

Flood Consequence Assessment

Island Green, Wrexham.

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Flood Consequence Assessment

Island Green, Wrexham.

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Flood Consequence Assessment

Island Green, Wrexham.

Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2008 and BS EN ISO 14001: 2004)

Issue	Date	Prepared by	Checked by	Approved by
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Second	November 2015	Richard Baker Associate Director	Stephen Brindle Associate Director	John Hughes Regional Director

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EXECUTIVE SUMMARY

This Flood Consequence Assessment has been prepared on behalf of our Client in support of proposals at Island Green, Wrexham.

Proposals include two elements:

- Modifications to the existing parking arrangement at locations across the wider development (Site 1); and
- The construction of a new Restaurant development on an existing parking area within the existing development (Site 2).

The main conclusions of this study can be summarised as:

- The new Restaurant application boundary comprises land located partially within TAN 15 Zone C2 or partially within the Environment Agency's Flood Zone 2 where the annual probability of flooding from rivers is up to a 0.1% (1 in 1000) chance of flooding each year.
- There are various locations within the wider development that alterations to existing car parking arrangements are proposed. These areas are located within TAN 15 Zones A, B & C2 or within the Environment Agency's Flood Zone 2 or 1. Where the annual probability of flooding from rivers is up to a 0.1% (1 in 1000) chance of flooding each year or less than 0.1% respectively.
- The risk associated with fluvial flooding is considered low.
- The risk of flooding from ground water and overland flooding is considered to be low
- The risk of flooding from sewers is considered to be low and from other sources as very low.

In conclusion the Development proposal does not exacerbate the existing risk of flooding and it will not increase flood risk at the site or elsewhere. The development is therefore considered appropriate and in accordance with the Planning Policy Wales (TAN 15).

1. Introduction

1.1 The Brief

Waterman Infrastructure & Environment Limited has been instructed to prepare a Flood Consequence Assessment as required by Planning Policy Wales Technical Advice Note 15 (TAN15) July 2004.

Reference is made to the National Planning Policy Framework (NPPF): Development and Flood Risk, published in March 2012 as the Natural Resources Wales Fluvial Flood Zone mapping obtained for the site references Flood Zones 2 and 3.

Proposals include two elements:

• Modifications to the existing parking arrangement at locations across the wider development (Site 1); and

• The construction of a new Restaurant development on an existing parking area within the existing development (Site 2)

A location plan is included within Appendix A. Supporting proposed master planning layouts are including within Appendix B.

The report describes the existing site conditions and proposed Developments. It assesses the potential sources of flooding to the site from tidal, fluvial, groundwater, surface water and other sources, taking a risk based approach.

2. Site Description and Proposals

2.1 Existing Site Location

The Island Green site is located in the centre of Wrexham, in an area of mixed residential and commercial use is bound by Petre Felin to the south with commercial buildings to the east and west. The River Gwenfro flows through the Island Green site, albeit culverted for the majority of its length. Adjacent to the northern boundary Site 2 the river exits the culvert and flows through a cutting, at a level significantly below the existing site level.

A Site location plan is included in Appendix A.

2.2 Proposed Development

Master plan layout information can be found in Appendix B.

The proposed development include the following;

- Modifications to the existing car parking arrangement across the wider development (Site 1); and.
- The provision of new restaurant including drive-through arrangement, alterations to the existing car park arrangement, retaining walls, footway link and changes to landscaping (Site 2).

3. Scope of the Assessment

In accordance with Planning Policy Wales Technical Advice Note 15 (TAN15) and the National Planning Policy Framework (NPPF), the aim of these planning document are:

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

TAN 15 provides guidance to planners on how to consider flood risk issues in relation to development proposals. TAN 15 identifies when a Flood Consequence Assessment (FCA) is required and where different types of development are appropriate. This is done by assigning a flood risk level to all land in Wales through Development Advice Maps (DAM). Several Zones are defined within the DAM.

Zone A – Considered to be little or no risk of fluvial or tidal/costal flooding.

Zone B - Area known to have been flooded in the past evidenced by sedimentary deposits.

Zone C1 – Based on Environment Agency extreme flood outline, equal to or greater than 1 in 1000 (0.1%AEP) annual probability of river of sea flooding in any one year. Areas of floodplain which are developed and served by significant infrastructure, including flood defences.

Zone C2 – Based on Environment Agency extreme flood outline, equal to or greater than 1 in 1000 year (0.1%AEP) annual probability of river or sea flooding in any year. Areas of flood plain without significant flood defence infrastructure.

The Welsh Government's TAN 15 Development Advice Flood Maps indicate the site is partially located in Zone C2 with the remainder in Zone A.

Natural Resources Wales have provided site specific Fluvial Flood Zones for the Island Green site. This flood map references the Environment Agency Flood Zone categories and this is why we have referenced these categories within this assessment.

The Natural Resources Wales Flood Zone Mapping Information can be found in Appendix C.

The River Gwenfro was subject of a modelling exercise and is covered JBA Consulting's Modelling report dated February 2009.The Halcrow 1d-2d linked ISIS-TUFLOW model of the Gwenfro was used to update the local Flood Map. Flood outlines for the 5%, 1%, 1% plus climate change and 0.1%AEP events are provided with the assessment. The 1d hydraulic model results were also review against the existing topography of the site.

Therefore, with reference to Flood Maps the site lies is located within an area already being used for retail usage (less vulnerable classification under TAN15/NPPF) and as discussed later in this assessment it is

not considered that proposals increase the potential risk of flooding either to the site directly or to adjacent sites. Therefore, the development is considered appropriate under TAN15.

4. Consultations

4.1 Natural Resources Wales

Natural Resources Wales have provided their Fluvial Flood Zone Mapping, which indicates the site is located partially within Flood Zone 2. In addition they have also provided the Afon Gwenfro Flood Risk Mapping Study carried out by JBA Consulting in 2009.

TAN 15 Development Advice Map identifies the site is located within Flood Zone C2 and Zone A and B respectively.

4.2 Wrexham County Borough Council

The Borough Council were contacted to establish if they held any historical flood information for the site. Their response identifies the nearest event they have recorded occurred to the east of the site boundary and involved surface water flooding. No further information was available.

4.3 Dŵr Cymru Welsh Water

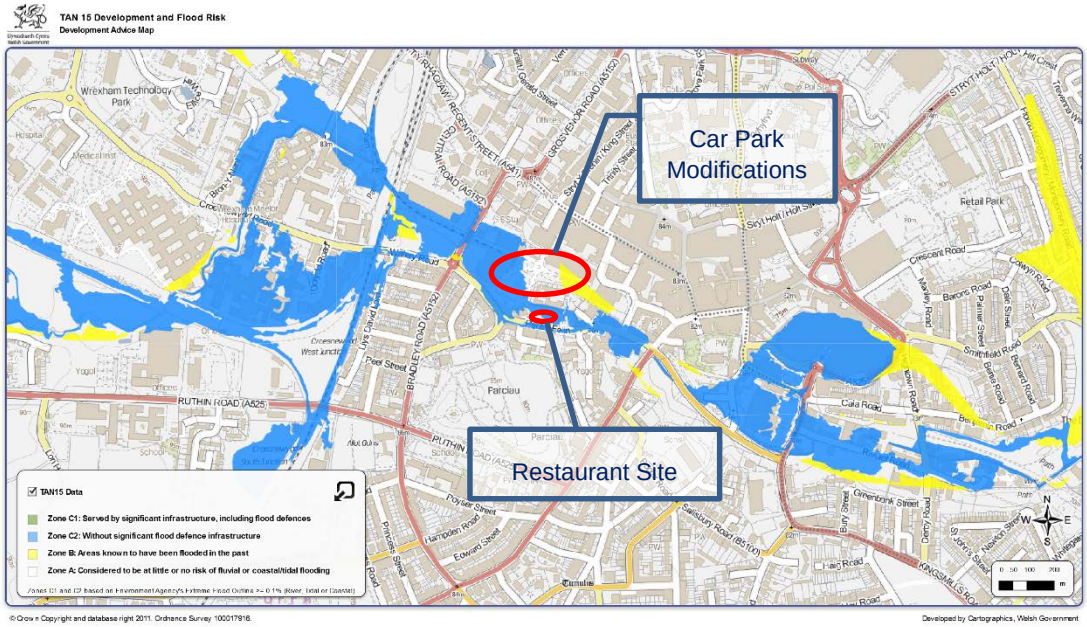
Sewer records have been obtained by the Services Consultant which have been incorporated into a consolidated existing services drawing. This drawing is included in Appendix D

5. Sources of Flooding

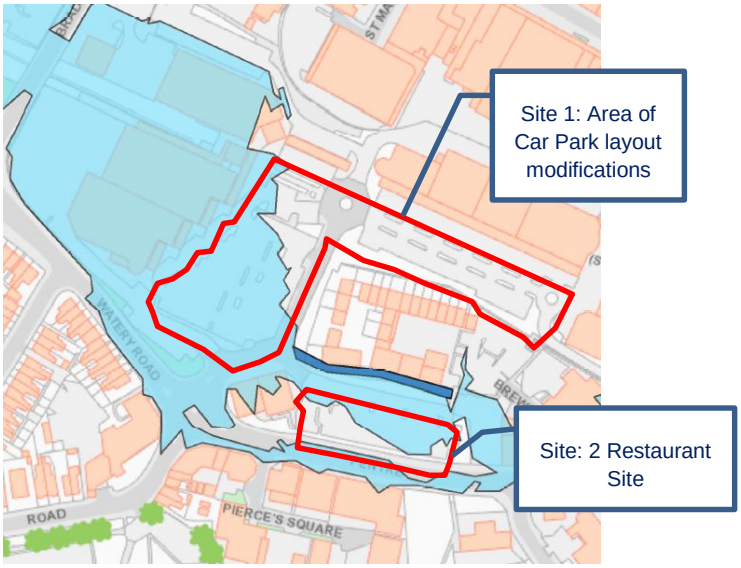
5.1 Flooding from Rivers

The River Gwenfro runs through the site, albeit culverted along the majority of its length. Adjacent to the location of the proposed Restaurant the river is in cutting significantly below the level of the site.

