

Former Golden Grove Inn, Rossett

Flood Consequences Assessment

June 2015



DOCUMENT VERIFICATION RECORD

**CLIENT:**

Urban Developments and Construction Ltd

SCHEME:

Flood Consequences Assessment for a proposed residential development at the former Golden Grove Inn, Rossett, Wrexham, LL12 0AS. The purpose of this report is to support the Planning Application.

INSTRUCTION:

The instruction to carry out this Flood Consequences Assessment was received from Mr Glen Moody of Hardie Brack, acting on behalf of the client.

REPORT FORMAT:

This report has been prepared in accordance with Technical Advice Note 15: Development and Flood Risk (TAN15).

ISSUE HISTORY:

Issue Date	Comment
29/05/2015	First issue
01/06/2015	First revision

DOCUMENT REVIEW & APPROVAL

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Waterco Document Reference Number.....w1862-150601-FCA

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Supporting Documents:

Welsh Government Technical Advice Note (TAN) 15: Development and Flood Risk (2004)

Wrexham County Borough Preliminary Flood Risk Assessment (June 2011)

Waterco Consultants Hydraulic Modelling Report (Document Reference: w3178-150529-HMR)

Abbreviations

AEP *Annual Exceedance Probability*

CCA *Climate Change Allowance*

DCWW *Dwr Cymru Welsh Water*

FCA *Flood Consequences Assessment*

HMR *Hydraulic Modelling Report*

LiDAR *Light Detection and Ranging*

m AOD *metres Above Ordnance Datum*

NRW *Natural Resources Wales*

PFRA *Preliminary Flood Risk Assessment*

SUDS *Sustainable Drainage Systems*

TAN15 *Welsh Government Technical Advice Note 15: Development & Flood Risk*

WCBC *Wrexham County Borough Council*

1 Introduction

- 1.1 Waterco Consultants have been instructed to prepare a Flood Consequences Assessment report in respect of a proposed residential development at the former Golden Grove Inn, Llyndir Lane, Rossett, Wrexham, LL12 0AS (grid reference: 335371E 358658N). A location plan and an aerial image of the site are included in Appendix A.
- 1.2 The existing site consists of the Golden Grove Inn, a dwelling and associated outbuildings. The site covers an area of approximately 6025m². The site is bordered by Llyndir Lane to the north, agricultural land to the east, south and west as well as a tributary drain of Golden Grove Drain to the south and Golden Grove Drain to the west.
- 1.3 The proposed development is for two detached dwellings with associated garages and landscaping. Plot 2 will include a half basement storey to the rear of the property. Proposed development plans are included in Appendix B.
- 1.4 LiDAR data shows that site levels vary from a high of 13.5m Above Ordnance Datum (m AOD) in the eastern extent of the site, to a low of 12.5m AOD in the southern and northern extents of the site.
- 1.5 Hydraulic flood modelling of Golden Grove Drain has been undertaken by Waterco Consultants. This report should be read in conjunction with the Hydraulic Modelling Report (HMR) (document reference: w3178-150529-HMR).

2 Flood Zone Category and Justification

- 2.1 The Welsh Government Development Advice Map included in Appendix C shows that the majority of the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or tidal flooding, with a less than 0.1% chance of flooding in any given year. Parts of the northern and southern extents of the site are located within Flood Zone C2 – an area considered to be at flood risk, without significant defence infrastructure, with a 0.1% (1 in 1000) chance or greater of flooding in any given year.
- 2.2 The EA Flood Map for Planning (Rivers and Sea) (Appendix C) shows that the majority of the site is located within Flood Zone 1 – an area considered to have the lowest probability of fluvial flooding. It is assessed as having a less than 0.1% annual probability of flooding. Parts

of the northern and southern extents of the site are located within Flood Zone 2 – an area at risk with between a 1% (1 in 100) and 0.1% chance or greater of flooding in any given year.

- 2.3 The proposed residential development is considered to be 'highly vulnerable' in accordance with Figure 2 of the Welsh Government's Technical Advice Note 15 - Development and Flood Risk (TAN15).
- 2.4 Highly vulnerable development is considered to be appropriate within Flood Zone A. Therefore any development located within this extent of the site is compliant with TAN15.
- 2.5 TAN15 states that highly vulnerable development is not considered to be acceptable within Flood Zone C2 and that plan allocations should not be made for such development and planning applications not proposed. However detailed hydraulic modelling undertaken by Waterco Consultants has demonstrated that the site falls outside of the 1% Annual Exceedance Probability (AEP) + Climate Change Allowance (CCA) flood extent and the extreme 0.1% AEP flood extent and should therefore be considered as Flood Zone A. The development is therefore compliant with TAN15.

Justification

- 2.6 The TAN15 justification test should be applied for all development within Flood Zone C. The aim of the test is to direct new development away from Flood Zone C. Detailed hydraulic modelling has demonstrated that the site is flood free during the extreme 0.1% AEP event and should therefore be considered as Flood Zone A. Residential development is considered to be appropriate within Flood Zone A and the development is therefore justified in this location.

3 TAN15 Acceptability Criteria

- 3.1 The development site is shown to be flood free during the extreme 0.1% AEP event and should be considered as Flood Zone A. TAN15 section 9 'Summary of Policy Requirements' states that for 'highly vulnerable' development in Flood Zone A the following Acceptability Criteria should be satisfied:
- No increase in flooding elsewhere
- 3.2 The impact of the development on flood risk elsewhere is discussed in the following sections, but firstly the potential sources of flooding are considered below to provide context for the assessment.

4 Potential Sources of Flooding and Probability

4.1 This section will document the likely sources of flooding that could affect the proposed development site and the probability of occurrence. In order to determine these sources, a review of the following has been undertaken:

- Hydraulic Modelling Report undertaken by Waterco Consultants (document reference: w3149-150529-HMR).
- Welsh Government Development Advice Map (Appendix C)
- Environment Agency Flood Map (Appendix C)
- Wrexham County Council Preliminary Flood Risk Assessment (PFRA) (June 2011)
- Site Specific Homecheck Flood Report (obtained from Landmark) (Appendix D)
- Internet Searches for Historic Flood Events

Fluvial

4.2 The site is located within the River Dee catchment. The nearest watercourse is Golden Grove Drain, located along the western boundary of the site. There is also an unnamed tributary drain of Golden Grove Drain located along the southern boundary of the site. The unnamed tributary drain flows west to its confluence with Golden Grove Drain. Golden Grove Drain flows north to join with Pulford Brook. Pulford Brook is located approximately 260m north-west of the site at its nearest point and flows east in this location to its confluence with the River Dee approximately 5.6km south-east of the site.

4.3 Fluvial flooding could occur if Golden Grove Drain overtopped its banks during or following an extreme rainfall event. Flooding could be exacerbated by a blockage of the Llyndir Lane Culvert located adjacent to the north-western site boundary.

4.4 The PFRA contains no records of flooding at the site. Correspondence with Natural Resources Wales (NRW) included in Appendix C states that 'we have no record of historic flooding affecting this site, however, land in the adjacent fields to the south were flooded in 2000.'

Waterco Modelled Flood Maps

4.5 An integrated 1-Dimension / 2-Dimensional (1D/2D) hydrodynamic model of Golden Grove Drain and the surrounding flood plain has been constructed to estimate flood levels for the site. The modelling results, including flood depth, velocity and hazard mapping are included in Appendix D, with map extracts provided overleaf.

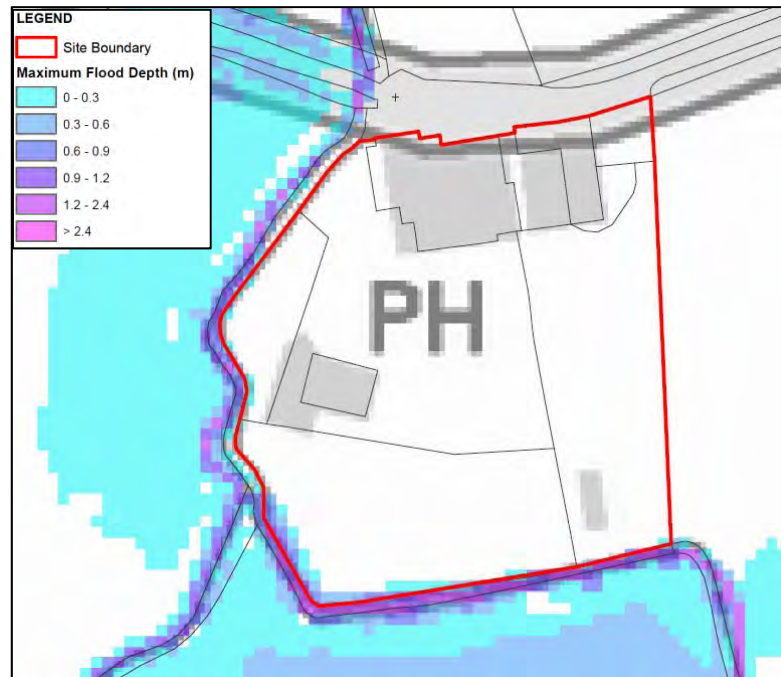


Figure 1 – Maximum Flood Depth – 1% AEP + CCA event

- 4.6 As shown in Figure 1, the site is shown to be flood free during the 1% AEP + CCA event. Access to the site is also shown to be flood free.

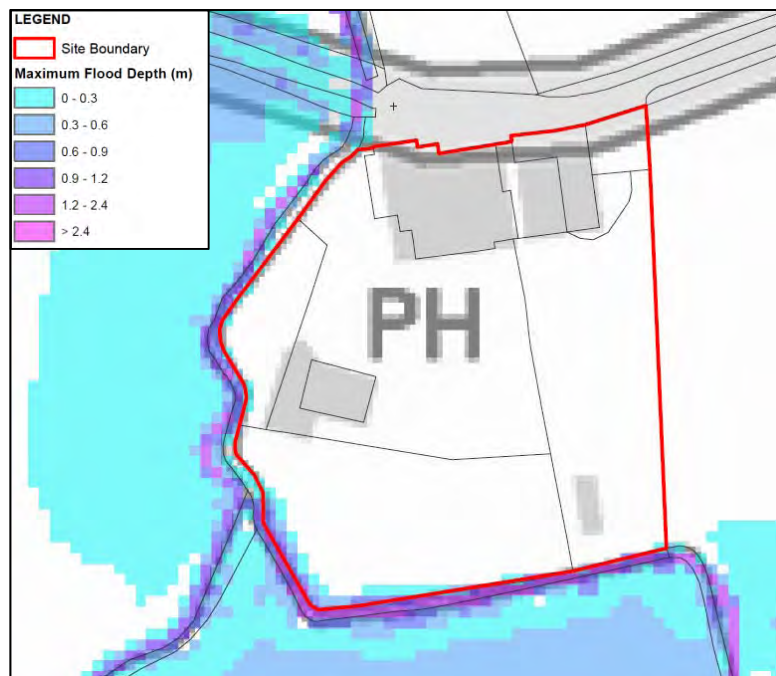


Figure 2 – Maximum Flood Depth – 0.1% AEP event

- 4.7 As shown in Figure 2, the site is shown to be flood free during the extreme 0.1% AEP event. Access to the site is also shown to be flood free.

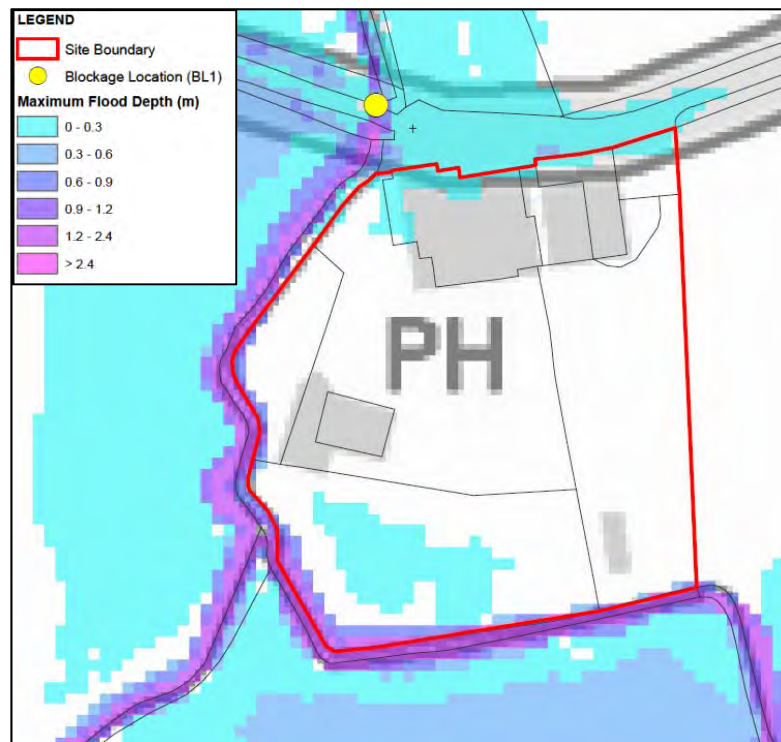


Figure 3 – Maximum Flood Depth – 1% AEP + CCA event – 100% Blockage of the Llyndir Lane Culvert

4.8 As shown in Figure 3, the northern and southern extents of the site are shown to flood during the 1% AEP + CCA event including a 100% blockage of the Llyndir Lane Culvert. The access to the site is also shown to flood. However flood depths in the northern extent of the site do not exceed 50mm, with flood depths in the southern extent of the site not exceeding 170mm. Maximum velocities do not exceed 0.1m/s and the overall hazard rating for the site and access during this event is low.

4.9 It can be concluded that the site is at low risk of fluvial flooding.

Tidal

4.10 The site is located at a minimum of 12.5m AOD and over 13km from the nearest tidal estuary. The site is therefore not at risk from tidal flooding.

Pluvial flooding

4.11 This is defined as local flooding in areas not normally associated with natural or manmade watercourses, which result from rainfall-generated overland flow before the runoff enters any watercourse or sewer. It is usually associated with high intensity rainfall events, but can also occur with lower intensity rainfall or melting snow, where the ground is saturated, frozen or developed, resulting in overland flow and ponding in depressions in topography. Pluvial

flooding is unpredictable to the extent that the localised heavy rainfall can occur anywhere without any warning. However, flow paths and depths can be determined by consideration of contours and relative levels.

- 4.12 The Homecheck Report (Appendix E) shows that the southern extent of the site is at risk of surface water flooding during the 1 in 75, 1 in 200 and 1 in 1000 year events. The EA 'Risk of Flooding from Surface Water' map (Appendix C) shows the site is at very low risk of surface water flooding. The high risk to the south and western extent of the site is associated with Golden Grove Drain.
- 4.13 The PFRA contains no records of surface water flooding at or near to the site. Any potential surface water flooding arising at or near to the site would be directed south-west, into Golden Grove Drain, following the local topography.
- 4.14 It can therefore be concluded that the risk of pluvial flooding is low.

Groundwater flooding

- 4.15 Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.
- 4.16 The Homecheck Report (Appendix E) shows that the site is at moderate risk of groundwater flooding. This is likely due to the site's proximity to Golden Grove Drain. Groundwater levels will correspond with river levels, and as such during periods of high flow, surrounding ground levels are likely to be high. The PFRA states that 'there were no records of past groundwater flooding within WCBC; this is due to the topography and geology of the area'.
- 4.17 It can therefore be concluded that the risk of groundwater flooding is low.

Sewer flooding

- 4.18 Flooding from a sewer can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged or is of inadequate capacity. This is mostly applicable to combined and surface water sewers.
- 4.19 The Dwr Cymru Welsh Water (DCWW) sewer plans show that there are no public sewers within the vicinity of the site. Therefore there is no public sewer infrastructure in the vicinity of the site that could cause sewer flooding. The SFRA and PFRA contain no records of sewer

flooding at or near to the site. It can therefore be concluded that the risk of sewer flooding is low.

Artificial sources of flooding

- 4.20 There are no canals in this area. The EA Flooding from Reservoirs Map (included in Appendix C) shows the site is not at risk of flooding from reservoirs. Therefore the probability of flooding from artificial sources is low.

Summary of Potential Flood Sources

- 4.21 It can be concluded that flooding from Golden Grove Drain during the 1% AEP + CCA event including a 100% blockage of the Llyndir Lane culvert is considered to be the main potential source of flooding at this site. However, the site remains flood free during the 1% AEP + CCA event and extreme 0.1% AEP event.

5 Acceptable Consequences for Nature of Use

- 5.1 In accordance with section A1.14 of TAN15 there is a frequency threshold of flooding below which flooding of development should not be allowed. The following table, taken from TAN15, provides indicative guidance as to what the frequency threshold could be for different types of development in terms of annual probability of occurrence.

Table 1 – TAN15 Flood frequency thresholds

Type of Development	Threshold Frequency (Years)	
	Fluvial	Tidal
Residential	1%	0.5%
Commercial/Retail	1%	0.5%
Industrial	1%	0.5%
Emergency Services	0.1%	0.1%
General Infrastructure	1%	0.5%

- 5.2 According to the table, no flooding should occur for residential development during the 1% AEP event for the lifetime of the development. As detailed in Section 4, no flooding occurs on site during the 1% AEP + CCA event and the development is therefore compliant with TAN15 for this event.

- 5.3 In accordance with section A1.15 of TAN15, beyond the threshold frequency (beyond the 1% AEP + CCA event in this case) the proposed development would be expected to flood under extreme conditions. The following table, taken from TAN15, provides indicative guidance on what is considered tolerable conditions for different types of developments.

Table 2 – TAN15 Tolerable conditions

Type of Development	Max depth of flooding (mm)	Max rate of rise of floodwaters (m/hr)	Max speed of inundation of flood risk area (hrs)	Max velocity of floodwaters (m/s)
	Property Access			Property Access
Residential (habitable rooms)	600 600	0.1	4	0.15 0.3
Commercial & Retail	600 600	0.3	2	0.15 0.3
Industrial	1000 1000	0.3	2	0.3 0.45
Emergency Services	450 600	0.1	4	0.15 0.3
General Infrastructure	600 600	0.3	2	0.3 0.3

- 5.4 The 0.1% AEP event has been used for the assessment under A1.15 of TAN15. No flooding occurs on site or at the site's access during the 0.1% AEP event and the development is therefore compliant with section A1.15 of TAN15.

6 Flood Resistant Design / Consideration of Layout

- 6.1 As described above, there is no flooding on site during the 1% AEP + CCA and 0.1% AEP events. No flooding is estimated in the location of the proposed buildings during a blockage scenario of the Llyndir Lane culvert. Therefore no specific flood mitigation measures are required.

7 No Increase in Flooding Elsewhere

- 7.1 The proposed development falls outside of the 0.1% AEP flood extent and is not located in the functional floodplain. Therefore the development will not be depriving flood storage space from the floodplain.
- 7.2 It is therefore reasonable to conclude that there will be no increase in flooding elsewhere as a result of the proposed development. Surface water runoff will be appropriately managed as discussed in the following section.

8 Surface Water – No Adverse Impact

- 8.1 The existing site consists of the Golden Grove Inn, a dwelling and associated outbuildings and is approximately 9.6% impermeable. The proposed development will increase the impermeable area by approximately 76m².
- 8.2 A comparison of the pre- and post-development runoff rates and volumes is provided below. The calculations are included in Appendix F. A 30% allowance for climate change has been included in the post-development calculations.

Table 3 – Comparison of pre- and post-development runoff rates

Event	Greenfield (l/s)	Post Development (l/s)	Change (l/s)
1-1yr	2.17	8.15	+5.98
1-30yr	4.69	19.51	+14.82
1-100yr	5.77	24.36	+18.59

Table 4 – Comparison of pre- and post-development runoff volumes

Event	Greenfield (m ³)	Post-development (m ³)	Change (m ³)
1-100 yr	175.97	255.82	+79.85

- 8.3 The figures show that the proposed development will increase the surface water runoff rates and volumes. In order to ensure this will not have an impact elsewhere, the runoff should be dealt with using appropriate sustainable drainage techniques to reduce the peak runoff rates.

8.4 In accordance with Building Regulations Part H, the following hierarchy of surface water disposal options have been considered and are discussed further below:

- 1) Soakaway
- 2) Watercourse
- 3) Sewer

Soakaway

8.5 The Cranfield University 'Soilscapes' map indicates that the site is underlain by 'loamy soils with naturally high groundwater'. Therefore the use of soakaways may not be a feasible option for the site.

8.6 It is recommended that infiltration tests are carried out in accordance with the BRE 365 specification to determine the feasibility of soakaways.

Watercourse

8.7 Where soakaways are not suitable, discharge to watercourse should be established. The nearest watercourses to the site are Golden Grove Drain and its unnamed tributary drain, located immediately adjacent to the western and southern boundaries of the site. Discharge of surface water to either watercourse appears to be the most practical option for the site.

8.8 In order to ensure no increase in flood risk elsewhere, surface water discharge will need to be restricted to greenfield runoff rates. The estimated 1 in 1 year greenfield runoff rate is 2.17 l/s. Where a runoff rate of less than 5 l/s is estimated, a runoff rate of 5 l/s should be applied in order to prevent siltation and pipe blockage.

Sewer

8.9 The final option considered for surface water disposal is sewer. The site is located in a rural area and there is no public sewer infrastructure within the vicinity of the site. As discharge to watercourse is a feasible option for the site, surface water disposal via sewer is not required.

Surface Water Storage

8.10 In order to achieve a discharge rate of 5 l/s, attenuation and flow control will be required. Attenuation storage could be provided in the form of geocellular storage and / or a pond. Flow control could be provided in the form of a hydrobrake (outflow orifice).

8.11 Attenuation storage calculations are included in Appendix G. The attenuation volume has been calculated for the 1% AEP storm event including a 30% CCA.

- 8.12 An estimated storage volume of 15m³ will be required for the proposed development. This volume is based on a limited discharge rate of 5 l/s and an impermeable drainage area of 655m² which accounts for all buildings.
- 8.13 The attenuation volume is provided for indicative purposes and should be verified when undertaking the detailed drainage design.

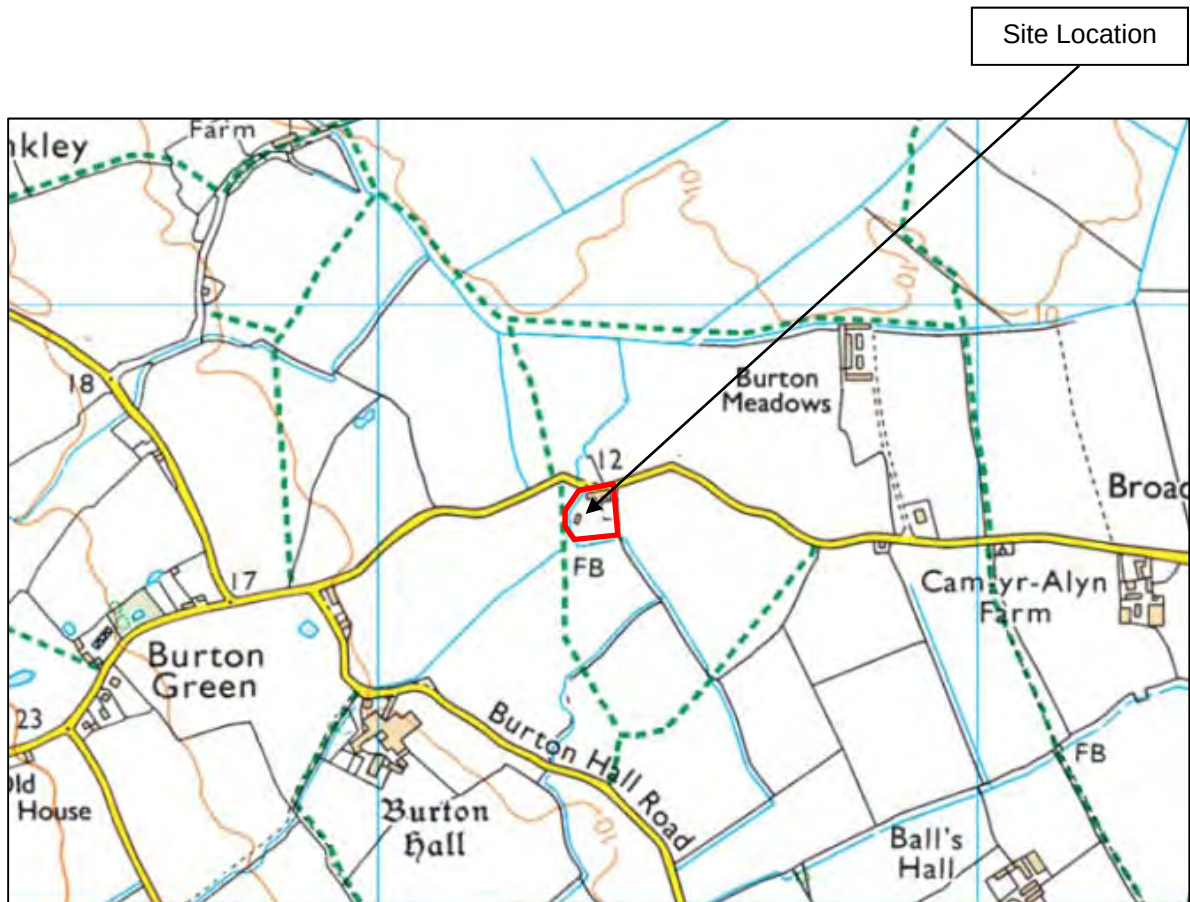
9 Summary and Conclusions

- 9.1 The proposed development at the former Golden Grove Inn, Rossett is located within Flood Zone C2 on the Welsh Government Development Advice Map and Flood Zone 2 on the EA Flood Map.
- 9.2 The existing site comprises of the Golden Grove Inn, a dwelling and associated outbuildings. The proposed development is for two detached dwellings with associated garages and landscaping. Plot 2 will include a half basement storey to the rear of the property. The proposed development is classified as 'highly vulnerable' development in accordance with TAN15.
- 9.3 All potential sources of flooding have been considered as part of this report including fluvial, tidal, pluvial, sewer, groundwater and artificial sources. The site is at low risk from all sources.
- 9.4 Hydraulic modelling of Golden Grove Drain has been undertaken by Waterco Consultants and shows that the site and its access are flood free during all fluvial events up to and including the extreme 0.1% AEP event.
- 9.5 There is some shallow depth flooding in the northern and southern extents of the site during a 100% blockage of the Llyndir Lane culvert coinciding with the 1% AEP + CCA event. The properties will be located outside of the 100% blockage flood extent. The development therefore achieves compliance with sections A1.14 and A1.15 of TAN15.
- 9.6 The site is not located within the extreme 0.1% AEP extent and therefore the development will not remove flood storage space from the floodplain.
- 9.7 The proposed development will increase the impermeable area of the site. This results in an increase in runoff rates and volumes. In order to ensure no increase in flood risk elsewhere, the increase in runoff rates and volumes will be dealt with through the use of sustainable drainage systems.
- 9.8 The most practical option for surface water disposal is soakaways (subject to infiltration tests). If surface water disposal via infiltration is not feasible, a connection to Golden Grove Drain or its unnamed tributary drain appears to be a practical option. In order to ensure the development does not increase flood risk elsewhere, surface water runoff rates should be restricted to 5 l/s.

10 Recommendations

- 10.1 Soil infiltration tests should be carried out in accordance with the BRE 365 specification to determine the feasibility of soakaways.
- 10.2 This Flood Consequences Assessment Report should be submitted to the Local Planning Authority in support of the planning application.

