



DRAINAGE REPORT

PROPOSED INDUSTRIAL DEVELOPMENT AT, CROESFOEL INDUSTRIAL ESTATE RHOSTYLLLEN, WREXHAM

FEBRUARY 2016

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1.0 General Overview

The Site is located at the end of Croesfoel Industrial Estate, Wrexham Rd, Rhostyllen, Wrexham, Clwyd, LL14 4BJ. The site is a 4,900m² greenfield site which will be used to house 5 Commercial Units with associated, carpark and access roads. The Glanyrafon Brook is located approximately 500m south of the site. The site is generally flat, however the topographical survey shows slight falls towards the southern boundary. the Northern, Eastern, and Western boundaries of the site are all battered down into the site. The site is located at National Grid Reference: SJ 30949 48628, Refer to **(Appendix A)** for the site location plan.

2.0 Porosity Tests

Porosity tests have been undertaken as part of the design brief. Reference is made to the Porosity report contained in **(Appendix F)**. The tests were conducted on the 4th December 2015, the report concludes that 1 of the 3 tests which were conducted posed suitable for the use of infiltration system such as soakaways for the disposal of surface water run off generated from the development proposal. In accordance with the SuDS hierarchy, the surface water drainage design will be undertaken using infiltration systems such as soakaways.

The trial pit which posed suitable for the use of soakaways was free draining and it a test was unable to be conducted, due to the water infiltrating too quickly. The calculations in this report have been based on an infiltration rate of $5.00 \times 10^{-4}ms$ as a rate of free draining gravels.

3.0 Design Philosophy

The disposal of surface water should be designed in strict accordance with the provision of Tan 15, the Flood and Water Management Act 2010 and best practice documents such as the recently published SUDS Manual from CIRIA.

In accordance with the SuDS Hierarchy surface water should be designed and constructed disposing of run off volumes into the ground via infiltration systems where possible. Porosity tests undertaken on site have determined the underlying strata is suitable for the use of soakaways.

3.1 Existing Arrangement

The site is currently a brownfield site, which has recently been used to stockpile materials. The existing site ground make up is a compacted granular material which in accordance with IHR124 and the Modified Rational Method provides a 60% Coe-efficient run off. Based on the Wallingford maps a soil value of 4 is given for the site.

3.2 Proposed Philosophy

Based upon the existing site information an assessment of run off is to be undertaken to quantify existing and proposed run off based upon the existing and proposed hard standing areas. An assessment of run off in accordance with IHR 124 is to be undertaken.

The tables on the following page summarises the existing and proposed effective areas with their corresponding run off coefficients as per the Wallingford procedure, IHR 124 and the Modified Rational Method.

Existing Areas

Surface	Coefficient	Effective Area
Gravel	0.6	1910.90m ²

Proposed Areas

Surface	Coefficient	Effective Area
Grassed	0.35	58.40m ²
Macadam – Access Road	0.75	1289.32m ²
Roofed	1.00	1260.00m ²

Reference should be made to the attached calculations (**Appendix D**) for run off volumes which are summarised as follows:

Reference	1 in 1 year	1 in 100 year
Existing	0.947L/s	2.429L/s
Proposed + 20%	1.552L/s	3.980L/s

Reference	Volume run off 1 in 100 year
Existing	134.39m ³
Proposed	183.49m ³

The above output is based upon the use of 20% climate change and the design storm events as shown. The volume of run off is also calculated to the 1 in 100 year storm events with a climate change factor as above included. The increase of volumetric run off equates to:

$$\text{Volume Increase 1 in 100 year} = 49.10\text{m}^3$$

3.3 Climate Change

TAN15 states that a value for climate change should be included within the attenuation system on site, however TAN15 does not provide a table of the percentage should be taken for climate change for the age of the building. PPS25 is the English equivalent of TAN15. PPS25 contains a table derived from *Defra FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts, October 2006*, which considers the effects of climate change for different design criteria. In this particular case the commercial units and parking has a design life of approximately 50 years. Based upon the table B.2 below this would equate to a climate change factor of 20% applied to peak rainfall intensity.

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%	

Climate Change Factor - 20 %

3.4 Design Criteria

The system is to be designed to the following criteria:

- Utilising infiltration systems such as soakaways for the disposal of surface water run off.
- The 1 in 100 year event and an additional 20% for climate change to be accommodated on site with the possibility of allowing above ground storage.
- No surface water from the development will leave the site up to the threshold event.

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

- Approved Document H, Building Regulations
- BRE Digest 365
- Flood And Water Management Act
- IHR 124
- Modified Rational Method
- Wallingford Procedure
- TAN15

4.0 Surface Water Design

As the proposals include the construction of 5 industrial units and associated parking, a surface water drainage layout should be design in accordance with Approved Document H of the Building Regulations 2010 will be applied in line with National Resources Wales' recommendations.

The surface water run-off, will discharge into the proposed soakaways located beneath a section of the each parking bay. Refer to the site drainage layout 01016/ EA (95) 01 (**Appendix B**) and the proposed flood routing layout, 01016/ EL (95) 01 (**Appendix C**).

The surface water drainage system which has being designed will accommodate the surface water run-off for the 1 in 100 year event + 20% for climate change for all proposed hardstanding areas generated by the proposed developed area, including the access road, parking bays, roofs and grassed areas. Attenuation will be provided within the Soakaway attenuation, large diameter chamber and additional offline attenuation crates at a shallower depth. Refer to (**Appendix D**) run off calculation.

Enclosed (**Appendix E**) are the design calculations for the infiltration systems. In accordance with the National Resources Wales' guidelines, the attenuation calculations have been completed assuming a threshold event of 1 in 100 year + 20% for climate change.

The attached porosity (**Appendix F**) report states that if a use of a soakaway is to be utilised as a method of disposing of surface water it must be installed at a depth of 3600mm (at the level of free draining gravels)

A summary of the calculations attached in (**Appendix E**) is found on the following page:

System 1

Effective Area: $= 2483.33\text{m}^2$

Storage Requirement 1 in 100yr event + 20% (c.c) $= 57.97\text{m}^3$

Proposed infiltration method – Attenuation Crate Soakaway

Effective area of soakaway taken as base only.

Soakaway Provision $= 5.0 \times 5.0 \times 2.0 \times 0.95\%$

Storage provided $= 47.500\text{m}^3$

Additional storage is provided within chamber S1. the chamber has the following provision ;

$\varnothing 2100\text{mm} \times 3.6\text{m Deep} = 12.469\text{m}^3$

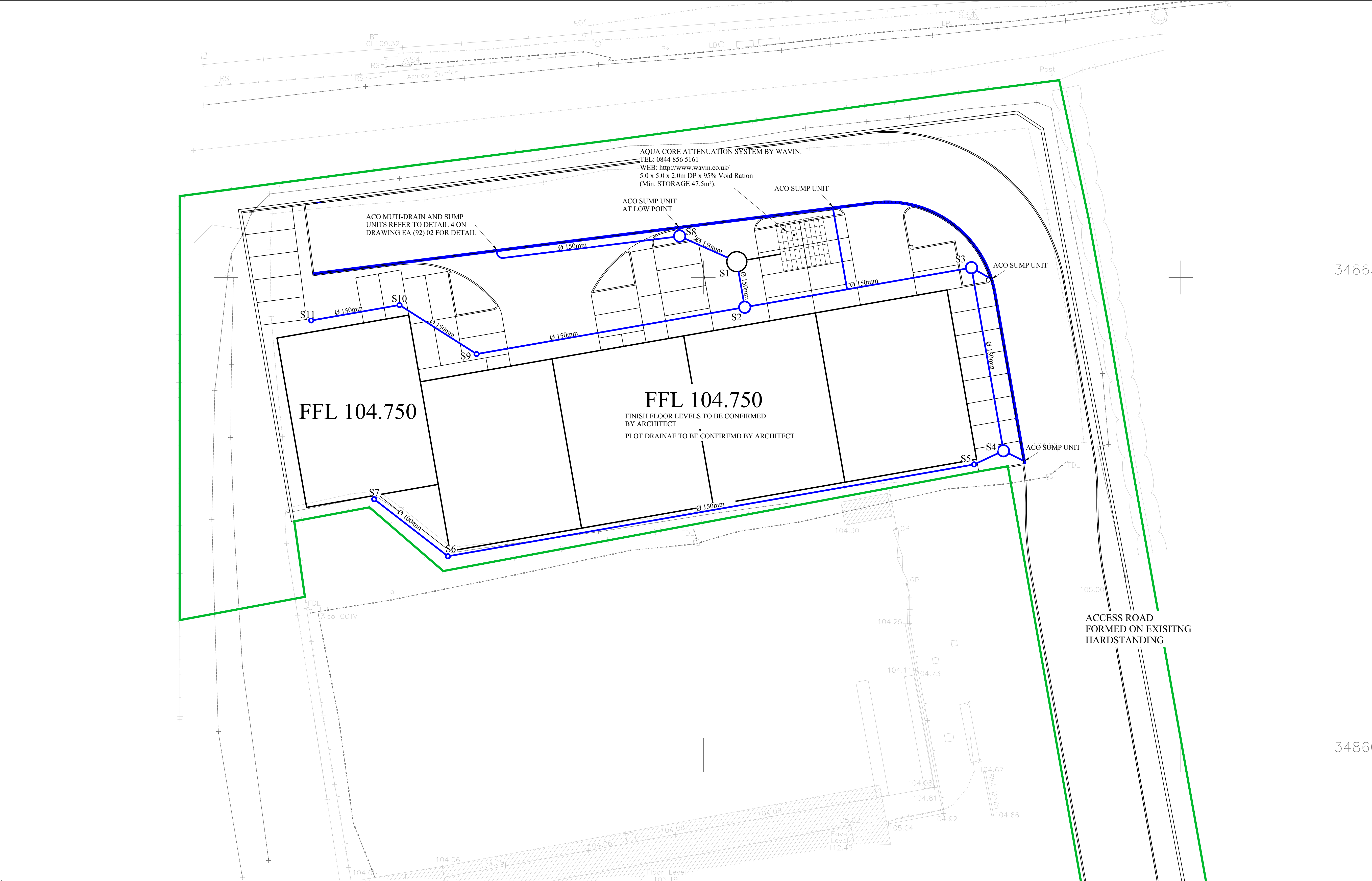
4.1 Extreme Event

The proposed development finish floor levels are to be set 150mm above all ground level to prevent surface water run-off generated up to the extreme event from flowing into the buildings.

APPENDICES

APPENDIX A – SITE LOCATION PLAN

APPENDIX B – PROPOSED DRAINAGE LAYOUT



CHAMBER SCHEDULE								
CHAMBER REF	COVER LEVEL	INVERT LEVEL	DROP LEVEL	CHAMBER TYPE	CHAMBER SIZE	COVER TYPE	CHAMBER DEPTH	DOWN STREAM PIPE Ø
SURFACE WATER								
SW1	104.267	100.667	102.631	TYPE 2	Ø 2100mm	D400	3.600	Ø 150mm
SW2	104.508	102.692		TYPE 2	Ø 1200mm	D400	1.816	Ø 150mm
SW3	104.625	102.993		TYPE 2	Ø 1200mm	B125	1.632	Ø 150mm
SW4	104.485	103.236		TYPE 2	Ø 1200mm	C250	1.249	Ø 150mm
SW5	104.600	103.279		TYPE 4	Ø 460mm UPVC	B125	1.321	Ø 150mm
SW6	104.600	103.978		TYPE 4	Ø 460mm UPVC	B125	0.622	Ø 150mm
SW7	104.600	100.150		TYPE 4	Ø 460mm UPVC	B125	4.450	Ø 100mm
SW8	104.160	102.810		TYPE 2	Ø 1200mm	D400	1.350	Ø 150mm
SW9	104.561	103.283		TYPE 4	Ø 460mm UPVC	C250	1.278	Ø 150mm
SW10	104.484	103.403		TYPE 4	Ø 460mm UPVC	C250	1.081	Ø 150mm
SW11	104.570	103.520		TYPE 4	Ø 460mm UPVC	C250	1.050	Ø 150mm

NOTES

- ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.
- PLEASE REFER TO ARCHITECTS DRAWINGS FOR FINAL BUILDING LOCATION.
- ALL DRAINAGE COMPONENTS ARE TO COMPLY WITH CURRENT BRITISH STANDARDS AND BUILDING REGULATIONS REQUIREMENTS.
- ALL WORKS TO IN ACCORDANCE WITH ROADS FOR ADOPTION IN GWYNEDD.
- ALL WORKS AND MATERIALS TO BE IN ACCORDANCE WITH THE SPECIFICATION FOR HIGHWAY WORKS (SIW SERIES 500).
- DRAIN PIPE THROUGH WALLS OR BENEATH FOUNDATIONS (SPREAD ONLY) TO HAVE R.C BRIDGE LINTELS OVER AND PIPE SURROUNDED IN FLEXIBLE MATERIAL (50mm).
- FINAL LOCATIONS AND DETAILS OF SOIL VENT PIPES, STUB STACKS, RAINWATER DOWN PIPES, GULLIES ETC. TO BE CONFIRMED BY REFERENCE TO ARCHITECT' DRAWINGS.
- ALL THRESHOLD DRAIN DETAILS TO BE TO ARCHITECT' DETAILS.
- ALL PIPES INTO CHAMBERS TO SOFFIT TO SOFFIT U.N.O.
- 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.
- ALL GRAVITY UPVC PIPEWORK TO BE TO BS 4660 OR BS 5481 WHERE RELEVANT UNLESS NOTED OTHERWISE.
- 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.
- 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.
- TERMOPLASTIC PIPES & FITTINGS:

TERMOPLASTIC PIPES, JOINTS & FITTINGS FOR GRAVITY SEWERS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN 1401-1, BS EN 1852 & BS EN 12666-1.
- TERMOPLASTIC STRUCTURED WALL PIPE:

TERMOPLASTIC 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 BS1 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.
- 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.
- OPTIMUM TRENCH WIDTH

OPTIMUM TRENCH WIDTH = PIPE + 300mm. CONTRACTOR TO ENSURE TRENCH WALLS ARE SUITABLY PROPPED.

