OPEN ROAD ENGINEERING LTD

DRAINAGE STRATEGY

Phoenix House, Stockpit Road, Liverpool

Date: 28.04.2025

Document Verification

Client Name:	Mulberry Waste Ltd
Site Address:	Phoenix House, Knowsley Industrial Estate Stockpit Road, Liverpool L33 7TQ
Date:	28.04.2025
Document Title:	Drainage Strategy
Document ref	1074-ORE-XX-XX-RP-C-0001
Revision:	A

Prepared by:	Dan Baker, BEng (Hons) TMICE Senior Civil Engineer
Reviewed by:	Dan Baker, BEng (Hons) TMICE Director

Terms and Conditions

This report has been prepared by Open Road Engineering Ltd who have exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant, experienced in preparing similar reports.

However, to the extent that the report relies upon information contained in records or obtained from 3rd parties, Open Road Engineering Ltd give no assurance as to the accuracy or completeness of such information.

The report is prepared solely for the client and the client's professional advisers and may not be relied upon or issued to any third parties without the permission of Open Road Engineering Ltd.

Background

1. The below Drainage Strategy Report has been created by Open Road Engineering Ltd to support and inform detailed Planning Conditions for a site known as Phoenix House, Stockpit Road, Liverpool.

2. The Report relates to the construction of a single storey industrial building, relocation of an existing industrial building and associated works.

3. A proposed development Plan can be found in appendix 01.

Surface Water Drainage Strategy

4. Reference should be made to the Proposed Drainage GA 1074-ORE-ZZ-XX-DR-C-1001.

5. The drainage strategy for the proposed development should incorporate the principles of, and where appropriate, demonstrate compliance with, the NPPF, SUDS Manual (c753) and Knowsley Strategic Flood Risk Assessment.

6. Any proposed drainage works should be designed in accordance with BS EN 752 and Building Regulations Approved Document H (2010). Approved Document H indicates the following hierarchy for the disposal of surface water drainage from new development sites:

    - Discharge via infiltration
    - Discharge to watercourse
    - Discharge to sewer.

7. These options are discussed in further detail below.

8. **Surface water discharge via infiltration:** The online BGS plans and local borehole records indicate that the site comprises made ground directly underlain by clay down to 4mbgl which is not conducive for using soakaways & other infiltration techniques. A borehole extract can be found appended to this report.

9. **Surface water discharge via watercourse:** A review of online mapping and consultation with the client has confirmed that there are no watercourses within the vicinity of the proposed development.

10. **Surface water discharge via public sewer:** A review of the United Utilities (UU) Public Sewer Records confirm that there is a 450mm foul water sewer and a 900mm diameter surface water sewer which passes through the western part of the site running south-north as shown on the below extract.

11. A copy of the UU public sewer records can be found appended to this report.

Surface Water Drainage Proposals

12. The drainage proposals outlined within this document and shown on Proposed Drainage GA ref; 1074-ORE-ZZ-XX-DR-C-1001 are based upon disposal of all surface water from the development via a new connection to the existing public surface water sewer network.

13. As noted within section 10, United Utilities Public Sewer Records indicate that there are large diameter public foul and surface water sewers located within the site boundary to the west of the site running south-north.

14. A drainage survey undertaken by SDS Ltd of 2No. manholes located within the western part of the existing site confirmed the arrangement indicated on the sewer records and the depth of the existing surface water sewer as 3.57mbgl.

15. Given the above, the drainage proposals outlined on drawing ref: 1074-ORE-ZZ-XX-DR-C-1001 intend to construction a new external backdrop connection to the existing UU surface water manhole located within the site boundary.

16. The existing site is developed and is mostly impermeable, comprising an existing storage building & broken hardstanding and is therefore classified as 'Brownfield'.

17. It is understood that Local planning policy is that any new development should aim to discharge surface water runoff at the pre-developed Greenfield runoff rate where possible, however brownfield sites should reduce discharge by 50% as a minimum to account for the impacts on climate change.

18. An existing runoff calculation has been undertaken using a rainfall intensity of 54.60mm/Hr (1:2-year event) over the existing site impermeable area (3,080m²) which has resulted in an existing site runoff rate of 46.7 l/s.

19. Based upon a minimum 50% reduction in surface water discharge, the new allowable flow rate for the proposed development would be 23.3 l/s.

20. A Greenfield assessment has also been undertaken for the existing development using MicroDrainage Software and has concluded the following pre-development runoff rates;

    - 1:1 Year – 1.9 l/s
    - 1:30 Year – 3.1 l/s
    - 1:100 Year – 3.4 l/s

21. Given the significant betterment provided by the above greenfield runoff rates over the existing calculated flow rate, it is proposed to restrict all surface water runoff from the proposed development to the pre-development runoff rates for all storm durations up to and including the critical 100-year event plus a 45% climate change allowance.

22. A copy of the hydraulic calculations can be found appended to this report.

23. It is proposed to collect roof water via traditional rainwater pipes and discharge via a series of drainage troughs located around the building footprint.

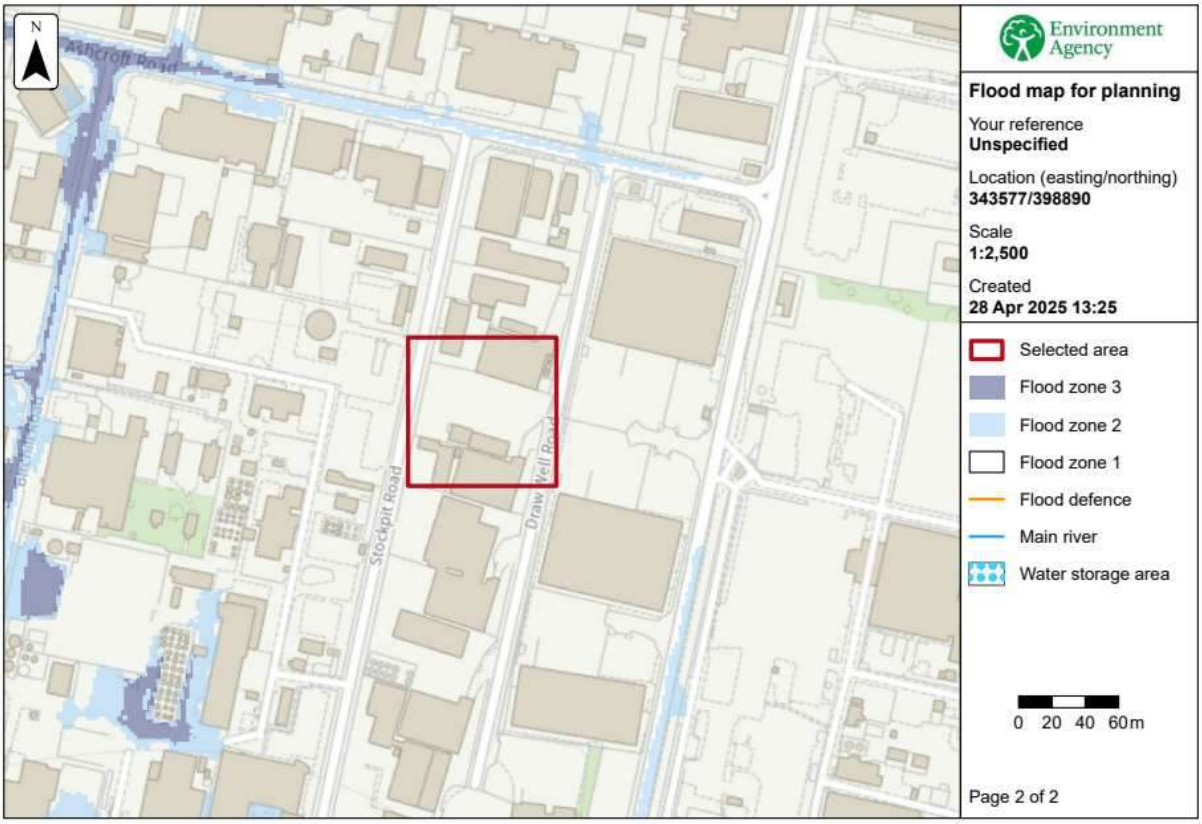
24. External paving is to be comprise concrete hardstanding. The proposed site levels as shown on drawing ref; 1074-ORE-ZZ-XX-DR-C-1010 demonstrate that the majority of the external yard slab will be directed to a central drainage trough where it will be collected and passes through a full retention separator prior to being held within a dedicated below ground cellular attenuation system.

25. The remaining external hardstanding falls to the western boundary with Stockpit road where it will be captured by a separate dedicated drainage trough. From here captured surface water runoff will be transported through a series of below ground pipes to the same separator unit and attenuation system as noted above.

26. Lastly, surface water runoff will pass through a Hydrobrake flow control unit (or similar) which will limit runoff to the pre-development flow rates as noted above.

Residual Flood Risk Mitigation

27. A review of the Environment Agency Online Flood Risk Maps shows the site to situated within Flood Zone 1 with a very low risk (less than 0.1% probability of occurring each year) of flooding from all sources.



28. It is therefore considered that no further mitigation measures are required.

Exceedance Flooding

29. It is understood that the primary use of the site is the decommissioning, recycling and storage of electrical equipment, therefore the site is to be bunded to prevent contaminated runoff leaving the site.

30. Given the above, the proposed external site levels shown on drawing ref; 1074-ORE-ZZ-XX-DR-C-1010 have been designed in such a way that surface water runoff is directed away from the buildings but contained within the site boundary via large drainage troughs, new trief kerbs/dwarf walls (south & west) and the existing concrete retaining structures (north & east).

31. As noted within section 21, the proposed drainage system has been designed to accommodate all surface water runoff for storm durations up to and including the critical 100-year event plus a 45% climate change allowance in accordance with current design regulations.

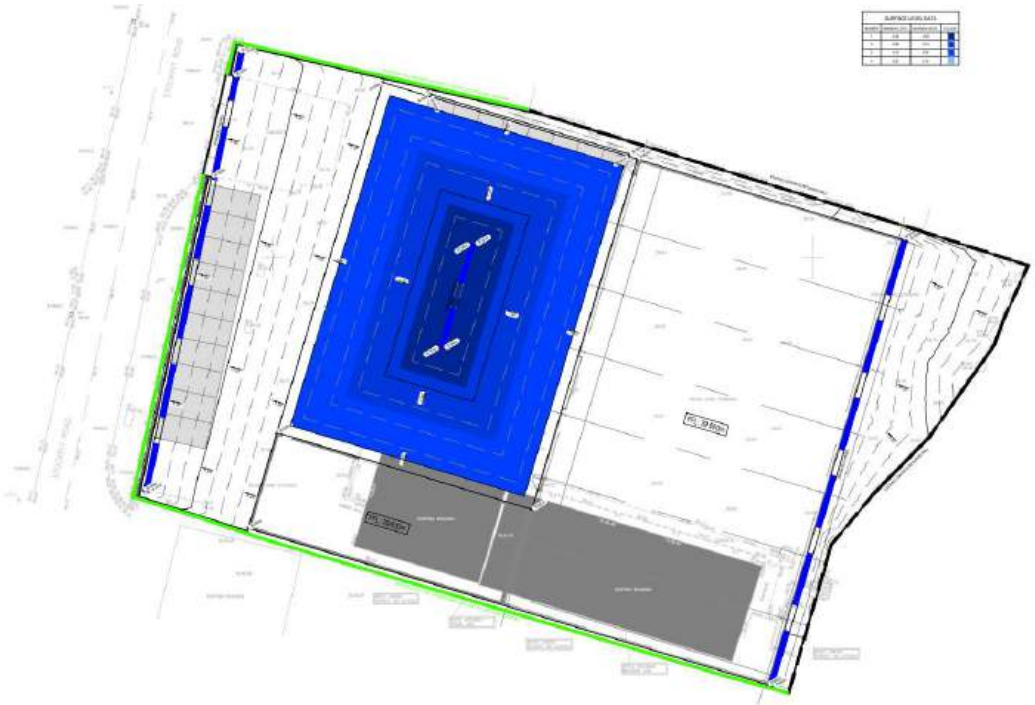
32. Further hydraulic simulations have been undertaken on the proposed drainage network for exceedance storms of 1:200, 1:500 and 1:1000-year events and the results demonstrate that if properly maintained, the proposed drainage system will contain all exceedance storm water without flooding the proposed development or neighbouring third-party land.

33. In the unlikely event that the proposed drainage system is not maintained or the outfall to the existing UU surface water sewer is obstructed, the system would surcharge which would likely result in surface level flooding.

34. An additional set of hydraulic simulations have been undertaken based on having a net zero forward flow rate from the site. The results indicate that during the 1440-minute 100-year storm event plus 45% climate change allowance there would be a total estimated flood volume of 74.629m³ broken down as follows;

    a. 36.988m³ at manhole S3
    b. 37.553m³ at manhole S4
    c. 0.088m³ at manhole S5

35. A 3D flooding analysis demonstrated that the resultant flood water would actually be contained within the extent of external hardstanding adjacent to the buildings as shown on the below extract.



36. The above 3D flood analysis doesn't take into account the additional storage within the extensive lengths of drainage troughs; therefore, it is considered that the extent of flooding shown can be reduced.

37. Given the above, it is considered that the risk to the site from exceedance storm events is negligible.

SUDs Review

38. SUDs should be considered as part of the detailed drainage design for the new build development area and are discussed in further detail below.

39. Storing water for later use could be a viable option for this site. Blue/green roof systems were considered as part of the design for the store building however as the buildings are of long span lightweight construction, therefore the implications of including a green or blue roof system would add significant embodied carbon to the supporting structure & building foundations.

40. A rainwater harvesting buts attached to RWPs could allow the capture of rainwater/surface water runoff to be reused. This option is to be discussed with the client/end user prior to detailed design to determine whether such a system would benefit the daily operations for this development.

41. Above ground SUDs features such as storage / basins and swales were deliberated during the drainage design for this site, however due to the primary usage of the development being a recycling and the lack of any soft landscaping available within the immediate site boundary to implement such features they have been considered to be not a practical solution for this project.

42. Permeable surfacing was also considered as part of the drainage proposals for this site. However as noted in section 8, the underlying ground conditions are understood to comprise made ground over clay which are not suitable for the use of infiltration techniques.

43. In addition, given the primary usage for the development and the anticipated vehicle movements across the site, it is understood that the external yard area is to comprise concrete slab construction which is characteristically impermeable in nature.

44. The quality of surface water runoff prior to discharge from the site should also be considered when reviewing potential SUDS options for the development works and this is reviewed in further detail below.

Water Treatment

45. As discussed within the above strategy, it has been necessary to ensure that the water quality leaving the site is suitable for disposal into the existing United Utilities surface water network.

46. From table 26.2 of the SUDs manual, the proposed roof area is deemed to have a "low" pollution hazard level. I.e., TSS = 0.3, Metals = 0.2, Hydrocarbons = 0.05.

47. Whilst also from table 26.2 of the SUDs manual, the proposed yard, car park and access areas are deemed to have a "high" pollution hazard level. I.e., TSS = 0.8, Metals = 0.8, Hydrocarbons = 0.9.

48. Given this it is considered that multiple treatment stages will be required on this project.

49. Unfortunately, due to the site limitations it has not been possible to incorporate traditional SUDs treatment features (as discussed in the above SUDs review) and therefore it has been necessary to incorporate alternative proprietary systems to ensure water quality is achieved.

50. Gully traps, sump units and catch pits have been incorporated within the drainage proposals for each site to remove contaminants/pollutants from all surface water runoff prior to disposal from the site.

51. Lastly, a full retention separator and downstream defender has also been integrated into the drainage network prior the final connection with the UU sewer network to remove any remaining sediments and oils etc. that have not already been captured by the above.

52. A comparison between the pollution hazard indices and the mitigation measures proposed can be found in the below table.

Pollution				
Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Roof	Low	0.3	0.2	0.05
External	Medium	0.8	0.8	0.9
Total		**1.1**	**1.0**	**0.95**

Mitigation			
Type of SUDs/Treatment	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Downstream Defender Advanced Vortex	0.5	0.4	0.5
Klargester Retention Separator	0.8	0.6	0.9
Total	**1.3**	**1.0**	**1.4**

53. Given the above, it is considered that the level of water treatment provided by the proposed drainage system satisfies the minimum level required by for discharge of surface water to the existing public sewer network

Waste Water proposal

54. As noted in section 11, a review of the UU public sewer records indicates that the presence of a foul water sewer located within the western extent of the development boundary.

