

LAND OFF SHOCKLACH ROAD, THREAPWOOD

FLOOD CONSEQUENCES ASSESSMENT

Final Report v1.2

April 2018

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Flood Consequences Assessment
Final Report v1.2

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1 INTRODUCTION

1.1 PURPOSE OF REPORT

Weetwood Services Ltd ("Weetwood") prepared a Flood Consequences Assessment (FCA) in May 2015¹ in support of a planning application² for the proposed replacement of an existing dwelling on land off Shocklach Road, Threapwood. Planning permission was subsequently granted by Wrexham County Borough Council (WCBC) in August 2015. However, this permission has since expired.

Weetwood has therefore been instructed by Lister Carter Ltd to prepare an updated FCA in support of the re-submission of the planning application in order to ensure that this takes into account the most recent flood risk data available and national and local planning policy and guidance.

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

1.2 STRUCTURE OF THE REPORT

The report is structured as follows:

- Section 1** Introduction and report structure
- Section 2** Presents national and local flood risk and drainage planning policy
- Section 3** Provides background information relating to the development site, the development proposals, ground conditions and existing site access arrangements
- Section 4** Assesses the potential sources of flooding to the development site
- Section 5** Presents flood risk mitigation measures based on the findings of the assessment
- Section 6** Addresses the effect of the proposed development on surface water runoff and presents an illustrative surface water drainage scheme to ensure that surface water runoff is sustainably managed and flood risk is not increased elsewhere.
- Section 7** Presents a summary of key findings
- Section 8** Presents the recommendations

¹ Weetwood FCA dated 15 May 2015 (Ref:2845/FCAv1.1/12 May 2015)

² Wrexham County Borough Council Planning Application Ref: P/2015/0434

2 PLANNING POLICY AND GUIDANCE

2.1 NATIONAL PLANNING POLICY AND GUIDANCE

2.1.1 Technical Advice Note 15; Development and Flood Risk

The general approach of TAN15 is to set out a precautionary framework to guide planning decisions in areas at high risk of flooding. The overarching aim of the framework is, in order of preference, to:

- Direct new development away from those areas which are at a high risk of flooding.
- Where development has to be considered in high risk areas (i.e. Zone C) only those development which can be justified should be located in such areas.

2.1.1.1 Justification Test

In accordance with Paragraph 6 of TAN15 for the Justification Test to be passed it must be demonstrated that:

- i Its location in Zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; **or**,
- ii Its location in Zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

and,

- iii It concurs with the aims of Planning Policy Wales (PPW) and meets the definition of previously developed land (PPW Fig 2.1); and,
- iv The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.

2.1.1.2 Surface Water Drainage

TAN15 provides an overview of the requirements for the management of surface water to ensure that development does not increase flood risk at the site or elsewhere.

Paragraph 8.3 of TAN15 states “...the aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce runoff where possible. It is accepted that there may be practical difficulties in achieving this aim”.

2.1.2 Welsh Government

National policy requires that planning applications for all new development proposals should provide Sustainable Drainage Systems (SuDS) for the management of surface water runoff, wherever they will be effective.

Interim non-statutory standards for SuDS have been published by Welsh Government in relation to the design, construction and operation of SuDS serving new developments of more than one house or larger than 300 m² floorspace. In addition, guidance states that clear arrangements must be in place for ongoing maintenance of the drainage system for the lifetime of the development.

2.1.2.1 Standard S2 – Surface water runoff hydraulic control

Standard S2 'Surface water runoff and hydraulic control' of the Sustainable Drainage Systems Standards for Wales³ aim is to manage the surface water runoff from and on a site to protect people on the site from flooding from the drainage system for events up to a suitable return period, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage.

- Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5mm
- The surface water runoff rate for the 1 in 1 year return period event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the development runoff on the morphology and associated ecology of the receiving surface water bodies.
- The surface water runoff (rate and volume) for the 1% (1 in 100 year) return period event (or agreed equivalent) should be controlled to help mitigate negative impacts of the development on flood risk in the receiving water body.
- The surface water runoff for events up to the 1% (1 in 100 year) return period (or agreed equivalent) should be managed to protect people and property on and adjacent to the site from flooding from the drainage system.
- The risks (both on site and off site) associated with the surface water runoff for events greater than the 1% (1 in 100 year) return period should be considered. Where the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.
- Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or blockage), and the associated flood risks managed where possible.

2.2 LOCAL PLANNING POLICY AND GUIDANCE

The Wrexham County Borough Council (WCBC) Unitary Development Plan (UDP) 1996-2011 was adopted in 2005 and is the current Development Plan for the Borough.

The following policies are relevant in respect of flood risk and drainage:

Policy EC12; Development and Flood Risk

- Development (including the raising of land) within defined flood plains will only be permitted if it:-
 - a. would not be subject to an unacceptable risk of flooding on-site; and/or
 - b. does not result in an unacceptable risk of flooding on or off-site; and/or
 - c. does not adversely affect flood management or maintenance schemes

Policy EC13; Surface Water Run-off

- Development which would result in an unacceptable adverse impact on the water environment due to additional surface water run-off will not be permitted

WCBC is currently preparing a Local Development Plan (LDP) for the Borough covering the period 2018-2028, which will replace the current adopted UDP.

³ <http://gov.wales/docs/desh/publications/151230-suds-standards-en.pdf>

2.3 NATURAL RESOURCES WALES

Natural Resources Wales (NRW) has been consulted regarding the proposed replacement dwelling, and has advised⁴ that:

'Considering that the proposals appear to involve the demolition of an existing dwelling and construction of a single replacement dwelling, and on the assumption that the footprint of the replacement property will not be significantly greater than existing....the FCA should focus on the measures that will be incorporated into the new property to improve its resilience and resistance to flooding'.

2.4 CONSENTS

An Environmental Permit for Flood Risk Activities may be required from NRW for work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

Further information can be found by visiting the NRW website⁵.

If the location of an activity is on any watercourse that lies within an Internal Drainage District (IDD) an application will need to be made to NRW for a Flood Risk Activity Permit.

Ordinary Watercourse Consent may be required from the lead local flood authority for work to an ordinary watercourse.

Undertaking activities controlled by local Byelaws (made under the Water Resources Act 1991) also requires the relevant consent.

2.5 RELEVANT DOCUMENTS

The FCA has been informed by the following documents:

- Local Flood Risk Management Strategy (LFRMS), WCBC, April 2013
- Flood Risk Management Plan (FRMP), WCBC, July 2016

⁴ Email from NRW to Weetwood dated 25 November 2014

⁵ <https://naturalresources.wales/apply-for-a-permit/flood-risk-activities/flood-risk-activity-permits-information/?lang=en>

3 SITE DETAILS AND PROPOSED DEVELOPMENT

3.1 SITE LOCATION

The site is located west of Frog Lane at Ordnance Survey National Grid Reference SJ 430 468 as shown in **Figure 1**. The site is approximately 0.320 hectares (ha) in area.

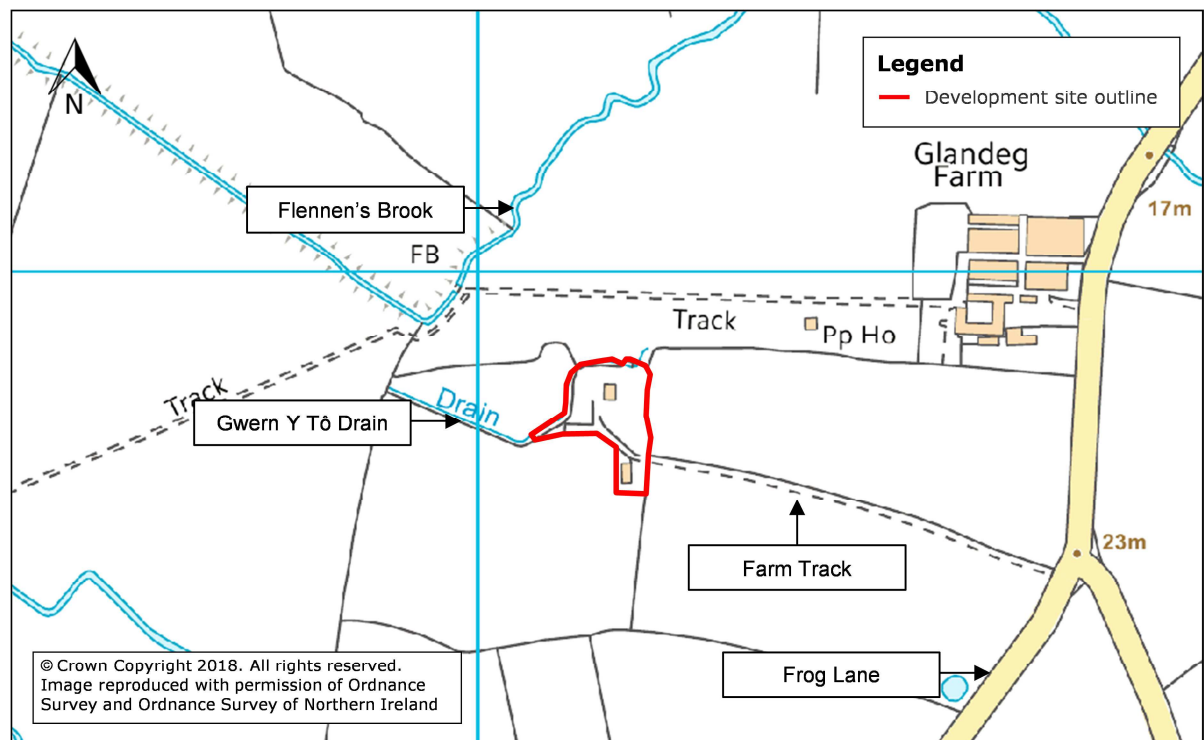


Figure 1: Site Location

3.2 EXISTING AND PROPOSED DEVELOPMENT

The site currently consists of a single dwelling and shippon building (i.e. agricultural use). The existing property and shippon building have a combined approximate area of 0.013 ha.