KEY

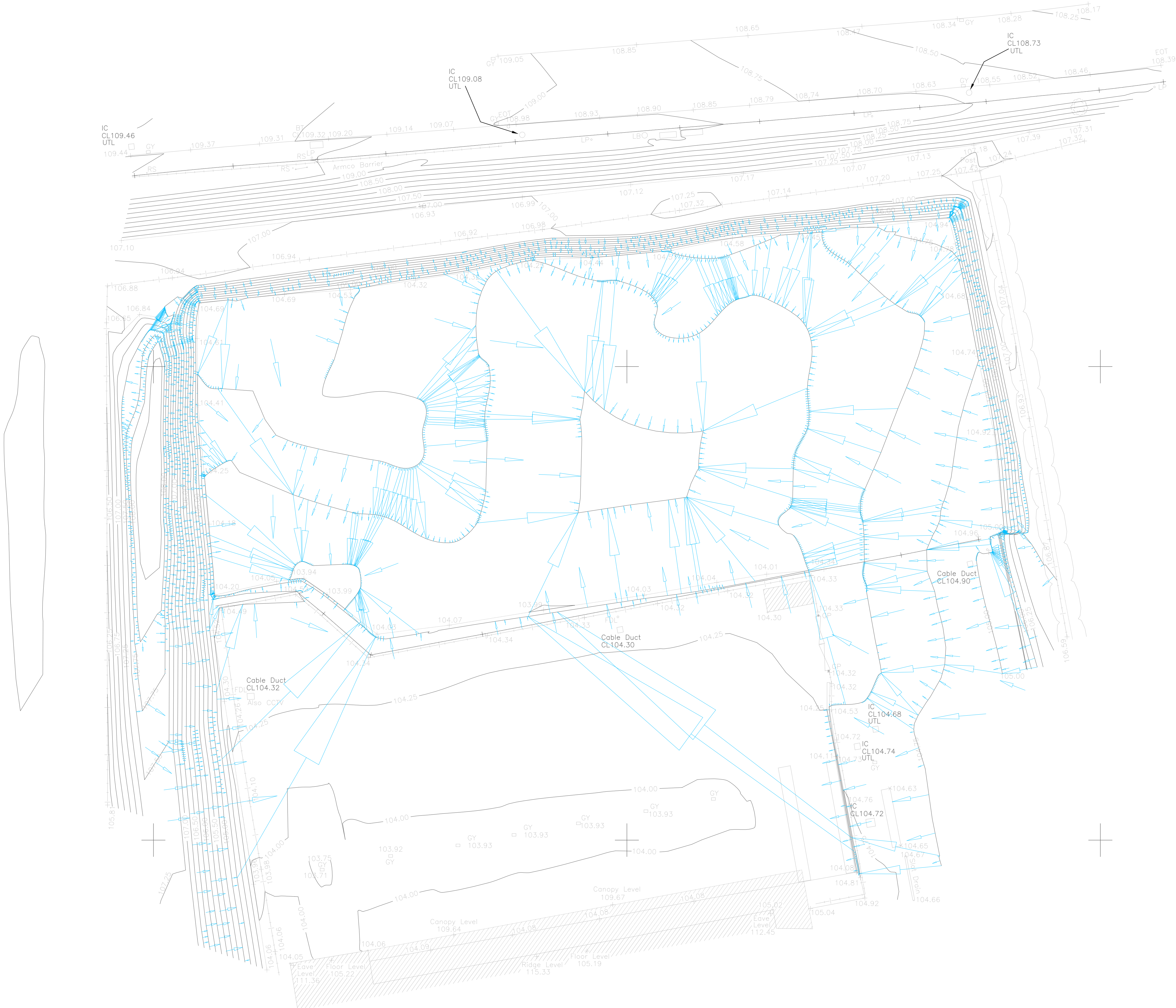
DENOTES PROPOSED SURFACE WATER CHAMBER & PIPE RUN.

REV	DATE	DESCRIPTION	BY	CHK	APP
REVISIONS					
Project: PROPOSED INDUSTRIAL UNITS, CROESFOEL INDUSTRIAL ESTATE, RHOSTYLLLEN, WREXHAM					
Title: PROPOSED SURFACE WATER DRAINAGE LAYOUT					
Job Ref:	Drawing Ref:		Revision:		
01016	EL (95) 01		*		
Drawn by:	Date:	Checked by:	Scale:	Paper Size:	
B.Thorne	02/02/16	I. R.	1/200	A1	

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APPENDIX C – FLOOD ROUTING



- NOTES**
1. ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
 2. ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS
 3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEERS AND ARCHITECTS DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

KEY

 DENOTES EXISTING FLOOD ROUTING

REV	DATE	DESCRIPTION	BY	CHK	APP
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REVISIONS

Project: **PROPOSED INDUSTRIAL UNITS, CROESFOEL INDUSTRIAL ESTATE, RHOSYLLLEN, WREXHAM**

Title: **EXISTING SURFACE WATER FLOOD ROUTING**

Job Ref:	Drawing Ref:	Revision:
01016	EL (9-) 02	*
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APPENDIX D – COEFFICIENT RUN OFF CALCULATIONS

The following design calculations summarise the peak Greenfield Run-off rates for the following various storm events as summarised below. The design calculations have been compiled in strict compliance with IHR 124 - flood estimation for small catchments.

Storm Events:

1 in 1 Year return period

1 in 100 Year return period

Due to the location of the proposal being classed as 'RURAL' the peak run-off is calculated using the following :-

$$Q_{BAR} = 0.00108 \times AREA^{(0.89)} \times SAAR^{(1.17)} \times SOIL^{(2.17)}$$

The site specific data has been collated using the FEH and is summarised as follows :

Site Area -	50	SAAR -	823	SOIL	4
Ms-60 -	17	r -	0.3	SPR	0.47

Pre Development:

$$Q_{BAR (RURAL)} = (0.00108 \times (50^{0.89}) \times (823^{1.17}) \times (0.3^{2.17}))$$

$$= 291.73 \text{ L/S/50Ha}$$

$$= 5.83 \text{ L/S/Ha}$$

The pre development site Run-off coefficients are as follows :-

Greenfield = 0.35 = 35% roadways and parking = 0.75 = 75% Hardstanding = 1.0 = 100%

The pre development site area measures as follows:-

Gravel =	3,183	0.6	1909.9 m ²
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Total Site measures :	1,910	m ² or	0.191	Ha
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Post Development:

The post development site run-off coefficients are as follows :-

Greenfield - 0.35 = 35%
Roofs - 1.0 = 100%
Footpaths - 0.75 = 75%
Housepaths - 1.0 = 100%
Roads - 0.75 = 75%

The proposal site areas measures as follows :

	Area	Coefficient	
Roofs	1260.000	1.00	1260.000
Acess Roads =	1719.089	0.75	1289.316
Greenfeild =	166.868	0.35	58.404

Total Site Area =	2607.720 m ² or	0.261 Ha
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Run-off

Using growth charts the actual predicted run-off can be calculated for both storm events Pre and Post development.

In accordance with PPS25 a climate change factor should be included :

$$Q_{BAR} (RURAL) = 0.261 \times 1.20 = 0.3132 \text{ (20\% Climate change)}$$

Pre Development

1 in 1 Year =	0.85x(5.83 x 0.191) =	0.947	L/S
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1 in 100 Year =	2.18x(5.83 x 0.191) =	2.429	L/S
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Post Development

1 in 1 Year =	0.85x(5.83 x 0.3132) =	1.552	L/S
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1 in 100 Year =	2.18x(5.83 x 0.3132) =	3.980	L/S
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The resulted increase in run-off will need to be mitigated.

Run-off Volume

The increase in run-off demonstrated through calculation will lead to an inevitable increase in the volumetric run-off. The volumetric run-off, both pre and post development are calculated using the modified rational method. Reference is made to the attached calculations summarised below:

Pre development volume run-off =	134.39 m ³
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Post development volume run-off =	183.49 m ³
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Note-: The above volumetric run-off's are calculated for the 6 hour 1 in 100 year event.

The increase in Volumetric run-off is calculated as:- 49.1 m³

The volumetric increase must be contained within site. Therefore the proposed soakaways must be sized such to accommodate the calculated additional volume.

APPENDIX E – SOAKAWAY CALCULATIONS

Soakaway calculations to BRE Digest 365

Calculation Sheet 01
Project Croesfoel Industrial Estate, Wrexham
Job Ref 01016
Calculation Sheet Proposed 1 in 10 Soakaway

20% allowance for climate change											
M5-60min				17.0							
M5-60min				20.4							
Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M10-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	20.4	0.3	0.34	6.9	1.20	8.3	100.01	2483.33	20.71	3.75	16.96
10.0	20.4	0.3	0.50	10.1	1.22	12.3	73.94	2483.33	30.64	7.50	23.14
15.0	20.4	0.3	0.59	12.0	1.23	14.8	59.03	2483.33	36.70	11.25	25.45
30.0	20.4	0.3	0.78	15.9	1.24	19.7	39.46	2483.33	49.10	22.50	26.60
60.0	20.4	0.3	1.00	20.4	1.24	25.3	25.30	2483.33	63.03	45.00	18.03
120.0	20.4	0.3	1.24	25.3	1.23	31.1	15.56	2483.33	77.68	90.00	-12.32
240.0	20.4	0.3	1.55	31.6	1.22	38.6	9.64	2483.33	96.63	180.00	-83.37
360.0	20.4	0.3	1.80	36.7	1.21	44.4	7.41	2483.33	111.59	270.00	-158.41
600.0	20.4	0.3	2.13	43.5	1.19	51.7	5.17	2483.33	130.50	450.00	-319.50
1440.0	20.4	0.3	2.79	56.9	1.17	66.6	2.77	2483.33	170.38	1080.00	-909.62
2880.0	20.4	0.3	3.50	71.4	1.15	82.1	1.71	2483.33	213.93	2160.00	-1946.07

Percolation factor	(m/s)	5.00E-04
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Stormbloc: Outflow and storage based on:	
No of Trenches	(nr)
Soakaway Length	(m)
Soakaway Width	(m)
Effective Depth	(m)
Effective Area of Soakaway Taken As Base Only	
Effective Area of soakaway	(sq m)
Storage	(cu m)
Total Storage provided	(cu m)

Soakaway calculations to BRE Digest 365

Calculation Sheet

02

Project

Croesfoel Industrial Estate, Wrexham

Job Ref

01016

Calculation Sheet

Proposed 1 in 30 Soakaway

20% allowance for climate change
M5-60min 17.0
M5-60min 20.4

Duration (min)	M5-60min (mm)	r	Z1	M5-D (mm)	Z2	M30-D (mm)	I (mm/hr)	Area (sq m)	Inflow (cu m)	Outflow (cu m)	Storage (cu m)
5.0	20.4	0.3	0.34	6.9	1.45	10.1	120.79	2483.33	25.01	3.75	21.26
10.0	20.4	0.3	0.50	10.1	1.49	15.1	90.32	2483.33	37.42	7.50	29.92
15.0	20.4	0.3	0.59	12.0	1.50	18.1	72.45	2483.33	45.03	11.25	33.78
30.0	20.4	0.3	0.78	15.9	1.53	24.3	48.68	2483.33	60.55	22.50	38.05
60.0	20.4	0.3	1.00	20.4	1.54	31.5	31.47	2483.33	78.35	45.00	33.35
120.0	20.4	0.3	1.24	25.3	1.53	38.8	19.38	2483.33	96.66	90.00	6.66
240.0	20.4	0.3	1.55	31.6	1.50	47.6	11.89	2483.33	118.96	180.00	-61.04
360.0	20.4	0.3	1.80	36.7	1.48	54.4	9.07	2483.33	136.39	270.00	-133.61
600.0	20.4	0.3	2.13	43.5	1.45	63.0	6.30	2483.33	158.61	450.00	-291.39
1440.0	20.4	0.3	2.79	56.9	1.40	79.6	3.32	2483.33	202.72	1080.00	-877.28
2880.0	20.4	0.3	3.50	71.4	1.35	96.7	2.01	2483.33	250.17	2160.00	-1909.83

Percolation factor	(m/s)	5.00E-04
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Stormbloc: Outflow and storage based on:

No of Trenches	(nr)	1.000
Soakaway Length	(m)	5.000
Soakaway Width	(m)	5.000
Effective Depth	(m)	1.200
<u>Effective Area of Soakaway Taken As Base Only</u>		
Effective Area of soakaway	(sq m)	25.000
Storage	(cu m)	28.500
Total Storage provided	(cu m)	28.500

20% allowance for climate change											
M5-60min				17.0							
M5-60min				20.4							
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	20.4	0.3	0.34	6.9	1.84	12.7	152.85	2483.33	31.65	3.75	27.90
10.0	20.4	0.3	0.50	10.1	1.91	19.3	115.82	2483.33	47.97	7.50	40.47
15.0	20.4	0.3	0.59	12.0	1.94	23.4	93.52	2483.33	58.11	11.25	46.86
30.0	20.4	0.3	0.78	15.9	2.00	31.8	63.56	2483.33	79.03	22.50	56.53
60.0	20.4	0.3	1.00	20.4	2.03	41.4	41.38	2483.33	102.97	45.00	57.97
120.0	20.4	0.3	1.24	25.3	2.01	50.8	25.39	2483.33	126.53	90.00	36.53
240.0	20.4	0.3	1.55	31.6	1.96	61.9	15.47	2483.33	154.51	180.00	-25.49
360.0	20.4	0.3	1.80	36.7	1.92	70.4	11.73	2483.33	175.99	270.00	-94.01
600.0	20.4	0.3	2.13	43.5	1.86	80.9	8.09	2483.33	203.05	450.00	-246.95
1440.0	20.4	0.3	2.79	56.9	1.76	100.3	4.18	2483.33	254.19	1080.00	-825.81
2880.0	20.4	0.3	3.50	71.4	1.66	118.8	2.48	2483.33	305.15	2160.00	-1854.85

Percolation factor	(m/s)	5.00E-04
--------------------	-------	----------

Stormbloc: Outflow and storage based on:	
No of Trenches	(nr)
Soakaway Length	(m)
Soakaway Width	(m)
Effective Depth	(m)
Effective Area of Soakaway Taken As Base Only	
Effective Area of soakaway	(sq m)
Storage	(cu m)
Total Storage provided	(cu m)

APPENDIX F – POROSITY REPORT



POROSITY REPORT

PROPOSED CARPARK, AT RHOSTYLLLEN, WREXHAM

INFILTRATION TEST

DECEMBER 2015

Prepared for:

Mr Gino Paletta,
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Chester Road,
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Prepared by:

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E mail Byron@cadarnconsulting.co.uk

Prepared by:

Signed: 

Date: 08/12/2015

Checked by:

Signed: 

Date: 08/12/2015

Appraised by:

Signed: 

Date: 08/12/2015

CONTENTS

- 1.0 General Overview**
- 2.0 Site Conditions**
- 3.0 Soil Infiltration Results**
- 4.0 Conclusions**

Appendices

- A Site Location Plan**
- B Trial Pit Location Plan**
- C Trial Pit Log**

1.0 General Overview

The Site is located at the end of Croesfoel Industrial Estate, Wrexham Rd, Rhostyllen, Wrexham, Clwyd, LL14 4BJ. The site is a 4,900m² greenfield site which will be used to house 5 Commercial Units with associated, carpark and access roads. The Glanyrafon Brook is located approximately 500m south of the site. The site is generally flat, however the topographical survey shows slight falls towards the southern boundary. the Northern, Eastern, and Western boundaries of the site are all battered down into the site. The site is located at National Grid Reference: SJ 30949 48628, Refer to **(Appendix A)** for the site location plan.

The main purpose of the investigation was to undertake Soil Infiltration tests in accordance with BRE Digest 365 and Approved Document H of the Building Regulations 2010 and determine the infiltration values of the existing strata.

On the 4th December 2015, three trial pits were excavated to a maximum depth of 3600mm using a JCB. The infiltration tests were undertaken strictly in accordance with BRE Digest 365. The trial pits were located as per the attached plan **(Appendix B)**.

2.0 Site Conditions

The weather at the time of the test as dry, however following 2 days/nights of heavy rainfall, during which a months' worth of rainfall landed in a 48 hour period causing floods over the country.

3.0 Soil infiltration results

The data from the soakaway trial pits may be summarised as follows:

<u>Reference</u>	<u>Depth</u>	<u>Ground Water Depth</u>	<u>Soil Infiltration Rate</u>
TP-1	1800mm	1500mm	Test Abandoned
TP-2	2400mm	2100mm	Test Abandoned
TP-3	3600mm	N/A	Self-Draining

Infiltration calculation have not been undertaken due to the finding of self-draining materials on site, in accordance with table 2.1 of CIRIA guidance 2007 an infiltration rate of 1.00×10^{-3} m/s is given for self-draining materials.

Trial Pit 1 comprised of a layer of 500mm of crushed engineering brick (made ground) overlaying a layer of 1000mm well graded angular gravels in a slightly sandy dense silty matrix commonly known as glacial till, before hitting ground water level at 1500mm deep with water level, the test was abandoned due to the height of the water table.

Trial Pit 2 comprised of a layer of 600mm of crushed engineering brick (made ground) overlaying a layer of 1500mm well graded angular gravels in a slightly sandy dense silty matrix commonly known as glacial till, before hitting ground water level at 2100mm deep with water level, the test was abandoned due to the height of the water table.

Trial Pit 3, which is considered self-draining, comprised of 550mm of crushed engineering brick (made ground) overlaying a 2950mm deep layer of a well graded angular gravels in a slightly sandy dense silty matrix commonly known as glacial till. The glacial till was dry and cohesionless, however compacted in place. Beneath the glacial till was a layer of free draining gravels the test was only conducted 100mm into these gravels. Refer to trial pit log for illustration of underlying strata (**Appendix C**).

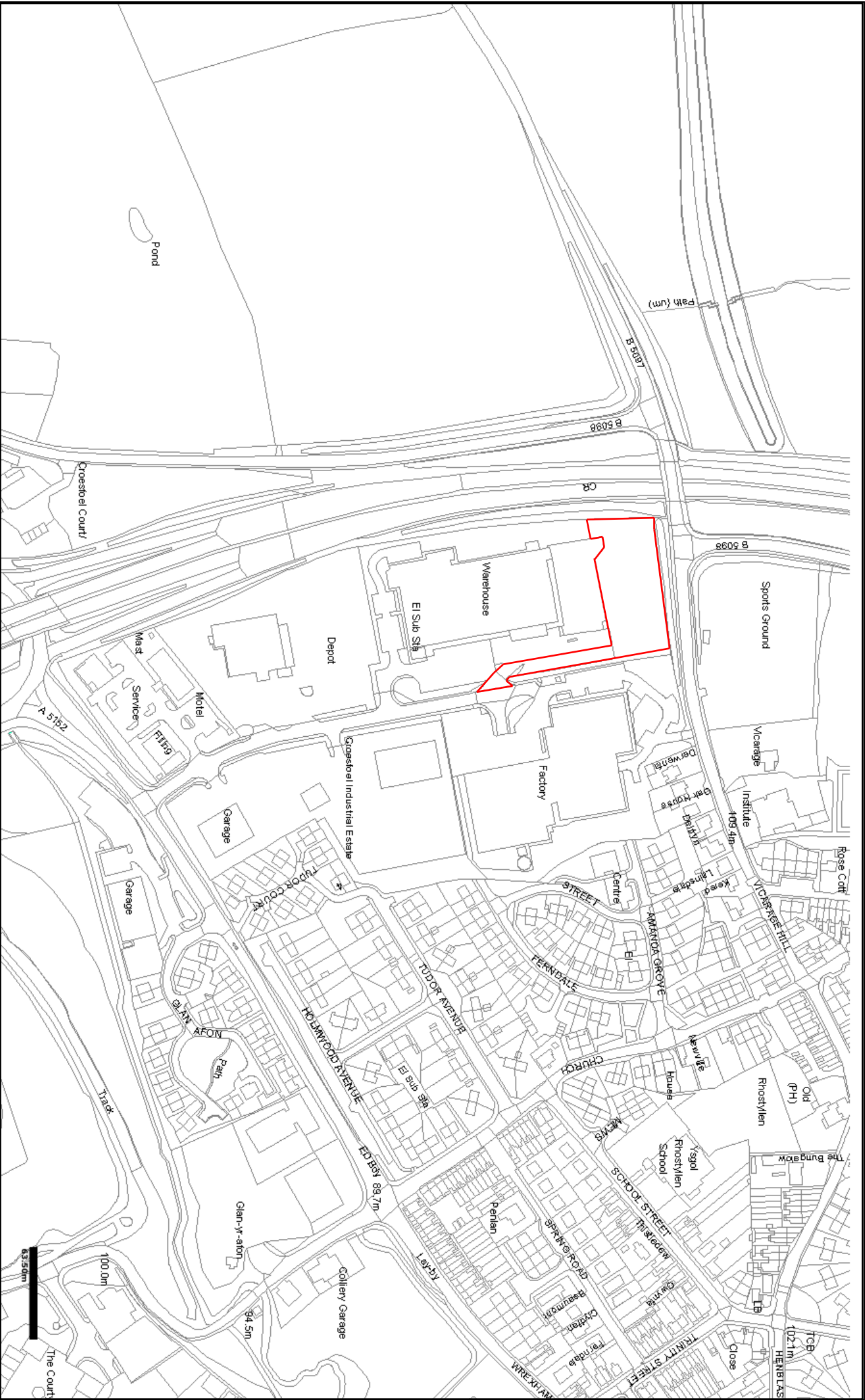
4.0 Conclusions

A test was unable to be conducted in TP-1 and TP-2 due to the nature of the underlying strata. The finding of free draining gravels in TP-3 meant that the water infiltrated into the soil quicker than we could fill up the trial pit.

Therefore a soakaway must be designed below 3500mm so that the self-draining material can be utilised.

APPENDICES

APPENDIX A – SITE LOCATION PLAN



Project:

Title:

PROPOSED CARPARK,
CROESFOEL INDUSTRIAL ESTATE,
RHOSTYLLLEN, WREXHAM,

SITE LOCATION PLAN

Job Ref:	Drawing Ref:	Revision:
17715	EL (96) 01	*
Drawn by:	Date:	Checked by:
B.Thorne	07/12/15	D.P
		NTS
		Scale:
		Page Size:
		A4

CADARN
CONSULTING ENGINEERS

Address:

Yr Afon,
Tudor Court,
Rhostyllen,
Wrexham,
LL20 4AD

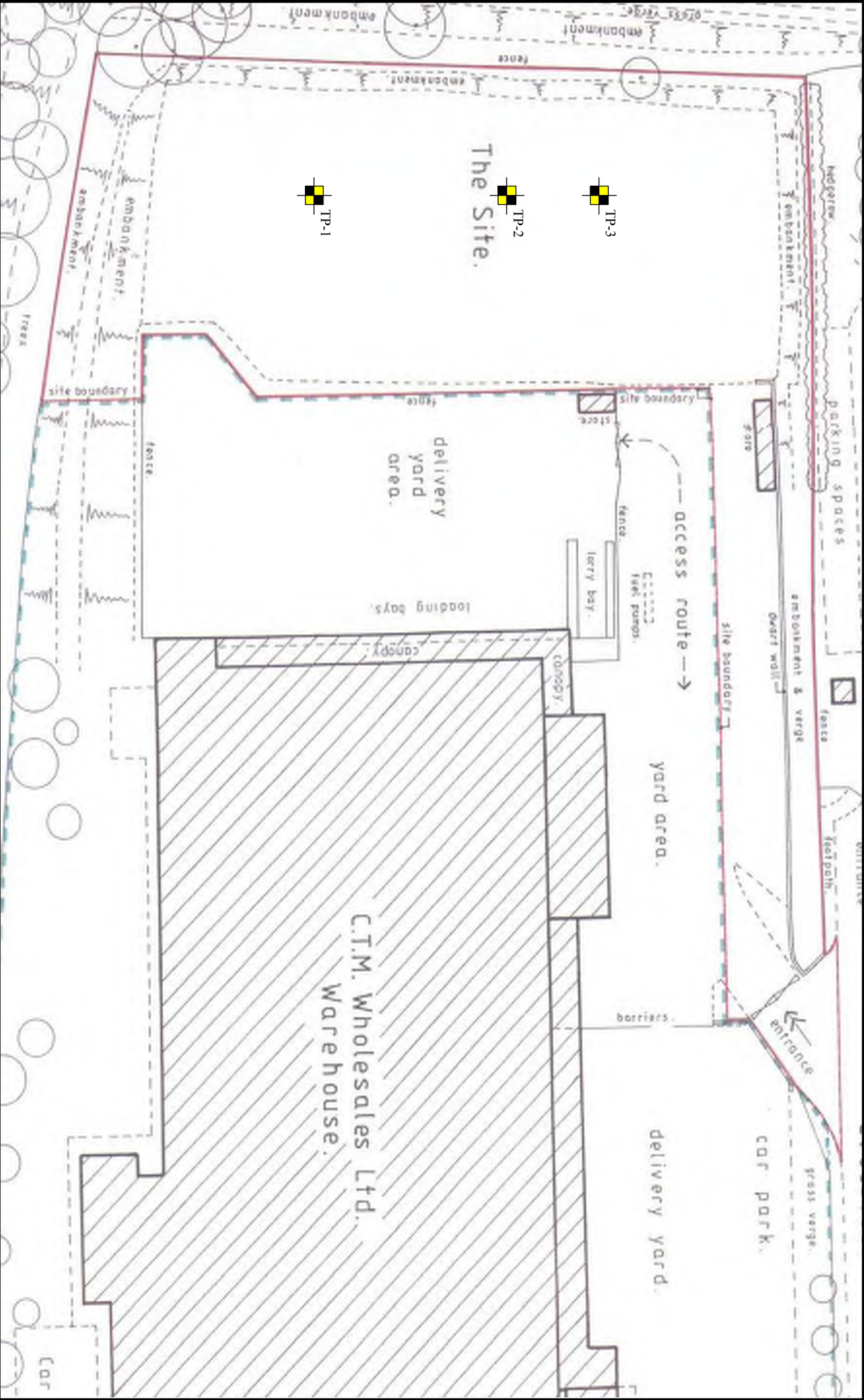
Mobile:

01497 730912
07930 352919

e-mail:

info@cadarnconsulting.co.uk

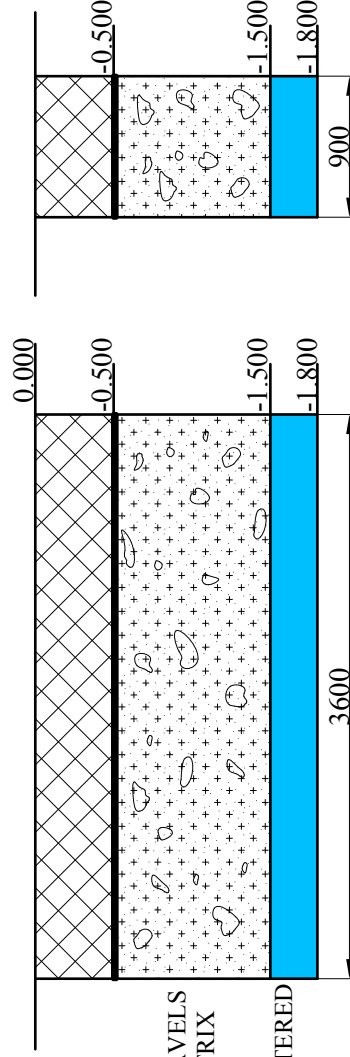
APPENDIX B – TRIAL PIT LOCATION PLAN



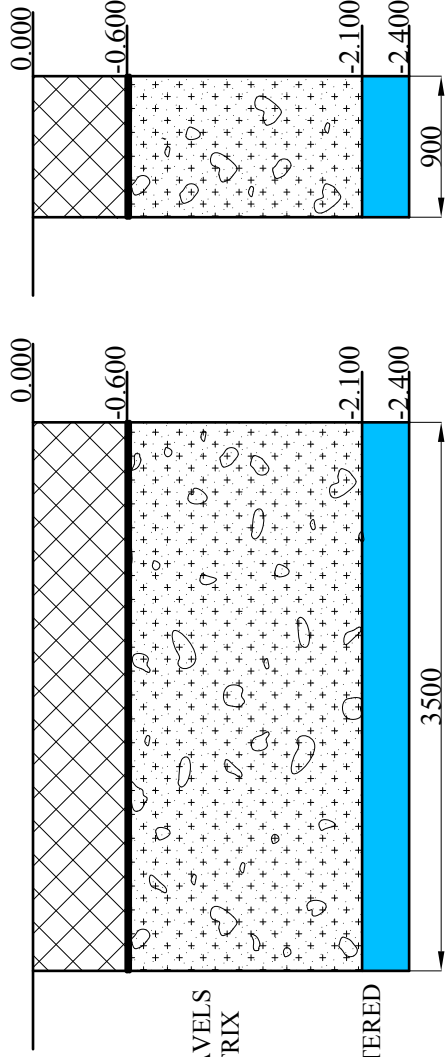
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PROPOSED CARPARK, CROESFOEL INDUSTRIAL ESTATE, RHOSTYLLLEN, WREXHAM,		TRAIL PIT LOCATION PLAN	
Job Ref:	Drawing Ref:	Revision:	
17715	EL (96) 02	*	
Drawn by:	Date:	Checked by:	Scale:
B. Thorne	07/12/15	D.P	NTS
Page Size:	A4		
CADARN CONSULTING ENGINEERS		CADARN CONSULTING ENGINEERS	
Address: Y. Adams, 10 Holliswood, Llangefnog, LL26 4AD		Tel: 01497 730912 Mobile: 07930 352979 e-mail: info@cadarnconsulting.co.uk	

APPENDIX C – TRIAL PIT LOG

500mm CRUSHED ENGINEERING BRICK (MADE GROUND).
BLACK ORGANIC LAYER 10-20mm.
1000mm OF WELL GRADED ANGULAR GRAVELS IN A SLIGHTLY SANDY DENSE SILTY MATRIX COMMONLY KNOWN AS GLACIAL TILL.
LOCALISED POCKET OF WATER ENCOUNTERED AT 1500mm BELOW GROUND LEVEL.



600mm CRUSHED ENGINEERING BRICK (MADE GROUND)
BLACK ORGANIC LAYER 10-20mm.
1500mm OF WELL GRADED ANGULAR GRAVELS IN A SLIGHTLY SANDY DENSE SILTY MATRIX COMMONLY KNOWN AS GLACIAL TILL.
LOCALISED POCKET OF WATER ENCOUNTERED AT 2100mm BELOW GROUND LEVEL.



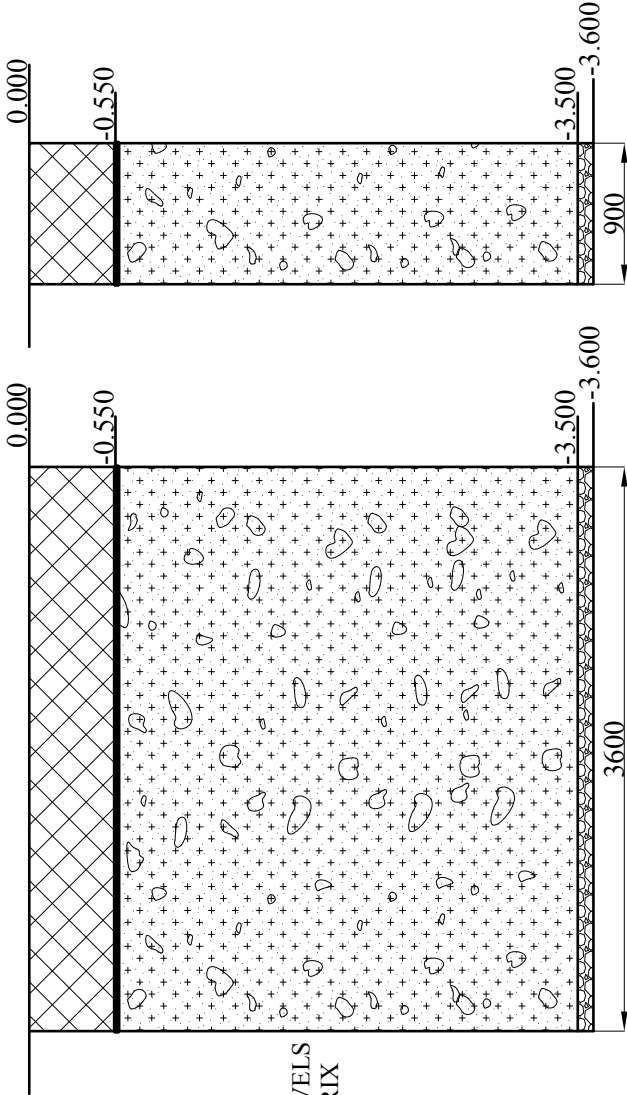
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Job Ref: 17715	Drawing Ref: ED (95) 01		Revision: *
Drawn by: B.Thorne	Date: 07/12/15	Checked by: D.P	Paper Size: A4
		Scale: 1/50	
CADARN CONSULTING ENGINEERS Address: CADARN Consulting Engineers, Yr Adwy, Llanfairfach, Wrexham, Anglesey, LL16 4AD. e-mail: info@cadarnconsulting.co.uk tel: 01407 730912 mobile 07890 382979			

600mm CRUSHED ENGINEERING BRICK
(MADE GROUND)

BLACK ORGANIC LAYER 10-20mm.

1500mm OF WELL GRADED ANGULAR GRAVELS
IN A SLIGHTLY SANDY DENSE SILTY MATRIX
COMMONLY KNOWN AS GLACIAL TILL.

FREE DRAINING GRAVELS



Project: PROPOSED CARPARK, CROSEFOEL INDUSTRIAL ESTATE, RHOSTYLLEN, WREXHAM	Title: TRIAL PIT LOGS SHEET 2 OF 2	Job Ref: 17715	Drawing Ref: ED (95) 02		Revision: *
		Drawn by: B.Thorne	Date: 07/12/15	Checked by: D.P	Paper Size: A4
		Scale: 1/50			
CADARN CONSULTING ENGINEERS Address: CADARN Consulting Engineers, 17 Ardwy, Llandudnant, Anglesey, LL65 4UD. tel: 01407 730912 mobile: 07890 382979 email: info@cadarnconsulting.co.uk					

APPENDIX G – Envirocheck Report

JBA 100 Year Return Flood Map (Un defended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

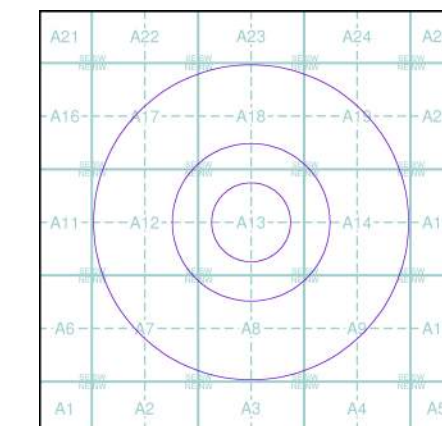
Modelled Flood Depth

Fluvial Depth	Coastal Depth
0.5mm - 10cm	< 10cm
10cm - 30cm	10cm - 30cm
30cm - 1m	30cm - 1m
>1m	>1m

Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

JBA 100 Year Return Flood Map (Un defended) - Slice A

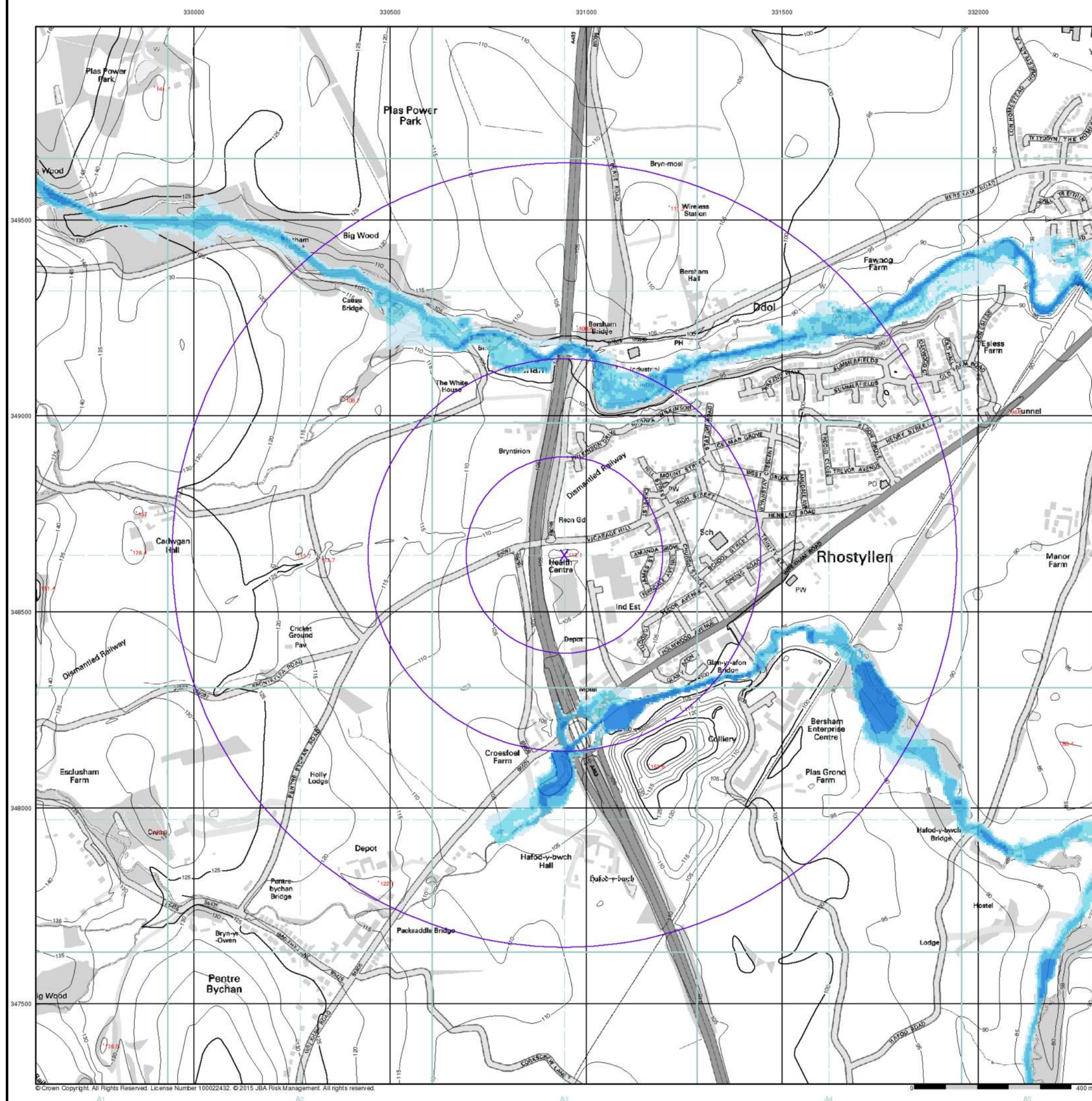


Order Details

Order Number: 78278398_1_1
Customer Ref: 01016
National Grid Reference: 330940, 348640
Slice: A
Site Area (Ha): 0.01
Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhosyllen, WREXHAM, Clwyd, LL14 4GA