55. The drainage survey undertaken by SDS ltd confirmed the arrangement shown on UU sewer records and identified an existing outfall chamber from the site.

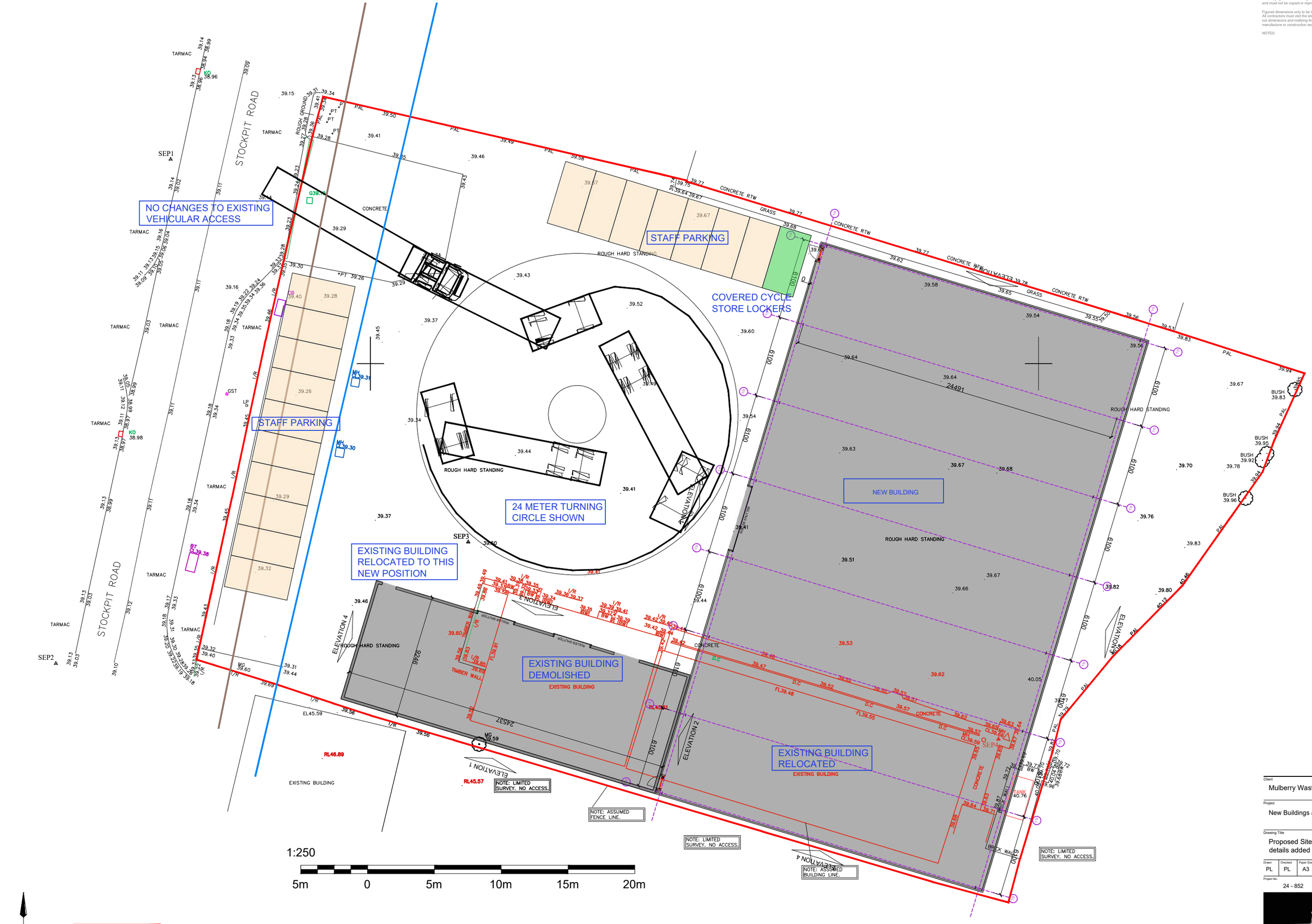
56. It is understood that there are no waste water requirements as part of the development proposals for the site, therefore it is proposed to leave the existing outfall chamber insitu and seal/cap the existing outfall to prevent the accidental passage of surface water runoff entering the public foul sewerage network.

Appendix 1 – Proposed Development Plan

The copyright of this drawing is vested with Philip Lambert Architecture Ltd and must not be copied or reproduced without the consent of the company.

Figured dimensions only to be taken from this drawing. DO NOT SCALE. All contractors must visit the site and be responsible for checking all setting out dimensions and notifying the architect of any discrepancies prior to any manufacture or construction work.

NOTES:



RED LINE DENOTES SITE BOUNDARY

Client
Mulberry Waste Limited

Project
New Buildings at Stockpit Road, L33 7TQ

Drawing Title
Proposed Site Plan with building details added

Drawn	Checked	Paper Size	Scale	Date
PL	PL	A3	1:250	FEB 2025

Project No.	Drawing No.	Revision
24 - 852	01-02	B

Philip Lambert
RIBA Chartered Architect

Appendix 2 – Local Borehole Extract

(British Geological Survey Records)

BOREHOLE NUMBER: WS307	PAGE 1 of 1
DRILLING DATES: 6 October 05	DRILLING METHODS : Window Sampler
DRILLER : Geotron UK Ltd	BOREHOLE DIAMETER : 70/55mm
LOGGED BY : J MILLER	SCREEN TYPE & DIAM: -
CHECKED BY : K WEBSTER	SCREEN SLOT SIZE: -

BOREHOLE CONSTRUCTION	SAMPLE NUMBER	SAMPLE TYPE	SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	DESCRIPTION	COMMENTS
	WS307 0.3-0.6m		0.3-0.6m 1.5ppm		0.0		MADE GROUND: Concrete.	
							MADE GROUND: Black fine to coarse sand and gravel with much angular cobbles of concrete and brick.	NVO, dry.
					0.5		MADE GROUND: Red brick.	
							MADE GROUND: Black clayey sand and gravel with cobbles of brick fragments.	NVO. dry.
					1.0		MADE GROUND: Black angular cobbles (2-3cm diam.) of red brick and concrete in a fine to coarse black sand and gravel matrix from 1.0m.	
							Dark brown organic matter (PEAT).	Mild chemical odour, moist.
			1.4-1.6m 5.1ppm		1.5		Medium-fine to coarse grey SAND.	Moderate chemical odour, moist.
					2.0		Dark brown organic material (PEAT).	
							Soft grey-brown silty CLAY	NVO, wet (silty CLAY).
			2.5-2.6m 0.6ppm		2.5		Soft to firm light brown CLAY	
					3.0		...becoming firmer with depth and contains occasional smooth subangular gravel and smaller rounded smooth cobbles (becoming more frequent with depth).	NVO.
					3.5			
					4.0		Borehole terminated at 4.0m. Borehole backfilled with bentonite.	
					4.5			
					5.0			

LOCATION / NOTES:
NVO = No visual or olfactory evidence of contamination

LEGEND
- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

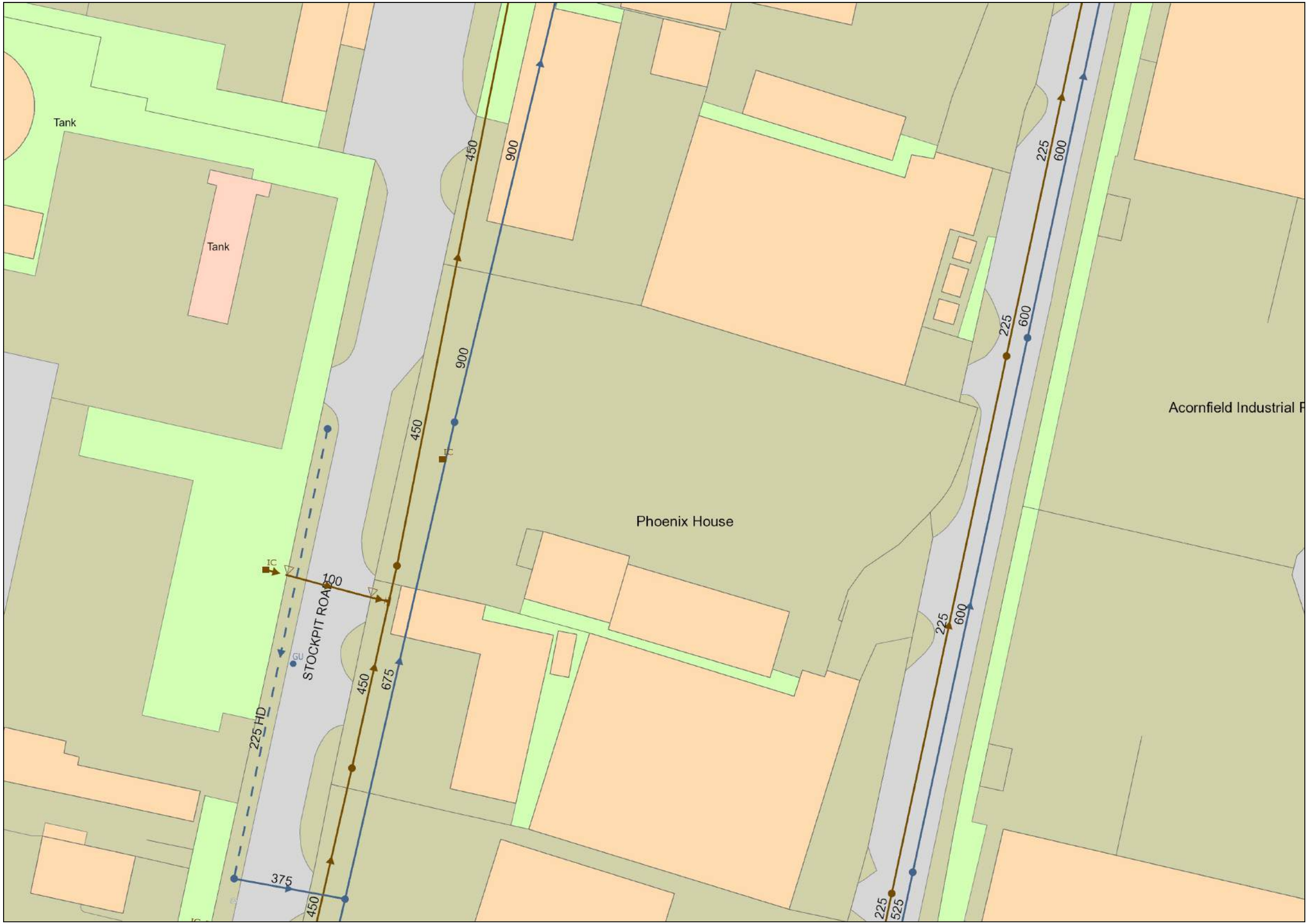
BOREHOLE LOG

Job Title: Phase II Investigation
Location: Kirkby, Liverpool
Client: Baker Petrolite

URS

App'd:	Date: 25/10/05
Drawn :	Ref: KW/MCH
Scale: As Shown	Job No: 44319748
Drg. Size: A4	BOREHOLE LOG

Appendix 3 – United Utilities Sewer Records



United Utilities Maps for SafeDig

Date :	28/04/2025 22:01:28
Centre X:	343575
Centre Y:	398892
Scale :	500
UserName:	NETWRKPLS

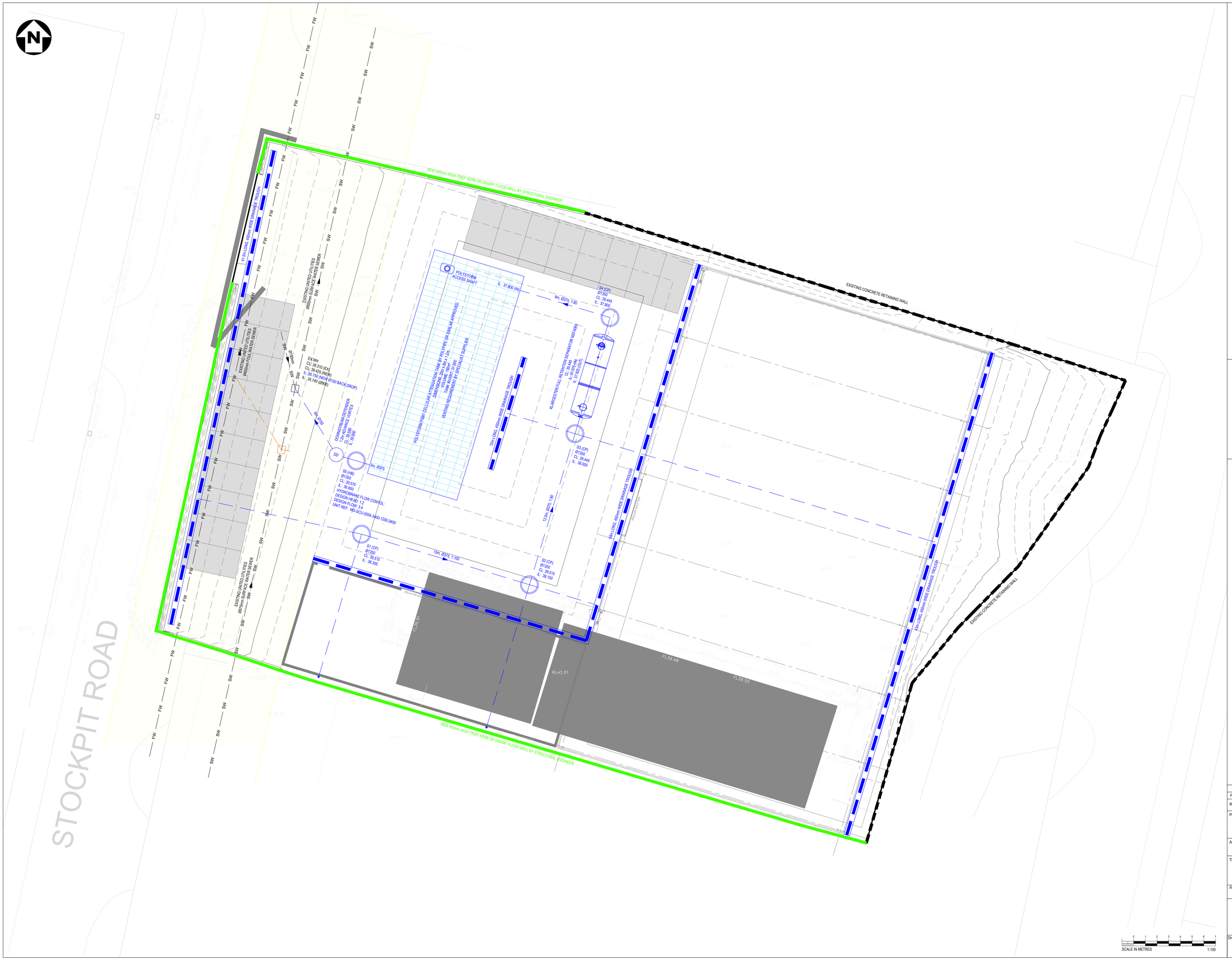
Extract from maps of United Utilities' Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

Crown copyright and database rights 2025.Ordnance Survey 0000813445 This plan is based on the Ordnance Survey Map with the sanction of the Controller of H.M. Stationary Office. Crown and United Utilities Water copyrights are reserved. Unauthorised reproduction will infringe these copyrights.

United Utilities
Water for the North West

Appendix 4 – Proposed Drainage GA



GENERAL NOTES

DO NOT SCALE FROM THIS DRAWING WORK TO FIGURED DIMENSIONS ONLY.

NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.

ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.

THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH AND SAFETY PLAN.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH TYPICAL DRAINAGE DETAIL DRAWINGS.

THE CONTRACTOR IS RESPONSIBLE FOR CHECKING INVERT LEVELS AND POSITIONS OF ALL EXISTING DRAINS, SEWERS, INSPECTION CHAMBERS AND MANHOLES SHOWN ON THIS DRAWING IMMEDIATELY ON SITE ESTABLISHMENT. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER IMMEDIATELY.

WHERE THE NEW SITE DRAINAGE CONNECTS IN TO EXISTING MANHOLES IN CARRIAGEWAYS AND/OR EXISTING ADOPTED SEWERS, THE CONTRACTOR IS RESPONSIBLE FOR ALL LIAISON WITH THE RELEVANT STATUTORY UNDERTAKER AND LOCAL AUTHORITY WITH REGARD TO ROAD CLOSURES, TRAFFIC MANAGEMENT, PERMITS TO WORK, SUBMISSION OF CONTRACTORS METHOD STATEMENTS AND RISK ASSESSMENTS AND OTHER DOCUMENTATION AND CORRESPONDENCE ASSOCIATED WITH THE SITE STAGE (PART 2) ELEMENT OF THE WORKS.