Proposals are for the demolition of the existing dwelling and shippon building, and erection of a replacement dwelling (**Appendix A**).

TAN15 classifies residential development as '*highly vulnerable*' land use⁶. The vulnerability classification of the site will not change following redevelopment.

3.3 WATERBODIES IN THE VICINITY OF THE SITE

The locations of the waterbodies within the vicinity of the site are shown in **Figure 1**.

Gwern Y Tô drain flows in a easterly direction along the north western boundary of the site.

⁶ TAN15, Figure 2

Flennen's Brook is located approximately 120 m north-west of the site and flows in a south-westerly and then north-westerly direction ultimately outfalling to the River Dee.

The River Dee is located approximately 1.5 km north-west of the site and flows in a northerly direction.

Gwern Y Tô drain, Flennen's Brook and the River Dee are classified as 'main river'.

3.4 GROUND CONDITIONS

According to the Soilscales maps produced by the National Soils Research Institute⁷, soil conditions at the site and within the surrounding area are described as 'loamy and clayey floodplain soils with naturally high groundwater'.

The British Geological Survey (BGS) geology maps indicate that the bedrock at the site comprises 'Wilmslow Sandstone Formation – Sandstone', which is overlain by superficial deposits comprising 'River Terrace Deposits, 1 - Sand And Gravel'.

BGS records⁸ for a borehole located approximately 347 m south east of the site indicate strata comprising of 'sand and gravel' between 0 and 3.0 m below ground level (bgl). Between 3.0 and 4.0 m bgl the recorded strata transitions to 'soft sandy marl', which is subsequently underlain by 'clay'.

3.5 SITE LEVELS

A topographic survey of the site has been undertaken by Angle Surveys to local datum (LD) and is provided in **Appendix B**.

Levels on site are generally shown to be in the region of 48.9 – 50.8 metres (m) LD, with levels typically rising from all boundaries to the centre of the site.

Ground levels surrounding the existing property are in the region 50.1 - 50.8 m LD.

It is understood that the existing dwelling has a finished floor level of 51.08 m LD.

LiDAR data has also been obtained for the site to assess levels across the site in m Above Ordnance Datum (AOD).

This information has been utilised to develop a digital elevation model as illustrated in **Figure 2**. Site levels are generally shown to be in the region of 10.1 – 12.9 m AOD.

3.6 ACCESS AND EGRESS

Access and egress to the site is currently provided via a farm track off Frog Lane, to the east of the site.

⁷ Soilscales www.landis.org.uk/soilscales/

⁸ www.bgs.ac.uk/data/boreholescans/home.html, Ref: SD37NE15/B

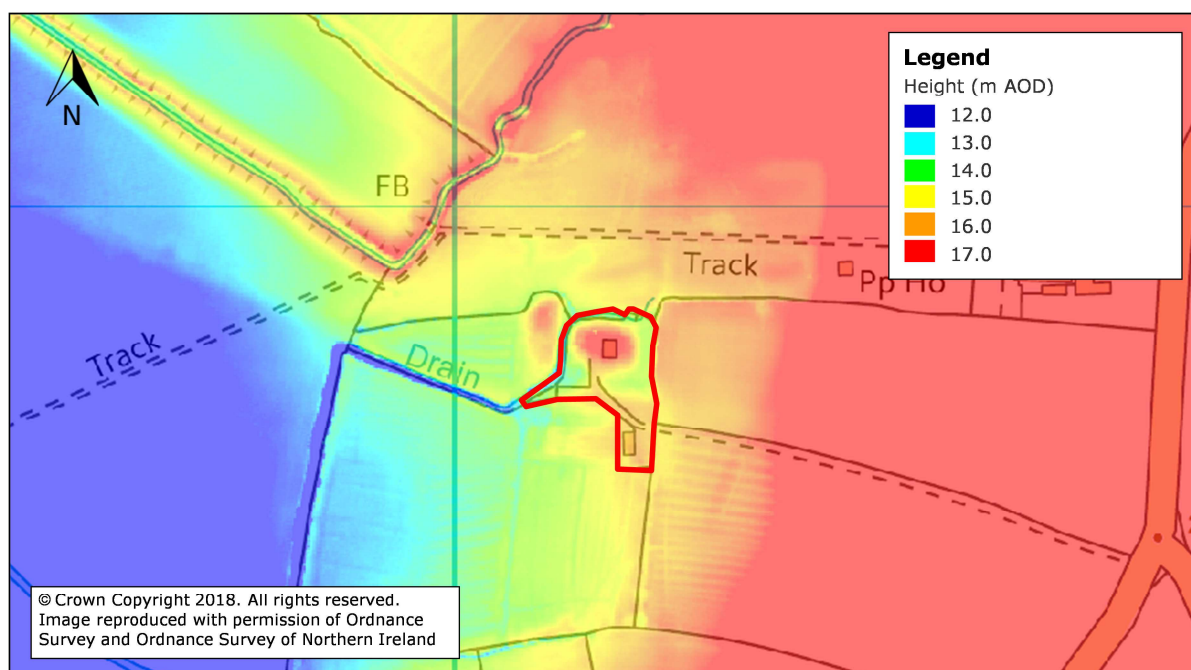


Figure 2: Digital Elevation Model

4 REVIEW OF FLOOD RISK

4.1 FLOOD ZONE DESIGNATION

Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. TAN15 defines flood zones as follows⁹:

- **Zone A.** Considered to be at little or no risk of fluvial or tidal/coastal flooding.
- **Zone B.** Areas known to have been flooded in the past evidenced by sedimentary deposits.
- **Zone C.** Based on NRW extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal). Zone C is subdivided into the following two zones:
 - **Zone C1.** Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.
 - **Zone C2.** Areas of the floodplain without significant flood defence infrastructure.

The Flood Zones are currently shown on the NRW Flood Risk Map and do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

4.1.1 Development Advice Map

According to the latest Development Advice Map the site is located within Zone C2 (**Figure 3**); however, the majority of the farm track and the entirety of Frog Lane are located within Zone A.

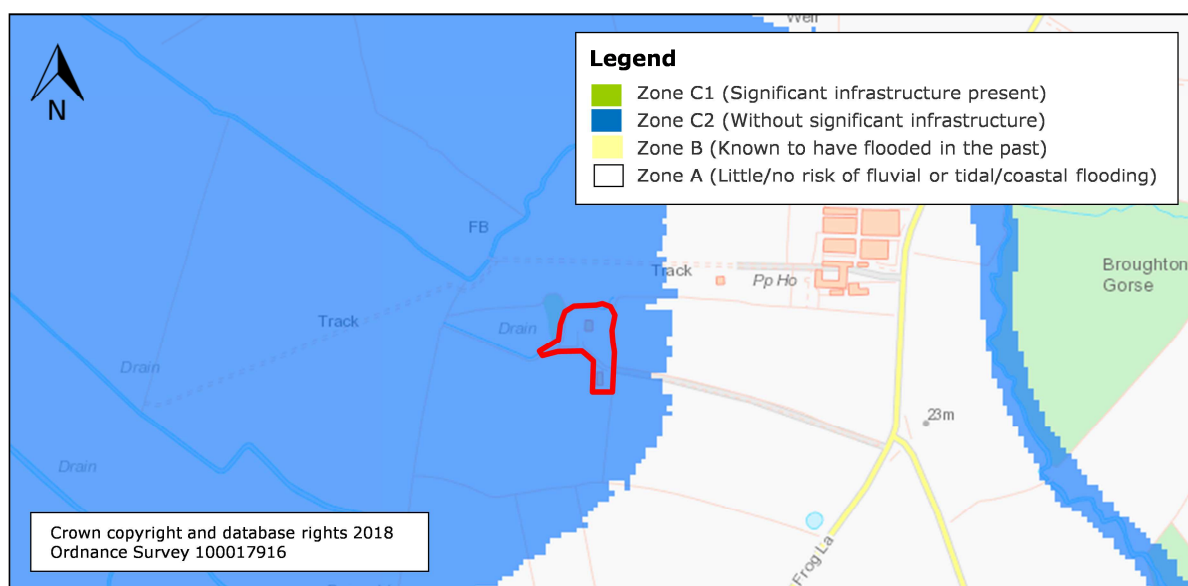


Figure 3: Development Advice Map
(Source: NRW website)

4.1.2 Natural Resources Wales Flood Risk Map

According to the NRW Flood Risk Map the site is located in the 1 in 100 annual probability fluvial flood outline, whilst the farm track and Frog's Lane are shown to have less than a 1 in 1,000 annual probability of flooding.

