Drainage Strategy Report

Land South of A465 | Burley Gate | Herefordshire | HR1 3QR

January 2019

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Document Control Sheet

Document Title: **Drainage Strategy Report**

Document Reference: **296A31-DR/01**

Project Name: **Land South of A465,**

Burley Gate, Herefordshire, HR1 3QR

Project Number: **296A31**

Client: **Shire Consulting Ltd**

Issue Record

Revision	**Date**	**Status**	**Comment**
0	20.11.2018	Preliminary	Issued for comment
1	19.12.2018	Planning	Revised following HCC LLFA comments – basin crest increased from 1.0m to 1.5m
2	11.01.2019	Planning	Foul water treatment to include phosphate dosing

Contents

1.0 Introduction

It is proposed to develop agricultural land for the provision of 15no dwellings and a convenience store together with associated access road, driveways, parking, pathway, garden areas and landscaping. The houses are to be a mix of 2bed, 3bed and 4bed 2storey properties together with 2bed and 3bed 1storey dwellings laid out as 4no terraced and 11 no detached units.

The Environment Agency Flood Map for Planning does not show the site of approximately 0.95ha to be affected by fluvial flooding from watercourses. The nearest significant watercourse is an unnamed tributary of Little Lugg fed initially by runoff and springs originating from Moreton Jeffries, Upper Town and Felton. This is situated approximately 1km north to north westwards from the site where ground levels are below 75m AOD compared to site levels that vary between 103m AOD and 98.5m AOD. The terrain of the site is such that runoff not drained to the ground will flow westwards and then southwards towards A417 and an unnamed watercourse beyond that is similarly a tributary of Little Lugg.

The Environment Agency Long Term Flood Risk Maps do not show the site to be susceptible to flood risk from either surface water or reservoir sources.

This Drainage Report is intended to provide the background and design criteria used to arrive at the proposed drainage strategy as presented on the appended key plan and supported by the accompanying Micro Drainage (MD) calculations. The strategy is not a final drainage design and it is expected that if planning permission is granted that a condition will require the submission and agreement of drainage details that would subsequently be implemented. There would necessarily need to be discussion with both DCWW and Herefordshire Council as both Highway Authority and Lead Local Flood Authority due to the proposed adoptable elements of the surface water drainage system. However, the principles set out in this report demonstrate the viability of the proposed scheme, with regard to both foul and surface water drainage.

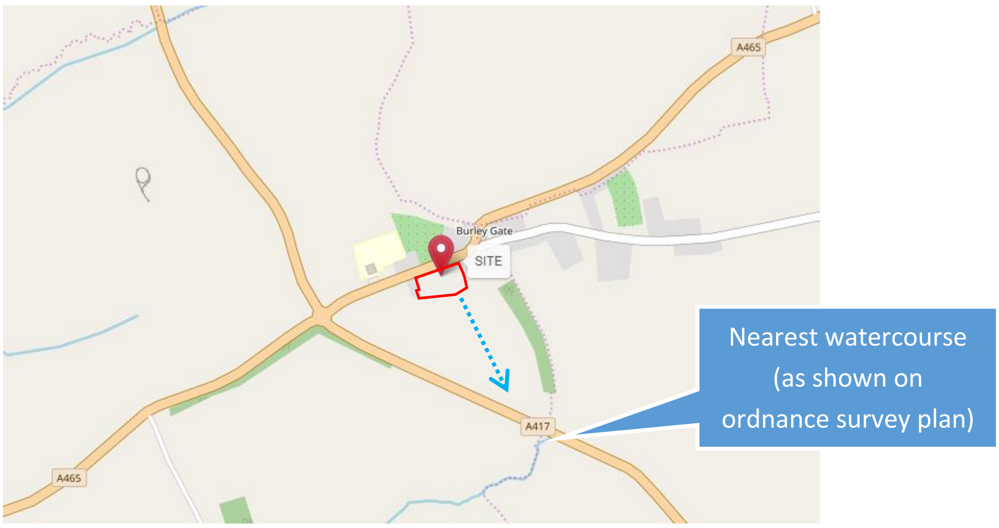

FIGURE 1 SITE LOCATION[1]

[1] https://www.openstreetmap.org/copyright

2.0 Drainage Design Parameters

2.1 Sustainable Drainage Systems (SuDS)

According to the Town and Country Planning (Development Management Procedure) (England) Order 2015, proposals would be classified as major development where they: are on a site greater than 1ha; comprise more than 10 dwellings; or are on a site exceeding 0.5ha where it is not known whether the number of dwellings would exceed 10. The updated NPPF[2] clarifies that 'major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate'.

In terms of local planning, Herefordshire Council's Adopted Core Strategy includes Policy SD3 (Sustainable Water Management and Water Resources) requires development to 'include appropriate SuDS to manage surface water appropriate to the hydrological setting of the site'. HC's SuDS Handbook[3] advises that 'SuDS need to be applied to any development and demonstration of compliance with the SuDS hierarchy will always be required. Runoff requirements will be imposed in compliance with Council Policy'.

SuDS are a natural approach to managing drainage in and around properties and other developments. They work by slowing and holding back the water that runs off from a site, allowing natural processes to break down pollutants[4]. There is a hierarchy of surface water disposal options to follow as set out in Building Regulations Approved Document H and Planning Practice Guidance: into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain, or another drainage system; to a combined sewer.

2.2 Ground Investigation

Some ground investigation has been undertaken at the site by Shire Geotechnical in the form of percolation testing to ascertain whether infiltration drainage for both rainwater and treated foul water effluent will be viable. The report[5] describes percolation testing undertaken on 1st and 2nd August in three trial pits at the site following the methodology of BRE Digest 365. Ground conditions encountered are described as 'red brown clay with a disturbed/reworked appearance to a depth of between 0.25m and 0.4m over firm becoming very stiff red brown and grey silty clay with layers of mudstone and siltstone below 1.0m'. It was noted that 'it was not possible to penetrate the mudstone in BRE 3 below a depth of 1.85m' and that 'there was no drop in the water level in any of the test pits over a 24-hour period'. In conclusion, the use of infiltration drainage at the site via either rain water soakaways or field drainage for secondary treatment of foul water effluent is not appropriate.

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[2] Paragraph 165, NPPF July 2018
[3] Doc ref RCLHP001-AM0064-TR-001-I, June 2018, Section 1.3
https://www.herefordshire.gov.uk/download/downloads/id/14026/sustainable_drainage_systems_handbook.pdf
[4] http://www.netregs.org.uk/environmental-topics/water/sustainable-drainage-systems-suds/
[5] Reference G-18-179/G1-1, September 2018

On examination of British Geological Survey maps, superficial deposits at and in the vicinity of the site are not recorded, whilst the bedrock geology is noted as Raglan Mudstone Formation - Siltstone and Mudstone, interbedded. This compares well with the in-situ ground investigation by Shire Geotechnical as described above.

2.3 Available Outfalls

The ground investigation demonstrates that ground conditions are not suitable for disposal of surface water runoff via infiltration to the ground. Following the hierarchy of outfall options, it is necessary to next consider draining to a watercourse. A review of ordnance survey maps shows that the site is not within close proximity to open watercourses, the nearest being an un-named tributary of Little Lugg over 0.5km to the southeast of the site (as shown on figure 1 above). However, the applicant owns land between the red line site boundary and watercourse and so it is possible to provide a means of conveyance between the site and outfall without potential third party land ownership issues.

3.0 Surface Water Drainage

3.1 Runoff Areas

The proposed roof and paved areas are identified on appended key plan [1] and total 0.505ha. The key plan hatch colours provide a separation of types of runoff area, with roof runoff and pedestrian paving being considered to be clean, whilst access driveway and parking areas together with the proposed adoptable highway areas that will be trafficked by vehicles would require a stage of treatment to suit the potential for contamination.

3.2 Discharge Rate

Non-statutory technical standards for SuDS published by Defra require discharges from all development sites (previously developed and greenfield) to be limited to greenfield rates as far as reasonably practicable.

The greenfield rate based on default parameters for the site location has been determined as per appended MicroDrainage sheet 1 to be q_{bar} = 1.8l/s/ha. It is noted that this is for a SOIL value of 0.3 that would typically represent very permeable to moderately permeable soils. However, in line with actual ground conditions, a SOIL value of 0.5 has been substituted to more appropriately represent the very low permeability of the underlying ground. The q_{bar} rate adopted for design is therefore 5.5l/s/ha as per MD sheet 2.

For the connected area of 0.505ha (refer to section 3.6), this would require a limiting rate of 2.8l/s which can be achieved using a vortex flow control device such as a hydrobrake optimum unit. If the hydraulic head applied is limited to 1.3m, the control aperture will be 75mm diameter[6] and therefore should be acceptable for adoption by the sewerage undertaker.

3.3 Water Quality

In accordance with table 4.3 of the SuDS Manual (CIRIA C753), residential roofs have a 'very low' pollution hazard level requiring 'removal of gross solids and sediments only' whilst a 'low pollution hazard level is attributed to 'individual property driveways' and 'low traffic roads (eg cul de sacs, home zones, general access roads). The car parking for the convenience store can be classified as 'non-residential car parking with frequent change (eg, hospitals, retail) and therefore has a 'medium' pollution hazard level.

Water quality management methods for the areas with low and medium pollution hazard levels can be determined by the 'simple index approach' that provides requirements for treating discharge via the consideration of pollution hazard and mitigation indices.

Table 26.3 of the SuDS Manual demonstrates that a permeable pavement will provide mitigation indices of 0.7 TSS, 0.6 Metals and 0.7 Hydrocarbons, which matches the requirement for medium pollution hazard levels (ie the retail car parking area) shown in table 26.2 of the SuDS Manual and will therefore also address the pollution hazard indices for areas of low pollution hazard levels (ie plot driveways and access road). Further treatment is available via the proposed detention basin which can provide mitigation indices of 0.5 TSS, 0.5 Metals and 0.6 Hydrocarbons. As the low pollution hazard levels will be treated at source, the basin will address runoff from the residential access road which would present pollution hazard indices of 0.5TSS, 0.4 Metals and 0.4 Hydrocarbons with some initial treatment provided by road gully pots.

Whilst not explicitly provided for attenuation as noted in section 3.2, the flow of water through permeable paved areas (plot driveways and retail parking area) will also retard flows, increase time lag for rainfall to response and reduce peak discharge rates.

3.4 Rainfall Intensity

It is necessary to provide capacity in the drainage system for runoff due to 1in30year return period rainfall with runoff exceeding this up to and including 1in100year return period intensities increased for climate change managed safely on site. Due to the site constraints (ie limited space available, proximity of properties to boundaries, fall of terrain, etc) this assessment assumes the below ground attenuation facilities will require capacity for the 1in100year+cc scenario.

3.5 Climate Change

The effect of changes in the climate have to be considered in respect of flood risk. Principally the effect of changes to rainfall intensity, duration and frequency is critical for surface water flood risk, rate of rise in

[6] Hydrobrake optimum reference SHE-0075-2800-1300-2800 (aperture 75mm, design head 1.3m, design flow 2.8l/s)

river and minor watercourse water levels together with the extent of flooding when watercourse banksides and drainage system capacities are exceeded.

The Environment Agency provide advice[7] for climate change allowances that should be considered in flood risk assessments for both river flows and rainfall intensities. Table 2 of the guidance shows anticipated changes in extreme rainfall intensity in small and urban catchments and it is advised that the effects of both the central and upper end allowances are assessed to understand the range of impact. An increase of between 20% and 40% is to be considered for the '2080s' (2070 to 2115), which would be appropriate for the design life of residential development. A 20% allowance is generally used for initial design with a 40% increase subsequently applied to test the system so that any residual risk can be understood and adequate management allowed.

3.6 Urban Creep

Once established the owners of individual properties on a development may decide to extend roof and paved areas, which would add runoff to the drainage system. To allow for this change, an increase in runoff areas can be applied to the initial design. In accordance with LASOO[8] guidance and table 8.11 of HC's SuDS Handbook a 10% increase applied to the impermeable area within the property curtilage should be allowed. Therefore, the total area to be drained will be 0.253*1.1 + 0.226 = 0.505ha (refer also to appended key plan [1]).

3.7 Attenuation sizing

Initially the sizing of detention basin has been undertaken in isolation as shown on appended MD sheets 3-6 allowing 0.505ha runoff area and 2.8l/s discharge rate. The critical duration event for 1in100year rainfall that has been increased by 40% for climate change is 10hours and a storage volume of 320.9m^3 is needed. This can be provided via a basin with base area of 200sqm that has side slopes of 1V to 3H. The maximum depth of water in this facility for the critical event is approx. 1.1m, allowing 0.2m fall between basin and control chamber, a design head of 1.3m is therefore adequate.

3.8 Network Simulation

The foregoing attenuation sizing is typically robust and an increase in size is generally not required unless other external factors influence design (eg, a surcharged outfall). However, to illustrate how a drainage system and detention basin can be accommodate relative to proposed and existing ground levels, a preliminary pipe network serving the development has been prepared as shown on keyplan [5]. The site level pipe numbering and catchment areas for surface water drainage are shown on key plans [2] and [3] respectively. It has been necessary to consider finished ground levels across the site, principally along the main access routes, sufficient to establish plot floor levels and demonstrate that pipe levels are compatible.

