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CADARN
CONSULTING ENGINEERS

DRAINAGE STRATEGY

PROPOSED SECOND PHASE OF THE RESIDENTIAL DEVELOPMENT AT MELIDEN ROAD, DYSERTH

APRIL 2020
Suitability S1
Revision P01

Prepared on Behalf of:
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CONTENTS PAGES

APPENDICES

A **Site Location Plan**

B **Existing & Proposed Surface Water Above Ground Flood Routing**

C **NRW Flood Advice Map**

D **Dŵr Cymru / Welsh Water Apparatus Map**

E **PHASE 1 – Section 104 Drainage Layout**

F **Groundsolve Ltd Porosity Report**

G **'*Causeway Flow*' Hydraulic Modelling Output**

H **Existing & Proposed Site Area Layout**

I **Proposed Section 104 Drainage Layout**

J **Proposed Soakaway Calculations**

1.0 Introduction

1.1 Project Background

1.1.1 Cadarn Consulting Engineers Ltd have been appointed by Macbryde Homes Ltd to provide a drainage strategy, for both surface water and foul, for the proposed second phase to their Cysgod Y Graig residential development located off the A547, Dyserth, Rhyl, LL18 6BP (National Grid Reference **SJ 05318 79620**). Refer to the drawing enclosed in **Appendix A** for the proposed site location plan.

1.1.2 Cadarn Consulting Engineers Ltd reserve the right to undertake further investigation into the adequacy of the proposed drainage strategy based on changes in regulations, if works on site have not commenced within twelve months of the issuing of this report.

1.2 Scope of Proposed Drainage Strategy

1.2.1 This report aims to provide a suitable drainage strategy for the discharge of surface water and foul effluent generated by the proposed development.

1.2.2 The purpose of the calculations and accompanying details enclosed within this report are to produce a drainage layout that complies with the relevant legislation of the Tan 15, CIRIA C753 '*The SuDS Manual*' and Approved Document H of the Building Regulations 2010.

1.3 Proposed Development

1.3.1 The proposal involves the construction of an additional 31 dwellings to the site, which already contains 63 dwellings which are currently being constructed as part of the phase 1 works. The second phase of the development is located in the adjoining land to the south of the existing site.

2.0 Existing Site Baseline

2.1 Site Boundaries

2.1.1 The proposed second phase of the development is to be located partly on an existing agricultural greenfield site, on the outskirts of the rural village of Dyserth and partly on an area of overgrown waste land. The Northern boundary of the site is bounded by the first phase of the development which is currently being constructed. As the development is on the outskirts of the village the western and South-western boundaries are formed by agricultural land, and the eastern and South-eastern boundary bounded partly by a play area but mostly by residential properties. The boundaries described above are illustrated within **Figure 1.**

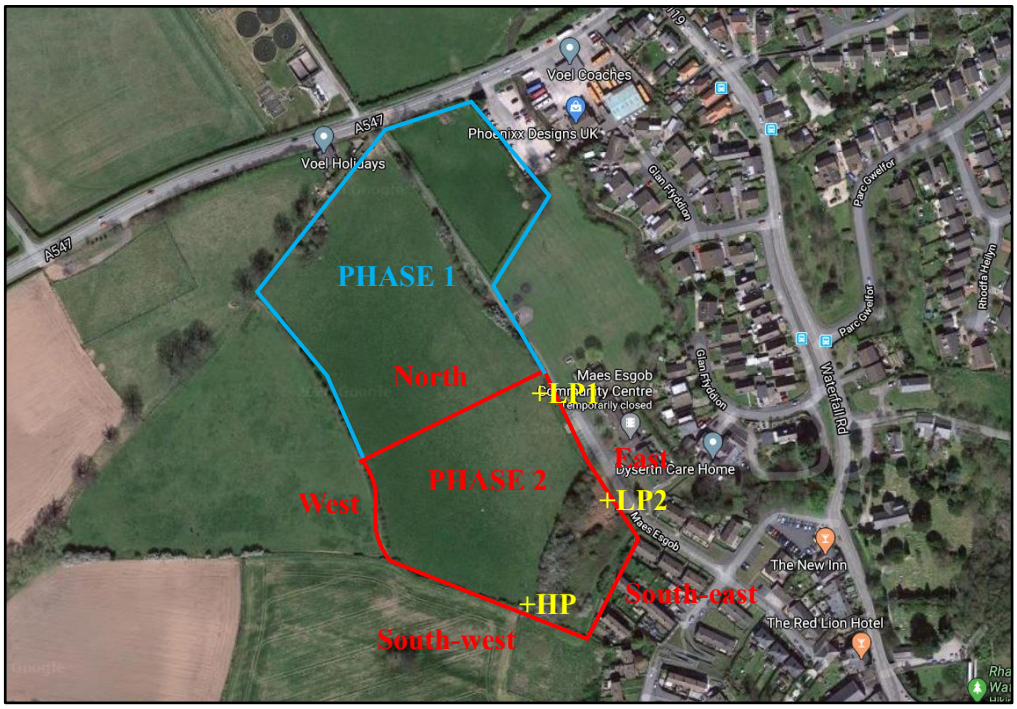

Figure 1. *Proposal Site Boundaries*

2.2 Existing Hydrology

2.2.1 The site is a steeply sloping site which generally falls towards the eastern boundary at a approximate gradient of 1:6. There is a high point at the boundary between the existing agricultural greenfield site and the overgrown waste land and therefore surface water which lands on the agricultural greenfield site falls slightly towards the North, and the overgrown waste land to the South East. The location of the high pints and low points are illustrated within **Figure 1.**

- HP – 52.320m A.O.D
- LP1 – 36.280m A.O.D
- LP2 – 36.000m A.O.D (approx.)

2.2.2 The above existing above ground flood routing is illustrated on the plan contained within **Appendix B**.

2.3 Existing Watercourses

2.3.1 The Glan Ffyddion is located approx. 55m West of the development at its closest running to the rear of Maes Esgob Community Centre. There are no land drainage ditches within the curtilage of the site and no evidence of any land drainage ditches historically.

2.3.2 The drainage strategy report of phase 1 of the development included an assessment into the risk of flooding from the watercourse as a small portion of the North Eastern corner adjacent to the A547 and the boundary car park flooded during the 1:1000 year return period with an 80% blockage at the culvert passing beneath the A547, however this does not need to be assessed within this report as no part of the phase 2 development floods during any modelled return period with blockages included, a copy of the NRW flood advice map for the area is contained within **Appendix C**.

2.4 Existing Nearby Drainage

2.4.1 The Dwr Cymru / Welsh Water (DCWW) apparatus map contained within **Appendix D** indicates there is a Ø 375mm combined public sewer located beneath the site adjacent to the South-eastern boundary running in a North-easterly direction, before increasing to a Ø 450mm, at the Eastern corner of the site, and again to a dual pipe network of Ø 600mm & Ø 225mm adjacent to the Eastern boundary running in a northerly direction to the sewerage treatment works located on the opposite site of the A547.

2.4.2 In addition to the public sewer network noted above, there is also a proposed foul sewer network accommodating the first phase of the development which has a an agreement under section 104 of the Waters Industries Act 1991 for the adoption of the network by the sewerage undertaker (DCWW), this drainage network is illustrated on the proposed section 104 drainage layout for the first phase of the development contained within **Appendix E**.

3.0 Design Criteria

3.1.1 The following design criteria will apply to the surface water run-off and foul discharge design for the site:

- Approved Document H, Building Regulations;
- BRE Digest 365;
- BS EN 752:2017;
- CIRIA C753 'The SuDS Manual' 2015;
- DEFRA / Environment Agency 'Preliminary Rainfall Runoff Management for Developments' Technical Report;
- Discharge Units from BS EN 12056: Part 2;
- Flood & Water Management Act 2010;
- Highways Act 1991;
- Institute of Hydrology Report (IHR) 124;
- Land Drainage Act 1991;
- Modified Rational Method;
- Sewers for Adoption 7th Edition;
- Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems
- Technical Advice Note (TAN) 15: Development and Flood Risk;
- Wallingford Procedure;
- Water Industries Act 1991.

4.0 Surface Water & Foul Drainage Strategy

4.1 Guiding Principles

4.1.1 The disposal of surface water has been designed in strict accordance with the provision of TAN 15, the Flood and Water Management Act 2010 and other best practice documents, such as CIRIA C753 'SuDS Manual' 2015.

4.2 Method of discharge

4.2.1 In accordance with the SuDS Manual 2015, surface water should be managed and discharged from a new development in line with the following hierarchy:

- Re-use of water;
- Infiltration into ground;
- Discharge to a water body;
- Discharge to a surface water run-off drain;
- Discharge to a combined surface water run-off and foul drain.

4.2.2 Due to the nature of the development, there is unlikely to be a requirement for the re-use of large volumes of grey water within the building and a rainwater harvesting system would be unfeasible.

3.1.1 Porosity tests for the first phase of the development were conducted by Groundsolve Ltd between the 9th and 11th of October 2017. The report concludes that the use of infiltration systems such as soakaways for the disposal of surface water run-off generated from the proposed development is suitable. a copy of this report is contained within **Appendix F**. Therefore, all surface water run-off for the first phase of the development discharged to ground at the natural infiltration rate within individual soakaways for each plot and a separate system for the highway network.

3.1.2 Porosity testing for the second phase of the development is yet to be undertaken by Cadarn Consulting Engineers, due to the current situation with COVID-19 this is not possible, to ensure the project can progress the site is deemed to have similar ground characteristics as phase 1 of the development, therefore the infiltration rate used for the design of the soakaway structures for phase 1 of the

development will be used for phase 2 at this preliminary stage. However further porosity testing should be conducted on site following the pandemic to confirm the assumption; that the infiltration rates of the proposed development are similar to those of the first phase of the development.

3.1.3 The infiltration rate to be used for design purposes at this preliminary stage of the design is: ***1.63 x 10^{-04} m/s***

4.2.3 Based on this, and in order to comply with the above hierarchy, the drainage philosophy for the site will focus on attenuating surface water in periods of heavy rainfall whilst releasing into the ground at the natural infiltration rate.

4.2 Climate Change

4.2.1 TAN 15 states that an allowance for climate change should be provided within the on-site attenuation, without specifying what allowance should be made. The NPPF, which is the English equivalent of TAN 15, does however provide guidance derived from DEFRA FCDPAG3 'Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts' October 2006 (see **Table 1**). This document considers the effects of climate change for different design criteria.

4.2.2 The proposed development will have a design life of 100 years; based on the NPPF's guidance, the development therefore requires an allowance of 30% for climate change to be applied to the peak rainfall intensity.