⁹ TAN15, Figure 1

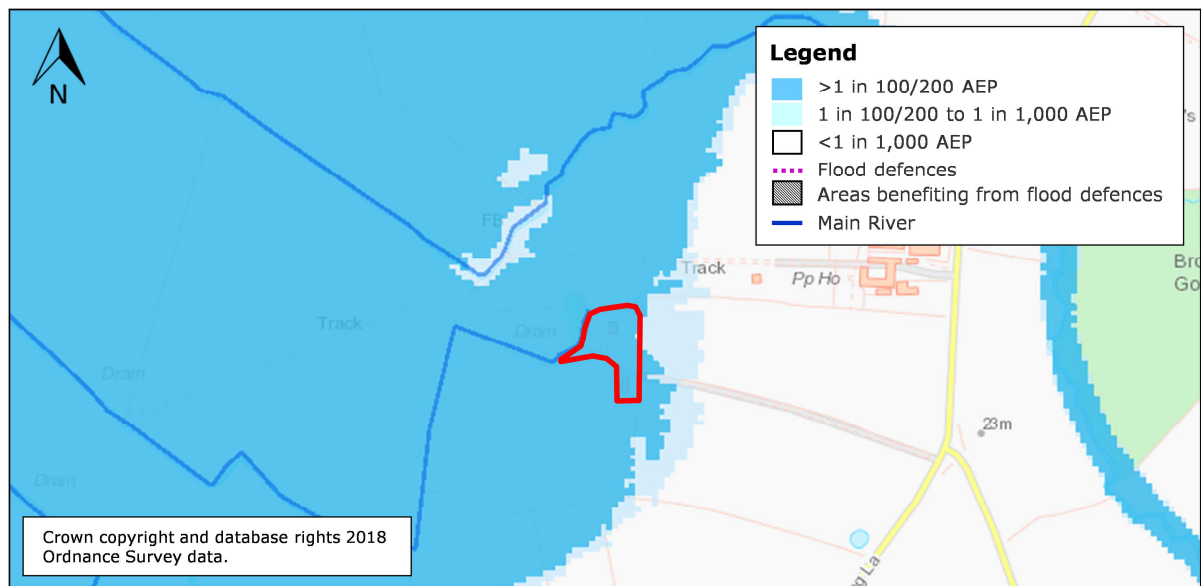


Figure 4: Natural Resources Wales Flood Risk Map
(Source: NRW website)

4.2 JUSTIFICATION TEST

As the proposals involve the redevelopment of an existing residential building it is considered that the requirements of the justification test are met, save for part (iv) which is addressed by this report.

4.3 HISTORICAL RECORDS OF FLOODING

NRW historical flood outlines¹⁰ indicate that the site has been flooded previously, notably in January 1964. The source of flooding for the event has been classified as fluvial, with floodwater overtopping flood defences, however no further details are provided regarding the depths of flooding that may have been experienced on site.

NRW historical flood outlines indicate that land to the west of the site was impacted by flooding in November 2009; however, the site ownership boundary and proposed location for the development was not impacted.

4.4 FLUVIAL FLOOD RISK - GWERN Y TÔ DRAIN/FLENNEN'S BROOK

As discussed in **Section 3.3**, Gwern Y Tô drain flows in a easterly direction along the north-western boundary of the site, whilst Flenner's Brook flows in a south-westerly and then north-westerly direction approximately 120 m to the north-west of the site.

NRW has confirmed¹¹ that there is currently no detailed modelled flood data available for Flenner's Brook or any other watercourses within the vicinity of the site, with the current flood outlines produced by application of its National Generalised Model (i.e. JFLOW).

¹⁰ Lle Catalogue Website

¹¹ Email from NRW to Weetwood, 18 April 2018

In light of this and, as outlined within the FCA produced by Weetwood for the site in May 2015¹², NRW were consulted regarding the required scope of the FCA, considering that proposals are for the replacement of a single dwelling and that vulnerability classification of the development is not set to increase. As discussed in **Section 2.3**, NRW advised that an FCA focusing on flood resilience and resistance measures is suitable.

The proposed measures for increasing the flood resilience and resistance of the new property are discussed in **Section 5** of this report.

4.5 FLOOD RISK FROM RESERVOIRS, CANALS AND OTHER ARTIFICIAL SOURCES

Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

The NRW Risk of Flooding from Reservoirs map (**Figure 5**) indicates that the site is at risk of flooding from several reservoir sources, including the Alwen Reservoir, Llyn Brenig, Llyn Tegid and Llyn Celyn. The Alwen Reservoir and Llyn Brenig are located approximately 45 km to the west of the site. Llyn Celyn and Llyn Tegid are located within the Snowdonia National Park, approximately 50 km to the west of the site.

Potential depths and velocities for reservoir flooding are also available on the NRW website. These indicate that potential flood depths on site could be in the region of 0.3-2.0 m, with velocities less than 0.5 m/s.

Due to the distance between the site and the reservoirs the risk of flooding from this source may be considered low. Furthermore, reservoir flooding is extremely unlikely to happen as all large reservoirs are regularly inspected by reservoir panel engineers and essential safety work is carried out.

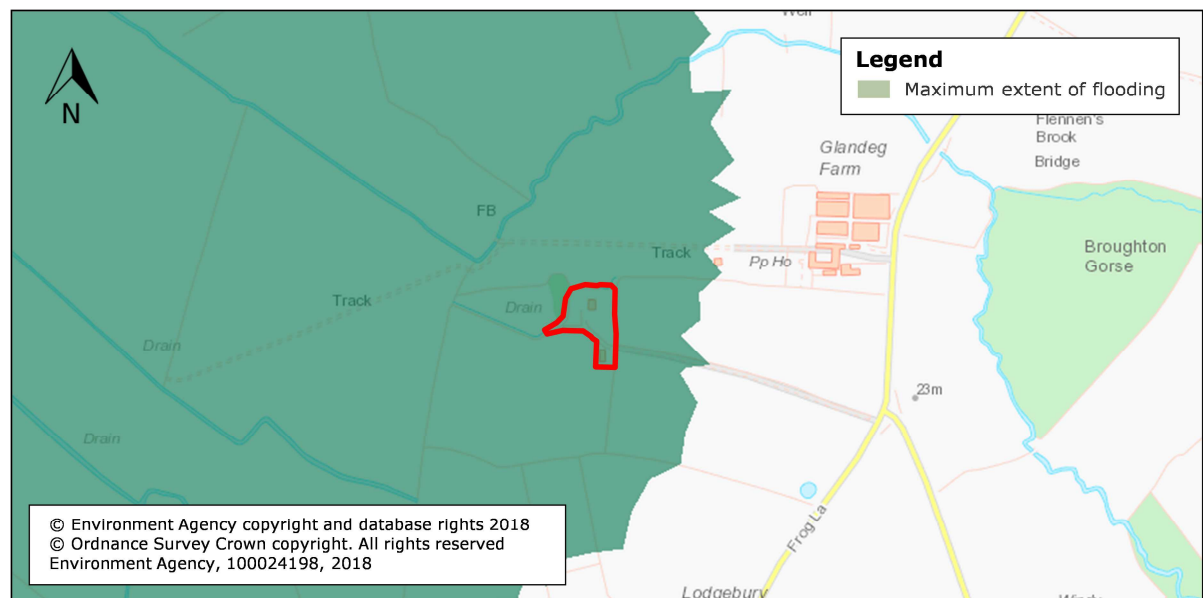


Figure 5: Risk of Flooding from Reservoirs Map
(Source: NRW website)

¹² Footnote 1

There are no canals or other artificial sources located within the immediate vicinity of the site. The site is therefore not assessed to be at risk of flooding from canals or any other artificial sources.

4.6 FLOOD RISK FROM GROUNDWATER

Groundwater flooding generally occurs during intense, long-duration rainfall events, when infiltration of rainwater into the ground raises the level of the water table until it exceeds ground levels. It is most common in low-lying areas overlain by permeable soils and permeable geology, or in areas with a naturally high water table.

As detailed in **Section 3.4** ground conditions at the site and within the surrounding area are described as clayey and loamy with naturally high groundwater. There may therefore be the propensity for some groundwater flooding. According to the BGS Groundwater Flooding Hazard map (**Figure 6**) the susceptibility to groundwater flooding is moderate to significant.

However, ground levels are shown to fall away from the proposed location of the new dwelling, towards the site boundaries. As such floodwater would not be expected to accumulate to any significant depth within the vicinity of the proposed development.

Any residual risk of flooding from this source will be mitigated through the implementation of the measures proposed in **Section 5** of this report.

