Marston Business Park, St Neots

TECHNICAL NOTE

DOCUMENT CONTROL SHEET

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Client: Top Road

Project: Marston Business Park, St Neots

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Title: Discharge Condition 12 – Surface Water Drainage

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P01	06.05.2025	Issued for Information
P02	09.05.2025	Revised to suit Planning Consultants comments
P03	01.07.2025	Revised to suit FEH Hydraulic Calculations

Burrows Graham Limited has prepared this report in accordance with the instructions of the above-named Client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

Introduction

Planning permission for the development of the site was granted by Huntingdonshire District Council (HDC) in August 2023, planning application ref. 22/02332/FUL. The planning permission includes the following condition in relation to surface water drainage.

Condition 12

No laying of services, creation of hard surfaces or erection of a building shall commence until a detailed design of the surface water drainage of the site has been submitted to and approved in writing by the Local Planning Authority. Those elements of the surface water drainage system not adopted by a statutory undertaker shall thereafter be maintained and managed in accordance with the approved management and maintenance plan.

The scheme shall be based upon the principles within the agreed Flood Risk Assessment & Drainage Strategy report version 3 prepared by Conisbee (ref 210714/R Fallow) dated 16 May 2023 and shall also include:

a) Full calculations detailing the existing surface water runoff rates for the QBAR, 3.3% Annual Exceedance Probability (AEP) (1 in 30) and 1% AEP (1 in 100) storm events;
b) Full results of the proposed drainage system modelling in the above-referenced storm events (as well as 1% AEP plus climate change), inclusive of all collection, conveyance, storage, flow control and disposal elements and including an allowance for urban creep, together with an assessment of system performance;
c) Detailed drawings of the entire proposed surface water drainage system, attenuation and flow control measures, including levels, gradients, dimensions and pipe reference numbers, designed to accord with the CIRIA C753 SuDS Manual (or any equivalent guidance that may supersede or replace it);
d) Full details on SuDS proposals (including location, type, size, depths, side slopes and cross sections);
e) Details of overland flood flow routes in the event of system exceedance, with demonstration that such flows can be appropriately managed on site without increasing flood risk to occupants;
f) Demonstration that the surface water drainage of the site is in accordance with DEFRA non-statutory technical standards for suitable drainage systems;
g) Full details of the maintenance/adoption of the surface water drainage system;
h) Measures taken to prevent pollution of the receiving groundwater and/or surface water.

The drainage scheme must adhere to the hierarchy of drainage options as outlined in the National Planning Policy Framework Planning Practice Guidance. The drainage scheme shall be installed in accordance with the approved details prior to the first use of the building hereby permitted.

This Technical Note shall be read in conjunction with the Flood Risk Assessment and Drainage Strategy REV 3, produced by Conisbee dated 16 May 2023 approved as part of the original planning permission and referred to in Condition 12.

Surface Water Drainage Strategy

Disposal of surface water

The method for removal of surface water from the site has been selected in accordance with the hierarchy outlined in Building Regulations Part H as summarised below:

- Infiltration to the ground
- Discharge to a watercourse
- Connection to a surface water sewer
- Connection to a combined sewer

Due to the cohesive nature of the soils on site, it is considered that infiltration will not be a suitable means of disposing surface water runoff from the development site.

The nearest watercourse, Hen Brook, is located approximately 170m from site, so discharging directly to this is also not considered a suitable means of disposing surface water runoff.

It is therefore proposed that surface water runoff from the development site will be discharged to the Anglian Water surface water public sewer. This method of discharge is outlined in the Flood Risk Assessment and Drainage Strategy report produced by Conisbee that was approved as part of the original planning permission and referred to in Condition 12.

Surface Water Discharge Rates

The proposed site location is situated on a previous developed land (brownfield). Cambridgeshire Flood and Water SPD states that brownfield sites must reduce the existing runoff rates, providing betterment. Where possible, redevelopments should reinstate greenfield runoff rates.

The Cambridgeshire SWPG states *'Where a complex flow control is proposed the peak runoff rate from the developed site for events up to and including the 1% AEP plus climate change event should not exceed the greenfield equivalent'*.

Greenfield runoff rates for the site have been calculated using the IH124 runoff estimation approach, as summarised below. For greenfield runoff calculations refer to Flood Risk Assessment and Drainage Strategy referenced 210714/ R Fallow that was approved as part of the original planning permission and referred to in Condition 12.

Return Period	Existing Runoff Rate (l/s)	Greenfield Runoff Rate (/s)	Existing Discharge Volume (m^3)
1 in 1 year	39.00	1.81	209.50
1 in 30 years	95.70	5.10	460.40
1 in 100 years	125.00	7.41	598.10

The existing run off rates were determined by the Wallingford Rational Method with a rainstorm of 30 minutes duration; Volumetric runoff coefficient = 1 for impermeable areas, and 0 for permeable areas.

Calculated based on IH124 and 'Rainfall runoff management for developments.

Based on BS8582 Section 9.8

It is proposed to restrict surface water runoff to the greenfield rates set out in the table above, which have been previously approved by the Local Planning Authority.

SuDS Strategy

Sustainable Drainage Systems (SuDS) will be utilised in line with The SuDS Manual (C753) guidance and aim to minimise the impact a development has on the runoff quantity and quality and maximise amenity and biodiversity opportunities.

The management train approach is a fundamental principle of SuDS, it aims to primarily reduce pollution, flow rates and volume of runoff from the site. The main objective is to treat the runoff as close to the source as possible and it is imperative that at least two of the following should be included within the drainage strategy.

- **Prevention** – The use of good site design and rainwater re-use measures to prevent runoff.
- **Source Control** – Controlling the runoff as close to source as possible by using; porous pavements and Filter drains.
- **Site Control** – Use of water management techniques within local area, i.e. detention basins and geo-cellular storage.
- **Regional Control** – Management of water from a number of sites in a specific location, i.e. balancing ponds and wetlands.

The proposed drainage design for this development will incorporate prevention, source control and site control in the form of the following and as shown on the drainage layout in Appendix A:

- Oil separator, removing pollutants attached to silts and debris within surface water runoff.
- Permeable paving
- Filter drains
- Attenuation tanks
- Flow control

Design and Modelling

The drainage design has been analysed using Causeway Flow hydraulic software for the 1 in 1 year, 1 in 30 years and 1 in 100 years return period, with an additional allowance for climate change. FEH rainfall data has been used for storm durations up to 1440 minutes.

Urban creep has not been considered for this development, in line with the Drainage Strategy reference 210714/ R Fallow.

For Causeway Flow surface water calculations, refer to Appendix B

The surface water calculations demonstrate that the drainage system will operate without flooding for storm events up to and including the 1 in 30 years return period, with an additional 35% allowance for climate change.

For the 1 in 100 years return period, with 40% climate change allowance, the calculations indicate small volumes of flooding during critical storm durations. The volume of flooding will be contained on site within the external yards. Refer to Appendix C.

Flow control devices will be incorporated to restrict discharge from the system for all events up to and including the 1 in 100-year rainfall period, including 40% climate change allowance.

Water quality

Table 26.2 of the SuDS Manual (2015) provides pollution hazard indices for different land use classifications. The relevant land uses and associated hazards indices from this table are set out below.

Land Use	Pollution Hazard Level	Total suspended solids (TSS)	Metals	Hydrocarbons
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2	0.05
Low traffic roads and non-residential car parking with infrequent change	Low	0.5	0.4	0.4
Commercial yard and delivery areas	Medium	0.7	0.6	0.7

Water quality has been considered in line with the approved planning strategy, and the following measures have been included within the surface

water drainage proposals:

- All drainage from car park areas, which are considered low risk, will pass through permeable paving prior to discharging to the main attenuation tank, which will ultimately pass through the Aqua Swirl Oil Separator chamber, providing a second stage of treatment for all runoff from these areas.
- All drainage from service yards, which are considered high risk, will pass through the Aqua Swirl Oil Separator chamber
- All drainage from the site road and other hard surfaces will also pass through the Aqua Swirl Oil Separator chamber
- Silt will be prevented from entering the system by the use of channels with silt traps and catch pits where required.

The following mitigation indices have been identified for the proposed SuDS components from the SuDS Manual.

SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Paving	0.7	0.6	0.7
SDS Aqua-Swirl	0.8	0.5	0.7

Exceedance Flows

In accordance with the DEFRA Non-statutory technical standards for suitable drainage systems, the drainage system has been designed to accommodate the 1 in 100-year return period, with an additional 40% allowance for climate change.

In the event where the capacity of the surface water system is exceeded, surface water will flood from the drainage system but will remain on site.

The hydraulic surface water calculations indicated that flooding would occur in the 1 in 100 years, plus 40% climate change, return period. An exceedance flow route drawings has been provided, demonstrating that the flooded volume is contained on site. Refer to Appendix C.

