



**GRAINGER PLC
BLUE STAR LAND
WATERLOOVILLE**

SUDS DESIGN DOCUMENT

MAY 2023



the journey is the reward

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BLUE STAR LAND
WATERLOOVILLE**

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MAY 2023

Project Code:	GTWVILLE_BSL
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Approved by:	RHA
Issue Date:	MAY 2023
Status:	Planning
Document Ref:	GTWVILLE_BSL-DOC_03_A

Issue Details

Issue	Date	Revision Details	Checked
1st	26/05/23	For Planning	RHA
A	03/04/24	For Planning	RHA

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1 Introduction

- 1.1 This document sets out the design principles for the drainage associated with the proposed Blue Star Land development (BSL).
- 1.2 The BSL site covers an area of 1.96Ha and is located between the Berewood development site and the A3/Maurepas Way (OS Grid Ref. SU678093). A location plan of the site is shown on Dwg. GTWVILLE_BSL_GA_01 in Appendix B.
- 1.3 The site historically contained public allotments which have since been relocated. Since then, it has mainly been vacant apart from the construction of a footway network providing access from Laxton Leaze and the Forest End estate to London Road.
- 1.4 The BSL development will comprise of up to 69 residential units with a primary highway access off Laxton Leaze to the west and an emergency/pedestrian access off Peasgood Lane in the north-west corner of the site.

2 Existing Condition

Topography

- 2.1 A topographical survey of the existing land was undertaken by Encompass Surveys Ltd in March 2023. The site slopes predominantly from the south to the northeast. Ground levels range from approximately from 38.00mAOD to 44.50mAOD. The site is predominantly overgrown grassed areas intersected by two 3m wide pedestrian paths running from Laxton Leaze (west side) and Forest End (south side) to London Rd (east side). A number of mature trees are situated along the northern and eastern boundaries with smaller trees dispersed within the site. A mature hedge borders the western boundary of the site.
- 2.2 A tree survey has been carried out by James Fuller in March 2023. Relevant extracts from the subsequent report (Ref. JFA9514) are contained in Appendix A.
- 2.3 There is a hard surfaced area in the southeast corner of the site, which used to serve as the allotment parking. It is not clear at the moment what the make up or extent of the parking area is due to the existing overgrowth.

Geology and Hydrogeology

- 2.4 The original land use was agricultural, before being utilised as public allotments approximately 80 years ago.
- 2.5 A geological survey is to be undertaken in the immediate future once ecological constraints have been addressed. However, there is extensive geological information from the adjacent Berewood sites to suggest the ground make up is topsoil overlying silty/clay subsoil overlying Oxford Clay head deposits, overlying chalk.
- 2.6 The Oxford clay and overlying sub-soil will be the main materials affecting the drainage strategy. Results from the adjacent Berewood ground investigations for Berewood Phases 1 and 3B indicate that the ground will be unsuitable for infiltration.
- 2.7 A ground investigation was undertaken in April 2023 (T & P Report Ref. P0841/CS-1725). Relevant extracts of the report are contained in Appendix A.

- 2.8 The ground investigation identified a general topsoil thickness of between 0.2 and 0.3m, underlain by firm going to stiff London Clay to a minimum depth of 4m bgl.
- 2.9 Ground water wasn't encountered during the investigation. However, further seasonal monitoring may be necessary to determine the level of risk.
- 2.10 The properties of the London clay make infiltration impractical.

Hydrology

- 2.11 The main recipient watercourse for site run-off will be the River Wallington, which flows east to west and is located approximately 250m to the north of the site.
- 2.12 The site is bordered on the south west and north side by field ditches typical of those on the adjacent Berewood site prior to development. An additional ditch also crosses the site from the southern boundary to the north east corner of the site. Dwg. GTWVILLE/DR/01 in Appendix B shows the general surface water flow routes for the site and the overland flood flow paths. Generally overland flows are collected and drain northwards via the ditches on the east and west sides of the site.

Arboricultural Assets

- 2.13 Appendix A contains an extract from the tree survey which was undertaken in March 2023 by James Fuller. The plan in Appendix A indicates that all of the trees within the proposed SuDs footprint are Category C (Trees of Low Quality). There are two Category B trees (Trees of Moderate Quality) on the northern boundary of the site. The pond has been located to ensure it sits outside the potential root zone of these trees.

3 Proposals

Proposed Drainage Network and SuDS Provision

- 3.1 Dwg GTWVILLE_BSL/DR/03 in Appendix B shows the proposed SuDS provision in context with the site and an outline drainage network.
- 3.2 The drainage layout indicated on Dwg. GTWVILLE_BSL/DR/03, is a preliminary layout used to test the available falls across the site. The proposed networks will need to be developed further once a more detailed layout of the development is available.
- 3.3 The stormwater drainage will comprise of two networks. Both networks will drain via a vortex flow control unit to ensure the maximum run-of rate is as close as possible to the greenfield run-off rate of 5.06l/s/Ha.
- 3.4 Network A will drain the northern sector of the site and discharge via a SuDs basin to the existing ditch on the northern boundary. Network B will drain the southern sector of the site and discharge via an underground storage tank to the existing ditch running across the centre of the site.
- 3.5 Dwg. GTWVILLE_BSL/DR/04 in Appendix B shows the proposed SuDS basin in more detail and provides a cross-section of the basin to inform how it would sit within the existing topography. The basin will have a rim level of 39.50m AoD and a base level of 38.01m AoD.
- 3.6 Dwg GTWVILLE_BSL/DR/07 in Appendix B shows the proposed underground storage tank. The tank will be 1m deep and will have a minimum cover of 1m. The tank will comprise of proprietary modular storage units and will be maintained by the development management company.
- 3.7 The drainage networks (excluding the storage tank and SuDs basin) will be adopted by LEEP under a S104 agreement. Any drainage solely draining public highway will be adopted Hampshire County Council (HCC) under a S38 agreement. The underground tank will be maintained by a private management company on behalf of the developer.
- 3.8 The SuDs basin has been located to avoid tree root protection zones within the vicinity whilst optimising the remaining amenity space. The pond has been positioned a minimum 5m from the existing medium pressure gas main which runs along the eastern boundary of the site. This is more than the required 3m clearance.

- 3.9 The SuDs basin will be maintained by Havant Borough Council as part of a wider open space maintenance agreement. The underground tank will be maintained by a private management company on behalf of the developer.
- 3.10 A vortex silt separator will be provided upstream of the basin and storage tank inlet to intercept as much solid matter as possible. This measure also intercepts a significant amount of potential pollutants thereby maintaining water quality within the basin and downstream.
- 3.11 The outfalls from the basin and storage tank will be fitted with a Pollution Control Valve (PCV) and a vortex flow restrictor. The PCV's will enable routine maintenance of the flow control units and allow immediate detention of flow in the event of contamination spillages upstream.
- 3.12 Both flow controls will be fitted with an overflow to avoid the risk of flooding due to an exceedance event.
- 3.13 The existing ditches, which are to receive discharge from Networks A and B are heavily vegetated and silted. The ditch networks in the vicinity and downstream of the outfalls will be cleaned out beforehand to ensure the design outfall IL can be achieved.
- 3.14 The basin is to be designed to be dry during dry weather periods. Planting/landscaping of the basin will be in co-ordination with the wider open space. The planting/landscaping proposals are being developed by Allen Pyke Associates (APA).
- 3.15 Erosion control at the inlet to the SuDs basin will be provided as a combination of hessian erosion control matting and rip-rap stone.
- 3.16 The overflow for the SuDs basin will be a series of highway gullies set into the northern slope of the pond. With an outfall pipe connected to the outfall headwall. The overflow for the tank will be an integral weir within the vortex flow control chamber.

4 Design

Design Methodology

- 4.1 The design has been modelled using Microdrainage Network software to determine the size of the required SuDs basin. A preliminary network has been developed to ensure general falls across the site align with the general topography and to ensure the design water levels within the basin do not adversely affect the upstream network.
- 4.2 Current pipe sizing has been selected to ensure flooding does not occur for storm events of 1 in 30yrs and less. There is likely to be local flooding within the network for storm events over 1 in 30yrs. It is assumed that local flooding within the site will be routed along overland flow paths and captured at other recepticals downstream to ensure all rainfall is directed through the attenuation systems.
- 4.3 Overland flow paths will be developed into the residential layout during design development.

Design Parameters

- 4.4 For the purposes of the design, it is assumed there are no impermeable areas within the existing site.
- 4.5 The flow control units will be sized to restrict flows to 5l/s. This is considered the smallest practicable discharge rate whilst reducing the risk of blockage to an acceptable level. Therefore, the overall discharge rate from the site will be 10l/s.

Rainfall and Run-off Parameters

- 4.6 The discharge rate for the adjacent Berewood development has been agreed at the outline planning stage and is written into the Berewood S.106 Agreement. A QBAR greenfield run-off rate of 5.06l/s/ha has been assumed for the purposes of the BSL drainage design. This rate is considered to be representative for the BSL site.
- 4.7 The design has been tested for storm events 1 in 1yr, 1 in 30yr and 1 in 100yr+45% (climate change allowance). The design has also been tested for exceedance using a 1 in 200yr event. The Exceedance event assumes the

flow control is blocked so that resulting head water would then be drained via an overflow.

- 4.8 Storm durations have been tested from 15 minutes up to 10080 minutes where necessary to ensure worst case scenario is considered.
- 4.9 Both FEH and FSR rainfall parameters have been used to ensure the worst case for short and long duration rainfall events is considered.
- 4.10 The FEH parameters relevant to the BSL site are:

$C(1km) = -0.027$ $D1(1km) = 0.461$ $D2(1km) = 0.293$
 $D3(1km) = 0.380$ $E(1km) = 0.306$ $F(1km) = 2.247$

Catchment Areas

- 4.11 The catchment details for the BSL site are based on 65% of the site being initially impermeable with a further 10% increase to allow for 'urban creep'. Table 4.1 shows the design areas based on the figures above.

Description	
Total Development Area (TDA)*	1.96Ha
Total 'Built up' Area	1.48Ha
Development Drained Area (design impermeable area) (TDA x 0.65 x 1.10)	1.06Ha
SuDs basin Footprint	0.07Ha
Total Drained Area (1.06+0.07)	1.13Ha
Design Discharge Rate (5.06 x 1.48)	9.9l/s

Table 4.1: Assumed Run-off Factors and Discharge Rate

- 4.12 Urban Creep can be described as future urban expansion within a development such as extensions to buildings and paving of gardens. These activities increase the impermeable area of a site and often sit outside of the development control process. Therefore, an allowance for a 10% increase in the impermeable area on the development site has been made to allow for urban creep.
- 4.13 The SuDs basin will also be considered impermeable assuming that ground infiltration will be insignificant. The SuDs basin has a permeability factor of 1.0.
- 4.14 The combined design discharge rate of the underground tank and SuDs basin of 10l/s is slightly greater than the 9.9l/s design greenfield runoff rate (Figure

4.1 above). However, the additional flow is not considered to pose a significant flood risk.

Summary of Results

- 4.15 The model data output is contained in Appendix C. Details of the required storage and storm event water levels for each network is contained in Table 4.2 and 4.3 below.

Network A

Event	Pond Overflow Level (m)	Water Level (mAoD)	Depth (m)	Discharge Rate (l/s)	Remaining Freeboard to Overflow (mm)
1 in 1yr (720min)	39.400	38.268	0.238	4.7	1132
1 in 30yr (720mins)		38.722	0.690	4.9	778
1 in 100yr+45% (720mins)		39.311	1.281	4.9	39
1 in 200yr (Exceedance Event)* (4320mins)		39.374	1.463	7.1	-24

Table 4.2: Network A SuDs Basin Operation Parameters

- 4.16 The overflow will be set at 39.350m to prevent the pond being breached during exceedance events.
- 4.17 The pond overflow will operate after 6 hours of an exceedance event happening and will exceed 5l/s after 44 hours until 48 hours. It is expected a maintenance response would take place within the 44 hours.

Network B

Event	Tank Overflow Level (m)	Water Level (mAoD)	Depth (m)	Discharge Rate (l/s)	Remaining Freeboard to Overflow (mm)
1 in 1yr (360mins)	41.200	39.607	0.12	3.6	1377
1 in 30yr (360mins)		39.844	0.36	4.5	1140
1 in 100yr+45% (600mins)		40.408	0.924	4.5	576
1 in 200yr (Exceedance Event)* (960mins)		41.007	1.523	5.9	-23

Table 4.3: Network B Underground Tank Operation Parameters

- 4.18 The tank overflow will be set at 40.984m to prevent the tank flooding during exceedance events. Consequently, the overflow will be 260mm lower than the lowest cover level across Network B.
- 4.19 The tank overflow will operate between 10.5hrs and 11hrs after an exceedance event happening and total flow will reach 5.9l/s during this period.

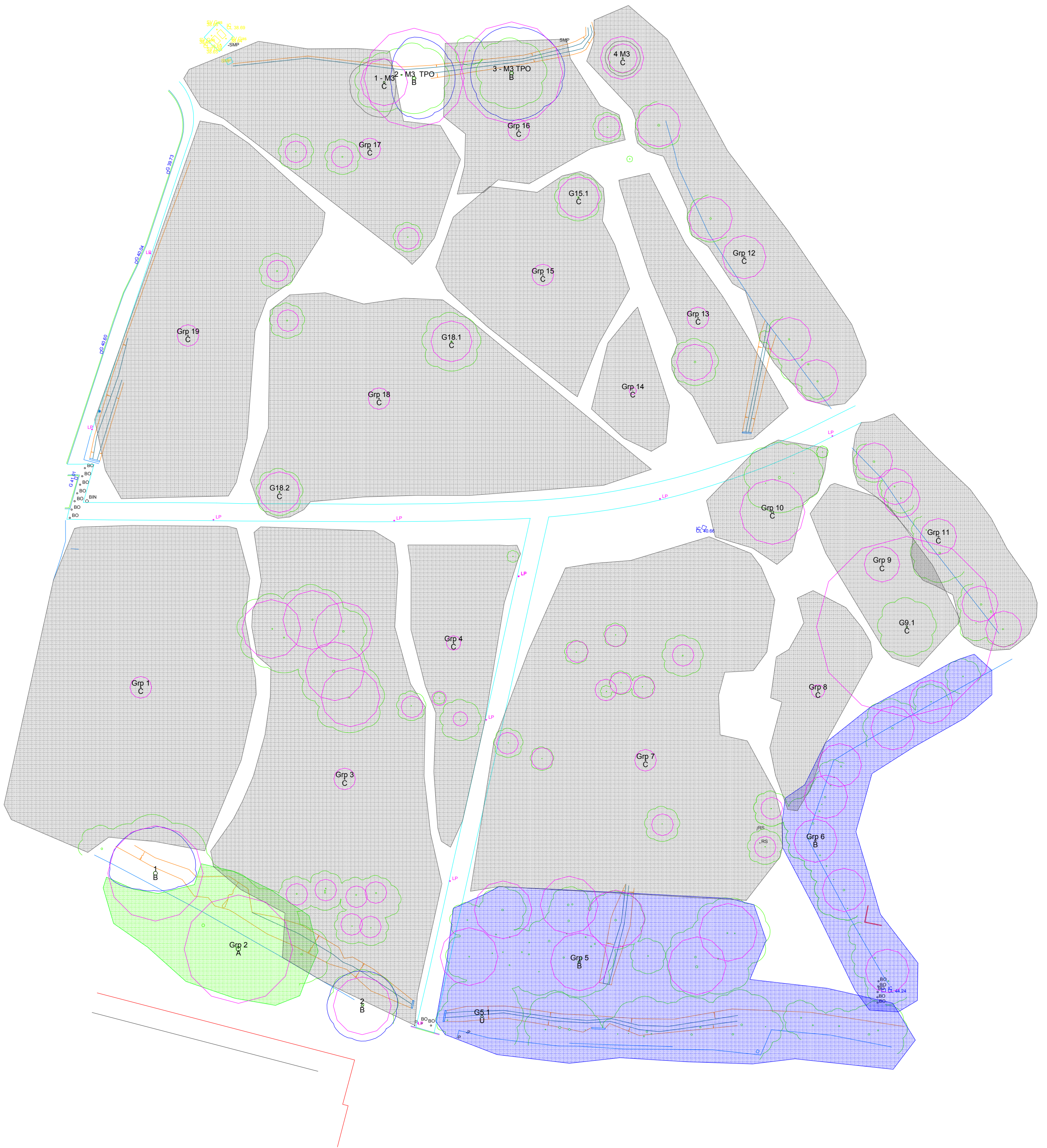
Maintenance

- 4.20 A maintenance schedule can be found in Appendix D.
- 4.21 The outlet controls for the SuDs basin (Network A) will be accessed via a 2m cinder surfaced path connected to the nearest adoptable highway. If necessary, a maintenance bay will be provided for visiting maintenance crew.