Table 1 – *Climate change requirements.*

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak Rainfall Intensity	+5%	+10%	+20%	**+30%**
Peak River Flow	+10%	+20%		
Offshore Wind Speed	+5%		+10%	
Extreme Wave Height	+5%		+10%	

5.0 Surface Water Drainage Design

5.1 Design Philosophy

5.1.1 Based upon existing site information and the details of the proposed development, an assessment of the site run-off has been undertaken utilising the 'Flow' hydraulic modelling package (refer to **Appendix G**). This has enabled the existing and proposed run-off flows to be assessed and quantified, in accordance with IHR 124.

5.1.2 The tables below summarise the existing and proposed effective areas with their corresponding run-off coefficients, as per the Wallingford procedure, IHR 124 and the Modified Rational Method.

Table 2 – *Existing and proposed areas.*

Surface	Total Area	Coefficient	Effective Area
Existing – Grass	9,915.195 m²	0.35	3,470.318m²
Proposed – Roofs	2,288.367 m²	1.00	2,288.367 m²
Proposed – External Paths	673.315 m²	1.00	673.315 m²
Proposed - Highway	1,328.337 m²	0.75	996.253 m²
Proposed – Private Road	506.737 m²	0.75	380.053 m²
Proposed – Parking Areas	904.313 m²	0.75	678.235 m²
Proposed – Grass	4,214.126 m²	0.35	1,474.944 m²

5.1.3 The Areas provided within table 2 are provided on the existing and proposed area drawings contained within **Appendix H .** Reference should be made to the attached calculations for run-off volumes (**Appendix G**), which are summarised as follows:

Table 3 – *Run-off rates for different return periods.*

Reference	1 in 1 Year	1 in 30 Year	1 in 100 Year
Existing	1.70 l/s	3.40 l/s	4.10 l/s

5.1.4 As noted in section 4.2 it is proposed to discharge surface water run-off from the proposed development into the ground and therefore the surface water run-off from the site will be significantly reduced.

5.2 Method of Storage

5.2.1 Surface water run-off generated from all proposed hardstanding areas for the 1 in 100-year return period plus an allowance of 30% for climate change is to be provided onsite within below ground soakaway structures. Individual soakaways are to be provided for each property (where possible) and separately beneath the adopted highway accommodating the surface water run-off from the highway itself. The proposed surface water drainage layout illustrating this is contained within **Appendix I.**

5.2.2 There are four different soakaway types which are proposed in order to accommodate the proposed plots and highway drainage. The varying in soakaway type is as a result of the catchment area, these are summarised within the **Table 4**.

Table 4 – *Soakaway types & catchment areas*

Catchment Area Region	Soakaway Type
0m² – 90m²	A
90m² – 150m²	B
0m² – 150m²	C
400m²	D

5.2.3 The proposed hardstanding areas for each plot and the soakaway type specified are summarised within **Table 5**.

Table 5 – *Proposed hardstanding areas and soakaway type breakdown.*

Plot Number	Roof (m²)	Parking (m²)	External Paths (m²)	Private (m²)	Total (m²)	Soakaway Type
1	48.967	36.625	4.324		89.916	A
2	39.48	23.237	6.488		69.205	A
3	41.133	23.247	18.681		83.061	A
4 & 5	68.607	35.271	47.793		151.671	C
6 & 7	68.607	35.328	46.882		150.817	C
8	83.034	31.35	18.819		133.203	B
9	84.683	27.585	20.729		132.997	B
10	83.034	26.624	18.819		128.477	B
11	92.298	26.29	26.124		144.712	C
12 & 13	190.384	56.095	47.07	105.541	399.09	D
14 & 15	150.291	54.526	32.17	158.469	395.456	D
16	83.034	30.093	18.819		131.946	B
17	84.683	30.011	20.729		135.423	C
18	98.086	29.996	20.946		149.028	C
19	92.298	30.975	26.124		149.397	C
20	84.683	34.096	20.729		139.508	C
21	98.086	32.997	20.946		152.029	C
22	92.298	30.692	26.124		149.114	C
23	98.086	29.997	20.946		149.029	C
24	92.298	29.697	26.124		148.119	C
25	98.086	29.909	20.946		148.941	C
26	77.118	30.555	16.085		123.758	B
27	73.173	30.835	16.085		120.093	B
28	47.014	44.972	27.776		119.762	B
29	41.133	22.152	23.739		87.024	A
30	41.133	23.04	3.681		67.854	A
31	41.133	23.04	25.007		89.18	A
32	41.133	23.04	3.681		67.854	A
33	47.014	23.038	18.797		88.849	A

5.2.4 The characteristics of the four soakaway types is provided below.

5.2.5 <u>Soakaway Type A</u>

Geocellular Storage Crates: 2.000m x 1.000m

Depth: 1.200m

Storage Requirements: 2.165m³

Storage Provided: 2.280 m³

5.2.6 Soakaway Type B

Geocellular Storage Crates:	2.000m x 2.000m
Depth:	1.200m
Storage Requirements:	3.695m³
Storage Provided:	4.560 m³

5.2.7 Soakaway Type C

Granular Trench:	2.010m x 2.010m
Integrated Chamber:	1.500m Ø
Depth:	1.450m
Storage Requirements:	3.382 m³
Storage Provided:	2.447 m³

5.2.8 Due to the location of an existing combined sewer at the rear of plots 12 – 15, there is two communal soakaways each accommodating two of the four properties and an area of the private access track as indicated within **Table 5.**

5.2.9 Soakaway Type D

Granular Trench:	3.350m x 3.350m
Integrated Chamber:	2.400m Ø
Depth:	1.600m
Storage Requirements:	10.127 m³
Storage Provided:	10.364 m³

5.2.10 Calculations for each soakaway type are contained within **Appendix J**.

5.3 Drainage System Maintenance

5.3.1 The SuDS Manual 2015 requires appropriate measures to be in place for the maintenance of surface water drainage systems and sustainable drainage features.

5.3.2 The maintenance schedule shown in **Tables 6 & 7** have been derived in strict accordance with the SuDS Manual 2015 and from a risk-assessed approach during the design stage. These schedules are not exhaustive and should be reassessed at regular intervals to determine if any additional maintenance requirements are required to preserve the performance and condition of the site drainage system.

5.3.3 The surface water drainage system for the highway network is to be adopted under section 38 of the Highways Act 1980 and therefore will be maintained by the Highway Authority, a maintenance schedule for this network is contained within **Table 6**.

5.3.4 The Chamber soakaways for each individual plot are the responsibility of the future homeowner and should be maintained in line with **Table 7**.

5.3.5 As noted in **Section 5.2**, there are two communal soakaways located beneath the private access road each accommodating two properties and an area of the private roads in addition to this there are two additional soakaways accommodating other private roads across the site, these are to be offered to a management and maintenance company and are to be maintained in line with the **Table 6**.

5.3.6 Provided preventive maintenance measures are undertaken in accordance with the frequencies recommended in **Table 6 & 7**, the need for corrective maintenance should rarely arise.

5.3.7 Maintenance activities should be detailed in the Principal Contractor's Health and Safety Plan and Risk Assessments and should be updated on a regular basis to ensure the continued performance and long-term condition of the drainage system.

Table 6 – *Operation and maintenance requirements for highway chamber soakaways, pipework and Highway gullies.*

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspection for sediments and debris build up within base of Soakaway and Highway Gullies.	Annually.
Occasional Maintenance	Removal of sediments and debris from sump within base of Soakaway and Highway Gullies.	As required based upon inspection.
Remedial Actions/ Corrective Maintenance.	Reconstruct soakaway and/or replace or clean void fill if performance deteriorates or failure occurs.	As Required.
	Jetting of pipework to remove silts and debris build up from pipework and removal of sediments and debris from base of soakaway.	As Required.
	Replacement of clogged geotextile wrap around system (Will require reconstruction of soakaway). if performance deteriorates or failure occurs.	As Required.
Monitoring	Inspect silt traps in gullies and note rate of sediment accumulation.	3 Monthly in the first year and then annually.
	Check Soakaway to ensure emptying is occurring.	3 Monthly in the first year and then annually.

Table 6 – *Operation and maintenance requirements for private property chamber soakaways, pipework and chambers upstream.*

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspection for sediments and debris build up within base of Soakaway.	Annually.
Occasional Maintenance	Removal of sediments and debris from sump within base of Soakaway.	As required based upon inspection.
Remedial Actions/ Corrective Maintenance.	Reconstruct soakaway and/or replace or clean void fill if performance deteriorates or failure occurs.	As Required.
	Jetting of pipework to remove silts and debris build up from pipework and removal of sediments and debris from base of soakaway.	As Required.
	Replacement of clogged geotextile wrap around system (Will require reconstruction of soakaway). if performance deteriorates or failure occurs.	As Required.
Monitoring	Inspect silt traps in gullies and note rate of sediment accumulation.	3 Monthly in the first year and then annually.
	Check Soakaway to ensure emptying is occurring.	3 Monthly in the first year and then annually.

6.0 Foul Drainage Design

6.1 Method of Discharge

6.1.1 Design of the foul sewers included within the proposal has been carried out in accordance with BS EN 12056 Part 2, Approved Document H of the Building Regulations 2010 and other best practice documents, such as the 'Sewers for Adoption' 7th edition. In accordance with Approved Document H, the preference in terms of discharging foul effluent is to discharge into a public foul sewerage system. If a connection to the foul drainage network cannot be sought consideration should be given to the list below in order of priority;

- Discharge into a public combined sewerage system,
- Discharge into a private sewerage system,
- Discharge using treatment plant into an infiltration system,
- Discharge using treatment plant into a watercourse, and

6.1.2 As stated within **Section 2.3** there is an foul sewerage network which is current being constructed and adopted under a section 104 the Waters Industries Act 1991 as part of the first phase of the development. Therefore, it is proposed to communicate foul effluent under section 106 of the Waters Industries Act 1991 for the proposed into this sewerage network. In order to do this a Section 106 application should be submitted to DCWW as the owner to provide 21 days of notice before the connection is made.

6.1.3 The hierarchy outlined in Approved Document H of the Building Regulations 2010 can therefore be satisfied by connecting into this sewerage system. This shall be achieved by conveying the foul arising from the proposed development within a Ø 150mm gravity pipe.

6.1.4 In line with Sewers for adoption 7th all Ø 150mm foul pipework should be laid at gradients to suit the site's topography, whilst ensuring that a minimum gradient of 1:150 is achieved, and minimum of 1:80 for all 100mm pipework.