As the Site has been confirmed as located within Flood Zone A or Flood Zone 1 where the annual probability of flooding from rivers is 0.1% or less the risk of flooding from Rivers is low. Below is an extract from the TAN 15 Flood Map

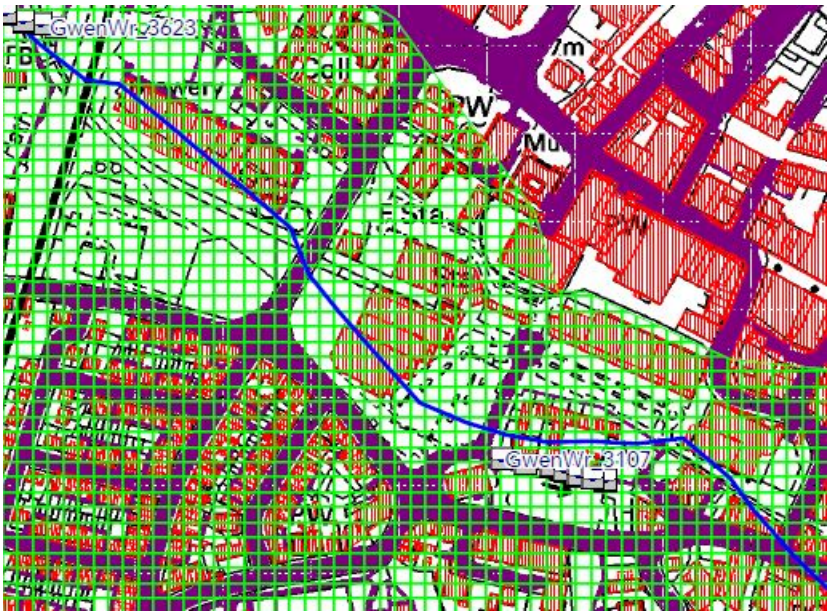


Below is an extract from the fluvial flood map received from Natural Resources Wales, which can be seen in appendix C. The light blue shading represents Flood Zone 2 with the dark blue being Flood Zone 3 which appears to be contained within the width of the river cross section.



The River Gwenfro was subject of a modelling exercise and is covered JBA Consulting's Modelling report dated February 2009.The Halcrow 1d-2d linked ISIS-TUFLOW model of the River Gwenfro was used to update the local Flood Map.

From the ISIS-TUFLOW Model schematic plan it can be seen the nearest model node (3107) is adjacent to the proposed restaurant site. 3107 appears to be located at the exit to the culvert before flowing down stream to 3073 (mid-way through the site) and 3033 is at the downstream end of the site. Due to the close proximity of the node to the site, the predicted 1d level for this point have been reviewed against the topographic survey which would be to a higher degree of accuracy than the 2d model data.



When comparing the 1d hydraulic model results were also review against the existing topography of the site it can be seen that the predicted flood levels are as follows:

Figures are extracted from Afron Gwenfro Flood Risk Mapping Study: Appendix C 1D Hydraulic Model Results Tables

Label	0.1% AEP	1%+CC AEP	1%AEP	5%AEP
GwrenWR_3107	77.08	76.54	76.38	75.98
GwrenWR_3073	76.85	76.34	76.07	75.59
GwrenWR_3033	76.81	76.28	75.98	75.45

The above levels from the 1d modelling would suggest the flow remains within channel of the river for all events, so the extent of the flood contour reflects the possible overland flow route.

Flood outlines for the 5%, 1%, 1% plus climate change and 0.1%AEP events are provided with the assessment and copies can be found in Appendix C of this report.

The extent of the 0.1% AEP event appears to cross the existing car parking area within the proposed restaurant site.

The topography of the site adjacent to the boundary with the River Gwenfro is at its lowest point circa 77.46m AOD which is significantly higher than the 0.1% (1in1000) year AEP.

However the flood depth plan associated with this event indicates the bulk of the existing car park at “0mm” depth of flooding across its entire width, with only suggesting the river edge is up to “200mm”.

At the widest point in the extent of flood water the topographic survey indicates a minimum level of 77.46m along the river edge of the development, whilst the opposite side of the car park rises to circa 78m which would suggest there is a discrepancy within the mapping accuracy and the extent of the 0.1%AEP is likely to be less than indicated.

Levels used within the modelling exercise are suspected to project a surface that is lower than actually found on site, this is likely to be attributed the relative accuracy and spread of the data used in comparison with the site specific topographic information.

To reflect this we have reviewed the flood contour using the max depth of water indicated on the flood hazard map of circa 200mm. When comparing the actual site level +200mm to produce a “top water” level these levels as you work along the site edge would produce a different contour line. This has been annotated onto the topographic survey and can be found in Appendix C

We would consider the risk of flooding from the River Gwenfro to be low.

5.2 Flooding from the Sea

The Site is a significant distance from the nearest tidal estuary and is, therefore, not at risk of flooding from the sea. As such, coastal and tidal flooding is not considered further within this assessment.

5.3 Flooding from Land

Overland flow occurs when intense rainfall exceeds the infiltration capacity of the ground, when the ground is saturated or when the water runoff exceeds the capacities of sewers and/or water courses. Overland flow can cause localised flooding in natural valley bottoms as normally dry areas become covered in flowing water and in natural low spots where the water may pond. Flooding from this source is most likely to occur

in relatively low lying areas, or where the pathway for runoff is restricted by terrain or man-made obstructions.

It is believed when reviewed against the topography of adjacent areas and the fact that the site is elevated above the River Gwenfro, that the risk associated with pluvial flooding is low.

5.4 Flooding from Groundwater

Groundwater flooding tends to occur after much longer periods of sustained high rainfall. The areas that are at risk tend to be those low-lying areas where the water table is shallow. Flooding tends to occur in areas that are underlain by major aquifers, although groundwater flooding is also noted in localised floodplain sands and gravels. The main causes of groundwater flooding are:

- Natural groundwater rising due to exceptionally wet periods leading to rapid recharge.
- Groundwater rebound due to cessation of abstraction and mine dewatering
- Existence of confined aquifers and springs

A Preliminary Environmental Risk Assessment has been undertaken and the underlying strata is said to be made ground across the study area. The thickness is anticipated to be between 3m and 4m in thickness and is comprised of Sands and clays commonly including brick, ash coal and sandstone cobbles.

Given the underlying ground conditions and natural topography of the site we consider the risk of groundwater flooding to be low.

5.5 Flooding from Sewers

Flooding from drainage system occurs when flow entering a system exceeds its discharge capacity, the system becomes blocked or, in the case of surface water sewers, it cannot discharge due to high water level in the receiving watercourse. Sewer flooding is often caused by surface water discharging into the combined sewerage system, sewer capacity is exceeded in large rainfall events causing backing up of flood waters within properties or discharging through manholes.

The site is served by a private surface water drainage system that is attenuated and discharge would appear to be controlled before discharging into the River Gwenfro. The design standards for this network are unknown but given the extent of attenuation provided within the scheme significant protection against flooding is provided.

There is a network of foul drains within the site which appear to link the site into the adjacent public combined sewer system which is located adjacent to the site within Watery Road and Pentre Felin.

Existing private drainage records and the Consolidated Services Plan (including public sewer system) can be found in appendix D

Considering the above, the previously referred to flood maps and the proximity of the site to existing sewers, the risk of flooding from sewers and the drainage systems is considered low.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

There are no Reservoirs, Canals, or other Artificial Sources within close proximity to the site which would be a source of potential flooding.

6. Flood Risk Assessment

With reference to the points raised in section 5, the following is a summary of the likely risk associated with each potential source of flooding.

6.1 Rivers

The application boundary of the proposed development comprises land located within Flood Zone C2, A & B.

With reference to the proposed re-configuration of the parking layout (Site 1) we would consider the risk of fluvial flooding to be low

With reference to the proposed drive thru restaurant (Site 2) we would considered the risk of fluvial flooding to be low.

6.2 Sea

Due to the proximity of the Site from the Sea, the risk of flooding is not applicable and therefore not considered further in this assessment.

6.3 Land

Given the local topography and proximity to existing ditch drainage system it is believed that the risk associated with pluvial flooding is low.

6.4 Groundwater

The risk of flooding from groundwater is assessed as low.

6.5 Sewers

The risk of flooding to the site is considered to be low.

6.6 Reservoirs, Canals and Other Artificial Sources

No Reservoirs, Canals or Other Artificial Sources within close proximity to the site have been identified as being possible sources of flood risk.

6.7 Climate Change

It is generally accepted that man-induced climate change will increase the risk of flooding. Projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long duration rainfall could be expected. These changes would have implications for river flooding and for local flash flooding.

The implications for climate change for this period should be made using the precautionary allowances and indicative sensitivity ranges in TAN15 and NPPF.

For the purposes of this assessment with a development lifespan of circa 100 years, increasing peak rainfall intensity by 30% will provide an appropriate precautionary response to the uncertainty about climate change impacts.

