

Our ref: 6896DS

Drainage Strategy
for
Land off Eversley Court
at
Minera, Wrexham

For : Gower Homes
8 Temple Row
Wrexham
LL13 8LY

03 May 2019

Drainage Strategy
for land off Everslet Court at Minera, Wrexham

Introduction

Coopers have been instructed to produce a Drainage Strategy Report for a site in Minera, Wrexham. Gower Homes are planning the construction of 9 detached residential properties with associated access road, parking, vehicular access and landscaping subject to conditions.

The site is greenfield and covers an area of 0.445ha. Site topography falls in a southerly direction with an average gradient of 1:25.

Surface Water Drainage

General

The design for a surface water drainage system for the proposed development will be guided by the principles set out in the Welsh Government's 'Recommended non-statutory standards for sustainable drainage (SuDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems' (2017)

The SuDS Standards Wales sets out the following hierarchy for surface water runoff destination:

- Priority Level 1: Surface water runoff is collected for use;
- Priority Level 2: Surface water runoff is infiltrated to ground;
- Priority Level 3: Surface water runoff is discharged to a surface water body;
- Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;
- Priority Level 5: Surface water runoff is discharged to a combined sewer.

Note that Priority Level 1 is the preferred (highest priority) and that 4 and 5 should only be used in exceptional circumstances.

Existing Surface Water Drainage

Surface water flows from the site currently drain to a shallow ditch located along the southern boundary. It is understood this then connects into a culverted watercourse routed through the housing estate to the south east of the site but details of the routes and connectivity are unclear.

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Existing Site Runoff

HR Wallingford 'greenfield runoff estimate' tool has been used to calculate run-off rates.

The greenfield runoff rate has been calculated as follows:

1yr	= 2.7 l/s
30yr	= 5.5 l/s
100yr	= 6.7 l/s
QBAR	= 3.1 l/s

The outputs are provided in Appendix 2.

Proposed Surface Water Drainage and Runoff Rates

Priority Level 1

Whilst rainwater harvesting has been considered for the proposed development it should be noted that any device enabling water re-use cannot be taken into account when sizing attenuation as the storage facility may be full when a storm event occurs. Therefore, an over flow to an infiltration device (where ground conditions allow) or to a watercourse / sewer will be required.

Gower Homes are not proposing to incorporate rainwater harvesting within the development, however they are proposing to install a water butt to each dwelling which will allow for water collection for garden re-use.

Priority Level 2

Infiltration tests have been undertaken by GroundSolve Ltd and confirmed the site is not suitable for infiltration techniques for disposal of surface water flows generated from the development. The results are provided in Appendix 2.

Priority Level 3

The site currently drains to a shallow ditch located at the southern boundary of the site. We are proposing to discharge all surface water flows from the proposed development to this

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watercourse to mimic the existing situation. Flows will be restricted to greenfield run-off rates prior to discharging to the watercourse.

Attenuation is provided within an on-line swale and dry basin. These are both shallow features with flows being restricted using a orifice plate device before being passed forward.

Please refer to Coopers Drawing No. 6986-12 for the surface water drainage proposals.

From 7 January 2019, all new developments of more than 1 dwelling house or where the construction area is 100m² or more, will require Sustainable Drainage Systems (SuDS) for surface water. From this date onwards, SuDS on new developments must be designed and built in accordance with the Statutory SuDS Standards published by the Welsh Ministers and SuDS Schemes must be approved by the local authority acting in its SAB role, before construction work begins.

Schedule 3 to the Flood and Water Management Act 2010 makes SuDS a mandatory requirement for all new developments. SuDS aim to manage rainfall in a way similar to natural processes, making use of the landscape and natural vegetation to control the flow and volume of surface water. SuDS can deliver multiple benefits including:

- flood risk reduction,
- improved water quality,
- opportunities for habitat creation,
- enhanced biodiversity,
- supporting well-being through bringing people closer to green and blue community spaces.

This development will be subject to a Full SABS Application demonstrating compliance with the Statutory SuDS Standards for the design, construction, operation and maintenance of surface water drainage systems serving new developments. Applications may be submitted to the SAB for determination either directly as a free standing application or alongside the planning application via the LPA. It is important to note that construction work which has drainage implications must not be commenced unless the drainage system for the work has been approved by the SAB.

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Foul Drainage

Following a review of Welsh Water sewers, we are proposing to connect into the public sewers in Eversley Court. A levels appraisal has confirmed a gravity connection from the site is achievable.

All foul sewers serving more than 1 plot will be subject to a S104 Adoption Agreement with Welsh Water. Refer to Appendix 1 for details of the proposed foul drainage.

Conclusion

Infiltration testing has confirmed the site is not suitable for infiltration techniques to dispose of surface water flows generated by the development.

We are proposing a discharge to the shallow watercourse located on the southern boundary. This will mimic the existing situation for the undeveloped site.

Surface water flows will be restricted to greenfield run-off rates and will not cause any increase in flood risk.

The surface water network will be subject to SABS approval and will require a full SABS Application.

The SABS application will provide full details of SUDS management plan and a Management Company will take responsibility for all SABS components. Gower Homes will provide details of the management company to satisfy the SABS Application.

The foul network will be offered for adoption to Welsh Water subject to a Section 104 Agreement

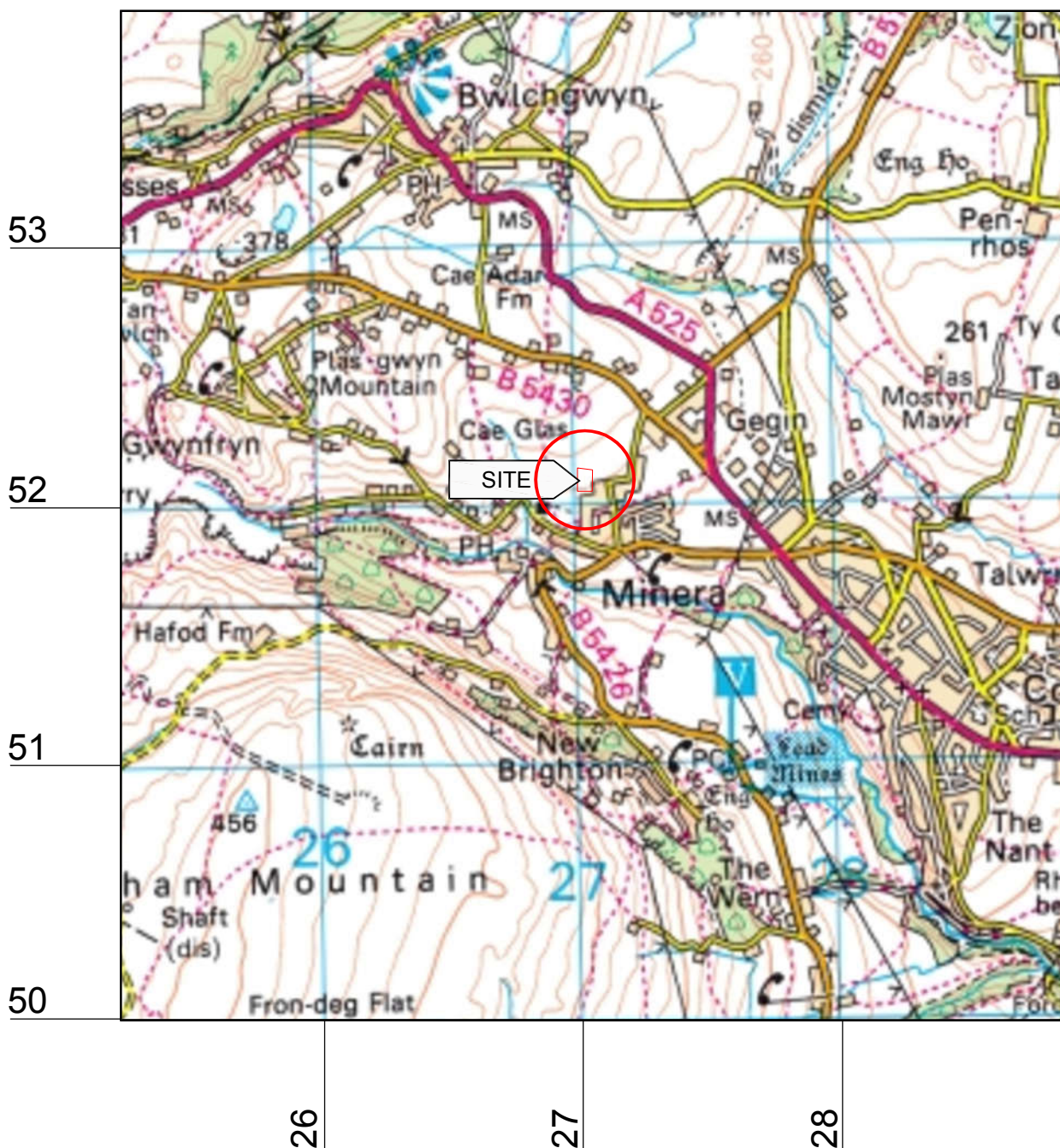
Drainage Strategy
for land off Eversley Court at Minera, Wrexham