5 Conclusion

- 5.1 The total discharge rate for the worst-case scenario (1 in 100 year return period +45% for climate change) from the BSL development.
- 5.2 The maximum combined discharge from the site will be a maximum of 9.4l/s during a 1 in 100yr +45% (720mins). Overflows from the tank and the SuDs basin will not operate during any 1 in 100yr + 45% events.
- 5.3 Therefore, the greenfield discharge rate (9.9l/s) will not be exceeded unless both SuDs features have a simultaneous exceedance event.

**APPENDIX A: Extracts from Tree Survey Report Ref. JFA9514 and Ground
Investigation Report (Ref. P0841/CS-1725)**



NOTES:
1. The site is not located within a Conservation Area.
2. Trees 2 M3 and 3 M3 are protected by a TPO, enforced by Havant Borough Council.



Tree Survey Plan

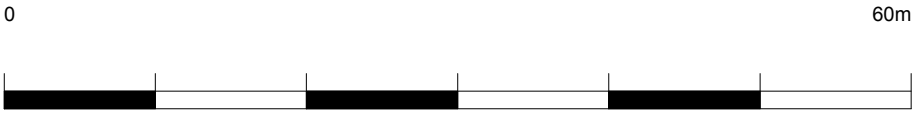
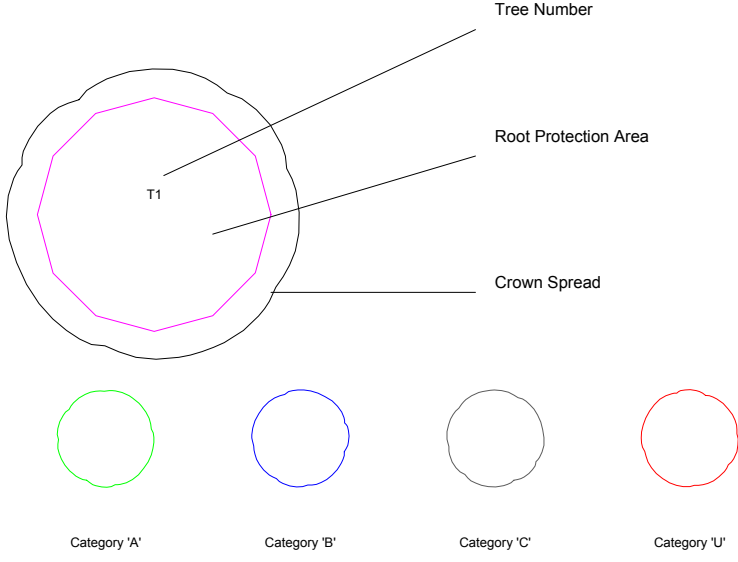
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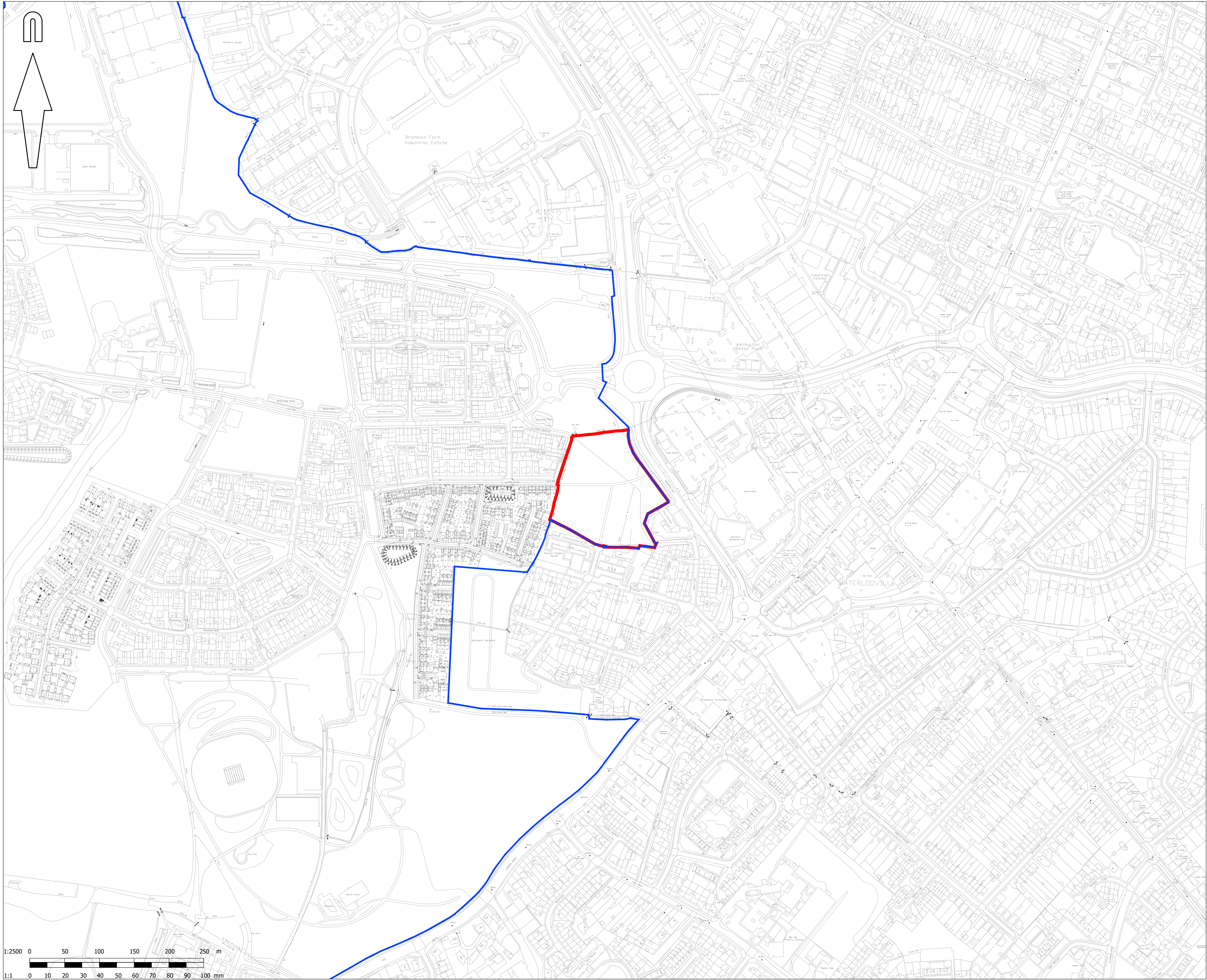
EXECUTIVE SUMMARY

Project Information	
Project details	This Desk Study and Ground Investigation report has been prepared by T&P Regeneration Ltd on behalf of West Waterloooville Developments Ltd for Blue Star, Berewood, Waterloooville, PO7 3AY / NGR: 467830, 109340.
Site description and current land use	The site occupies an area of 20,000 square meters currently consists of an area of densely vegetated public open space with tarmacadam footpaths bisecting the site north-south and east-west. A number of corridors had been cleared of vegetation across the site prior to the T&P ground investigation attendance due to ecological constraints. The site elevation ranges between approximately 40 and 43 metres Above Ordnance Datum (mAOD) and is generally level.
Development	T&P understands that the proposed development is intended to comprise the construction of traditional two storey residential dwellings with associated areas of communal and private soft landscaping with hard landscaped access and parking.
Site Setting	
Environmental setting	The site is indicated to be entirely underlain by the London Clay Formation. The London Clay Formation is classified as an Unproductive Strata. The nearest surface water feature is an unnamed drain which runs north-south through the eastern portion of the site. The site is in a Flood Zone 1 with a low probability of flooding. However, as the site is over 1 hectare, a flood risk assessment will be required. The site is not located within an environmentally/ecologically sensitive area.
Radon	The site is in a low risk radon area. Radon protection measures are not necessary.
UXO	A UXO desk study and risk assessment was previously completed for the site by a third party which classified the site as being at low risk of unexploded bombs.
Site history	From the time of the earliest maps in the late 1800's, the site is shown to be undeveloped and comprised of agricultural land which is later marked as allotments with an area of woodland to the immediate south and west. A footpath is shown running across the northern portion of the site. Few significant changes were noted across the site, with the exception of a drain marked running north to south through the site on the 1955-1977 map and the addition of another footpath. A break in slope is marked along the eastern boundary of the site by 1977-1989 associated with the development of the A3 road. The present day site includes tarmacadam paths running through the central portion. The immediate area off site surrounding the site comprises agricultural land and small woods to the north and west with residential development to the south and east. By 1953-1965 the woods had been removed with additional residential development to the immediate south. The 1977-1989 map shows a fire station located to the immediate south-east of the site and A3 road along the eastern site boundary, with associated break in slope encroaching onto the site boundary.
Areas of potential concern at desk study stage	<u>On-site:</u> - Made ground associated with previous site use and adjacent land development. - Agricultural pest/weed control associated with former agricultural practices. <u>Off-site:</u> - Berewood fire station location immediately adjacent to the southern site boundary. - Commercial units within the wider area to the east including a fuel station 39m to the north east.
Phase 2 Ground Investigation	
Scope of work	An intrusive ground investigation was undertaken on the 20th April 2023, comprising the following: - Excavation of 7N^o trial pits; - Drilling of 3N^o dynamic windowless soil sampling boreholes; <i>In situ</i> vehicle mounted California Bearing Ratio (CBR) tests in 6N^o locations; - Installation of 3N^o boreholes as environmental monitoring wells.

Ground conditions	Made ground was only encountered in a single exploratory location (WS03) in the east of the site with a reported thickness of 0.5m. Made ground was found to comprise slightly silty gravelly sand, which included concrete, glass and brick fragments. A geotextile membrane was noted at the base of the made ground. Topsoil was encountered in all exploratory locations (excluding WS03) with a typical thickness ranging between 0.20 and 0.30m. The London Clay Formation was encountered within all exploratory hole locations to the base of the holes with a maximum depth of 4.00mbgl. In general, the London Clay comprised firm orangish brown silty clay which graded into a stiff bluish grey silty clay with depth. With the exception of made ground within WS03, no significant visible or olfactory evidence of any contamination was noted during the ground investigation.
Groundwater	Groundwater was not encountered during the ground investigation.
Principal Findings and Conclusions	
Human health and plant growth	A review of soil data has not identified any contaminants soil concentrations to be elevated against adopted phytotoxic screening levels or human health screening levels for a 'residential with homegrown produce' end use within topsoil or natural soils. While a full suite of contaminate testing was not undertaken within the limited made ground encountered, it is considered that this material will be physically unsuitable to remain within areas of soft landscaping in any case.
Controlled waters	Based on the findings of the ground investigation, and in consideration of the site conceptual model, it is concluded that the risks to Controlled Waters are low. No further work is considered to be required.
Gas protection	In consideration of the site conceptual model, and ground investigation findings no viable on- or off-site sources of ground gas have been identified. Therefore, it is considered that the site has a low ground gas generating potential and that risks to future residents associated with ground gases are low. No ground gas protection measures are deemed necessary within future development. Radon protection measures are not considered necessary for the proposed development.
Potable supply pipework	It is concluded that PVC pipework will likely be suitable for the majority of the buried potable water supply network on site. Further testing in line with the UKWIR criteria is recommended to confirm this assessment taking into account the minor exceedance noted in TP04.
Waste	All samples tested were classified as non-hazardous waste. Based on the initial chemical data the natural soils are anticipated to be treated as inert. However, further Waste Acceptance Criteria (WAC) testing may be required by the receiving site.
Engineering design	The cohesive soils have shown to be of high shrinkage potential and as a result will be highly susceptible to the influence of trees. it is considered that traditional shallow strip foundations placed at the minimum depth of 1.0mbgl within the firm clay may be designed for an allowable bearing capacity of 115kPa for acceptable settlement. Given the results of the foundation zonal plan however, it is likely that the majority of plots within the proposed development will require piled foundations due to the influence of nearby trees. Based on the test results a design CBR value of 1.5% is recommended subject to the cohesive soils of the London Clay Formation being encountered at formation level. Sulphate testing of selected soil samples indicates that a suitable design mix for concrete for buried structures is likely to be DS-3 AC-2s.
Considerations and Recommendations for Further Work	
Considerations	- Access across the site was significantly limited due to ecological constraints and vegetation cover. - The extent of the made ground in the east has not been delineated.

Recommendations	<u>Human health/plant growth</u> • It is recommended that further investigation and laboratory testing is undertaken once full access is available across the site to delineate areas of made ground and assess the potential for contamination within areas previous inaccessible due to ecological constraints. • Following supplementary ground investigation, a Remediation Strategy should be completed to defined remedial action required for the proposed development. <u>Potable water supply pipework</u> • Elevated contaminants within the made ground with respect to the UKWIR guidelines indicate that PVC pipework should be suitable across the site, although further testing in line with the UKWIR criteria should be undertaken to confirm this assessment given the localised elevated BaP recorded in TP04. <u>Engineering</u> • Further investigation comprising cable percussive boreholes should be undertaken to derive design parameters should a piled foundation solution be required due to overdeepening of foundations within the influence of trees. • Further in-situ CBR testing could be undertaken during more favourable weather conditions to potentially achieve a higher design value. <u>General</u> • A Flood Risk Assessment will be required to support future development. • Discussions should be held with local landfill/soil waste treatment facilities to agree material classification/pre-treatment required for any soils to be disposed off-site as a result of proposed construction works. • Ground workers should remain vigilant for visible and olfactory signs of contamination following demolition of on-site buildings. • Ground workers should be vigilant for potential UXO and seek immediate professional advice if anything suspicious is encountered during groundworks. • On-site monitoring wells should be protected from damage until such time as conclusions/recommendations within this report are agreed with the regulators. Monitoring installations should then be decommissioned in accordance with Environment Agency guidelines. • A site-specific health and safety plan should be prepared to inform on risks posed from the previous site use and mitigations for ground workers developing the site e.g. requirements for appropriate PPE, hygiene practices, environmental monitoring and requirements for mitigation measures during construction works. • A copy of this report should be provided to the relevant regulatory authorities to confirm that they are in agreement with the report findings.
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APPENDIX B: Drawings



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A1 ORIGINAL

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NOTES:

1. ALL AREAS OF BUILT HIGHWAYS, SUDS AND LANDSCAPE INFRASTRUCTURE (OUTSIDE THE SALE BOUNDARY) WILL BE ADOPTABLE BUT WILL NOT FORM PART OF THE SALE.

