 5.865mAOD, depth 1.10m
Surface water to the rear of 48-58 Upnor Road: Invert Level 5.899mAOD, depth 0.67m

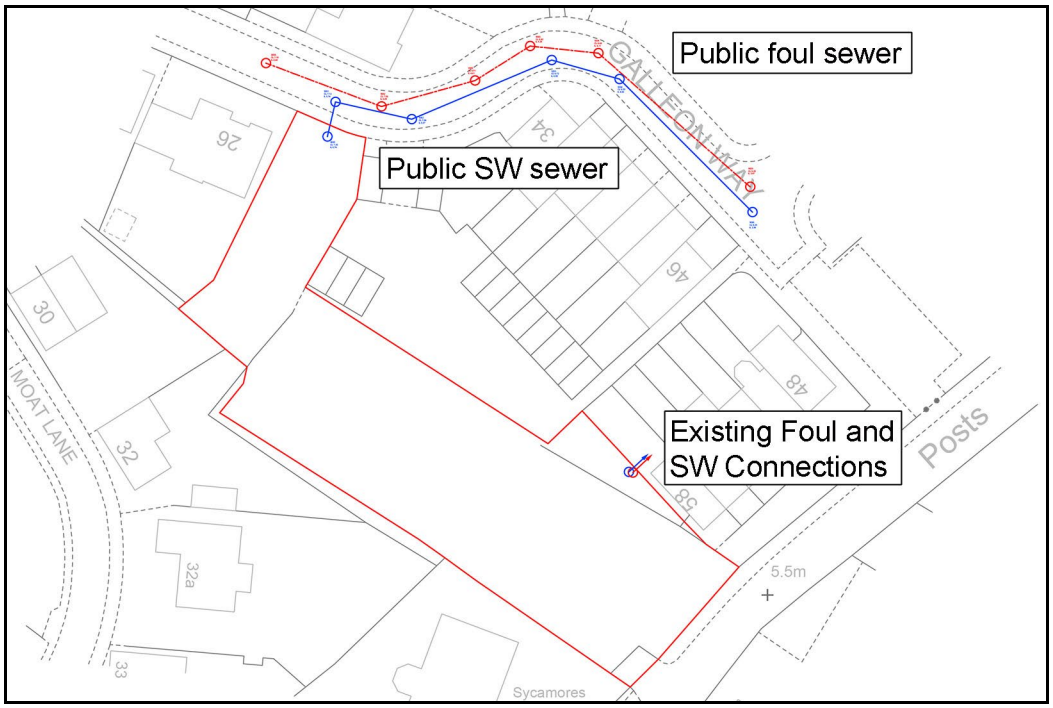


Figure 5. Existing drainage.

4. Foul Drainage

The foul drainage design is based on the detached northern plot connecting to the public foul sewer within Galleon Way and the remaining plots connecting to the foul connection provided to the site along the rear of 48-58 Upnor Road.

The foul drainage design is shown on the following drawings attached at Appendix B:

1262/201 Drainage Layout - Plot 9
1262/202 Drainage Layout - Plots 1 - 8

The foul drainage has been analysed using FLOW software published by Causeway. This analysis is attached at Appendix C.

5. Surface Water Drainage

Proposed Site - The site will be covered with 1,010m^2 of impermeable materials consisting of 520m^2 of roof area and 490m^2 of paved area, Figure 6. The peak rate of runoff and volume of runoff for the critical storm duration for the existing and proposed site is shown in Table 4.

Figure 6. Proposed impermeable areas.

Storm Return Period (years)	Peak Runoff (Q l/s)		Volume of Runoff 360 minute duration storm (m^3)	
	Existing (1,280m^2)	Proposed (1,010m^2)	Existing (1,280m^2)	Proposed (1,010m^2)
2	16	13	26	20
30	43	34	54	43
100	54	43	71	56
100 + 20%	65	52	85	67
100 + 40%	79	62	103	82

Table 4. Peak rate of runoff and volume of runoff from the existing and proposed site.

The proposed development reduces the impermeable area at the site.

Constraints - The following constraints have been identified for the surface water drainage design:

Infiltration to ground has been discounted for the following reasons:

- Significant depths of fill.
- The recommendation that garden areas should be remediated.

The existing surface water connection to the rear of 48-58 Upnor Road is only 0.67m deep with an invert level of 5.229mAOD. This is too shallow to allow a gravity connection from the following areas:

- The refuse stores and paving along Upnor Road
- An attenuated connection from the northeastern elevation of the apartment block.

Surface Water Drainage Strategy - The surface water drainage design is based on a limited discharge to the public surface water sewers. There are two connection points, to Galleon Way and to the rear of 48-58 Upnor Road. Each discharge point is limited to 2 l/s. Infiltration via subbase replacement crates for the refuse stores and paving along Upnor Road is proposed as it is not possible to connect these areas via gravity to the surface water sewers. The limited discharge to ground is considered acceptable given the lack of alternatives. An unattenuated connection to the surface water sewers is required from the rainwater pipes along the northeastern elevation of the apartment block due to the depth of the connection point and the limited space along this elevation.

The surface water drainage design is shown on the following drawings attached at Appendix B:

1262/201 Drainage Layout - Plot 9
1262/202 Drainage Layout - Plots 1 - 8

Surface water drainage has been analysed using FLOW software published by Causeway. This analysis is attached at Appendix D.

There is no flooding under the critical storm duration for the 1 in 100 year + 45% allowance for climate change event.

The peak runoff from the site is shown in Table 5. The proposed drainage strategy reduces runoff from the site by 83 - 92%.

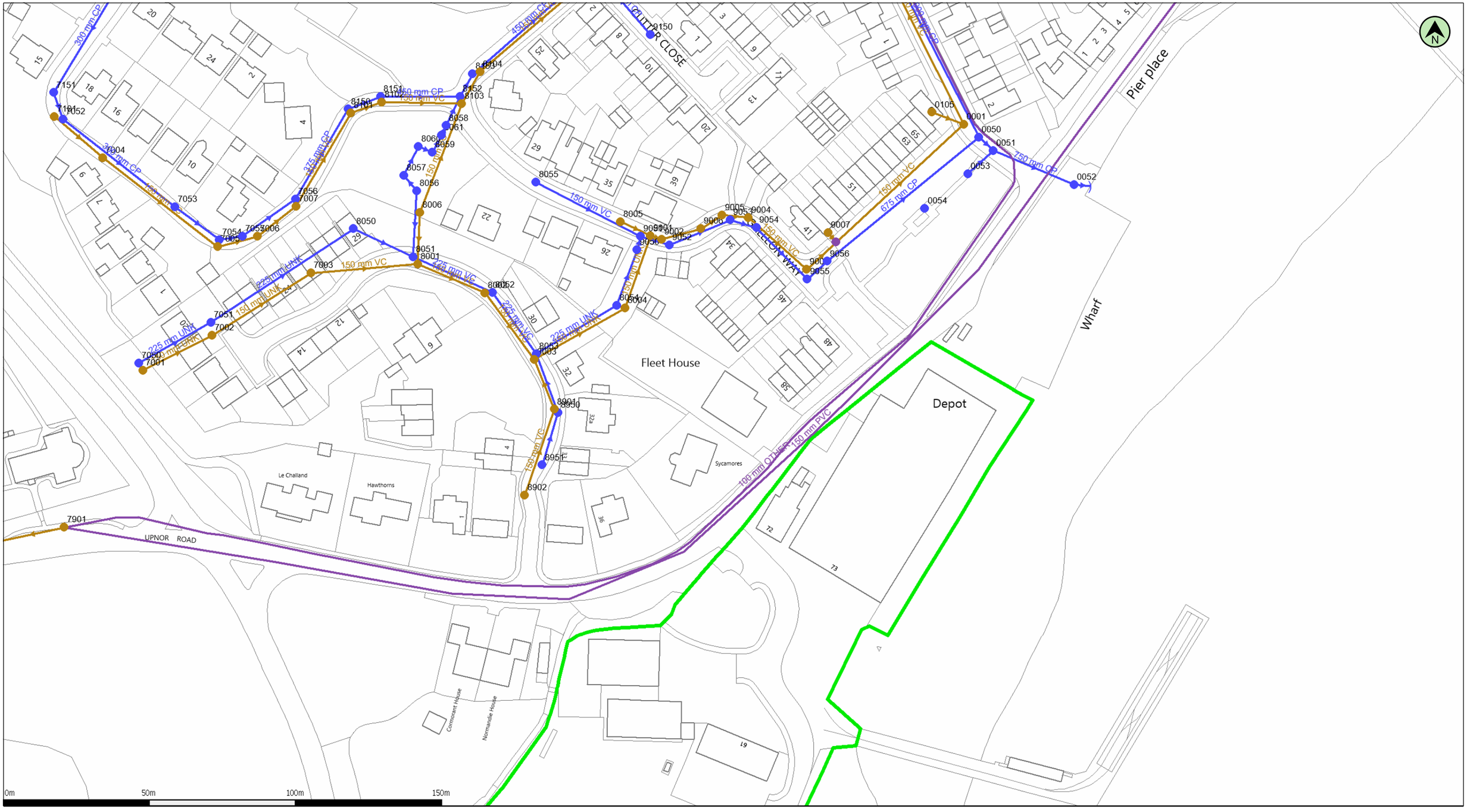
Storm Return Period (years)	Peak Runoff (Q l/s)			Reduction Compared to Existing (%)
	Existing (1,280m^2)	Proposed (1,010m^2)	Proposed with Mitigation (1,010m^2)	
2	16	13	2.7	83
30	43	34	4.7	89
100	54	43	5.4	90
100 + 20%	65	52	6.0	91
100 + 40%	79	62	6.7	92

Table 5. Peak rate of runoff from the existing and proposed site with mitigation.