Appendix A – Site Location and Aerial Image



Location Plan

(Source: Street Map)

Site Location

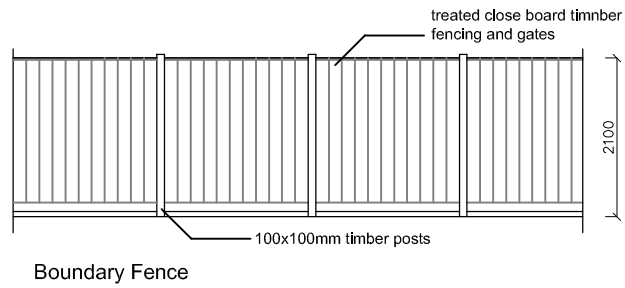
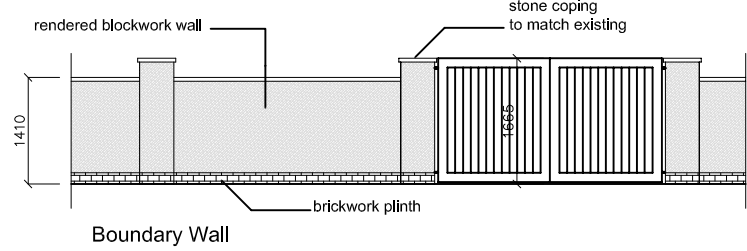


Aerial Photograph

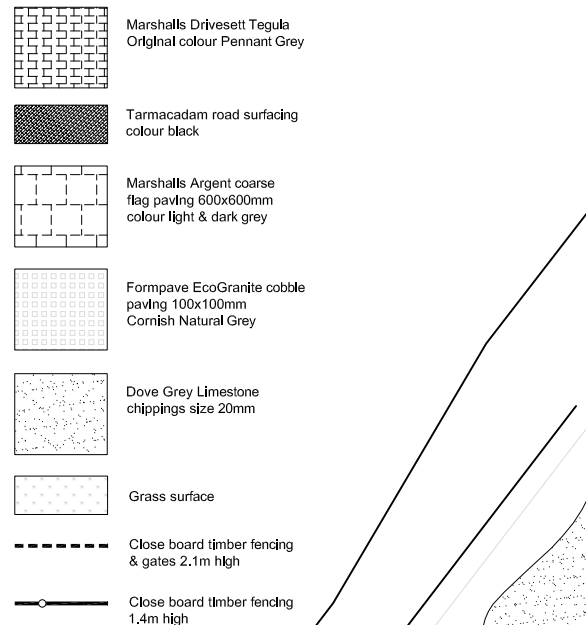
(Source: Bing Maps)

Appendix B – Proposed Development Plans

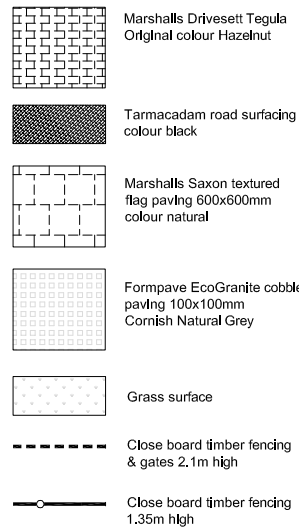
BOUNDARY TREATMENTS



LANDSCAPING KEY - PLOT 2



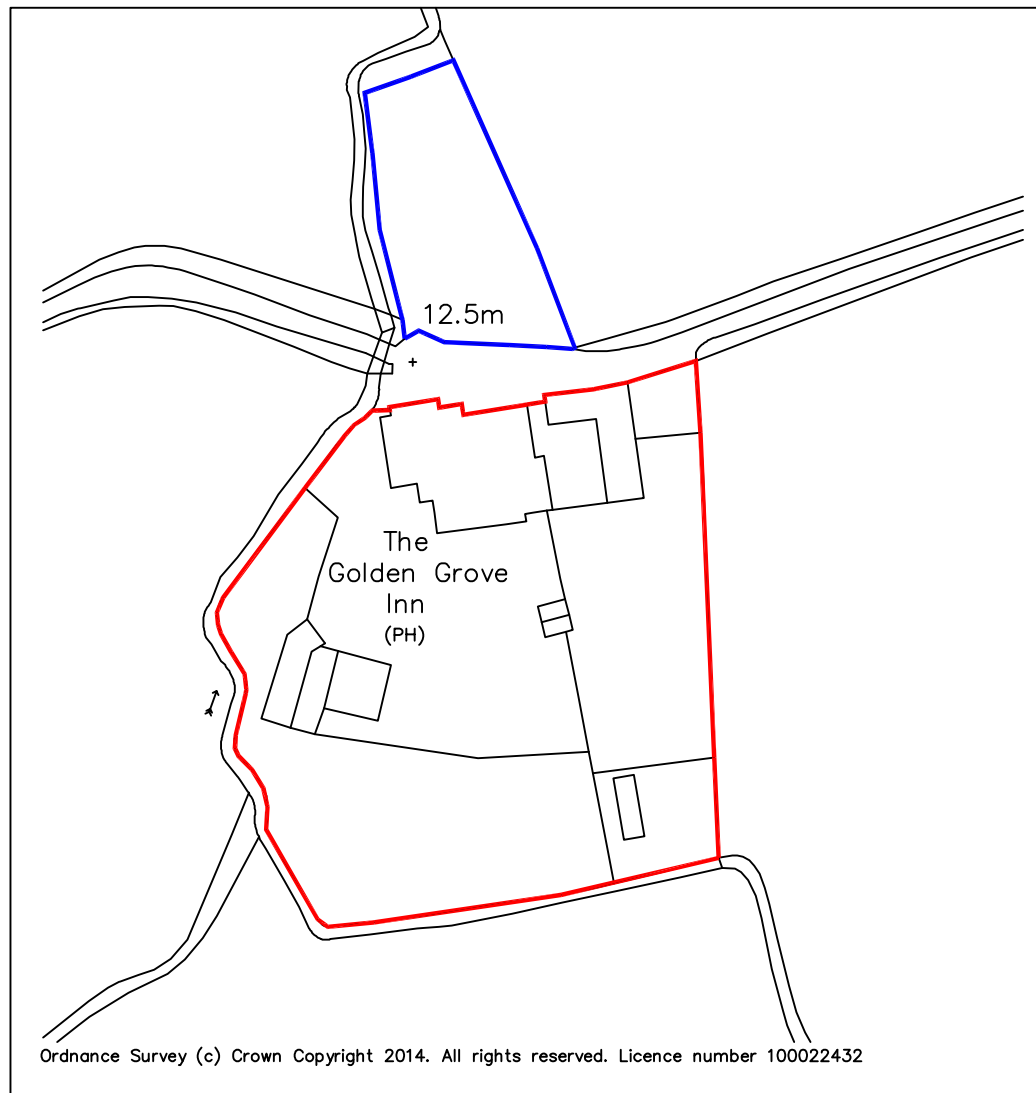
LANDSCAPING KEY - PLOT 1



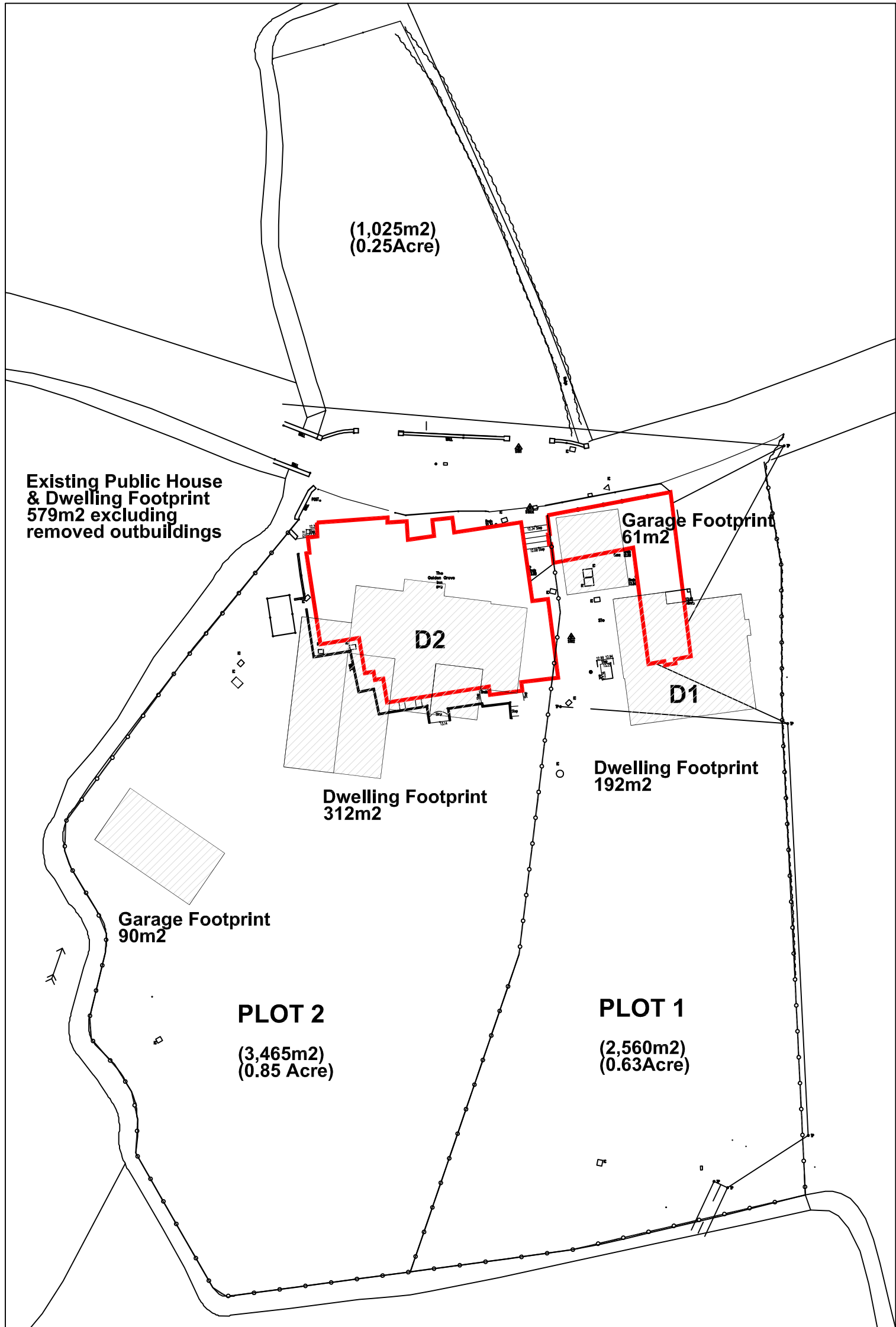
PLOT 1

PLOT 2

Site Plan [Scale 1:200]



Ordnance Survey Map [Scale 1:1250]



Site Plan Overlay Proposed Development - [Scale 1:500]

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2. DRAWINGS MUST BE READ IN ASSOCIATION WITH THE RELEVANT **HARDIE BRACK** SPECIFICATIONS & SCHEDULES OF WORKS.

3. THE DRAWINGS SHOULD NOT BE RECALLED FROM THE CONTRACTOR MUST SITE CHECK ALL DIMENSIONS PRIOR TO ORDERING MATERIALS. FIGURED DIMENSIONS ARE TO BE USED FOR TENDER PURPOSES ONLY. DISCREPANCIES MUST BE REPORTED IMMEDIATELY TO THE CONTRACT ADMINISTRATOR BEFORE PROCEEDING.

4. ALL BUILDING MATERIALS SPECIFIED SHALL COMPLY WITH THE REQUIREMENTS OF THE CURRENT BUILDING REGULATIONS, BRITISH STANDARDS, BRITISH STANDARDS CODES OF PRACTICE AND SHALL BE TO THE SATISFACTION OF THE LOCAL AUTHORITY BUILDING CONTROL OFFICERS & CONTRACT ADMINISTRATOR.

5. ALL STRUCTURAL WORKS ARE TO BE CARRIED OUT IN FULL ACCORDANCE WITH STRUCTURAL ENGINEERS APPROVED CALCULATIONS AND DETAILS AND TO THE SATISFACTION OF THE LOCAL AUTHORITY BUILDING CONTROL OFFICER.

6. DRAINAGE WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE HIGHWAY ACT 1959 & THE CONSTRUCTION DESIGN & MANAGEMENT (CDM) REGULATIONS 2007. THE CONTRACTOR SHALL NOT DISTURB ANY ASBESTOS PRODUCTS DURING THE WORKS. ANY DISCOVERY OF ASBESTOS OR SUSPECTED ASBESTOS PRODUCTS WHICH ARE DUE TO BE DISTURBED DURING THE WORKS SHALL IMMEDIATELY BE REPORTED TO THE CONTRACT ADMINISTRATOR. WHERE SPECIFIED WORKING WITH ASBESTOS SHALL BE CARRIED OUT IN FULL ACCORDANCE WITH THE CONTROL OF ASBESTOS REGULATIONS 2006.

7. THE PLANS MUST NOT BE ACTED UPON UNTIL THEY HAVE BEEN APPROVED IN ACCORDANCE WITH CLAUSE 14 & 12 (2) (b) OF BUILDING REGULATIONS. SHOULD THE OWNER OR CONTRACTOR COMMENCE WORK WITHOUT THE ABOVE APPROVALS, THEY DO SO AT THEIR OWN RISK.

8. TO BE READ IN CONJUNCTION WITH SPECIALIST DRAWINGS FOR STRUCTURAL, ENGINEERING, DRAINAGE AND SERVICES DESIGN.

Revision	Drawn by	Date	Details
Hardie Brack Pekin Building 23 Harrington Street Liverpool L2 9QA T : 0151 242 1500 F : 0151 231 1096 www.dearbrack.co.uk			
Client: Urban Developments			
Project Title: New Housing Development			
Site Location: Former Golden Grove Inn, Llyndir Lane, Rosset, Wrexham LL120AS			
Drawing Title: Site Layout & Landscaping as Proposed			
Scale:	Drawn:	Used:	Project No:
1:200 /500@ A1	GLM	06.10.14	PP14-1170
Drawing No:			Revision:
DC-01			-



Front Elevation as Proposed



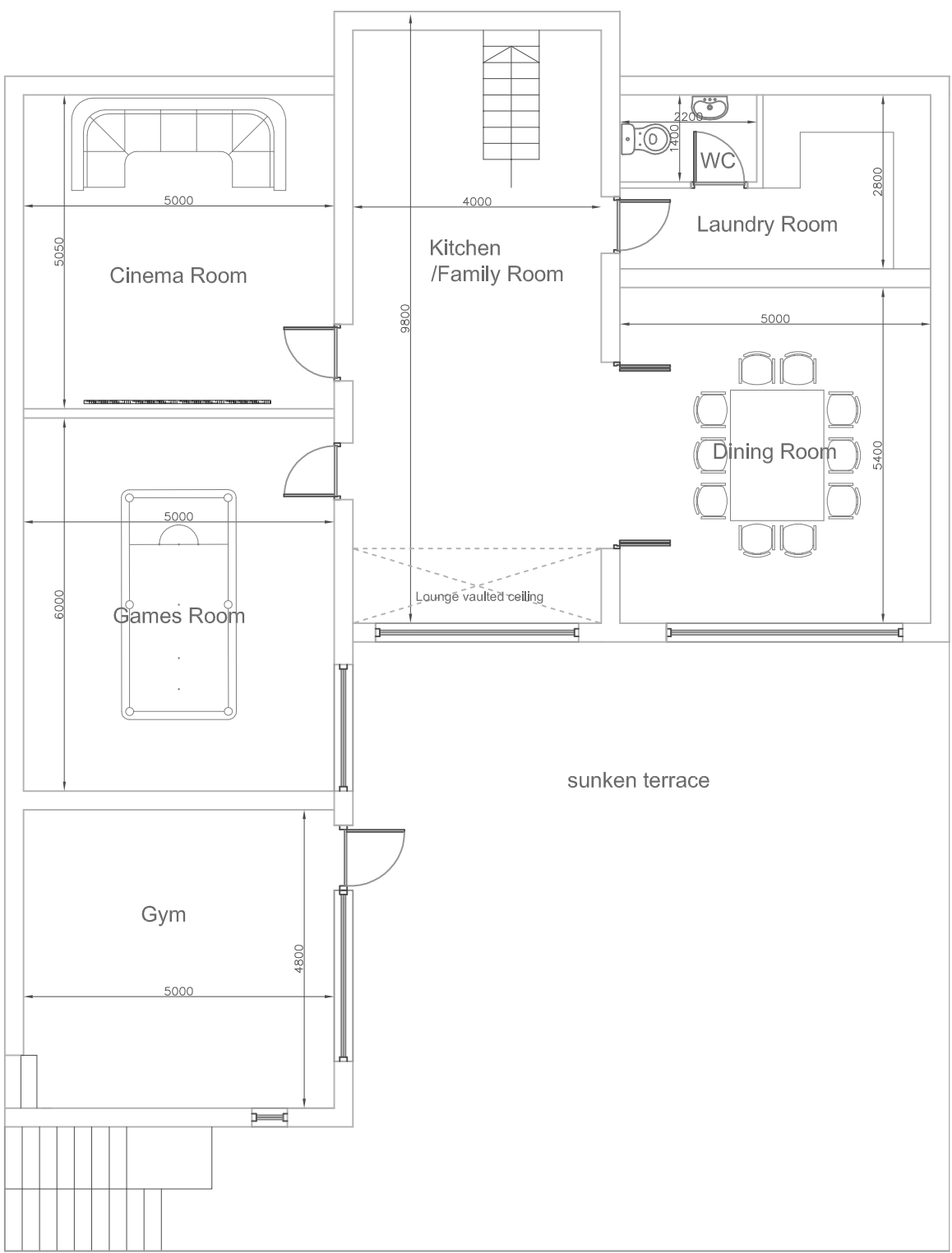
Right Side Elevation as Proposed



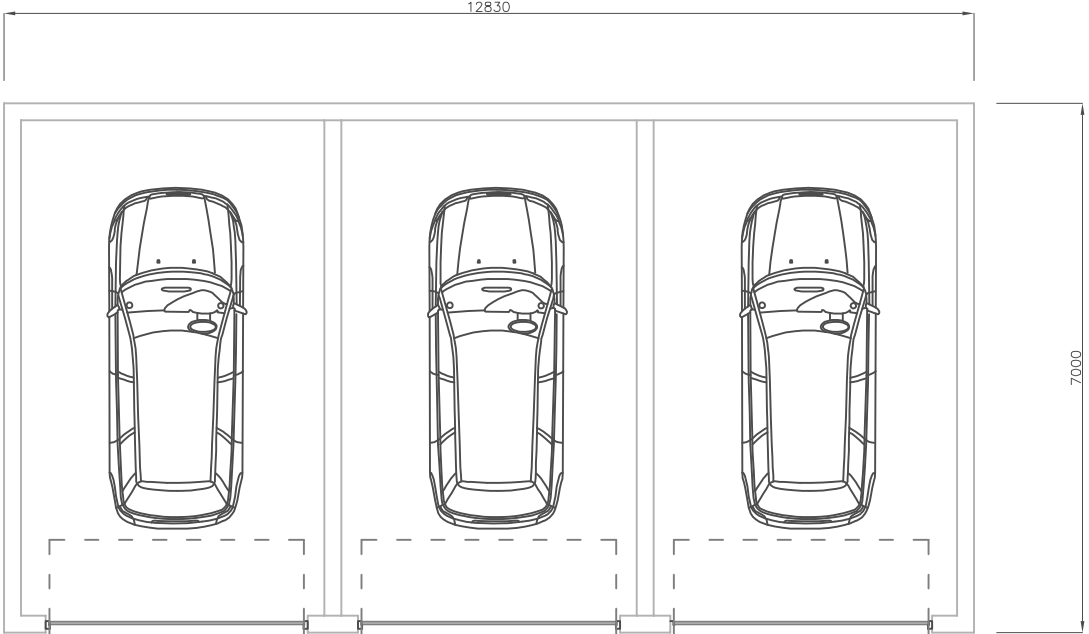
Rear Elevation as Proposed



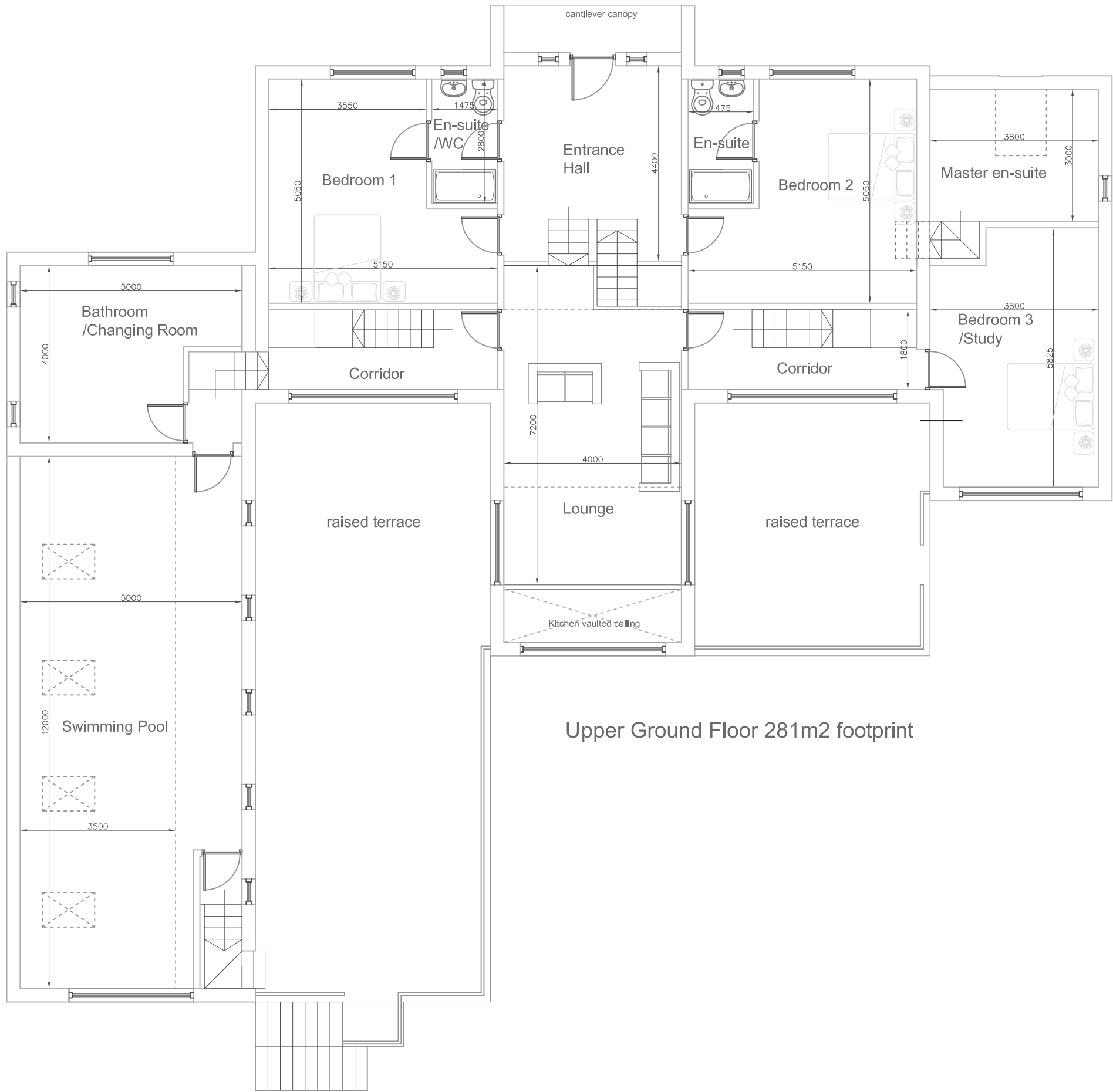
Left Side Elevation as Proposed



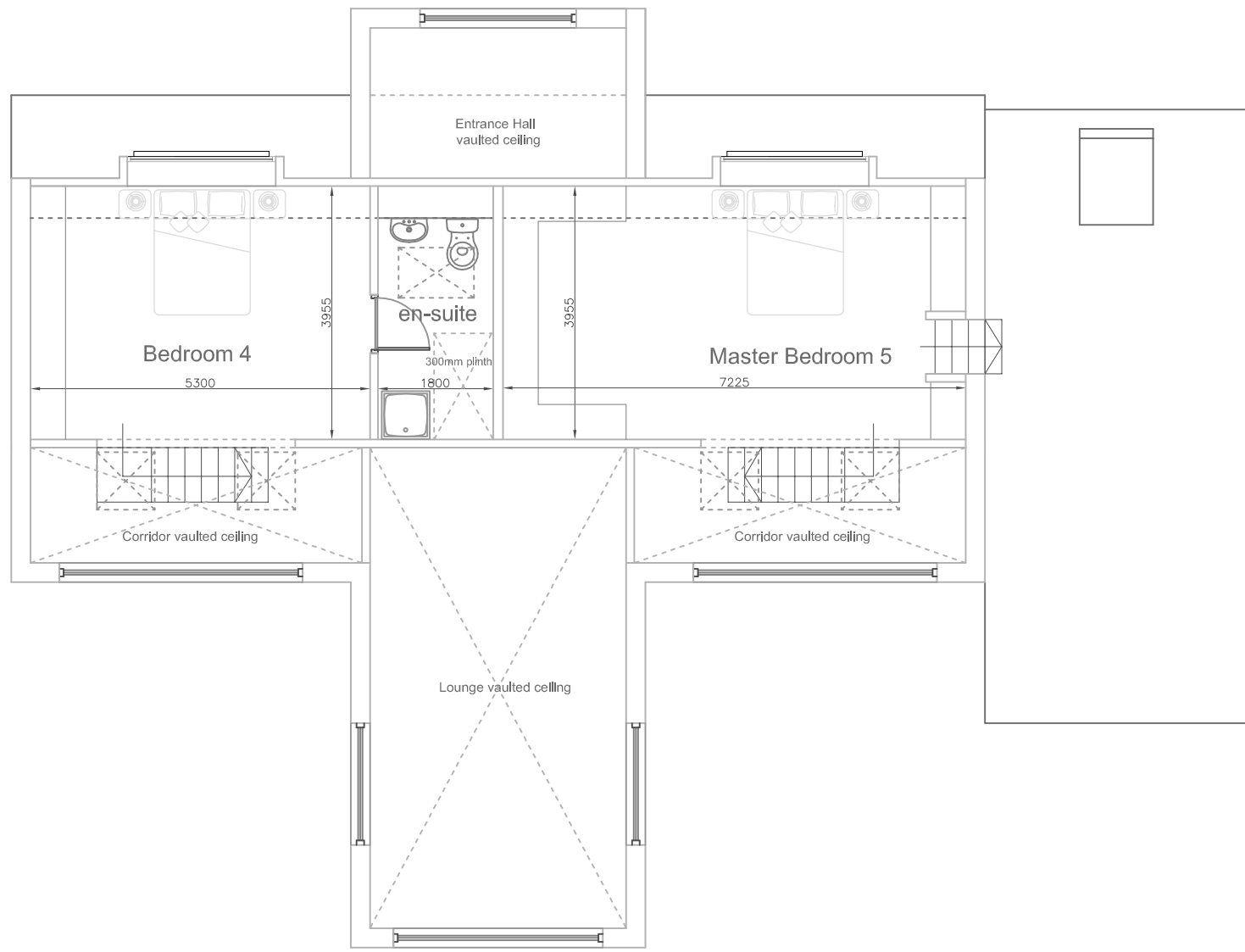
Lower Ground Floor 187m2 footprint



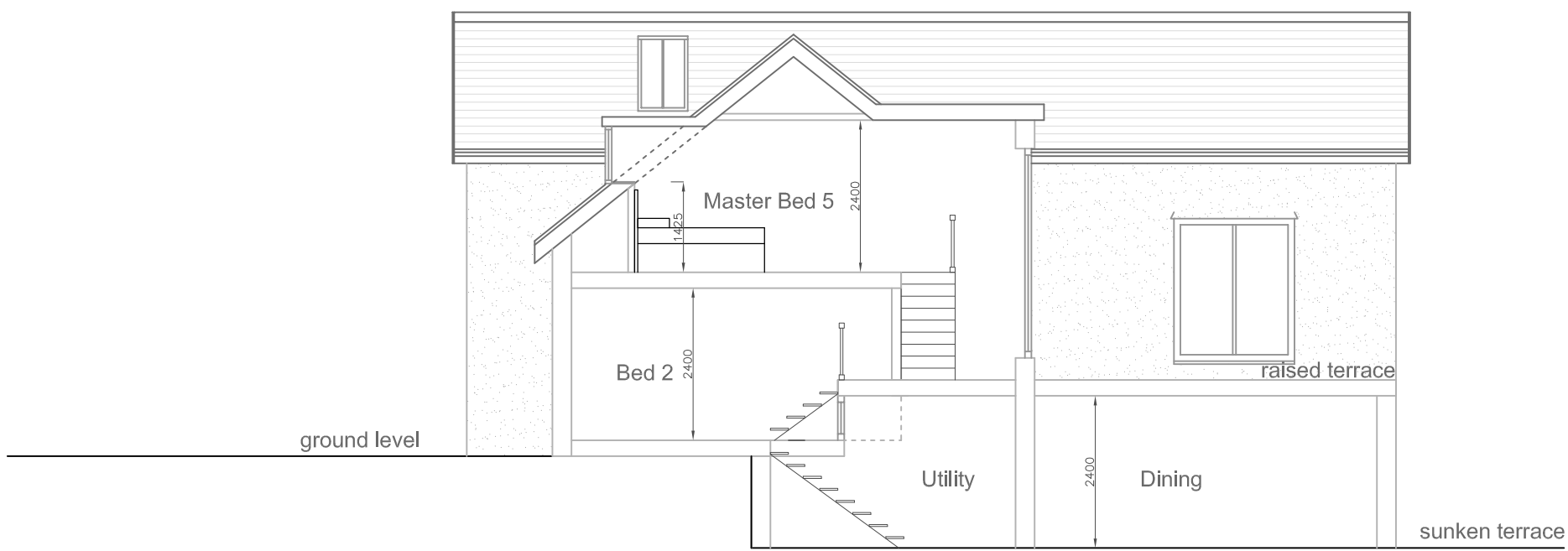
Plot 2 Garage Plan as Proposed (90m2 footprint)



