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ENVIRONMENT

Vastint
Lamby Way
Cardiff

SUSTAINABLE DRAINAGE STATEMENT

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SUSTAINABLE DRAINAGE STATEMENT

Birmingham
Livery Place, 35 Livery Street, Colmore Business District, Birmingham, B3 2PB
T: 0121 233 3322

Leeds
Whitehall Waterfront, 2 Riverside Way, Leeds LS1 4EH
T: 0113 233 8000

London
11 Borough High Street
London
SE1 9SE
T: 020 74073879

Manchester
4th Floor Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG
T: 0161 233 4260

Nottingham
Waterfront House, Station Street, Nottingham
NG2 3DQ
T: 0115 924 1100

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S2	P5	04/01/2019	Lauren Towle BSc (Hons)	Heather Griffiths BSc (Hons)	Graham Littlewood BEng (Hons)

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(i) The date on which this assessment was undertaken, and
(ii) The date on which the final report is delivered

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The information presented and conclusions drawn are based on statistical data and are for guidance purposes only. The study provides no guarantee against flooding of the study site or elsewhere, nor of the absolute accuracy of water levels, flow rates and associated probabilities.

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CONTENTS

1.0 INTRODUCTION

Site Details

1.1 This Sustainable Drainage Statement has been produced by BWB Consulting on behalf of Vastint in respect of a site located at Lamby Way, Cardiff. A site location plan is included for reference as **Figure 1.1.**

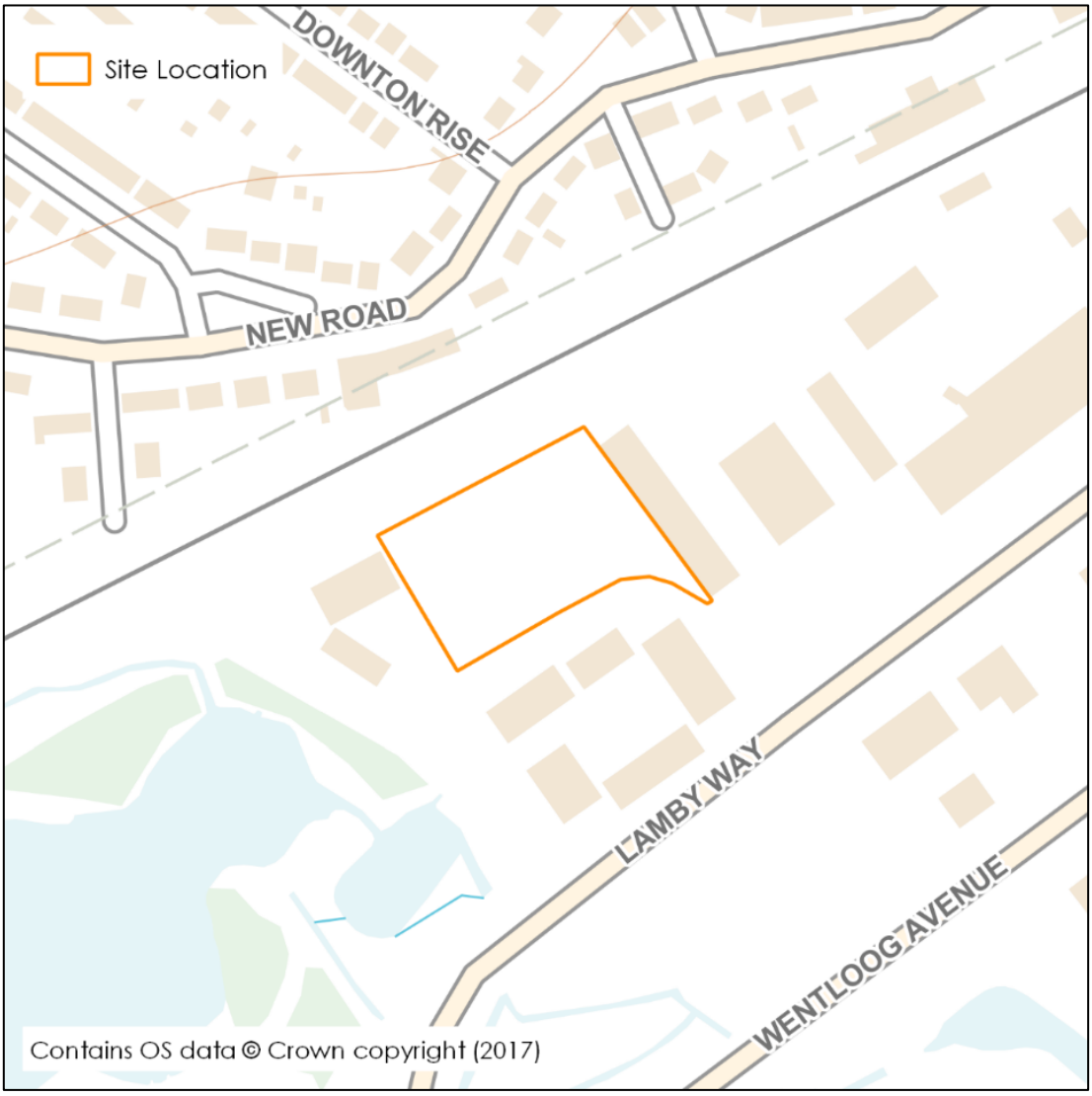


Figure 1.1 - Site Location

1.2 A Sustainable Drainage Statement sets out the principles of the drainage design for the development and summarises the reasoning behind the chosen design. This includes justification of specific flow rates, volumes of attenuation and the level of treatment provided to runoff.

1.3 A Flood Consequence Assessment has been developed for the site (reference LWC-BWB-EWE-XX-RP-EN-0003-FCA) and this Sustainable Drainage Statement accompanies this overarching document.

