

Our Reference: 2020 – EG09 – A

Flood Risk and Drainage Solutions Ltd
144 New Lane
Oswaldtwistle
Lancashire
BB5 3QW
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Date: 21/02/20

SABS Drainage Impact Assessment to Support the Proposed Drive Thru Coffee Shop at ASDA Superstore, Holt Road, Wrexham

Introduction

Flood Risk and Drainage Solutions Ltd have been commissioned by Euro Garages Ltd to provide a Detailed Drainage Design for the development of a drive through coffee shop, located on part of the existing car parking area serving the ASDA site on Holt Road in Wrexham.

Existing Site

At present the site comprises of car parking area associated with the ASDA Supermarket to the north of the application site

- Developable area = 0.195Ha

Redline Boundary

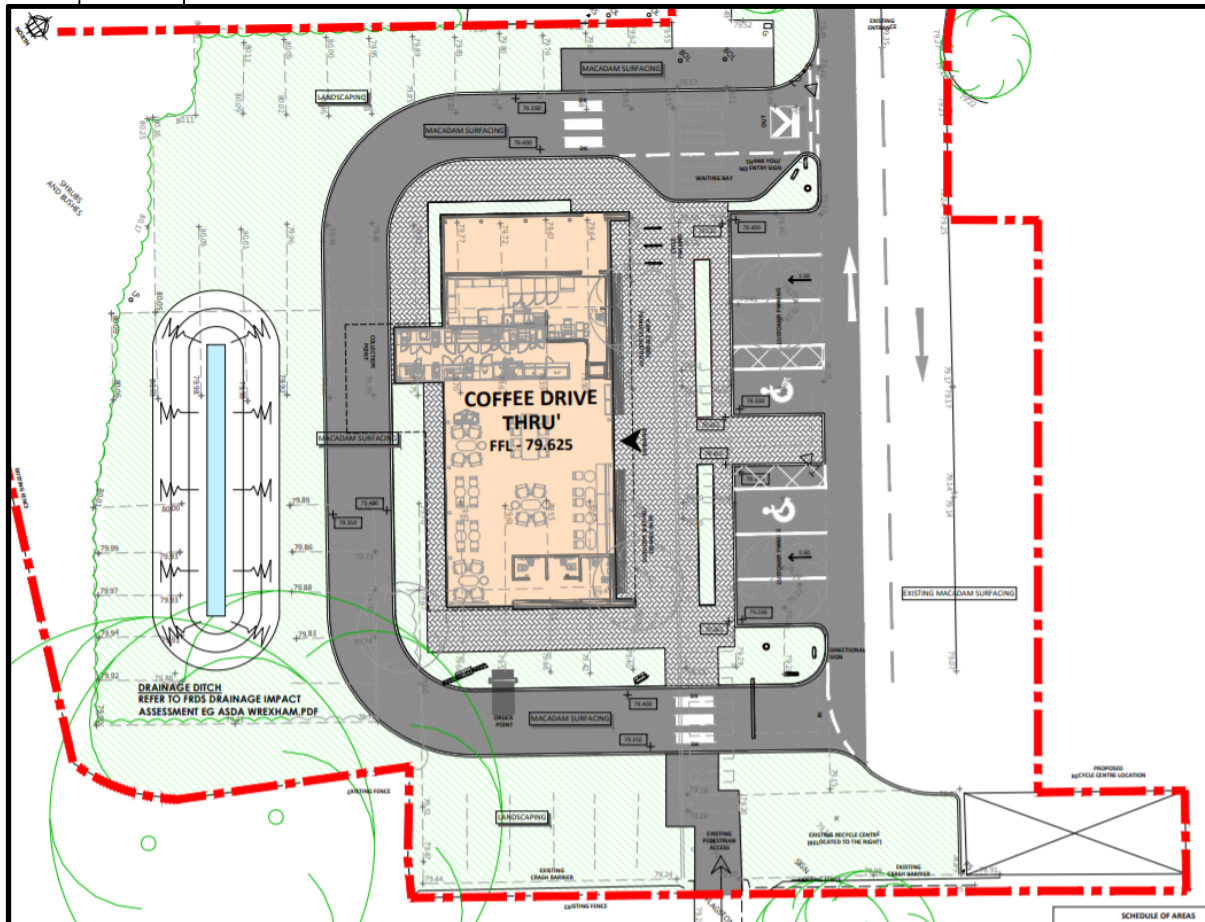


Development Proposals

Development proposals comprise of the erection of a drive through coffee shop with associated car parking provisions and a reduction in impermeable area approx. 50% compared to the existing situation.

Post development the impermeable area of the site will reduce from 100% i.e. 0.195Ha to approximately 47% 0.0926Ha.

Development Proposals



Existing Drainage

A CCTV Survey was unavailable at the time of writing, however it is understood that the existing car parking area is currently positively drained via a network of linier drainage channels which ultimately pass through a bypass separator, before discharging into a Public Sewer Network.

Welsh Water Sewer Records show that the nearest public surface water sewer is a public combined sewer located on Stryt Holt Road located south east of the site.

It is also noted that the ASDA Petrol Filling Station located over the north west boundary is served by a private foul sewer which serves the petrol filling forecourt.

Hierarchy of Surface Water Disposal

The hierarchy for disposal of surface water from new developments is outlined within the Building Regulations Approved Document H and specifies the following methods in order of preference:

- Infiltration via soakaway or other suitable infiltration device
- Discharge to watercourse

- Discharge to public surface water sewer
- Discharge to public combined sewer

Infiltration

Borehole logs taken from the BGS online service approximately 100m north of the application site show that the underlying ground comprises of sand and gravel down to 7.5m BGL, which is considered suitable for the use of infiltration techniques.

Furthermore, Soilscape maps identify that the proposed development site is located on ground which is considered to be freely draining on acid loamy soils.

*See attachments for Desktop Ground Conditions.

Taking the above into consideration disposal of surface water via infiltration methods is considered to be suitable.

Infiltration Rates

At the time of writing on-site percolation testing had not been undertaken, therefore in the interim indicative infiltration rates have been used within the Pre-Application Drainage Design to estimate surface water storage volumes.

- CIRIA Project Report 21 – Sand (worst-case) 0.36m/hr or 10⁻⁵m/s

Following receipt of on-site percolation test results (undertaken in accordance with BRE Digest 365 at the location of the proposed basin) the drainage strategy will be updated and amended to reflect the findings.

Surface Water Runoff Volumes

- Rainfall Depth = 70.04mm during the 100 Year 6 Hour Event

M5-D=M5-6x-Z1

M5-D=17x2.0

M5-D=34

M5-DxZ2

34x2.06=70.04mm

Existing Site Impermeable Area = 0.195Ha

- Existing Volume = 136.5m³ During the 100 Year Event

Proposed Site Impermeable Area = 0.0926Ha

- Proposed Volume = 77.8m³ During the 100 Year + 20% Climate Change Event

Indicative Attenuation Volumes

Indicative attenuation volumes based on a proposed impermeable area of 0.926Ha and an infiltration rate of 0.36m/hr have been calculated using FLOW Software for the 100 year + 20% climate change event as **7m³ – 26m³**.

Proposed Surface Water Drainage Strategy

Surface water flows from the application site are to be collected via rainwater down pipes and a network of trapped gullies, before being directed into a Dry Detention Basin which incorporates an infiltration trench at the base, located on land to the west of the site.

Dry Detention Basin/Infiltration Trench

- Top Area = 136m²
- Side Slopes = 1:3
- Depth of Basin = 1m
- Base Length = 15m
- Base Width = 1m
- Infiltration Trench length = 15m
- Trench Width = 1m
- Trench Depth = 1.5m
- Trench Porosity = 0.33
- Total Porosity Combined with Basin = 0.81
- Total Volume Combined = 66.825
- Indicative Infiltration Rate = 0.36m/hr

Pollution Control

- Trapped Gullies, Manhole Silt Traps and Infiltration Trench

Proposed Surface Water Discharge Rates

The proposed surface water drainage strategy has been modelled using FLOW Software for the 1 year + 20% climate change, 30 year + 20% climate change and 100 year + 20% climate change events, the results are tabulated below for reference.

Proposed Discharge Rates

Return Period	Comment
1 Year + 20% Climate Change	OK
30 Year + 20% Climate Change	Surcharged
100 Year + 20% Climate Change	Flood Risk

Half Drain Down within 24 Hours

Modelling during normal conditions shows that all the structures drained down within 1440 mins i.e. 24 hours during the 100 year + 20% climate change event.