KEY

- EXTENT OF BLUE STAR LAND SALE BOUNDARY
- BEREWOOD DEVELOPMENT BOUNDARY



FOR INFORMATION
NOT FOR CONSTRUCTION

rev.	amendment	checked	date
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project
BEREWOOD, WATERLOOVILLE
BLUE STAR LAND

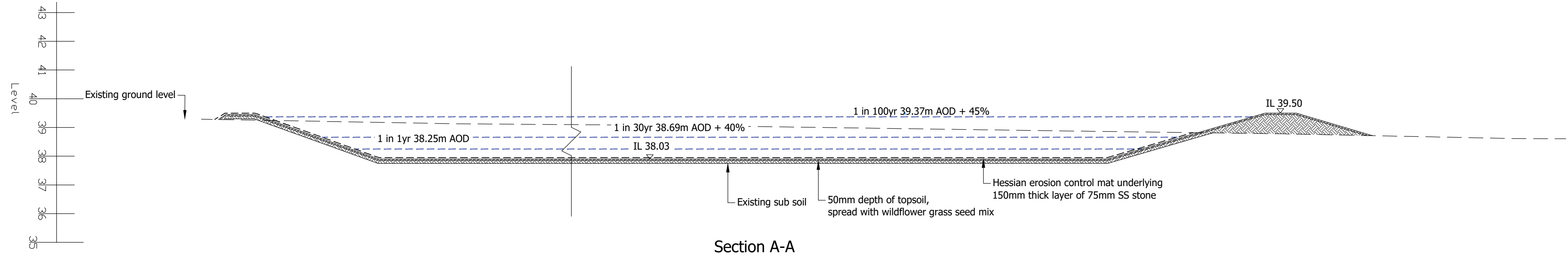
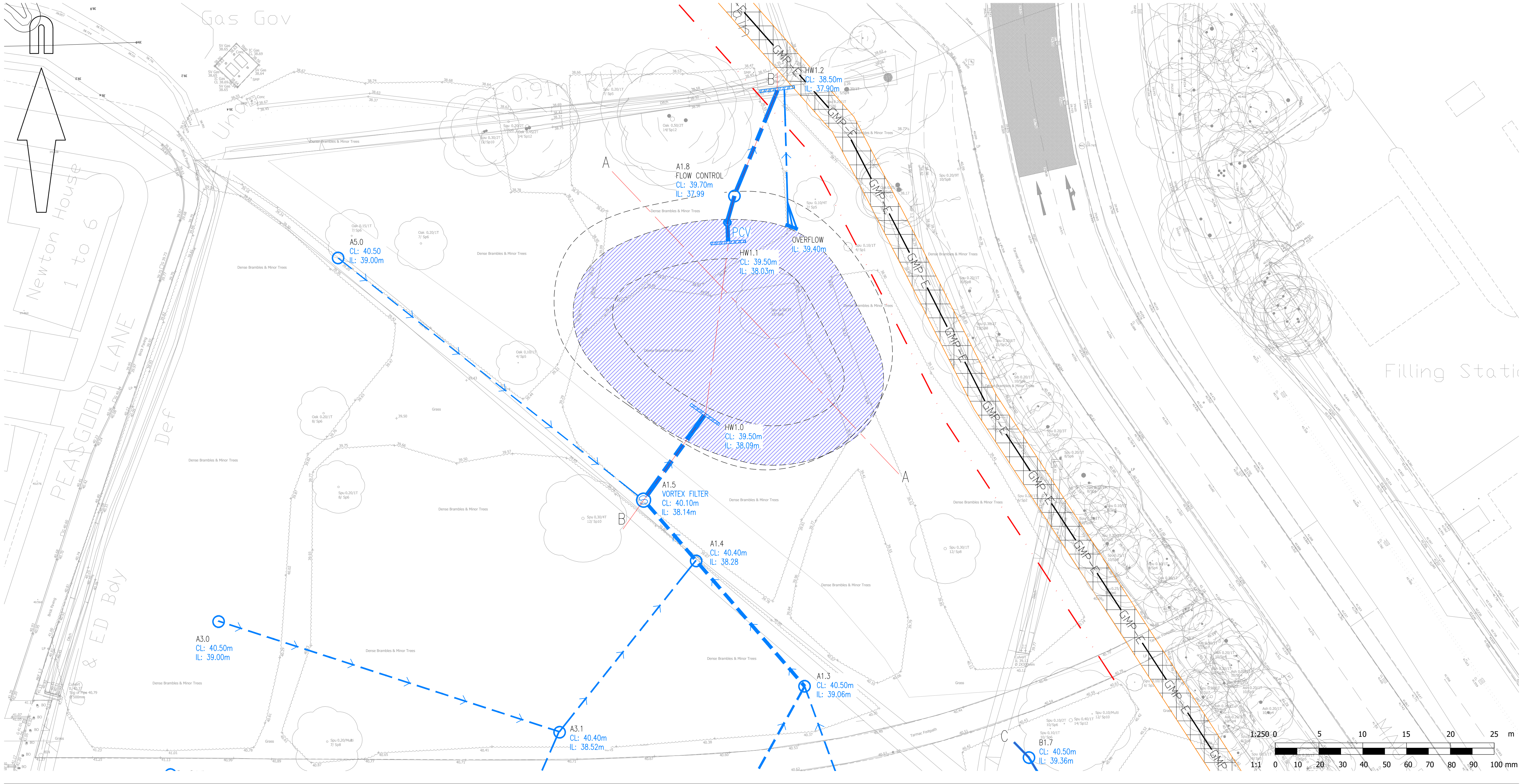
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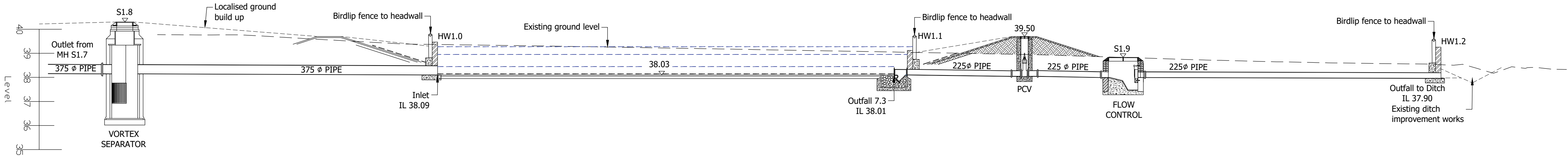
title
LOCATION PLAN

drawing number
GTWVILLE_BSL/GA/01

rev.



Section A-A



Section B-B

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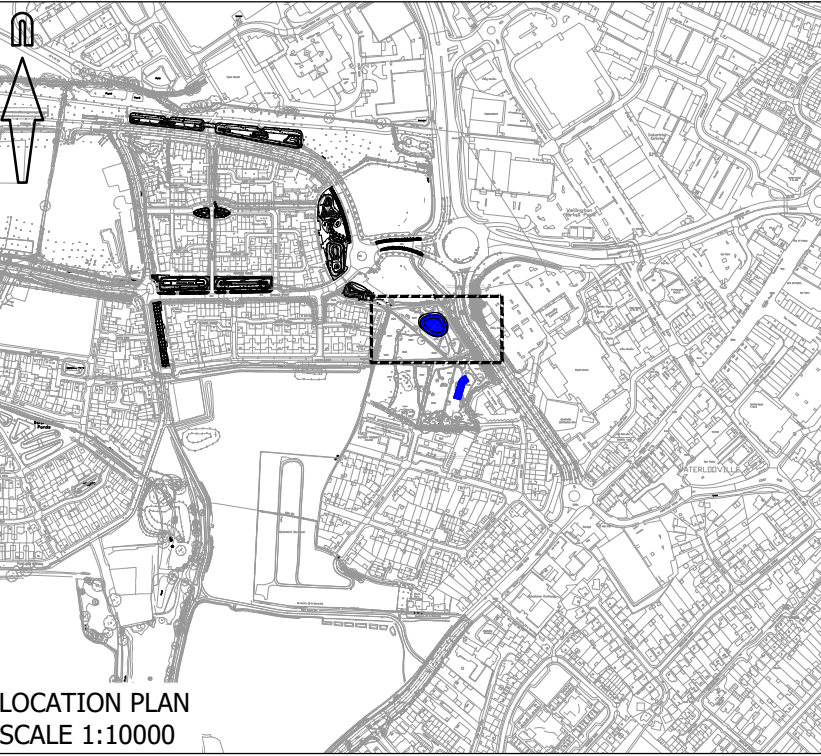
NOTES:

- DRAINAGE NETWORK BASED ON CONCEPT LAYOUT. ANY SUBSEQUENT ALTERNATIVE LAYOUT WILL REQUIRE RE-ROUTING OF NETWORK BRANCHES WHERE NECESSARY.
- REFER TO DWG. GTWVILLE_BSL/DR/02 FOR FULL EXTENT OF DRAINAGE NETWORKS.

KEY

EXISTING GAS MAIN EASEMENT

GAS MAIN 5m CLEARANCE (INDICATIVE)



FOR APPROVAL
NOT FOR CONSTRUCTION

A		SUDS POND REDUCED/TANK ADDED	RHA	02/04/2024
rev.	amendment	checked	date	

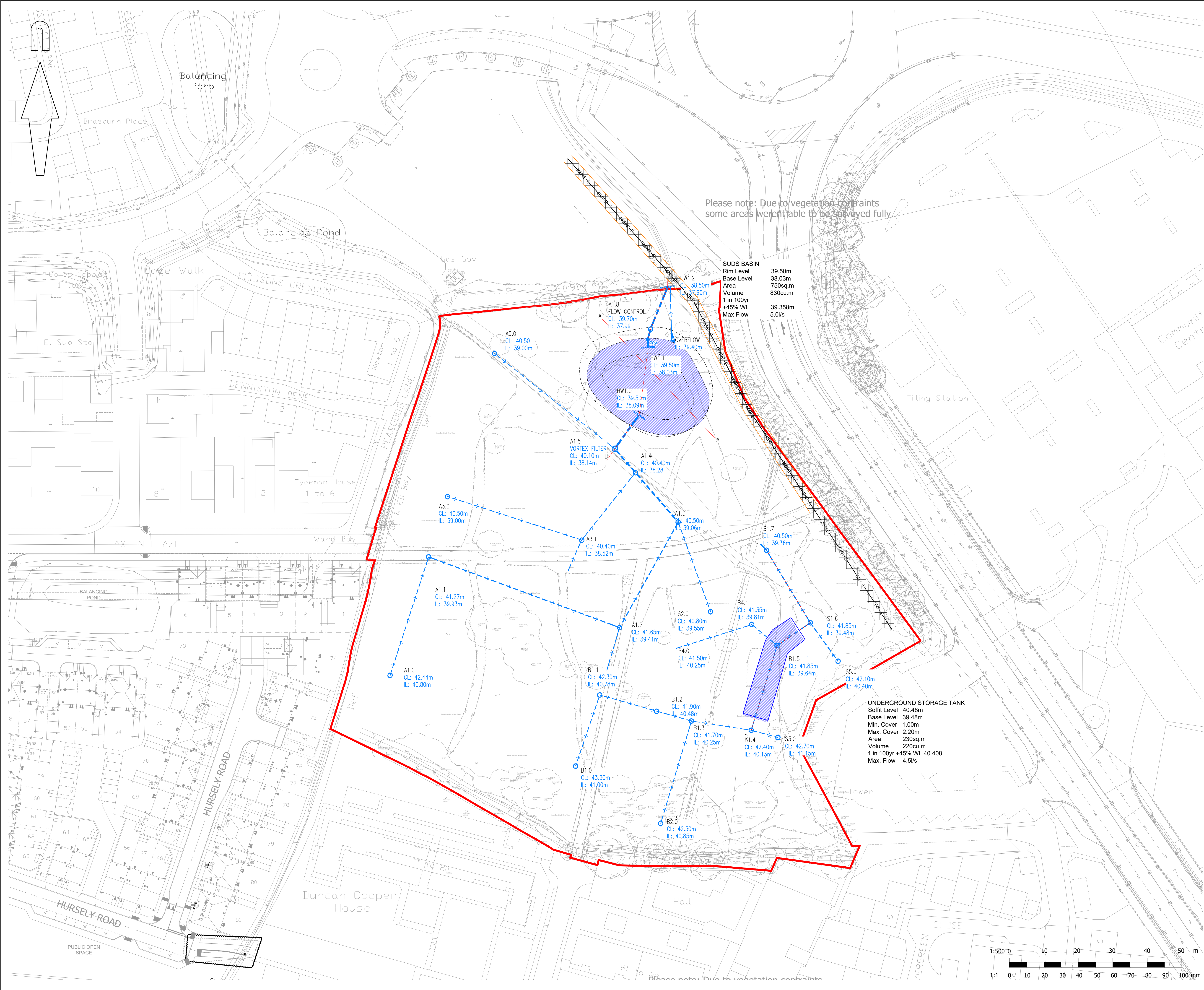
m3 mayer brown

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client **grainger plc** Investing in homes since 1912

project BLUE STAR LAND, WATERLOOVILLE

scale 1:250/1:100	drawn by NT	checked by RHA
date MARCH 2023	cad file DR_04.DWG	
title SUDS POND DETAILS		
drawing number GTWVILLE_BSL/DR/04	rev. A	



