Land at Pendle Road, Clitheroe

Flood Risk Assessment & Drainage Strategy

May 2022

MÜLLER
PROPERTY GROUP

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PENDLE MILL, CLITHEROE

Flood Risk Assessment

Prepared for:

MÜLLER PROPERTY GROUP

Report Ref: BEK-22035-3

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Project Quality Assurance Information Sheet

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PROJECT NO: 22035

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REVISION STATUS / HISTORY

Rev	Date	Issue / Comment	Prepared	Checked

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EXECUTIVE SUMMARY

BEK Enviro have been appointed by Muller Property Group to provide a Flood Risk Assessment in support of a planning application for the development of a 70No bed care home, located on land currently occupied by commercial buildings on Pendle Road in Clitheroe, Lancashire.

The site is shown to be situated within Flood Zone 2 of the Environment Agency Flood Map and therefore has a medium risk of fluvial flooding.

An initial assessment indicates that the primary flood risk at the proposed development is from the fluvial source Shaw Brook.

Consideration has also been given to the site flooding from secondary sources such as pluvial, groundwater; artificial water bodies; infrastructure failure and ponding.

The application site is currently occupied by commercial buuldings and comprises of approximately 5No physically attached buildings with basement storage areas, car parking and turning area at the frontage onto Pendle Road, with green space to the north.

The nearest watercourse to the site is Shaw Brook which flows in a westerly direction and is culverted through the northern extent of the site, where it exits becoming open channel at the north west boundary.

The topographical survey provided identifies that the basement entrance located at the south west of the site is at a level of 87.550m AOD, the north west corner of the site located closest to the open stretch of Shaw Brook is at a level of 85.000m AOD. The north east corner of the site is at a level of 88.70m AOD and the south east adjacent to Pendle Road is at a level of 93.700m AOD. In general, the site falls from east to west with a topographical depression along the route of the culvert.

Fluvial Flooding: Shaw Brook

Following a review of the available Environment Agency Flood Data, flood levels during the 100 year + 70% climate change range from 85.75m AOD (west of the site) to 89.28m AOD (east of the site).

Engineering judgement suggests that this a result of the culverted watercourse downsizing and becoming constricted as it traverses through the site causing flooding during storm events in excess of the 100 year + 35% climate change event.

Flows within the culvert then surcharge within the manholes then flood above ground, where they flow overland following topography along the culverts route, before making its way back into the open section of the watercourse at the downstream headwall west of the site.

Taking the above into account, flooding at the site is considered to be a fluvial overland flow route when the capacity of the culvert is exceeded, rather than a flood plain where levels would have less of a range.

Development proposals provide an 8m easement from the edge of the culvert, providing a betterment compared to the existing building (which builds over the culvert). As such the flow route can now be contained within the easement where levels could be graded off directing flows towards the route of the culvert, rather than it backing up against the building's envelope.

In order to ensure that level access can be maintained throughout the ground floor level of the proposed development, finished floor levels have been based on the 100 year + 70% climate change flood level at Node Sample Point 2: i.e., 88.16m AOD + 0.600m (freeboard), which equated to a finished floor level of 88.76m AOD.

Providing that mitigation measures as outlined within this report are implemented into the development the risk of fluvial flooding can be suitably managed.

Preliminary Drainage Strategy

The preliminary drainage strategy directs surface water flows from the roof and car parking area into the open channelled section of Shaw Brook, located at the north of the site via a new outfall.

The preliminary network has been modelled using FLOW Software for the proposed impermeable area of 0.288Ha, with discharge rates into the watercourse restricted to no more than 35.7l/s for all return periods up to and including the 100 year + 40% climate change event via a vortex flow control chamber. Flows in excess of this will be attenuated within a geo-cellular storage tank located within the car parking area and also within the piped network itself.

Modelled Tank Details

- *Area = 30m^2*
- *Depth of crate = 1m*
- *95% void ratio*

Modelled Flow Control

- *Design Flow = 35.7l/s*
- *Design Depth = 2m*

Permeable paving was considered, however once drainage runs from the rear of the building were brought to the frontage, the required depth of sub-base would not be economically viable and would be well in excess of the storage volume required.

Furthermore, providing permeable paving for only the car parking area would still require an additional tank to take flows from the roof area. This combined with the excessive maintenance burden discounted permeable paving from the preliminary drainage strategy.

The Environment Agency may require any works within 8m of the culverted watercourse apply for an Environmental Permit prior to any works being undertaken, this will include any new headwall structure.

Mitigation Measures

Finished Floor Levels

Due to the application site being located within Flood Zone 2 finished floor levels of the site should be elevated whichever is the highest.

- 300mm above existing ground level
- 600mm above the 100 year + climate change event

The existing site has a range in level of approximately 5m. Because the development requires level access on the ground floor level a stepped approach is not feasible, therefore finished floor levels have been elevated 600mm above the 100 year + 70% climate change event at the Sample Point labelled No2.

- Sample Point 2: i.e., 88.16m AOD + 0.600m (freeboard) = finished floor level of 88.76m AOD

Watercourse Easements

The Environment Agency will require an 8m easement from the edge of the culverted watercourse, which has been incorporated into the development proposals. This provides a significant benefit over the existing building which built over the culvert.

Business Flood Plan

It is also recommended that staff create the business flood plan. This is a simple document that assists the staff/customers to prioritise actions required at the property before, during and following a flood event.

A copy of a business flood plan template has been provided within the appendices of this report

1. INTRODUCTION

1.1 Appointment

1.1.1 BEK Enviro Limited (BEK) has been commissioned by Muller Property Group to prepare a Flood Risk Assessment in support of a planning application for the development of a 70No bed care home, located on land currently occupied by commercial buildings in Clitheroe, Lancashire.

1.1.2 The site is shown to be situated within Flood Zone 2 of the Environment Agency Flood Map and therefore has a medium risk of fluvial flooding.

1.1.3 It is usual for the Environment Agency to raise an objection to development applications within the floodplain, or Zones 2 and 3 of the flood map, until the issue of flood risk has been properly evaluated. The Agency will also object to developments where the total site area is in excess of 1 Hectare until suitable consideration has been given to the management of surface water runoff.

1.2 Objectives

1.2.1 The objective of this assessment is to evaluate the following issues in regard to flood risk at the application site.

- Suitability of the proposed development in accordance with current planning policy.
- Identify the risk to both the proposed development and people from all forms of flooding.
- Provide a preliminary assessment of foul and surface water management.
- Increasing the risk of flooding elsewhere e.g. surface water flows and flood routing.
- Recommendation of appropriate measures to mitigate against flooding both within the proposed development, and neighbouring land and property.

1.3 Data Sources

1.3.1 This assessment is based on desk-top study of information from the following sources:

- National Planning Policy Framework (2018)
- Planning Practice Guidance at www.gov.uk
- Building Regulations Approved Document H
- Environment Agency Flood Mapping
- Ribble Valley Borough Council Level 1 Strategic Flood Risk Assessment April 2017
- Ribble Valley District Flood Report February 2017
- British Geological Society – Historic Borehole Logs
- Cranfield University's Soilscape Viewer

- CIRIA C697 The SUDS Manual
- Chronology of British Hydrological Events (Dundee University)
- R&D Technical Report FD2320/TR2 (2005)

2. PLANNING POLICY CONTEXT

2.1 Approach to the Assessment

2.1.1 An initial assessment indicates that the primary flood risk at the proposed development is from the fluvial source Shaw Brook.

2.1.2 Consideration has also been given to the site flooding from secondary sources such as pluvial, groundwater; artificial water bodies; infrastructure failure and ponding.

2.1.3 The requirements for flood risk assessments are generally as set out in the 'Technical Guidance to the National Planning Policy Framework', updated in February 2021; and in more detail from the Environment Agency's 'Standing Advice on Flood Risk' available from: https://www.gov.uk/government/publications/national-planning-policy-framework--2 .

2.2 National Planning Policy Framework (NPPF)

2.1.1 The information provided in the flood risk assessment should be credible and fit for purpose. A flood risk assessment should also be appropriate to the scale, nature and location of the development.

2.1.2 Site-specific flood risk assessments should always be proportionate to the degree of flood risk and make optimum use of information already available, including information in a Strategic Flood Risk Assessment for the area, and the interactive flood risk maps available on the Environment Agency's website.

2.3 Site Specific Flood Risk Assessment Checklist

2.3.1 The following checklist has been extracted from Flood Risk & Coastal Change Section available from www.gov.uk, updated in August 2021.

1. Development Site and Location

Provide a description of the site you are proposing to develop, including, or making reference to, a location map which clearly indicates the development site.

A. Where is the development site located? (e.g. postal address or national grid reference)
B. What is the current use of the site? (e.g. undeveloped land, housing, shops, offices)
C. Which Flood Zone (for river or sea flooding) is the site within? (i.e. Flood Zone 1, Flood Zone 2, Flood Zone 3).

Check the Flood Map for Planning (Rivers and Sea) and the Strategic Flood Risk Assessment for the area available from the local planning authority.

2. Development Proposals

Provide a general summary of the development proposals, including, or making reference to, an existing block plan and a proposed block plan, where appropriate.

A. What are the development proposal(s) for this site? Will this involve a change of use of the site and, if so, what will that change be?
B. In terms of vulnerability to flooding, what is the vulnerability classification of the proposed development?
C. What is the expected or estimated lifetime of the proposed development likely to be? (E.g. less than 20 years, 20-50 years, 50-100 years?).

3. Sequential Test

For developments in flood zones 2 or 3 only.
(If the development site is wholly within flood zone 1, this section can be skipped - go to section 4).

Describe how the sequential test has been applied to the development (if required, and as set out in paragraphs 101-104 of the National Planning Policy Framework); and provide the evidence to demonstrate how the requirements of the test have been met.

See paragraph 033 of the NPPF guidance for further information. (It is recommended that the Developer or Agent contacts the LPA to confirm whether the sequential test should be applied and to ensure the appropriate level of information is provided).

A. What other locations with a lower risk of flooding have you considered for the proposed development?
B. If you have not considered any other locations, what are the reasons for this?
C. Explain why you consider the development cannot reasonably be located within an area with the lowest probability of flooding (flood zone 1); and, if your chosen site is within flood zone 3, explain why you consider the development cannot reasonably be located in flood zone 2.
D. As well as flood risk from rivers or the sea, have you taken account of the risk from any other sources of flooding in selecting the location for the development?

Exception test

Provide the evidence to support certain development proposals in flood zones 2 or 3 if, following application of the sequential test, it is appropriate to apply the exception test, as set out in paragraphs 102-104 of the National Planning Policy Framework.

It is advisable to contact the local planning authority to confirm whether the exception test needs to be applied and to ensure the appropriate level of information is provided.

A. Would the proposed development provide wider sustainability benefits to the community? If so, could these benefits be considered to outweigh the flood risk to and from the proposed development?
B. How can it be demonstrated that the proposed development will remain safe over its lifetime without increasing flood risk elsewhere?
C. Will it be possible to for the development to reduce flood risk overall (e.g. through the provision of improved drainage)?

4. Climate Change

How is flood risk at the site likely to be affected by climate change? (The local planning authority's Strategic Flood Risk Assessment should have taken this into account). Further advice on how to take account of the impacts of climate change in flood risk assessments is available from the Environment Agency.

5. Site Specific Flood Risk

Describe the risk of flooding to and from the proposed development over its expected lifetime, including appropriate allowances for the impacts of climate change. It would be helpful to include any evidence, such as maps and level surveys of the site, flood datasets (e.g. flood levels, depths and/or velocities) and any other relevant data, which can be acquired through consultation with the Environment Agency, the lead local flood authority for the area, or any other relevant flood risk management authority. Alternatively, you may consider undertaking or commissioning your own assessment of flood risk, using methods such as computer flood modelling.

A. What is/ are the main source(s) of flood risk to the site? (E.g. tidal/sea, fluvial or rivers, surface water, groundwater, other?). You should consider the flood mapping available from the Environment Agency, the Strategic Flood Risk Assessment for the area, historic flooding records and any other relevant and available information.
B. What is the probability of the site flooding, taking account of the maps of flood risk available from the Environment Agency, the local planning authority's Strategic Flood Risk Assessment and any further flood risk information?
C. Are you aware of any other sources of flooding that may affect the site?
D. What is the expected depth and level for the design flood? See paragraph 055 of the NPPF guidance for information on what is meant by a "design flood". If possible, flood levels should be presented in metres above Ordnance Datum (i.e., the height above average sea level).
E. Are properties expected to flood internally in the design flood and to what depth? Internal flood depths should be provided in metres.
F. How will the development be made safe from flooding and the impacts of climate change, for its lifetime? Further information can be found in paragraphs 054 and 059 (including on the use of flood resilience and resistance measures) of the NPPF guidance.

G. How will you ensure that the development and any measures to protect the site from flooding will not cause any increase in flood risk off-site and elsewhere? Have you taken into account the impacts of climate change, over the expected lifetime of the development? (e.g. providing compensatory flood storage which has been agreed with the Environment Agency).
H. Are there any opportunities offered by the development to reduce the causes and impacts of flooding?

6. Surface Water Management*

Describe the existing and proposed surface water management arrangements at the site using sustainable drainage systems wherever appropriate, to ensure there is no increase in flood risk to others off-site.

A. What are the existing surface water drainage arrangements for the site?
B. If known, what (approximately) are the existing rates and volumes of surface water run-off generated by the site?
C. What are the proposals for managing and discharging surface water from the site, including any measures for restricting discharge rates? For major developments (e.g. of ten or more homes or major commercial developments), and for all developments in areas at risk of flooding, sustainable drainage systems should be used, unless demonstrated to be inappropriate.
D. How will you prevent run-off from the completed development causing an impact elsewhere?
E. Where applicable, what are the plans for the ongoing operation and/or maintenance of the surface water drainage systems?

7. Occupants and Users of the Development

Provide a summary of the numbers of future occupants and users of the new development; the likely future pattern of occupancy and use; and proposed measures for protecting more vulnerable people from flooding.

A. Will the development proposals increase the overall number of occupants and/or people using the building or land, compared with the current use? If this is the case, by approximately how many will the number(s) increase?
B. Will the proposals change the nature or times of occupation or use, such that it may affect the degree of flood risk to these people? If this is the case, describe the extent of the change.
C. Where appropriate, are you able to demonstrate how the occupants and users that may be more vulnerable to the impact of flooding (e.g., residents who will sleep in the building; people with health or mobility issues; etc.,) will be located primarily in the parts of the building and site that are at lowest risk of flooding? If not, are there any overriding reasons why this approach is not being followed?

8. Residual Risk

Describe any residual risks that remain after the flood risk management and mitigation measures are implemented, and to explain how these risks can be managed to keep the users of the development safe over its lifetime.

A. What flood related risks will remain after the flood risk management and mitigation measures have been implemented?
B. How, and by whom, will these risks be managed over the lifetime of the development? (e.g., putting in place flood warning and evacuation plans).

9. Flood Risk Assessment Credentials

Provide details of the author and date of the flood risk assessment.

A. Who has undertaken the flood risk assessment?
B. When was the flood risk assessment completed?

Other considerations

* Managing surface water

The site-specific flood risk assessment will need to show how surface water runoff generated by the developed site will be managed. In some cases, it may be advisable to detail the surface water management for the proposed development in a separate drainage strategy or plan. You may like to discuss this approach with the lead local flood authority.

Surface water drainage elements of major planning applications (e.g., of ten or more homes) are reviewed by the lead local flood authority for the area. As a result, there may be specific issues or local policies, for example the Local Flood Risk Management Strategy or Surface Water Management Plan, that will need to be considered when assessing and managing surface water matters.

It is advisable to contact the appropriate lead local flood authority prior to completing the surface water drainage section of the flood risk assessment, to ensure that the relevant matters are covered in sufficient detail.
Proximity to Main Rivers

If the development of the site involves any activity within specified distances of main rivers, a flood risk activity permit may be required in addition to planning permission.

For non-tidal main rivers, a flood risk activity permit may be required if the development of the site is within 8 metres of a river, flood defence structure or culvert.

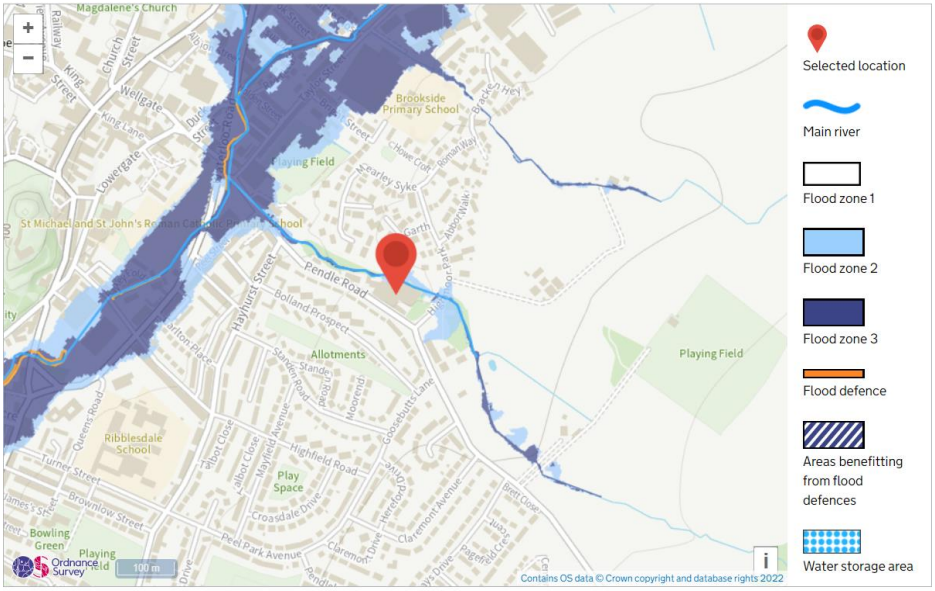
For tidal main rivers, a flood risk activity permit may be required if the development of the site is within 16 metres of a river, flood defence structure or culvert.

Details on obtaining a Flood Risk Activity Permit are available from the Environment Agency.

2.4 Sources of Flooding

- **Rivers (fluvial):** Flooding occurs when flow within river channels exceeds capacity; and the type of flood event experienced e.g. flash flooding; depends upon the characteristics of the river catchment.
- **The Sea (tidal):** Flooding at low lying coastline and tidal estuaries is caused by storm surges and high tides; with overtopping and breach failure of sea defences possible during extreme storm events.
- **Pluvial (surface flooding or overland flows):** Heavy rainfall, which is unable to soak away via infiltration or enter drainage systems can flow overland, resulting in localised flooding. Topography generally influences the direction and depth of flooding caused by this mechanism.
- **Groundwater:** Caused when ground water levels rise to the surface; and is most likely to occur in low lying areas underlain by aquifers.
- **Sewers and drains:** Generally occurs in more urban areas; where sewers and drains are overwhelmed by heavy rainfall or blocked pipes and gullies.
- **Artificial Sources (reservoirs, canals, lakes and ponds):** Reservoir and canal flooding may occur as a result of capacity exceedance or structural failure.

Figure 1: The Environment Agency Flood Map



Source: www.gov.uk

2.5 Flood Zones

- Flood Zone 1: Low probability (less than 1 in 1000 year (<0.1% AEP) annual probability of river or sea flooding in any year.
- Flood Zone 2: Medium probability (between 1 in 100 year (1.0% AEP) and 1 in 1000 year (0.1% AEP) annual probability of river flooding; or between 1 in 200 year (0.2% AEP) and 1 in 1000 year (0.1% AEP) annual probability of sea flooding in any year).
- Flood Zone 3a: High probability (1 in 100 year (1.0% AEP) or greater annual probability of river flooding in any year or 1 in 200 year (0.5% AEP) or greater annual probability of sea flooding in any year).
- Flood Zone 3b: This zone comprises land where water has to flow or be stored in times of flood. Land which would flood with an annual probability of 1 in 20 (5% AEP), or is designed to flood in an extreme flood (0.1%) should provide a starting point for discussions to identify functional floodplain.

2.6 Vulnerability of Different Development Types

- Essential Infrastructure: Transport infrastructure (railways and motorways etc…); utility infrastructure (primary sub-stations, water treatment facilities; power stations; and wind turbines).
- Water Compatible Development: Flood control infrastructure; water and sewage infrastructure; navigation facilities.
- Highly Vulnerable: Emergency services; basement dwellings; mobile home parks; industrial or other facilities requiring hazardous substance consent.
- More Vulnerable: Hospitals; residential dwellings; educational facilities; landfill sites caravan and camping sites.
- Less Vulnerable: Commercial premises; emergency services not required during a flood; agricultural land.

2.7 Climate Change

2.7.1 The NPPF requires the application of climate change over the lifetime of a development. As of 06th October 2021, the Technical Guidance for NPPF has updated the climate change allowances based on river basin catchments. The climate change allowance for the Ribble Management Catchment is tabulated below:

Parameter	Allowance Category	2020's	2050's	2080's
Peak Rainfall Intensity	Upper	+27%	+44%	+71%
	Higher	+ 19%	+ 29%	+46%
	Central	+ 16%	+ 23%	+36%

***Table* 1:** *Ribble Management Catchment Climate Change Allowances*

2.7.2 Due to the development being located within Flood Zone 2 and being considered highly vulnerable development, the central allowance of 36% should be applied to peak river flow to account for climate change.

Applied Across All of England	2015 - 2039	2040 - 2069	2070 - 2115
Upper End	10%	20%	40%
Central	5%	10%	20%

Table 2: Peak Rainfall Intensity Allowance

2.7.3 Due to the development having a proposed life span in excess of 50 years, 40% should be applied to rainfall intensity when developing the drainage strategy, to account for climate change over the lifetime of the development.

3. DETAILS OF THE SITE

3.1 Site Details

Site Name:	Pendle Mill
Purpose of Development:	Care home
Existing Land Use:	Commercial
OS NGR:	SD7492641547
Country:	England
County:	Lancashire
Local Planning Authority:	Ribble Valley Borough Council
Internal Drainage Board:	Not Applicable
Other Authority (e.g. British Waterways/ Harbour Authority)	Not Applicable

Location Plan:

Source: Google

Table 3: *Development Location*

3.2 Site Description

3.2.1 The application site is currently occupied by Worthington Brougham Furniture Ltd and comprises of approximately 5No physically attached buildings with basement storage areas, car parking and turning area at the frontage onto Pendle Road, with green space to the north.

3.2.2 The nearest watercourse to the site is Shaw Brook which flows in a westerly direction and is culverted through the northern extent of the site, where it exits becoming open channel at the north west boundary.

3.2.3 The topographical survey provided identifies that the basement entrance located at the south west of the site is at a level of 87.550m AOD, the north west corner of the site located closest to the open stretch of Shaw Brook is at a level of 85.000m AOD. The north east corner of the site is at a level of 88.70m AOD and the south east adjacent to Pendle Road is at a level of 93.700m AOD. In general, the site falls from east to west with a topographical depression along the route of the culvert.