Upper Ground Floor 281m2 footprint



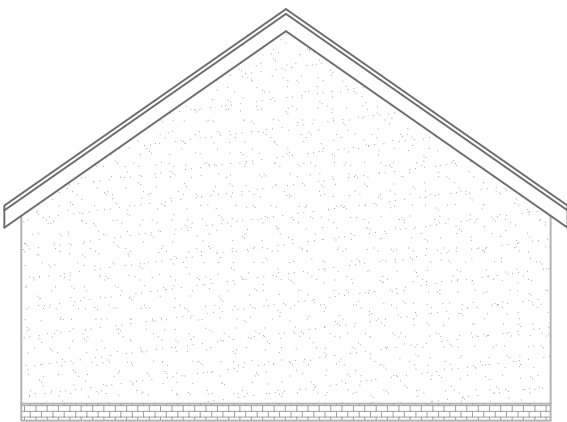
First Floor 64m2 footprint



Section Detail



Plot 2 Garage Front Elevation as Proposed



Plot 2 Garage Side Elevation as Proposed

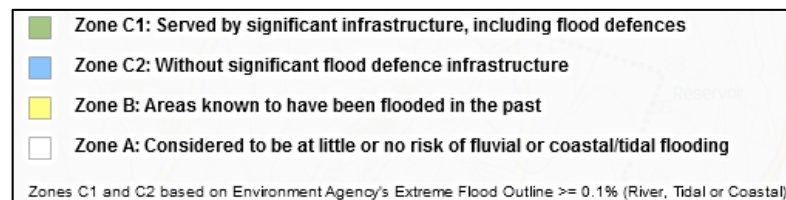
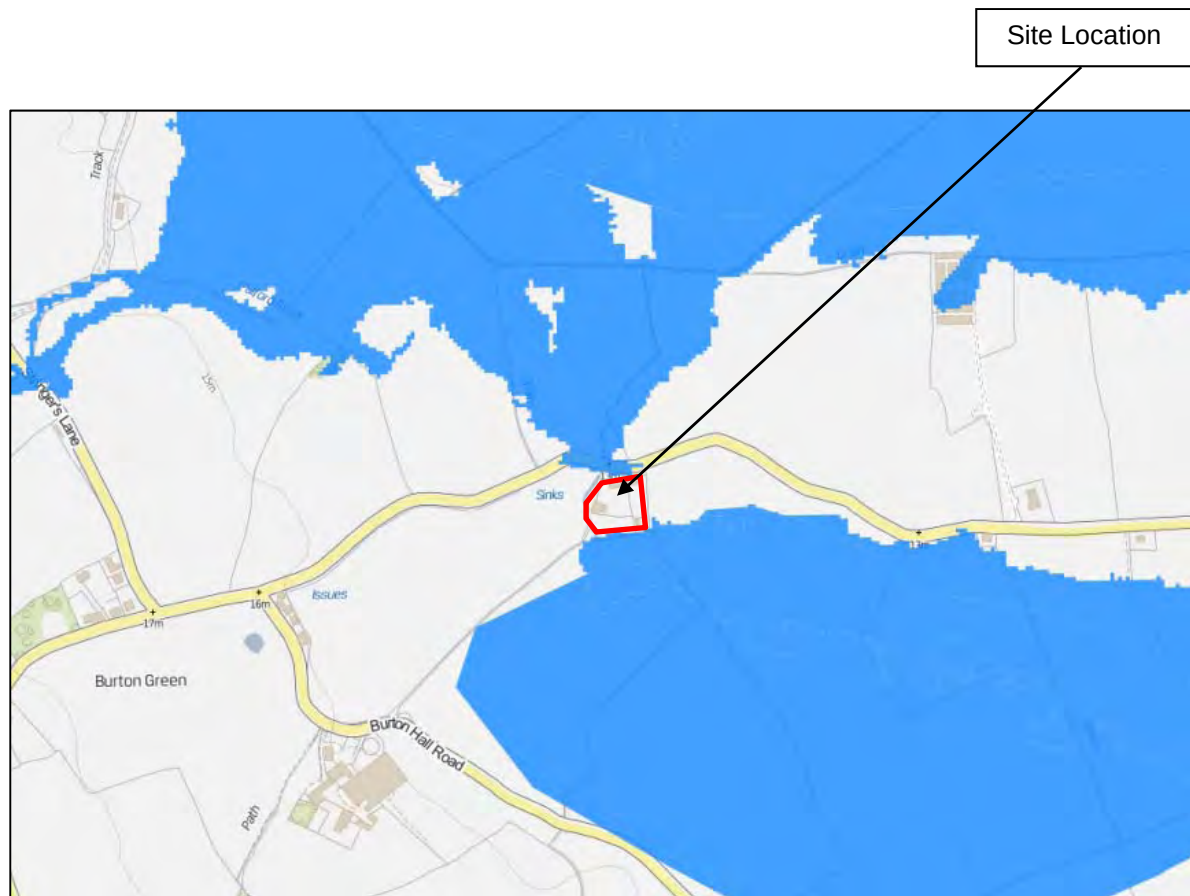


Enclosed Ibstock Bat Box 215x290mm
Designed specifically for the pipistrelle bat
Available colours in smooth blue, smooth gold & smooth red

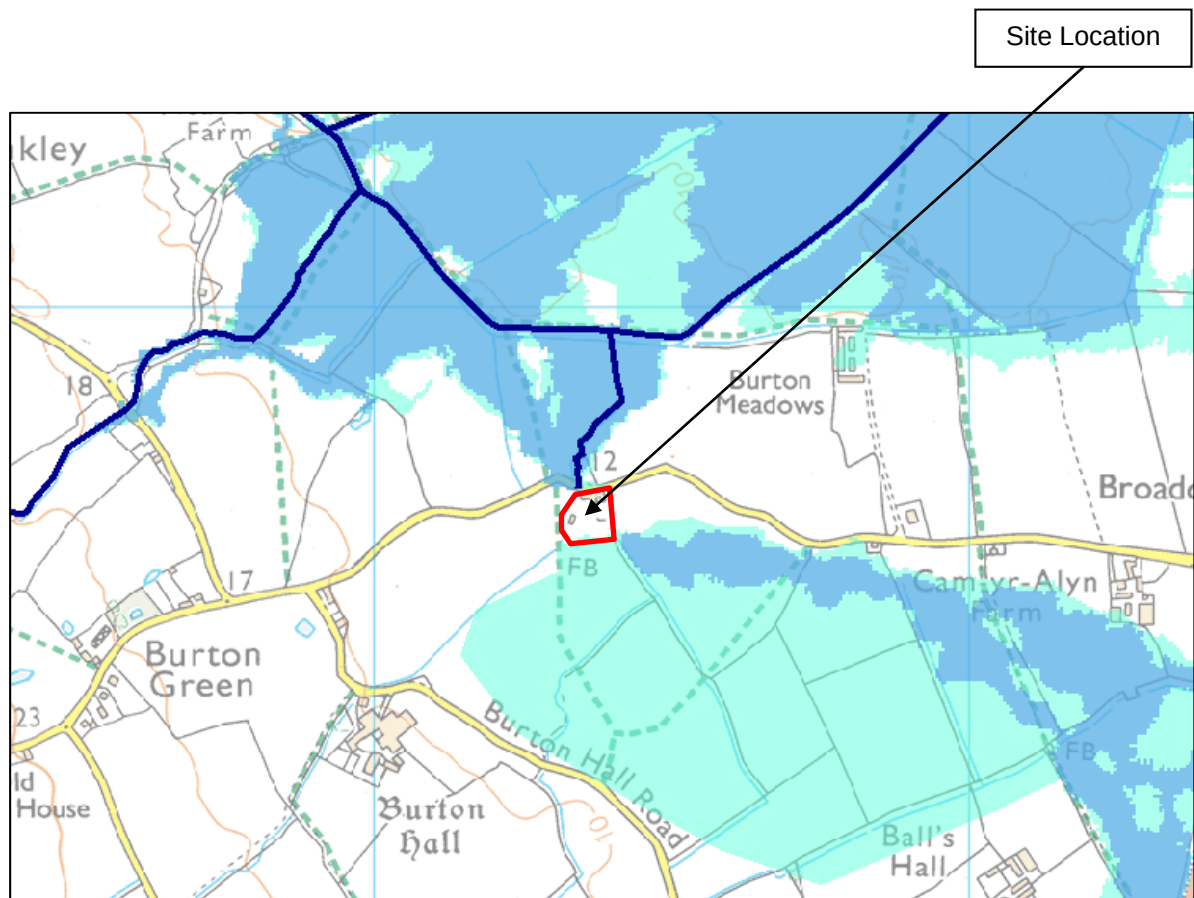
- DISCLAIMER**
- THIS DOCUMENT AND ALL DRAWINGS ARE COPYRIGHT OF **HARDIE BRACK** AND MAY NOT BE REPRODUCED WITHOUT THEIR SPECIFIC PERMISSION.
 - DRAWINGS MUST BE READ IN ASSOCIATION WITH THE RELEVANT **HARDIE BRACK** SPECIFICATIONS & SCHEDULE OF WORKS.
 - THE DRAWINGS SHOULD NOT BE SCALED FROM THE CONSTRUCTION MUST SITE CHECK ALL DIMENSIONS PRIOR TO ORDERING MATERIALS. FIGURED DIMENSIONS ARE TO BE USED FOR TENDRY PURPOSES ONLY. DISCREPANCIES MUST BE REPORTED IMMEDIATELY TO THE CONTRACT ADMINISTRATOR BEFORE PROCEEDING.
 - ALL BUILDING MATERIALS SPECIFIED SHALL COMPLY WITH THE REQUIREMENTS OF THE CURRENT BUILDING REGULATIONS, BRITISH STANDARDS, BRITISH STANDARD CODES OF PRACTICE AND SHALL BE TO THE SATISFACTION OF THE LOCAL AUTHORITY BUILDING CONTROL OFFICER & CONTRACT ADMINISTRATOR.
 - ALL STRUCTURAL WORKS ARE TO BE CARRIED OUT IN FULL ACCORDANCE WITH STRUCTURAL ENGINEERS APPROVED CALCULATIONS AND DETAILS AND TO THE SATISFACTION OF THE LOCAL AUTHORITY BUILDING CONTROL OFFICER.
 - DEMOLITION WORKS TO BE CARRIED OUT IN ACCORDANCE WITH THE HANBY ACT 1974 & THE CONSTRUCTION DESIGN & MANAGEMENT (CDM) REGULATIONS AND THE CONTRACTOR SHALL NOT DISTURB ANY ASBESTOS PRODUCTS DURING THE WORKS. ANY DISCOVERY OF ASBESTOS OR SUSPECTED ASBESTOS PRODUCTS, WHICH ARE LIKELY TO BE DISTURBED DURING THE WORKS, SHALL IMMEDIATELY BE REPORTED TO THE CONTRACT ADMINISTRATOR, WHERE SPECIFIED WORKING WITH ASBESTOS SHALL BE CARRIED OUT IN FULL ACCORDANCE WITH THE CONTROL OF ASBESTOS REGULATIONS 2006.
 - THE PLANS MUST NOT BE ACTED UPON UNTIL THEY HAVE BEEN APPROVED IN ACCORDANCE WITH CLAUSE 14.12 (2) OF BUILDING REGULATIONS. SHOULD THE OWNER OR CONTRACTOR COMMENCE WORK WITHOUT THE ABOVE APPROVALS THEY DO SO AT THEIR OWN RISK.
 - TO BE READ IN CONJUNCTION WITH SPECIALIST DRAWINGS FOR STRUCTURAL, ENGINEERING, DRAINAGE AND SERVICES DESIGN.

A	glm	24.02.15	Bat boxes to gable elevations
Revision	Drawn by	Date	Details
Hardie Brack Pekin Building 23 Harrington Sreet Liverpool L2 9QA T : 0151 242 1500 F : 0151 231 1056 www.dearsbrack.co.uk			
ESIA			
Client: Urban Developments			
Project Title: New Housing Development			
Site Location: Former Golden Grove Inn, Llyndir Lane, Rosset, Wrexham LL120AS			
Drawing Title: Preliminary Plans & Elevations Plot 2 as Proposed			
Scale:	Drawn:	Used:	Project No:
1:100 @ A1	GLM	03.10.14	-
			DC-03
			A

Appendix C – Flood Maps and NRW Correspondence



Welsh Government TAN15 Development Advice Map
(June 2015)

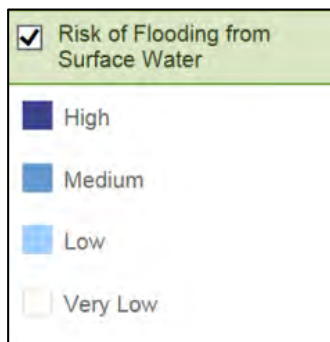


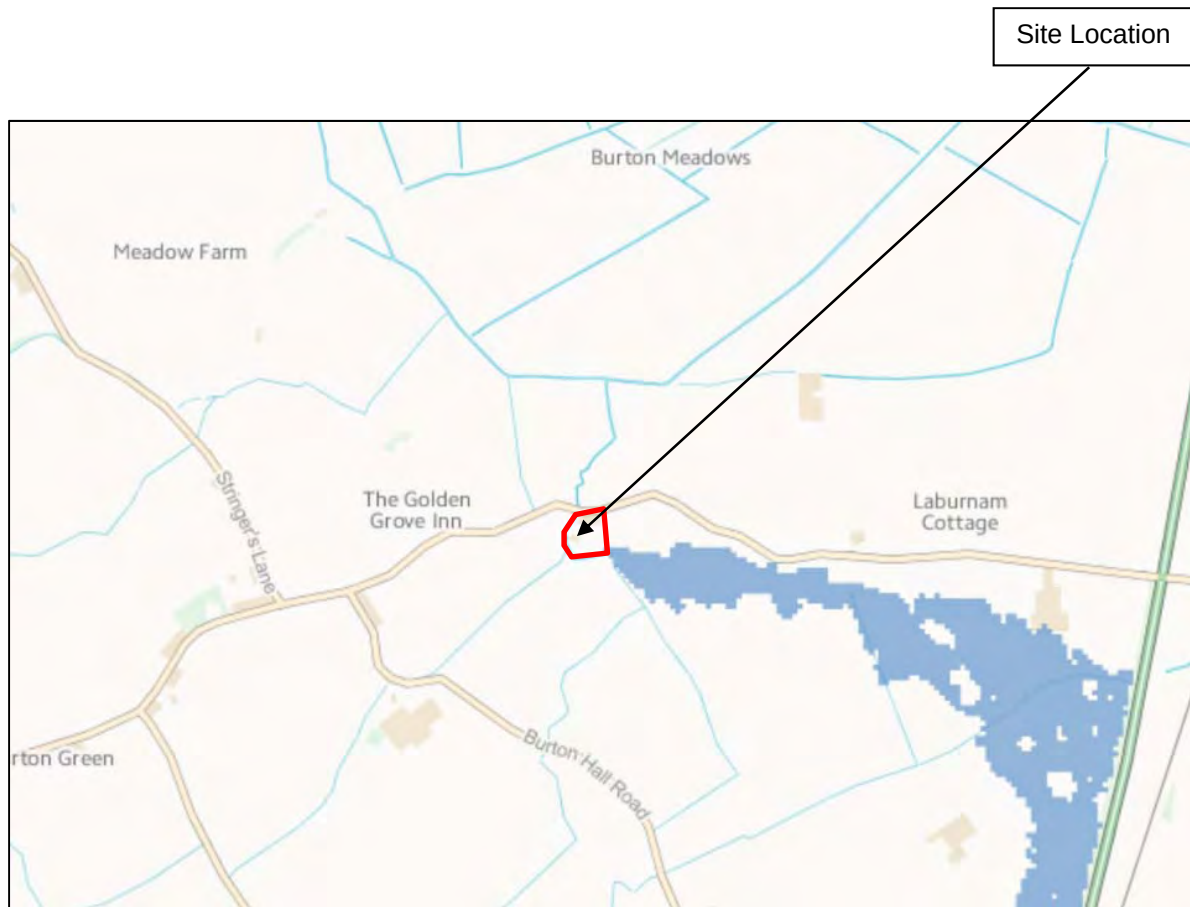
Environment Agency Flood Map for Planning (Rivers and Sea)
(June 2015)

	Flooding from rivers or sea without defences
	Extent of extreme flood
	Flood defences
	Areas benefiting from flood defences



Environment Agency Risk of Flooding from Surface Water Map
(June 2015)





Environment Agency Risk of Flooding from Reservoirs Map
(June 2015)

Map legend	
☒	Risk of Flooding from Reservoirs
☐	Maximum extent of flooding

Jordan Jones

From: Thomas, Gareth <Gareth.Thomas@cyfoethnaturiolcymru.gov.uk>
Sent: 04 February 2015 12:12
To: Jordan Jones
Cc: Crump, Angharad
Subject: w1766 - Former Golden Grove Inn, Lyndir Lane, Rossett, LL12 0AS - Pre Planning Opinion (NT/2015/116645)
Attachments: image002.gif; DC-01 Site Plan.pdf
Categories: Information received

Dear Ms Jones,

Thank you for referring the above application, which we received on 12th January 2015.

We have the following comments:

Flood Risk

The site lies partially within Zone C2 as defined in TAN 15 Development & Flood Risk (2004) and shown on Welsh Government's Development Advice Map. This flood outline is based on Natural Resources Wales' 0.1% AEP present-day flood event outline. However, the existing flood outline (reflected in both the Floodmap and DAM) in the vicinity of the property is unlikely to reflect the true flood risk.

This is because the upstream extent of the flood model on the Golden Grove Drain is at the site's north-west corner, where this watercourse is no longer a main river, and so the flood risk associated with the reach of the river which flows along the southern and western boundary of the site is unknown.

We have no record of historic flooding affecting this site, however, land in the adjacent fields to the south were flooded in 2000.

Any FCA should be supported by additional flood risk modelling of the 'ordinary' reaches of Golden Grove Drain in the vicinity of the site and upstream as far as necessary to capture any overland flow routes which may affect the site. The FCA should consider the flood risk associated with blockage at the culvert where the watercourse leaves the site, and the effects of climate change on the flood risks. Please contact Lucy Stephenson, Flood Risk Analysis Engineer, on 0300 065 3873 should you wish to discuss this further.

Protected Species

There would be a need to demonstrate as part of any formal planning application for conversion or demolition of the existing buildings on site that the proposal would not be detrimental to the maintenance of the Favourable Conservation Status (FCS) of protected species, including bats. We recommend that you seek further advice from the Local Planning Authority's internal ecological adviser and/or third sector nature conservation organisations such as the local wildlife trust, RSPB, etc. The Wales Biodiversity Partnership's web site has guidance for assessing proposals that have implications for section 42 habitats and species (www.biodiversitywales.org.uk).

Foul Drainage

The foul drainage associated with this development will require a new Environmental Permit under the Environmental Permitting Regulations 2010, from Natural Resources Wales, unless an exemption

applies. The site already benefits from a discharge consent (CG0364101), for the discharge from the existing public house. The applicant is advised to contact Natural Resources Wales for further advice and to discuss the issues likely to be raised. You should be aware that a permit may not be granted. Additional guidance on 'Environmental Permitting' can be accessed:

<http://www.environment-agency.gov.uk/business/sectors/32320.aspx>.

Please note that our comments are without prejudice to any comments we may wish to make when consulted on any planning application for development on this land. At that time there may be new information available which we will need to take into account in making a formal response.

Kind regards,

Gareth Thomas

Swyddog Cyswllt Cynllunio / Planning Liaison Officer

Cyfoeth Naturiol Cymru / Natural Resources Wales

Ffôn/Tel: (0300) 065 3786 **Siaradwr Cymraeg / Welsh Speaker** 

E-bost/E-mail: Gareth.Thomas@cyfoethnaturiolcymru.gov.uk Gareth.Thomas@naturalresourceswales.gov.uk

Gwefan / Website: www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

Ein diben yw sicrhau bod adnoddau naturiol Cymru yn cael eu cynnal, eu gwella a'u defnyddio yn gynaliadwy, yn awr ac yn y dyfodol.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

From: Jordan Jones <jordan.jones@waterco.co.uk>

Sent: 12 January 2015 12:11

To: Planning

Subject: w1766 - Former Golden Grove Inn, Lyndir Lane, Rossett - Pre Planning Opinion

Proposed residential development at the former Golden Grove Inn, Lyndir Lane, Rossett, Wrexham, LL12 0AS.

Grid Ref: 335371E, 358658N.

Dear Sir / Madam,

Please could you provide me with a Pre-Planning Opinion for a site at the above address.

The proposed development is for two residential properties with associated parking facilities and landscaping. I have attached a proposed site plan for reference.

Please could you advise if there will be any specific requirements for a Flood Consequences Assessment at this site and if you have any records of historical flooding in this area.

If you have any questions or require any further information, please do not hesitate to contact me.

Kind Regards,

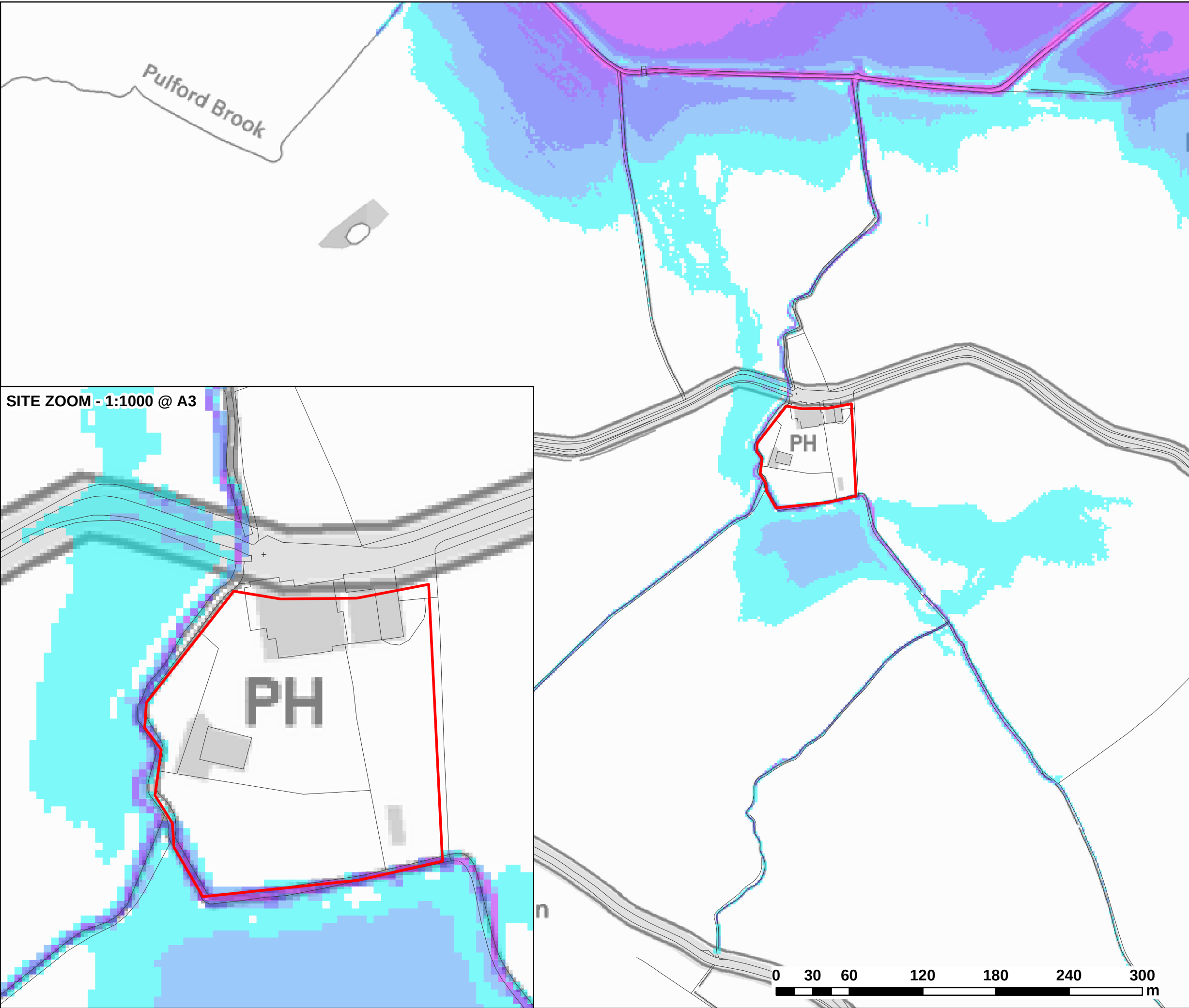
Jordan Jones

For email confidentiality, limitations and company details please see our [disclaimer webpage](#).
Registered in Wales under company no. 3577754.



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Appendix D – Hydraulic Modelling Results



LEGEND

Site Boundary

Maximum Flood Depth (m)

0 - 0.3

0.3 - 0.6

0.6 - 0.9

0.9 - 1.2

1.2 - 2.4

> 2.4



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

PLOT TITLE:

MAXIMUM FLOOD DEPTH
1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS

PLOT STATUS:

ISSUE

DRAWN:
RCL

CHECKED:
JJ

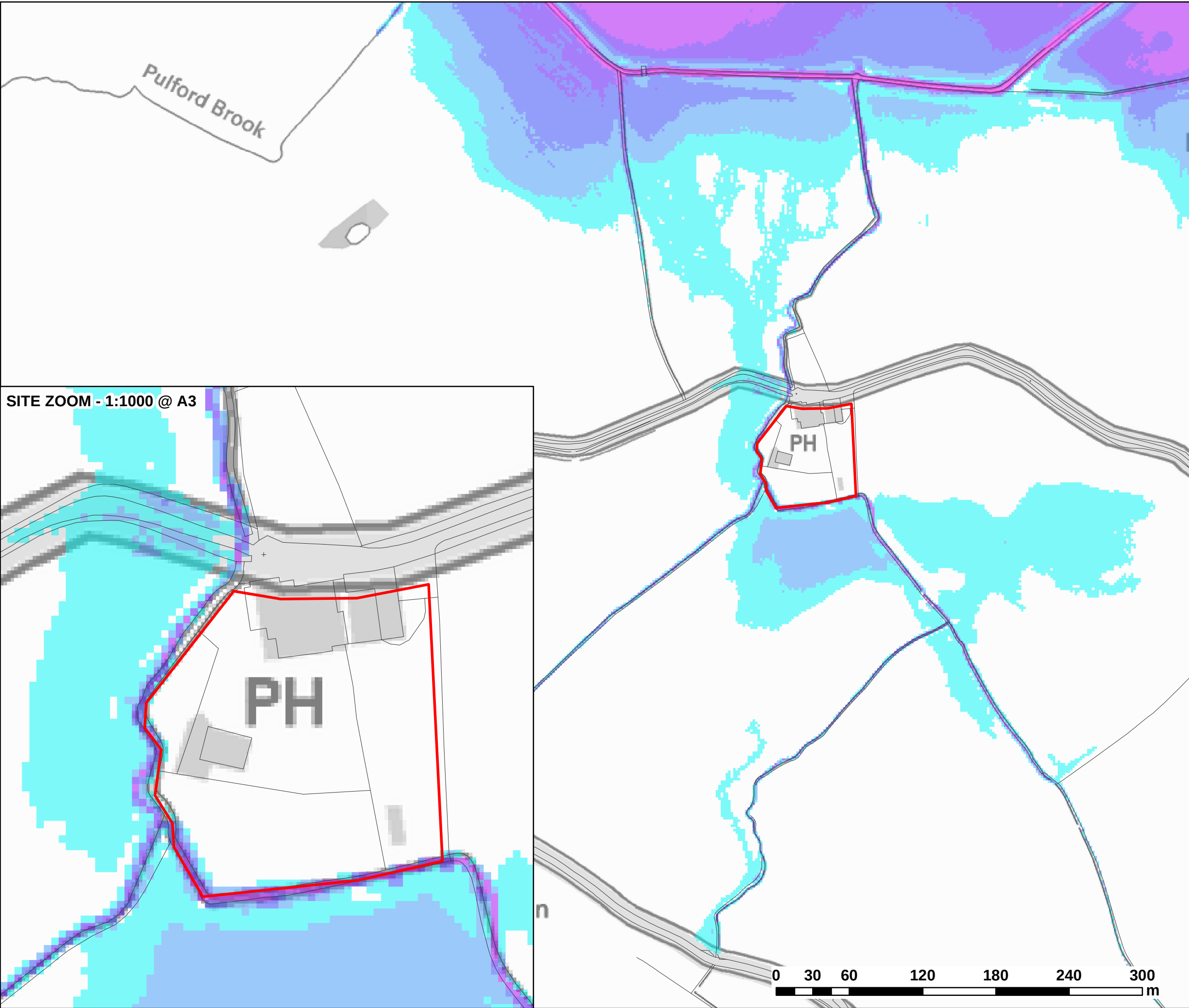
APPROVED:
RCL

PLOT SCALE @ A3:
1:3,000
(UNLESS STATED OTHERWISE)