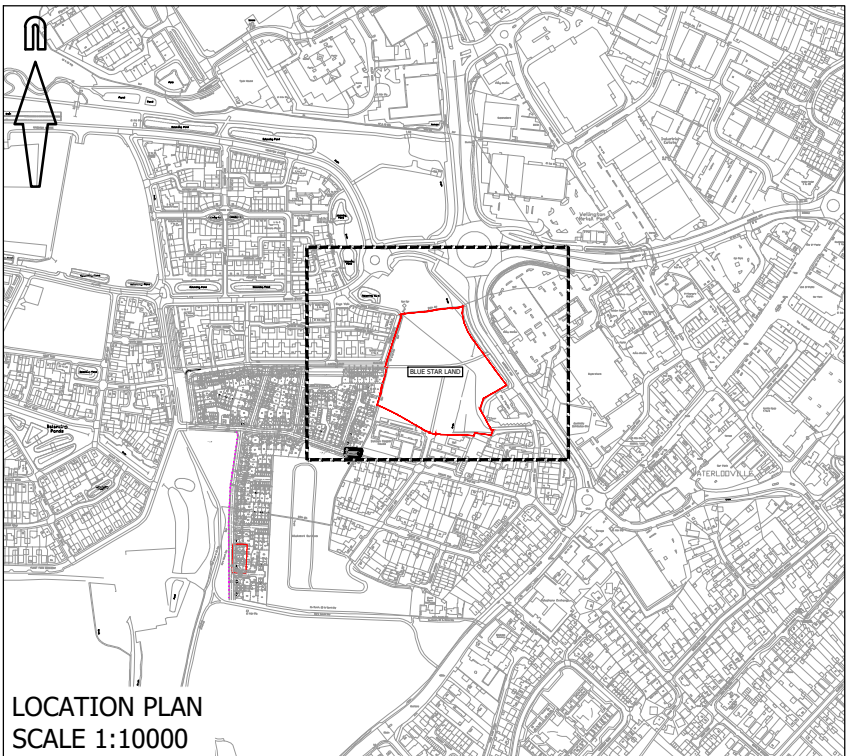
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KEY

EXTENT OF DEVELOPMENT BOUNDARY



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NOT FOR CONSTRUCTION

A Issued for Planning - Pond Reduced/Tank Added RHA 03/04/2024

rev. amendment checked date



Mayer Brown Limited
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client **grainger plc**

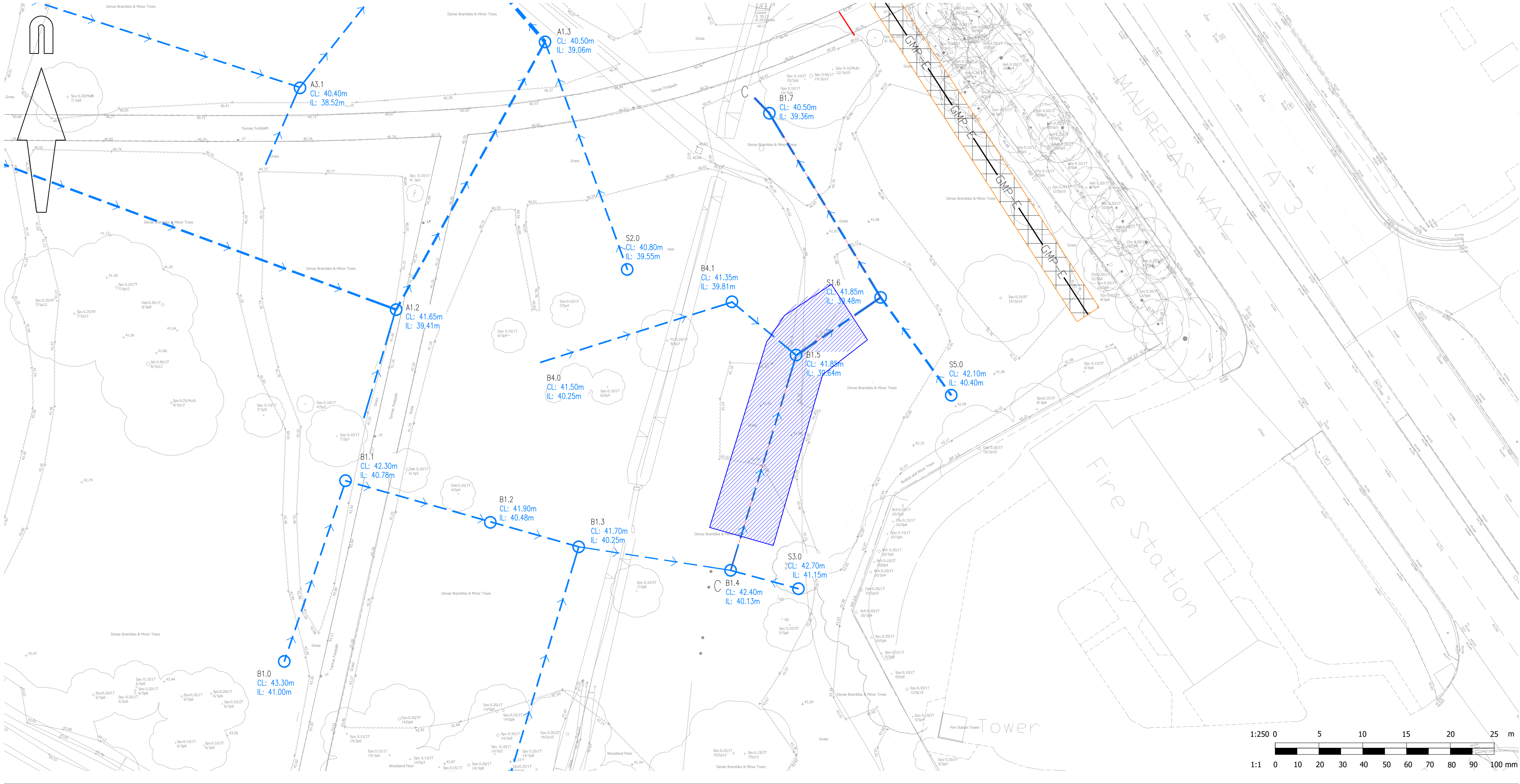
project **BLUE STAR LAND, WATERLOOVILLE**

scale 1:500 drawn by KD checked by RHA

date JANUARY 2023 cad file DR_03.DWG

title **PRELIMINARY DRAINAGE NETWORK**

drawing number **GTWVILLE_BSL/DR/03** rev. **A**



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A1 ORIGINAL

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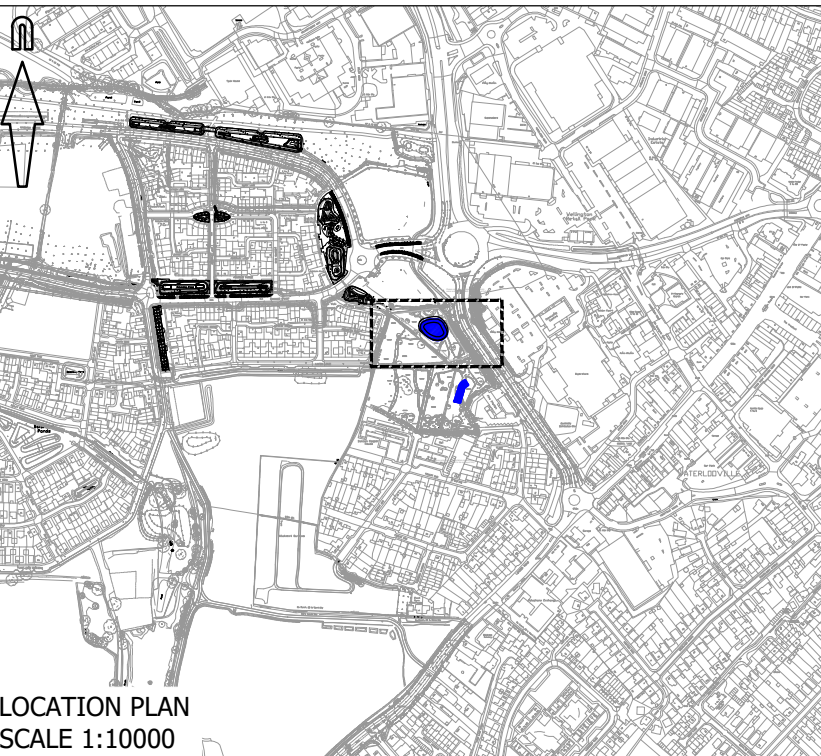
NOTES:

- DRAINAGE NETWORK BASED ON CONCEPT LAYOUT. ANY SUBSEQUENT ALTERNATIVE LAYOUT WILL REQUIRE RE-ROUTING OF NETWORK BRANCHES WHERE NECESSARY.
- REFER TO DWG. GTWVILLE_BSL/DR/03 FOR FULL EXTENT OF DRAINAGE NETWORKS.

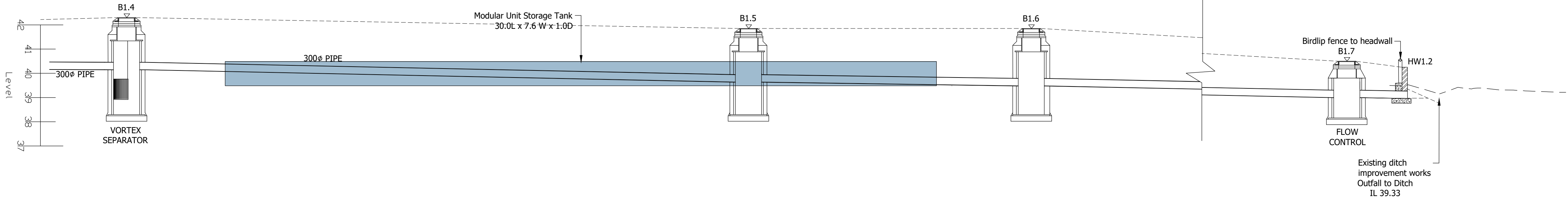
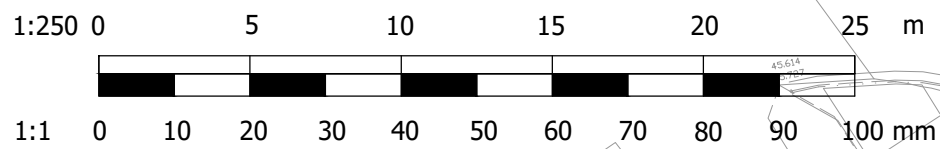
KEY

EXISTING GAS MAIN EASEMENT

GAS MAIN 5m CLEARANCE (INDICATIVE)



FOR APPROVAL
NOT FOR CONSTRUCTION



Section C-C

rev.	amendment	checked	date
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client **grainger plc**

project **BLUE STAR LAND, WATERLOOVILLE**

scale 1:250/1:100 drawn by NT checked by RHA

date APRIL 2024 cad file DR_04.DWG

title **UNDERGROUND STORAGE TANK**

drawing number **GTWVILLE_BSL/DR/07**

rev.

APPENDIX C: Model Data Output

Mayer Brown Limited		Page 1	
Lion House Oriental Road Woking GU22 8AP		Blue Star Land, Berewood	
Date 02/04/2024		Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX		Checked by IC	
Micro Drainage		Network 2020.1.3	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Network A

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
A1.000	36.118	0.722	50.0	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
A1.001	59.065	0.516	114.5	0.098	0.00	0.0	0.600	o	300	Pipe/Conduit	
A1.002	34.982	0.350	99.9	0.148	0.00	0.0	0.600	o	300	Pipe/Conduit	
A2.000	27.592	0.276	100.0	0.036	4.00	0.0	0.600	o	150	Pipe/Conduit	
A1.003	18.991	0.113	168.1	0.108	0.00	0.0	0.600	o	300	Pipe/Conduit	
A3.000	40.931	0.409	100.1	0.098	4.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
A1.000	50.00	4.42	40.800	0.000	0.0	0.0	0.0	1.43	25.2	0.0
A1.001	50.00	5.09	39.928	0.098	0.0	0.0	0.0	1.47	103.8	13.3
A1.002	50.00	5.46	39.412	0.246	0.0	0.0	0.0	1.57	111.2	33.3
A2.000	50.00	4.46	39.550	0.036	0.0	0.0	0.0	1.00	17.8	4.9
A1.003	50.00	5.72	39.062	0.390	0.0	0.0	0.0	1.21	85.5	52.8
A3.000	50.00	4.68	39.000	0.098	0.0	0.0	0.0	1.00	17.7	13.3

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Mayer Brown Limited			Page 3		
Lion House Oriental Road Woking GU22 8AP		Blue Star Land, Berewood			
Date 02/04/2024		Designed by RHA			
File 240328 BSL FEH 65%+10%.MDX		Checked by IC			
Micro Drainage			Network 2020.1.3		

Area Summary for Network A

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.098	0.098	0.098
1.002	-	-	100	0.148	0.148	0.148
2.000	-	-	100	0.036	0.036	0.036
1.003	-	-	100	0.108	0.108	0.108
3.000	-	-	100	0.098	0.098	0.098
4.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.017	0.017	0.017
1.004	-	-	100	0.060	0.060	0.060
5.000	-	-	100	0.100	0.100	0.100
1.005	-	-	100	0.070	0.070	0.070
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	User	-	100	0.059	0.059	0.059
				Total	Total	Total
				0.794	0.794	0.794

Free Flowing Outfall Details for Network A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
A1.009	A1.10	38.200	37.895	39.250	0	0