5. Management and Maintenance

A Sustainable Urban Drainage Systems Management and Maintenance Plan is attached at Appendix E.

Appendix A - Public Sewer Record



Date: 12/04/22 | Scale: 1:1250 | Map Centre: 575935,171002 | Data updated: 21/03/22 | Our Ref: 829091 - 1 | Wastewater Plan A3

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2022 Ordnance Survey 100031673 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Foul Gravity Sewer
Combined Gravity Sewer
Culverted Water Course or Treated Effluent
Surface Water Gravity Sewer
Rising Main, Vacuum or Syphon
Combined Outfall
Surface Water Outfall
Foul Outfall
Surface Water Inlet
Combined Pumping Station
Surface Water Pumping Station
Foul Pumping Station
Water Treatment Works
Section 104 Area
Building Over Agreement Area
Foul Manhole
Combined Manhole
Surface Water Manhole
Side Entry Manhole, Decarcation Chamber, Dummy Manhole or Surface Water Soakaway

simon.stoate@lustreconsulting.com

Fleet House

WATER for LIFE from Southern Water

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
0001	F	5.87	2.95	
0105	F	0.00	0.00	
7001	F	9.11	7.37	
7002	F	8.46	5.72	
7003	F	8.18	6.40	
7004	F	8.35	6.84	
7005	F	7.76	5.78	
7006	F	7.65	5.65	
7007	F	7.58	5.32	
7101	F	8.74	7.37	
7901	F	15.00	13.04	
8001	F	8.02	5.50	
8002	F	7.82	5.65	
8003	F	7.64	5.85	
8004	F	7.18	5.53	
8005	F	7.18	4.68	
8006	F	7.95	5.12	
8101	F	8.00	5.07	
8102	F	8.07	5.00	
8103	F	7.90	4.70	
8104	F	7.89	4.59	
8901	F	8.05	5.98	
8902	F	7.74	6.34	
9001	F	7.09	4.55	
9002	F	7.06	4.49	
9003	F	6.26	3.47	
9004	F	6.68	4.11	
9005	F	6.80	4.26	
9006	F	6.91	4.41	
9007	F	0.00	0.00	
0050	S	5.67	3.17	
0051	S	5.41	3.16	
0052	S	5.41	2.96	
0053	S	5.63	3.45	
0054	S	5.80	3.74	
7050	S	9.16	7.72	
7051	S	8.48	7.06	
7052	S	8.62	6.82	
7053	S	7.93	6.17	
7054	S	7.71	5.94	
7055	S	7.64	5.92	
7056	S	7.57	5.77	
7151	S	8.76	7.12	
8050	S	8.30	6.51	
8051	S	8.05	6.32	
8052	S	7.85	6.50	
8053	S	7.60	6.69	
8054	S	7.18	5.89	
8055	S	7.63	6.25	
8056	S	8.33	6.02	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
8057	S	8.32	5.87	
8058	S	8.08	5.52	
8059	S	8.19	5.63	
8060	S	8.11	5.71	
8061	S	8.06	0.00	
8150	S	8.04	5.47	
8151	S	8.10	5.43	
8152	S	7.95	5.39	
8153	S	7.92	5.32	
8950	S	8.03	6.84	
8951	S	8.19	6.95	
9050	S	7.35	5.76	
9051	S	7.13	5.74	
9052	S	7.04	5.57	
9053	S	6.72	4.99	
9054	S	6.59	4.63	
9055	S	6.25	3.94	
9056	S	6.04	3.79	
9150	S	7.07	5.10	

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix B - **1262/201 Drainage Layout - Plot 9**

1262/202 Drainage Layout - Plots 1 - 8

Fleet House

Notes:

Please report all discrepancies, errors and omissions.

Verify all dimensions on site before commencing any work on site or preparing shop drawings.

All materials, components and workmanship are to comply with the relevant British Standards, Codes of Practice, and appropriate manufacturers recommendations that from time to time shall apply.

For all specialist work, see relevant drawings.

When this document is provided in electronic file format it is intended as a guide only and the recipient is to verify all dimensions and details with the Architects. If this is not acceptable, the files must be returned unused together with a written communication declining acceptance of this condition.

Key

- Public foul sewer
- Public SW sewer
- Foul drainage
- SW drainage
- Channel Drain
- RE — Rodding eye
- F1.000 / 100 / 80.0 / 2.000 — Reference / diameter / gradient / length
- Tree Protection
- No dig hard surfacing
- New wearing course over existing hardstanding

Levels based on topographical survey and finished floor levels.

8005
CL 7.18
IL 4.68

SW Drainage Notes

SW10_OUT is the existing public SW manhole 9050.

Connection to be made using a vitrified clay pipe.

Foul Drainage Notes

F4.003 is a connection to the existing public foul sewer manhole 9002.

Connection to be made using a vitrified clay pipe.

Attenuation and Control

Attenuation crates 2m x 3m x 0.4m deep.

SW10 orifice control manhole with 39mm Ø orifice. 100mm Ø overflow pipe with IL 6.250mAOD

SW3 and SW6 are silt traps

9005
CL 6.80
IL 4.26

9004
CL 6.68
IL 4.11

9006
CL 6.91
IL 4.41

9053
CL 6.72
IL 4.99

9054
CL 6.59
IL 4.63

F23_OUT
CL 7.060
IL 4.540
Depth 2.520m

9002
CL 7.06
IL 4.49

150Ø

9051
CL 7.13
IL 5.74

150Ø

9052
CL 7.04
IL 5.57

F4.003 / 100
2.9 / 0.721m

SW10
CL 7.250
IL 5.835
Depth 1.415m

9050
CL 7.35
IL 5.76

SW10_OUT
CL 7.250
IL 5.810
Depth 1.440m

SW3
CL 7.170
IL 5.821
Depth 1.349m

SW1.002
SW1.005
SW1.006
SW4
SW1.003
SW9
SW1.004
SW8
SW2.003
SW7
SW2.001

F23
CL 7.200
IL 6.494
Depth 0.706m

SW6
CL 7.170
IL 6.142
Depth 1.028m

SW2.000 / 100
92.5 / 4.780m

F4.002 / 100
79.8 / 5.992m

SW1.001 / 100
59.5 / 17.865m

SW5
CL 7.100
IL 6.650
Depth 0.450m

F22
CL 7.100
IL 6.568
Depth 0.532m

F4.001 / 100
39.2 / 4.515m

F4.000 / 100
39.9 / 1.947m

F21
CL 7.100
IL 6.625
Depth 0.475m

F20
CL 7.100
IL 6.650
Depth 0.450m

SW2
CL 7.100
IL 6.484
Depth 0.616m

SW1.000 / 100
56.6 / 9.401m

SW1
CL 7.100
IL 6.650
Depth 0.450m

SW4 CL 7.170 IL 5.855 Depth 1.315m	Connection to attenuation crates	SW1.002 / 100 14.9 / 1.727m
		SW1.003 / 100 0.0 / 1.500m — Represents the attenuation crates
SW7 CL 7.170 IL 5.855 Depth 1.315m	Connection to attenuation crates	SW1.004 / 100 0.0 / 1.000m — Represents the attenuation crates
SW8 CL 7.170 IL 5.855 Depth 1.315m	Attenuation crates	SW1.005 / 100 60.0 / 1.200m
		SW1.006 / 100 60.0 / 1.500m
SW9 CL 7.200 IL 5.855 Depth 1.345m	Connection to attenuation crates	SW2.001 / 100 2.7 / 1.200m
		SW2.002 / 100 0.0 / 2.974m — Represents the attenuation crates

F2
CL 7.000
IL 6.251
Depth 0.749m

F1.001 / 100
39.9 / 6.387m

F1.000 / 100
39.9 / 5.606m

SW1.001 / 100
39.4 / 12.245m

SW2
CL 7.000
IL 6.345
Depth 0.655m

F3
CL 7.000
IL 6.091
Depth 0.909m

F1.002 / 100
40.0 / 5.354m

F4
CL 7.000
IL 5.957
Depth 1.043m

F1
CL 7.000
IL 6.400
Depth 0.600m

SW1.000 / 100
74.1 / 2.187m

F5
CL 7.075
IL 5.891
Depth 1.184m

003 / 100
2.835m

SW3
CL 7.000

Attenuation and Control

Attenuation crates 8m x 9m x 0.4m deep.

SW14 HydroBrake control manhole CTL_SHE-0075-2000-0500-2000.

Plot 9

FFL=7.100

FFL=7.250

FFL=7.150

Rev.

