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CONSULTING LIMITED




Client: Dewhurst Properties Ltd.
Flood Risk Assessment for the Proposed Development at Land at Beech House, Alston Lane, Preston

June 2020

Canterbury Office
Unit 6 & 7
Barham Business Park
Elham Valley Road
Barham
Canterbury
Kent
CT4 6DQ

London Office
Unit D
Taper Building
Weston Street
London
SE1 3QB

Tel 01227 833855
www.herringtonconsulting.co.uk

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Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date
1	0	Draft report issued by email.	08 June 2020
2	1	Changes to client details. Final report issued by email.	10 June 2020

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Document Verification

Issue	Revision	Date:	08 June 2020
1	0	Author(s):	Anne Wiltshire
		First Check By:	Kirsty Thomas
		Amendments Agreed:	Anne Wiltshire
		Second Check By:	Kirsty Thomas
		Director Sign Off:	Simon Maiden-Brooks
Issue	**Revision**	**Date:**	**10 June 2020**
2	1	Author(s):	Anne Wiltshire
		Check By:	Toby Vaughan

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1 Background and Scope of Appraisal

The objectives of the Flood Risk Assessment (FRA) are therefore to establish the following:

- whether a proposed development is likely to be affected by current or future flooding from any source
- whether the development will increase flood risk elsewhere within the floodplain
- whether the measures proposed to address these effects and risks are appropriate
- whether the site will pass Part B of the Exception Test (where applicable).

Herrington Consulting has been commissioned by Dewhurst Properties Ltd to prepare a Flood Risk Assessment (FRA) for the proposed development at **Land at Beech House, Alston Lane, Longridge, Preston, PR3 3BN**.

This appraisal has been undertaken in accordance with the requirements of the National Planning Policy Framework (2019) and the National Planning Practice Guidance Suite (March 2014) that has been published by the Department for Communities and Local Government. The *Flood Risk and Coastal Change* planning practice guidance included within the Suite represents the most contemporary technical guidance on preparing FRAs. In addition, reference has also been made to Local Planning Policy.

To ensure that due account is taken of industry best practice, this FRA has been carried out in line with the CIRIA Report C624 'Development and flood risk - guidance for the construction industry'.

2 Development Description and Planning Context

2.1 Site Location and Existing Use

The site is located at OS coordinates 361444, 433438, off Alston Lane in Preston. The site covers an area of approximately 0.2 hectares and currently comprises undeveloped land. The location of the site in relation to the surrounding area and the River Ribble is shown in Figure 2.1.

Figure 2.1 – Location map (Contains Ordnance Survey data © Crown copyright and database right 2020).

The site plan included in Appendix A.1 of this report provides more detail in relation to the site location and layout.

2.2 Proposed Development

The proposals for development comprise the construction 3 holiday lets, with associated parking and access (Figure 2.2). More detailed drawings of the proposed scheme are included in Appendix A.1 of this report.

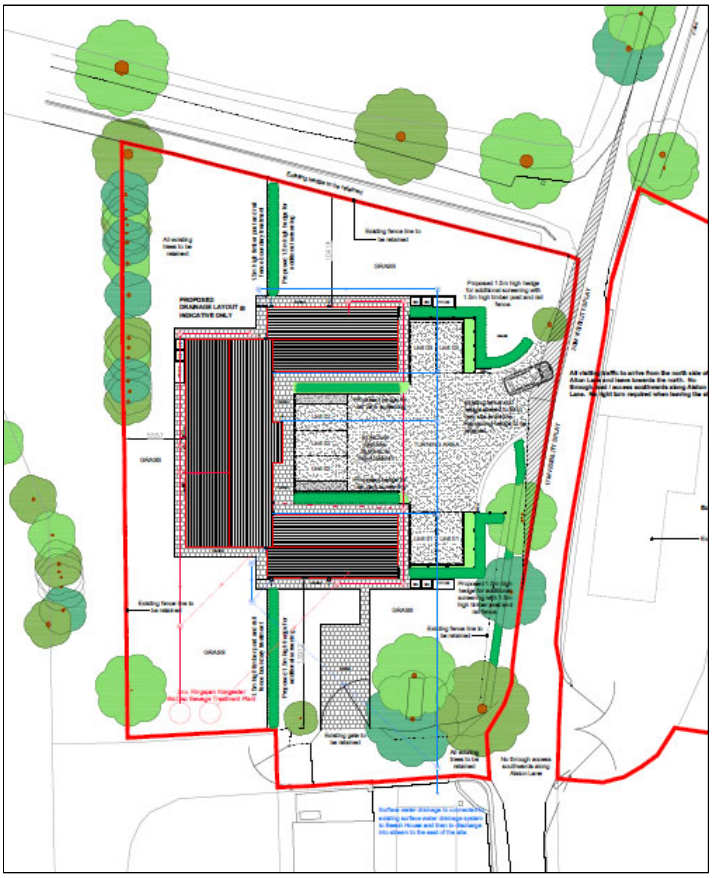


Figure 2.2 – Proposed development layout.

3 Definition of Flood Hazard

3.1 Site Specific Information

Information from a wide range of sources has been referenced in order to appraise the true risk of flooding at this location. This section summarises the additional information collected as part of this FRA.

Site specific flood level data provided by the EA – The EA has previously been contacted to request modelled flood level information for the neighbouring site and a copy of their response is included in Appendix A.2 of this report.

Information contained within the SFRA – The Ribble Valley Borough Council SFRA (2017) contains detailed mapping of flood extents from a wide range of sources. This document has been referenced as part of this site-specific FRA.

Site specific topographic surveys – A topographic survey has been undertaken for the site and a copy of this is included in Appendix A.1. From this it can be seen that the level of the site varies between 20.7m and 22.0m Above Ordnance Datum Newlyn (AODN). In general, land levels in the area of proposed development are shown to be relatively flat, varying between 21.5m and 21.8m AODN. Land levels in the surrounding area fall from north to south, towards the River Ribble.

Geology – Reference to the British Geological Survey (BGS) map shows that the underlying solid geology in the location of the subject site is Samlesbury Formation (mudstone). Overlying this are superficial River Terrace Deposits (sand and gravel).

Historic flooding – Information provided by the EA shows that the development site is located outside the extent of flooding for an event which occurred on 27th October 1980. In addition to the EA mapping, the applicant has provided photographs of flooding within the surrounding catchment which occurred in December 2015 and has confirmed that the development site remained unaffected during this event. No other records of historic flooding in this location were identified from desktop searches.

3.2 Potential Sources of Flooding

The main sources of flooding have been assessed as part of this appraisal. The specific issues relating to each one and its impact on this development are discussed below. Table 3.1 at the end of this section summarises the risks associated with each of the sources of flooding.

Flooding from Rivers – The site lies within Flood Zone 3 of the River Ribble (main river), which is situated 110m to the south of the site, as shown on the EA's 'Flood Map for Planning' (Figure 3.1 below).

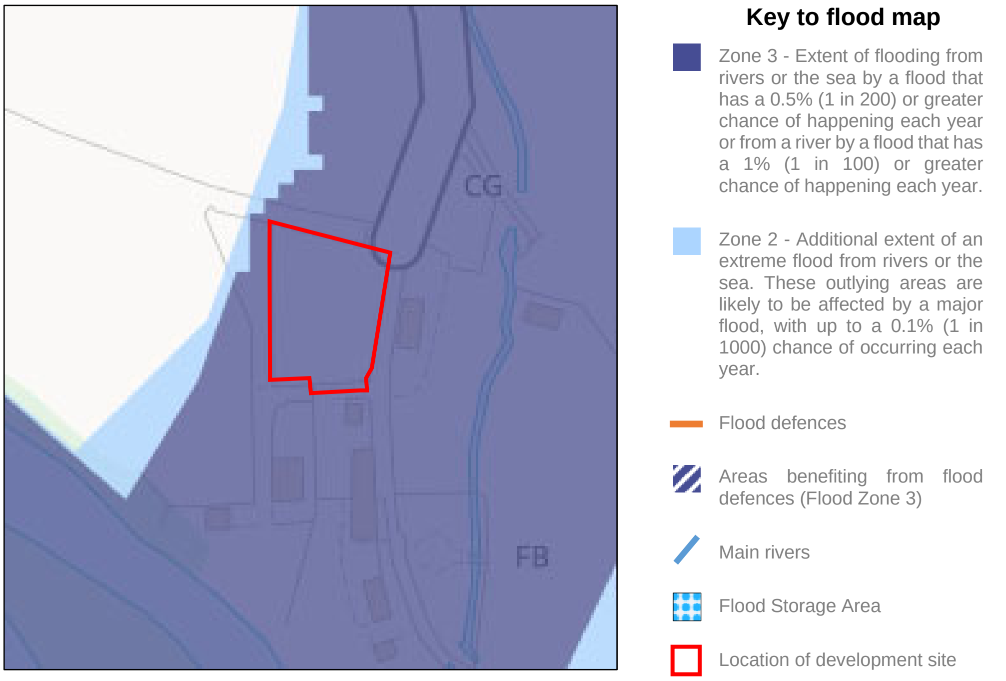


Figure 3.1 – Flood zone map showing the location of the development site (© Environment Agency)

The flood zone maps are used as a consultation tool by planners to highlight areas where more detailed investigation of flood risk is required. Consequently, given the location of the site within Flood Zone 3, the risk of flooding from this source has been examined in more detail as part of this FRA.

Flooding from Ordinary or Man-made Watercourses – Natural watercourses that have not been enmained and man-made drainage systems such as irrigation drains, sewers or ditches could potentially cause flooding.

Inspection of OS mapping and aerial height data of site and surrounding area reveals that there is a small watercourse 40m east of the site which flows into the River Ribble. The EA's 'Flood Map for Planning' suggests that the development site could lie within Flood Zones 2 and 3 of the watercourse and consequently, the risk of flooding from this source will be appraised in greater detail as part of this FRA.

Flooding from the Sea – The site is located a significant distance inland and is elevated well above predicted extreme tide levels. Consequently, the risk of flooding from this source is considered to be *low.*

Flooding from Land (overland flow and surface water runoff) – Overland flooding typically occurs in natural valley bottoms as normally dry areas become covered in flowing water and in low spots where water may pond. This flooding mechanism can occur almost anywhere but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

Figure 3.2 below is an extract of the Environment Agency's 'Flood Risk from Surface Water' map which can be interrogated to identify whether the site is located in an area at risk of surface water flooding.

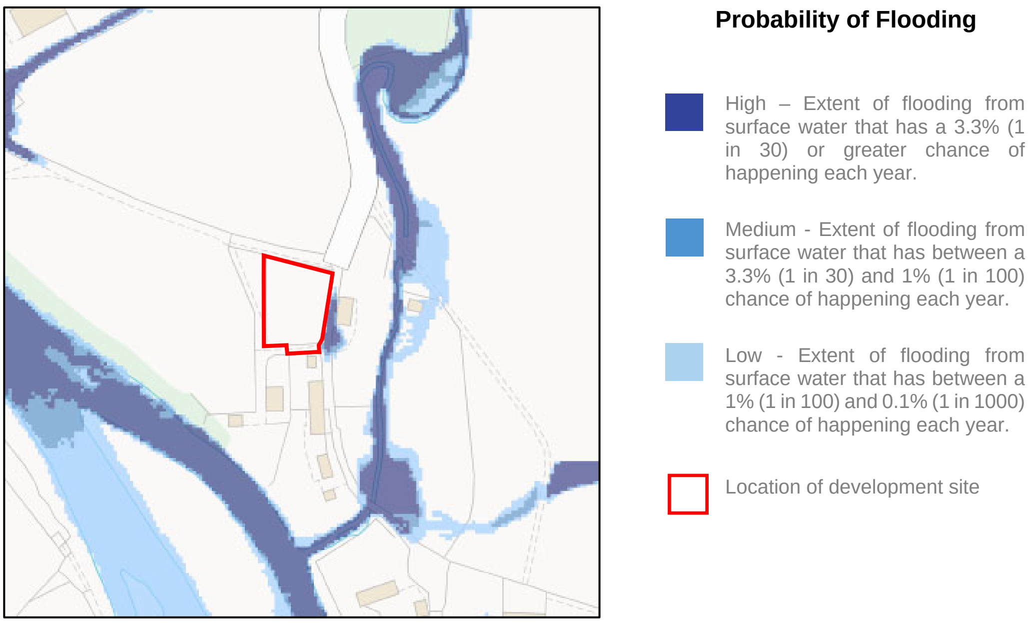


Figure 3.2 – Surface water flooding map showing the location of the development site (© Environment Agency)

The above mapping shows that the majority of the development site is shown to be located outside the flood extents of an extreme pluvial event with a return period of 1 in 1000 years (i.e. it has a very low probability of flooding). However, a small area to the east of the site boundary is shown to be at 'low' to 'high' risk of surface water flooding.

Examination of aerial height data and the site-specific topographic survey reveals that there is a small topographic depression within Alston Lane. Land levels in this area suggest that water could pond at this location following an extreme rainfall event, with the potential to reach a maximum level equal to 20.0m AODN. Above this level water would flow away in a south-easterly direction, towards the watercourse. Notwithstanding this, land levels at the site are elevated over 0.7m above this level, and as such would remain dry during an extreme pluvial event. This is supported by the EA's mapping and the Ribble SFRA which shows the majority of the site to be in an area at 'very low' risk of surface water flooding, with no historic records of flooding from surface water. The risk of flooding to the site from this source is therefore concluded to be *low.*

Flooding from Groundwater – Water levels below the ground rise during wet winter months, and fall again in the summer as water flows out into rivers. In very wet winters, rising water levels may lead to the flooding of normally dry land, as well as reactivating flow in 'bournes' (streams that only flow for part of the year).