Simulation Criteria for Network A

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Return Period (years)	5	Profile Type	Summer
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Mayer Brown Limited		Page 4
Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Storm Duration (mins) 30		
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Mayer Brown Limited		Page 5																																																																								
Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood																																																																									
Date 02/04/2024	Designed by RHA																																																																									
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Micro Drainage	Network 2020.1.3																																																																									
Online Controls for Network A																																																																										
Hydro-Brake® Optimum Manhole: A1.9, DS/PN: A1.009, Volume (m³): 2.0																																																																										
Unit Reference MD-SHE-0098-5000-1500-5000																																																																										
Design Head (m)1.500																																																																										
Design Flow (l/s)5.0																																																																										
Flush-Flo™Calculated																																																																										
ObjectiveMinimise upstream storage																																																																										
ApplicationSurface																																																																										
Sump AvailableYes																																																																										
Diameter (mm)98																																																																										
Invert Level (m)37.994																																																																										
Minimum Outlet Pipe Diameter (mm)150																																																																										
Suggested Manhole Diameter (mm)1200																																																																										
<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.500</td><td>5.0</td><td>Kick-Flo®</td><td>0.878</td><td>3.9</td></tr><tr><td>Flush-Flo™</td><td>0.431</td><td>4.9</td><td>Mean Flow over Head Range</td><td>-</td><td>4.3</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.500	5.0	Kick-Flo®	0.878	3.9	Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3																																																						
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Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3																																																																					
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated																																																																										
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>3.2</td><td>1.200</td><td>4.5</td><td>3.000</td><td>6.9</td><td>7.000</td><td>10.3</td></tr><tr><td>0.200</td><td>4.4</td><td>1.400</td><td>4.8</td><td>3.500</td><td>7.4</td><td>7.500</td><td>10.7</td></tr><tr><td>0.300</td><td>4.8</td><td>1.600</td><td>5.1</td><td>4.000</td><td>7.9</td><td>8.000</td><td>11.0</td></tr><tr><td>0.400</td><td>4.9</td><td>1.800</td><td>5.4</td><td>4.500</td><td>8.4</td><td>8.500</td><td>11.3</td></tr><tr><td>0.500</td><td>4.9</td><td>2.000</td><td>5.7</td><td>5.000</td><td>8.8</td><td>9.000</td><td>11.6</td></tr><tr><td>0.600</td><td>4.8</td><td>2.200</td><td>6.0</td><td>5.500</td><td>9.2</td><td>9.500</td><td>11.9</td></tr><tr><td>0.800</td><td>4.3</td><td>2.400</td><td>6.2</td><td>6.000</td><td>9.6</td><td></td><td></td></tr><tr><td>1.000</td><td>4.1</td><td>2.600</td><td>6.5</td><td>6.500</td><td>10.0</td><td></td><td></td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.2	1.200	4.5	3.000	6.9	7.000	10.3	0.200	4.4	1.400	4.8	3.500	7.4	7.500	10.7	0.300	4.8	1.600	5.1	4.000	7.9	8.000	11.0	0.400	4.9	1.800	5.4	4.500	8.4	8.500	11.3	0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.6	0.600	4.8	2.200	6.0	5.500	9.2	9.500	11.9	0.800	4.3	2.400	6.2	6.000	9.6			1.000	4.1	2.600	6.5	6.500	10.0		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
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Mayer Brown Limited		Page 6
Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Offline Controls for Network A</u> <u>Weir Manhole: A1.8, DS/PN: A1.008, Loop to PN: None</u> Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 39.350		
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood									
Date 02/04/2024	Designed by RHA									
File 240328 BSL FEH 65%+10%.MDX	Checked by IC									
Micro Drainage	Network 2020.1.3									
<u>Storage Structures for Network A</u> <u>Tank or Pond Manhole: A1.7, DS/PN: A1.007</u> Invert Level (m) 38.027 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>363.0</td><td>1.500</td><td>750.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	363.0	1.500	750.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	363.0	1.500	750.0							
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Summary of Critical Results by Maximum Level (Rank 1) for Network A																																																																																																																																																																				
Simulation Criteria Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000 Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000 Hot Start Level (mm) 0 Inlet Coefficient 0.800 Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000 Foul Sewage per hectare (l/s) 0.000																																																																																																																																																																				
Number of Input Hydrographs 0 Number of Offline Controls 1 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0																																																																																																																																																																				
Synthetic Rainfall Details Rainfall Model FEH D1 (1km) 0.461 F (1km) 2.247 FEH Rainfall Version 1999 D2 (1km) 0.293 Cv (Summer) 0.750 Site Location D3 (1km) 0.380 Cv (Winter) 0.840 C (1km) -0.027 E (1km) 0.306																																																																																																																																																																				
Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status ON DVD Status OFF Inertia Status OFF																																																																																																																																																																				
Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760 Return Period(s) (years) 1 Climate Change (%) 0																																																																																																																																																																				
<table><tr><th colspan="6"></th><th>Water</th></tr><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Level (m)</th></tr><tr><td>A1.000</td><td>A1.0</td><td>15 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>40.800</td></tr><tr><td>A1.001</td><td>A1.1</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.983</td></tr><tr><td>A1.002</td><td>A1.2</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.498</td></tr><tr><td>A2.000</td><td>A2.0</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.596</td></tr><tr><td>A1.003</td><td>A1.3</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.194</td></tr><tr><td>A3.000</td><td>A3.0</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.079</td></tr><tr><td>A4.000</td><td>A4.0</td><td>15 Summer</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>39.230</td></tr><tr><td>A3.001</td><td>A3.1</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>38.596</td></tr><tr><td>A1.004</td><td>A1.4</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>38.464</td></tr><tr><td>A5.000</td><td>A5.0</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>38.980</td></tr><tr><td>A1.005</td><td>A1.5</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>38.338</td></tr><tr><td>A1.006</td><td>A1.6</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>38.297</td></tr><tr><td>A1.007</td><td>A1.7</td><td>720 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>38.264</td></tr><tr><td>A1.008</td><td>A1.8</td><td>720 Winter</td><td>1</td><td>+0%</td><td>1/360 Winter</td><td></td><td></td><td>0</td><td>38.268</td></tr></table>														Water	PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	A1.000	A1.0	15 Summer	1	+0%					40.800	A1.001	A1.1	15 Winter	1	+0%					39.983	A1.002	A1.2	15 Winter	1	+0%					39.498	A2.000	A2.0	15 Winter	1	+0%					39.596	A1.003	A1.3	15 Winter	1	+0%					39.194	A3.000	A3.0	15 Winter	1	+0%					39.079	A4.000	A4.0	15 Summer	1	+0%					39.230	A3.001	A3.1	15 Winter	1	+0%					38.596	A1.004	A1.4	15 Winter	1	+0%					38.464	A5.000	A5.0	15 Winter	1	+0%					38.980	A1.005	A1.5	15 Winter	1	+0%					38.338	A1.006	A1.6	15 Winter	1	+0%					38.297	A1.007	A1.7	720 Winter	1	+0%					38.264	A1.008	A1.8	720 Winter	1	+0%	1/360 Winter			0	38.268
						Water																																																																																																																																																														
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A3.000	A3.0	15 Winter	1	+0%					39.079																																																																																																																																																											
A4.000	A4.0	15 Summer	1	+0%					39.230																																																																																																																																																											
A3.001	A3.1	15 Winter	1	+0%					38.596																																																																																																																																																											
A1.004	A1.4	15 Winter	1	+0%					38.464																																																																																																																																																											
A5.000	A5.0	15 Winter	1	+0%					38.980																																																																																																																																																											
A1.005	A1.5	15 Winter	1	+0%					38.338																																																																																																																																																											
A1.006	A1.6	15 Winter	1	+0%					38.297																																																																																																																																																											
A1.007	A1.7	720 Winter	1	+0%					38.264																																																																																																																																																											
A1.008	A1.8	720 Winter	1	+0%	1/360 Winter			0	38.268																																																																																																																																																											
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
A1.000	A1.0	-0.150	0.000	0.00			0.0	OK	
A1.001	A1.1	-0.245	0.000	0.07			7.3	OK	
A1.002	A1.2	-0.214	0.000	0.18			18.4	OK	
A2.000	A2.0	-0.104	0.000	0.20			3.5	OK	
A1.003	A1.3	-0.168	0.000	0.40			29.7	OK	
A3.000	A3.0	-0.071	0.000	0.54			9.3	OK	
A4.000	A4.0	-0.150	0.000	0.00			0.0	OK	
A3.001	A3.1	-0.145	0.000	0.27			10.6	OK	
A1.004	A1.4	-0.110	0.000	0.72			44.5	OK	
A5.000	A5.0	-0.070	0.000	0.55			9.5	OK	
A1.005	A1.5	-0.175	0.000	0.55			58.7	OK	
A1.006	A1.6	-0.175	0.000	0.55			58.7	OK	
A1.007	A1.7	-0.138	0.000	0.24			8.6	OK	
A1.008	A1.8	0.022	0.000	0.19	0.0		5.7	SURCHARGED	

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
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File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	

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

	US/MH		Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period Change	Surcharge	Flood	Overflow	Act.	Level
								(m)
A1.009	A1.9	720 Winter	1	+0%	1/240 Winter			38.267

	US/MH	Surcharged	Flooded		Half Drain	Pipe		
PN	Name	Depth	Volume	Flow /	Time	Flow		Level
		(m)	(m ³)	Cap.	(l/s)	(mins)	(l/s)	Exceeded
							Status	
A1.009	A1.9	0.048	0.000	0.13			4.7 SURCHARGED	

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
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File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Storm Duration (mins) 30		
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Micro Drainage		Network 2020.1.3

Online Controls for Network A

Hydro-Brake® Optimum Manhole: A1.9, DS/PN: A1.009, Volume (m³): 2.0

Unit Reference	MD-SHE-0098-5000-1500-5000
Design Head (m)	1.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	37.994
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.0	Kick-Flo®	0.878	3.9
Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	1.200	4.5	3.000	6.9	7.000	10.3
0.200	4.4	1.400	4.8	3.500	7.4	7.500	10.7
0.300	4.8	1.600	5.1	4.000	7.9	8.000	11.0
0.400	4.9	1.800	5.4	4.500	8.4	8.500	11.3
0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.6
0.600	4.8	2.200	6.0	5.500	9.2	9.500	11.9
0.800	4.3	2.400	6.2	6.000	9.6		
1.000	4.1	2.600	6.5	6.500	10.0		

Mayer Brown Limited		Page 6
Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Offline Controls for Network A</u> <u>Weir Manhole: A1.8, DS/PN: A1.008, Loop to PN: None</u> Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 39.350		
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood									
Date 02/04/2024	Designed by RHA									
File 240328 BSL FEH 65%+10%.MDX	Checked by IC									
Micro Drainage	Network 2020.1.3									
<u>Storage Structures for Network A</u> <u>Tank or Pond Manhole: A1.7, DS/PN: A1.007</u> Invert Level (m) 38.027 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>363.0</td><td>1.500</td><td>750.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	363.0	1.500	750.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	363.0	1.500	750.0							
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Lion House Oriental Road Woking GU22 8AP			Blue Star Land, Berewood						
Date 02/04/2024 File 240328 BSL FEH 65%+10%.MDX			Designed by RHA Checked by IC						
Micro Drainage			Network 2020.1.3						
Summary of Critical Results by Maximum Level (Rank 1) for Network A									
Simulation Criteria									
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000									
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000									
Hot Start Level (mm) 0 Inlet Coefficient 0.800									
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000									
Foul Sewage per hectare (l/s) 0.000									
Number of Input Hydrographs 0 Number of Offline Controls 1 Number of Time/Area Diagrams 0									
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0									
Synthetic Rainfall Details									
Rainfall Model FEH D1 (1km) 0.461 F (1km) 2.247									
FEH Rainfall Version 1999 D2 (1km) 0.293 Cv (Summer) 0.750									
Site Location D3 (1km) 0.380 Cv (Winter) 0.840									
C (1km) -0.027 E (1km) 0.306									
Margin for Flood Risk Warning (mm) 300.0									
Analysis Timestep 2.5 Second Increment (Extended)									
DTS Status ON									
DVD Status OFF									
Inertia Status OFF									
Profile(s) Summer and Winter									
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760									
Return Period(s) (years) 30									
Climate Change (%) 0									
Water									
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)
A1.000	A1.0	15 Summer	30	+0%					40.800
A1.001	A1.1	15 Winter	30	+0%					40.041
A1.002	A1.2	15 Winter	30	+0%					39.646
A2.000	A2.0	15 Winter	30	+0%					39.638
A1.003	A1.3	15 Winter	30	+0%	30/15 Summer				39.484
A3.000	A3.0	15 Winter	30	+0%	30/15 Summer				39.837
A4.000	A4.0	15 Summer	30	+0%					39.230
A3.001	A3.1	15 Winter	30	+0%	30/15 Summer				39.203
A1.004	A1.4	15 Winter	30	+0%	30/15 Summer				39.141
A5.000	A5.0	15 Winter	30	+0%	30/15 Summer				39.648
A1.005	A1.5	15 Winter	30	+0%	30/15 Summer				38.814
A1.006	A1.6	720 Winter	30	+0%	30/15 Summer				38.674
A1.007	A1.7	720 Winter	30	+0%	30/60 Winter				38.673
A1.008	A1.8	720 Winter	30	+0%	30/15 Summer			0	38.722
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Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
A1.000	A1.0	-0.150	0.000	0.00			0.0	OK	
A1.001	A1.1	-0.187	0.000	0.30			29.3	OK	
A1.002	A1.2	-0.066	0.000	0.68			69.3	OK	
A2.000	A2.0	-0.062	0.000	0.65			11.0	OK	
A1.003	A1.3	0.122	0.000	1.48			109.2	SURCHARGED	
A3.000	A3.0	0.687	0.000	1.22			21.0	SURCHARGED	
A4.000	A4.0	-0.150	0.000	0.00			0.0	OK	
A3.001	A3.1	0.462	0.000	0.80			31.1	SURCHARGED	
A1.004	A1.4	0.567	0.000	2.31			143.2	SURCHARGED	
A5.000	A5.0	0.598	0.000	1.35			23.2	SURCHARGED	
A1.005	A1.5	0.301	0.000	1.70			180.6	SURCHARGED	
A1.006	A1.6	0.202	0.000	0.22			23.7	SURCHARGED	
A1.007	A1.7	0.271	0.000	0.21			7.8	SURCHARGED	
A1.008	A1.8	0.476	0.000	0.23	0.0		6.6	SURCHARGED	

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Micro Drainage		Network 2020.1.3

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

	US/MH		Return Climate	First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period Change	Surcharge	Flood	Overflow	Act.	Level (m)
A1.009	A1.9	720 Winter	30	+0%	30/15 Summer			38.761

	US/MH	Surcharged	Flooded		Half Drain	Pipe		
PN	Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status
A1.009	A1.9	0.542	0.000	0.13			4.9	SURCHARGED

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Micro Drainage	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

« - Indicates pipe capacity < flow

Network Results Table

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Lion House Oriental Road Woking GU22 8AP		
Date 02/04/2024 File 240328 BSL FEH 65%+10%.MDX		
Designed by RHA Checked by IC		
Micro Drainage		Network 2020.1.3

Area Summary for Network A

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.098	0.098	0.098
1.002	-	-	100	0.148	0.148	0.148
2.000	-	-	100	0.036	0.036	0.036
1.003	-	-	100	0.108	0.108	0.108
3.000	-	-	100	0.098	0.098	0.098
4.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.017	0.017	0.017
1.004	-	-	100	0.060	0.060	0.060
5.000	-	-	100	0.100	0.100	0.100
1.005	-	-	100	0.070	0.070	0.070
1.006	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
1.009	User	-	100	0.059	0.059	0.059
				Total	Total	Total
				0.794	0.794	0.794

Free Flowing Outfall Details for Network A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
A1.009	A1.10	38.200	37.895	39.250	0	0