1.4 The site currently consists of greenfield land.

1.5 A topographical survey of the site to Ordnance Datum is provided within **Appendix 1** of the Flood Consequence Assessment, submitted as an accompanying document in support of this planning application. It shows that the site is relatively flat, with ground levels ranging from 8.41mAOD to 8.90mAOD for the main portion of the site. Although there is no drainage infrastructure within the site itself, it is expected that the has been graded so that surface water drains towards the highway in the south.

1.6 The proposed development is to be submitted to Cardiff City Council for a full planning application and the details in this strategy are based upon the submitted scheme.

1.7 The Lead Local Flood Authority (LLFA) do not have any specific SuDS guidance to inform planning applications and in the absence of further information, the Non-Statutory Technical Standards for Sustainable Drainage Systems[1] as published by DEFRA have been utilised to inform the strategy.

Table 1.1 - Existing Site Details

Site Name	Lamby Way
Location	Cardiff
NGR (approx.)	322029, 178600
Application Site Area (ha)	0.69 (approximate)
Development Type	Industrial
Local Planning Authority	City of Cardiff Council
Lead Local Flood Authority	City of Cardiff Council
Sewerage Undertaker	Welsh Water

SuDS Summary

1.8 It is proposed that a Biffa Waste Transfer Station be located at the site. This will consist of 20 storage bays and a two-storey office building. A proposed site development plan is included as **Appendix 1.**

1.9 **Table 1.2** summarises the findings of this document with discussion and explanation of the points expanded upon in **Section 2.0**.

Table 1.2 - SDS Summary

Outfall Location	Sewer
Existing Site Peak Runoff Rate	4.1 l/s (100 year)
Infiltration Rate	N/A
Existing Runoff Volume (100yr RP 6 hour Storm)	184m^3
Proposed Runoff Volume (100yr RP 6 hour Storm)	511m^3
Long Term Storage	327 m^3

[1] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems

Proposed Site Peak Runoff Rate	5.0 l/s
Proposed Storage Volume	327 m^3
Flow Control Type	Vortex
Maintenance Responsibility	Management Company / Welsh Water
LLFA/EA/WC/IDB Guidance	None

2.0 DRAINAGE STRATEGY

Existing Site Runoff

Runoff Rate

2.1 An assessment of the existing greenfield runoff rates has been undertaken using the ICP SUDS calculation module within Micro Drainage and the results are summarised in **Table 2.2.** Calculations are included within **Appendix 2.**

Runoff Volume

2.2 Volume of runoff for proposed developments is compared for a 100 year return period, 6 hour storm. As the existing site is greenfield, this volume has been calculated using the Source Control module within Micro Drainage to be **184m^3**, results are included within **Appendix 2**.

Proposed Site Runoff

Drainage Hierarchy

2.3 The SuDS Manual identifes that surface water runoff from a development should be disposed of in the following order of preference:

i. Infiltration via soakaways

ii. Watercourse

iii. Surface Water Sewer

iv. Combined Water Sewer

2.4 The aim of this approach is to manage surface water runoff close to where it falls and mimic natural drainage as closely as possible.

2.5 A topographic survey of the existing site has been undertaken and is included as **Appendix 1** within the Flood Consequence. This shows that there are no existing drainage features within the site boundary and runoff is therefore considered to infiltrate into the existing ground.

2.6 Given the increase in impermeable area and urban location of the scheme it is impractical for drainage to be infiltrated into the existing ground as soakaways should be located a minimum of 5m from buildings, trees and adopted highways. Moreover,

the underlying strata is unlikely to be suitable for infiltration being comprised of clayey silt overlying a mudstone.

2.7 There are no existing watercourses in the vicinity which would be suitable for the site to discharge to and this method is therefore not achievable.

2.8 The topographical survey of the site demonstratesthat there is a drainage asset located along the highway, Lamby Way, to the south of the site. It is therefore proposed to discharge to this asset, subject to a drainage connectivity survey being undertaken to confirm its ultimate outfall location.

2.9 The presence of a significant network of adopted sewers, as shown on the Welsh Water sewer records included as **Appendix 3** would appear to demonstrate that the surrounding area drains to these. It is therefore considered to be likely that the drainage asset connects into the Welsh Water sewer network downstream of the site.

2.10 As connection to a sewer is shown to be the most preferred option, approval at a restricted rate will be acceptable.

Runoff Rate

2.11 In order to comply with the Non-Statutory Technical Standards for Sustainable Drainage Systems2, runoff should not exceed existing greenfield rates for the 1 and 100 year return period events.

2.12 Post development discharge rates will be restricted to 5l/s as shown in **Table 2.2** for all storms up to the 100 year + 30% climate change storm.

2.13 As the volume of runoff has been calculated to increase post development, it is necessary to comply with the volume control criterion as per requirements S4-S6 of the Non-Statutory Technical Standards (otherwise known as long term storage). It is necessary to either prevent any excess volume from leaving the site or otherwise discharge it "*at a rate which does not adversely affect flood risk*" which is taken to be no more than;

- *The pre development 1-year peak flow rate; OR*
- *The mean annual flow rate Qbar; OR*
- *2l/s/ha*

2.14 A control structure limiting flows to less than 5l/s would be impractically small and prone to blockage, it is therefore proposed to adopt a fixed discharge rate of 5l/s. This is in-line with DEFRA and EA recommendations[3].

Runoff Volume

2.15 The proposed runoff volume can be derived using an average rainfall intensity of **12.4mm/hr** as calculated using FEH rainfall data within Micro Drainage, and multiplied by the impermeable site area. The site is assumed to be 87% impermeable. The rainfall profile is shown in **Figure 2.1**, and the calculated volume is as follows;

[2] 2015, DEFRA. Non-statutory technical standards for sustainable drainage systems
[3] 2013, Kellagher. Preliminary rainfall runoff management for developments – Technical Report. W5-074/A/TR/1, Revision E. Environment Agency / Defra.