Groundwater flooding is most likely to occur in low-lying areas that are underlain by permeable rock (aquifers). The underlying geology in this area is Samlesbury Formation (mudstone), which is not typically associated with groundwater flooding. Furthermore, the River Ribble and nearby watercourse will act to drain the soils in this location, thus maintaining lower groundwater levels in the surrounding area. This is supported by mapping on groundwater emergence provided as part of the Defra Groundwater Flood Scoping Study (May 2004), which shows that no groundwater flooding events were recorded during the very wet periods of 2000/01 or 2002/03. It also shows that the site itself is not located within an area where groundwater emergence is predicted.

In addition to the above, the area of proposed development is elevated approximately 4.0m above the watercourse. Therefore, even in the unlikely instance of groundwater emergence at or near to the site, any floodwater would simply flow away from the site in a south-easterly where it would be intercepted by the watercourse. It is therefore concluded that the risk of flooding from this source is *low*.

Flooding from Sewers – In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and wastewater known as “combined sewers”. Flooding can result when the sewer is overwhelmed by heavy rainfall, becomes blocked, or is of inadequate capacity; this will continue until the water drains away.

The Ribble Valley Borough SFRA holds no historic record of sewer flooding in this area, furthermore, no past sewer flooding events were discovered through a desktop search. Additionally, the topography of the land within the site and the surrounding area suggests that any above ground flooding that might occur as a result of a surcharged sewer would be encouraged to flow away from the site, flowing southwards towards the lower lying River Ribble. Therefore, the risk of flooding from this source is considered to be *low.*

Flooding from Reservoirs, Canals and other Artificial Sources – Non-natural or artificial sources of flooding can include reservoirs, canals and lakes where water is retained above natural ground level, operational and redundant industrial processes including mining, quarrying and sand and gravel extraction, as they may increase floodwater depths and velocities in adjacent areas. The potential effects of flood risk management infrastructure and other structures also need to be considered. Reservoir or canal flooding may occur as a result of the facility being overwhelmed and/or as a result of dam or bank failure.

Inspection of the OS mapping for the area shows that there are no artificial sources of flooding within close proximity to the site. However, the EA’s ‘Flood Risk from Reservoirs’ website (Figure 3.3) shows that the site is located within an area considered to be at risk of flooding from the Alston Reservoirs No.1 and No.2 which are situated 2.7km to the north. The site is also within an area considered to be at risk of flooding from the Spade Mill Reservoirs No.1 and No.2 which are 3.9km to the north of the site.

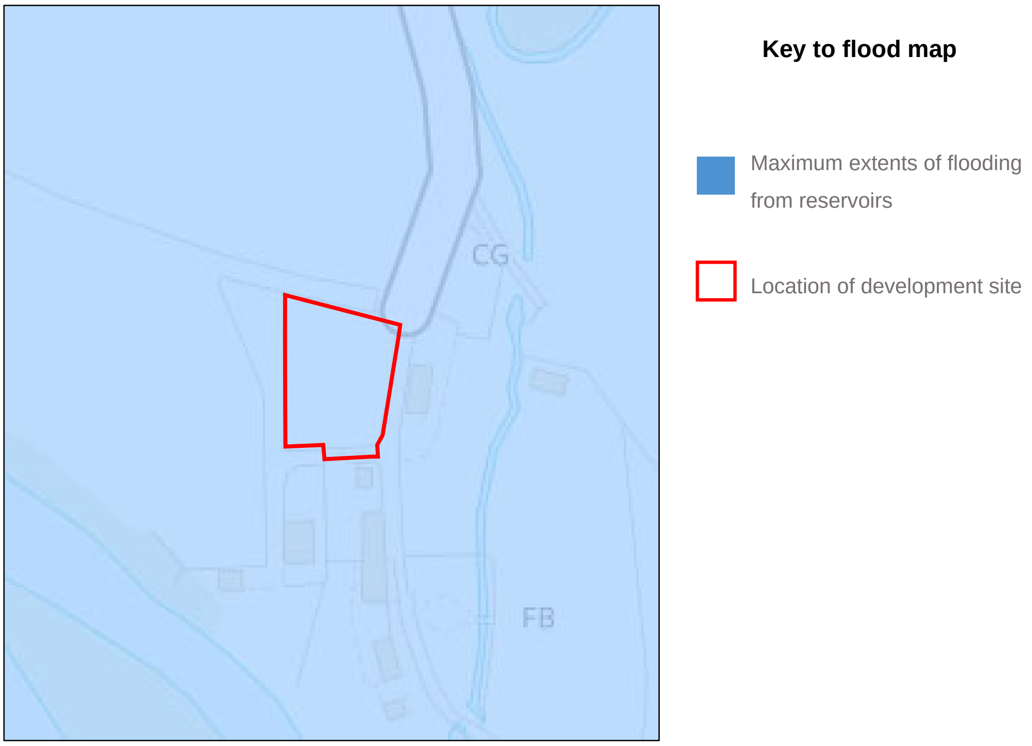


Figure 3.3 – Risk of Flooding from Reservoirs map showing the location of the development site (© Environment Agency).

When considering the risk of flooding from this source it is necessary to take into account the fact that these reservoirs are located a significant distance from the site and are owned and operated by the relevant water companies, who have a duty under the Reservoirs Act to ensure that they are maintained in a good working order and are inspected regularly. Consequently, due to the high standard of protection the risk of flooding from these man-made water bodies is considered to be low.

A summary of the overall risk of flooding from each source is provided in Table 3.1 below.

Source of flooding	Initial level of risk	Appraisal method applied at the initial flood risk assessment stage
Rivers (fluvial)	Appraised further in Section 5	Environment Agency flood zone map and OS mapping
Sea	Low	OS mapping and aerial height data
Ordinary and man-made watercourses	Appraised further in Section 5	OS mapping and aerial height data
Overland flow	Low	Environment Agency 'Flood Risk from Surface Water' flood maps, aerial height data, OS mapping, topographic survey
Groundwater	Low	Defra Groundwater Flood Scoping Study, BGS geological data, aerial height data, OS mapping, topographic survey.
Sewers	Low	Aerial height data, OS mapping, topographic survey, historic records in Ribble Valley Borough SFRA
Artificial sources	Low	OS mapping and Environment Agency 'Flood Risk from Reservoirs' flood map

Table 3.1 – Summary of flood sources and risks.

3.3 Existing Flood Risk Management Measures

There are no formal flood defence structures that provide protection to the development site.

4 Climate Change

When the impact of climate change is considered it is generally accepted that the standard of protection provided by current defences will reduce with time. The global climate is constantly changing, but it is widely recognised that we are now entering a period of accelerating change. Over the last few decades there have been numerous studies into the impact of potential changes in the future and there is now an increasing body of scientific evidence which supports the fact that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant global climate change during this century.

The nature of climate change at a regional level will vary: for the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall of the type responsible for the recent UK flooding could be expected.

These effects will tend to increase the size of flood zones associated with rivers, and the amount of flooding experienced from other inland sources. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels. It will also increase the extent of the area at risk should sea defences fail. Changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events are also predicted.

All of the recommended allowances for climate change outlined below should be used as a guideline and can be superseded if local evidence supports the use of other data or allowances.

4.1 Planning Horizon

To ensure that any recommended mitigation measures are sustainable and effective throughout the lifetime of the development, it is necessary to base the appraisal on the extreme flood level that is commensurate with the planning horizon for the proposed development. The NPPF and supporting Planning Practice Guidance Suite state that residential development should be considered for a minimum of 100 years, but that the lifetime of a non-residential development depends on the characteristics of the development. In this case, the proposals are for holiday lodges, which includes sleeping accommodation and therefore, a conservative approach has been adopted and the lifetime has been assumed to be 100 years.

4.2 Potential Changes in Climate

Peak River Flow

Recognising that the impact of climate change will vary across the UK, the allowances show the anticipated changes to peak river flow by river basin district. The proposed development site is covered by the North West River Basin District, as defined by the Environment Agency River Basin maps.

For each district a range of climate change allowances are provided for different time epochs over the next century, which correlate with the planning horizons for the varying classifications of development.

For each epoch there are three climate change allowances defined. These represent different levels of statistical confidence in the possible emissions scenarios on which they are calculated. The three levels of allowance are as follows:

- Central: based on the 50th percentile
- Higher Central: based on the 70th percentile
- Upper End: based on the 90th percentile

As well as encouraging sustainable development to meet the demands of a growing population, the NPPF also promotes a precautionary approach. For more vulnerable development in areas of higher risk of flooding, a higher percentile allowance is recommended in order to manage the risk of flooding over the lifetime of the proposed development. The Environment Agency has therefore provided guidance regarding the application of the climate change allowances and how they should be applied in the planning process. The range of allowance for the river basin in which the development site is located are shown in Table 4.1 below.

River Basin District	Allowance Category	2015 to 2039	2040 to 2069	2070 to 2115
North West	Upper End	20%	35%	70%
	Higher Central	20%	30%	35%
	Central	15%	25%	30%

Table 4.1 – Recommended peak river flow allowances for each epoch for the North West river basin district (1961 to 1990 baseline).

For more vulnerable development with a design life of 100 years in Flood Zone 3a, a **Higher Central** climate change allowance is recommended. From Table 4.2 above, it can be seen that the recommended climate change allowance for this site is a **35%** increase for all peak river flows.

Peak Rainfall Intensity

The recommended allowances for increases in peak rainfall intensity are applicable nationally. There is a range of values provided which correspond with the central and upper end percentiles (the 50th and 90th percentile respectively) over three time epochs. The recommended allowances are shown in Table 4.2 below.

Allowance Category (applicable nationwide)	Total potential change anticipated for each epoch		
	2015 to 2039	**2040 to 2069**	**2070 to 2115**
Upper End	+10%	+20%	+40%
Central	+5%	+10%	+20%

Table 4.2 – Recommended peak rainfall intensity allowance for small and urban catchments (1961 to 1990 baseline).

Guidance published by the EA states that the 'Upper End' allowance should be considered when designing a sustainable drainage system. As the development subject to this FRA has a planning horizon of 100 years, a 40% increase in peak rainfall intensity has been applied to the calculations in the surface water management section (refer to Section 8).

5 Probability and Consequence of Flooding

5.1 The Likelihood of Flooding

When appraising the risk of flooding to new development it is necessary to assess the impact of the 'design flood event'. Flood conditions can be predicted for a range of return periods and these are expressed in either years or as a probability, i.e. the probability that the event will occur in any given year, or Annual Exceedance Probability (AEP). The design flood event is taken as the 1 in 100 year (1% AEP) event for fluvial flooding, including an appropriate allowance for climate change (refer to Section 4.2).

The analysis in Section 3.2 of this report has identified that the primary risk of flooding to the development site is from fluvial sources, including the River Ribble and the watercourse located to the east of the development site. The risk of flooding from these rivers have therefore been appraised independently in the following sections.

5.2 Risk of Flooding from the River Ribble

The EA has provided modelled data taken from the Ribble-Douglas Strategic Flood Risk Mapping Study (2010) for the neighbouring site. The information includes in-channel flood levels and flows for a number of node points along the river. The location of the node points in relation to the development site is shown in Figure 5.1 below.

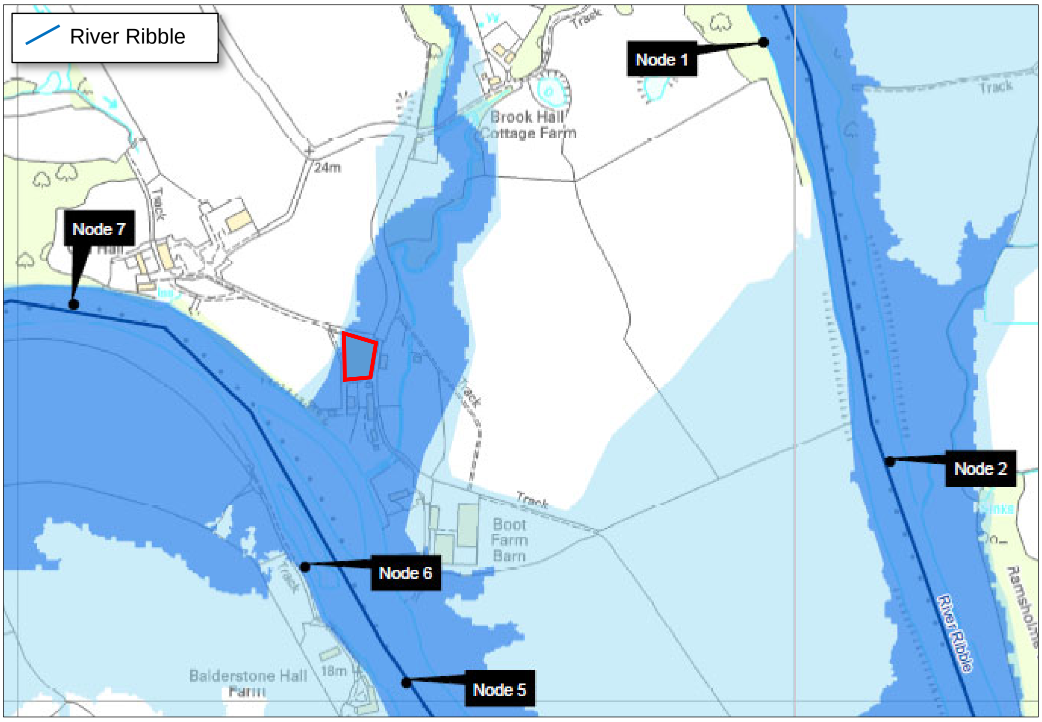


Figure 5.1 – Flood node location map (provided by the EA). Development site outlined in red.

As part of their response the EA has confirmed that this location is not currently protected by any formal flood defence infrastructure and therefore results for an 'undefended' scenario have been provided. The modelled flood levels for the nearest node point to the development site (node 6) are outlined in Table 5.1 below.

Return Period (Years)	Modelled flood levels at Node 6 (m AODN)
1 in 100	18.65
1 in 100 (+20% allowance for climate change)	19.08
1 in 200	18.92
1 in 1000	19.52

Table 5.1 – Modelled in-channel flood levels provided by the EA (at Node 6)

As part of their response, the EA has provided modelled flood level data and flows for a range of return period events, including the 100 year plus 20% climate change event. However, the data does not include the correct allowance for climate change, as defined by EA's most recent climate change guidance. This more recent guidance states that for a residential development with an assumed lifetime of 100 years, a 35% increase for all peak river flows should be considered (refer to Section 4.2 of this report).