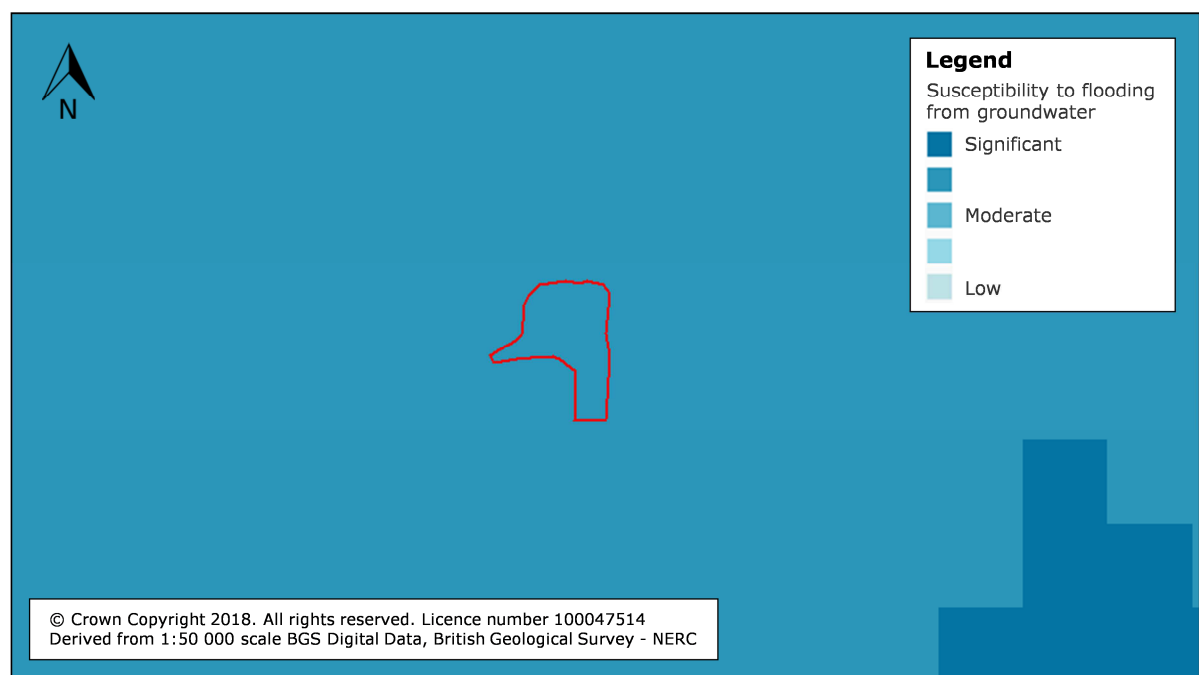


Figure 6: Groundwater Flooding Hazard Map
(Source: Findmaps)

4.7 FLOOD RISK FROM SURFACE WATER

Surface water flooding comprises pluvial flooding and flooding from sewers and highway drains and gullies.

4.7.1 Risk of Pluvial Flooding

Pluvial flooding results from rainfall-generated overland flow, before the runoff enters any watercourse or sewer, or where the sewerage/drainage systems and watercourses are overwhelmed and therefore unable to accept surface water.

Pluvial flooding is usually associated with high intensity rainfall events but may also occur with lower intensity rainfall where the ground is saturated, developed or otherwise has low permeability resulting in overland flow and ponding within depressions in the topography.

As detailed in **Section 3.4** ground conditions at the site and within the surrounding area are described as clayey and loamy with naturally high groundwater. There may therefore be the propensity for surface water flooding at the existing site.

The NRW Risk of Flooding from Surface Water map (**Figure 7**) indicates that areas in the east and west of the site are at 'low' to 'medium' (less than 0.15 m) risk from surface water flooding, whilst the proposed location for the new development itself is deemed not to be at risk.

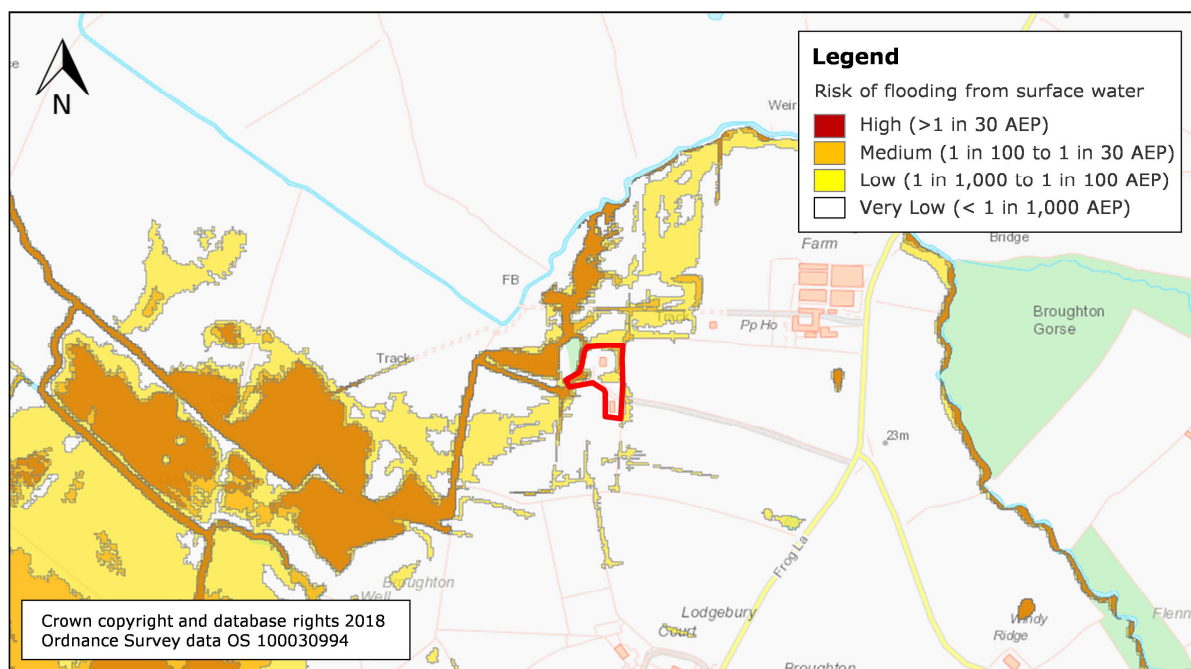


Figure 7: Natural Resources Wales Risk of Flooding from Surface Water

(Source: NRW website)

The risk of pluvial flooding at the site is assessed to be low. However, any residual flood risk from this source will be addressed through the mitigation measures as detailed in **Section 5**.

4.7.2 Risk of Flooding from Sewers and Highway Drains and Gullies

Flooding of land and/or property can occur when the capacity of the sewer/drainage system is overwhelmed by heavy rainfall, becomes blocked or is of inadequate capacity or where the normal discharge of sewers and drains through outfalls is impeded by high water levels in receiving waters.

Dŵr Cymru Welsh Water (DCWW) has been consulted to ascertain whether it holds any records of sewer flooding at the site. A response was received¹³ indicating there are no records of sewer flooding within the direct vicinity of the site.

WCBC has been consulted to ascertain whether it holds any records of highways flooding at or within the vicinity of the site. A response was received¹⁴ indicating there are no records of sewer flooding within the direct vicinity of the site.

¹³ Email from Dŵr Cymru Welsh Water to Weetwood dated 11 April 2018

¹⁴ Email from Wrexham County Borough Council to Weetwood dated 9 April 2018

5 FLOOD RISK MITIGATION MEASURES

5.1 FLOOD MITIGATION

The flood risk to the site from fluvial sources and any residual risk of groundwater and surface water flooding will be mitigated through the implementation of the measures proposed within the following sections of this report.

5.1.1 Finished Floor Levels

It is recommended that the finished floor level of the proposed dwelling should be set at a minimum of 300 mm above the threshold level of the existing dwelling shown on the topographic survey provided in **Appendix B**, noting that the survey is to Local Datum (LD).

This will enable any potential overland flows to be conveyed safely across the site without affecting property in accordance with the approach promoted by government policy¹⁵.

5.1.2 Flood Resistant and Resilient Construction

Flood resilient construction techniques should be incorporated into the design of the building, in line with government guidance¹⁶. These include design features and finish materials to minimise the entry of water and/or reduce the damage in the unlikely event of the development being inundated.

A number of measures may be used for flood resistance, as summarised in **Table 1**.

Table 1: Flood Resistant Measures

Flood Resistant Measures	
Anti-flood airbrick/airbrick cover	Designed to prevent the incursion of floodwater through airbrick vents, but still allow free air circulation. Certain designs can replace traditional air bricks, and have a self-activating gate which is triggered under flood conditions.
Demountable flood gates	Demountable flood gates will be installed on each entrance of the property. These can be removed when there is no risk of flooding. Effective for preventing water from entering buildings, and come in a range of sizes to fit various doors.
Suitable flooring materials	Damp Proof Membranes should be used to prevent incursion of water through the ground floor.

Flood resilience measures can also be incorporated, which aim to reduce the damage caused in the event that floodwaters enter the property. This can consist of raising electrical sockets and meters and laying down flood resilient floors. Important documentation should also be stored in raised areas (e.g. on shelves) to minimise impact of flooding.

¹⁵ Making Space for Water, Taking forward a new Government strategy for flood and coastal erosion risk management in England, March 2005, Dept for Environment, Food and Rural Affairs

¹⁶ Improving the Flood Performance of New Buildings: Flood Resilient Construction. Dept for Communities and Local Government. May 2007.

5.1.3 Watercourse Maintenance

The proposed dwelling is located approximately 15 m away from Gwern Y Tô drain at its closest point. As such the proposed development should not affect the future maintenance of this watercourse.

5.2 FLOOD RISK ELSEWHERE

Any proposal to modify ground levels should demonstrate that there is no increase in flood risk to the development itself, or to any existing buildings which are known to, or are likely to flood.

Developers must ensure there will be no loss of flood flow or flood storage capacity for floods up to the severity of the 1 in 100 annual probability fluvial event. Whilst not specified by TAN15, NRW generally recommends that this should be the case over the lifetime of development (i.e. should take into account climate change).

As outlined in **Section 3.2**, the existing dwelling and shippon building have a combined approximate area of 0.013 ha. It is understood that the proposed development will have a total area of 0.018 ha, resulting in a negligible increase in total impermeable area of 0.005 ha. Given this, it can be assumed that any flood storage lost would be negligible.