3.3 Proposed Development Details

3.3.1 Development proposals include demolition of the existing building to make way for the erection of a 70No bedroom care home with access from Pendle Road and car parking provisions.

4. HISTORIC FLOODING

4.1 Internet Search

4.1.1 An internet search for historic flooding within the area of Pendle Road came back with no recorded incidents.

4.2 Ribble Valley Council SFRA April 2017

4.2.1 The Strategic Flood Risk Assessment (SFRA) was undertaken by Ribble Valley Borough Council and was completed in April 2017.

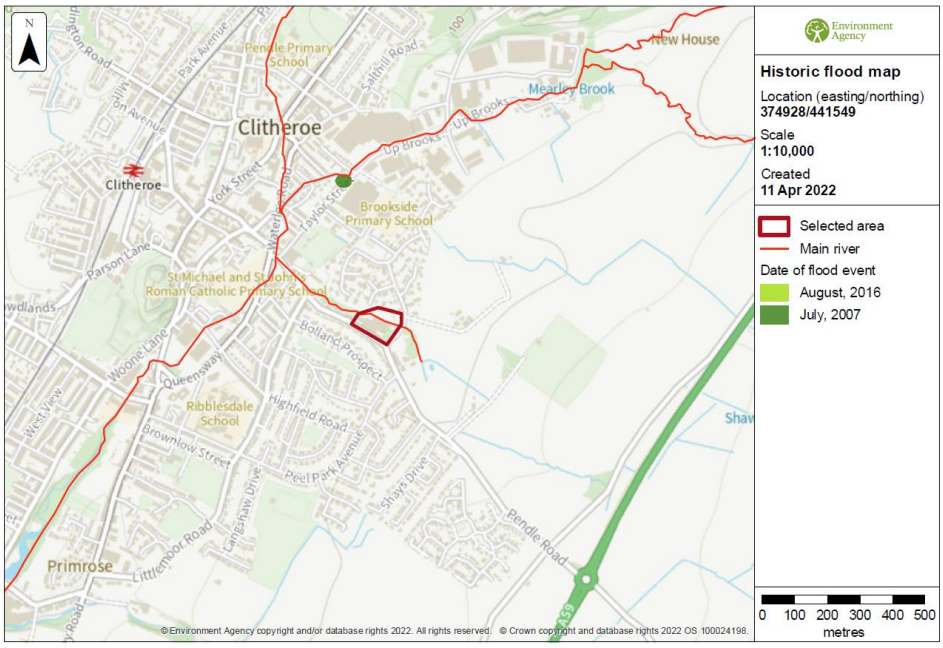
4.2.2 Section 4.4 Table 1 Major Historical Floods Recorded in the Ribble Catchment and RVBC Communities Worst Hit identifies that Clitheroe was affected during the following events:

- 1866 – Clitheroe - River Ribble
- 1923 – Clitheroe – River Ribble, River Calder

4.3 Environment Agency Historic Flooding

4.3.1 The Environment Agency have provided Historic Flood Information in relation to historic flood events which shows that the application site was no affected during the floods of August 2016 and July 2017.

Figure 2: Environment Agency Historic Flood Map



Source: EA Data

5. Initial Evaluation of Flood Risk

5.1 Environment Agency Flood Map

5.1.1 The Environment Agency Flood Map illustrated within Figure 1, confirms that proposed development site is located in Flood Zone 2. The definition for each of the flood zones highlighted above is provided for reference within Section 2.5 of this report.

5.2 Sources of Flooding

Source/Pathway	Significant?	Comment/Reason
Fluvial	Yes	Flood Zone 2 (Shaw Brook)
Canal	No	Not Applicable
Tidal/Coastal	No	Not Applicable
Reservoir	No	EA Map shows that the site is not affected by reservoir flooding.
Pluvial (urban drainage)	Yes	Site will require a new drainage strategy
Groundwater	No	SFRA states that groundwater flooding within the area is not considered to be a significant risk
Surface Water Flooding	No	Site is located within an area that has a medium risk of flooding
Overland Flow	No	EA mapping shows velocity from overland flow to be low risk.
Blockage	No	Potential of culvert blocking upstream, however the culvert head is approx. 50m east of the site, as such there is a low risk associated with blockage onsite.
Infrastructure failure	No	Not Applicable
Rainfall Ponding	No	Small area of ponding identified within the boundary of the site, which will be served by a positive drainage strategy.

Table 1: *Possible Flooding Mechanisms*

5.2.1 From the initial assessment it is concluded that the primary source of flood risk will be from the fluvial source Shaw Brook and surface water runoff resulting from the development.

5.3 Fluvial: Shaw Brook

5.3.1 Shaw Brook emanates from Pendle Hill located approximately 3km east of the development site, where it flows west through the north of Clitheroe for approximately 3.7km, before joining Mearley Brook under Shaw Bridge Street approximately 300m west of the site.

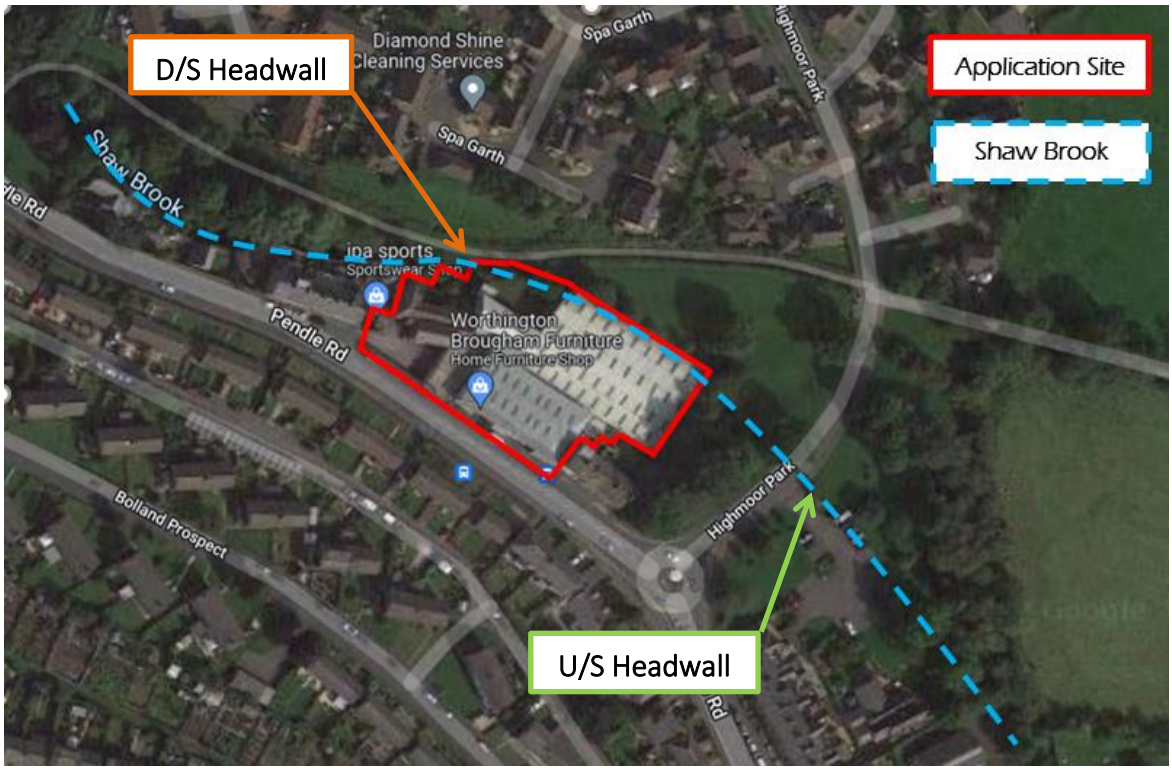
5.3.2 Shaw Brook is culverted at a number of locations along its reach and this applies to the application site also. Within the immediate vicinity of the site, the upstream head of the culvert is located approx. 50m east of the site within a car park associated with Highmoor Park The head of the culvert is surrounded by low lying green open space, which is shown to provide some flood storage during extreme rainfall events.

5.3.3 The culvert stretches for approx. 120m, where it passes under Highmoor Park Road and traverses through the northern extent of the site, before exiting at the downstream head located at the north west corner of the application site, it then continues to flow west towards Mearley Brook.

5.3.4 Shaw Brook is considered to be a 'Main River' and therefore the Environment Agency have certain roles and responsibilities regarding maintenance and management of the watercourse.

5.3.5 Due to the proposed development site being located within Flood Zones 2 and therefore having a medium risk of fluvial flooding, further evaluation is required and is undertaken within Section 6 of this report.

Figure 3: *Shaw Brook Headwall Locations*



Source: Google Maps

Figure 4: *Shaw Brook Upstream Culvert Headwall*

Source: BEK Enviro

Figure 5: Shaw Brook Downstream Culvert Headwall

Source: BEK Enviro

5.4 Groundwater

5.4.1 Section 4.2.9 of the Ribble Valley Borough Councils SFRA states the following in relation to groundwater flooding:

'Following consultation with the EA, no evidence of groundwater flooding in the area has been identified. While no risk has been demonstrated, this is not to say that unrecorded groundwater flooding events may have taken place or that groundwater flooding may not occur in the future, but using the best available information they are not considered to be a significant risk at this time.'

5.4.2 A review of local borehole logs taken the BGS online service from approximately 300m east identifies that no water was struck at 5.50m BGL. The borehole records are available for reference within the appendix of this report.

5.4.3 In conclusion groundwater emergence is considered to be a low-risk flooding mechanism.

5.5 Surface Water Flooding

5.5.1 The Environment Agency's Surface Water Flood Map identifies that the application site has a medium risk associated with pluvial (surface water) flooding.

Figure 6: Environment Agency Surface Water Flood Map

Source: www.gov.uk

- **Medium risk** means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

5.5.2 Surface water flooding to the north of the existing building is considered to be as a result of interaction with fluvial flooding associated with Shaw Brook and therefore has been assessed as part of the fluvial flooding assessment within Section 6 of this report.

5.5.3 The main area of surface water flooding attributed to the existing site is associated with the lower-level basement storage entrance.

5.5.4 During the worst-case low risk event i.e., 1000-year event there are no flow routes present and the depth is considered to be between 300mm-900mm. Taking this into account engineering judgment suggests that surface water flooding in this location is as a result of poor surface water drainage. Following development the scheme will have a new surface water drainage strategy, as such flooding at this location can be suitably managed.

5.5.5 Taking the above into consideration, flooding from surface water can be suitable managed within the proposed drainage strategy.

5.6 Pluvial: Exceedance and Local System Failure (Sewer Flooding)

5.6.1 The following text has been extracted from CIRIA 2906 'Managing Extreme Events by Designing for Exceedance January 2013':

'Climate change and urbanisation is already contributing to increased surface water flooding, where the capacity of the existing drainage systems are overwhelmed (or exceeded).

The traditional approach to fixing the problem is to build bigger pipes or provide underground storage. Ofwat, the Environment Agency and others believe that this approach is unsustainable and unaffordable and are encouraging sewerage undertakers, Lead Local Flood Authorities and highway authorities to look at different approaches to managing sewer and surface water flooding.

One approach being promoted is "designing for exceedance".

Designing for exceedance is an approach to manage flood risk (particularly from extreme events) by planning, designing and retrofitting drainage schemes that can safely accommodate rainfall and flooding that exceeds their design capacity (normally a 1 in 30 rainfall event). This is often achieved by considering flood pathways (such as managing runoff on highways) or providing additional storage (preferably on the surface through car parks, or multifunctional detention basins).

In England and Wales Sewers for Adoption and the National Planning Policy Framework encourage the consideration of drainage exceedance, it is a flexible approach to manage extreme events that can be used to reduce the need for more traditional, expensive underground approaches to manage surface water and often complement sustainable drainage and other local urban design initiatives.'

5.6.2 The impact of extreme rainfall events and/or local system failure will therefore need to be assessed as part of the overall surface water management strategy for the proposed development.

6. QUANTITATIVE FLOOD RISK ASSESSMENT

6.1 Fluvial: Shaw Brook

Culvert Details

6.1.1 The culverted section of Shaw Brook within the redline boundary has been surveyed to GPS coordinates in order to determine its route through the site, the findings are identified below:

- At the upstream extent of the culvert (from the upstream headwall where it passes under Highmoor Park Road) comprises of a 1m diameter pipe, for a length of approx. 25m.
- The culvert then downsizes to a 950mm x 650mm box culvert supported by lintels (it is noted that a manhole is at this location), this section continues for approx. 21m.
- The culvert then upsizes to a 1m diameter culvert, at this location another culverted ordinary watercourse enters the culvert from the south at a 90-degree angle (it is noted that a buried manhole is at this location), the main culverted section of Shaw Brook continues under the edge of the existing building for approx. 81m.
- The culvert then upsizes to a 1.6m diameter brick culvert, where it continues for approx. 15m, then exists at the downstream headwall to become open course.

6.1.2 A survey of the culverted watercourse is provided as an appendix within this report.

6.2 Flood Defences

6.2.1 The EA Flood Data identifies that the application site is not considered to be formally benefit from flood defences, however Shaw Brook does have flood defences downstream of the application site. It is noted that levels within Shaw Brook are shown to be higher during the defended scenario.

6.3 Environment Agency Modelled Flood Levels

6.3.1 The Environment Agency have provided modelled flood sample point levels associated with the application site at 4No locations, for a range of return periods.

6.3.2 Due to flood levels being higher during the defended scenario, these have been used as worst-case scenario in order to undertake the comparison.

6.3.3 The Environment Agency require the application of the central allowance for climate change i.e., 36%. The EA have provided flood levels with the application of 30%, 35% and 70% climate change.

6.3.4 As a result of the steep nature of the site ground levels at the locations of the flood sample positions and node locations have been used to determine flood depths.

6.3.5 On site flood sample points have been provided for only the defended 100 year, 100 yea + 70% climate change and 1000 year events, however the 100 year + 35% climate change on-site levels have not been included.

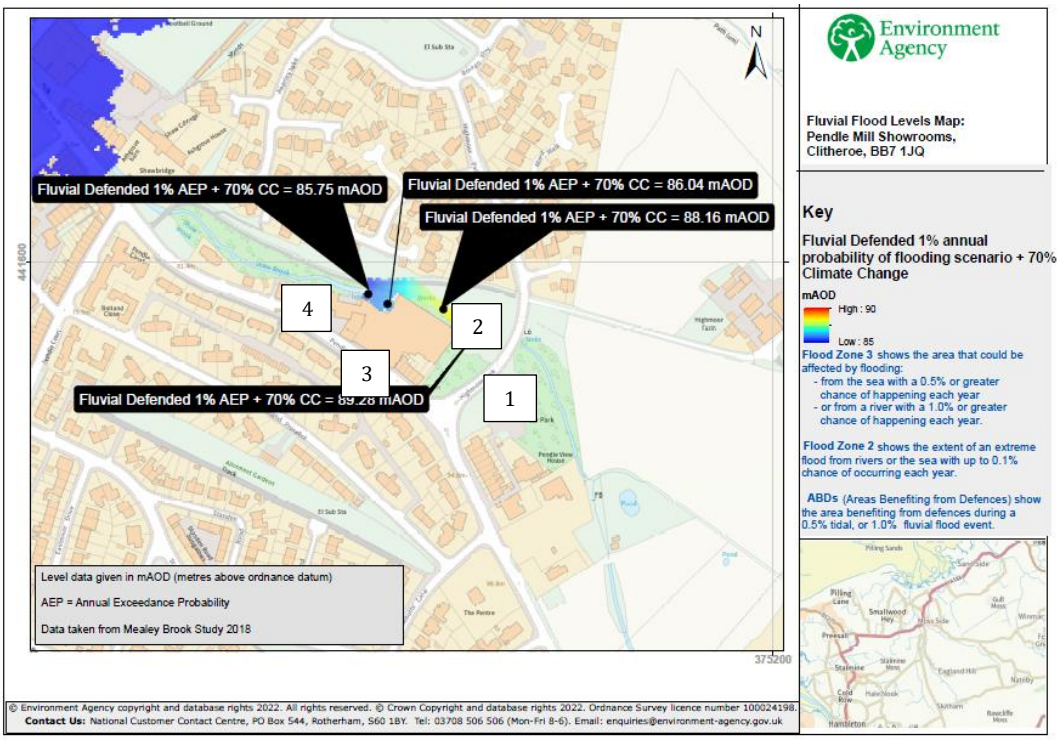
6.3.6 As such, to determine the 100 year + 35% climate change flood level Nodes 5 (at the downstream headwall) and Node 6 (at the upstream headwall on Highmoor Park road) have been used.

6.3.7 Due to the fact that no flooding is recorded on-site during the 100 year + 35% climate change event, flood levels during the 100 year + 70% climate change event have been used when determining appropriate mitigation measures.

Sample Point	Ground Level	1 in 100 Year	1 in 100 Year + 70%	1 in 1000 Year
U/S 1	88.91	No Flooding	89.28(Depth=0.37)	89.32(Depth=0.41)
2	87.98	No Flooding	88.16(Depth=0.18)	88.16(Depth=0.18)
3	85.87	No Flooding	86.04(Depth=0.17)	86.06(Depth=0.19)
D/S 4	85.16	No Flooding	85.75(Depth=0.59)	85.80(Depth=0.64)

Table 2: Flood Depths Using Flood Sample Points

Figure 7: Environment Agency Sample Point Locations and Numbering



Source: EA Flood Data

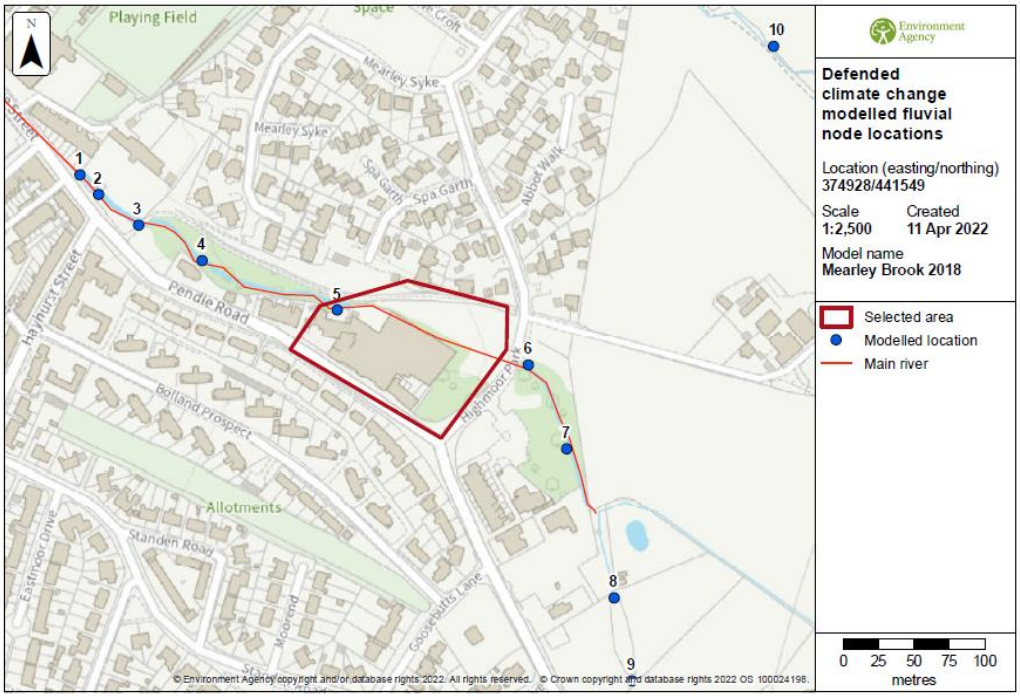
6.3.8 Following evaluation of flood depths associated with sample points it has determined that the site will flood during the 100 year + 70% climate change event and the 1000 year event, however it has a low risk of flooding during the 100 year event.

6.3.9 A review of flood depths associated with flood nodes during the 100 year + 35% climate change event determined that no flooding is present at the downstream node (Node 5) and flooding of 0.22m at the upstream node (Node 6).

Node Point	Ground Level	1 in 100 Year + 35%
Node 5	85.02	81.91(No Flooding)
Node 6	82.71	82.93(Depth=0.22)

Table 6: Flood Depths Using Flood Nodes

Figure 8: Environment Agency Node Locations



Source: EA Flood Data

6.4 Fluvial Conclusion

6.4.1 Following a review of the available Environment Agency Flood Data, flood levels during the 100 year + 70% climate change range from 85.75m AOD (west of the site) to 89.28m AOD (east of the site).

6.4.2 Engineering judgement suggests that this a result of the culverted watercourse downsizing and becoming constricted as it traverses through the site causing flooding during storm events in excess of the 100 year + 35% climate change event.

6.4.3 Flows within the culvert then surcharge within the manholes then flood above ground, where they flow overland following topography along the culverts route, before making its way back into the open section of the watercourse at the downstream headwall west of the site.

6.4.4 Taking the above into account, flooding at the site is considered to be a fluvial overland flow route when the capacity of the culvert is exceeded, rather than a flood plain where levels would have less of a range.

6.4.5 Development proposals provide an 8 m easement from the edge of the culvert, providing a betterment compared to the existing building (which builds over the culvert). As such the flow route can now be contained within the easement where levels could be graded off directing flows towards the route of the culvert, rather than it backing up against the building's envelope

6.4.6 In order to ensure that level access can be maintained throughout the ground floor level of the proposed development, finished floor levels have been based on the 100 year + 70% climate change flood level at Node Sample Point 2: 88.16m AOD + 0.600m (freeboard), which equated to a finished floor level of 88.76m AOD.

6.4.7 Providing that mitigation measures as outlined within this report are implemented into the development the risk of fluvial flooding can be suitably managed.

7. SURFACE WATER RUNOFF

7.1 General

7.1.1 The application site is currently occupied by Worthington Brougham Furniture Ltd and comprises of approximately 5No physically attached buildings with basement storage areas, car parking and turning area at the frontage onto Pendle Road with green space to the north.

- The total existing impermeable site area is approximately 0.367Ha
- The total proposed impermeable site area is approximately 0.228Ha (40% reduction compared to existing)

7.2 Existing on Site Drainage Regime

7.2.1 At present a CCTV Survey has not been undertaken, however engineering judgement suggests that surface water flows from the existing building/s and associated car parking areas are positively drained, directing flows to Shaw Brook at an unrestricted rate.

7.3 Existing Sewer

7.3.1 United Utilities sewer records identify that the only public sewer within the vicinity of the site is a 300mm diameter public combined sewer located within Pendle Road flowing west.