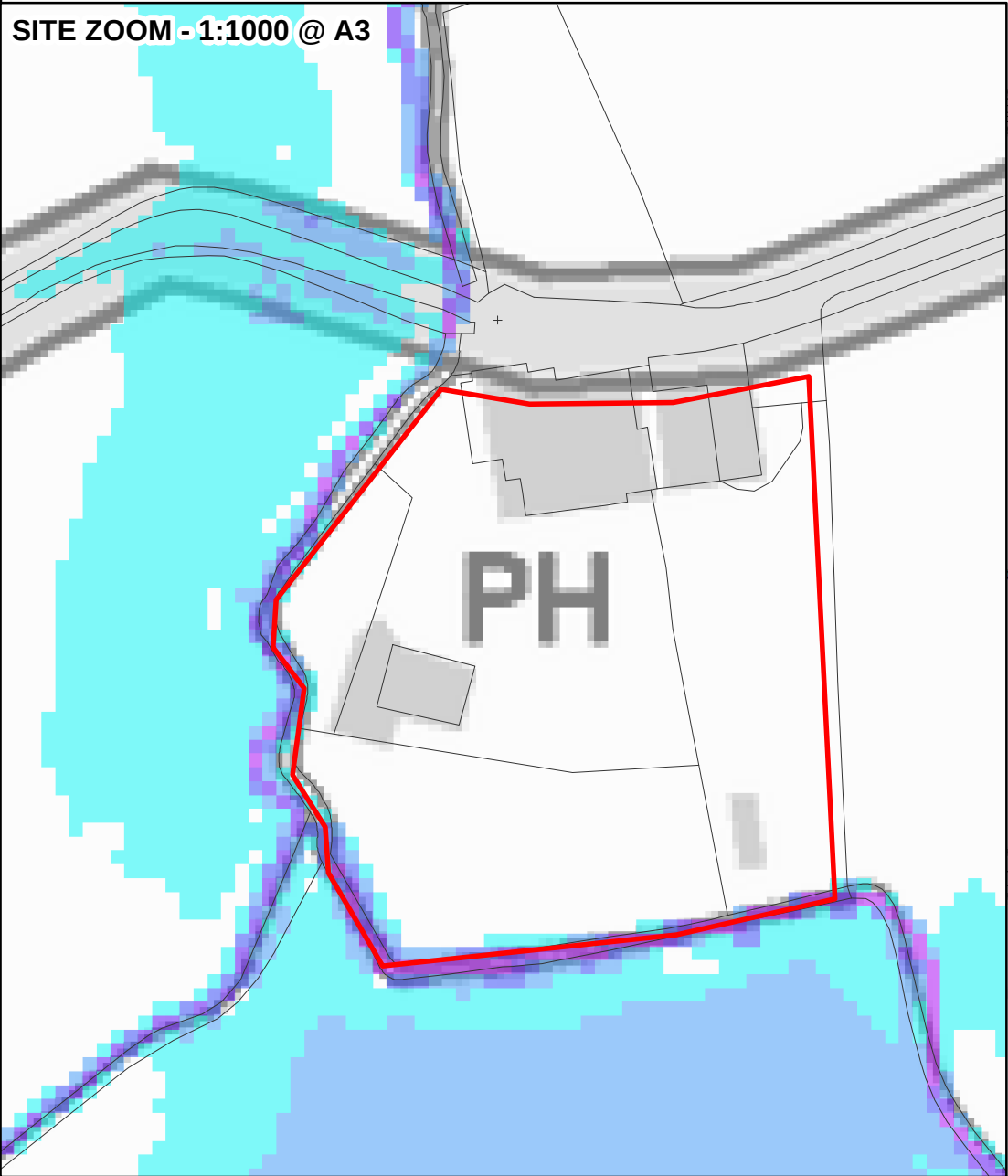
DATE:
28/05/2015

PLOT NAME:
W3178-Q100-EXT-D

REV:
-



SITE ZOOM - 1:1000 @ A3



LEGEND

Site Boundary

Maximum Flood Depth (m)

- 0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- 1.2 - 2.4
- > 2.4



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

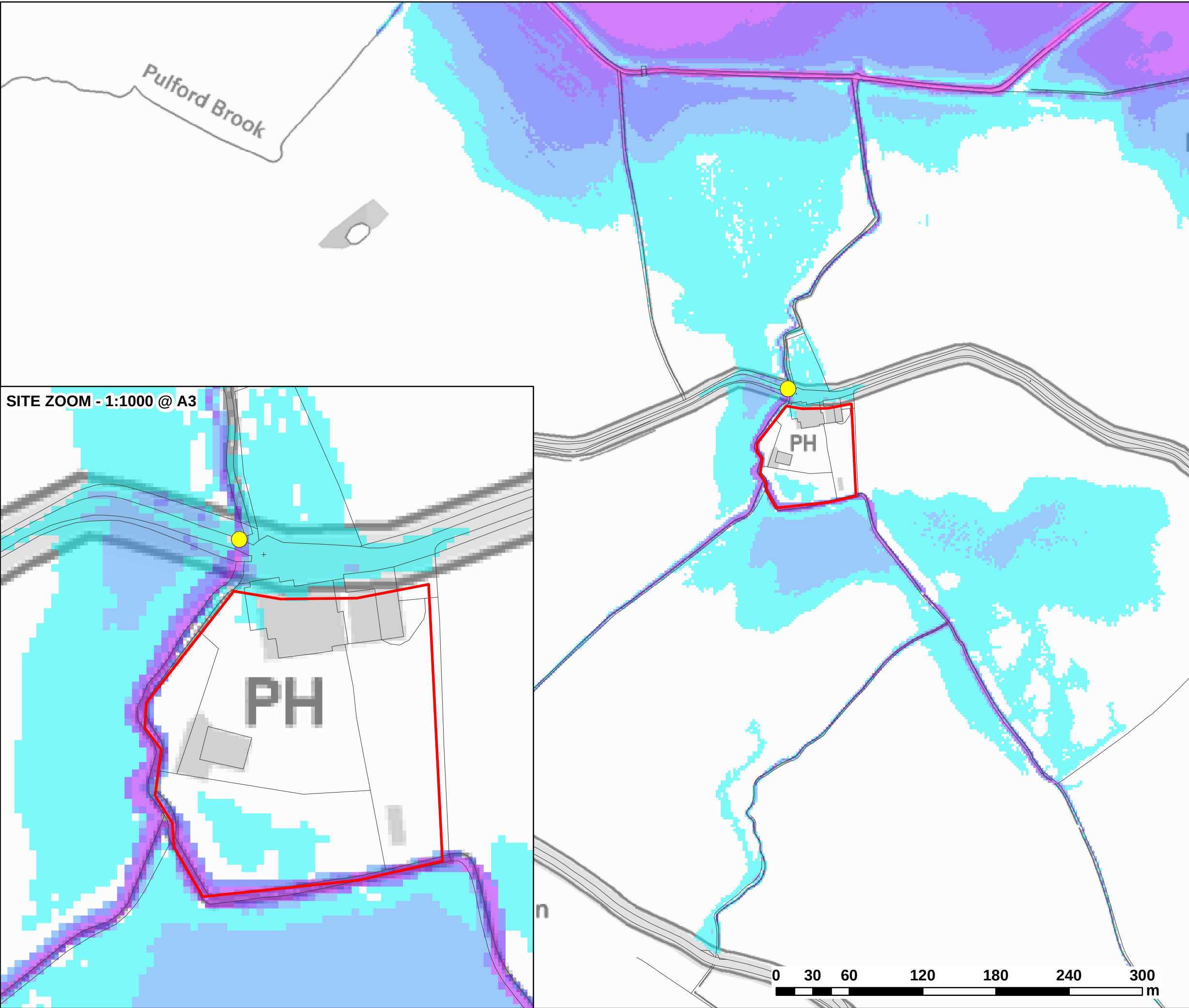
PLOT TITLE:

**MAXIMUM FLOOD DEPTH
1% AEP + CCA FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-EXT-D	REV: -	



LEGEND

Site Boundary

Blockage Location (BL1)

Maximum Flood Depth (m)

0 - 0.3

0.3 - 0.6

0.6 - 0.9

0.9 - 1.2

1.2 - 2.4

> 2.4

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd

Eden Court, Ruthin, LL15 1NJ

01824 702220

www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

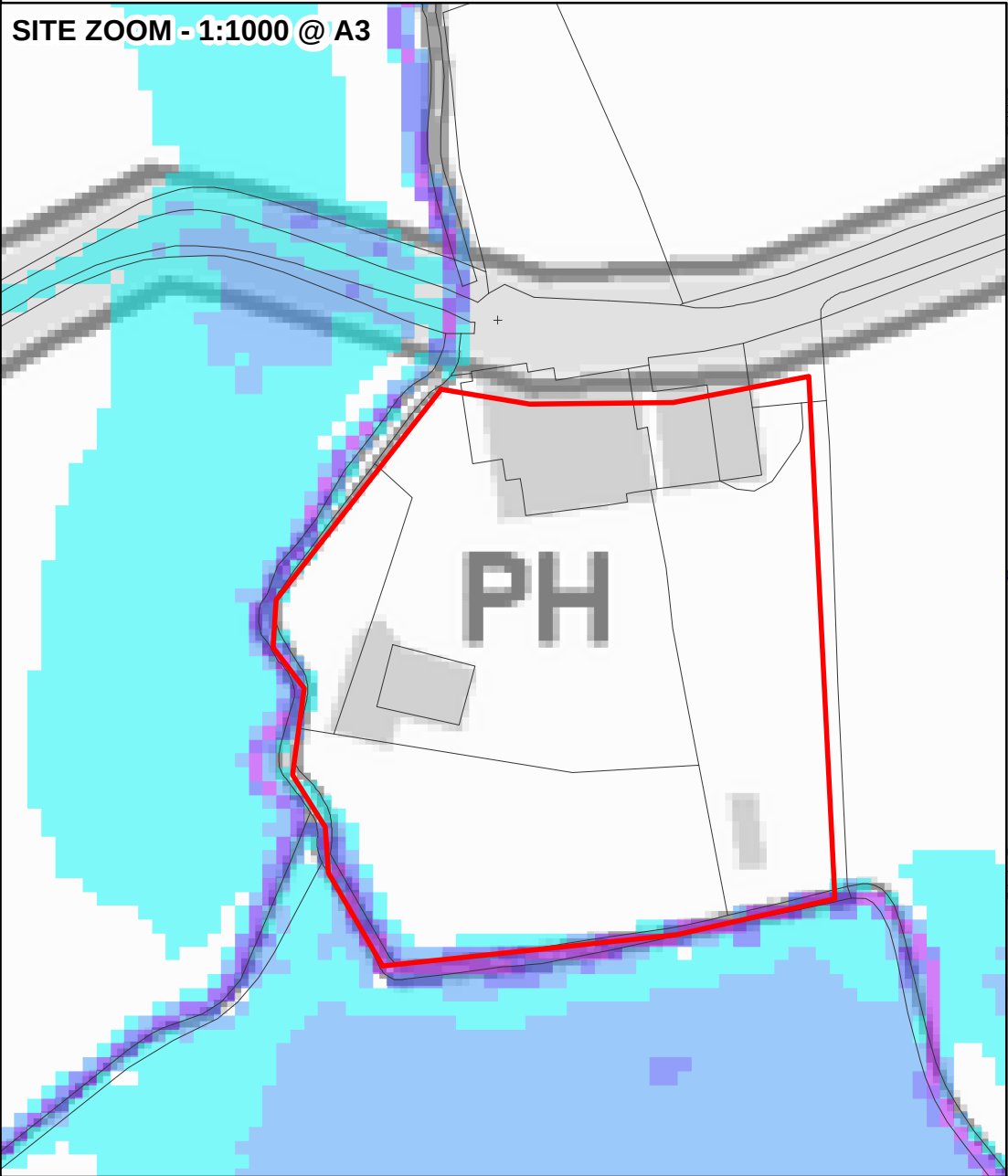
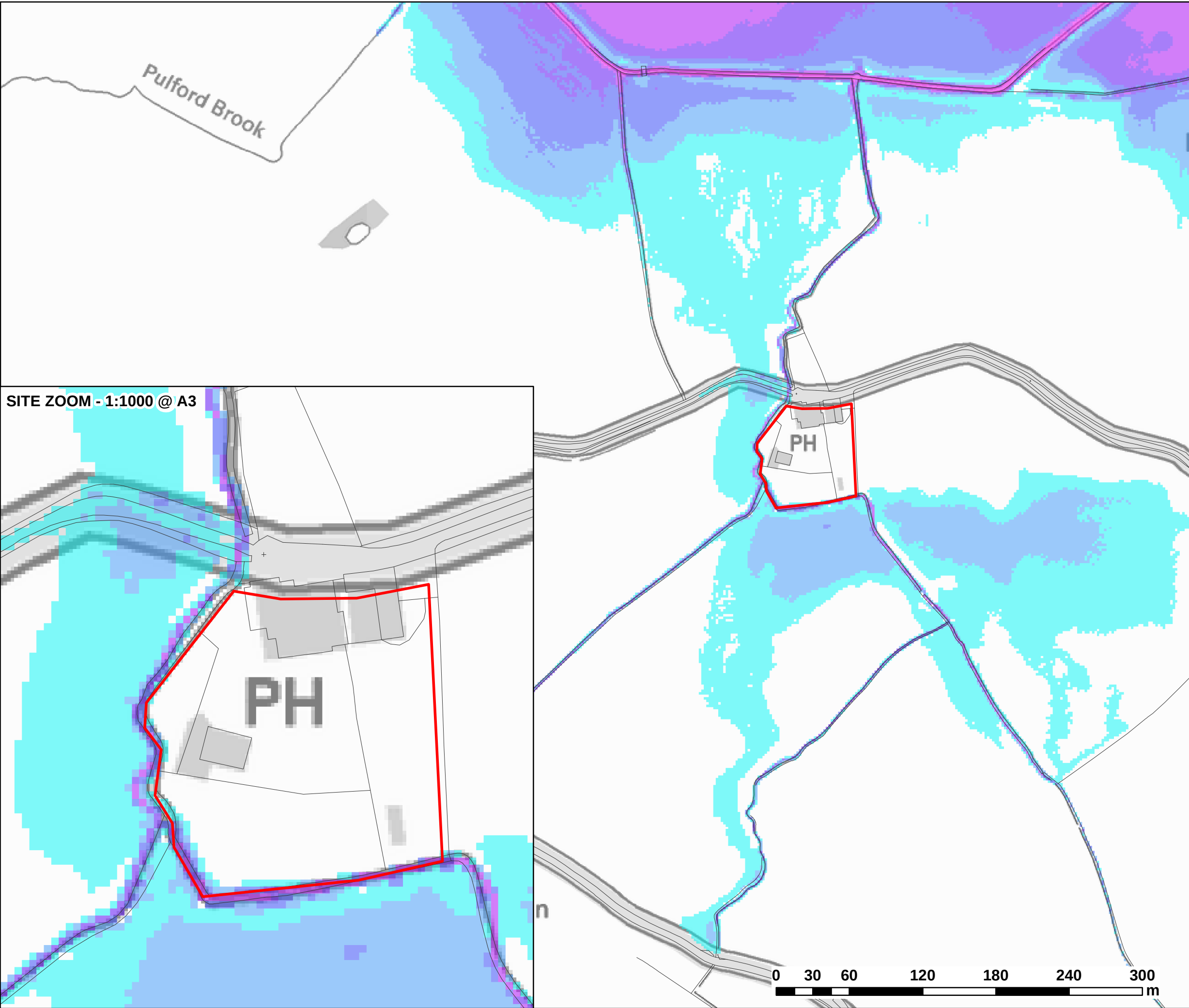
PLOT TITLE:

MAXIMUM FLOOD DEPTH
1% AEP + CCA FLUVIAL EVENT
LLYNDIR LN CULVERT BLOCKAGE (100%)

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-BL1-100-D		REV: -



LEGEND

Site Boundary

Maximum Flood Depth (m)

	0 - 0.3
	0.3 - 0.6
	0.6 - 0.9
	0.9 - 1.2
	1.2 - 2.4
	> 2.4

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

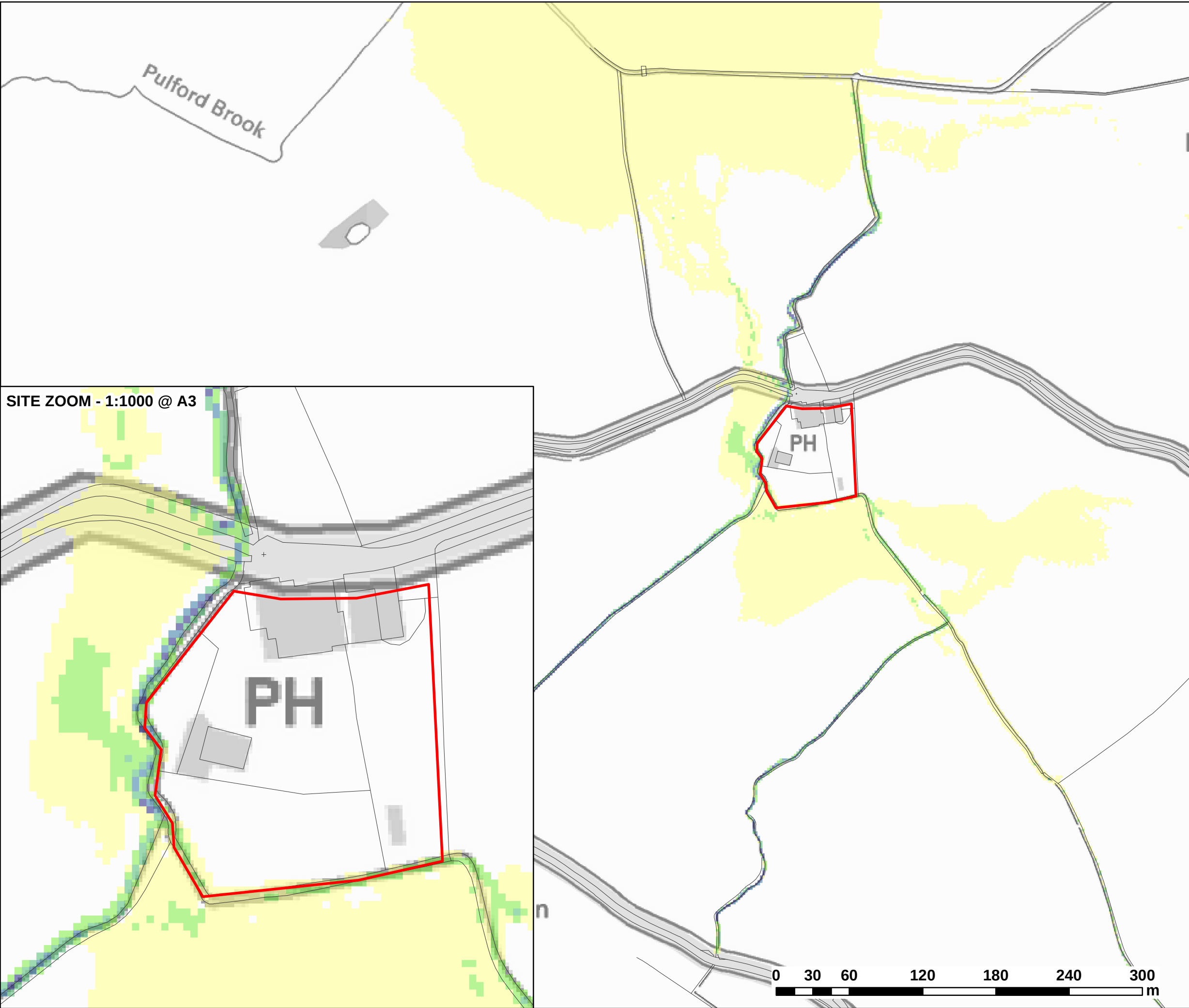
**MAXIMUM FLOOD DEPTH
0.1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
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DATE: 28/05/2015	PLOT NAME: W3178-Q1000-EXT-D	REV: -
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SITE ZOOM - 1:1000 @ A3

LEGEND

Site Boundary

Maximum Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
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01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

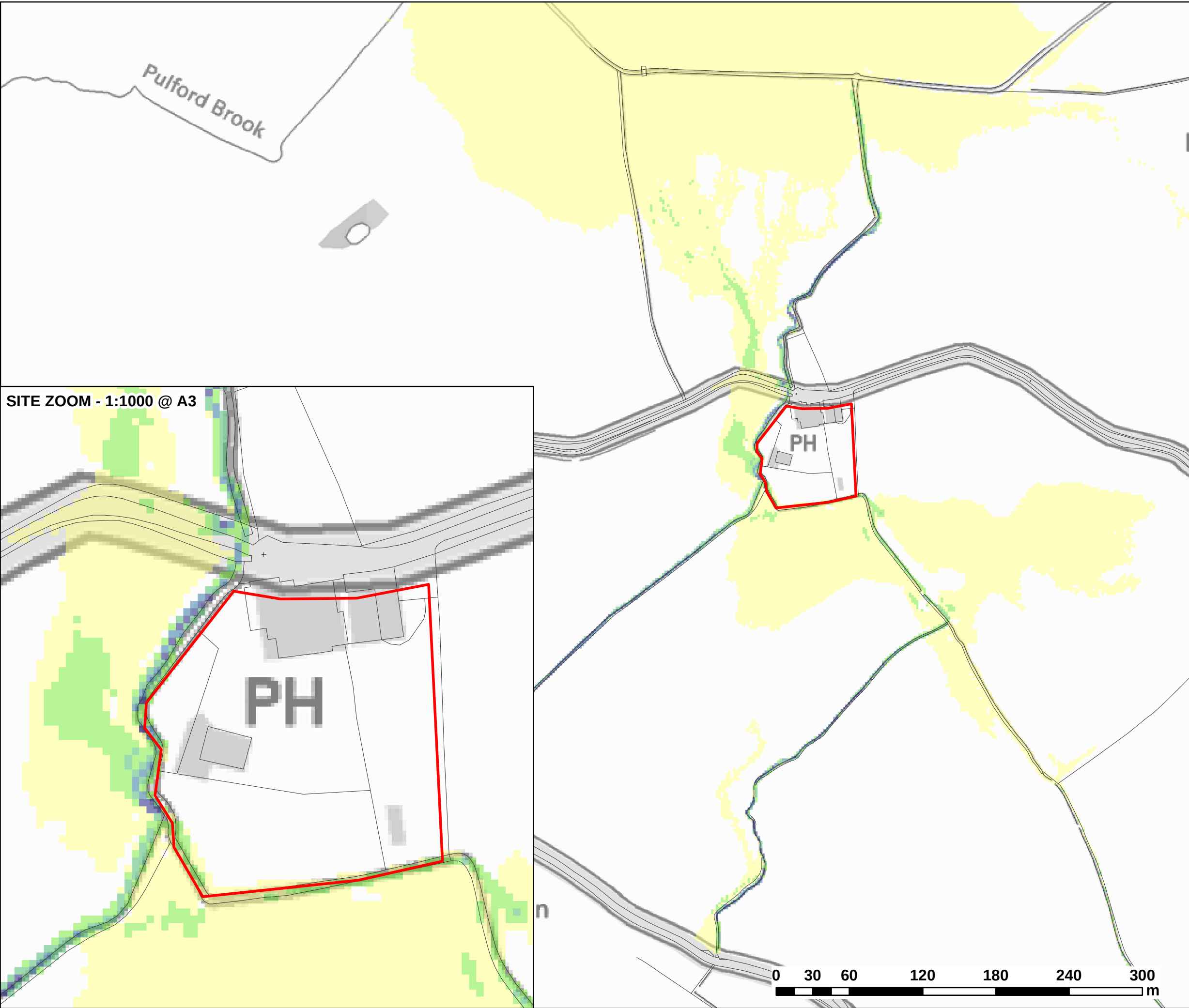
PLOT TITLE:

MAXIMUM VELOCITY
1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100-EXT-V	REV: -	



LEGEND

Site Boundary

Maximum Velocity (m/s)

0.0 - 0.3

0.3 - 0.6

0.6 - 0.9

0.9 - 1.2

> 1.2

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

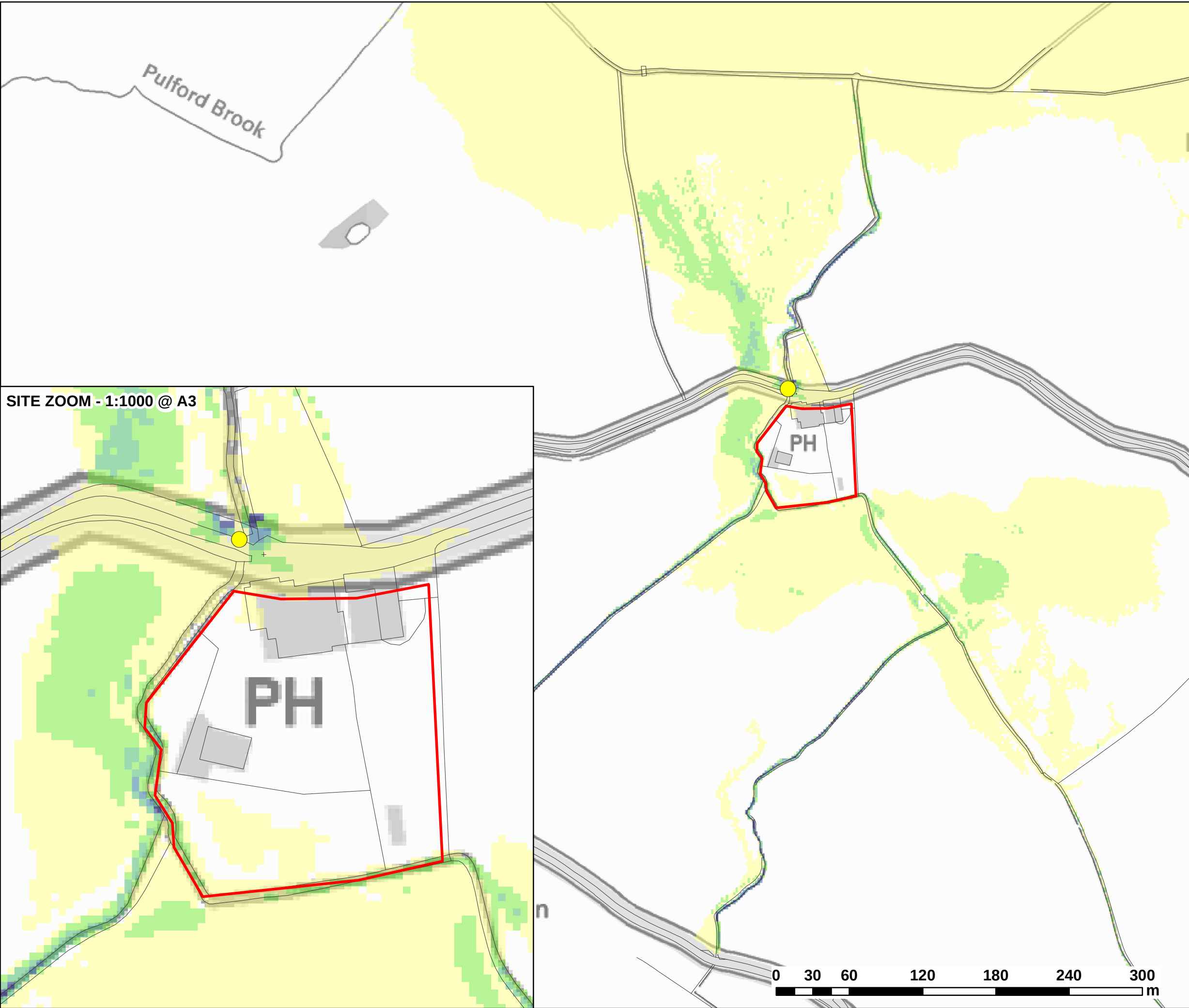
PLOT TITLE:

**MAXIMUM VELOCITY
1% AEP + CCA FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-EXT-V		REV: -



SITE ZOOM - 1:1000 @ A3

LEGEND

- Site Boundary
- Blockage Location (BL1)
- Maximum Velocity (m/s)
 - 0.0 - 0.3
 - 0.3 - 0.6
 - 0.6 - 0.9
 - 0.9 - 1.2
 - > 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT

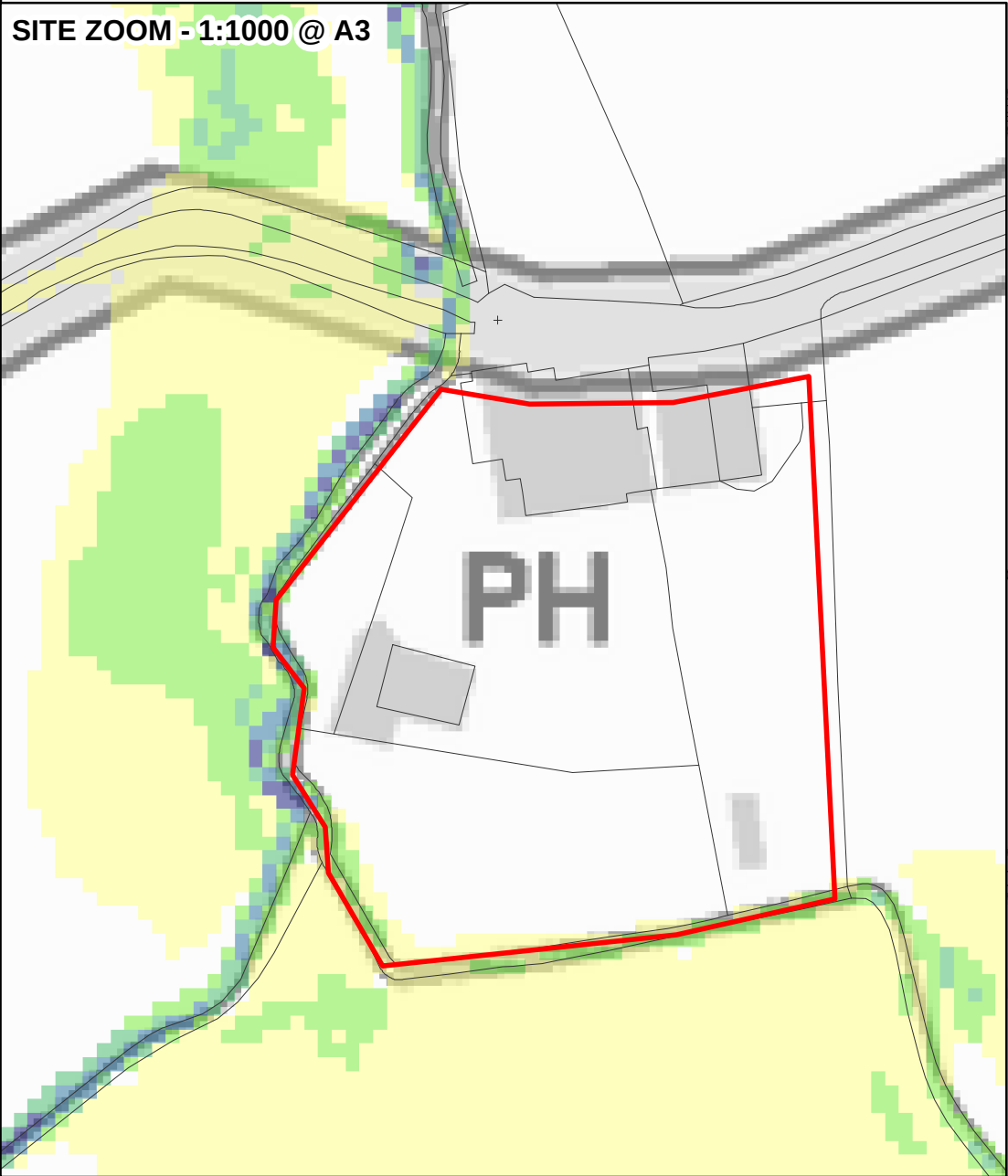
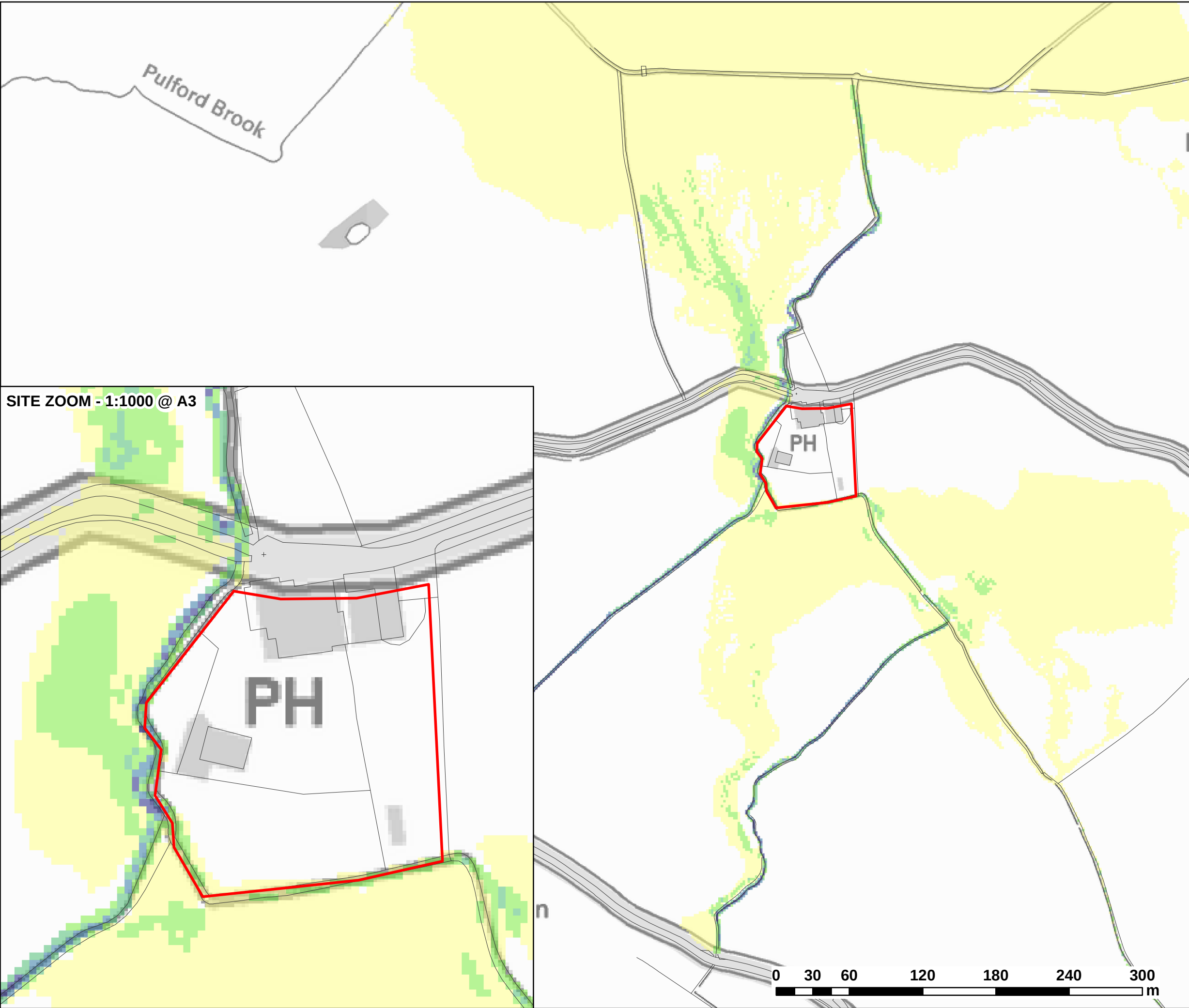
PLOT TITLE:

MAXIMUM VELOCITY
1% AEP + CCA FLUVIAL EVENT
LLYNDIR LN CULVERT BLOCKAGE (100%)

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-BL1-100-V	REV: -	



LEGEND

-  Site Boundary
- Maximum Velocity (m/s)**
-  0.0 - 0.3
 -  0.3 - 0.6
 -  0.6 - 0.9
 -  0.9 - 1.2
 -  > 1.2



CLIENT:

URBAN DEVELOPMENTS



Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

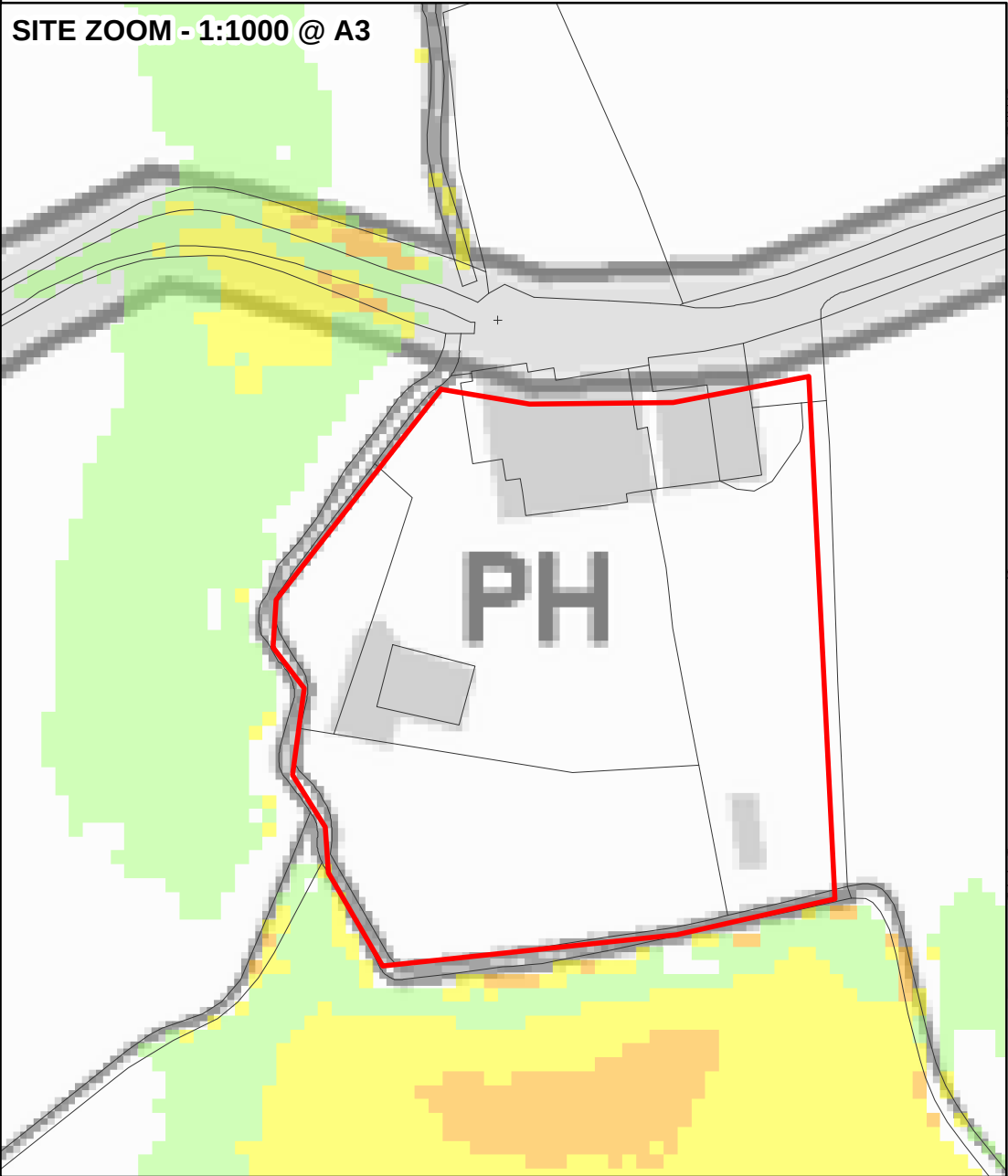
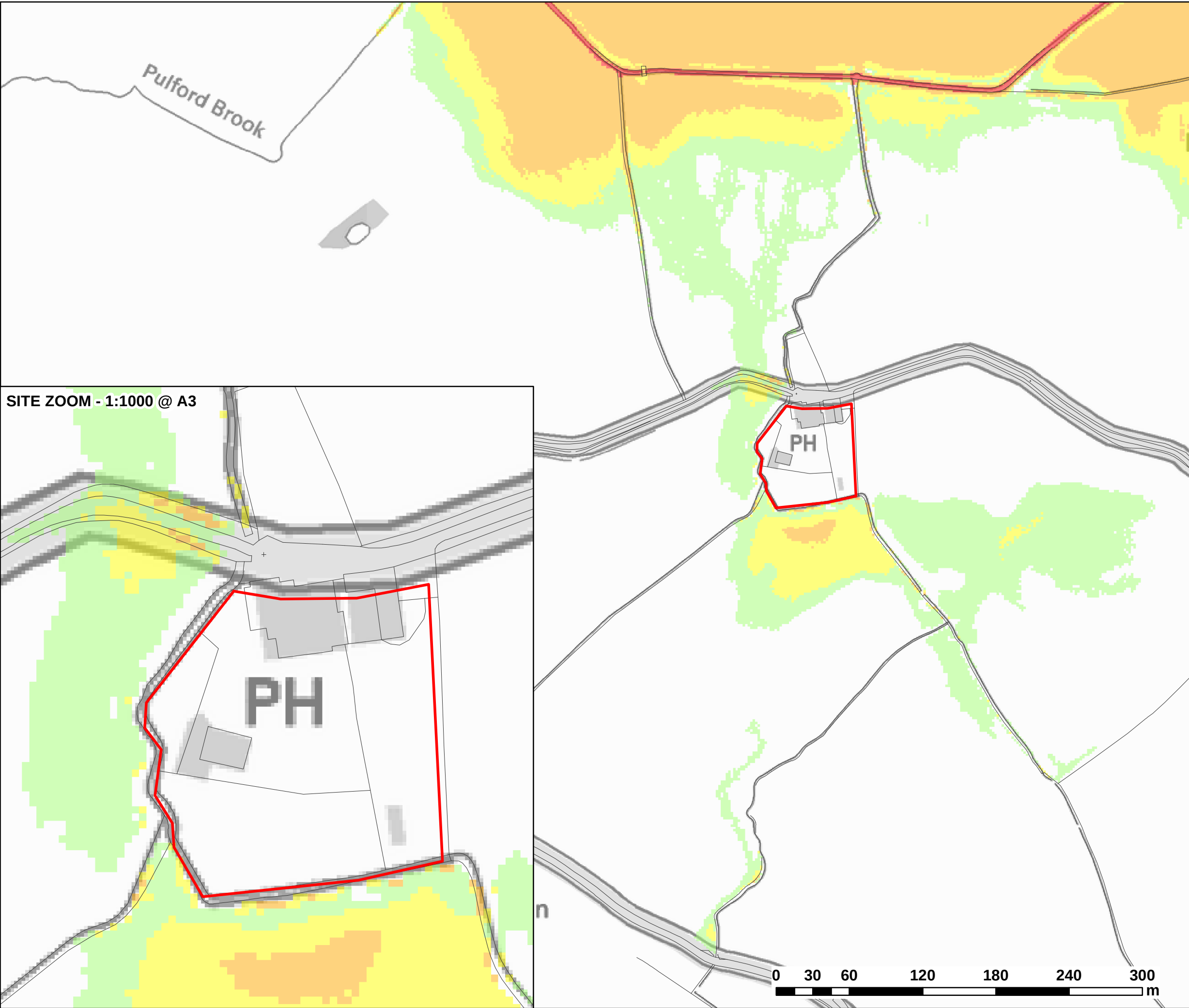
PLOT TITLE:

**MAXIMUM VELOCITY
0.1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q1000-EXT-V	REV: -	



LEGEND

Site Boundary

Maximum Flood Hazard Rating (FD2320)

< 0.75 (Caution)

0.75 - 1.25 (Danger for Some)

1.25 - 2 (Danger for Most)

> 2.0 (Danger for All)

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ

01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

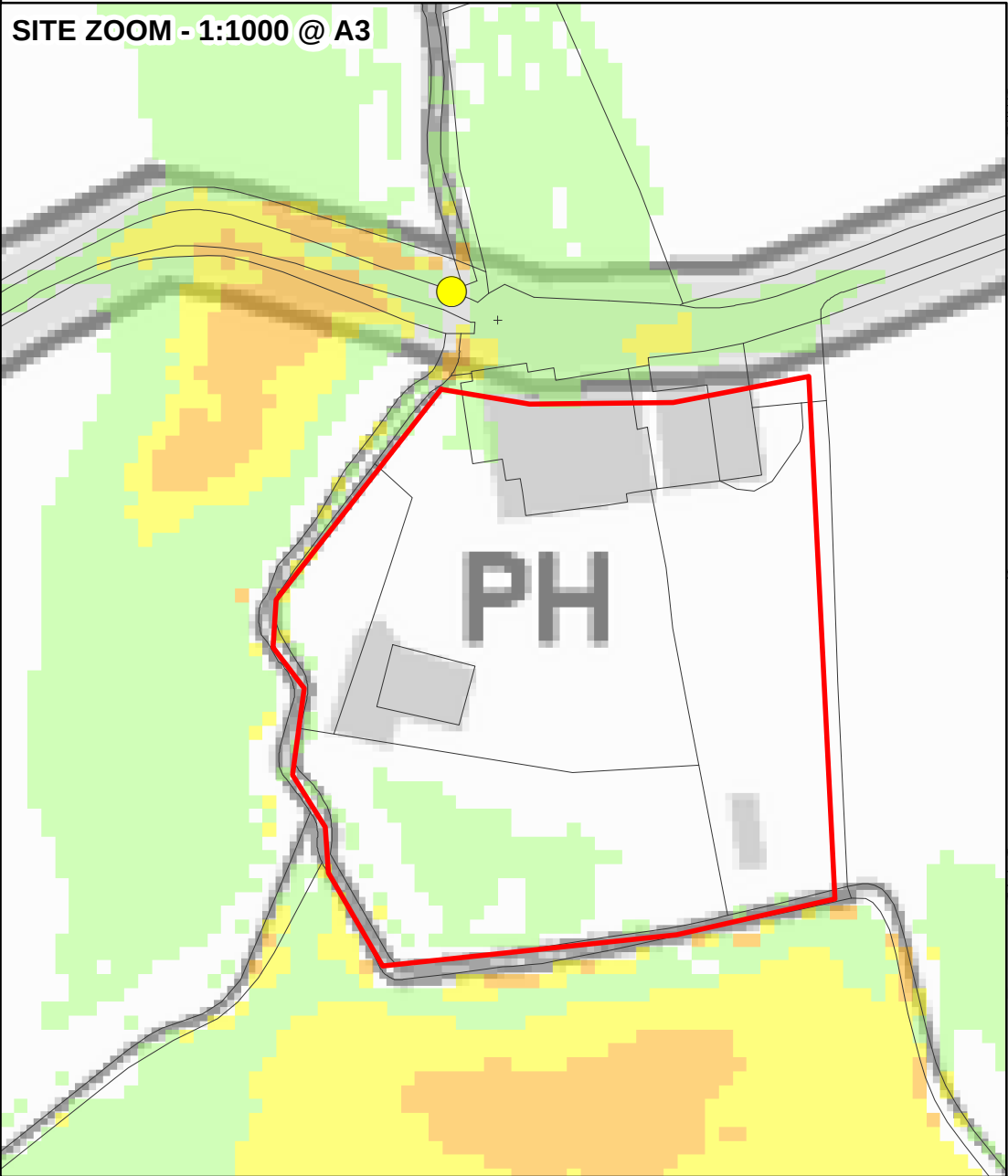
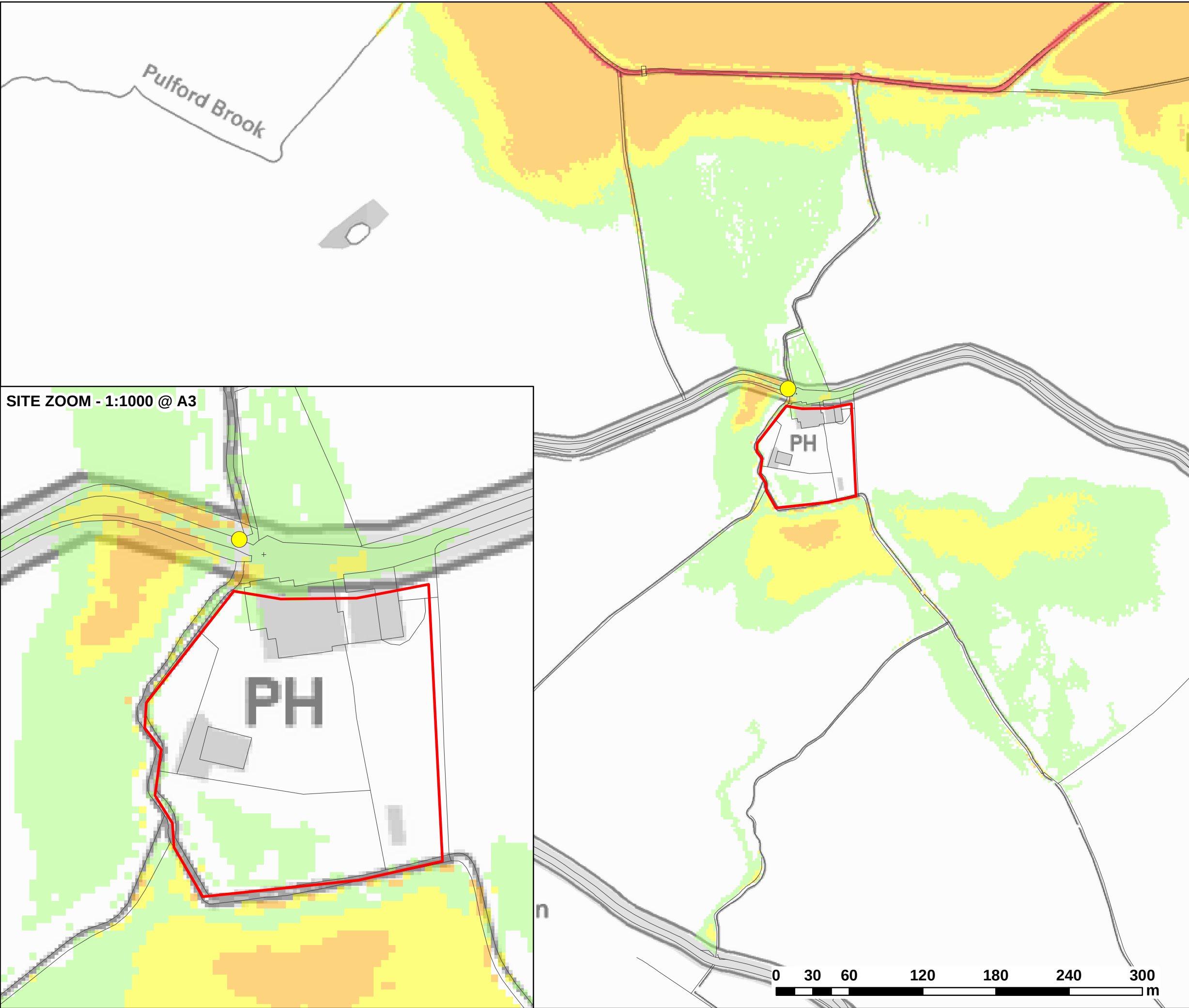
**FLOOD HAZARD RATING
1% AEP + CCA FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
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DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-EXT-H	REV: -
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LEGEND

Site Boundary

Blockage Location (BL1)

Maximum Flood Hazard Rating (FD2320)

< 0.75 (Caution)

0.75 - 1.25 (Danger for Some)

1.25 - 2 (Danger for Most)

> 2.0 (Danger for All)



CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

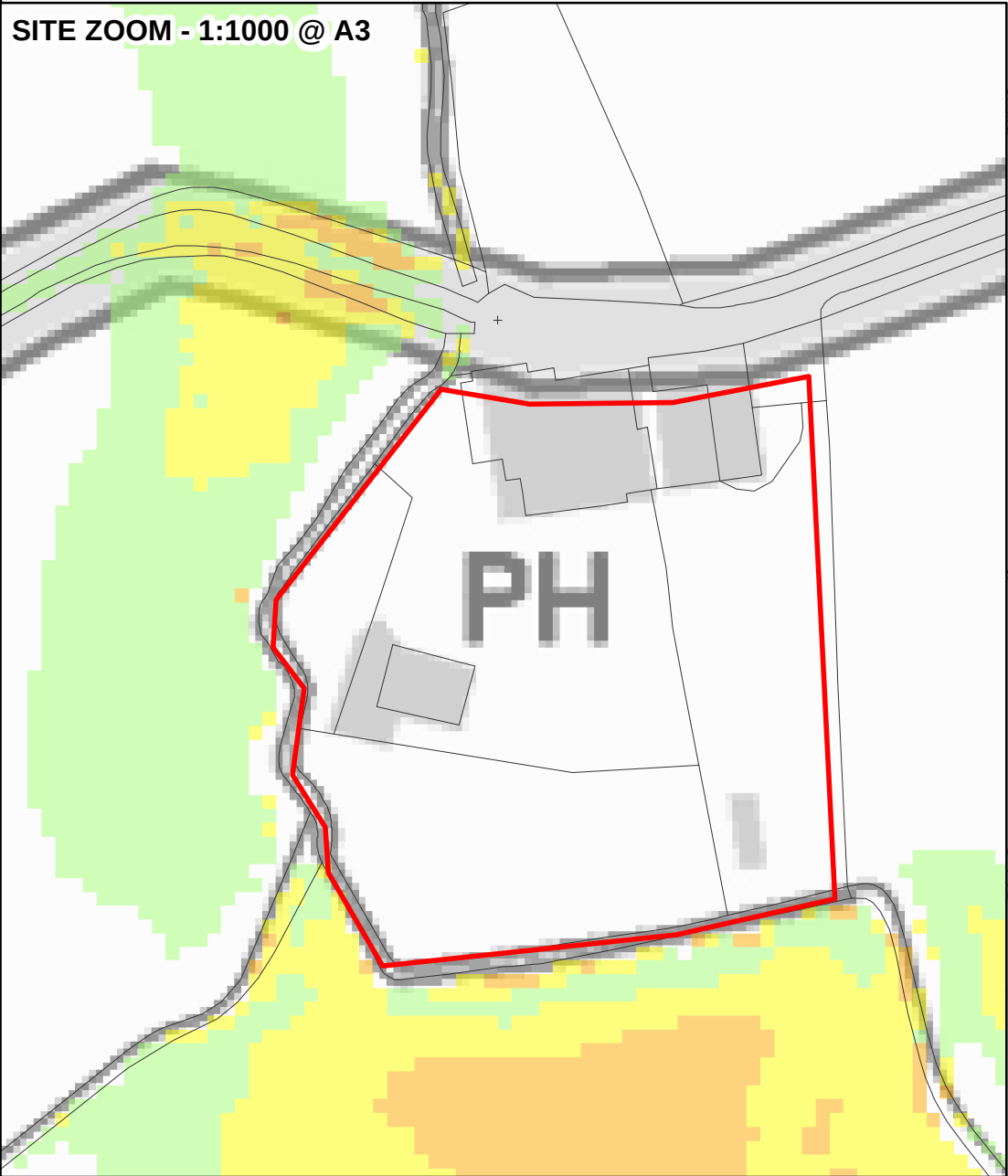
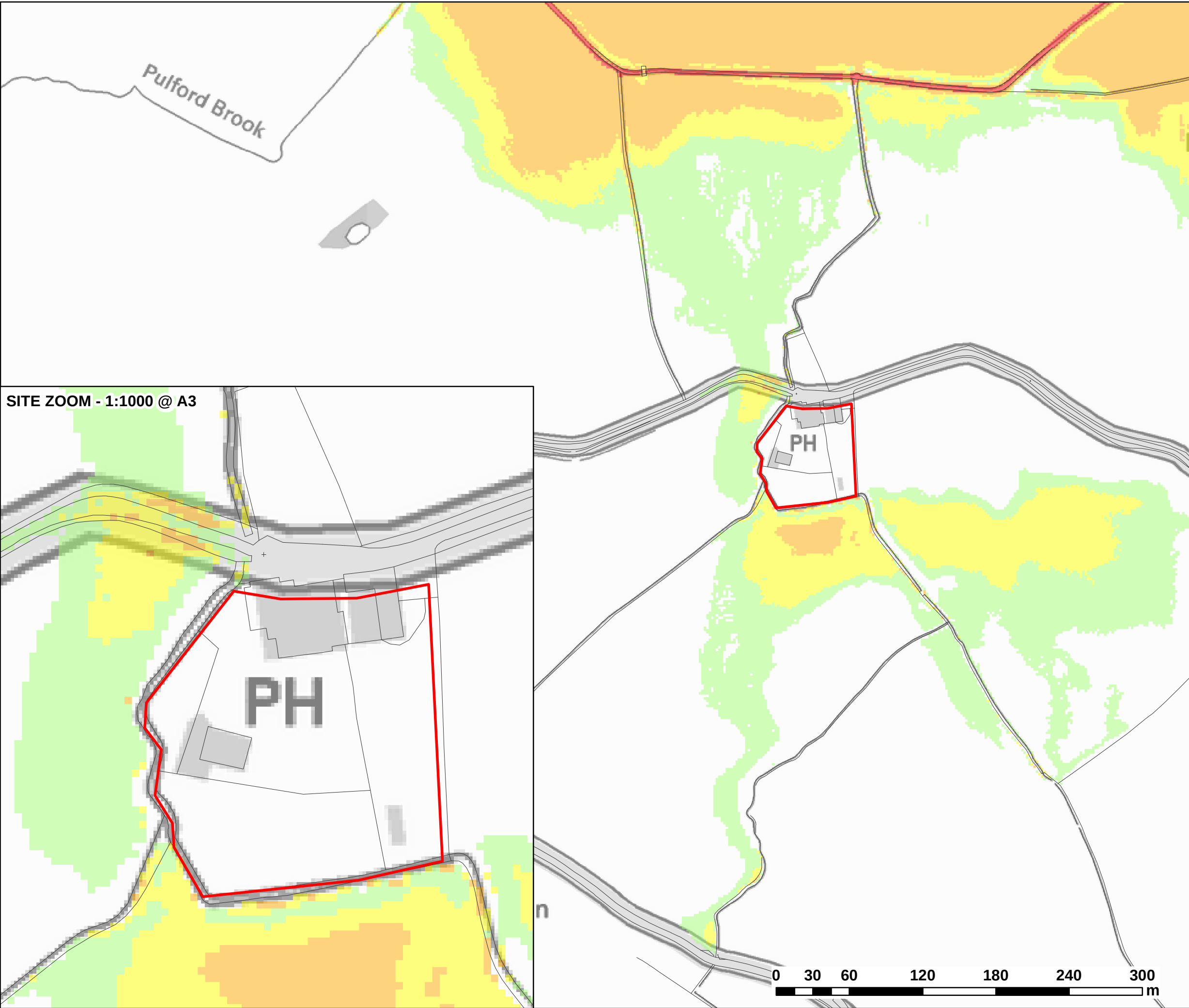
PLOT TITLE:

**FLOOD HAZARD RATING
1% AEP + CCA FLUVIAL EVENT
LLYNDIR LN CULVERT BLOCKAGE (100%)**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
DATE: 28/05/2015	PLOT NAME: W3178-Q100CC-BL1-100-H		REV: -



LEGEND

Site Boundary

Maximum Flood Hazard Rating (FD2320)

< 0.75 (Caution)

0.75 - 1.25 (Danger for Some)

1.25 - 2 (Danger for Most)

> 2.0 (Danger for All)

CLIENT:

URBAN DEVELOPMENTS

Waterco Ltd
Eden Court, Ruthin, LL15 1NJ
01824 702220
www.waterco.co.uk

SCHEME:

**FORMER GOLDEN GROVES INN,
LLYNDIR LANE, ROSSETT**

PLOT TITLE:

**FLOOD HAZARD RATING
0.1% AEP FLUVIAL EVENT
EXISTING SITE LEVELS**

PLOT STATUS:

ISSUE

DRAWN: RCL	CHECKED: JJ	APPROVED: RCL	PLOT SCALE @ A3: 1:3,000 (UNLESS STATED OTHERWISE)
---------------	----------------	------------------	--

DATE: 28/05/2015	PLOT NAME: W3178-Q1000-EXT-H	REV: -
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Appendix E – Homecheck Flood Report

Flood Report



Flood Risk Assessment FURTHER ACTION

Professional Opinion

The Site falls within an area which has an elevated risk of flooding as demonstrated on the gauges below.
Recommendations are on page 2 and information about flood resistance and resilience measures is on page 4.