0 5m

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client	Fleet House	drawing	Drainage Layout - Plot 9
project	Fleet House Upnor Road Lower Upnor ME2 4UP	scale	1:100 @ A1
		drawing no.	1262/201
		date	March 2024
		drawn by	RB

Drainage Layout - Plot 9
Fleet House, Upnor Road, Lower Upnor, ME2 4UP

Fleet House

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- RE — Rodding eye
- F1.000 / 100 / 80.0 / 2.000 — Reference / diameter gradient / length
- Tree Protection
- No dig hard surfacing
- New wearing course over existing hardstanding

Levels based on topographical survey and finished floor levels.

F1 CL 7.000 IL 6.400 Depth 0.600m

F2 CL 7.000 IL 6.251 Depth 0.749m

SW2 CL 7.000 IL 6.345 Depth 0.655m

F3 CL 7.000 IL 6.091 Depth 0.909m

F4 CL 7.000 IL 5.957 Depth 1.043m

F5 CL 7.075 IL 5.891 Depth 1.184m

SW3 CL 7.000 IL 6.139 Depth 0.861m

F6 CL 7.075 IL 5.808 Depth 1.267m

F7 CL 7.000 IL 6.550 Depth 0.450m

SW1 CL 7.000 IL 6.550 Depth 0.450m

SW5 CL 7.090 IL 5.582 Depth 1.508m

F8 CL 7.000 IL 6.410 Depth 0.590m

SW6 CL 7.000 IL 5.402 Depth 1.598m

F9 CL 7.000 IL 6.250 Depth 0.750m

F12 CL 7.075 IL 5.715 Depth 1.360m

F11 CL 7.075 IL 6.058 Depth 1.017m

SW4 CL 7.100 IL 6.650 Depth 0.450m

F10 CL 7.000 IL 6.116 Depth 0.884m

SW7 CL 6.630 IL 5.402 Depth 1.228m

SW8 CL 6.550 IL 5.402 Depth 1.148m

SW12 CL 6.150 IL 5.047 Depth 1.103m

F14 CL 6.150 IL 5.096 Depth 1.054m

F13 CL 6.650 IL 5.450 Depth 1.200m

F15 CL 6.225 IL 5.022 Depth 1.203m

SW13 CL 6.225 IL 5.325 Depth 0.900m

SW14 CL 6.380 IL 5.367 Depth 1.013m

F16 CL 6.225 IL 4.979 Depth 1.246m

F17 CL 6.150 IL 4.897 Depth 1.253m

SW15 CL 6.150 IL 5.279 Depth 0.871m

SW15_OUT CL 6.150 IL 5.267 Depth 0.883m

F19 CL 6.150 IL 4.815 Depth 1.335m

F19_OUT CL 6.150 IL 4.795 Depth 1.355m

F18 CL 6.150 IL 5.700 Depth 0.450m

SW11 CL 6.150 IL 5.668 Depth 0.482m

SW10 CL 6.150 IL 5.707 Depth 0.443m

SW9 CL 6.225 IL 5.775 Depth 0.450m

SW3 CL 5.625 IL 5.175 Depth 0.450m

SW1 CL 6.150 IL 4.793 Depth 1.357m

SW3_OUT CL 5.585 IL 5.175 Depth 0.410m

SW2 CL 6.150 IL 4.793 Depth 1.357m

SW1_OUT CL 5.640 IL 4.840 Depth 0.800m

SW1 CL 5.490 IL 4.840 Depth 0.650m

Attenuation and Control

Attenuation crates 8m x 9m x 0.4m deep.

SW14 HydroBrake control manhole CTL_SHE-0075-2000-0500-2000.

100mm Ø overflow pipe with IL 5.900mAOD

SW5, SW12 and SW13 are silt traps

Car Parking Area

Car park area drained to attenuation storage crates. Final connection mechanism to be designed once external surfaces have been specified.

SW Drainage Notes

SW15 is an existing manhole.

SW1.008 and SW15_OUT represent existing drainage and are not to be constructed.

Confirmation of which manhole is on the SW run to be made before connection.

Rainwater pipes along northeast face to be connected directly to the existing drainage.

Foul Drainage Notes

F19 is an existing manhole.

F1.012 and F19_OUT represent existing drainage and are not to be constucted.

Confirmation of which manhole is on the foul run to be made before connection.

Channel drain with sump connected to SW11

Channel drain with sump connected to subbase replacement crates.

Soakaway (Detail A)

Soakaway subbase replacement crates 1.416m x 3.540m x 0.150m deep.

Design based on assumed infiltration rate of 1x 10^{-5} m/s. To be checked on site before construction.

SW1 and SW2 are silt traps

Soakaway (Detail B)

Soakaway subbase replacement crates 2.124m x 4.958m x 0.150m deep with 300mm coarse graded aggregate above.

Design based on assumed infiltration rate of 1x 10^{-5} m/s. To be checked on site before construction.

Plot 8 · Plot 7 · Plots 1 - 6 · Sycamores

FFL=7.150 · FFL=7.000 · FFL=6.300 · FFL=5.610

Rev.

N

0 5m

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RMB

client	Fleet House	drawing	Drainage Layout - Plots 1 - 8
project	Fleet House Upnor Road Lower Upnor ME2 4UP	scale	1:100 @ A1
		drawing no.	1262/202
		date	March 2024
		drawn by	RB

Drainage Layout - Plots 1 - 8
Fleet House, Upnor Road, Lower Upnor, ME2 4UP

Appendix C - Foul Drainage Design

Design Settings

Frequency of use (kDU)	0.50	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	4000	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	2.000
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.350
Additional Flow (%)	0	Include Intermediate Ground	✓

Private Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
110	345	160	450

>160 Link+150 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
0.600	345	2.000	450

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150

Nodes

Name	Dwellings	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
1		7.000	Private	575906.273	171024.677	0.600
2		7.000	Private	575909.463	171029.671	0.749
3		7.000	Private	575914.846	171026.233	0.909
4		7.000	Private	575919.359	171023.352	1.043
5		7.075	Private	575917.942	171021.133	1.184
6	1	7.075	Private	575916.169	171018.357	1.267
7		7.000	Private	575902.297	171018.451	0.450
8		7.000	Private	575899.296	171013.752	0.590
9		7.000	Private	575904.679	171010.313	0.750
10		7.000	Private	575909.191	171007.431	0.884
11		7.075	Private	575910.419	171009.355	1.017
12	1	7.075	Private	575912.192	171012.131	1.360
13		6.650	Private	575930.037	171000.733	1.200
14	3	6.150	Private	575931.334	171001.949	1.054
15		6.225	Private	575935.598	171005.948	1.203

Nodes

Name	Dwellings	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
16		6.225	Private	575938.092	171008.287	1.246
17		6.150	Private	575942.853	171012.753	1.253
18	3	6.150	Private	575948.419	171006.819	0.450
19		6.150	Private	575944.600	171010.891	1.335
19_OUT		6.150		575945.475	171011.712	1.355
20	1	7.100	Private	575905.339	171042.442	0.450
21		7.100	Private	575906.209	171044.184	0.475
22		7.100	Private	575908.225	171048.224	0.532
23		7.200	Private	575908.560	171054.116	0.706
23_OUT		7.060	Adoptable	575911.552	171058.992	2.520

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.012	19	19_OUT	1.200	1.500	4.815	4.795	0.020	60.0	150
1.011	17	19	2.553	1.500	4.897	4.865	0.032	79.8	100
3.000	18	19	5.583	1.500	5.700	4.865	0.835	6.7	100
1.010	16	17	6.528	1.500	4.979	4.897	0.082	79.6	100
1.009	15	16	3.419	1.500	5.022	4.979	0.043	79.5	100
1.008	14	15	5.846	1.500	5.096	5.022	0.074	79.0	100
1.007	13	14	1.778	1.500	5.450	5.096	0.354	5.0	100
1.006	12	13	21.174	1.500	5.715	5.450	0.265	79.9	100
1.005	6	12	7.388	1.500	5.808	5.715	0.093	79.4	100
2.004	11	12	3.294	1.500	6.058	5.715	0.343	9.6	100
2.003	10	11	2.282	1.500	6.116	6.058	0.058	39.4	100
2.002	9	10	5.354	1.500	6.250	6.116	0.134	40.0	100
2.001	8	9	6.388	1.500	6.410	6.250	0.160	39.9	100
2.000	7	8	5.576	1.500	6.550	6.410	0.140	39.8	100
1.004	5	6	3.294	1.500	5.891	5.808	0.083	39.7	100