6.8 Surface Water Runoff

Previous sections of the Assessment discuss the potential flood risk to the site itself, however, it is equally important to ensure that the Development does not increase flood risk elsewhere by increasing surface water runoff.

Guidance for the disposal of surface water from a development site is for soakaways to be considered as the primary solution. If this is not practical, discharge to a watercourse is to be considered as the next available alternative. Only if neither of these options is available, and other sustainable drainage methods not possible, should the use of the public sewerage system be considered.

The site is connected to a private drainage system as identified in section 5.5 with surface water attenuated before discharge into the River Gwenfro.

There is a net reduction in impermeable area within the proposed restaurant development site (Site 2) and the proposed modifications to the parking arrangement (Site 1) doesn't have an impact on the impermeable area or existing drainage catchments.

6.9 Sustainable Drainage Systems

The use of SuDS will be considered to reduce runoff from the development. SuDS fall into three broad categories; the techniques aim to:

- Reduce the quantity of runoff from the site (source control techniques);
- Slow the velocity of runoff to allow settlement, filtering and infiltration (permeable conveyance); and
- Provide passive treatment to collected surface water before discharge into land or to a watercourse (end of pipe system).

The detailed design of SuDS is beyond the scope of this FCA. However, this study does present an evaluation of potential SuDS methodology available for surface water drainage on the site. As recognised in CIRIA C697 (ref 10), Site characteristics have a significant influence on the suitability of SuDS methods, and as such has been give due consideration.

Rainwater Harvesting and Greywater Recycling

Rainwater harvesting allows for reuse of rainwater within the site and in doing so reduces the demand on potable water resources and decreases runoff from the development. Grey water includes non-industrial wastewater generated from domestic processes such as dish washing, laundry and bathing; the use of these techniques can help to meet the stringent condition of the Water Use Category in the Code for Sustainable Homes.

The attenuation provided by rainwater harvesting systems cannot be included in the surface water runoff calculations, as it is possible that there may not be any spare attenuation volume available when required. i.e. during a significant rainfall event. This is because the design standard for the storage offered by rainwater harvesting systems is significantly less than runoff generated during a 1in100 year event, therefore it is possible that the structure used to store recycled water would be near to capacity and unable to provide any additional attenuation. This also depends on the end use of the recycled water, for example there would be regular demand for recycled water used for toilet flushing, however demand for irrigation would be more variable and seasonally dependant.

Rainwater harvesting and greywater recycling will be considered for uses during the detailed design stage in order to deliver reductions in potable water usage.

Infiltration Techniques

The use of infiltration based drainage techniques is preferable because they reduce the total volume of runoff reaching the surface water sewer and river system, rather than just the peak discharge. Examples of infiltration techniques include soakaways, detention basins and infiltration trenches.

The underlying strata and high water table preclude the use of infiltration based techniques.

Soakage tests in accordance with BRE Digest 365, and consultation with the NRW should be undertaken to confirm the feasibility of using infiltration techniques during the detailed design stage.

Permeable Surfaces

Permeable surfaces, such as permeable block paving and porous resin bound gravel or macadam, can mimic soft landscaping by allowing surface water to drain through the surface and into granular sub-base, from where infiltration into the underlying subsoil can occur.

Permeable paving should ideally discharge into the ground, and soakage tests, in line with BRE Digest 365 should be undertaken to assess the suitability of permeable surfaces for the development. If infiltration techniques are not found to be suitable for the site, the sub-base of permeable paving units could still be used to provide attenuation storage.

The replacement of existing impermeable parking spaces with a permeable construction will be considered during the detailed design.

Basins, Ponds and Swales

The most sustainable means of drainage are open, vegetative features that allow for evaporation and can effectively remove pollutants through biological action, such as wet swales, filter strips, ponds and wetlands.

Due to the nature of the site and the underlying ground conditions such drainage techniques are not considered appropriate or viable at this site.

Summary

Due to the nature of proposals and as there is a net increase in permeable area within Site 2 a degree of betterment to the existing scenario is provided. Further consideration will be given to the replacement of parking spaces impacted upon by proposal with a permeable construction.

7. Conclusions and Recommendations

The risk associated with various potential sources of flooding has been considered above and is summarised below.

- The risk of fluvial flooding is assessed as low
- The risk of flooding from ground water is and overland flooding is assessed as low.
- The risk associated with flooding from sewers is assessed as low and from other sources of flooding as very low.
- As part of the restaurant site proposals there is a net increase in the amount of permeable area, as such there is a reduction in the surface water discharge from the site.
- The proposed changes to the parking bay arrangement does not have an impact on the impermeable area or drainage catchments as such the proposals do not have an impact on flood risk
- The use of permeable paving where parking spaces are to be replaced will be considered during the development of the detailed design. This would provide the potential to provide a minor reduction in surface water discharge from the site.

In conclusion the Development is not at risk of flooding and it will not increase flood risk at the site or elsewhere. The development is therefore considered appropriate and in accordance with the TAN15.

APPENDICES

Appendix A Location Plan



Appendix B Development Master Plans



KEY PLAN

NOTES

This drawing must not be scaled. Use figured dimensions.

All dimensions are to be verified and checked on site. Any discrepancies that are, or become apparent should be reported to Chapman Taylor.

- New Paving finish
- Proposed Car Parking
- Existing Car Parking
- Proposed Trees
- Existing Trees / Groups Retained
- Proposed Specimen Shrub
- Proposed Green Areas
- Existing Green Areas

REV	DATE	IN'L	DESCRIPTION	CHK	REV	DATE	IN'L	DESCRIPTION	CHK

PROJECT

ISLAND GREEN
DRIVE THRU RESTAURANT
WREXHAM

CLIENT

Henderson Retail
Warehouse Fund

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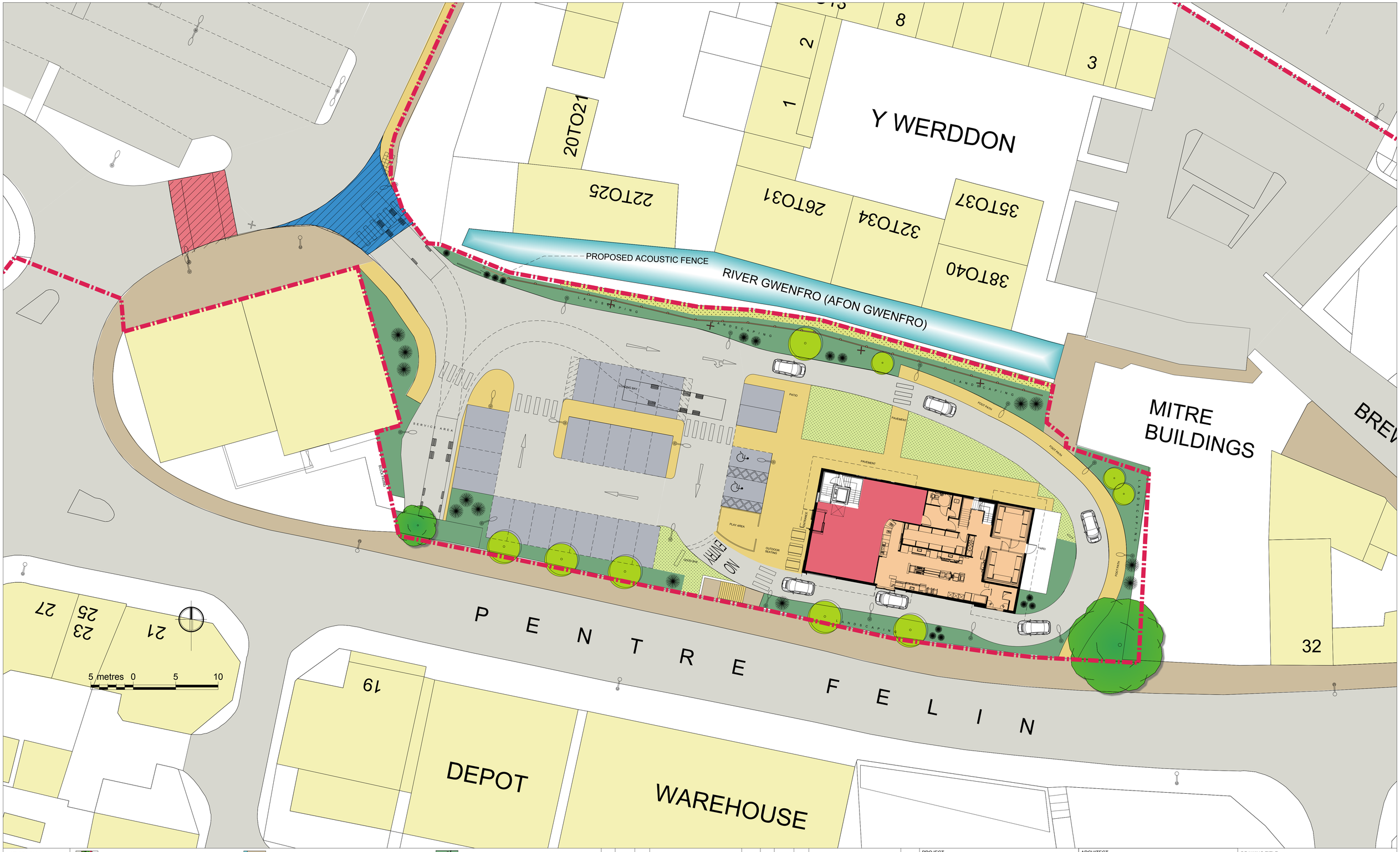
DRAWING TITLE