Appendix 1

Reference Drawings

<u>Drawing No.</u>	<u>Revision</u>	<u>Title</u>
6896 / P01	-	Site Location Plan
6896 / P02	-	Surface Water Impermeable Areas
6896 / 01	-	Drainage Layout
6896 / 12	-	Surface Water SUDS Details


 National Grid reference
 of the proposed site.

SJ 270 520


0 200 400 600 800 1000 1500 2000

SCALE BAR (m)

DO NOT SCALE



SW AREAS	
Plots	690
Garages	120
Driveways	320
Private Roads	0
Highway	1140
Total	2270



Chartered Consulting Engineers

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Web: http://coopers.co.uk

Park House
Sandpiper Court
Chester Business Park
Chester
CH4 9QU

Client

GOWER HOMES

Project

EVERSLEY COURT,
MINERA, WREXHAM

Title

Proposed Drainage Plan

DRAWING NUMBER

SCALE at A2 1:250

6896 / P02

DATE

NOV 18

REVISION

DRAWN

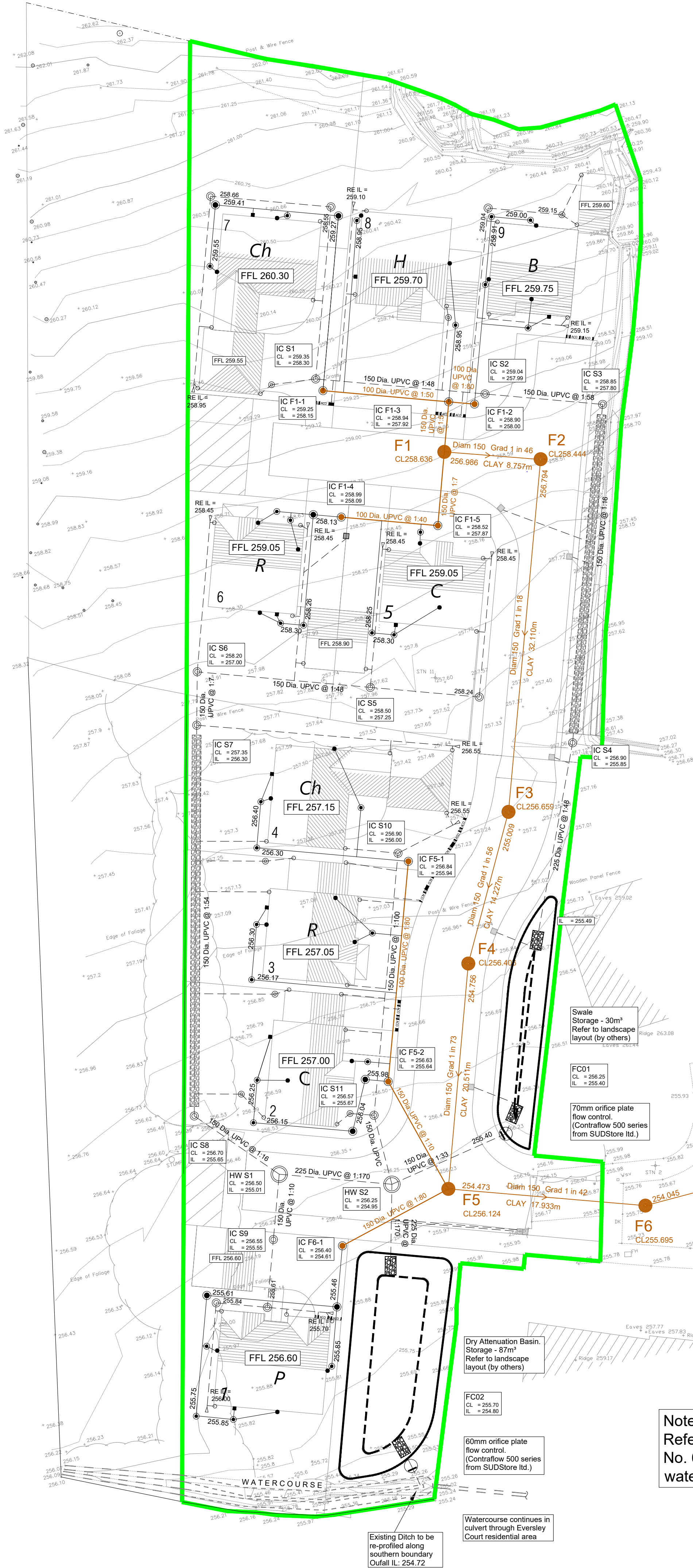
WC

A

CHECKED

AJ

DO NOT SCALE



Note:
Refer to Coopers drawing
No. 6896 / 12 for surface
water network / SUDS details