[7] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[8] Local Authority SuDS Officer Organisation

The surface drainage network including detention basin (but excluding plot level pipes that are shown indicatively on the plans) has then been modelled in MicroDrainage to check pipe capacities as per appended MD sheets 7-12. Various durations of rainfall for return periods of 1in1year, 1in30year and 1in100year have then been simulated with +40% applied to 1in100year events. The results of simulations are summarised on MD sheets 13-15 and demonstrate that there would not be any localised flooding and the design flow rate of 2.8l/s is not exceeded. The maximum water level in the detention basin is 97.185m for the critical duration event of 8hours. This represents a depth of 1.035m, equivalent to a hydraulic head of 1.185m acting on the flow control. The basin crest level has been set at 97.50m, so a freeboard exceeding 300mm is available, although the flow control chamber would have a cover level of 97.20m, so flood water egress would primarily occur at this point in an exceedance event.

4.0 Foul Water Drainage

4.1 Public Sewer Availability

HC's SuDS Handbook advises that 'a robust foul drainage strategy needs to be developed at Outline planning stage' and that 'the use of Packaged Treatment works should only be considered after a gravity or pumped discharge to a public foul sewer has been considered'. Typically, a 30m distance to sewer per property (ie total of 450m for the subject site) would be considered a reasonable distance for mandatory sewer connection in preference to an off mains outfall. DCWW have been contacted by the architect via a pre-planning enquiry and their response[9] confirms that 'there are no public sewers in the vicinity of the proposed development'. Therefore, the management of foul water effluent via off-mains systems will be necessary.

HC's SuDS handbook also advises that: 'the use of a drainage field serving two or more properties will only be permitted if a Private Management Company is set up to manage land that is held in joint ownership (of all land owners that are served by the foul drainage scheme). In this scenario the Private Management Company would also be responsible for maintaining the Package Treatment Plant. Herefordshire Council reserve the right to review any such applications on a case by case basis; for small residential developments, individual drainage fields and plants are recommended and supported. Foul water pumps are liable to block and are a potential liability for domestic homeowners. Where practical foul drainage networks should be set out to eliminate the need to pump raw sewage. Owing to the risk of blockage and surface water ingress, external foul water pumps should be located a minimum of 7m from domestic or commercial property. Package Treatment Plants can be located at low points, with treated effluent pumped uphill'.

It is clear from inspection of the site plan that there is insufficient space available within individual property curtilages to provide separate treatment plans. Instead it is proposed that a single plant is used as shown on the appended Drainage Strategy Plan that will cater for all 15no properties together with the

[9] DCWW Pre Planning Enquiry reference PPA0002987, 04/05/2018

community shop. In line with British Water's guidance[10] a population equivalent of 67P has been determined as follows:
13no 2bed and 3bed properties with minimum population of 5people = 65P
2no 4bed properties with population of 6people = 12P
Total population for dwellings = 77P.
20% reduction for a group of houses = 61.6P, rounded up to 62P.
Allowance of 4no full time staff and 8no visitors using WC facilities, equivalent to residential ammonia load of 5P.
Overall population = 62+5 = **67P.**

A suitable packaged treatment plant would be a Denitrifying Wastewater Treatment Plant (DSAF) by Premier Tech Aqua (PTA), details of which are appended to this document. The plant (and also any shared upstream pipes and chambers, together with downstream sampling chamber and pipes down to outfall) would need to be managed by a Private Management Company in line with HC's guidance.

A daily flow of 67*150 = 10,050litres exceeds the 5m^3 threshold for discharge to surface water groundwater and so compliance with the general binding rules alone is insufficient and an application to the Environment Agency for a consent to discharge[11] must be undertaken.

As advised by Herefordshire County Councils Ecologist, it is also necessary to provide a means of mitigating residual phosphate in the outfall. Therefore, a phosphate dosing system is proposed in addition and complimentary to the foul water sewage treatment plant to reduce the phosphate loading in the final outfall to watercourse to a level in line with that currently achievable through best available technology as noted in the appended proposal from PTA. The Environment Agency do not require consent for or provide a specific limit to phosphate loads in treated domestic foul water effluent.

5.0 Construction, Operation & Maintenance

5.1 General Requirements

As highlighted by S13 and S14 of Defra's non-statutory technical standards for SuDS, it is important to consider: the 'mode of construction of any communication with an existing sewer or drainage system'; and 'damage to the drainage system resulting from associated construction activities' respectively. The requirements of S13 are not relevant for this site due to the off-mains nature of surface water and foul water outfalls. A competent contractor will ensure that S14 is observed, primarily through consideration of the sequence of works (i.e. postponing the installation of permeable pavements until after the new buildings have been constructed or otherwise providing appropriate protection or restricted use of the affected areas).

[10] British Water, Code of Practice, Loads & Flows 4 - Sizing Criteria, Treatment Capacity for Sewage Treatment Systems
[11] https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-b65-discharging-up-to-15m3-a-day-into-ground-or-up-to-20m3-a-day-to-surface-water

Standards S10 and S11 of the technical standards focus on the structural integrity of the drainage system allowing for the proximity and associated interaction with existing and proposed structures (eg buildings, walls, etc). The drainage system must also be designed to allow accessibility for inspection and maintenance, which may include repair or replacement work.

5.2 Site Specific Requirements

It is important that all of the drainage system is regularly inspected and cleansed as necessary including above ground elements (eg gutters). The most important below ground item is the flow control chamber that should be inspected on a monthly basis and after significant rainfall events.

It is envisaged that individual property owners will be responsible for the maintenance and operation of the drainage system that is immediately local to their property (eg gutters, rwps, gullies, etc), whilst a private management company would be employed to manage the shared and main components (ie packaged treatment plant and associated 'shared' pipes and chambers) that are not adoptable. It is proposed that the detention basin and flow controls together with associated 'shared' pipes and chambers put forward for adoption primarily by DCWW as sewerage undertaker, but it is expected that the LLFA would adopt the detention basin.

The exact means of adoption would need to be discussed with the relevant bodies as part of detailed drainage design, but it is clear at this stage that there is a mechanism for adoption of surface water systems and private management of foul water drainage systems at the site.

The following schedule of activities is provided for guidance in relation to the principle components that are necessary for flood control. The frequency of activities may be varied as necessary.

Drainage Component	Comments	Operation & Maintenance Activity		
		Regular	Occasional	Remedial
Flow Control (Hydrobrake Chambers)	*Chamber has been sited in open areas to ensure 24/7/365 access is available.*	Inspect monthly and after every significant rainfall event.	Check functionality of pivoting by-pass door facility and ensure steel operating rope is adequately secured within reach of chamber cover opening.	Cleansing of the chamber sump will be required possibly annually, but this can be assessed when the by-pass facility is inspected.
Permeable Pavements	*The form of pavement should be considered with respect to long term maintenance*	Inspect Weekly. Removal of litter and debris by sweeping is recommended on at least a monthly interval or as	To prevent sedimentation of joints it is recommended that vacuum sweeping of the pavement is undertaken annually	Regular sweeping should prevent weed and moss growth. If necessary weed removal or treatment with herbicide can be

	(unlike block paving, unbound gravel systems cannot be swept or vacuumed).	informed by inspection.	with appropriate disposal of the sediment and replenishment of pavement joints with grit.	undertaken with jet washing to clear moss and algae, providing joints are replenished with grit as necessary.
Detention Basin	*Tanks will be placed in an online configuration, upstream facilities to manage silt (permeable paving, silt traps, etc) are required.*	Remove litter and debris and inspect inlets and outlets monthly. Cut grass in basin twice annually.	Remove sediments in basin – initially allow annually, but likely to extend to every five years or more due to upstream silt removal measures (ie permeable paving, gully pots, etc). Re-seed areas of poor vegetation growth.	Repair erosion or other damage by re-seeing or re-turfing as informed by monthly inspection. Relevel uneven surfaces and reinstate design levels as required.

Once the drainage system has been constructed, a record plan of the as built information (if varied from the design layout and details) should be created that can be used as a reference for those who will manage and maintain the system.

It is also recommended that an initial survey of the system should be undertaken (eg camera survey of pipes, removal and replacing chamber covers, ground level survey of basin, etc) to verify the condition and accessibility of the system as a baseline condition for further inspection and maintenance works.

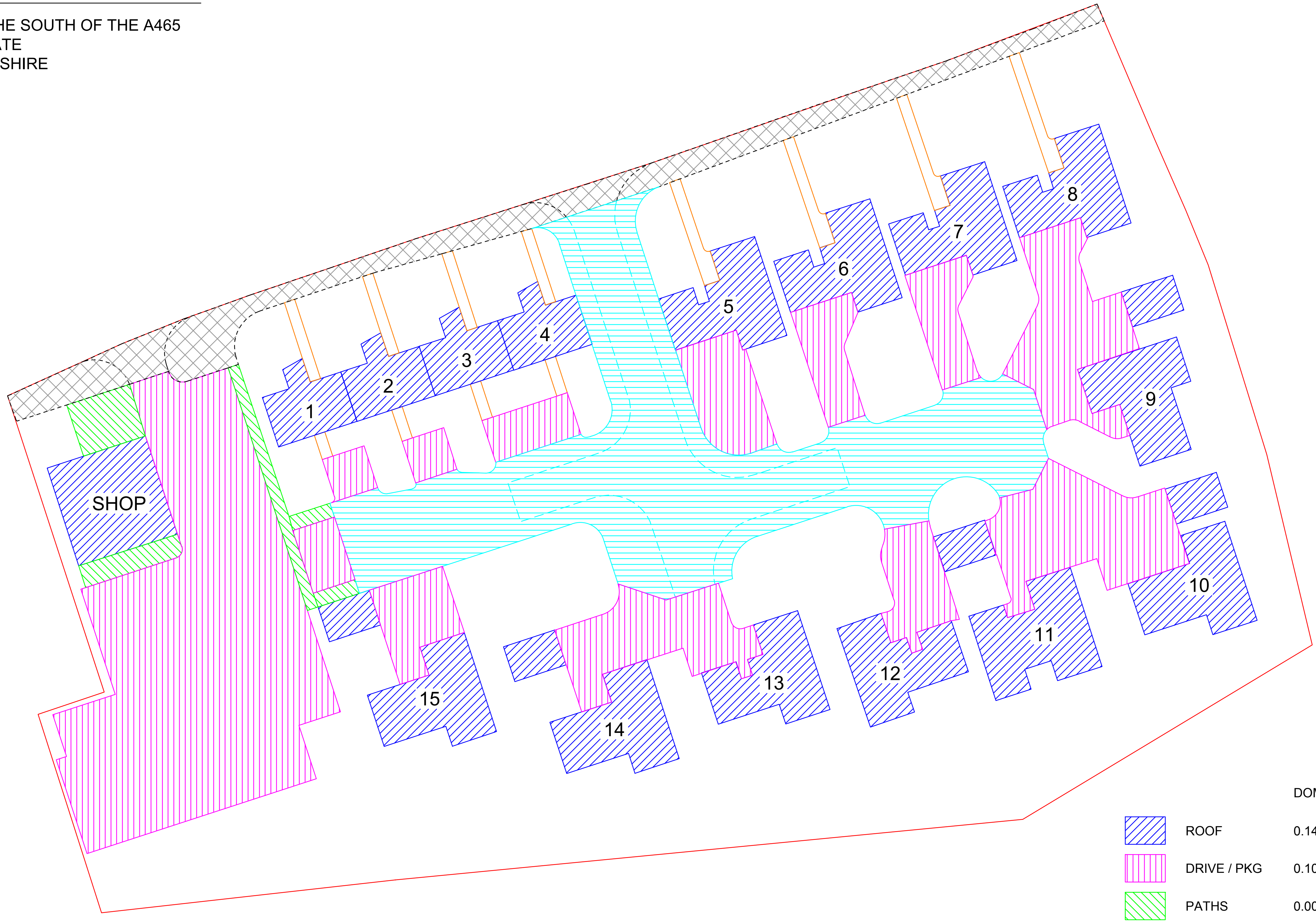
6.0 Conclusions

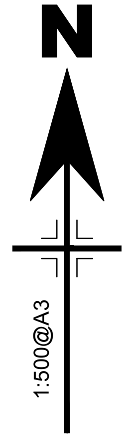
This drainage report and appended strategy demonstrate that within the confines of the site, surface water runoff and foul water effluent can be adequately managed. It is expected that if planning permission is granted that a condition will require the submission and agreement of drainage details that would subsequently be implemented. However, the principles set out in this report demonstrate the viability of the proposed scheme, with regard to both foul and surface water drainage.