PROPOSED CAR PARK LAYOUT

JOB NUMBER	SCALE	DRAWN BY	FIRST ISSUE
A816/LGW	1:500@A1	IMCN	JUNE2015

PRELIMINARY

COMPANY CODE	BUILDING / ZONE	LEVEL	CATEGORY	DRAWING No.	REVISION
CTL	XXX	00	00	1003	00



KEY PLAN

- Existing Trees / Group Retained
- Proposed Amenity Trees
- Proposed Shrubs
- Proposed Car Parking
- Proposed Path
- Existing Path
- Proposed Scrubs with Native Species
- Proposed Amenity Grass/ Landscaping
- Proposed Amentity Shrub Planting
- Proposed Acoustic Fence
- Proposed Climber Planting
- B.O.H Area
- Customer Area
- Existing Raised Crossovers
- Proposed Raised Crossovers

REV	DATE	INT.	DESCRIPTION	CHK	REV	DATE	INT.	DESCRIPTION	CHK

PROJECT

ISLAND GREEN
DRIVE THRU RESTAURANT
WREXHAM

CLIENT

Henderson Retail
Warehouse Fund

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DRAWING TITLE

GROUND FLOOR FAST FOOD RESTAURANT LAYOUT

JOB NUMBER	SCALE	DRAWN BY	FIRST ISSUE
A816/IGW	1:200@A1	IMcN	JUNE 2015

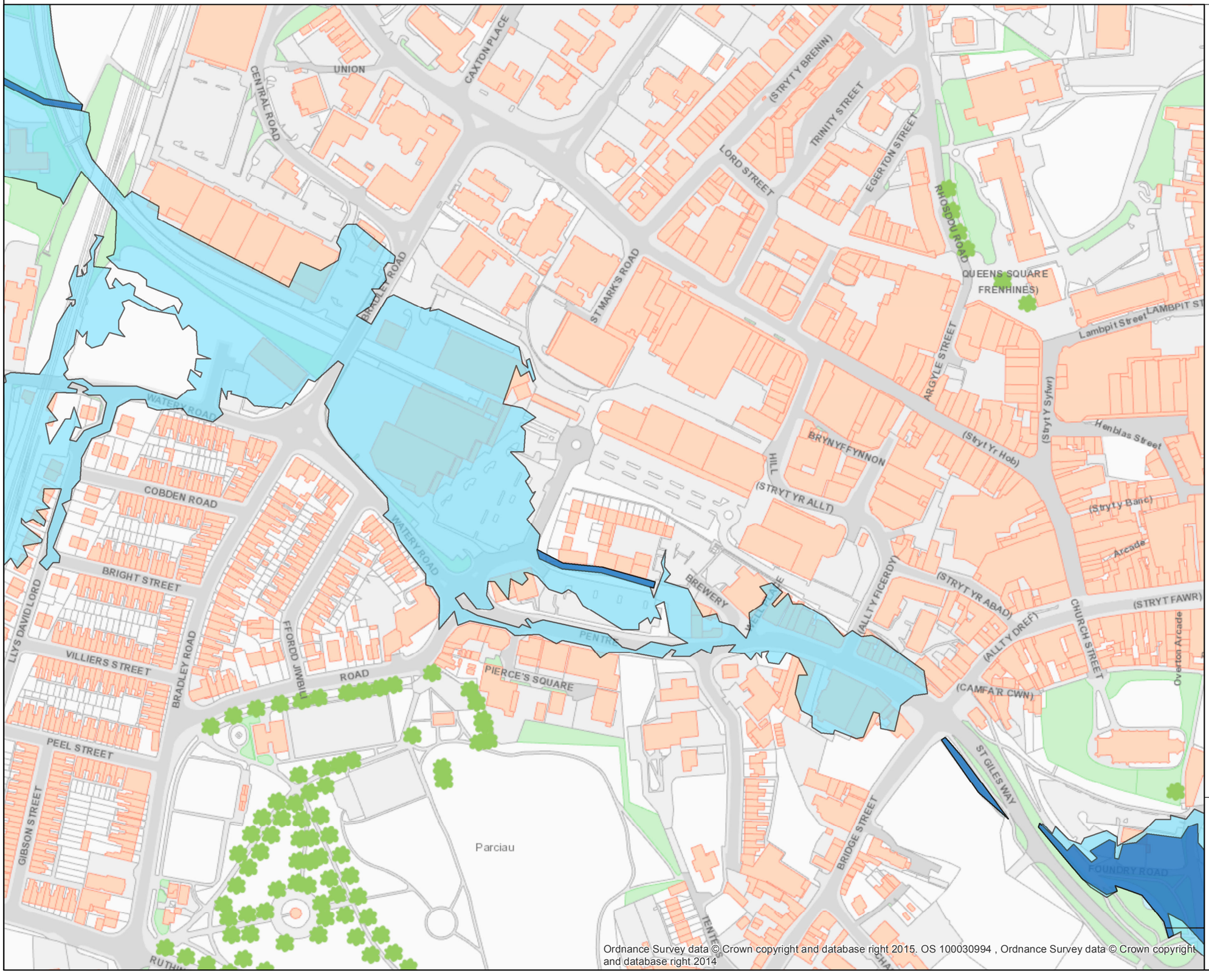
PRELIMINARY

COMPANY CODE	BUILDING / ZONE	LEVEL	CATEGORY	DRAWING No.	REVISION
CTL	XXX	20	(00)	2001	01

Appendix C Flood Zone Mapping Information

Cyfoeth Naturiol Cymru
Natural Resources Wales

Fluvial Flood Zones at site adjacent to Island Green



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Legend

- Fluvial Flood Zone 3
- Fluvial Flood Zone 2

Flood Zone 3 (fluvial) indicates the area that could be flooded with a 1% (1 in 100) or greater chance of happening each year.

Flood Zone 2 (fluvial) indicates the extent of an extreme flood from a river. These areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

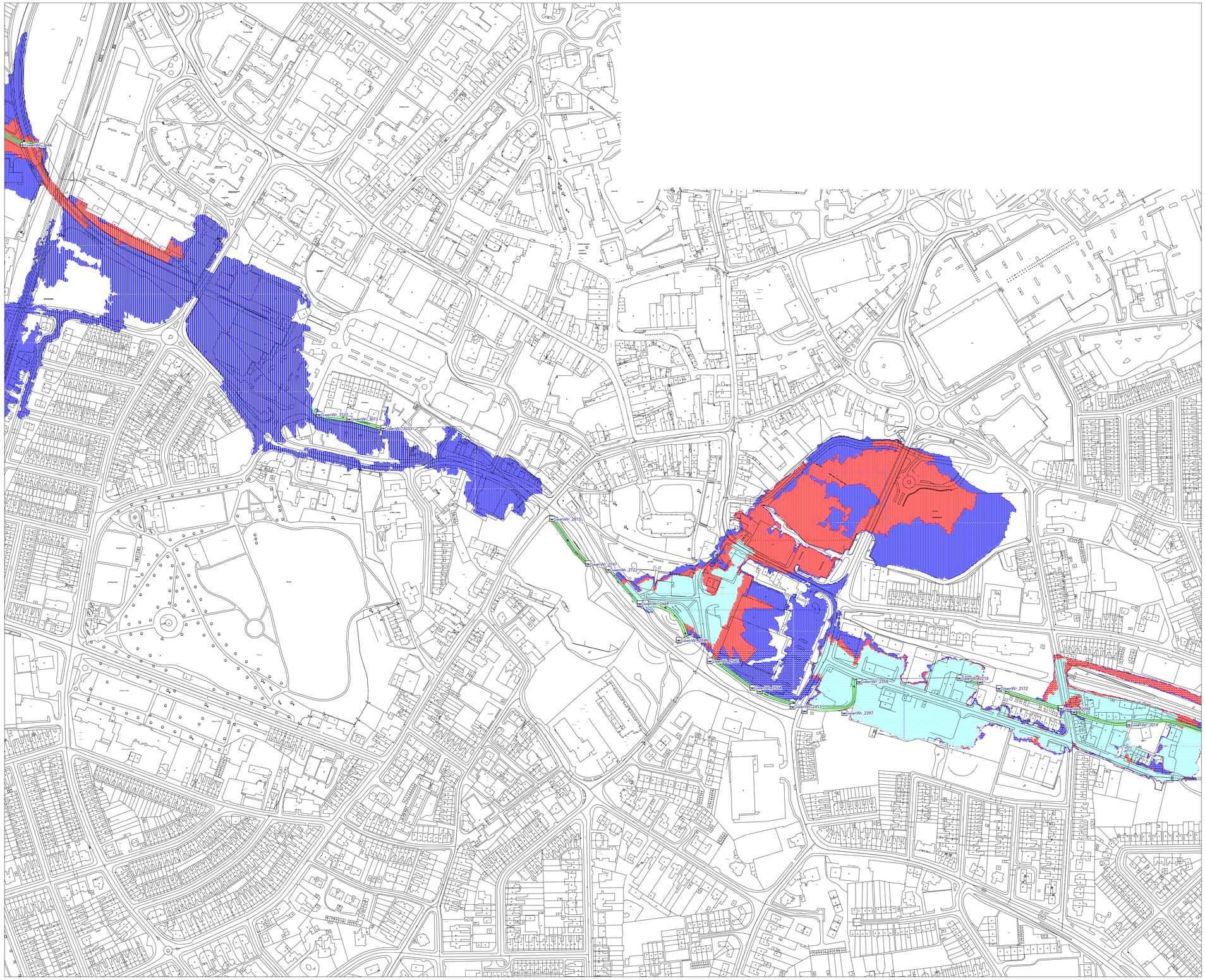
Flood Zones do not provide information on flooding from groundwater or other sources.