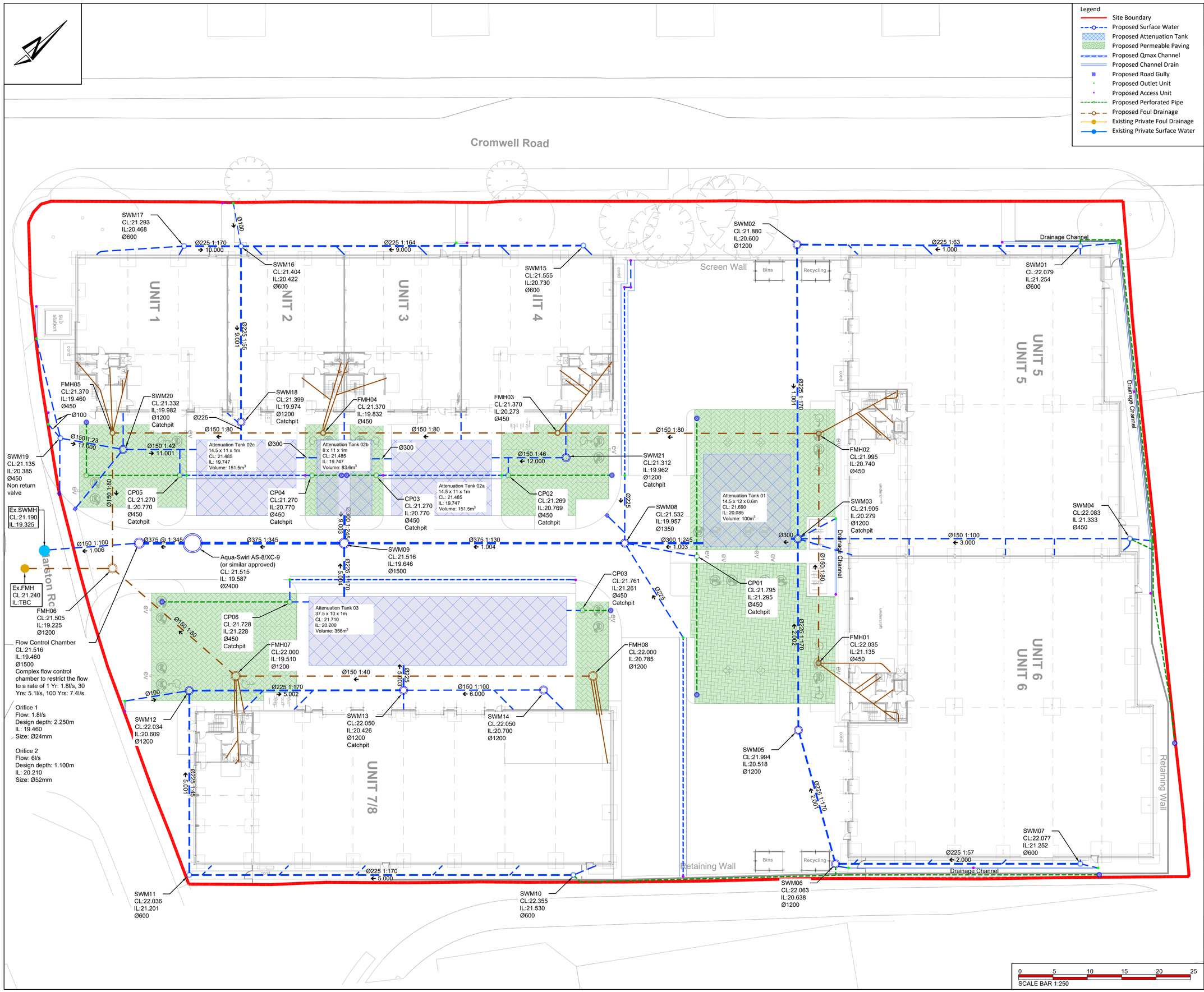
External levels have been designed to prevent flooding of the units, with external levels falling away from the units to a low point in the service yards.

Maintenance

Reference should be made to the Drainage Inspection and Maintenance Schedule in Appendix D, which includes required actions and typical frequencies for all drainage infrastructure serving the development.

The drainage will be managed and maintained by an appointed Management Company.

Appendix A – Drainage Layout



Legend

- Site Boundary
- Proposed Surface Water
- Proposed Attenuation Tank
- Proposed Permeable Paving
- Proposed Qmax Channel
- Proposed Channel Drain
- Proposed Road Gully
- Proposed Outlet Unit
- Proposed Access Unit
- Proposed Perforated Pipe
- Proposed Foul Drainage
- Existing Private Foul Drainage
- Existing Private Surface Water

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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION

MAINTENANCE

DEMOLITION

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT

GENERAL NOTES:

1. This drawing shall be read in conjunction with all the relevant architects, engineers' and service engineers drawings & specifications.
2. All units in millimeters U.O.N. on the drawing. Do not scale off the drawing.
3. All temporary works for formwork, excavations etc., to be the design responsibility of the Contractor.
4. The Contractor shall allow for the protection, temporary and permanent support and diversion works as necessary, to all existing services to the satisfaction of the asset owners.
5. The Contractor shall allow for dealing with surface water run-off into excavations and from groundwater by means of sumps, pumping and de-watering as appropriate, in order to keep the excavation as reasonably dry as possible during the construction of the works.
6. The Contractor is responsible for obtaining all required permits and licenses.
7. All private drainage within the site is to comply with the requirements of the relevant British/European Standard, (including BS EN 752, BS EN 1610, BS EN 295, BS EN 1917, BS5911, BS8000-D & 14 and BS EN 124), and the Building Regulations Part H.
8. Any adoptable drainage is to be in accordance with the requirements of the adopting authority. If in doubt seek clarification.
9. All pipework within chambers are to be laid soffit to soffit (U.O.N). All chamber invert levels are for the outgoing pipe levels. Backdrop pipework shall be connected at soffit to soffit with the backdrop / rodding access level specified.
10. Catchpit invert levels are for the outgoing pipe, pipes to be soffits level, sump level specified separately. All Catchpits are to be built with a 300 sump (U.O.N).
11. Any gradients of drains indicated are indicative only and the Contractor shall install the drains to the specified levels shown for each chamber (U.O.N).
12. Cover levels of the access points are provisional and subject to adjustment on site to suit the finished ground levels.
13. Positions and sizes of above ground foul and surface water drainage connections ("pop-ups") are indicative only. Setting out and confirmation of the internal requirements is the responsibility of the Architect. Contractor to confirm requirement prior to construction.
14. Ø of PCC manholes varies with pipe size, number of connections, depth etc. Minimum sizes are shown on the Burrows Graham Standard Details drawings. Sizes shown on drainage layout and/or manhole schedules take precedence over minimum sizes.
15. Flow control chambers should be built in accordance with the requirement of the manufacturer. Allowance should be made for a 600 sump and double covers and frames on the chambers.
16. Insitu concrete grades to be as stated on the drawings. Design chemical class for all precast concrete products shall be DC4 unless agreed otherwise.
17. All separators shall be in accordance with Building Regulations Part H3-A and with BS EN 858 and be kite-marked / CE- marked in accordingly. The oil alarm system is to be in accordance with Client's requirements. Separators to be installed in accordance with manufacturer's recommendations / requirements (venting, protection etc)
18. All below ground plastic/GRP tanks shall be installed in accordance with the manufacturers instructions / requirements. They shall be provided with sufficient concrete surround to counter floatation and shall have a wall thickness adequate to resist the highest ground water level which could be encountered at their location.
19. All existing drainage/structures to be abandoned shall be broken out and removed from site, the excavation shall be backfilled with a suitable granular material to the required level. Alternatively, deep drains may be cleaned and grouted with a 1:10 cementitious grout, with structures broken down to 1m below proposed finished ground level and infilled with a suitable granular material. Abandoned gullies are to be removed from site and abandoned tails are to be sealed with a 300 thick concrete plug at a depth of 1.0m below proposed finished ground level.
20. Where utility/land drainage trenches etc cross over drainage trenches, the Contractor shall construct an impermeable barrier to prevent groundwater infiltrating into the drainage trench.
21. Design assumes that no sewerage authority sewers or other drainage systems require modification, diversion or abandoning (U.O.N on the drawings)
22. All manholes less than 1.5m deep are considered as none man entry and shall be maintained from ground level.
23. Upon completion of the works, the Contractor shall clean all drainage by jetting, removing all debris from site and the system is to be CCTV surveyed. No debris shall be permitted to enter the existing drainage system.
24. No deep rooting trees/vegetation should be planted within 5.0m of any drainage works.
25. The storage and installation of all proprietary drainage items used are to be strictly in accordance with the manufacturers instructions / requirements.
26. Any works within the public highway to be reinstated to highway authority requirements. All relevant permits/licences must be sought by the contractor prior to the works being undertaken.
27. Statutory Undertakers information, where shown, is indicative only based on supplied records. The contractor shall verify the depth position and nature of the services as necessary in order to construct the works.
28. Drainage channels are to be ACO Qmax in service yards and ACO Multidrain in car parks, or similar approved. Channels are to be sized by the supplier and approved by the Engineer in writing prior to ordering. Drainage channels to be installed to manufacturers' requirements. Design of channels shall be based on a 1 in 30 year storm return period, 15 minute duration. Outlet units on channel drains to include silt traps.
29. All RWP, gully and channel connections shall be Ø150 U.O.N. Waste/soil stack connections shall be Ø100mm. U.O.N and shall have internal above ground rodding eyes or large access fittings in accordance with Building Regulations.
30. All WPC's, SRWP's and RWP's are shown indicatively. Locations shall be confirmed by others.
31. Below ground drainage connections to be provided to all canopy downpipes
31.1. Ø150mm with concrete bed and surround U.O.N.