EA/NRW Surface Water 30 Year Return Depth Map (1:10,000)

General
 Specified Site Specified Buffer(s) X Bearing Reference Point

Surface Water Depth

0 - 0.15m
 0.15 - 0.30m
 0.30 - 0.60m
 0.60 - 0.90m
 0.90 - 1.20m
 > 1.20m

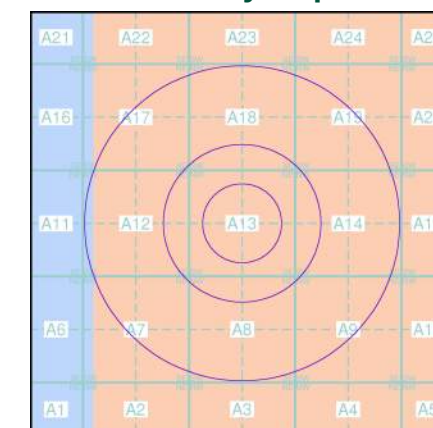
Contours (height in metres)

Standard Contour 105 100 95
 Master Contour 105 100 95
 Spot Height *167.8
 MLW Mean Low Water
 MHW Mean High Water

Suitability

See the suitability map below
 National to county
 County to town
 Town to street
 Street to parcels of land
 Property

EA/NRW Suitability Map - Slice A

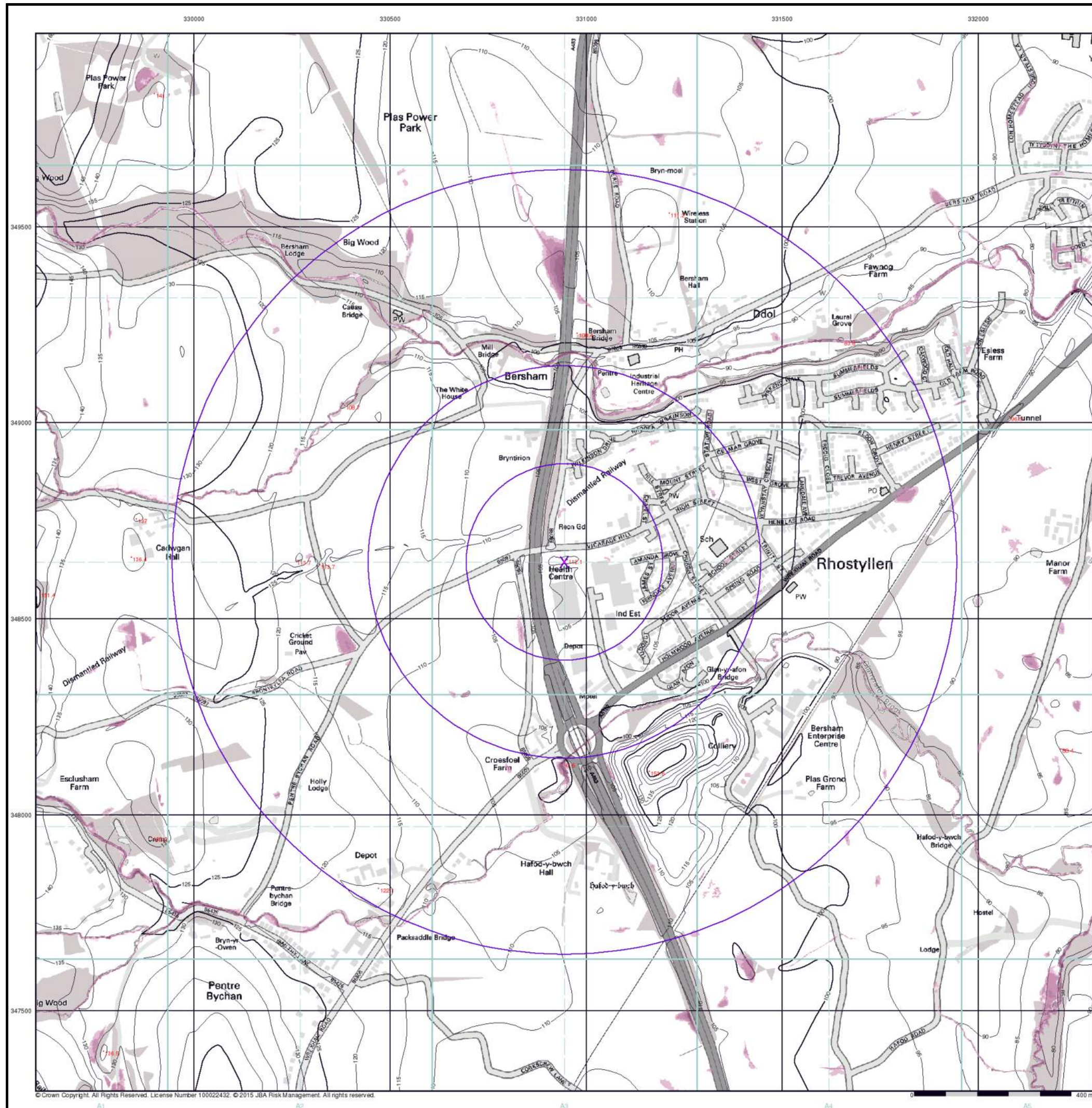


Order Details

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 Customer Ref: 01016
 National Grid Reference: 330940, 348640
 Slice: A
 Site Area (Ha): 0.01
 Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhostyllen, WREXHAM, Clwyd, LL14 4GA



EA/NRW Surface Water 100 Year Return Depth Map

General
 Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Depth

0 - 0.15m
 0.15 - 0.30m
 0.30 - 0.60m
 0.60 - 0.90m
 0.90 - 1.20m
 > 1.20m

Contours (height in metres)

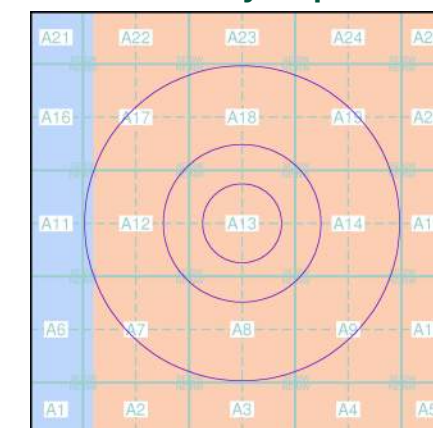
Standard Contour
 Master Contour
 Spot Height
 *167.8

MLW Mean Low Water
 MHW Mean High Water

Suitability

See the suitability map below
 National to county
 County to town
 Town to street
 Street to parcels of land
 Property

EA/NRW Suitability Map - Slice A

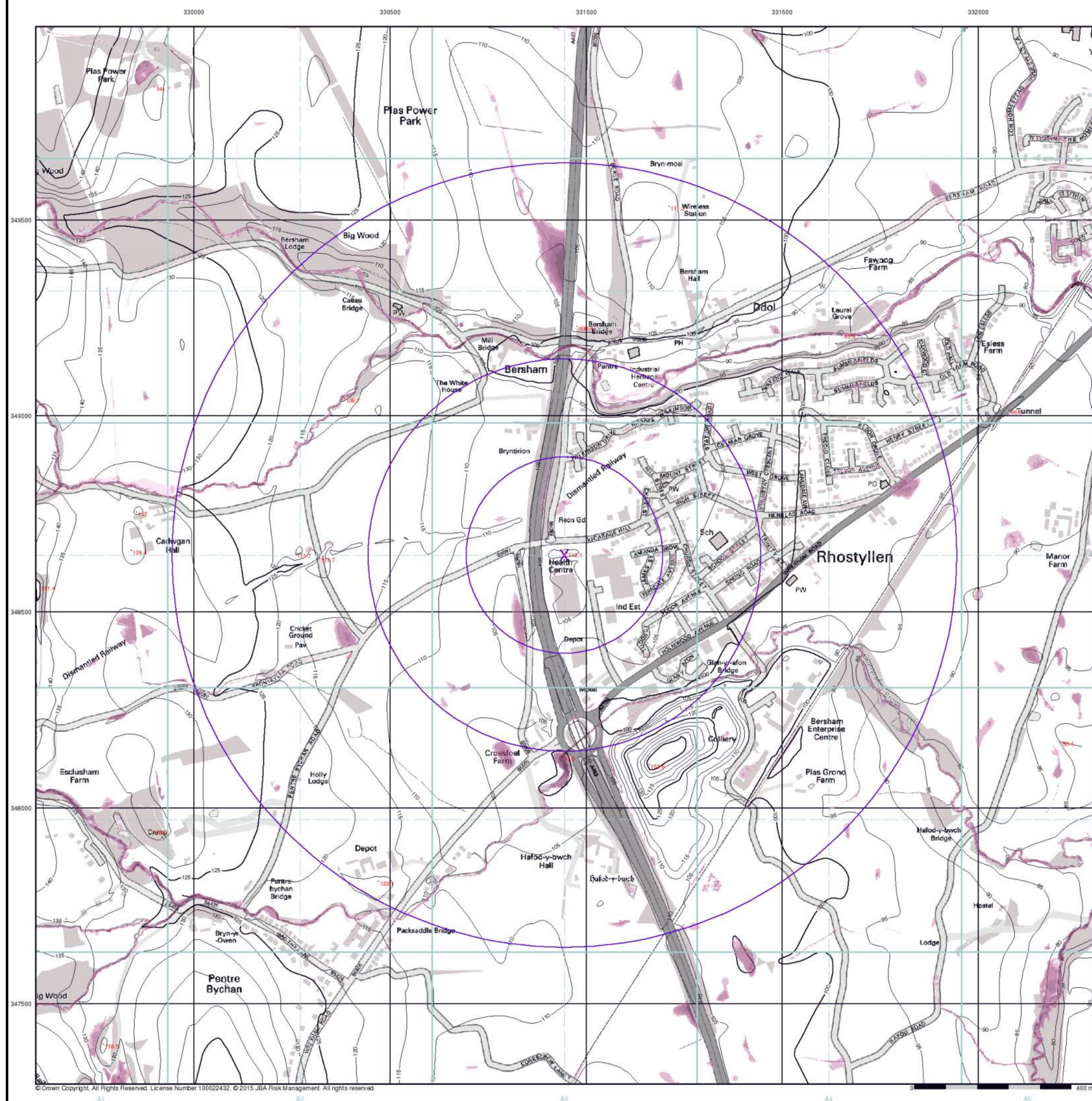


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 Slice: A
 Site Area (Ha): 0.01
 Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhostyllen, WREXHAM, Clwyd, LL14 4GA



EA/NRW Surface Water 30 Year Return Hazard Rating Map (1:10,000)

General
 Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Hazard Rating

- Low (0.5 – 0.75)
- Moderate (0.75 – 1.25)
- Significant (1.25 – 2.0)
- Extreme (>2.0)

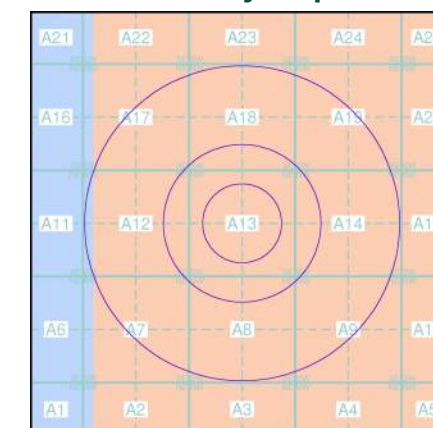
Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

Suitability

- See the suitability map below
- National to county
 - County to town
 - Town to street
 - Street to parcels of land
 - Property