In the absence of modelled flood level data for the 35% increase in peak river flow, a stage-flow discharge rating curve for current day conditions has been derived. This curve has subsequently been extrapolated to derive a flood level based on a 35% increase in peak flow. Figure 5.2 below shows the stage-discharge curve constructed for the node 6.

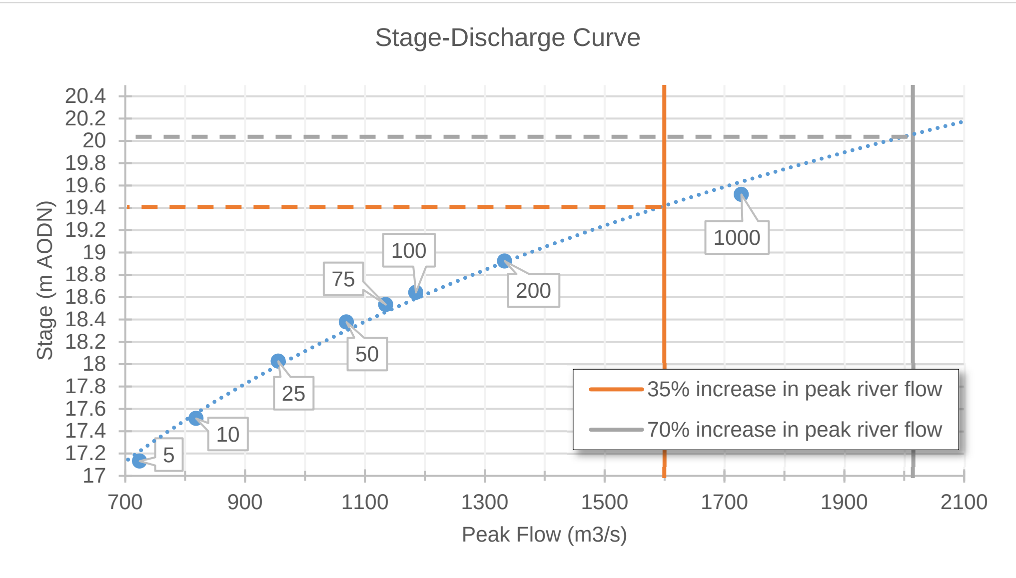


Figure 5.2 – Stage-discharge curve for in-channel node 6. Return period in years indicated by call-out boxes.

In order to derive the peak river flow for the 'design event' (i.e. the 1 in 100 year event, including a 35% allowance for climate change), the peak flow under the 1 in 100 year flood event (1184m^3/s) has been multiplied by 1.35, yielding a peak river flow of 1598 m^3/s. Reference to the stage-discharge curve identifies that for a 35% increase in peak river flow, the in-channel water level is predicted to be approximately 19.4m AODN.

Comparison of this flood level with land levels from the site-specific topographic survey identifies that the development site is located over 1m above the flood level and consequently, would remain dry.

Residual Risk

When considering residual risk, it is necessary to make predictions as to the impacts of a flood event that exceeds the design event, or in the case of areas that are already defended to an adequate standard, the impact of a failure of these defences.

The EA has confirmed that the development site does not benefit from defences, and therefore the impact of an exceedance event has been considered. Using the stage-discharge curve in Figure 5.2, the flood level for the EA's 'Upper End' climate change allowance (i.e. a 70% increase in peak river flow) has been calculated. The peak flow under the 1 in 100 year flood event (1184 m^3/s) has been multiplied by 1.70, yielding a peak river flow of 2013 m^3/s under the 1 in 100 year flood event (including a 70% allowance for climate change). Reference to the stage-discharge curve identifies that for a 70% increase in peak river flow, the in-channel water level is predicted to be approximately 20.1m AODN. The lowest land level at the site is shown to be 20.7m AODN and consequently, the site would remain unaffected even during an exceedance event. It is therefore concluded that the risk of flooding from the River Ribble is low.

5.3 Risk of Flooding from the Watercourse

There is no detailed modelled data of the watercourse to the east of the site. However, detailed hydrodynamic modelling of the watercourse has been constructed as part of a previous planning application for the neighbouring site which has since been granted planning permission. A summary of the modelling methodology is provided in the following sections.

Numerical Model

The hydraulic numerical model that has been used is ESTRY (version 4.3.6458.29637), which is an industry standard one-dimensional solver. With this approach, the channel is defined by a number of cross sections which include data on geometric features such as banks, the boundary of the domain to be modelled, and material zones with material properties such as Manning's 'n' value.

Land use	Manning's *n*
In-channel (free of weed)	0.04
Channel banks (grassy)	0.03
Concrete pipe (moulded)	0.018
Bridge main channel archway (cobbles and stones)	0.04
Bridge secondary channel archways (stones brush and vegetation)	0.05

Table 5.2 - Manning's n values used in the 1D model according to land use

Flood routing equations in the model calculate the water surface elevation within the cross sections over time, as well as information on flow rate, and energy. This numerical model uses cross-section data which has been derived using a combination of;

- 2m resolution LiDAR Digital Terrain Model (DTM) provided by the Environment Agency
- Elevations taken from the site-specific topographic survey site

Using the cross-section data, the flow along the watercourse is calculated using a number of governing equations for flow in open channels and hydraulic structures. The 1D network is shown in Figure 5.3.

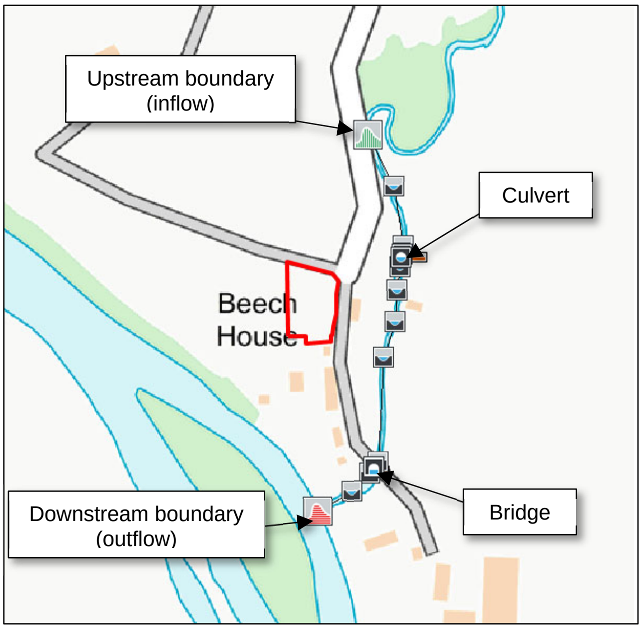


Figure 5.3 – Schematic showing the extent of the 1d model network in relation to the development site (outlined in red).

Derivation of Inflows

As there are no gauged flow data for the watercourse, the maximum extreme flows within the watercourse have been calculated using a combination of the hydrological prediction methods.

The first stage in the process is to define the catchment boundaries, which have been derived from the FEH web service. The elevation data used to derive this catchment has a resolution of 50m, and therefore it has been necessary to review the catchment boundaries using the more accurate 2m resolution LiDAR data provided by the EA. Following a review of the LiDAR, the catchment boundary has been adjusted. Figure 5.4 shows the original catchment boundary in comparison to revised catchment.

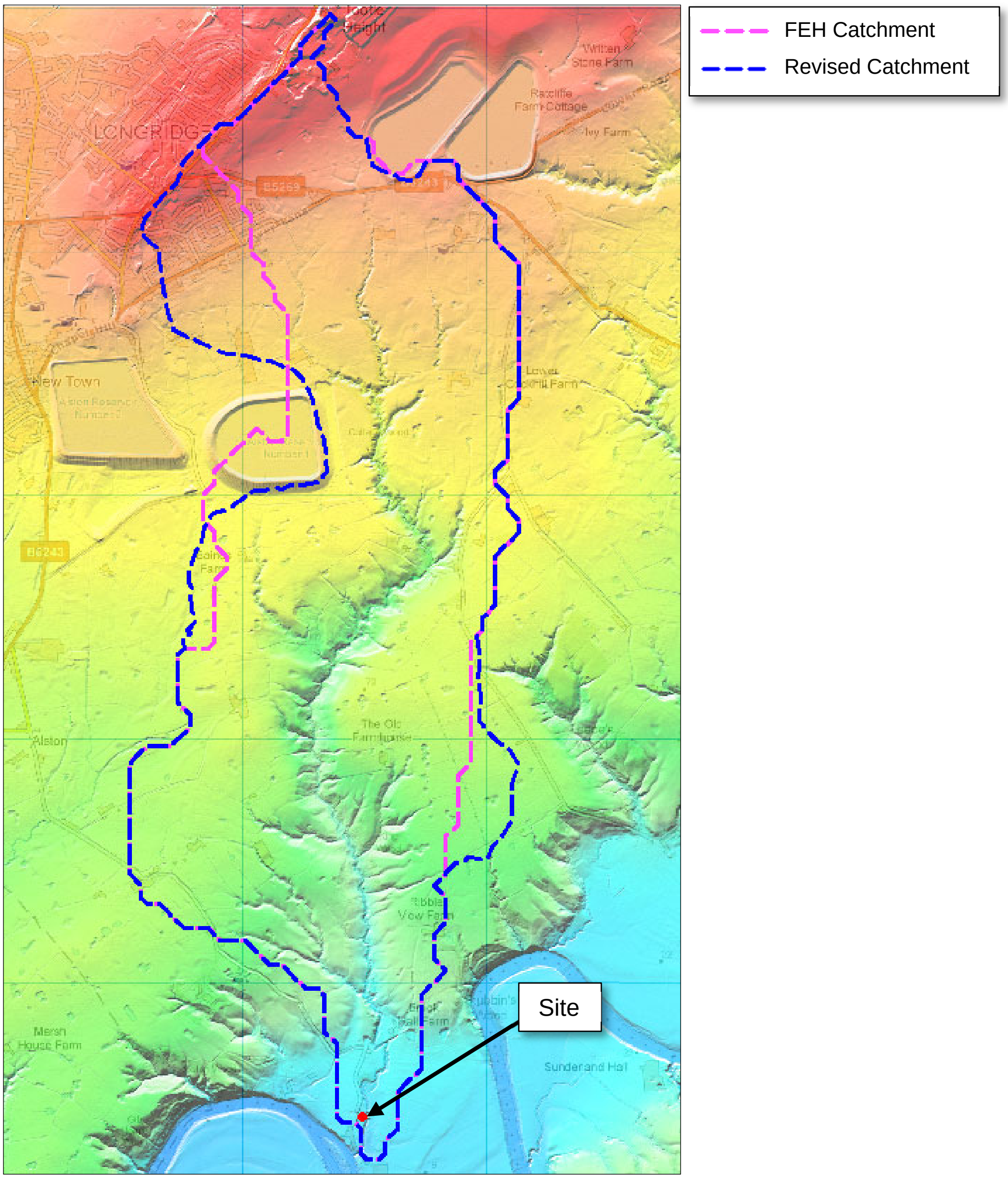


Figure 5.4 – Catchment boundaries derived from FEH online web service, and revised boundary using 2m resolution LiDAR data.

The FEH software then generates ‘catchment descriptors’ and these are listed below:

FARL	0.988	RMED-1H	10.4
PROPWET	0.51	RMED-1D	39.3
ALTBAR	80	RMED-2D	50.9
ASPBAR	171	SAAR	1108
ASPVAR	0.62	SAAR4170	1090
BFIHOST	0.394	SPRHOST	40.43
DPLBAR	2.92	URBCONC1990	-999999
DPSBAR	47.4	URBEXT1990	0.0018
LDP	5.82	URBLOC1990	-999999
C	-0.025	C(1km)	-0.025
D1	0.40629	D1(1km)	0.39
D2	0.33274	D2(1km)	0.332
D3	0.41325	D3(1km)	0.413
E	0.297	E(1km)	0.297
F	2.45055	F(1km)	2.445

Table 5.3 – Catchment Descriptors from FEH

Using the catchment descriptors, two industry standard methods can be used to derive extreme flows; the Flood Estimation Handbook (FEH) Statistical Procedure and the Revitalised Flood Hydrograph (ReFH2) model methodology. The FEH advises that ReFH2 should not be used for highly permeable catchments (where either the BFIHOST value is greater than 0.65 or the SPR value is lower than 0.20) or highly urbanised catchments (URBEXT is greater than 0.025).

The catchment in which the site is located is relatively impermeable with a BFIHOST value of 0.394 and following the review of the catchment boundary (shown in Figure 5.2) has an updated URBEXT value of 0.04. The FEH statistical method is therefore recommended for the estimation of extreme flows in this instance.

Given that there is no gauged data for the catchment, the pooled analysis methodology has been adopted for the derivation of flood flows. This method uses catchment characteristics to identify a number of gauged catchments which are hydrologically similar to the target catchment. The observed flood data for the 'similar' gauged catchments are then used to estimate peak flows at the ungauged target catchment.

To account for 100 years of climate change the 1 in 100 year flow rate was further increased by 35%, in accordance with the values stated in the NPPF. The peak flows derived from the analysis are shown in Table 5.4.

Return Period in years (%AEP)	Peak flow rate Q (m^3/s)
2 (50%)	2.6
20 (5%)	5.4
50 (2%)	6.8
100 (1%)	8.0
100+35%cc	**10.8**

Table 5.4 – Values of flow rate derived using FEH statistical method (m^3/s)

Whilst the FEH statistical method provides estimates of peak flow, it is necessary to use flood hydrographs generated using the ReFH2 model for input into the model. The design hydrographs are calculated for a specified initial soil moisture content and a design rainfall event. Both soil moisture and rainfall are specified on a seasonal basis depending on the degree of urbanisation of the catchment under consideration. In this instance, a winter profile has been used.