ROCKER PIPES TO BE PROVIDED AT ALL CONCRETE CASED INTERFACES.

THE CONTRACTOR IS TO PROVIDE ADEQUATE PROTECTION TO MAINTAIN MINIMUM COVER TO DRAINS DURING THE CONSTRUCTION PERIOD.

COVER LEVELS ON THIS DRAWING ARE APPROXIMATE AND INDICATIVE ONLY. ARCHITECT TO CONFIRM COVER LEVELS TO ALL MANHOLES PRIOR TO CONSTRUCTION.

THE LAYOUT OF DRAINAGE ON THIS DRAWING IS INDICATIVE ONLY. ARCHITECT TO CONFIRM EXACT LOCATION OF MANHOLES AND GULLIES PRIOR TO CONSTRUCTION.

UNO. ALL DRAINAGE GOODS & FITTINGS TO BE TWIN WALL STRUCTURED PLASTIC APPROVED BY THE ENGINEER.

ALL COVERS AND RODDING ACCESS POINTS TO BE SEALED AND SCREWED TIGHT.

ALL PIPEWORK TO BE INSTALLED WITH SOFFITS LEVEL (E.G. AT CHANGES IN PIPE SIZE) U.N.O.

ON COMPLETION OF DRAINAGE WORKS, THE NEW DRAINAGE SYSTEM IS TO BE THOROUGHLY CLEANED AND A CCTV SURVEY CARRIED OUT TO CONFIRM NO CONSTRUCTION DEBRIS OR BLOCKAGES REMAIN.

PIPE GRADIENTS SHOWN ARE INDICATIVE MINIMUMS.

MANHOLES:

ALL PROPOSED NEW MANHOLES TO BE PRECAST RING MANHOLES TYPE 4 IN ACCORDANCE WITH UU DEVELOPER SERVICES CONSTRUCTION DETAILS UNLESS NOTED OTHERWISE.

MANHOLE COVERS:

CARRIAGEWAYS GENERAL - EN124 CLASS D400
CARRIAGEWAYS WITHIN 0.5m OF KERB - EN124 CLASS C250
SLOW MOVING HGV [38t] - EN 124 CLASS B125 SLOW MOVING
GLV [10t] - EN 124 CLASS B125 SLOW MOVING PRIVATE CARS - EN124 CLASS B125.

LEGEND

- EXISTING PRIVATE FOUL WATER DRAIN
- EXISTING PUBLIC FOUL WATER SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- DENOTES SEWER EASEMENT (6m)
- PROPOSED PRIVATE SURFACE WATER DRAIN
- DENOTES SITE BOUNDARY
- DENOTES EXISTING CONCRETE RETAINING WALL
- DENOTES PROPOSED TRIEF KERB / DWARF WALL

DRAWING NOTES

THE EXISTING DRAINAGE INFORMATION SHOWN ON THIS DRAWING IS BASED UPON INFORMATION SHOWN ON THE UNITED UTILITIES ONLINE SEWER RECORDS.

THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING THE LOCATION, LEVEL AND CONDITION OF ALL EXISTING DRAINAGE INFRASTRUCTURE WITHIN THE VICINITY OF THE PROPOSED DEVELOPMENT PRIOR TO CONSTRUCTION.

IT IS RECOMMENDED THAT THE CONTRACTOR UNDERTAKES A CCTV SURVEY TO CONFIRM THE ABOVE AND THAT ANY DISCREPANCIES ARE REPORTED TO THE ENGINEER IMMEDIATELY.

THE PROPOSED DRAINAGE INFORMATION SHOWN ON THIS DRAWING IS INDICATIVE ONLY.

PROPOSED COVER LEVELS ARE BASED UPON THE PROPOSED LEVEL INFORMATION SHOWN ON DRAWING 1074-ORE-ZZ-XX-DR-C-1010.

EXISTING DRAINAGE INVERT LEVELS ARE BASED UPON SURVEY INFORMATION PROVIDED BY SDS DRAINAGE SURVEYS ALONG WITH INFORMATION SHOWN ON THE ONLINE UNITED UTILITIES SEWER RECORDS WHICH NEEDS TO BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

THE DRAINAGE PROPOSALS SHOWN INCLUDE A HYDROBRAKE FLOW CONTROL DEVICE. THE CONTRACTOR IS TO INSTALL THE DEVICE IN ACCORDANCE WITH THE SPECIALIST SUPPLIER DETAILS / SPECIFICATION INCLUDING ANY SUMP / BENCHING REQUIREMENTS.

PRELIMINARY

Rev.	Amendment	Date	By	Chkd
P01	PRELIMINARY ISSUE.	25.04.25	DB	DB

Project
PHOENIX HOUSE,
STOCKPIT ROAD, LIVERPOOL

ARCH/CLIENT
MULBERRY WASTE LTD

Title
PROPOSED DRAINAGE GA

Job No.	Drawn	Checked	Date	Scale
1074	DB	DB	MARCH 2025	1:100 @ A0

OPEN ROAD ENGINEERING LTD
27A Well Lane
Weaverham
Northwich
Cheshire CW8 3PE
Tel: 07968 525 970
e-mail Dan.Baker@live.com

Drawing No.

Project	Originator	Volume	Level	Type	Role	Number	Rev
1074	- ORE -	ZZ -	XX -	DR -	C -	1001	P01

Appendix 5 – Proposed Site Levels GA

NOTES

GENERAL NOTES

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THIS DRAWING IS TO BE READ IN CONJUNCTION WITH TYPICAL DETAIL DRAWINGS.

DRAWING NOTES

EXISTING TOPOGRAPHICAL SURVEY INFORMATION SHOWN IS BASED UPON INFORMATION RECEIVED 24.03.2025 .

THE PROPOSED LEVEL INFORMATION SHOWN IS INDICATIVE ONLY FOR PLANNING PURPOSES AND IS SUBJECT TO FURTHER DETAILED DESIGN.

THE DWARF / FLOOD WALL SHOWN IS INDICATIVE ONLY AND IS SUBJECT TO DETAILED DESIGN BY THE STRUCTURAL ENGINEER.

LEGEND

	PROPOSED SITE MAJOR CONTOUR (0.5m INTERVALS)
	PROPOSED SITE MINOR CONTOUR (0.1m INTERVALS)
53.50	PROPOSED SPOT LEVEL
1:35	PROPOSED GRADIENT
	DENOTES DEVELOPMENT BOUNDARY
	DENOTES EXISTING CONCRETE RETAINING WALL
	DENOTES PROPOSED TRIEF KERB / DWARF WALL
	DENOTES DRAINAGE CHANNEL

PRELIMINARY

Rev.	Amendment	Date	By	Chkd
P01	PRELIMINARY ISSUE.	25.04.25	DB	DB

Project
PHOENIX HOUSE,
STOCKPIT ROAD, LIVERPOOL

ARCH/CLIENT
MULBERRY WASTE LTD

Title
PROPOSED SITE LEVELS GA

Job No.	Drawn	Checked	Date	Scale
1074	DB	DB	MARCH 2025	1:100 @ A0

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Tel: 07968 525 670
e-mail Dan.Baker@live.com

Drawing No.

Project	Originator	Volume	Level	Type	Role	Number	Rev
1074	- ORE	- ZZ	- XX	- DR	- C	- 1010	P01

Appendix 6 – Surface Water Calculations

OPEN ROAD ENGINEERING LTD

SURFACE WATER CALCULATIONS

Phoenix House, Stockpit Road, Liverpool

Date: 28.04.2025

Document Verification

Client Name:	Mulberry Waste Ltd
Site Address:	Phoenix House, Knowsley Industrial Estate Stockpit Road, Liverpool L33 7TQ
Date:	28.04.2025
Document Title:	Surface Water Calculations
Document ref	1074-ORE-XX-XX-CA-C-0001
Revision:	A

Prepared by:	Dan Baker, BEng (Hons) TMICE Senior Civil Engineer
Reviewed by:	Dan Baker, BEng (Hons) TMICE Director

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General Notes

1. The calculations within this document have been undertaken using MicroDrainage Software version 2020.

2. This document is to be read in conjunction with the following documents;

    a. 1074-ORE-ZZ-XX-DR-C-1001 – Proposed Drainage GA
    b. 1074-ORE-XX-XX-RP-C-0001 – Drainage Strategy Document

Summary of Results

3. As noted within the drainage strategy document, the drainage proposals outlined within the report and the associated drainage drawing, intends to restrict surface water runoff to the pre-development runoff rates.

4. The below summary table confirms the proposed flow rates to be discharged to the public sewer network.

Greenfield Runoff Rate* (l/s)	Proposed Site Runoff Rate – Manhole S4 (l/s)
Q1: 1.9 Q30: 3.1 Q100: 3.4	1:1: 1.9 1:30: 2.5 1:100 + 45%: 3.4

*An urban factor of 0.75 has been applied for the current site

Greenfield Runoff Calculation

Date 24/04/2025 20:42	Designed by DBaker
File	Checked by
Innovyze	Source Control 2020.1.3

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.308	Urban	0.750
SAAR (mm)	890	Region Number	Region 10

Results	**l/s**
QBAR Rural	0.7
QBAR Urban	2.1
Q100 years	3.4
Q1 year	1.9
Q30 years	3.1
Q100 years	3.4

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Surface Water Network Calculation

Date 28/04/2025 15:00	Designed by DBaker
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	0
Ratio R	0.380	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

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	15.000	0.150	100.0	0.062	5.00	0.0	0.600	o	375	Pipe/Conduit	
S1.001	13.500	0.150	90.0	0.011	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.002	10.383	0.100	103.8	0.227	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.003	8.041	0.100	80.4	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.004	9.621	0.000	0.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.005	10.078	0.000	0.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.006	3.000	0.050	60.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
S1.007	6.673	0.200	33.4	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)
S1.000	50.00	5.14	38.300	0.062	0.0	0.0	0.0	1.81	200.1	8.4
S1.001	50.00	5.26	38.150	0.073	0.0	0.0	0.0	1.91	211.0	9.9
S1.002	50.00	5.35	38.000	0.300	0.0	0.0	0.0	1.78	196.4	40.6
S1.003	50.00	5.42	37.900	0.300	0.0	0.0	0.0	2.02	223.3	40.6
S1.004	47.88	6.35	37.800	0.300	0.0	0.0	0.0	0.17	19.1«	40.6
S1.005	44.68	7.32	37.000	0.300	0.0	0.0	0.0	0.17	19.1«	40.6
S1.006	44.61	7.34	37.000	0.300	0.0	0.0	0.0	2.34	258.8	40.6
S1.007	44.42	7.40	36.950	0.300	0.0	0.0	0.0	1.75	30.9«	40.6

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File 1074 - Surface Water Ne...	Checked by
Innovyze	Network 2020.1.3

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	39.515	1.215	Open Manhole	1350	S1.000	38.300	375				
S2	39.515	1.365	Open Manhole	1350	S1.001	38.150	375	S1.000	38.150	375	
S3	39.445	1.445	Open Manhole	1350	S1.002	38.000	375	S1.001	38.000	375	
S4	39.445	1.545	Open Manhole	1350	S1.003	37.900	375	S1.002	37.900	375	
S-JCT	39.350	1.550	Junction		S1.004	37.800	375	S1.003	37.800	375	
S-TANK	39.350	2.350	Junction		S1.005	37.000	375	S1.004	37.800	375	800
S-JCT	39.580	2.580	Junction		S1.006	37.000	375	S1.005	37.000	375	
S5	39.570	2.620	Open Manhole	1350	S1.007	36.950	150	S1.006	36.950	375	
S	39.425	2.675	Open Manhole	0		OUTFALL		S1.007	36.750	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S1	343554.562	398886.122	343554.562	398886.122	Required	
S2	343568.924	398881.793	343568.924	398881.793	Required	
S3	343572.820	398894.719	343572.820	398894.719	Required	
S4	343575.816	398904.660	343575.816	398904.660	Required	
S-JCT	343568.117	398906.980			No Entry	
S-TANK	343561.762	398899.757			No Entry	
S-JCT	343555.264	398892.054			No Entry	
S5	343552.391	398892.920	343552.391	398892.920	Required	
S	343548.879	398898.593			No Entry	

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PIPELINE SCHEDULES for Storm

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	375	S1	39.515	38.300	0.840	Open Manhole	1350
S1.001	o	375	S2	39.515	38.150	0.990	Open Manhole	1350
S1.002	o	375	S3	39.445	38.000	1.070	Open Manhole	1350
S1.003	o	375	S4	39.445	37.900	1.170	Open Manhole	1350
S1.004	o	375	S-JCT	39.350	37.800	1.175	Junction	
S1.005	o	375	S-TANK	39.350	37.000	1.975	Junction	
S1.006	o	375	S-JCT	39.580	37.000	2.205	Junction	
S1.007	o	150	S5	39.570	36.950	2.470	Open Manhole	1350

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	15.000	100.0	S2	39.515	38.150	0.990	Open Manhole	1350
S1.001	13.500	90.0	S3	39.445	38.000	1.070	Open Manhole	1350
S1.002	10.383	103.8	S4	39.445	37.900	1.170	Open Manhole	1350
S1.003	8.041	80.4	S-JCT	39.350	37.800	1.175	Junction	
S1.004	9.621	0.0	S-TANK	39.350	37.800	1.175	Junction	
S1.005	10.078	0.0	S-JCT	39.580	37.000	2.205	Junction	
S1.006	3.000	60.0	S5	39.570	36.950	2.245	Open Manhole	1350
S1.007	6.673	33.4	S	39.425	36.750	2.525	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.007	S	39.425	36.750	0.000	0	0

Simulation Criteria for Storm

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

Synthetic Rainfall Details

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File 1074 - Surface Water Ne...	Checked by
Innovyze	Network 2020.1.3

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.380		

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File 1074 - Surface Water Ne...	Checked by
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S5, DS/PN: S1.007, Volume (m³): 4.0

Unit Reference	MD-SCU-0054-3400-1200-3400
Design Head (m)	1.200
Design Flow (l/s)	3.4
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	54
Invert Level (m)	36.950
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.4
Flush-Flo™	0.082	1.0
Kick-Flo®	0.082	1.0
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)
0.100	1.1	1.200	3.4	3.000	5.2	7.000	7.8
0.200	1.5	1.400	3.7	3.500	5.6	7.500	8.1
0.300	1.8	1.600	3.9	4.000	6.0	8.000	8.3
0.400	2.1	1.800	4.1	4.500	6.3	8.500	8.6
0.500	2.3	2.000	4.3	5.000	6.7	9.000	8.8
0.600	2.5	2.200	4.5	5.500	7.0	9.500	9.0
0.800	2.8	2.400	4.7	6.000	7.3		
1.000	3.1	2.600	4.9	6.500	7.5		

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Storage Structures for Storm

Cellular Storage Manhole: S-TANK, DS/PN: S1.005

Invert Level (m) 37.000 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	160.0	160.0	5.200	0.0	230.8
0.400	160.0	180.2	5.600	0.0	230.8
0.800	160.0	200.5	6.000	0.0	230.8
1.200	160.0	220.7	6.400	0.0	230.8
1.600	0.0	230.8	6.800	0.0	230.8
2.000	0.0	230.8	7.200	0.0	230.8
2.400	0.0	230.8	7.600	0.0	230.8
2.800	0.0	230.8	8.000	0.0	230.8
3.200	0.0	230.8	8.400	0.0	230.8
3.600	0.0	230.8	8.800	0.0	230.8
4.000	0.0	230.8	9.200	0.0	230.8
4.400	0.0	230.8	9.600	0.0	230.8
4.800	0.0	230.8	10.000	0.0	230.8

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File 1074 - Surface Water Ne...	Checked by
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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	2	+0%	100/15 Summer				38.367
S1.001	S2	15 Winter	2	+0%	100/15 Summer				38.223
S1.002	S3	15 Winter	2	+0%	30/15 Summer				38.160
S1.003	S4	15 Winter	2	+0%	30/15 Summer				38.060
S1.004	S-JCT	15 Winter	2	+0%					38.020
S1.005	S-TANK	240 Winter	2	+0%	30/60 Summer				37.272
S1.006	S-JCT	240 Winter	2	+0%					37.275
S1.007	S5	240 Winter	2	+0%	2/15 Summer				37.275