Notes

- All dimensions are in millimetres unless otherwise shown.
- All adoptable drainage shall be constructed in accordance with 'Sewers for Adoption' 7th Edition, Welsh Ministers Standards and Welsh Water Details and Guidelines.
- All private drainage works are to comply fully with Part H of the Building Regulations.
- All existing invert levels to be checked by the contractor at the start of works and any other discrepancies notified to the Engineer prior to commencing works. All levels are based on topographical survey information provided by others.
- It is the responsibility of the Contractor to verify all information given with regards to existing services and drainage connections etc. prior to commencing the works.
- The Contractor shall adhere to the CDM Regulations at all times.
- Only trained personnel shall be permitted to enter confined spaces.
- All materials to bear the relevant B.S. Kitemark and comply fully with the Sewers for Adoption 7th Specification. All concrete & concrete products must use Sulphate resistant cement (unless the site investigation report proves that sulphate attack from soils and groundwater will not occur to withstand a class 3 condition).
- All opening notices etc. as required under Highways Acts etc. are to be obtained prior to commencement of works. All works are to be inspected by L.A., NHBC or Welsh Water as applicable.
- Trench backfill in highways to within 1m of highway shall, as directed by the Highway Authority be a suitable granular material all in accordance with Sewers for Adoption.
- Cover loadings shall be as detailed on the Manhole Schedule.
- Drain trenches should not be excavated lower than the foundations of any building nearby unless either:
a) The trench is within 1m of the foundation, the trench is filled with concrete up to the lowest level of the foundation, or
b) Where the trench is further than 1m from the building, the trench is filled with concrete to a level below the lowest level for the building equal to the distance from the build, less 150mm.
- All SVP and RWP connections are indicative and shall be confirmed by the client.
- Pipe gradients out of the building to connecting manhole to be laid at 1:40 in accordance with Building Regulations, Part H, Table 6.
- Where pipe sizes are not indicated :
100Ø to be used for foul
100Ø to be used for surface water unless stated otherwise.
- Minimum surface water gradients shall be:
100Ø laid at 1:100 with the exception of the first connection which shall be minimum 1:60. 150Ø laid at 1:150
- Minimum 100Ø foul drainage gradient to be 1:80 with the exception of the first connection which shall be minimum 1:40.
- Manhole covers to be marked FWS or SW as appropriate.
- All manhole covers and frames shall comply with BS EN124. All adoptable manholes and chambers shall comply with Sewers for Adoption 7th Edition. Covers in roads to be grade D400 and be 150mm deep. Manhole covers in car parking areas and drives to be grade B125 and covers in landscaping areas to be grade A15. All to be sized in accordance with Building Regulations Part H, Tables 11 & 12.
- Precast concrete rings to be reinforced.
- Backdrops in private manholes / inspection chambers to be internal
- Private drains laid under adopted / private roads to be Class S granular bed and surround with a minimum of 1.2m cover, where this cannot be achieved a Class Z concrete bed and surround shall be provided.
- Private drains located under landscape areas or driveways / car parking bays to be Class B granular bed and surround with a minimum 0.6m cover, where this cannot be achieved a Class Z concrete bed and surround shall be provided.
- Pipes have not been designed to accommodate construction traffic loading. The contractor is responsible for providing adequate protection to the pipes during construction.
- Slab levels shall not be varied without reference to the Engineer for guidance.
- The developer must self-vet and certify that the design criteria, material standards and workmanship specifications for the proposed adoptable sewers are in accordance with those set out in 'Sewers for Adoption' 7th Edition (SFA 7th). The Welsh Ministers Standards and the requirement of DCWW as the Statutory Sewerage Undertaker.
- Subject to a Section 104 Adoption Agreement being complete, a Section 106 application to connect must be made to DCWW the developer shall be given 21 days notice prior to connection. The works may only be undertaken by an SSIP Health & Safety approved contractor.
- Adoptable materials and workmanship conform to part E of 'Sewers for Adoption' 7th Edition.
- Highway gullies to be 150mm pipework connecting into main Surface Water sewer

MH Reference: SJ27511998
Foul network point of connection
(subject to Welsh Water Approval)

APPROVAL

A	15.04.19	Foul drainage updated (old F5 removed)	WC	AJ
Rev.	Date	Revision	By	Appd.
 chartered consulting engineers Tel: 01244 684910 Fax: 01244 684911 Email: admin@coopers.co.uk Web: http://coopers.co.uk Park House Sandpiper Court Chester Business Park Chester CH4 9QU				
Client		GOWER HOMES		
Project		Eversley Court, Minera, Wrexham		
Title		Drainage Layout		
DRAWING NUMBER		SCALE at A1		1:250
6896 / 01		DATE	MAR 19	REVISION
		DRAWN	WC	A
		CHECKED	AJ	

Legend

- Site Boundary

Existing Combined Drain

Existing Highway Drain

F01

Proposed Adoptable Foul Sewer

Proposed Surface Water (subject to SAB approval)

Proposed Private Foul Drain

FFL 19.00

Plot Slab Level

G

Highway Gully
- SVP

BIG

RWP

Rodding Eye

Linear Drainage Channel

Pipe Materials Table

Pipe Materials Table	Pipe Materials Table
100	CLAYWARE
150	CLAYWARE
225	CLAYWARE
300	CLAYWARE
375	CONCRETE

Bedding and Surround Table

Depth to Soffit	Bedding and Surround Type
>1.2m	Class S
<1.2m	Class Z

Contractor may elect to use thermoplastics pipes. These shall comply with the relevant provisions of BS EN 1401-1, BS EN 1852 and BS EN 12666-1 and should be Welsh Water approved products

DO NOT SCALE

Residents Safety Information Board
(Wording to be agreed with WCBC)

**Example:
DRY BASIN**
This feature is part of the surface water drainage network for this development. Temporary water depths of 700mm can be expected in storm events and should not be accessed during such events. Please contact WCBC to report any issues relating to condition or misuse.

SITE PLAN
Scale 1:250

© Copyright The original of this drawing contained coloured symbols and/or features. Any black and white reproduction should not be relied upon.

Surface Water Flow Rates

Developable Site Area = 0.445ha

Existing Greenfield Run-off Rates

1yr = 2.7 l/s
30yr = 5.5 l/s
100yr = 6.7 l/s
Qbar = 3.1 l/s

Proposed Run-off Rates

1yr = 3.2 l/s
30yr = 4.9 l/s
100yr = 6.4 l/s

Proposed impermeable areas = 2240sq.m. (42% Imp)

100yr attenuation storage = approx 117cu.m (+40% climate change)

Maintenance / Responsibilities

Adoption and maintenance of all surface water components serving 2 or more properties subject to SAB approval.

Gower Homes are proposing to set up a 'Private Management Company' to maintain the SAB approved surface water network in the future. WCBC SABS require details of the Management Company

Pipes and manholes:

All piped networks to have CCTV survey at end of construction activities. Any debris to be removed. Future maintenance to involve inspections to ensure no silt build ups within network. SUDS Management Plan to be produced to address frequency and type of maintenance activities

Filter Drain:

To be maintained by private 'Management Company' SUDS Management Plan to be produced to address frequency and type of maintenance activities

Swale:

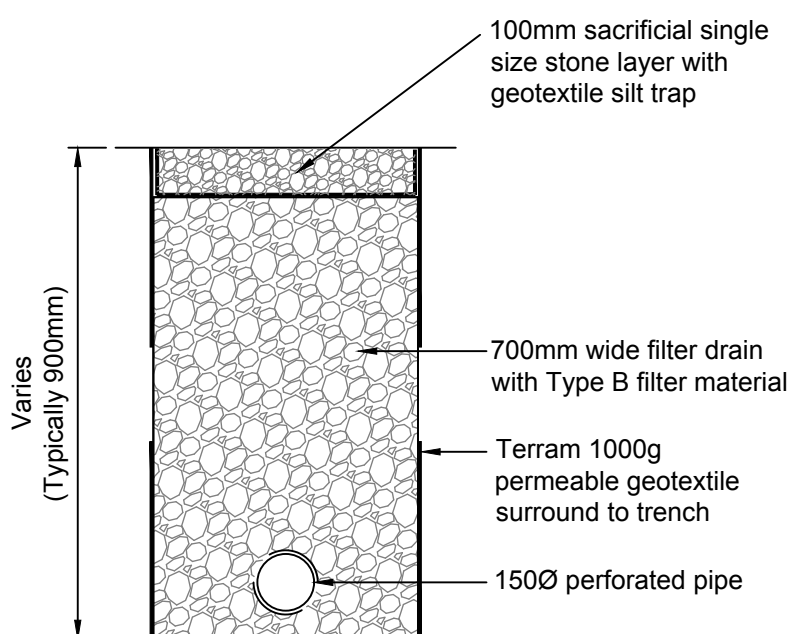
To be maintained by private 'Management Company' SUDS Management Plan to be produced to address frequency and type of maintenance activities

Dry Basin:

To be maintained by private 'Management Company' SUDS Management Plan to be produced to address frequency and type of maintenance activities.

Flow Control:

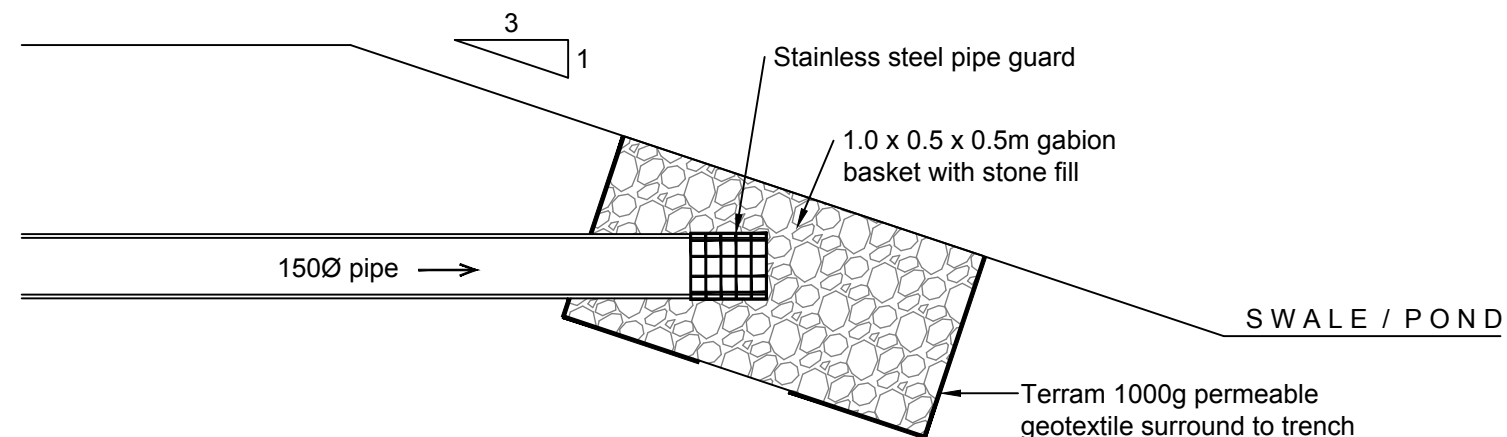
To be maintained by private 'Management Company' SUDS Management Plan to be produced to address frequency and type of maintenance activities.