6.1.5 The design of the foul drainage system, along with the surface water system, for the proposed development is illustrated in the drawing enclosed in **Appendix I**.

7.0 Conclusion & Recommendations

7.1.1 This Drainage Strategy Report provides a suitable drainage strategy for the discharge of surface water run-off and foul effluent generated as a result of the proposed development.

7.1.2 Surface water run-off from the proposed hardstanding areas will be stored within a below ground soakaway structures and will be released into the ground at the natural infiltration rate.

7.1.3 All foul generated from the proposed development will discharged directly into the proposed public foul drainage network, currently being constructed as part of the first phase of the development, via a gravity drainage system.

7.1.4 Further porosity testing should be carried out at the position and depth of the proposed soakaways to ensure that the ground conditions are consistent with the ground conditions encountered within the first phase of the development.

APPENDICES

APPENDIX A
Site Location Plan

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

KEY

SUITABILITY	REV	DATE	DESCRIPTION	Org.	Chk'd	App'd	Auth'd
S1	P01		FIRST ISSUE				

DRAWING STATUS:

PROJECT TITLE:

MELIDEN ROAD, DYSERTH
PHASE 2

DRAWING TITLE:

SITE LOCATION PLAN

DRAWING No.:

PROJECT	ORIGINATOR	VOL.	LOC.	TYPE	ROLE
003920	CCE	V1	XX	40:40:34	C

CLASSIFICATION	No.	SUITABILITY	REVISION
80	0001	S1	P01

ORIGINATOR:	DATE:	SCALE:	ORIGINAL SIZE:
B.Thorne	17.04.2020	1:2500	A4

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APPENDIX B

Existing Above Ground Surface Water Flood Routing

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS.
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KEY

DENOTES DIRECTION OF SURFACE WATER FLOOD ROUTING.

S1	P01			FIRST ISSUE				
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PROJECT TITLE:

MELIDEN ROAD, DYSERTH
PHASE 2

DRAWING TITLE:

EXISTING SURFACE WATER ABOVE GROUND FLOOD ROUTING

DRAWING No:

PROJECT	ORIGINATOR	VOL.	LOC.	TYPE:	ROLE
003920	**CCE**	**V1**	**XX**	**40:40:01**	**C**
50:30 CLASSIFICATION		**0003** No.	**S1** SUITABILITY	**P01** REVISION	

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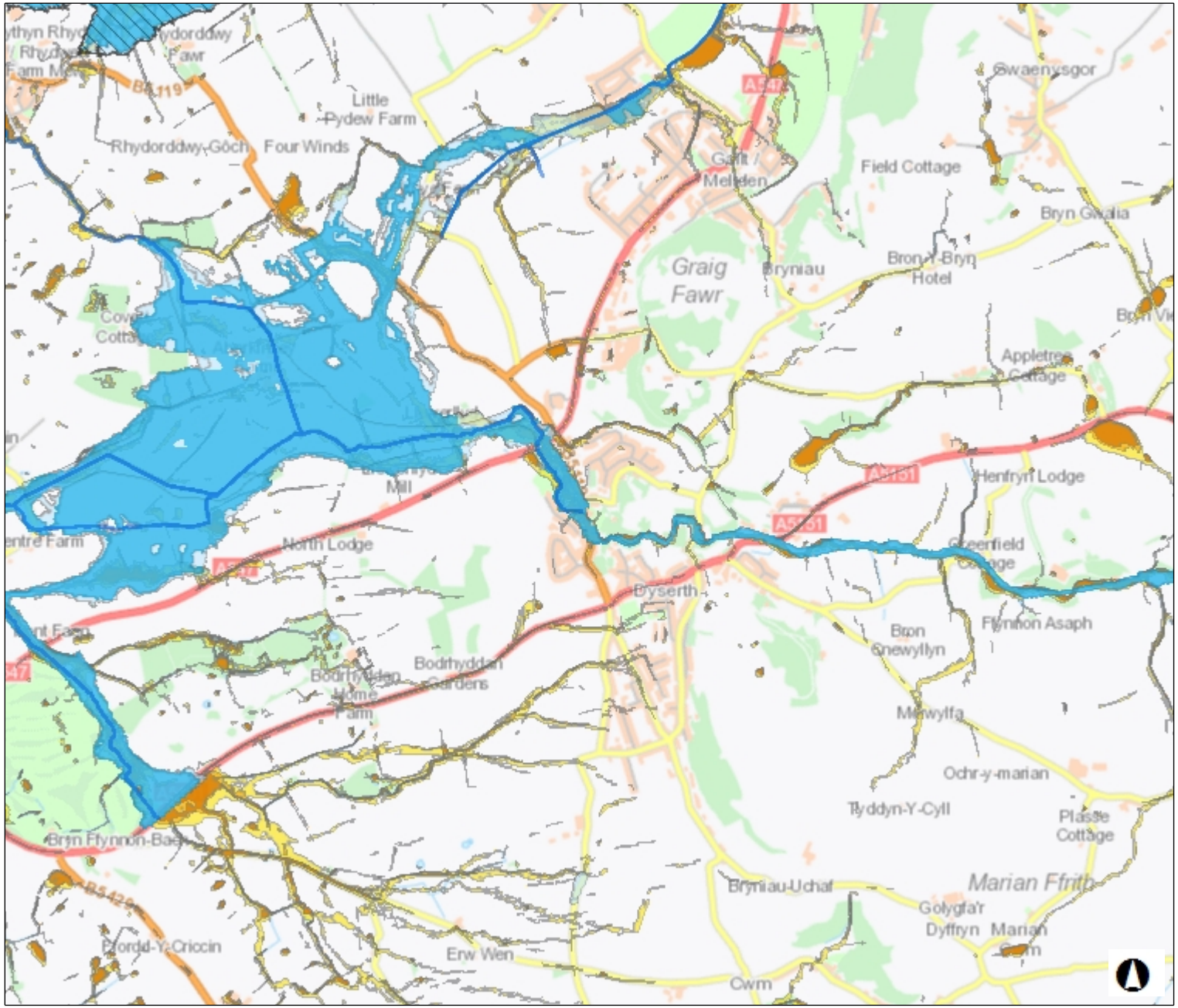
APPENDIX C
NRW Flood Advice Map



Cyfoeth Naturiol Cymru
Natural Resources Wales

003920-CCE-V1-XX-301093-C-5030-0002-S1-P01.- NRW FLOOD ADVICE MAP

Map Perygl Llifogydd / Flood Risk Map

Allwedd / Map Key

- Main Rivers
- Flood Defences
- Areas Benefiting from Flood Defences
- Flood Storage Areas
- Floodmap Flood Zone 3
- Floodmap Flood Zone 2
- Reservoir Depths
  - 0 - 0.3m
  - 0.3 - 2.0m
  - Greater than 2.0m
- High Surface Water Flood Risk - Extent
- Medium Surface Water Flood Risk - Extent
- Low Surface Water Flood Risk - Extent

Graddfa / Scale 1: 25,000

Dyddiad / Date
20/04/2020

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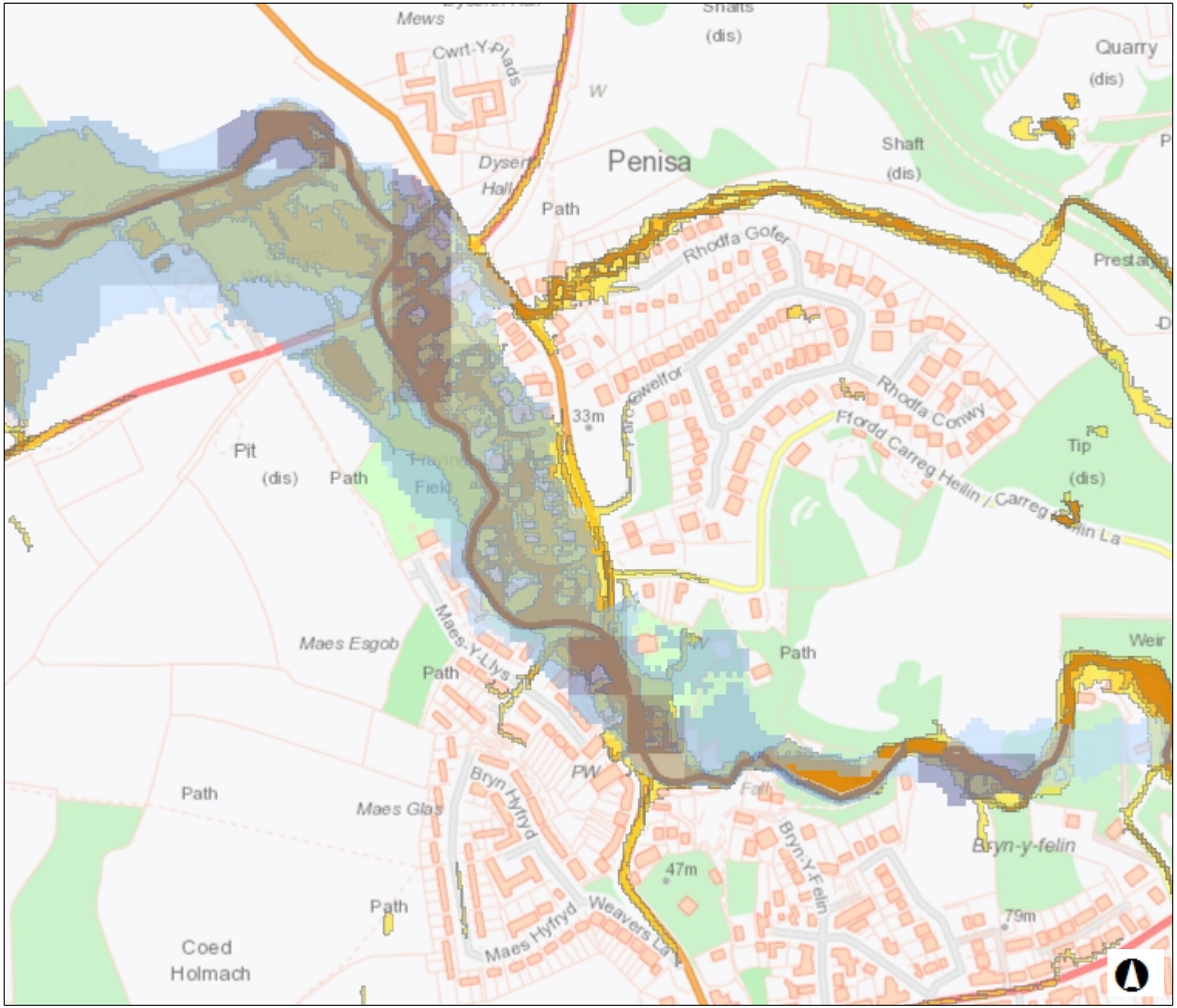
British_National_Grid Kilometers