Average Rainfall Intensity (mm/hr) x 6 (hours) x Site Area (ha) x 10 = Runoff Volume (m^3)

12.4 (mm/hr) x 6 (hours) x 0.60 (ha) x 10 = Runoff Volume (m^3)

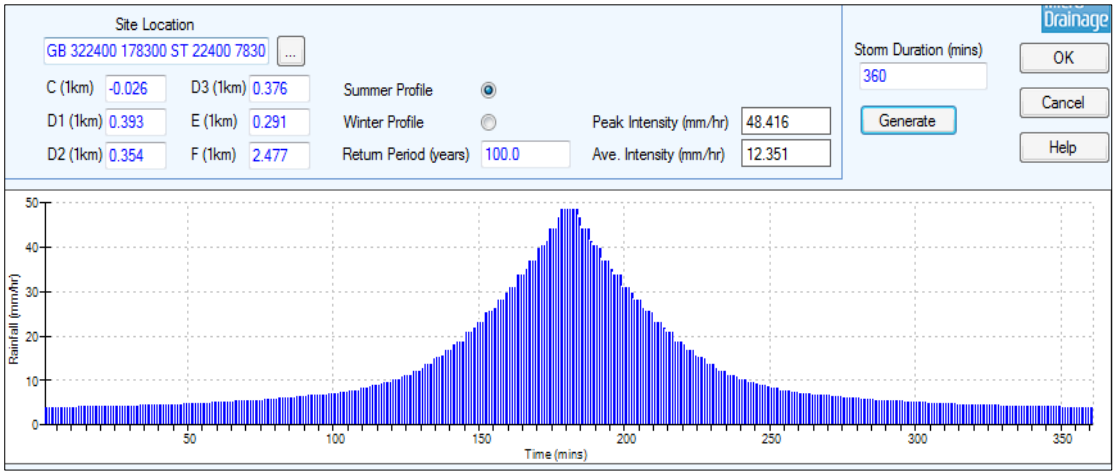


Figure 2.1 - 100-Year 6 Hour Rainfall Intensity

Site Runoff Summary

2.16 The following tables summarise the calculated runoff volumes and rates for the proposed development.

Table 2.1 - Existing and Proposed Runoff Volumes

Existing Volume (m^3)	Proposed Volume (m^3)	Difference (m^3)
184	511	327

Table 2.2 - Existing & Proposed Runoff Rates

Return Period (Yr.)	Runoff Rate (l/s)	Propose Runoff Rate (l/s)
1	1.7	5.0
QBAR	1.9	5.0
30	3.3	5.0
100	4.1	5.0
100 + 40%	-	5.0

Attenuation Requirements

2.17 Using a restriction of 5.0l/s, the volume of attenuation required for the site has been calculated for storm events up to the 100 year + 30% storm.

2.18 A simulation has been run using Micro Drainage and the results are summarised in **Table 2.3** and calculations included as **Appendix 4**.

Table 2.3 - Attenuation Requirement

Rainfall Method	Critical Storm	Maximum Volume (m^3)
FSR	600 min Winter	370
FEH	720 min Winter	420

2.19 A minimum of 420m^3 of attenuation will be provided to cater for the maximum anticipated runoff volume for all storm durations up to the 1 in 100 year return period storm, including a 30% climate change allowance.

Long Term Storage

2.20 A requirement for long term storage has been identified and a runoff rate proposed which meets the requirements of sites discharging additional surface water volume. The proposed development therefore complies with this criterion and no further restrictions are necessary.

2.21 As discussed in paragraph **2.14**, restricting flows to below 5l/s is impractical and this is recognised in the BREEAM assessment guidance (Pol 03, Compliance Note CN18) which states;

"For the surface water run off credits, where the limiting discharge flow rate would require a flow rate of less than 5 l/s at a discharge point, a flow rate of up to 5 l/s may be used where required to reduce the risk of blockage. Discharge points are points of discharge into rivers, streams, ditches, drains, cuts, culverts, dykes, sluices, sewers and passages through which water flows."

2.22 Given this, it is proposed not to restrict additional flow as it would require the rate to be reduced below 5l/s. This is a function of the small size of the site and is a commonly accepted occurrence, and should therefore not preclude the site being shown to comply with the relevant criteria.

Sustainable Drainage Systems

2.23 It is proposed that runoff from the site in storm events up to and including the 100 year return period (including a 30% allowance for climate change) will be accommodated on the proposed development site.

2.24 A proposed drainage plan for the development has been produced by HBL Associates Ltd (Dwg No. SK-02) and is included as **Appendix 5**.

Modelling of Proposed Drainage Systems

2.25 The attenuation storage requirement for the site has been calculated and the relevant calculation results are included as **Appendix 4**. These demonstrate that there is adequate storage for all storms up to the 100 year + 30% climate change storm with a restriction of 5l/s.

Residual Risk and Designing for Exceedance

2.26 In the event that the capacity of the attenuation is exceeded, flood water will be directed away from buildings and pool within the vehicle entrance.

Maintenance

2.27 It is recommended that all drainage features should be located in open areas which are readily accessible.

2.28 Requirements for ongoing maintenance of the drainage network should form part of the Operation and Maintenance manual for the site and should be undertaken by the building management. Any specialist or proprietary products that are specified at detailed design should have a manufacturer specific maintenance regime which should be included within the document.

3.0 FOUL WATER DRAINAGE STRATEGY

3.1 Foul water will be discharged from the site via the public foul water sewer located to the south-east of the site. Consultation from Welsh Water confirms this is likely to be acceptable.