Simulation Criteria for Network A

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Return Period (years)	5	Profile Type	Summer
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
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Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Storm Duration (mins) 30		
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood																																																																									
Date 02/04/2024	Designed by RHA																																																																									
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Micro Drainage	Network 2020.1.3																																																																									
Online Controls for Network A																																																																										
Hydro-Brake® Optimum Manhole: A1.9, DS/PN: A1.009, Volume (m³): 2.0																																																																										
Unit Reference MD-SHE-0098-5000-1500-5000 Design Head (m)1.500 Design Flow (l/s)5.0 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)98 Invert Level (m)37.994 Minimum Outlet Pipe Diameter (mm)150 Suggested Manhole Diameter (mm)1200																																																																										
<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.500</td><td>5.0</td><td>Kick-Flo®</td><td>0.878</td><td>3.9</td></tr><tr><td>Flush-Flo™</td><td>0.431</td><td>4.9</td><td>Mean Flow over Head Range</td><td>-</td><td>4.3</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.500	5.0	Kick-Flo®	0.878	3.9	Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3																																																						
Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)																																																																					
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Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3																																																																					
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated																																																																										
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>3.2</td><td>1.200</td><td>4.5</td><td>3.000</td><td>6.9</td><td>7.000</td><td>10.3</td></tr><tr><td>0.200</td><td>4.4</td><td>1.400</td><td>4.8</td><td>3.500</td><td>7.4</td><td>7.500</td><td>10.7</td></tr><tr><td>0.300</td><td>4.8</td><td>1.600</td><td>5.1</td><td>4.000</td><td>7.9</td><td>8.000</td><td>11.0</td></tr><tr><td>0.400</td><td>4.9</td><td>1.800</td><td>5.4</td><td>4.500</td><td>8.4</td><td>8.500</td><td>11.3</td></tr><tr><td>0.500</td><td>4.9</td><td>2.000</td><td>5.7</td><td>5.000</td><td>8.8</td><td>9.000</td><td>11.6</td></tr><tr><td>0.600</td><td>4.8</td><td>2.200</td><td>6.0</td><td>5.500</td><td>9.2</td><td>9.500</td><td>11.9</td></tr><tr><td>0.800</td><td>4.3</td><td>2.400</td><td>6.2</td><td>6.000</td><td>9.6</td><td></td><td></td></tr><tr><td>1.000</td><td>4.1</td><td>2.600</td><td>6.5</td><td>6.500</td><td>10.0</td><td></td><td></td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	3.2	1.200	4.5	3.000	6.9	7.000	10.3	0.200	4.4	1.400	4.8	3.500	7.4	7.500	10.7	0.300	4.8	1.600	5.1	4.000	7.9	8.000	11.0	0.400	4.9	1.800	5.4	4.500	8.4	8.500	11.3	0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.6	0.600	4.8	2.200	6.0	5.500	9.2	9.500	11.9	0.800	4.3	2.400	6.2	6.000	9.6			1.000	4.1	2.600	6.5	6.500	10.0		
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
0.100	3.2	1.200	4.5	3.000	6.9	7.000	10.3																																																																			
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0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.6																																																																			
0.600	4.8	2.200	6.0	5.500	9.2	9.500	11.9																																																																			
0.800	4.3	2.400	6.2	6.000	9.6																																																																					
1.000	4.1	2.600	6.5	6.500	10.0																																																																					
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File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Offline Controls for Network A</u> <u>Weir Manhole: A1.8, DS/PN: A1.008, Loop to PN: None</u> Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 39.350		
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Date 02/04/2024	Designed by RHA									
File 240328 BSL FEH 65%+10%.MDX	Checked by IC									
Micro Drainage	Network 2020.1.3									
<u>Storage Structures for Network A</u> <u>Tank or Pond Manhole: A1.7, DS/PN: A1.007</u> Invert Level (m) 38.027 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>363.0</td><td>1.500</td><td>750.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	363.0	1.500	750.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	363.0	1.500	750.0							
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Lion House Oriental Road Woking GU22 8AP		Blue Star Land, Berewood	
Date 02/04/2024 File 240328 BSL FEH 65%+10%.MDX		Designed by RHA Checked by IC	
Micro Drainage		Network 2020.1.3	

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

Simulation Criteria

Areal Reduction Factor 1.000	Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0	MADD Factor * 10m ³ /ha Storage 2.000
Hot Start Level (mm) 0	Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500	Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000	

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

Synthetic Rainfall Details

Rainfall Model FEH D1 (1km)	0.461	F (1km) 2.247
FEH Rainfall Version 1999 D2 (1km)	0.293	Cv (Summer) 0.750
Site Location D3 (1km)	0.380	Cv (Winter) 0.840
C (1km) -0.027	E (1km) 0.306	

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep 2.5 Second Increment (Extended)	
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)

Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	100
Climate Change (%)	45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
A1.000	A1.0	15 Winter	100	+45%	100/15 Summer			
A1.001	A1.1	15 Winter	100	+45%	100/15 Summer			
A1.002	A1.2	15 Winter	100	+45%	100/15 Summer			
A2.000	A2.0	15 Winter	100	+45%	100/15 Summer	100/15 Summer		
A1.003	A1.3	15 Winter	100	+45%	100/15 Summer	100/15 Summer		
A3.000	A3.0	15 Winter	100	+45%	100/15 Summer	100/15 Summer		
A4.000	A4.0	15 Winter	100	+45%	100/15 Summer			
A3.001	A3.1	15 Winter	100	+45%	100/15 Summer			
A1.004	A1.4	15 Winter	100	+45%	100/15 Summer			
A5.000	A5.0	15 Winter	100	+45%	100/15 Summer	100/15 Summer		
A1.005	A1.5	15 Winter	100	+45%	100/15 Summer			
A1.006	A1.6	720 Winter	100	+45%	100/15 Summer			
A1.007	A1.7	720 Winter	100	+45%	100/15 Summer			
A1.008	A1.8	720 Winter	100	+45%	100/15 Summer		100/720 Winter	1

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Overflow Cap. (l/s)	Half Drain Time (mins)	Pipe	Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)			Flow (l/s)		
A1.000	A1.0	41.220	0.270	0.000	0.15		3.7	SURCHARGED	
A1.001	A1.1	41.233	1.005	0.000	0.51		50.7	FLOOD RISK	
A1.002	A1.2	41.090	1.378	0.000	1.24		127.2	SURCHARGED	
A2.000	A2.0	40.800	1.100	0.207	1.03		17.4	FLOOD	2
A1.003	A1.3	40.507	1.145	7.557	2.32		171.5	FLOOD	2
A3.000	A3.0	40.510	1.360	9.773	1.98		34.2	FLOOD	6
A4.000	A4.0	40.151	0.771	0.000	0.36		5.7	SURCHARGED	
A3.001	A3.1	40.160	1.419	0.000	1.13		44.1	FLOOD RISK	
A1.004	A1.4	40.087	1.513	0.000	3.36		208.2	SURCHARGED	
A5.000	A5.0	40.407	1.357	7.371	1.83		31.7	FLOOD	5
A1.005	A1.5	39.407	0.894	0.000	2.60		276.1	SURCHARGED	
A1.006	A1.6	39.313	0.841	0.000	0.43		45.9	FLOOD RISK	
A1.007	A1.7	39.311	0.909	0.000	0.17		6.3	FLOOD RISK	
A1.008	A1.8	39.358	1.112	0.000	0.17	0.0	5.0	FLOOD RISK	



Micro
Drainage

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
A1.009	A1.9	720 Winter	100	+45%	100/15 Summer				39.397

PN	US/MH	Surcharged	Flooded			Half Drain	Pipe	Status	Level Exceeded
	Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)		
A1.009	A1.9	1.178	0.000	0.13			4.9	SURCHARGED	

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood Exceedance Event	
Date 02/04/2024 File 240328 BSL FEH 65%+10%.MDX	Designed by RHA Checked by IC	
Micro Drainage Network 2020.1.3		

STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

« - Indicates pipe capacity < flow

Network Results Table

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood Exceedance Event	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Storm Duration (mins) 30		
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood Exceedance Event																																																																									
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Online Controls for Network A																																																																										
Hydro-Brake® Optimum Manhole: A1.9, DS/PN: A1.009, Volume (m³): 2.0																																																																										
Unit Reference MD-SHE-0012-1000-1500-1000 Design Head (m)1.500 Design Flow (l/s)0.1 Flush-Flo™Calculated ObjectiveMinimise upstream storage ApplicationSurface Sump AvailableYes Diameter (mm)12 Invert Level (m)37.994 Minimum Outlet Pipe Diameter (mm)75 Suggested Manhole Diameter (mm)1200																																																																										
<table><tr><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td><td>Control Points</td><td>Head (m)</td><td>Flow (l/s)</td></tr><tr><td>Design Point (Calculated)</td><td>1.500</td><td>0.1</td><td>Kick-Flo®</td><td>0.109</td><td>0.0</td></tr><tr><td>Flush-Flo™</td><td>0.044</td><td>0.0</td><td>Mean Flow over Head Range</td><td>-</td><td>0.1</td></tr></table>			Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.500	0.1	Kick-Flo®	0.109	0.0	Flush-Flo™	0.044	0.0	Mean Flow over Head Range	-	0.1																																																						
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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)																																																																			
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood Exceedance Event	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Offline Controls for Network A</u> <u>Weir Manhole: A1.8, DS/PN: A1.008, Loop to PN: None</u> Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 39.350		
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood Exceedance Event									
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Micro Drainage	Network 2020.1.3									
<u>Storage Structures for Network A</u> <u>Tank or Pond Manhole: A1.7, DS/PN: A1.007</u> Invert Level (m) 38.027 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>363.0</td><td>1.500</td><td>750.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	363.0	1.500	750.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	363.0	1.500	750.0							
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood Exceedance Event	
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File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Overflow Cap. (l/s)	Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m³)					
A1.000	A1.0	40.950	0.000	0.000	0.07		1.6	OK	
A1.001	A1.1	40.998	0.770	0.000	0.47		46.6	FLOOD RISK	
A1.002	A1.2	40.904	1.192	0.000	1.00		102.7	SURCHARGED	
A2.000	A2.0	40.713	1.013	0.000	0.94		16.0	FLOOD RISK	
A1.003	A1.3	40.500	1.138	0.490	2.13		158.0	FLOOD	1
A3.000	A3.0	40.506	1.356	6.448	1.83		31.5	FLOOD	4
A4.000	A4.0	40.082	0.702	0.000	0.24		3.7	SURCHARGED	
A3.001	A3.1	40.090	1.349	0.000	1.13		44.3	SURCHARGED	
A1.004	A1.4	40.021	1.447	0.000	3.35		207.5	SURCHARGED	
A5.000	A5.0	40.405	1.355	4.593	1.82		31.4	FLOOD	4
A1.005	A1.5	39.376	0.863	0.000	0.08		8.4	SURCHARGED	
A1.006	A1.6	39.374	0.902	0.000	0.08		8.4	FLOOD RISK	
A1.007	A1.7	39.372	0.970	0.000	0.18		6.4	FLOOD RISK	

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Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow
A1.008	A1.8	4320 Winter	200	+0%	200/15 Summer		200/600 Winter
A1.009	A1.9	8640 Winter	200	+0%	200/15 Summer	200/1440 Winter	

PN	US/MH Name	Overflow Act.	Water Surcharged			Flooded			Half Drain Pipe	
			Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status
A1.008	A1.8	21	39.413	1.167	0.000	0.05	5.7		1.4	FLOOD RISK
A1.009	A1.9		39.477	1.258	0.000	0.00			0.1	FLOOD RISK

PN	US/MH Name	Level Exceeded
A1.008	A1.8	
A1.009	A1.9	

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Lion House Oriental Road Woking GU22 8AP		Blue Star Land, Berewood	
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Network A

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
A1.000	36.118	0.722	50.0	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
A1.001	59.065	0.516	114.5	0.098	0.00	0.0	0.600	o	300	Pipe/Conduit	
A1.002	34.982	0.350	99.9	0.148	0.00	0.0	0.600	o	300	Pipe/Conduit	
A2.000	27.592	0.276	100.0	0.036	4.00	0.0	0.600	o	150	Pipe/Conduit	
A1.003	18.991	0.113	168.1	0.108	0.00	0.0	0.600	o	300	Pipe/Conduit	
A3.000	40.931	0.409	100.1	0.098	4.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
A1.000	50.00	4.42	40.800	0.000	0.0	0.0	0.0	1.43	25.2	0.0
A1.001	50.00	5.09	39.928	0.098	0.0	0.0	0.0	1.47	103.8	13.3
A1.002	50.00	5.46	39.412	0.246	0.0	0.0	0.0	1.57	111.2	33.3
A2.000	50.00	4.46	39.550	0.036	0.0	0.0	0.0	1.00	17.8	4.9
A1.003	50.00	5.72	39.062	0.390	0.0	0.0	0.0	1.21	85.5	52.8
A3.000	50.00	4.68	39.000	0.098	0.0	0.0	0.0	1.00	17.7	13.3

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Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Storm Duration (mins) 30		
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Online Controls for Network A

Hydro-Brake® Optimum Manhole: A1.9, DS/PN: A1.009, Volume (m³): 2.0

Unit Reference	MD-SHE-0098-5000-1500-5000
Design Head (m)	1.500
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	98
Invert Level (m)	37.994
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	5.0	Kick-Flo®	0.878	3.9
Flush-Flo™	0.431	4.9	Mean Flow over Head Range	-	4.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.2	1.200	4.5	3.000	6.9	7.000	10.3
0.200	4.4	1.400	4.8	3.500	7.4	7.500	10.7
0.300	4.8	1.600	5.1	4.000	7.9	8.000	11.0
0.400	4.9	1.800	5.4	4.500	8.4	8.500	11.3
0.500	4.9	2.000	5.7	5.000	8.8	9.000	11.6
0.600	4.8	2.200	6.0	5.500	9.2	9.500	11.9
0.800	4.3	2.400	6.2	6.000	9.6		
1.000	4.1	2.600	6.5	6.500	10.0		

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
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<u>Offline Controls for Network A</u> <u>Weir Manhole: A1.8, DS/PN: A1.008, Loop to PN: None</u> Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 39.350		
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Micro Drainage	Network 2020.1.3									
<u>Storage Structures for Network A</u> <u>Tank or Pond Manhole: A1.7, DS/PN: A1.007</u> Invert Level (m) 38.027 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>363.0</td><td>1.500</td><td>750.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	363.0	1.500	750.0
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	363.0	1.500	750.0							
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Lion House Oriental Road Woking GU22 8AP				Blue Star Land, Berewood					
Date 02/04/2024 File 240328 BSL FEH 65%+10%.MDX				Designed by RHA Checked by IC					
Micro Drainage				Network 2020.1.3					
<u>Summary of Critical Results by Maximum Level (Rank 1) for Network A</u>									
		Surcharged Flooded				Half Drain	Pipe		
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status	Level Exceeded
A1.000	A1.0	0.131	0.000	0.12			2.8	SURCHARGED	
A1.001	A1.1	0.873	0.000	0.46			45.1	FLOOD RISK	
A1.002	A1.2	1.273	0.000	1.10			112.9	SURCHARGED	
A2.000	A2.0	1.090	0.000	0.96			16.2	FLOOD RISK	
A1.003	A1.3	1.141	3.191	2.22			164.3	FLOOD	2
A3.000	A3.0	1.358	7.889	1.93			33.2	FLOOD	6
A4.000	A4.0	0.735	0.000	0.32			5.1	SURCHARGED	
A3.001	A3.1	1.376	0.000	1.12			43.7	FLOOD RISK	
A1.004	A1.4	1.466	0.000	3.36			208.0	SURCHARGED	
A5.000	A5.0	1.356	5.762	1.83			31.6	FLOOD	5
A1.005	A1.5	0.835	0.000	2.56			271.1	SURCHARGED	
A1.006	A1.6	0.659	0.000	0.36			38.5	SURCHARGED	
A1.007	A1.7	0.728	0.000	0.19			7.0	SURCHARGED	
A1.008	A1.8	0.931	0.000	0.16	0.0		4.6	SURCHARGED	
A1.009	A1.9	0.996	0.000	0.13			4.9	SURCHARGED	
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Ratio R 0.350 Cv (Winter) 0.840 Profile Type Summer Storm Duration (mins) 30 Cv (Summer) 0.750		
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
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Micro Drainage		Network 2020.1.3