5.3 ACCESS AND EGRESS

Frog Lane is located in Flood Zone A and the majority of the farm track serving the site is also not considered to be at risk of flooding.

5.3.1 Flood Plan

According to the NRW Flood Warning Areas map (**Figure 8**), the site is located within an area covered by flood warnings.

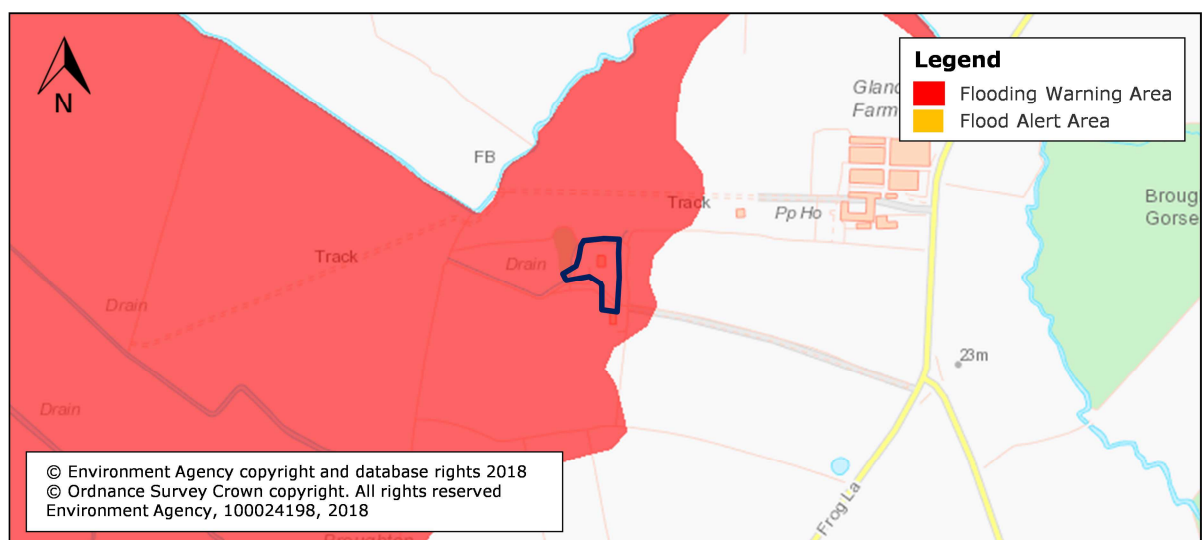


Figure 8: Natural Resources Wales Flood Warning Areas
(Source: NRW website)

It is recommended that a Flood Plan is prepared in consultation with WCBC Emergency Planners prior to occupation of the building. This should detail the existing flood risk to

the site, the actions that should be taken to prepare for flooding and those necessary in the event of flooding.

The requirement to produce a Flood Plan may be conditioned as part of any planning permission subsequently granted.

NRW offers a free flood warning service called Floodline Warnings Direct (FWD) across England and Wales. Users of the site may register with the EA to receive flood warnings by telephone, email, text or fax. More information can be found either by visiting the NRW website or by calling Floodline on 0345 988 1188. The smartphone Flood Alert app can also be used to monitor flood warnings.

6 SURFACE WATER MANAGEMENT

6.1 EXISTING DRAINAGE REGIME

The site currently consists of 0.307 ha of permeable land, with hardstanding areas comprising 0.013 ha.

No information is available regarding the existing drainage system at the site; however, it may be reasonable to assume that surface water discharges to Gwern Y Tô drain or runs-off to surrounding land.

6.2 DISPOSAL OF SURFACE WATER

Building Regulations Approved Document Part H sets out a hierarchy of preferred methods for the disposal of surface water runoff. Disposal by infiltration is preferred, followed by disposal to a watercourse, with disposal to a public sewer the least preferred option¹⁷.

As discussed in **Section 3.4**, the site is underlain by clayey soils with high groundwater, and it is therefore assumed that infiltration is not feasible. Given this, it is proposed to direct all runoff from the developed site to Gwern Y Tô drain.

6.3 PEAK FLOW CONTROL

For sites which were previously developed, the peak runoff rate from the proposed development to any drain, sewer or surface water body for the 1 in 1 annual probability rainfall event and the 1 in 100 annual probability rainfall event must be as close as reasonably practicable to the greenfield runoff rate for the same rainfall event, but should not exceed the rate of discharge from the site prior to redevelopment for that event.

The site has a total area of 0.320 ha. The greenfield runoff rate for the site has been calculated using the ICP SUDS method within MicroDrainage (**Appendix C**), whilst the rate of discharge from the existing impermeable areas has been calculated using the Modified Rationale Method (MRM) (**Appendix D**). The results are summarised in **Table 2**.

Table 2: Peak Runoff Rate - Existing Site

Annual probability of rainfall event	Runoff Rate for 0.307 ha of Permeable Areas (l/s)	Runoff Rate from 0.013 ha of Impermeable Areas (l/s)	Total Runoff Rate for 0.320 ha site (l/s)
1 in 1	0.89	0.90	1.79
QBAR	1.01	1.17	2.18
1 in 30	1.78	2.21	3.99
1 in 100	2.21	2.83	5.04

¹⁷ Building Regulations Approved Document H, Section 3 page 45

The runoff rates as outlined in **Table 2** will be achieved so far as is practicable; however, it is recognised that a flow control with a diameter of less than 100 mm and/or a design discharge rate of 5.0 l/s may pose a risk of blockage to the drainage system. As such a minimum discharge rate of 5.0 l/s will be applied to the drainage system in accordance with national guidance¹⁸.

6.4 VOLUME CONTROL

Where reasonably practicable, for sites which have been previously developed, the runoff volume from the proposed development to any highway drain, sewer or surface water body in the 1 in 100 annual probability, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

This is usually addressed by designing a Long Term Storage (LTS) facility within the site. As advised by the EA¹⁹, there are situations where applying the concept of LTS to a site and ensuring the drainage system operates to meet this criterion is difficult. In such situations, an alternative peak rate of discharge is applied to the site for sizing the attenuation storage without using LTS. Instead of using the flow rates for the 1 in 1 and 1 in 100 annual probability events, the discharge limits are set to the 1 in 1 and QBAR flow rates.

Given the small scale of the development it is not feasible to limit flow rates to the existing 1 in 1 and QBAR flow rates as this would pose a risk of blockage to the drainage system (refer to **Section 6.3**). Discharge rates will be limited so far as is practicable, which will minimise the impact of the development in terms of increased volumes of surface water discharged from the site. Irrespective, given the scale of the proposed development compared to the existing situation the potential impact is considered to be negligible.

6.5 MANAGING SURFACE WATER WITHIN THE DEVELOPMENT

The surface water storage requirements have been modelled using the Detailed Design module of MicroDrainage Source Control (**Appendix E**).

The required storage volume has been sized to store the 1 in 100 annual probability rainfall event including a 30% increase in rainfall intensity in order to allow for climate change in accordance with DEFRA guidance⁶.

Assuming a peak discharge rate of 5.0 l/s (**Section 6.3**), a storage volume of 3.4 m³ would be required.

Such small storage volumes should be possible to attenuate within the on-site pipe network and manholes, without any formal storage area.

SuDS are not typically required for developments of this scale but could be included if desired, which may be revisited at the detailed design stage.

¹⁸ Rainfall runoff management for developments – Report SC030219, Defra/EA – Point 17

¹⁹ Rainfall Runoff Management for Developments – Report SC030219, Draft/EA – Section 3.4, October 2013

6.6 MAINTENANCE

The pipe network, designed to Sewers for Adoption (7th edition) standard, may be adopted by the sewerage undertaker.

6.7 SUMMARY

The purpose of this FCA is to demonstrate that a surface water drainage strategy is feasible for the site given the development proposals and the land available. The storage calculations may be refined at the detailed design stage and a final decision made on the types of storage to be provided.

7 SUMMARY

This FCA has been prepared on behalf of Lister Carter Ltd and relates to the proposed erection of a replacement dwelling on land off Shocklach Road, Threapwood.

According to the NRW Flood Risk Map the proposed development site is located within the 1 in 100 annual probability flood outline and is defined by TAN15 as being situated within Zone C2.

As the proposals involve the redevelopment of an existing residential building it is considered that the requirements of the justification test are met, save for part (iv) which is addressed by this report.

Both Gwern Y Tô drain and Flennen's Brook are located in vicinity of the site; no detailed flood modelling data is available for these watercourses. NRW has advised that in light of the development proposals, a FCA focusing on flood resilience and resistance measures is appropriate for the site.

The NRW Risk of Flooding from Reservoirs Map indicates that the site may be at risk from reservoir flooding, however, reservoir flooding is extremely unlikely to happen as all large reservoirs are regularly inspected by reservoir panel engineers and essential safety work is carried out.

There are no canals or other artificial sources located within the immediate vicinity of the site. The site is therefore not assessed to be at risk of flooding from canals or any other artificial sources.

The site is assessed to be at moderate to significant risk of groundwater flooding.

The majority of the site is assessed to be at very low to low risk of surface water flooding.

It is recommended that the finished floor level of the proposed dwelling should be set at a minimum of 300 mm above the threshold level of the existing dwelling as shown on the topographic survey provided, noting that the survey is to Local Datum (LD).

Flood resistant and resilient construction techniques should be incorporated into the design of the building.