Appendix A – Key plans, Micro Drainage calculations, flow control and treatment plant details

[1] POST DEV RUNOFF

LAND TO THE SOUTH OF THE A465
BURLEY GATE
HEREFORDSHIRE
HR1 3QR





	DOMESTIC	RETAIL	COMBINED
ROOF	0.145HA	0.013HA	0.158HA
DRIVE / PKG	0.106HA	0.093HA	0.199HA
PATHS	0.002HA	0.011HA	0.013HA
10% CREEP	0.026HA	0.000HA	0.026HA
ROAD	0.109HA	0.000HA	0.109HA
TOTAL	0.388HA	0.117HA	0.505HA

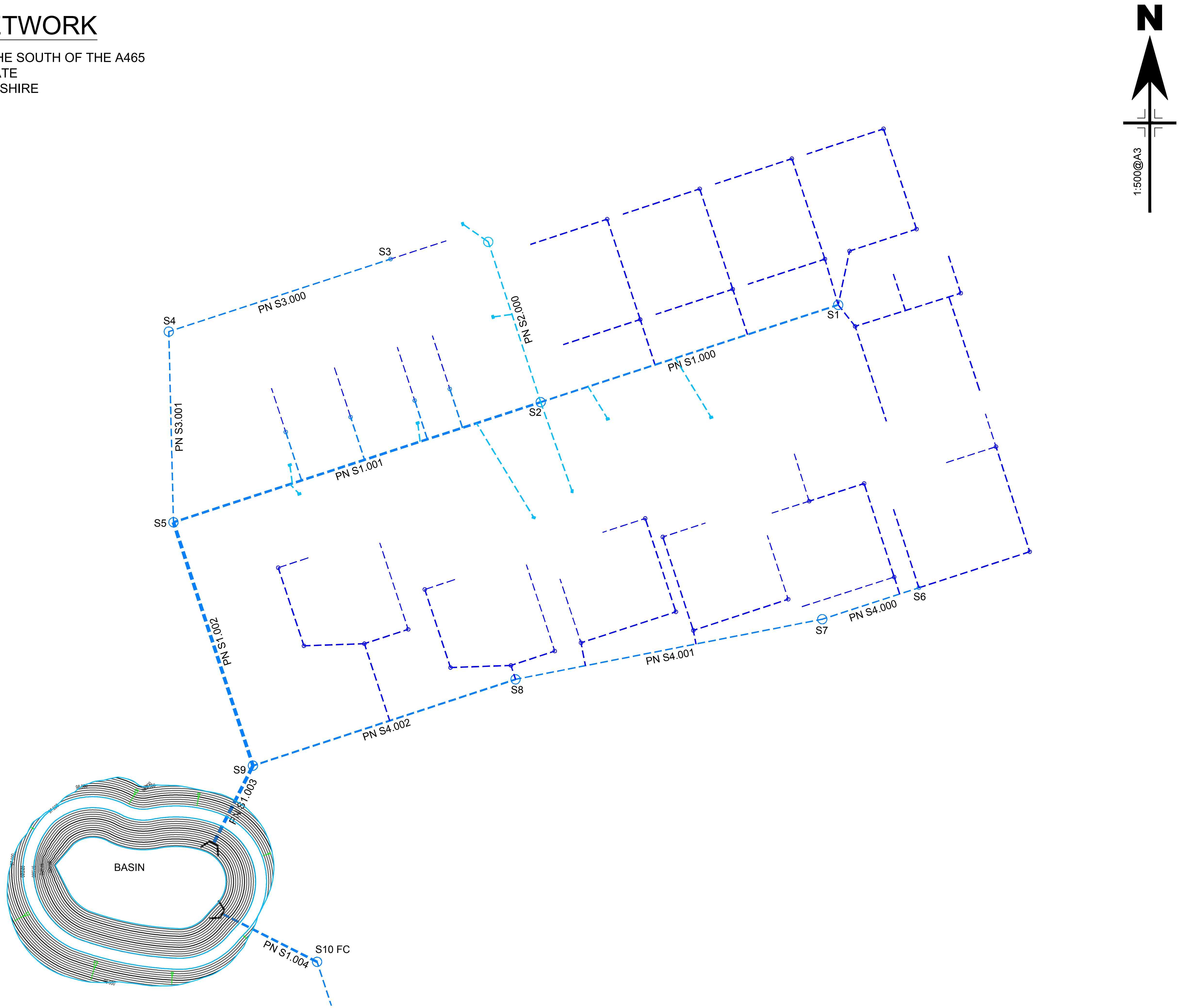
EXISTING HIGHWAY AND LAND GIVEN OVER TO HIGHWAY TO CREATE FOOTWAY. TO DISCHARGE TO EXISTING HIGHWAY DRAINAGE OR AS AGREED WITH HIGHWAY AUTHORITY.

MINOR PEDESTRIAN PAVING WITH CROSSFALL SHEDDING RUNOFF TO ADJACENT SOFT LANDSCAPING.

SITE 0.950HA

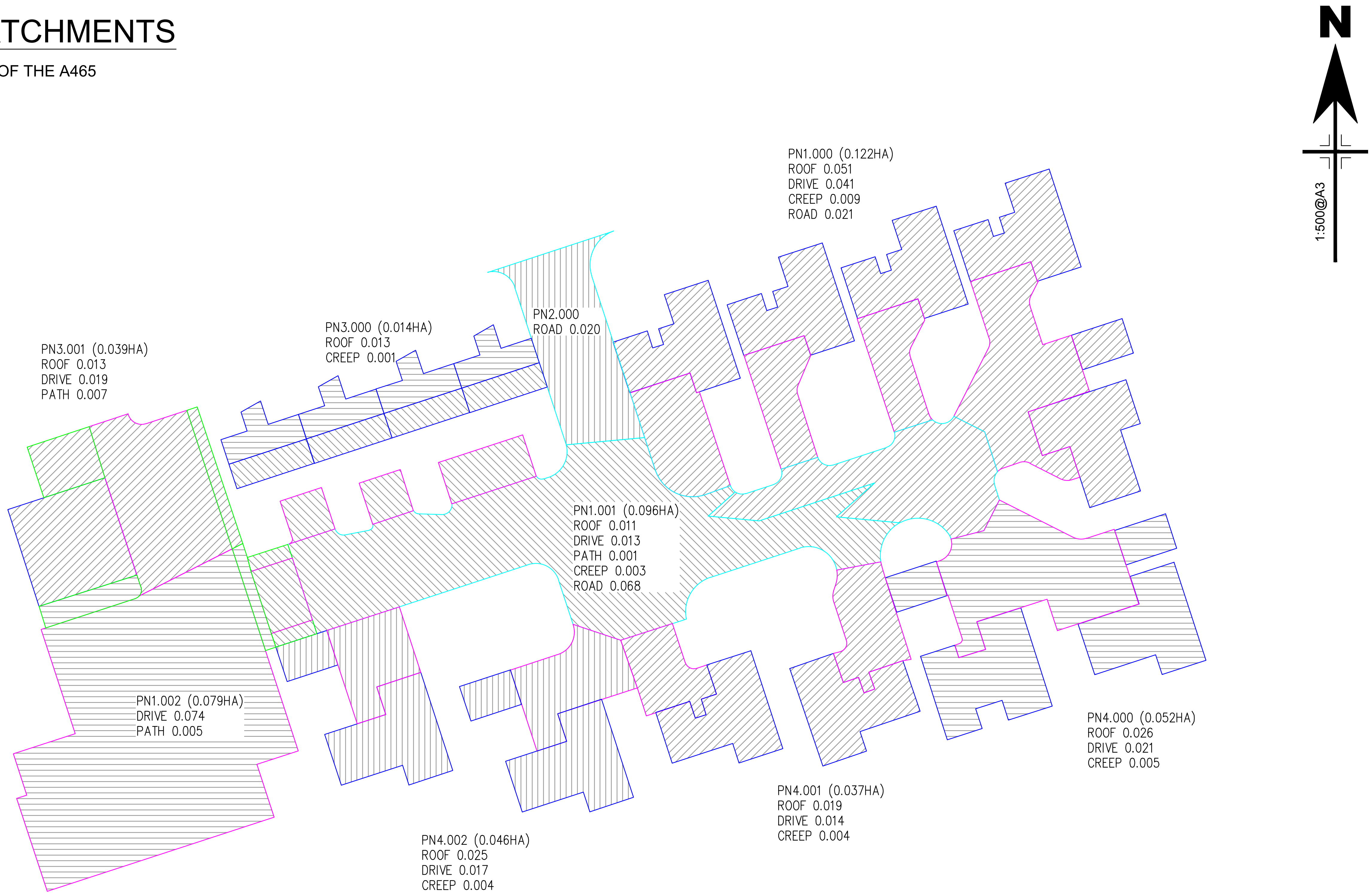
[2] SW NETWORK

LAND TO THE SOUTH OF THE A465
BURLEY GATE
HEREFORDSHIRE
HR1 3QR



[3] SW PIPE CATCHMENTS

LAND TO THE SOUTH OF THE A465
BURLEY GATE
HEREFORDSHIRE
HR1 3QR



[4] FW NETWORK

LAND TO THE SOUTH OF THE A465
BURLEY GATE
HEREFORDSHIRE
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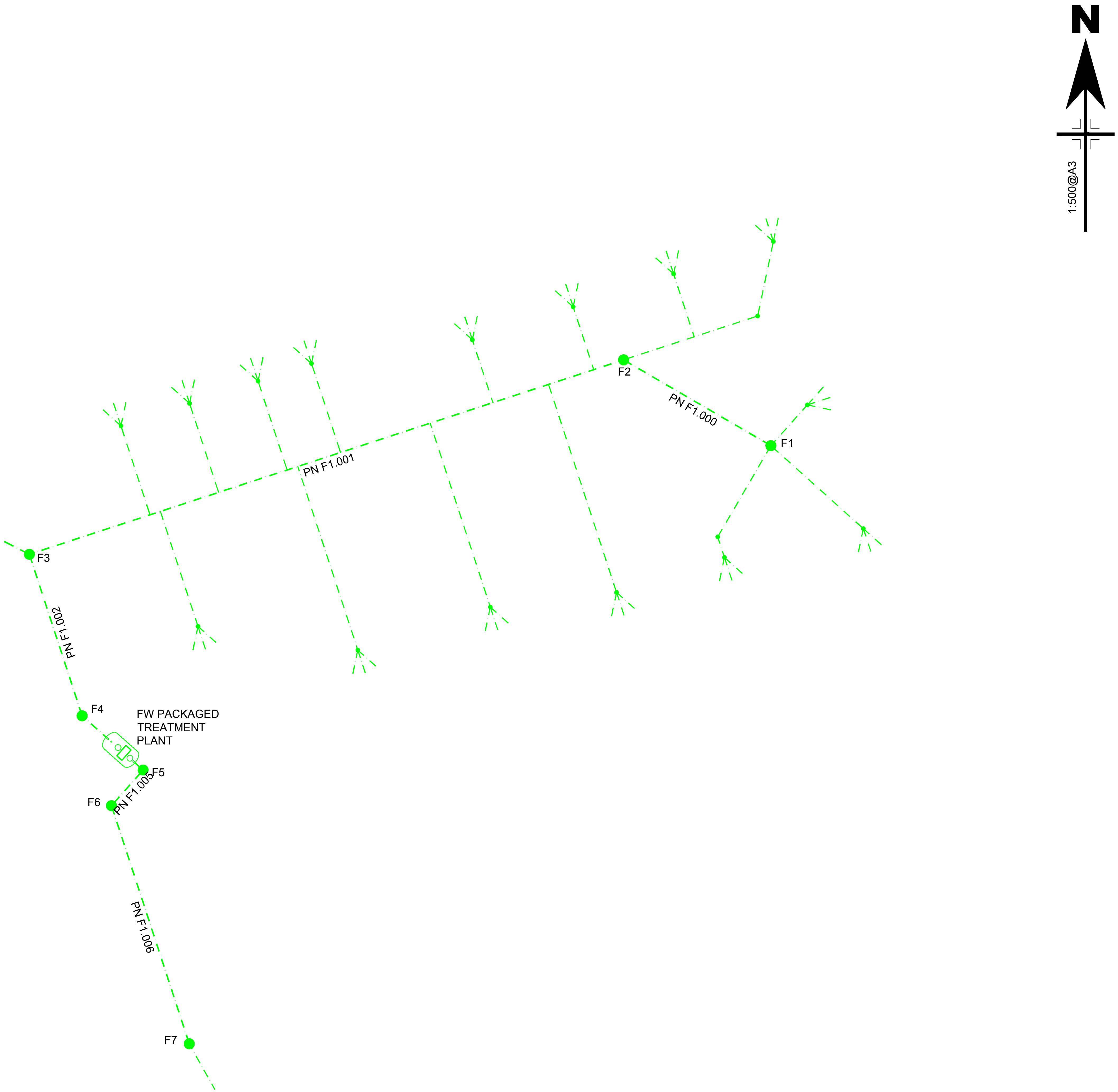