Online Controls for Network B

Complex Manhole: B1.6, DS/PN: B1.006, Volume (m³): 3.3

Hydro-Brake® Optimum

Unit Reference MD-SHE-0095-5000-1700-5000
Design Head (m) 1.700
Design Flow (l/s) 5.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 95
Invert Level (m) 39.484
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	5.0	Kick-Flo®	0.851	3.6
Flush-Flo™	0.417	4.5	Mean Flow over Head Range	-	4.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.3	3.000	6.5	7.000	9.7
0.200	4.2	1.400	4.6	3.500	7.0	7.500	10.1
0.300	4.5	1.600	4.9	4.000	7.5	8.000	10.4
0.400	4.5	1.800	5.1	4.500	7.9	8.500	10.7
0.500	4.5	2.000	5.4	5.000	8.3	9.000	11.0
0.600	4.4	2.200	5.6	5.500	8.7	9.500	11.3
0.800	3.9	2.400	5.9	6.000	9.0		
1.000	3.9	2.600	6.1	6.500	9.4		

Weir

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 40.984

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood																			
Date 02/04/2024	Designed by RHA																			
File 240328 BSL FEH 65%+10%.MDX	Checked by IC																			
Micro Drainage	Network 2020.1.3																			
<u>Storage Structures for Network B</u> <u>Tank or Pond Manhole: B1.6, DS/PN: B1.006</u> Invert Level (m) 39.484 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>220.0</td><td>1.001</td><td>0.0</td><td>2.001</td><td>0.0</td></tr><tr><td>1.000</td><td>220.0</td><td>2.000</td><td>0.0</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	220.0	1.001	0.0	2.001	0.0	1.000	220.0	2.000	0.0		
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)															
0.000	220.0	1.001	0.0	2.001	0.0															
1.000	220.0	2.000	0.0																	
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Mayer Brown Limited

Lion House

Oriental Road

Woking GU22 8AP

Date 02/04/2024

File 240328 BSL FEH 65%+10%.MDX

Blue Star Land, Berewood

Designed by RHA

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Micro Drainage

Network 2020.1.3

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

Simulation Criteria

Areal Reduction Factor 1.000

Hot Start (mins) 0

Hot Start Level (mm) 0

Manhole Headloss Coeff (Global) 0.500

Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000

MADD Factor * 10m³/ha Storage 2.000

Inlet Coeffiecient 0.800

Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0

Number of Offline Controls 0

Number of Time/Area Diagrams 0

Number of Online Controls 1

Number of Storage Structures 1

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D1 (1km) 0.461

FEH Rainfall Version 1999 D2 (1km) 0.293

Site Location D3 (1km) 0.380

C (1km) -0.027

F (1km) 2.247

Cv (Summer) 0.750

Cv (Winter) 0.840

E (1km) 0.306

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status ON

DVD Status OFF

Inertia Status OFF

Profile(s) Summer and Winter

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

Return Period(s) (years) 1

Climate Change (%) 0

									Water
	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)
B1.000	B1.0	15 Summer	1	+0%					41.000
B1.001	B1.1	15 Winter	1	+0%					40.841
B1.002	B1.2	15 Winter	1	+0%					40.551
B2.000	B2.0	15 Summer	1	+0%					40.850
B1.003	B1.3	15 Winter	1	+0%					40.332
B3.000	B3.0	15 Summer	1	+0%					41.177
B1.004	B1.4	15 Winter	1	+0%					40.221
B4.000	B4.0	15 Winter	1	+0%					40.288
B4.001	B4.1	15 Winter	1	+0%					39.856
B1.005	B1.5	15 Winter	1	+0%					39.757
B5.000	B5.0	15 Summer	1	+0%					40.422
B1.006	B1.6	360 Winter	1	+0%					39.607
B1.007	B1.7	360 Winter	1	+0%					39.411

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Surcharged		Flooded		Half Drain		Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Flow		
B1.000	B1.0	-0.150	0.000	0.00			0.0		OK	
B1.001	B1.1	-0.091	0.000	0.32			6.1		OK	
B1.002	B1.2	-0.152	0.000	0.23			8.2		OK	
B2.000	B2.0	-0.150	0.000	0.00			0.0		OK	
B1.003	B1.3	-0.139	0.000	0.31			11.8		OK	
B3.000	B3.0	-0.123	0.000	0.07			1.5		OK	
B1.004	B1.4	-0.133	0.000	0.35			13.8		OK	
B4.000	B4.0	-0.112	0.000	0.15			3.3		OK	
B4.001	B4.1	-0.101	0.000	0.23			3.7		OK	
B1.005	B1.5	-0.105	0.000	0.55			20.0		OK	
B5.000	B5.0	-0.128	0.000	0.05			1.1		OK	
B1.006	B1.6	-0.177	0.000	0.05			3.6		OK	
B1.007	B1.7	-0.250	0.000	0.07			3.6		OK	

Mayer Brown Limited		Page 1
Lion House Oriental Road Woking GU22 8AP		
Date 02/04/2024 File 240328 BSL FEH 65%+10%.MDX		
Designed by RHA Checked by IC		
Micro Drainage		Network 2020.1.3

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Network B

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	19.100	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Network B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
B1.000	21.797	0.218	100.0	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
B1.001	17.205	0.229	75.1	0.080	0.00	0.0	0.600	o	150	Pipe/Conduit	
B1.002	10.471	0.070	149.6	0.027	0.00	0.0	0.600	o	225	Pipe/Conduit	
B2.000	30.968	0.529	58.5	0.000	4.00	0.0	0.600	o	150	Pipe/Conduit	
B1.003	17.542	0.117	149.9	0.048	0.00	0.0	0.600	o	225	Pipe/Conduit	
B3.000	8.021	0.137	58.5	0.015	4.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
B1.000	50.00	4.36	41.000	0.000	0.0	0.0	0.0	1.00	17.8	0.0
B1.001	50.00	4.61	40.782	0.080	0.0	0.0	0.0	1.16	20.5	10.9
B1.002	50.00	4.77	40.478	0.108	0.0	0.0	0.0	1.07	42.4	14.6
B2.000	50.00	4.39	40.850	0.000	0.0	0.0	0.0	1.32	23.3	0.0
B1.003	50.00	5.05	40.246	0.155	0.0	0.0	0.0	1.07	42.4	21.0
B3.000	50.00	4.10	41.150	0.015	0.0	0.0	0.0	1.32	23.3	2.1

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Lion House Oriental Road Woking GU22 8AP			Blue Star Land, Berewood		
Date 02/04/2024			Designed by RHA		
File 240328 BSL FEH 65%+10%.MDX			Checked by IC		
Micro Drainage			Network 2020.1.3		

Area Summary for Network B

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	User	-	100	0.080	0.080	0.080
1.002	User	-	100	0.019	0.019	0.019
	User	-	100	0.008	0.008	0.027
2.000	-	-	100	0.000	0.000	0.000
1.003	User	-	100	0.046	0.046	0.046
	User	-	100	0.002	0.002	0.048
3.000	User	-	100	0.015	0.015	0.015
1.004	User	-	100	0.010	0.010	0.010
4.000	User	-	100	0.034	0.034	0.034
4.001	User	-	100	0.005	0.005	0.005
1.005	User	-	100	0.036	0.036	0.036
5.000	User	-	100	0.012	0.012	0.012
1.006	User	-	100	0.026	0.026	0.026
	User	-	100	0.001	0.001	0.027
	User	-	100	0.021	0.021	0.048
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.316	0.316	0.316

Free Flowing Outfall Details for Network B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
B1.007	B1.9	40.500	39.331	0.000	0	0

Simulation Criteria for Network B

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Synthetic Rainfall Details

Rainfall Model	FSR	Region	England and Wales
Return Period (years)	5 M5-60 (mm)		19.100

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024	Designed by RHA	
File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage		Network 2020.1.3
<u>Synthetic Rainfall Details</u> Ratio R 0.350 Cv (Winter) 0.840 Profile Type Summer Storm Duration (mins) 30 Cv (Summer) 0.750		
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
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File 240328 BSL FEH 65%+10%.MDX	Checked by IC	
Micro Drainage		Network 2020.1.3

Online Controls for Network B

Complex Manhole: B1.6, DS/PN: B1.006, Volume (m³): 3.3

Hydro-Brake® Optimum

Unit Reference MD-SHE-0095-5000-1700-5000
Design Head (m) 1.700
Design Flow (l/s) 5.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 95
Invert Level (m) 39.484
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	5.0	Kick-Flo®	0.851	3.6
Flush-Flo™	0.417	4.5	Mean Flow over Head Range	-	4.1

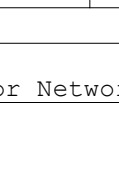
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.3	3.000	6.5	7.000	9.7
0.200	4.2	1.400	4.6	3.500	7.0	7.500	10.1
0.300	4.5	1.600	4.9	4.000	7.5	8.000	10.4
0.400	4.5	1.800	5.1	4.500	7.9	8.500	10.7
0.500	4.5	2.000	5.4	5.000	8.3	9.000	11.0
0.600	4.4	2.200	5.6	5.500	8.7	9.500	11.3
0.800	3.9	2.400	5.9	6.000	9.0		
1.000	3.9	2.600	6.1	6.500	9.4		

Weir

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 40.984

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood																			
Date 02/04/2024	Designed by RHA																			
File 240328 BSL FEH 65%+10%.MDX	Checked by IC																			
Micro Drainage	Network 2020.1.3																			
<u>Storage Structures for Network B</u> <u>Tank or Pond Manhole: B1.6, DS/PN: B1.006</u> Invert Level (m) 39.484 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>220.0</td><td>1.001</td><td>0.0</td><td>2.001</td><td>0.0</td></tr><tr><td>1.000</td><td>220.0</td><td>2.000</td><td>0.0</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	220.0	1.001	0.0	2.001	0.0	1.000	220.0	2.000	0.0		
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)															
0.000	220.0	1.001	0.0	2.001	0.0															
1.000	220.0	2.000	0.0																	
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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
Date 02/04/2024 File 240328 BSL FEH 65%+10%.MDX	Designed by RHA Checked by IC	
Micro Drainage Network 2020.1.3		

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

Simulation Criteria

Areal Reduction Factor 1.000	Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0	MADD Factor * 10m ³ /ha Storage 2.000
Hot Start Level (mm) 0	Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500	Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000	

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

Synthetic Rainfall Details

Rainfall Model	FEH D1 (1km) 0.461	F (1km) 2.247	
FEH Rainfall Version	1999 D2 (1km) 0.293	Cv (Summer) 0.750	
Site Location	D3 (1km) 0.380	Cv (Winter) 0.840	
C (1km) -0.027	E (1km) 0.306		

Margin for Flood Risk Warning (mm) 300.0
 Analysis Timestep 2.5 Second Increment (Extended)
 DTS Status ON
 DVD Status OFF
 Inertia Status OFF

Profile(s) Summer and Winter
 Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
 Return Period(s) (years) 30
 Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
B1.000	B1.0	15 Winter	30	+0%					41.004
B1.001	B1.1	15 Winter	30	+0%	30/15 Summer				41.024
B1.002	B1.2	15 Winter	30	+0%					40.640
B2.000	B2.0	15 Summer	30	+0%					40.850
B1.003	B1.3	15 Winter	30	+0%	30/15 Summer				40.571
B3.000	B3.0	15 Winter	30	+0%					41.199
B1.004	B1.4	15 Winter	30	+0%	30/15 Summer				40.430
B4.000	B4.0	15 Winter	30	+0%					40.322
B4.001	B4.1	15 Winter	30	+0%	30/15 Summer				40.085
B1.005	B1.5	15 Winter	30	+0%	30/15 Summer				40.045
B5.000	B5.0	15 Summer	30	+0%					40.441
B1.006	B1.6	360 Winter	30	+0%	30/120 Winter				39.844
B1.007	B1.7	360 Winter	30	+0%					39.419

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Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)				
B1.000	B1.0	-0.146	0.000	0.00			0.0	OK	
B1.001	B1.1	0.092	0.000	1.18			22.6	SURCHARGED	
B1.002	B1.2	-0.063	0.000	0.85			30.1	OK	
B2.000	B2.0	-0.150	0.000	0.00			0.0	OK	
B1.003	B1.3	0.100	0.000	1.09			41.3	SURCHARGED	
B3.000	B3.0	-0.101	0.000	0.23			4.7	OK	
B1.004	B1.4	0.076	0.000	1.21			47.5	SURCHARGED	
B4.000	B4.0	-0.078	0.000	0.47			10.4	OK	
B4.001	B4.1	0.128	0.000	0.70			10.9	SURCHARGED	
B1.005	B1.5	0.183	0.000	1.84			66.3	SURCHARGED	
B5.000	B5.0	-0.109	0.000	0.17			3.6	OK	
B1.006	B1.6	0.060	0.000	0.06			4.5	SURCHARGED	
B1.007	B1.7	-0.242	0.000	0.08			4.5	OK	

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Lion House Oriental Road Woking GU22 8AP	Blue Star Land, Berewood	
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Micro Drainage		Network 2020.1.3
<u>Synthetic Rainfall Details</u> Ratio R 0.350 Cv (Winter) 0.840 Profile Type Summer Storm Duration (mins) 30 Cv (Summer) 0.750		
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Online Controls for Network B

Complex Manhole: B1.6, DS/PN: B1.006, Volume (m³): 3.3

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0095-5000-1700-5000
Design Head (m)	1.700
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	39.484
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	5.0	Kick-Flo®	0.851	3.6
Flush-Flo™	0.417	4.5	Mean Flow over Head Range	-	4.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.3	3.000	6.5	7.000	9.7
0.200	4.2	1.400	4.6	3.500	7.0	7.500	10.1
0.300	4.5	1.600	4.9	4.000	7.5	8.000	10.4
0.400	4.5	1.800	5.1	4.500	7.9	8.500	10.7
0.500	4.5	2.000	5.4	5.000	8.3	9.000	11.0
0.600	4.4	2.200	5.6	5.500	8.7	9.500	11.3
0.800	3.9	2.400	5.9	6.000	9.0		
1.000	3.9	2.600	6.1	6.500	9.4		

Weir

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 40.984

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Date 02/04/2024	Designed by RHA																			
File 240328 BSL FEH 65%+10%.MDX	Checked by IC																			
Micro Drainage	Network 2020.1.3																			
<u>Storage Structures for Network B</u> <u>Tank or Pond Manhole: B1.6, DS/PN: B1.006</u> Invert Level (m) 39.484 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>220.0</td><td>1.001</td><td>0.0</td><td>2.001</td><td>0.0</td></tr><tr><td>1.000</td><td>220.0</td><td>2.000</td><td>0.0</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	220.0	1.001	0.0	2.001	0.0	1.000	220.0	2.000	0.0		
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)															
0.000	220.0	1.001	0.0	2.001	0.0															
1.000	220.0	2.000	0.0																	
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Micro Drainage		Network 2020.1.3

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

		Water	Surcharged	Flooded				Half Drain	Pipe		
	US/MH	Level	Depth	Volume	Flow /	Overflow	Time	Flow		Level	
PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status	Exceeded	
B1.000	B1.0	42.300	1.150	0.000	0.37			6.2	SURCHARGED		
B1.001	B1.1	42.300	1.368	0.376	1.75			33.5	FLOOD	1	
B1.002	B1.2	41.666	0.963	0.000	1.26			44.9	FLOOD RISK		
B2.000	B2.0	41.524	0.524	0.000	0.17			3.8	SURCHARGED		
B1.003	B1.3	41.554	1.083	0.000	1.71			64.8	FLOOD RISK		
B3.000	B3.0	41.226	-0.074	0.000	0.51			10.4	OK		
B1.004	B1.4	41.205	0.851	0.000	1.95			76.5	SURCHARGED		
B4.000	B4.0	40.976	0.576	0.000	0.78			17.2	SURCHARGED		
B4.001	B4.1	40.698	0.741	0.000	1.27			20.0	SURCHARGED		
B1.005	B1.5	40.554	0.692	0.000	3.12			112.7	SURCHARGED		
B5.000	B5.0	40.463	-0.087	0.000	0.38			8.0	OK		
B1.006	B1.6	40.408	0.624	0.000	0.07			4.5	SURCHARGED		
B1.007	B1.7	39.419	-0.242	0.000	0.08			4.5	OK		