0 12.5 25 50 75 100 Meters

N

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Atgynhyrchwyd â chaniatâd yr Arolwg Ordnans ar ran Llyfrfa ei Mawrhydi. © Hawlfraint a hawliau cronfa ddata'r Goron 2013. Rhif Trwydded yr Arolwg Ordnans 100019741.



USER NOTES

This plan has been produced in accordance with TAN 15 - development and flood risk.

Because the information is indicative rather than specific, local planning authorities will nevertheless need to consult the Environment Agency on individual applications.

Users should note that the flood plain extents were mapped at 1:2,500 scale, as appropriate to the level of investigation and are based on information available at the time of survey.

Amendments will be required in future to account for information gathered subsequently e.g. changes in hydrological river response or observations following flood events. When in doubt the Environment Agency should be consulted.

TECHNICAL NOTES

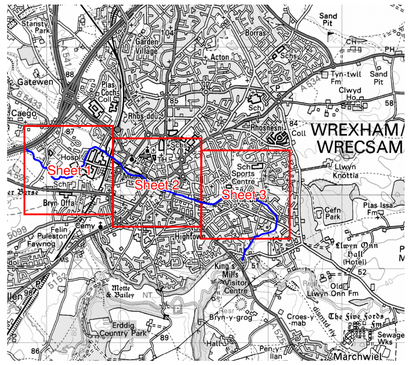
It should be noted that certain locations not shown may be at risk of flooding from other sources (piped drain systems, watermains etc.) and from other watercourses not shown in this study.

Flood levels have been derived from water levels predicted using a model representing "typical" conditions. Gate movements are either based on known operating rules or set to achieve target upstream water levels.

Failure to operate the gates or the application of "non-standard" gate operation would result in different water levels and flood limits.

Channel roughness used in the model represent average conditions without any blockages and would not reflect the position if heavy weed growth or debris were allowed to build up in the channel.

It is assumed that embankments remain intact during flood events and act as an impermeable barrier. Were embankments to fail this could result in greater inundation.



LEGEND

- 5% AEP Event Outline
- 1% AEP Event Outline
- 1% AEP Plus Climate Change Event Outline
- 0.1% AEP Event Outline
- Model Node Point

REV	DATE	REMARKS

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Environment Agency, 100026380, (2008).

Asiantaeth yr Amgylchedd Cymru
Environment Agency Wales

ENVIRONMENT AGENCY WALES
CHESTER ROAD
BUCKLEY
FLINTSHIRE
CH7 3AJ

jba CONSULTING

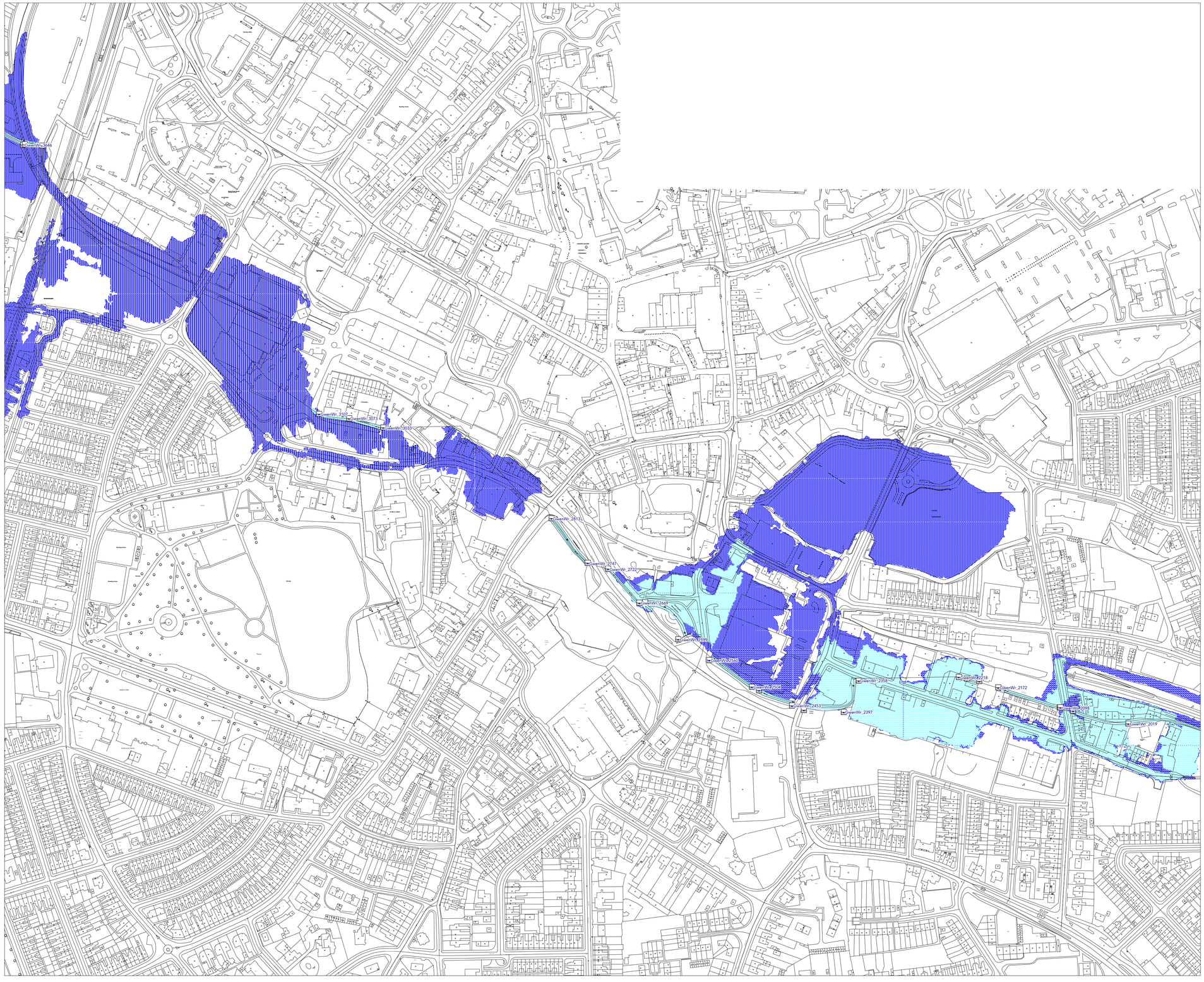
FLOOD EXTENT MAP

AFON GWENFRO
Predicted Flood Extents for the 5%, 1%, 1% Plus Climate Change and 0.1% AEP Events
Sheet 2 of 3

DATE OF ISSUE: November 2008 **REV NO:** 2 **REV DATE:** April 2009

NOT TO SCALE (APPROX 1:2,500)

DRAWING NO: **2008s3577//1% EE2**



USER NOTES

This plan has been produced in accordance with TAN 15 - development and flood risk.

Because the information is indicative rather than specific, local planning authorities will nevertheless need to consult the Environment Agency on individual applications.

Users should note that the flood plain extents were mapped at 1:2,500 scale, as appropriate to the level of investigation and are based on information available at the time of survey.

Amendments will be required in future to account for information gathered subsequently e.g. changes in hydrological river response or observations following flood events. When in doubt the Environment Agency should be consulted.

TECHNICAL NOTES

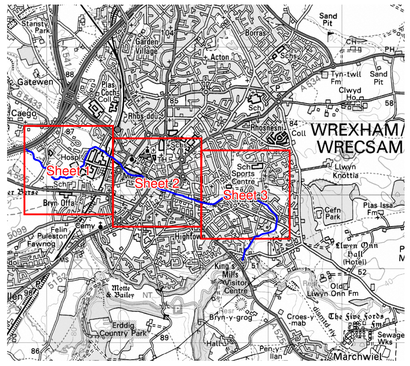
It should be noted that certain locations not shown may be at risk of flooding from other sources (piped drain systems, watermains etc.) and from other watercourses not shown in this study.

Flood levels have been derived from water levels predicted using a model representing "typical" conditions. Gate movements are either based on known operating rules or set to achieve target upstream water levels.

Failure to operate the gates or the application of "non-standard" gate operation would result in different water levels and flood limits.

Channel roughness used in the model represent average conditions without any blockages and would not reflect the position if heavy weed growth or debris were allowed to build up in the channel.

It is assumed that embankments remain intact during flood events and act as an impermeable barrier. Were embankments to fail this could result in greater inundation.