[5] DRAINAGE STRATEGY

LAND TO THE SOUTH OF THE A465
BURLEY GATE
HEREFORDSHIRE
HR1 3QR

MH No.	MANHOLE DIAMETER (mm)	MANHOLE TYPE	COVER LEVEL (m)	INVERT LEVEL (m)	DEPTH (m)	EASTING (m)	NORTHING (m)
S1	1200	Type E	102.55	101.05	1.50	359699.128	247233.417
S2	1200	Type E	100.03	98.68	1.35	359651.416	247242.010
S3	1200	Type B	100.27	98.29	1.98	359658.566	247220.149
S4	450	Type 4	100.12	99.07	1.05	359638.102	247239.665
S5	1200	Type E	99.59	98.14	1.45	359607.863	247229.775
S6	1240x900	Type C	99.12	97.47	1.65	359608.501	247203.773
S7	450	Type 4	102.00	100.95	1.05	359710.130	247194.847
S8	1200	Type E	101.90	100.40	1.50	359696.950	247190.561
S9	1200	Type D	99.75	98.60	1.15	359655.138	247182.359
S10	1240x900	Type C	98.60	96.95	1.65	359619.341	247170.593
S11 FC	1200	Type E	97.20	96.00	1.20	359628.083	247143.840
S12	1200	Type E	95.00	93.65	1.35	359672.072	247065.331
S13	1200	Type E	89.19	87.84	1.35	359716.065	246986.816
S14	1200	Type E	83.88	82.53	1.35	359712.478	246904.513
S15	1200	Type E	81.45	80.10	1.35	359793.771	246865.894
S16	1200	Type E	79.04	77.84	1.20	359875.064	246827.275
S17	1200	Type D	78.00	76.94	1.06	359956.358	246788.656
S18	1200	Type D	77.80	76.72	1.08	359976.208	246781.280
F1	1200	Type E	102.45	100.90	1.55	359702.232	247219.258
F2	1200	Type B	101.80	99.80	2.00	359683.807	247229.984
F3	1200	Type B	99.14	97.07	2.07	359609.462	247205.666
F4	1200	Type B	99.05	96.77	2.28	359616.060	247185.468
F5	1200	Type B	98.90	96.48	2.42	359623.692	247178.682
F6	1200	Type B	98.72	96.40	2.32	359619.732	247174.228
F7	1200	Type E	97.20	95.85	1.35	359629.463	247144.445
F8	1200	Type E	95.16	93.81	1.35	359673.523	247065.811
F9	1200	Type E	89.14	87.79	1.35	359717.583	246987.177
F10	1200	Type E	83.92	82.57	1.35	359714.020	246905.441
F11	1200	Type E	81.55	80.20	1.35	359795.313	246866.822
F12	1200	Type E	79.13	77.83	1.30	359876.606	246828.203
F13	1200	Type D	78.00	76.93	1.07	359957.899	246789.584
F14	1200	Type D	77.80	76.73	1.07	359976.648	246783.028

[6] DRAINAGE OVERVIEW

LAND TO THE SOUTH OF THE A465
BURLEY GATE
HEREFORDSHIRE
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[7] BASIN CROSS SECTIONS

LAND TO THE SOUTH OF THE A465
BURLEY GATE
HEREFORDSHIRE
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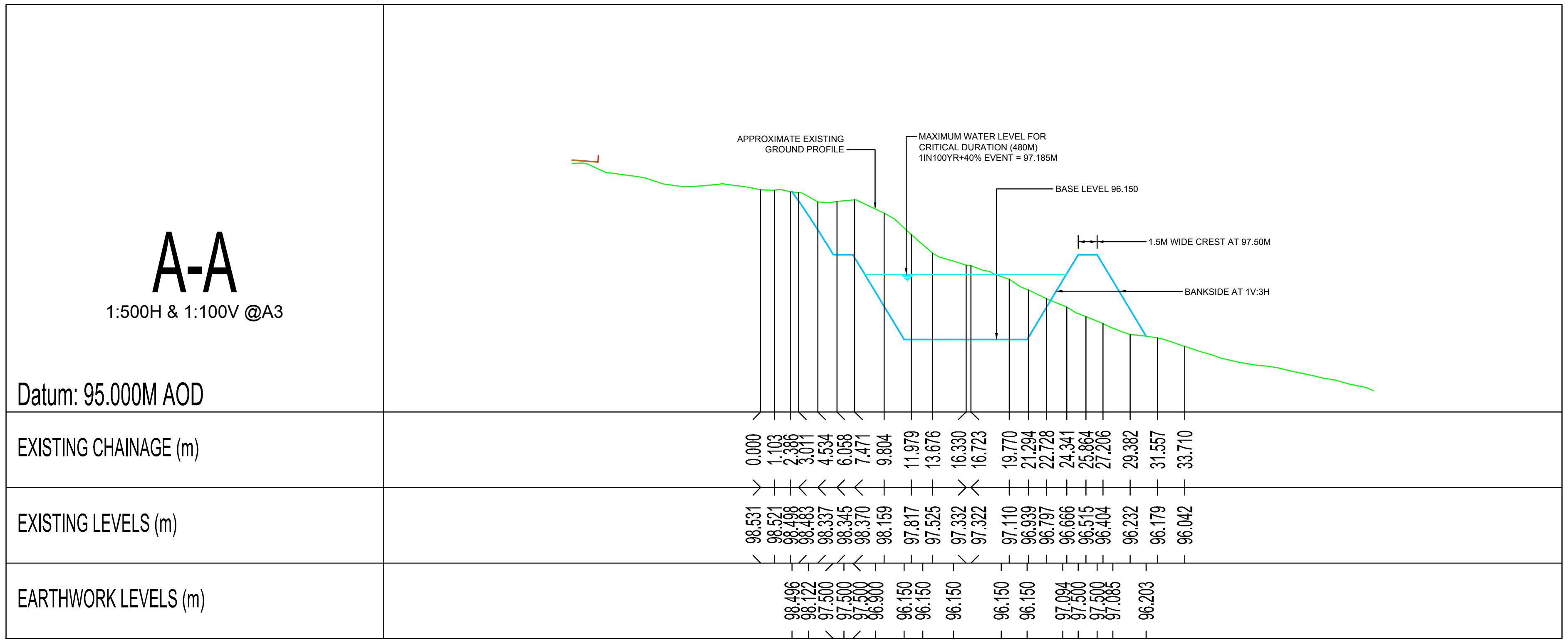
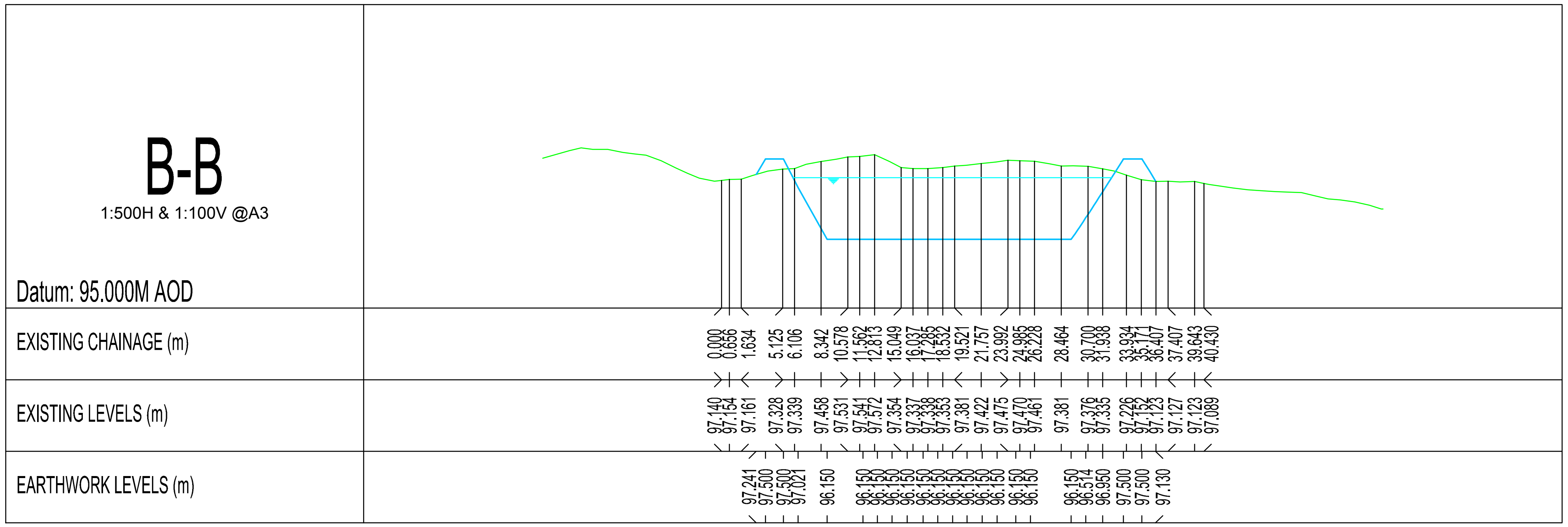




ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	SAAR (mm)	700	Urban	0.000
Area (ha)	1.000	Soil	0.300	Region Number	Region 4

Results	**l/s**
QBAR Rural	1.8
QBAR Urban	1.8
Q1 year	1.5
Q1 year	1.5
Q30 years	3.6
Q100 years	4.7

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	SAAR (mm)	700	Urban	0.000
Area (ha)	1.000	Soil	0.500	Region Number	Region 4

Results	**l/s**
QBAR Rural	5.5
QBAR Urban	5.5
Q1 year	4.6
Q1 year	4.6
Q30 years	10.8
Q100 years	14.2

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	96.670	0.520	2.6	125.6	O K
30 min Summer	96.799	0.649	2.6	164.2	O K
60 min Summer	96.919	0.769	2.6	202.5	O K
120 min Summer	97.023	0.873	2.6	238.0	O K
180 min Summer	97.071	0.921	2.6	255.4	O K
240 min Summer	97.097	0.947	2.6	264.9	O K
360 min Summer	97.122	0.972	2.6	274.0	O K
480 min Summer	97.129	0.979	2.6	276.7	O K
600 min Summer	97.126	0.976	2.6	275.7	O K
720 min Summer	97.117	0.967	2.6	272.1	O K
960 min Summer	97.088	0.938	2.6	261.6	O K
1440 min Summer	97.042	0.892	2.6	244.8	O K
2160 min Summer	96.987	0.837	2.6	225.5	O K
2880 min Summer	96.936	0.786	2.6	208.1	O K
4320 min Summer	96.836	0.686	2.6	175.7	O K
5760 min Summer	96.735	0.585	2.6	144.7	O K
7200 min Summer	96.612	0.462	2.6	109.3	O K
8640 min Summer	96.501	0.351	2.6	79.9	O K
10080 min Summer	96.411	0.261	2.6	57.5	O K
15 min Winter	96.723	0.573	2.6	141.2	O K
30 min Winter	96.864	0.714	2.6	184.6	O K
60 min Winter	96.994	0.844	2.6	228.1	O K
120 min Winter	97.109	0.959	2.6	269.1	O K
180 min Winter	97.164	1.014	2.7	289.8	O K
240 min Winter	97.195	1.045	2.7	301.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.640	0.0	129.3	26
30 min Summer	89.730	0.0	169.8	41
60 min Summer	56.129	0.0	212.5	70
120 min Summer	33.920	0.0	256.7	130
180 min Summer	24.926	0.0	283.0	188
240 min Summer	19.911	0.0	301.6	248
360 min Summer	14.459	0.0	328.4	366
480 min Summer	11.523	0.0	349.1	484
600 min Summer	9.656	0.0	365.6	602
720 min Summer	8.354	0.0	379.5	720
960 min Summer	6.641	0.0	402.3	874
1440 min Summer	4.799	0.0	404.9	1114
2160 min Summer	3.463	0.0	472.1	1512
2880 min Summer	2.744	0.0	499.0	1932
4320 min Summer	1.974	0.0	538.4	2736
5760 min Summer	1.561	0.0	567.8	3576
7200 min Summer	1.301	0.0	591.4	4320
8640 min Summer	1.120	0.0	611.1	4936
10080 min Summer	0.987	0.0	628.2	5648
15 min Winter	136.640	0.0	144.8	26
30 min Winter	89.730	0.0	190.2	41
60 min Winter	56.129	0.0	237.9	70
120 min Winter	33.920	0.0	287.6	128
180 min Winter	24.926	0.0	317.1	186
240 min Winter	19.911	0.0	337.7	244

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
360 min Winter	97.227	1.077	2.7	314.3	O K
480 min Winter	97.240	1.090	2.7	319.7	O K
600 min Winter	97.243	1.093	2.7	320.9	O K
720 min Winter	97.240	1.090	2.7	319.4	O K
960 min Winter	97.220	1.070	2.7	311.5	O K
1440 min Winter	97.161	1.011	2.7	288.8	O K
2160 min Winter	97.091	0.941	2.6	262.8	O K
2880 min Winter	97.022	0.872	2.6	237.8	O K
4320 min Winter	96.879	0.729	2.6	189.3	O K
5760 min Winter	96.725	0.575	2.6	141.5	O K
7200 min Winter	96.524	0.374	2.6	85.9	O K
8640 min Winter	96.375	0.225	2.6	48.8	O K
10080 min Winter	96.267	0.117	2.5	24.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
360 min Winter	14.459	0.0	368.1	358
480 min Winter	11.523	0.0	391.0	474
600 min Winter	9.656	0.0	409.6	588
720 min Winter	8.354	0.0	421.9	700
960 min Winter	6.641	0.0	420.0	916
1440 min Winter	4.799	0.0	411.8	1168
2160 min Winter	3.463	0.0	528.8	1624
2880 min Winter	2.744	0.0	558.6	2080
4320 min Winter	1.974	0.0	602.5	2984
5760 min Winter	1.561	0.0	635.8	3864
7200 min Winter	1.301	0.0	661.9	4472
8640 min Winter	1.120	0.0	684.3	5104
10080 min Winter	0.987	0.0	703.0	5656