EA/NRW Suitability Map - Slice A

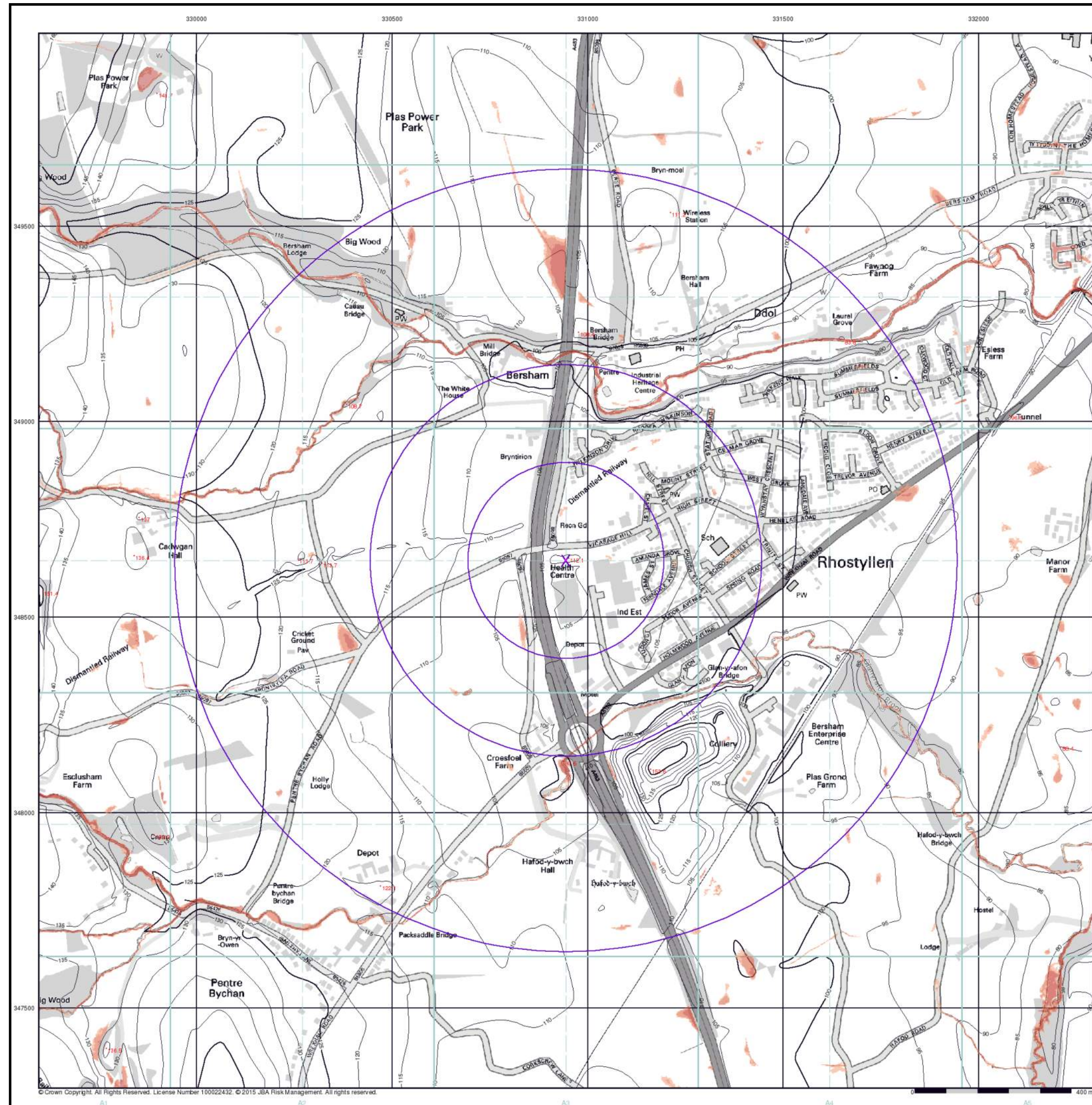


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 Slice: A
 Site Area (Ha): 0.01
 Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhostyllen, WREXHAM, Clwyd, LL14 4GA



EA/NRW Surface Water 100 Year Return Hazard Rating Map (1:10,000)

General
 Specified Site Specified Buffer(s) Bearing Reference Point

Surface Water Hazard Rating

Low (0.5 – 0.75)
 Moderate (0.75 – 1.25)
 Significant (1.25 – 2.0)
 Extreme (>2.0)

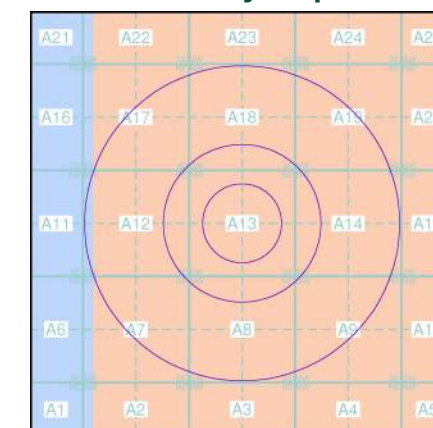
Contours (height in metres)

Standard Contour
 Master Contour
 Spot Height
 Mean Low Water
 Mean High Water
 167.8

Suitability

See the suitability map below
 National to county
 County to town
 Town to street
 Street to parcels of land
 Property

EA/NRW Suitability Map - Slice A

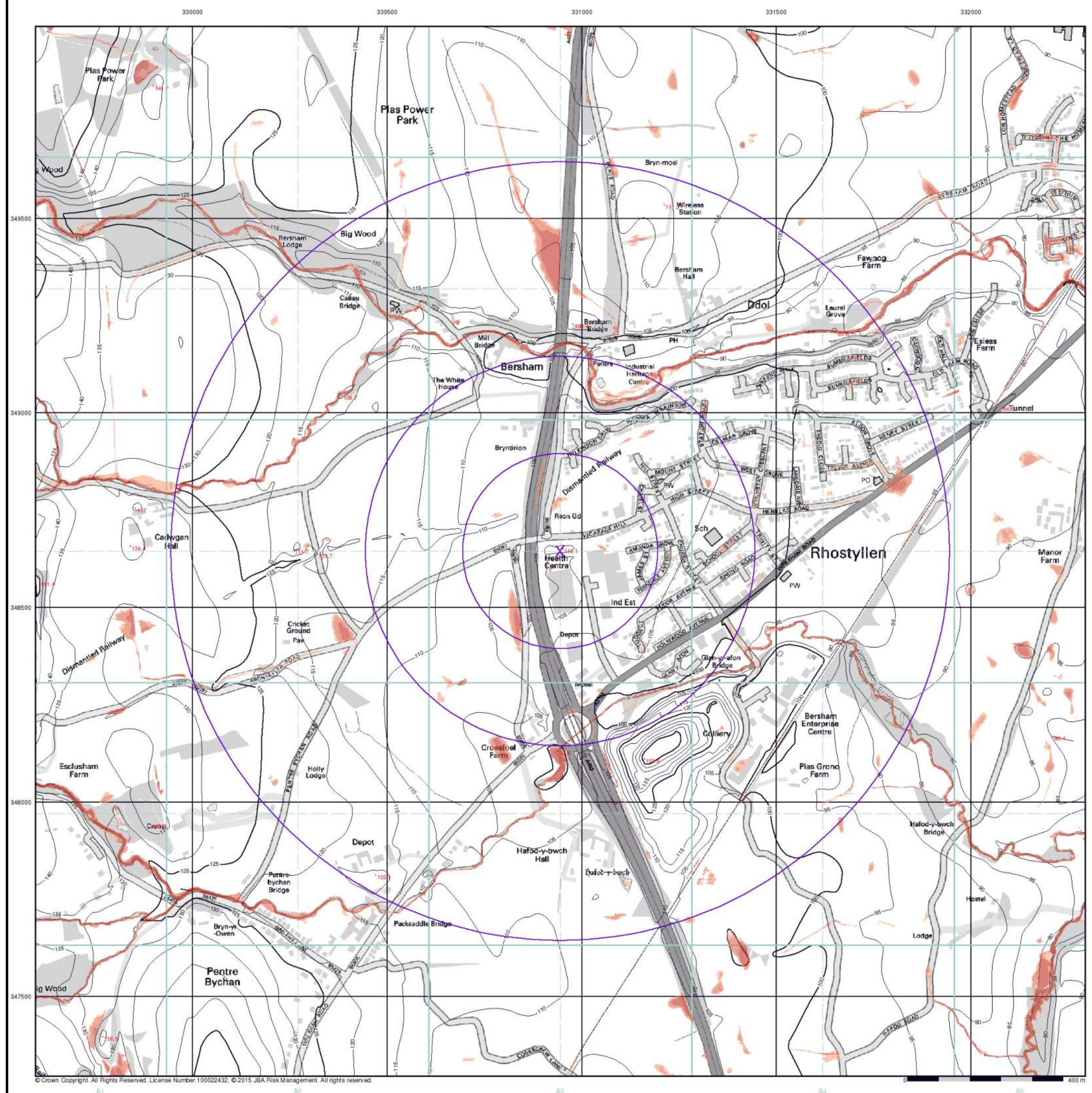


Order Details

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 Slice: A
 Site Area (Ha): 0.01
 Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhostyllen, WREXHAM, Clwyd, LL14 4GA



Detailed River Network Map (1:10,000)

General

-  Specified Site
-  Specified Buffer(s)
-  Bearing Reference Point
-  Map ID

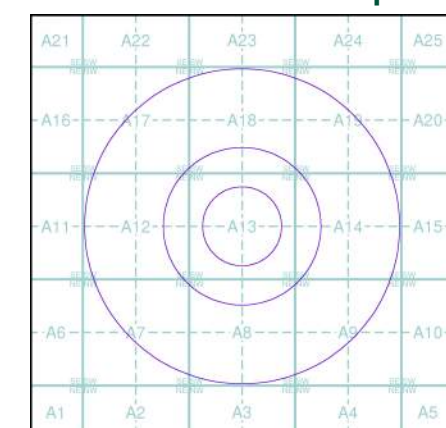
Detailed River Network Data

- | | |
|--|---|
|  Primary River |  Extended Culvert (greater than 50m) |
|  Secondary River |  Underground River (inferred) |
|  Tertiary River |  Underground River (local knowledge) |
|  Canal |  Downstream of High Water Mark |
|  Canal Tunnel |  Downstream of Seaward Extension |
|  Undefined River |  Not assigned River feature |
|  Lake/Reservoir | |
|  Source |  Not assigned River feature |
|  Junction |  Pseudo Node (general) |
|  Sink |  Pseudo Node (High Water Mark) |
|  Non-interactive Node |  Pseudo Node (OS MasterMap polygon boundary) |
|  Offline Drainage Feature | |

Contours (height in metres)

- Standard Contour  105  Mean Low Water
- Master Contour  100  Mean High Water
- Spot Height  *167.3