Cyfoeth Naturiol Cymru
Natural Resources Wales

003920-CCE-V1-XX-301093-C-5030-0003-S1-P01 - NRW FLOOD ADVICE MAP

Map Perygl Llifogydd / Flood Risk Map

Allwedd / Map Key

- Flood Defences
- Risk of Flooding from Rivers & Sea
  - High
  - Medium
  - Low
  - Very Low
- Risk of Flooding from Reservoirs - Extent
- High Surface Water Flood Risk - Extent
- Medium Surface Water Flood Risk - Extent
- Low Surface Water Flood Risk - Extent

Graddfa / Scale 1: 5,001

Dyddiad / Date
20/04/2020

0.3 0 0.13 0.3

British_National_Grid Kilometers

APPENDIX D

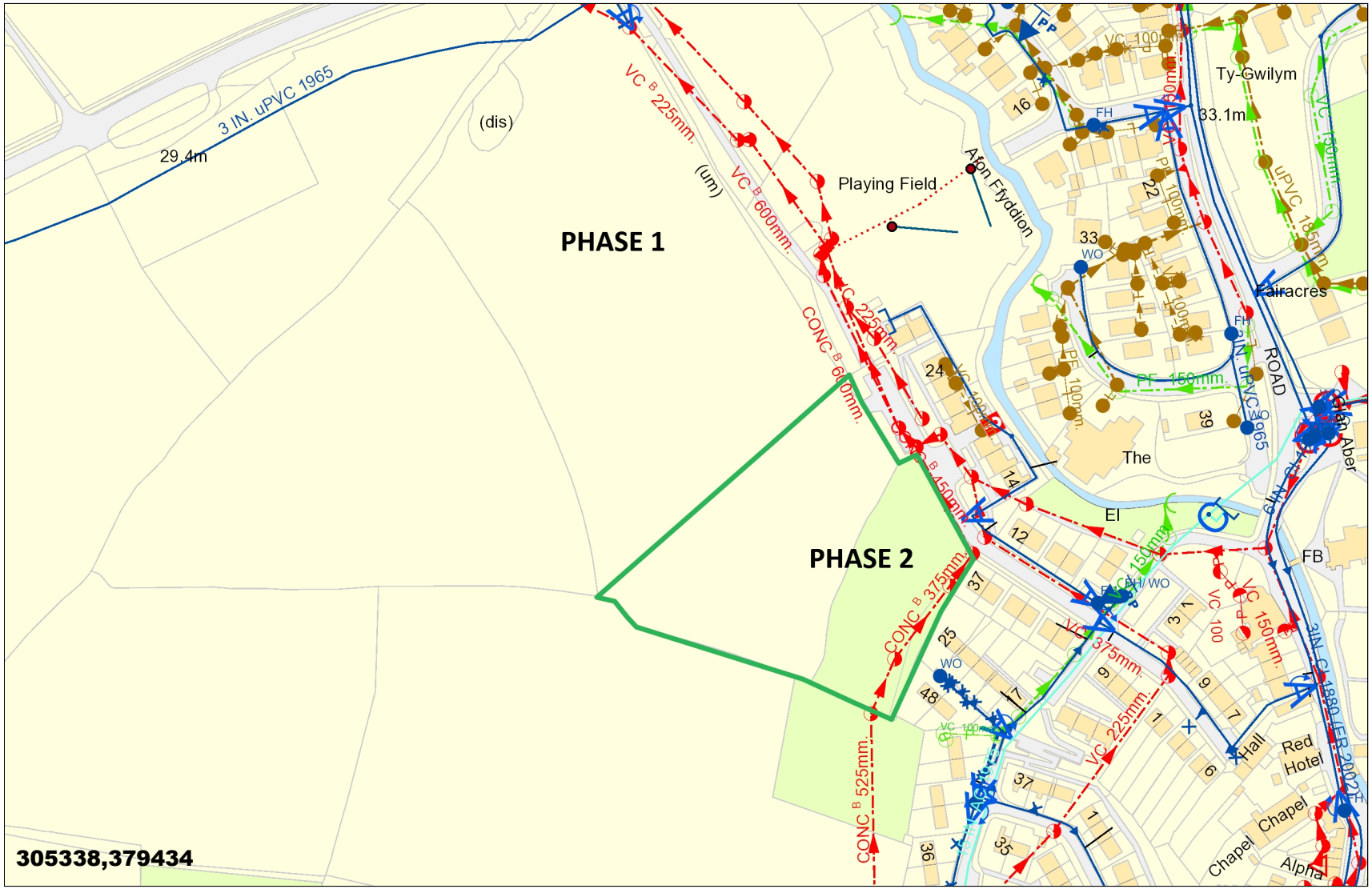
Dŵr Cymru / Welsh Water Apparatus Map

Dŵr Cymru
Welsh Water

003920-CCE-V1-XX-301093-C-5030-0001-S1-P01 - Dwr Cymru Welsh Water Apparatus Maps

20/04/2020

Scale: 1: 2500



LEGEND

Clean Water

- Sluice Val
- Air Val, SINGLE
- Tap
- Pressure Reducing Valve
- Meter
- BULK Meter
- FH
- Cap
- Existing Main
- NON COMPANY

Sewerage External

- Foul
- Surface Water
- Combined
- Rising Main
- Private
- Treatment Works
- Pumping Station
- Special Purpose
- Unknown End
- Change, Combined Overflow
- Outfall, FOUL
- Lamp Hole, Foul
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

Dwr 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 and any onus of locating the apparatus before carrying out any excavations rests entirely on you. The information which is supplied hereby the company, is done so in accordance with statutory requirements of sections 198 and 199 f the water industry Act 1991 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 disclosure the existence of a drain sewer or disposal main 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 us 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.

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

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

APPENDIX E

PHASE 1 – Section 104 Drainage Layout

NOTES CONTINUED

18. CONNECTION TO THE PUBLIC SEWER
A SECTION 106 APPLICATION TO CONNECT MUST BE MADE TO DCWW. THE DEVELOPER SHALL GIVE 21 DAYS NOTICE PRIOR TO CONNECTION, THE WORKS MAY ONLY BE UNDERTAKEN BY A DCWW HEALTH AND SAFETY APPROVED CONTRACTOR.
19. OPTIMUM TRENCH WIDTH
OPTIMUM TRENCH WIDTH = PIPE + 300mm. CONTRACTOR TO ENSURE TRENCH WALLS ARE SUITABLY PROPPED.
20. BACKFILLING TO PIPE TRENCHES BENEATH ROADS, CAR PARKING AND STRUCTURES TO BE M.O.T. TYPE 1 GRANULAR MATERIAL UP TO FORMATION LEVEL FROM THE TOP OF THE SPECIFIED PIPE SURROUND (WELL COMPACTED IN 150mm LAYERS).
21. BACKFILLING TO PIPER TRENCHES BENEATH LANDSCAPED AREAS TO BE SELECTED EXCAVATE MATERIAL FREE FROM LARGE STONES GREATER THAN 0mm, LUMPS OF CLAY OVER 100mm, ANY TIMBER, FROZEN MATERIAL OR VEGETATION MATTER UP TO FROMATION / GROUND LEVEL FROM THE TOP OF THE SPECIFIED PIPE SURROUND (WELL COMPACTED IN 150mm LAYERS).
22. GRANULAR MATERIAL NOMINAL SIZE 10mm SINGLE SIZED OR 14mm TO 5mm GRADED.
23. BACKFILL MUST NOT BE LACED ON CONCRETE BEDDING OR SURROUND UNTIL THE CONCRETE COMPRESSIVE STRENGTH HAS REACHED 15N/mm².
24. BRICKS OR BLOCKS MUST NOT BE PLACED IN THE BEDDING MORTAR FOR SETTING THE PIPES TO LEVEL .
25. ALL ROCKER PIPE LENGHTS TO BE 600mm.
26. PROVIDE ROCKER PIPES AT TRANSITION FROM CONCRETE SURROUND TO GRANULAR SURROUND.
27. MAX DISTANCE FROM FACE OF CONCRETE SURROUND TO FIRST FLEXIBLE JOINT TO BE 150mm.
28. MANHOLE COVERS AND FRAMES
MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF THE BS EN 124,M BS 7903 AND HIGHWAYS AGENCY GUIDANCE DOCUMENT HA 104/09. THEY SHALL BE OF NON ROCKING DESIGN WHICH DOES NOT RELAY TO THE CUSHION INSERTS.

    MANHOLE COVER ON FOUL ONLY SEWERS SHALL BE OF LOW LEAKAGE TYPES IN ORDER TOP PREVENT EXCESSIVE SURFACE WATER INGRESS

    AS A MINIMUM, CLASS D400 SHALL BE USED IN CARRIAGEWAYS OR ROADS (INCLUDING PEDESTRIAN STREETS), HARD SHOULDERS AND PARKING AREAS USED BY ALL TYPES OF VEHICLES.
29. CONSTRUCTION OF SEWER TO BE IN ACCORDANCE WITH WELSH MINISTERS STANDARDS AND SFA 7TH EDITION.
30. LOCATION OF PRIVATE RAIN WATER PIPES TO BE CONFIRED BY ARCHITECT

KEY

- DENOTES PROPOSED SURFACE WATER CHAMBER & PIPE RUN TO BE ADOPTED BY DENBIGHSHIRE COUNTY COUNCIL HIGHWAY AUTORITY.
- DENOTES PROPOSED FOUL CHAMBER & PIPE RUN TO BE ADOPTED BY WELSH WATER.
- DENOTES PROPOSED FOUL CHAMBER & PIPE RUN TO REMAIN PRIVATE.
- DENOTES EXISTING COMBINED CHAMBER & PIPE RUN TO BE ADOPTED BY WELSH WATER.
- G1 DENOTES EXISTING COMBINED CHAMBER & PIPE RUN TO BE ADOPTED BY WELSH WATER.
- DENOTES PROPSOSED GRANULAR SOAKAWAY.
- DENOTES PROPOSED SITE BOUNDARY.
- — W —— W — ASSUMED POSITION OF EXISTING DCWW WATERMAIN.