7.4 Surface Water Drainage Hierarchy

7.4.1 The hierarchy for disposal of surface water from new developments is outlined within the Buildings Regulations Approved Document H and specifies the following methods in order of preference:

- Infiltration via soakaway or other suitable infiltration device
- Discharge to watercourse
- Discharge to public surface water sewer
- Discharge to public combined sewer

Infiltration

7.4.2 Following a non-intrusive desk top study infiltration at the site is not considered to be feasible, a review of Soilscape maps identifies the site to be located on land which is considered to be 'Slowly permeable seasonally wet acid loamy and clayey soils'.

7.4.3 A review of local borehole logs taken from the BGS online service approx. 300 west identifies that the underlying ground comprises of boulder clay down to 9m BGL.

7.4.4 A desk top study of the ground conditions is provided within the appendix of this report.

7.4.5 Taking the above into consideration the use of soakaways at the proposed development is not considered to be feasible.

Watercourse

7.4.5 The nearest watercourse to the proposed development is the Shaw Brook which is culverted located along the north boundary of the site.

7.4.6 Due to the fact that infiltration methods are unlikely to be feasible, it is recommended that surface water flows from the site are directed into Shaw Brook mimicking the existing situation.

7.5 Existing Runoff Rates

7.5.1 Existing runoff rates have been calculated using the Modified Rational Method for a total impermeable area of 0.367Ha.

- 2.78 x 0.367 x 50 = 51 l/s

7.6 Restricted Discharge Rate

7.6.1 It is recommended that surface water flows from the site are restricted no more than 70% of the existing discharge rate for all return periods up to and including the 100 year + 40% climate change event.

- 70% of 51l/s = 35.7l/s

7.7 Indicative Attenuation Rates

7.7.1 Indicative attenuation volumes have been calculated using the proposed impermeable area of 0.228Ha with flows restricted to 35.7l/s during the 100 year + 40% climate change event.

- 100 year + 40% climate change event = $34m^3 – 72m^3$

7.8 Sustainable Urban Drainage Systems (SUDS)

7.8.1 SUDS act to reduce the impact of surface water runoff from the development by limiting runoff volumes and rates from leaving the site.

7.8.2 Undertaking an assessment using the SUDS Planner a number of different methods could be used within the development. A summary of the results is tabulated below:

SUDS Criteria	Rank 1	Rank 2	Rank 3
Hydrological	On/offline Storage	Infiltration Trench/Soakaway	Wet Pond
Land Use	Infiltration Trench/Soakaway	Permeable Paving	Green Roof
Site Features	Permeable Pavements	On/offline Storage	Filtration Techniques
Community & Environment	Bioretention Area	Permeable Paving	Stormwater Wetlands
Economics & Maintenance	On/offline Storage	Filter Strip	Dry Detention
Total	On/Offline Storage	Permeable Paving	Green Roof

Table 7: SUDS Planner

1. Source Control

The inclusion of source control in SUDS schemes is one of the more important principles of SUDS design, and source control components should be upstream of any pond, wetland or other SUDS component.

Source control can help provide interception storage which can handle and treat some of the more frequent but smaller, polluting events (at least 5mm).

Most source control components will be located within the private properties or highway areas. Their purpose is to manage rainfall close to where it falls, not allowing it to become a problem elsewhere.

The main types of source control include:

- Green roofs
- Rainwater harvesting
- Permeable paving
- Other permeable surfaces

Source control methods look to maximize permeability within a site to promote attenuation, treatment and infiltration, thereby reducing the need for off-site conveyance.

a) Green Roofs

Green roof solutions generally comprise of a multi-layered system that covers the roof of a building with vegetation cover, and/or landscaping over a drainage layer, designed to intercept and retain rainfall.

The incorporation of green roofs is to be decided by the architect/developers during the final design stage and is largely dependent on the final building design.

The likelihood of green roofs being utilised is considered to be low due to the increase in structural cost of the development.

b) Rainwater Harvesting

Rainwater harvesting provides a source of non-potable water, for purposes such as car washing; and landscaped area irrigation etc… and can be used for some industrial processes to reduce consumption of water from conventional supplies.

This SUDS solution, like green roof technology, is also designed to provide interception storage i.e. acts to reduce the volume of surface water leaving the proposed development; thereby helping to alleviate the current pressures on the receiving watercourse.

Rainwater harvesting can be installed at relatively low costs dependant on the chosen structure providing that the development site has scope.

c) Permeable Paving

Pervious surfaces can be either porous or permeable. The important distinction between the two is:

Porous surfacing is a surface that infiltrates water across the entire surface. Permeable surfacing is formed of material that is itself impervious to water but, by virtue of voids formed through the surface, allows infiltration through the pattern of voids.

Pervious surfaces provide a surface suitable for pedestrian and/or vehicular traffic, while allowing rainwater to infiltrate through the surface and into underlying layers.

The water can be temporarily stored before infiltration to the ground, reused, or discharged to a watercourse or other drainage system. Surfaces with an aggregate sub-base can provide good water quality treatment.

*Due to the proposed development having large drainage runs which cause excessive depths and the fact that the system will be privately maintained, permeable paving is unlikely to suitable for the proposed development site

2. On/Offline Storage

This is a traditional form of surface water attenuation and may be provided via online or offline structures such as oversized pipes; or shallow attenuation structures such as geo-cellular crate systems e.g. Hydro-International's Stormcell System or similar. These structures may be easily placed within either hardstanding or landscaped areas to provide ease of access for maintenance purposes.

7.9 Preliminary Drainage Strategy

7.9.1 The preliminary drainage strategy directs surface water flows from the roof and car parking area into the open channelled section of Shaw Brook, located at the north of the site via a new outfall.

7.9.2 The preliminary network has been modelled using FLOW Software for the proposed impermeable area of 0.288Ha, with discharge rates into the watercourse restricted to no more than 35.7l/s for all return periods up to and including the 100 year + 40% climate change event via a vortex flow control chamber. Flows in excess of this will be attenuated within a geo-cellular storage tank located within the car parking area and also within the piped network itself.

Modelled Tank Details

- *Area = 30m^2*
- *Depth of crate = 1m*
- *95% void ratio*

Modelled Flow Control

- *Design Flow = 35.7l/s*
- *Design Depth = 2m*

7.9.3 Permeable paving was considered, however once drainage runs from the rear of the building were brought to the frontage, the required depth of sub-base would not be economically viable and would be well in excess of the storage volume required.

7.9.4 Furthermore, providing permeable paving for only the car parking area would still require an additional tank to take flows from the roof area. This combined with the excessive maintenance burden discounted permeable paving from the preliminary drainage strategy.

7.10 Environmental Permit

7.10.1 The Environment Agency may require any works within 8m of the culverted watercourse apply for an Environmental Permit prior to any works being undertaken, this will include any new headwall structure.

7.11 Maintenance

7.11.1 It is anticipated that the proposed drainage network will remain private and therefore the land/property owner will be responsible for maintaining all the drainage elements.

7.12 Foul

7.12.1 It is recommended that foul flows from the proposed development site are directed into the 300mm diameter public combined sewer located within Pendle Road, following consent from United Utilities.

8. MITIGATION MEASURES

8.1 Finished Development Levels

8.1.1 Due to the application site being located within Flood Zone 2 finished floor levels of the site should be elevated whichever is the highest.

- 300mm above existing ground level
- 600mm above the 100 year + climate change event

8.1.2 The existing site has a range in level of approximately 5m. Because the development requires level access on the ground floor level a stepped approach is not feasible, therefore finished floor levels have been elevated 600mm above the 100 year + 70% climate change event at the Sample Point labelled No2.

- Sample Point 2: 88.16m AOD + 0.600m (freeboard) = finished floor level of **88.76m AOD**

8.2 Flood Resistance/Resilience Measures

8.2.1 Due to the finished floor levels of the proposed building being elevated to the required levels flood resilience/resistance measures are not required.

8.3 Access and Egress

8.3.1 Dry access and egress is available at all time via the main entrance at the south of the site, directly onto Pendle Road into Flood Zone 1.

8.4 Easement

8.4.1 The Environment Agency will require an 8m easement from the edge of the culverted watercourse, which has been incorporated into the development proposals. This provides a significant benefit over the existing building which built over the culvert.

8.5 Business Flood Plan

8.5.1 It is also recommended that staff create the business flood plan. This is a simple document that assists the staff/customers to prioritise actions required at the property before, during and following a flood event.

8.5.2 A copy of a business flood plan template has been provided within the appendices of this report.

9. CONCLUSIONS & RECOMMENDATIONS

Fluvial Flooding

9.1 Following a review of the available Environment Agency Flood Data, flood levels during the 100 year + 70% climate change range from 85.75m AOD (west of the site) to 89.28m AOD (east of the site).

9.2 Engineering judgement suggests that this a result of the culverted watercourse downsizing and becoming constricted as it traverses through the site causing flooding during storm events in excess of the 100 year + 35% climate change event.

9.3 Flows within the culvert then surcharge within the manholes then flood above ground, where they flow overland following topography along the culverts route, before making its way back into the open section of the watercourse at the downstream headwall west of the site.

9.4 Taking the above into account, flooding at the site is considered to be a fluvial overland flow route when the capacity of the culvert is exceeded, rather than a flood plain where levels would have less of a range.

9.5 Development proposals provide an 8m easement from the edge of the culvert, providing a betterment compared to the existing building (which builds over the culvert). As such the flow route can now be contained within the easement where levels could be graded off directing flows towards the route of the culvert, rather than it backing up against the building's envelope

9.6 In order to ensure that level access can be maintained throughout the ground floor level of the proposed development, finished floor levels have been based on the 100 year + 70% climate change flood level at Node Sample Point 2: 88.16m AOD + 0.600m (freeboard), which equated to a finished floor level of 88.76m AOD.

9.7 Providing that mitigation measures as outlined within this report are implemented into the development the risk of fluvial flooding can be suitably managed.

Preliminary Drainage Strategy

9.8 The preliminary drainage strategy directs surface water flows from the roof and car parking area into the open channelled section of Shaw Brook, located at the north of the site via a new outfall.

9.9 The preliminary network has been modelled using FLOW Software for the proposed impermeable area of 0.288Ha, with discharge rates into the watercourse restricted to no more than 35.7l/s for all return periods up to and including the 100 year + 40% climate change event via a vortex flow control chamber.

9.10 Flows in excess of this will be attenuated within a geo-cellular storage tank located within the car parking area and also within the piped network itself.

Modelled Tank Details
- Area = 30m2
- Depth of crate = 1m
- 95% void ratio

Modelled Flow Control
- Design Flow = 35.7l/s
- Design Depth = 2m

9.11 Permeable paving was considered, however once drainage runs from the rear of the building were brought to the frontage, the required depth of sub-base would not be economically viable and would be well in excess of the storage volume required.

9.12 Furthermore, providing permeable paving for only the car parking area would still require an additional tank to take flows from the roof area. This combined with the excessive maintenance burden discounted permeable paving from the preliminary drainage strategy.

9.13 The Environment Agency may require any works within 8m of the culverted watercourse apply for an Environmental Permit prior to any works being undertaken, this will include any new headwall structure.

Mitigation Measures

Finished Floor Levels

9.14 Due to the application site being located within Flood Zone 2 finished floor levels of the site should be elevated whichever is the highest.

- 300mm above existing ground level
- 600mm above the 100 year + climate change event

9.15 The existing site has a range in level of approximately 5m. Because the development requires level access on the ground floor level a stepped approach is not feasible, therefore finished floor levels have been elevated 600mm above the 100 year + 70% climate change event at the Sample Point labelled No2.

- Sample Point 2: 88.16m AOD + 0.600m (freeboard) = finished floor level of 88.76m AOD

Watercourse Easements

9.16 The Environment Agency will require an 8m easement from the edge of the culverted watercourse, which has been incorporated into the development proposals. This provides a significant benefit over the existing building which built over the culvert.

Business Flood Plan

9.17 It is also recommended that staff create the business flood plan. This is a simple document that assists the staff/customers to prioritise actions required at the property before, during and following a flood event.

9.18 A copy of a business flood plan template has been provided within the appendices of this report

APPENDIX A

Development Proposals

Rev	Date	Revision Description	Drawn By	Approved By
C	15/05/22	Road layout has been revised to accommodate the highways comments	JB	JB
B	09/05/22	Road layout has been revised to accommodate the highways comments	JB	JB
A	04/04/22	Layout has been revised to show the detail	JB	JB
-	01/01/21	Original Drawing	JB	JB

ADG ARCHITECTS
6 Pioneer Court, Darlington, DL1 4WD
t: 01325 464 111
e: studio@adgarchitects.co.uk
w: www.adgarchitects.co.uk

Client
Muller Property

Project Information
Proposed 70 Bed Care Home, Pendle Road, Clitheroe

Drawing Title
Proposed Site Plan with Topographical Survey

A1 Scale	A3 Scale
1:200	

Job Number	Drawing Number	Revision
H.21.78	(9-) 2	C

Drawing Issue
FEASIBILITY

APPENDIX B

Topographical Survey

CSL SURVEYS

CONSULTING SURVEYORS
LAND-ENGINEERING-BUILDING

751 Scott Hall Road ▪ Moortown ▪ Leeds
Tel 01132 893924 ▪ Tel 07739 753 651
Email info@cslsurveys.co.uk ▪ www.cslsurveys.co.uk

TITLE
Topographical Survey
Pendle Mill, Pendle Road
Clitheroe

CLIENT: Muller Strategic Projects Limited

DATE	DRAWN BY	CHKD. BY
April 2022	ACA	SA

DRG NO	PLOT SCALE
10923 - 01	1:200 @ A0

REV	AMENDMENT	DATE	BY	CHKD.

NOTES

This survey has been fitted to Ordnance Survey Grid and Datum using GPS coordinates system OSGB36-15 and has been drawn at a scale factor of 1.0000.

Although this survey is tied to Ordnance Survey, due to the scale factor, any setting out or design works should strictly use the control co-ordinates contained within the table.

Boundaries shown are physical features on site and do not necessarily represent the legal extents of ownership.

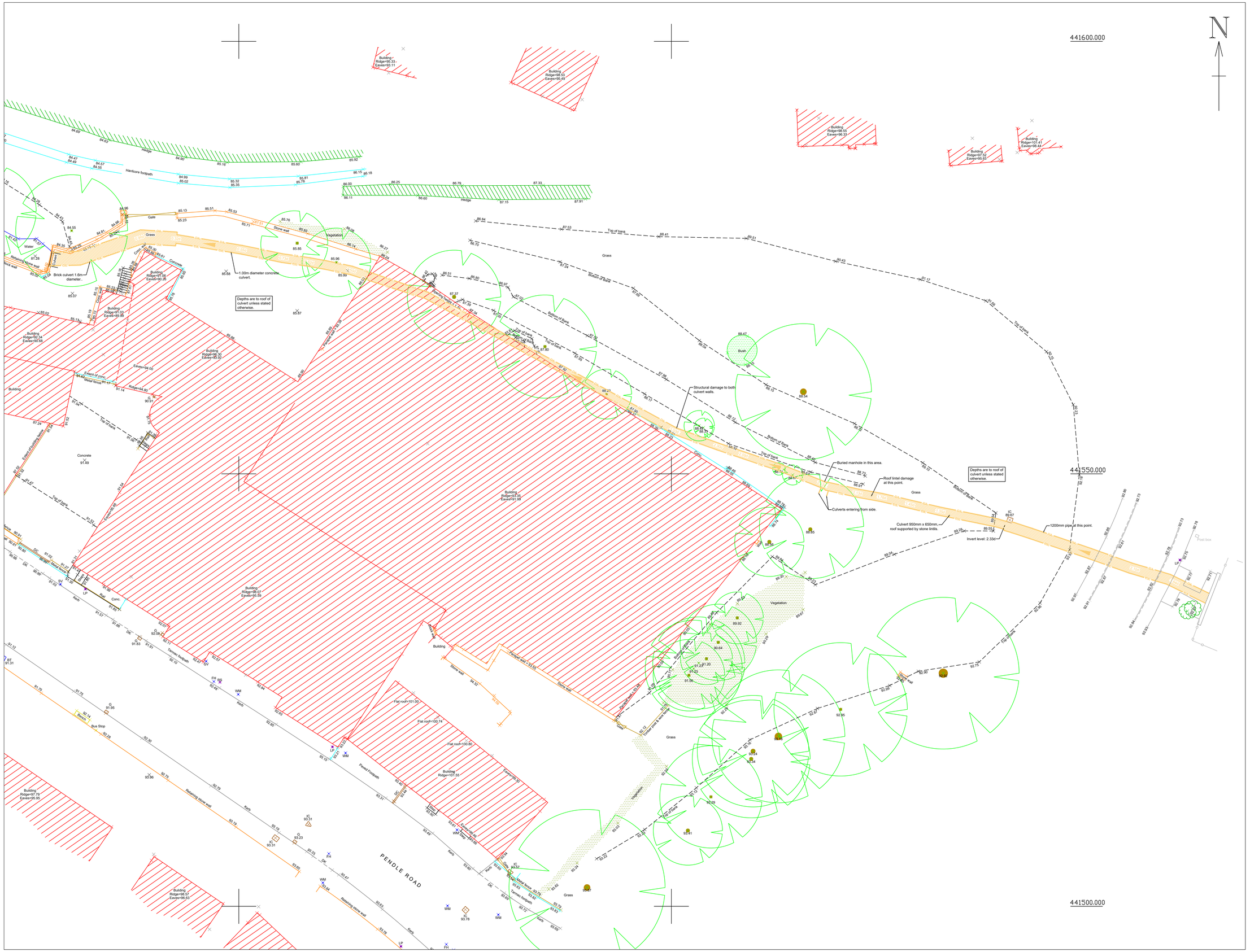
Control Station Coordinates

Station	Easting	Northing	Level
CSL52	374848.740	441562.282	88.275
CSL53	374869.856	441544.761	90.442
CSL54	374931.473	441483.083	93.835

AC	Air Condition
ARMC.	Armco Barrier
AV	Air Valve
BALC.	Balcony
BD	Building
BDCAN	Building Canopy
BH	Borehole
BL	Bed Level
BOB	Bottom Of Bank
BOL.	Bollard
BRDG	Bridge
BSHEL	Bus Shelter
BSTOP	Bus Stop
BT	British Telecom
BUSH	Bush
CARA.	Caravan
CATV	CATV
CB	Control Box
CBL	Cable
CCTV	CCTV
COL.	Column
CON.	Contour
CP	Car Parking
CPY	Canopy
CSL	Survey Station
CTR	Container
DC	Drainage Channel
DIA	Diameter
DK	Drop Kerb
EA	Edge Area
EP	Electric Pole-Pylon
ER	Earth Rod
EV	Eaves
F	Fence
FE	Fire Escape
FH	Fire Hydrant
FHT	Fence Height
FL	Floor Level
FP	Flag Pole
FR	Flat Roof
G	Gully
GARG	Garage
GH	Greenhouse
GT	Gate
GV	Gas Valve
H	Hedge
HH	Hedge Height
IC	Inspection Chamber
IL	Invert Level
K	Kerb
LP	Lamp post
MK	Marker
NB	Notice Board
OC	Overhead Cable
PI	Pipe
PE	Playground Equipment
PRT	Portacabin
PST	Post
RD	Ridge
RE	Rodding Eye
RM	Road Markings
RMP	Ramp
RS	Road Sign
SF	Street Furniture
SHD	Shed
ST	Stone
STP	Steps
SV	Stop Valve
TH	Threshold
TL	Traffic Light
TNK	Tank
TOB	Top Of Bank
TP	Telegraph Pole
TPT	Telegraph Pole Tie
TRH	Tree Height
TT	Tree Trunk
UTL	Unable To Lift
V	Vegetation
VH	Vegetation Height
VN	Vent
W	Wall
WH	Wall Height
WL	Water Level
WM	Water Meter
WO	Water Orifice
WTR	Water

APPENDIX C

Culvert Survey



LEGEND

CULVERT

ABBREVIATIONS

AV	AIR VALVE	IC	INSPECTION COVER
BH	BOREHOLE	IL	INVERT LEVEL
BOL	BOLLARD	LC	LIGHTING COLUMN
CAB	CABINET	LP	LAMP POST
CATV	CABLE TELEVISION COVER	MH	MANHOLE
CL	COVER LEVEL	P	POST
DP	DOWN PIPE	RE	RODDING EYE
D/U	DEPTH UNKNOWN	SP	SIGN POST
EJB	ELECTRICITY JUNCTION BOX	ST	STOP TAP
EOT	END OF TRACE	SV	SERVICE VALVE
ER	EARTH ROD	TL	TRAFFIC LIGHT
FH	FIRE HYDRANT	TP	TELEGRAPH POLE
FP	FLAG POLE	UTR	UNABLE TO RAISE
G	GULLY	UTT	UNABLE TO TRACE
GV	GAS VALVE	VP	VENT PIPE

NOTES

A RANGE OF METHODS ARE USED TO OBTAIN THE UNDERGROUND INFORMATION PRODUCED IN THIS DRAWING. VARIATIONS IN GROUND CONDITIONS CAN AFFECT THE QUALITY OF THE DATA AND THEREFORE AN ABSOLUTE AFFIRMATION CANNOT BE GUARANTEED.

POWER CARRYING FEATURES SHOWN ON THIS DRAWING ARE ILLUSTRATED BY AN INDIVIDUAL SERVICE LINE. THIS DOES NOT NECESSARILY REPRESENT THE NUMBER OF CABLES.

DEPTH OF UTILITY IS TAKEN AT THE POINT SHOWN ON THE DRAWING AND IS TO THE TOP OF THE SERVICE UNLESS STATED OTHERWISE. ALL DEPTHS ARE APPROXIMATE.

ALL DRAINAGE DEPTHS ARE TO PIPE INVERT UNLESS STATED OTHERWISE.

PIPE SIZES ARE SHOWN ONLY FROM VISUAL INSPECTION OR TAKEN FROM STATUTORY RECORDS.

A DEFINITION OF A SUB SURFACE ANOMALY IS AN AREA WHERE THE RADAR DATA SHOWS A SUBSTANTIAL CHANGE IN THE UNIFORM DATA FROM THE SURROUNDING AREA. THESE AREAS COULD BE VOIDS, HEAVILY SATURATED GROUND, BURIED TANKS OR OTHER SUB-SURFACE FEATURES.

EXCAVATIONS IN THE VICINITY OF SERVICES SHOWN ARE TO BE CARRIED OUT WITH DUE DILLIGENCE. (REF) HSG47.

THE FOLLOWING TEXT IS AN EXTRACT FROM SURVEYS OF LAND, BUILDINGS AND UTILITY SURVEYS AT SCALES OF 1:500 AND LARGER.ISSUED BY THE ROYAL INSTITUTE OF CHARTERED SURVEYORS (FEBRUARY 1996). "ELECTRONIC TRACING IS A RELIABLE METHOD OF LOCATING BURIED SERVICES. ON HEVILY BUILT UP SITES 85% COMPLETENESS IS PROBABLY ALL THAT CAN BE EXPECTED "PLAN ACCURACIES OF THE ORDER + OR - 150MM MAY BE ACHIEVED BUT THIS FIGURE WILL DEPEND ON THE DEPTH OF THE SERVICE BELOW GROUND LEVEL. WHERE SIMILAR SERVICES RUN IN CLOSE PROXIMITY, SEPARATION MAY BE IMPOSSIBLE. SUCESSFUL TRACING OF NON-METALLIC PIPES MAY BE LIMITED. "EXISTING RECORD INFORMATION SHOWING UNDERGROUND SERVICES IS OFTEN INCOMPLETE AND OF DOUBTFUL ACCURACY. IT SHOULD BE REGARDED ONLY AS AN INDICATION AND CANNOT BE GUARANTEED.