LEGEND

1% AEP Event Outline

0.1% AEP Event Outline

Model Node Point

REV	DATE	REMARKS

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FLOOD EXTENT MAP

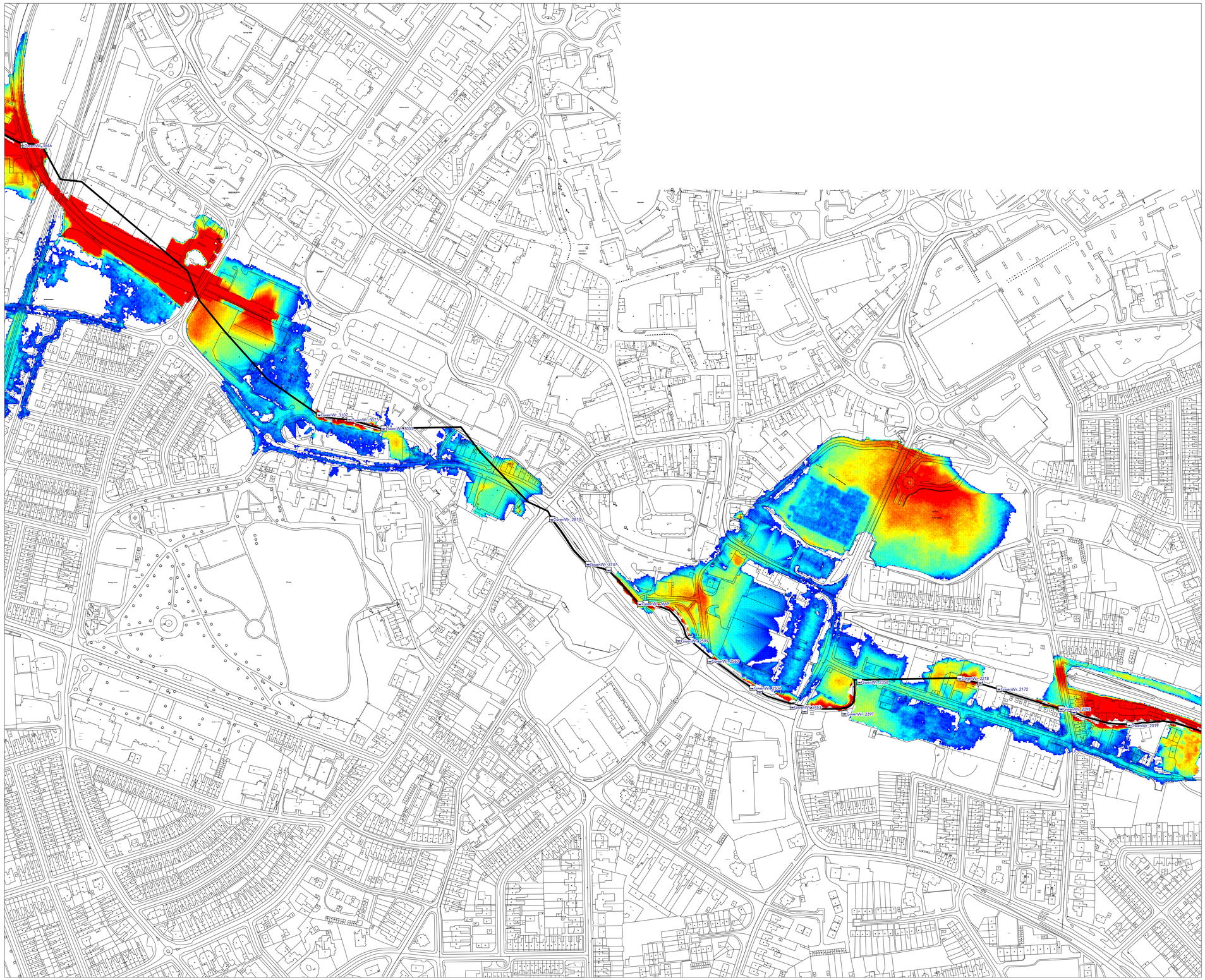
AFON GWENFRO
Predicted Flood Extents for the 1% and 0.1% AEP Events

Sheet 2 of 3

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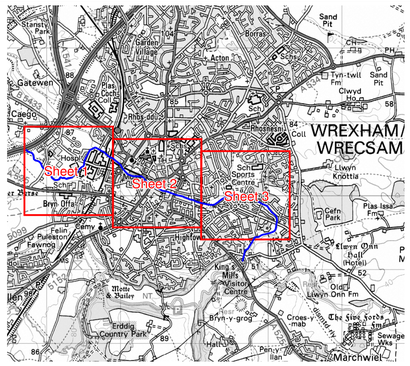
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LEGEND

- 0m Flood Depth
- 0.2m Flood Depth
- 0.4m Flood Depth
- 0.6m Flood Depth
- 0.8m Flood Depth
- 1m Flood Depth
- Model Node Point

REV	DATE	REMARKS

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FLOOD DEPTH MAP

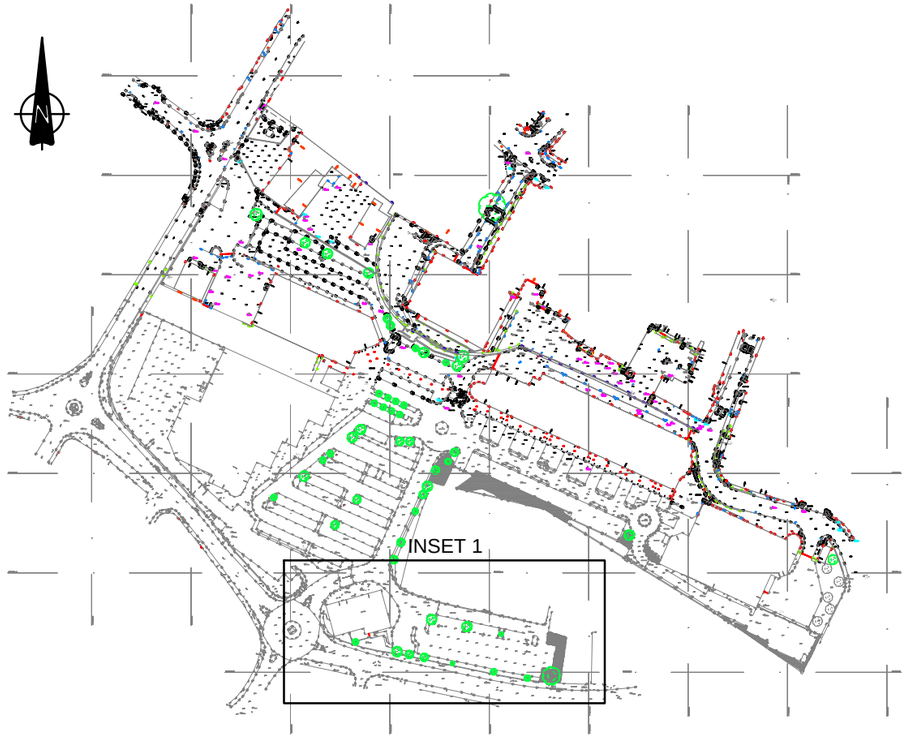
AFON GWENFRO
0.1% AEP Event Predicted Peak Flood Depths

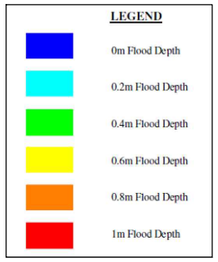
Sheet 2 of 3

DATE OF ISSUE: November 2008 **REV NO:** 1 **REV DATE:** February 2009

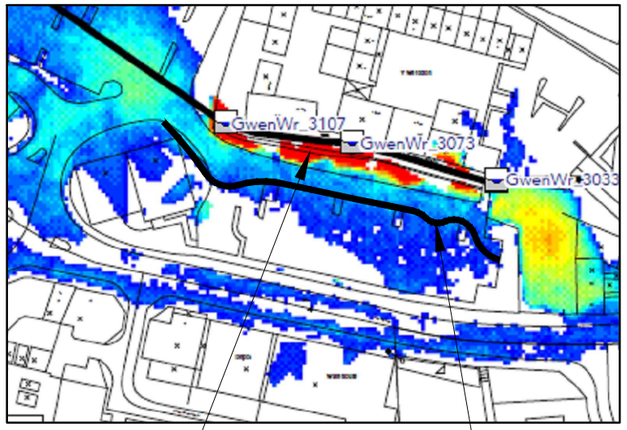
NOT TO SCALE (APPROX 1:2,500)

DRAWING NO:
2008s3577//0.1% D2





Extract from the Flood Depth Map.
0.1% AEP Event Predicted Peak Flood Depth,
drawing number 2008s3577//00.1% D2.



Red area is within river channel.

+200mm Contour (Water Level) as shown in blue below.

This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand.

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Pickfords Wharf, Clink Street, London SE1 9DG t 020 7928 7888 f 03333 444 501

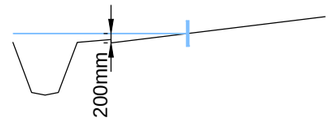
Notes:

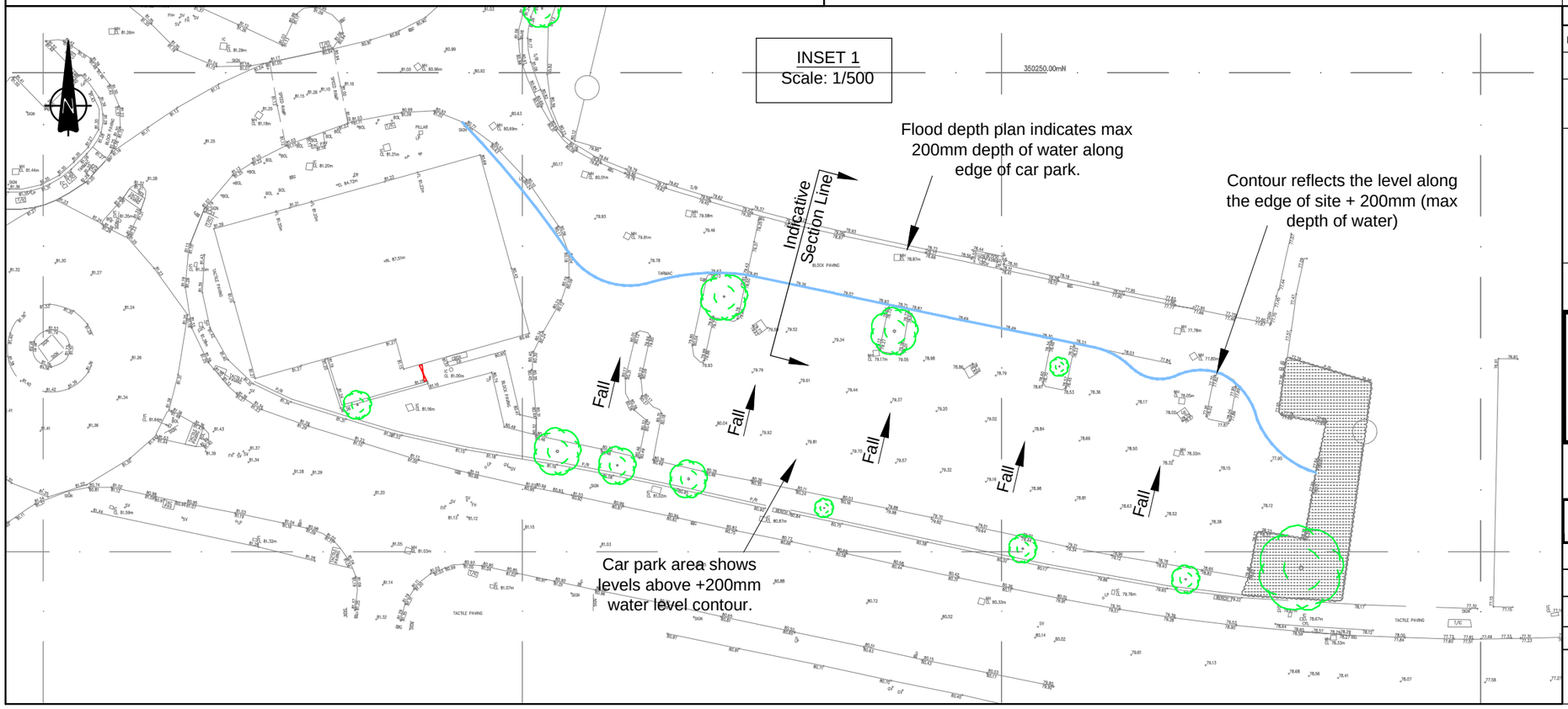
1) Sketched contour line is based on Flood Depth Map, 0.1% AEP Event Predicted Peak Flood Depth, drawing number 2008s3577//00.1% D2.

Key:

+200mm Contour (Water Level)

Indicitive Section





Rev	Date	Description	By
A01	17.07.15	FIRST ISSUE	CD

Amendments

Project
Wrexham

Title
WATER LEVEL CONTOUR
1:1000 YR

Client

Waterman
SOUTH CENTRAL, 11 PETER STREET, MANCHESTER.
TEL:0161 839 8392, FAX: 0161 839 8394
mail@watermangroup.com www.watermangroup.com

Drawing Status
PRELIMINARY

Designed by	CD	Checked by	RB	Project No
Drawn by		Date	17.07.15	BID
Scales @ A3 work to figured dimensions only	500			Computer File No WIE SA 92 001 WATER LEVEL CONTOUR.dwg

Publisher	Zone	Category	Number	Revision
WIE	SA	92	001	A01

File Path K:\Projects\Bids\wrexham\Island_green\CAD\

A3-Wat-S

Appendix D Existing Consolidated Services Plan & Private Drainage Records



General Notes

This drawing to be read in conjunction with all standard details and specifications. All dimensions to be verified on site. All works to comply with current building regulations.

NOTES

1. THIS DRAWING HAS BEEN COMPILED FROM INFORMATION PROVIDED BY BT OPENREACH, WELSH WATER, DEE VALLEY WATER, SP ENERGY NETWORKS (SP MANWEB, PLC) AND WALES AND WEST UTILITIES.
2. THIS DRAWING IS NOT A PRECISE RECORD OF THE LOCATION OF SERVICES AND ANY PROPOSED EXCAVATIONS ON SITE MUST BE PRECEDED BY A DETAILED GPR SURVEY AND CAREFUL HAND DIGGING.
3. WHERE SPECIFIC INFORMATION IS NOT AVAILABLE SOME ASPECTS HAVE BEEN ASSUMED OR NOTED AS UNKNOWN.
4. ELECTRICAL POWER DISTRIBUTION HAS BEEN INDICATED AS A SINGLE LINE BUT MAY ALSO REPRESENT MULTIPLE CABLE GROUPS.

Rev.	Description	Init.	Date

INFORMATION

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www.cuddbentley.co.uk

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Ashurst Manor, Church Lane, Ascot, Berkshire, SL5 7DD
(t) 01344 626821 (f) 01344 623448 (e) info@cuddbentley.co.uk

Cudd Bentley Consulting Ltd.
Suite 1, Shelly Crescent Centre, 25 Farmhouse Way, Solihull, B90 4EH
(t) 0121 7114343 (f) 0121 7113535 (e) info@cuddbentley.co.uk

Client

CENTROS

Project/Site Location

ISLAND GREEN
SHOPPING CENTRE
WREXHAM

Drawing Title

SITE PLAN
UTILITIES
COMBINED SERVICES

Scale	CAD	Engineer	Approved	Date
1:500@a0	JC	DW		March '15

CAD Reference: T:\4514-Island Green Shopping Centre - Wrexham\CO_ORD\M-E-01.dwg

Project No.	Drawing No.	Revision
4514	M-E- 01	

Our Ref: MPW/48052R

Mr Derek Wilson
Cudd Bentley Consulting
Suite 1 Shelley Crescent
20 Farmhouse Way
Monkspath
Solihull
B90 4EH

Subsight Surveys Ltd
Subsight House
2 Cross Lane
Braunston
Daventry
Northants
NN11 7HH

Tel: 01788 891721
Fax: 01788 891621
Email: mail@subsight.co.uk
Web: www.subsight.co.uk

3rd June 2015

Dear Derek,

Island Green Shopping Centre, Wrexham, LL13 7TG
Topographical Survey & Electronic Location of Underground Services and Drains

Please find attached our drawing no. 48052 which shows the results of our recent survey at the above site.

Generally notes relating to the survey findings are on the drawing, however, we would like to draw your attention to the following points:-

1. All drainage manhole covers were lifted and chambers surveyed wherever possible and all anomalies were proven electronically. Any stuck covers, assumed routes or routes plotted from records are annotated as such on the drawing.

   We were unable to electronically locate the culverted watercourse through site with drain rods and transmitting sewer sonde, but we believe the targets obtained with radar may be watercourse in located only in part.

   There is also an attenuation tank present on site and the extents has been assumed, any detail shown has been plotted by reference to the existing manholes, if additional detail is required than a man entry survey would be necessary.

2. All known electric routes have been located.

3. All metallic water pipework has been located wherever possible. Any non-metallic water pipework has been plotted from trench scar detail records or best assumption wherever possible, based on the location of pipe risers and position of stop cocks and water meters.

4. All metallic gas pipework has been located wherever possible. Any non-metallic gas pipework has been plotted from trench scar detail, records or best assumption wherever possible, based on the location of pipe risers and position of gas valves and gas meters.

5. All known BT & CATV ducts have been located.

6. A number of unidentified services have been located on site, we are unable to confirm their identities using out survey instruments and they are not declared on any of the statutory record drawings.

7. No statutory record drawings were made available to us only a composite CAD plan which does not show pipe sizes or materials this detail would be shown on the original statutory record drawings but has seemingly not been transposed to the composite CAD plan.

8. All reasonable effort was made to obtain access to private property, closed areas or other places not under the control of the Client that are necessary for our work, however there were still some areas that we could not survey fully, partly due to access issues or because of overgrown vegetation and stored materials, these areas are identified on the drawing.

9. Every effort has been made to show the above ground routes of services for completeness of systems, but the client should treat this information as schematic and incomplete.

10. A combination of Electromagnetic and Ground Penetrating Radar techniques have been used, as appropriate, in the location of underground services. The results are not infallible and trial excavations should be carried out to confirm service identification, positions and particularly depths, where these are deemed critical to the project design. Although all reasonable effort has been made in searching for service risers within buildings and all available record drawings the completeness of the underground services information cannot be guaranteed.

11. Contractors utilising our drawings for intrusive work should take all reasonable measures to work safely in accordance with HSG47 Guidelines "Avoiding Danger from Underground Services".

12. Any assumed routes or routes plotted from records are annotated as such on the drawing.

Our invoice for this site will follow by post and we would be grateful if you could pass this onto your accounts department.

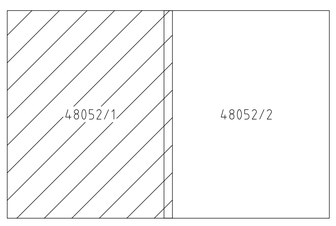
If you have any queries, please contact us.