4.0 SUMMARY

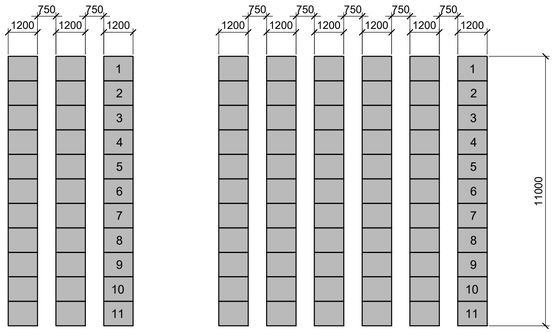
4.1 This statement and supporting appendices demonstrate that the drainage design for the development will comply with the relevant local and national standards, specifically the hierarchy of discharge, runoff rate and volume criterion.

4.2 An indicative surface water and foul water drainage network has been designed which demonstrated that the site can be successfully drained.

4.3 The design of the system will be developed at the detailed design stage. It will be based on the principles outlined in the document to provide the information necessary to satisfy the LLFA and other stakeholders.

APPENDIX 1

Proposed Site Development Plan



TYPICAL IBC SPACING

DO NOT SCALE FROM THIS DRAWING

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER HBL DRAWINGS ISSUED FOR THIS PROJECT

LEGEND

- CONCRETE SURFACE
- TARMAC SURFACE
- BUILDING FOOTPRINT
- PERSONNEL ACCESS / WALKWAY
- MEZZANINE LEVEL (HATCHED)
- ARMCO BARRIER
- PALISADE FENCE LINE
- LC — LIGHTING COLUMN
- CCTV — CCTV COLUMN

REV.	DATE	DRAWN	DESCRIPTION	CHKD	APPRD
P1	OCT'17	HM	SURFACE MATERIAL CHANGED TO CONCRETE	ALS	ALS
P0	AUG'17	HM	PRELIMINARY ISSUE	ALS	ALS

HBL ASSOCIATES Ltd.
CONSULTING CIVIL AND STRUCTURAL ENGINEERS
Brook House, Weybrook Road, Heaton Chapel, Stockport M19 2QD
Telephone: 0161 432 9977
Facsimile: 0161 432 7979
Email : consultants@hblassociates.co.uk

Biffa

STATUS: PRELIMINARY

CLIENT: BIFFA WASTE SERVICES LTD	DRAWN: H.MAMAGANI
PROJECT: BIFFA RELOCATION	CHECKED: A.L.SMITH
LOCATION: LAMBY WAY, CARDIFF	APPROVED: A.L.SMITH
DRAWING TITLE: PROPOSED SITE PLAN	DATE: AUGUST 2017
	SCALE(S): 1:200 — A1
DRAWING No.: 102	HBL REF.: 6042
	REVISION: P1

FILE REF: R:\JOBS CURRENT\

APPENDIX 2

Existing Surface Water Drainage Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (ha)	0.690	Urban	0.000
SAAR (mm)	993	Region Number	Region 9

Results l/s

QBAR Rural	1.9
QBAR Urban	1.9
Q100 years	4.1
Q1 year	1.7
Q30 years	3.3
Q100 years	4.1

Greenfield Runoff Volume

FEH Data

Return Period (years)	100
Storm Duration (mins)	360
Site Location	GB 322400 178300 ST 22400 78300
C(1km)	-0.026
D1(1km)	0.393
D2(1km)	0.354
D3(1km)	0.376
E(1km)	0.291
F(1km)	2.477
Areal Reduction Factor	1.00
Area (ha)	0.690
SAAR (mm)	993
CWI	123.349
SPR Host	28.320
URBEXT (1990)	0.1207

Results

Percentage Runoff (%)	35.96
Greenfield Runoff Volume (m^3)	183.877

APPENDIX 3

Welsh Water Sewer Records

Dŵr Cymru
Welsh Water

Developer Services
PO Box 3146
Cardiff
CF30 0EH

Tel: +44 (0)800 917 2652
Fax: +44 (0)2920 740472
E.mail: developer.services@dwrcymru.com

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
CF30 0EH

Ffôn: +44 (0)800 917 2652
Ffacs: +44 (0)2920 740472
E.bost: developer.services@dwrcymru.com

Ms Lauren Towle
BWB Consulting Ltd
Berwick House 35 Livery Street
Birmingham
West Midlands
B3 2PB

Date: 14/03/2017
Our Ref: PPA0001918

Dear Ms Towle

Grid Ref: 322018 178617
Site Address: Lamby Way Cardiff
Development: Commercial/ Industrial use

I refer to your pre-planning enquiry received relating to the above site, seeking our views on the capacity of our network of assets and infrastructure to accommodate your proposed development. Having reviewed the details submitted I can provide the following comments which should be taken into account within any future planning application for the development.

SEWERAGE

It is likely that the foul flows only from the proposed development can be accommodated within the public sewerage system and receiving waste water treatment works. However, insufficient information has been provided as part of this pre planning enquiry and we have not been able to conduct a thorough assessment. It will be necessary to submit further information in the form of a drainage strategy for the site to allow us a further opportunity to review the proposal and offer a suitable point of connection on the public sewerage system.

Should a planning application be submitted for this development we will seek to control these points of communication and a drainage strategy via appropriate planning conditions and therefore recommend that any drainage layout or strategy submitted as part of your application takes this into account. We therefore recommend that early discussions commence to establish an effective drainage strategy in advance of a planning application being submitted to the Local Planning Authority.

There is no problem in making a 'domestic' mains water supply available to the proposed development. However, the developer is advised to contact us if it is intended to utilise potable water for industrial/commercial uses as constraints may arise. We are not obliged to provide potable water for use in any industrial process.

I trust the above information is helpful and will assist you in forming water and drainage strategies that should accompany any future planning application. I also attach copies of our water and sewer extract plans for the area, and a copy of our Planning Guidance Note which provides further information on our approach to the planning process, making connections to our systems and ensuring any existing public assets or infrastructure located within new development sites are protected.