SHEET LAYOUT

REVISION	DESCRIPTION	DATE

PRODAR SURVEYS LTD.
Unit 20 Carlisle House
Carlisle Street
Goole DN14 5DS
T: +44 (0) 1482 778 588
F: +44 (0) 8443 913 111
E: info@prodarsurveys.co.uk
W: www.prodarsurveys.co.uk

JOB TITLE:	CSL SURVEYS (ENGINEERING) LTD PENDLE MILL CLITHEROE BB7 1JQ
DRAWING TITLE:	CULVERT LINE AND LEVEL SURVEY

DRAWING NO:	92307-001	DATE:	29/04/2022
SHEET NO:	No.1 of 1	REVISION:	
DRAWN BY:	MG	SCALE:	1:200 @ A1
CHECKED BY:	AB	APPROVED BY:	AG

SCALE BAR: 0.0m 2.0m 4.0m 6.0m 8.0m 10.0m

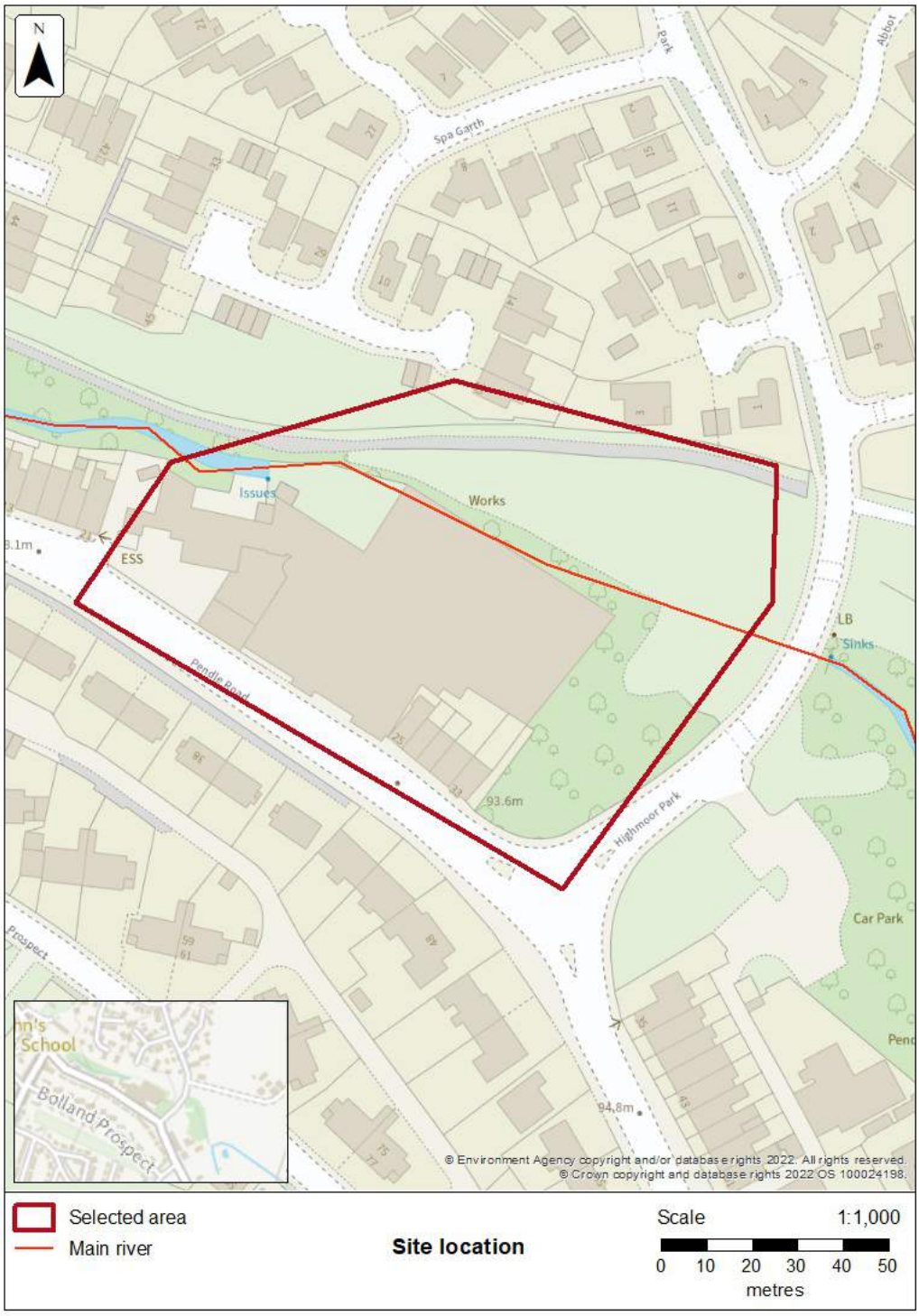
APPENDIX D

Environment Agency Modelled Flood Data

Flood risk assessment data

Location of site: 374928 / 441549 (shown as easting and northing coordinates)
Document created on: 11 April 2022
This information was previously known as a product 4.
Customer reference number: P6CRH2EYX3XG

Map showing the location that flood risk assessment data has been requested for.



How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

> **We recommend that you work with a flood risk consultant to get your flood risk assessment.**

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- areas benefiting from defences
- historic flooding
- flood defences and attributes
- modelled data
- climate change modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Not included in this document

This document does not include a Flood Defence Breach Hazard Map.

As your location benefits from flood defences, you need to request a Flood Defence Breach Hazard Map and information about the level of flood protection offered at your location from the Cumbria and Lancashire Environment Agency team at inforequests.cmblnc@environment-agency.gov.uk. This information will only be available if modelling has been carried out for breach scenarios.

Include a site location map in your request.

Surface water and other sources of flooding

Use the long term flood risk service to find out about the risk of flooding from:

- surface water
- ordinary watercourses
- reservoirs

For information about sewer flooding, contact the relevant water company for the area.

About the models used

Model name: Mearley Brook 2018
Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial
Date: 1 December 2017

This model contains the most relevant data for your area of interest.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occuring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your development is in flood zone 3.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change

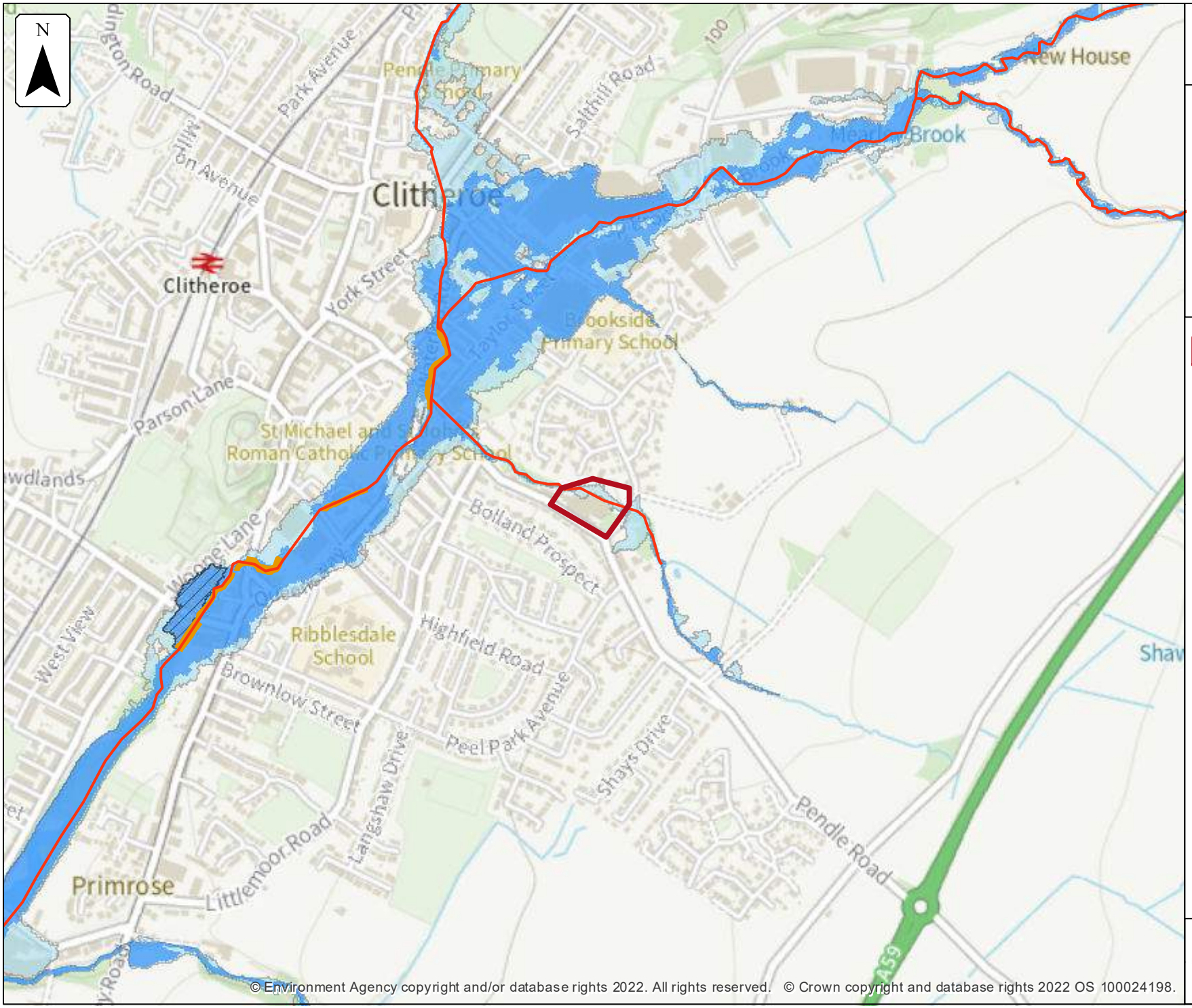
This data is updated on a quarterly basis as better data becomes available.

Areas benefiting from defences

This map shows the areas benefiting from defences for 2 possible events:

- fluvial (river flooding) event that has a 1% annual exceedance probability (AEP), this means a 1% chance of occurring in any one year
- tidal or coastal event that has a 0.5% annual exceedance probability (AEP), this means a 0.5% chance of occurring in any one year

Download the GIS dataset for areas benefiting from defences



Environment Agency

Flood map for planning

Location (easting/northing)
374928/441549

Scale
1:10,000

Created
11 Apr 2022

- Selected area
- Main river
- Flood defence
- Areas benefiting from flood defence
- Flood zone 3
- Flood zone 2

0 100 200 300 400 500
metres

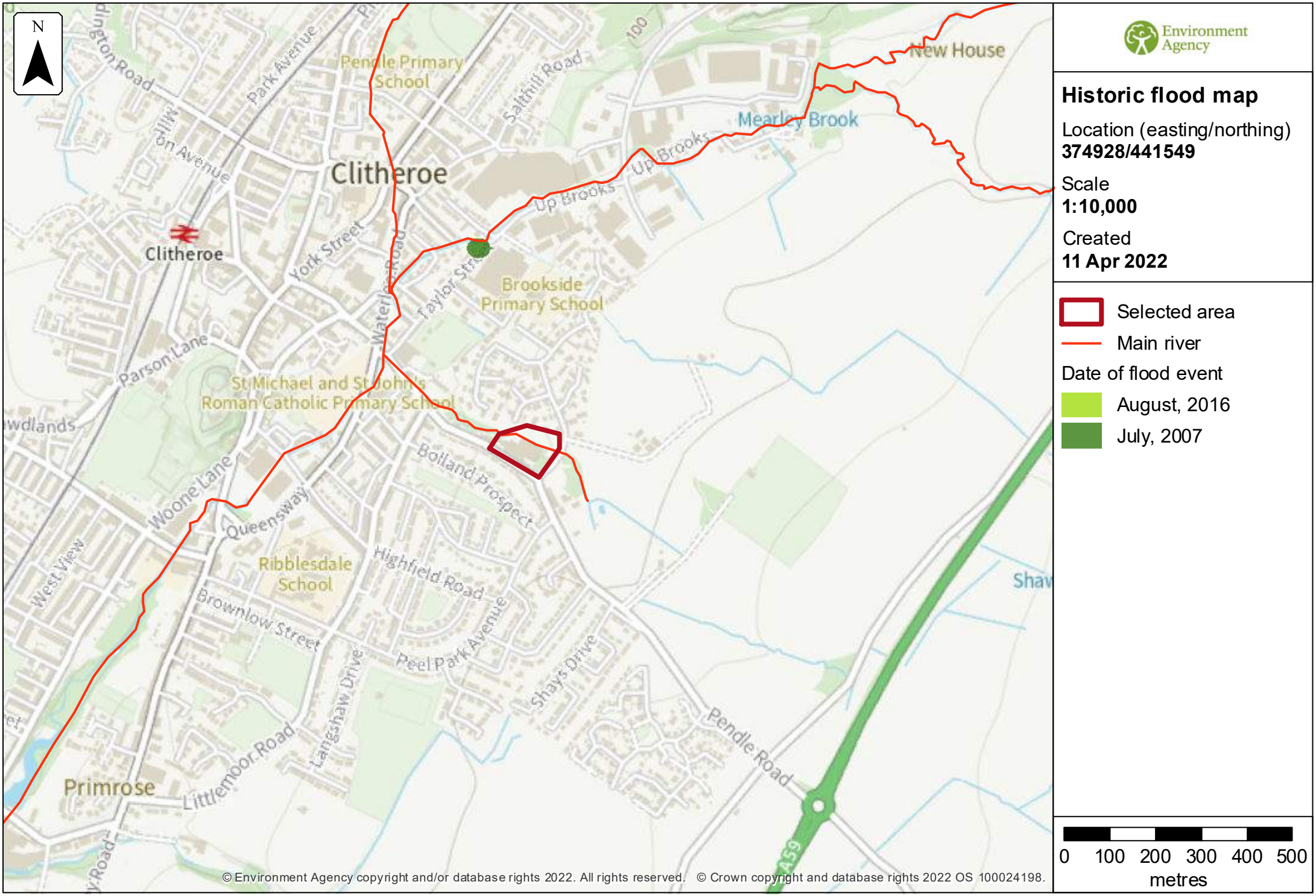
Historic flooding

This map is an indicative outline of areas that have previously flooded. Remember that:

- our records are incomplete, so the information here is based on the best available data
- it is possible not all properties within this area will have flooded
- other flooding may have occurred that we do not have records for
- flooding can come from a range of different sources - we can only supply flood risk data relating to flooding from rivers or the sea

You can also contact your Lead Local Flood Authority or Internal Drainage Board to see if they have other relevant local flood information. Please note that some areas do not have an Internal Drainage Board.

Download recorded flood outlines in GIS format



Environment Agency

Historic flood map

Location (easting/northing)
374928/441549

Scale
1:10,000

Created
11 Apr 2022

Selected area

Main river

Date of flood event

August, 2016

July, 2007

0 100 200 300 400 500
metres

Historic flood event data

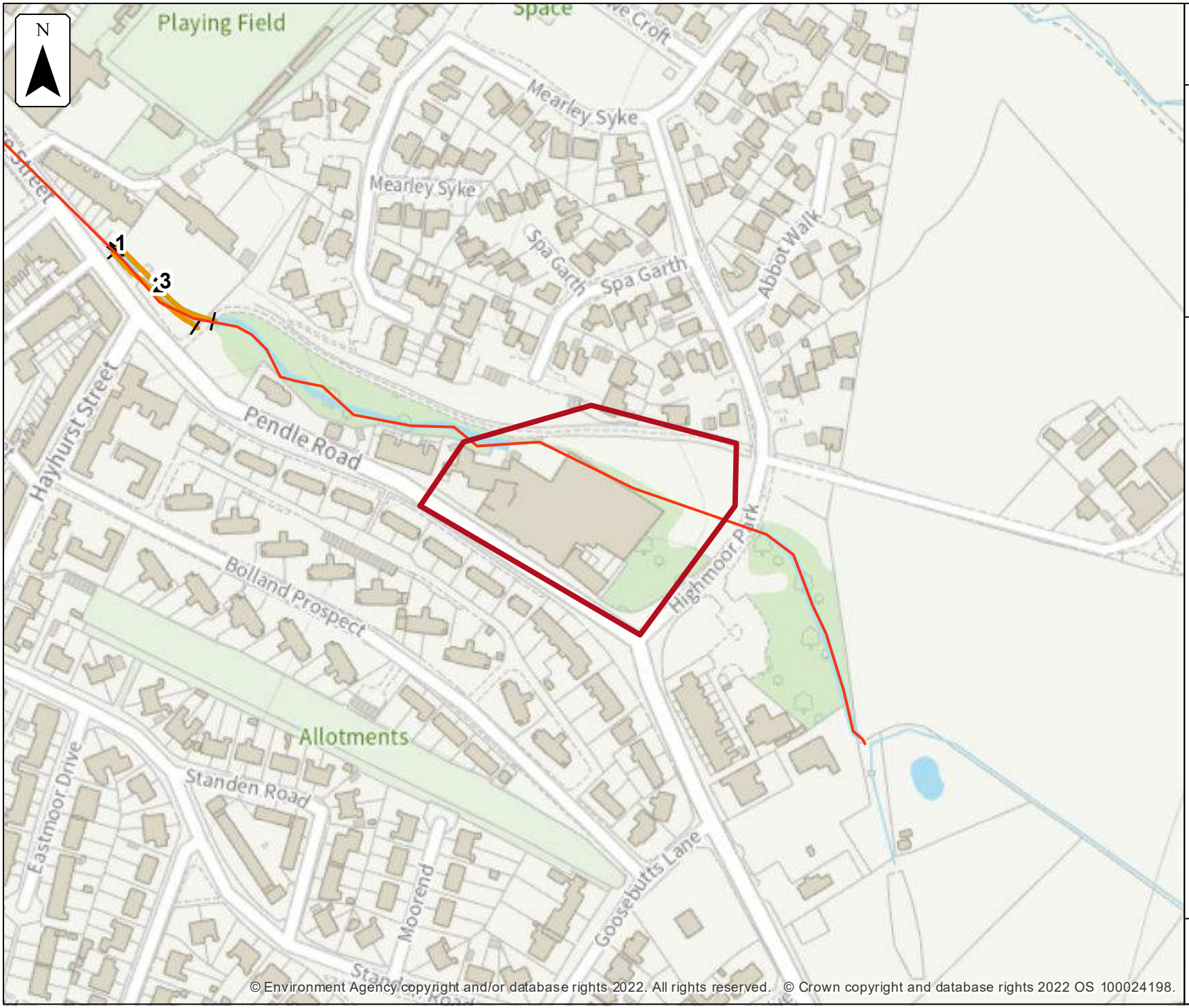
Start date	End date	Source of flood	Cause of flood	Affects location
22 August 2016	23 August 2016	main river	channel capacity exceeded (no raised defences)	No
3 July 2007	4 July 2007	ordinary watercourse	obstruction/blockage - culvert	No

Flood defences and attributes

The flood defences map shows the location of the flood defences present.

The flood defences data table shows the type of defences, their condition and the standard of protection. It shows the height above sea level of the top of the flood defence (crest level). The height is In mAOD which is the metres above the mean sea level at Newlyn, Cornwall.

It's important to remember that flood defence data may not be updated on a regular basis. The information here is based on the best available data.



Environment Agency

Flood defences

Location (easting/northing)
374928/441549

Scale
1:2,500

Created
11 Apr 2022

Selected area
Main river
Flood defence

0 25 50 75 100
metres

Flood defences data

Label	Asset ID	Asset Type	Standard of protection (years)	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
1	536674	Flood Gate		Fair	77.10	77.10	77.10
2	148786	Wall	10	Poor	78.25	79.30	78.25
3	150181	Wall	10	Poor	78.10	79.90	78.10

Any blank cells show where a particular value has not been recorded for an asset.

Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- modelled node point map(s) showing the points used to get the data to model the scenarios and table(s) providing details of the flood risk for different return periods
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

Climate change

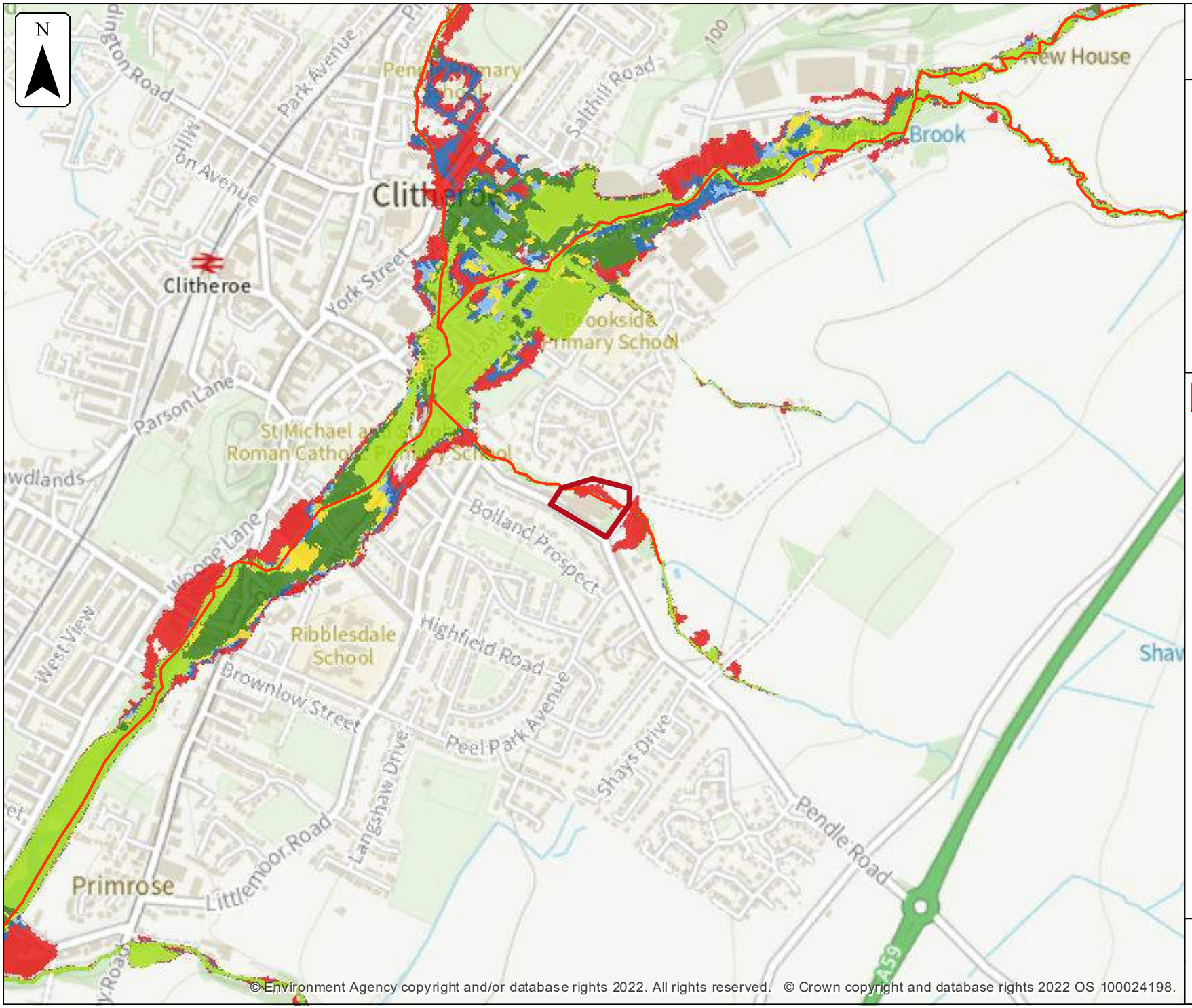
The climate change data included in the models may not include the latest flood risk assessment climate change allowances. Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

Modelled scenarios

The following scenarios are included:

- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- Defences removed modelled fluvial: risk of flooding from rivers where flood defences have been removed
- Defended climate change modelled fluvial: risk of flooding from rivers where there are flood defences, including estimated impact of climate change



Environment Agency

Defended modelled fluvial extent

Location (easting/northing)
374928/441549

Scale
1:10,000

Created
11 Apr 2022

Model name
Mearley Brook 2018

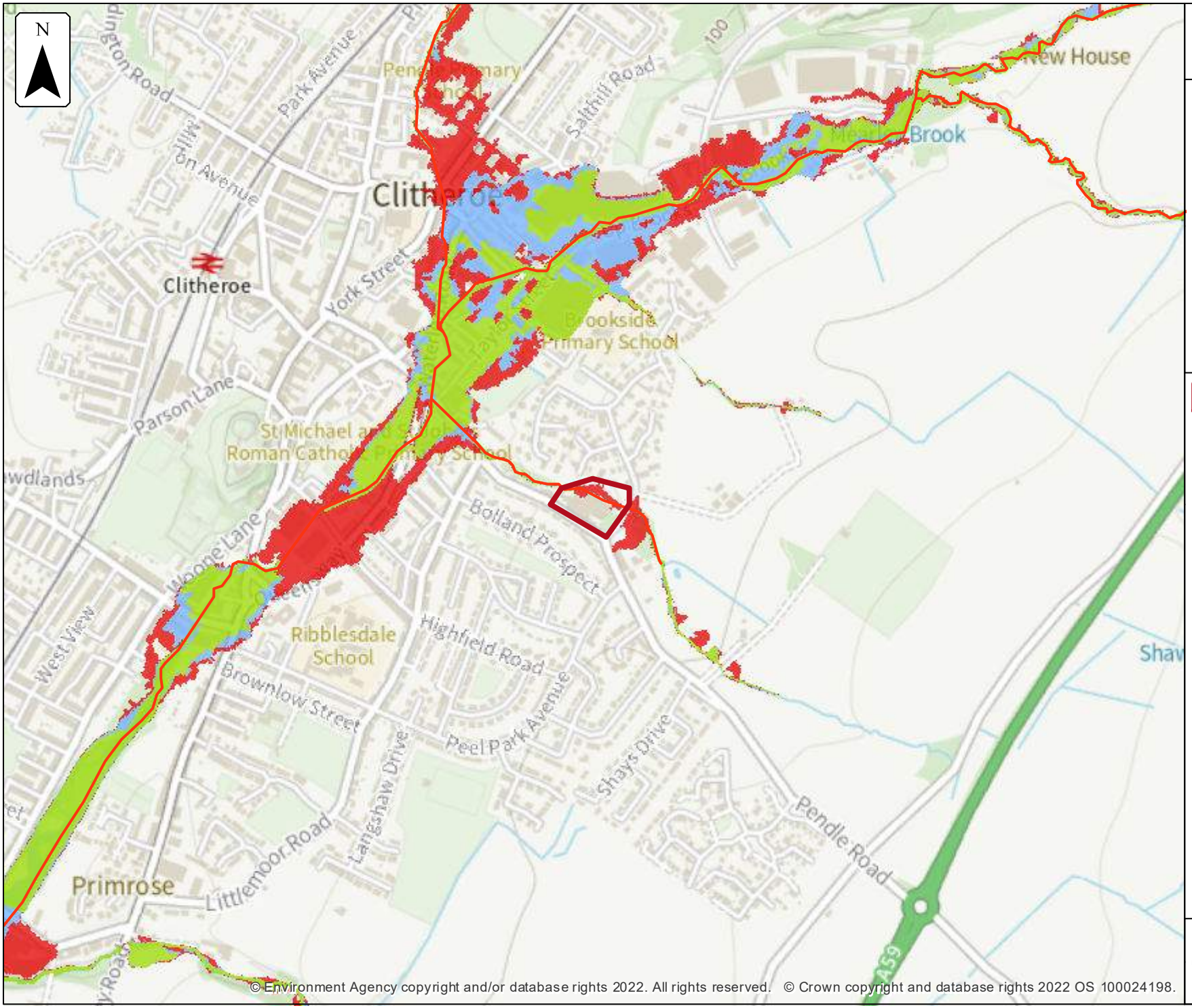
- Selected area
- Main river

Modelled flood extent

- 5% AEP
- 2% AEP
- 1.33% AEP
- 1% AEP
- 0.5% AEP
- 0.1% AEP

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres



Environment Agency

Defences removed modelled fluvial extent

Location (easting/northing)
374928/441549

Scale
1:10,000

Created
11 Apr 2022

Model name
Mearley Brook 2018

Selected area

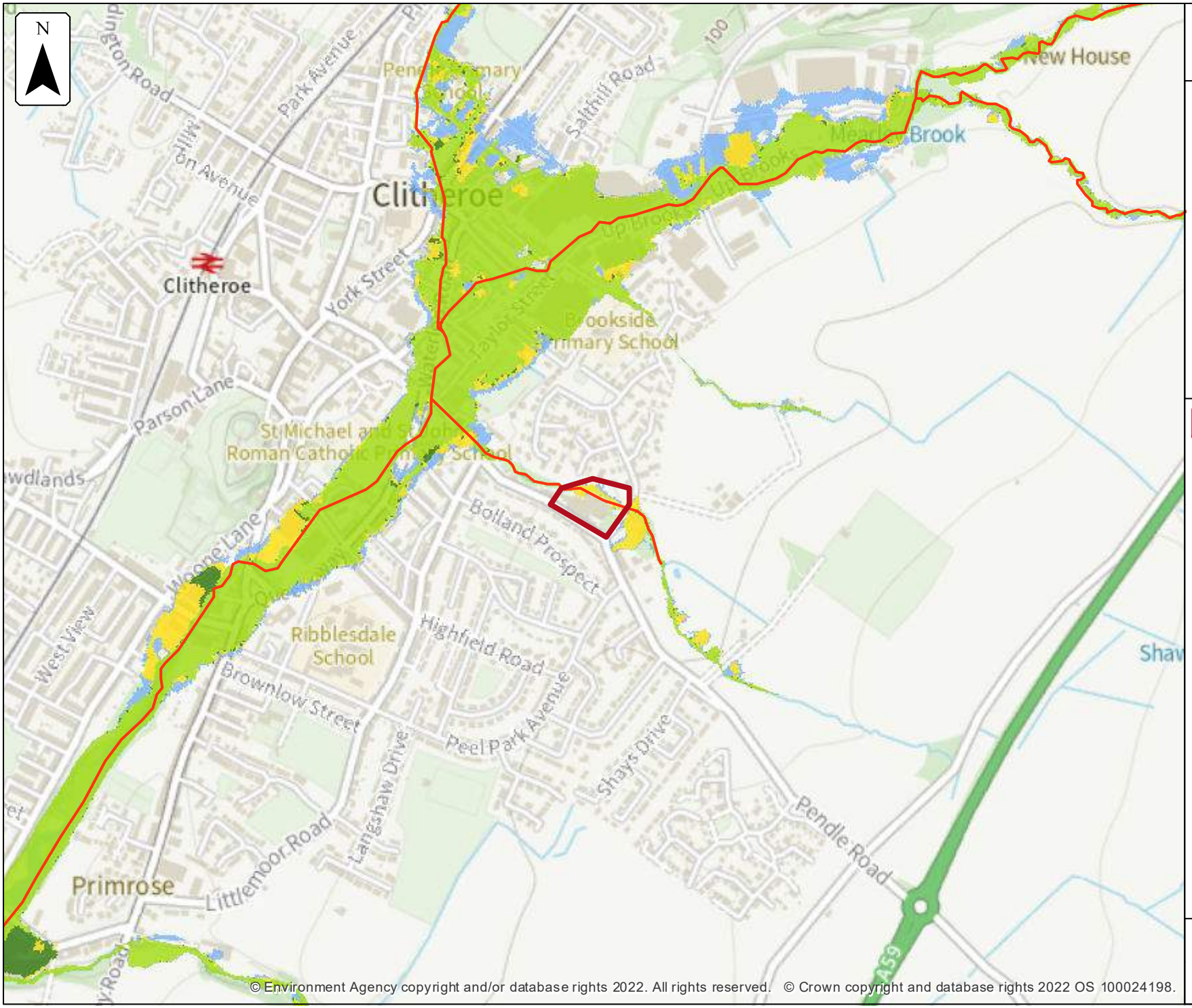
Main river

Modelled flood extent

- 5% AEP
- 1% AEP
- 0.1% AEP

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres



Environment Agency

Defended climate change modelled fluvial extent

Location (easting/northing)
374928/441549

Scale
1:10,000

Created
11 Apr 2022

Model name
Mearley Brook 2018

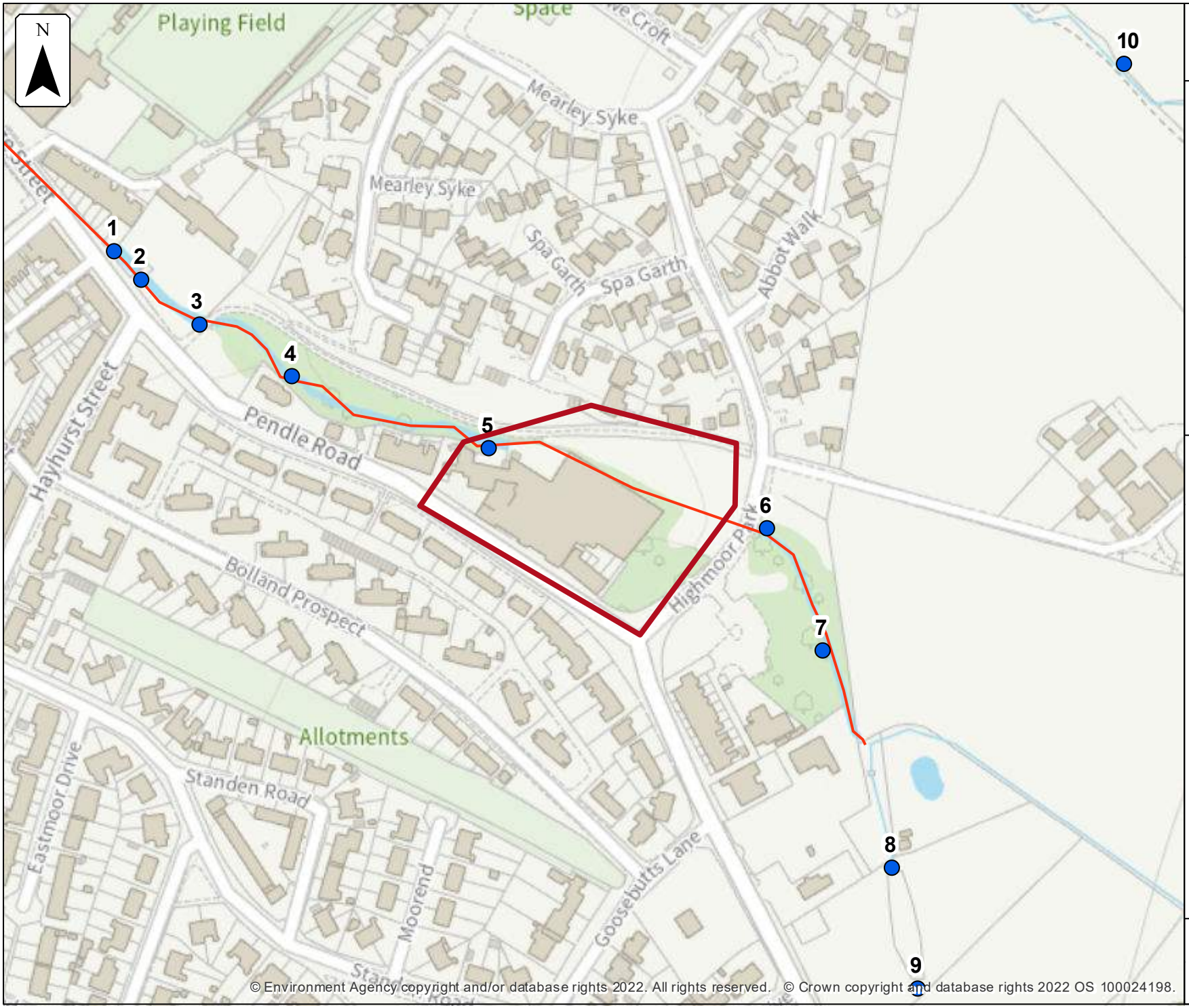
- Selected area
- Main river

Modelled flood extent

- 1.0% AEP (+30%)
- 1.0% AEP (+35%)
- 1.0% AEP (+70%)
- 0.1% AEP (+30%)

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres



Environment Agency

Defended modelled fluvial node locations

Location (easting/northing)
374928/441549

Scale
1:2,500

Created
11 Apr 2022

Model name
Mearley Brook 2018

Selected area
Modelled location
Main river

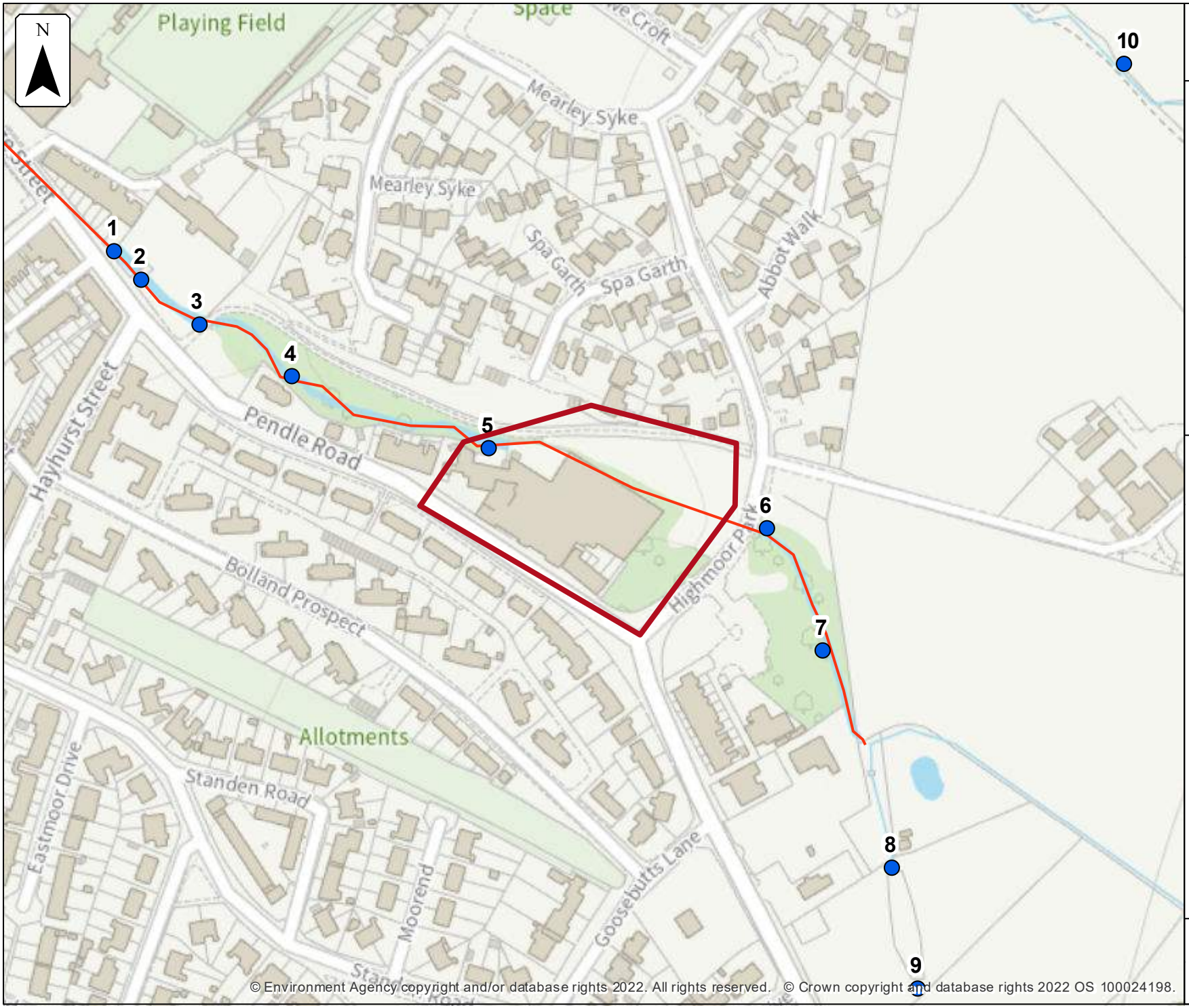
0 25 50 75 100
metres

Modelled node locations data

Defended

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	982264	374694	441672	75.61	2.22	75.83	2.75	76.07	3.02	76.26	3.23	76.85	3.85	77.74	4.69
2	982352	374708	441658	76.58	2.22	76.65	2.75	76.68	3.02	76.72	3.25	76.98	3.86	77.98	6.04
3	982269	374736	441636	77.26	2.22	77.33	2.75	77.36	3.02	77.38	3.24	77.49	3.86	78.03	6.04
4	982263	374781	441611	78.61	2.08	78.67	2.57	78.69	2.82	78.71	3.02	78.76	3.61	78.91	5.64
5	982431	374877	441576	81.72	2.08	81.77	2.57	81.79	2.82	81.81	3.02	81.87	3.60	81.96	4.59
6	982333	375013	441537	91.84	2.08	92.03	2.57	92.12	2.82	92.20	3.02	92.61	3.60	93.33	5.65
7	982374	375040	441477	93.40	1.78	93.47	2.20	93.51	2.42	93.61	2.97	93.62	3.26	93.88	4.85
8	982382	375074	441372	96.40	1.78	96.56	2.20	96.64	2.42	96.70	2.80	96.70	3.09	96.84	4.85
9	982365	375086	441313	97.52	1.78	97.60	2.20	97.64	2.42	97.67	2.59	97.73	3.09	97.85	4.85
10	982456	375187	441763	93.92	1.50	93.97	1.85	94.0	2.03	94.02	2.18	94.08	2.60	94.21	4.08

Data in this table comes from the Mearley Brook 2018 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defences removed modelled fluvial node locations

Location (easting/northing)
374928/441549

Scale
1:2,500

Created
11 Apr 2022

Model name
Mearley Brook 2018

Selected area
Modelled location
Main river

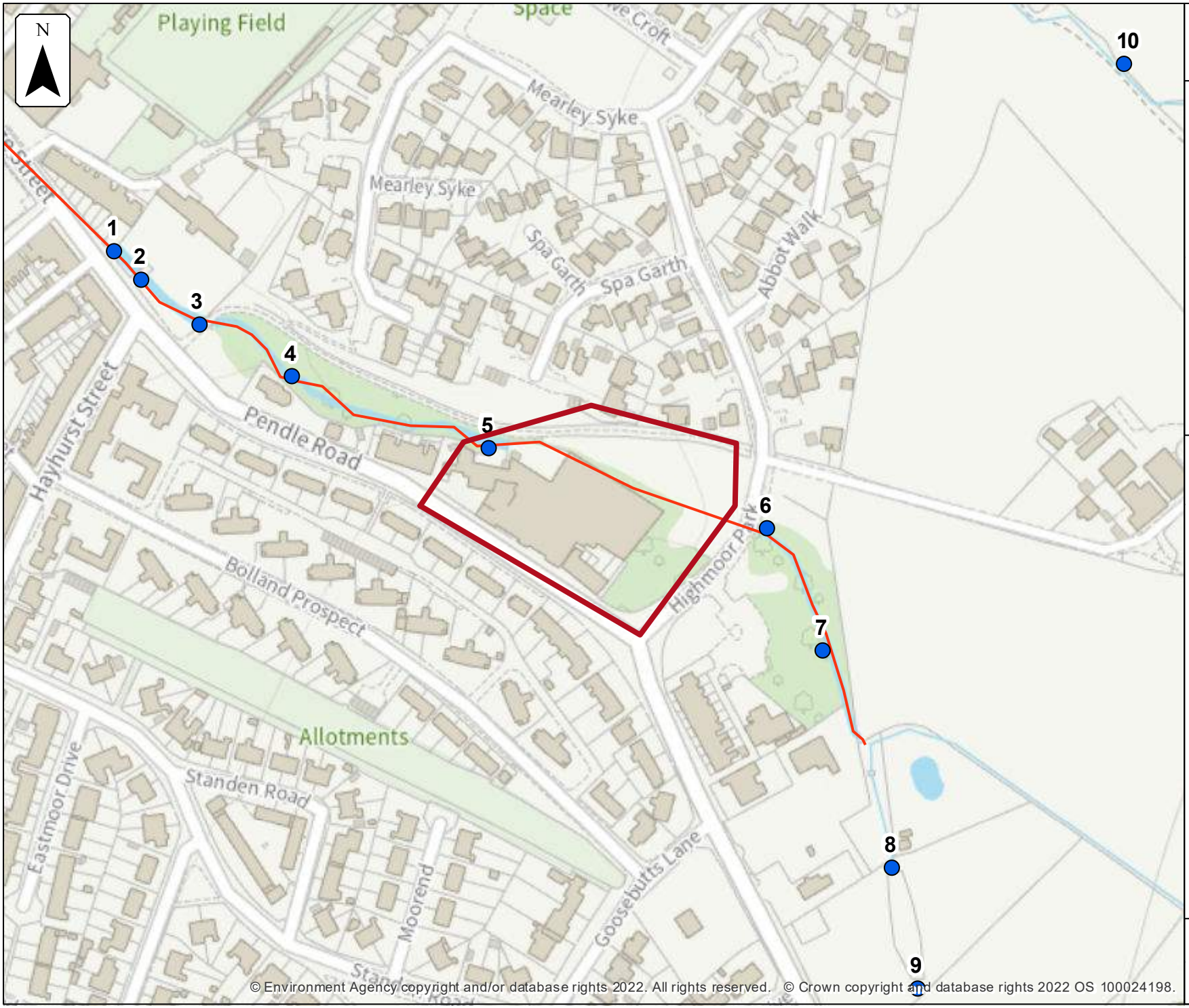
0 25 50 75 100
metres

Modelled node locations data

Defences removed

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	982264	374694	441672	75.61	2.22					76.21	3.23			76.53	3.46
2	982352	374708	441658	76.58	2.22					76.72	3.25			76.99	5.70
3	982269	374736	441636	77.26	2.22					77.38	3.24			77.66	6.04
4	982263	374781	441611	78.61	2.08					78.71	3.02			78.95	5.64
5	982431	374877	441576	81.72	2.08					81.81	3.02			81.94	4.59
6	982333	375013	441537	91.84	2.08					92.20	3.02			93.33	5.65
7	982374	375040	441477	93.40	1.78					93.61	2.97			93.88	4.85
8	982382	375074	441372	96.40	1.78					96.70	2.80			96.84	4.85
9	982365	375086	441313	97.52	1.78					97.67	2.59			97.85	4.85
10	982456	375187	441763	93.92	1.50					94.02	2.18			94.21	4.08