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.505

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.168	4	8	0.168	8	12	0.168

Model Details

Storage is Online Cover Level (m) 97.500

Tank or Pond Structure

Invert Level (m) 96.150

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	200.0	1.350	454.6

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0075-2800-1300-2800
Design Head (m)	1.300
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	96.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	2.8	Kick-Flo®	0.672	2.1
Flush-Flo™	0.331	2.6	Mean Flow over Head Range	-	2.3

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)	Depth (m)	Flow (l/s)
0.100	2.1	0.800	2.2	2.000	3.4	4.000	4.7	7.000	6.1
0.200	2.5	1.000	2.5	2.200	3.6	4.500	5.0	7.500	6.3
0.300	2.6	1.200	2.7	2.400	3.7	5.000	5.2	8.000	6.5
0.400	2.6	1.400	2.9	2.600	3.9	5.500	5.5	8.500	6.7
0.500	2.5	1.600	3.1	3.000	4.1	6.000	5.7	9.000	6.9
0.600	2.3	1.800	3.2	3.500	4.4	6.500	5.9	9.500	7.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.800	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
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

Time Area Diagram for SW

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.000	4-8	0.162	8-12	0.343

Total Area Contributing (ha) = 0.505

Total Pipe Volume (m³) = 29.277

Network Design Table for SW

« - 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
S1.000	42.676	2.685	15.9	0.122	4.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	23.000	0.240	95.8	0.020	4.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	52.676	0.670	78.6	0.096	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	31.815	0.930	34.2	0.014	4.00	0.0	0.600	o	150	Pipe/Conduit	
S3.001	26.009	0.370	70.3	0.039	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	34.906	0.520	67.1	0.079	0.00	0.0	0.600	o	450	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)
S1.000	50.00	4.22	101.050	0.122	0.0	0.0	0.0	3.30	131.2	16.5
S2.000	50.00	4.37	98.680	0.020	0.0	0.0	0.0	1.03	18.1	2.7
S1.001	50.00	4.87	98.290	0.238	0.0	0.0	0.0	1.77	125.5	32.2
S3.000	50.00	4.31	99.070	0.014	0.0	0.0	0.0	1.73	30.5	1.9
S3.001	50.00	4.67	98.140	0.053	0.0	0.0	0.0	1.20	21.2	7.2
S1.002	50.00	5.10	97.470	0.370	0.0	0.0	0.0	2.48	395.1	50.1

Network Design Table for SW

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
S4.000	13.860	0.550	25.2	0.052	4.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S4.001	42.609	1.725	24.7	0.037	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S4.002	37.680	1.425	26.4	0.046	0.00	0.0	0.600	o	225	Pipe/Conduit	🔒
S1.003	19.902	0.800	24.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔒
S1.004	19.902	0.150	132.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	🔒
S1.005	89.994	2.350	38.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S1.006	90.000	5.810	15.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S1.007	82.381	5.310	15.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S1.008	90.000	2.430	37.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S1.009	90.000	2.260	39.8	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S1.010	90.000	0.900	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S1.011	21.177	0.220	96.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒
S1.012	1.500	0.020	75.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S4.000	50.00	4.11	100.950	0.052	0.0	0.0	0.0	2.01	35.6	7.0
S4.001	50.00	4.46	100.400	0.089	0.0	0.0	0.0	2.03	36.0	12.1
S4.002	50.00	4.71	98.600	0.135	0.0	0.0	0.0	2.55	101.6	18.3
S1.003	50.00	5.18	96.950	0.505	0.0	0.0	0.0	4.09	650.4	68.4
S1.004	50.00	5.43	96.150	0.505	0.0	0.0	0.0	1.36	96.4	68.4
S1.005	48.56	6.35	96.000	0.505	0.0	0.0	0.0	1.63	28.8«	68.4
S1.006	46.52	6.93	93.650	0.505	0.0	0.0	0.0	2.57	45.5«	68.4
S1.007	44.81	7.46	87.840	0.505	0.0	0.0	0.0	2.57	45.4«	68.4
S1.008	42.22	8.37	82.530	0.505	0.0	0.0	0.0	1.66	29.3«	68.4
S1.009	39.91	9.31	80.100	0.505	0.0	0.0	0.0	1.60	28.3«	68.4
S1.010	36.90	10.80	77.840	0.505	0.0	0.0	0.0	1.00	17.8«	68.4
S1.011	36.27	11.14	76.940	0.505	0.0	0.0	0.0	1.02	18.1«	68.4
S1.012	36.24	11.16	76.720	0.505	0.0	0.0	0.0	1.16	20.5«	68.4

Manhole Schedules for SW

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN (Pipe Out)	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN (Pipes In)	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	102.550	1.500	Open Manhole	1200	S1.000	101.050	225				
S2	100.030	1.350	Open Manhole	1200	S2.000	98.680	150				
S3	100.270	1.980	Open Manhole	1200	S1.001	98.290	300	S1.000	98.365	225	
								S2.000	98.440	150	
S4	100.120	1.050	Open Manhole	450	S3.000	99.070	150				
S5	99.590	1.450	Open Manhole	1200	S3.001	98.140	150	S3.000	98.140	150	
S6	99.120	1.650	Open Manhole	1240 x 900	S1.002	97.470	450	S1.001	97.620	300	
								S3.001	97.770	150	
S7	102.000	1.050	Open Manhole	450	S4.000	100.950	150				
S8	101.900	1.500	Open Manhole	1200	S4.001	100.400	150	S4.000	100.400	150	
S9	99.750	1.150	Open Manhole	675 x 900	S4.002	98.600	225	S4.001	98.675	150	
S10	98.600	1.650	Open Manhole	1240 x 900	S1.003	96.950	450	S1.002	96.950	450	
								S4.002	97.175	225	
BASIN	97.594	1.444	Open Manhole	100	S1.004	96.150	300	S1.003	96.150	450	
S11 FC	97.200	1.200	Open Manhole	1200	S1.005	96.000	150	S1.004	96.000	300	
S12	95.000	1.350	Open Manhole	1200	S1.006	93.650	150	S1.005	93.650	150	
S13	89.190	1.350	Open Manhole	1200	S1.007	87.840	150	S1.006	87.840	150	
S14	83.880	1.350	Open Manhole	1200	S1.008	82.530	150	S1.007	82.530	150	
S15	81.450	1.350	Open Manhole	1200	S1.009	80.100	150	S1.008	80.100	150	
S16	79.040	1.200	Open Manhole	1200	S1.010	77.840	150	S1.009	77.840	150	
S17	78.000	1.060	Open Manhole	675 x 900	S1.011	76.940	150	S1.010	76.940	150	
S18	77.800	1.080	Open Manhole	675 x 900	S1.012	76.720	150	S1.011	76.720	150	
SW OUTFALL	77.200	0.500	Open Manhole	0		OUTFALL		S1.012	76.700	150	

PIPELINE SCHEDULES for SW

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	225	S1	102.550	101.050	1.275	Open Manhole	1200
S2.000	o	150	S2	100.030	98.680	1.200	Open Manhole	1200
S1.001	o	300	S3	100.270	98.290	1.680	Open Manhole	1200
S3.000	o	150	S4	100.120	99.070	0.900	Open Manhole	450
S3.001	o	150	S5	99.590	98.140	1.300	Open Manhole	1200
S1.002	o	450	S6	99.120	97.470	1.200	Open Manhole	1240 x 900
S4.000	o	150	S7	102.000	100.950	0.900	Open Manhole	450
S4.001	o	150	S8	101.900	100.400	1.350	Open Manhole	1200
S4.002	o	225	S9	99.750	98.600	0.925	Open Manhole	675 x 900
S1.003	o	450	S10	98.600	96.950	1.200	Open Manhole	1240 x 900
S1.004	o	300	BASIN	97.594	96.150	1.144	Open Manhole	100
S1.005	o	150	S11 FC	97.200	96.000	1.050	Open Manhole	1200
S1.006	o	150	S12	95.000	93.650	1.200	Open Manhole	1200
S1.007	o	150	S13	89.190	87.840	1.200	Open Manhole	1200
S1.008	o	150	S14	83.880	82.530	1.200	Open Manhole	1200
S1.009	o	150	S15	81.450	80.100	1.200	Open Manhole	1200
S1.010	o	150	S16	79.040	77.840	1.050	Open Manhole	1200
S1.011	o	150	S17	78.000	76.940	0.910	Open Manhole	675 x 900
S1.012	o	150	S18	77.800	76.720	0.930	Open Manhole	675 x 900

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	42.676	15.9	S3	100.270	98.365	1.680	Open Manhole	1200
S2.000	23.000	95.8	S3	100.270	98.440	1.680	Open Manhole	1200
S1.001	52.676	78.6	S6	99.120	97.620	1.200	Open Manhole	1240 x 900
S3.000	31.815	34.2	S5	99.590	98.140	1.300	Open Manhole	1200
S3.001	26.009	70.3	S6	99.120	97.770	1.200	Open Manhole	1240 x 900
S1.002	34.906	67.1	S10	98.600	96.950	1.200	Open Manhole	1240 x 900
S4.000	13.860	25.2	S8	101.900	100.400	1.350	Open Manhole	1200
S4.001	42.609	24.7	S9	99.750	98.675	0.925	Open Manhole	675 x 900
S4.002	37.680	26.4	S10	98.600	97.175	1.200	Open Manhole	1240 x 900
S1.003	19.902	24.9	BASIN	97.594	96.150	0.994	Open Manhole	100
S1.004	19.902	132.7	S11 FC	97.200	96.000	0.900	Open Manhole	1200
S1.005	89.994	38.3	S12	95.000	93.650	1.200	Open Manhole	1200
S1.006	90.000	15.5	S13	89.190	87.840	1.200	Open Manhole	1200
S1.007	82.381	15.5	S14	83.880	82.530	1.200	Open Manhole	1200
S1.008	90.000	37.0	S15	81.450	80.100	1.200	Open Manhole	1200
S1.009	90.000	39.8	S16	79.040	77.840	1.050	Open Manhole	1200
S1.010	90.000	100.0	S17	78.000	76.940	0.910	Open Manhole	675 x 900
S1.011	21.177	96.3	S18	77.800	76.720	0.930	Open Manhole	675 x 900
S1.012	1.500	75.0	SW OUTFALL	77.200	76.700	0.350	Open Manhole	0

Setting Out Information - True Coordinates (SW)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
S1.000	S1	1200		359699.128	247233.417	
S2.000	S2	1200		359651.416	247242.010	
S1.001	S3	1200		359658.566	247220.149	
S3.000	S4	450		359638.102	247239.665	
S3.001	S5	1200		359607.863	247229.775	
S1.002	S6	1240	900	359608.501	247203.773	
S4.000	S7	450		359710.130	247194.847	
S4.001	S8	1200		359696.950	247190.561	
S4.002	S9	675	900	359655.138	247182.359	
S1.003	S10	1240	900	359619.341	247170.593	
S1.004	BASIN	100		359610.335	247152.846	
S1.005	S11 FC	1200		359628.083	247143.840	
S1.006	S12	1200		359672.072	247065.331	
S1.007	S13	1200		359716.065	246986.816	
S1.008	S14	1200		359712.478	246904.513	
S1.009	S15	1200		359793.771	246865.894	
S1.010	S16	1200		359875.064	246827.275	
S1.011	S17	675	900	359956.358	246788.656	
S1.012	S18	675	900	359976.208	246781.280	

Setting Out Information - True Coordinates (SW)

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
S1.012	SW OUTFALL	0		359976.710	246779.866	

Free Flowing Outfall Details for SW

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.012	SW OUTFALL	77.200	76.700	0.000	0	0

Online Controls for SW

Hydro-Brake® Optimum Manhole: S11 FC, DS/PN: S1.005, Volume (m^3): 2.7

Unit Reference	MD-SHE-0075-2800-1300-2800
Design Head (m)	1.300
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	75
Invert Level (m)	96.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.300	2.8	Kick-Flo®	0.672	2.1
Flush-Flo™	0.331	2.6	Mean Flow over Head Range	-	2.3

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)**	**Depth (m)**	**Flow (l/s)**
0.100	2.1	0.800	2.2	2.000	3.4	4.000	4.7	7.000	6.1
0.200	2.5	1.000	2.5	2.200	3.6	4.500	5.0	7.500	6.3
0.300	2.6	1.200	2.7	2.400	3.7	5.000	5.2	8.000	6.5
0.400	2.6	1.400	2.9	2.600	3.9	5.500	5.5	8.500	6.7
0.500	2.5	1.600	3.1	3.000	4.1	6.000	5.7	9.000	6.9
0.600	2.3	1.800	3.2	3.500	4.4	6.500	5.9	9.500	7.1