The groundwater flooding risk is indicative for the area. The risk will vary at specific properties depending on elevation and other environmental factors. Groundwater flooding is more of a problem if the property has cellars or a basement. To better understand groundwater flooding please see the FAQs in Section C.

This report is issued for the property described as:

**Site at 335370,
358660**

Report Reference:
67274278_1

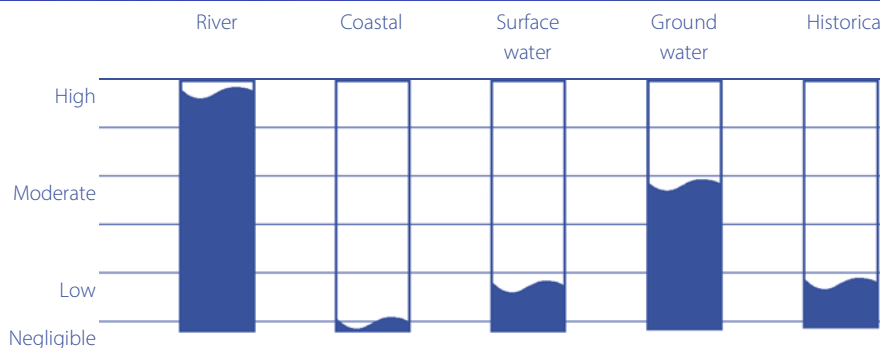
National Grid Reference:
335364E, 358648N

Client Reference:
w1862-150508_HCF

Report Date:
8 May 2015



Overall Flood Risk



Insurance:

The flood risk identified may affect obtaining insurance at standard terms

Contact Details

If you require any assistance please contact our customer services team on **0844 844 9966**

or email **helpdesk@landmark.co.uk**

www.landmark.co.uk
Empowering People with Information



Telephone for **specialist insurance advice**

All quotations subject to certain standard underwriting conditions including the number, type and value of previous losses. Further information can be found within the report.

Call 08455 199 070



Flood Risk Assessment

Professional Opinion



Further action

The property has been identified as being at an increased risk of flooding from one or more sources following an assessment of all the data contained within this report. Consequently the following recommendations should be considered in order to further assess the risk of flooding at the property and to identify appropriate flood protection measures.

RECOMMENDATIONS

1. We recommend undertaking further assessment of the property to identify appropriate flood protection measures. Such measures, including flood guards, gates, temporary barriers and tanking systems, may assist in reducing the effects of flooding on the property (if defences are absent or fail) and could help to obtain property insurance (if not already available). The regulatory body supports the use of kitemarked flood products, which have been independently tested and meet the required standards. An initial survey of the property can be conducted for around £300-400 plus VAT and most providers will deduct this from the costs of any recommended products. Most houses can be protected for between £2000 and £6000, although more may be required for high risk Sites such as this. More information on flood protection measures is presented on page 4 along with additional advice on reducing the impacts of flooding. Details of providers are available from the Flood Protection Association (contact details can be found at the end of this report). Landmark would be happy to arrange a survey by an approved supplier. Please contact us for further information.
2. It would be prudent to ask the vendor to confirm whether or not they are aware of any previous flooding at the property. In addition, we would draw your attention to the additional advice on page 4.

Approved by



Christopher S. Taylor BSc (Hons), MSc, AIEMA
Chartered Water and Environmental Manager
Technical Director, Argyll Environmental Ltd

Summary of Findings

A '-' indicates no data found. Those factors with a 'Yes' will offer further explanation in Sections A-D.

Section A.1 – River, Coastal, and Surface Water Flood Risk: 1 in 75 Year – From JBA

	On-site	1-250m
River	YES	YES
Coastal	-	-
Surface Water	YES	YES

Section A.2 – River, Coastal, and Surface Water Flood Risk: 1 in 200 Year – From JBA

	On-site	1-250m
River	YES	YES
Coastal	-	-
Surface Water	YES	YES

Section A.3 – River, Coastal and Surface Water Flood Risk: 1 in 1000 Year – From JBA

	On-site	1-250m
River	YES	YES
Coastal	-	-
Surface Water	YES	YES

Section B – Floodplains, Flood Defences, and Flood Risk – From regulatory body

	On-site	1-250m
Rivers and coastal (zone 2)	YES	YES
Rivers and coastal (zone 3)	-	YES
Flood defended area	-	-
Flood defences	-	YES
Risk of Flooding from Rivers and Sea	YES	YES

Section C – Groundwater

	On-site	1-250m
Risk of groundwater flooding	YES	YES

Section D – Historical

	On-site	1-250m
Historical flooding	-	YES
Flood insurance claim rating	YES	YES

Flood Resistance and Resilience Measures

Flooding can usually be managed by the installation of flood protection measures either on or within the building(s) or across the property. Flood protection measures can be divided into two categories; flood resistance and flood resilience.

Flood resistance measures aim to prevent flood water from entering a property (i.e. barriers and baffles) while flood resilience measures aim to reduce the impact of flood water once it enters a property. Both flood resistance and flood resilience solutions can be integrated into design proposals for new developments or be retro-fitted to existing properties. A total solution may often include both resistance and resilience measures and will depend on a number of factors including flood source, likely flood depths, property design and age.

Most properties can be protected against shallow flash flooding from between £2000 and £6000, although significantly more may be required for high risk properties. Details of providers are available from the Flood Protection Association (contact details can be found at the end of this report). For further information about flood resistance measures or to be put in touch with one of our partners in this field please contact customer services on 0844 844 9966 or email helpdesk@landmark.co.uk

Guideline Costs for Resistance Measures

Building feature	Cost estimate including installation (excluding VAT)
Standard single door	£500-£995
Standard garage door	£700-£1500
Standard window	£350-£600
Single air brick	£40-£100
Patio doors	£500-£1500
Simple non-return valve	£20-£50
Large non-return valve	£300-£800
Tanking a basement, walls, or floors	£25 per metre ²

Additional Advice

In purchasing this report you have taken the first step in understanding the risk of flooding at your property. In addition to the installation of flood protection measures, such as those outlined above, there are a number of further practical steps you may wish to consider in order to ensure you are fully prepared in the event of a flood:

- **Understand your flood risk:** Take time to understand the sources of flooding affecting your property. Additional information on flooding in your area may be available from the Local Authority if they have completed a Strategic Flood Risk Assessment examining flood risk in the wider area. Alternatively, you may wish to consider a further strategic appraisal of flooding at your property to more closely examine available data and provide a more accurate estimate of anticipated flood depths. Further assessment can be undertaken starting from £500 plus VAT please contact customer services on 0844 844 9966 or email helpdesk@landmark.co.uk for more details.
- **Sign up to flood warnings:** Natural Resources Wales operates a free flood warning service providing alerts by phone, text or email when flooding is anticipated providing an opportunity for home owners to take necessary precautions.
- **Make a flood plan:** Prepare a flood plan outlining the precautions and actions you should take when a flood event is anticipated to help reduce the impact and damage flooding may cause. Sensible precautions would include raising electrical items, irreplaceable items and sentimental items off the ground or where possible moving them to a higher floor, rolling up carpets and rugs and turning off utilities. In addition, consider what actions you would take should the property need to be evacuated including access and egress routes and preparing a flood kit in advance containing warm clothing, medication, a torch, food and wellingtons.

Further information is available from Natural Resources Wales on how to prepare and what to do in the event of a flood at their website or by calling their Floodline on 0845 988 1188.

Property Location



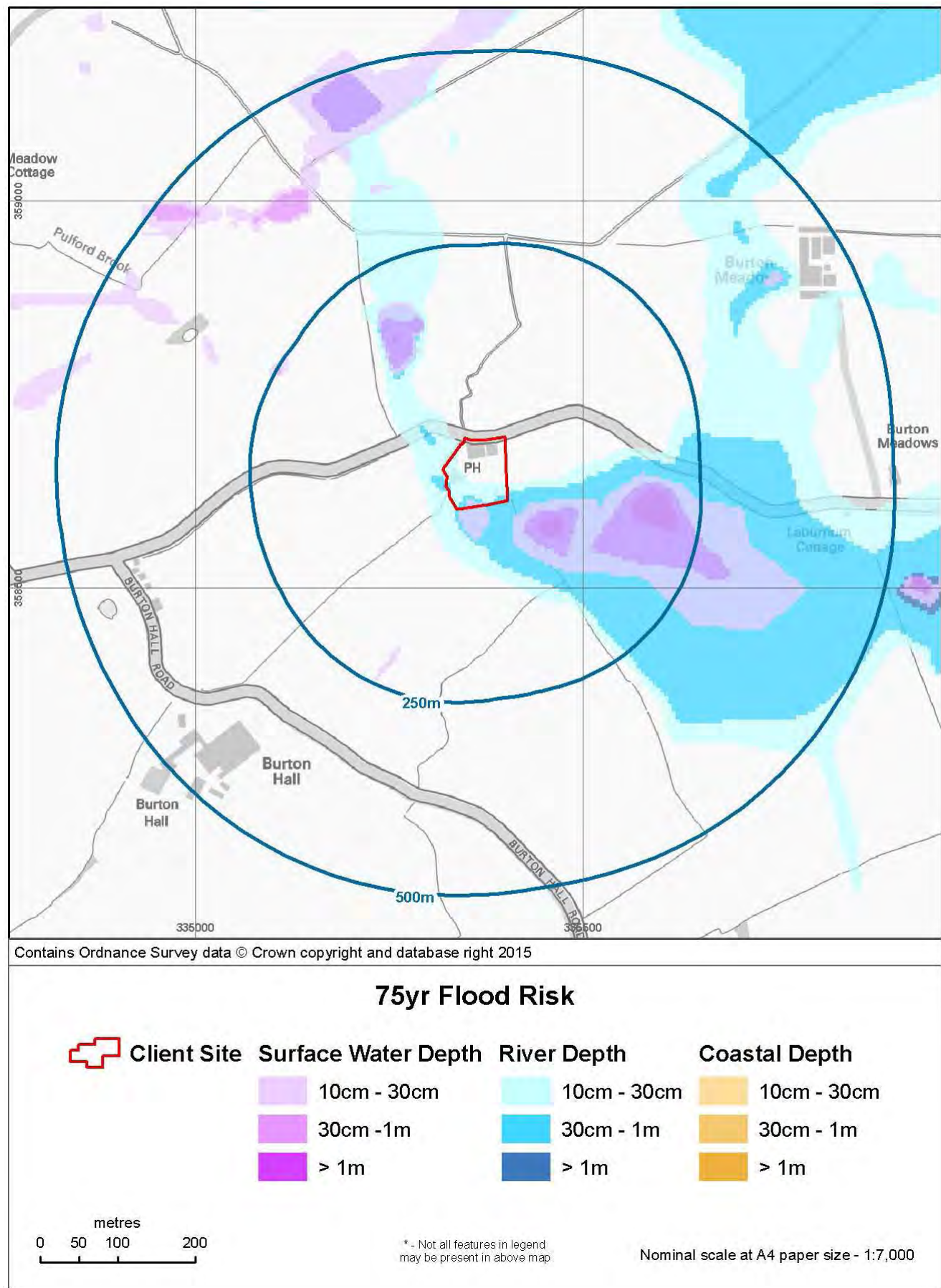
Section A.1 – River, Coastal and Surface Water Flood Risk: 1 in 75 Year – From JBA

Enquiry	Distance	Result	Note
River What is the risk of river water flooding?	On-site 1-250m	Medium High	Information regarding the risk of river (fluvial) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 75 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
Coastal What is the risk of coastal flooding?	On-site 1-250m	Negligible Negligible	Information regarding the risk of coastal (tidal) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 75 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
Surface Water What is the risk of surface water flooding?	On-site 1-250m	Low Medium	Information regarding the risk of natural surface water or pluvial flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 75 return period. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of potential surface water flooding.

Comment

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Section A.1 – River, Coastal and Surface Water Flood Risk: 1 in 75 Year – From JBA



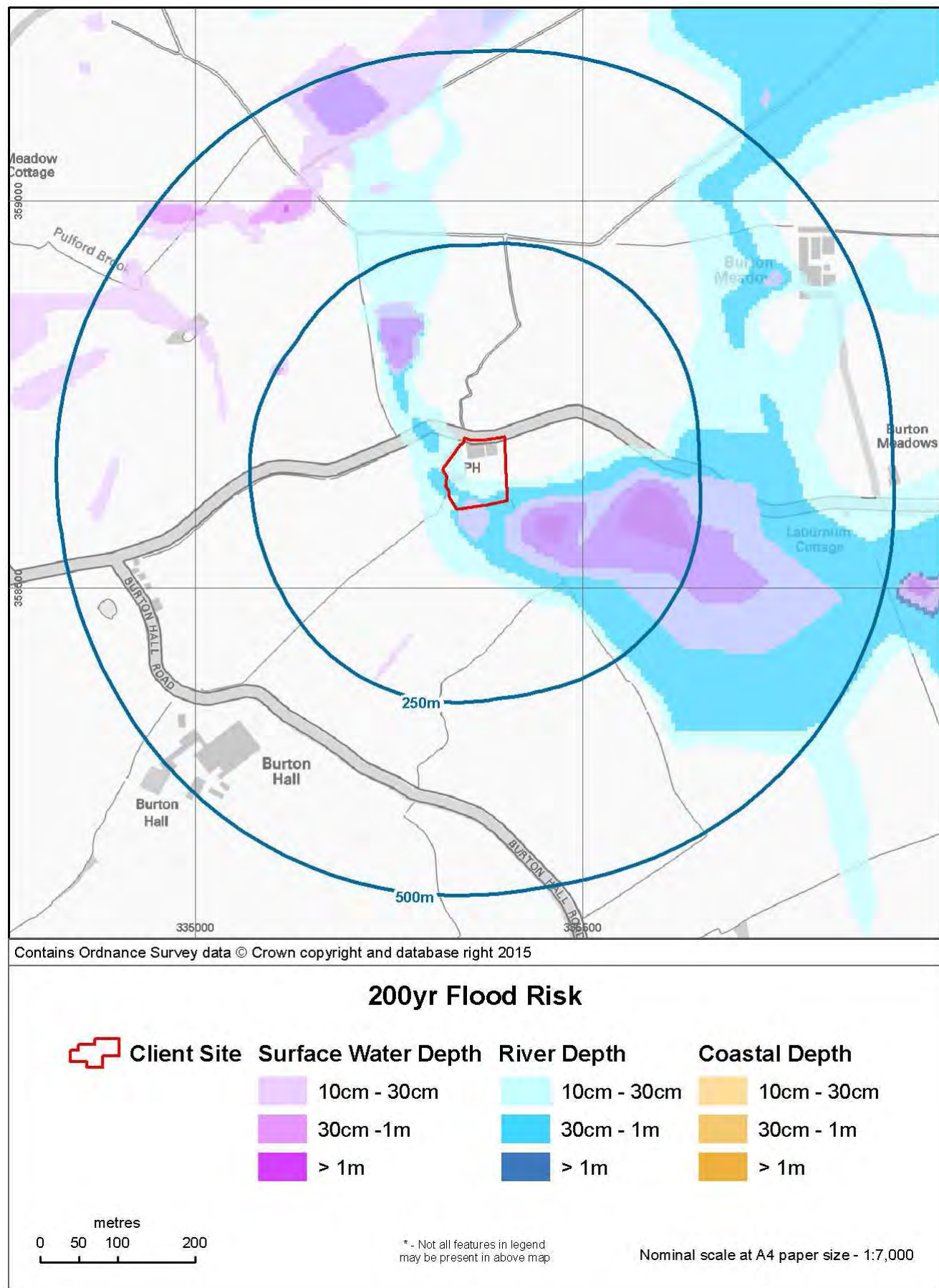
Section A.2 – River, Coastal, and Surface Water Flood Risk: 1 in 200 Year – From JBA

Enquiry	Distance	Result	Note
River	On-site	Medium	Information regarding the risk of river flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 200 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
What is the risk of river water flooding?	1-250m	High	
Coastal	On-site	Negligible	Information regarding the risk of coastal flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 200 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
What is the risk of coastal flooding?	1-250m	Negligible	
Surface Water	On-site	Low	Information regarding the risk of natural surface water flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 200 return period. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of potential surface water flooding.
What is the risk of surface water flooding?	1-250m	Medium	

Comment

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Section A.2 – River, Coastal, and Surface Water Flood Risk: 1 in 200 Year – From JBA



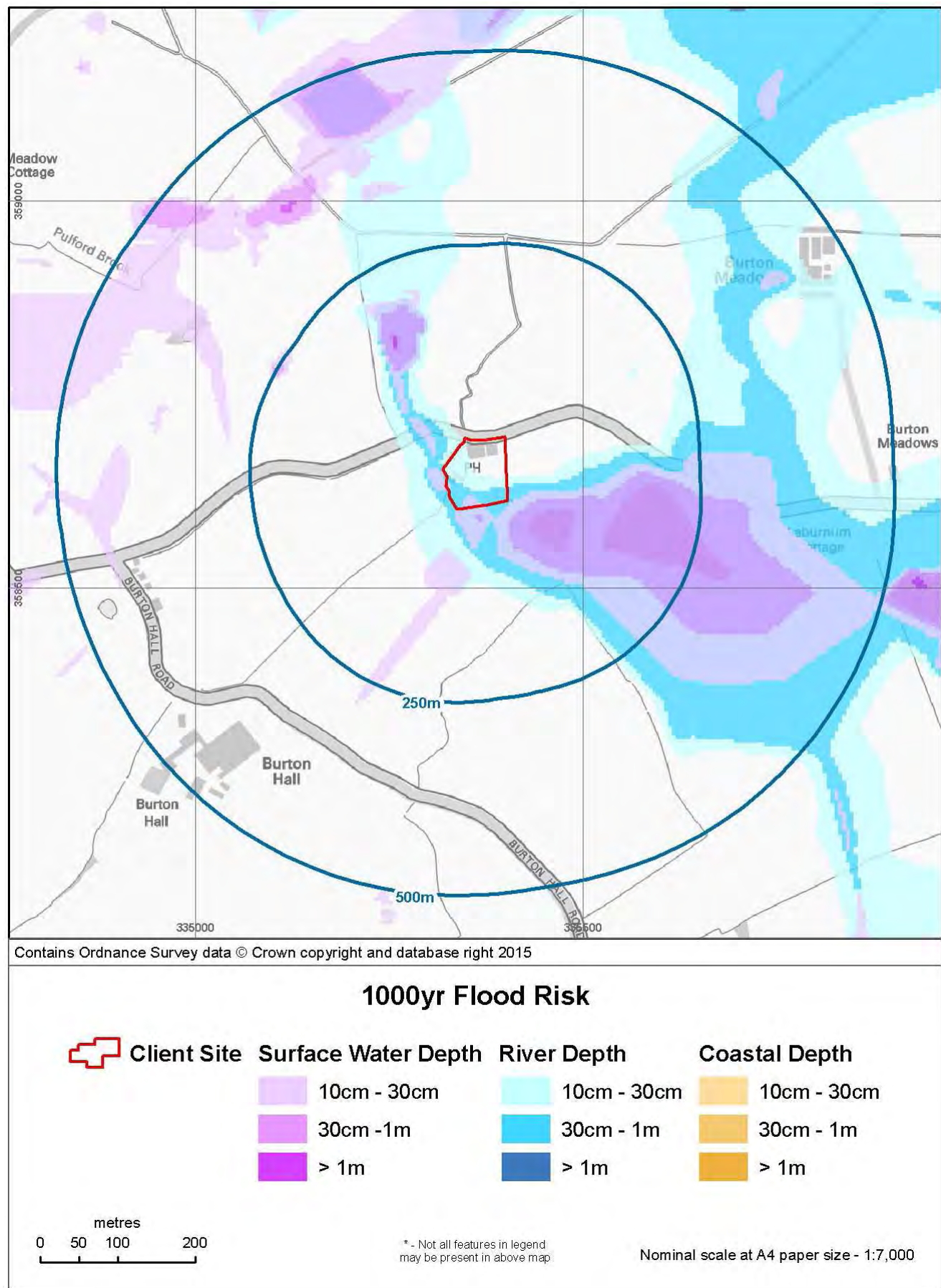
Section A.3 – River, Coastal and Surface Water Flood Risk: 1 in 1000 Year – From JBA

Enquiry	Distance	Result	Note
River What is the risk of river water flooding?	On-site 1-250m	Medium High	Information regarding the risk of river (fluvial) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 1000 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
Coastal What is the risk of coastal flooding?	On-site 1-250m	Negligible Negligible	Information regarding the risk of coastal (tidal) flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 1000 return period. This data has been modelled assuming an 'undefended' scenario where no defences are present. However, where flood defences are identified in this report this will be reflected in our overall risk assessment. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of river flooding.
Surface Water What is the risk of surface water flooding?	On-site 1-250m	Low High	Information regarding the risk of natural surface water or pluvial flooding has been modelled by JBA Consulting in this instance using the anticipated water volumes expected during a 1 in 1000 return period. The risk is classified by JBA into four categories, negligible, low (more than 0.1m), medium (more than 0.3m) and high (more than 1m) which reflect varying depths of potential surface water flooding.

Comment

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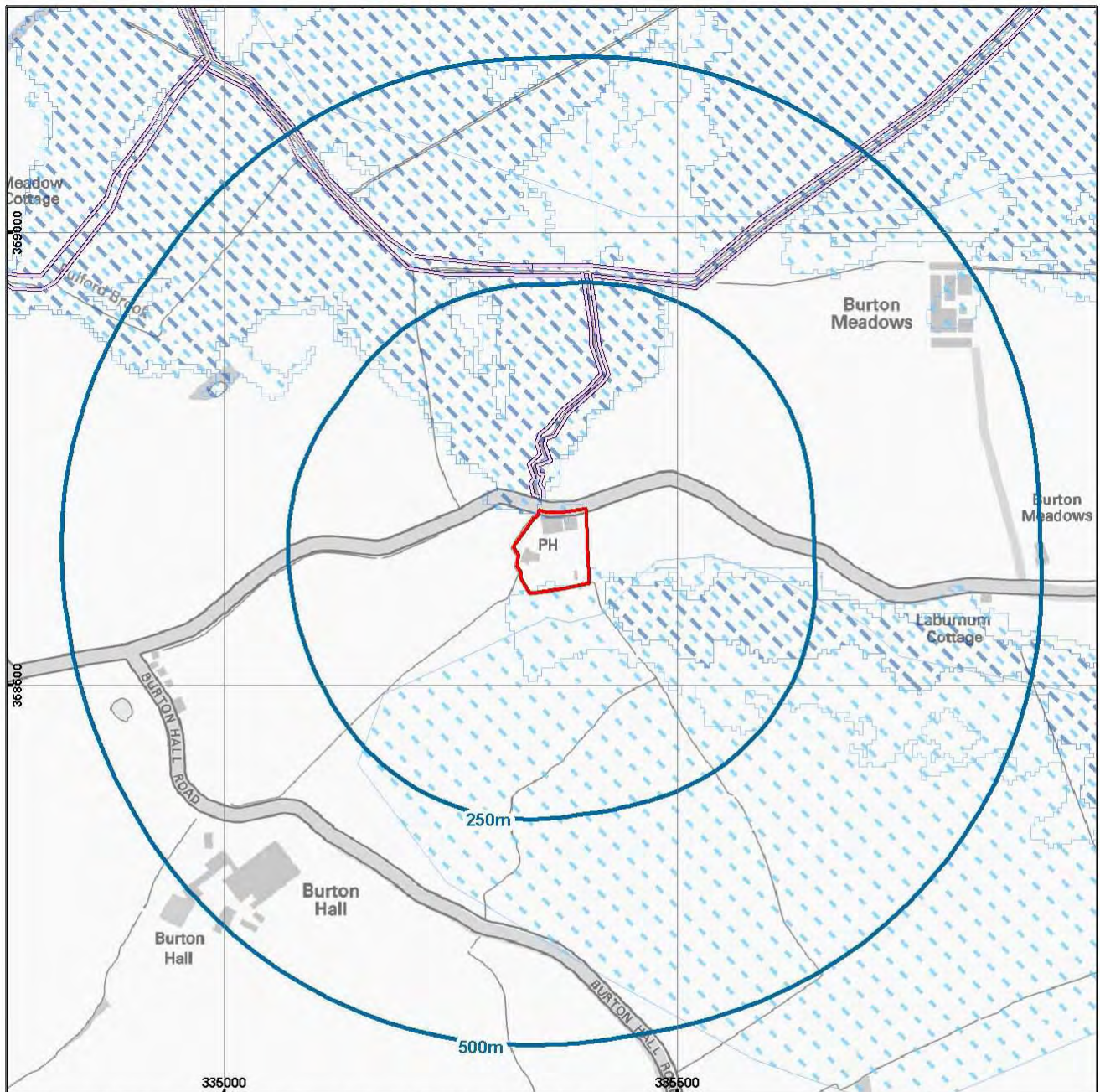
Section A.3 – River, Coastal and Surface Water Flood Risk: 1 in 1000 Year – From JBA



Section B – Floodplains, Flood Defences, and Flood Risk – From regulatory body

Enquiry	Distance	Result	Note
Rivers and coastal Is the property in an area affected by flooding (Flood Zone 3) or extreme flooding (Flood Zone 2)?	On-site 1-250m	YES YES	The site has been identified as being on or within 25m of Flood zone 2 according to the regulatory body Flood Map and is at a moderate risk of river or coastal flooding. The annual probability of flooding is either between 0.1% and 1% from rivers or between 0.1% and 0.5% from the sea. All proposed developments would need to be accompanied by a full Flood Risk Assessment, in accordance with the National Planning Policy Framework. It may be prudent to consider further assessment to further quantify the flood risk and suggest appropriate flood protection measures.
Flood defended area Is the property in an area benefiting from flood defences ?	On-site	NO	The site is not situated within 250m of an area benefiting from flood defences according to the regulatory body Flood Map. Natural Resources Wales defines areas benefiting from flood defences which should be afforded protection by existing flood defences during flood events with an annual probability of 1% from rivers and 0.5% from the sea. However, not all areas have been mapped and the property may still benefit from some flood defences.
Flood defences Are there any flood defences within 250m?	On-site 1-250m	NO YES	Flood defences were identified within 250m of the site which should afford it some level of flood protection. However, there may be a residual risk of flooding should the protection standard of those defences be exceeded (and the defences over-topped) or should the defences fail. Natural Resources Wales data regarding the presence and location of flood defences includes linear flood defences (such as walls and embankments). Not all flood defences may yet be registered and as a result not all flood defences may be shown.
Risk of Flooding from Rivers and Sea What is the flood likelihood category for the property?	On-site	High	The site is classified as being at a significant risk of flooding. This classification relates to the locality as a whole, rather than the individual site and solely considers river and coastal flooding. Flood insurance may be difficult to obtain for properties in this locality as the annual probability of flooding exceeds 1.3%. Further assessment is recommended to further define the risk of flooding in order to suggest appropriate flood protection measures and obtain further information to provide insurers. The data in the Risk of Flooding from Rivers and Sea dataset is sourced from Natural Resources Wales's National Property Dataset (NPD2). The information provided includes the flood likelihood category low, moderate, or significant according to the flood risk analysis. Some areas may be classified as having no result. This occurs where there is no output data from the analysis, but the area falls within the extreme flood outline (with a 0.1% or 1 in 1000 chance of flooding in any year).

Section B – Floodplains, Flood Defences, and Flood Risk – From regulatory body



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Flood Zones, Defended Areas and Flood Defences

- | | | | |
|---|----------------|---|--------------|
|  | Client Site |  | Flood Zone 2 |
|  | Flood Defences |  | Flood Zone 3 |
|  | Defended Areas | | |

0 50 100 200
meters

* - Not all features in legend
may be present in above map

Nominal scale at A4 paper size - 1:7,000

Section C – Groundwater

Enquiry	Result	Note
Groundwater Flood Risk What is the risk of groundwater flooding based on the underlying geological conditions?	Moderate Risk	ESI provides data to Argyll in relation to groundwater flooding. Through research and development, building on their expertise in addressing groundwater flooding issues for Natural Resources Wales and other clients in the UK, ESI has developed algorithms and calibrated predictions of the risk of groundwater flooding occurring. This differs from other suppliers of data regarding groundwater flooding which only report on the susceptibility of groundwater flooding. Susceptibility merely has to be identified, whereas risk must be quantified. The resulting map is a 50x50m classification of groundwater flooding risk into four categories (Negligible, Low, Moderate and High). ESI's classifications are based on the level of risk, combining severity and uncertainty that a site will suffer groundwater flooding within a return period of about 200 years. The map is a general purpose indicative screening tool, and is intended to provide a useful initial view for a wide variety of applications. However, it does not provide an alternative to a site specific assessment, and a detailed risk assessment should be used for any site where the impact of groundwater flooding would have significant adverse consequences.