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.308	0.000	0.07			10.9	OK	
S1.001	S2	-0.302	0.000	0.08			12.5	OK	
S1.002	S3	-0.215	0.000	0.38			46.4	OK	
S1.003	S4	-0.215	0.000	0.38			46.7	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.004	S-JCT	-0.155	0.000	0.65			46.5	OK*	
S1.005	S-TANK	-0.103	0.000	0.03		246	2.3	OK*	
S1.006	S-JCT	-0.100	0.000	0.02			1.9	OK*	
S1.007	S5	0.175	0.000	0.07			1.9	SURCHARGED	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%	100/15 Summer			
S1.001	S2	15 Winter	30	+0%	100/15 Summer			
S1.002	S3	15 Winter	30	+0%	30/15 Summer			
S1.003	S4	15 Winter	30	+0%	30/15 Summer			
S1.004	S-JCT	15 Summer	30	+0%				
S1.005	S-TANK	240 Winter	30	+0%	30/60 Summer			
S1.006	S-JCT	1440 Summer	30	+0%				
S1.007	S5	240 Winter	30	+0%	2/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	38.437	-0.238	0.000	0.13			19.7	OK

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File 1074 - Surface Water Ne...	Checked by
Innovyze	Network 2020.1.3

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.001	S2	38.426	-0.099	0.000	0.16			23.9	OK
S1.002	S3	38.407	0.032	0.000	0.71			87.6	SURCHARGED
S1.003	S4	38.295	0.020	0.000	0.70			86.3	SURCHARGED
S1.004	S-JCT	38.175	0.000	0.000	1.15			81.9	SURCHARGED*
S1.005	S-TANK	37.557	0.182	0.000	0.08			5.5	SURCHARGED*
S1.006	S-JCT	37.375	0.000	0.000	0.02			2.4	SURCHARGED*
S1.007	S5	37.625	0.525	0.000	0.09			2.5	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S1.002	S3	
S1.003	S4	
S1.004	S-JCT	
S1.005	S-TANK	
S1.006	S-JCT	
S1.007	S5	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+45%	100/15 Summer				39.059
S1.001	S2	15 Winter	100	+45%	100/15 Summer				38.943
S1.002	S3	15 Winter	100	+45%	30/15 Summer				38.805
S1.003	S4	15 Winter	100	+45%	30/15 Summer				38.583
S1.004	S-JCT	15 Summer	100	+45%					38.175
S1.005	S-TANK	360 Winter	100	+45%	30/60 Summer				38.143
S1.006	S-JCT	15 Summer	100	+45%					37.375
S1.007	S5	360 Winter	100	+45%	2/15 Summer				38.216

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.384	0.000	0.26			39.0	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S2	0.418	0.000	0.32			48.1	SURCHARGED	
S1.002	S3	0.430	0.000	1.43			177.5	SURCHARGED	
S1.003	S4	0.308	0.000	1.44			178.2	SURCHARGED	
S1.004	S-JCT	0.000	0.000	2.44			174.4	SURCHARGED*	
S1.005	S-TANK	0.768	0.000	0.11			7.2	SURCHARGED*	
S1.006	S-JCT	0.000	0.000	0.04			4.3	SURCHARGED*	
S1.007	S5	1.116	0.000	0.13			3.4	SURCHARGED	

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Exceedance Storm Calculations

(1:200, 1:500 & 1:1000 years)

Date 28/04/2025 14:58	Designed by DBaker
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200 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 200, 500, 1000
Climate Change (%) 0, 0, 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	200	+0%	200/15 Summer				38.750
S1.001	S2	15 Winter	200	+0%	200/15 Summer				38.656
S1.002	S3	15 Winter	200	+0%	200/15 Summer				38.582
S1.003	S4	15 Winter	200	+0%	200/15 Summer				38.438
S1.004	S-JCT	15 Summer	200	+0%					38.175
S1.005	S-TANK	360 Winter	200	+0%	200/15 Summer				37.899
S1.006	S-JCT	15 Summer	200	+0%					37.375
S1.007	S5	360 Winter	200	+0%	200/15 Summer				37.973

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.075	0.000	0.19			29.2	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S2	0.131	0.000	0.24			36.7	SURCHARGED	
S1.002	S3	0.207	0.000	1.14			141.5	SURCHARGED	
S1.003	S4	0.163	0.000	1.15			142.9	SURCHARGED	
S1.004	S-JCT	0.000	0.000	1.97			140.6	SURCHARGED*	
S1.005	S-TANK	0.524	0.000	0.09			6.5	SURCHARGED*	
S1.006	S-JCT	0.000	0.000	0.04			3.8	SURCHARGED*	
S1.007	S5	0.873	0.000	0.12			3.0	SURCHARGED	

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 200, 500, 1000
Climate Change (%) 0, 0, 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	500	+0%	200/15 Summer				39.027
S1.001	S2	15 Winter	500	+0%	200/15 Summer				38.910
S1.002	S3	15 Winter	500	+0%	200/15 Summer				38.777
S1.003	S4	15 Winter	500	+0%	200/15 Summer				38.565
S1.004	S-JCT	15 Summer	500	+0%					38.175
S1.005	S-TANK	360 Winter	500	+0%	200/15 Summer				38.113
S1.006	S-JCT	15 Summer	500	+0%					37.375
S1.007	S5	360 Winter	500	+0%	200/15 Summer				38.185

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.352	0.000	0.25			38.2	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S2	0.385	0.000	0.31			47.0	SURCHARGED	
S1.002	S3	0.402	0.000	1.40			173.2	SURCHARGED	
S1.003	S4	0.290	0.000	1.41			174.1	SURCHARGED	
S1.004	S-JCT	0.000	0.000	2.39			170.5	SURCHARGED*	
S1.005	S-TANK	0.738	0.000	0.10			7.1	SURCHARGED*	
S1.006	S-JCT	0.000	0.000	0.04			4.1	SURCHARGED*	
S1.007	S5	1.085	0.000	0.13			3.3	SURCHARGED	

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1000 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 200, 500, 1000
Climate Change (%) 0, 0, 0

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	1000	+0%	200/15 Summer				39.250
S1.001	S2	15 Winter	1000	+0%	200/15 Summer				39.125
S1.002	S3	15 Winter	1000	+0%	200/15 Summer				38.985
S1.003	S4	15 Winter	1000	+0%	200/15 Summer				38.698
S1.004	S-JCT	15 Summer	1000	+0%					38.175
S1.005	S-TANK	360 Winter	1000	+0%	200/15 Summer				38.334
S1.006	S-JCT	15 Summer	1000	+0%					37.375
S1.007	S5	360 Winter	1000	+0%	200/15 Summer				38.399

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.575	0.000	0.28			42.5	FLOOD RISK	

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1000 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.001	S2	0.600	0.000	0.35			53.3	SURCHARGED	
S1.002	S3	0.610	0.000	1.63			202.0	SURCHARGED	
S1.003	S4	0.423	0.000	1.63			202.3	SURCHARGED	
S1.004	S-JCT	0.000	0.000	2.75			196.5	SURCHARGED*	
S1.005	S-TANK	0.959	0.000	0.11			7.4	SURCHARGED*	
S1.006	S-JCT	0.000	0.000	0.04			4.4	SURCHARGED*	
S1.007	S5	1.299	0.000	0.14			3.6	SURCHARGED	

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Exceedance Storm Calculations

(Zero net flow)

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	2	+0%	100/15 Summer			
S1.001	S2	15 Winter	2	+0%	100/15 Summer			
S1.002	S3	15 Winter	2	+0%	30/15 Summer	100/480 Winter		
S1.003	S4	15 Winter	2	+0%	30/15 Summer	100/480 Winter		
S1.004	S-JCT	15 Winter	2	+0%				
S1.005	S-TANK	1440 Winter	2	+0%	2/240 Winter			
S1.006	S-JCT	1440 Summer	2	+0%				
S1.007	S5	1440 Winter	2	+0%	2/15 Summer	100/480 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	38.367	-0.308	0.000	0.07			10.9	OK

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.001	S2	38.223	-0.302	0.000	0.08			12.5	OK
S1.002	S3	38.160	-0.215	0.000	0.38			46.4	OK
S1.003	S4	38.060	-0.215	0.000	0.38			46.7	OK
S1.004	S-JCT	38.020	-0.155	0.000	0.65			46.5	OK*
S1.005	S-TANK	37.623	0.248	0.000	0.04			2.6	SURCHARGED*
S1.006	S-JCT	37.375	0.000	0.000	0.02			1.6	SURCHARGED*
S1.007	S5	37.701	0.601	0.000	0.00			0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S1.002	S3	8
S1.003	S4	8
S1.004	S-JCT	
S1.005	S-TANK	8
S1.006	S-JCT	
S1.007	S5	8

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	15 Winter	30	+0%	100/15 Summer			
S1.001	S2	15 Winter	30	+0%	100/15 Summer			
S1.002	S3	15 Winter	30	+0%	30/15 Summer	100/480 Winter		
S1.003	S4	15 Winter	30	+0%	30/15 Summer	100/480 Winter		
S1.004	S-JCT	15 Summer	30	+0%				
S1.005	S-TANK	1440 Winter	30	+0%	2/240 Winter			
S1.006	S-JCT	1440 Summer	30	+0%				
S1.007	S5	1440 Winter	30	+0%	2/15 Summer	100/480 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	38.437	-0.238	0.000	0.13			19.7	OK

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.001	S2	38.426	-0.099	0.000	0.16			23.9	OK
S1.002	S3	38.407	0.032	0.000	0.71			87.6	SURCHARGED
S1.003	S4	38.295	0.020	0.000	0.70			86.3	SURCHARGED
S1.004	S-JCT	38.175	0.000	0.000	1.15			81.9	SURCHARGED*
S1.005	S-TANK	38.062	0.687	0.000	0.04			3.1	SURCHARGED*
S1.006	S-JCT	37.375	0.000	0.000	0.02			1.7	SURCHARGED*
S1.007	S5	38.142	1.042	0.000	0.00			0.0	SURCHARGED

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S1.002	S3	8
S1.003	S4	8
S1.004	S-JCT	
S1.005	S-TANK	8
S1.006	S-JCT	
S1.007	S5	8

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

Simulation Criteria

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

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.385
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.900 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 45

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	1440 Winter	100	+45%	100/15 Summer			
S1.001	S2	1440 Winter	100	+45%	100/15 Summer			
S1.002	S3	1440 Winter	100	+45%	30/15 Summer	100/480 Winter		
S1.003	S4	1440 Winter	100	+45%	30/15 Summer	100/480 Winter		
S1.004	S-JCT	15 Summer	100	+45%				
S1.005	S-TANK	1440 Winter	100	+45%	2/240 Winter			
S1.006	S-JCT	15 Summer	100	+45%				
S1.007	S5	1440 Winter	100	+45%	2/15 Summer	100/480 Winter		

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.000	S1	39.482	0.807	0.000	0.01			1.9	FLOOD RISK

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status
S1.001	S2	39.482	0.957	0.000	0.01			2.2	FLOOD RISK
S1.002	S3	39.482	1.107	36.988	0.07			9.1	FLOOD
S1.003	S4	39.483	1.208	37.553	0.13			16.3	FLOOD
S1.004	S-JCT	38.175	0.000	0.000	2.44			174.4	SURCHARGED*
S1.005	S-TANK	39.565	2.190	0.000	0.15			10.3	FLOOD
S1.006	S-JCT	37.375	0.000	0.000	0.02			2.4	SURCHARGED*
S1.007	S5	39.570	2.470	0.088	0.00			0.0	FLOOD

PN	US/MH Name	Level Exceeded
S1.000	S1	
S1.001	S2	
S1.002	S3	8
S1.003	S4	8
S1.004	S-JCT	
S1.005	S-TANK	8
S1.006	S-JCT	
S1.007	S5	8

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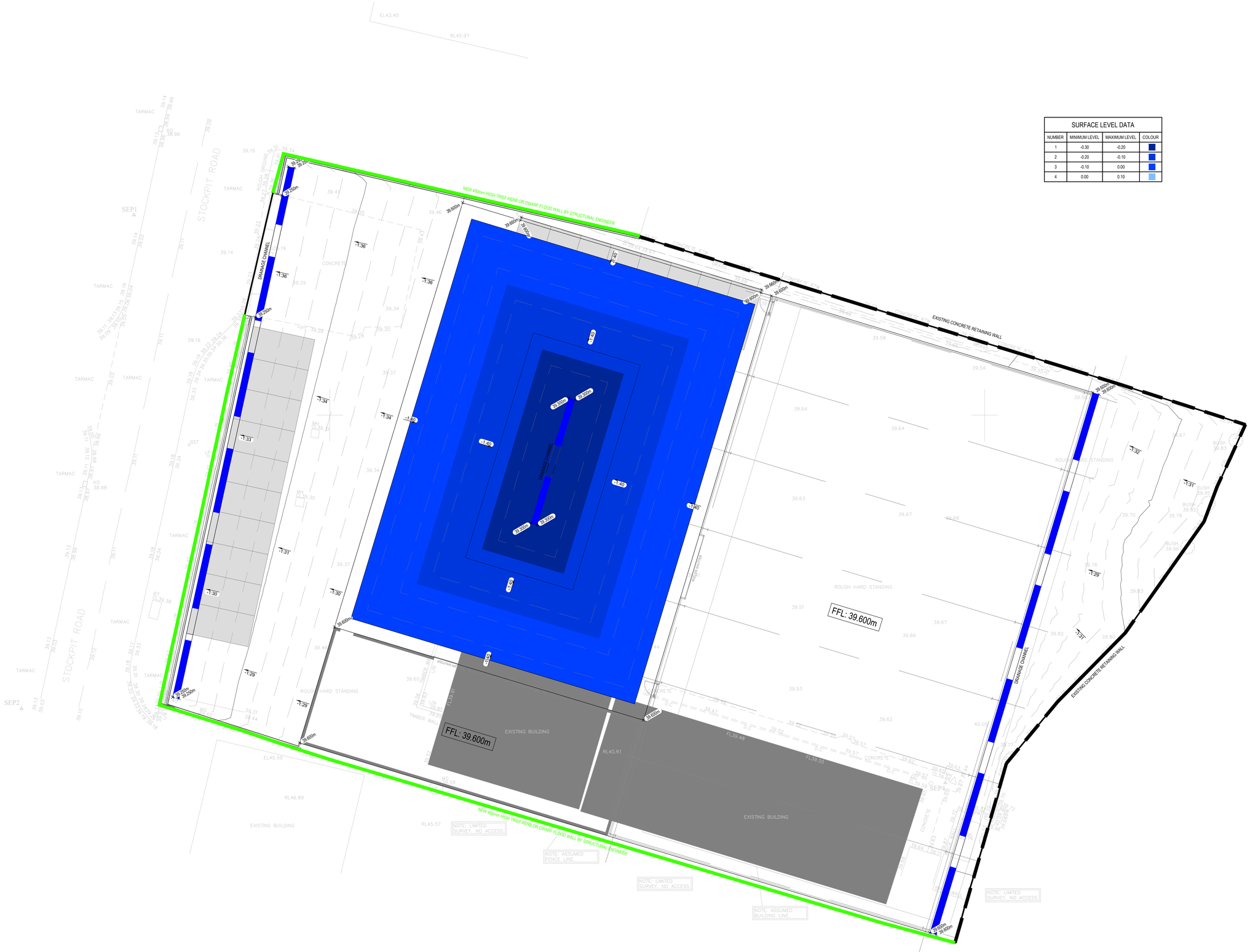