Storage Structures for SW

Tank or Pond Manhole: BASIN, DS/PN: S1.004

Invert Level (m) 96.150

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	208.4	0.300	262.2	0.600	321.1	0.900	385.1	1.200	454.2
0.100	225.8	0.400	281.3	0.700	341.9	1.000	407.6	1.300	478.4
0.200	243.7	0.500	300.9	0.800	363.2	1.100	430.6	1.349	490.4

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.800 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

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, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Duration (mins)	First (X) Surcharge	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	15		101.107	-0.168	0.000	0.14		18.0	OK
S2.000	S2	15	100/15 Summer	98.721	-0.109	0.000	0.17		3.0	OK
S1.001	S3	15	100/15 Summer	98.396	-0.194	0.000	0.27		32.0	OK
S3.000	S4	15		99.096	-0.124	0.000	0.07		2.1	OK
S3.001	S5	15	100/15 Summer	98.199	-0.091	0.000	0.32		6.5	OK
S1.002	S6	15		97.581	-0.339	0.000	0.14		47.6	OK
S4.000	S7	15	100/15 Summer	100.999	-0.101	0.000	0.24		7.7	OK
S4.001	S8	15	100/15 Summer	100.461	-0.089	0.000	0.34		12.0	OK
S4.002	S9	15		98.664	-0.161	0.000	0.18		17.3	OK
S1.003	S10	15		97.058	-0.342	0.000	0.13		65.2	OK
S1.004	BASIN	240	30/15 Winter	96.378	-0.072	0.000	0.05		4.1	OK
S1.005	S11 FC	240	1/15 Summer	96.619	0.469	0.000	0.09		2.6	SURCHARGED
S1.006	S12	480		93.673	-0.127	0.000	0.06		2.6	OK
S1.007	S13	480		87.863	-0.127	0.000	0.06		2.6	OK
S1.008	S14	480		82.560	-0.120	0.000	0.09		2.6	OK
S1.009	S15	480		80.131	-0.119	0.000	0.09		2.6	OK
S1.010	S16	480		77.878	-0.112	0.000	0.15		2.6	OK
S1.011	S17	480		76.979	-0.111	0.000	0.15		2.6	OK
S1.012	S18	480		76.769	-0.101	0.000	0.24		2.6	OK

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.800 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

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, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Duration (mins)	First (X) Surcharge	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	15		101.142	-0.133	0.000	0.35		44.2	OK
S2.000	S2	15	100/15 Summer	98.748	-0.082	0.000	0.42		7.2	OK
S1.001	S3	15	100/15 Summer	98.480	-0.110	0.000	0.72		85.2	OK
S3.000	S4	15		99.112	-0.108	0.000	0.17		5.1	OK
S3.001	S5	15	100/15 Summer	98.255	-0.035	0.000	0.95		19.1	OK
S1.002	S6	15		97.664	-0.256	0.000	0.38		132.5	OK
S4.000	S7	15	100/15 Summer	101.032	-0.068	0.000	0.58		18.8	OK
S4.001	S8	15	100/15 Summer	100.513	-0.037	0.000	0.92		32.1	OK
S4.002	S9	15		98.714	-0.111	0.000	0.51		48.7	OK
S1.003	S10	15		97.137	-0.263	0.000	0.36		180.3	OK
S1.004	BASIN	360	30/15 Winter	96.739	0.289	0.000	0.04		3.2	SURCHARGED
S1.005	S11 FC	360	1/15 Summer	96.754	0.604	0.000	0.09		2.6	SURCHARGED
S1.006	S12	960		93.673	-0.127	0.000	0.06		2.6	OK
S1.007	S13	960		87.863	-0.127	0.000	0.06		2.6	OK
S1.008	S14	960		82.560	-0.120	0.000	0.09		2.6	OK
S1.009	S15	960		80.131	-0.119	0.000	0.09		2.6	OK
S1.010	S16	960		77.878	-0.112	0.000	0.15		2.6	OK
S1.011	S17	1440		76.979	-0.111	0.000	0.15		2.6	OK
S1.012	S18	1440		76.769	-0.101	0.000	0.24		2.6	OK

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.800 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

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, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Duration (mins)	First (X) Surcharge	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S1	15		101.181	-0.094	0.000	0.64		80.2	OK
S2.000	S2	15	100/15 Summer	99.134	0.304	0.000	0.82		14.1	SURCHARGED
S1.001	S3	15	100/15 Summer	99.021	0.431	0.000	1.25		148.1	SURCHARGED
S3.000	S4	15		99.127	-0.093	0.000	0.31		9.2	OK
S3.001	S5	15	100/15 Summer	98.833	0.543	0.000	1.57		31.7	SURCHARGED
S1.002	S6	15		97.742	-0.178	0.000	0.65		226.4	OK
S4.000	S7	15	100/15 Summer	102.001	0.901	0.896	0.89		29.1	FLOOD
S4.001	S8	15	100/15 Summer	101.779	1.229	0.000	1.30		45.4	FLOOD RISK
S4.002	S9	15		98.751	-0.074	0.000	0.77		73.6	OK
S1.003	S10	15		97.204	-0.196	0.000	0.60		300.9	OK
S1.004	BASIN	480	30/15 Winter	97.185	0.735	0.000	0.04		3.3	SURCHARGED
S1.005	S11 FC	480	1/15 Summer	97.187	1.037	0.000	0.09		2.7	FLOOD RISK
S1.006	S12	480		93.674	-0.126	0.000	0.06		2.7	OK
S1.007	S13	480		87.864	-0.126	0.000	0.06		2.7	OK
S1.008	S14	480		82.561	-0.119	0.000	0.09		2.7	OK
S1.009	S15	480		80.131	-0.119	0.000	0.10		2.7	OK
S1.010	S16	480		77.879	-0.111	0.000	0.15		2.7	OK
S1.011	S17	480		76.979	-0.111	0.000	0.16		2.7	OK
S1.012	S18	480		76.770	-0.100	0.000	0.25		2.7	OK

FOUL SEWERAGE DESIGN

Design Criteria for FW

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.60	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for FW

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	21.319	1.100	19.4	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
F1.001	78.221	2.730	28.7	0.000	12	0.0	1.500	o	150	Pipe/Conduit	
F1.002	21.248	0.300	70.8	0.160	0	0.0	1.500	o	150	Pipe/Conduit	
F1.003	5.988	0.095	63.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.004	4.225	0.060	70.4	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.005	5.960	0.080	74.5	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.006	31.332	0.550	57.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.007	90.137	2.040	44.2	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.008	90.137	6.020	15.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.009	81.813	5.220	15.7	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.010	90.000	2.370	38.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.011	90.000	2.370	38.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.012	90.000	0.900	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.013	19.862	0.200	99.3	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.014	3.000	0.030	100.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	100.900	0.000	0.0	3	0.0	7	0.45	2.00	35.3	0.1
F1.001	99.800	0.000	0.0	15	0.0	16	0.67	1.64	29.0	0.7
F1.002	97.070	0.160	0.0	15	0.0	27	0.59	1.04	18.4	1.3
F1.003	96.770	0.160	0.0	15	0.0	26	0.61	1.10	19.5	1.3
F1.004	96.540	0.160	0.0	15	0.0	27	0.59	1.04	18.5	1.3
F1.005	96.480	0.160	0.0	15	0.0	27	0.58	1.02	17.9	1.3
F1.006	96.400	0.160	0.0	15	0.0	25	0.64	1.16	20.5	1.3
F1.007	95.850	0.160	0.0	15	0.0	24	0.70	1.32	23.3	1.3
F1.008	93.810	0.160	0.0	15	0.0	19	1.01	2.27	40.1	1.3
F1.009	87.790	0.160	0.0	15	0.0	19	1.00	2.22	39.2	1.3
F1.010	82.570	0.160	0.0	15	0.0	23	0.73	1.42	25.2	1.3
F1.011	80.200	0.160	0.0	15	0.0	23	0.73	1.42	25.2	1.3
F1.012	77.830	0.160	0.0	15	0.0	29	0.52	0.88	15.5	1.3
F1.013	76.930	0.160	0.0	15	0.0	29	0.52	0.88	15.5	1.3
F1.014	76.730	0.160	0.0	15	0.0	29	0.52	0.88	15.5	1.3

Manhole Schedules for FW

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	102.450	1.550	Open Manhole	1200	F1.000	100.900	150				
F2	101.800	2.000	Open Manhole	1200	F1.001	99.800	150	F1.000	99.800	150	
F3	99.140	2.070	Open Manhole	1200	F1.002	97.070	150	F1.001	97.070	150	
F4	99.050	2.280	Open Manhole	1200	F1.003	96.770	150	F1.002	96.770	150	
PTP	99.000	2.460	Open Manhole	1200	F1.004	96.540	150	F1.003	96.675	150	135
F5	98.900	2.420	Open Manhole	1200	F1.005	96.480	150	F1.004	96.480	150	
F6	98.720	2.320	Open Manhole	1200	F1.006	96.400	150	F1.005	96.400	150	
F7	97.200	1.350	Open Manhole	1200	F1.007	95.850	150	F1.006	95.850	150	
F8	95.160	1.350	Open Manhole	1200	F1.008	93.810	150	F1.007	93.810	150	
F9	89.140	1.350	Open Manhole	1200	F1.009	87.790	150	F1.008	87.790	150	
F10	83.920	1.350	Open Manhole	1200	F1.010	82.570	150	F1.009	82.570	150	
F11	81.550	1.350	Open Manhole	1200	F1.011	80.200	150	F1.010	80.200	150	
F12	79.130	1.300	Open Manhole	1200	F1.012	77.830	150	F1.011	77.830	150	
F13	78.000	1.070	Open Manhole	1200	F1.013	76.930	150	F1.012	76.930	150	
F14	77.800	1.070	Open Manhole	1200	F1.014	76.730	150	F1.013	76.730	150	
FW OUTFALL	77.200	0.500	Open Manhole	0		OUTFALL		F1.014	76.700	150	

PIPELINE SCHEDULES for FW

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	150	F1	102.450	100.900	1.400	Open Manhole	1200
F1.001	o	150	F2	101.800	99.800	1.850	Open Manhole	1200
F1.002	o	150	F3	99.140	97.070	1.920	Open Manhole	1200
F1.003	o	150	F4	99.050	96.770	2.130	Open Manhole	1200
F1.004	o	150	PTP	99.000	96.540	2.310	Open Manhole	1200
F1.005	o	150	F5	98.900	96.480	2.270	Open Manhole	1200
F1.006	o	150	F6	98.720	96.400	2.170	Open Manhole	1200
F1.007	o	150	F7	97.200	95.850	1.200	Open Manhole	1200
F1.008	o	150	F8	95.160	93.810	1.200	Open Manhole	1200
F1.009	o	150	F9	89.140	87.790	1.200	Open Manhole	1200
F1.010	o	150	F10	83.920	82.570	1.200	Open Manhole	1200
F1.011	o	150	F11	81.550	80.200	1.200	Open Manhole	1200
F1.012	o	150	F12	79.130	77.830	1.150	Open Manhole	1200
F1.013	o	150	F13	78.000	76.930	0.920	Open Manhole	1200
F1.014	o	150	F14	77.800	76.730	0.920	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	21.319	19.4	F2	101.800	99.800	1.850	Open Manhole	1200
F1.001	78.221	28.7	F3	99.140	97.070	1.920	Open Manhole	1200
F1.002	21.248	70.8	F4	99.050	96.770	2.130	Open Manhole	1200
F1.003	5.988	63.0	PTP	99.000	96.675	2.175	Open Manhole	1200
F1.004	4.225	70.4	F5	98.900	96.480	2.270	Open Manhole	1200
F1.005	5.960	74.5	F6	98.720	96.400	2.170	Open Manhole	1200
F1.006	31.332	57.0	F7	97.200	95.850	1.200	Open Manhole	1200
F1.007	90.137	44.2	F8	95.160	93.810	1.200	Open Manhole	1200
F1.008	90.137	15.0	F9	89.140	87.790	1.200	Open Manhole	1200
F1.009	81.813	15.7	F10	83.920	82.570	1.200	Open Manhole	1200
F1.010	90.000	38.0	F11	81.550	80.200	1.200	Open Manhole	1200
F1.011	90.000	38.0	F12	79.130	77.830	1.150	Open Manhole	1200
F1.012	90.000	100.0	F13	78.000	76.930	0.920	Open Manhole	1200
F1.013	19.862	99.3	F14	77.800	76.730	0.920	Open Manhole	1200
F1.014	3.000	100.0	FW OUTFALL	77.200	76.700	0.350	Open Manhole	0

Setting Out Information - True Coordinates (FW)