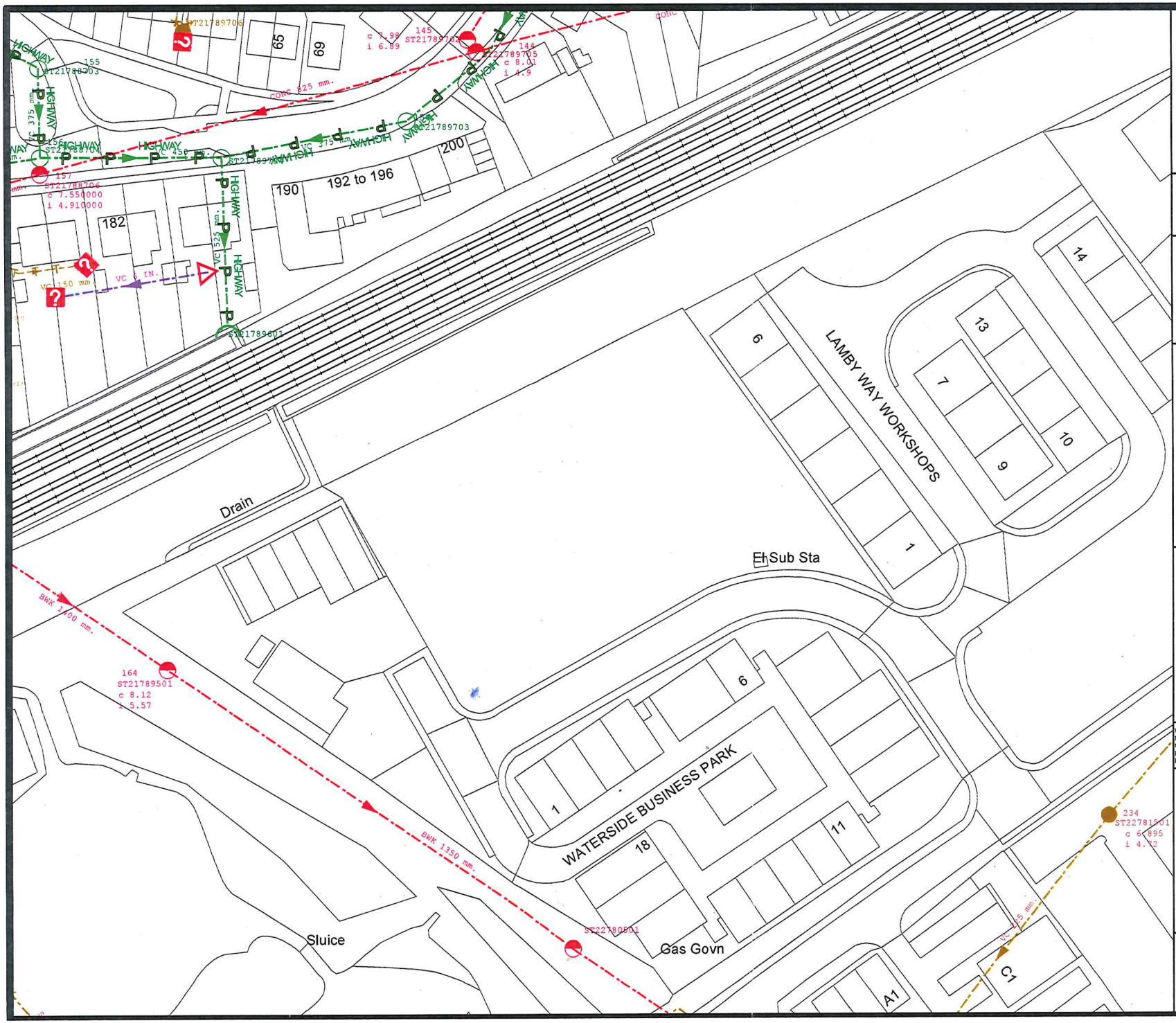
Please note that our response is based on the information provided in your enquiry and should the information change we reserve the right to make a new representation. Should you have any queries or wish to discuss any aspect of our response please do not hesitate to contact our dedicated team of planning officers, either on 0800 917 2652 or via email at **developer.services@dwrcymru.com**

Please quote our reference number in all communications and correspondence.

Yours faithfully,

Owain George
Planning Liaison Manager
Developer Services

***Please Note** that demands upon the water and sewerage systems change continually; consequently the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.*