Data in this table comes from the Mearley Brook 2018 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defended climate change modelled fluvial node locations

Location (easting/northing)
374928/441549

Scale
1:2,500

Created
11 Apr 2022

Model name
Mearley Brook 2018

Selected area
Modelled location
Main river

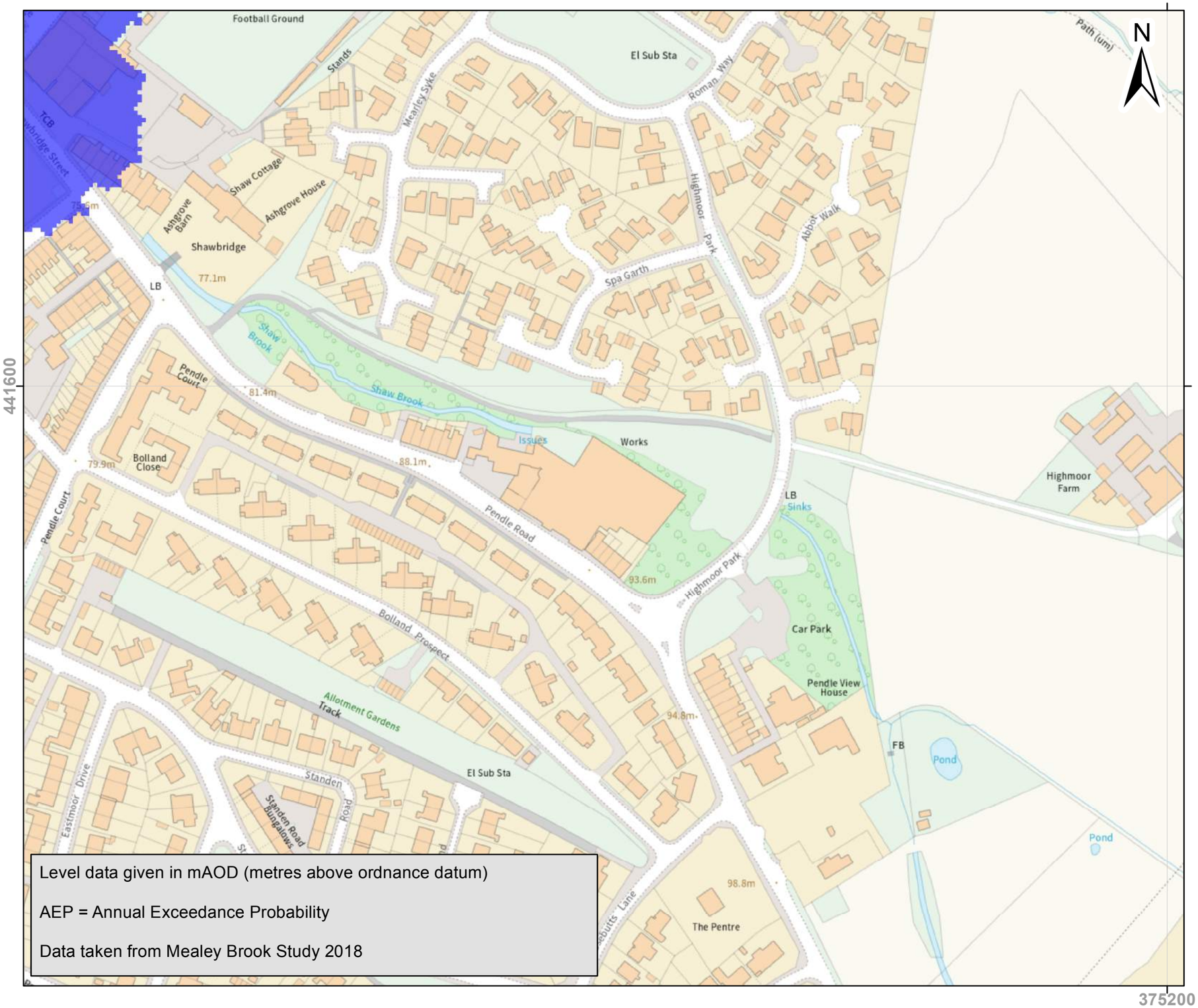
0 25 50 75 100
metres

Modelled node locations data

Defended climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+30%)		1.0% AEP (+35%)		1.0% AEP (+70%)		0.1% AEP (+30%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	982264	374694	441672	77.19	4.19	77.36	4.35	77.71	4.66	77.81	4.74
2	982352	374708	441658	77.32	4.20	77.50	4.35	77.91	5.52	78.16	7.63
3	982269	374736	441636	77.58	4.20	77.65	4.36	77.97	5.52	78.20	7.83
4	982263	374781	441611	78.77	3.92	78.78	4.07	78.86	5.16	79.06	7.30
5	982431	374877	441576	81.90	3.92	81.91	4.07	81.95	4.55	81.98	4.68
6	982333	375013	441537	92.83	3.92	92.93	4.07	93.30	5.13	93.40	7.35
7	982374	375040	441477	93.68	3.36	93.71	3.50	93.85	4.40	93.94	6.30
8	982382	375074	441372	96.70	3.36	96.71	3.50	96.81	4.40	96.91	6.30
9	982365	375086	441313	97.75	3.36	97.76	3.49	97.83	4.40	97.91	6.30
10	982456	375187	441763	94.10	2.83	94.11	2.94	94.18	3.70	94.32	5.30

Data in this table comes from the Mearley Brook 2018 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Mealey Brook Study 2018

Environment Agency

Fluvial Flood Levels Map:
Pendle Mill Showrooms,
Clitheroe, BB7 1JQ

Key

Fluvial Defended 1% annual probability of flooding scenario

mAOD

High : 89

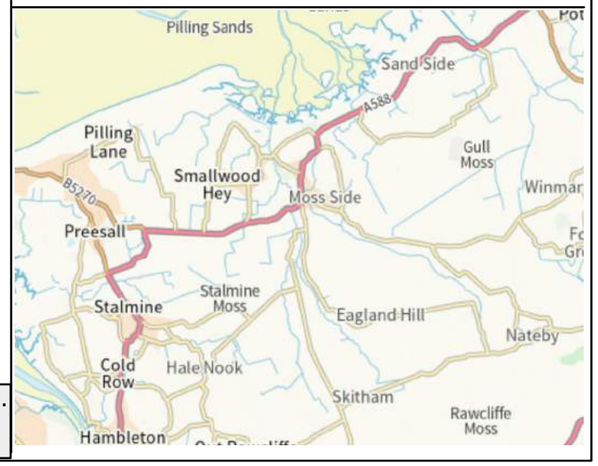
Low : 85

Flood Zone 3 shows the area that could be affected by flooding:

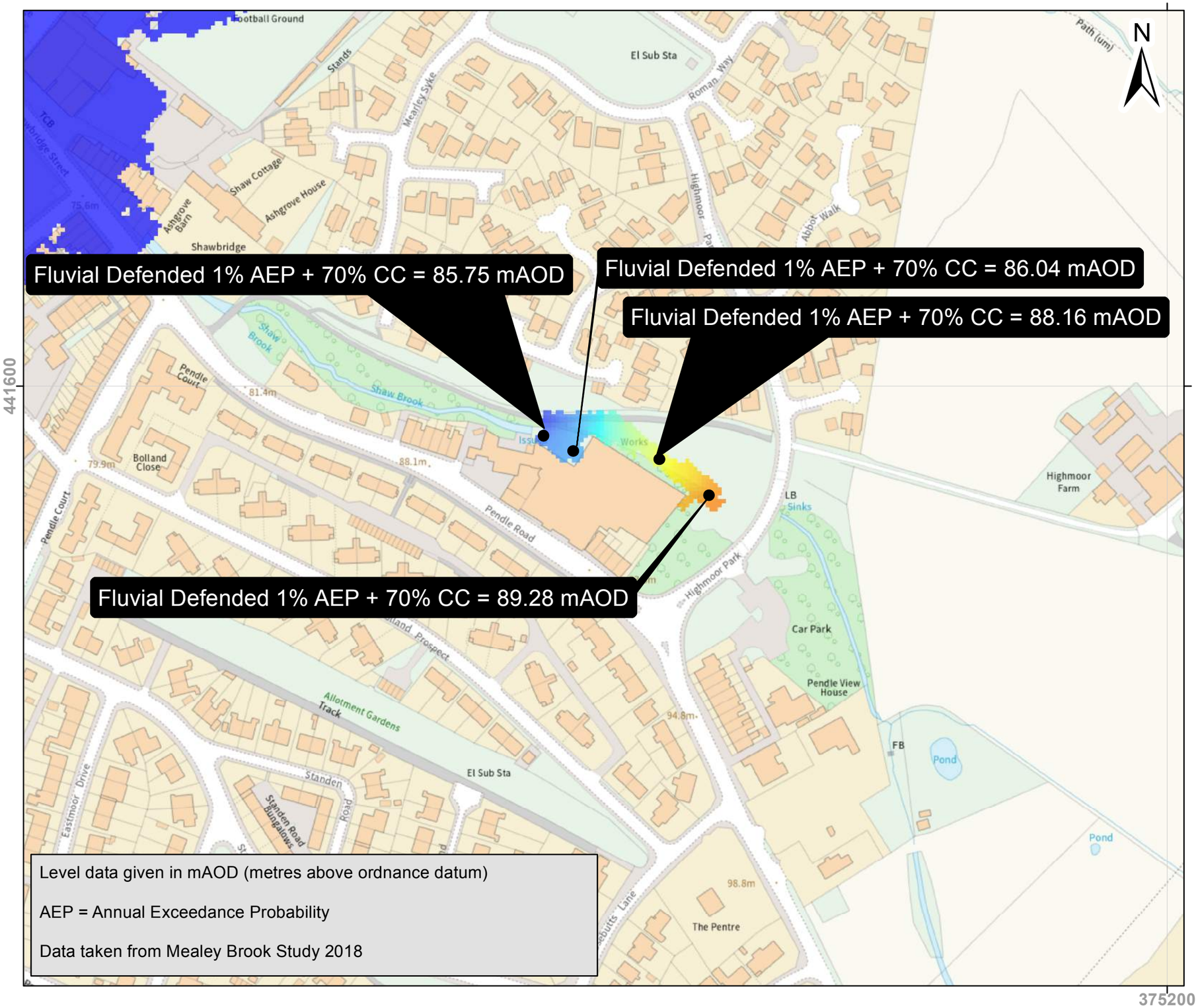
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 0.5% tidal, or 1.0% fluvial flood event.



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



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Mealey Brook Study 2018

Environment Agency

Fluvial Flood Levels Map:
Pendle Mill Showrooms,
Clitheroe, BB7 1JQ

Key

Fluvial Defended 1% annual probability of flooding scenario + 70% Climate Change

mAOD

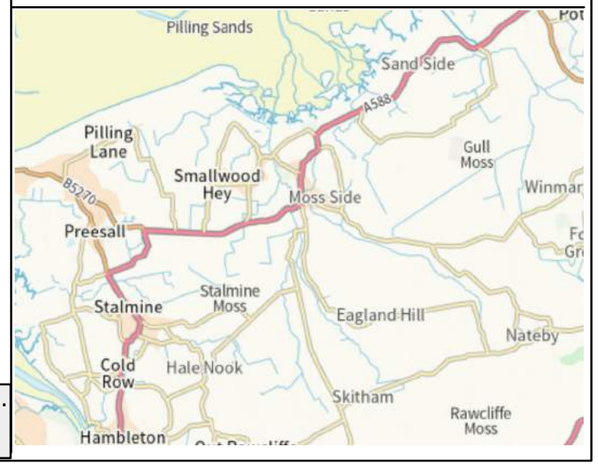
High : 90

Low : 85

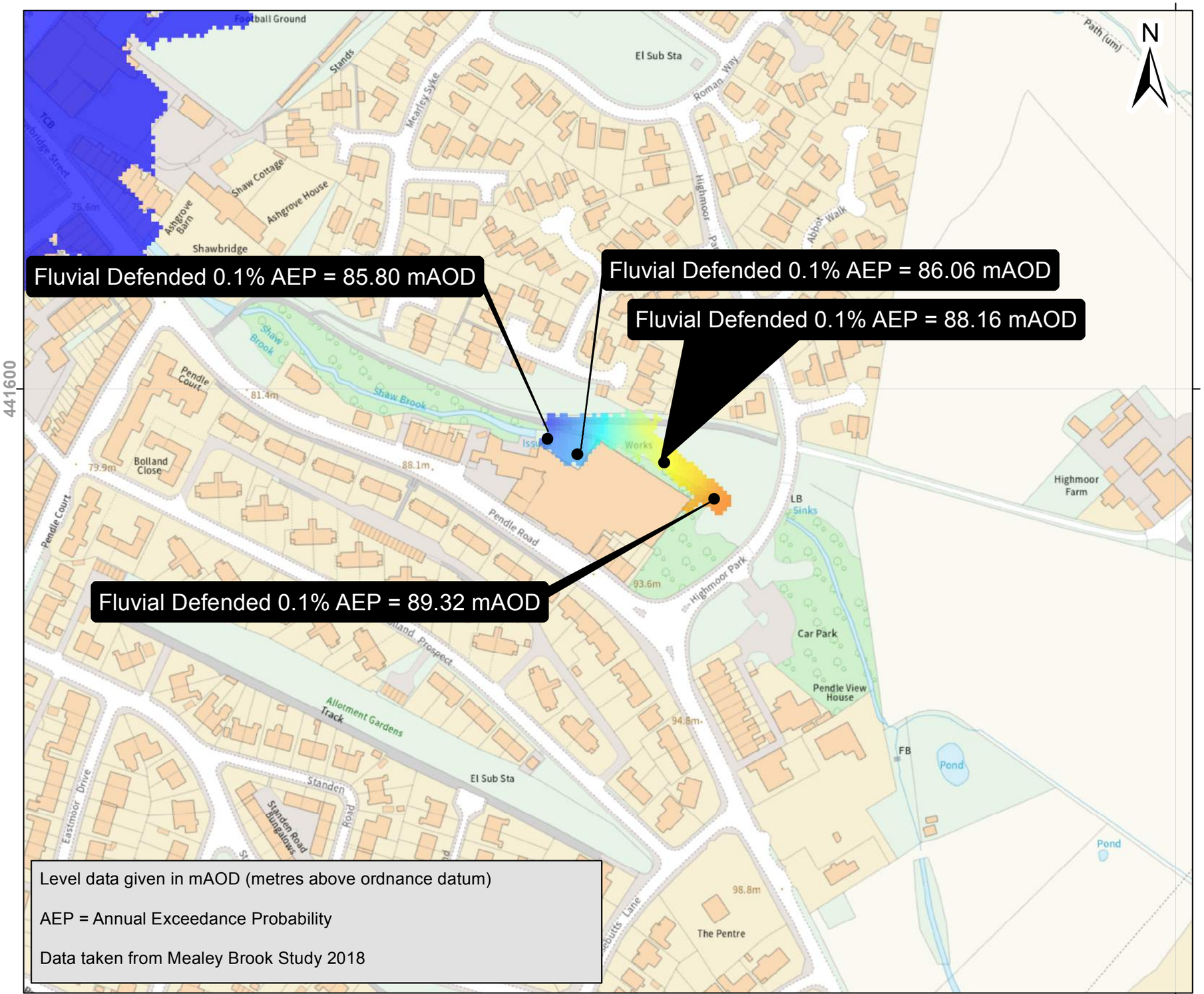
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 0.5% tidal, or 1.0% fluvial flood event.



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



Environment Agency

Fluvial Flood Levels Map:
Pendle Mill Showrooms,
Clitheroe, BB7 1JQ

Key

Fluvial Defended 0.1% annual probability of flooding scenario

mAOD

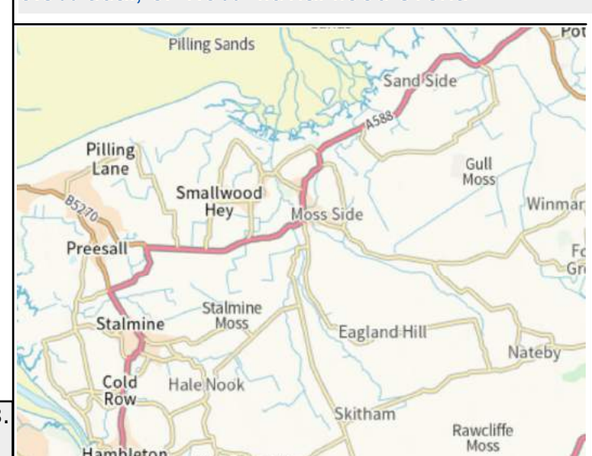
High : 90

Low : 85

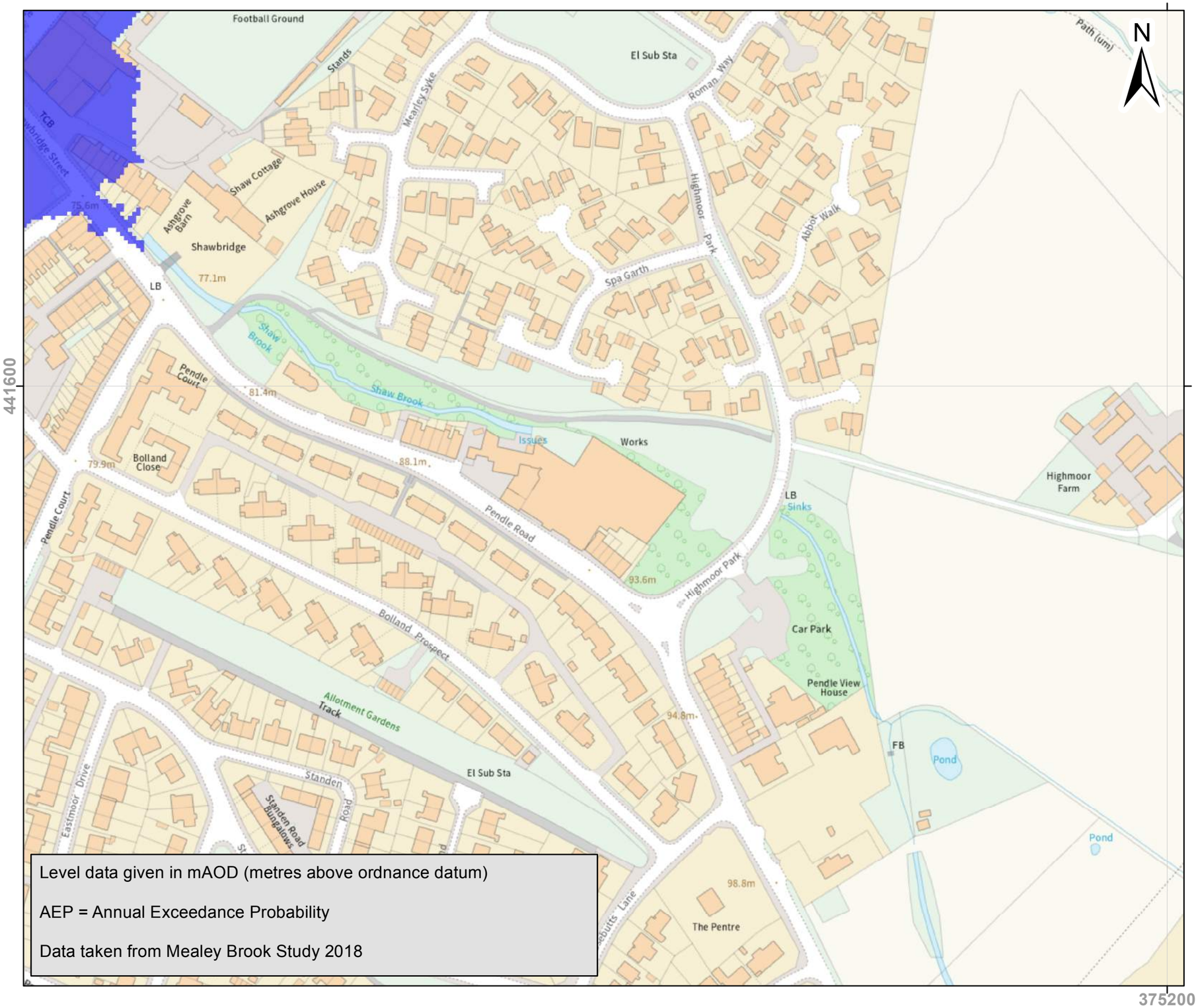
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 0.5% tidal, or 1.0% fluvial flood event.