PN	USMH Name	Dia/Len (mm)	Width (mm)	US Easting (m)	US Northing (m)	Layout (North)
F1.000	F1	1200		359702.232	247219.258	
F1.001	F2	1200		359683.807	247229.984	
F1.002	F3	1200		359609.462	247205.666	
F1.003	F4	1200		359616.060	247185.468	
F1.004	PTP	1200		359620.535	247181.489	
F1.005	F5	1200		359623.692	247178.682	
F1.006	F6	1200		359619.732	247174.228	
F1.007	F7	1200		359629.463	247144.445	
F1.008	F8	1200		359673.523	247065.811	
F1.009	F9	1200		359717.583	246987.177	
F1.010	F10	1200		359714.020	246905.441	
F1.011	F11	1200		359795.313	246866.822	
F1.012	F12	1200		359876.606	246828.203	
F1.013	F13	1200		359957.899	246789.584	
F1.014	F14	1200		359976.648	246783.028	

PN	DSMH Name	Dia/Len (mm)	Width (mm)	DS Easting (m)	DS Northing (m)	Layout (North)
F1.014	FW OUTFALL	0		359977.652	246780.201	

Free Flowing Outfall Details for FW

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
F1.014	FW OUTFALL	77.200	76.700	0.000	0	0

Technical Specification

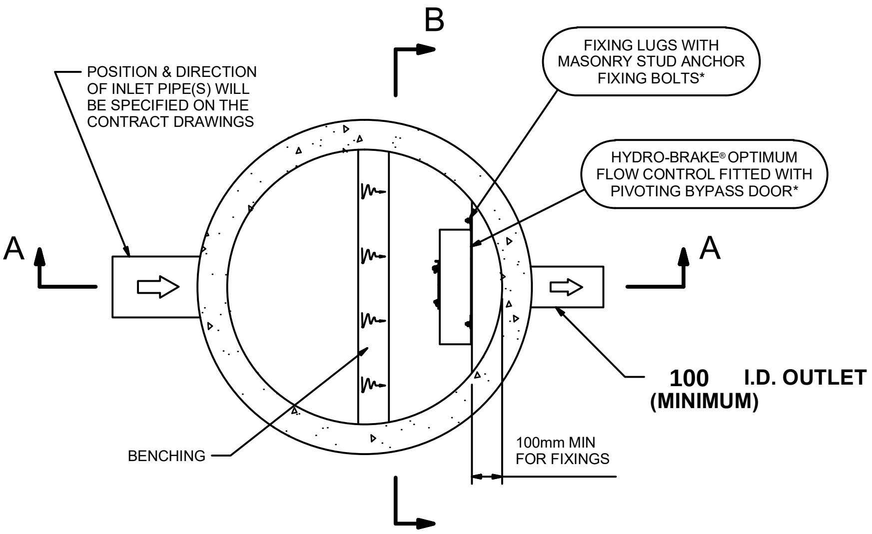
Control Point	Head (m)	Flow (l/s)
Primary Design	1.300	2.800
Flush-Flo™	0.331	2.567
Kick-Flo®	0.672	2.072
Mean Flow		2.332

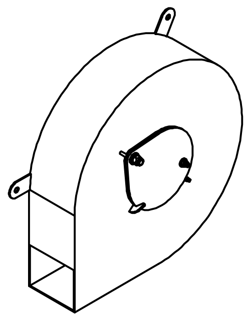
Hydro-Brake® Optimum Flow Control including:

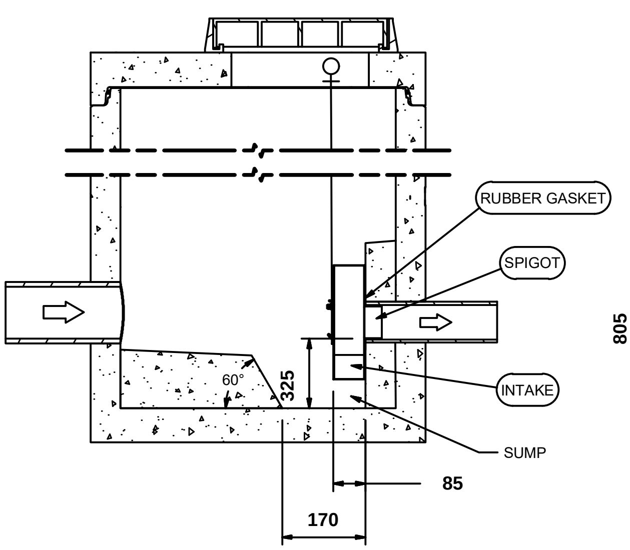
- 3 mm grade 304L stainless steel
- Integral stainless steel pivoting by-pass door allowing clear line of sight through to outlet, c/w stainless steel operating rope
- Beed blasted finish to maximise corrosion resistance
- Stainless steel fixings
- Rubber gasket to seal outlet

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE 08/4596

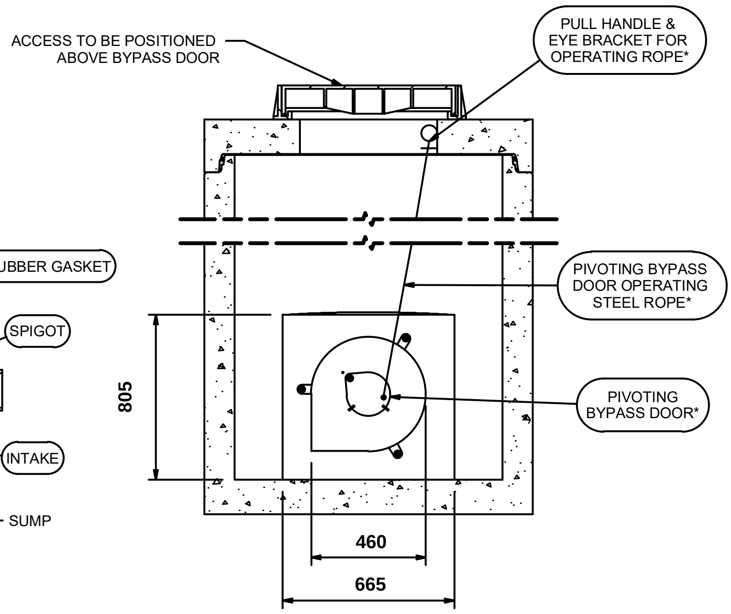
WRc Approved PT/329/0412







SECTION A-A



SECTION B-B

IMPORTANT: ⬭ LIMIT OF HYDRO INTERNATIONAL SUPPLY
THE DEVICE WILL BE HANDED TO SUIT SITE CONDITIONS
FOR SITE SPECIFIC DETAILS AND MINIMUM CHAMBER SIZE REFER TO HYDRO INTERNATIONAL
ALL CIVIL AND INSTALLATION WORK BY OTHERS
* WHERE SUPPLIED
HYDRO-BRAKE® FLOW CONTROL & HYDRO-BRAKE® OPTIMUM FLOW CONTROL ARE REGISTERED TRADEMARKS FOR FLOW CONTROLS DESIGNED AND MANUFACTURED EXCLUSIVELY BY HYDRO INTERNATIONAL

THIS DESIGN LAYOUT IS FOR ILLUSTRATIVE PURPOSES ONLY. NOT TO SCALE.

DESIGN ADVICE !

The head/flow characteristics of this SHE-0075-2800-1300-2800 Hydro-Brake® Optimum Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve. **The use of any other flow control will invalidate any design based on this data and could constitute a flood risk**.

Hydro International ®

DATE	11/20/2018 12:10 PM
SITE	Burley Gate
DESIGNER	Chris Emm
REF	296A31

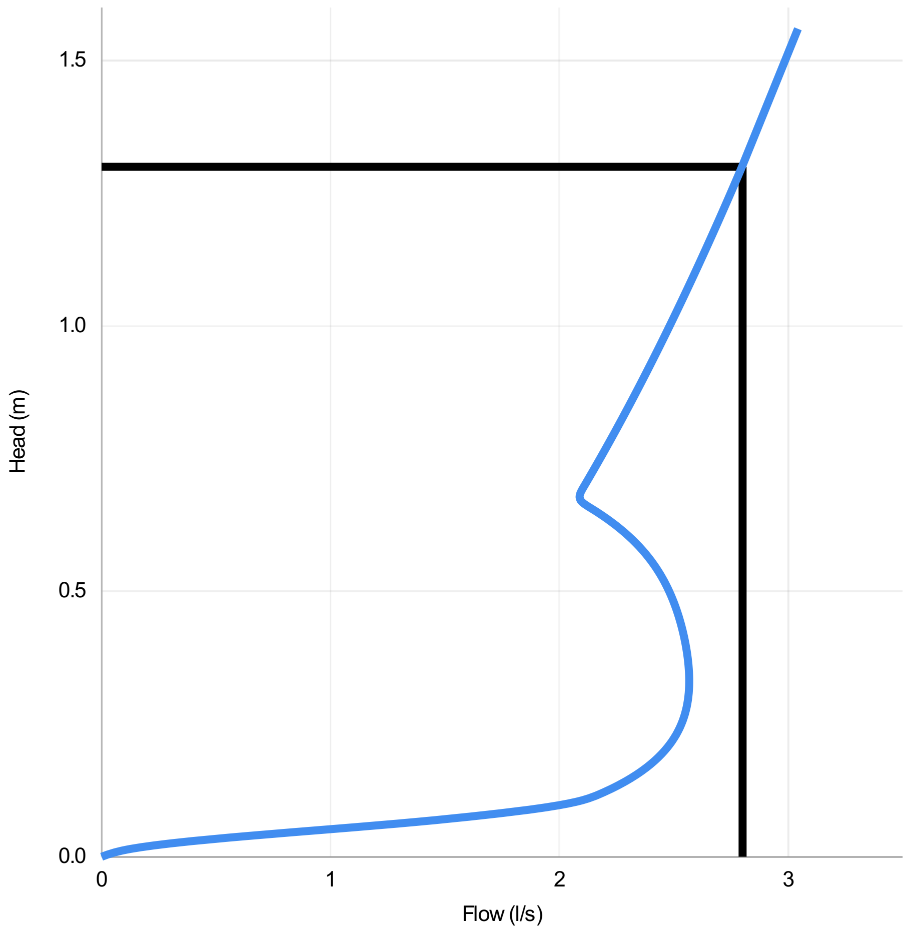
SHE-0075-2800-1300-2800

Hydro-Brake® Optimum

Technical Specification		
Control Point	Head (m)	Flow (l/s)
Primary Design	1.300	2.800
Flush-Flo™	0.331	2.567
Kick-Flo®	0.672	2.072
Mean Flow		2.332

BBA APPROVAL INSPECTION TESTING CERTIFICATION CERTIFICATE No 08/4596

WRc APPROVED PT/329/0412



Head (m)	Flow (l/s)
0.000	0.000
0.045	0.792
0.090	1.895
0.134	2.257
0.179	2.413
0.224	2.502
0.269	2.548
0.314	2.566
0.359	2.564
0.403	2.550
0.448	2.524
0.493	2.487
0.538	2.432
0.583	2.352
0.628	2.237
0.672	2.080
0.717	2.134
0.762	2.193
0.807	2.250
0.852	2.306
0.897	2.361
0.941	2.414
0.986	2.465
1.031	2.516
1.076	2.565
1.121	2.614
1.166	2.661
1.210	2.707
1.255	2.753
1.300	2.797

DESIGN ADVICE

!

The head/flow characteristics of this SHE-0075-2800-1300-2800 Hydro-Brake Optimum® Flow Control are unique. Dynamic hydraulic modelling evaluates the full head/flow characteristic curve.

The use of any other flow control will invalidate any design based on this data and could constitute a flood risk.