REV	DATE	BY	DESCRIPTION	CHKD
P04	01.07.25	JB	Revised to suit FEH Hydraulic Calculations	JW
P03	14.05.25	JB	Retaining wall drainage added	RJ
P02	25.04.25	JB	Unit 1-4 attenuation tank spilt to accomondate incoming utilities. Foul pop-ups revised to suit MBA drawings.	RJ
P01	17.04.25	JB	Issued for Information	RJ

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CLIENT

TOP ROAD

PROJECT

MARSTON BUSINESS PARK
ST NEOTS

DRAWING TITLE

PROPOSED DRAINAGE LAYOUT

BGL PROJECT NUMBER	DRAWING STATUS	OFFICE	
30278	PRELIMINARY	NORTH	
SCALE @ A1	DATE	DRAWN BY	CHECKED BY
1:250	17.04.2025	JB	RJ

DRAWING No

30278-BGL-XX-XX-DR-C-00210

REV

P04

Appendix B – Surface Water Calculations

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)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
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)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SWM04	0.035	5.00	22.083	450	519237.696	259622.803	0.750
1			21.195	1200	519137.408	259501.210	1.870
Flow Control Chamber			21.516	1500	519145.330	259512.169	2.056
SWM09			21.516	1500	519164.537	259534.965	1.870
SWM08	0.207	5.00	21.532	1350	519190.840	259566.184	1.575
Attenuation Tank 01			21.691		519199.135	259576.029	1.606
SWM03	0.250	5.00	21.905	1200	519206.564	259585.853	1.626
SWM05			21.994	1200	519227.915	259567.965	1.476
SWM06	0.066	5.00	22.063	1200	519246.680	259560.043	1.425
SWM07	0.037	5.00	22.077	600	519269.228	259586.806	0.825
Attenuation Tank 03			21.709		519170.487	259530.078	1.507
SWM13	0.162	5.00	22.050	1200	519186.469	259527.778	1.624
SWM12			22.034	1200	519166.430	259503.911	1.425
SWM11	0.059	5.00	22.036	600	519186.954	259486.618	0.835
SWM10	0.010	5.00	22.355	600	519222.951	259529.518	0.825
SWM14	0.013	5.00	22.050	1200	519199.572	259543.385	1.350
CP06		5.00	21.728		519165.982	259523.411	0.500
Attenuation Tank 02	0.038	5.00	21.483		519159.750	259538.998	1.736
SWM18	0.019	5.00	21.399	1200	519141.053	259534.470	1.425
SWM16	0.057	5.00	21.404	600	519121.915	259550.595	0.982
SWM17	0.024	5.00	21.293	600	519116.887	259544.668	0.825
SWM15	0.011	5.00	21.555	600	519154.447	259589.358	0.825
SWM20	0.017	5.00	21.332	1200	519133.392	259519.157	1.350
SWM19	0.017	5.00	21.135	450	519126.264	259513.242	0.750
CP05	0.093	8.00	21.270		519141.586	259523.036	0.970
CP03	0.008	8.00	21.761		519194.383	259555.171	0.500
SWM21	0.016	5.00	21.312	1200	519175.830	259567.663	1.350
CP02	0.105	8.00	21.269		519172.380	259559.588	0.969
SWM01	0.031	5.00	22.079	600	519200.899	259644.377	0.825
SWM02	0.062	5.00	21.880	1200	519174.338	259612.852	1.280
CP01		5.00	21.795		519199.656	259573.737	0.500

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.006	Flow Control Chamber	1	13.522	0.600	19.460	19.325	0.135	100.2	150	9.28	38.6
1.005	SWM09	Flow Control Chamber	29.809	0.600	19.646	19.460	0.186	160.3	375	9.05	39.2
1.004	SWM08	SWM09	40.822	0.600	19.957	19.646	0.311	131.3	375	6.89	45.5
9.003	Attenuation Tank 02	SWM09	6.259	0.600	19.747	19.721	0.026	240.7	300	8.53	40.6
5.004	Attenuation Tank 03	SWM09	7.700	0.600	20.202	20.157	0.045	170.0	225	8.70	40.1
8.000	CP06	Attenuation Tank 03	8.046	0.600	21.228	21.148	0.080	100.0	150	5.13	50.0
5.003	SWM13	Attenuation Tank 03	16.147	0.600	20.426	20.331	0.095	170.0	225	6.95	45.3
6.000	SWM14	SWM13	20.378	0.600	20.700	20.501	0.199	102.4	150	5.34	50.0
5.002	SWM12	SWM13	31.164	0.600	20.609	20.426	0.183	170.0	225	6.68	46.3
5.001	SWM11	SWM12	26.838	0.600	21.201	20.609	0.592	45.3	225	6.16	48.2
5.000	SWM10	SWM11	56.002	0.600	21.530	21.201	0.329	170.0	225	5.93	49.0
13.000	CP05	Attenuation Tank 02	24.181	0.600	20.300	20.083	0.217	111.4	150	8.42	40.8
11.001	SWM20	Attenuation Tank 02	32.991	0.600	19.982	19.747	0.235	140.4	150	5.72	49.9
9.002	SWM18	Attenuation Tank 02	19.237	0.600	19.974	19.747	0.227	84.7	225	6.29	47.7
9.001	SWM16	SWM18	25.026	0.600	20.432	19.974	0.458	54.6	225	6.06	48.5
9.000	SWM15	SWM16	50.605	0.600	20.730	20.422	0.308	164.3	225	5.83	49.4
10.000	SWM17	SWM16	7.772	0.600	20.468	20.422	0.046	170.0	225	5.13	50.0
11.000	SWM19	SWM20	9.263	0.600	20.385	19.982	0.403	23.0	150	5.07	50.0
4.000	CP01	SWM08	11.609	0.600	21.295	21.179	0.116	100.0	150	5.19	50.0
1.003	Attenuation Tank 01	SWM08	12.874	0.600	20.085	20.032	0.053	242.9	300	6.46	47.1
1.002	SWM03	Attenuation Tank 01	12.317	0.600	20.279	20.085	0.194	63.5	300	6.24	47.9
2.002	SWM05	SWM03	27.854	0.600	20.518	20.354	0.164	170.0	225	6.14	48.2
3.000	SWM04	SWM03	48.317	0.600	21.333	20.850	0.483	100.0	150	5.80	49.6
2.001	SWM06	SWM05	20.369	0.600	20.638	20.518	0.120	169.7	225	5.68	50.0

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	1.004	17.7	139.7	1.906	1.720	1.334	0.0	150	1.023
1.005	1.428	157.8	141.6	1.495	1.681	1.334	0.0	279	1.607
1.004	1.580	174.5	84.8	1.200	1.495	0.687	0.0	184	1.568
9.003	1.009	71.3	43.5	1.436	1.495	0.396	0.0	170	1.057
5.004	1.000	39.7	27.2	1.282	1.134	0.251	0.0	137	1.074
8.000	1.005	17.8	0.0	0.350	0.411	0.000	0.0	0	0.000
5.003	1.000	39.7	29.8	1.399	1.153	0.243	0.0	145	1.094
6.000	0.993	17.5	1.7	1.200	1.399	0.013	0.0	31	0.627
5.002	1.000	39.7	8.6	1.200	1.399	0.069	0.0	71	0.800
5.001	1.948	77.4	9.0	0.610	1.200	0.069	0.0	51	1.309
5.000	1.000	39.7	1.3	0.600	0.610	0.010	0.0	28	0.459
13.000	0.951	16.8	10.3	0.820	1.250	0.093	0.0	85	0.997
11.001	0.846	14.9	4.5	1.200	1.586	0.033	0.0	57	0.742
9.002	1.421	56.5	14.2	1.200	1.511	0.110	0.0	77	1.189
9.001	1.773	70.5	12.0	0.747	1.200	0.091	0.0	63	1.333
9.000	1.017	40.4	1.4	0.600	0.757	0.011	0.0	29	0.477
10.000	1.000	39.7	3.3	0.600	0.757	0.024	0.0	44	0.607
11.000	2.109	37.3	2.3	0.600	1.200	0.017	0.0	25	1.164
4.000	1.005	17.8	0.0	0.350	0.203	0.000	0.0	0	0.000
1.003	1.004	71.0	61.4	1.306	1.200	0.481	0.0	216	1.125
1.002	1.976	139.7	62.4	1.326	1.306	0.481	0.0	140	1.922
2.002	1.000	39.7	13.5	1.251	1.326	0.103	0.0	90	0.905
3.000	1.005	17.8	4.7	0.600	0.905	0.035	0.0	52	0.848
2.001	1.000	39.8	13.9	1.200	1.251	0.103	0.0	92	0.914