SURFACE LEVEL DATA

NUMBER	MINIMUM LEVEL	MAXIMUM LEVEL	COLOUR
1	-0.30	-0.20	
2	-0.20	-0.10	
3	-0.10	0.00	
4	0.00	0.10	

Hydrobrake Characteristics & Specification

Technical Specification

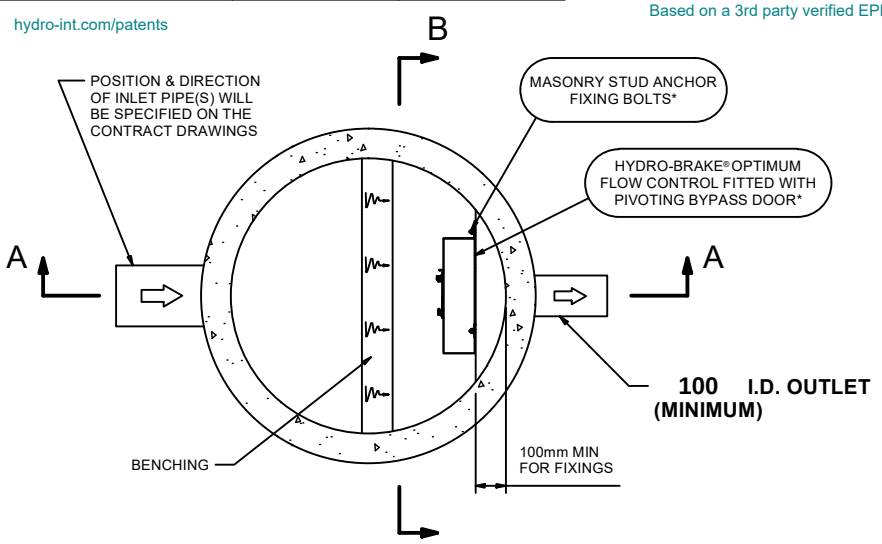
Control Point	Head (m)	Flow (l/s)
Primary Design	1.200	3.400
Flush-Flo™	0.363	3.400
Kick-Flo®	0.743	2.727
Mean Flow		2.986

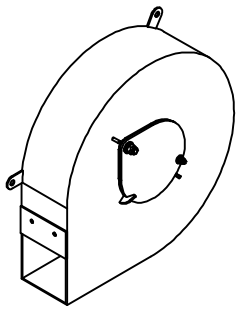
This Hydro-Brake® Optimum includes:

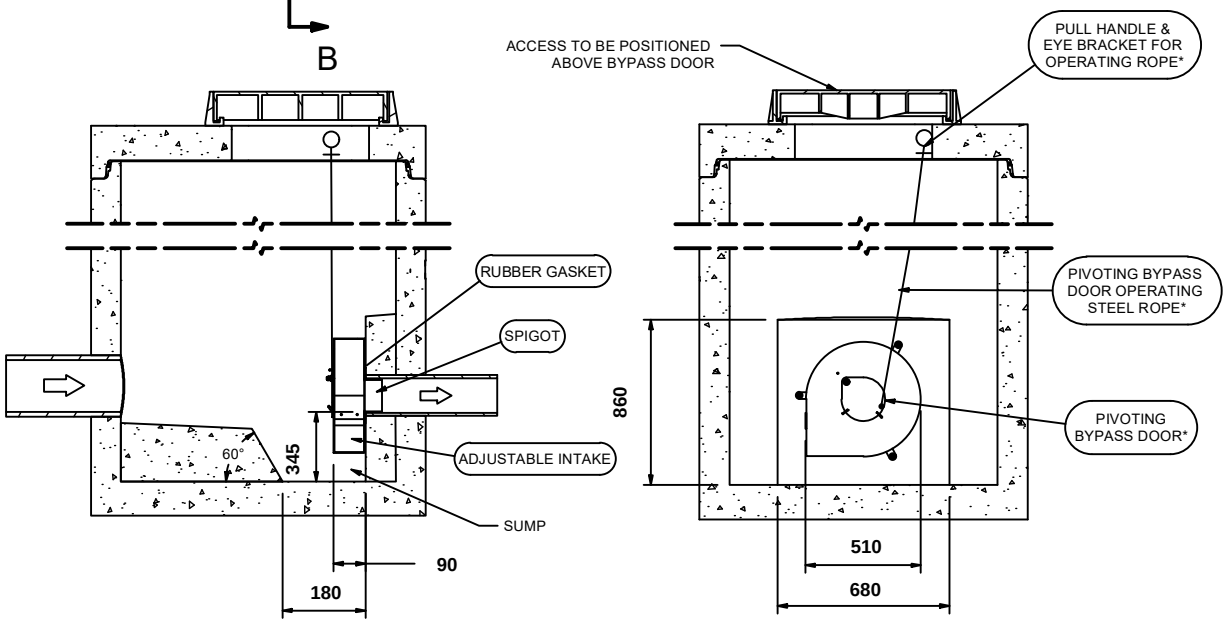
- All in 3 mm Grade 304L stainless steel
- Integral pivoting by-pass door allowing clear line of sight through to outlet, c/w operating rope
- Media blasted for corrosion resistance
- Variable flow rate post installation via adjustable inlet (if necessary)
- Indicative Weight: 15 kg
- Product Carbon Footprint: 59.62 kgCO2e

Based on a 3rd party verified EPD: hydro-int.com/epd

hydro-int.com/patents







SECTION A-A

SECTION B-B

IMPORTANT: (oval) 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® IS A REGISTERED TRADEMARK 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-0085-3400-1200-3400 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.

DATE	28/04/2025 13:55
SITE	Phoenix House
DESIGNER	Dan Baker
REF	1074

SHE-0085-3400-1200-3400
Hydro-Brake® Optimum

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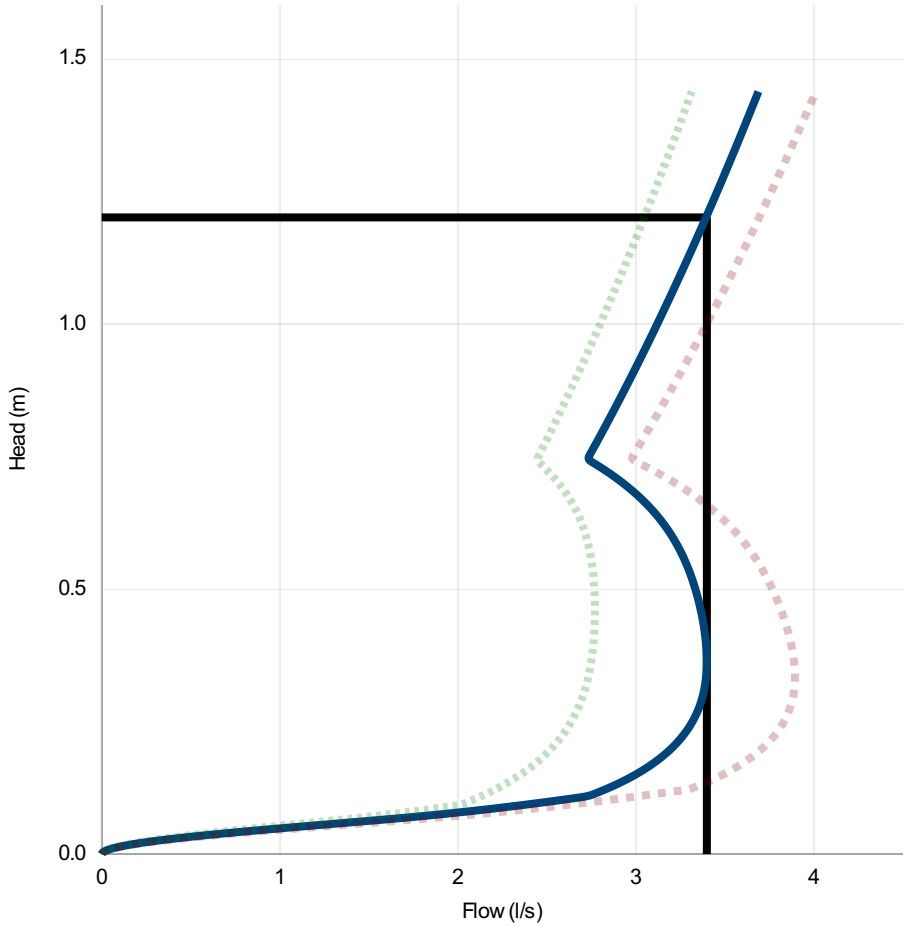
daniel.baker@wmlconsulting.com

Technical Specification

	Original Setting		Minimum Setting		Maximum Setting	
Control Point	**Head (m)**	**Flow (l/s)**	**Head (m)**	**Flow (l/s)**	**Head (m)**	**Flow (l/s)**
Primary Design	1.200	3.400	1.200	3.049	1.200	3.695
Flush-Flo™	0.363	3.400	0.461	2.771	0.335	3.895
Kick-Flo®	0.743	2.727	0.741	2.441	0.743	2.972
Mean Flow		2.986		2.546		3.332

hydro-int.com/patents



Head (m)	Flow (l/s)
0.000	0.000
0.041	0.761
0.083	2.120
0.124	2.844
0.166	3.075
0.207	3.224
0.248	3.317
0.290	3.370
0.331	3.395
0.372	3.399
0.414	3.389
0.455	3.369
0.497	3.338
0.538	3.296
0.579	3.239
0.621	3.161
0.662	3.055
0.703	2.912
0.745	2.736
0.786	2.797
0.828	2.864
0.869	2.928
0.910	2.991
0.952	3.053
0.993	3.113
1.034	3.171
1.076	3.229
1.117	3.285
1.159	3.341
1.200	3.395

DESIGN ADVICE

The head/flow characteristics of this SHE-0085-3400-1200-3400 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.

DATE	28/04/2025 13:55
Site	Phoenix House
DESIGNER	Dan Baker
Ref	1074

SHE-0085-3400-1200-3400

Hydro-Brake® Optimum

© 2024 Hydro International, Rivermead Court, Kenn Business Park, Windmill Road, Kenn, Clevedon, BS21 6FT. Tel 01275 878371 Fax 01275 874979 Web www.hydro-int.com Email designtools@hydro-int.com

Appendix 7 – Maintenance Plan

Maintenance of the below ground drainage system

1. It is understood that the proposed drainage system is to be the sole responsibility of the client or their management team / company and no part will be offered up for adoption to United Utilities.

2. The below ground foul and surface water drainage proposals indicated are relatively traditional in nature, and should provide years of relatively low maintenance operation in relation to the anticipated lifespan of the proposed development.

3. In line with current good practice: -

   - **Drainage troughs / channels.** These should be inspected and / or cleaned out at 6 monthly intervals or following heavy storms that may wash detritus into them. Any problems highlighted by these inspections will need to be investigated to confirm the nature of the problem and to allow it to be remedied in a timely manner.

   - **Inspection chambers, manholes, catchpits, etc.** These should be inspected at 6 monthly intervals or following heavy storms to ensure that the pipework associated with them is running freely. Any problems highlighted by these inspections will need to be investigated, possibly by CCTV survey, to confirm the nature of the problem and to allow it to be remedied in a timely manner.

   - **Hydrobrake flow control.** It has been necessary to incorporate 1No. Hydrobrake flow control device as part of the proposed surface water design. It should be inspected at 6 monthly intervals or following heavy storms to ensure that the pipework associated with it is running freely. Any problems highlighted by these inspections will need to be investigated, possibly by CCTV survey, to confirm the nature of the problem and to allow it to be remedied in a timely manner.

     The flow control manufacturer, Hydro International, provides a cleaning, maintenance and repair services for the hydrobrake that includes; scheduled cleaning, emergency breakdown assistance, on-site repairs, equipment strip-down, planned maintenance & planned spares replacements. Should this be of interest to the occupier, the contact information for Hydro International can be found below;

     Hydro International
     Unit 2 Rivermead Court,
     Kenn Business Park,
     Clevedon,
     BS21 6FT
     +44 (0)1275 878371
     enquiries@hydro-int.com

   - **Polystorm Cellular Attenuation System.** It has been necessary to incorporate 1No. cellular attenuation system in order to store surface water runoff until it can be released at the pre-development runoff rate.

     The crate system should be inspected every 6 months initially via CCTV survey to determine the amount of debris/sediment likely to accumulate within the system. Where suitable, the maintenance schedule can then be relaxed to annual inspections and the system cleaned with high-pressure water jetting to remove any debris/sediment that may have been transferred to the tank.

- **Downstream Defender 1.2m Vortex.** A downstream defender unit has been incorporated within the drainage system to capture a range of pollutants and prevent them being discharged to the public surface water system.

  The frequency of cleanout is determined after installation. It is recommended that during the first year of operation the unit should be inspected every 6 months to determine the rate of sediment and floatable accumulation. The maintenance schedule can then be adjusted as required to suit the performance of the unit.

  Maintenance events include the inspection, oil and floatable removal and sediment removal which should be logged and the record kept securely on site at all times.

  An Operational and Maintenance Manual provided by the supplier which includes a Maintenance Log Sheet has been appended to this document.

- **Klargester Full Retention Separator NSFA065.** It has been necessary to incorporate a separator unit to remove pollutants from captured surface water runoff prior to discharge from the site.

  Separated light liquids must be removed from the separator when the oil capacity has been reached. The optional oil level alarm system gives warning when the separated liquid/water interface level reached 90% of the maximum recommended oil storage volume.

  It is recommended that the operator is not solely reliant on the oil level alarm to prompt maintenance, instead separators should be inspected at least every 3- 6 months during the first year of operation and then the maintenance schedule adjusted accordingly as the operational experience dictates.

  If the oil level alarm is triggered then the oil should be removed immediately along with any accumulated silt at the same time.

  Separator waste is a "special waste" under the terms of The Waste Management Code of Practice. The Code imposes a duty of care on the waste producer to ensure that the cleansing contractor is registered with the Environment Agency and that the final disposal of the waste is to a licensed facility.

  It is recommended that consideration be given to the purchase of a maintenance service, from a competent installer, which includes bi-annual inspections, removal of oil and silt, cleaning of the alarm probe and cleaning or replacement of the coalescer media (where appropriate).

  An Operational and Maintenance Manual provided by the supplier which includes a Maintenance Log Sheet has been appended to this document.

- **Emergencies.** At sites where there is a high risk of spillage, spill kits containing drain seals, absorbent materials, disposal containers and other appropriate equipment should be held. In the event of a spillage on site, the material should be contained, (if a spill kit is not available, sand or soil may be used) and the Environment Agency notified immediately using the appropriate emergency hotline number listed in the Agency Guideline PPG3. Year 2012 – 0800 80 70 60

4. It is anticipated that the majority of the maintenance of the below ground drainage system will be carried out by the site owner's management team / company. Though it may be necessary to involve a specialist drainage maintenance company also as and when needed.

Appendix 1 – Downstream Defender

Operations and Maintenance Manual

Operation and Maintenance Manual

Downstream Defender® hydrodynamic separator with 5mm Screen

Vortex Separator for Stormwater Treatment

Turning Water Around ...®

Table of Contents

3 **Downstream Defender® by Hydro International**
- **Benefits of the Downstream Defender®**
- **Applications**
- **Downstream Defender® Components**

4 **Operation**
- **Introduction**
- **Pollutant Capture and Retention**
- **Wet Sump**
- **Blockage Protection**

4 **Maintenance**
- **Overview**
- **Determining You Maintenance Schedule**

5 **Maintenance Procedures**
- **Inspection**
- **Floatables and Sediment Cleanout**

8 **Downstream Defender® Installation Log**

9 **Downstream Defender® Inspection and Maintenance Log**

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DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's Downstream Defender®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc have a policy of continuous product development and reserve the right to amend specifications without notice.

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Downstream Defender® by Hydro International

The Downstream Defender® is an advanced Hydrodynamic Vortex Separator designed to provide high removal efficiencies of settleable solids and their associated pollutants, oil, and floatables over a wide range of flow rates.

The Downstream Defender® has unique, flow-modifying internal components developed from extensive full-scale testing, CFD modeling and over thirty years of hydrodynamic separation experience in wastewater, combined sewer and stormwater applications. These internal components distinguish the Downstream Defender® from simple swirl-type devices and conventional oil/grit separators by minimizing turbulence and headlosses, enhancing separation, and preventing washout of previously stored pollutants.

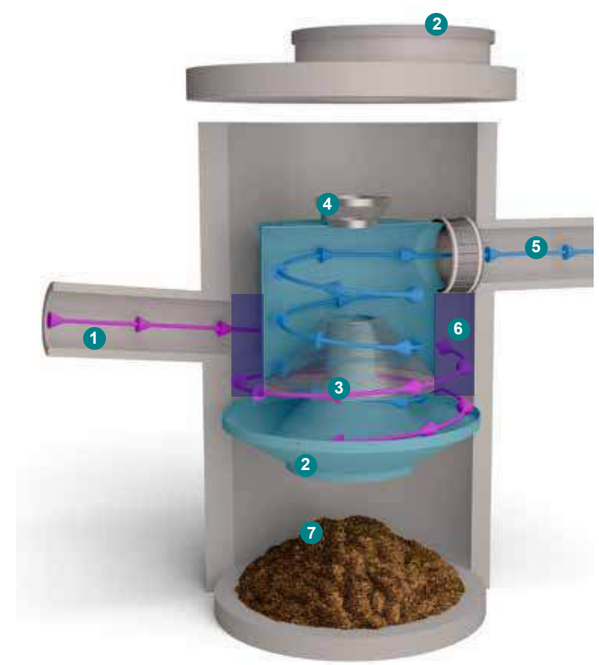
The high removal efficiencies and inherent low headlosses of the Downstream Defender® allow for a small footprint making it a compact and economical solution for the treatment of non-point source pollution.