Dŵr Cymru
Welsh Water

PPA0001918

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

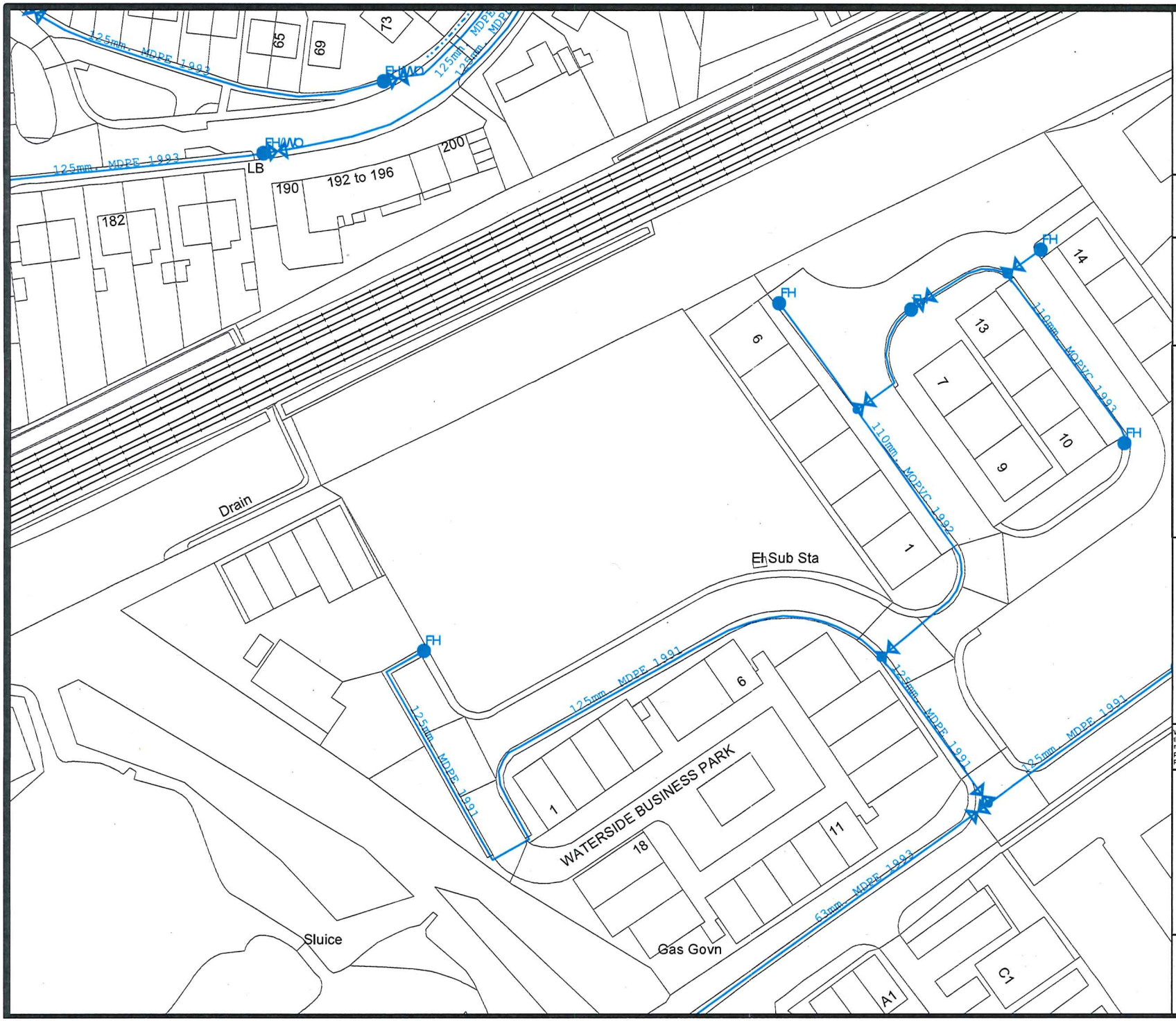
Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dwr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	322018 178617
Map scale:	1:1,250
Printed by:	
Printed on:	



Dŵr Cymru
Welsh Water

PPA0001918

N
W E
S

LEGEND

Clean network:

- Sluice valve
- Pressure reducing valve
- Meter
- Bulk meter
- Hydrant
- Cap end
- Air valve
- Stop tap
- Water Treatment Works
- Water Pumping Station
- Existing main
- Non-operational main
- Raw Water

NB: Water main symbol colour indicates the type.

LIGHT BLUE - Trunk
DARK BLUE - Distribution
YELLOW - Raw Water

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

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EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	322018 178617
Map scale:	1:1,250
Printed by:	
Printed on:	

APPENDIX 4

Attenuation Requirements Calculations

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	6.635	0.535	5.0	0.0	5.0	176.5	O K
30 min Summer	6.741	0.641	5.0	0.0	5.0	211.6	O K
60 min Summer	6.862	0.762	5.0	0.0	5.0	251.5	O K
120 min Summer	6.993	0.893	5.0	0.0	5.0	294.7	O K
180 min Summer	7.067	0.967	5.0	0.0	5.0	319.0	O K
240 min Summer	7.114	1.014	5.0	0.0	5.0	334.7	O K
360 min Summer	7.168	1.068	5.0	0.0	5.0	352.5	O K
480 min Summer	7.192	1.092	5.0	0.0	5.0	360.3	O K
600 min Summer	7.198	1.098	5.0	0.0	5.0	362.2	O K
720 min Summer	7.197	1.097	5.0	0.0	5.0	362.1	O K
960 min Summer	7.175	1.075	5.0	0.0	5.0	354.8	O K
1440 min Summer	7.125	1.025	5.0	0.0	5.0	338.4	O K
2160 min Summer	7.047	0.947	5.0	0.0	5.0	312.6	O K
2880 min Summer	6.967	0.867	5.0	0.0	5.0	286.1	O K
4320 min Summer	6.796	0.696	5.0	0.0	5.0	229.5	O K
5760 min Summer	6.650	0.550	5.0	0.0	5.0	181.4	O K
7200 min Summer	6.535	0.435	5.0	0.0	5.0	143.4	O K
8640 min Summer	6.446	0.346	5.0	0.0	5.0	114.2	O K
10080 min Summer	6.380	0.280	4.9	0.0	4.9	92.3	O K
15 min Winter	6.701	0.601	5.0	0.0	5.0	198.3	O K
30 min Winter	6.821	0.721	5.0	0.0	5.0	238.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	161.628	0.0	178.5	0.0	26
30 min Summer	97.676	0.0	215.8	0.0	41
60 min Summer	59.028	0.0	264.1	0.0	70
120 min Summer	35.672	0.0	319.3	0.0	128
180 min Summer	26.569	0.0	356.8	0.0	188
240 min Summer	21.557	0.0	386.0	0.0	246
360 min Summer	16.056	0.0	431.2	0.0	364
480 min Summer	13.028	0.0	466.4	0.0	482
600 min Summer	11.078	0.0	495.6	0.0	590
720 min Summer	9.703	0.0	520.8	0.0	638
960 min Summer	7.785	0.0	556.6	0.0	764
1440 min Summer	5.708	0.0	609.9	0.0	1028
2160 min Summer	4.184	0.0	676.8	0.0	1452
2880 min Summer	3.357	0.0	723.9	0.0	1872
4320 min Summer	2.483	0.0	802.6	0.0	2640
5760 min Summer	2.005	0.0	865.7	0.0	3352
7200 min Summer	1.699	0.0	916.5	0.0	4040
8640 min Summer	1.483	0.0	960.1	0.0	4752
10080 min Summer	1.323	0.0	998.0	0.0	5440
15 min Winter	161.628	0.0	200.0	0.0	26
30 min Winter	97.676	0.0	241.7	0.0	40