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.012	0.290	1.132	20.0	0.4	1.185	1.205	0.000	8	0.0	0.0	14	0.422
1.011	0.241	0.745	5.8	0.2	1.153	1.185	0.000	5	0.0	0.0	14	0.347
3.000	0.441	2.586	20.3	0.1	0.350	1.185	0.000	3	0.0	0.0	6	0.659
1.010	0.242	0.746	5.9	0.2	1.146	1.153	0.000	5	0.0	0.0	14	0.348
1.009	0.242	0.746	5.9	0.2	1.103	1.146	0.000	5	0.0	0.0	14	0.348
1.008	0.243	0.749	5.9	0.2	0.954	1.103	0.000	5	0.0	0.0	14	0.349
1.007	0.414	2.984	23.4	0.1	1.100	0.954	0.000	2	0.0	0.0	5	0.682
1.006	0.187	0.744	5.8	0.1	1.260	1.100	0.000	2	0.0	0.0	9	0.258
1.005	0.147	0.746	5.9	0.0	1.167	1.260	0.000	1	0.0	0.0	7	0.207
2.004	0.000	2.157	16.9	0.0	0.917	1.260	0.000	0	0.0	0.0	0	0.000
2.003	0.000	1.063	8.3	0.0	0.784	0.917	0.000	0	0.0	0.0	0	0.000
2.002	0.000	1.055	8.3	0.0	0.650	0.784	0.000	0	0.0	0.0	0	0.000
2.001	0.000	1.055	8.3	0.0	0.490	0.650	0.000	0	0.0	0.0	0	0.000
2.000	0.000	1.056	8.3	0.0	0.350	0.490	0.000	0	0.0	0.0	0	0.000
1.004	0.000	1.058	8.3	0.0	1.084	1.167	0.000	0	0.0	0.0	0	0.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.003	4	5	2.633	1.500	5.957	5.891	0.066	39.9	100
1.002	3	4	5.354	1.500	6.091	5.957	0.134	40.0	100
1.001	2	3	6.387	1.500	6.251	6.091	0.160	39.9	100
1.000	1	2	5.926	1.500	6.400	6.251	0.149	39.8	100
4.003	23	23_OUT	5.721	1.500	6.494	4.540	1.954	2.9	100
4.002	22	23	5.902	1.500	6.568	6.494	0.074	79.8	100
4.001	21	22	4.515	1.500	6.625	6.568	0.057	79.2	100
4.000	20	21	1.947	1.500	6.650	6.625	0.025	77.9	100

Name	Pro Vel @ 1/3 Q (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Dwellings (ha)	Σ Units (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)
1.003	0.000	1.056	8.3	0.0	0.943	1.084	0.000	0	0.0	0.0	0	0.000
1.002	0.000	1.055	8.3	0.0	0.809	0.943	0.000	0	0.0	0.0	0	0.000
1.001	0.000	1.055	8.3	0.0	0.649	0.809	0.000	0	0.0	0.0	0	0.000
1.000	0.000	1.057	8.3	0.0	0.500	0.649	0.000	0	0.0	0.0	0	0.000
4.003	0.406	3.910	30.7	0.0	0.606	2.420	0.000	1	0.0	0.0	4	0.669
4.002	0.146	0.745	5.9	0.0	0.432	0.606	0.000	1	0.0	0.0	7	0.206
4.001	0.147	0.748	5.9	0.0	0.375	0.432	0.000	1	0.0	0.0	7	0.207
4.000	0.148	0.754	5.9	0.0	0.350	0.375	0.000	1	0.0	0.0	7	0.209

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.012	1.200	60.0	150	Circular	6.150	4.815	1.185	6.150	4.795	1.205
1.011	2.553	79.8	100	Circular	6.150	4.897	1.153	6.150	4.865	1.185
3.000	5.583	6.7	100	Circular	6.150	5.700	0.350	6.150	4.865	1.185
1.010	6.528	79.6	100	Circular	6.225	4.979	1.146	6.150	4.897	1.153
1.009	3.419	79.5	100	Circular	6.225	5.022	1.103	6.225	4.979	1.146
1.008	5.846	79.0	100	Circular	6.150	5.096	0.954	6.225	5.022	1.103
1.007	1.778	5.0	100	Circular	6.650	5.450	1.100	6.150	5.096	0.954
1.006	21.174	79.9	100	Circular	7.075	5.715	1.260	6.650	5.450	1.100
1.005	7.388	79.4	100	Circular	7.075	5.808	1.167	7.075	5.715	1.260
2.004	3.294	9.6	100	Circular	7.075	6.058	0.917	7.075	5.715	1.260

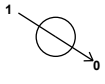
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.012	19	450	Manhole	Private	19_OUT		Junction	
1.011	17	450	Manhole	Private	19	450	Manhole	Private
3.000	18	345	Manhole	Private	19	450	Manhole	Private
1.010	16	450	Manhole	Private	17	450	Manhole	Private
1.009	15	450	Manhole	Private	16	450	Manhole	Private
1.008	14	450	Manhole	Private	15	450	Manhole	Private
1.007	13	450	Manhole	Private	14	450	Manhole	Private
1.006	12	450	Manhole	Private	13	450	Manhole	Private
1.005	6	450	Manhole	Private	12	450	Manhole	Private
2.004	11	450	Manhole	Private	12	450	Manhole	Private

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.003	2.282	39.4	100	Circular	7.000	6.116	0.784	7.075	6.058	0.917
2.002	5.354	40.0	100	Circular	7.000	6.250	0.650	7.000	6.116	0.784
2.001	6.388	39.9	100	Circular	7.000	6.410	0.490	7.000	6.250	0.650
2.000	5.576	39.8	100	Circular	7.000	6.550	0.350	7.000	6.410	0.490
1.004	3.294	39.7	100	Circular	7.075	5.891	1.084	7.075	5.808	1.167
1.003	2.633	39.9	100	Circular	7.000	5.957	0.943	7.075	5.891	1.084
1.002	5.354	40.0	100	Circular	7.000	6.091	0.809	7.000	5.957	0.943
1.001	6.387	39.9	100	Circular	7.000	6.251	0.649	7.000	6.091	0.809
1.000	5.926	39.8	100	Circular	7.000	6.400	0.500	7.000	6.251	0.649
4.003	5.721	2.9	100	Circular	7.200	6.494	0.606	7.060	4.540	2.420
4.002	5.902	79.8	100	Circular	7.100	6.568	0.432	7.200	6.494	0.606
4.001	4.515	79.2	100	Circular	7.100	6.625	0.375	7.100	6.568	0.432
4.000	1.947	77.9	100	Circular	7.100	6.650	0.350	7.100	6.625	0.375

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.003	10	450	Manhole	Private	11	450	Manhole	Private
2.002	9	450	Manhole	Private	10	450	Manhole	Private
2.001	8	345	Manhole	Private	9	450	Manhole	Private
2.000	7	345	Manhole	Private	8	345	Manhole	Private
1.004	5	450	Manhole	Private	6	450	Manhole	Private
1.003	4	450	Manhole	Private	5	450	Manhole	Private
1.002	3	450	Manhole	Private	4	450	Manhole	Private
1.001	2	450	Manhole	Private	3	450	Manhole	Private
1.000	1	345	Manhole	Private	2	450	Manhole	Private
4.003	23	450	Manhole	Private	23_OUT	1200	Manhole	Adoptable
4.002	22	345	Manhole	Private	23	450	Manhole	Private
4.001	21	345	Manhole	Private	22	345	Manhole	Private
4.000	20	345	Manhole	Private	21	345	Manhole	Private

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	575906.273	171024.677	7.000	0.600	345				
						0	1.000	6.400	100
2	575909.463	171029.671	7.000	0.749	450	1	1.000	6.251	100
									
						0	1.001	6.251	100
3	575914.846	171026.233	7.000	0.909	450	1	1.001	6.091	100
									
						0	1.002	6.091	100
4	575919.359	171023.352	7.000	1.043	450	1	1.002	5.957	100
									
						0	1.003	5.957	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
5	575917.942	171021.133	7.075	1.184	450	1	1.003	5.891	100
						0	1.004	5.891	100
6	575916.169	171018.357	7.075	1.267	450	1	1.004	5.808	100
						0	1.005	5.808	100
7	575902.297	171018.451	7.000	0.450	345	0	2.000	6.550	100
8	575899.296	171013.752	7.000	0.590	345	1	2.000	6.410	100
						0	2.001	6.410	100
9	575904.679	171010.313	7.000	0.750	450	1	2.001	6.250	100
						0	2.002	6.250	100
10	575909.191	171007.431	7.000	0.884	450	1	2.002	6.116	100
						0	2.003	6.116	100
11	575910.419	171009.355	7.075	1.017	450	1	2.003	6.058	100
						0	2.004	6.058	100
12	575912.192	171012.131	7.075	1.360	450	1	2.004	5.715	100
						2	1.005	5.715	100
						0	1.006	5.715	100
13	575930.037	171000.733	6.650	1.200	450	1	1.006	5.450	100
						0	1.007	5.450	100
14	575931.334	171001.949	6.150	1.054	450	1	1.007	5.096	100
						0	1.008	5.096	100
15	575935.598	171005.948	6.225	1.203	450	1	1.008	5.022	100
						0	1.009	5.022	100
16	575938.092	171008.287	6.225	1.246	450	1	1.009	4.979	100
						0	1.010	4.979	100
17	575942.853	171012.753	6.150	1.253	450	1	1.010	4.897	100
						0	1.011	4.897	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
18	575948.419	171006.819	6.150	0.450	345				
						0	3.000	5.700	100
19	575944.600	171010.891	6.150	1.335	450		1	3.000	4.865	100
							2	1.011	4.865	100
						0	1.012	4.815	150
19_OUT	575945.475	171011.712	6.150	1.355			1	1.012	4.795	150
20	575905.339	171042.442	7.100	0.450	345					
						0	4.000	6.650	100
21	575906.209	171044.184	7.100	0.475	345		1	4.000	6.625	100
						0	4.001	6.625	100
22	575908.225	171048.224	7.100	0.532	345		1	4.001	6.568	100
						0	4.002	6.568	100
23	575908.560	171054.116	7.200	0.706	450		1	4.002	6.494	100
						0	4.003	6.494	100
23_OUT	575911.552	171058.992	7.060	2.520	1200		1	4.003	4.540	100