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	SWM07	SWM06	34.995	0.600	21.252	20.638	0.614	57.0	225	5.34	50.0
7.000	CP03	Attenuation Tank 03	34.651	0.600	21.261	20.914	0.347	100.0	150	8.57	40.4
12.000	SWM21	Attenuation Tank 02	32.867	0.600	19.962	19.747	0.215	152.9	150	5.68	50.0
14.000	CP02	Attenuation Tank 02	24.155	0.600	20.300	20.083	0.217	111.3	150	8.42	40.8
1.000	SWM01	SWM02	41.223	0.600	21.254	20.600	0.654	63.0	225	5.42	50.0
1.001	SWM02	SWM03	42.041	0.600	20.600	20.354	0.246	170.9	225	6.12	48.3

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)
2.000	1.736	69.0	5.0	0.600	1.200	0.037	0.0	41	1.019
7.000	1.005	17.8	0.8	0.350	0.645	0.008	0.0	22	0.510
12.000	0.810	14.3	2.2	1.200	1.586	0.016	0.0	40	0.591
14.000	0.952	16.8	11.6	0.819	1.250	0.105	0.0	92	1.025
1.000	1.650	65.6	4.2	0.600	1.055	0.031	0.0	38	0.930
1.001	0.997	39.6	12.2	1.055	1.326	0.093	0.0	86	0.881

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Normal	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	0.840	Additional Storage (m³/ha)	0.0		

Storm Durations

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

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
30	35	0	0
100	0	0	0
100	40	0	0

Node Flow Control Chamber Online Orifice Control

Flap Valve	x	Design Depth (m)	2.250	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	1.8		
Invert Level (m)	19.460	Diameter (m)	0.024		

Node SWM19 Online Orifice Control

Flap Valve	✓	Design Depth (m)	0.750	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	39.0		
Invert Level (m)	20.385	Diameter (m)	0.150		

Node Flow Control Chamber Online Orifice Control

Flap Valve	x	Design Depth (m)	1.100	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	6.0		
Invert Level (m)	20.210	Diameter (m)	0.052		

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Node CP01 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	21.295	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	43.000	Inf Depth (m)	
Porosity	0.30	Length (m)	20.000		

Node CP02 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.300	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.350
Safety Factor	2.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	12.000		

Node CP03 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	21.261	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	15.000	Inf Depth (m)	
Porosity	0.30	Length (m)	5.000		

Node CP06 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	21.228	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	0.350
Safety Factor	2.0	Width (m)	21.000	Inf Depth (m)	
Porosity	0.30	Length (m)	15.000		

Node CP05 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	20.300	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.350
Safety Factor	2.0	Width (m)	20.000	Inf Depth (m)	
Porosity	0.30	Length (m)	12.000		

Node Attenuation Tank 02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	19.747
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	407.0	0.0	1.000	407.0	0.0	1.001	0.0	0.0

Node Attenuation Tank 03 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	20.202
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	375.0	0.0	1.000	375.0	0.0	1.001	0.0	0.0

Node Attenuation Tank 01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	20.085
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

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Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	174.0	0.0	0.600	174.0	0.0	0.601	0.0	0.0

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWM04	11	21.371	0.038	2.5	0.0060	0.0000	OK
720 minute winter	1	720	19.349	0.024	1.0	0.0000	0.0000	OK
720 minute winter	Flow Control Chamber	720	20.150	0.690	1.0	1.2191	0.0000	SURCHARGED
720 minute winter	SWM09	720	20.150	0.504	8.4	0.8904	0.0000	SURCHARGED
720 minute winter	SWM08	720	20.150	0.193	6.5	0.2761	0.0000	OK
120 minute summer	Attenuation Tank 01	72	20.171	0.086	18.5	14.2667	0.0000	OK
15 minute winter	SWM03	10	20.386	0.107	32.9	0.1212	0.0000	OK
15 minute winter	SWM05	11	20.584	0.066	7.3	0.0743	0.0000	OK
15 minute winter	SWM06	11	20.705	0.067	7.4	0.0754	0.0000	OK
15 minute winter	SWM07	10	21.282	0.030	2.7	0.0085	0.0000	OK
240 minute winter	Attenuation Tank 03	156	20.246	0.043	5.3	15.4960	0.0000	OK
15 minute winter	SWM13	11	20.530	0.104	17.0	0.1181	0.0000	OK
15 minute winter	SWM12	11	20.661	0.052	4.8	0.0590	0.0000	OK
15 minute winter	SWM11	11	21.239	0.038	4.9	0.0107	0.0000	OK
15 minute winter	SWM10	11	21.550	0.020	0.7	0.0058	0.0000	OK
15 minute winter	SWM14	11	20.723	0.023	0.9	0.0261	0.0000	OK
15 minute summer	CP06	1	21.228	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Attenuation Tank 02	720	20.150	0.403	11.0	155.7902	0.0000	SURCHARGED
720 minute winter	SWM18	720	20.150	0.176	1.0	0.1990	0.0000	OK
15 minute winter	SWM16	11	20.477	0.055	6.5	0.0157	0.0000	OK
15 minute winter	SWM17	10	20.499	0.031	1.7	0.0089	0.0000	OK
15 minute winter	SWM15	11	20.751	0.021	0.8	0.0059	0.0000	OK
720 minute winter	SWM20	705	20.150	0.168	0.4	0.1896	0.0000	SURCHARGED
15 minute winter	SWM19	11	20.417	0.032	1.2	0.0050	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	SWM04	3.000	SWM03	2.4	0.704	0.136	0.1658	
720 minute winter	Flow Control Chamber	1.006	1	1.0	0.537	0.055	0.0247	45.4
720 minute winter	Flow Control Chamber	Orifice	1	0.0				0.0
720 minute winter	SWM09	1.005	Flow Control Chamber	1.0	0.149	0.006	3.2878	
720 minute winter	SWM08	1.004	SWM09	6.5	0.404	0.037	3.4171	
120 minute summer	Attenuation Tank 01	1.003	SWM08	12.4	0.754	0.174	0.2111	
15 minute winter	SWM03	1.002	Attenuation Tank 01	33.0	2.591	0.237	0.1819	
15 minute winter	SWM05	2.002	SWM03	7.1	0.755	0.179	0.2630	
15 minute winter	SWM06	2.001	SWM05	7.3	0.759	0.183	0.1981	
15 minute winter	SWM07	2.000	SWM06	2.6	0.423	0.038	0.2258	
240 minute winter	Attenuation Tank 03	5.004	SWM09	3.1	0.593	0.079	0.0406	
15 minute winter	SWM13	5.003	Attenuation Tank 03	16.9	0.954	0.424	0.2855	
15 minute winter	SWM12	5.002	SWM13	4.7	0.395	0.119	0.3893	
15 minute winter	SWM11	5.001	SWM12	4.8	0.876	0.062	0.1525	
15 minute winter	SWM10	5.000	SWM11	0.7	0.224	0.017	0.1730	
15 minute winter	SWM14	6.000	SWM13	0.9	0.488	0.051	0.0422	
15 minute summer	CP06	8.000	Attenuation Tank 03	0.0	0.000	0.000	0.0000	
720 minute winter	Attenuation Tank 02	9.003	SWM09	-7.2	0.249	-0.100	0.4408	
720 minute winter	SWM18	9.002	Attenuation Tank 02	1.0	0.535	0.018	0.7030	
15 minute winter	SWM16	9.001	SWM18	6.3	0.838	0.090	0.1909	
15 minute winter	SWM17	10.000	SWM16	1.7	0.317	0.042	0.0421	
15 minute winter	SWM15	9.000	SWM16	0.7	0.164	0.018	0.2382	
720 minute winter	SWM20	11.001	Attenuation Tank 02	0.4	0.185	0.027	0.5808	
15 minute winter	SWM19	Orifice	SWM20	1.2				