Freeboard

Modelling during normal conditions shows that the basin has freeboard of 0.464m during the 100 year + 20% climate change event.

Exceedance Route

Modelling normal conditions during the 100 year + 20% climate change event shows that the proposed drainage network has sufficient capacity to accommodate flows below ground level with no flooding.

System Failure

System failure was simulated by reducing the infiltration rate by 50%. During system failure the proposed drainage network has sufficient capacity to retain flows below ground and crest level of the structure. The freeboard level has now reduced to 0.362m

Management/Maintenance

Following development, the drainage network serving the site will remain private, upon request from the LPA the developer is to provide evidence of the funding mechanism for the management and maintenance of the drainage system.

Typical maintenance requirements for infiltration basins and soakaways are provided below:

TABLE 13.2 Operation and maintenance requirements for infiltration basins

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter, debris and trash	Monthly
	Cut grass – for landscaped areas and access routes	Monthly (during growing season) or as required
	Cut grass – meadow grass in and around basin	Half yearly: spring (before nesting season) and autumn
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
Occasional maintenance	Reseed areas of poor vegetation growth	Annually, or as required
	Prune and trim trees and remove cuttings	As required
	Remove sediment from pre-treatment system when 50% full	As required
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realign the rip-rap	As required
	Repair or rehabilitate inlets, outlets and overflows	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates	As required
	Relevel uneven surfaces and reinstate design levels	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation; establish appropriate silt removal frequencies	Half yearly
	Inspect infiltration surfaces for compaction and ponding	Monthly

TABLE 13.1 Operation and maintenance requirements for soakaways

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Foul Flows

Foul flows from the proposed development are to be connected to the private foul drainage system serving the ASDA Petrol Filling Station forecourt, downstream of the forecourt separator, located over the north west boundary of the site.

SABS Checklist

1. Initial Surface Water Discharge Hierarchy – Infiltration (on-site percolation testing to be undertaken)
2. Initial Infiltration Assessment – Works to be carried out prior detailed design: Percolation Testing, Desk Top Ground Investigation Report (outlining groundwater potential and contaminated land).
3. Approximate Impermeable area – Pre development = 0.1950Ha, Post development = 0.0926Ha
4. Initial Calculation for Peak Discharge – Not required infiltration used.
5. Initial Calculation for Long Term Storage – Existing = 136m³ Proposed = 77.8m³
6. Initial Calculation of Attenuation Storage – 100Y + 20% Climate Change Event = 7-26m³
7. Water Quality - Trapped Gullies, Silt Trap Manholes and Infiltration Trench
8. Biodiversity – Grassed areas and planting increased by 50% compared to the existing situation
9. Amenity – Enhanced public amenity provided by outdoor seating areas, grassed areas, planting and SUDS Basin.
10. Non-performance Bond, Adoption, Operation & Maintenance – Upon request from the LPA developer to provide the funding mechanism

Attachments

- Location Plan
- Development Proposals
- Existing Site
- Desktop Ground Conditions
- Welsh Water Sewer Records
- Initial Assessment of Attenuation Storage
- Proposed Drainage Layout Drawing
- Typical Drainage Details Drawing and Manhole Schedule
- Modelled Surface Water Network Simulation Report (Normal Conditions)
- Modelled Surface Water Network Simulation Report (System Failure)

We trust that the above is acceptable and look forward to hearing from you in due course; however, should you have any queries, please do not hesitate to contact me.

Yours Sincerely,



Chris Vose

Flood Risk and Drainage Solutions Ltd

Location Plan



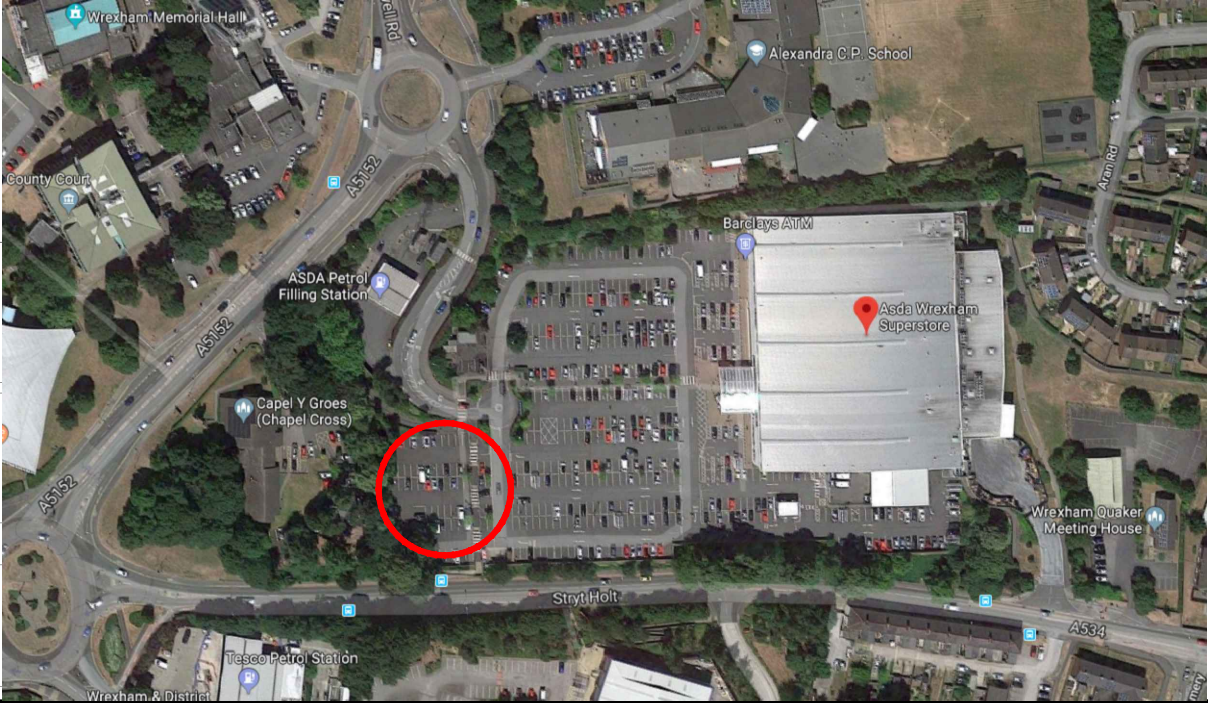
GENERAL NOTES

This drawing has been prepared for feasibility purposes only & has been prepared of Ordnance Survey Data.

Do not scale off this drawing - if dimensions are required contact Jennings Design Ltd.

Site boundary has been shown for indicative purposes only, overlay of ownership boundary is to be confirmed upon receipt of title documentation.