Yours sincerely
Subsight Surveys Limited

MWeaver

Martin Weaver
Managing Director

Sheet layout



Abbreviations for underground services

AC	Asbestos cement	ES	Earthing strap	NL-R	Not located - route plotted from records	TCB	Telephone call box
ALK	Alkathene	FH	Fire hydrant	NL-T	Not located - plotted from visible trench scar detail	T/I	Trapped inlet
AV	Air valve	FL	Floor level	NRV	Non return valve	T/O	Trapped outlet
BD	Back drop	Flt	Flood light	NS	No signal	TP	Telephone pole
BH	Bore hole	F/O	Fibre optic	O/H	Overhead	UST	Underground storage tank
Br	Brick	FP	Feeder pillar	PE	Polyethylene	UTL	Unable to lift
BTIC	British Telecom inspection chamber	G	Gully	PR	Pipe riser	UTF	Unable to find
BTMH	British Telecom manhole	GM	Gas meter	PRV	Pressure reducing valve	UTGA	Unable to gain access
CA	Compressed air	GPR	Ground penetrating radar	PVC	Polyvinyl chloride	UTR	Unable to rod
CATV	Cable tv	GV	Gas valve	RE	Rodding eye	UTS	Unable to survey
CCTV	Closed circuit television	HV	High voltage	RG	Road gully	UTT	Unable to trace
CH	Coal hole	IC	Inspection chamber	RS	Road sign	VC	Vitrified clay
CI	Cast iron	IL	Invert level	RWP	Rain water pipe	VP	Vent pipe
CL	Cover level	Kv	Kilo volts	S/A	Soakaway	WL	Water level
CM	Cable marker	LD	Land drain	SC	Stop cock	WM	Water meter
CONC	Concrete	LH	Lamp hole	SE	Side entry	WO	Wash out
C/PIT	Catch pit	LP	Lamp post	SI	Spun iron		
CU	Copper	LPG	Liquid petroleum gas	SL	Soffit level		
CR	Cable riser	LV	Low voltage	SP	Soil pipe		
DB	Direct buried	MDPE	Medium density polyethylene	ST	Steel		
DI	Ductile iron	MH	Manhole	SV	Stop valve		
ECP	Electric cable pit	Mkr	Marker post	SVP	Soil vent pipe		
EHV	Extra high voltage	NFI	No further information	SW	Sink waste		
EJB	Electric joint box	NL-A	Not located - route assumed				
EP	Electricity pole	NL-I	Not located - route plotted from on-site information				
ER	Earthing rod						

THE SURVEY ASSOCIATION

Accredited Contractor www.chas.gov.uk

Key for underground services

- Foul/Combined water drain
- Foul/Combined drain 450Ø and above
- Surface water drain
- Surface water drain 450Ø and above
- Pumping main
- End of trace — EOT
- Electric cables
- HV cables
- EHV cables — EHV
- Band of electric cables — E
- Earthing strap — E
- Gas
- Water
- Telephone
- Data Cabling — DATA
- Ground penetrating radar — GPR
- End of trench scar — EOSc
- Unidentified
- Overhead service — o/h
- Characteristic change
- Survey Boundary
- Where chamber extents are significantly greater than the cover size, their approximate extents are shown thus;
- Inaccessible areas, shown thus;
- Inaccessible areas due to vegetation, shown thus;

Notes for underground services

I. A combination of electromagnetic techniques & ground penetrating radar have been used, as appropriate, in the location of underground services and drains. The results are not infallible and trial excavations should be carried out to confirm service identification, positions and particularly depths, where these are critical. Although all reasonable effort has been made in searching available record drawings, the completeness of the underground services information cannot be guaranteed.
II. Where no cover level is available, depths to pipe inverts are shown thus; IL 8.95d
III. Depths of services at inspection chambers, where possible, are shown thus; 0.95d
IV. Depths obtained electronically are generally to the centre of the service and are shown thus; (0.80)
V. Number of duct ways, where known, shown thus; 2W
VI. Pipe sizes, which cannot be obtained by visual survey, are taken from record drawings/marker plates where available.
VII. Cable routes shown as a single line may actually consist of many cables.
VIII. Electric cable routes shown are assumed to be LV unless otherwise annotated
IX. Information taken from records is suffixed thus; (R)
X. Drainage pipe sizes & invert levels have been determined without man entry into chambers. Every effort has been made to correctly obtain this information, however, accuracy is dependent on visibility from the surface.
XI. To assist with clarity of presentation, services and drains have been extended within buildings.

REV NO	REV NOTE	DATE	SIGNED	CHECKED

Type of survey

Topographical ☐ Drainage ☑ Services ☑

Subsight House
2 Cross Lane
Braunston
Daventry
Northants. NN11 7HH

T: 01788 891721 F: 01788 891621
E: mail@subsight.co.uk W: www.subsight.co.uk

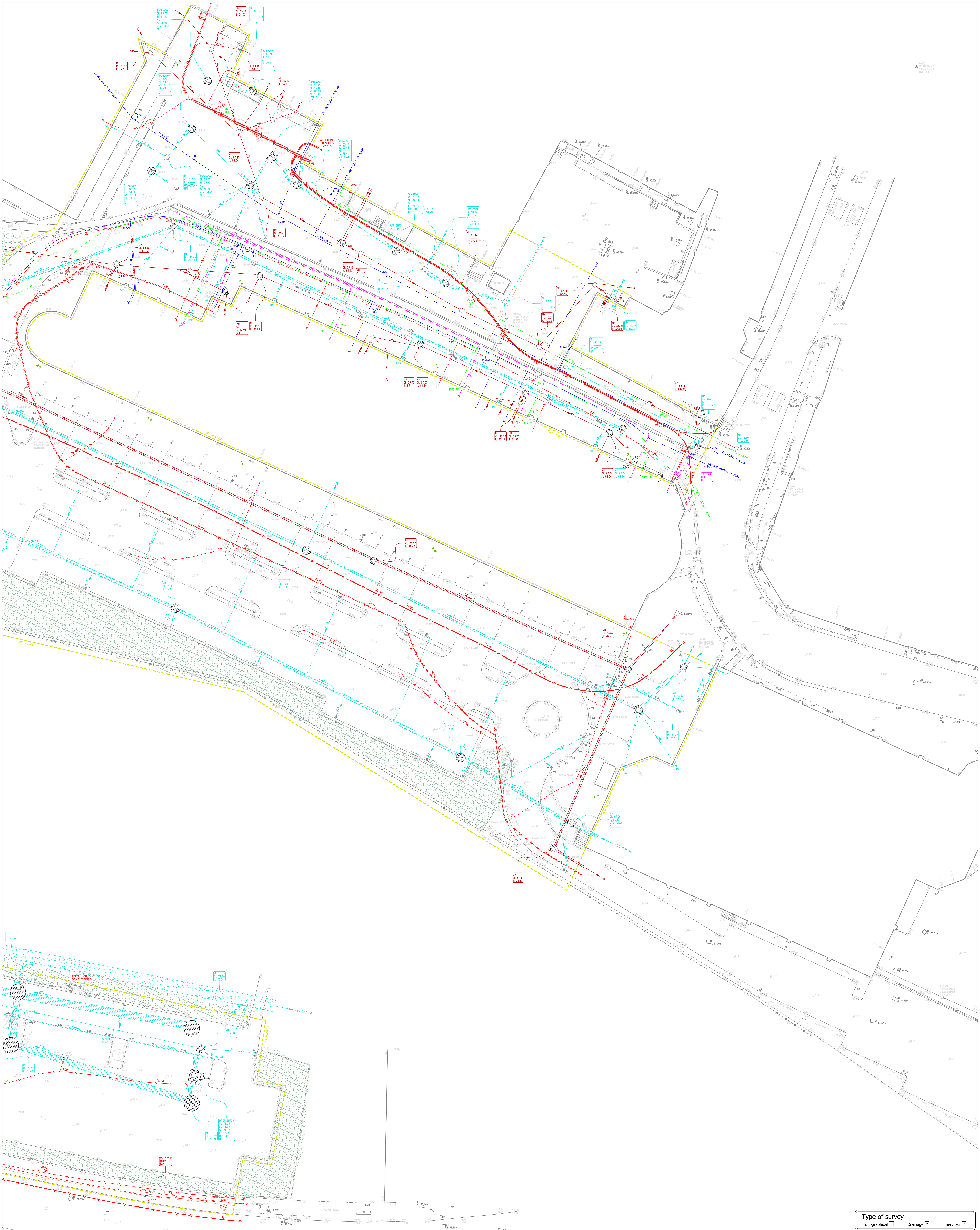
Subsight SURVEYS LIMITED

Client: Henderson Retail Warehouse Fund

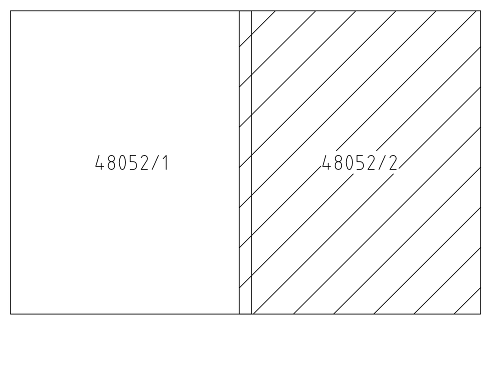
Title: Location of Underground Services and Drains
Island Green Shopping Centre
Watery Road, Wrexham

Surveyed	DC/CG	Date	May 2015
Drawn	DC	Scale	1:200@A0
Checked	MPW		

Drawing No. 48052/1 Rev.



Sheet layout



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THE SURVEY ASSOCIATION

SAFEcontractor APPROVED

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Type of survey
Topographical ☐ Drainage ☑ Services ☑

Subsight House
2 Cross Lane
Braunston
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Northants. NN11 7HH

Subsight SURVEYS LIMITED

T: 01788 891721 F: 01788 891621
E: mail@subsight.co.uk W: www.subsight.co.uk

Client Henderson Retail Warehouse Fund

Title Location of Underground Services and Drains
Island Green Shopping Centre
Watery Road, Wrexham

Surveyed DC/CG Date May 2015
Drawn DC Scale 1:200@A0
Checked MPW

Drawing No. 48052/2 Rev.