It is recommended that a Flood Plan is prepared in consultation with WCBC Emergency Planners prior to occupation of the building. The site is situated in a flood warning area. Occupants of the property should sign up to receive flood warnings.

Surface water runoff from the developed site can be sustainably managed in accordance with TAN15 and local policy.

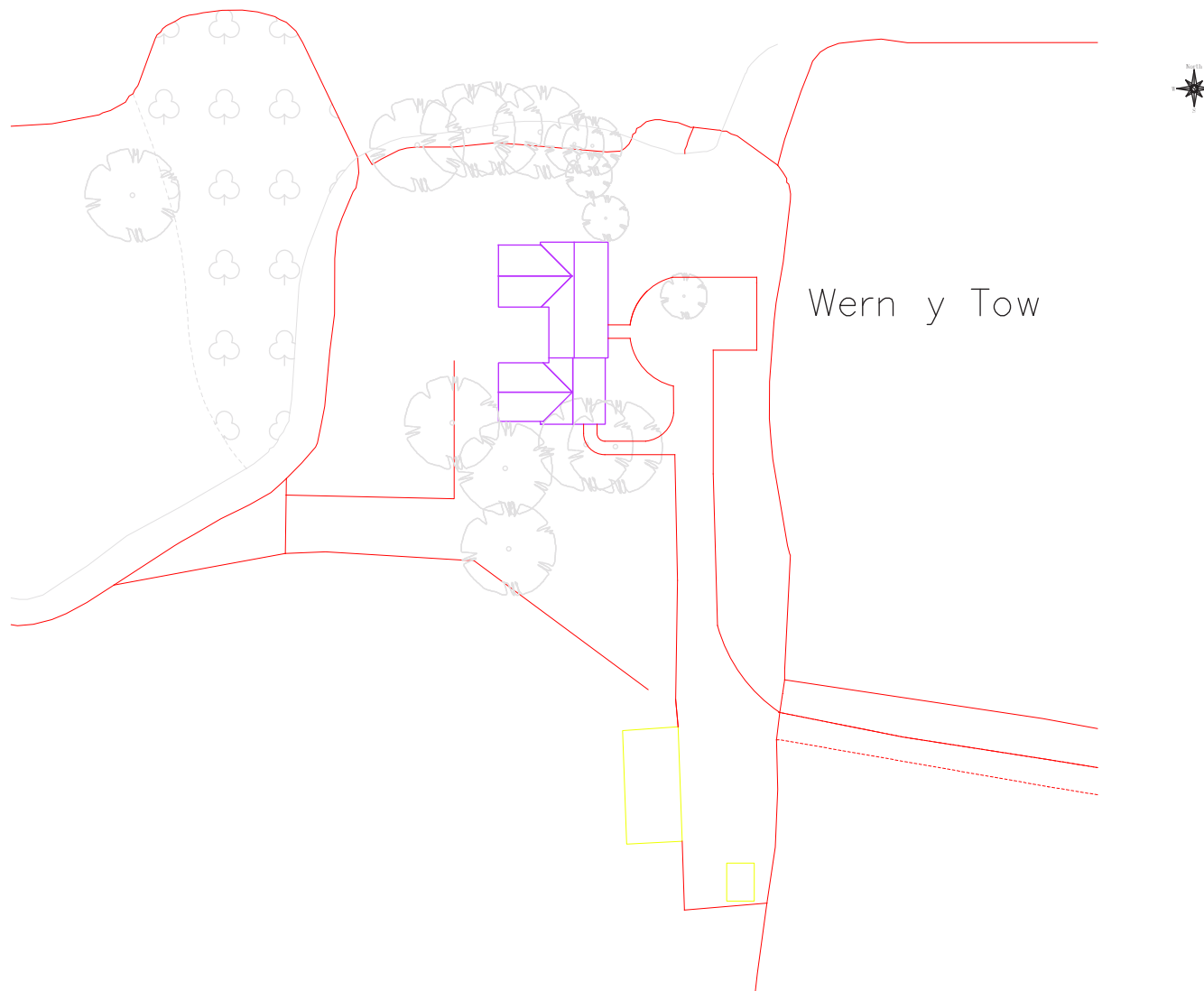
8 RECOMMENDATIONS

This FCA has demonstrated that the proposed development may be completed without conflicting with the requirements of TAN15 subject to the following:

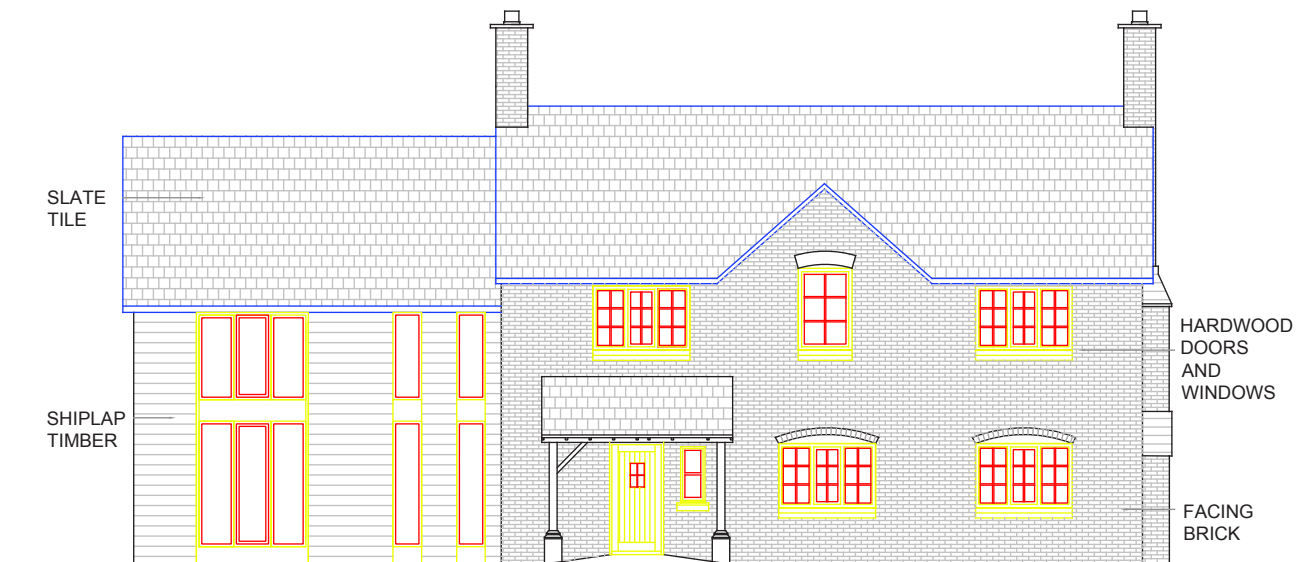
- Finished floor levels to be set at a minimum level of 300 mm above the threshold level of the existing dwelling as shown on the topographic survey provided, noting that the survey is to Local Datum (LD).
- The latest best practice flood resistant and resilient construction techniques to be incorporated into the design of the buildings
- A Flood Plan should be prepared in consultation with WCBC Emergency Planners prior to occupation of the building
- The detailed drainage design, developed in accordance with the principles set down in this FCA, should be submitted to and approved by the local planning authority prior to the commencement of development

APPENDIX A:

Development Proposals



PROPOSED SITE PLAN
SCALE 1:500



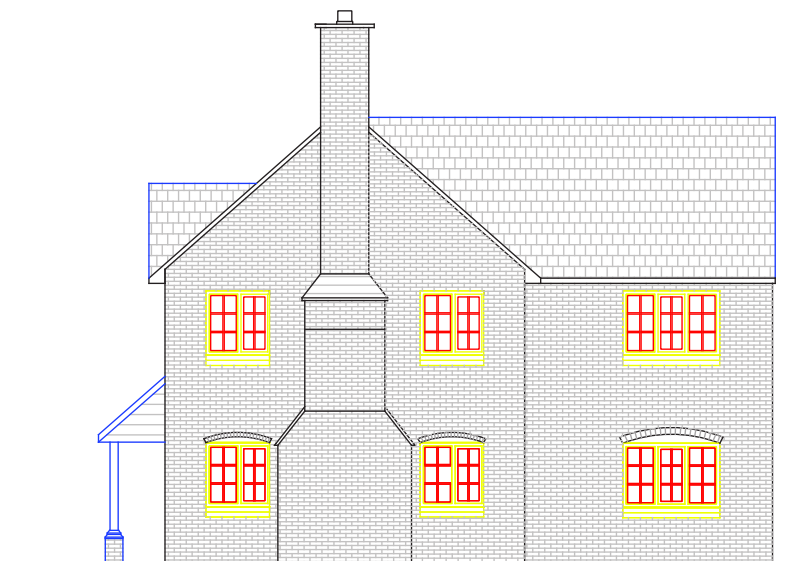
PROPOSED FRONT ELEVATION

SCALE 1:100



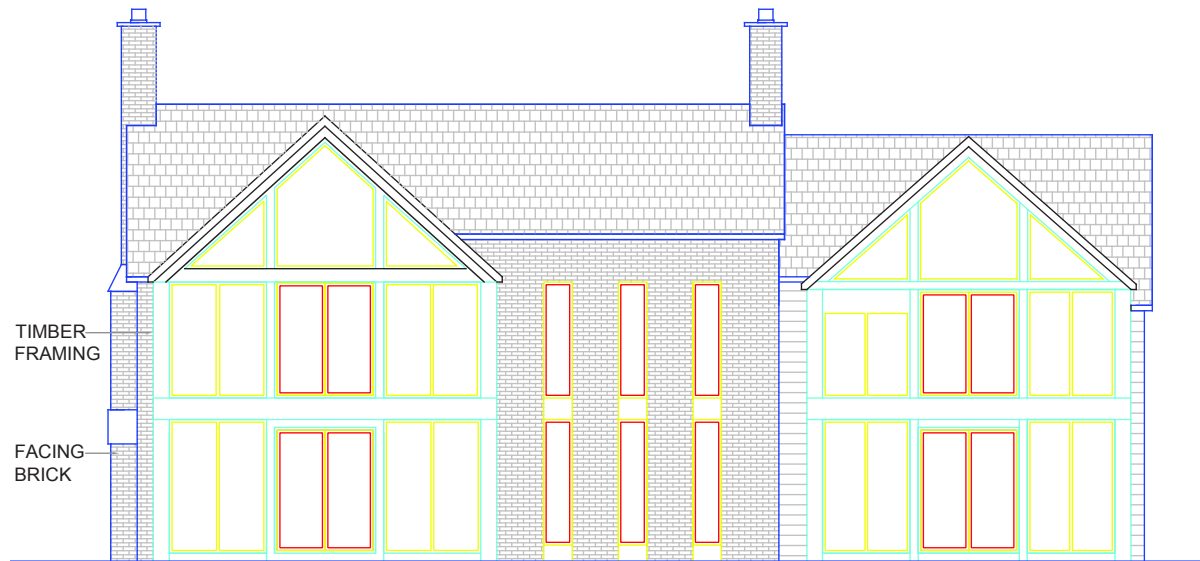
PROPOSED SIDE ELEVATION

SCALE 1:100



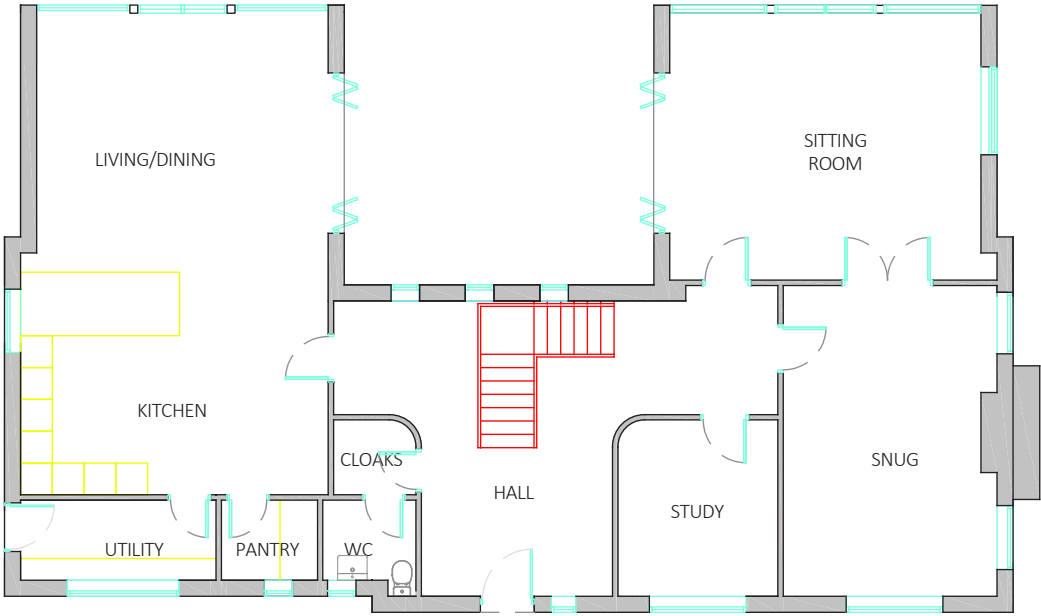
PROPOSED SIDE ELEVATION

SCALE 1:100



PROPOSED REAR ELEVATION

SCALE 1:100



PROPOSED GROUND FLOOR PLAN
SCALE 1:100

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STATUS KEY: SKE: SKETCH DESIGN PLA: PLANNING TENDER: TEN
CON: CONSTRUCTION SUR: SURVEY

REVISION / DESCRIPTION	DRAWN	CHECKED	DATE

REVISION / DESCRIPTION	DRAWN	CHECKED	DATE

REVISION / DESCRIPTION	DRAWN	CHECKED	DATE

RADM Ltd

69 Ridgewood Drive

Pensby

Wirral CH61 9RF

RADM

Architects

Telephone: 0151 648 5570

Email: enquiries@radm.co.uk

Website: www.radm.co.uk

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PROJECT TITLE:

JOB No:

DRAWING TITLE:

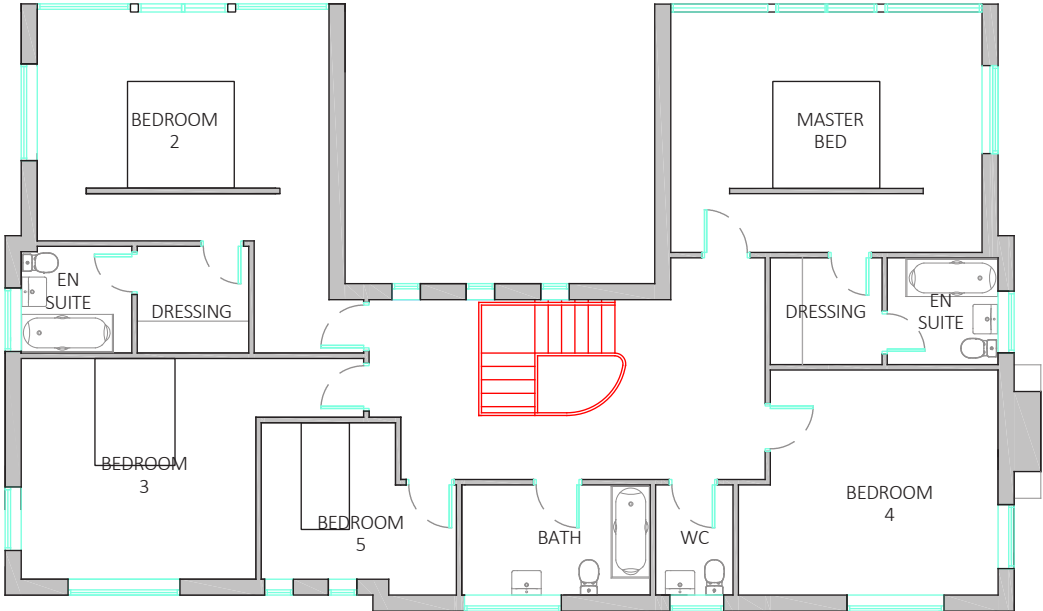
DRAWING No:

SCALE: @A3

DATE:

STATUS:

REVISION:



PROPOSED FIRST FLOOR PLAN
SCALE 1:100

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REVISION / DESCRIPTION	DRAWN	CHECKED	DATE

REVISION / DESCRIPTION	DRAWN	CHECKED	DATE

REVISION / DESCRIPTION	DRAWN	CHECKED	DATE

REVISION / DESCRIPTION	DRAWN	CHECKED	DATE

RADM Architects		RADM Ltd 69 Ridgewood Drive Penrhy Wrexham CH61 6RS Telephone: 0151 648 5570 Email: enquiries@radm.co.uk Website: www.radm.co.uk © RADM Ltd 2015	
PROJECT TITLE:		JOB No:	
DRAWING TITLE:		DRAWING No:	
SCALE: @A3	DATE:	STATUS:	REVISION:

APPENDIX B:

Topographic Survey

Client
Lister Carter Ltd
Bank Farm Buildings
Aldford
Chester
CH3 6HJ

Survey Stations				
Local Plane Metric				
Abbayney, level related to station 1, Value: 50.00mm				
STATIONS	EAST	NORTH	HEIGHT	DESCRIPTION
A	505.000	1005.000	50.000	Nail
B	469.348	999.889	49.594	Nail

Only trees with a bole diameter of 300mm or greater are shown

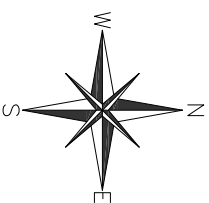
The site is extremely overgrown so some detail may have been missed

Legend

NAME	ANNOVATION	Unit	Number
1	Bed	Bed	1
2	Bed	Bed	1
3	Bed	Bed	1
4	Bed	Bed	1
5	Bed	Bed	1
6	Bed	Bed	1
7	Bed	Bed	1
8	Bed	Bed	1
9	Bed	Bed	1
10	Bed	Bed	1
11	Bed	Bed	1
12	Bed	Bed	1
13	Bed	Bed	1
14	Bed	Bed	1
15	Bed	Bed	1
16	Bed	Bed	1
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47	Bed	Bed	1
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91	Bed	Bed	1
92	Bed	Bed	1
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95	Bed	Bed	1
96	Bed	Bed	1
97	Bed	Bed	1
98	Bed	Bed	1
99	Bed	Bed	1
100	Bed	Bed	1

SW	Bath wire	EW	Tree
WP	Woolen panel	WP	Wool panel
CP	Carpeted floor	CP	Carpet
CL	Chain link	CL	Chain link
CP	Concrete panel	CP	Concrete panel
HR	Hand rail	HR	Hand rail
R	Ron railing	R	Ron railing
PC	Post and rail	PC	Post and rail
RP	Post and wire	RP	Post and wire
ST	Security fence	ST	Security fence
WM	Wire mesh	WM	Wire mesh

Spot level Security Control unit 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100	Spot level Security Control unit 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100
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APPENDIX C:

Greenfield Runoff Calculations

Weetwood		Page 1
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold		
Date 18/04/2018 15:29 File	Designed by OwenAstbury Checked by	
Micro Drainage		Source Control 2017.1.2
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.400 Area (ha) 1.000 Urban 0.000 SAAR (mm) 680 Region Number Region 9 Results 1/s QBAR Rural 3.3 QBAR Urban 3.3 Q100 years 7.2 Q1 year 2.9 Q30 years 5.8 Q100 years 7.2		
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APPENDIX D:

Peak Runoff Rate from Impermeable Areas - Existing Site

The peak discharge rates of surface water runoff from the impermeable areas at the site have been calculated based on the Modified Rational Method. The lower of the two values has determined the existing discharge rates from the impermeable areas at the existing site.