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Results for 1 year Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute summer	CP05	70	20.339	0.039	3.5	2.3544	0.0000	OK
180 minute winter	CP03	108	21.272	0.011	0.2	0.1901	0.0000	OK
720 minute winter	SWM21	720	20.150	0.188	0.2	0.2127	0.0000	SURCHARGED
120 minute summer	CP02	70	20.342	0.042	4.0	2.5584	0.0000	OK
15 minute winter	SWM01	10	21.282	0.028	2.3	0.0080	0.0000	OK
15 minute winter	SWM02	11	20.661	0.061	6.7	0.0691	0.0000	OK
15 minute summer	CP01	1	21.295	0.000	0.0	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)
120 minute summer	CP05	13.000	Attenuation Tank 02	2.5	0.685	0.146	0.0868	
180 minute winter	CP03	7.000	Attenuation Tank 03	0.2	0.328	0.011	0.0197	
720 minute winter	SWM21	12.000	Attenuation Tank 02	0.2	0.079	0.014	0.5786	
120 minute summer	CP02	14.000	Attenuation Tank 02	2.8	0.713	0.168	0.0958	
15 minute winter	SWM01	1.000	SWM02	2.2	0.417	0.034	0.2377	
15 minute winter	SWM02	1.001	SWM03	6.3	0.729	0.158	0.3613	
15 minute summer	CP01	4.000	SWM08	0.0	0.000	0.000	0.0000	

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWM04	11	21.435	0.102	14.4	0.0162	0.0000	OK
600 minute winter	1	585	19.352	0.027	1.2	0.0000	0.0000	OK
600 minute winter	Flow Control Chamber	585	20.563	1.103	4.5	1.9485	0.0000	SURCHARGED
600 minute winter	SWM09	585	20.563	0.917	21.6	1.6202	0.0000	SURCHARGED
600 minute winter	SWM08	585	20.563	0.606	17.6	0.8671	0.0000	SURCHARGED
600 minute winter	Attenuation Tank 01	585	20.563	0.478	17.0	79.0143	0.0000	SURCHARGED
15 minute winter	SWM03	11	20.746	0.467	180.2	0.5285	0.0000	SURCHARGED
15 minute winter	SWM05	11	20.912	0.394	37.6	0.4454	0.0000	SURCHARGED
15 minute winter	SWM06	11	21.045	0.407	42.4	0.4598	0.0000	SURCHARGED
15 minute winter	SWM07	10	21.323	0.071	15.2	0.0201	0.0000	OK
600 minute winter	Attenuation Tank 03	585	20.563	0.361	18.8	128.5887	0.0000	SURCHARGED
15 minute winter	SWM13	11	21.138	0.712	93.3	0.8058	0.0000	SURCHARGED
15 minute winter	SWM12	11	21.228	0.619	27.7	0.6999	0.0000	SURCHARGED
15 minute winter	SWM11	11	21.299	0.098	28.3	0.0277	0.0000	OK
15 minute winter	SWM10	11	21.577	0.047	4.0	0.0132	0.0000	OK
15 minute winter	SWM14	11	21.161	0.461	9.3	0.5208	0.0000	SURCHARGED
15 minute summer	CP06	1	21.228	0.000	0.0	0.0000	0.0000	OK
600 minute winter	Attenuation Tank 02	585	20.563	0.816	30.3	315.4843	0.0000	SURCHARGED
600 minute winter	SWM18	585	20.563	0.589	3.9	0.6661	0.0000	SURCHARGED
600 minute winter	SWM16	585	20.563	0.141	3.2	0.0399	0.0000	OK
600 minute winter	SWM17	585	20.563	0.095	0.8	0.0269	0.0000	OK
15 minute winter	SWM15	11	20.779	0.049	4.4	0.0138	0.0000	OK
720 minute winter	SWM20	705	20.565	0.583	1.0	0.6589	0.0000	SURCHARGED
720 minute winter	SWM19	690	20.562	0.177	0.5	0.0282	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWM04	3.000	SWM03	13.9	1.106	0.783	0.6074	
600 minute winter	Flow Control Chamber	1.006	1	1.2	0.575	0.070	0.0293	51.9
600 minute winter	Flow Control Chamber	Orifice	1	3.2				96.5
600 minute winter	SWM09	1.005	Flow Control Chamber	4.5	0.129	0.028	3.2878	
600 minute winter	SWM08	1.004	SWM09	16.9	0.475	0.097	4.5025	
600 minute winter	Attenuation Tank 01	1.003	SWM08	11.9	0.745	0.168	0.9066	
15 minute winter	SWM03	1.002	Attenuation Tank 01	179.4	3.219	1.284	0.8669	
15 minute winter	SWM05	2.002	SWM03	38.8	1.006	0.975	1.1078	
15 minute winter	SWM06	2.001	SWM05	37.6	1.083	0.945	0.8101	
15 minute winter	SWM07	2.000	SWM06	15.0	0.602	0.218	0.8835	
600 minute winter	Attenuation Tank 03	5.004	SWM09	-10.0	0.698	-0.253	0.3062	
15 minute winter	SWM13	5.003	Attenuation Tank 03	93.3	2.347	2.349	0.6357	
15 minute winter	SWM12	5.002	SWM13	29.0	0.730	0.731	1.2394	
15 minute winter	SWM11	5.001	SWM12	27.7	1.231	0.358	0.7564	
15 minute winter	SWM10	5.000	SWM11	3.8	0.363	0.096	0.6312	
15 minute winter	SWM14	6.000	SWM13	6.8	0.461	0.390	0.3588	
15 minute summer	CP06	8.000	Attenuation Tank 03	0.0	0.000	0.000	0.0000	
600 minute winter	Attenuation Tank 02	9.003	SWM09	-20.1	-0.391	-0.282	0.4408	
600 minute winter	SWM18	9.002	Attenuation Tank 02	3.8	0.767	0.067	0.7651	
600 minute winter	SWM16	9.001	SWM18	3.2	0.665	0.045	0.7976	
600 minute winter	SWM17	10.000	SWM16	0.8	0.232	0.020	0.1635	
15 minute winter	SWM15	9.000	SWM16	4.2	0.295	0.104	0.7469	
720 minute winter	SWM20	11.001	Attenuation Tank 02	1.0	0.492	0.064	0.5808	
720 minute winter	SWM19	Orifice	SWM20	0.7				

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Results for 30 year Critical Storm Duration. Lowest mass balance: 99.33%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	CP05	585	20.563	0.263	3.3	18.5084	0.0000	SURCHARGED
15 minute winter	CP03	15	21.292	0.031	2.4	0.6405	0.0000	OK
600 minute winter	SWM21	585	20.563	0.601	0.6	0.6797	0.0000	SURCHARGED
600 minute winter	CP02	585	20.563	0.263	3.7	18.5074	0.0000	SURCHARGED
15 minute winter	SWM01	10	21.321	0.067	12.9	0.0189	0.0000	OK
15 minute winter	SWM02	11	20.945	0.345	38.4	0.3899	0.0000	SURCHARGED
15 minute summer	CP01	1	21.295	0.000	0.0	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)
600 minute winter	CP05	13.000	Attenuation Tank 02	3.3	0.670	0.195	0.4257	
15 minute winter	CP03	7.000	Attenuation Tank 03	1.7	0.635	0.093	0.0906	
600 minute winter	SWM21	12.000	Attenuation Tank 02	0.6	0.412	0.038	0.5786	
600 minute winter	CP02	14.000	Attenuation Tank 02	3.7	0.698	0.219	0.4252	
15 minute winter	SWM01	1.000	SWM02	12.7	0.614	0.194	1.0176	
15 minute winter	SWM02	1.001	SWM03	35.1	0.912	0.884	1.6720	
15 minute summer	CP01	4.000	SWM08	0.0	0.000	0.000	0.0000	