Model Outflow

The downstream end of the watercourse discharges directly into the River Ribble. The analysis in Section 5.1 has demonstrated that under the design flood event, the development site would not be affected by floodwater from the River Ribble. Given that the catchment of the River Ribble is at least an order of magnitude greater than the catchment of the watercourse which lies in proximity to the site, and comprises a large number of other tributaries, the likelihood of a rainfall event large enough to result in the design flood event in all sub-catchments of the Ribble is considered to be extremely low. Therefore, it is considered that the circumstances related to a design flood event occurring in the watercourse would be independent from those resulting in the design flood event within the River Ribble. Consequently, it is not deemed appropriate to apply the water level under design flood conditions within the River Ribble catchment to the downstream boundary of the watercourse model.

To determine the risk of flooding to the site under the design flood event from the watercourse as an independent source, the water level within the Ribble under normal flow conditions has been applied. To represent 'normal' flow condition, a conservative approach has been adopted whereby the 1 in 2 year flood level for the Ribble has been used. The EA has not provided model data for the Ribble for a 1 in 2 year return period, and therefore the in-channel flow rate has been approximated by considering the relationship between return period and flow based on the model data provided by the EA. Using this flow rate ($628m^3/s$), the stage-discharge curve (Figure 5.2) has been extrapolated to derive an in-channel water level of 16.83m AODN for the 1 in 2 year event.

Calibration of Detailed Modelling

Although the hydrological procedures outlined in the FEH are suitable for determining flood flows within catchments of this size, the main controlling factor when constructing any model is being able to validate the results using known historic events. This enables the model to be calibrated and adjustments made to ensure that the model is representative of real life.

The applicant has provided photographs of the opposite site and surrounding area during a flood event in December 2015. However, as there is no gauge data available for this catchment under this event, it is not possible to comment on the estimated return period of this event and therefore the information cannot be used to verify the magnitude of flooding predicted under design flood conditions. Notwithstanding this, the images have been used to confirm the areas which could be affected during flood conditions. Desktop searches have revealed that there are no further records of historic flooding at the site.

Notwithstanding the above, given the absence of gauged data available to calibrate the model, sensitivity runs were undertaken to test the model's response to changes in the parameters applied.

Model Results

Design Flood Event

The model was run for a range of scenarios up to and including the design event. In order to determine the impact of climate change on the site, flows within the watercourse were increased to represent the design event; i.e. an extreme event with a 1 in 100 year return period, including an allowance for climate change (increase of 35% peak flow rate).

Inspection of the results show that, due to the steeply sloping bed of the channel, the maximum modelled water level varies from 18.4m AODN to the north to 17.3m AODN further to the south. Notwithstanding this, the land levels at the site are situated above the design flood level (i.e. at a minimum level of 20.7m AODN) and will therefore remain unaffected by flooding under the design flood event.

Sensitivity Testing

In line with the precautionary principle that is promoted by the NPPF, a number of sensitivity tests have been undertaken for the design event;

1. *Channel Blockage:* This comprises two separate scenarios whereby the culvert upstream of the site, and bridge downstream of the site were blocked by 50%, thus restricting the volume of water that can leave the system.

2. *Changes to channel roughness:* This comprises increasing and decreasing the roughness value within the channel by 20% to evaluate the impact that this would have on the modelled results. This can be interpreted as representing a scenario in which either the channel became overgrown (increased roughness) or where clearance of the channel was undertaken (decreased roughness).

3. *Exceedance event:* The flow hydrograph for the 1 in 100 year return period event was increased by 70%, to represent the Upper End climate change allowance. This highlights the sensitivity of flooding at the site in respect to changes in water level, and clarifies any uncertainty that may be present when calculating the flood hydrograph.

The maximum modelled water level for the development site for each scenario is summarised in Table 5.5 below.

Scenario	Maximum modelled water level at the site
20% increase in roughness coefficient	18.50
20% decrease in roughness coefficient	18.27
50% blockage of culvert	18.39
50% blockage of bridge	18.40
Exceedance event (1 in 100 year+70%cc)	18.53

Table 5.5 – Maximum modelled water level at the site for a range of sensitivity scenarios tested within the model.

From the results of the sensitivity testing, it can be seen that the highest predicted water level within the watercourse remains over 2m below land levels at the site. Consequently, it is concluded that the risk of flooding from the adjacent watercourse is low.

6 Offsite Impacts and Other Considerations

6.1 Displacement of Floodwater

The construction of a new building within the floodplain has the potential to displace water and to increase the risk elsewhere by raising flood levels. A compensatory flood storage scheme can be used to mitigate this impact, ensuring the volume of water displaced is minimised.

It has been demonstrated that the development site is located outside the predicted extents of flooding from the River Ribble and the adjacent watercourse. As such, the development will not result in floodwater being displaced and therefore, compensatory floodplain storage is not required.

6.2 Public Safety and Access

The NPPF states that safe access and escape should be available to/from new developments located within areas at risk of flooding. The Practice Guide goes on to state that access routes should enable occupants to safely access and exit their dwellings during design flood conditions and that vehicular access should be available to allow the emergency services to safely reach the development.

The proposed development is located outside the design flood events from both the River Ribble and adjacent tributary. Furthermore, the access route to the site via Alston Lane will also remain unaffected. Consequently, safe access/egress to/from the site can be achieved.

6.3 Proximity to Watercourse

Under the Land Drainage Act 1991, as amended by the Flood and Water Management Act 2010, Lead Local Flood Authorities (LLFA) are responsible for the regulation of ordinary watercourses. The Land Drainage Act requires that formal written consider is sought for any works adjacent to, or within a watercourse that could affect in-channel flows. For main rivers, and internal drainage board-maintained watercourses consent is required for works within 8m of the toe of the river bank.

The development site is located more than 40m from the watercourse further to the east and over 80m from the River Ribble. As such, the proposals will not compromise any of the maintenance or access requirements.

6.4 Impact on Fluvial Morphology and Impedance of Flood Flows

It has been shown that the proposed development is located outside the area affected by flooding under both the design and exceedance event, and therefore the proposals will not impede flood flows or affect the morphology of the watercourse.

7 Flood Mitigation Measures

The key objectives of flood risk mitigation are:

- to reduce the risk of the development being flooded.
- to ensure continued operation and safety during flood events
- to ensure that the flood risk downstream of the site is not increased by increased runoff
- to ensure that the development does not have an adverse impact on flood risk elsewhere

The following section of this report examines ways in which the risk of flooding at the development site can be mitigated.

Mitigation Measure	Appropriate	Comment
Careful location of development within site boundaries (i.e. Sequential Approach)	✓	Refer to Section 7.1
Raising floor levels	x	Refer to Section 7.2
Land raising	x	Not required
Compensatory floodplain storage	x	Not required
Flood resistance & resilience	x	Refer to Section 7.3
Alterations/ improvements to channels and hydraulic structures	x	Not required
Flood defences	x	Not required
Flood warning	✓	Refer to Section 7.4
Surface water management	✓	Refer to Section 8

Table 7.1 – Appropriateness of mitigation measures.

7.1 Application of the Sequential Approach at a Local Scale

The sequential approach to flood risk management can also be adopted on a site based scale and this can often be the most effective form of mitigation. For example, on a large scheme this would mean locating the more vulnerable dwellings on the higher parts of the site and placing parking, recreational land or commercial buildings in the lower lying and higher risk areas.

In this instance, the entire development site has been shown to be located outside the predicted extents of flooding and therefore, there is limited benefit in applying this approach in this instance.

7.2 Raising Floor Levels

The EA recommends that the minimum floor level of buildings at risk of flooding should be 300mm above the design flood level. The EA's guidance also requires that all sleeping accommodation be raised a minimum of 600mm above the design flood level.

The design flood level for this development is 19.4m AODN and therefore based on the above guidance, the minimum floor levels are as follows:

Living accommodation = 19.7m AODN

Sleeping accommodation = 20.0m AODN

Inspection of the site-specific topographic survey identifies that the minimum land level at the site 20.7m AODN and as such, the minimum finished floor level requirements set out above have been achieved.

7.3 Flood Resistance and Resilience

During a flood event, floodwater can find its way into properties through a variety of routes including:

- Ingress around closed doorways.
- Ingress through airbricks and up through the ground floor.
- Backflow through overloaded sewers/package treatment works discharging inside the property through ground floor toilets and sinks.
- Seepage through the external walls.
- Seepage through the ground and up through the ground floor.
- Ingress around cable services through external walls.

Since flood management measures only manage the risk of flooding rather than eliminate it completely, flood resilience and resistance measures may need to be incorporated into the design of the buildings. The two possible alternatives are:

Flood Resistance or 'dry proofing', where flood water is prevented from entering the building. For example using flood barriers across doorways and airbricks, or raising floor levels. These measures are considered appropriate for 'more vulnerable' development where recovery from internal flooding is not considered to be practical.

Flood Resilience or 'wet proofing', accepts that flood water will enter the building and allows for this situation through careful internal design for example raising electrical sockets and fitting tiled floors. The finishes and services are such that the building can quickly be returned to use after the flood. Such measures are generally only considered appropriate for some 'less vulnerable' uses and where the use of an existing building is to be changed and it can be demonstrated that no other measure is practicable.

In this circumstance, the proposed holiday units have been shown to remain unaffected by flooding under the design and exceedance flood events from both the River Ribble and watercourse adjacent to the site. As such, flood resistance and resilience construction techniques are not considered to be necessary in this instance.

7.4 Flood Warning

The analysis in Section 5 of this report has shown that the development site is at low risk of flooding from the nearby watercourse and the River Ribble. Notwithstanding this, it is recommended that the managers of the holiday lets sign up to the EA's Flood Warning service to ensure that they are aware of flooding in the surrounding flood compartment.

Occupants of the site can sign up to the EA's Flood Warning Service either by calling 0345 988 1188, or by visiting;

https://www.gov.uk/sign-up-for-flood-warnings

8 Surface Water Management Strategy

8.1 Background and Policy

The general requirement for all new development with respect to surface water runoff is to ensure that the runoff is managed sustainably and that the drainage solution for the development does not increase the risk of flooding at the site, or within the surrounding area. In the case of brownfield sites, drainage proposals are typically measured against the existing performance of the site, although it is preferable (where practicable) to provide runoff characteristics that are similar to greenfield behaviour.

The Non-statutory Technical Standards for SuDS (NTSS) specify criteria to ensure sustainable drainage is included within developments classified as 'major' development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010). In this instance, the development is not classified as 'major development'. As a result, the NTSS will not apply. Nonetheless, the use of SuDS has been considered with the aim of minimising the risk of flooding both on and off site.

8.2 Surface Water Management Overview

The main characteristics of the site that have the potential to influence surface water drainage are summarised in Table 8.1 below.

Site Characteristic	Value
Total area of site	0.2 ha
Impermeable area (existing)	**~85 m^2**
Impermeable area (proposed)	Roof area = 294 m^2 Hardstanding = 452 m^2 **Total = 746 m^2**
Current site condition	Brownfield site
Greenfield runoff rates (based on IH124 HR Wallingford)	QBar = 7.8 l/s/ha Q30 = 13.2 l/s/ha Q100 = 16.1 l/s/ha
Infiltration coefficient	~0.001 to 0.01 m/hr (assumed based on underlying geology and typical soil conditions)
Current surface water discharge method	Assumed informal runoff into the adjacent watercourse
Is there a watercourse within proximity to site?	No

Table 8.1 – Site characteristics affecting rainfall runoff.

Synthetic rainfall data has been derived using the variables obtained from the Flood Studies Report (FSR) and the routines within the Causeway Flow+ software. The peak surface water flows generated on site for the existing and post-development conditions have been calculated by using the Modified Rational Method.

Runoff rates have been calculated for a range of annual return probabilities including the 100 year return period event, with a 40% increase in rainfall intensity to account for future climatic changes. These values are summarised in Table 8.2 for a range of return periods.

Return period (years)	Peak runoff (l/s)	
	Existing site	Developed site
1	1.6	14.9
30	3.9	36.6
100	5.1	47.5
100 + 40%	7.1	66.5

Table 8.2 – Summary of peak runoff.

The total volume of water discharged from the site for the 100 year 6 hour event is also summarised in Table 8.3 below, for both the existing and proposed site conditions.

Site condition	Total volume discharged
Existing site (present day)	5m^3
Proposed development including a 40% increase in rainfall intensity to account for climate change (prior to any mitigation)	65.1m^3
Difference in volume between existing site (present day) and proposed development (including allowance for climate change)	60.1m^3 increase

Table 8.3 – Total volume discharged from the 100 yr+40%cc 6 hour event.

Reference to the tables above shows the proposed development will increase the percentage of impermeable area within the boundaries of the site and consequently, this will increase the rate and volume of surface water runoff discharged from the site. However, the development subject to this report is classified as 'minor development' and as such, it is not strictly necessary to reduce the rate of runoff from the site in accordance with the NTTS. Nevertheless, the potential use of SuDS within the proposed development will be considered to assess the opportunity to replicate pre-developed runoff behaviour and provide a betterment where feasible, in accordance with the NPPF.

8.3 Opportunities for Draining Surface Water Runoff from the Site

With reference to Part H of the Building Regulations, runoff should be discharged from the development via infiltration wherever possible, or alternatively to a watercourse if infiltration is not considered to be viable. As a last resort, runoff can be drained to the public sewer system, providing the other opportunities have been discounted. The opportunities for managing runoff discharged from the development are outlined in order of priority below.

Infiltration – The underlying bedrock at the site is Samlesbury formation, which is considered to be relatively impermeable. However, the bedrock is overlain by superficial deposits of River Terrace Deposits, which are relatively permeable. Whilst groundwater flows could occur between the interface of the bedrock and superficial deposits, the nearby River Ribble and watercourse act to drain the soils in this area, maintaining lower groundwater levels. Consequently, it is likely that the infiltration rate of the soils and lower groundwater table are sufficient for shallow infiltration SuDS to be utilised. Notwithstanding this, in the absence of any detailed ground investigations, alternative solutions for managing surface water runoff from the proposed development will also be considered.