What is groundwater flooding?

Groundwater flooding occurs when groundwater levels are sufficiently raised to exceed ground level. This can occur in two main ways:

1. Clearwater Flooding. This type of groundwater flooding occurs when the water table within a bedrock aquifer rises above ground level. This is dependent upon local geology.
2. Permeable Superficial Deposits (PSD) Flooding. This type of groundwater flooding is often associated with river flooding. It occurs when river levels are swollen and the water table rises in response, within the superficial deposits associated with the watercourse, and rises above ground level.

How is groundwater flood risk identified?

ESI are a consultancy specialising in groundwater flood risk. ESI have produced a national groundwater flood risk map, which considers a number of factors to determine the likelihood and severity of groundwater flooding in a 1 in 200 year return period (i.e. an extreme event). The key components considered are:

1. Bedrock geology
2. Superficial permeable deposits
3. Topography
4. Proximity to nearby watercourses

How accurate is the groundwater data?

Although it is the most comprehensive groundwater dataset available, the ESI groundwater risk map has a 50m resolution. Therefore, it should not be considered a property-specific flood risk assessment, but rather a risk screening tool of the potential for groundwater flooding based on local factors identified.

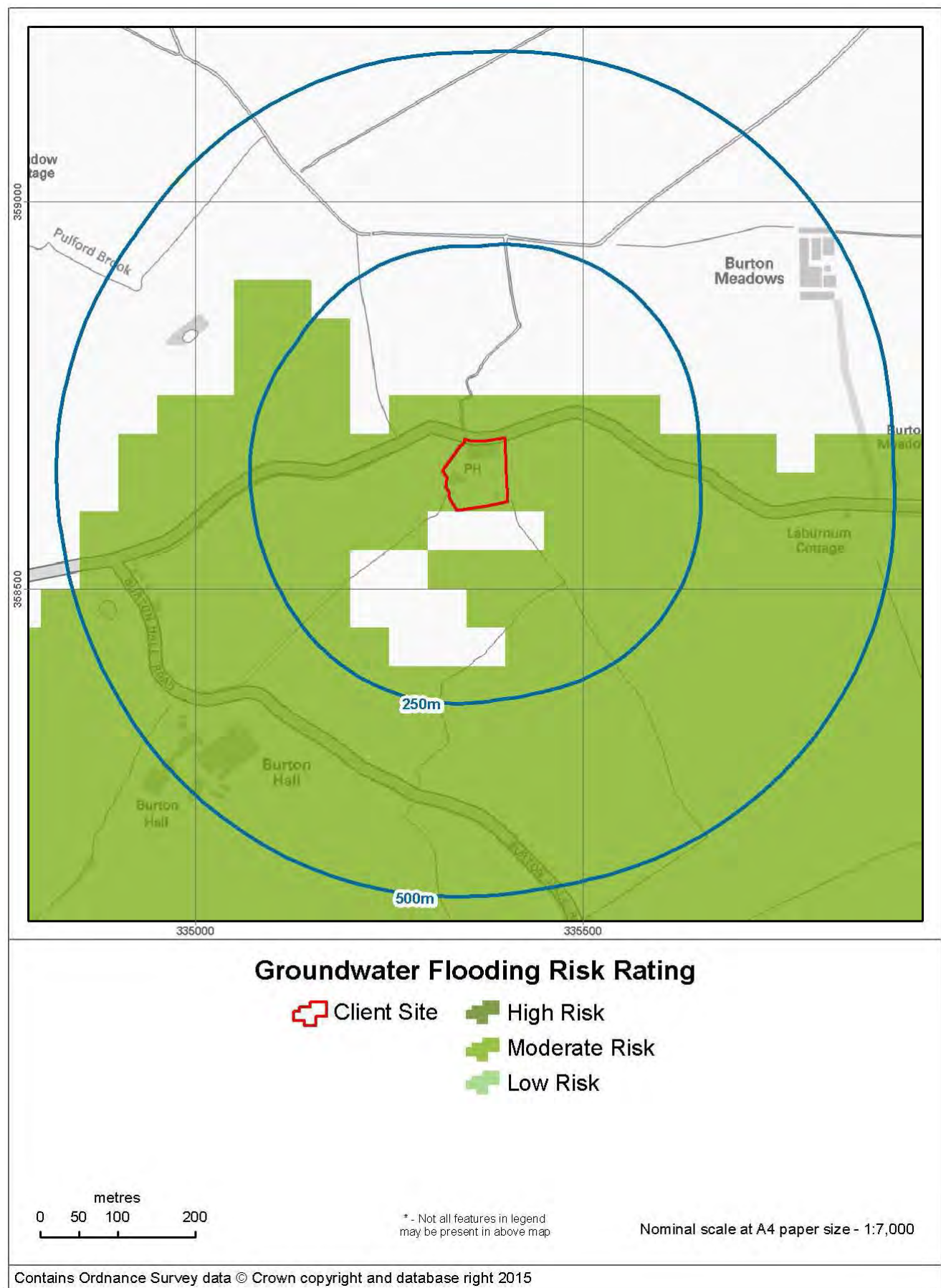
My property has been identified as being at risk of groundwater flooding, what should I do now?

There are some factors you can identify to establish if groundwater flooding is likely to be an issue. A property will be more susceptible to groundwater flooding if:

1. It has a basement or cellar
2. It is in a depression
3. It is located on a floodplain (i.e. within a Flood Zone 2 or Flood Zone 3)
4. It is located on a spring line or within an intermittent river valley such as a winterbourne (a stream that is dry through the summer months).

If any of the above apply to your property, you may wish to have a more detailed and property specific groundwater assessment report undertaken, to clarify if groundwater flooding is likely to be an issue. Please contact us for a quote.

Section C – Groundwater



Section D – Historical

Enquiry	Result	Note
Historical Flooding Have any historical flood events occurred at the site or within 250m?	YES	The regulatory body's records indicate past flooding within 250m of the site. It would be prudent to ask the property owner whether they are aware of any previous flooding at the property or in the surrounding area. It would be possible to ask the regulatory body for more details of the recorded incident of past flooding. Natural Resources Wales has collated extensive records (including outlines) of flooding from rivers, the sea, or groundwater which have occurred since c.1950 in order to map the outlines of recorded historical flood events. This information comes from various sources including maps, aerial photographs and private records. It is not necessarily comprehensive.
Flood Insurance Claim Rating How do Crawford's rate the area for insurance claims?	Medium	Between 2 and 5 claims per 1000 households Crawford & Co is the world's largest independent provider of claims management solutions to the risk management and insurance industries. Crawford have compiled information in over 9,000 postcode sectors regarding the number of insurance claims made as a result of flooding. The risk has been classified by Crawford into five categories, too few, very low (no claims), low (less than 2 claims per 1000 households), moderate (between 2 and 5 claims per 1000 households) and high (more than 5 claims per 1000 households). This information is not necessarily comprehensive and excludes flood claims arising as a result of burst pipes and domestic appliances.

Flood Risk Screening Methodology

The Homecheck Professional® report is a desktop flood risk screening report, designed to enable home buyers and property professionals to assess the risk of flooding at residential sites. It examines two key areas; the overall risk of flooding at a site taking into account any flood defences present (where these are identified) and how flood risk affects the availability of insurance for a site. The report considers current Government guidance including the National Planning Policy Framework (NPPF) and the current agreement between insurance companies and central Government. The report has been designed and produced by qualified flood risk specialists using the data available in this report.

Flood Risk Rating

An overall flood risk rating is provided based on an assessment of the data provided within this report. The overall risk rating in the report takes into account the effect of flood defences, where these are identified, based on the presence of flood defences registered by Natural Resources Wales within the vicinity of the property. It should be noted that a residual risk of flooding may remain if such defences were to fail owing to extreme weather conditions, over-topping or poor maintenance. In addition, it should be noted that flood defences do not generally offer protection against groundwater or surface water flooding.

Where no flood defences are present in the vicinity of the property the overall risk rating provides a worst case scenario which may be alleviated by smaller scale local flood defences or recently constructed flood defences not currently registered by Natural Resources Wales. Replies in Scotland will always present the worst case scenario where there are no flood defences in the area benefiting the site or assuming any flood defences will fail or be over-topped. This is because data regarding flood defences in Scotland is currently unavailable from the Scottish Environment Protection Agency and Local Lead Flood Authorities.

The overall risk of flooding will be answered by one of four standard responses:

Response	Meaning
Negligible	The overall flood risk rating for the property is assessed to be 'Negligible'. Existing datasets do not indicate any risk at the property itself, or any feature within the locality of the property, which would be expected to pose a threat of flooding. It is not considered that any further investigations are necessary in regard to flood risk.
Low	The overall flood risk rating for the property is assessed to be 'Low'. Although large sites (over 1 ha) would require a Flood Risk Assessment examining the impact the development would have on local drainage to accompany any planning application, it is not considered necessary to undertake any other further investigations into the flood risk at the property.
Moderate	The overall flood risk rating for the property is assessed to be 'Moderate'. Information from existing datasets suggests that there are certain features which may present a risk to the property and its occupants. Further assessment would normally be suggested as a prudent measure to clarify the risk of flooding at the property.
High	The overall flood risk rating for property is assessed to be 'High', with a consequent risk to life and property. This means that existing datasets reveal significant flood risk issues which need to be addressed. Further assessment is usually recommended in order to clarify the risk of flooding at the property.

Flood Risk Gauges

The flood risk gauges provide a more detailed analysis of the risk from each of the four main types of flooding – river, coastal, groundwater and surface water. In addition, a fifth gauge provides an analysis of other factors (i.e. historic flood events) that may affect the overall flood risk. For undefended fluvial and tidal flood risk and surface water flood risk data provided by JBA, only the risk rating generated during the modelled the 1:200 year return event is considered in the overall risk assessment. The data on 1:75 year and 1:1000 year return events are provided for information only. For further information on each of these types of flooding, please refer to the Homecheck Professional® User Guide.

This analysis takes into account any existing flood defences, where these are identified, that are intended to protect the property and assumes that these work as designed. The analysis also takes into account the other information contained in those data sections of the report which are relevant to that particular type of flooding. The assessment of the risk as shown in the flood gauges should therefore take priority over the information in the individual data sections of the report.

Insurance Availability

An indication of whether the property is likely to be insurable for flood risk at standard terms is provided by this report. Replies in England and Wales are based on consideration of the Risk of Flooding from Rivers and Sea dataset supplied by Natural Resources Wales, surface water flooding data supplied by JBA Consulting and Groundwater Flooding risk data supplied by ESI. Replies in Scotland are based on the consideration of the river flood (undefended fluvial) data and surface water flooding data supplied by JBA Consulting. This data is commonly used by insurance companies to determine the suitability of a property for insurance, although they may access additional information which could affect their assessment.

Under the Association of British Insurers' Revised Statement of Principles on the Provision of Flooding Insurance (July 2008), the general policy of member companies is that flood insurance for domestic properties and small businesses should continue to be available for as many customers as possible until 1 July 2013, by which time a longer term solution should be implemented. The premiums charged and other terms will reflect the risk of flooding but insurance will be available:

- 1) for properties where the flood risk is not significant (generally defined as no worse than 1.33% or 1-in-75 years annual probability of flooding); and
- 2) to existing domestic property and small business customers at significant risk, providing Natural Resources Wales has announced plans to reduce that risk within five years, such as improving flood defences. (The commitment to offer cover will extend to the new owner of any applicable property subject to satisfactory information about the new owner).

However, for significant risk areas where no improvements in flood defences are planned, and in all cases other than domestic properties and small businesses, insurers cannot guarantee to provide cover, but will examine the risks on a case-by-case basis. The implementation of the revised Statement of Principles depends on action from the Government and is continually reviewed by insurers. In addition, the revised Statement of Principles does not apply to properties built after 1st January 2009. Different guidance applies to these (see Climate Change – Guidance on Insurance Issues for New Developments from www.abi.org.uk).

The responses to the question 'Is the property likely to be insurable at standard terms?' assumes the property is an existing domestic property or small business and makes no allowance for previous claims arising from any type of flooding, nor for non-flood related risks such as subsidence.

Response	Meaning
Yes	The property is likely to be considered acceptable by insurance companies at standard terms and flood insurance should not be difficult to obtain. No further action required.
No	The property may not be considered acceptable by insurance companies at standard terms, on the basis of current information. Further work may be required in order to obtain acceptable insurance terms for the flood risk. This could include a more detailed risk assessment or the use of accredited products, flood resilient materials and temporary defences to defend the property.

Limitations of the Report

The Homecheck Professional® report has been designed to satisfy basic flood-related environmental due-diligence enquiries for residential properties. It is a desktop review of information provided by the client and from selected private and public databases. It does not include a site investigation, nor are specific information requests made of the regulatory authorities for any relevant information. Therefore, Landmark cannot guarantee that all issues of concern will be identified by this report, or that the data and information supplied to it by third parties is accurate and complete. The assessment within the report has been undertaken on a point location provided by the client and a 25m buffer placed around that point in order to assess the most likely areas associated with the property of interest. Landmark cannot be responsible for incidents where the 25m buffer does not encompass the entirety of the property demise.

This report includes an assessment of surface water flooding which examines the risk of the general drainage network overflowing during periods of extreme rainfall. This report does not make a detailed site-specific assessment of the suitability of the existing drainage on the property. If this is required, then a site survey should be considered. The assessment of pluvial flooding does not take into account particular local or temporary factors that may cause surface water flooding such as the blockage or failure of structures on or within watercourses, drains, foul sewers, water mains, canals and other water infrastructure; and any history of drains flooding at the property or in the locality. Surface water flooding can occur before surface water reaches the general drainage network, for example on hills and inclines.

Natural Resources Wales and JBA fluvial and coastal flood data does not include flood risk from very small catchments as models of such small scale catchments are not considered to be reliable for UK-wide flood risk assessments. The potential impact of climate change on flood risk to the property would require further study.

Replies in Scotland are based on the best available data in that locality. The overall risk assessment and insurability assessment will still provide a response based on the best available information within this report. Where information is unavailable or has not been provided for a region the relevant data section will report No Data.

When answering any questions within this report, current applicable legislation is taken into account.

The data used in this report may have inherent limitations and qualifications. Further details are set out in the Homecheck Professional® User Guide which is available by calling one of our customer services team on 0844 844 9966 or emailing helpdesk@landmark.co.uk.

Homecheck Professional® is provided by Sitescope Limited, part of Landmark Information Group. Sitescope is a leading UK provider of spatially-enabled property and environmental risk information to lawyers, banks, insurance companies, home inspectors and other property professionals.

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If you experience difficulties accessing our Terms & Conditions, if you copy and paste the link directly into your browser, you will be able to access our Terms & Conditions from there.

Should you still experience difficulties, then please telephone our Customer Service Team on 0844 844 9966

Contacts

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Fax 0844 844 9980

Email info@landmark.co.uk

Website www.landmark.co.uk

For advice on the report

Natural Resources Wales

Ty Cambria
29 Newport Road
Cardiff
CF24 0TP

General enquiries 0300 065 3000
Floodline 0845 988 1188

Email enquiries@naturalresourceswales.gov.uk

For advice on regulatory information

Flood Protection Association

10 Cavalry Ride
Norwich
NR3 1U

Telephone 01603 633 440
Fax 01603 763256

Website www.floodprotectionassoc.co.uk

For advice on Flood Protection Measures



Important Consumer Protection Information

This search has been produced by Landmark Information Group Ltd, Imperium, Imperial Way, Reading, RG2 0TD. Telephone 0844 844 9966, Fax No. 0844 844 9980 email helpdesk@landmark.co.uk which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practice and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details:

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk.

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE

Complaints procedure

If you want to make a complaint, we will:

- Acknowledge it within 5 working days of receipt.
- Normally deal with it fully and provide a final response, in writing, within 20 working days of receipt.
- Keep you informed by letter, telephone or e-mail, as you prefer, if we need more time.
- Provide a final response, in writing, at the latest within 40 working days of receipt.
- Liaise, at your request, with anyone acting formally on your behalf.

Complaints should be sent to:

Head of Customer Relations
Landmark Information Group Ltd
Landmark UK Property
Imperium
Imperial Way
Reading
RG2 0TD

Telephone: 0844 844 9966

Email: helpdesk@landmark.co.uk

Fax: 0844 844 9980

If you are not satisfied with our final response, or if we exceed the response timescales, you may refer the complaint to The Property Ombudsman scheme (TPOs): Tel: 01722 333306, E-mail: admin@tpos.co.uk.

We will co-operate fully with the Ombudsman during an investigation and comply with his final decision.

Appendix F – Surface Water Runoff Calculations

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref w1862
Client :	Urban Developments and Construction Ltd		no of pages attached: 1 of 14	
Scheme :	Former Golden Grove Inn, Rossett		prefix	revision
Section :	Surface Water Runoff		SWR	A
prepared by: Jordan Jones		date:		08/05/2015
checked by: Johanne Williams		date:		28/05/2015
approved by: Peter Jones		date:		28/05/2015
<u>Comparison of pre-development and post-development runoff rates and volumes for greenfield or brownfield sites up to 200 Ha</u> <u>Site description</u> Proposed development at the Former Golden Grove Inn, Rossett, Wrexham, LL12 0AS. Development includes the erection of two detached dwellings with associated garages and landscaping see page SWR14. National Grid Reference (centre of site) approx. 335371E 358658N. <u>Design Brief</u> To calculate both pre and post development rainfall runoff in accordance with the requirements of the Interim Code of Practice for Sustainable Drainage Systems. The peak runoff rates are to be estimated for return periods of up to 100 years and the runoff volumes are also to be calculated for a 1 in 100 year event of 6 hour duration. An allowance for climate change should be included only in the case of the post-development runoff calculation. <u>Documents Referenced</u> 1. Interim Code of Practice for Sustainable Drainage Systems (ICP-SUDS)(July 2004) 2. I o H Report 124 - Flood Estimation for Small Catchments (Marshall & Bayliss, 1994) 3. FSSR 16 runoff model - Fixed Percentage Runoff Method 4. Wallingford Procedure 1981 5. CIRIA C697 - The SUDS Manual (Feb 2007) <u>Basis of estimates</u> The Interim Code of Practice for Sustainable Drainage Systems (July 2004)^[1] recommends the use of I o H 124^[2] for calculating peak greenfield runoff rates for sites up to 200 Ha. For site less than 50 Ha, the runoff should be calculated for 50 Ha and adjusted in proportion for the actual area. For sites greater than 200 Ha, the FEH runoff model should be used. CIRIA C697^[5] recommends the use of the FSSR 16^[3] runoff method for calculating the runoff volume for greenfield sites. For brownfield sites with a recognised drainage system, the Rational Method^[4] has been used to calculate the runoff for the impermeable portions of the catchment (pre- & post development). For sites without a proper drainage system, the pre-development runoff is calculated as for a greenfield site, assuming soil type 5, regardless of type indicated on mapping. In accordance with Technical Advice Note 15 (TAN15) and assuming a 100yr projection, a 30% on peak rainfall intensity increase in rainfall / runoff has been included to allow for the climate change anticipated in the years 2085 - 2115. Rainfall data is taken from maps in Defra / EA Tech Report W5-074/A Rev D (see page SWR10 & 11). Standard Average Annual Rainfall and Soil classification from maps in FSR Report (see page SWR8 & 9). N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.				

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
				prefix - page no. SWR2
Scheme :	Former Golden Grove Inn, Rossett			dated : 08/05/2015
Section :	Surface Water Runoff			

Basis of calculations

Peak run-off rate based on combination of IOH 124 method & Rational method

Run-off volume based on combination of FSSR 16 method & Rational method

N.B. Rational method used for impervious portion of total area for both pre and post development, allowing for pre-development of site where appropriate.

Catchment Details - input data

Proportions of soil type (from maps)

Prop S1	(fraction)		(x 0.15)
Prop S2	(fraction)		(x 0.30)
Prop S3	(fraction)		(x 0.40)
Prop S4	(fraction)	1.000	(x 0.45)
Prop S5	(fraction)		(x 0.50)
Total fraction		1.000	OK - total = 1
Calculated value of SOIL		0.450	
Calculated value of SPR		47.000	

$$\text{SOIL} = (0.15S1 + 0.3S2 + 0.4S3 + 0.45S4 + 0.5S5) / (S1 + S2 + S3 + S4 + S5)$$

$$\text{SPR} = 10S1 + 30S2 + 37S3 + 47S4 + 53S5$$

Region number	9	Select from list
AREA (Ha)	0.6025	(1Ha = 0.01Km ²)
SOIL (fraction)	0.450	Calculated above
SAAR (mm)	700	From FSR maps
CWI	105	From FSR graph
M5-60 rainfall (mm)	17.00	From Defra / EA maps
Ratio M5-60/M5-2d	0.30	From Defra / EA maps
M100-6hr rainfall (mm)	61.00	From Defra / EA maps
Storm duration (min)	15	(To give peak run-off-15 min for small site)
PIMP Pre-develop (%)	0.00	Provided by client
PIMP Post-develop (%)	10.87	Provided by client
Pre-dev drain system?	N/A	If "No", whole site assumed pervious - Soil type 5 & pre-dev PIMP taken as zero in following calcs
Climate change		
Rainfall increase (%)	30	Based on TAN15 (for years 2085 - 2115) Applied to post development case only

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220		Calculations		ref : w1862	
						prefix - page no. SWR3	
Scheme :		Former Golden Grove Inn, Rossett				dated :	
Section :		Surface Water Runoff				08/05/2015	

Pre- & Post-development peak run-off - Rational Method
(for impervious portions of catchment only)

Input data from sheet 2

Total area (Ha)	0.6025	from sht 2	
Pre dev PIMP (%)	0.00	from sht 2	Or zero if no pre-development drainage
Post dev PIMP (%)	10.87	from sht 2	
Pre-dev Imp area (Ha)	0.0000	calculated	
Post-dev Imp area (Ha)	0.0655	calculated	

M5-60min rain (mm)	17.00	from sht 2
Ratio "r"	0.30	from sht 2
Climate change (%)	30	from sht 2
Storm duration (min)	15.00	from sht 2

Rational Method

Peak run-off $Q_i = 2.78 C_v C_r i A$

Z1 Factor from table	0.590	pro-rata
Volume coeff C_v	0.75	(Typical 0.75)
Routing coeff C_r	1.30	(Standard value 1.3)

Calculation

M5-Dmin rain (mm)	10.030	M5-60min * Z1 factor
Climate change factor	1.30	Applied to post-development run-off only

Return period	1 yr	30 yr	100 yr
Z2 factor from table	0.610	1.520	1.910
Rainfall (mm)	6.12	15.25	19.16
Rainfall intensity (mm/hr)	24.5	61.0	76.6
Rainfall + CC (mm)	7.96	19.83	24.91
R. Intensity + CC (mm/hr)	31.8	79.3	99.6

Peak run-off rate

Pre-development Q_i (l/s)	0.00	0.00	0.00
Post-development Q_i (l/s)	5.64	14.08	17.68

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
			prefix - page no. SWR4
Scheme :	Former Golden Grove Inn, Rossett		dated :
Section :	Surface Water Runoff		08/05/2015

Pre & Post development peak run-off
IOH124 method for pervious areas - Rational method for impervious areas

Input data from sheet 2

Total Area (Ha)	0.6025	from sht 2
Pre-dev PIMP (%)	0.00	from sht 2 Or zero if no pre-development drainage
Post-dev PIMP (%)	10.87	from sht 3
Pre-dev Perv area (Ha)	0.6025	Calculated < 50 Ha or 0.5 Km2
Post-dev Perv area (Ha)	0.5370	Calculated < 50 Ha or 0.5 Km2

Region number	9	from sht 2
SOIL (fraction)	0.450	from sht 2
SAAR (mm)	700	from sht 2

Pre-dev SOIL 0.450 from sht 2 or fixed 0.5 if no drainage system

Regional growth factors

Multiplier for 1/1 yrs	0.82	FSSR 14 table 1 (lookup table)
Multiplier for 1/30 yrs	1.77	FSSR 14 table 1
Multiplier for 1/100 yrs	2.18	FSSR 14 table 1

Climate change factor 1.3 Applied to post-development run-off only

Mean annual flood $Qbar = 0.00108 * (AREA/100)^{0.89} * SAAR^{1.17} * SOIL^{2.17}$

	Pre-development	Post development
Qbar' (for 50 Ha) (m3/s)	0.21966 basis of pro-rata	0.21966 basis of pro-rata
Qbar (actual area) (m3/s)	0.00265 pro-rata (A/50)*Qbar'	0.00236 pro-rata (A/50)*Qbar'

Peak flows (IoH 124)

	1 yr	30 yr	100 yr	1 yr	30 yr	100 yr
Return period Multiplier	0.820	1.770	2.180	0.820	1.770	2.180
Peak run-off (m³/s)	0.00217	0.00469	0.00577	0.00193	0.00418	0.00514
Peak + CC Qp (m³/s)	n/a	n/a	n/a	0.00251	0.00543	0.00668

Total peak flows (l/s)

Perv area flow-Qp (l/s)	2.17	4.69	5.77	2.51	5.43	6.68
Imp area flow -Qi (l/s)	0.00	0.00	0.00	5.64	14.08	17.68
Total peak flow Q (l/s)	2.17	4.69	5.77	8.15	19.51	24.36

Peak flow increase (l/s)	5.98	14.82	18.59
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N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862 prefix - page no. SWR5 dated : 08/05/2015
Scheme :	Former Golden Grove Inn, Rossett			
Section :	Surface Water Runoff			

Pre & Post development run-off volume - FSSR 16
Applied to pervious and impervious areas
For 1 in 100yr 6hr storm

Input data from sheet 2

Total area (Ha)	0.6025	from sht 2	
Pre-dev PIMP (%)	0.00	from sht 2	Or zero if no pre-development drainage
Post-dev PIMP (%)	10.87	from sht 2	
Pre-dev Perv Area (Ha)	0.6025	calculated	
Pre-dev Imp Area (Ha)	0.0000	calculated	
Post-dev Perv Area (Ha)	0.5370	calculated	
Post-dev Imp Area (Ha)	0.0655	calculated	
SAAR (mm)	700.0	from sht 2	
CWI	105	from sht 2	
SPR (%)	47.00	from sht 2	

Rainfall data
(M100-360 min)

Rainfall P (mm)	61.00	from sht 2	
CC factor	1.30	from sht 2	
Rainfall Pcc (mm)	79.30	calculated	

DPR _{CWI} (%)	-5.000	calc	0.25*(CWI-125)
DPR _{RAIN} (%)	5.879	calc	0.45*(P-40)^0.7 for P>40mm
PR _p (%) (perv area)	47.879	calc	SPR + DPR _{CWI} + DPR _{RAIN}
PR _i (%) (imp area)	100.000	defined	100% of impervious area

Storm duration (mins) 360 defined

Run-off volume $V = PR/100 * A * 100000 * P/1000 = PR * A * P / 10$ (m3)

where PR = Percentage run-off PR_p or PR_i (%)
 A = Catchment area A_p or A_i (Ha)
 P = Rainfall depth (M100-360) P or Pcc (mm)
 (including climate change for post development only)

	Pre-dev	Post dev
	-	incl CC
Run-off volume- Pervious area (m3)	175.97	203.89
Run-off volume- Impervious area (m3)	0.00	51.93
Total run-off volume (m3)	175.97	255.82
Volume increase (m3)	79.85	

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
Scheme :		Former Golden Grove Inn, Rossett		prefix - page no. SWR6
Section :		Surface Water Runoff		dated : 08/05/2015

Z1 Factor for England & Wales (Values from BRE 365 - Table 1)

Ratio	Rainfall Duration (mins)					
r	15	30	60	120	240	360
0.12	0.450	0.670	1.000	1.480	2.170	2.750
0.15	0.480	0.690	1.000	1.420	2.020	2.460
0.18	0.510	0.710	1.000	1.360	1.860	2.250
0.20	0.530	0.723	1.000	1.340	1.800	2.163
0.21	0.540	0.730	1.000	1.330	1.770	2.120
0.24	0.560	0.750	1.000	1.300	1.710	2.000
0.25	0.567	0.753	1.000	1.290	1.687	1.960
0.27	0.580	0.760	1.000	1.270	1.640	1.880
0.30	0.590	0.770	1.000	1.250	1.570	1.780
0.33	0.610	0.780	1.000	1.230	1.530	1.730
0.35	0.617	0.787	1.000	1.223	1.497	1.690
0.36	0.620	0.790	1.000	1.220	1.480	1.670
0.39	0.630	0.800	1.000	1.210	1.460	1.620
0.40	0.633	0.803	1.000	1.207	1.447	1.603
0.42	0.640	0.810	1.000	1.200	1.420	1.570
0.45	0.650	0.820	1.000	1.190	1.380	1.510