Benefits of the Downstream Defender®

- Removes sediment, floatables, oil and grease
- No pollutant washouts
- Small footprint
- No loss of treatment capacity between clean-outs
- Low headloss
- Efficient over a wide ranges of flows
- Easy to install
- Low maintenance

Applications

- New developments and retrofits
- Utility yards
- Streets and roadways
- Parking lots
- Pre-treatment for filters, infiltration and storage
- Industrial and commercial facilities
- Wetlands protection



Downstream Defender® Components

1. Tangential inlet
2. Benching skirt
3. Bypass Screen
4. Inline Screen
5. Outlet Pipe
6. Floatables Storage
7. Isolated Sediment Storage Zone

Hydro Maintenance Services

Hydro International has been engineering stormwater treatment systems for over 30 years. We understand the mechanics of removing pollutants from stormwater and how to keep systems running at an optimal level.

Nobody Knows our Systems Better than we do

Avoid Service Negligence

Sanitation services providers not intimately familiar with stormwater treatment systems are at risk of the following:

- Inadvertently breaking parts or failing to clean/replace system components appropriately.
- Charging you for more frequent maintenance because they lacked the tools to service your system properly in the first place.
- Billing you for replacement parts that might have been covered under your Hydro warranty plan
- Charging for maintenance that may not yet have been required.

Leave the Dirty Work to us

Trash, sediment and polluted water is stored inside treatment systems until they are removed by our team with a vactor truck. Sometimes teams must physically enter the system chambers in order to prepare the system for maintenance and install any replacement parts. Services include but are not limited to:

- Solids removal
- Removal of liquid pollutants
- Replacement media installation (when applicable)

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Downstream Defender® Operation and Maintenance Manual

Better Tools, Better Results

Not all vactor trucks are created equal. Appropriate tools and suction power are needed to service stormwater systems appropriately. Companies who don't specialize in stormwater treatment won't have the tools to properly clean systems or install new parts.

Service Warranty

Make sure you're not paying for service that is covered under your warranty plan. Only Hydro International's service teams can identify tune-ups that should be on us, not you.

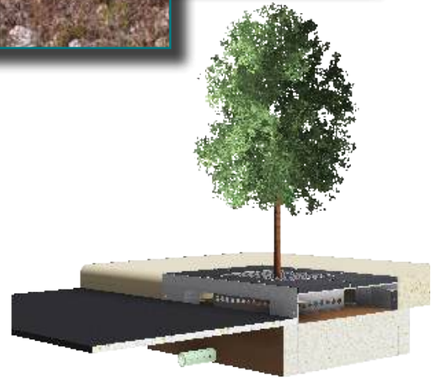
Treatment Systems Serviced by Hydro:

- Stormwwater filters
- Stormwater separators
- Baffle boxes
- Biofilters/biorention systems
- Storage structures
- Catch basins
- Stormwater ponds
- Permeable pavement

SAVE TIME & MONEY: CALL HYDRO FOR A QUOTE

1 (888) 382-7808

LEARN MORE AT HYDRO-INT.COM/SERVICE



Operation

Introduction

The Downstream Defender® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The Downstream Defender® has been designed to allow for easy and safe access for inspection/monitoring and clean-out procedures. Entry into the unit or removal of the internal components is not necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the Downstream Defender® have been designed to protect the oil, floatables and sediment storage volumes so that separator performance is not reduced as pollutants accumulate between clean-outs. Additionally, the Downstream Defender® is designed and installed into the storm drain system so that the vessel remains wet between storm events. Oil and floatables are stored on the water surface in the outer annulus separate from the sediment storage volume in the sump of the unit providing the option for separate oil disposal, and accessories such as adsorbant pads. Since the oil/floatables and sediment storage volumes are isolated from the active separation region, the potential for re-suspension and washout of stored pollutants between clean-outs is minimized.

Wet Sump

The sump of the Downstream Defender® retains a standing water level between storm events. The water in the sump prevents stored sediment from solidifying in the base of the unit. The clean-out procedure becomes more difficult and labor intensive if the system allows fine sediment to dry-out and consolidate. Dried sediment must be manually removed by maintenance crews. This is a labor intensive operation in a hazardous environment.

Maintenance

Overview

The Downstream Defender® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the Downstream Defender®. The Downstream Defender® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the Downstream Defender® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

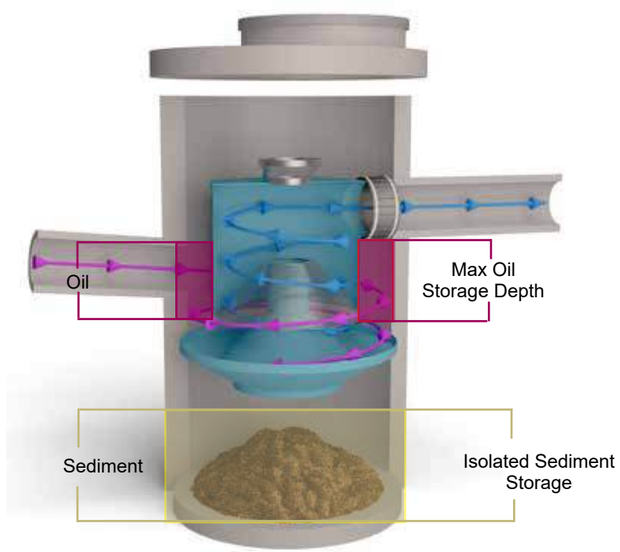


Fig.1 Pollutant storage volumes of the Downswtream Defender®.

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The Downstream Defender® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole. On the 6-ft, 8-ft and 10-ft units, the floatables access port is above the outlet pipe between the concrete manhole wall and the dip plate. The sediment removal access ports for all Downstream Defender® models are located directly over the bypass screen.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the Downstream Defender®, nor do they require the internal components of the Downstream Defender® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Determining Your Maintenance Schedule

The frequency of cleanout is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil/flotables removal, for a 6-ft Downstream Defender® typically takes less than 30 minutes and removes a combined water/oil volume of about 500 gallons.

Inspection Procedures

Inspection is a simple process that does not involve entry into the Downstream Defender®. Maintenance crews should be familiar with the Downstream Defender® and its components prior to inspection.

Scheduling

- It is important to inspect your Downstream Defender® every six months during the first year of operation to determine your site-specific rate of pollutant accumulation
- Typically, inspection may be conducted during any season of the year
- Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1

Recommended Equipment

- Safety Equipment and Personal Protective Equipment (traffic cones, work gloves, etc.)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net
- Sediment probe (such as a Sludge Judge®)
- Trash bag for removed floatables

Table 1. Downstream Defender® Pollutant Storage Capacities and Max. Cleanout Depths.

Unit Diameter	Total Oil Storage	Oil Clean-out Depth	Total Sediment Storage	Sediment Clean-out Depth	Max. Liquid Volume Removed
(feet)	(gallons)	(inches)	(gallons)	(inches)	(gallons)
4	70	<16	141	<18	384
6	216	<23	424	<24	1,239
8	540	<33	939	<30	2,884
10	1,050	<42	1,757	<36	5,546
12	1,770	<49	2,970	<42	9,460

NOTES

1. Refer to Dowmstream Defender® Clean-out Detail (Fig. 1) for measurement of depths.

2. Oil accumulation is typically less than sediment, however, removal of oil and sediment during the same service is recommended.

3. Remove floatables first, then remove sediment storage volume.

4. Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.

Fig.4

Fig.5

Fig.6

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the lids to the manhole (Fig. 4). NOTE: The 4-ft Downstream Defender® will only have one lid.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. See Fig.7 and 8 for typical inspection views.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the outer annulus of the chamber.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel (Fig.5).

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Cleanout

Floatables cleanout is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.6).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump cleanout are typically conducted once a year during any season.
- If sediment depths are greater than 75% of maximum clean-out depths stated in Table 1, sediment removal is required.
- Floatables and sump cleanout should occur as soon as possible following a spill in the contributing drainage area.

Fig.7 View over center shaft into sediment storage zone.

Fig.8 View of outer annulus of floatables and oil collection zone.

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Recommended Equipment

- Safety Equipment (traffic cones, etc)
- Crow bar or other tool to remove grate or lid
- Pole with skimmer or net (if only floatables are being removed)
- Sediment probe (such as a Sludge Judge®)
- Vactor truck (6-inch flexible hose recommended)
- Downstream Defender® Maintenance Log

1. Set up any necessary safety equipment around the access port or grate of the Downstream Defender® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the lid to the manhole (NOTE: The 6-ft, 8-ft, 10-ft and 12-ft Downstream Defender® will have 2 lids).

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Using the Floatables Port for access, remove oil and floatables stored on the surface of the water with the vactor hose or the skimmer net (Fig.9).

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (Pg.9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump via the Central Access Port. Vactor out the sediment and gross debris off the sump floor (Fig.6).

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

9. Securely replace the grate or lid.

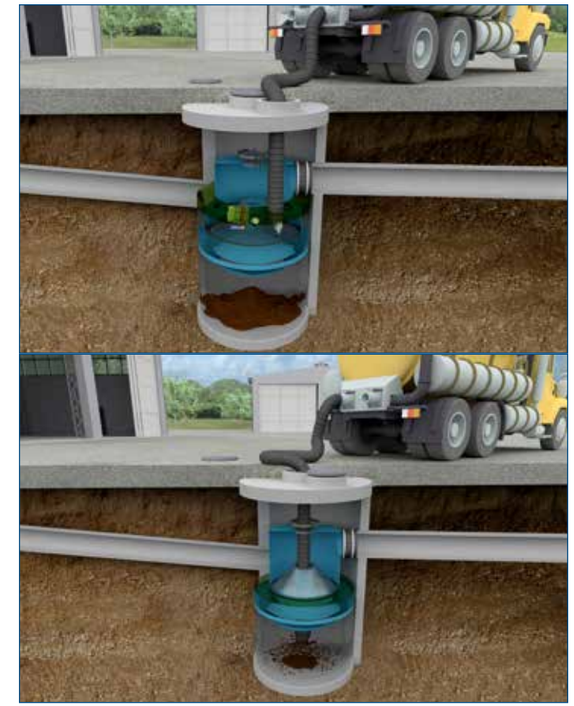

Fig.9 Floatables and sediment are removed with a vactor hose

Maintenance at a Glance

Activity	Frequency
Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most cleanouts it is not necessary to remove the entire volume of liquid in the vessel. Only removing the first few inches of oils/floatables and the sediment storage volume is required.	

Downstream Defender® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL (CIRCLE ONE): **4-FT** **6-FT** **8-FT** **10-FT** **CUSTOM**

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Downstream Defender® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment * Depth Measured	Volume of Sediment Removed	Site Activity and Comments

*Note: Sediment removal is not required unless sediment depths exceed 75% of maximum clean-out depths stated in Table 1.

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Notes

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Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®

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Appendix 2 – Klargester Separator NSFA065

Operations and Maintenance Manual

011259

NSFA020 – NSFA065 Full Retention Separators Installation & Maintenance Guidelines

Kingspan Environmental Service Contact Numbers:

GB: 0844 846 0500

NI: 028 3025 4077

IRL: 048 3025 4077

Enclosed Documents

DS0911P	**NSFA020 – NSFA065 Full Retention Separators Sales Drawing**
DS0859P	**Neck & Coalescer Extension Details**
PD0323	**Oil Probe Fitting Details**

Issue	Description	Date
04	CC1425 – Class 2 References Deleted	April 2018

HEALTH & SAFETY

These warnings are provided in the interest of safety. You must read them carefully before installing or using the equipment.
It is important that this document is retained with the equipment for future reference. Should the equipment be transferred to a new owner, always ensure that all relevant documents are supplied in order that the new owner can be acquainted with the functioning of the equipment and the relevant warnings.

Installation should only be carried out by a suitably experienced contractor, following these guidelines.

We recommend the use of a dust mask and gloves when cutting GRP components.

Electrical work should be carried out by a qualified electrician.

Contaminated surface water can contain substances harmful to human health. Any person carrying out maintenance on the equipment should wear suitable protective clothing, including gloves. Good hygiene practice should also be observed.

Access covers should be selected with reference to the location of the unit and traffic loads to be accommodated. These are not (normally) part of the Separator supply.

When covers are removed precautions must be taken against personnel falling into the unit.

Should you wish to inspect the operation of the equipment, please observe all necessary precautions, including those listed below, which apply to maintenance procedures.

Ensure that you are familiar with the safe working areas and accesses. Ensure that the working area is adequately lit.

Take care to maintain correct posture, particularly when lifting. Use appropriate lifting equipment when necessary. Keep proper footing and balance at all times. Avoid any sharp edges.

OIL ALARM SYSTEMS

PPG3 recommends that that the oil level alarm be fitted, tested and commissioned by a competent Installer. This is to ensure that the oil probe is calibrated correctly, raising an alarm when 90% of the oil storage volume is reached. Should the oil level alarm fail to provide an early warning, excessive oil could pass through the separator, thus polluting the environment. This could result in substantial cleanup costs and legal action being taken under the water resources act 1991.

MAINTENANCE

The correct ongoing maintenance is essential for the proper operation of the equipment. Operators who rely on oil level alarms to prompt them to service separators between maintenance intervals run the risk of polluting, should the alarms not work, hence the ongoing functional assessment of the oil alarm systems is fundamental if pollution incidents are to be avoided.

The removal of sediment and retained oil/grease should be carried out by a contractor holding the relevant permits to transport and dispose of such waste. The contractor must refer to the guidelines in this document.

CE

Kingspan Environmental
College Road North
Aston Clinton
Aylesbury
Buckinghamshire
HP22 5EW

10

EN 858 : Separator systems for light liquids

GRP Glass Reinforced Plastic Tank

Full Retention Separators NS003 - NS200

Class 1 & 2

Watertightness	Passed
Structural Testing	Passed
Hydraulic efficency	Passed

CONTENTS

Page

Health & Safety 2

1. Introduction 4
2. Handling & Storage 4
3. Site Planning 4
4. Installation - General 5
   Concrete Specification 6
5. Separator Installation 6
6. Alarm Installation 7
7. Operation 8
8. Maintenance 8
9. Emergencies 10

Appendices

Separator Maintenance Log

1.0 Introduction

These Guidelines represent Best Practice for the installation of the above Full Retention Separator Units. Many years of specialist experience has led to the successful installation of thousands of separator units. It must be noted, however, that these Guidelines are necessarily of a general nature. It is the responsibility of others to verify that they are appropriate for the specific ground conditions and in-service loads of each installation. Similarly, a qualified specialist (e.g. Civil engineering consultant) must verify any information or advice given by employees or agents of the company regarding the design of an installation.

For guidance of Separator selection and application, please refer to the most recent issue of Environment Agency Guidelines No.3 (PPG3) and BS EN 858. Our Units have been independently tested by BSI and are certified as meeting the standards.

2.0 Handling & Storage

2.1. Care must be taken to ensure that units are not damaged during delivery and handling on site. Please take care and place unit so that it can not fall and become damaged.

2.2. The design requirements of our products will frequently mean that the centre of gravity of the unit is "offset". Care must therefore be taken to ensure that the unit is stable when lifting. Rainwater may also collect inside units, particularly if they have been stored on site prior to installation, adding weight and increasing instability. Check units before lifting and pump out any excess water.

2.3. When lifting units, use webbing slings of a suitable specification. Do not use chains.

2.4. A suitable spreader bar should be used to ensure that units are stable and that loads are evenly distributed during lifting. When lifting separators, a spreader bar should be used where the slings would otherwise be at an angle > 30 degrees to the vertical.

2.5. Lifting equipment should be selected by taking into account the unit weight, length and the distance of lift required on site.

2.6. We accept no responsibility for the selection of lifting equipment.

2.7. Whenever our units are stored or moved on site, ensure that the storage location is free of rock, debris and any sharp objects, which may damage the unit. The units must be placed on ground, which is flat and level to evenly support the base of the unit. Do not roll separators.

3.0 Site Planning

The following points should be considered before installation of the equipment:

3.1. The discharge must have the consent of the relevant Environmental Regulator.

3.2. The installation should have Planning and Building Control approval.

3.3. Consider installing flow cut-off valves to isolate the separator in an emergency or during site cleaning operations. See Environment Agency Guidelines PPG3.