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.
4. PLEASE REFER TO ARCHITECTS DRAWINGS FOR FINAL BUILDING LOCATION.
5. ALL DRAINAGE COMPONENTS ARE TO COMPLY WITH CURRENT BRITISH STANDARDS AND BUILDING REGULATIONS REQUIREMENTS.
6. ALL WORKS TO IN ACCORDANCE WITH ROADS FOR ADOPTION IN DENBIGHSHIRE.
7. ALL WORKS AND MATERIALS TO BE IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS (SHW SERIES 500).
8. DRAIN PIPE THROUGH WALLS OR BENEATH FOUNDATIONS (SPREAD ONLY) TO HAVE R.C BRIDGE LINTELS OVER AND PIPE SURROUNDED IN FLEXIBLE MATERIAL (50mm).
9. FINAL LOCATIONS AND DETAILS OF SOIL VENT PIPES, STUB STACKS, RAINWATER DOWN PIPES, GULLIES ETC. TO BE CONFIRMED BY REFERENCE TO ARCHITECT' DRAWINGS.
10. ALL THRESHOLD DRAIN DETAILS TO BE TO ARCHITECT' DETAILS.
11. ALL PIPES INTO CHAMBERS TO SOFFIT TO SOFFIT U.N.O.
12. AT ALL OUTFALL POINTS TO AN EXISTING NETWORK, THE POSITION AND INVERT LEVEL OF EXISTING DRAINS MUST BE CONFIRMED WELL IN ADVANCE OF THE PROGRAMMED DATE FOR INSTALLING ANY OF THE UPSTREAM DRAINAGE, OR ORDERING OF ANY MATERIALS IN ORDER TO ALLOW TIME FOR ANY NECESSARY REVISIONS TO THE HYDRAULIC DESIGN.
13. ALL GRAVITY UPVC PIPEWORK TO BE TO BS 4660 OR BS 5481 WHERE RELEVANT UNLESS NOTED OTHERWISE.
14. ALL NON ADOPTABLE DOMESTIC FOUL AND SURFACE WATER PIPE RUNS SHALL CONSIST OF 100MM DIA. PIPES LAID AT NO FLATTER THAN 1 IN 80 FALLS U.N.O.
A SEWER OR LATERAL DRAIN WITH A NOMINAL INTERNAL DIAMETER OF 100mm, OR A LATERAL DRAIN SERVING TEN OR LESS PROPERTIES IS LAID TO A GRADIENT NOT FLATTER THAN 1:80, WHERE THERE IS AT LEAST ONE WC CONNECTED AND 1:40 IF THERE IS NO WC CONNECTED.
15. ALL CONNECTIONS FROM HIGHWAY GULLIES TO BE 150mm DIA. LAID AT FALLS OF BETWEEN 1 IN 20 AND 1 IN 100 WITH TYPE S BED AND SURROUND TO ALL CONNECTIONS WITH MIN. 1.20m COVER, TYPE Z BED AND SURROUND TO ALL OTHER CONNECTIONS.
16. THERMOPLASTIC PIPES & FITTINGS:
THERMOPLASTIC PIPES, JOINTS & FITTINGS FOR GRAVITY SEWERS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1401-1, BS EN 1852 & BS EN 12666-1.
17. THERMOPLASTIC STRUCTURED WALL PIPE:
THERMOPLASTIC STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476-1 & WIS 4-35-01 AND BS EN 13476-2 OR BS EN 13476-3. PIPES SHALL BE BSI KITEMARKED OR HAVE EQUIVALENT THIRD PART CERTIFICATION. PIPES LESS THAN OR EQUAL TO 500mm IN DIAMETER SHALL HAVE NOMINAL SHORT-TERM RING STIFFNESS NOT LESS THAN 8KN/m² (SN8) OR BE SUBJECT TO A QUALITY SYSTEM FOR STORAGE & EMBEDMENT.

    Nom. SHORT TERM RING STIFFNESS OF 2KN/m² (SN2) IS ACCEPTABLE FOR PIPES GREATER THAN Ø500mm, SUBJECT TO SUPPORTING STRUCTURAL DESIGN LOAD CALCULATIONS BEING PROVIDED.

    TRANSPORTATION, HANDLING, STORAGE AND LAYING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

    WHERE A FITTING IS INSTALLED ON A SEWER LENGTH, IT SHALL HAVE THE SAME INTERNAL BORE AS THE SEWER. Max. LENGTH OF PIPE FOR LAYING IS 3.0m OR Ø x 10, WHICHEVER IS THE GREATER, UNLESS WELDED JOINTS ARE USED.

REV	DATE	DESCRIPTION	BY	CHK	APP
C10	19/03/2020	PLOT 37, 38 & 39 AMENDED TO SUIT REVISED ARCHITCTS LAYOUT (REV N)			
C9	21/11/2019	POSITION OF SOAKAWAY UPDATED TO SUIT UPDATED GAS TANK			
C8	05/11/2019	POSITION OF SOAKAWAY CHAMBERS FOR PLOTS 2 TO 17 AMENDED TO AVOID CLASH WITH TENSAR GRID FORMING THE RETAINING WALL			
C7	11/09/2019	PRIVATE SURFACE WATER DRIANAGE ARRANGEMENT PLOT 51-61 AMENDED			
C6	27/08/2019	SURFACE WATER DRAINAGE SHOWN ON LAYOUT, HIGHWAY GULLIES AMENDED ON ROAD 5			
C5	23/08/2019	SITE LAYOUT UPDATED			
C4	26/07/2019	GULLY 29, 30 & 31 ADDED			
C3	25/07/2019	FFL TO PLOTS 18 AND 23 UPDATED, RUN BETWEEN F17 & F54A UPDATED	T.W.		
C2	09/07/2019	AMENDED TO MATCH LATEST ARCHITECTS LAYOUT.			
C1	22/05/2019	LAYOUT AMENDED TO CONSTRUCTION ISSUE.			
M	08/02/2019	FOR APPROVAL REMOVED FROM LAYOUT AS REQUESTED BY DCWW.	B.T.	E.R.	I.R.
L	22/11/2018	FOR APPROVAL REMOVED FROM LAYOUT AS REQUESTED BY DCWW.	B.T.	E.R.	I.R.
K	15/10/2018	VISABILITY SPALY REMOVED FROM LAYOUT	B.T.	E.R.	I.R.
J	15/10/2018	ADD AMENDED CHAMBER SCHEDULE.	K.B.	B.T.	I.R.
I	08/10/2018	MINOR AMENDMENTS MADE TO LAYOUTS.	K.B.	R.T.	I.R.
H	05/10/2018	MINOR AMENDMENTS MADE TO LAYOUTS.	K.B.	R.T.	I.R.
G	06/06/2018	POINT OF CONNECTION AMENDED & SECTION 104 CHAMBER SCHEDULE ADDED TO LAYOUT.	K.B.	I.R.	I.R.
F	27/04/2018	AMENDED TO REVISED LAYOUT.	K.B.	I.R.	I.R.
E	15/03/2018	DESIGN DEVELOPED	B.T.	I.R.	I.R.
D	09/03/2018	DESIGN DEVELOPED	B.T.	I.R.	I.R.
C	07/02/2018	DRAFT REMOVED AND PRIVATE SURFACE WATER DRAINAGE LINE DASH AMENDED FOR CLARITY.	B.T.	I.R.	I.R.
B	30/01/2018	SOAKAWAYS AMENDED ON PLOTS '7 - 10, 14 - 17, 43 - 46 & 53 - 56.	B.T.	I.R.	I.R.
A	18/01/2018	SURFACE WATER DRAINAGE AMENDED TO HAVE INDIVIDUAL PLOT SOAKAWAY	B.T.	I.R.	I.R.

REVISIONS

CONSTRUCTION ISSUE

RESIDUAL RISKS

1. CONTRACTOR TO ASCERTAIN EXACT POSITION/DEPTH OF ALL SERVICES, INCLUDING BUT NOT LIMITED TO:
    - SURFACE WATER & FOUL DRAINAGE
    - HIGHWAY DRAINAGE
    - WATER
    - ELECTRICITY
    - TELECOMMUNICATIONS
    - CCTV
    - GAS & ANY OTHER UTILITIES WHICH MAY BE PRESENT
2. ALL TEMPORARY WORKS ARE THE RESPONSIBILITY OF THE CONTRACTOR. ALL TEMPORARY WORKS TO BE DESIGNED & DETAILED BY THE CONTRACTOR. SHORING/PROPPING ARRANGEMENTS TO BE ADEQUATE TO SUPPORT ALL APPLIED LOADS AND CONSIDERATION GIVEN TO THE ADJACENT STRUCTURE IN THE TEMPORARY CONDITION.
3. PRIOR TO COMMENCEMENT OF THE WORKS, CONTRACTOR TO ESTABLISH THE EXISTING FOUNDATION LEVELS OF THE ADJACENT PROPERTIES TO ASCERTAIN WHETHER FURTHER RETAINING STRUCTURES ARE REQUIRED.
4. ALL WORKS CONTAINED WITHIN THE HIGHWAY ARE SUBJECT TO HIGHWAY APPROVAL.

Project: PROPOSED RESIDENTIAL DEVELOPMENT AT MELIDEN, DYSERTH

Title: PROPOSED SECTION 104 DRAINAGE LAYOUT

Job Ref:	Drawing Ref:			Revision:
15417	EL (95) 01			C10
Drawn by:	**Date:**	**Checked by:**	**Scale:**	**Paper Size:**
B.Thorne	22/12/17	E.R.	1/500	A1

CADARN
CONSULTING ENGINEERS

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APPENDIX F

Groundsolve Ltd Porosity Report

The Groundsolve site investigation and porosity report has not been included due to the file size however this is available upon request.