Discharge to Watercourses – There is a watercourse approximately 40m to the east of the development site which drains into the River Ribble, located further to the south of the development site. Consequently, if ground investigations show that shallow infiltration SuDS are not feasible, a connection to the watercourse is likely to present the most suitable solution for draining surface water runoff from the proposed development. The applicant has confirmed that the surface water drainage from the development site could be connected to the existing surface water drainage system for the adjacent property (Beech House) to the south, which subsequently discharges into the watercourse.

Discharge to the Public Sewer System – The existing site comprises an agricultural barn and is located within a rural area. Therefore, it is assumed that there is no direct connection to a public sewer and as such, this option for discharging surface water runoff from the proposed development has been discounted.

8.4 Sustainable Drainage Systems (SuDS)

Appropriately designed SuDS can be utilised such that they not only attenuate runoff but also provide a level of improvement to the quality of the water passed on to watercourses, or into the groundwater table. This is known as source control and is a fundamental part of the SuDS philosophy.

A range of typical SuDS that can be used to improve the environmental impact of a development is listed in Table 8.4 below, along with the relative benefits of each SuDS and the appropriateness for their use at the subject site.

SuDS	Description	Constraints/Comments	Appropriate for site?
Rainwater harvesting systems	Collecting rainwater and storing for reuse on site.	There are no known constraints.	Yes
Green roofs	Provide landscaping and planting at roof level to reduce surface water runoff rates.	Unsuitable roof design.	No
Infiltration systems	Allow water to percolate into the ground at a controlled rate via natural infiltration.	Potentially suitable. Groundwater level and infiltration rate to be confirmed.	Yes
Filter strips	Wide gently sloping densely planted areas promoting sedimentation and filtration	Limited space due to site layout. Groundwater level and infiltration rate to be confirmed.	Potential
Filter drains	Trenches infilled with stone/gravel providing attenuation, sedimentation and filtration	Limited space due to site layout. Groundwater level and infiltration rate to be confirmed.	No
Swales	Broad shallow channels that convey and store runoff and allow infiltration.	Potentially suitable. Groundwater level and infiltration rate to be confirmed.	Yes
Bioretention systems / rain gardens	A shallow landscaped depression allowing runoff to pond temporarily on the surface.	There are no known constraints.	Yes
Pervious surfacing	Runoff is allowed to soak into structural paving and stored, potentially being allowed to infiltrate	Potentially suitable. Groundwater level and infiltration rate to be confirmed.	Yes
Attenuation storage tanks	Large, below ground voided spaces which can be used to temporarily store storm water.	Potentially suitable. Groundwater level and infiltration rate to be confirmed.	Yes
Detention basins	A landscaped depression for attenuation with a restricted runoff.	Limited space due to site layout	No
Ponds and wetlands	A permanent pool of water which can be used for attenuation and controlled outflows by water levels.	Limited space due to site layout	No

Table 8.4 – Suitability of SuDS.

The proposals for development include the use of porous gravel surfacing for the car parking and turning area. However, it will still be necessary to manage the surface water runoff from the proposed roof area and the remaining areas of hardstanding. From Table 8.4 above it can be seen that there are a number of SuDS which could potentially be suitable for use at this site, which could help to manage the surface water runoff from the development.

The preferred option for discharging runoff would be via infiltration, in line with the drainage hierarchy outlined in Section 8.3. This could be achieved through the use of traditional soakaways or gravel filled storage, which could be situated beneath the car parking and turning area. Surface water runoff from both the roofs and the remaining areas of hardstanding can be discharged to these shallow soakaway(s), allowing water to infiltrate directly into the ground.

If infiltration is found to be unsuitable (i.e. through site specific testing), it may be possible to incorporate cellular storage crates into the scheme proposals, located beneath the car parking area. The surface water from this storage system would subsequently be discharged into the existing surface water drainage system at a restricted rate, by utilising a flow control device. Ideally, the discharge rate from the site should be restricted to mimic greenfield runoff rates, although where this is not practicable, the discharge rate should be restricted to match the current discharge rate of the pre-developed site as a minimum. Given the potential for elevated groundwater levels, it is recommended that the storage beneath the car parking area is kept shallow.

If it is necessary to discharge runoff into the existing drainage system at Beech House, it is recognised that the storm water will eventually be discharged into the adjacent watercourse. As the development site is located within a Drinking Water Safeguard Zone, it will be necessary to treat any water before it is discharged offsite.

8.5 Additional Opportunities for SuDS

Table 8.4 shows that there are a number of additional opportunities for SuDS that could be suitable for the site, which are discussed in more detail below.

Swales

It may be possible to use swales as conveyance features to redirect runoff from the development to the proposed soakaways/attenuation system. Swales would provide storage for runoff and an additional treatment system for filtering pollutants from the areas of hardstanding.

Rainwater Harvesting

Based on the proposed scheme there is potential to incorporate a rainwater harvesting system. Utilising rainwater harvesting would not only provide some additional storage for storm water, but would also help to reduce the developments reliance on potable water supplies. If rainwater harvesting is proposed, analysis of the potential demand and yield, as well as the cost effectiveness of utilising such a system, should be examined at the detailed design stage. At this stage, the surface water management strategy simply outlines the potential possibility of incorporating rainwater harvesting within the scheme.

Water Butts

To reduce the developments reliance on potable water supplies for external use there is the potential to incorporate water butts within the communal garden area. Typical sizes and dimensions of water butts are outlined below.

Typical house water butt options	Dimensions of a typical house water butt	Volume of storage provided (litres)
Type 1 (wall mounted – Small)	1.22m high x 0.46m x 0.23m	100
Type 2 (Standard house water butt)	0.9m high x 0.68m diameter	210
Type 3 (Large house water butt)	1.26m high x 1.24m x 0.8m	510
Type 4 (Column tank – Very large)	2.23m high x 1.28m diameter	2000

Table 8.5 – Estimated storage capacity of available water butts.

9 The Sequential and Exception Test

9.1 The Sequential Test

Local Planning Authorities (LPA) are encouraged to take a risk-based approach to proposals for development in areas at risk of flooding through the application of the Sequential Test. The objectives of this test are to steer new development away from high risk areas towards those areas at a lower risk of flooding. However, in some areas where developable land is in short supply there can be an overriding need to build in areas that are at risk of flooding. In such circumstances, the application of the Sequential Test is used to ensure that the lower risk sites are developed before the higher risk ones.

The National Planning Policy Framework (NPPF) requires the Sequential Test to be applied at all stages of the planning process and generally the starting point is the Environment Agency's flood zone maps. The development site is shown by the EA's mapping (Figure 3.1) to be located within Flood Zone 3 and therefore it is necessary to apply the Sequential Test.

A Sequential Test assessment has not been undertaken in support of the development. However, planning permission has previously been granted for the neighbouring site for holiday units. As such, it is concluded that this type of development is considered appropriate for its location.

Furthermore, the detailed analysis undertaken as part of this report has shown that the development would remain unaffected by flooding under both the 1 in 100 year and 1 in 1000 year return period flood events from both the River Ribble and nearby watercourse. Consequently, it is concluded that the site is located in an area at lowest risk and therefore, the development will meet the requirements of the Sequential Test.

9.2 The Exception Test

The detailed analysis undertaken in this report has shown that the risk of flooding to the development is low, and that the development fits within the EA's definition of Flood Zone 1. Notwithstanding this, the EA's Flood Zone mapping still shows the development site to be classified as Flood Zone 3 and as such, the application of the Exception Test has been considered based on the type and nature of the development.

The Planning Practice Guidance: *Flood Risk and Coastal Change* defines the type and nature of different development classifications in the context of their flood risk vulnerability. This has been summarised in Table 9.1 below.

Flood Risk Vulnerability Classification	Zone 1	Zone 2	Zone 3a	Zone 3b
Essential infrastructure – Essential transport infrastructure, strategic utility infrastructure, including electricity generating power stations	✓	✓	e	e
High vulnerability – Emergency services, basement dwellings caravans and mobile homes intended for permanent residential use	✓	e	×	×
More vulnerable – Hospitals, residential care homes, buildings used for dwelling houses, halls of residence, pubs, hotels, non-residential uses for health services, nurseries and education	✓	✓	e	×
Less vulnerable – Shops, offices, restaurants, general industry, agriculture, sewerage treatment plants	✓	✓	✓	×
Water compatible development – Flood control infrastructure, sewerage infrastructure, docks, marinas, ship building, water-based recreation etc.	✓	✓	✓	✓

Key:

✓ Development is appropriate

× Development should not be permitted

e Exception Test required

(grey) Classification based on EA's Flood Zone maps

(green) Classification based on results of detailed analysis

Table 9.1 – Flood risk vulnerability and flood zone compatibility.

From Table 9.1 above, it can be seen that, based on the results of the site-specific analysis undertaken within this report, the development site is considered to fall within a classification in which more vulnerable development is considered appropriate. Notwithstanding this, the site is technically classified as being located within Flood Zone 3 based on the EA's Flood Zone mapping and therefore the development falls into a classification that requires the Exception Test to be applied. For the Exception Test to be passed it should be demonstrated that:

A. *the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*

B. *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

Both parts of the test will have to be passed for development to be allocated or permitted.

Demonstrating that the development provides wider sustainability benefits to the community that outweigh flood risk is outside the scope of this report. Nevertheless, reference has been made to the SFRA to establish the key risks associated with flooding to help demonstrate that this objective can be achieved. The key focus of this FRA is therefore to establish whether the site is likely to pass Part B of the Exception Test.

From the analysis undertaken it has been demonstrated that the development site would be at low risk of flooding from all sources, even in the unlikely event of an exceedance flood event from either the River Ribble or watercourse adjacent to the site. This remains the case even when considering the impacts of climate change over the lifetime of the development. It has also been shown that the development will not increase the risk of flooding elsewhere. Therefore, it is concluded that the development passes Part B of the Exception test.

10 Conclusions and Recommendations

The overarching objective of this report is to appraise the risk of flooding at Land adjacent to Beech House, Alston Lane, Preston to ensure that the proposals for development are acceptable and that any risk of flooding to the occupants of the site is appropriately managed.

In this case, the proposals are for 3 holiday units located within Flood Zone 3. Consequently, it has been recognised that it may be necessary for the planning authority to demonstrate that the development can pass the Sequential Test. Notwithstanding this, planning approval has previously been granted for a similar development directly opposite to the subject site. In addition, this report has demonstrated that the risk of flooding to the development site is significantly lower than that depicted by the EA's 'Flood Map for Planning'. Consequently, it is concluded that the proposed development can meet the requirements of the Sequential Test.

In addition to the Sequential Test it is also necessary to consider the type and nature of the development and whether the Exception Test is applicable. From Table 9.1 it can be seen that, whilst the detailed appraisal within the report has shown that the site is located in the equivalent to Flood Zone 1, it has been necessary to apply the Exception Test based on the EA's 'Flood Map for Planning'. It is the conclusion of this report, that the site passes Part B of the Exception Test.

In determining the risk of flooding from all sources, it has been shown that the proposed development site is at a low risk of flooding from all sources and located outside the predicted extents of flooding under design event conditions for both the River Ribble and the watercourse located to the east of the site. Consequently, the proposed development will remain dry and safe throughout the entire duration of the flood event. Notwithstanding this, in accordance with best practice, it is recommended that occupants sign up to the EA's flood warning service to ensure that all occupants are aware of the potential risk of flooding in the surrounding flood compartment. This will enable sufficient forewarning to evacuate the area if required.

With respect to the risk of flooding offsite, inspection of the scheme drawings shows that the proposed development will increase the impermeable area within the site and as such, the potential use of SuDS has been considered to reduce the impact of the development.

It has been identified that there are two options available for discharging surface water runoff from the development. The preferred option is to use infiltration, via shallow permeable surfacing, or crate soakaways located beneath the proposed car parking area. However, if site specific ground investigations identify that infiltration is not a suitable solution, surface water could be stored within an underground storage system and discharged at a restricted rate to the existing surface water drainage system for Beech House.

Other potential opportunities to incorporate SuDS within the scheme have been explored, including the use of swales, rainwater harvesting and water butts. It is recommended that a detailed surface water drainage design is developed following award of planning permission, taking into consideration the requirements outlined in Section 8 of this report.

In conclusion, this report demonstrates that the risk of flooding to the development is low and that the development will not increase the risk of flooding elsewhere. It is therefore concluded that the development can pass Part B of the Exception Test and will meet the requirements of the NPPF and its Planning Practice Guidance.