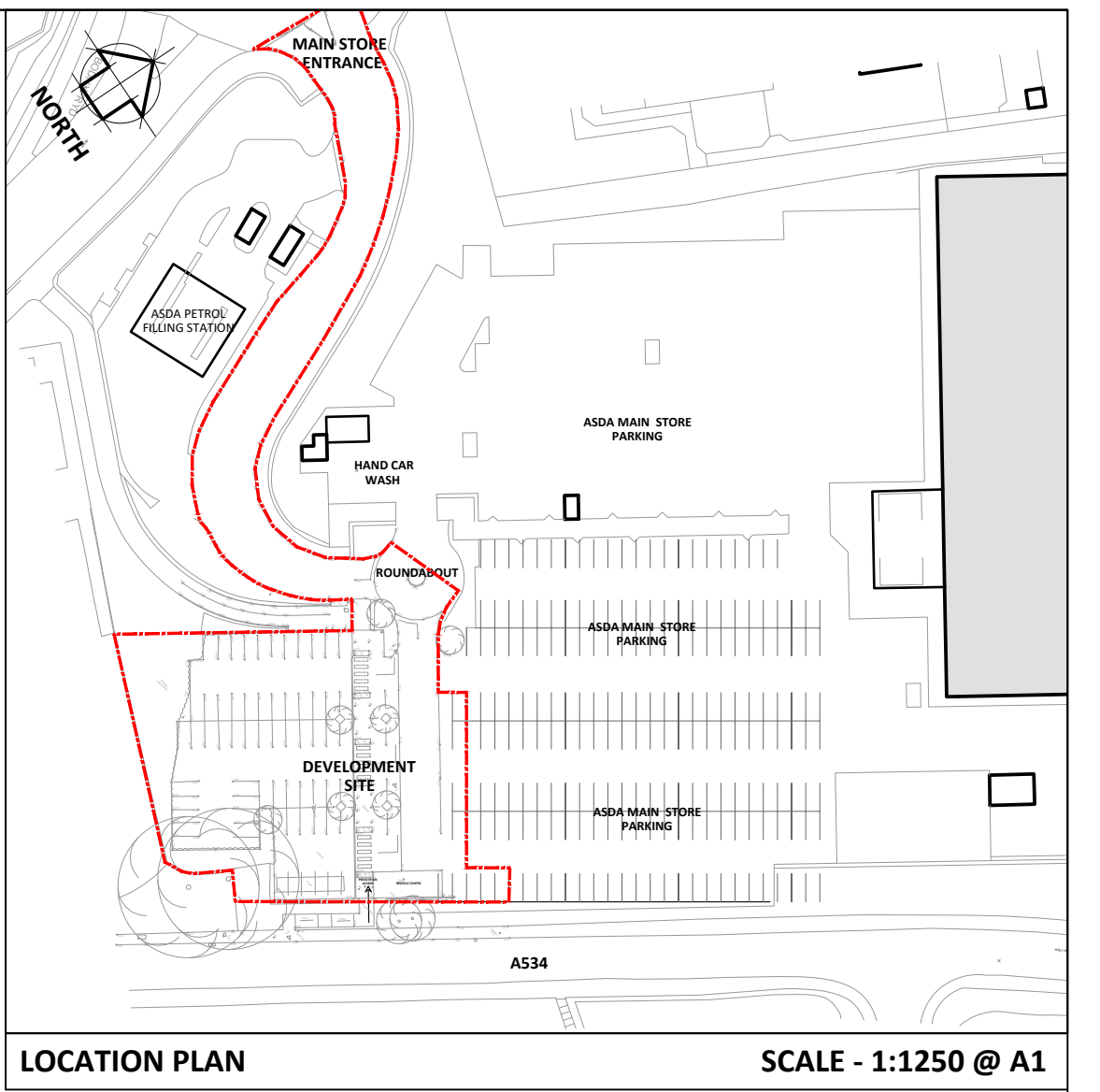
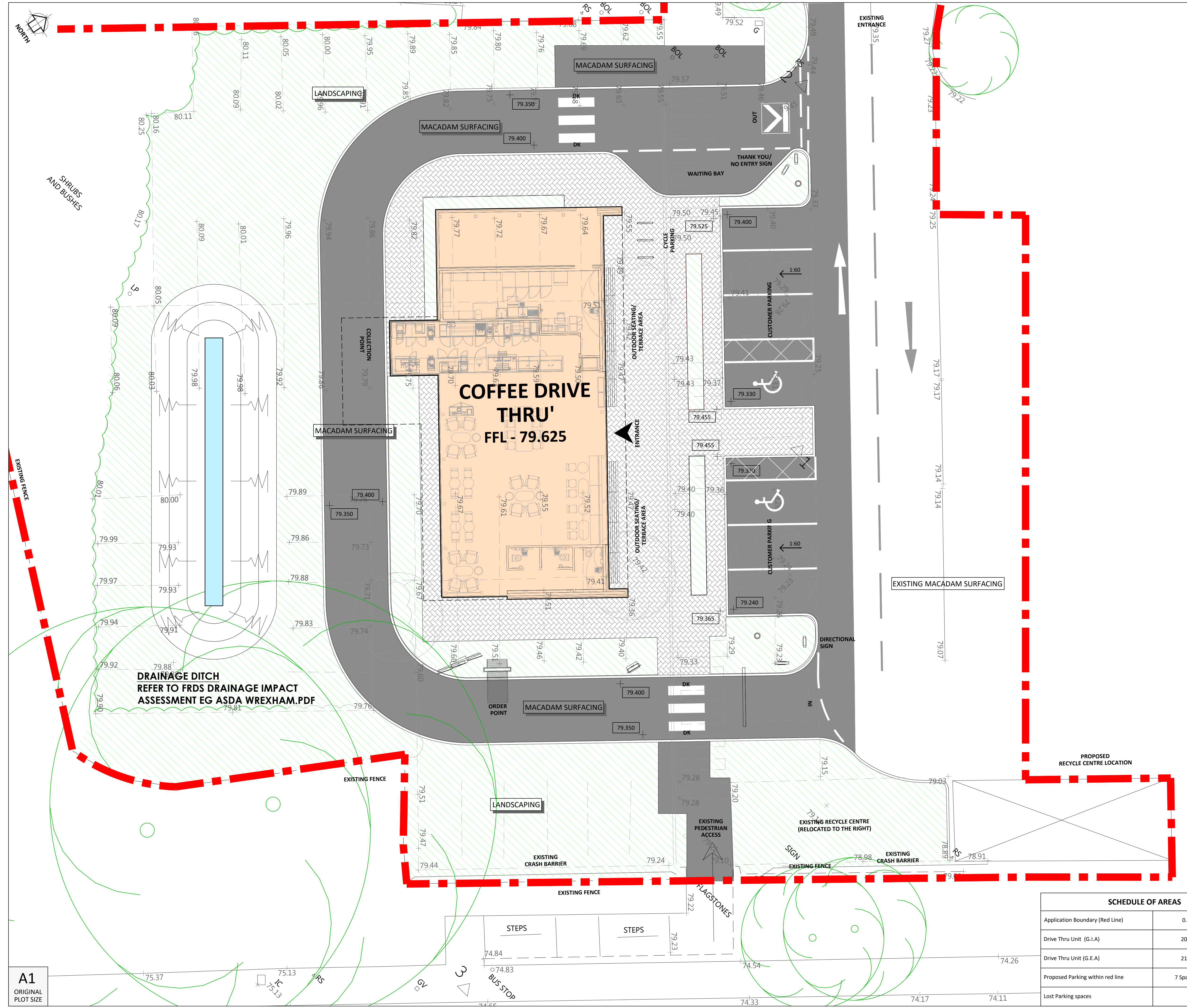
CDM 2015 - Designer
There are no unusual hazards or risks on site other than those specified on the drawing or below;



STATUS			RED LINE PLAN			CLIENT		Euro Garages		 SCALE - METRES 1:500 @ A3		 Euro Garages													
DRAWN BY		MDB		ISSUE DATE		September '19		SCALE		1:500 @ A3				ADDRESS		JENNINGS DESIGN LTD		© Protected by UK Copyright Law							
PLAN NUMBER		190815-RLP-01		REVISION		--		Holt Rd		Wrexham				LL13 8HL		York House Valley Court		Canal Road		Bradford		Tel: 01274 395 422		West Yorkshire BD1 4SP	



Development Proposals



- GENERAL NOTES**
- This plan has been prepared for the submission and approval under Town and Country Planning only.
 - Fuel installation to be fully compliant with all relevant current Licensing and Environmental Standard and Regulations.
- Any advertisement shown is subject to a separate application.
- GENERAL SITE NOTES**
- BUILDING MATERIALS**
Refer to Proposed Building Elevations Sheet.
- LANDSCAPING**
All denoted landscaped margins will either be seeded / turfed & any planting will be detailed by specialist
- SURFACED MATERIAL**
See surfacing key for all relevant surface finishes
- CROSSINGS**
ENTRANCE/EXIT - Existing entrance/exit crossing to be used with the installation of appropriate entry / no exit signage.
- NOTE - ALL HIGHWAY WORKS ARE SHOWN FOR INDICATIVE PURPOSES ONLY, DETAILED DESIGN TO BE DONE BY SPECIALIST**
- FLOODLIGHTS:**
5 meter column floodlights (Location shown diagrammatically) to be installed on site as per specialist design layout, together with any building mounted bulkhead lights. all lighting to be LED
- SURFACE FINISHES:**
- Denotes selected & approved paving stones for seated terraced area to the side of the building
 - Denotes macadam road surfaced areas
 - Denotes seeded & turfed landscape margin areas to the site perimeters (any planting to be detailed by specialist)

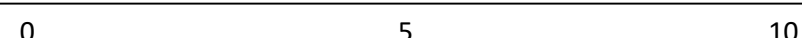
C	20.02.20	Site boundary updated & DDA bay adjusted.	JS
B	17.02.20	Proposed recycle centre shown on the drawing.	JS
A	31.01.20	Drainage ditch added at the back of the shop. Site boundary updated.	JS
Rev	Date	Comments	
STATUS	PLANNING		
PROPOSAL	Drive Thru' Coffee Shop		
SITE LOCATION	ASDA WREXHAM Holt Rd Wrexham, LL13 8HL		
TITLE	PROPOSED LAYOUT		



JENNINGS DESIGN LIMITED

York House, Valley Court, Canal Road,
Bradford, West Yorkshire, BD1 4SP.