Appendix D - Surface Water Drainage Design

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	2.000
CV	0.750	Preferred Cover Depth (m)	0.350
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	500.0		

Private Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
110	345	160	450

>160 Link+150 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
0.600	345	2.000	450

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.002	5.00	7.100	345	575901.862	171039.313	0.450
2	0.002	5.00	7.100	450	575893.450	171043.511	0.616
3	0.002	5.00	7.170	450	575899.108	171054.846	1.349
4			7.170		575900.653	171054.075	1.315
5	0.001	5.00	7.100	345	575907.911	171048.940	0.450
6	0.007	5.00	7.170	450	575904.411	171052.199	1.028
7			7.170		575903.337	171052.735	1.315
8			7.170		575901.995	171053.405	1.315
9			7.200	450	575902.442	171054.300	1.345
10			7.250	450	575902.978	171055.374	1.415
10_OUT			7.250	1200	575904.438	171055.032	1.440

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.006	10	10_OUT	1.500	0.600	5.835	5.810	0.025	60.0	100	5.47	48.6
1.005	9	10	1.200	0.600	5.855	5.835	0.020	60.0	100	5.44	48.7
1.004	8	9	1.000	0.600	5.855	5.855	0.000	0.0	100	5.42	48.7
1.003	4	8	1.500	0.600	5.855	5.855	0.000	0.0	100	5.40	48.9
2.002	7	8	2.974	0.600	5.855	5.855	0.000	0.0	100	5.15	50.0
2.001	6	7	1.200	0.600	6.592	6.155	0.437	2.7	100	5.10	50.0
2.000	5	6	4.782	0.600	6.650	6.592	0.058	82.5	100	5.09	50.0
1.002	3	4	1.727	0.600	6.271	6.155	0.116	14.9	100	5.38	48.9
1.001	2	3	12.669	0.600	6.484	6.271	0.213	59.5	100	5.36	49.0
1.000	1	2	9.401	0.600	6.650	6.484	0.166	56.6	100	5.15	49.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.006	0.996	7.8	1.9	1.315	1.340	0.015	0.0	34	0.826
1.005	0.996	7.8	1.9	1.245	1.315	0.015	0.0	34	0.826
1.004	1.000	7.9	1.9	1.215	1.245	0.015	0.0	0	∞
1.003	1.000	7.9	0.8	1.215	1.215	0.006	0.0	0	∞
2.002	1.000	7.9	1.2	1.215	1.215	0.009	0.0	0	∞
2.001	4.702	36.9	1.2	0.478	0.915	0.009	0.0	12	2.107
2.000	0.848	6.7	0.2	0.350	0.478	0.001	0.0	11	0.358
1.002	2.012	15.8	0.8	0.799	0.915	0.006	0.0	15	1.042
1.001	1.000	7.9	0.6	0.516	0.799	0.005	0.0	19	0.595
1.000	1.025	8.1	0.3	0.350	0.516	0.002	0.0	14	0.492

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.006	1.500	60.0	100	Circular	7.250	5.835	1.315	7.250	5.810	1.340
1.005	1.200	60.0	100	Circular	7.200	5.855	1.245	7.250	5.835	1.315
1.004	1.000	0.0	100	Circular	7.170	5.855	1.215	7.200	5.855	1.245
1.003	1.500	0.0	100	Circular	7.170	5.855	1.215	7.170	5.855	1.215
2.002	2.974	0.0	100	Circular	7.170	5.855	1.215	7.170	5.855	1.215
2.001	1.200	2.7	100	Circular	7.170	6.592	0.478	7.170	6.155	0.915
2.000	4.782	82.5	100	Circular	7.100	6.650	0.350	7.170	6.592	0.478
1.002	1.727	14.9	100	Circular	7.170	6.271	0.799	7.170	6.155	0.915

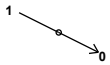
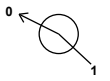
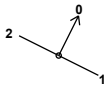
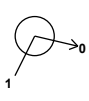
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.006	10	450	Manhole	Private	10_OUT	1200	Manhole	Adoptable
1.005	9	450	Manhole	Private	10	450	Manhole	Private
1.004	8		Junction		9	450	Manhole	Private
1.003	4		Junction		8		Junction	
2.002	7		Junction		8		Junction	
2.001	6	450	Manhole	Private	7		Junction	
2.000	5	345	Manhole	Private	6	450	Manhole	Private
1.002	3	450	Manhole	Private	4		Junction	

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	12.669	59.5	100	Circular	7.100	6.484	0.516	7.170	6.271	0.799
1.000	9.401	56.6	100	Circular	7.100	6.650	0.350	7.100	6.484	0.516

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	2	450	Manhole	Private	3	450	Manhole	Private
1.000	1	345	Manhole	Private	2	450	Manhole	Private

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	575901.862	171039.313	7.100	0.450	345	 0	1.000	6.650	100
2	575893.450	171043.511	7.100	0.616	450	 1 0	1.000 1.001	6.484 6.484	100 100
3	575899.108	171054.846	7.170	1.349	450	 1 0	1.001 1.002	6.271 6.271	100 100
4	575900.653	171054.075	7.170	1.315		 1 0	1.002 1.003	6.155 5.855	100 100
5	575907.911	171048.940	7.100	0.450	345	 0	2.000	6.650	100
6	575904.411	171052.199	7.170	1.028	450	 1 0	2.000 2.001	6.592 6.592	100 100
7	575903.337	171052.735	7.170	1.315		 1 0	2.001 2.002	6.155 5.855	100 100
8	575901.995	171053.405	7.170	1.315		 1 2 0	2.002 1.003 1.004	5.855 5.855 5.855	100 100 100
9	575902.442	171054.300	7.200	1.345	450	 1 0	1.004 1.005	5.855 5.855	100 100
10	575902.978	171055.374	7.250	1.415	450	 1 0	1.005 1.006	5.835 5.835	100 100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
10_OUT	575904.438	171055.032	7.250	1.440	1200	1	1.006	5.810	100

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	100 year (l/s)	0.0
Summer CV	0.750	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	20	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 100 year (l/s)	
SPR	0.10		

Node 10 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.400	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	2.0		
Invert Level (m)	5.835	Diameter (m)	0.039		

Node 8 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.855
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	21

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	6.0	0.0	0.400	6.0	0.0	0.401	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	6.663	0.013	0.3	0.0012	0.0000	OK
15 minute winter	2	11	6.503	0.019	0.6	0.0031	0.0000	OK
15 minute winter	3	11	6.287	0.016	0.8	0.0025	0.0000	OK
15 minute winter	4	15	5.909	0.054	0.8	0.0000	0.0000	OK
15 minute winter	5	11	6.662	0.012	0.2	0.0011	0.0000	OK
15 minute winter	6	11	6.604	0.012	1.1	0.0020	0.0000	OK
15 minute winter	7	15	5.909	0.054	1.1	0.0000	0.0000	OK
15 minute winter	8	15	5.909	0.054	1.7	0.3058	0.0000	OK
15 minute winter	9	15	5.908	0.053	1.0	0.0084	0.0000	OK
15 minute winter	10	15	5.908	0.073	0.8	0.0115	0.0000	OK
15 minute winter	10_OUT	16	5.830	0.020	0.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	0.3	0.362	0.037	0.0079	
15 minute winter	2	1.001	3	0.6	0.642	0.076	0.0118	
15 minute winter	3	1.002	4	0.8	1.024	0.050	0.0013	
15 minute winter	4	1.003	8	0.7	0.351	0.090	0.0064	
15 minute winter	5	2.000	6	0.2	0.364	0.030	0.0026	
15 minute winter	6	2.001	7	1.1	2.053	0.030	0.0006	
15 minute winter	7	2.002	8	1.0	0.556	0.132	0.0128	
15 minute winter	8	1.004	9	1.0	0.483	0.132	0.0042	
15 minute winter	9	1.005	10	0.8	0.620	0.106	0.0062	
15 minute winter	10	1.006	10_OUT	0.7	0.583	0.091	0.0018	0.9