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



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Mealey Brook Study 2018

Environment Agency

Fluvial Flood Levels Map:
Pendle Mill Showrooms,
Clitheroe, BB7 1JQ

Key

Fluvial Undefended 1% annual probability of flooding scenario

mAOD

High : 89

Low : 85

Flood Zone 3 shows the area that could be affected by flooding:

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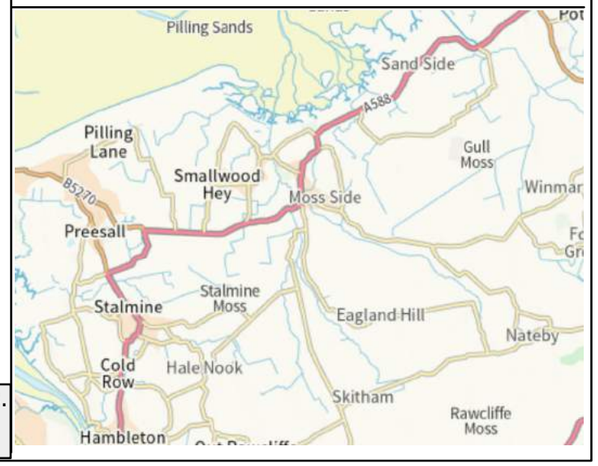

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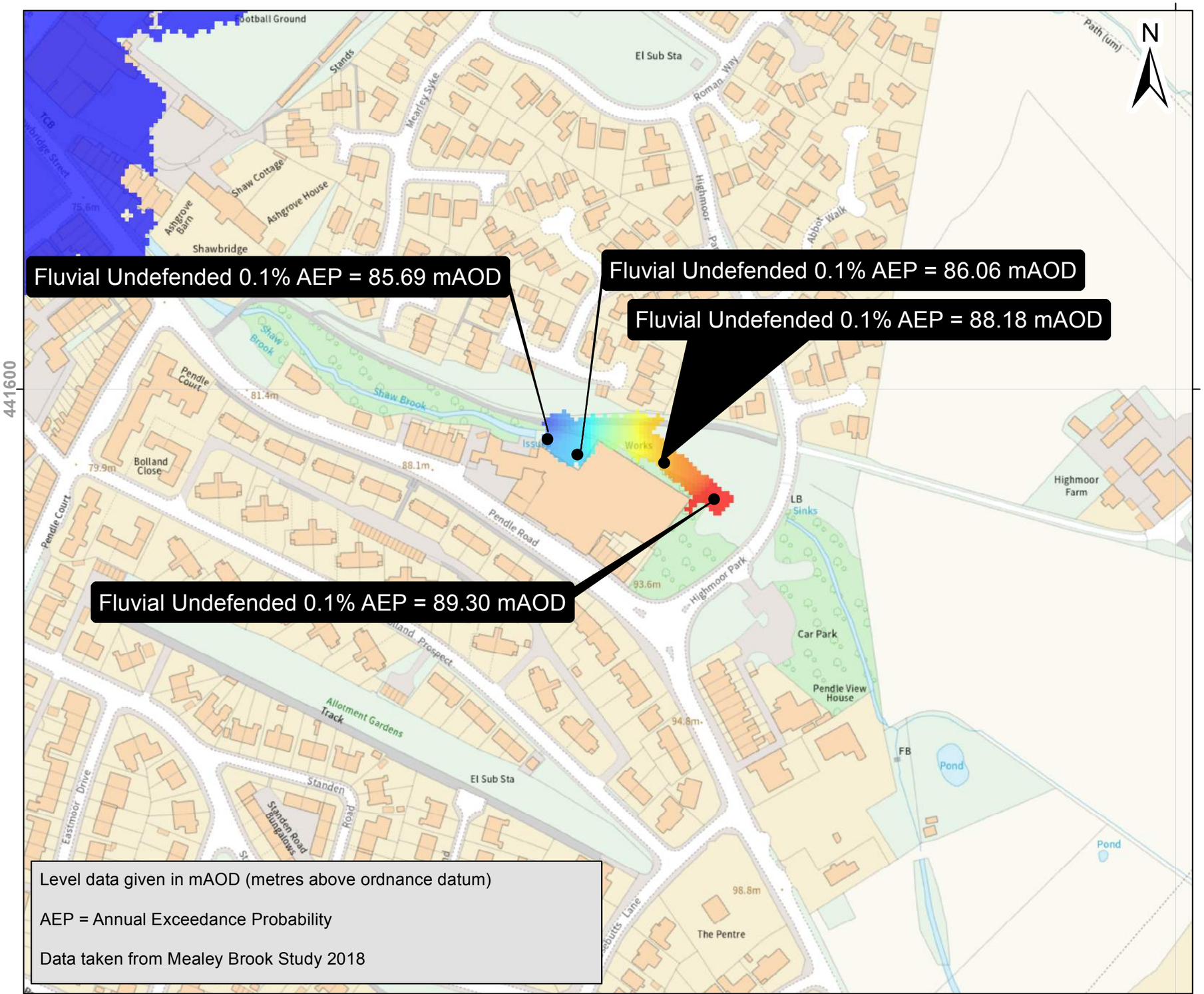

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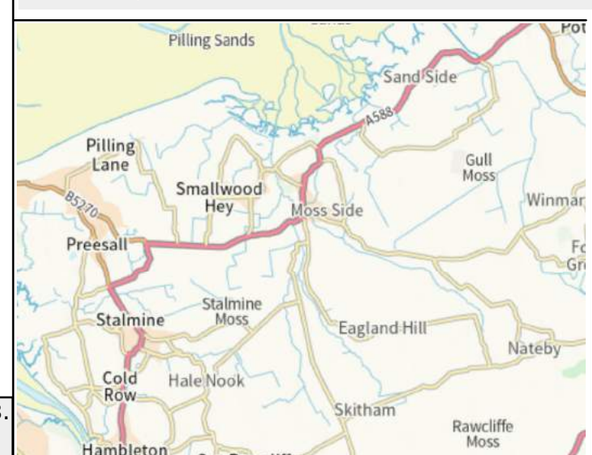


Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

Find out more about flood risk activity permits

Help and advice

Contact the Cumbria and Lancashire Environment Agency team at inforequests.cmblnc@environment-agency.gov.uk for:

- more information about getting a product 5, 6, 7 or 8
- general help and advice about the site you're requesting data for

Site Location	Pendle Mill Showrooms, Pendle Rd., Clitheroe	CL253138

Fluvial Defences

Asset ID	National Grid Reference	Asset Type	Protection Type	Location	Maintained By	Design Standard (Return Period)	Overall Condition Grade	Effective Crest Level (m)		E.C.L Data Quality (Reliable 1-4 Unreliable)	Length (m)	Height (m)
								UCL (mAOD)	DCL (mAOD)			
67006	SD7431441441	Wall	Fluvial	Moor Lane to Culvert at Homebase Car Park off Queensway	Environment Agency	10	3 - Fair	72.86	73.65	2	89.42	3.3
67140	SD7461941745	Wall	Fluvial	Shawbridge Street to Holden Street	Environment Agency	5	3 - Fair	76.01	75.92	1	179.94	3.8
148786	SD7469441672	Wall	Fluvial	Culvert adjacent Shawbridge Street to Access Bridge off Pendle Road	Environment Agency	10	4 - Poor	79.3	78.25	1	55.06	-
536674	SD7469641674	Flood Gate	Fluvial	Shawbridge Street	Environment Agency	-	3 - Fair	77.1	77.1	2	2.3	1.5
150181	SD7469641674	Wall	Fluvial	Culvert adjacent Shawbridge Street to Access Bridge off Pendle Road	Environment Agency	10	4 - Poor	79.9	78.1	1	63.33	-

The Environmental Permitting (England and Wales) Regulations 2016 require a permit to be obtained for any activities which will take place:

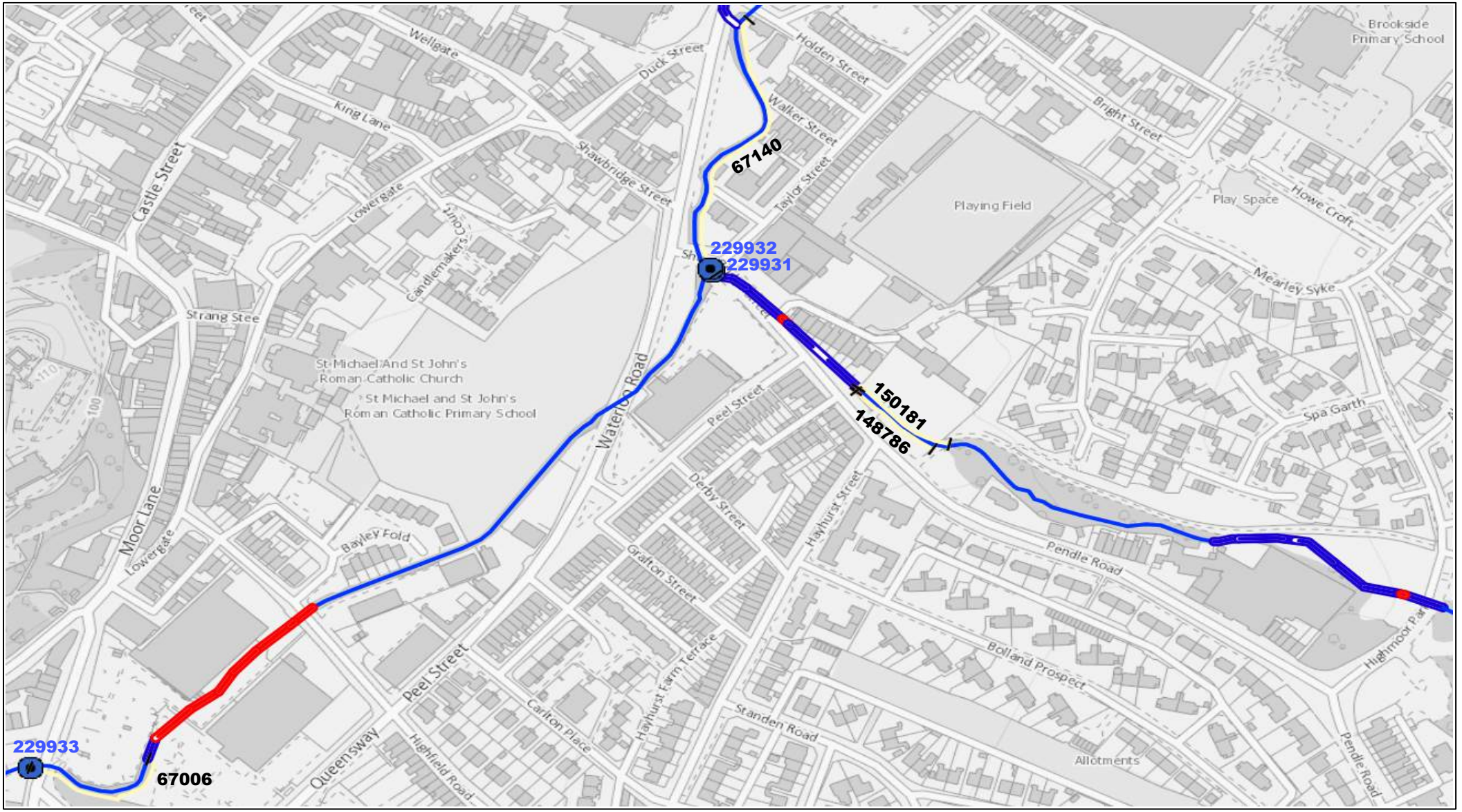
- **on or within 8 metres of a flood defence structure or culvert (16 metres if tidal)**
- **on or within 16 metres of a sea defence**

Site Location	Pendle Mill Showrooms, Pendle Rd., Clitheroe	CL253138

Fluvial Structures

Asset ID	National Grid Reference	Asset Type	Protection Type	Location	Maintained By	Design Standard (Return Period)	Overall Condition Grade	Width (m)	Height (m)
229933	SD74254143	Outfall	Fluvial	Downstream face of Moor Lane	Private individual, Company or Charity	-	3 - Fair	0.3	2.2
229931	SD74614174	Outfall	Fluvial	Downstream of Shawbridge Street	Private individual, Company or Charity	-	3 - Fair	-	-
229932	SD74614174	Outfall	Fluvial	Downstream of Shawbridge Street	Private individual, Company or Charity	-	3 - Fair	-	1.5

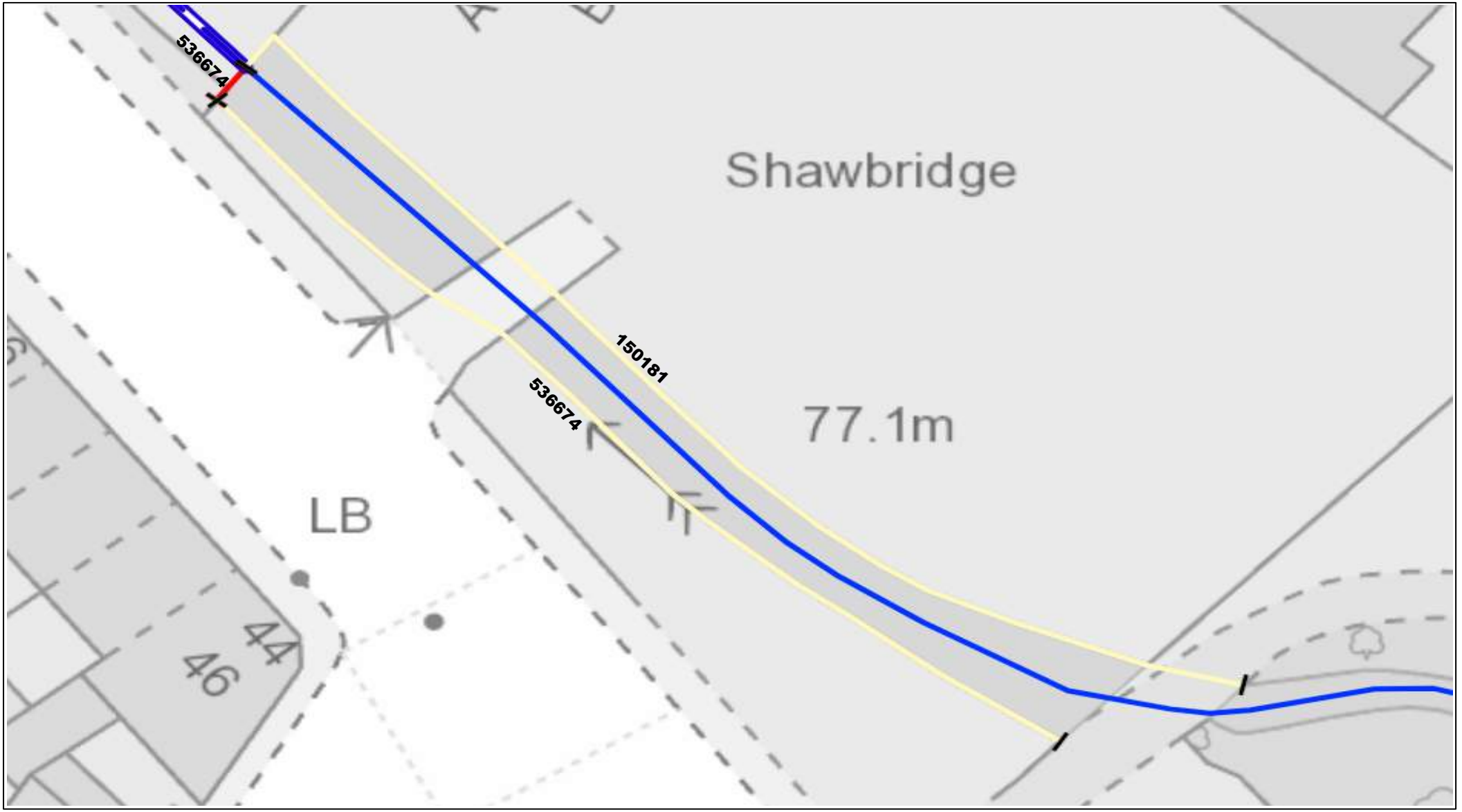
CL253138 Pendle Mill Showrooms, Pendle Rd., Clitheroe - Overview Map



March 8, 2022

- Beach
- Bridge Abutment
- Cliff
- Demountable Defence
- Dunes
- Embankment
- Engineered High Ground
- Flood Gate
- Natural High Ground
- Spillway
- Wall
- Open Channel
- Simple Culvert
- Complex Culvert
- Outfall

CL253138 Pendle Mill Showrooms, Pendle Rd., Clitheroe - Map 1



March 8, 2022

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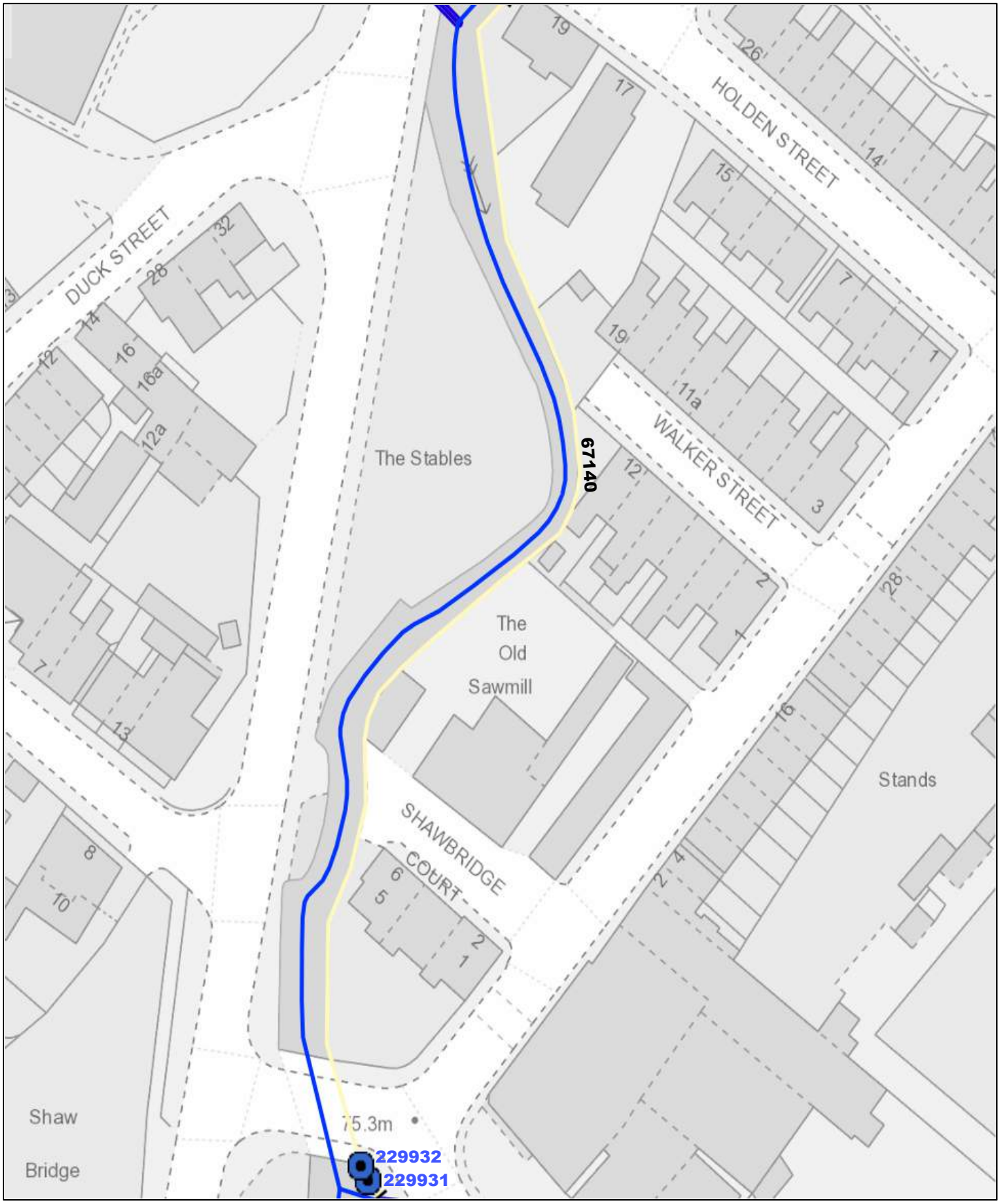
- Simple Culvert
- Complex Culvert
- Outfall

CL253138 Pendle Mill Showrooms, Pendle Rd., Clitheroe - Map 2

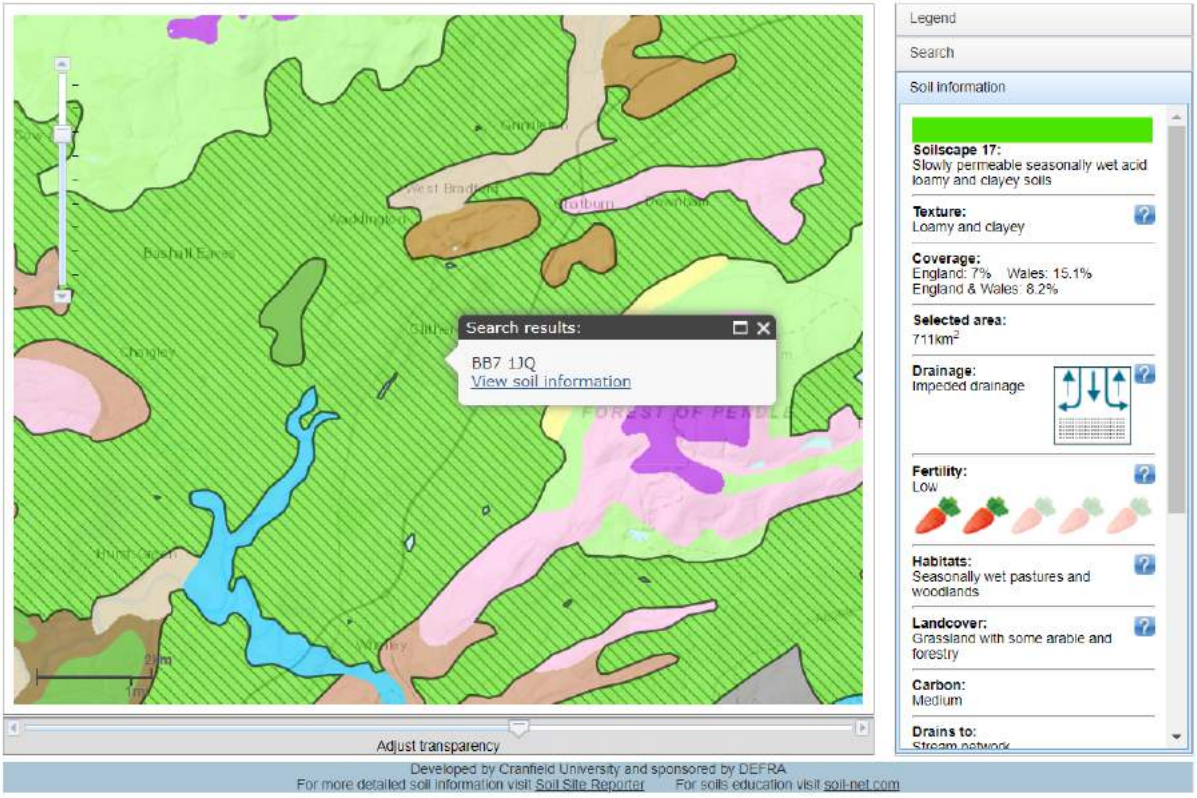


March 8, 2022

- Beach
- Bridge Abutment
- Cliff
- Demountable Defence
- Dunes
- Embankment
- Engineered High Ground
- Flood Gate
- Natural High Ground
- Spillway
- Wall
- Open Channel
- Simple Culvert
- Complex Culvert
- Outfall

APPENDIX E

Desktop Ground Condition Review


Search results:
BB7 1JQ
View soil information
Adjust transparency
Legend
Search
Soil information
Soilscape 17:
Slowly permeable seasonally wet acid loamy and clayey soils
Texture:
Loamy and clayey
Coverage:
England: 7% Wales: 15.1%
England & Wales: 8.2%
Selected area:
711km²
Drainage:
Impeded drainage
Fertility:
Low
Habitats:
Seasonally wet pastures and woodlands
Landcover:
Grassland with some arable and forestry
Carbon:
Medium
Drains to:
Developed by Cranfield University and sponsored by DEFRA
For more detailed soil information visit Soil Site Reporter
For soils education visit soil-net.com

STRATA SURVEYS LTD.,
Telephone: 0606 84 4637 Fax: 0606 84 6657

Borehole Number : 1 374543
Sheet 1 of 1. 441424

Job Number : 5587 Location : Carlton Place, Clitheroe.