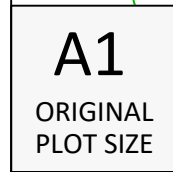
TEL. No. 01274 395422
FAX. No. 01274 395427
E-mail office@jen305.com

Drawn by:	JS	Checked by:	JHJ
Date:	January 2020	Scales:	1:100 @ A1
PLAN NO. 190815 - PLNG3 - C			
			
SCALE - METRES - 1:100			

SCHEDULE OF AREAS	
Application Boundary (Red Line)	0.40 H / 1.00 A
Drive Thru Unit (G.I.A)	200m² / 2150ft²
Drive Thru Unit (G.E.A)	215m² / 2315ft²
Proposed Parking within red line	7 Spaces (Inc. 2 DDA)
Lost Parking spaces	62 Bays

A1
ORIGINAL
PLOT SIZE

Existing Site



GENERAL NOTES

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2. Fuel installation to be fully compliant with all relevant current Licensing and Environmental Standard and Regulations.

Any advertisement shown is subject to a separate application.

The logo for Euro Garages features a large, stylized green 'EG' monogram. Below the monogram, the words 'Euro Garages' are written in a blue, sans-serif font.

Euro Garages

JENNINGS DESIGN LIMITED

York House, Valley Court, Canal Road,
Bradford, West Yorkshire, BD1 4SP.

TEL No. 01274 395422
FAX No. 01274 395427
E-mail office@jen305.com

Drawn by: JS	Checked by: JHJ
Date: January 2020	Scales: 1:200 @ A1
PLAN NO. 190815 - PLNG1	
0 10 20 SCALE - METRES - 1:200	

Desktop Ground Conditions

SJ 35 SW / 481
NGR 3391 5069

Moist Soil Engineering Limited

PARKSIDE LANE

LEEDS LS16 3X.

Contract No. SI0758/E2370

Borehole No. 4

Location Wrexham

Ground Level ca 80 m AOD

Client Bingham Bladec & Ptnrs.

Date 2.12.72

BOREHOLE LOG

STRATA	Legend	Depth below Ground Level	Thickness of Strata	Type of Sample	c kN/sq.m	ϕ deg.	m.c %	γ kg/cu.m	N
Tarmac		0.07	0.07						
MADE GROUND: Sandstone, bricks, shale, ashes, stones, sand and soil		0.90	0.83	0.90					
Brown sandy SOIL		1.20	0.30						21
Compact brown SAND AND GRAVEL		1.85	0.65	1.85					15
Compact to dense, fine to medium brown SAND with occasional pebbles		3.05							40
		4.60							36
		6.10							23
		7.60							30
		7.80	5.95						

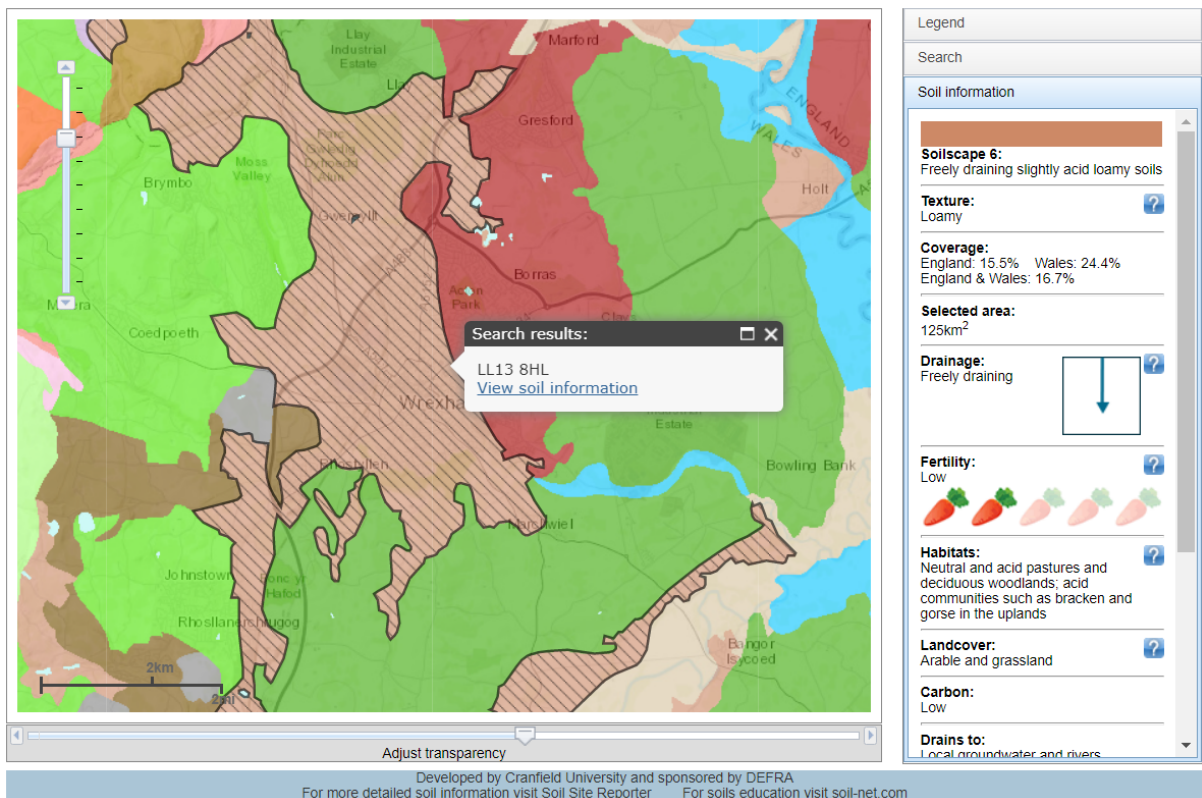
Water Struck at None encountered

Maximum Observed Water Level

Undisturbed Sample ☐
Disturbed Sample ☐
Water Sample
Penetration Test

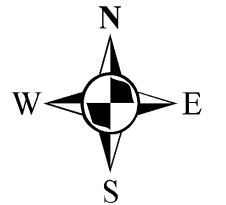
c = Cohesion
 ϕ = Angle of Internal Friction
m.c = Moisture Content
 γ = Bulk Density
N = Standard Penetration Value

Water levels are subject to seasonal or tidal variation and should not be taken as constant



Welsh Water Sewer Records

Asda Wrexham



LEGEND(Representative of most common features)

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

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and 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. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and 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.**

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Map Ref: 334001,350731
Map scale: 1:2500
Printed by: Denning Kelly-Ann
Printed on: 26 Sep 2019