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.671	0.021	0.8	0.0019	0.0000	OK
15 minute winter	2	10	6.515	0.031	1.6	0.0049	0.0000	OK
15 minute winter	3	11	6.297	0.026	2.0	0.0041	0.0000	OK
30 minute winter	4	25	6.029	0.174	1.6	0.0000	0.0000	SURCHARGED
15 minute summer	5	11	6.667	0.017	0.4	0.0016	0.0000	OK
15 minute winter	6	10	6.612	0.020	2.8	0.0032	0.0000	OK
30 minute winter	7	25	6.029	0.174	2.2	0.0000	0.0000	SURCHARGED
30 minute winter	8	25	6.029	0.174	3.2	0.9891	0.0000	SURCHARGED
30 minute winter	9	25	6.028	0.173	1.6	0.0275	0.0000	SURCHARGED
30 minute winter	10	25	6.026	0.191	1.4	0.0304	0.0000	SURCHARGED
30 minute winter	10_OUT	25	5.837	0.027	1.3	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	0.8	0.476	0.095	0.0153	
15 minute winter	2	1.001	3	1.5	0.826	0.190	0.0230	
15 minute winter	3	1.002	4	2.0	1.325	0.127	0.0026	
30 minute winter	4	1.003	8	1.3	0.336	0.169	0.0117	
15 minute summer	5	2.000	6	0.4	0.417	0.060	0.0046	
15 minute winter	6	2.001	7	2.8	2.665	0.075	0.0013	
30 minute winter	7	2.002	8	1.9	0.543	0.243	0.0233	
30 minute winter	8	1.004	9	1.6	0.466	0.206	0.0078	
30 minute winter	9	1.005	10	1.4	0.568	0.176	0.0094	
30 minute winter	10	1.006	10_OUT	1.3	0.678	0.163	0.0028	2.9

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.673	0.023	1.0	0.0022	0.0000	OK
15 minute winter	2	10	6.519	0.035	2.0	0.0056	0.0000	OK
15 minute winter	3	10	6.300	0.029	2.6	0.0046	0.0000	OK
30 minute winter	4	25	6.095	0.240	2.1	0.0000	0.0000	SURCHARGED
30 minute summer	5	18	6.669	0.019	0.5	0.0017	0.0000	OK
15 minute winter	6	10	6.615	0.023	3.6	0.0036	0.0000	OK
30 minute winter	7	25	6.095	0.240	2.8	0.0000	0.0000	SURCHARGED
30 minute winter	8	25	6.095	0.240	4.1	1.3664	0.0000	SURCHARGED
30 minute winter	9	25	6.094	0.239	2.0	0.0379	0.0000	SURCHARGED
30 minute winter	10	26	6.092	0.257	1.7	0.0408	0.0000	SURCHARGED
30 minute winter	10_OUT	26	5.840	0.030	1.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.0	0.507	0.121	0.0182	
15 minute winter	2	1.001	3	1.9	0.877	0.242	0.0276	
15 minute winter	3	1.002	4	2.5	1.410	0.161	0.0031	
30 minute winter	4	1.003	8	1.7	0.346	0.216	0.0117	
30 minute summer	5	2.000	6	0.5	0.444	0.075	0.0054	
15 minute winter	6	2.001	7	3.6	2.852	0.097	0.0015	
30 minute winter	7	2.002	8	2.4	0.578	0.308	0.0233	
30 minute winter	8	1.004	9	2.0	0.455	0.252	0.0078	
30 minute winter	9	1.005	10	1.7	0.583	0.212	0.0094	
30 minute winter	10	1.006	10_OUT	1.5	0.707	0.192	0.0032	3.9

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	6.676	0.026	1.2	0.0024	0.0000	OK
15 minute winter	2	10	6.523	0.039	2.4	0.0062	0.0000	OK
15 minute winter	3	10	6.303	0.032	3.1	0.0051	0.0000	OK
30 minute winter	4	26	6.146	0.291	2.4	0.0000	0.0000	SURCHARGED
15 minute winter	5	10	6.672	0.022	0.7	0.0020	0.0000	OK
15 minute winter	6	10	6.617	0.025	4.4	0.0040	0.0000	OK
30 minute winter	7	26	6.146	0.291	3.4	0.0000	0.0000	SURCHARGED
30 minute winter	8	26	6.146	0.291	4.9	1.6573	0.0000	SURCHARGED
30 minute winter	9	26	6.144	0.289	2.3	0.0460	0.0000	SURCHARGED
30 minute winter	10	26	6.142	0.307	1.9	0.0489	0.0000	SURCHARGED
30 minute winter	10_OUT	26	5.841	0.031	1.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.2	0.533	0.146	0.0209	
15 minute winter	2	1.001	3	2.3	0.923	0.293	0.0317	
15 minute winter	3	1.002	4	3.0	1.477	0.193	0.0036	
30 minute winter	4	1.003	8	2.0	0.322	0.249	0.0117	
15 minute winter	5	2.000	6	0.7	0.473	0.100	0.0067	
15 minute winter	6	2.001	7	4.3	2.999	0.118	0.0017	
30 minute winter	7	2.002	8	2.9	0.627	0.373	0.0233	
30 minute winter	8	1.004	9	2.3	0.477	0.289	0.0078	
30 minute winter	9	1.005	10	1.9	0.595	0.238	0.0094	
30 minute winter	10	1.006	10_OUT	1.7	0.725	0.212	0.0034	4.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	6.678	0.028	1.4	0.0026	0.0000	OK
15 minute winter	2	11	6.527	0.043	2.8	0.0069	0.0000	OK
15 minute winter	3	10	6.307	0.036	3.8	0.0057	0.0000	OK
30 minute winter	4	26	6.217	0.362	2.9	0.0000	0.0000	SURCHARGED
15 minute summer	5	10	6.674	0.024	0.8	0.0022	0.0000	OK
15 minute winter	6	10	6.620	0.028	5.3	0.0045	0.0000	OK
30 minute winter	7	26	6.217	0.362	4.1	0.0000	0.0000	SURCHARGED
30 minute winter	8	27	6.216	0.361	5.8	2.0604	0.0000	SURCHARGED
30 minute winter	9	27	6.215	0.360	2.6	0.0572	0.0000	SURCHARGED
30 minute winter	10	27	6.212	0.377	2.1	0.0600	0.0000	SURCHARGED
30 minute winter	10_OUT	27	5.843	0.033	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	1.4	0.556	0.174	0.0239	
15 minute winter	2	1.001	3	2.8	0.969	0.356	0.0368	
15 minute winter	3	1.002	4	3.8	1.560	0.238	0.0042	
30 minute winter	4	1.003	8	2.4	0.354	0.300	0.0117	
15 minute summer	5	2.000	6	0.8	0.488	0.115	0.0075	
15 minute winter	6	2.001	7	5.2	3.148	0.142	0.0020	
30 minute winter	7	2.002	8	3.5	0.628	0.449	0.0233	
30 minute winter	8	1.004	9	2.6	0.477	0.334	0.0078	
30 minute winter	9	1.005	10	2.1	0.563	0.270	0.0094	
30 minute winter	10	1.006	10_OUT	1.9	0.745	0.237	0.0037	5.5

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	2.000
CV	0.750	Preferred Cover Depth (m)	0.350
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	500.0		

Private Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
110	345	160	450

>160 Link+150 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
0.600	345	2.000	450

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.003	5.00	7.000		575903.056	171018.710	0.450
2	0.003	5.00	7.000	450	575909.615	171028.981	0.655
3	0.003	5.00	7.000	450	575919.932	171022.392	0.861
4	0.003	5.00	7.100		575910.254	171007.236	0.450
5	0.009	5.00	7.090	450	575916.531	171017.065	1.508
6			7.000		575919.553	171015.136	1.598
7			6.630		575927.138	171010.291	1.228
8	0.026	5.00	6.550	1200	575928.823	171009.214	1.148
9	0.007	5.00	6.225	345	575945.726	170995.667	0.450
10	0.002	5.00	6.150	345	575940.783	170991.030	0.443
11	0.008	5.00	6.150	345	575937.797	170993.466	0.482
12	0.002	5.00	6.150	450	575929.513	171002.297	1.103
13	0.006	5.00	6.225	450	575937.519	171006.190	0.900
14			6.380	1200	575935.715	171008.114	1.013
15	0.004	5.00	6.150	450	575944.078	171010.978	0.871
15_OUT			6.150		575944.957	171011.795	0.883

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.008	15	15_OUT	1.200	0.600	5.279	5.267	0.012	100.0	150	6.05	46.4
1.007	14	15	8.840	0.600	5.367	5.279	0.088	100.5	150	6.03	46.7
1.006	8	14	6.979	0.600	5.402	5.367	0.035	199.4	225	5.88	47.3
4.000	13	14	2.637	0.600	5.775	5.492	0.283	9.3	100	5.02	50.3
3.003	12	14	8.503	0.600	5.497	5.442	0.055	154.6	150	5.67	47.8
3.002	11	12	12.108	0.600	5.668	5.547	0.121	100.1	100	5.49	48.5
3.001	10	11	3.854	0.600	5.707	5.668	0.039	98.8	100	5.23	49.5
3.000	9	10	6.778	0.600	5.775	5.707	0.068	99.7	100	5.15	49.8
1.005	7	8	2.000	0.600	5.402	5.402	0.000	0.0	225	5.75	47.6
1.004	6	7	11.000	0.600	5.402	5.402	0.000	0.0	100	5.72	47.6
1.003	5	6	3.585	0.600	6.032	5.702	0.330	10.9	100	5.54	48.3
1.002	3	5	6.320	0.600	6.139	6.032	0.107	59.1	100	5.51	48.4
2.000	4	5	11.662	0.600	6.650	6.032	0.618	18.9	100	5.11	50.0
1.001	2	3	12.242	0.600	6.345	6.139	0.206	59.4	100	5.41	48.8
1.000	1	2	12.187	0.600	6.550	6.345	0.205	59.4	100	5.20	49.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.008	1.005	17.8	9.6	0.721	0.733	0.076	0.0	78	1.022
1.007	1.002	17.7	9.1	0.863	0.721	0.072	0.0	76	1.007
1.006	0.922	36.7	5.9	0.923	0.788	0.046	0.0	61	0.681
4.000	2.547	20.0	0.8	0.350	0.788	0.006	0.0	14	1.231
3.003	0.806	14.2	2.5	0.503	0.788	0.020	0.0	42	0.607
3.002	0.768	6.0	2.3	0.382	0.503	0.017	0.0	43	0.714
3.001	0.773	6.1	1.3	0.343	0.382	0.010	0.0	32	0.617
3.000	0.770	6.0	1.0	0.350	0.343	0.007	0.0	28	0.570
1.005	1.000	39.8	2.6	1.003	0.923	0.020	0.0	0	∞
1.004	1.000	7.9	2.6	1.498	1.128	0.020	0.0	0	∞
1.003	2.358	18.5	2.6	0.958	1.198	0.020	0.0	25	1.667
1.002	1.004	7.9	1.1	0.761	0.958	0.009	0.0	26	0.720
2.000	1.786	14.0	0.4	0.350	0.958	0.003	0.0	12	0.796
1.001	1.001	7.9	0.8	0.555	0.761	0.006	0.0	21	0.625
1.000	1.001	7.9	0.4	0.350	0.555	0.003	0.0	15	0.515