APPENDIX G

'*Causeway Flow*' Hydraulic Modelling Output

Drainage Design Report

Flow+

v7.0

Network	Storm Network
Filename	\\192.168.0.200\data\Readyshare\CADARN CONSULTING ENGINEERS\2020\Job File\03920 – Meliden Road, Dyserth - Phase 2\3. Design\a. Calcs\Flow\flow .pfd
Username	Byron Thorne (byron@cadarnconsulting.co.uk)
Report produced on	17/04/2020 10:31:40

Causeway Sales

Tel:	+44(0) 1628 552000
Fax:	+44(0) 1628 552001
Email:	marketing@causeway.com
Web:	www.causeway.com

Technical support web portal:

http://support.causeway.com

Rainfall Methodology	FSR
Return Period (years)	
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	
Ratio-R	
CV	0.750
Time of Entry (mins)	
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Enforce best practice design rules	

	Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)	Notes

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)	Con Offset (m)	Min DS IL (m)	Lateral Area (ha)	Lateral Ins Point (%)	Lateral T of E (mins)

	Name	US Node	DS Node	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Minimum Depth (m)	Maximum Depth (m)	Σ Area (ha)	Σ Add Inflow (ha)	Pro Depth (mm)	Pro Velocity (m/s)	Notes

Link Name	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)	US Node Name	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node Name	Dia (mm)	Width (mm)	Node Type	MH Type

Node Name	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Node Type	MH Type		Link ID	IL (m)	Dia (mm)	Link Type

Rainfall Methodology	FSR		Return Period (years)	Climate Change (%)
FSR Region	England and Wales		1	0
M5-60 (mm)	17.000		30	0
Ratio-R	0.400		100	0
Summer CV	0.750			
Winter CV	0.840			
Analysis Speed	Normal			
Drain Down Time (mins)	240			
Additional Storage (m³/ha)	20.0			
Storm Durations (mins)	15			
	30			
	60			
	120			
	180			
	240			
	360			
	480			
	600			
	720			
	960			
	1440			
Check Discharge Rate(s)				
1 year (l/s)	1.7			
30 year (l/s)	3.4			
100 year (l/s)	4.1			
Check Discharge Volume				
100 year 360 minute (m³)				

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.992
SAAR (mm)	731
Soil Index	2
SPR	0.30
Region	9
Growth Factor 1 year	0.88
Growth Factor 30 years	1.80
Growth Factor 100 years	2.18
Betterment (%)	0
QBar	1.9
Q 1 year (l/s)	1.7
Q 30 year (l/s)	3.4
Q 100 year (l/s)	4.1

Default Values			Overrides					
Entry Loss (manhole)	0.250		**Link**	**Entry Loss**	**Exit Loss**		**Node**	**Flood Risk (m)**
Exit Loss (manhole)	0.250							
Entry Loss (junction)	0.000							
Exit Loss (junction)	0.000							
Flood Risk (m)	0.300							

Node Size	
Node Losses	
Link Size	
Minimum Diameter (mm)	150
Link Length	
Maximum Length (m)	100.000
Coordinates	
Accuracy (m)	1.000
Crossings	
Cover Depth	
Minimum Cover Depth (m)	
Maximum Cover Depth (m)	3.000
Backdrops	
Minimum Backdrop Height (m)	
Maximum Backdrop Height (m)	1.500
Full Bore Velocity	
Minimum Full Bore Velocity (m/s)	
Maximum Full Bore Velocity (m/s)	3.000
Proportional Velocity	
Return Period (years)	
Minimum Proportional Velocity (m/s)	0.750
Maximum Proportional Velocity (m/s)	3.000
Surcharged Depth	
Return Period (years)	
Maximum Surcharged Depth (m)	0.100
Flooding	
Return Period (years)	30
Discharge Rates	
1 year (l/s)	
30 year (l/s)	
100 year (l/s)	
Discharge Volume	

100 year 360 minute (m³)	

Adoptable						
Max Width (mm)	**Diameter (mm)**	**Width (mm)**		**Max Depth (m)**	**Diameter (mm)**	**Width (mm)**
374	1200			1.500	1050	
499	1350			99.999	1200	
749	1500					
900	1800					
>900	Link+900 mm					

Circular						
Shape	Circular		**Dia (mm)**			
Barrels	1		100			
Height (mm)			150			
Width (mm)			225			
Side Slope (1:X)						
Auto Increment (mm)	75					
Preferred Cover (m)	0.500					
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Default					
ks (mm) / n						
culvert						
Shape	Closed Rectangular		**Dia (mm)**			
Barrels	1		1000			
Height (mm)						
Width (mm)	2000					
Side Slope (1:X)						
Auto Increment (mm)	100					
Preferred Cover (m)						
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Manning					
ks (mm) / n	0.600					
Open channel						
Shape	Open User Defined		**Dia (mm)**		**Width / Total**	**Depth / Total**
Barrels	1		900		0.000	0.000

Height (mm)					0.000	1.000
Width (mm)	1800				1.000	1.000
Side Slope (1:X)						
Auto Increment (mm)	100					
Preferred Cover (m)						
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Manning					
ks (mm) / n	0.600					
2 600						
Shape	Circular		**Dia (mm)**			
Barrels	2		600			
Height (mm)						
Width (mm)						
Side Slope (1:X)						
Auto Increment (mm)	75					
Preferred Cover (m)	1.200					
Steep Slope (1:X)						
Follow Ground	x					
Velocity	Default					
ks (mm) / n						

APPENDIX H

Existing & Proposed Site Area Layout

SURFACE	TOTAL AREA	COEFFICIENT	EFFECTIVE AREA
ROOFS	2,288.367 m²	1.00	2,288.367 m²

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

KEY

DENOTES AREA OF PROPOSED GRASS.

S1	P01		FIRST ISSUE				
SUITABILITY	REV	DATE	DESCRIPTION	Org.	Ch'd	Appr'd	Auth.

DRAWING STATUS:

PROJECT TITLE:

MELIDEN ROAD, DYSERTH
PHASE 2

DRAWING TITLE:

EXISTING GREENFEILD
RUN-OFF AREAS

DRAWING No:

PROJECT	ORIGINATOR	VOL.	LOC	TYPE	ROLE
003920	CCE	V1	XX	40:40:01	C
50:30		0001	S1	P01	
CLASSIFICATION		No.	SUITABILITY	REVISION	

ORIGINATOR:	DATE:	SCALE:	ORIGINAL SIZE:
-.-.	-.-.	1:250	A1

CADARN CONSULTING ENGINEERS

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E-mail: Admin@cadarnconsulting.co.uk

SURFACE	TOTAL AREA	COEFFICIENT	EFFECTIVE AREA
ROOFS	2,288.367 m²	1.00	2,288.367 m²
EXTERNAL PATHS	673.315 m²	1.00	673.315 m²
HIGHWAY	1,328.337 m²	0.75	996.253 m²
PRIVATE ROAD	506.737 m²	0.75	380.053 m²
PARKING AREAS	904.313 m²	0.75	678.235 m²
GRASS	4,214.126 m²	0.35	1,474.944 m²

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
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3. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

KEY

- DENOTES AREA OF PROPOSED GRASS.
- DENOTES AREA OF PROPOSED HOUSES.
- DENOTES AREA OF PROPSOED PARKING.
- DENOTES AREA OF PROPOSED EXTERNAL PATHS.
- DENOTES AREA OF PROPOSED ADOPTABLE HIGHWAY.
- DENOTES AREA OF PROPOSED PRIVATE ROAD.

S1	P01			FIRST ISSUE					
SUITABILITY	REV	DATE	DESCRIPTION	Org.	Ch'd	App'd	Auth.		

DRAWING STATUS:

PROJECT TITLE:

MELIDEN ROAD, DYSERTH
PHASE 2

DRAWING TITLE:

PROPOSED DEVELOPED
RUN-OFF AREAS

DRAWING No:

PROJECT	ORIGINATOR	VOL.	LOC.	TYPE	ROLE
003920	CCE	V1	XX	40:40:01	C
50:30	0002	S1	P01		
CLASSIFICATION	No.	SUITABILITY	REVISION		

ORIGINATOR:	DATE:	SCALE:	ORIGINAL SIZE:
B.Thorne	17.04.2020	1:250	A1

CADARN CONSULTING ENGINEERS

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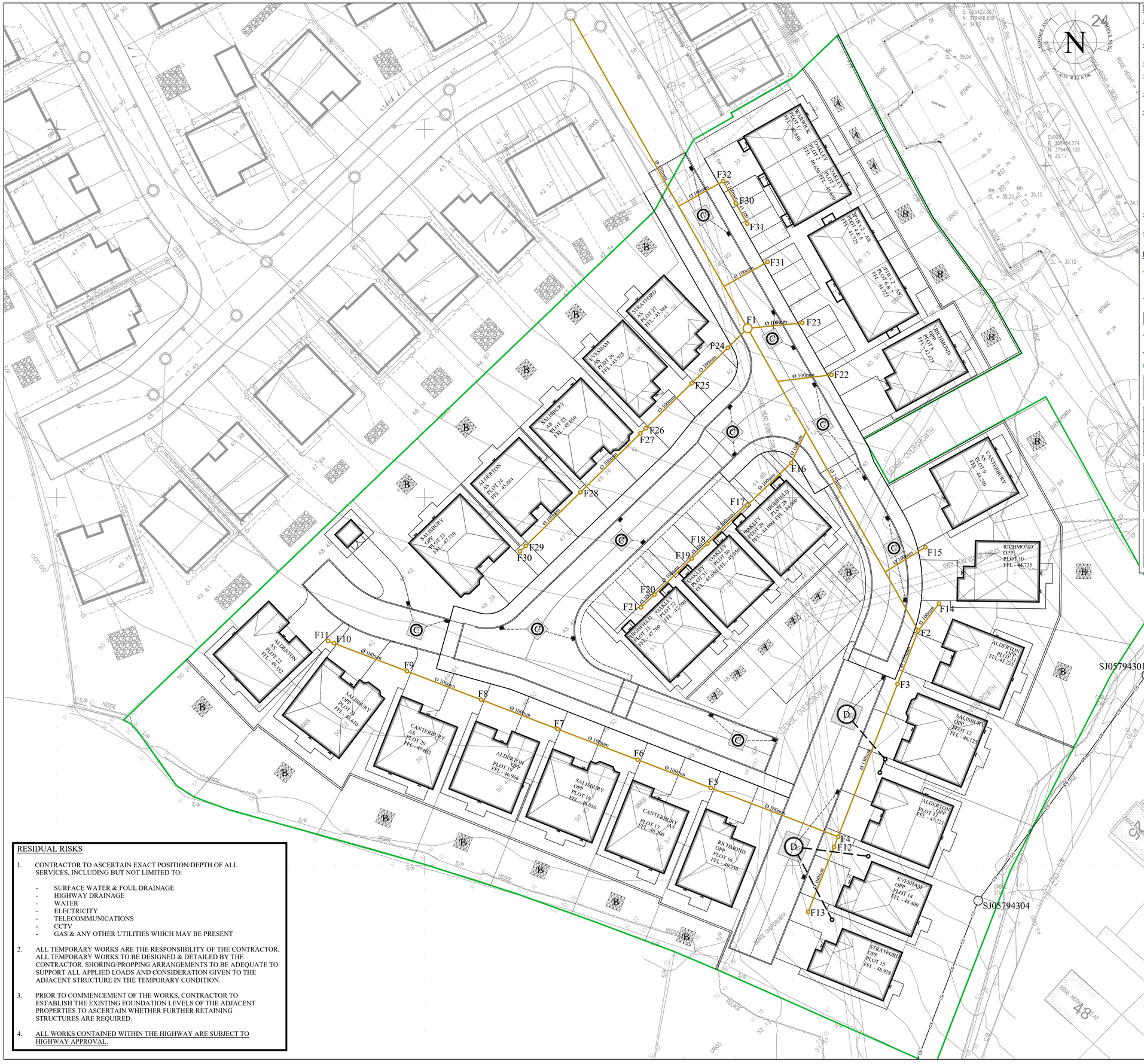
APPENDIX I