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	6.959	0.859	5.0	0.0	5.0	283.6	O K
120 min Winter	7.108	1.008	5.0	0.0	5.0	332.6	O K
180 min Winter	7.194	1.094	5.0	0.0	5.0	361.1	O K
240 min Winter	7.251	1.151	5.0	0.0	5.0	379.9	O K
360 min Winter	7.320	1.220	5.0	0.0	5.0	402.5	O K
480 min Winter	7.354	1.254	5.0	0.0	5.0	413.7	O K
600 min Winter	7.368	1.268	5.0	0.0	5.0	418.6	O K
720 min Winter	7.371	1.271	5.0	0.0	5.0	419.5	O K
960 min Winter	7.338	1.238	5.0	0.0	5.0	408.6	O K
1440 min Winter	7.274	1.174	5.0	0.0	5.0	387.6	O K
2160 min Winter	7.160	1.060	5.0	0.0	5.0	349.9	O K
2880 min Winter	7.040	0.940	5.0	0.0	5.0	310.1	O K
4320 min Winter	6.766	0.666	5.0	0.0	5.0	219.9	O K
5760 min Winter	6.551	0.451	5.0	0.0	5.0	148.8	O K
7200 min Winter	6.406	0.306	4.9	0.0	4.9	101.1	O K
8640 min Winter	6.317	0.217	4.7	0.0	4.7	71.6	O K
10080 min Winter	6.262	0.162	4.4	0.0	4.4	53.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
60 min Winter	59.028	0.0	295.9	0.0	70
120 min Winter	35.672	0.0	357.7	0.0	126
180 min Winter	26.569	0.0	399.6	0.0	184
240 min Winter	21.557	0.0	432.3	0.0	242
360 min Winter	16.056	0.0	482.9	0.0	356
480 min Winter	13.028	0.0	522.2	0.0	470
600 min Winter	11.078	0.0	554.9	0.0	580
720 min Winter	9.703	0.0	582.9	0.0	686
960 min Winter	7.785	0.0	622.6	0.0	808
1440 min Winter	5.708	0.0	679.8	0.0	1098
2160 min Winter	4.184	0.0	758.1	0.0	1564
2880 min Winter	3.357	0.0	810.8	0.0	2024
4320 min Winter	2.483	0.0	899.2	0.0	2816
5760 min Winter	2.005	0.0	969.6	0.0	3512
7200 min Winter	1.699	0.0	1026.6	0.0	4120
8640 min Winter	1.483	0.0	1075.5	0.0	4760
10080 min Winter	1.323	0.0	1118.1	0.0	5424

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	6.491	0.391	5.0	0.0	5.0	117.3	O K
30 min Summer	6.638	0.538	5.0	0.0	5.0	161.5	O K
60 min Summer	6.802	0.702	5.0	0.0	5.0	210.5	O K
120 min Summer	6.969	0.869	5.0	0.0	5.0	260.8	O K
180 min Summer	7.052	0.952	5.0	0.0	5.0	285.6	O K
240 min Summer	7.098	0.998	5.0	0.0	5.0	299.4	O K
360 min Summer	7.149	1.049	5.0	0.0	5.0	314.7	O K
480 min Summer	7.166	1.066	5.0	0.0	5.0	319.9	O K
600 min Summer	7.167	1.067	5.0	0.0	5.0	320.1	O K
720 min Summer	7.164	1.064	5.0	0.0	5.0	319.1	O K
960 min Summer	7.148	1.048	5.0	0.0	5.0	314.5	O K
1440 min Summer	7.105	1.005	5.0	0.0	5.0	301.4	O K
2160 min Summer	7.026	0.926	5.0	0.0	5.0	277.9	O K
2880 min Summer	6.940	0.840	5.0	0.0	5.0	252.1	O K
4320 min Summer	6.742	0.642	5.0	0.0	5.0	192.7	O K
5760 min Summer	6.592	0.492	5.0	0.0	5.0	147.5	O K
7200 min Summer	6.478	0.378	5.0	0.0	5.0	113.4	O K
8640 min Summer	6.396	0.296	4.9	0.0	4.9	88.8	O K
10080 min Summer	6.337	0.237	4.8	0.0	4.8	71.2	O K
15 min Winter	6.540	0.440	5.0	0.0	5.0	131.9	O K
30 min Winter	6.706	0.606	5.0	0.0	5.0	181.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	108.746	0.0	120.0	0.0	26
30 min Summer	75.351	0.0	166.8	0.0	40
60 min Summer	49.937	0.0	223.5	0.0	70
120 min Summer	31.884	0.0	285.6	0.0	128
180 min Summer	24.076	0.0	323.6	0.0	186
240 min Summer	19.574	0.0	350.8	0.0	246
360 min Summer	14.634	0.0	393.4	0.0	362
480 min Summer	11.882	0.0	425.8	0.0	480
600 min Summer	10.097	0.0	452.3	0.0	558
720 min Summer	8.834	0.0	474.7	0.0	614
960 min Summer	7.146	0.0	511.7	0.0	742
1440 min Summer	5.286	0.0	566.6	0.0	1010
2160 min Summer	3.898	0.0	630.6	0.0	1432
2880 min Summer	3.135	0.0	676.2	0.0	1848
4320 min Summer	2.304	0.0	745.0	0.0	2596
5760 min Summer	1.855	0.0	800.8	0.0	3296
7200 min Summer	1.568	0.0	846.0	0.0	3968
8640 min Summer	1.367	0.0	884.9	0.0	4672
10080 min Summer	1.218	0.0	919.1	0.0	5352
15 min Winter	108.746	0.0	134.6	0.0	26
30 min Winter	75.351	0.0	187.0	0.0	40