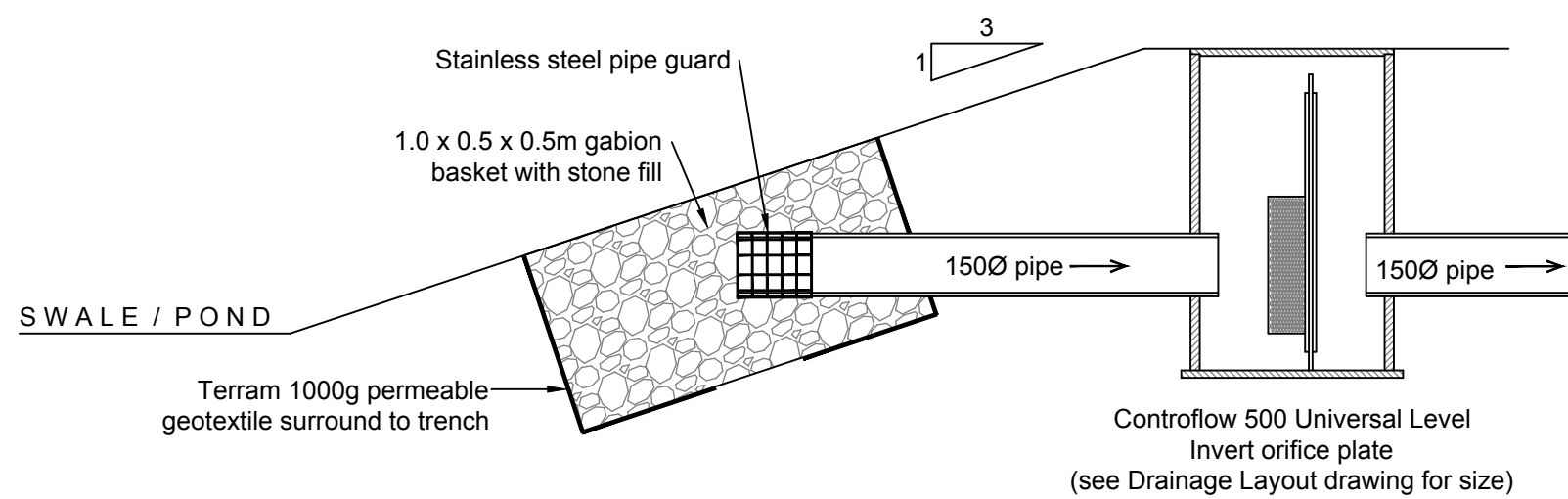
DETAIL 1 - FILTER DRAIN
Scale 1:20

Surface Water Inspection Chamber Schedule

Manhole Number	Coordinates	Cover Level	Pipe In	Pipe Out	Depth to Invert Level	Pipe Diameter	Manhole Size	Manhole Type	Manhole Cover
IC S1	E. 327037.227 N. 352057.147	259.35	258.35	258.30	1.050	100 150	450	Type 4 PPIC	C250
IC S2	E. 327052.582 N. 352055.787	259.04	257.99	257.99	1.050	150 150	450	Type 4 PPIC	C250
IC S3	E. 327063.241 N. 352054.840	258.85	257.80	257.80	1.050	150 150	450	Type 4 PPIC	C250
IC S4	E. 327060.521 N. 352024.162	258.90	255.85	255.85	1.050	150 150	450	Type 4 PPIC	C250
IC S5	E. 327042.179 N. 352029.182	258.50	257.30	257.25	1.250	100 150	450	Type 4 PPIC	C250
IC S6	E. 327026.487 N. 352030.600	258.20	257.00	257.00	1.200	150 150	450	Type 4 PPIC	C250
IC S7	E. 327026.441 N. 352025.753	257.35	256.30	256.30	1.050	150 150	450	Type 4 PPIC	C250
IC S8	E. 327026.219 N. 351990.324	256.70	255.65	255.65	1.050	150 150	450	Type 3 PPIC	C250
IC S9	E. 327033.392 N. 351979.121	256.55	255.55	255.55	1.000	100 150	450	Type 4 PPIC	C250
IC S10	E. 327044.692 N. 352014.150	256.90	256.00	256.00	0.900	150 150	450	Type 4 PPIC	C250
IC S11	E. 327042.519 N. 351990.389	256.57	255.67	255.67	0.900	150 150	450	Type 4 PPIC	C250
HW S1	E. 327033.920 N. 351985.041	256.50	255.01	255.01	1.490	225 225	1200	Type 2 PPIC	D400
HW S2	E. 327044.138 N. 351984.129	256.25	254.95	254.95	1.300	225 225	1200	Type 2 PPIC	D400
FC 01	E. 327054.459 N. 351988.711	256.25	254.40	255.40	0.850	150 150	500	Type 2 PPIC	C250
FC 02	E. 327045.866 N. 351958.595	255.70	254.80	254.80	0.900	150 150	500	Type 2 PPIC	C250



DETAIL 2 - SWALE / POND INCOMING PIPE
Scale 1:20



DETAIL 3 - SWALE / POND OUTGOING PIPE
Scale 1:20

Notes

- The specification in all respects shall be in accordance with the current Wrexham County Borough Council Specification and Construction publication in force in the county at the time of construction
- All adoptable drainage shall be constructed in accordance with 'Sewers for Adoption' 7th Edition, Welsh Ministers Standards and Welsh Water Details and Guidelines.
- All private drainage works are to comply fully with Part H of the Building Regulations.
- All existing invert levels to be checked by the contractor at the start of works and any other discrepancies notified to the Engineer prior to commencing works. All levels are based on topographical survey information provided by others.
- It is the responsibility of the Contractor to verify all information given with regards to existing services and drainage connections etc. prior to commencing the works.
- The Contractor shall adhere to the CDM Regulations at all times.
- Only trained personnel shall be permitted to enter confined spaces.
- All materials to bear the relevant B.S. Kitemark and comply fully with the Sewers for Adoption 7th Specification. All concrete & concrete products must use Sulphate resistant cement (unless the site investigation report proves that sulphate attack from soils and groundwater will not occur to withstand a class 3 condition).
- All opening notices etc. as required under Highways Acts etc. are to be obtained prior to commencement of works. All works are to be inspected by L.A., NHBC or Welsh Water as applicable.
- Trench backfill in highways to within 1m of highway shall, as directed by the Highway Authority be a suitable granular material all in accordance with Sewers for Adoption.
- Cover loadings shall be as detailed on the Manhole Schedule.
- Drain trenches should not be excavated lower than the foundations of any building nearby unless either:
a) The trench is within 1m of the foundation, the trench is filled with concrete up to the lowest level of the foundation, or
b) Where the trench is further than 1m from the building, the trench is filled with concrete to a level below the lowest level for the building equal to the distance from the build, less 150mm.
- All SVP and RWP connections are indicative and shall be confirmed by the client.
- Pipe gradients out of the building to connecting manhole to be laid at 1:40 in accordance with Building Regulations, Part H, Table 6.
- Where pipe sizes are not indicated :
100Ø to be used for foul
100Ø to be used for surface water unless stated otherwise.
- Minimum surface water gradients shall be:
100Ø laid at 1:100 with the exception of the first connection which shall be minimum 1:60. 150Ø laid at 1:150
- Minimum 100Ø foul drainage gradient to be 1:80 with the exception of the first connection which shall be minimum 1:40.
- Manhole covers to be marked FWS or SW as appropriate.
- All manhole covers and frames shall comply with BS EN124. All adoptable manholes and chambers shall comply with Sewers for Adoption 7th Edition. Covers in roads to be grade D400 and be 150mm deep. Manhole covers in car parking areas and drives to be grade B125 and covers in landscaping areas to be grade A15. All to be sized in accordance with Building Regulations Part H, Tables 11 & 12.
- Pipes have not been designed to accommodate construction traffic loading. The contractor is responsible for providing adequate protection to the pipes during construction.
- Highway gullies to be 150mm pipework connecting into main Surface Water sewer

APPROVAL

coopers
chartered consulting engineers

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Park House
Sandpiper Court
Chester Business Park
Chester
CH4 9QU

Client

GOWER HOMES

Project

Eversley Court
Minera

Title

Surface Water
SUDS Details

DRAWING NUMBER

6896 / 12

SCALE at A1 1:100

DATE	08.04.19	REVISION
DRAWN	LW	-
CHECKED	AJ	-

Drainage Strategy
for land off Eversley Court at Minera, Wrexham

Appendix 2

Infiltration Test Results

Extract from GroundSolve Ltd Report

Andy Jones

From: Andy Jones
Sent: 09 April 2019 14:30
To: 'jonhuxley@groundsolve.com'; dougbailey6@gmail.com
Subject: RE: R.E. Eversley Court Minera [Filed 09 Apr 2019 14:29]

Thanks Jon

Is there a final report in PDF format?

Regards

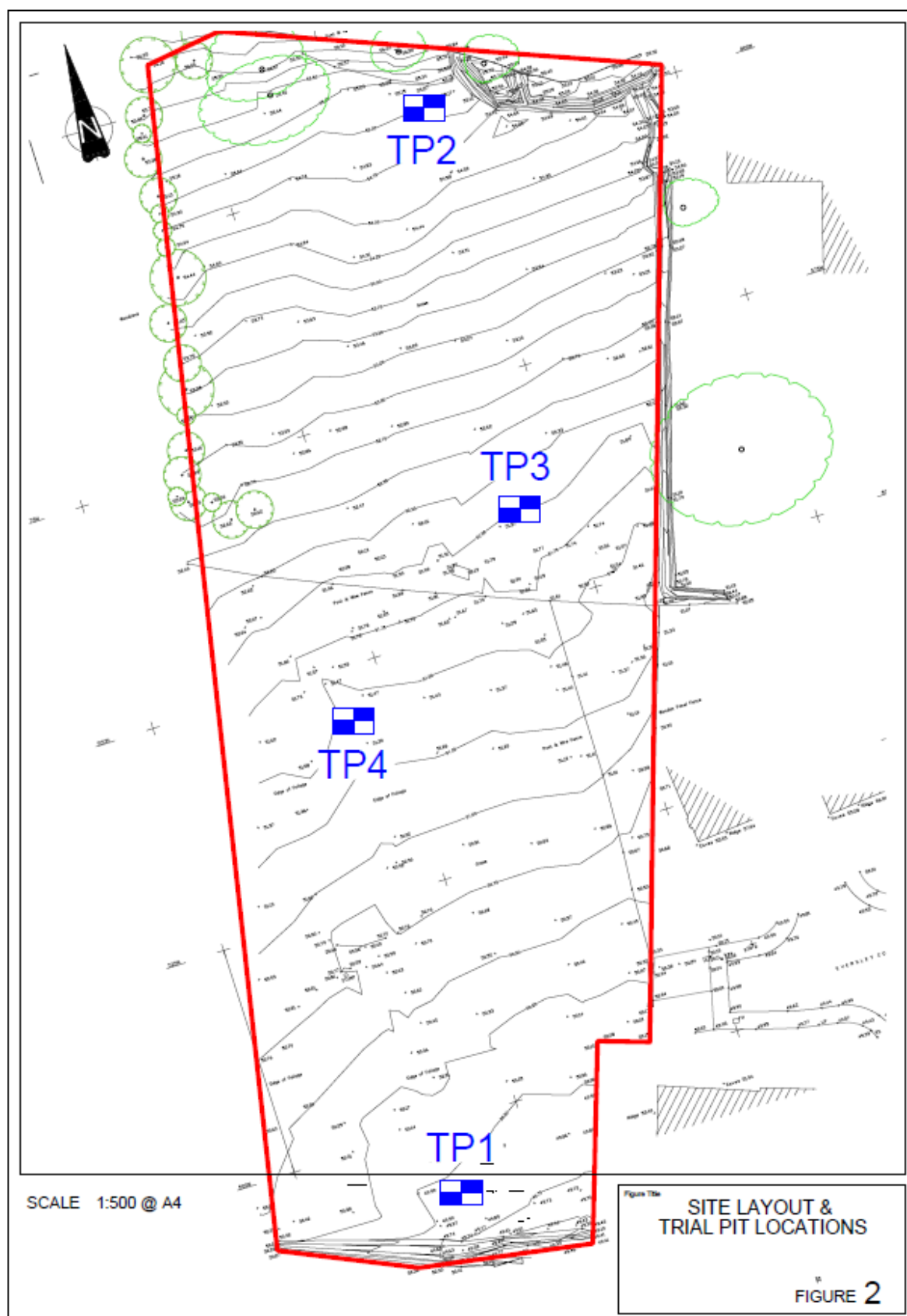
Andy Jones
Senior Infrastructure Engineer
COOPERS
Park House, Sandpiper Court, Chester Business Park, Chester, CH4 9QU