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.008	1.200	100.0	150	Circular	6.150	5.279	0.721	6.150	5.267	0.733
1.007	8.840	100.5	150	Circular	6.380	5.367	0.863	6.150	5.279	0.721
1.006	6.979	199.4	225	Circular	6.550	5.402	0.923	6.380	5.367	0.788

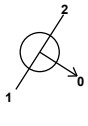
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.008	15	450	Manhole	Private	15_OUT		Junction	
1.007	14	1200	Manhole	Private	15	450	Manhole	Private
1.006	8	1200	Manhole	Private	14	1200	Manhole	Private

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.000	2.637	9.3	100	Circular	6.225	5.775	0.350	6.380	5.492	0.788
3.003	8.503	154.6	150	Circular	6.150	5.497	0.503	6.380	5.442	0.788
3.002	12.108	100.1	100	Circular	6.150	5.668	0.382	6.150	5.547	0.503
3.001	3.854	98.8	100	Circular	6.150	5.707	0.343	6.150	5.668	0.382
3.000	6.778	99.7	100	Circular	6.225	5.775	0.350	6.150	5.707	0.343
1.005	2.000	0.0	225	Circular	6.630	5.402	1.003	6.550	5.402	0.923
1.004	11.000	0.0	100	Circular	7.000	5.402	1.498	6.630	5.402	1.128
1.003	3.585	10.9	100	Circular	7.090	6.032	0.958	7.000	5.702	1.198
1.002	6.320	59.1	100	Circular	7.000	6.139	0.761	7.090	6.032	0.958
2.000	11.662	18.9	100	Circular	7.100	6.650	0.350	7.090	6.032	0.958
1.001	12.242	59.4	100	Circular	7.000	6.345	0.555	7.000	6.139	0.761
1.000	12.187	59.4	100	Circular	7.000	6.550	0.350	7.000	6.345	0.555

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	13	450	Manhole	Private	14	1200	Manhole	Private
3.003	12	450	Manhole	Private	14	1200	Manhole	Private
3.002	11	345	Manhole	Private	12	450	Manhole	Private
3.001	10	345	Manhole	Private	11	345	Manhole	Private
3.000	9	345	Manhole	Private	10	345	Manhole	Private
1.005	7		Junction		8	1200	Manhole	Private
1.004	6		Junction		7		Junction	
1.003	5	450	Manhole	Private	6		Junction	
1.002	3	450	Manhole	Private	5	450	Manhole	Private
2.000	4		Junction		5	450	Manhole	Private
1.001	2	450	Manhole	Private	3	450	Manhole	Private
1.000	1		Junction		2	450	Manhole	Private

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	575903.056	171018.710	7.000	0.450					
						0	1.000	6.550	100
2	575909.615	171028.981	7.000	0.655	450		1	1.000	6.345	100
						0	1.001	6.345	100
3	575919.932	171022.392	7.000	0.861	450		1	1.001	6.139	100
						0	1.002	6.139	100
4	575910.254	171007.236	7.100	0.450					
						0	2.000	6.650	100
5	575916.531	171017.065	7.090	1.508	450		1	2.000	6.032	100
							2	1.002	6.032	100
						0	1.003	6.032	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	575919.553	171015.136	7.000	1.598		1	1.003	5.702	100
						0	1.004	5.402	100
7	575927.138	171010.291	6.630	1.228		1	1.004	5.402	100
						0	1.005	5.402	225
8	575928.823	171009.214	6.550	1.148	1200	1	1.005	5.402	225
						0	1.006	5.402	225
9	575945.726	170995.667	6.225	0.450	345	0	3.000	5.775	100
10	575940.783	170991.030	6.150	0.443	345	1	3.000	5.707	100
						0	3.001	5.707	100
11	575937.797	170993.466	6.150	0.482	345	1	3.001	5.668	100
						0	3.002	5.668	100
12	575929.513	171002.297	6.150	1.103	450	1	3.002	5.547	100
						0	3.003	5.497	150
13	575937.519	171006.190	6.225	0.900	450	0	4.000	5.775	100
14	575935.715	171008.114	6.380	1.013	1200	1	4.000	5.492	100
						2	3.003	5.442	150
						3	1.006	5.367	225
						0	1.007	5.367	150
15	575944.078	171010.978	6.150	0.871	450	1	1.007	5.279	150
						0	1.008	5.279	150
15_OUT	575944.957	171011.795	6.150	0.883		1	1.008	5.267	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	100 year (l/s)	0.0
Summer CV	0.750	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	20	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 100 year (l/s)	
SPR	0.10		

Node 14 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	5.367	Product Number	CTL-SHE-0075-2000-0500-2000
Design Depth (m)	0.500	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node 7 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.402
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	72.0	0.0	0.400	72.0	0.0	0.401	0.0	0.0

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	2.000
CV	0.750	Preferred Cover Depth (m)	0.350
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	500.0		

Private Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
110	345	160	450

>160 Link+150 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
0.600	345	2.000	450

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.001	5.00	6.150	450	575952.093	170996.560	1.357
2	0.001	5.00	6.150	450	575946.197	170991.031	1.357
3			5.625		575949.145	170993.795	0.450
3_OUT	0.001		5.585		575950.439	170992.415	0.410

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.001	3	3_OUT	1.892	0.600	5.175	5.175	0.000	0.0	100	5.10	50.0
1.000	1	3	4.042	0.600	5.243	5.175	0.068	59.4	100	5.07	50.1
2.000	2	3	4.041	0.600	5.243	5.175	0.068	59.4	100	5.07	50.1

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.001	1.000	7.9	0.3	0.350	0.310	0.002	0.0	0	∞
1.000	1.001	7.9	0.2	0.807	0.350	0.001	0.0	11	0.404
2.000	1.001	7.9	0.1	0.807	0.350	0.001	0.0	7	0.317

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	1.892	0.0	100	Circular	5.625	5.175	0.350	5.585	5.175	0.310
1.000	4.042	59.4	100	Circular	6.150	5.243	0.807	5.625	5.175	0.350
2.000	4.041	59.4	100	Circular	6.150	5.243	0.807	5.625	5.175	0.350

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Node Type
1.001	3		Junction		3_OUT	Junction
1.000	1	450	Manhole	Private	3	Junction
2.000	2	450	Manhole	Private	3	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	575952.093	170996.560	6.150	1.357	450	 0	1.000	5.243	100
2	575946.197	170991.031	6.150	1.357	450	 0	2.000	5.243	100
3	575949.145	170993.795	5.625	0.450		 1 2 0	2.000 1.000 1.001	5.175 5.175 5.175	100 100 100
3_OUT	575950.439	170992.415	5.585	0.410		 1	1.001	5.175	100

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	100 year (l/s)	0.0
Summer CV	0.750	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	20	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 100 year (l/s)	
SPR	0.10		

Node 3_OUT Online Weir Control

Flap Valve	x	Invert Level (m)	5.485	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.500		

Node 3 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Safety Factor	2.0	Invert Level (m)	5.175
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	736