The Modified Rational Method²⁰ has been used to calculate the runoff from the impermeable surfaces at the existing site.

The following parameters have been obtained from the maps in Volume 3 of the Wallingford Procedure:

M5-60 minute rainfall depth:	17 mm
Ratio of M5-60 to M5-2 day rainfall:	0.3
Average Annual Rainfall:	680 mm
Winter Rain Acceptance Potential/ Soil Type :	4
The Urban Catchment Wetness Index (UCWI) value:	66.80

The time for runoff to flow to the discharge point has been set at 15 minutes.

A rainfall estimation calculation has been carried out to convert the M5-60 minute rainfall to the 5-minute duration rainfall for the 1 in 1 and 1 in 100 annual probability rainfall events. The calculated rainfall intensities for these events are 24.4 and 76.6 mm/hr respectively.

The flow rate as given by the Modified Rational Method is:

$$Q = 2.78 \times C_v \times C_r \times \text{rainfall intensity} \times \text{impermeable area}$$

where:

C_v is the volumetric runoff coefficient = $P_r / \text{PIMP} = 100$

where P_r is Percentage Runoff and PIMP is Percentage Impermeable Area

C_r is the routing coefficient = 1.3

Impermeable Area = 0.013 ha

The peak discharges of surface runoff from impermeable areas of the existing site are shown in the table below:

Peak Runoff Rate for Impermeable Surfaces at Existing Site – Modified Rational Method

Annual probability of rainfall event	Peak discharge for 0.013 ha impermeable area (l/s)
1 in 1	0.90
QBAR	1.17
1 in 30	2.21
1 in 100	2.83

²⁰ The Wallingford Procedure, Volume 4, 1981

APPENDIX E:

Surface Water Attenuation - Storage Volume Calculations

Weetwood					Page 1	
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold						
Date 18/04/2018 16:44 File 2018-04-16 2845 Q0100cc...						
Designed by OwenAstbury Checked by						
Micro Drainage			Source Control 2017.1.2			
Summary of Results for 100 year Return Period (+30%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status	
15 min Summer	0.836	0.836	5.0	2.8	O K	
30 min Summer	0.903	0.903	5.0	3.1	O K	
60 min Summer	0.808	0.808	5.0	2.7	O K	
120 min Summer	0.416	0.416	5.0	1.4	O K	
180 min Summer	0.208	0.208	4.9	0.7	O K	
240 min Summer	0.129	0.129	4.5	0.4	O K	
360 min Summer	0.096	0.096	3.4	0.3	O K	
480 min Summer	0.082	0.082	2.8	0.3	O K	
600 min Summer	0.074	0.074	2.4	0.3	O K	
720 min Summer	0.068	0.068	2.1	0.2	O K	
960 min Summer	0.059	0.059	1.7	0.2	O K	
1440 min Summer	0.050	0.050	1.3	0.2	O K	
2160 min Summer	0.042	0.042	0.9	0.1	O K	
2880 min Summer	0.038	0.038	0.8	0.1	O K	
4320 min Summer	0.032	0.032	0.5	0.1	O K	
5760 min Summer	0.029	0.029	0.5	0.1	O K	
7200 min Summer	0.026	0.026	0.4	0.1	O K	
8640 min Summer	0.024	0.024	0.3	0.1	O K	
10080 min Summer	0.023	0.023	0.3	0.1	O K	
15 min Winter	0.963	0.963	5.0	3.3	O K	
30 min Winter	0.990	0.990	5.0	3.4	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)		
15 min Summer	96.918	0.0	5.8	13		
30 min Summer	67.029	0.0	8.0	22		
60 min Summer	44.405	0.0	10.7	38		
120 min Summer	28.487	0.0	13.7	68		
180 min Summer	21.655	0.0	15.6	96		
240 min Summer	17.694	0.0	17.0	124		
360 min Summer	13.184	0.0	19.0	184		
480 min Summer	10.704	0.0	20.5	244		
600 min Summer	9.097	0.0	21.8	304		
720 min Summer	7.960	0.0	22.9	366		
960 min Summer	6.440	0.0	24.7	490		
1440 min Summer	4.766	0.0	27.5	718		
2160 min Summer	3.518	0.0	30.4	1068		
2880 min Summer	2.831	0.0	32.6	1444		
4320 min Summer	2.079	0.0	35.9	2128		
5760 min Summer	1.668	0.0	38.4	2904		
7200 min Summer	1.408	0.0	40.5	3672		
8640 min Summer	1.226	0.0	42.4	4368		
10080 min Summer	1.090	0.0	44.0	4984		
15 min Winter	96.918	0.0	6.5	14		
30 min Winter	67.029	0.0	9.0	23		
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Weetwood				Page 2	
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold					
Date 18/04/2018 16:44 File 2018-04-16 2845 Q0100cc...					
			Designed by OwenAstbury Checked by		
Micro Drainage			Source Control 2017.1.2		
<u>Summary of Results for 100 year Return Period (+30%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.772	0.772	5.0	2.6	O K
120 min Winter	0.217	0.217	4.9	0.7	O K
180 min Winter	0.114	0.114	4.1	0.4	O K
240 min Winter	0.094	0.094	3.3	0.3	O K
360 min Winter	0.076	0.076	2.5	0.3	O K
480 min Winter	0.066	0.066	2.0	0.2	O K
600 min Winter	0.060	0.060	1.7	0.2	O K
720 min Winter	0.056	0.056	1.5	0.2	O K
960 min Winter	0.049	0.049	1.2	0.2	O K
1440 min Winter	0.042	0.042	0.9	0.1	O K
2160 min Winter	0.035	0.035	0.7	0.1	O K
2880 min Winter	0.032	0.032	0.5	0.1	O K
4320 min Winter	0.027	0.027	0.4	0.1	O K
5760 min Winter	0.024	0.024	0.3	0.1	O K
7200 min Winter	0.022	0.022	0.3	0.1	O K
8640 min Winter	0.020	0.020	0.2	0.1	O K
10080 min Winter	0.019	0.019	0.2	0.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	44.405	0.0	11.9	42	
120 min Winter	28.487	0.0	15.3	68	
180 min Winter	21.655	0.0	17.5	94	
240 min Winter	17.694	0.0	19.0	124	
360 min Winter	13.184	0.0	21.3	184	
480 min Winter	10.704	0.0	23.0	240	
600 min Winter	9.097	0.0	24.5	308	
720 min Winter	7.960	0.0	25.7	358	
960 min Winter	6.440	0.0	27.7	476	
1440 min Winter	4.766	0.0	30.7	734	
2160 min Winter	3.518	0.0	34.0	1108	
2880 min Winter	2.831	0.0	36.5	1420	
4320 min Winter	2.079	0.0	40.2	2184	
5760 min Winter	1.668	0.0	43.0	2832	
7200 min Winter	1.408	0.0	45.4	3640	
8640 min Winter	1.226	0.0	47.4	4416	
10080 min Winter	1.090	0.0	49.2	5048	
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Weetwood		Page 3																																	
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold																																			
Date 18/04/2018 16:44 File 2018-04-16 2845 Q0100cc...	Designed by OwenAstbury Checked by																																		
Micro Drainage		Source Control 2017.1.2																																	
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>17.000</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.300</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+30</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.032 <table> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> <tr> <td>0</td> <td>4</td> <td>0.032</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	17.000	Shortest Storm (mins)	15	Ratio R	0.300	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+30	Time (mins)		Area	From:	To:	(ha)	0	4	0.032
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Weetwood		Page 4
Suite 1 Park House Broncoed Bus Park Wrexham Rd Mold		
Date 18/04/2018 16:44 File 2018-04-16 2845 Q0100cc...	Designed by OwenAstbury Checked by	
Micro Drainage Source Control 2017.1.2		

Model Details

Storage is Online Cover Level (m) 1.000

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	3.4	1.000	3.4

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0105-5000-1000-5000
Design Head (m)	1.000
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	105
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.296	5.0
Kick-Flo®	0.637	4.1
Mean Flow over Head Range	-	4.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.4	7.000	12.5
0.200	4.8	1.400	5.8	3.500	9.0	7.500	12.9
0.300	5.0	1.600	6.2	4.000	9.6	8.000	13.3
0.400	4.9	1.800	6.6	4.500	10.1	8.500	13.7
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.1
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.5
0.800	4.5	2.400	7.5	6.000	11.6		
1.000	5.0	2.600	7.8	6.500	12.1		

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