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
60 min Winter	6.893	0.793	5.0	0.0	5.0	237.8	O K
120 min Winter	7.082	0.982	5.0	0.0	5.0	294.7	O K
180 min Winter	7.179	1.079	5.0	0.0	5.0	323.6	O K
240 min Winter	7.234	1.134	5.0	0.0	5.0	340.3	O K
360 min Winter	7.300	1.200	5.0	0.0	5.0	360.0	O K
480 min Winter	7.328	1.228	5.0	0.0	5.0	368.4	O K
600 min Winter	7.335	1.235	5.0	0.0	5.0	370.6	O K
720 min Winter	7.330	1.230	5.0	0.0	5.0	369.1	O K
960 min Winter	7.307	1.207	5.0	0.0	5.0	362.1	O K
1440 min Winter	7.246	1.146	5.0	0.0	5.0	343.9	O K
2160 min Winter	7.128	1.028	5.0	0.0	5.0	308.4	O K
2880 min Winter	6.997	0.897	5.0	0.0	5.0	269.2	O K
4320 min Winter	6.686	0.586	5.0	0.0	5.0	175.9	O K
5760 min Winter	6.477	0.377	5.0	0.0	5.0	113.0	O K
7200 min Winter	6.349	0.249	4.8	0.0	4.8	74.7	O K
8640 min Winter	6.276	0.176	4.5	0.0	4.5	52.7	O K
10080 min Winter	6.233	0.133	4.2	0.0	4.2	40.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
60 min Winter	49.937	0.0	250.4	0.0	68
120 min Winter	31.884	0.0	319.9	0.0	126
180 min Winter	24.076	0.0	362.4	0.0	184
240 min Winter	19.574	0.0	392.9	0.0	240
360 min Winter	14.634	0.0	440.6	0.0	356
480 min Winter	11.882	0.0	476.9	0.0	468
600 min Winter	10.097	0.0	506.5	0.0	576
720 min Winter	8.834	0.0	531.6	0.0	678
960 min Winter	7.146	0.0	572.8	0.0	772
1440 min Winter	5.286	0.0	633.5	0.0	1084
2160 min Winter	3.898	0.0	706.4	0.0	1544
2880 min Winter	3.135	0.0	757.4	0.0	2000
4320 min Winter	2.304	0.0	834.7	0.0	2736
5760 min Winter	1.855	0.0	897.0	0.0	3408
7200 min Winter	1.568	0.0	947.6	0.0	4040
8640 min Winter	1.367	0.0	991.2	0.0	4672
10080 min Winter	1.218	0.0	1029.7	0.0	5256

APPENDIX 5

Proposed Drainage Plan

TANK PROVIDING 420m³
OF STORAGE
(323m² x 1.3m DEPTH)

HYDROBRAKE
CALIBRATED TO 5l/s

PENSTOCK

FUEL RETENTION
SEPARATOR

CONNECTS TO HIGHWAY
DRAINAGE ASSET (SUBJECT TO
AGREEMENTS & DESIGN)

CONTINUES TO PUBLIC FOUL
SEWER (SUBJECT TO
AGREEMENTS & DESIGN)

LOADING

LOADING

EXIT

NO ENTRY

CARS
ONLY

HGV
ONLY

TURN
RIGHT

Sub
Stn

MH
CL 8.49
IL 5.84

MH
CL 6.51

MH
CL 8.23
Meter

MH
CL 8.14
IL 6.17

MH
CL 8.45

Ø0.4
Ht 12.0

Ø0.225

Ø0.225

FPW Ht 1.2

FCL Ht 1.9

FSP Ht 2.2

FSP Ht 2.5

FSP Ht 1.9

Tarmac

Cable

Foul

Foul

Rdge 15.84

Eave 14.44

Rdge 16.32

Eave 14.24

Eave 13.64

Rdge 16.16

Rdge 15.00

Notes

1. Do not scale this drawing. All dimensions must be checked/ verified on site. If in doubt ask.
2. This drawing is to be read in conjunction with all relevant architects, engineers and specialists drawings and specifications.
3. All dimensions in millimetres unless noted otherwise. All levels in metres unless noted otherwise.
4. Any discrepancies noted on site are to be reported to the engineer immediately.
5. Do not build from this drawing.
6. This strategy is purely indicative and has been produced to demonstrate that the necessary surface water storage can be accommodated within the development layout. It is subject to change during the detailed design stage.

Legend

ILLUSTRATIVE TANK LOCATION

ILLUSTRATIVE SURFACE WATER PIPE

ILLUSTRATIVE FOUL WATER PIPE

Rev	Date	Details of issue / revision	Drw	Rev
P1	28.06.17	PRELIMINARY ISSUE	LT	RG

Issues & Revisions

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Birmingham | 0121 233 3322
Leeds | 0113 233 8000
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Manchester | 0161 233 4260
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Client
VASTINT

Project Title
LAMBY WAY

Drawing Title
ILLUSTRATIVE DRAINAGE STRATEGY

Drawn:	L. Towle		Reviewed:	J. O'Neill	
BWB Ref:	NTE 2313	Date:	04.01.19	Scale@A3:	NTS

Drawing Status
PRELIMINARY

Project - Originator - Zone - Level - Type - Role - Number	Status	Rev
LWC-BWB-HDG-XX-SK-CD-0001	S2	P2

Y:\NTE\NTE2313_Lamby Way, Cardiff\02. Project Delivery\01. WIP\Sketches\LWC-BWB-HDG-XX-SK-CD-S0-P2-0001_Illustrative Drainage Strategy.dwg

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