☎: (01244) 684910 ☎: Direct Dial No. (01244) 684933
📠: (01244) 684911
✉: ajones@coopers.co.uk
Web: <http://www.coopers.co.uk>

From: jonhuxley@groundsolve.com <jonhuxley@groundsolve.com>
Sent: 09 April 2019 13:46
To: dougbailey6@gmail.com; Andy Jones <ajones@coopers.co.uk>
Subject: R.E. Eversley Court Minera

Hi both,

Please find attached the trial pit logs for Eversley Court Minera along with a site plan of trial pit locations below.



No soakaway graphs were produced as the water levels did not drop in either pit over a period of 3.5 hours see below.

6.5 Soakaway Testing

Soakaway testing was carried out in two of the trial pits, in general accordance with BRE 365, Reference 3. Each pit was rapidly filled with water, and the falling water levels monitored over a period of time.

The results of the soakaway testing are summarised in the table below.

TP Ref.	Depth (m)	Test No.	Fall in water (cm)	Time (Hours)	Permeability (m/sec)
TP01	2.30	1	0	3.5	None Calculated
TP02	2.30	1	0	3.5	None Calculated

No infiltration was observed in any of the trial pits over a 3.5-hour monitoring period, therefore permeabilities could not be calculated. Minor collapses were noted of the pit walls in both trial pits after 3.5 hours of monitoring, causing a raise in water levels, and further monitoring was therefore abandoned.

The glacial till material has therefore been shown to have a very low permeability, with estimated permeabilities of less than 1×10^{-7} m/sec.

9.3 Drainage

The soakaway testing carried out has shown the glacial till deposits to be of very low permeability, and no infiltration rates could be calculated after 3.5 hours of monitoring.

Consequently, the site is considered unsuitable for soakaway drainage systems.

regards

Jonathan Huxley

MEng (Hons) , GMice

Graduate Geotechnical Engineer

[GroundSolve Ltd](#)

Consulting Geotechnical, Engineering Geology and Environmental Engineers

Web: www.groundsolve.com

Unit 1 Well House Barns, Chester Road, Bretton, Flintshire, CH4 0DH

✉: Jonhuxley@groundsolve.com

☎ 01244 661361 / 07958107124

Drainage Strategy
for land off Eversley Court at Minera, Wrexham

Appendix 3

Calculations

Greenfield Runoff Rate

Proposed Surface Water Drainage Calculations

Calculated by: Andy Jones

Site name: 6896 Eversley Court

Site location: Minera Wrxham

Site coordinates

Latitude: 53.06027° N

Longitude: 3.08995° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Reference: 6528472

Date: 2019-02-20T09:24:54

Methodology	IH124
-------------	-------

Site characteristics

Total site area (ha)	0.445
----------------------	-------

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	2	4
HOST class	---	---
SPR/SPRHOST	0.3	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm)	951	951
Hydrological region	9	9
Growth curve factor: 1 year	0.88	0.88
Growth curve factor: 30 year	1.78	1.78
Growth curve factor: 100 year	2.18	2.18

Notes:

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consents are usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set in which case blockage work must be addressed by using appropriate drainage elements

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite may be a requirement for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	1.16	3.07
1 in 1 year (l/s)	1.02	2.71
1 in 30 years (l/s)	2.07	5.47
1 in 100 years (l/s)	2.53	6.7

Coopers		Page 1
Park House Sandpiper Court Chester CH4 9QU	Eversley Court, Minera Surface Water Design SABS Compliant	
Date 01/04/2019 File 6896 SW10 SUDS.MDX	Designed by Coopers Checked by AJ	
Micro Drainage		Network 2018.1.1

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)	2	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.290	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

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
1.000	15.000	0.310	48.4	0.039	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	11.000	0.190	57.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	30.500	1.950	15.6	0.035	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	17.400	0.360	48.3	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	18.000	0.090	200.0	0.015	0.00	0.0	0.600	\	-1	Pipe/Conduit	
1.005	12.500	0.378	33.1	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	12.000	0.250	48.0	0.020	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	4.600	0.700	6.6	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.002	35.000	0.650	53.8	0.016	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.003	9.300	0.568	16.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.004	10.259	0.060	171.0	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	5.17	258.300	0.039	0.0	0.0	0.0	1.45	25.6	0.0
1.001	0.00	5.31	257.990	0.039	0.0	0.0	0.0	1.32	23.4	0.0
1.002	0.00	5.51	257.800	0.074	0.0	0.0	0.0	2.56	45.2	0.0
1.003	0.00	5.71	255.850	0.087	0.0	0.0	0.0	1.45	25.6	0.0
1.004	0.00	5.81	255.490	0.102	0.0	0.0	0.0	3.00	5091.0	0.0
1.005	0.00	5.93	255.400	0.116	0.0	0.0	0.0	1.76	31.0	0.0
2.000	0.00	5.14	257.250	0.020	0.0	0.0	0.0	1.46	25.7	0.0
2.001	0.00	5.16	257.000	0.024	0.0	0.0	0.0	3.96	69.9	0.0
2.002	0.00	5.58	256.300	0.040	0.0	0.0	0.0	1.37	24.3	0.0
2.003	0.00	5.64	255.650	0.040	0.0	0.0	0.0	2.50	44.2	0.0
2.004	0.00	5.81	255.007	0.056	0.0	0.0	0.0	1.00	39.6	0.0