Initial Assessment of Attenuation Storage

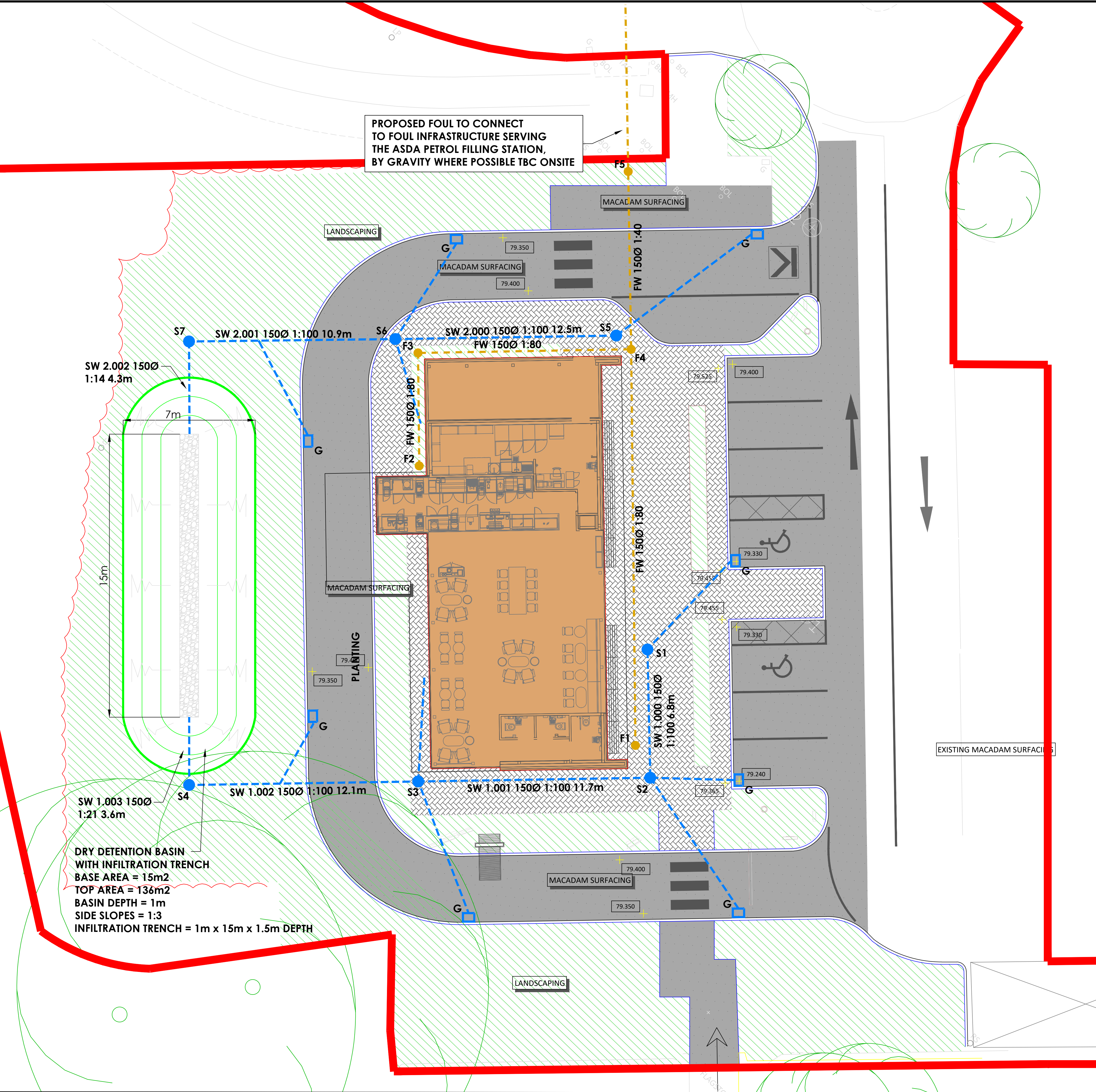
INDICATIVE ATTENUATION VOLUME

1 in 100 Year + 20% Climate Change Event

Storage Estimate

Return Period (years)	100
Climate Change (%)	20
Impermeable Area (ha)	0.093
Peak Discharge (l/s)	5.000
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	0.36000
Required Storage (m ³)	Calc
from	17
to	31
With infiltration (m ³)	
from	7
to	26

Proposed Drainage Layout Drawing and Manhole Schedule



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 7. PROPOSED FINISHED LEVELS HAVE ONLY BEEN ASSUMED AND SHOULD BE FINALISED BY A CIVIL ENGINEER.
 8. POSITION OF RAINWATER DOWN PIPES TO BE CONFIRMED BY THE ARCHITECT.

SURFACE WATER ATTENUATION

DRY DETENTION BASIN WITH INFILTRATION TRENCH
TOP AREA = 136m²
DEPTH OF BASIN = 1m
TRENCH = 1m x 15m x 1.5m DEPTH
SIDE SLOPES 1:3

BASED ON INDICATIVE INFILTRATION FOR SAND 0.36m/hr.

DESIGN TO BE REVISED FOLLOWING ON-SITE SOAKAWAY TESTING

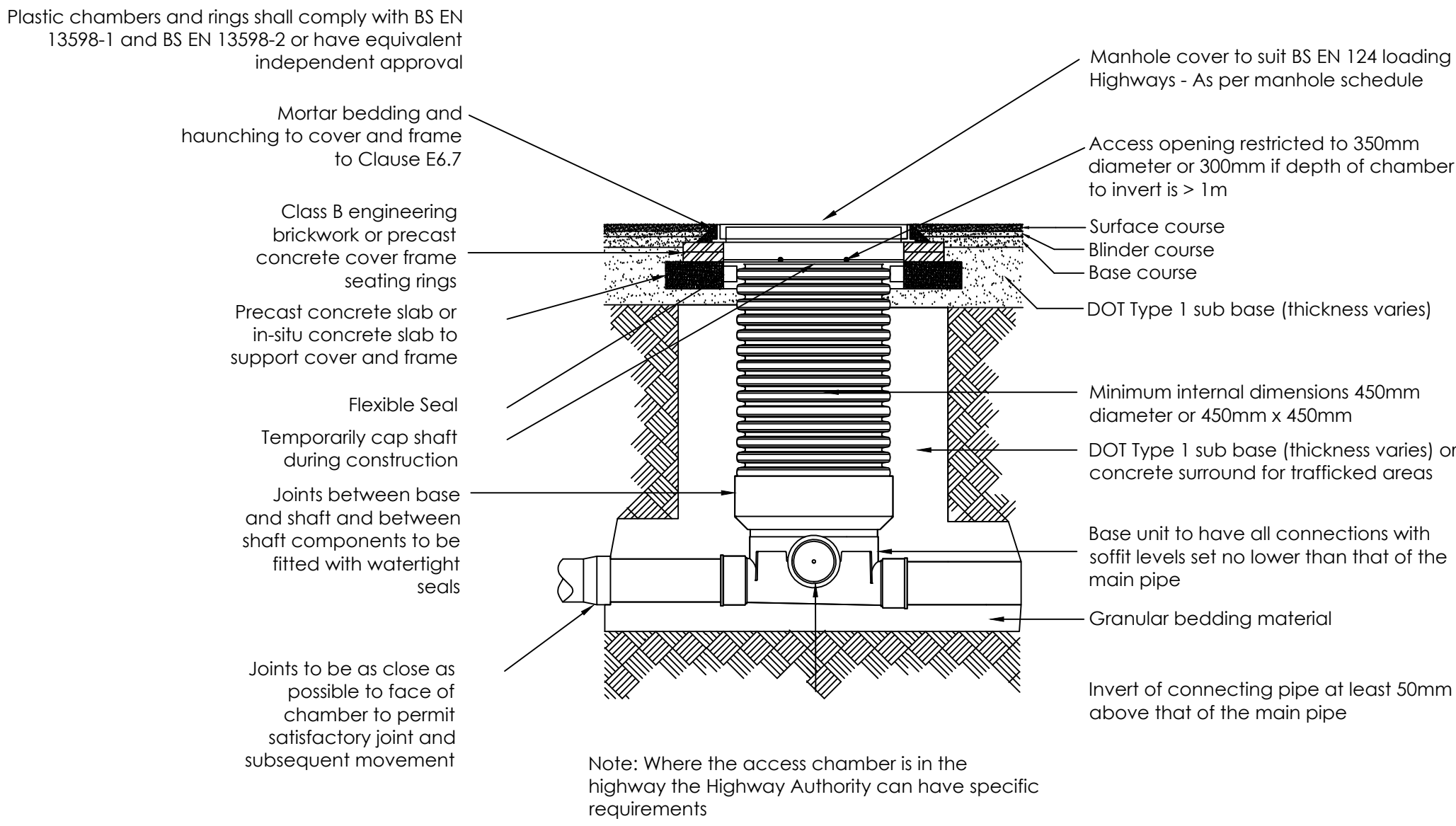
KEY

	PROPOSED LEVELS
	PROPOSED SURFACE WATER DRAIN
	PROPOSED FOUL DRAIN
	PROPOSED SURFACE WATER MANHOLE
	PROPOSED FOUL MANHOLE
	PROPOSED SURFACE WATER GULLY
	DRY DETENTION BASIN
	INFILTRATION TRENCH

A	MINOR AMENDMENTS TO DEVELOPMENT AREA	21/02/20	CV
REVISION	COMMENT	DATE	BY
 FLOOD RISK AND DRAINAGE SOLUTIONS LTD 144 New Lane, Oswaldtwistle, Lancashire, BB5 3QW WWW.FLOODRISK-DRAINAGE.CO.UK TEL: 07961477330		CLIENT:	DATE: 30/01/2020
		EURO GARAGES	STATUS:
		PROJECT:	DRAWN BY: CV
		DRIVE THRU COFFEE SHOP ASDA WREXHAM	SCALE: 1:100
		DRAWING TITLE: SABS PRE APPLICATION SURFACE WATER/FOUL LAYOUT	SIZE: A1
DRAWING REFERENCE: 2020-EG09-01	REVISION:		