Detailed River Network Map - Slice A

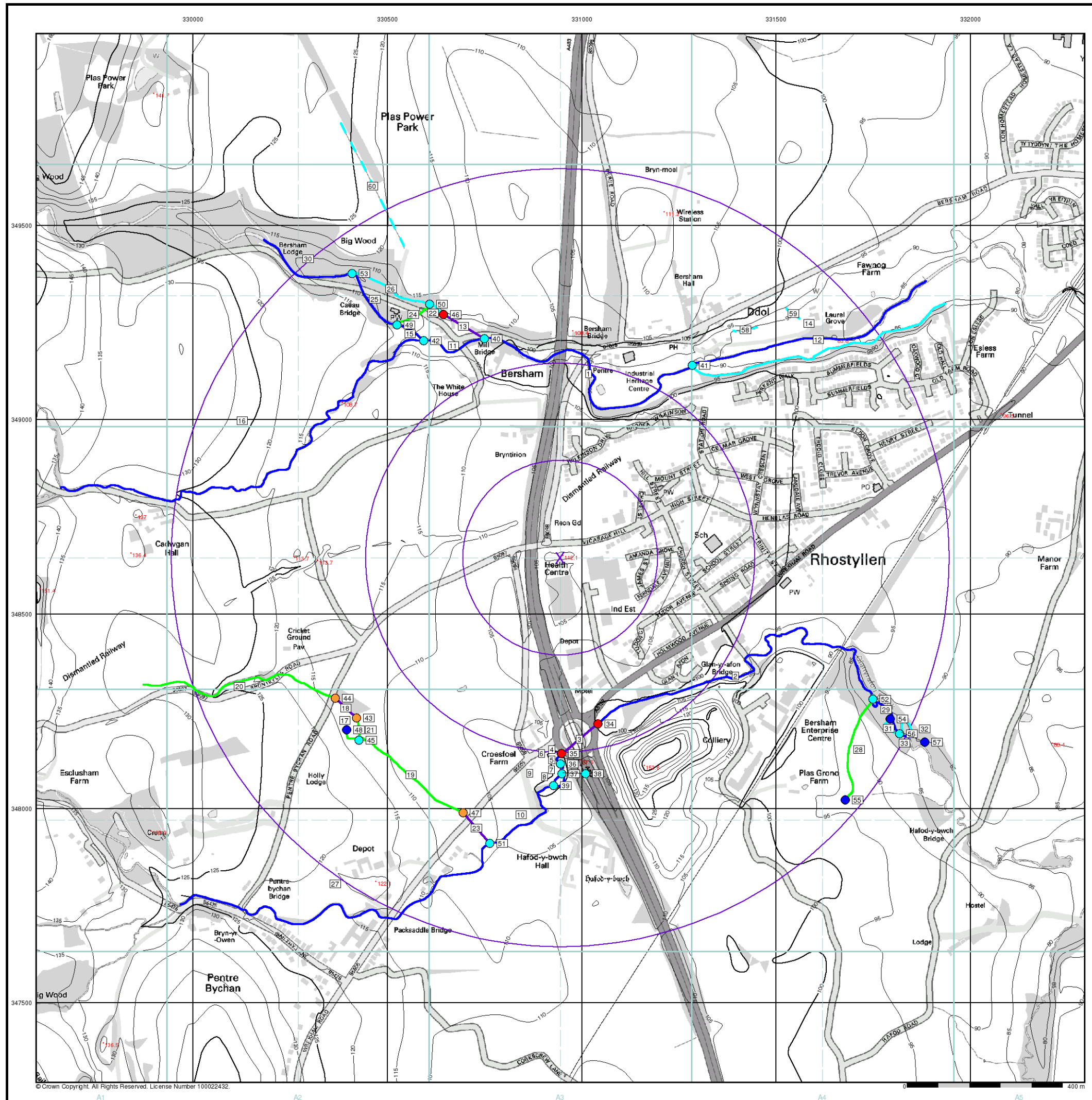


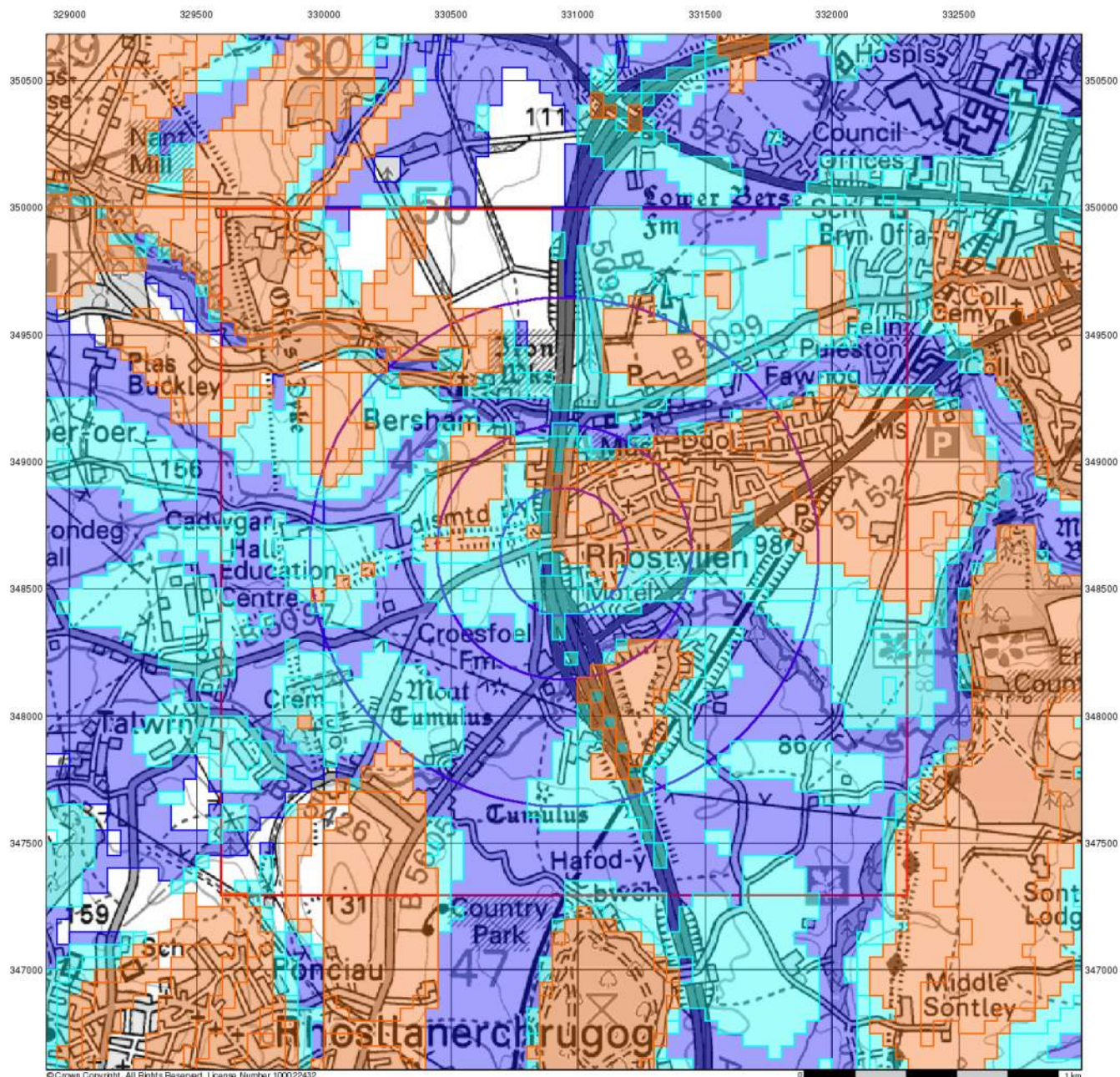
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 Slice: A
 Site Area (Ha): 0.01
 Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhostyllen, WREXHAM, Clwyd, LL14 4GA





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BGS Flood Data (1:50,000)

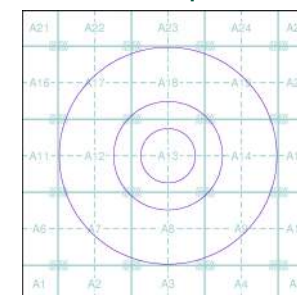
General

- ◇ Specified Site
- Specified Buffer(s)
- X Bearing Reference Point
- Slice
- B Map ID

BGS Groundwater Flooding Susceptibility

- Potential for Groundwater Flooding to Occur at Surface
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Limited Potential for Groundwater Flooding to Occur

BGS Flood Data Map - Slice A



Order Details

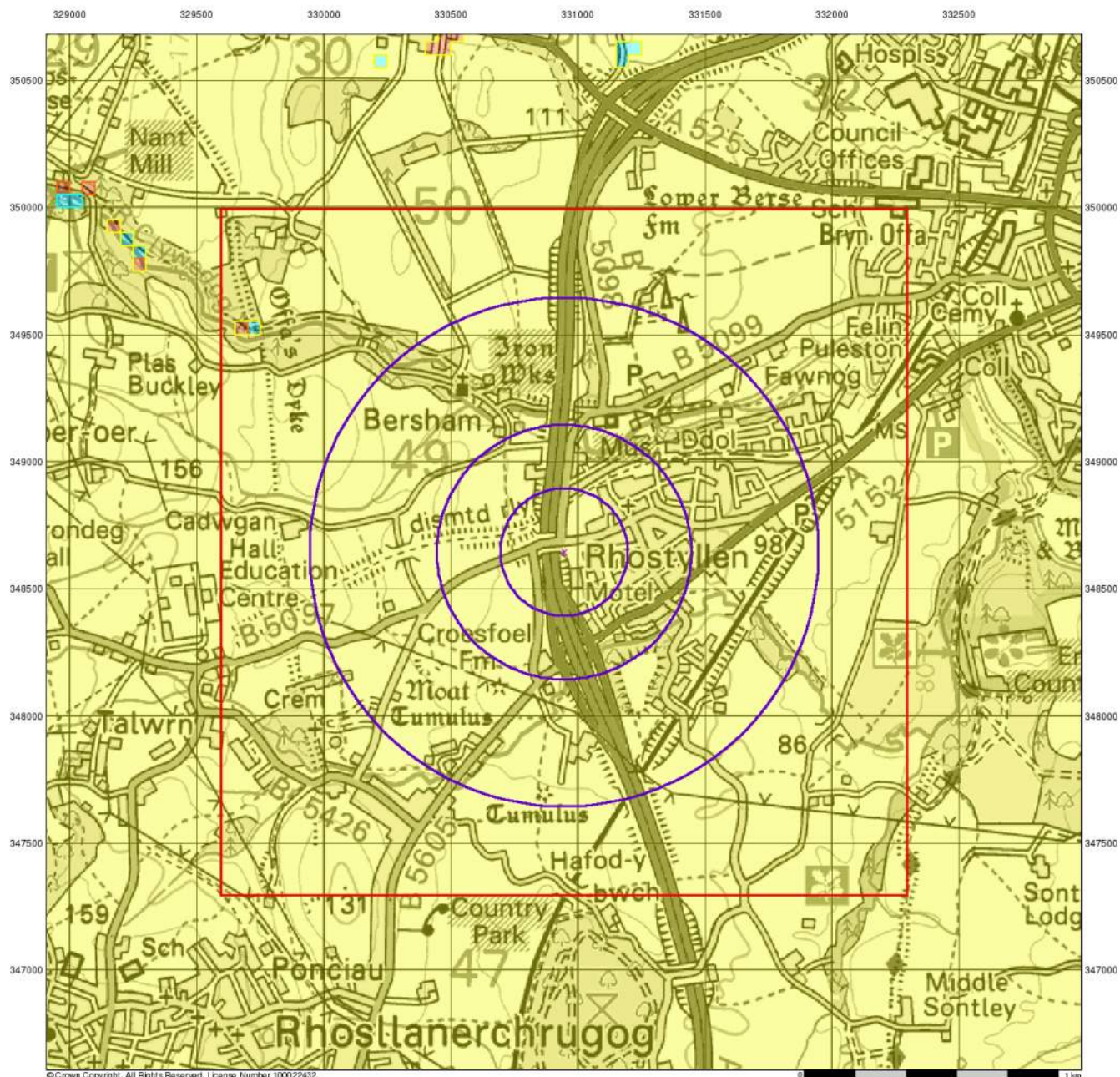
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 Customer Ref: 01016
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 Slice: A
 Site Area (Ha): 0.01
 Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhostyllen, WREXHAM, Clwyd, LL14 4GA



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 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk



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ESI Groundwater Flood Map (1:50,000)

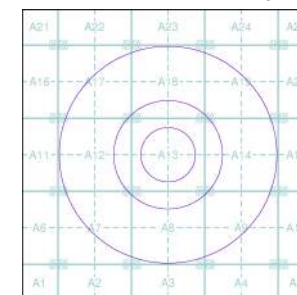
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice

ESI Groundwater Flooding Risk

- High Risk
- Moderate Risk
- Low Risk
- Negligible Risk

ESI Groundwater Flood Map - Slice A



Order Details

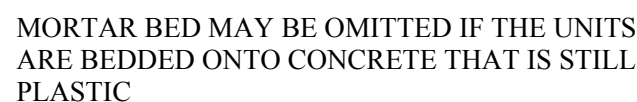
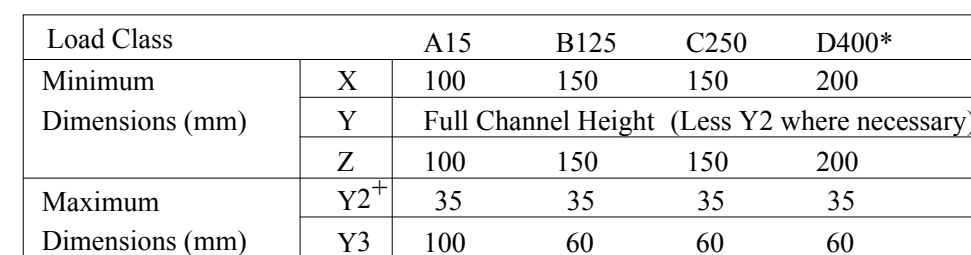
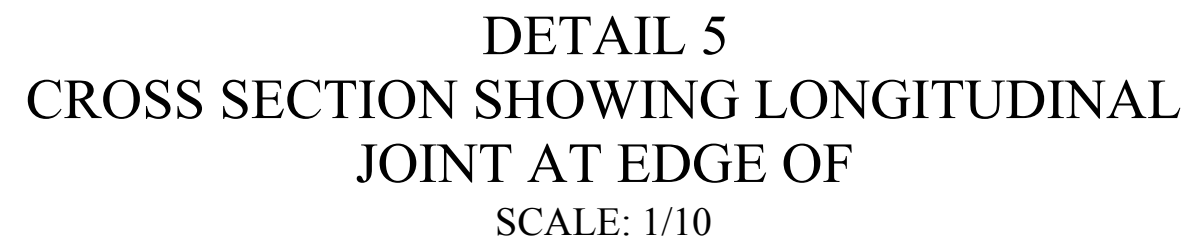
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 National Grid Reference: 330940, 348640
 Slice: A
 Site Area (Ha): 0.01
 Search Buffer (m): 1000

Site Details

8 Tudor Court, Rhostyllen, WREXHAM, Clwyd, LL14 4GA



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 Fax: 0844 844 9951
 Web: www.envirocheck.co.uk