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Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWM04	11	21.603	0.270	19.4	0.0429	0.0000	SURCHARGED
720 minute winter	1	705	19.353	0.028	1.4	0.0000	0.0000	OK
600 minute winter	Flow Control Chamber	585	20.830	1.370	5.8	2.4212	0.0000	SURCHARGED
600 minute winter	SWM09	585	20.830	1.184	24.1	2.0926	0.0000	SURCHARGED
600 minute winter	SWM08	585	20.830	0.873	23.0	1.2498	0.0000	SURCHARGED
600 minute winter	Attenuation Tank 01	585	20.831	0.746	23.0	99.2627	0.0000	SURCHARGED
15 minute winter	SWM03	11	21.099	0.820	234.3	0.9275	0.0000	SURCHARGED
15 minute winter	SWM05	12	21.396	0.878	48.9	0.9929	0.0000	SURCHARGED
15 minute winter	SWM06	12	21.615	0.977	53.6	1.1048	0.0000	SURCHARGED
15 minute winter	SWM07	12	21.661	0.409	20.5	0.1157	0.0000	SURCHARGED
720 minute winter	Attenuation Tank 03	705	20.830	0.628	18.7	223.7666	0.0000	SURCHARGED
15 minute winter	SWM13	11	21.467	1.041	117.2	1.1775	0.0000	SURCHARGED
15 minute winter	SWM12	11	21.569	0.960	35.8	1.0860	0.0000	SURCHARGED
15 minute winter	SWM11	11	21.658	0.457	38.2	0.1293	0.0000	SURCHARGED
15 minute winter	SWM10	12	21.686	0.156	8.1	0.0442	0.0000	OK
15 minute winter	SWM14	11	21.494	0.794	10.7	0.8981	0.0000	SURCHARGED
15 minute summer	CP06	1	21.228	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Attenuation Tank 02	705	20.830	1.083	25.5	386.8433	0.0000	SURCHARGED
720 minute winter	SWM18	705	20.830	0.856	4.5	0.9683	0.0000	SURCHARGED
600 minute winter	SWM16	585	20.830	0.408	4.3	0.1155	0.0000	SURCHARGED
600 minute winter	SWM17	585	20.830	0.362	1.1	0.1025	0.0000	SURCHARGED
600 minute winter	SWM15	585	20.830	0.100	0.5	0.0283	0.0000	OK
720 minute winter	SWM20	705	20.831	0.849	1.8	0.9607	0.0000	SURCHARGED
600 minute winter	SWM19	585	20.829	0.444	0.8	0.0706	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWM04	3.000	SWM03	17.3	1.117	0.975	0.8506	
600 minute winter	Flow Control Chamber	1.006	1	1.4	0.594	0.079	0.0317	56.5
600 minute winter	Flow Control Chamber	Orifice	1	4.4				130.1
600 minute winter	SWM09	1.005	Flow Control Chamber	5.8	0.121	0.037	3.2878	
600 minute winter	SWM08	1.004	SWM09	22.9	0.533	0.131	4.5025	
600 minute winter	Attenuation Tank 01	1.003	SWM08	13.2	0.739	0.186	0.9066	
15 minute winter	SWM03	1.002	Attenuation Tank 01	232.3	3.299	1.663	0.8674	
15 minute winter	SWM05	2.002	SWM03	49.5	1.244	1.244	1.1078	
15 minute winter	SWM06	2.001	SWM05	48.9	1.229	1.229	0.8101	
15 minute winter	SWM07	2.000	SWM06	18.8	0.617	0.272	1.3918	
720 minute winter	Attenuation Tank 03	5.004	SWM09	-9.5	0.673	-0.239	0.3062	
15 minute winter	SWM13	5.003	Attenuation Tank 03	116.2	2.921	2.923	0.6357	
15 minute winter	SWM12	5.002	SWM13	39.0	0.982	0.982	1.2394	
15 minute winter	SWM11	5.001	SWM12	35.8	1.215	0.463	1.0674	
15 minute winter	SWM10	5.000	SWM11	10.3	0.346	0.258	1.9363	
15 minute winter	SWM14	6.000	SWM13	8.4	0.475	0.477	0.3588	
15 minute summer	CP06	8.000	Attenuation Tank 03	0.0	0.000	0.000	0.0000	
720 minute winter	Attenuation Tank 02	9.003	SWM09	-17.0	-0.406	-0.239	0.4408	
720 minute winter	SWM18	9.002	Attenuation Tank 02	4.4	0.761	0.078	0.7651	
600 minute winter	SWM16	9.001	SWM18	4.3	0.651	0.061	0.9953	
600 minute winter	SWM17	10.000	SWM16	1.1	0.268	0.028	0.3091	
600 minute winter	SWM15	9.000	SWM16	0.5	0.143	0.012	1.4379	
720 minute winter	SWM20	11.001	Attenuation Tank 02	1.3	0.534	0.088	0.5808	
600 minute winter	SWM19	Orifice	SWM20	1.4				

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Results for 30 year +35% CC Critical Storm Duration. Lowest mass balance: 99.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	CP05	585	20.831	0.531	4.4	24.8046	0.0000	SURCHARGED
15 minute winter	CP03	15	21.299	0.038	3.3	0.7966	0.0000	OK
720 minute winter	SWM21	705	20.830	0.868	0.7	0.9820	0.0000	SURCHARGED
600 minute winter	CP02	585	20.831	0.531	5.0	24.8046	0.0000	SURCHARGED
15 minute winter	SWM01	12	21.466	0.212	17.4	0.0599	0.0000	OK
15 minute winter	SWM02	12	21.418	0.818	51.6	0.9253	0.0000	SURCHARGED
15 minute summer	CP01	1	21.295	0.000	0.0	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)
600 minute winter	CP05	13.000	Attenuation Tank 02	3.6	0.669	0.212	0.4257	
15 minute winter	CP03	7.000	Attenuation Tank 03	2.5	0.715	0.140	0.1208	
720 minute winter	SWM21	12.000	Attenuation Tank 02	0.6	0.409	0.045	0.5786	
600 minute winter	CP02	14.000	Attenuation Tank 02	4.1	0.694	0.242	0.4252	
15 minute winter	SWM01	1.000	SWM02	17.6	0.633	0.269	1.6193	
15 minute winter	SWM02	1.001	SWM03	43.6	1.096	1.099	1.6720	
15 minute summer	CP01	4.000	SWM08	0.0	0.000	0.000	0.0000	

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWM04	11	21.464	0.131	18.5	0.0208	0.0000	OK
720 minute winter	1	705	19.353	0.028	1.3	0.0000	0.0000	OK
720 minute winter	Flow Control Chamber	705	20.722	1.262	5.3	2.2299	0.0000	SURCHARGED
720 minute winter	SWM09	705	20.722	1.076	20.2	1.9017	0.0000	SURCHARGED
720 minute winter	SWM08	705	20.722	0.765	18.5	1.0951	0.0000	SURCHARGED
720 minute winter	Attenuation Tank 01	705	20.722	0.637	19.4	99.2627	0.0000	SURCHARGED
15 minute winter	SWM03	11	21.029	0.750	226.6	0.8479	0.0000	SURCHARGED
15 minute winter	SWM05	12	21.291	0.772	45.6	0.8737	0.0000	SURCHARGED
15 minute winter	SWM06	12	21.488	0.850	53.4	0.9610	0.0000	SURCHARGED
15 minute winter	SWM07	12	21.531	0.279	19.5	0.0790	0.0000	SURCHARGED
720 minute winter	Attenuation Tank 03	705	20.722	0.520	19.4	185.3560	0.0000	SURCHARGED
15 minute winter	SWM13	11	21.389	0.963	112.1	1.0894	0.0000	SURCHARGED
15 minute winter	SWM12	11	21.493	0.884	34.6	0.9998	0.0000	SURCHARGED
15 minute winter	SWM11	11	21.593	0.392	36.3	0.1110	0.0000	SURCHARGED
15 minute winter	SWM10	12	21.613	0.083	5.1	0.0235	0.0000	OK
15 minute winter	SWM14	11	21.405	0.705	8.2	0.7979	0.0000	SURCHARGED
15 minute summer	CP06	1	21.228	0.000	0.0	0.0000	0.0000	OK
720 minute winter	Attenuation Tank 02	705	20.722	0.975	27.8	377.0887	0.0000	SURCHARGED
720 minute winter	SWM18	705	20.722	0.748	4.1	0.8463	0.0000	SURCHARGED
720 minute winter	SWM16	705	20.722	0.300	3.4	0.0850	0.0000	SURCHARGED
720 minute winter	SWM17	705	20.722	0.254	0.9	0.0720	0.0000	SURCHARGED
15 minute winter	SWM15	10	20.785	0.055	5.6	0.0156	0.0000	OK
720 minute winter	SWM20	705	20.723	0.741	1.6	0.8380	0.0000	SURCHARGED
720 minute winter	SWM19	705	20.721	0.336	0.6	0.0535	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SWM04	3.000	SWM03	17.5	1.119	0.984	0.8196	
720 minute winter	Flow Control Chamber	1.006	1	1.3	0.587	0.075	0.0308	62.7
720 minute winter	Flow Control Chamber	Orifice	1	3.9				134.8
720 minute winter	SWM09	1.005	Flow Control Chamber	5.3	0.128	0.033	3.2878	
720 minute winter	SWM08	1.004	SWM09	18.4	0.465	0.105	4.5025	
720 minute winter	Attenuation Tank 01	1.003	SWM08	11.2	0.702	0.158	0.9066	
15 minute winter	SWM03	1.002	Attenuation Tank 01	225.8	3.282	1.617	0.8674	
15 minute winter	SWM05	2.002	SWM03	46.7	1.174	1.175	1.1078	
15 minute winter	SWM06	2.001	SWM05	45.6	1.147	1.146	0.8101	
15 minute winter	SWM07	2.000	SWM06	18.1	0.615	0.263	1.3918	
720 minute winter	Attenuation Tank 03	5.004	SWM09	-10.3	0.687	-0.259	0.3062	
15 minute winter	SWM13	5.003	Attenuation Tank 03	111.1	2.795	2.796	0.6357	
15 minute winter	SWM12	5.002	SWM13	39.5	0.994	0.995	1.2394	
15 minute winter	SWM11	5.001	SWM12	34.6	1.254	0.447	1.0674	
15 minute winter	SWM10	5.000	SWM11	6.0	0.360	0.151	1.4866	
15 minute winter	SWM14	6.000	SWM13	7.4	0.482	0.421	0.3588	
15 minute summer	CP06	8.000	Attenuation Tank 03	0.0	0.000	0.000	0.0000	
720 minute winter	Attenuation Tank 02	9.003	SWM09	-18.8	-0.398	-0.264	0.4408	
720 minute winter	SWM18	9.002	Attenuation Tank 02	4.0	0.777	0.071	0.7651	
720 minute winter	SWM16	9.001	SWM18	3.4	0.622	0.048	0.9953	
720 minute winter	SWM17	10.000	SWM16	0.9	0.246	0.023	0.3091	
15 minute winter	SWM15	9.000	SWM16	5.4	0.310	0.134	0.9033	
720 minute winter	SWM20	11.001	Attenuation Tank 02	1.2	0.543	0.077	0.5808	
720 minute winter	SWM19	Orifice	SWM20	1.1				