Typical Drainage Details and Manhole Schedule

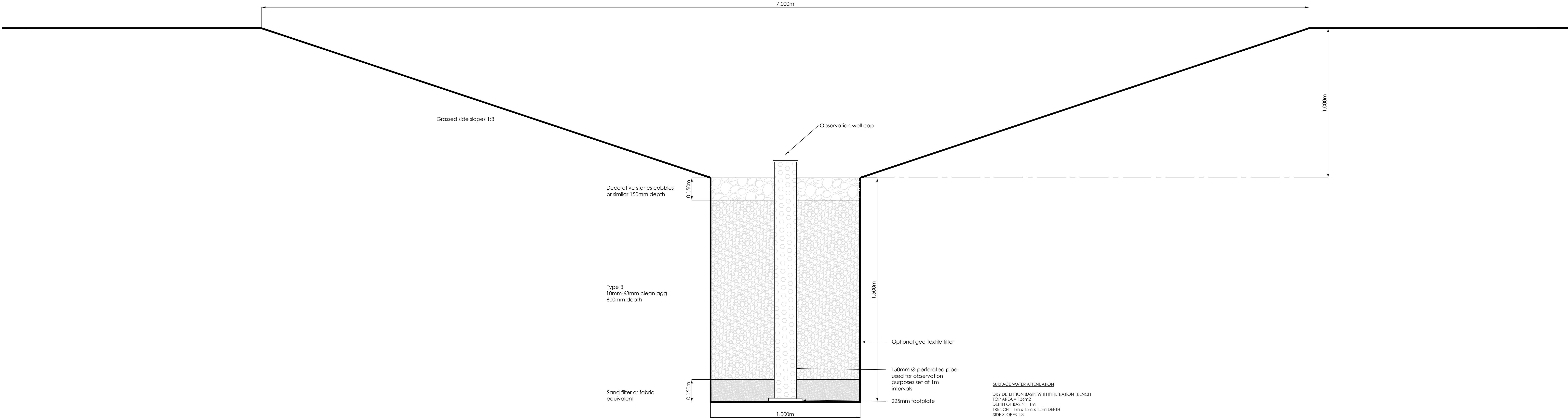
SURFACE WATER/FOUL MANHOLE SCHEDULE						
REFERENCE	CL	IL	DEPTH TO IL	MANHOLE DIA	CHAMBER TYPE	COVER TYPE
S1	79.450	78.800	0.650	600	PPIC	A15
S2	79.525	78.732	0.793	600	PPIC	A15
S3	79.525	78.615	0.910	600	PPIC	A15
S4	79.475	78.494	0.981	600	PPIC SILT TRAP	A15
S5	79.525	78.875	0.650	600	PPIC	A15
S6	79.525	78.750	0.775	600	PPIC	A15
S7	79.475	78.641	0.834	600	PPIC SILT TRAP	A15
F1	79.525	78.875	0.650	450	PPIC	A15
F2	79.525	78.829	0.696	450	PPIC	A15
F3	79.525	78.754	0.771	450	PPIC	A15
F4	79.525	78.613	0.912	450	PPIC	A15
F5	79.600	78.578	1.022	450	PPIC	A15



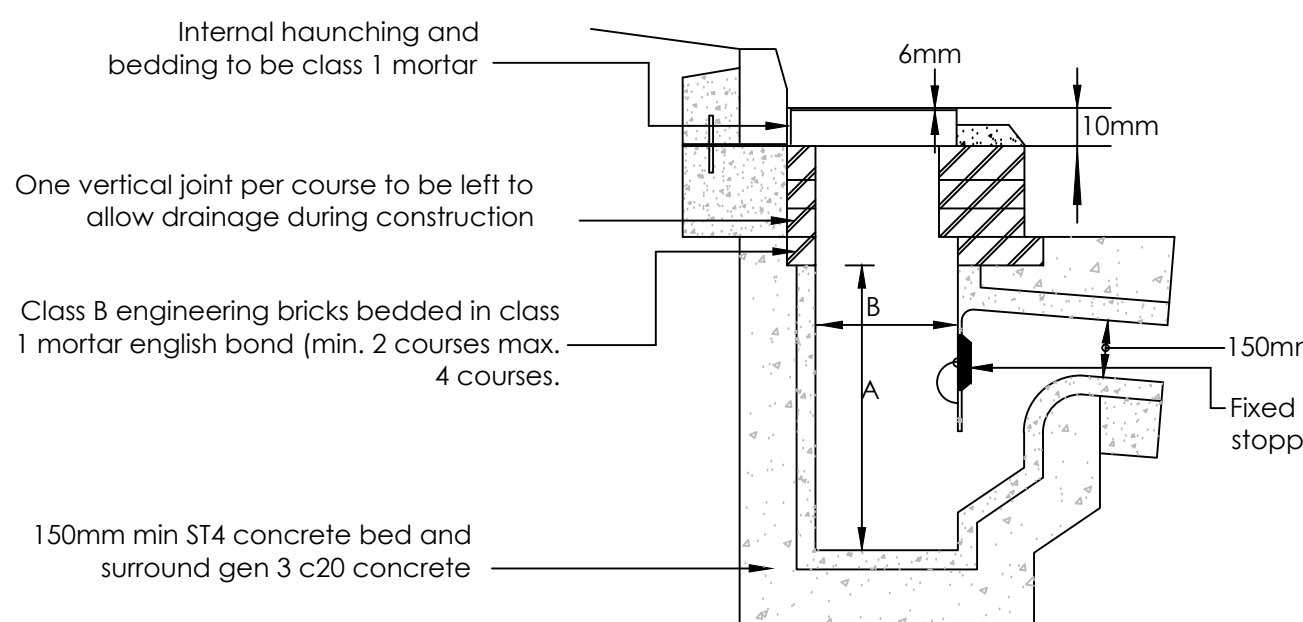
Typical Inspection Chamber
Max. 3m Deep Non Entry
Scale 1:20

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- PROPOSED FINISHED LEVELS HAVE ONLY BEEN ASSUMED AND SHOULD BE FINALISED BY A CIVIL ENGINEER.
- POSITION OF RAINWATER DOWN PIPES TO BE CONFIRMED BY THE ARCHITECT.



Dry Detention with
Infiltration Trench Base
Detail
Scale 1:10



Pre-Cast Concrete
Road Gully
(1:20)

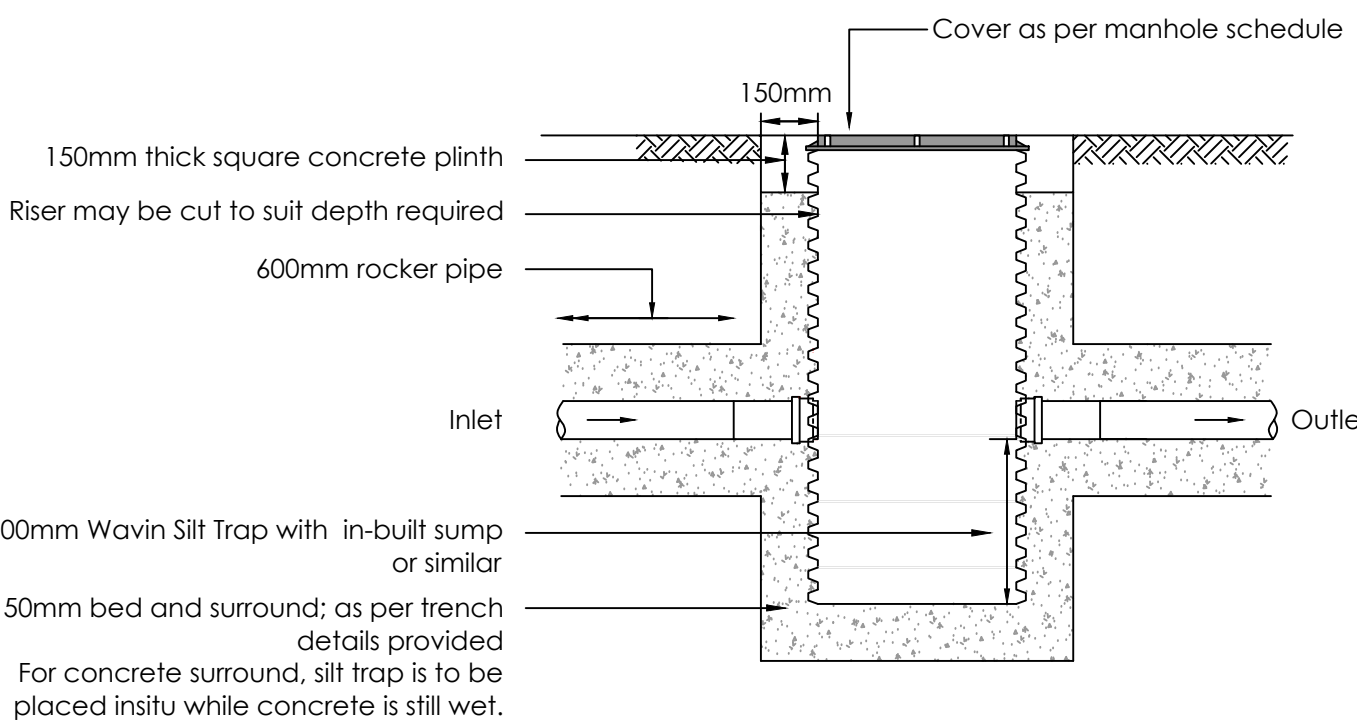
Gully grated to be BS EN 124 class 250.