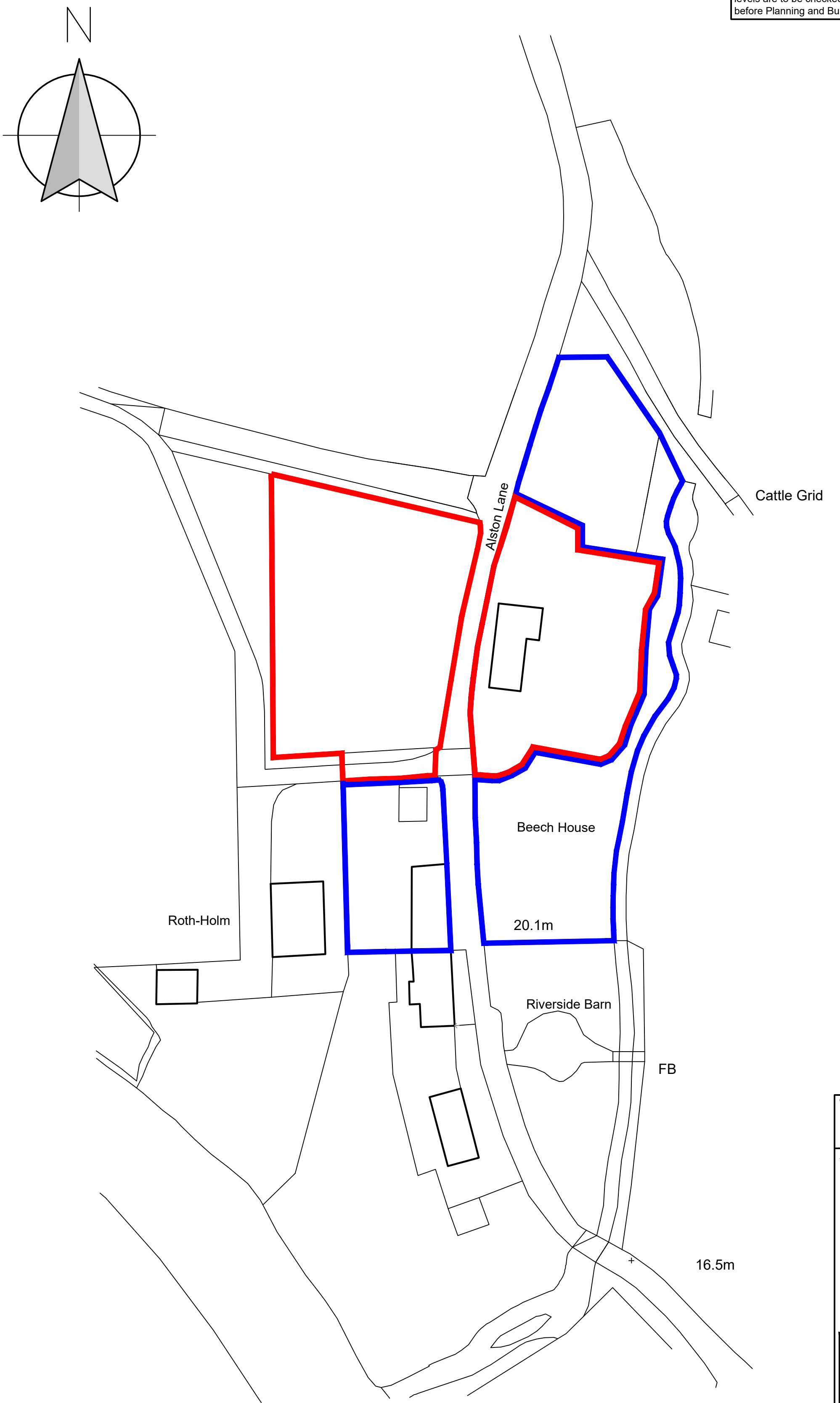
11 Appendices

Appendix A.1 – Drawings

Appendix A.2 – Environment Agency Flood Report

Appendix A.1 – Drawings

This drawing is to be read in conjunction with all relevant Architect, consultants' and specialists' drawings and specifications. The Architect is to be notified of any discrepancies before proceeding. Do not scale from this drawing. All dimensions and levels are to be checked on site. This drawing is subject to copyright. All work carried out before Planning and Building Permission has been granted is at the contractor/clients risk.



LOCATION PLAN

SCALE 1:1250

0 25 50 75 100m

Client
DEWHURST HOLDINGS LTD

Job Title
PROPOSED HOLIDAY LETS ON
LAND AT BEECH HOUSE
ALSTON
LONGRIDGE
LANCASHIRE

Drawing Title
LOCATION PLAN

Scale	Date	Drawn
1:1250 @ A4	APRIL 2020	MF

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SUNDERLAND PEACOCK & ASSOCIATES LTD.
HAZELMERE, PIMLICO ROAD, CLITHEROE
LANCASHIRE, BB7 2AG
T 01200 423178 F 01200 427328
E info@sunderlandpeacock.com
www.sunderlandpeacock.com

5335 - P05

EXISTING SITE PLAN
SCALE 1:200
0 5 10 15m

no.	by	chk.	revision	date
C	MF	-	RED EDGE SITE BOUNDARY AMENDED	04.05.20
B	MF	-	SPOT LEVELS ADDED	29.04.20
A	MF	-	RED EDGE SITE BOUNDARY AMENDED	23.03.20

Client
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Job Title
PROPOSED HOLIDAY LETS ON
LAND AT BEECH HOUSE
ALSTON
LONGRIDGE
LANCASHIRE

Drawing Title
EXISITNG SITE PLAN

FOR PLANNING APPROVAL

Scale	Date	Drawn
1:200 @ A1	MARCH 2020	MF

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SUNDERLAND PEACOCK & ASSOCIATES LTD.
HAZELMERE, PIMLICO ROAD, CLITHEROE
LANCASHIRE, BB7 2AG
T 01200 423178 F 01200 427328
E info@sunderlandpeacock.com
www.sunderlandpeacock.com

5335 - E01 C

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PROPOSED SITE PLAN
SCALE 1:200
0 5 10 15m

no.	by	chk.	revision	date
D	MF	-	RED EDGE SITE BOUNDARY AMENDED	04.05.20
C	MF	-	SEWAGE TREATMENT PLANT NOTE AMENDED.	30.04.20
B	MF	-	AMENDED IN ACCORDANCE WITH CLIENT COMMENTS	30.04.20
A	MF	-	RED EDGE SITE BOUNDARY AMENDED	23.03.20

Client
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Job Title
PROPOSED HOLIDAY LETS ON LAND AT BEECH HOUSE
ALSTON
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LANCASHIRE

Drawing Title
PROPOSED SITE PLAN

FOR PLANNING APPROVAL

Scale	Date	Drawn
1:200 @ A1	MARCH 2020	MF

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SUNDERLAND PEACOCK & ASSOCIATES LTD.
HAZELMERE, PIMLICO ROAD, CLITHEROE
LANCASHIRE, BB7 2AG
T 01200 423178 F 01200 427328
E info@sunderlandpeacock.com
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5335 - P04 D

This drawing is to be read in conjunction with all relevant Architect, consultants' and specialists' drawings and specifications. The Architect is to be notified of any discrepancies before proceeding. Do not scale from this drawing. All dimensions and levels are to be checked on site. This drawing is subject to copyright. All work carried out before Planning and Building Permission has been granted is at the contractor/clients risk.

PROPOSED GROUND FLOOR

SCALE 1:50

0 1 2 3m

no.	by	chk.	revision	date
B	MF	-	MINOR AMENDMENTS	29.04.20
A	MF	-	AMENDED FOLLOWING CLIENT COMMENTS	19.03.20

Client

DEWHURST HOLDINGS LTD

Job Title

PROPOSED HOLIDAY LETS ON
LAND AT BEECH HOUSE
ALSTON
LONGRIDGE
LANCASHIRE

Drawing Title

PROPOSED GROUND FLOOR PLAN

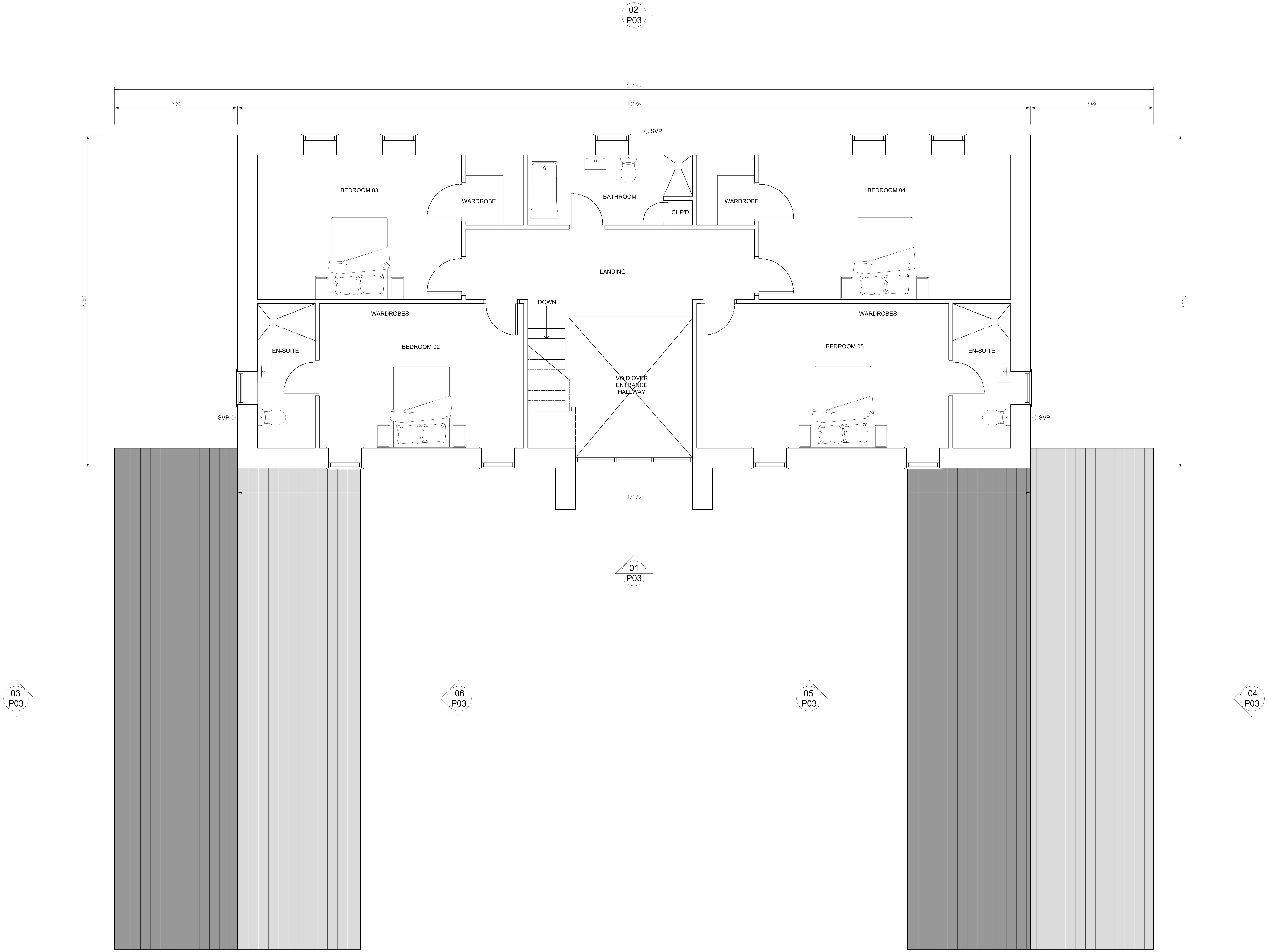
FOR PLANNING APPROVAL

Scale	Date	Drawn
1:50 @ A1	MARCH 2020	MF

SUNDERLAND PEACOCK ARCHITECTS

SUNDERLAND PEACOCK & ASSOCIATES LTD.
HAZELMERE, PIMLICO ROAD, CLITHEROE
LANCASHIRE, BB7 2AG
T 01200 423178 F 01200 427328
E info@sunderlandpeacock.com
www.sunderlandpeacock.com

5335 - P01 B



PROPOSED GROUND FLOOR

SCALE 1:50

0 1 2 3m

no.	by	chk.	revision	date
A	MF	-	AMENDED FOLLOWING CLIENT COMMENTS	19.03.20

Client

DEWHURST HOLDINGS LTD

Job Title

PROPOSED HOLIDAY LETS ON
LAND AT BEECH HOUSE
ALSTON
LONGRIDGE
LANCASHIRE

Drawing Title

PROPOSED FIRST FLOOR PLAN

Scale	Date	Drawn
1:50 @ A1	MARCH 2020	MF

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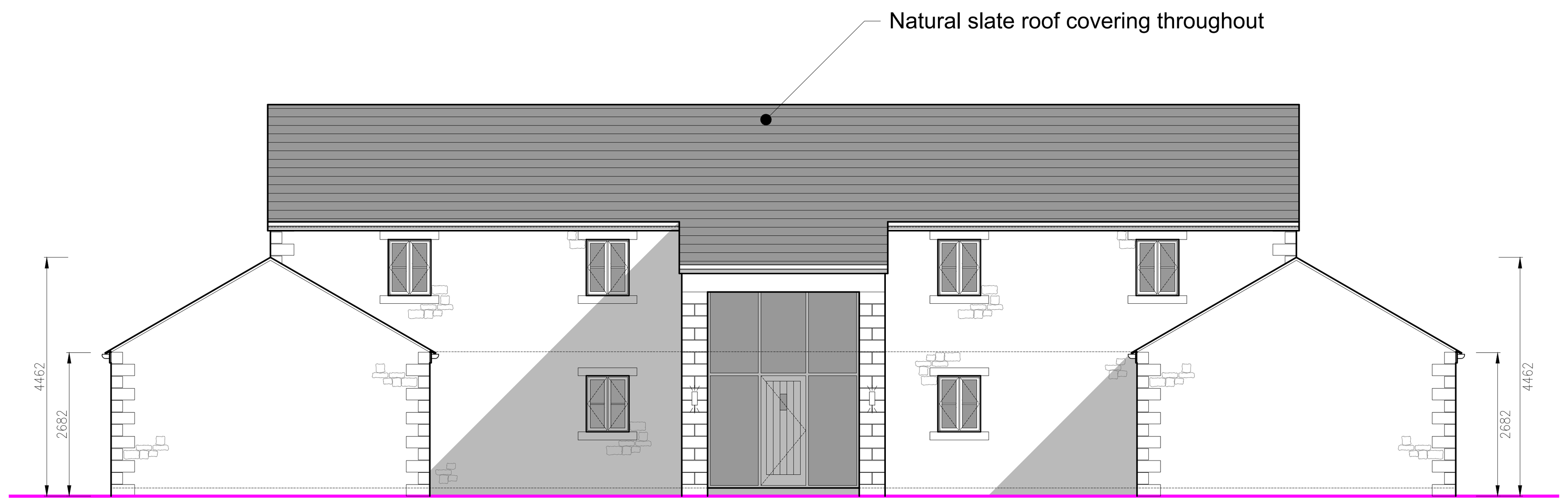
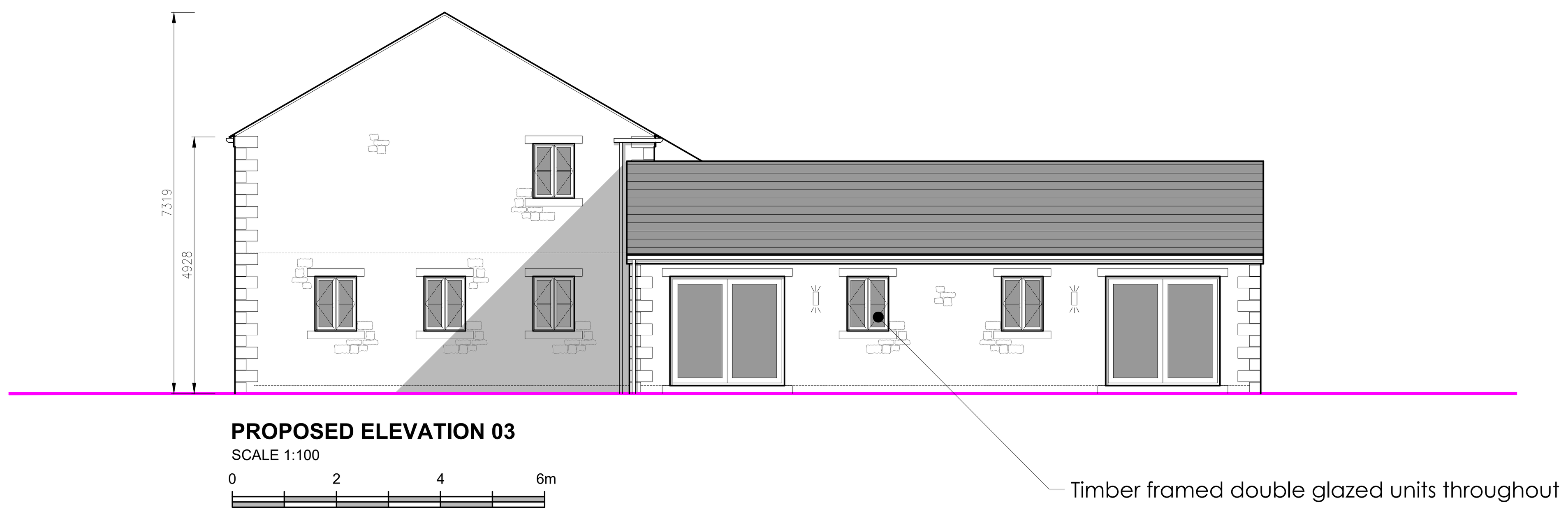
SUNDERLAND PEACOCK & ASSOCIATES LTD.
HAZELMERE, PIMLICO ROAD, CLITHEROE
LANCASHIRE, BB7 2AG
T 01200 423178 F 01200 427328
E info@sunderlandpeacock.com
www.sunderlandpeacock.com