Proposed Section 104 Drainage Layout



RESIDUAL RISKS

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   - SURFACE WATER & FOUL DRAINAGE
   - HIGHWAY DRAINAGE
   - WATER
   - ELECTRICITY
   - TELECOMMUNICATIONS
   - CCTV
   - GAS & ANY OTHER UTILITIES WHICH MAY BE PRESENT
2. ALL TEMPORARY WORKS ARE THE RESPONSIBILITY OF THE CONTRACTOR. ALL TEMPORARY WORKS TO BE DESIGNED & DETAILED BY THE CONTRACTOR. SHORING/PROPPING ARRANGEMENTS TO BE ADEQUATE TO SUPPORT ALL APPLIED LOADS AND CONSIDERATION GIVEN TO THE ADJACENT STRUCTURE IN THE TEMPORARY CONDITION.
3. PRIOR TO COMMENCEMENT OF THE WORKS, CONTRACTOR TO ESTABLISH THE EXISTING FOUNDATION LEVELS OF THE ADJACENT PROPERTIES TO ASCERTAIN WHETHER FURTHER RETAINING STRUCTURES ARE REQUIRED.
4. ALL WORKS CONTAINED WITHIN THE HIGHWAY ARE SUBJECT TO HIGHWAY APPROVAL.

NOTES

23. BACKFILL MUST NOT BE LACED ON CONCRETE BEDDING OR SURROUND UNTIL THE CONCRETE COMPRESSIVE STRENGTH HAS REACHED 15N/mm².
24. BRICKS OR BLOCKS MUST NOT BE PLACED IN THE BEDDING MORTAR FOR SETTING THE PIPES TO LEVEL .
25. ALL ROCKER PIPE LENGHTS TO BE 600mm.
26. PROVIDE ROCKER PIPES AT TRANSITION FROM CONCRETE SURROUND TO GRANULAR SURROUND.
27. MAX DISTANCE FROM FACE OF CONCRETE SURROUND TO FIRST FLEXIBLE JOINT TO BE 150mm.
28. MANHOLE COVERS AND FRAMES
    MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF THE BS EN 124,M BS 7903 AND HIGHWAYS AGENCY GUIDANCE DOCUMENT HA 104/09. THEY SHALL BE OF NON ROCKING DESIGN WHICH DOES NOT RELAY TO THE CUSHION INSERTS.

    MANHOLE COVER ON FOUL ONLY SEWERS SHALL BE OF LOW LEAKAGE TYPES IN ORDER TOP PREVENT EXCESSIVE SURFACE WATER INGRESS

    AS A MINIMUM, CLASS D400 SHALL BE USED IN CARRIAGEWAYS OR ROADS (INCLUDING PEDESTRIAN STREETS), HARD SHOULDERS AND PARKING AREAS USED BY ALL TYPES OF VEHICLES.
29. CONSTRUCTION OF SEWER TO BE IN ACCORDANCE WITH WELSH MINISTERS STANDARDS AND SFA 7TH EDITION.
30. LOCATION OF PRIVATE RAIN WATER PIPES TO BE CONFIRED BY ARCHITECT

KEY

- F1 — DENOTES PROPOSED FOUL CHAMBER AND PIPE RUNS TO BE ADOPTED BY DCWW UNDER SECTION 104 OF THE WATERS INDUSTRIES ACT 1991.
- F1.1 — DENOTES PROPOSED FOUL CHAMBER AND PIPEWORK TO REMAIN PRIVATE AND UNDER THE OWNERSHIP OF THE INDERVIDUAL HOME OWNERS.
- G — DENOTES PROPOSED HIGHWAY GULLY AND PIPE RUN.
- SH00 — DENOTES EXISTING COMBINED SEWER UNDER THE RESPONSIBILITY OF DCWW.
- SH00 — DENOTES EXISTING FOUL SEWER UNDER THE RESPONSIBILITY OF DCWW.
- DENOTES PROPOSED SITE BOUNDARY.

TYPE A - 0m² - 90m²
WAVIN AQUACELL GEOCELLULAR STORAGE
STORAGE PROVISION: 1.0m x 2.0m x 1.2m Deep x 95%
STORAGE PROVIDED: 2.280m³

TYPE B - 90m² - 150m²
WAVIN AQUACELL GEOCELLULAR STORAGE
STORAGE PROVISION: 2.0m x 2.0m x 1.2m Deep x 95%
STORAGE PROVIDED: 4.560m³

TYPE C - 0m² - 150m²
Ø 1500mm CONCRETE TYPE 2 PERFORATED CHAMBER WITH 2.010m x 2.010m GRANUAL SURROUND, ACCOMIDATING ADOPTED HIGHWAY AND PRIVATE ROADS.
STORAGE PROVIDED: 3.447m³

TYPE D - 400m²
Ø 2400mm CONCRETE TYPE 2 PERFORATED CHAMBER WITH 3.350m x 3.350m GRANULAL SURROUND ACCOMIDATING BOTH AN AREA OF PRIVATE ROADS AND TWO PROERTIES.
STORAGE PROVIDED: 10.364m³

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.
4. PLEASE REFER TO ARCHITECTS DRAWINGS FOR FINAL BUILDING LOCATION.
5. ALL DRAINAGE COMPONENTS ARE TO COMPLY WITH CURRENT BRITISH STANDARDS AND BUILDING REGULATIONS REQUIREMENTS.
6. ALL WORKS TO IN ACCORDANCE WITH ROADS FOR ADOPTION IN DENBIGHSHIRE.
7. ALL WORKS AND MATERIALS TO BE IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS (SHW SERIES 500).
8. DRAIN PIPE THROUGH WALLS OR BENEATH FOUNDATIONS (SPREAD ONLY) TO HAVE R.C BRIDGE LINTELS OVER AND PIPE SURROUNDED IN FLEXIBLE MATERIAL (50mm).
9. FINAL LOCATIONS AND DETAILS OF SOIL VENT PIPES, STUB STACKS, RAINWATER DOWN PIPES, GULLIES ETC. TO BE CONFIRMED BY REFERENCE TO ARCHITECT' DRAWINGS.
10. ALL THRESHOLD DRAIN DETAILS TO BE TO ARCHITECT' DETAILS.
11. ALL PIPES INTO CHAMBERS TO SOFFIT TO SOFFIT U.N.O.
12. AT ALL OUTFALL POINTS TO AN EXISTING NETWORK, THE POSITION AND INVERT LEVEL OF EXISTING DRAINS MUST BE CONFIRMED WELL IN ADVANCE OF THE PROGRAMMED DATE FOR INSTALLING ANY OF THE UPSTREAM DRAINAGE, OR ORDERING OF ANY MATERIALS IN ORDER TO ALLOW TIME FOR ANY NECESSARY REVISIONS TO THE HYDRAULIC DESIGN.
13. ALL GRAVITY UPVC PIPEWORK TO BE TO BS 4660 OR BS 5481 WHERE RELEVANT UNLESS NOTED OTHERWISE.
14. ALL NON ADOPTABLE DOMESTIC FOUL AND SURFACE WATER PIPE RUNS SHALL CONSIST OF 100MM DIA. PIPES LAID AT NO FLATTER THAN 1 IN 80 FALLS U.N.O.
    A SEWER OR LATERAL DRAIN WITH A NOMINAL INTERNAL DIAMETER OF 100mm, OR A LATERAL DRAIN SERVING TEN OR LESS PROPERTIES IS LAID TO A GRADIENT NOT FLATTER THAN 1:80. WHERE THERE IS AT LEAST ONE WC CONNECTED AND 1:40 IF THERE IS NO WC CONNECTED.
15. ALL CONNECTIONS FROM HIGHWAY GULLIES TO BE 150mm DIA. LAID AT FALLS OF BETWEEN 1 IN 20 AND 1 IN 100 WITH TYPE S BED AND SURROUND TO ALL CONNECTIONS WITH MIN. 1.20m COVER, TYPE Z BED AND SURROUND TO ALL OTHER CONNECTIONS.
16. THERMOPLASTIC PIPES & FITTINGS:
    THERMOPLASTIC PIPES, JOINTS & FITTINGS FOR GRAVITY SEWERS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1401-1, BS EN 1852 & BS EN 12666-1.
17. THERMOPLASTIC STRUCTURED WALL PIPE:
    THERMOPLASTIC STRUCTURED WALL SEWER PIPE SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 13476-1 & WIS 4-35-01 AND BS EN 13476-2 OR BS EN 13476-3. PIPES SHALL BE BSI KITEMARKED OR HAVE EQUIVALENT THIRD PART CERTIFICATION. PIPES LESS THAN OR EQUAL TO 500mm IN DIAMETER SHALL HAVE NOMINAL SHORT-TERM RING STIFFNESS NOT LESS THAN 8KN/m² (SN8) OR BE SUBJECT TO A QUALITY SYSTEM FOR STORAGE & EMBEDMENT.

    Nom. SHORT TERM RING STIFFNESS OF 2KN/m² (SN2) IS ACCEPTABLE FOR PIPES GREATER THAN Ø500mm, SUBJECT TO SUPPORTING STRUCTURAL DESIGN LOAD CALCULATIONS BEING PROVIDED.

    TRANSPORTATION, HANDLING, STORAGE AND LAYING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

    WHERE A FITTING IS INSTALLED ON A SEWER LENGTH, IT SHALL HAVE THE SAME INTERNAL BORE AS THE SEWER. Max. LENGTH OF PIPE FOR LAYING IS 3.0m OR Ø x 10, WHICHEVER IS THE GREATER, UNLESS WELDED JOINTS ARE USED.
18. CONNECTION TO THE PUBLIC SEWER
    A SECTION 106 APPLICATION TO CONNECT MUST BE MADE TO DCWW. THE DEVELOPER SHALL GIVE 21 DAYS NOTICE PRIOR TO CONNECTION, THE WORKS MAY ONLY BE UNDERTAKEN BY A DCWW HEALTH AND SAFETY APPROVED CONTRACTOR.
19. OPTIMUM TRENCH WIDTH
    OPTIMUM TRENCH WIDTH = PIPE + 300mm. CONTRACTOR TO ENSURE TRENCH WALLS ARE SUITABLY PROPPED.
20. BACKFILLING TO PIPE TRENCHES BENEATH ROADS, CAR PARKING AND STRUCTURES TO BE M.O.T. TYPE 1 GRANULAR MATERIAL UP TO FORMATION LEVEL FROM THE TOP OF THE SPECIFIED PIPE SURROUND (WELL COMPACTED IN 150mm LAYERS).
21. BACKFILLING TO PIPER TRENCHES BENEATH LANDSCAPED AREAS TO BE SELECTED EXCAVATE MATERIAL FREE FROM LARGE STONES GREATER THAN 0mm, LUMPS OF CLAY OVER 100mm, ANY TIMBER, FROZEN MATERIAL OR VEGETATION MATTER UP TO FROMATION / GROUND LEVEL FROM THE TOP OF THE SPECIFIED PIPE SURROUND (WELL COMPACTED IN 150mm LAYERS).
22. GRANULAR MATERIAL NOMINAL SIZE 10mm SINGLE SIZED OR 14mm TO 5mm GRADED.