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Micro Drainage		Network 2018.1.1

Network Design Table for Storm

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
1.006	25.000	0.147	170.1	0.052	0.00	0.0	0.600	0	225	Pipe/Conduit	
1.007	3.000	0.080	37.5	0.000	0.00	0.0	0.600	0	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)
1.006	0.00	6.34	254.947	0.224	0.0	0.0	0.0	1.00	39.7	0.0
1.007	0.00	6.37	254.800	0.224	0.0	0.0	0.0	1.65	29.1	0.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S1	259.350	1.050	Open Manhole	450	1.000	258.300	150				
S2	259.040	1.050	Open Manhole	450	1.001	257.990	150	1.000	257.990	150	
S3	258.850	1.050	Open Manhole	450	1.002	257.800	150	1.001	257.800	150	
S4	256.900	1.050	Open Manhole	450	1.003	255.850	150	1.002	255.850	150	
SWALE	256.500	1.010	Junction		1.004	255.490	-1	1.003	255.490	150	
FC1	256.250	0.850	Open Manhole	500	1.005	255.400	150	1.004	255.400	-1	
S5	258.500	1.250	Open Manhole	450	2.000	257.250	150				
S6	258.200	1.200	Open Manhole	450	2.001	257.000	150	2.000	257.000	150	
S7	257.350	1.050	Open Manhole	450	2.002	256.300	150	2.001	256.300	150	
S8	256.700	1.050	Open Manhole	450	2.003	255.650	150	2.002	255.650	150	
H1	256.500	1.493	Open Manhole	1200	2.004	255.007	225	2.003	255.082	150	
H2	256.250	1.303	Open Manhole	1200	1.006	254.947	225	1.005	255.022	150	
								2.004	254.947	225	
FC2	255.700	0.900	Open Manhole	500	1.007	254.800	150	1.006	254.800	225	
	255.200	0.480	Open Manhole	0		OUTFALL		1.007	254.720	150	

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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)
1.000	o	150	S1	259.350	258.300	0.900	Open Manhole	450
1.001	o	150	S2	259.040	257.990	0.900	Open Manhole	450
1.002	o	150	S3	258.850	257.800	0.900	Open Manhole	450
1.003	o	150	S4	256.900	255.850	0.900	Open Manhole	450
1.004	\	-1	SWALE	256.500	255.490	0.860	Junction	
1.005	o	150	FC1	256.250	255.400	0.700	Open Manhole	500
2.000	o	150	S5	258.500	257.250	1.100	Open Manhole	450
2.001	o	150	S6	258.200	257.000	1.050	Open Manhole	450
2.002	o	150	S7	257.350	256.300	0.900	Open Manhole	450
2.003	o	150	S8	256.700	255.650	0.900	Open Manhole	450
2.004	o	225	H1	256.500	255.007	1.268	Open Manhole	1200
1.006	o	225	H2	256.250	254.947	1.078	Open Manhole	1200
1.007	o	150	FC2	255.700	254.800	0.750	Open Manhole	500

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)
1.000	15.000	48.4	S2	259.040	257.990	0.900	Open Manhole	450
1.001	11.000	57.9	S3	258.850	257.800	0.900	Open Manhole	450
1.002	30.500	15.6	S4	256.900	255.850	0.900	Open Manhole	450
1.003	17.400	48.3	SWALE	256.500	255.490	0.860	Junction	
1.004	18.000	200.0	FC1	256.250	255.400	0.700	Open Manhole	500
1.005	12.500	33.1	H2	256.250	255.022	1.078	Open Manhole	1200
2.000	12.000	48.0	S6	258.200	257.000	1.050	Open Manhole	450
2.001	4.600	6.6	S7	257.350	256.300	0.900	Open Manhole	450
2.002	35.000	53.8	S8	256.700	255.650	0.900	Open Manhole	450
2.003	9.300	16.4	H1	256.500	255.082	1.268	Open Manhole	1200
2.004	10.259	171.0	H2	256.250	254.947	1.078	Open Manhole	1200
1.006	25.000	170.1	FC2	255.700	254.800	0.675	Open Manhole	500
1.007	3.000	37.5		255.200	254.720	0.330	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)
1.007		255.200	254.720	0.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.290		

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Micro Drainage	Network 2018.1.1	
<u>Online Controls for Storm</u> <u>Orifice Manhole: FC1, DS/PN: 1.005, Volume (m³): 30.3</u> Diameter (m) 0.070 Discharge Coefficient 0.600 Invert Level (m) 255.400 <u>Orifice Manhole: FC2, DS/PN: 1.007, Volume (m³): 1.1</u> Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 254.800		
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Micro Drainage		Network 2018.1.1

Storage Structures for Storm

Tank or Pond Manhole: FC2, DS/PN: 1.007

Invert Level (m) 254.800

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	65.0	1.400	0.0	2.800	0.0	4.200	0.0
0.200	85.0	1.600	0.0	3.000	0.0	4.400	0.0
0.400	107.0	1.800	0.0	3.200	0.0	4.600	0.0
0.600	132.0	2.000	0.0	3.400	0.0	4.800	0.0
0.800	159.0	2.200	0.0	3.600	0.0	5.000	0.0
0.801	0.0	2.400	0.0	3.800	0.0		
1.200	0.0	2.600	0.0	4.000	0.0		

Volume Summary (Static)

Length Calculations based on Centre-Centre

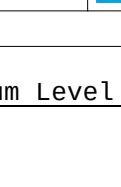
Pipe Number	USMH Name	Manhole Volume (m ³)	Pipe Volume (m ³)	Storage Structure Volume (m ³)	Total Volume (m ³)
1.000	S1	0.167	0.265	0.000	0.432
1.001	S2	0.167	0.194	0.000	0.361
1.002	S3	0.167	0.539	0.000	0.706
1.003	S4	0.167	0.307	0.000	0.474
1.004	SWALE	0.000	30.533	0.000	30.533
1.005	FC1	0.167	0.221	0.000	0.388
2.000	S5	0.199	0.212	0.000	0.411
2.001	S6	0.191	0.081	0.000	0.272
2.002	S7	0.167	0.619	0.000	0.785
2.003	S8	0.167	0.164	0.000	0.331
2.004	H1	1.689	0.408	0.000	2.096
1.006	H2	1.474	0.994	0.000	2.468
1.007	FC2	0.177	0.053	87.081	87.310
Total		4.897	34.591	87.081	126.569