5335 - P02 A



PROPOSED ELEVATION 01
SCALE 1:100
0 2 4 6m

PROPOSED ELEVATION 02
SCALE 1:100
0 2 4 6m



PROPOSED ELEVATION 03
SCALE 1:100
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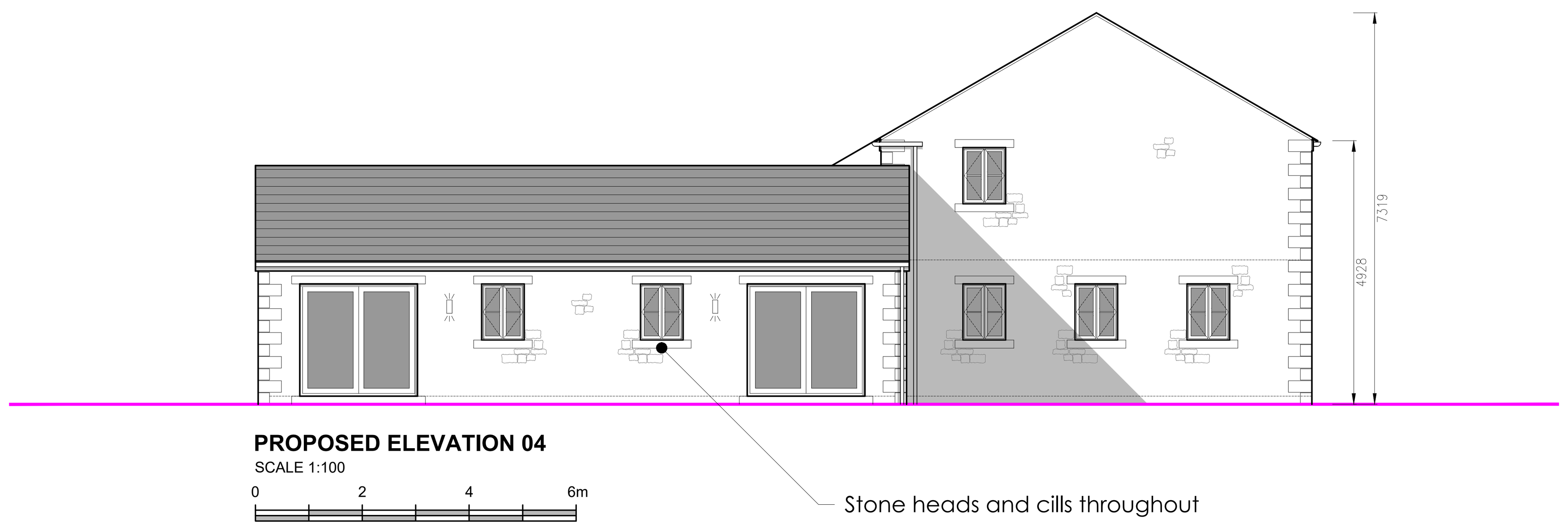
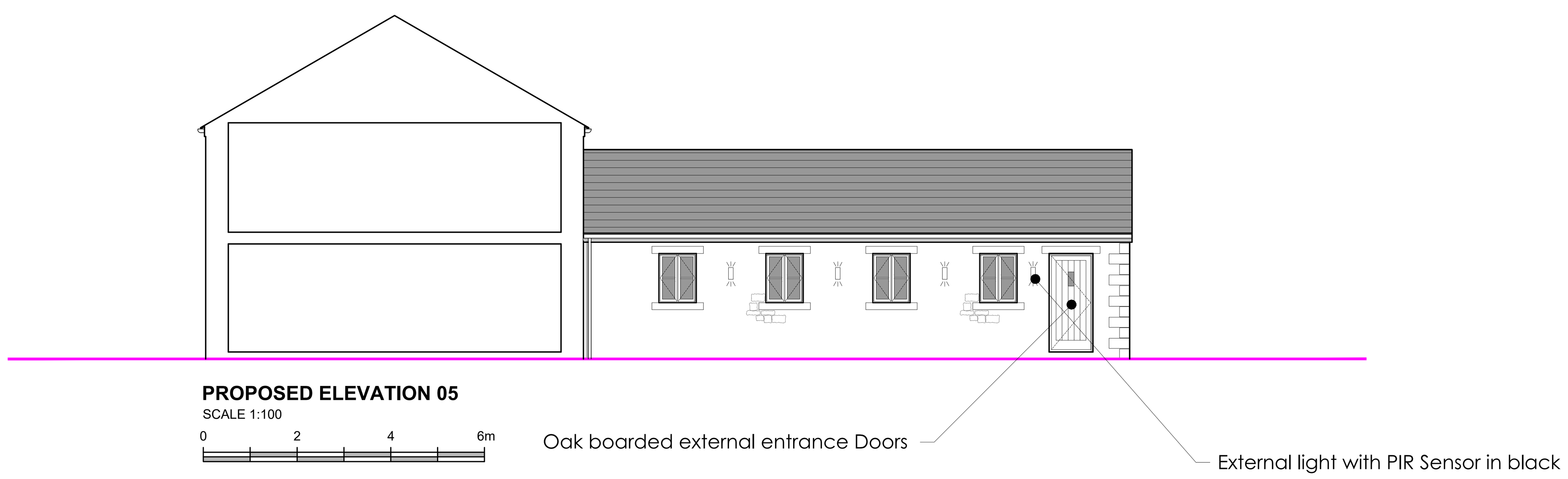


PROPOSED ELEVATION 04
SCALE 1:100
0 2 4 6m



PROPOSED ELEVATION 05
SCALE 1:100
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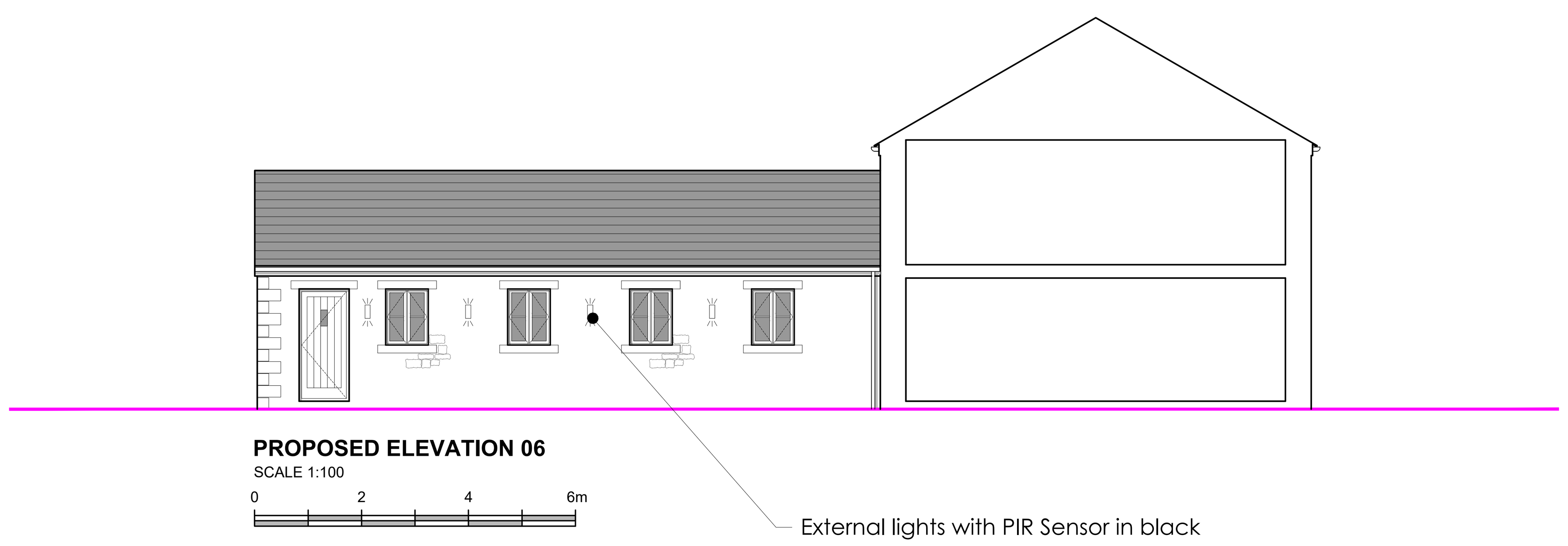

PROPOSED ELEVATION 06
SCALE 1:100
0 2 4 6m

no.	by	chk.	revision	date
B	MF	-	MINOR AMENDMENTS	29.04.20
A	MF	-	AMENDED FOLLOWING CLIENT COMMENTS	19.03.20

Client
DEWHURST HOLDINGS LTD

Job Title
PROPOSED HOLIDAY LETS ON
LAND AT BEECH HOUSE
ALSTON
LONGRIDGE
LANCASHIRE

Drawing Title
PROPOSED ELEVATIONS

FOR PLANNING APPROVAL

Scale	Date	Drawn
1:100 @ A1	MARCH 2020	MF

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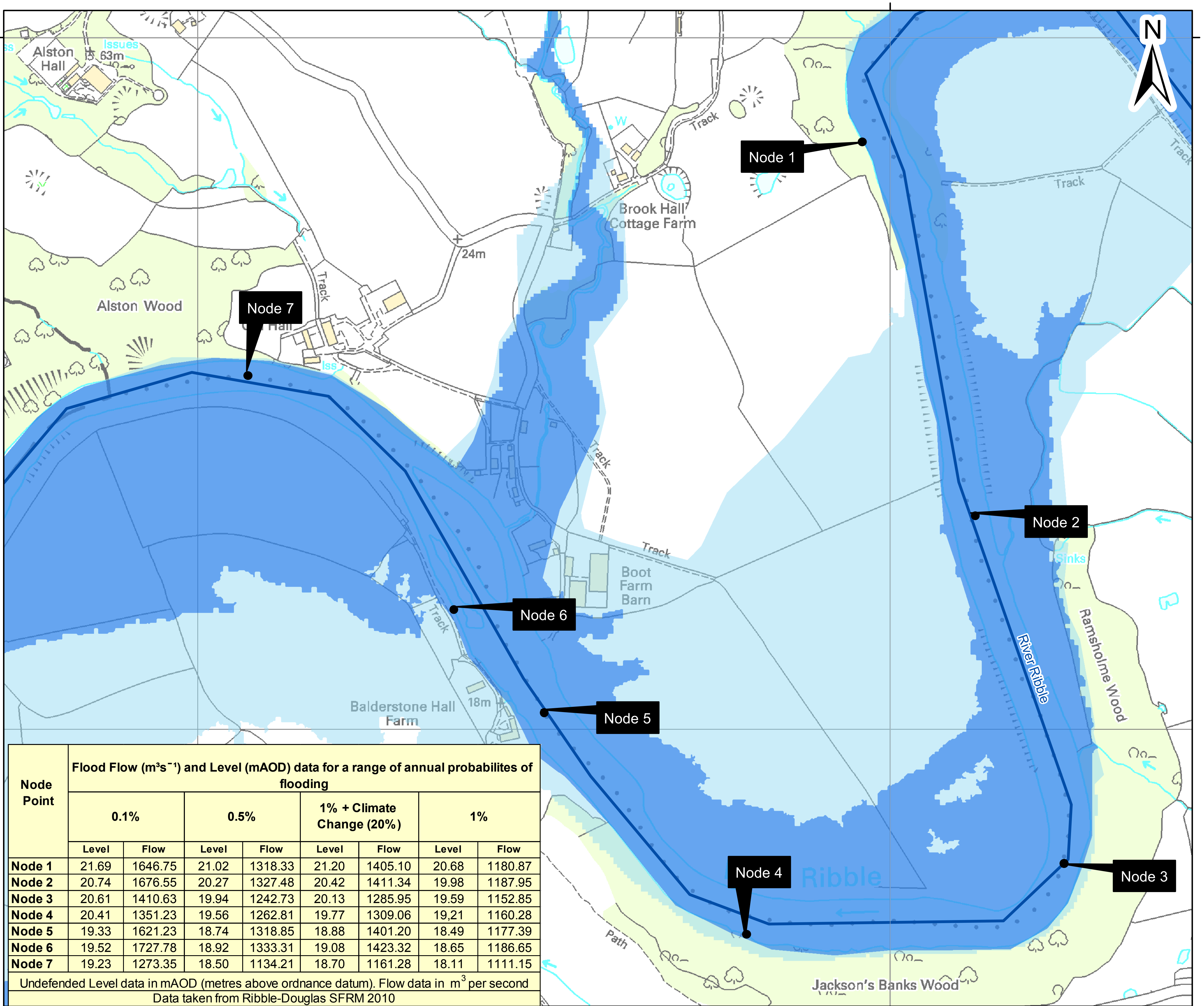
5335 - P03 B