Hydro International®

DATE	20/11/2018 12:10
SITE	Burley Gate
DESIGNER	Chris Emm
REF	296A31

SHE-0075-2800-1300-2800

Hydro-Brake Optimum®

<u>*Wastewater Treatment Scheme:*</u>

We have selected a DSAF Special wastewater treatment plant that will be suitable for installation in concrete backfill only. The treatment scheme will consist of the following:

1No Alkalinity Dosing Unit including controls

1No Phosphate Dosing Unit including controls

1No DSAF Wastewater Treatment Plant (2.5m diameter x 10.432m in length)

- Forward Feed Pump within Primary
- Re-circulation Pump within Humus

1No Three Phase Variable Speed Blower & Kiosk

Plant Loading Profile:

Concentration:	**Quantity:**
Hyudralic Loading:	10,000 Litres
Ammonia:	113.0 mg/l
BOD:	936.0 mg/l

The plant will give the following effluent quality:

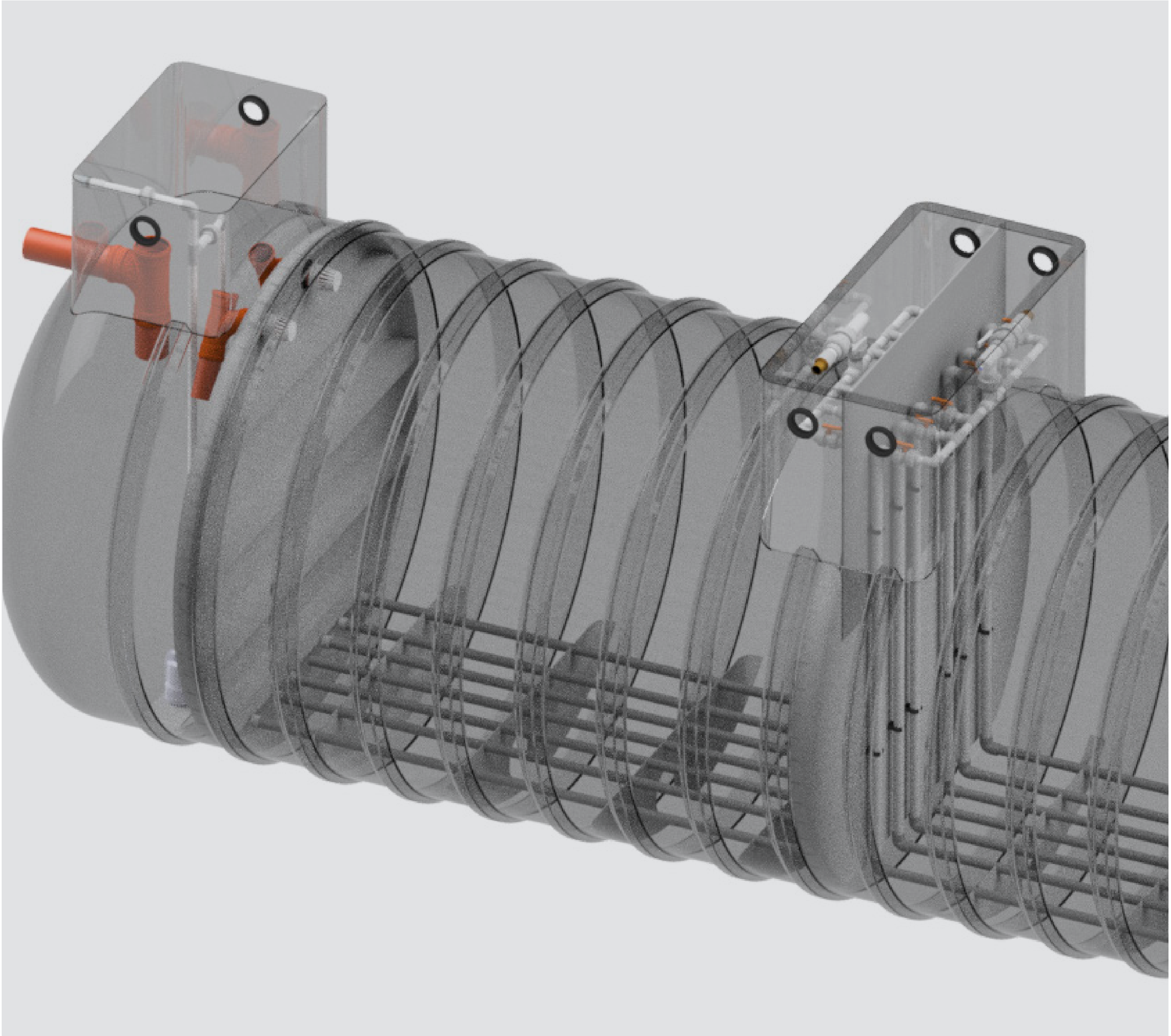
20mg/l BOD

30mg/l Suspended Solids

5mg/l Ammonia

1mg/l Total Phosphate

The treatment plant will require a 120 day de-sludge period at full loading.



DSAF

Denitrifying Wastewater Treatment Plants

Wastewater treatment plants for small and large scale projects.

The **Denitrifying Wastewater Treatment Plant (DSAF)** brings together proven wastewater treatment processes with Premier Tech Aqua UK's in-house engineering expertise.

Containing three treatment stages; a primary settlement zone, an aerobic biological zone and secondary clarification zone, the DSAF offers a tailor-made wastewater treatment solution - ideal for projects where hydraulic loading, BOD concentration and ammonia concentration levels are subject to tight controls.

Premier Tech Aqua UK has designed numerous individual treatment plants for customers across the globe and pioneered the development of package sewage treatment plants, the DSAF is the next level of innovation.

A robust and reliable solution, all DSAFs are designed and manufactured in the UK in accordance with EN 12566-3, the British Water Code of Practice for Flows and Loads.

Made from Glass Reinforced Plastic (GRP), the DSAF is supplied with pedestrian duty covers and access manways as standard. Reinforced, additional strength is provided via the bespoke design of the liner.

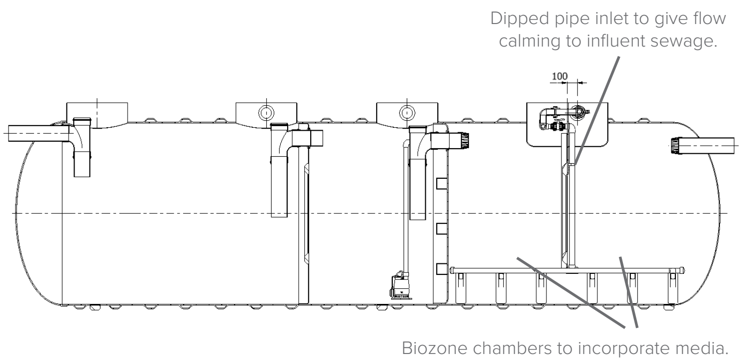
The adaptable design offers the flexibility of pumped influent or effluent, deeper inverts and high nitrification options and locations where the effluent cannot gravitate away.

Superior Technical Performance

Tailored to meet the needs of the individual customer, the DSAF configuration offers 5mg/L of ammonia (NH3) as standard and improved Biochemical oxygen demand (BOD), Nitrogen (N) and Suspended Solids (SS) quality.

Specification

The DSAF is a bespoke designed product - tailored to solve individual situations and challenges, where tight controls for effluent cleanliness exist.



How it works

STEP 1

Primary Settlement Zone

This is the initial stage of treatment, designed to settle out any large solids and other non-degradable materials for subsequent breakdown. It incorporates twin chambers to ensure efficient operation with a flow balancing facility.

STEP 2

Biozone

Substantial BOD reduction takes place in the Biozone. The treatment is achieved by high efficiency air diffusers continually pumping oxygen through the biological media and fluidised effluent.

STEP 3

Humus Settlement Zone

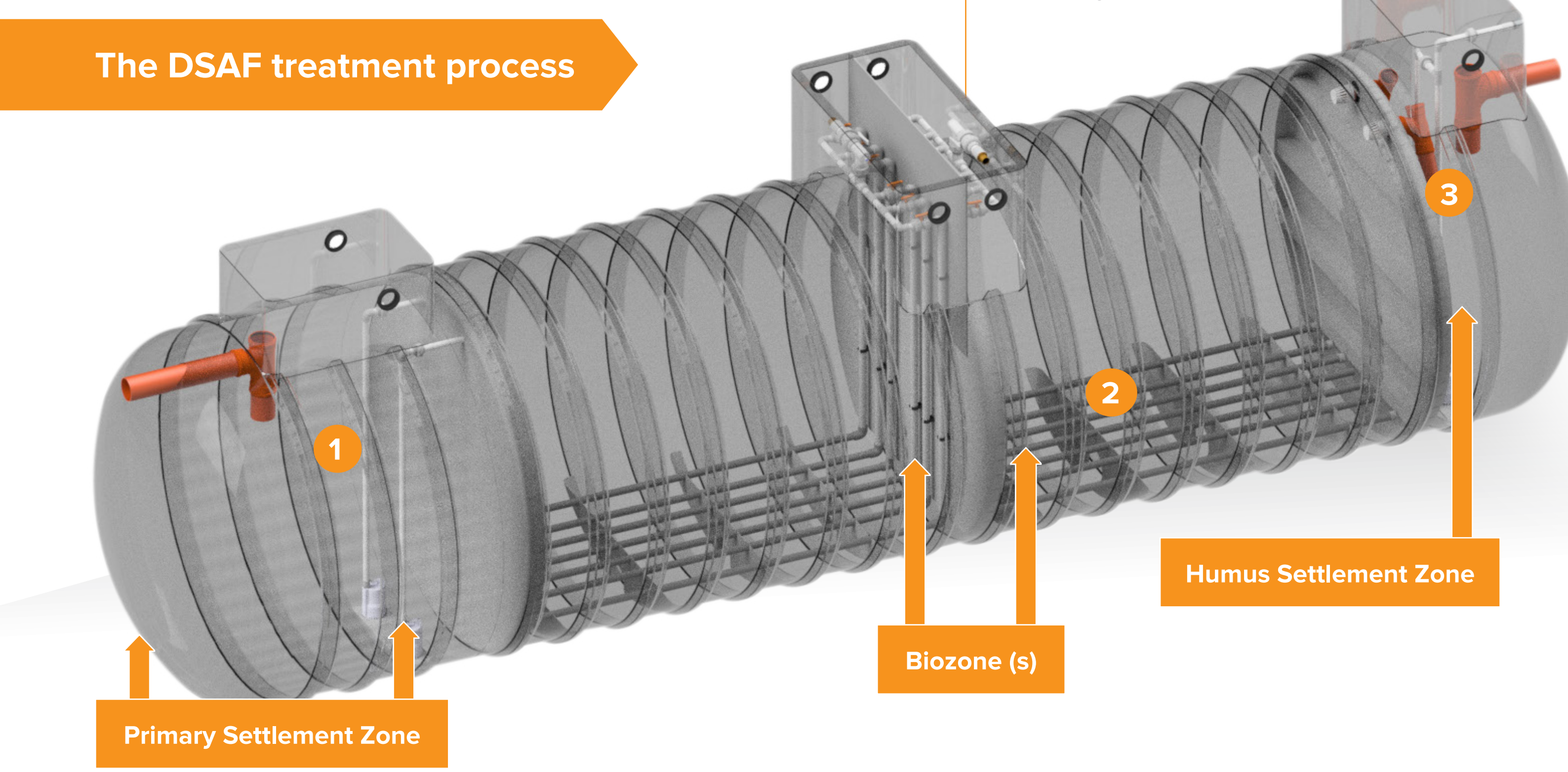
Fed from the biozone, the humus sludge is separated for further treatment and is then suitable for discharge via the outlet to a watercourse or drainage field.

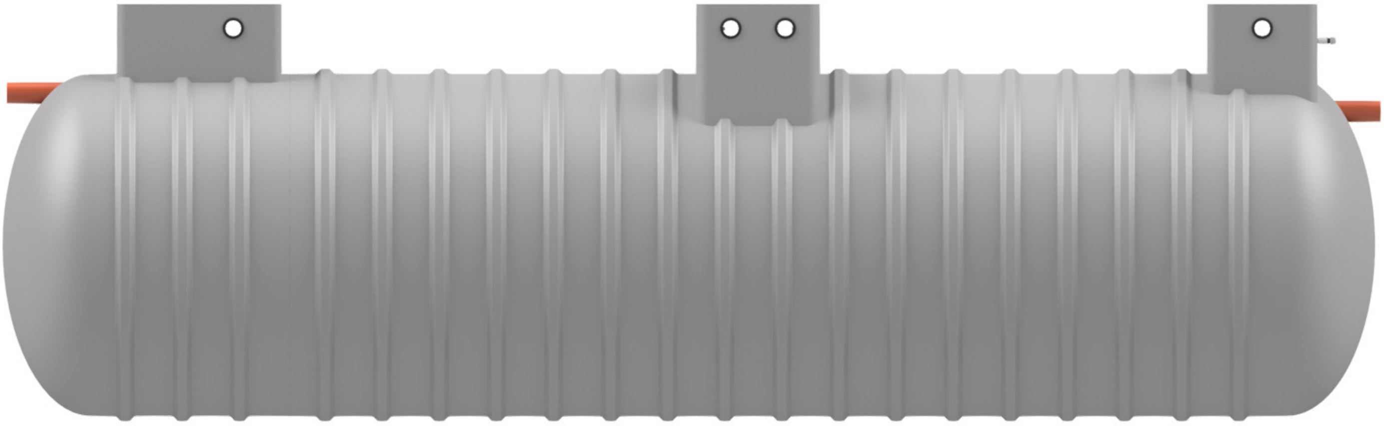
Added Benefits

Energy Saving
Optimised oxygen input for reduced aeration costs and includes variable speed blowers for cost efficiency over the life of the product.

Lower Maintenance
The DSAF has optimised sludge accommodation in the tank for minimized desludging and has pre-specified sludge volumes for precise emptying.

The DSAF treatment process





Installation and Servicing

Timely desludging of the primary tank and an annual maintenance contract is recommended for all treatment plants.

As well as an excellent design, build and consultancy service, we can arrange installation and maintenance through our extensive network of trusted partners.

For more information or to arrange a consultation contact: +44 (0) 8702 64 0004 or visit: www.premiertechaqua.co.uk to find your local representative.

A member of:

BRITISH WATER
expertise worldwide

riba product selector

NBS Plus

Registered with:

Achilles UVDB QUALIFIED

Warranty

All Premier Tech Aqua UK GRP tanks come with a twenty year warranty as standard.
Individual product and part warranties are available upon request.

PREMIER TECH AQUA

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