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Results for 100 year Critical Storm Duration. Lowest mass balance: 99.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	CP05	705	20.722	0.422	3.5	24.8046	0.0000	SURCHARGED
15 minute winter	CP03	15	21.297	0.036	3.1	0.7647	0.0000	OK
720 minute winter	SWM21	705	20.722	0.760	0.6	0.8599	0.0000	SURCHARGED
720 minute winter	CP02	705	20.722	0.422	4.0	24.8046	0.0000	SURCHARGED
15 minute winter	SWM01	12	21.373	0.119	16.6	0.0338	0.0000	OK
15 minute winter	SWM02	11	21.348	0.748	49.4	0.8464	0.0000	SURCHARGED
15 minute summer	CP01	1	21.295	0.000	0.0	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)
720 minute winter	CP05	13.000	Attenuation Tank 02	3.0	0.632	0.180	0.4257	
15 minute winter	CP03	7.000	Attenuation Tank 03	2.3	0.699	0.130	0.1144	
720 minute winter	SWM21	12.000	Attenuation Tank 02	0.6	0.418	0.039	0.5786	
720 minute winter	CP02	14.000	Attenuation Tank 02	3.4	0.652	0.204	0.4252	
15 minute winter	SWM01	1.000	SWM02	16.4	0.633	0.250	1.2604	
15 minute winter	SWM02	1.001	SWM03	43.4	1.091	1.095	1.6720	
15 minute summer	CP01	4.000	SWM08	0.0	0.000	0.000	0.0000	

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.42%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SWM04	10	22.083	0.750	25.9	0.1193	1.0289	FLOOD
240 minute winter	1	220	19.356	0.031	1.6	0.0000	0.0000	OK
240 minute winter	Flow Control Chamber	220	21.299	1.839	11.2	3.2497	0.0000	FLOOD RISK
240 minute winter	SWM09	220	21.299	1.653	77.5	2.9203	0.0000	FLOOD RISK
240 minute winter	SWM08	220	21.301	1.344	71.3	1.9226	0.0000	FLOOD RISK
30 minute winter	Attenuation Tank 01	21	21.543	1.458	250.0	99.2627	0.0000	FLOOD RISK
30 minute winter	SWM03	21	21.850	1.571	251.0	1.7772	0.0000	FLOOD RISK
30 minute winter	SWM05	21	21.974	1.456	52.3	1.6463	0.0000	FLOOD RISK
15 minute winter	SWM06	10	22.063	1.425	62.9	1.6117	1.2047	FLOOD
15 minute winter	SWM07	10	22.077	0.825	27.3	0.2335	2.4533	FLOOD
240 minute winter	Attenuation Tank 03	220	21.298	1.096	87.1	356.4281	0.0000	SURCHARGED
15 minute winter	SWM13	11	21.935	1.509	143.0	1.7070	0.0000	FLOOD RISK
15 minute winter	SWM12	11	21.990	1.381	38.3	1.5618	0.0000	FLOOD RISK
15 minute winter	SWM11	11	22.036	0.835	46.0	0.2363	2.4596	FLOOD
15 minute winter	SWM10	10	22.093	0.563	16.3	0.1594	0.0000	FLOOD RISK
15 minute winter	SWM14	11	22.009	1.309	9.3	1.4805	0.0000	FLOOD RISK
360 minute winter	CP06	312	21.295	0.067	4.5	5.5778	0.0000	OK
240 minute winter	Attenuation Tank 02	220	21.297	1.550	86.5	386.8433	0.0000	FLOOD RISK
240 minute winter	SWM18	220	21.294	1.320	14.6	1.4930	0.0000	FLOOD RISK
600 minute winter	SWM16	435	21.293	0.871	5.6	0.2465	0.0000	FLOOD RISK
360 minute winter	SWM17	280	21.293	0.825	2.3	0.2335	2.6402	FLOOD
600 minute winter	SWM15	435	21.294	0.564	0.7	0.1597	0.0000	FLOOD RISK
240 minute winter	SWM20	220	21.302	1.320	4.5	1.4935	0.0000	FLOOD RISK
1440 minute winter	SWM19	960	21.135	0.750	0.5	0.1193	3.4212	FLOOD

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	SWM04	3.000	SWM03	19.0	1.113	1.067	0.8506	
240 minute winter	Flow Control Chamber	1.006	1	1.6	0.620	0.091	0.0352	37.9
240 minute winter	Flow Control Chamber	Orifice	1	5.8				112.3
240 minute winter	SWM09	1.005	Flow Control Chamber	11.2	0.465	0.071	3.2878	
240 minute winter	SWM08	1.004	SWM09	71.2	0.649	0.408	4.5025	
30 minute winter	Attenuation Tank 01	1.003	SWM08	156.9	2.228	2.210	0.9066	
30 minute winter	SWM03	1.002	Attenuation Tank 01	250.0	3.550	1.790	0.8674	
30 minute winter	SWM05	2.002	SWM03	50.8	1.276	1.277	1.1078	
15 minute winter	SWM06	2.001	SWM05	51.8	1.303	1.302	0.8101	
15 minute winter	SWM07	2.000	SWM06	20.4	0.651	0.296	1.3918	
240 minute winter	Attenuation Tank 03	5.004	SWM09	-69.2	-1.740	-1.741	0.3062	
15 minute winter	SWM13	5.003	Attenuation Tank 03	142.8	3.592	3.593	0.6357	
15 minute winter	SWM12	5.002	SWM13	43.0	1.081	1.082	1.2394	
15 minute winter	SWM11	5.001	SWM12	38.3	1.291	0.494	1.0674	
15 minute winter	SWM10	5.000	SWM11	10.5	0.345	0.265	2.2273	
15 minute winter	SWM14	6.000	SWM13	10.6	0.602	0.604	0.3588	
360 minute winter	CP06	8.000	Attenuation Tank 03	-4.5	-0.464	-0.251	0.1006	
240 minute winter	Attenuation Tank 02	9.003	SWM09	-55.8	-0.889	-0.783	0.4408	
240 minute winter	SWM18	9.002	Attenuation Tank 02	14.2	1.206	0.251	0.7651	
600 minute winter	SWM16	9.001	SWM18	5.3	0.637	0.075	0.9953	
360 minute winter	SWM17	10.000	SWM16	2.3	0.355	0.058	0.3091	
600 minute winter	SWM15	9.000	SWM16	0.7	0.154	0.017	2.0126	
240 minute winter	SWM20	11.001	Attenuation Tank 02	4.2	0.715	0.279	0.5808	
1440 minute winter	SWM19	Orifice	SWM20	1.0				

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Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.42%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
600 minute winter	CP05	435	21.270	0.970	7.2	24.8046	41.8610	FLOOD
15 minute winter	CP03	15	21.306	0.045	4.4	0.9529	0.0000	OK
240 minute winter	SWM21	220	21.302	1.340	2.2	1.5161	0.0000	FLOOD RISK
720 minute winter	CP02	510	21.269	0.969	7.4	24.8046	47.1832	FLOOD
15 minute winter	SWM01	10	21.989	0.735	23.2	0.2081	0.0000	FLOOD RISK
15 minute winter	SWM02	10	21.880	1.280	65.1	1.4477	3.4248	FLOOD
480 minute winter	CP01	352	21.298	0.003	0.0	0.0692	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	CP05	13.000	Attenuation Tank 02	-5.3	0.646	-0.315	0.4257	
15 minute winter	CP03	7.000	Attenuation Tank 03	3.5	0.786	0.196	0.1531	
240 minute winter	SWM21	12.000	Attenuation Tank 02	2.0	0.540	0.142	0.5786	
720 minute winter	CP02	14.000	Attenuation Tank 02	-5.3	0.661	-0.318	0.4252	
15 minute winter	SWM01	1.000	SWM02	21.5	0.638	0.328	1.6395	
15 minute winter	SWM02	1.001	SWM03	48.7	1.225	1.229	1.6720	
480 minute winter	CP01	4.000	SWM08	0.0	0.018	0.001	0.0851	