Appendix A.2 – Environment Agency Flood Report



Node Point	Flood Flow (m^3s^{-1}) and Level (mAOD) data for a range of annual probabilites of flooding							
	0.1%		0.5%		1% + Climate Change (20%)		1%	
	Level	Flow	Level	Flow	Level	Flow	Level	Flow
Node 1	21.69	1646.75	21.02	1318.33	21.20	1405.10	20.68	1180.87
Node 2	20.74	1676.55	20.27	1327.48	20.42	1411.34	19.98	1187.95
Node 3	20.61	1410.63	19.94	1242.73	20.13	1285.95	19.59	1152.85
Node 4	20.41	1351.23	19.56	1262.81	19.77	1309.06	19,21	1160.28
Node 5	19.33	1621.23	18.74	1318.85	18.88	1401.20	18.49	1177.39
Node 6	19.52	1727.78	18.92	1333.31	19.08	1423.32	18.65	1186.65
Node 7	19.23	1273.35	18.50	1134.21	18.70	1161.28	18.11	1111.15

Undefended Level data in mAOD (metres above ordnance datum). Flow data in m^3 per second

Data taken from Ribble-Douglas SFRM 2010

Environment Agency

Fluvial Flood Level Map: Alston Lane, Longridge, PR3 3BN

Produced: 24 October 2017

Our Ref: CL62790

NGR: SD 61488 33472

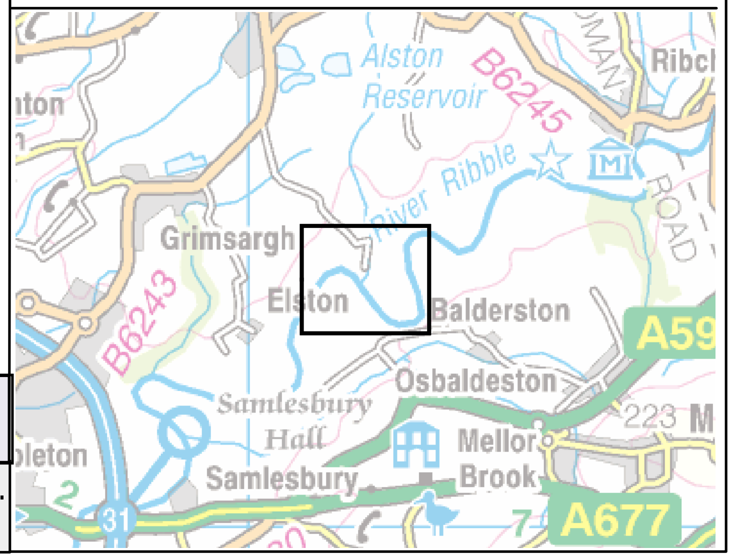
Key

- Main River
- Areas Benefitting from Defences
- Flood Zone 3
- Flood Zone 2

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

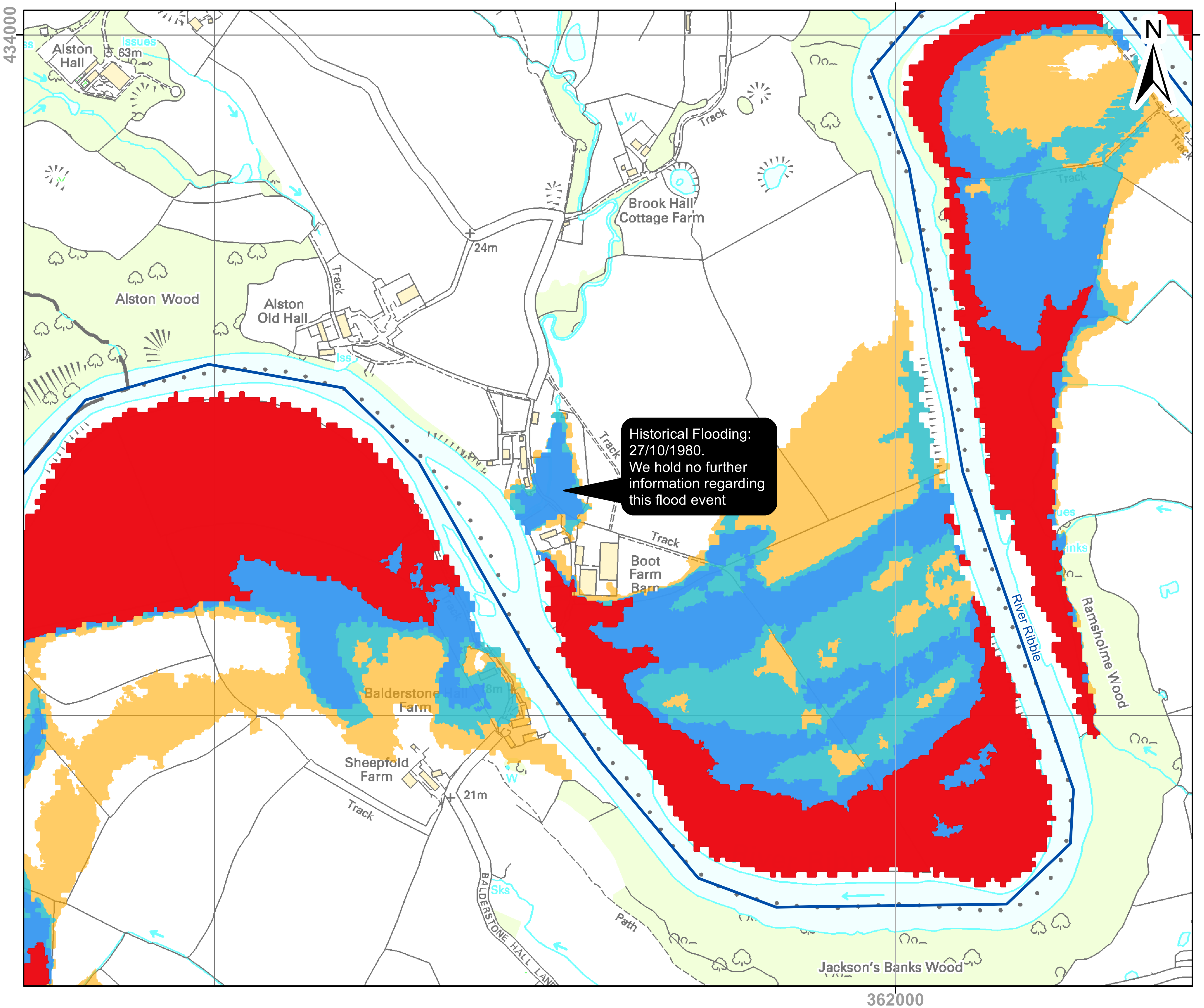
Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 1 in 200 tidal, or 1 in 100 fluvial flood event.



Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk



Undefended Modelled Flood Outlines: Alston Lane, Longridge, PR3 3BN

Produced: 24 October 2017
Our Ref: CL62790
NGR: SD 61488 33472

Key

- Main River
- Fluvial Undefended Scenario 1.0% annual probability of flooding
- Fluvial Undefended Scenario Climate Change (+20%) 1.0% annual probability of flooding
- Fluvial Undefended Scenario 0.5% annual probability of flooding
- Fluvial Undefended Scenario 0.1% annual probability of flooding

Flood Zone 3 shows the area that could be affected by flooding:
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- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 1 in 200 tidal, or 1 in 100 fluvial flood event.

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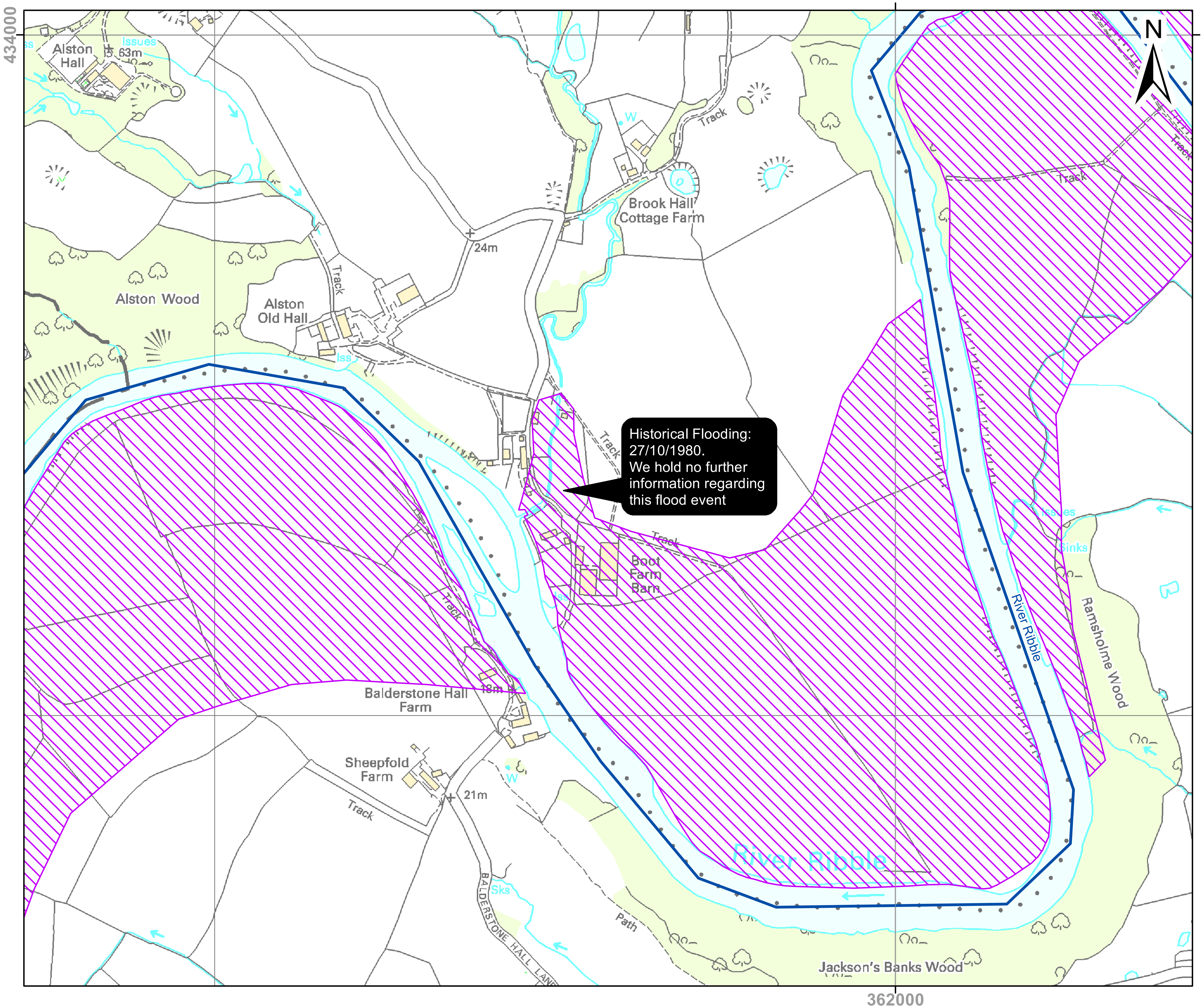


Historical Flood Map: Alston Lane, Longridge, PR3 3BN

Produced: 24 October 2017
Our Ref: CL62790
NGR: SD 61488 33472

Key

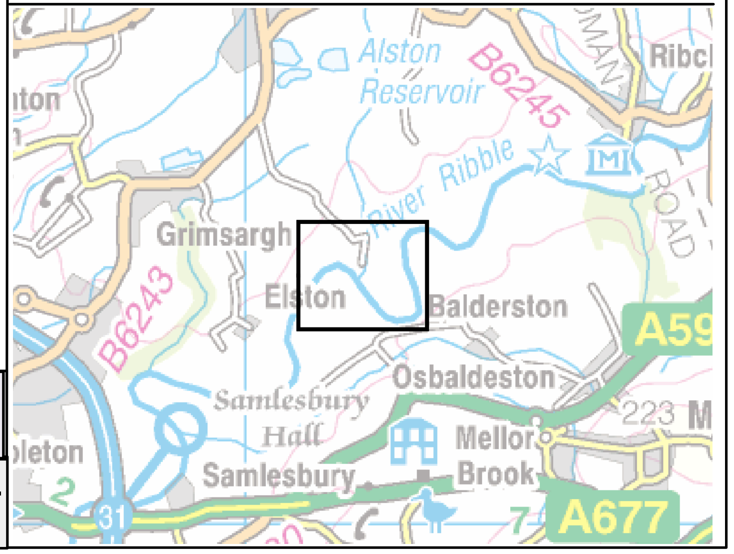
Main River

Historic Flooding

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 1 in 200 tidal, or 1 in 100 fluvial flood event.



Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

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