Ductile iron with captive hinge size 325 x 312mm clear opening.

Pedestrian friendly mesh type gravel to be fitted in shared access ways.

Gully Dimensions:
A = 750mm B = 375mm

Trapping p.conc gully pot to BS 5911 F44-2



Typical Silt Trap
Scale (1:20)

REVISION	COMMENT	DATE	BY
		30/01/2020	
		STATUS:	
		DRAWN BY:	CV
		SCALE:	AS SHOWN
		SITE:	A0
		REVISION:	
		2020-EG09-02	

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Modelled Surface Water Network Simulation Report (Normal Conditions)

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.500
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	6.800	100.0	150	Circular	79.450	78.800	0.500	79.525	78.732	0.643
1.001	11.700	100.0	150	Circular	79.525	78.732	0.643	79.525	78.615	0.760
1.002	12.100	100.0	150	Circular	79.525	78.615	0.760	79.475	78.494	0.831
1.003	3.600	21.3	150	Circular	79.475	78.494	0.831	79.475	78.325	1.000
2.000	12.500	100.0	150	Circular	79.525	78.875	0.500	79.525	78.750	0.625
2.001	10.900	100.0	150	Circular	79.525	78.750	0.625	79.475	78.641	0.684
2.002	4.300	13.6	150	Circular	79.475	78.641	0.684	79.475	78.325	1.000
1.004	1.000	100.0	150	Circular	79.475	78.325	1.000	79.475	78.315	1.010

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	600	Manhole	Adoptable	S2	600	Manhole	Adoptable
1.001	S2	600	Manhole	Adoptable	S3	600	Manhole	Adoptable
1.002	S3	600	Manhole	Adoptable	S4	600	Manhole	Adoptable
1.003	S4	600	Manhole	Adoptable	TRENCH	1	Manhole	Adoptable
2.000	S5	600	Manhole	Adoptable	S6	600	Manhole	Adoptable
2.001	S6	600	Manhole	Adoptable	S7	600	Manhole	Adoptable
2.002	S7	600	Manhole	Adoptable	TRENCH	1	Manhole	Adoptable
1.004	TRENCH	1	Manhole	Adoptable	DUMMY OUT	1	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	79.450	0.650	600				
				0	1.000	78.800	150
S2	79.525	0.793	600				
				0	1.001	78.732	150
S3	79.525	0.910	600				
				0	1.002	78.615	150
S4	79.475	0.981	600				
				0	1.003	78.494	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
S5	79.525	0.650	600		0	2.000	78.875	150
S6	79.525	0.775	600		1	2.000	78.750	150
					0	2.001	78.750	150
S7	79.475	0.834	600		1	2.001	78.641	150
					0	2.002	78.641	150
TRENCH	79.475	1.150	1		1	2.002	78.325	150
					2	1.003	78.325	150
					0	1.004	78.325	150
DUMMY OUT	79.475	1.160	1		1	1.004	78.315	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	20	0	0
30	20	0	0
100	20	0	0

Node DUMMY OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	78.315	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.001		

Node TRENCH Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.36000	Safety Factor	2.0	Invert Level (m)	76.975
Side Inf Coefficient (m/hr)	0.36000	Porosity	0.81	Time to half empty (mins)	124

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	15.0	15.0	1.500	15.0	15.0	2.500	136.0	136.0

Results for 1 year +20% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	78.838	0.038	2.3	0.0306	0.0000	OK
15 minute winter	S2	10	78.780	0.048	4.0	0.0282	0.0000	OK
15 minute winter	S3	10	78.687	0.072	7.4	0.0601	0.0000	OK
15 minute winter	S4	10	78.544	0.050	7.4	0.0141	0.0000	OK
15 minute winter	S5	10	78.930	0.055	5.1	0.0780	0.0000	OK
15 minute winter	S6	10	78.837	0.087	9.9	0.1029	0.0000	OK
15 minute winter	S7	10	78.692	0.051	9.9	0.0145	0.0000	OK
360 minute winter	TRENCH	280	78.114	-0.211	3.1	13.8375	0.0000	OK
15 minute summer	DUMMY OUT	1	78.315	0.000	0.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	2.3	0.550	0.130	0.0285	
15 minute winter	S2	1.001	S3	4.0	0.604	0.225	0.0777	
15 minute winter	S3	1.002	S4	7.4	1.097	0.416	0.0817	
15 minute winter	S4	1.003	TRENCH	7.4	1.557	0.190	0.0170	
15 minute winter	S5	2.000	S6	5.1	0.624	0.287	0.1024	
15 minute winter	S6	2.001	S7	9.9	1.252	0.557	0.0864	
15 minute winter	S7	2.002	TRENCH	9.9	2.002	0.204	0.0212	
15 minute summer	TRENCH	1.004	DUMMY OUT	0.0	0.000	0.000	0.0000	
15 minute summer	TRENCH	Infiltration		0.8				
15 minute summer	DUMMY OUT	Orifice		0.0				0.0

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	S1	10	78.864	0.064	5.7	0.0515	0.0000	OK
240 minute winter	S2	172	78.861	0.129	2.1	0.0757	0.0000	OK
240 minute winter	S3	172	78.861	0.246	3.9	0.2049	0.0000	SURCHARGED
240 minute winter	S4	172	78.860	0.366	4.1	0.1037	0.0000	SURCHARGED
15 minute winter	S5	10	79.053	0.178	12.4	0.2528	0.0000	SURCHARGED
15 minute winter	S6	10	78.986	0.236	23.0	0.2802	0.0000	SURCHARGED
240 minute winter	S7	172	78.861	0.220	5.3	0.0622	0.0000	SURCHARGED
240 minute winter	TRENCH	172	78.860	0.535	8.9	30.1716	0.0000	SURCHARGED
240 minute winter	DUMMY OUT	172	78.860	0.545	0.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	5.7	0.691	0.321	0.0561	
15 minute summer	S2	1.001	S3	9.7	0.727	0.546	0.1524	
15 minute winter	S3	1.002	S4	18.0	1.292	1.017	0.1651	
15 minute winter	S4	1.003	TRENCH	18.0	1.901	0.465	0.0341	
15 minute winter	S5	2.000	S6	11.5	0.727	0.647	0.2201	
15 minute winter	S6	2.001	S7	22.2	1.416	1.251	0.1522	
15 minute winter	S7	2.002	TRENCH	22.3	2.400	0.460	0.0400	
60 minute summer	TRENCH	1.004	DUMMY OUT	4.3	0.899	0.244	0.0176	
240 minute winter	TRENCH	Infiltration		3.1				
240 minute winter	DUMMY OUT	Orifice		0.0				0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.90%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	S1	172	79.014	0.214	1.6	0.1723	0.0000	SURCHARGED
240 minute winter	S2	172	79.014	0.282	2.7	0.1647	0.0000	SURCHARGED
240 minute winter	S3	172	79.013	0.398	5.1	0.3313	0.0000	SURCHARGED
240 minute winter	S4	172	79.012	0.518	4.8	0.1465	0.0000	SURCHARGED
15 minute winter	S5	11	79.246	0.371	15.9	0.5273	0.0000	FLOOD RISK
15 minute winter	S6	11	79.138	0.388	29.4	0.4602	0.0000	SURCHARGED
240 minute winter	S7	172	79.012	0.371	6.9	0.1050	0.0000	SURCHARGED
240 minute winter	TRENCH	172	79.011	0.686	11.5	38.8108	0.0000	SURCHARGED
240 minute winter	DUMMY OUT	172	79.011	0.696	1.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	7.2	0.696	0.408	0.1051	
15 minute winter	S2	1.001	S3	11.8	0.733	0.667	0.2060	
15 minute winter	S3	1.002	S4	21.1	1.292	1.189	0.1800	
15 minute winter	S4	1.003	TRENCH	21.2	1.962	0.547	0.0634	
15 minute winter	S5	2.000	S6	14.6	0.830	0.823	0.2201	
15 minute winter	S6	2.001	S7	28.4	1.714	1.597	0.1652	
15 minute winter	S7	2.002	TRENCH	28.5	2.508	0.587	0.0570	
60 minute winter	TRENCH	1.004	DUMMY OUT	4.6	0.425	0.259	0.0176	
240 minute winter	TRENCH	Infiltration		4.0				
240 minute winter	DUMMY OUT	Orifice		0.0				0.0