Z2 Factors for England & Wales from table 6.2 - Wallingford Procedure

M5 Rain	Diff	M1	M30	M100
(mm)	(mm)			
		1	30	100
5.00	5	0.62	1.45	1.79
10.00	5	0.61	1.52	1.91
15.00	5	0.62	1.55	1.99
20.00	5	0.64	1.58	2.03
25.00	5	0.66	1.57	2.01
30.00	10	0.68	1.55	1.97
40.00	10	0.70	1.50	1.89
50.00	25	0.72	1.45	1.84
75.00	25	0.76	1.36	1.64
100.00	50	0.78	1.32	1.54
150.00	50	0.78	1.26	1.45
200.00		0.78	1.24	1.40
N.B. M30 Factors interpolated graphically				

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
Scheme :		Former Golden Grove Inn, Rossett		prefix - page no. SWR7
Section :		Surface Water Runoff		dated : 08/05/2015

Hydrological Regions (From Defra / EA R&D Tech Report W5-074/A Rev D)



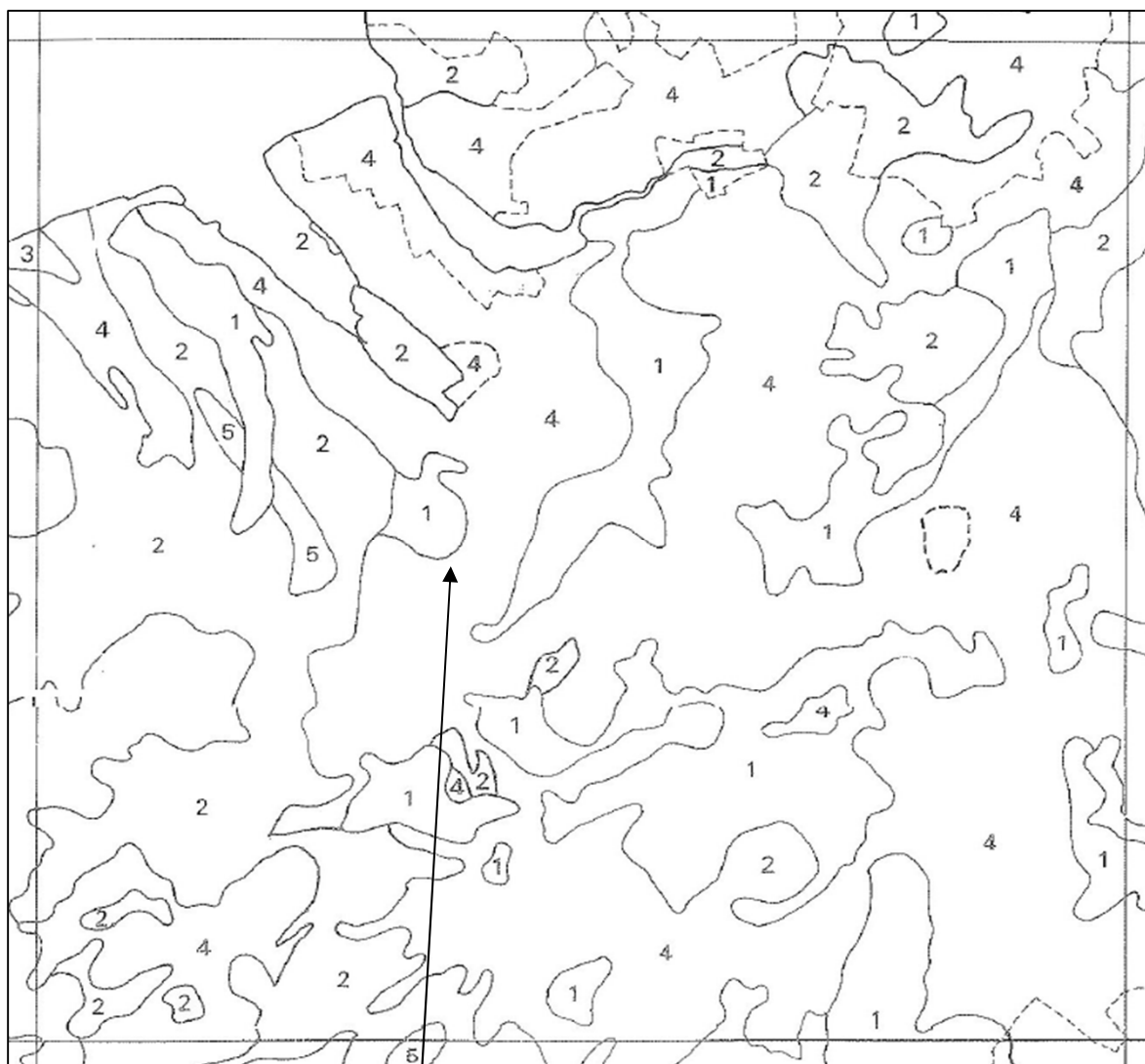
Figure 1.1 Hydrological regions of UK

Grid Ref: - 335371E 358658N - Hydrological region 9

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
Scheme :	Former Golden Grove Inn, Rossett		prefix - page no. SWR8
Section :	Surface Water Runoff		dated : 08/05/2015

Soil Classification Chart

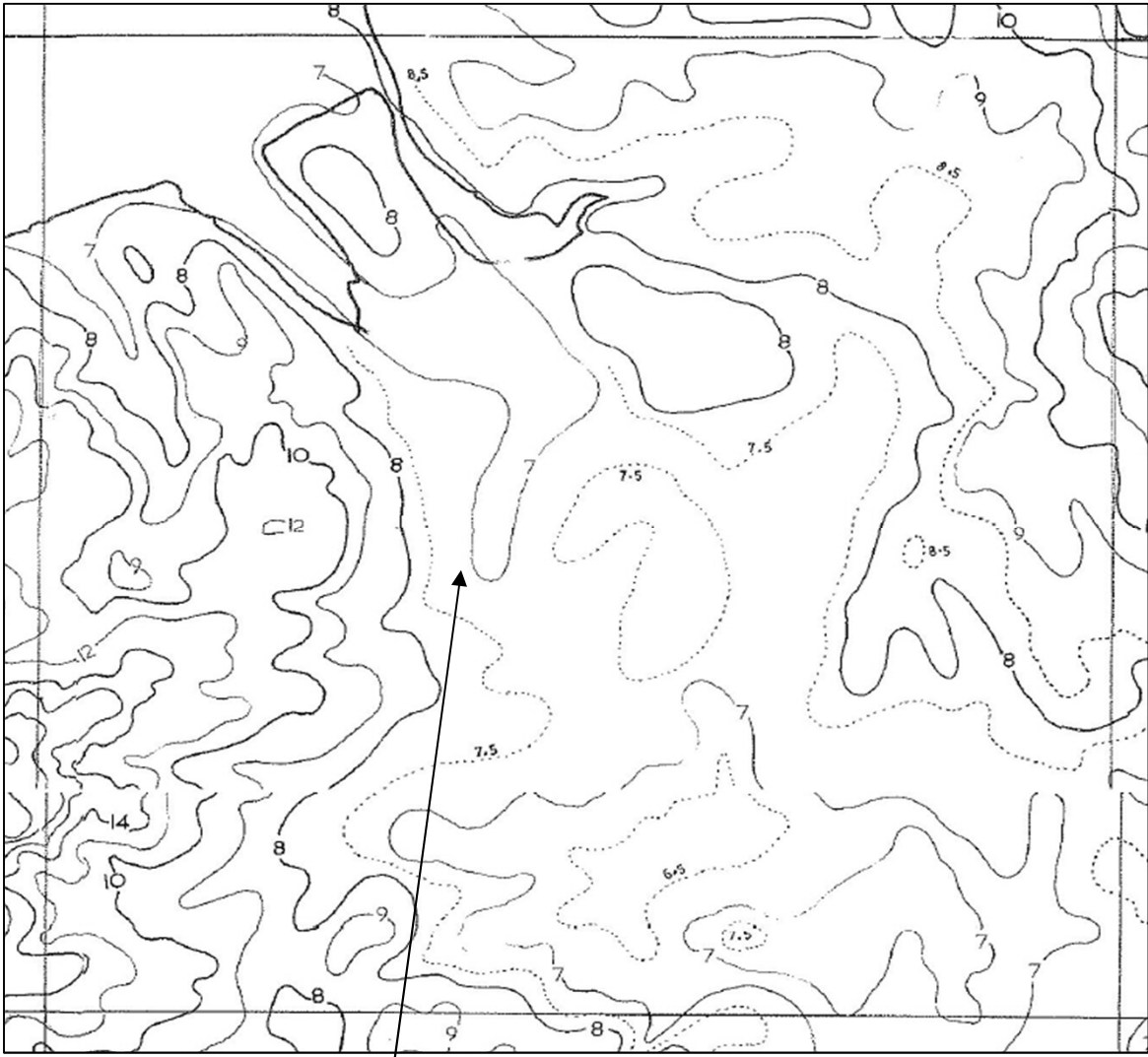


Grid Ref: - 335371E 358658N - Soil Classification = 4

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
				prefix - page no. SWR9
Scheme :	Former Golden Grove Inn, Rossett			dated :
Section :	Surface Water Runoff			08/05/2015

Standard Annual Average Rainfall (SAAR) Chart



Grid Ref: - 335371E 358658N - SAAR = 700mm

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
Scheme :		Former Golden Grove Inn, Rossett		prefix - page no. SWR10
Section :		Surface Water Runoff		dated : 08/05/2015

M5-60min Rainfall + r (From Defra / EA R&D Tech Report W5-074/A Rev D)

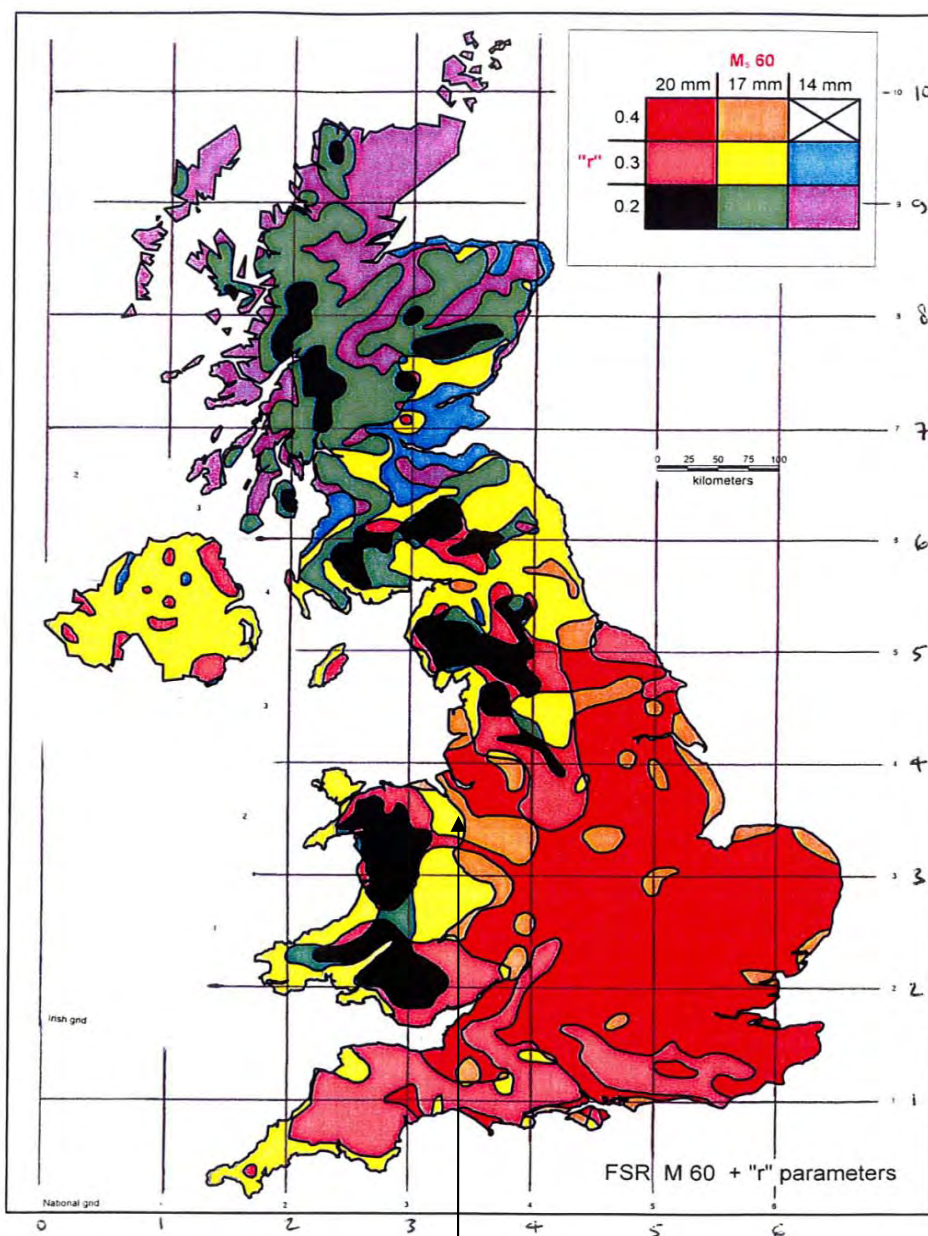


Figure 2 Hydrological rainfall zones of UK

Grid Ref: - 335371E 358658N - M5-60 = 17mm, 'r' = 0.3

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

Scheme :

Former Golden Grove Inn, Rossett

Section :

Surface Water Runoff

M100 6hr Rainfall (From Defra / EA R&D Tech Report W5-074/A Rev D)

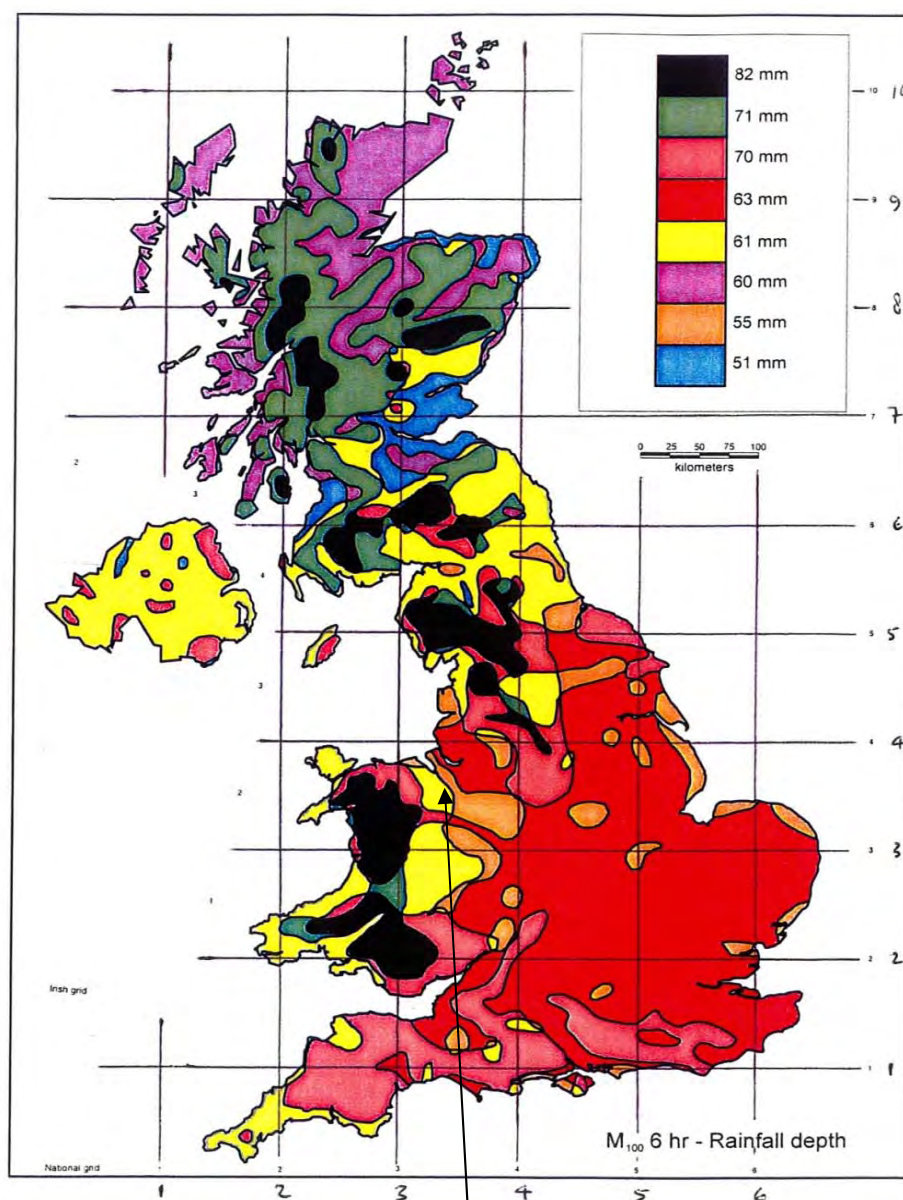


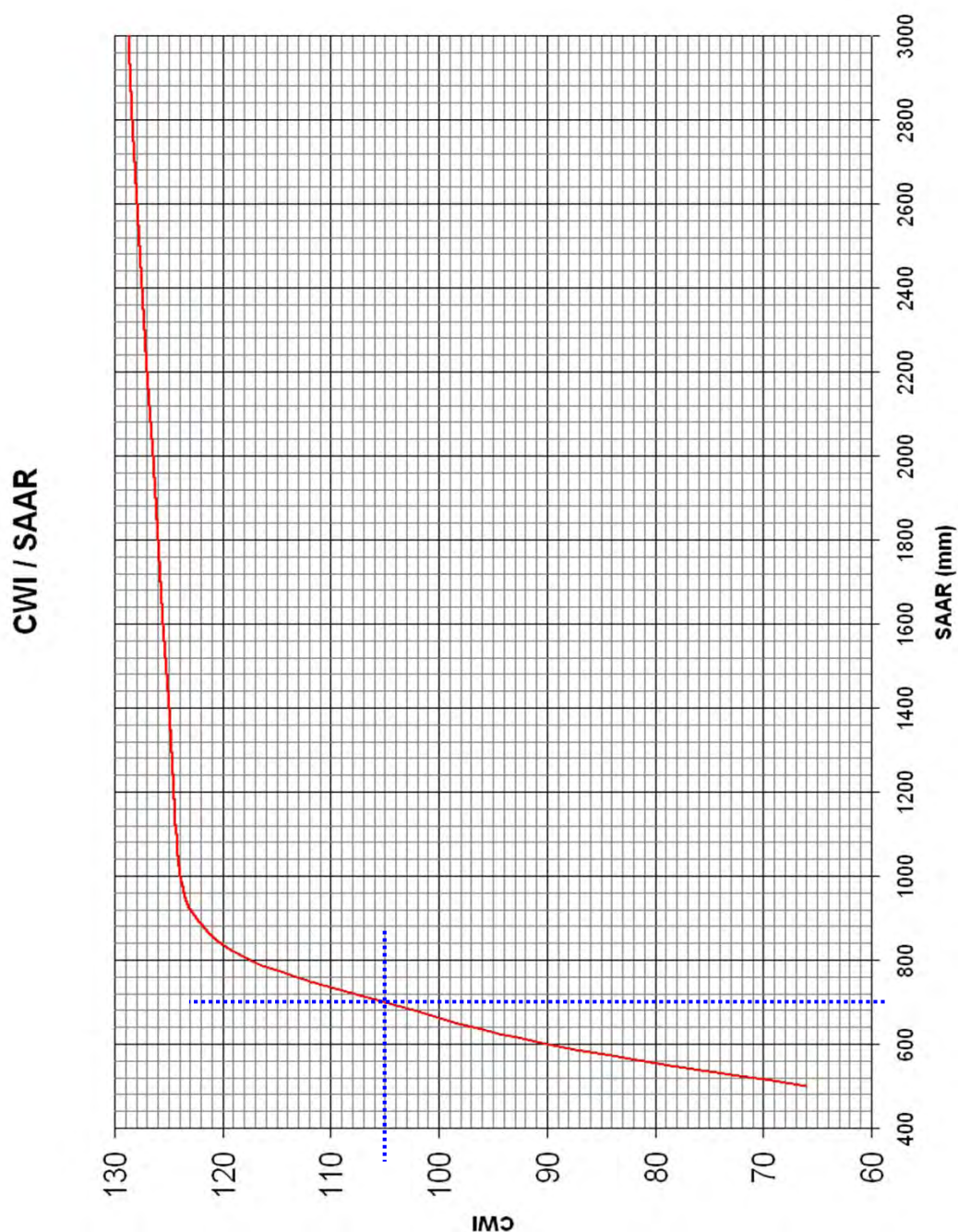
Figure 3.1 100 year 6 hour rainfall depths of UK

Grid Ref: - 335371E 358658N - M100-6hr Rainfall = 61mm

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
Scheme :		Former Golden Grove Inn, Rossett		prefix - page no. SWR12
Section :		Surface Water Runoff		dated : 08/05/2015

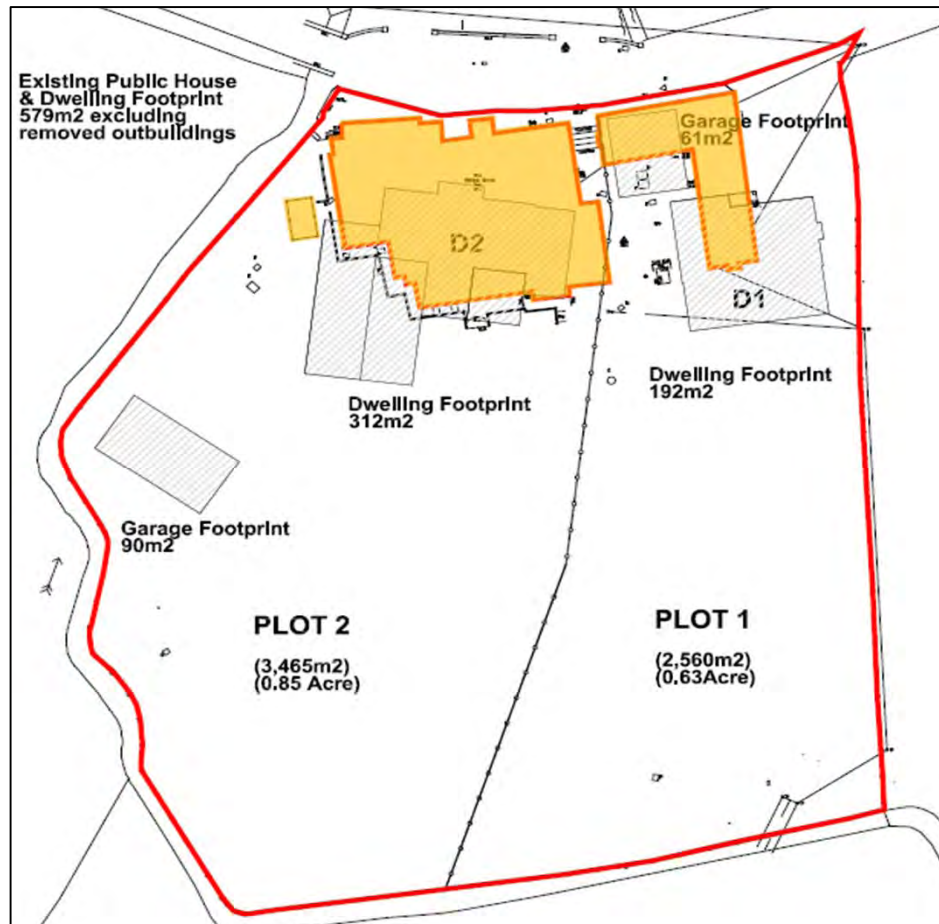
Catchment Wetness Index (CWI) vs Standard Annual Average Rainfall (SAAR)



N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

		Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
				prefix - page no. SWR13
Scheme :	Former Golden Grove Inn, Rossett			dated : 08/05/2015
Section :	Surface Water Runoff			

Pre-development Area



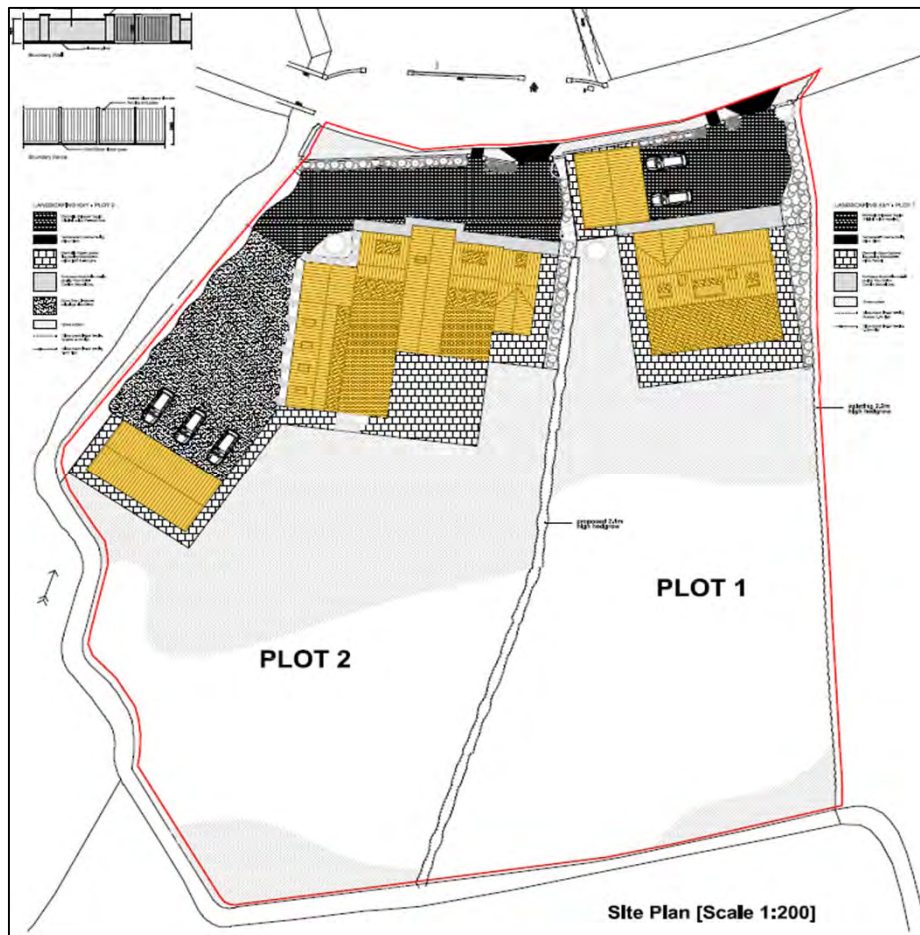
Total Area = 6025m²
Permeable Area = 90.4% = 5446m²
Impermeable Area = 9.6% = 579m²

- = Site Boundary
- = Impermeable Areas

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref : w1862
Scheme :	Former Golden Grove Inn, Rossett		prefix - page no. SWR14
Section :	Surface Water Runoff		dated : 08/05/2015

Post-development Area



Total Area = 6025m²
Permeable Area = 89.13% = 5370m²
Impermeable Area = 10.87% = 655m²

- = Site Boundary
- = Impermeable Areas

N.B. These calculations are for planning purposes only and will need to be reviewed at the detailed design stage.

Appendix G – Storm Water Storage Calculations

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref	w1862
Client:	Urban Developments and Construction Ltd	Page 1 of	1	
Scheme:	Former Golden Grove Inn, Rossett	Prefix	SWS	
Section:	Storm Water Storage	revision	A	
Prepared by:	Jordan Jones	date:	11/05/2015	
Checked by:	Johanne Williams	date:	28/05/2015	
Approved by:	Peter Jones	date:	28/05/2015	

Surface Water Attenuation - Required Storage Volume

Storm return frequency-once in	100	years
M5-60 min rainfall	17	mm
Ratio M5-60 / M5-2day - R	0.3	ratio
Climate change increase	30	%

Impervious Area (A) (Ha)	0.0655	Ha	(provided by client)
Allowable discharge (Qa)	5.000	l/s	(subject to agreement)

Discharge Coefficient (Cd)	0.840	(typical 0.75 summer / 0.84 winter)
Routing Coefficient (Cr)	1.300	(standard value)
O/A Coefficient (C = Cd * Cr)	1.092	
Climate change adj factor (Fc)	1.300	

Storage Volume required = (Qr-Qa)*D*60 (Litres)

SW Run-off (Qr) = 2.78 C i A * Fc

<u>Storm duration (D)</u>	<u>rainfall</u>	<u>Run-off rate</u>	<u>Storage Vol</u>	
<u>(Minutes)</u>	<u>(Hrs)</u>	<u>(mm/hr)</u>	<u>(L/s)</u>	<u>(m3)</u>
5	0.08	117.3	30.328	7.6
10	0.17	89.6	23.154	10.9
15	0.25	74.2	19.187	12.8
30	0.5	51.4	13.285	14.9
45	0.75	40.6	10.501	14.9
60	1	34.2	8.833	13.8
90	1.5	26.5	6.855	10.0
120	2	21.8	5.642	4.6
150	2.5	18.8	4.864	0.0
180	3	16.6	4.284	0.0
240	4	13.5	3.496	0.0
360	6	10.1	2.618	0.0
480	8	8.2	2.132	0.0
600	10	7.0	1.813	0.0
720	12	6.1	1.584	0.0
1440	24	3.7	0.961	0.0
2880	48	2.2	0.569	0.0

****Critical storm**

Design Storage requirement **14.9** m3