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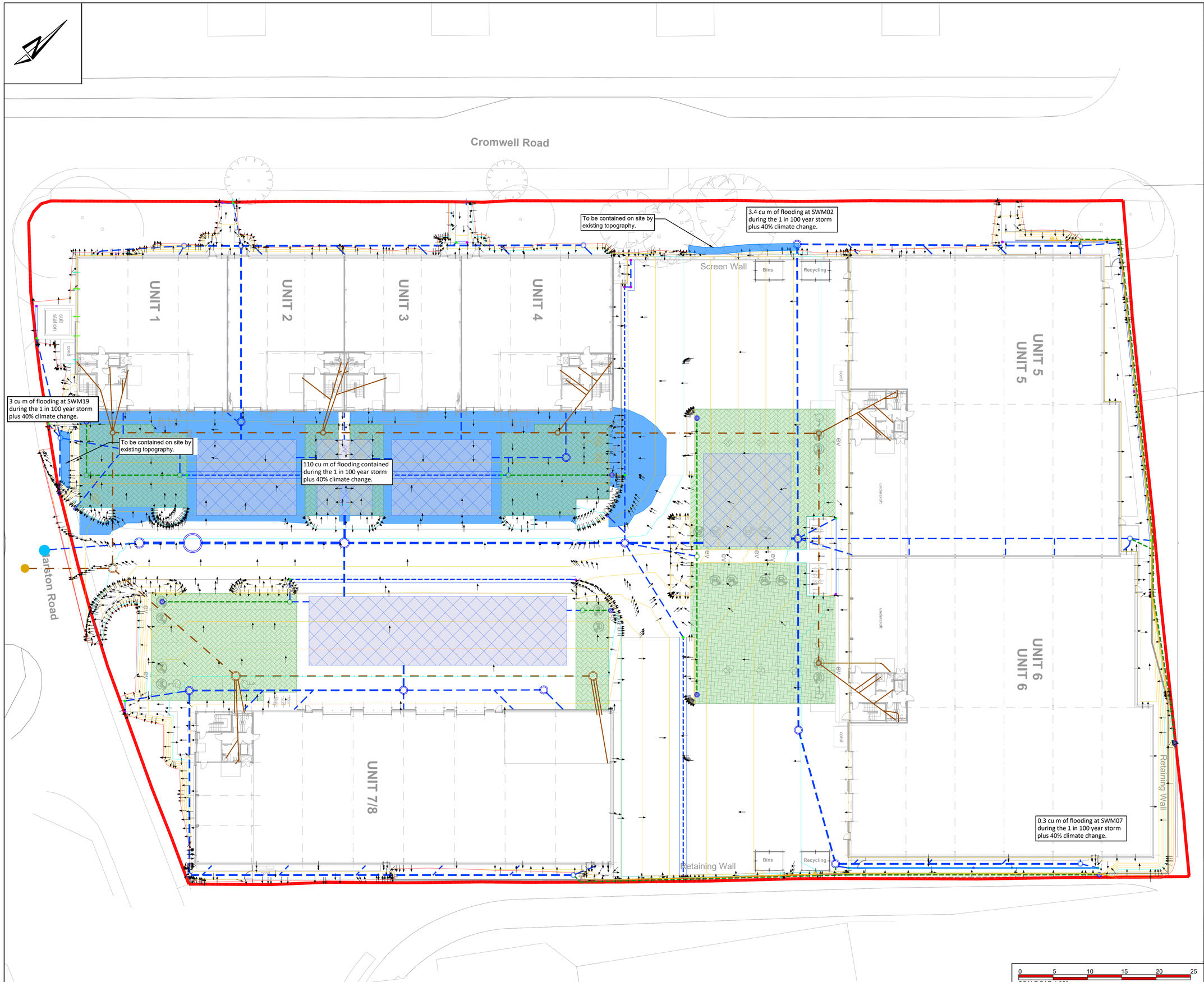
Appendix C – Exceedance Flow Route



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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION

MAINTENANCE

DEMOLITION

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT

GENERAL NOTES:

1. This drawing shall be read in conjunction with all the relevant architects, engineers' and service engineers drawings & specifications.
2. All units in millimeters U.O.N. on the drawing.
3. Do Not Scale off the drawing.

DRAWING NOTES:

1. This drawing is to be read in conjunction with '30278-BGL-XX-XX-DR-C-00200 - Proposed Finished Levels' and '30278-BGL-XX-XX-DR-C-00210 - Proposed Drainage Layout'.
2. Drawing indicates the locations of on site flooding during the 1 in 100 year + 40% climate change storm event. Extent of flooding demonstrated by solid blue hatch.

REV	DATE	BY	DESCRIPTION	CHKD
P02	01.07.25	JB	Revised to suit FEH Hydraulic Calculations	JW
P01	07.05.25	JB	Issued for Information	RJ

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CLIENT

TOP ROAD

PROJECT

MARSTON BUSINESS PARK
ST NEOTS

DRAWING TITLE

EXCEEDANCE FLOW ROUTE

BGL PROJECT NUMBER	DRAWING STATUS	OFFICE	
30278	PRELIMINARY	NORTH	
SCALE @ A1	DATE	DRAWN BY	CHECKED BY
1:250	07.05.2025	JB	RJ

DRAWING No

30278-BGL-XX-XX-DR-C-00211

REV

P02

Appendix D – Maintenance Schedule

Maintenance schedule (it is the responsibility of the client/tenant or nominated management company to carry out the maintenance outlined in this table)	Required action	Typical frequency
Below Ground Drainage Pipes, Manholes, etc		
Regular maintenance	Lift covers and inspect manholes for evidence of debris and silt deposits and evidence of blockages (standing water). Carry out CCTV survey if required	Quarterly
Remedial actions	High pressure jetting and/or remove minor blockages and silt build up Replace broken access covers, remove major blockages, repair structurally defective pipework	As required – 20% loss of pipe cross-section As required
Flow control chamber		
Regular maintenance	Lift covers and inspect chamber fore evidence of debris and silt deposits and evidence of blockages. Test bypass door operating correctly.	Quarterly
Remedial actions	High pressure jetting and or remove minor blockages and silt build up Replace broken access covers, remove major blockages, repair/replace defective flow control devices	As required As required
Linear channel drains and gullies		
Regular maintenance	Lift access covers and inspect for silt/debris accumulation	Quarterly
Remedial actions	Replace broken access covers, gratings High pressure jetting and/or remove minor blockages and silt build up	Annually As required
Rainwater pipes		
Regular maintenance	Inspect rainwater goods for evidence of leaking pipework	Monthly (or as required)
Occasional maintenance	Remove rodding eyes and carry out high pressure jetting to remove any debris	Quarterly
Remedial actions	Replace cracked / leaking pipework	As required
Permeable Paving		
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Annually
Occasional maintenance	Stabilise and mow contributing and advanced areas Removal of weeds or management using glyphosate applied directly into weeds by an applicator rather than spraying.	As required Annually/As required
Remedial actions	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50mm of the level of paving. Remedial work to any depressions rutting and cracked or broken blocks considered detrimental to the structure performance or a hazard to users and replace lost jointing material. Rehabilitation of surface and upper structure by remedial sweeping.	As required As required Every 10 to 15 years
Monitoring	Initial inspection Inspect for evidence of poor operation and/or weed growth – if required take remedial actions. Inspect silt accumulation rates and establish appropriate brushing frequencies. Monitor inspection chambers	Quarterly Quarterly Annually Annually

Below Ground Attenuation Tanks		
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually.
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
Remedial actions	Repair/rehabilitate inlets, outlets, overflows and vents.	As required
Monitoring	Inspect/check all inlets, outlets, overflows and vents to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of the tank for sediment build up and remove if necessary.	Every 5 years or as required
Treatment System		
Routine maintenance	Remove litter and debris and inspect sediment, oil and grease accumulation.	Six monthly
	Change filter media.	As recommended by manufacturer
	Remove sediment, oil, grease and floatables.	As necessary – indicated by system inspections or immediately following significant spill.
Remedial actions	Replace malfunctioning parts or structures.	As required
Monitoring	Inspect for evidence of poor operation.	Six monthly
	Inspect filter media and establish appropriate replacement frequencies.	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies.	Monthly for six months, then every six months