Modelled Surface Water Network Simulation Report (System Failure)

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.500
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	6.800	100.0	150	Circular	79.450	78.800	0.500	79.525	78.732	0.643
1.001	11.700	100.0	150	Circular	79.525	78.732	0.643	79.525	78.615	0.760
1.002	12.100	100.0	150	Circular	79.525	78.615	0.760	79.475	78.494	0.831
1.003	3.600	21.3	150	Circular	79.475	78.494	0.831	79.475	78.325	1.000
2.000	12.500	100.0	150	Circular	79.525	78.875	0.500	79.525	78.750	0.625
2.001	10.900	100.0	150	Circular	79.525	78.750	0.625	79.475	78.641	0.684
2.002	4.300	13.6	150	Circular	79.475	78.641	0.684	79.475	78.325	1.000
1.004	1.000	100.0	150	Circular	79.475	78.325	1.000	79.475	78.315	1.010

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S1	600	Manhole	Adoptable	S2	600	Manhole	Adoptable
1.001	S2	600	Manhole	Adoptable	S3	600	Manhole	Adoptable
1.002	S3	600	Manhole	Adoptable	S4	600	Manhole	Adoptable
1.003	S4	600	Manhole	Adoptable	TRENCH	1	Manhole	Adoptable
2.000	S5	600	Manhole	Adoptable	S6	600	Manhole	Adoptable
2.001	S6	600	Manhole	Adoptable	S7	600	Manhole	Adoptable
2.002	S7	600	Manhole	Adoptable	TRENCH	1	Manhole	Adoptable
1.004	TRENCH	1	Manhole	Adoptable	DUMMY OUT	1	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S1	79.450	0.650	600				
				0	1.000	78.800	150
S2	79.525	0.793	600				
				0	1.001	78.732	150
S3	79.525	0.910	600				
				0	1.002	78.615	150
S4	79.475	0.981	600				
				0	1.003	78.494	150

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S5	79.525	0.650	600	0	2.000	78.875	150
S6	79.525	0.775	600	0	2.000	78.750	150
S7	79.475	0.834	600	0	2.001	78.750	150
TRENCH	79.475	1.150	1	0	2.001	78.641	150
				0	2.002	78.641	150
				1	2.002	78.325	150
				2	1.003	78.325	150
				0	1.004	78.325	150
DUMMY OUT	79.475	1.160	1	1	1.004	78.315	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	20	0	0
30	20	0	0
100	20	0	0

Node DUMMY OUT Online Orifice Control

Flap Valve	x	Invert Level (m)	78.315	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Diameter (m)	0.001		

Node TRENCH Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.18000	Safety Factor	2.0	Invert Level (m)	76.975
Side Inf Coefficient (m/hr)	0.18000	Porosity	0.81	Time to half empty (mins)	328

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	15.0	15.0	1.500	15.0	15.0	2.500	136.0	136.0

Results for 1 year +20% CC Critical Storm Duration. Lowest mass balance: 99.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S1	10	78.838	0.038	2.3	0.0306	0.0000	OK
15 minute winter	S2	10	78.780	0.048	4.0	0.0282	0.0000	OK
15 minute winter	S3	10	78.687	0.072	7.4	0.0601	0.0000	OK
15 minute winter	S4	10	78.544	0.050	7.4	0.0141	0.0000	OK
15 minute winter	S5	10	78.930	0.055	5.1	0.0780	0.0000	OK
15 minute winter	S6	10	78.837	0.087	9.9	0.1029	0.0000	OK
15 minute winter	S7	10	78.692	0.051	9.9	0.0145	0.0000	OK
720 minute winter	TRENCH	540	78.538	0.213	2.1	19.1855	0.0000	SURCHARGED
720 minute winter	DUMMY OUT	540	78.538	0.223	0.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	2.3	0.550	0.130	0.0285	
15 minute winter	S2	1.001	S3	4.0	0.604	0.225	0.0777	
15 minute winter	S3	1.002	S4	7.4	1.097	0.416	0.0817	
15 minute winter	S4	1.003	TRENCH	7.4	1.557	0.190	0.0170	
15 minute winter	S5	2.000	S6	5.1	0.624	0.287	0.1024	
15 minute winter	S6	2.001	S7	9.9	1.252	0.557	0.0864	
15 minute winter	S7	2.002	TRENCH	9.9	2.002	0.204	0.0212	
960 minute summer	TRENCH	1.004	DUMMY OUT	0.2	0.205	0.010	0.0063	
720 minute winter	TRENCH	Infiltration		0.6				
720 minute winter	DUMMY OUT	Orifice		0.0				0.0

Results for 30 year +20% CC Critical Storm Duration. Lowest mass balance: 99.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	S1	344	78.972	0.172	0.8	0.1385	0.0000	SURCHARGED
480 minute winter	S2	344	78.972	0.240	1.3	0.1403	0.0000	SURCHARGED
480 minute winter	S3	344	78.972	0.357	2.4	0.2968	0.0000	SURCHARGED
480 minute winter	S4	344	78.971	0.477	2.2	0.1351	0.0000	SURCHARGED
15 minute winter	S5	10	79.053	0.178	12.4	0.2528	0.0000	SURCHARGED
15 minute winter	S6	10	78.986	0.236	23.0	0.2802	0.0000	SURCHARGED
480 minute winter	S7	344	78.971	0.330	3.3	0.0935	0.0000	SURCHARGED
480 minute winter	TRENCH	344	78.971	0.646	5.0	36.3182	0.0000	SURCHARGED
480 minute winter	DUMMY OUT	344	78.971	0.656	0.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	5.7	0.691	0.321	0.0561	
15 minute summer	S2	1.001	S3	9.7	0.727	0.546	0.1524	
15 minute winter	S3	1.002	S4	18.0	1.292	1.017	0.1651	
15 minute winter	S4	1.003	TRENCH	18.0	1.901	0.465	0.0341	
15 minute winter	S5	2.000	S6	11.5	0.727	0.647	0.2201	
15 minute winter	S6	2.001	S7	22.2	1.416	1.251	0.1522	
15 minute winter	S7	2.002	TRENCH	22.3	2.400	0.460	0.0400	
60 minute summer	TRENCH	1.004	DUMMY OUT	3.1	0.233	0.176	0.0176	
480 minute winter	TRENCH	Infiltration		1.9				
480 minute winter	DUMMY OUT	Orifice		0.0				0.0

Results for 100 year +20% CC Critical Storm Duration. Lowest mass balance: 99.34%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
480 minute winter	S1	344	79.133	0.333	1.0	0.2687	0.0000	SURCHARGED
480 minute winter	S2	344	79.133	0.401	1.6	0.2348	0.0000	SURCHARGED
480 minute winter	S3	344	79.133	0.518	2.9	0.4312	0.0000	SURCHARGED
480 minute winter	S4	344	79.133	0.639	2.9	0.1808	0.0000	SURCHARGED
15 minute winter	S5	11	79.246	0.371	15.9	0.5273	0.0000	FLOOD RISK
15 minute winter	S6	11	79.138	0.388	29.4	0.4602	0.0000	SURCHARGED
480 minute winter	S7	344	79.133	0.492	3.9	0.1393	0.0000	SURCHARGED
480 minute winter	TRENCH	344	79.133	0.808	9.0	47.4083	0.0000	SURCHARGED
480 minute winter	DUMMY OUT	344	79.133	0.818	0.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	S1	1.000	S2	7.2	0.696	0.408	0.1051	
15 minute winter	S2	1.001	S3	11.8	0.733	0.667	0.2060	
15 minute winter	S3	1.002	S4	21.1	1.292	1.189	0.1800	
15 minute winter	S4	1.003	TRENCH	21.2	1.962	0.547	0.0634	
15 minute winter	S5	2.000	S6	14.6	0.830	0.823	0.2201	
15 minute winter	S6	2.001	S7	28.4	1.714	1.597	0.1652	
15 minute winter	S7	2.002	TRENCH	28.5	2.508	0.587	0.0573	
30 minute summer	TRENCH	1.004	DUMMY OUT	8.7	1.013	0.490	0.0176	
480 minute winter	TRENCH	Infiltration		2.4				
480 minute winter	DUMMY OUT	Orifice		0.0				0.1