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	5.0	5.0	0.150	5.0	5.0	0.151	0.0	5.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	5.255	0.012	0.2	0.0019	0.0000	OK
15 minute summer	2	10	5.251	0.008	0.1	0.0013	0.0000	OK
30 minute winter	3	27	5.199	0.024	0.3	0.1136	0.0000	OK
30 minute winter	3_OUT	26	5.199	0.024	0.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	3	0.2	0.637	0.027	0.0026	
15 minute summer	2	2.000	3	0.1	0.441	0.013	0.0024	
30 minute winter	3	1.001	3_OUT	-0.1	-0.169	-0.012	0.0027	
30 minute winter	3	Infiltration		0.0				
30 minute winter	3_OUT	Weir		0.0				0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	128	5.269	0.026	0.1	0.0042	0.0000	OK
180 minute winter	2	128	5.270	0.027	0.1	0.0043	0.0000	OK
180 minute winter	3	128	5.269	0.094	0.3	0.4486	0.0000	OK
180 minute winter	3_OUT	128	5.269	0.094	0.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	1	1.000	3	0.1	0.561	0.013	0.0188	
180 minute winter	2	2.000	3	0.1	0.057	0.013	0.0189	
180 minute winter	3	1.001	3_OUT	-0.1	0.105	-0.010	0.0145	
180 minute winter	3	Infiltration		0.0				
180 minute winter	3_OUT	Weir		0.0				0.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	168	5.298	0.055	0.1	0.0087	0.0000	OK
240 minute winter	2	168	5.298	0.055	0.1	0.0087	0.0000	OK
240 minute winter	3	168	5.298	0.123	0.3	0.5840	0.0000	SURCHARGED
240 minute winter	3_OUT	168	5.298	0.123	0.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	1	1.000	3	0.1	0.561	0.014	0.0247	
240 minute winter	2	2.000	3	0.1	0.053	0.014	0.0247	
240 minute winter	3	1.001	3_OUT	-0.1	0.105	-0.010	0.0148	
240 minute winter	3	Infiltration		0.0				
240 minute winter	3_OUT	Weir		0.0				0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute winter	1	136	5.335	0.092	0.2	0.0146	0.0000	OK
180 minute winter	2	136	5.335	0.092	0.1	0.0146	0.0000	OK
180 minute winter	3	136	5.335	0.160	0.4	0.7149	0.0000	FLOOD RISK
180 minute winter	3_OUT	136	5.335	0.160	0.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
180 minute winter	1	1.000	3	0.2	0.561	0.029	0.0310	
180 minute winter	2	2.000	3	0.1	0.084	0.017	0.0310	
180 minute winter	3	1.001	3_OUT	-0.1	-0.104	-0.012	0.0148	
180 minute winter	3	Infiltration		0.0				
180 minute winter	3_OUT	Weir		0.0				0.0

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute winter	1	256	5.423	0.180	0.1	0.0287	0.0000	SURCHARGED
360 minute winter	2	256	5.423	0.180	0.1	0.0287	0.0000	SURCHARGED
360 minute winter	3	256	5.423	0.248	0.2	0.7149	0.0000	FLOOD RISK
360 minute winter	3_OUT	256	5.423	0.248	0.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
360 minute winter	1	1.000	3	0.1	0.506	0.013	0.0316	
360 minute winter	2	2.000	3	0.1	0.040	0.013	0.0316	
360 minute winter	3	1.001	3_OUT	-0.1	0.103	-0.011	0.0148	
360 minute winter	3	Infiltration		0.0				
360 minute winter	3_OUT	Weir		0.0				0.0

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	2.000
CV	0.750	Preferred Cover Depth (m)	0.350
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	500.0		

Private Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
110	345	160	450

>160 Link+150 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
0.600	345	2.000	450

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100 | 150

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
1	0.005	5.00	5.490	575945.885	170984.949	0.650
1_OUT			5.640	575945.057	170985.764	0.800

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	1_OUT	1.162	0.600	4.840	4.840	0.000	0.0	100	5.02	50.3

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.000	7.9	0.7	0.550	0.700	0.005	0.0	0	∞

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	1.162	0.0	100	Circular	5.490	4.840	0.550	5.640	4.840	0.700

Link	US Node	Node Type	DS Node	Node Type
1.000	1	Junction	1_OUT	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
1	575945.885	170984.949	5.490	0.650	0	1.000	4.840	100
1_OUT	575945.057	170985.764	5.640	0.800	1	1.000	4.840	100

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	100 year (l/s)	0.0
Summer CV	0.750	Drain Down Time (mins)	1440	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	20	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Region	1
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 100 year (l/s)	
SPR	0.10		

Node 1_OUT Online Weir Control

Flap Valve	x	Invert Level (m)	5.390	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	5.000		

Node 1_OUT Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Safety Factor	2.0	Invert Level (m)	4.840
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	795

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	10.5	10.5	0.150	10.5	10.5	0.151	0.0	10.5

Node 1_OUT Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.03600	Invert Level (m)	4.990	Slope (1:X)	9999.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	255	Depth (m)	0.300
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	2.500		

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	1	390	4.900	0.060	0.1	0.0000	0.0000	OK
600 minute winter	1_OUT	390	4.900	0.060	0.1	0.6033	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	1	1.000	1_OUT	0.1	0.377	0.012	0.0058	
600 minute winter	1_OUT	Weir		0.0				0.0
600 minute winter	1_OUT	Infiltration		0.1				
600 minute winter	1_OUT	Infiltration		0.0				

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	1	228	4.988	0.148	0.4	0.0000	0.0000	SURCHARGED
240 minute winter	1_OUT	228	4.988	0.148	0.4	1.4793	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	1	1.000	1_OUT	0.4	0.429	0.047	0.0091	
240 minute winter	1_OUT	Weir		0.0				0.0
240 minute winter	1_OUT	Infiltration		0.1				
240 minute winter	1_OUT	Infiltration		0.0				

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	1	320	5.065	0.225	0.3	0.0000	0.0000	SURCHARGED
480 minute winter	1_OUT	320	5.065	0.225	0.3	1.7823	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
480 minute winter	1	1.000	1_OUT	0.3	0.455	0.035	0.0091	
480 minute winter	1_OUT	Weir		0.0				0.0
480 minute winter	1_OUT	Infiltration		0.1				
480 minute winter	1_OUT	Infiltration		0.1				

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	1	405	5.156	0.316	0.3	0.0000	0.0000	SURCHARGED
600 minute winter	1_OUT	405	5.156	0.316	0.3	2.1229	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
600 minute winter	1	1.000	1_OUT	0.3	0.377	0.035	0.0091	
600 minute winter	1_OUT	Weir		0.0				0.0
600 minute winter	1_OUT	Infiltration		0.1				
600 minute winter	1_OUT	Infiltration		0.1				

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	1	495	5.276	0.436	0.3	0.0000	0.0000	FLOOD RISK
720 minute winter	1_OUT	495	5.276	0.436	0.3	2.5716	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
720 minute winter	1	1.000	1_OUT	0.3	0.377	0.035	0.0091	
720 minute winter	1_OUT	Weir		0.0				0.0
720 minute winter	1_OUT	Infiltration		0.1				
720 minute winter	1_OUT	Infiltration		0.1				

Appendix E - Sustainable Urban Drainage Systems Management and Maintenance Plan

Fleet House, Upnor Road, Lower Upnor, ME2 4UP
Sustainable Urban Drainage Systems Management and Maintenance Plan

1. Introduction

This Sustainable Urban Drainage Systems (SUDS) Management and Maintenance Plan has been produced for SUDS elements at Fleet House, Upnor Road, Lower Upnor, ME2 4UP.

The following SUDS elements are proposed within the development.

- Attenuation Crates
- Subbase Replacement Soakaway
- Control Structures

2. Management

The freehold owners of Plot 9 will be responsible for the management and maintenance of the surface water drainage system serving Plot 9. A management company will be appointed to manage and maintain the surface water drainage system servings Plots 1 - 8 and communal areas.

3. Maintenance

The following maintenance plans will be put in place for each of the SUDS elements present within the development.

Attenuation Crates

SUDS Element	**Attenuation Crates**	
Maintenance Issues	Debris entering storage causing blockage or siltation.	
Maintenance Period	**Maintenance Task**	**Frequency**
Regular	Inspect gutters, drainage system, silt traps and inlets to storage to identify any elements not working correctly.	Monthly for 3 months, then six monthly.
	Debris removal from gutters.	Annually in autumn after leaf fall.
	Remove sediment from silt traps.	Annually or as required.
Remedial Work	Clear or jet drainage systems if blocked ensuring debris is not jetted into storage.	As required.
	Repair gutters, drainage system, silt traps and inlets to storage.	As required.
	Clear out storage if it becomes blocked.	As required.
	Replace storage if it fails.	As required.

Subbase Replacement Soakaway

SUDS Element	**Subbase Replacement Soakaway**	
Maintenance Issues	Debris entering soakaway causing blockage or siltation.	
Maintenance Period	**Maintenance Task**	**Frequency**
Regular	Inspect gutters, drainage system, silt traps and inlets to soakaway to identify any elements not working correctly.	Monthly for 3 months, then six monthly.
	Debris removal from gutters.	Annually in autumn after leaf fall.
	Remove sediment from silt traps.	Annually or as required.
Remedial Work	Clear or jet drainage systems if blocked ensuring debris is not jetted into soakaway.	As required.
	Repair gutters, drainage system, silt traps and inlets to soakaway.	As required.
	Replace soakaway if it fails.	As required.

Control Structures

SUDS Element	**Control Structures**	
Maintenance Issues	Debris blocking control structure.	
Maintenance Period	**Maintenance Task**	**Frequency**
Regular	Inspect chamber and remove any debris from control device.	Quarterly and following heavy rainfall
	Debris removal from gutters.	Annually in autumn after leaf fall
	Remove sediment from silt traps.	Annually or as required
Remedial Work	Repair or replace control device if it is damaged.	As required