VEHICULAR UPSTAND 25mm. FLUSH FOR PEDESTRIAN CROSSINGS



ACCESS ROAD CONSTRUCTION

SURFACE COURSE:	40mm THK HOT ROLLED ASPHALT 55/10C surf 40/60 des PSV 55 to BS EN 13108-4
BINDER COURSE:	60mm THK DENSE BITUMEN MACADAM BINDER COURSE (125 PEN BINDER & 20mm AGGREGATE) TO BS 4987: PART 1 CLAUSE 6.5 (DTP SPECIFICATION CLAUSE 906)
BASE LAYER:	80mm THK DENSE BITUMEN MACADAM BASE COURSE (125 PEN BINDER & 28mm AGGREGATE) TO BS 4987: PART 1 CLAUSE 5.2 (DTP SPECIFICATION CLAUSE 903)
SUB-BASE:	150mm THK MOT TYPE 1 SUB-BASE MATERIAL TO SPECIFICATION CLAUSE 803
CAPPING/FILL:	MIN 150mm THK 6F1 OF TABLE 6.1 OF SPECIFICATION FOR HIGHWAY WORKS - SERIES 600 - EARTHWORKS (TO BE CONFIRMED BY CBR RESULTS TAKEN ON SITE)



- | NOTES | |
|-------|---|
| 1. | ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING. |
| 2. | ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS. |
| 3. | THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES. |

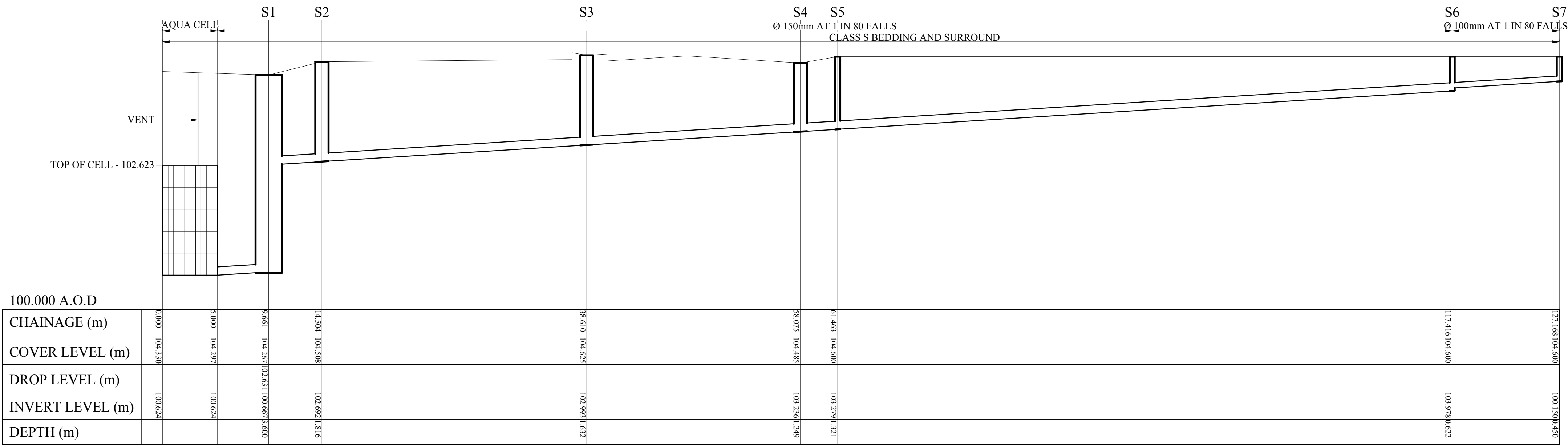
REV	DATE	DESCRIPTION	BY	CHK	APP

REVISIONS					
Project:	PROPOSED INDUSTRIAL UNITS, CROESFOEL INDUSTRIAL ESTATE, RHOSTYLLEN, WREXHAM				

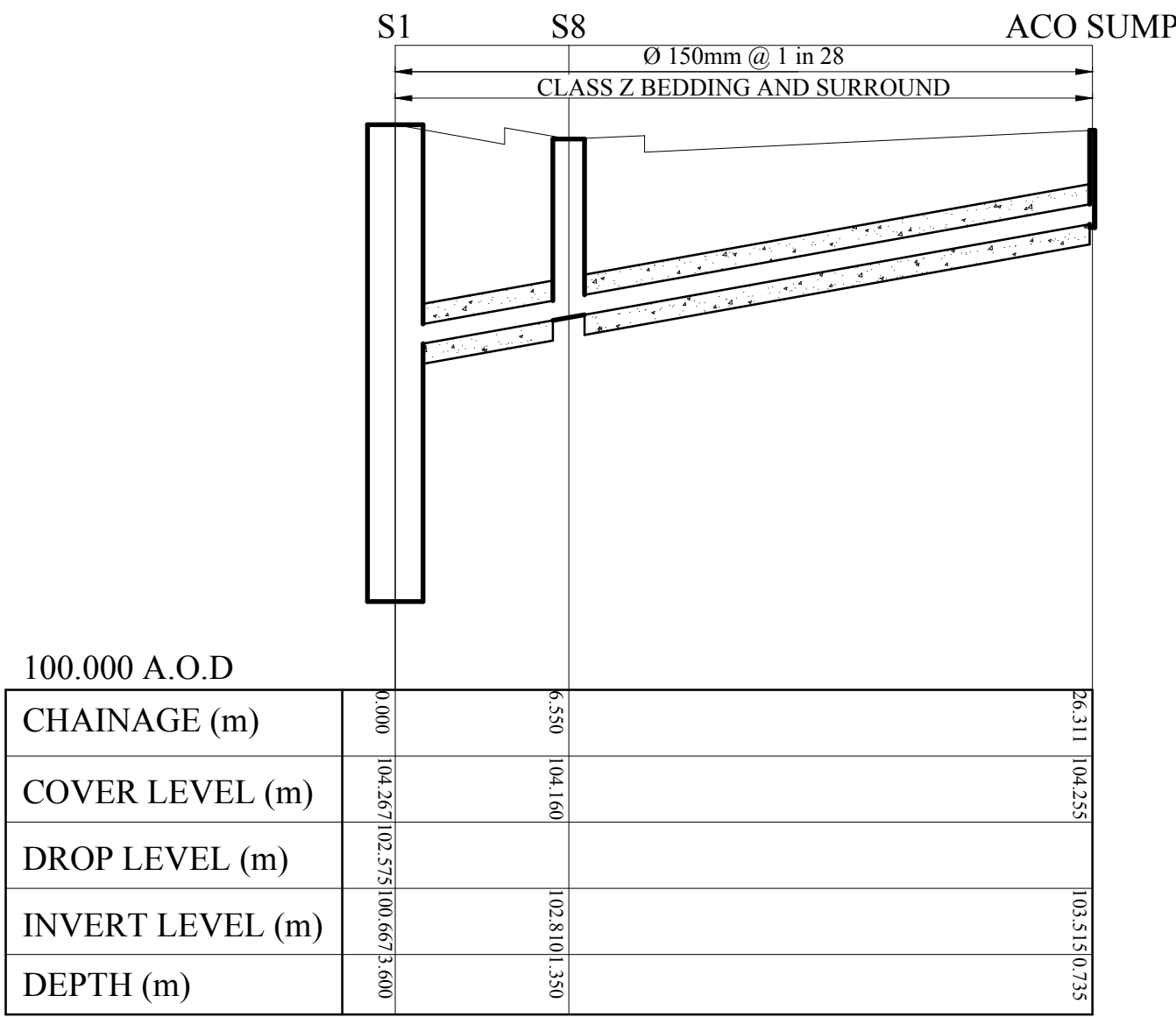
Title: **PROPOSED ACCESS ROAD
CONSTRUCTION DETAILS**

Job Ref: 01016	Drawing Ref: EA (92) 01			Revision: *
Drawn by: B. Thorne	Date: 05/02/16	Checked by: I. R.	Scale: AS STATED	Paper Size: A2

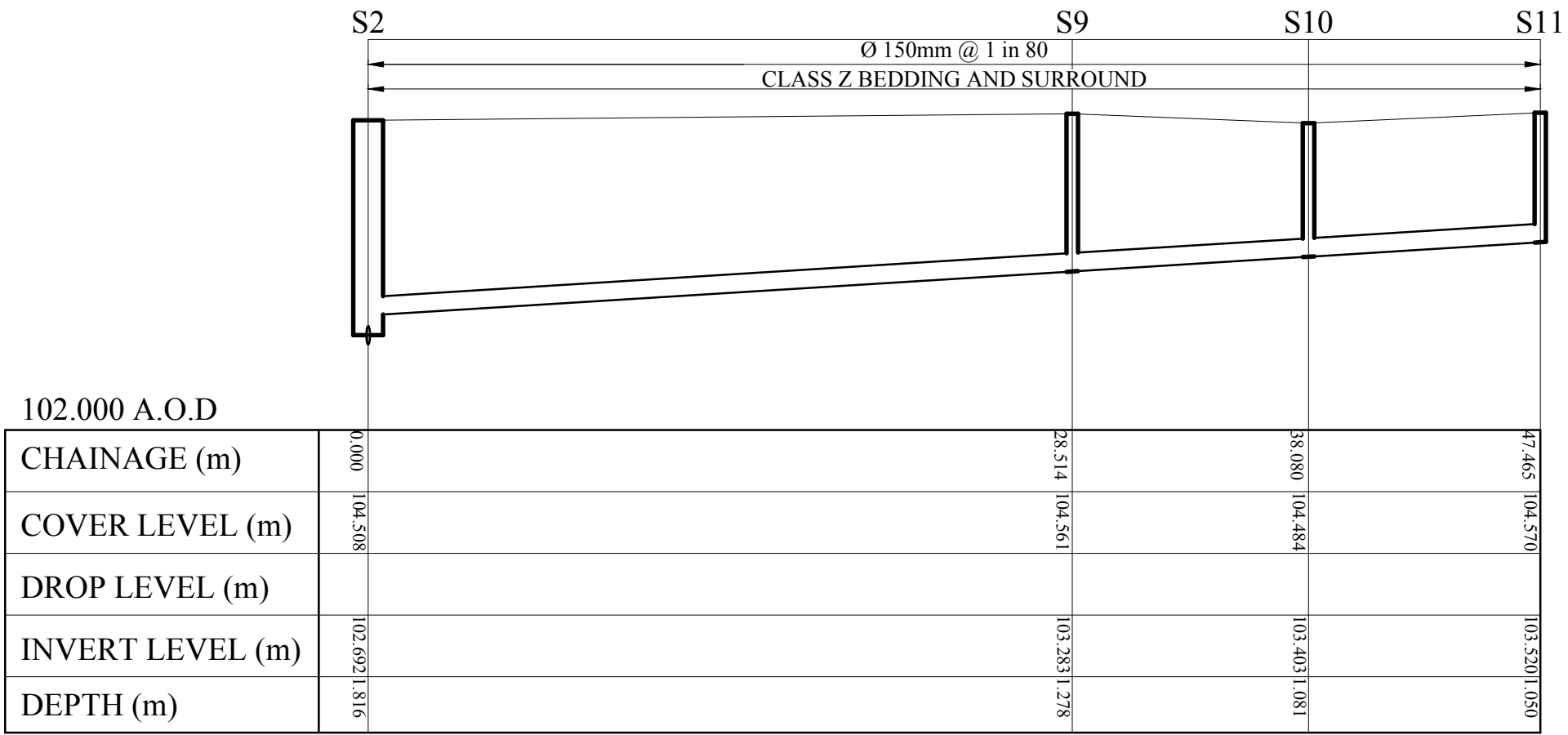
The logo for CADARN Consulting Engineers features the word 'CADARN' in a large, bold, white serif font against a solid blue rectangular background. Below 'CADARN', the words 'CONSULTING ENGINEERS' are written in a smaller, white, sans-serif font, all in capital letters.



PROPOSED SURFACE WATER DRAINAGE SECTION (S7 - AQUA CELL)
SCALE: H:1/250 V:1/50



PROPOSED SURFACE WATER DRAINAGE SECTION (S1 - ACO SUMP)
SCALE: H:1/250 V:1/50



PROPOSED SURFACE WATER DRAINAGE SECTION (S2 - S11)
SCALE: H:1/250 V:1/50

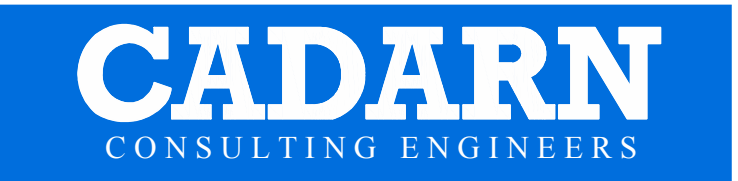
- NOTES
- ALL LEVELS IN METERS UNLESS NOTED OTHERWISE ON DRAWING.
 - ALL DIMENSIONS AND LEVELS TO BE CHECKED ON SITE PRIOR TO UNDERTAKING ANY WORKS, ORDERING MATERIALS OR FABRICATING ANY COMPONENTS
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ENGINEER'S AND ARCHITECT'S DRAWINGS AND RELEVANT SPECIFICATION CLAUSES.

REV	DATE	DESCRIPTION	BY	CHK	APP
REVISIONS					

Project: PROPOSED INDUSTRIAL UNITS, CROESFOEL INDUSTRIAL ESTATE, RHOSTYLLEN, WREXHAM

Title: SURFACE WATER DRAINAGE LONG SECTIONS

Job Ref:	Drawing Ref:	Revision:
01016	EA (95) 01	*
Drawn by:	Date:	Checked by:
B.Thorne	02/02/16	I. R.
		Scale: AS STATED
		Paper Size: A1



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