3.4. We will fit a tube to receive the alarm probe. This tube provides protection and ensures that the probe is positioned at the correct level to sense the oil build up. The tube design and probe level setting assumes the use of our standard oil alarm system and may not be suitable for other alarm supplier's equipment. The probe tube may be fitted either within the neck or within the body of the unit. It should be extended to ground level when fitted in the body of the tank and you should make provision to extend the tube to the required height before backfilling. Consult the alarm supplier's instructions for their detailed fitting installation instructions.

3.5. Consider venting of the unit. Comply with local regulations. In the UK, comply with the following regulations, for Petrol Stations: Health and Safety Guidance Note 41 (HS(G)41), for other applications: BS8301: 1985 (obsolescent) BS EN 752 Building Drainage. Adequate ventilation should be provided to the separator. The ventilation pipe should be as short as is practicable and be terminated not less than 2.5m above paving nor less than 1m above the head of an openable window or other opening into a building within a horizontal distance of 3m. Each neck should be vented independently, we advise against joining these below ground prior to their rising as vent stacks.

3.6. Uncontaminated run off such as roof water should be excluded from separators. (EA Guidelines PPG3.)

3.7. Consider installation of a sampling point downstream of the separator as there is no suitable facility to effectively sample the waste water from inside the unit. (Suggested in EN 858 Pt 1).

3.8. Ground conditions and water table level should be assessed. If the water table will be above the base of the units at any time of the year, adequate concrete backfill must be provided to avoid flotation. In poorly draining ground, consideration should also be given to the likelihood of flotation due to surface water collecting in the backfill, and an appropriate installation method devised to avoid this.

3.9. If the discharge is to a soakaway, a porosity test should be carried out as part of the assessment of suitability for sub-soil drainage.

3.10. The separator must be installed at a level that will allow connection to the incoming drain and a free discharge at the system outlet.

3.11. Do not install the unit deeper than necessary, if required, ensure that you purchase extension necks and coalescer extension chains. The minimum invert depth of the unit is shown on the customer drawing.

3.12. Adequate access must be provided for routine maintenance. Vehicles should not be permitted within a distance equal to the depth of the unit, unless suitable structural protection is provided to the installation.

3.13. There must be at least 1 metre of clear, level ground all around the access covers to allow for routine maintenance.

3.14. It is essential that a mains water supply is accessible for routine cleansing and refilling after removal of waste material and liquid.

3.15. Provide electrical supply for alarm system.

3.16. Installation should only be carried out by suitably qualified and experienced contractors in accordance with current Health and Safety Regulations. Electrical work should be carried out by a qualified electrician, working to the latest edition of IEE wiring regulations.

3.17. This unit is designed to operate with gravity in and out flows. The unit is not designed to operate with a pumped influent.

4.0 Installation – General

4.1. When units are installed in unstable ground conditions where movement of the surrounding material and/or unit may occur, the connecting pipework should be designed to minimise the risk of damage from differential movement of the unit(s) and/or surrounding material.

4.2. For separators with burial depths greater than 1000mm from cover level to the top of the unit, specific site conditions should be taken into consideration and the backfill designed to bear any loads which may be applied during and after installation to prevent the tank being subjected to these loads.

4.3. The excavation must be deep enough to provide bedding and cover depth as determined by the type of surface pavement and loading. Asphalt and concrete pads should extend a minimum of 300mm horizontally beyond the unit in all directions.

4.4. In situations where the excavation will not maintain a vertical wall, it will be necessary to shore up the side walls of the excavation with suitable trench sheets and bracing systems to maintain a vertical wall from the bottom to the top of the excavation. DO NOT completely remove the shoring system until the backfilling is complete, but before the concrete fully hardens.

4.5. In areas where the water table is above the bottom of the excavation and/or the excavation is liable to flood, the excavation should be dewatered using suitable pumping equipment and this should continue until the installation is complete.

4.6. During installation care must be taken to ensure that the body of any unit is uniformly supported so that point loads through the unit are avoided.

4.7. The Concrete Specification is not a site specific installation design.

GENERAL CONCRETE SPECIFICATION IN ACCORDANCE WITH BS EN 206-1 (BS 8500-1)		
TYPE OF MIX		(DC) DESIGN
PERMITTED TYPE OF CEMENT		BS 12 (OPC): BS 12 (RHPC): BS 4027 (SRPC)
PERMITTED TYPE OF AGGREGATE (coarse & fine)		BS 882
NOMINAL MAXIMUM SIZE OF AGGREGATE		20 mm
GRADES: C25 /30 C25 /30 C16 /20		REINFORCED & ABOVE GROUND WITH HOLDING DOWN BOLTS REINFORCED (EG. FOR HIGH WATER TABLE) UNREINFORCED (NORMAL CONDITIONS)
MINIMUM CEMENT CONTENT	C30 C20	270 - 280 Kg/M^3 220 - 230 Kg/M^3
SLUMP CLASS		S1 (25mm)
RATE OF SAMPLING		READY MIX CONCRETE SHOULD BE SUPPLIED COMPLETE WITH APPROPRIATE DELIVERY TICKET IN ACCORDANCE WITH BS EN 12350-1
NOTE: STANDARD MIXES SHOULD NOT BE USED WHERE SULPHATES OR OTHER AGGRESSIVE CHEMICALS EXIST IN GROUND WATER		

5.0 Separator Installation

5.1. Excavate a hole of sufficient length and width to accommodate the tank and a minimum 300mm concrete surround and to a depth that allows for the burial depth of the unit plus concrete base slab.

5.2. Construct a suitable concrete base slab appropriate to site conditions. Ensure that the slab is flat and level.

5.3. When the concrete base slab has set enough to support the installed load, add a concrete haunch so as to provide even support under the unit, and then lower the unit onto the haunch using suitable webbing slings and lifting equipment.

5.4. Locate the float valve in the coalescer unit(s). Lift float valve and secure in the open position before filling and release when full. If the valve is not lifted during filling, it may ”seat”. The valve is fitted with cord to aid lifting. Add cord if extending the invert and fasten end to a convenient point.

5.5. Pour no more than 300mm depth of clean water into the unit, avoiding shock loads. For units with more than one chamber, add water to each chamber simultaneously. DO NOT OVERFILL, the unit is not designed to hold water whilst unsupported. FILL THROUGH OUTLET AS WELL AS INLET.

5.6. Place concrete backfill to approximately 300mm depth under and to the sides of the tank ensuring good compaction to remove voids. DO NOT use vibrating pokers. Continue adding concrete backfill, simultaneously keeping the internal water level no more than 200mm above the backfill level at all times, until the backfill is just below the underside of the outlet drain, giving sufficient room to connect the inlet and outlet pipework.

5.7. Connect inlet and outlet drains and vent pipes when safe access to the backfill can be gained.

PIPEWORK CONNECTIONS

In all cases, ensure that the outlet pipework level is maintained for correct operation. (Unless specified on the order, the fall across the unit will be as per the customer drawings). Small units are generally fitted with **PVCu spigots** to both the outlet and the inlet. Connect using the same size PVCu socket or a suitable reducer. Larger units are generally fitted with our own **GRP** manufactured sockets. The connecting pipework should be pushed into the socket and a joint made to fill in the gap using rope/hemp with a cement mortar or bonding mix. Ensure that the seal is secure and watertight before backfilling the pipe. Alternatively, proprietary **flex seal couplings** can be obtained to fit over the outside of the site pipework and the outside of the GRP socket. When using this connection method, please be aware that the outside GRP laminate is not perfectly regular and that you may need to use a sealant on the outside diameter of the GRP. Take care not to over tighten the coupling when connecting to the GRP and ensure that the seal is secure before backfilling the pipe. Drawing DS0185 provides the ID of our GRP sockets. The OD is variable, as the wall thickness can be up to 15-20 mm. If purchasing a flex seal coupling for use with clay/concrete, we suggest that a size 110 mm larger than the ID is selected.

5.8. Oil Level Alarm Neck fitting

We will fit a tube to receive the oil alarm probe. This provides protection and ensures that the probe is positioned at the correct level to sense oil build up. See alarm supplier information and ensure that the probe is placed within the tube and can be accessed from ground level.

Continue backfilling with concrete over the tank body to the required level. Build up a shell of concrete, minimum 225mm thick, around the access shaft(s). Temporarily strut the access shaft to avoid distortion.

5.9. Where we supply an extension shaft to meet a deeper invert requirement, a coalescer extension chain is also provided when needed. Remove the coalescer from the unit before adding the extension shaft(s). It is advisable to seal the joints on the extension shafts (particularly on sites with high ground water) with proprietary sealant or by GRP lamination (if skilled operatives are available). Temporarily strut the extension neck(s) to avoid distortion during back filling. Where more than one neck section is required to suit a deep invert, consider back-filling section by section. If the extension neck is too long, it can be trimmed using a fine-toothed saw. The original fixing hole bolting the coalescer to the neck should be sealed. Ensure that the vent socket if cut out, is replaced elsewhere. The maximum recommended inlet invert is 2000mm (using 500mm long extension sections). If you are installing a unit deeper than this then you must make your own arrangements for removing and replacing the coalescer. Consideration must be given to the depth of lift involved.

5.10. If extending the neck, remember to add a suitable length of cord to enable the float valve to be lifted when the unit is emptied. If the valve is not raised during filling then the float valve may stick at the base.

5.11. Coalescer. When refitting, ensure that the core tube is correctly seated onto the base fitting.

5.12. Continue back-filling, ensuring minimum 225mm concrete thickness around the access shaft/ extension neck and alarm access tube (as applicable).

5.13. Mains powered alarm Systems. See alarm suppliers installation instructions. Lay 82mm diameter PVCu underground ducting between the alarm panel location and the alarm probe position. The ducting should be 500mm below ground level and fitted with a drawstring for later cable insertion. Any changes of direction should be by long radius bend. If necessary, drill a suitable hole in the access shaft adjacent to the alarm probe terminal box, to accept the ducting and seal.

5.14. In traffic areas a suitable top slab must be constructed. The top slab should bear on a suitable foundation to prevent superimposed loads being transmitted to the unit and access shafts. Loads applied to covers and frames must bear on the top slab, not the access shaft.

5.15. The unit should be filled with clean water up to the invert level of the outlet pipe. Ensure the unit identification is placed/marked inside the neck for future information. The unit is now ready for use.

6.0 Alarm Installation

6.1 Install the alarm probe and control panel, as per the Suppliers Alarm Installation Guidelines. Ensure that the probe is positioned correctly for the required storage of oil. The table below indicates the volume of oil stored and the depth of floating oil expected in the separation chamber.

Unit	Recommended Maximum Oil Storage volume	Max. Depth of floating oil (100 %) (Static)
NSFA020	200 litres	53mm
NSFA030	300 litres	60mm
NSFA040	400 litres	65mm
NSFA050	500 litres	70mm
NSFA065	650 litres	67mm

7.0 Operation

7.1 The unit is sized on treating a defined area and rainfall (50 mm/hour) EN 858 Part 1, and using the factor provided in the EA guidelines PPG 3. The entire flow up to the units listed flow rating is fully treated.

7.2 Units include a core tube with replaceable media. Separated Liquid enters the core tube after passing through the media, to the outlet. The coalescer media requires maintenance and replacement at intervals. See section 8.

7.3 Units are provided with a closure device, incorporating a float. As the level of oil builds up and forms a floating layer, so the float/closure device moves downward to prevent oily water being passed through the unit. The unit **MUST** be emptied after the closure device has operated. The coalescer media should be inspected and changed if fouled.

7.4 An oil probe should be positioned to detect the accumulation of oil when there is no or low flow conditions. It is a requirement to position the probe so that the alarm operates at 90% of the maximum recommended oil storage volume. **When the alarm operates, the oil should be removed. Accumulated silt should also be removed.**

7.5 These Separators are not effective for the removal of soluble or emulsified pollutants such as oil/detergent mixes found in vehicle wash effluents. With permission, such discharges may be drained to the foul sewer. See Environment Agency Guidelines PPG3. Or contact our Technical Sales Department for suitable alternative equipment.

8.0 Maintenance

Separated light liquid **must** be removed from the separator when the oil capacity has been reached.

8.1. An oil level alarm system is available which gives warning when the separated light liquid/water interface level reaches 90% of the maximum recommended oil storage volume.

8.2. Separators should be inspected at least every six months or more frequently if experience dictates. A log should be maintained detailing the depth of oil found, any volume removed and any silt removal or cleaning carried out. A specimen maintenance log is included in the appendices.

8.3. Every site is different, in respect to the amount and type of silt generated by the drain design and installation. Frequently, the site construction programme itself generates large and perhaps unusual quantities of silt and grit. We recommend that following the initial installation, an inspection of the separator contents be made to check that building rubble has not entered the unit. Further inspections at 3 and 6 months should be made so as to be able to assess the volumes of silt and oil accumulated. An inspection and emptying programme can then be defined following the first 6 months site experience. We recommend a maximum inspection interval of 6 months.

8.4. Coalescer media is a replaceable item and is available as a spare.

8.5. Alarm probes should be removed and cleaned with water whenever waste material is removed from the separator. Please note the alarm may alert until the liquid level is replaced. Consult the alarm supplier's literature.

8.6. If the unit is emptied, the float/closure device should be raised and then lowered after the unit has been refilled. (Do not lower it into an empty unit as the closure device will self seat)

8.7. **Separator waste is a "special waste" under the terms of The Waste Management Code of Practice. The Code imposes a duty of care on the waste producer to ensure that the Cleansing contractor is registered with the Environment Agency and that the final disposal of the waste is to a licensed facility.**

8.8. You should consider the purchase of a maintenance service, from a competent installer, which includes bi-annual inspections, removal of oil and silt, cleaning of the alarm probe and cleaning or replacement of the coalescer media (where appropriate).

Waste Removal Procedure – Oil & Silt

Oil should only be removed when there is no flow entering the unit. Isolate the unit and prevent flow from entering. Always remove the oil before attempting to remove the coalescer. If this is not done, when the coalescer is withdrawn, any excess oil may coat the media surface and when replaced could contaminate the effluent.

8.9. Remove the access cover and lower the desludging hose into the separation chamber. Draw off the surface oil.

8.10. When removing the silt, lower the desludging hose to the base of the tank and withdraw any grit or sludge that may be present. It is not necessary to remove all the liquid unless you need to ensure the unit has been fully emptied. Ensure that you access and clean all compartments.

8.11. Remove the alarm probe, clean with water and replace. Ensure that it is working correctly

8.12. Consider the period of time that the coalescer has been installed and consider removing and inspecting (cleaning or replacing) the coalescer media. If removed, ensure that it is correctly replaced. It is best to lower the liquid level when refitting. Replace the access covers.

8.13. Re-fill the separator with clean water up to the outlet level. The alarm may display an alarm condition until the separator is re-filled. Check alarm operation when unit full.

8.14. Check the float/closure device and raise, if it has self-seated.

Checking the Coalescer Assembly

8.15. Coalescers should be checked and cleaned regularly, also following a major incident replaced if necessary. It may be possible to squeeze/rinse out silt contamination from the media, but it is impossible to remove oil. Please contact Kingspan if you wish to purchase replacement coalescer foam media. Identify the type and size of separator (shown on labels inside the access neck).

8.16. Assemblies weighing less than 25 Kg may be removed by hand. Heavier assemblies should be lifted by mechanical means. Any lifting device employed must be capable of lifting:

- In excess of the maximum assembly weight.
- The assembly completely out of the access shaft.
- Giving a smooth and controlled lift.
- Swinging the assembly to one side clear of the access shaft.

Unit	Dry Weight (Kg) Core tube & media	Wet Weight (Kg Core tube & media	Silted Weight (Kg) Core tube & media	Replacement media part no.
NSFA020	27 kg	40 kg	≈ 55 kg	402733
NSFA030	27 kg	40 kg	≈ 55 kg	402733
NSFA040	27 kg	40 kg	≈ 55 kg	402733
NSFA050	27 kg	40 kg	≈ 55 kg	402733
NSFA065	27 kg	40 kg	≈ 55 kg	402733

8.17. Ensure that the area around the access shaft is clear and that there is space to place the coalescer core tube assembly once removed. If space is not available it will be necessary to support the assembly over the access shaft e.g. by scaffold poles and platform.

8.18. Only remove the access cover when necessary to remove the assembly. Do not leave the access shaft uncovered and unattended.