Mayer Brown Limited

Lion House

Oriental Road

Woking GU22 8AP

Date 02/04/2024

File 240328 BSL FEH 65%+10%.MDX

Micro Drainage

Blue Star Land, Berewood

Exceedance Event

Designed by RHA

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Area Summary for Network B

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	User	-	100	0.080	0.080	0.080
1.002	User	-	100	0.019	0.019	0.019
	User	-	100	0.008	0.008	0.027
2.000	-	-	100	0.000	0.000	0.000
1.003	User	-	100	0.046	0.046	0.046
	User	-	100	0.002	0.002	0.048
3.000	User	-	100	0.015	0.015	0.015
1.004	User	-	100	0.010	0.010	0.010
4.000	User	-	100	0.034	0.034	0.034
4.001	User	-	100	0.005	0.005	0.005
1.005	User	-	100	0.036	0.036	0.036
5.000	User	-	100	0.012	0.012	0.012
1.006	User	-	100	0.026	0.026	0.026
	User	-	100	0.001	0.001	0.027
	User	-	100	0.021	0.021	0.048
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.316	0.316	0.316

Free Flowing Outfall Details for Network B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
B1.007	B1.9	40.500	39.331	0.000	0	0

Simulation Criteria for Network B

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Offline Controls	0
Number of Online Controls	1	Number of Storage Structures	1
		Number of Time/Area Diagrams	0
		Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	England and Wales
Return Period (years)	5 M5-60 (mm)		19.100

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Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Ratio R 0.350 Cv (Winter) 0.840 Profile Type Summer Storm Duration (mins) 30 Cv (Summer) 0.750		
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Micro Drainage		Network 2020.1.3

Online Controls for Network B

Complex Manhole: B1.6, DS/PN: B1.006, Volume (m³): 3.3

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0012-1000-1700-1000
Design Head (m)	1.700
Design Flow (l/s)	0.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	12
Invert Level (m)	39.484
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	0.1	Kick-Flo®	0.107	0.0
Flush-Flo™	0.044	0.0	Mean Flow over Head Range	-	0.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.0	1.200	0.1	3.000	0.1	7.000	0.2
0.200	0.0	1.400	0.1	3.500	0.1	7.500	0.2
0.300	0.0	1.600	0.1	4.000	0.1	8.000	0.2
0.400	0.1	1.800	0.1	4.500	0.1	8.500	0.2
0.500	0.1	2.000	0.1	5.000	0.2	9.000	0.2
0.600	0.1	2.200	0.1	5.500	0.2	9.500	0.2
0.800	0.1	2.400	0.1	6.000	0.2		
1.000	0.1	2.600	0.1	6.500	0.2		

Weir

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 40.984

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File 240328 BSL FEH 65%+10%.MDX	Checked by IC																			
Micro Drainage	Network 2020.1.3																			
<u>Storage Structures for Network B</u> <u>Tank or Pond Manhole: B1.6, DS/PN: B1.006</u> Invert Level (m) 39.484 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>220.0</td><td>1.001</td><td>0.0</td><td>2.001</td><td>0.0</td></tr><tr><td>1.000</td><td>220.0</td><td>2.000</td><td>0.0</td><td></td><td></td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	220.0	1.001	0.0	2.001	0.0	1.000	220.0	2.000	0.0		
Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)															
0.000	220.0	1.001	0.0	2.001	0.0															
1.000	220.0	2.000	0.0																	
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Micro Drainage		Network 2020.1.3							
Summary of Critical Results by Maximum Level (Rank 1) for Network B									
Simulation Criteria									
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000									
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000									
Hot Start Level (mm) 0 Inlet Coefficient 0.800									
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000									
Foul Sewage per hectare (l/s) 0.000									
Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0									
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0									
Synthetic Rainfall Details									
Rainfall Model FEH D1 (1km) 0.461 F (1km) 2.247									
FEH Rainfall Version 1999 D2 (1km) 0.293 Cv (Summer) 0.750									
Site Location D3 (1km) 0.380 Cv (Winter) 0.840									
C (1km) -0.027 E (1km) 0.306									
Margin for Flood Risk Warning (mm) 300.0									
Analysis Timestep 2.5 Second Increment (Extended)									
DTS Status ON									
DVD Status OFF									
Inertia Status OFF									
Profile(s) Summer and Winter									
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080									
Return Period(s) (years) 200									
Climate Change (%) 0									
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
B1.000	B1.0	15 Winter	200	+0%	200/15 Summer				41.984
B1.001	B1.1	15 Winter	200	+0%	200/15 Summer				42.014
B1.002	B1.2	15 Winter	200	+0%	200/15 Summer				41.386
B2.000	B2.0	15 Winter	200	+0%	200/15 Summer				41.262
B1.003	B1.3	15 Winter	200	+0%	200/15 Summer				41.287
B3.000	B3.0	15 Winter	200	+0%					41.220
B1.004	B1.4	960 Winter	200	+0%	200/15 Summer				41.022
B4.000	B4.0	960 Winter	200	+0%	200/15 Summer				41.020
B4.001	B4.1	960 Winter	200	+0%	200/15 Summer				41.017
B1.005	B1.5	960 Winter	200	+0%	200/15 Summer				41.014
B5.000	B5.0	960 Winter	200	+0%	200/480 Winter				41.008
B1.006	B1.6	960 Winter	200	+0%	200/15 Summer				41.007
B1.007	B1.7	960 Winter	200	+0%					39.427
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Micro Drainage		Network 2020.1.3

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
B1.000	B1.0	0.834	0.000	0.31			5.1	SURCHARGED	
B1.001	B1.1	1.082	0.000	1.64			31.3	FLOOD RISK	
B1.002	B1.2	0.683	0.000	1.19			42.5	SURCHARGED	
B2.000	B2.0	0.262	0.000	0.13			2.9	SURCHARGED	
B1.003	B1.3	0.816	0.000	1.59			60.2	SURCHARGED	
B3.000	B3.0	-0.080	0.000	0.45			9.1	OK	
B1.004	B1.4	0.668	0.000	0.19			7.3	SURCHARGED	
B4.000	B4.0	0.620	0.000	0.06			1.4	SURCHARGED	
B4.001	B4.1	1.060	0.000	0.09			1.5	FLOOD RISK	
B1.005	B1.5	1.152	0.000	0.28			10.0	SURCHARGED	
B5.000	B5.0	0.458	0.000	0.02			0.5	SURCHARGED	
B1.006	B1.6	1.223	0.000	0.09			5.9	SURCHARGED	
B1.007	B1.7	-0.234	0.000	0.11			5.9	OK	



Micro
Drainage

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Lion House

Oriental Road

Woking GU22 8AP

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Micro Drainage

Blue Star Land, Berewood

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Area Summary for Network B

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	User	-	100	0.080	0.080	0.080
1.002	User	-	100	0.019	0.019	0.019
	User	-	100	0.008	0.008	0.027
2.000	-	-	100	0.000	0.000	0.000
1.003	User	-	100	0.046	0.046	0.046
	User	-	100	0.002	0.002	0.048
3.000	User	-	100	0.015	0.015	0.015
1.004	User	-	100	0.010	0.010	0.010
4.000	User	-	100	0.034	0.034	0.034
4.001	User	-	100	0.005	0.005	0.005
1.005	User	-	100	0.036	0.036	0.036
5.000	User	-	100	0.012	0.012	0.012
1.006	User	-	100	0.026	0.026	0.026
	User	-	100	0.001	0.001	0.027
	User	-	100	0.021	0.021	0.048
1.007	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.316	0.316	0.316

Free Flowing Outfall Details for Network B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
B1.007	B1.9	40.500	39.331	0.000	0	0

Simulation Criteria for Network B

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0

Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Region	England and Wales
Return Period (years)	5	M5-60 (mm)	19.100

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Micro Drainage	Network 2020.1.3	
<u>Synthetic Rainfall Details</u> Ratio R 0.350 Cv (Winter) 0.840 Profile Type Summer Storm Duration (mins) 30 Cv (Summer) 0.750		
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Online Controls for Network B

Complex Manhole: B1.6, DS/PN: B1.006, Volume (m³): 3.3

Hydro-Brake® Optimum

Unit Reference	MD-SHE-0095-5000-1700-5000
Design Head (m)	1.700
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	39.484
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	5.0	Kick-Flo®	0.851	3.6
Flush-Flo™	0.417	4.5	Mean Flow over Head Range	-	4.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.3	3.000	6.5	7.000	9.7
0.200	4.2	1.400	4.6	3.500	7.0	7.500	10.1
0.300	4.5	1.600	4.9	4.000	7.5	8.000	10.4
0.400	4.5	1.800	5.1	4.500	7.9	8.500	10.7
0.500	4.5	2.000	5.4	5.000	8.3	9.000	11.0
0.600	4.4	2.200	5.6	5.500	8.7	9.500	11.3
0.800	3.9	2.400	5.9	6.000	9.0		
1.000	3.9	2.600	6.1	6.500	9.4		

Weir

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 40.984

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Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)															
0.000	220.0	1.001	0.0	2.001	0.0															
1.000	220.0	2.000	0.0																	
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Summary of Critical Results by Maximum Level (Rank 1) for Network B

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)				
B1.000	B1.0	0.994	0.000	0.33			5.6	SURCHARGED	
B1.001	B1.1	1.247	0.000	1.70			32.4	FLOOD RISK	
B1.002	B1.2	0.804	0.000	1.23			43.9	SURCHARGED	
B2.000	B2.0	0.375	0.000	0.16			3.6	SURCHARGED	
B1.003	B1.3	0.930	0.000	1.65			62.4	FLOOD RISK	
B3.000	B3.0	-0.077	0.000	0.48			9.6	OK	
B1.004	B1.4	0.726	0.000	1.88			73.4	SURCHARGED	
B4.000	B4.0	0.453	0.000	0.72			16.1	SURCHARGED	
B4.001	B4.1	0.653	0.000	1.20			18.8	SURCHARGED	
B1.005	B1.5	0.620	0.000	2.97			107.3	SURCHARGED	
B5.000	B5.0	-0.089	0.000	0.35			7.4	OK	
B1.006	B1.6	0.483	0.000	0.07			4.5	SURCHARGED	
B1.007	B1.7	-0.242	0.000	0.08			4.5	OK	

APPENDIX D: Maintenance Schedule

Blue Star Land, Waterloooville
Drainage Maintenance Plan

Introduction

This document sets out the planned maintenance requirements for the (non-highways) Sustainable Drainage System (SuDS), which are associated with the Blue Star Land development, Waterloooville. This plan should be reviewed and updated periodically by the adopting authority as additional experience is gained. The SuDS consist of open space features, distribution pipework and a SuDs basin.

Schedule of Open Space SuDS Maintenance Requirements

Activity Breakdown

Flow Controls (HydroBrakes)

Frequency – 6 Monthly Inspections

Tasks

- Remove covers to chambers and enter where safe to do to. Staff to be appropriately trained and equipped for confined entry.
- Inspect visually for damage or corrosion.
- Check for and clear any obstructions. Wash down if required.
- Check correct operation of Bypass door and handle on HydroBrakes, grease lightly if required
- File Record of Visit and Actions Taken, report any defects for repair.

Shut-Off Valves

Frequency – 6 Monthly Inspections

Tasks

- Remove covers & attach operating tool
- Confirm valve was previously left in the open position
- Operate Valve to fully closed and reopen
- Repeat operation 3 times and leave in fully open position
- File Record of Visit and report any defect or stiff operation for repair.

Weirs (Kerb Gully Type)

Frequency – 6 monthly or where defects reported

Tasks

- Remove covers, remove any debris and rod through to junction
- File Record of Visit and report any defects for repair or blockage for jetting.

Rock Outlets

Frequency – 6 Monthly or where defects reported

Tasks

- Ensure that pipe and basket are covered by rocks as intended.
- Reposition or replace any rocks that have been removed.
- Check for and clear any debris or self sown vegetation caught between the rocks.
- File Record of Visit and report any defects for repair.

Landscape Maintenance

Frequency – As Specified in the Landscape Management Plan

- The Contractor shall regularly inspect and maintain SuDS features to ensure their effective operation as designed. Regular mowing in and around detention basins is required only along maintenance access routes, amenity areas (e.g. footpaths), across embankments and main storage area. The remaining areas can be managed as damp meadow grass, unless additional management is required for landscaping purposes.
- Management of vegetation and removal of nuisance plants.
- Remove sediment from inlets, outlet and fore bay. Tidy all dead growth before start of growing season.
- Repair erosion or other damage by re-seeding or re-turfing. Realignment of rip-rap, repair and rehabilitation of inlets, outlets and overflows, re-level uneven surfaces and reinstate design levels as required.

Silt Monitoring & Removal

Frequency – Monitor Annually, Remove as required (Assumed 5 yearly)

Tasks

Sustainable Drainage Maintenance Plan

- Take measurements and record depths of silt annually in pool areas of SuDS
- Arrange Removal of Silts in deep pools, where average depth is approximately 100mm, and a maximum not exceeding 300mm. Before de-silting a particular pond it should be trapped and netted out for amphibians and macro-invertebrates which should be transferred to a nearby pond assuming no fish are present. Not all ponds are to be de-silted in the
- Remove silts in dry basins where it threatens to restrict the capacity of inlets or outlets or is unsightly.
- NOTE - Sediments excavated from detention basins that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or land filling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. In the majority of cases it will be acceptable to distribute the sediment on site if there is an appropriate safe and acceptable location to do so.

SuDS Ancillaries

In addition to the open space SuDS and associated maintenance activities as listed above, there are a number of other items requiring periodic inspection and maintenance as follows:

Pipes

Frequency –Annual visit initially, then adjust as necessary

Tasks

- CCTV survey and jetting of areas of sediment build-up, repeat after 1 year.
- Re-jet Jet identified sedimentation areas on a cycle as determined
- CCTV survey on a 10 year cycle to identify blockages and structural defects.
-

Chambers

Frequency –Annual Surface Inspection, below ground inspection as above

Tasks

- Visual inspection of covers and frames to identify defects on an annual basis

Sustainable Drainage Maintenance Plan

- View internal chamber structure when CCTV surveys of pipework are carried out to identify structural defects or maintenance issues.

Signage

Frequency – 6 monthly

Tasks

- Check that pollution shut-off signage is intact.
- Clean sign face with soapy water
- Report any defects for repair

Fencing

Frequency – 6 monthly

Tasks

- Check that fencing is intact and secure, check for signs of corrosion / rot.
- Report any defects for repair or replacement