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1 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 2 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 0.287 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 18.000 Cv (Winter) 0.840 Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status ON 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) 1, 30, 100 Climate Change (%) 0, 0, 40																																																																																																																																															
<table><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surcharge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Water Level (m)</th></tr><tr><td>1.000</td><td>S1</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>258.344</td></tr><tr><td>1.001</td><td>S2</td><td>15 Winter</td><td>1</td><td>+0%</td><td>100/15 Winter</td><td></td><td></td><td></td><td>258.036</td></tr><tr><td>1.002</td><td>S3</td><td>15 Winter</td><td>1</td><td>+0%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>257.843</td></tr><tr><td>1.003</td><td>S4</td><td>15 Winter</td><td>1</td><td>+0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>255.914</td></tr><tr><td>1.004</td><td>SWALE</td><td>30 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>255.639</td></tr><tr><td>1.005</td><td>FC1</td><td>30 Winter</td><td>1</td><td>+0%</td><td>1/15 Summer</td><td></td><td></td><td></td><td>255.639</td></tr><tr><td>2.000</td><td>S5</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>257.281</td></tr><tr><td>2.001</td><td>S6</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>257.022</td></tr><tr><td>2.002</td><td>S7</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>256.343</td></tr><tr><td>2.003</td><td>S8</td><td>15 Winter</td><td>1</td><td>+0%</td><td></td><td></td><td></td><td></td><td>255.682</td></tr><tr><td>2.004</td><td>H1</td><td>15 Winter</td><td>1</td><td>+0%</td><td>30/120 Winter</td><td></td><td></td><td></td><td>255.072</td></tr><tr><td>1.006</td><td>H2</td><td>15 Winter</td><td>1</td><td>+0%</td><td>30/60 Winter</td><td></td><td></td><td></td><td>255.044</td></tr><tr><td>1.007</td><td>FC2</td><td>180 Winter</td><td>1</td><td>+0%</td><td>1/30 Winter</td><td></td><td></td><td></td><td>255.015</td></tr></table>				PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	1.000	S1	15 Winter	1	+0%					258.344	1.001	S2	15 Winter	1	+0%	100/15 Winter				258.036	1.002	S3	15 Winter	1	+0%	100/15 Summer				257.843	1.003	S4	15 Winter	1	+0%	30/15 Summer				255.914	1.004	SWALE	30 Winter	1	+0%					255.639	1.005	FC1	30 Winter	1	+0%	1/15 Summer				255.639	2.000	S5	15 Winter	1	+0%					257.281	2.001	S6	15 Winter	1	+0%					257.022	2.002	S7	15 Winter	1	+0%					256.343	2.003	S8	15 Winter	1	+0%					255.682	2.004	H1	15 Winter	1	+0%	30/120 Winter				255.072	1.006	H2	15 Winter	1	+0%	30/60 Winter				255.044	1.007	FC2	180 Winter	1	+0%	1/30 Winter				255.015
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)																																																																																																																																						
1.000	S1	15 Winter	1	+0%					258.344																																																																																																																																						
1.001	S2	15 Winter	1	+0%	100/15 Winter				258.036																																																																																																																																						
1.002	S3	15 Winter	1	+0%	100/15 Summer				257.843																																																																																																																																						
1.003	S4	15 Winter	1	+0%	30/15 Summer				255.914																																																																																																																																						
1.004	SWALE	30 Winter	1	+0%					255.639																																																																																																																																						
1.005	FC1	30 Winter	1	+0%	1/15 Summer				255.639																																																																																																																																						
2.000	S5	15 Winter	1	+0%					257.281																																																																																																																																						
2.001	S6	15 Winter	1	+0%					257.022																																																																																																																																						
2.002	S7	15 Winter	1	+0%					256.343																																																																																																																																						
2.003	S8	15 Winter	1	+0%					255.682																																																																																																																																						
2.004	H1	15 Winter	1	+0%	30/120 Winter				255.072																																																																																																																																						
1.006	H2	15 Winter	1	+0%	30/60 Winter				255.044																																																																																																																																						
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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
1.000	S1	-0.106	0.000	0.18		4.4		OK	
1.001	S2	-0.104	0.000	0.20		4.3		OK	
1.002	S3	-0.107	0.000	0.18		7.6		OK	
1.003	S4	-0.086	0.000	0.37		8.9		OK	
1.004	SWALE	-0.551	0.000	0.00		8.4		OK	
1.005	FC1	0.089	0.000	0.16		4.6	SURCHARGED		
2.000	S5	-0.119	0.000	0.10		2.2		OK	
2.001	S6	-0.128	0.000	0.05		2.6		OK	
2.002	S7	-0.107	0.000	0.18		4.1		OK	
2.003	S8	-0.118	0.000	0.11		4.1		OK	
2.004	H1	-0.160	0.000	0.17		5.6		OK	
1.006	H2	-0.128	0.000	0.38		14.1		OK	
1.007	FC2	0.065	0.000	0.18		3.2	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 * 10m ³ /ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	2	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	0.287
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
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)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S1	15 Winter	30	+0%					258.371
1.001	S2	15 Winter	30	+0%	100/15 Winter				258.066
1.002	S3	15 Winter	30	+0%	100/15 Summer				257.874
1.003	S4	15 Winter	30	+0%	30/15 Summer				256.103
1.004	SWALE	60 Winter	30	+0%					255.874
1.005	FC1	60 Winter	30	+0%	1/15 Summer				255.873
2.000	S5	15 Winter	30	+0%					257.299
2.001	S6	15 Winter	30	+0%					257.035
2.002	S7	15 Winter	30	+0%					256.374
2.003	S8	15 Winter	30	+0%					255.705
2.004	H1	180 Winter	30	+0%	30/120 Winter				255.278
1.006	H2	180 Winter	30	+0%	30/60 Winter				255.277
1.007	FC2	180 Winter	30	+0%	1/30 Winter				255.265

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Micro Drainage		Network 2018.1.1

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

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
1.000	S1	-0.079	0.000	0.45		10.6		OK	
1.001	S2	-0.074	0.000	0.50		10.5		OK	
1.002	S3	-0.076	0.000	0.48		20.7		OK	
1.003	S4	0.103	0.000	0.98		23.5	SURCHARGED		
1.004	SWALE	-0.316	0.000	0.00		15.5		OK	
1.005	FC1	0.323	0.000	0.24		6.8	SURCHARGED		
2.000	S5	-0.101	0.000	0.23		5.5		OK	
2.001	S6	-0.115	0.000	0.13		6.6		OK	
2.002	S7	-0.076	0.000	0.47		11.1		OK	
2.003	S8	-0.095	0.000	0.28		11.0		OK	
2.004	H1	0.046	0.000	0.13		4.3	SURCHARGED		
1.006	H2	0.105	0.000	0.37		13.5	SURCHARGED		
1.007	FC2	0.315	0.000	0.28		5.0	SURCHARGED		

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Micro Drainage	Network 2018.1.1	

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

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
1.000	S1	-0.046	0.000	0.81		19.2		OK	
1.001	S2	0.057	0.000	0.87		18.3		SURCHARGED	
1.002	S3	0.108	0.000	0.78		33.7		SURCHARGED	
1.003	S4	0.890	0.000	1.65		39.4		FLOOD RISK	
1.004	SWALE	-0.027	0.000	0.01		28.6		OK	
1.005	FC1	0.605	0.000	0.31		8.7		FLOOD RISK	
2.000	S5	-0.082	0.000	0.42		9.9		OK	
2.001	S6	-0.101	0.000	0.23		11.9		OK	
2.002	S7	-0.041	0.000	0.85		19.9		OK	
2.003	S8	-0.073	0.000	0.51		19.8		OK	
2.004	H1	0.343	0.000	0.20		6.5		SURCHARGED	
1.006	H2	0.402	0.000	0.53		19.4		SURCHARGED	
1.007	FC2	0.608	0.000	0.36		6.4		FLOOD RISK	