8.19. It is recommended that core tubes be lifted by mechanical means, especially if it is suspected that the coalescer media be silted.

8.20. Removing the coalescer assembly.

8.21. A cut out is provided in the top of the coalescer tube to aid lifting. When the unit is installed the coalescer tube is bolted to the neck for transport. Deeper invert units are provided with a coalescer tube extension chain of the appropriate length.

8.22. Lift the assembly with a smooth and steady motion. Core tubes and media will become lighter as water drains from the exposed media. Allow the water to drain completely. Assemblies blocked with fine silt may be very heavy.

8.23. Fully extract the assembly and set it down adjacent to the access shaft. Consider cleaning or replacement of the media.

8.24. Cleaning the coalescer assembly /Media Replacement.

8.25. Hose down the assembly using clean water at normal pressure. (You may be able to return the cleaning water into the separator, if there is sufficient separator capacity.) Do not allow untreated cleaning water to pass out of the unit. Continue hosing media until the water runs clear. If the media is heavily contaminated with oil and silt it may not be possible to clean effectively by hosing and should be replaced.

8.26. When replacing the media, undo the banding. Slide media off the core tube and slide new media on. Ensure all the apertures on the core tube are covered by the media. Re-secure or replace banding. Consider replacing media every two years.

8.27. Replacing the coalescer assembly.

8.28. Position coalescer assembly over the access shaft and remove any safety coverings.

8.29. Lower the assembly steadily into the access shaft, orientate core tube correctly and locate over sump cone. Check the float/closure device is free to operate.

9.0 Emergencies

9.1. At sites where there is a high risk of spillage, spill kits containing drain seals, absorbent materials, disposal containers and other appropriate equipment should be held. In the event of a spillage on site, the material should be contained, (if a spill kit is not available, sand or soil may be used) and the Environment Agency notified immediately using the appropriate emergency hotline number listed in the Agency Guideline PPG3. Year 2012 – 0800 80 70 60

SEPARATOR MAINTENANCE LOG

Site address/location .....

.....

Separator location .....

.....

Type of separator .....

Nominal Flow .....

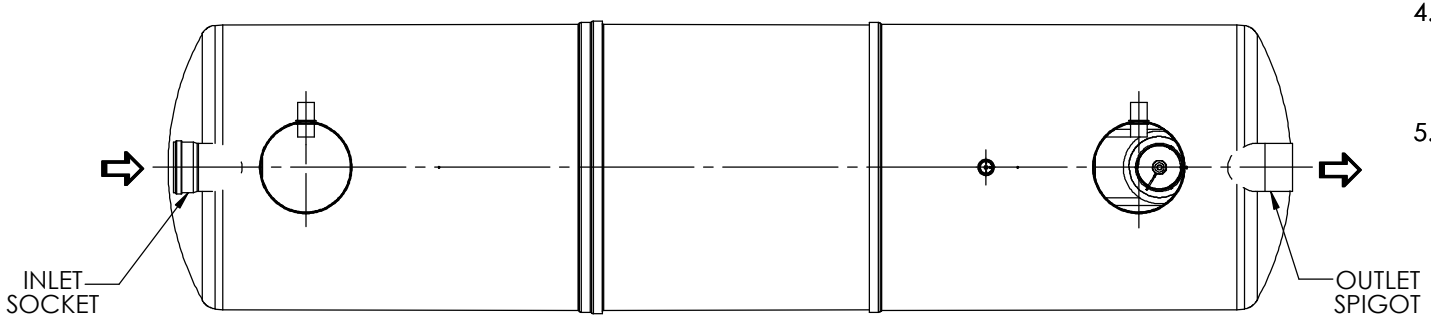
Total capacity .....

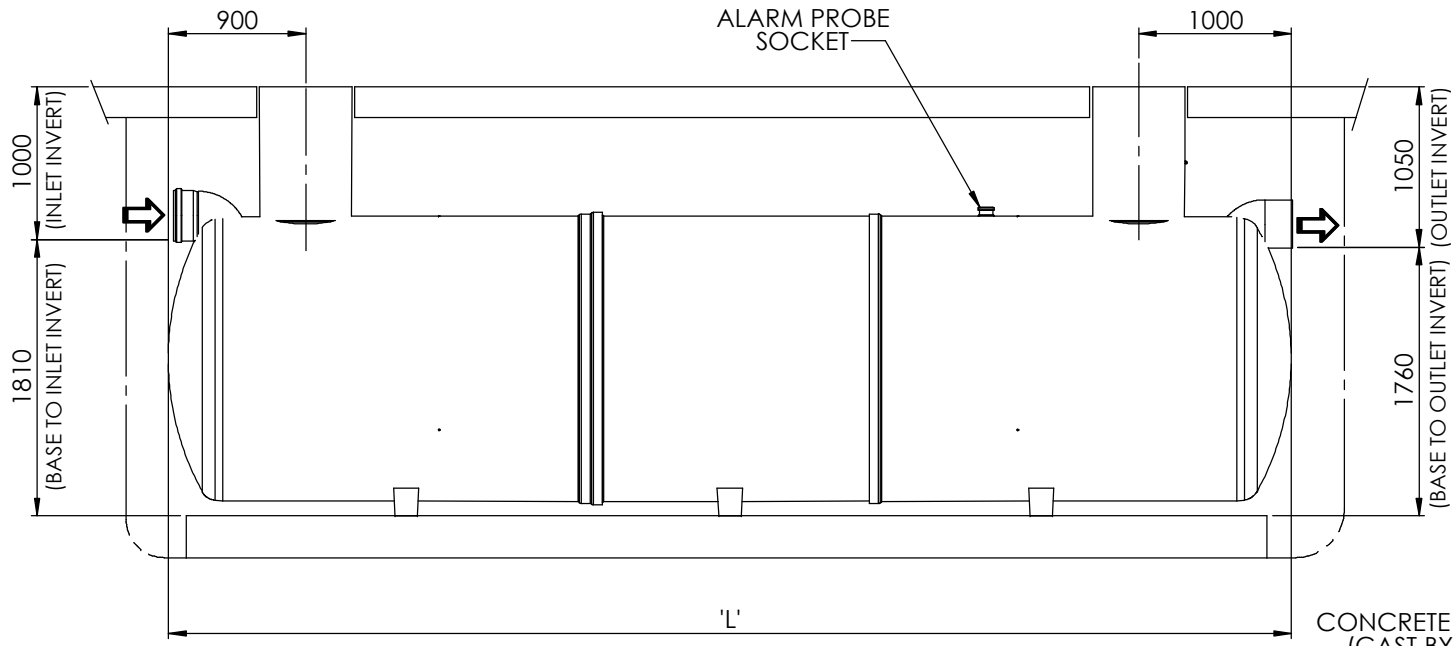
Inspection/ Maintenance Date	Comments	Waste Volumes Removed (if appropriate)

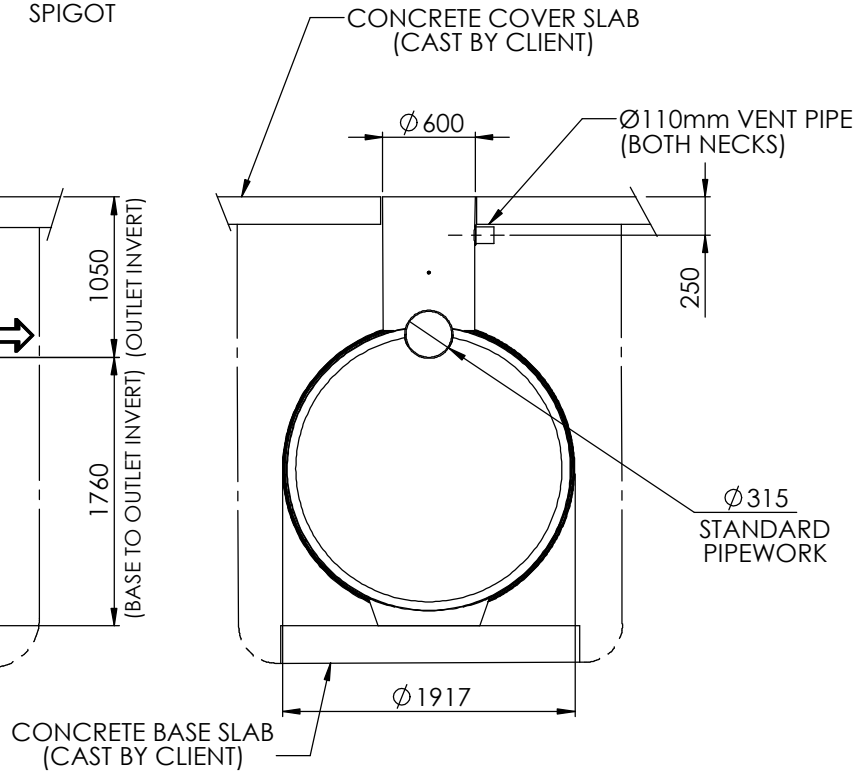
UNIT REF.	NOMINAL FLOW RATE (L/s)	APPROX. EMPTY WEIGHT (kg)	OVERALL LENGTH 'L'
NSFA020	20	575	3230
NSFA030	30	665	3960
NSFA040	40	740	4750
NSFA050	50	985	5790
NSFA065	65	1145	7360

NOTES:-

1. INLET/OUTLET PIPES ARE PLAIN PIPE Ø315mm PVCu. THE STANDARD EN858 STATES MINIMUM CONNECTION SIZES, UNITS ORDERED WITH DIFFERENT SIZED CONNECTIONS ARE NOT FULLY COMPLIANT WITH THE STANDARD.
2. EXTENSION NECKS FOR DEEPER INVERTS CAN BE PROVIDED IN 0.5m INCREMENTS, FOR ON SITE ASSEMBLY. MAXIMUM 2.0m INVERT RECOMMENDED.
3. ALL UNITS REQUIRE APPROPRIATE COVER AND FRAME TO SUIT APPLIED LOADINGS.
4. THIS DRAWING SHOULD BE USED FOR DIMENSIONAL INFORMATION ONLY. IT IS ESSENTIAL THAT THIS DRAWING IS READ IN CONJUNCTION WITH INSTALLATION GUIDELINES SUPPLIED WITH UNIT. (COPIES ARE AVAILABLE FROM OUR SALES DEPARTMENT).
5. THIS DRAWING IS ALSO AVAILABLE ON OUR WEBSITE www.kingspanenv.com







Issue	Date	Drawn by	Description
04	03.04.18	T.Kelly	CC1425 - Class 2 Reference Deleted
03	29.10.14	T.Kelly	CC1151 - Cases Changed
02	29.01.09	JC	Update Border

All dimensions in mm

Scale: Not to scale

R:\Drawing Data\02 - Sales Drawings\DS\DS - 09\DS0911P NSFA020 - 065 Full Retention Separators

Material : Various
Finish : n/a
Weight : n/a
Tolerance : ± 5mm
Thickness : n/a
Surface Area : n/a

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Drawing : DS0911P

NSFA020 - NSFA065 Full Retention Separators

Kingspan Environmental

Appendix 8 – Flood Risk Summary

< Back to select an address

Flood risk summary

Your selected location: Atlas Sheds, Stockpit Road, Knowsley Industrial Park, Liverpool, L33 7TQ

This information tells you the flood risk of the land around a building, not the building itself.

- How we assess an area's flood risk
- Flood risk and climate change

Surface water

More about your surface water flood risk (/surface-water)

Yearly chance of flooding

Very low | Low | Medium | High

Yearly chance of flooding between 2040 and 2060

Very low | Low | Medium | High

What surface water is

Surface water flooding is sometimes known as flash flooding. It happens when rainwater cannot drain away through normal drainage systems.

- Why surface water flooding is a problem

Rivers and the sea

More about your rivers and sea flood risk (/rivers-and-sea)

Yearly chance of flooding

Very low Low Medium High

Yearly chance of flooding between 2036 and 2069

Very low Low Medium High

What makes rivers and sea flooding more likely

Low-lying areas that are close to rivers or the sea are more likely to flood when water levels rise.

This information takes into account any flood defences.

- Why flood defences cannot completely prevent flooding

Other flood risks

More about groundwater and reservoirs (/ground-water)

Groundwater

Flooding from groundwater is unlikely in this area.

Reservoirs

Flooding from reservoirs is unlikely in this area.

Flood map for planning

Your reference	Location (easting/northing)	Created
Unspecified	**343577/398890**	**28 April 2025 13:25**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following**:

- bigger than 1 hectare (ha)
- in an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

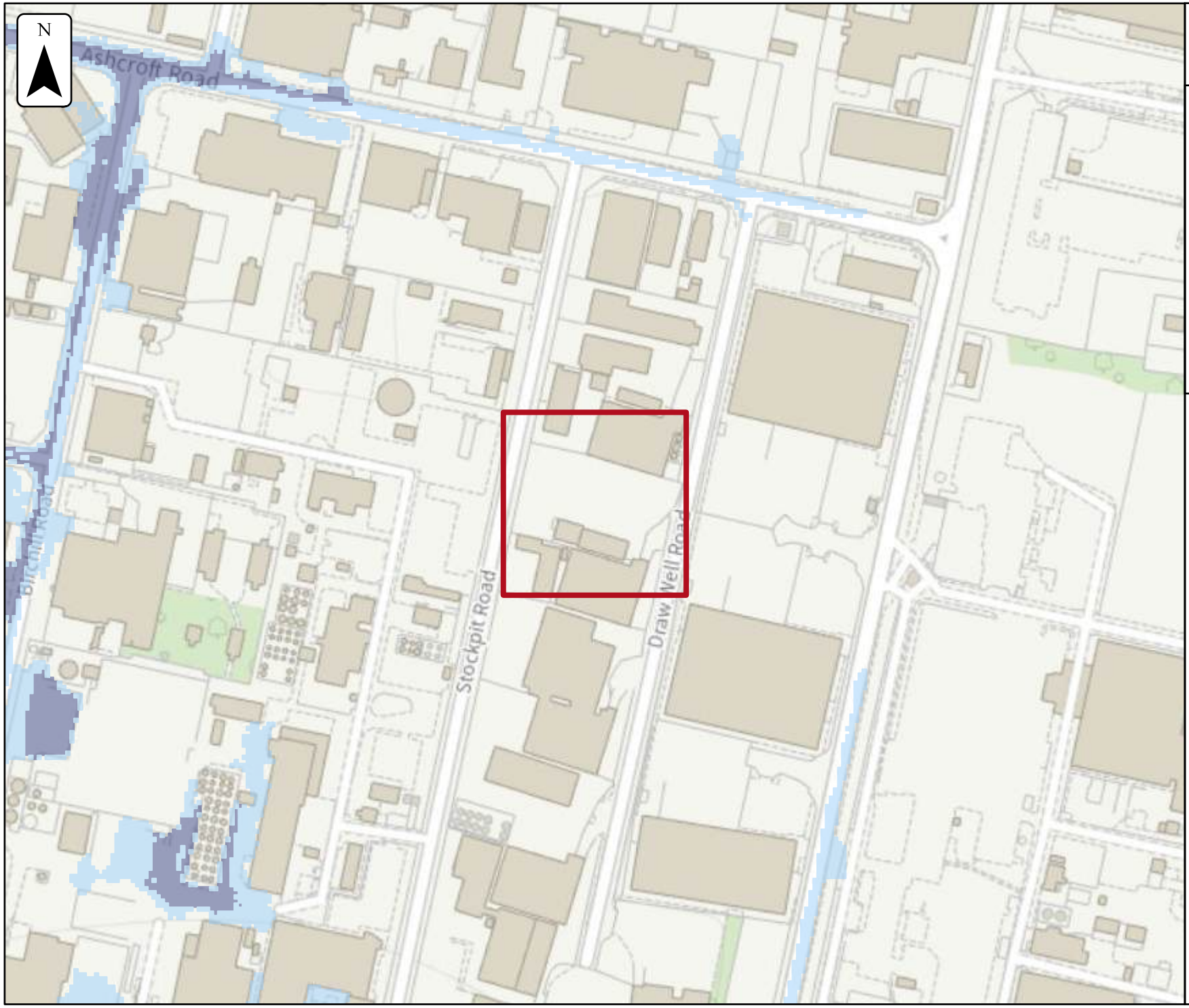
Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2025 AC0000807064. https://flood-map-for-planning.service.gov.uk/os-terms



Environment Agency

Flood map for planning

Your reference
Unspecified

Location (easting/northing)
343577/398890

Scale
1:2,500

Created
28 Apr 2025 13:25

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

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