SUITABILITY	REV	DATE	DESCRIPTION	Orig.	Chk'd	App'd	Auth.
S1	P01		FIRST ISSUE				

DRAWING STATUS:

PROJECT TITLE:

MELIDEN ROAD, DYSERTH
PHASE 2

DRAWING TITLE:

PROPOSED HIGHWAY SOAKAWAY CATCHMENT AREAS

DRAWING No:

PROJECT	ORIGINATOR	VOL.	LOC.	TYPE	ROLE
003920	CCE	V1	XX	40:40:01	C
CLASSIFICATION: 50:30		No.: 0006	SUITABILITY: S1	REVISION: P01	

ORIGINATOR:	DATE:	SCALE:	ORIGINAL SIZE:
B.Thorne	17.04.2020	1:250	A1

CADARN CONSULTING ENGINEERS

Address: CADARN Consulting Engineers, Yr Hen Ysgol, Llanddeusant, Holyhead, Anglesey, LL65 4AD.
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APPENDIX J

Proposed Soakaway Calculations

CADARN CONSULTING ENGINEERS

Soakaway calculations to BRE Digest 365

Project:	Meliden Road, Dyserth, Phase 2		
Job Reference:	03920	**Done By:**	Byron Thorne
Location:	**TYPE A**	**Date**	17.04.2020

1 In 100 Year + 30% For Climate Change

M5-60min 20.0
M5-60min + 30% **26**

Runoff Coefficients

Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M100-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	26.0	0.3	0.34	8.8	1.88	16.6	199.66	90.00	1.51	0.27	1.241
10.0	26.0	0.3	0.50	12.9	1.96	25.2	151.04	90.00	2.30	0.55	1.753
15.0	26.0	0.3	0.59	15.3	1.99	30.6	122.27	90.00	2.80	0.82	1.982
30.0	26.0	0.3	0.78	20.3	2.03	41.1	82.29	90.00	3.81	1.64	**2.165**
60.0	26.0	0.3	1.00	26.0	2.00	52.1	52.05	90.00	4.89	3.28	1.609
120.0	26.0	0.3	1.24	32.2	1.95	62.9	31.47	90.00	6.08	6.57	-0.488
240.0	26.0	0.3	1.55	40.3	1.89	76.1	19.02	90.00	7.68	13.14	-5.458
360.0	26.0	0.3	1.80	46.8	1.84	85.9	14.32	90.00	8.98	19.71	-10.725
600.0	26.0	0.3	2.13	55.4	1.77	98.2	9.82	90.00	10.93	32.85	-21.921
1440.0	26.0	0.3	2.79	72.5	1.66	120.2	5.01	90.00	15.83	78.84	-63.008

Percolation factor	**(m/s)**	1.63E-04

Geocellular Soakaway		
No of Trenches	**(nr)**	1.000
Trench Width	**(m)**	2.000
Trench Length	**(m)**	1.000
Effective Depth	**(m)**	1.200
Eff Area of soakaway	**(sq m)**	5.600
Storage provided	**(cu m)**	**2.280**
Total Storage provided	**(cu m)**	**2.280**

CADARN CONSULTING ENGINEERS

Soakaway calculations to BRE Digest 365

Project:	Meliden Road, Dyserth, Phase 2		
Job Reference:	03920	**Done By:**	Byron Thorne
Location:	**TYPE B**	**Date**	17.04.2020

1 In 100 Year + 30% For Climate Change

M5-60min 20.0
M5-60min + 30% **26**

Runoff Coefficients

Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M100-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	26.0	0.3	0.34	8.8	1.88	16.6	199.66	150.00	2.51	0.43	2.083
10.0	26.0	0.3	0.50	12.9	1.96	25.2	151.04	150.00	3.81	0.86	2.950
15.0	26.0	0.3	0.59	15.3	1.99	30.6	122.27	150.00	4.64	1.29	3.347
30.0	26.0	0.3	0.78	20.3	2.03	41.1	82.29	150.00	6.28	2.58	**3.695**
60.0	26.0	0.3	1.00	26.0	2.00	52.1	52.05	150.00	8.02	5.16	2.855
120.0	26.0	0.3	1.24	32.2	1.95	62.9	31.47	150.00	9.86	10.32	-0.466
240.0	26.0	0.3	1.55	40.3	1.89	76.1	19.02	150.00	12.25	20.65	-8.402
360.0	26.0	0.3	1.80	46.8	1.84	85.9	14.32	150.00	14.14	30.97	-16.832
600.0	26.0	0.3	2.13	55.4	1.77	98.2	9.82	150.00	16.82	51.62	-34.799
1440.0	26.0	0.3	2.79	72.5	1.66	120.2	5.01	150.00	23.04	123.88	-100.846

Percolation factor	**(m/s)**	1.63E-04

Geocellular Soakaway		
No of Trenches	**(nr)**	1.000
Trench Width	**(m)**	2.000
Trench Length	**(m)**	2.000
Effective Depth	**(m)**	1.200
Eff Area of soakaway	**(sq m)**	8.800
Storage provided	**(cu m)**	**4.560**
Total Storage provided	**(cu m)**	**4.560**

CADARN CONSULTING ENGINEERS

Soakaway calculations to BRE Digest 365

Project:	Meliden Road, Dyserth, Phase 2		
Job Reference:	03920	**Done By:**	Byron Thorne
Location:	**TYPE C**	**Date**	17.04.2020

1 In 100 Year + 30% For Climate Change

M5-60min 20.0
M5-60min + 30% **26**

Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M100-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	26.0	0.3	0.34	8.8	1.88	16.6	199.66	150.00	2.51	0.48	2.031
10.0	26.0	0.3	0.50	12.9	1.96	25.2	151.04	150.00	3.81	0.96	2.846
15.0	26.0	0.3	0.59	15.3	1.99	30.6	122.27	150.00	4.64	1.45	3.190
30.0	26.0	0.3	0.78	20.3	2.03	41.1	82.29	150.00	6.28	2.89	**3.382**
60.0	26.0	0.3	1.00	26.0	2.00	52.1	52.05	150.00	8.02	5.79	2.228
120.0	26.0	0.3	1.24	32.2	1.95	62.9	31.47	150.00	9.86	11.58	-1.720
240.0	26.0	0.3	1.55	40.3	1.89	76.1	19.02	150.00	12.25	23.16	-10.910
360.0	26.0	0.3	1.80	46.8	1.84	85.9	14.32	150.00	14.14	34.73	-20.595
600.0	26.0	0.3	2.13	55.4	1.77	98.2	9.82	150.00	16.82	57.89	-41.070
1440.0	26.0	0.3	2.79	72.5	1.66	120.2	5.01	150.00	23.04	138.93	-115.897

Percolation factor	**(m/s)**	1.63E-04

Concrete Ring Soakaway		
No of Trenches	**(nr)**	1.000
Trench Width	**(m)**	2.010
Trench Length	**(m)**	2.010
Effective Depth	**(m)**	1.450
Eff Area of soakaway	**(sq m)**	9.869
Storage provided	**(cu m)**	**0.885**

Total Storage provided	**(cu m)**	**3.447**

Additional Storage within Chamber		
No of Chambers	**(nr)**	1.000
Ring Diameter	**(m)**	1.500
Chamber Wall Thickness	**(m)**	0.105
Depth Of Chamber	**(m)**	1.450
Storage provided	**(cu m)**	**2.563**

CADARN CONSULTING ENGINEERS

Soakaway calculations to BRE Digest 365

Project:	Meliden Road, Dyserth, Phase 2		
Job Reference:	03920	**Done By:**	Byron Thorne
Location:	**TYPE D**	**Date**	17.04.2020

1 In 100 Year + 30% For Climate Change

M5-60min 20.0
M5-60min + 30% **26**

Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M100-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	26.0	0.3	0.34	8.8	1.88	16.6	199.66	400.00	6.67	1.07	5.600
10.0	26.0	0.3	0.50	12.9	1.96	25.2	151.04	400.00	10.10	2.15	7.959
15.0	26.0	0.3	0.59	15.3	1.99	30.6	122.27	400.00	12.28	3.22	9.062
30.0	26.0	0.3	0.78	20.3	2.03	41.1	82.29	400.00	16.56	6.44	**10.127**
60.0	26.0	0.3	1.00	26.0	2.00	52.1	52.05	400.00	21.03	12.87	8.159
120.0	26.0	0.3	1.24	32.2	1.95	62.9	31.47	400.00	25.59	25.74	-0.150
240.0	26.0	0.3	1.55	40.3	1.89	76.1	19.02	400.00	31.26	51.48	-20.220
360.0	26.0	0.3	1.80	46.8	1.84	85.9	14.32	400.00	35.62	77.23	-41.610
600.0	26.0	0.3	2.13	55.4	1.77	98.2	9.82	400.00	41.37	128.71	-87.336
1440.0	26.0	0.3	2.79	72.5	1.66	120.2	5.01	400.00	53.08	308.90	-255.818

Percolation factor	**(m/s)**	1.63E-04

Concrete Ring Soakaway		
No of Trenches	**(nr)**	1.000
Trench Width	**(m)**	3.350
Trench Length	**(m)**	3.350
Effective Depth	**(m)**	1.600
Eff Area of soakaway	**(sq m)**	21.943
Storage provided	**(cu m)**	**3.125**

Total Storage provided	**(cu m)**	**10.364**

Additional Storage within Chamber		
No of Chambers	**(nr)**	1.000
Ring Diameter	**(m)**	2.400
Chamber Wall Thickness	**(m)**	0.140
Depth Of Chamber	**(m)**	1.600
Storage provided	**(cu m)**	**7.239**