Client : Consulting Engineers Co-partnership

Dia. & Drilling Methods
150mm Diameter light cable percussion

Description of Strata	Red. Level	Legend	Thick -ness	Depth m	Sample Depths	Sample Types	N Value	Cu	ø	Water Level	Pie -zo	Daily Prog.
Soft to firm brown grey silty CLAY, with fine to coarse gravel and cobbles. (Boulder Clay)			(0.60)	0.00								
				0.60	0.50 - 0.95	S 1	N 7					
Firm to stiff grey sandy CLAY, with fine to coarse gravel and cobbles. (Boulder Clay)						D 1						
					1.00							
					1.50 - 1.75	U 1						
					2.00	D 2						
					2.50 - 2.95	S 2	N 25					
			(4.90)		3.00	D 3						
					3.50 - 3.95	S 3	N 23					
					4.00	D 4						
					4.50 - 4.95	S 4	N 97					
					5.00	D 5						
Cobble obstruction				5.50								29/6
Borehole Completed												

General Remarks :
No water encountered during drilling.
Chiselling and slow drilling (3 hours)
Chiselling cobble obstruction (1 hour)

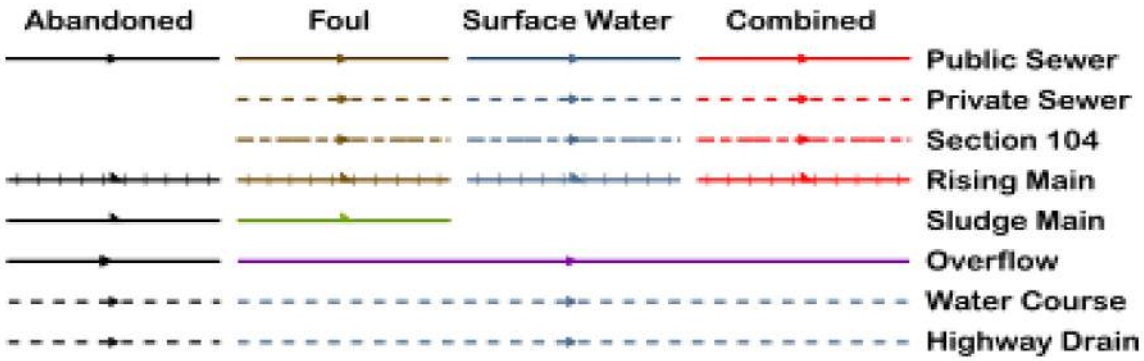
Dates : 29 JUNE 90
Driller : T.A.M
Engineer: G.H

APPENDIX F

United Utilities Sewer records

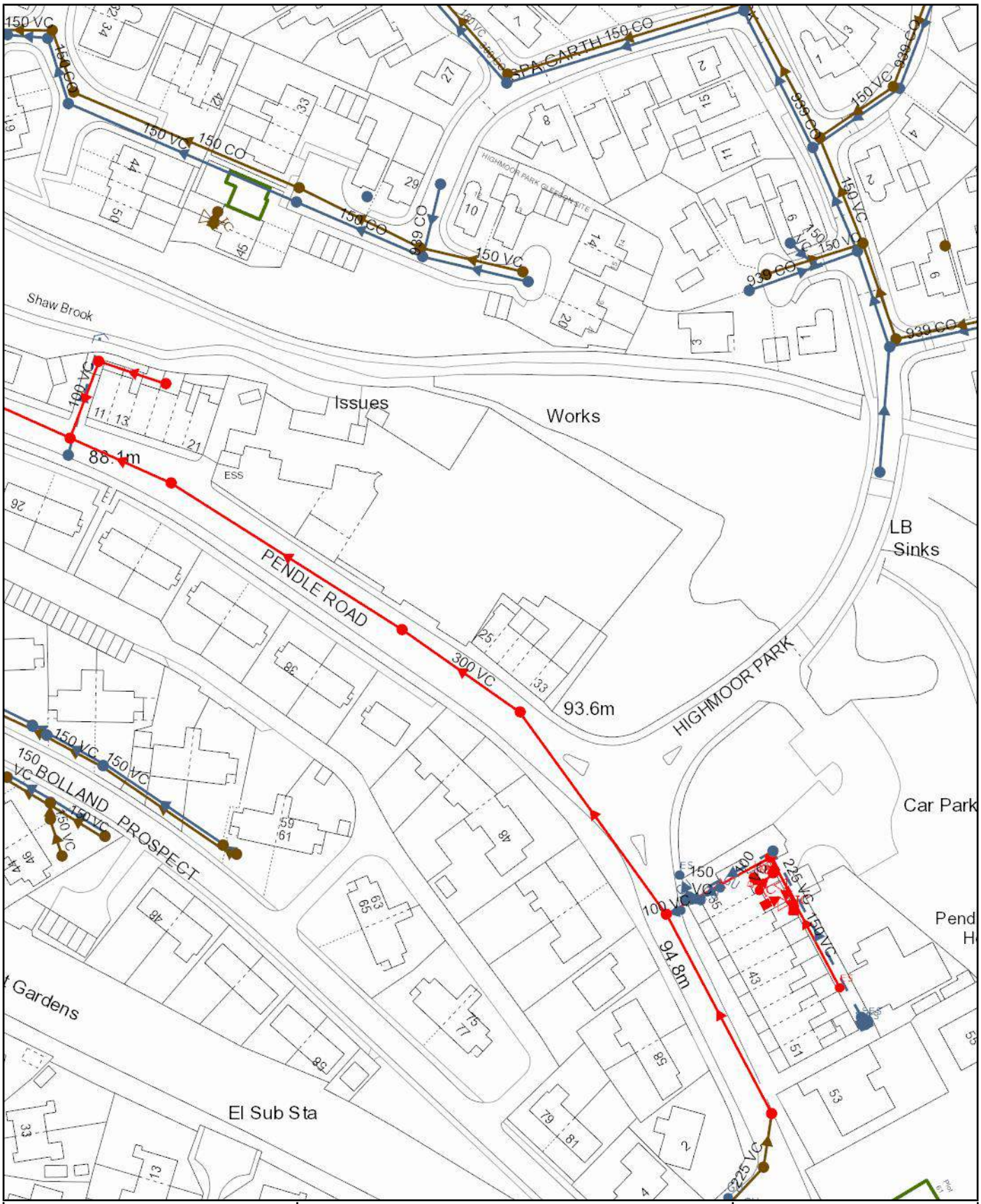
United Utilities
Water for the North West

Wastewater Symbology



All point assets follow the standard colour convention: red – combined, brown - foul, blue – surface water, purple - overflow

- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- T Network Storage Tank
- V Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- CK Control Kiosk
- Change of Characteristic



Scale:	1:1250	**SEWER RECORDS**	United Utilities Water for the North West
Date:	23/05/2022		
Address or Site Reference:	WORTHINGTON BROUGHAM FURNITURE LTD PENDLE MILL PENDLE ROAD, CLITHEROE, BB7 1JQ		
Printed by:	Property Searches		

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

APPENDIX G

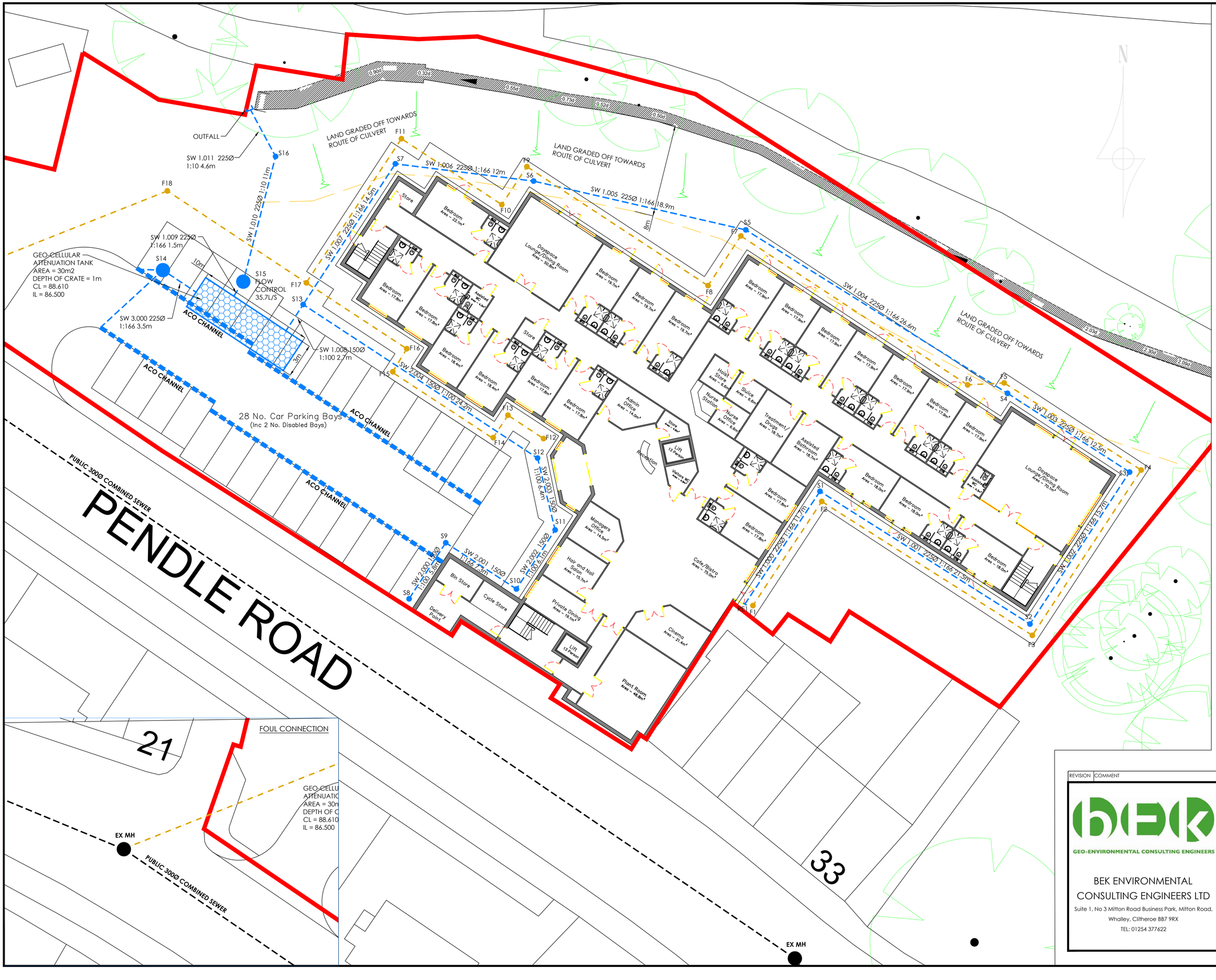
Indicative Attenuation Requirements

Storage Estimate

Return Period (years)	100
Climate Change (%)	40
Impermeable Area (ha)	0.228
Peak Discharge (l/s)	35.700
Infiltration Coefficient (m/hr) (leave blank if no infiltration)	
Required Storage (m^3)	Calc
from	34
to	72

APPENDIX H

Drainage Design



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4. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES UNLESS OTHERWISE STATED.
5. NO DIMENSIONS TO BE SCALED FROM THIS DRAWING.
6. THE LOCATION AND LEVELS OF EXISTING DRAINAGE PIPES AND CULVERTS MUST BE CHECKED ON-SITE PRIOR TO CONSTRUCTION.
7. PROPOSED FINISHED LEVELS HAVE ONLY BEEN ASSUMED AND SHOULD BE FINALISED BY A CIVIL ENGINEER.
8. POSITION OF SOIL VENT PIPES & RAINWATER DOWN PIPES TO BE CONFIRMED BY THE ARCHITECT.

KEY

- SW 1.000 — PROPOSED SURFACE WATER DRAIN
- FW 1.000 — PROPOSED FOUL DRAIN
- S1 — PROPOSED SURFACE WATER MANHOLE
- F1 — PROPOSED FOUL MANHOLE
- ATTENUATION TANK

SURFACE WATER ATTENUATION

GEO-CELLULAR TANK
CL = 88.61
IL = 86.50
COVER = 1.11
AREA = 30m2
DEPTH OF CRATE = 1.000m

FLOW CONTROL S17

DESIGN DEPTH = 2m
FLOW RATE = 35.7L/S

PRELIMINARY DISCHARGE RATES

1 IN 1 YEAR EVENT = 22.9L/S
1 IN 30 YEAR EVENT = 35.7L/S
1 IN 100 YEAR EVENT + 40% CLIMATE CHANGE = 35.7L/S

REVISION	COMMENT	DATE	BY

GEO-ENVIRONMENTAL CONSULTING ENGINEERS

BEK ENVIRONMENTAL CONSULTING ENGINEERS LTD
Suite 1, No 3 Mitton Road Business Park, Mitton Road, Whalley, Clitheroe BB7 9RX
TEL: 01254 377622

CLIENT: MULLER PROPERTIES	DATE: 26/05/2022
	STATUS:
PROJECT: CARE HOME AT PENDLE ROAD, CLITHEROE	DRAWN BY: CV
	SCALE: 1:150
DRAWING TITLE: PRELIMINARY DRAINAGE STRATEGY	SIZE: A1
DRAWING REFERENCE: 2022-025-01	REVISION:

APPENDIX I

Modelled Calculation Report

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.500
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Depth (m)	Notes
✓	RE1	0.026	4.00	88.610	Manhole	Adoptable	150	0.725	
✓	S1	0.018	4.00	88.610	Manhole	Adoptable	600	0.795	
✓	S2	0.018	4.00	88.610	Manhole	Adoptable	600	0.925	
✓	S3	0.008	4.00	88.610	Manhole	Adoptable	600	1.020	
✓	S4			88.610	Manhole	Adoptable	600	1.095	
✓	S5	0.016	4.00	88.610	Manhole	Adoptable	600	1.255	
✓	S6	0.013	4.00	88.610	Manhole	Adoptable	600	1.369	
✓	S7	0.004	4.00	88.610	Manhole	Adoptable	600	1.441	
✓	S8	0.004	4.00	88.610	Manhole	Adoptable	600	0.650	
✓	S9			88.610	Manhole	Adoptable	600	0.708	
✓	S10			88.610	Manhole	Adoptable	600	0.781	
✓	S11	0.013	4.00	88.610	Manhole	Adoptable	600	0.842	
✓	S12	0.006	4.00	88.610	Manhole	Adoptable	600	0.906	
✓	S13	0.027	4.00	88.610	Manhole	Adoptable	600	1.529	
✓	S14	0.075	4.00	88.610	Manhole	Adoptable	600	1.524	
✓	TANK			88.610	Manhole	Adoptable	600	2.110	
✓	S15			88.610	Manhole	Adoptable	1500	2.610	Auto-design is off
✓	S16			86.000	Manhole	Adoptable	1200	4.000	
✓	OUT			85.040	Manhole	Adoptable	1	3.500	

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	11.700	166.0	225	Circular	88.610	87.885	0.500	88.610	87.815	0.570
1.001	21.500	166.0	225	Circular	88.610	87.815	0.570	88.610	87.685	0.700
1.002	15.700	166.0	225	Circular	88.610	87.685	0.700	88.610	87.590	0.795
1.003	12.500	166.0	225	Circular	88.610	87.590	0.795	88.610	87.515	0.870
1.004	26.600	166.0	225	Circular	88.610	87.515	0.870	88.610	87.355	1.030
1.005	18.900	166.0	225	Circular	88.610	87.355	1.030	88.610	87.241	1.144
1.006	12.000	166.0	225	Circular	88.610	87.241	1.144	88.610	87.169	1.216

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RE1	150	Manhole	Adoptable	S1	600	Manhole	Adoptable
1.001	S1	600	Manhole	Adoptable	S2	600	Manhole	Adoptable
1.002	S2	600	Manhole	Adoptable	S3	600	Manhole	Adoptable
1.003	S3	600	Manhole	Adoptable	S4	600	Manhole	Adoptable
1.004	S4	600	Manhole	Adoptable	S5	600	Manhole	Adoptable
1.005	S5	600	Manhole	Adoptable	S6	600	Manhole	Adoptable
1.006	S6	600	Manhole	Adoptable	S7	600	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	14.600	166.0	225	Circular	88.610	87.169	1.216	88.610	87.081	1.304
2.000	5.800	100.0	150	Circular	88.610	87.960	0.500	88.610	87.902	0.558
2.001	7.300	100.0	150	Circular	88.610	87.902	0.558	88.610	87.829	0.631
2.002	6.100	100.0	150	Circular	88.610	87.829	0.631	88.610	87.768	0.692
2.003	6.400	100.0	150	Circular	88.610	87.768	0.692	88.610	87.704	0.756
2.004	24.200	44.9	150	Circular	88.610	87.704	0.756	88.610	87.165	1.295
1.008	2.700	166.0	225	Circular	88.610	87.081	1.304	88.610	87.065	1.320
3.000	3.500	166.7	225	Circular	88.610	87.086	1.299	88.610	87.065	1.320
1.009	1.500	166.7	225	Circular	88.610	86.500	1.885	88.610	86.491	1.894
1.010	11.000	10.0	225	Circular	88.610	86.000	2.385	86.000	84.900	0.875
1.011	4.600	10.0	225	Circular	86.000	82.000	3.775	85.040	81.540	3.275

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	S7	600	Manhole	Adoptable	S13	600	Manhole	Adoptable
2.000	S8	600	Manhole	Adoptable	S9	600	Manhole	Adoptable
2.001	S9	600	Manhole	Adoptable	S10	600	Manhole	Adoptable
2.002	S10	600	Manhole	Adoptable	S11	600	Manhole	Adoptable
2.003	S11	600	Manhole	Adoptable	S12	600	Manhole	Adoptable
2.004	S12	600	Manhole	Adoptable	S13	600	Manhole	Adoptable
1.008	S13	600	Manhole	Adoptable	TANK	600	Manhole	Adoptable
3.000	S14	600	Manhole	Adoptable	TANK	600	Manhole	Adoptable
1.009	TANK	600	Manhole	Adoptable	S15	1500	Manhole	Adoptable
1.010	S15	1500	Manhole	Adoptable	S16	1200	Manhole	Adoptable
1.011	S16	1200	Manhole	Adoptable	OUT	1	Manhole	Adoptable

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
RE1	88.610	0.725	150	Manhole	Adoptable	0	1.000	87.885	225	Circular
S1	88.610	0.795	600	Manhole	Adoptable	1	1.000	87.815	225	Circular
						0	1.001	87.815	225	Circular
S2	88.610	0.925	600	Manhole	Adoptable	1	1.001	87.685	225	Circular
						0	1.002	87.685	225	Circular
S3	88.610	1.020	600	Manhole	Adoptable	1	1.002	87.590	225	Circular
						0	1.003	87.590	225	Circular
S4	88.610	1.095	600	Manhole	Adoptable	1	1.003	87.515	225	Circular
						0	1.004	87.515	225	Circular

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
S5	88.610	1.255	600	Manhole	Adoptable	1	1.004	87.355	225	Circular
						0	1.005	87.355	225	Circular
S6	88.610	1.369	600	Manhole	Adoptable	1	1.005	87.241	225	Circular
						0	1.006	87.241	225	Circular
S7	88.610	1.441	600	Manhole	Adoptable	1	1.006	87.169	225	Circular
						0	1.007	87.169	225	Circular
S8	88.610	0.650	600	Manhole	Adoptable	0	2.000	87.960	150	Circular
S9	88.610	0.708	600	Manhole	Adoptable	1	2.000	87.902	150	Circular
						0	2.001	87.902	150	Circular
S10	88.610	0.781	600	Manhole	Adoptable	1	2.001	87.829	150	Circular
						0	2.002	87.829	150	Circular
S11	88.610	0.842	600	Manhole	Adoptable	1	2.002	87.768	150	Circular
						0	2.003	87.768	150	Circular
S12	88.610	0.906	600	Manhole	Adoptable	1	2.003	87.704	150	Circular
						0	2.004	87.704	150	Circular
S13	88.610	1.529	600	Manhole	Adoptable	1	2.004	87.165	150	Circular
						2	1.007	87.081	225	Circular
						0	1.008	87.081	225	Circular
S14	88.610	1.524	600	Manhole	Adoptable	0	3.000	87.086	225	Circular
TANK	88.610	2.110	600	Manhole	Adoptable	1	3.000	87.065	225	Circular
						2	1.008	87.065	225	Circular
						0	1.009	86.500	225	Circular
S15	88.610	2.610	1500	Manhole	Adoptable	1	1.009	86.491	225	Circular
						0	1.010	86.000	225	Circular
S16	86.000	4.000	1200	Manhole	Adoptable	1	1.010	84.900	225	Circular
						0	1.011	82.000	225	Circular

Manhole Schedule

Node	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
OUT	85.040	3.500	1	Manhole	Adoptable	1	1.011	81.540	225	Circular

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node S15 Online ACO Q-Brake Control

Flap Valve	x	Design Depth (m)	2.000	Min Node Diameter (mm)	1500
Replaces Downstream Link	✓	Design Flow (l/s)	35.7	Orifice Diameter (mm)	0.219
Invert Level (m)	86.000	Min Outlet Diameter (m)	0.220		

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	86.500
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	24

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	30.0	0.0	1.000	30.0	0.0	1.001	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE1	10	87.930	0.045	3.5	0.0329	0.0000	OK
15 minute summer	S1	10	87.873	0.058	5.9	0.0426	0.0000	OK
15 minute winter	S2	10	87.757	0.072	8.3	0.0482	0.0000	OK
15 minute winter	S3	10	87.667	0.077	9.3	0.0338	0.0000	OK
15 minute winter	S4	11	87.589	0.074	9.1	0.0210	0.0000	OK
15 minute winter	S5	11	87.439	0.084	11.1	0.0452	0.0000	OK
15 minute winter	S6	11	87.333	0.092	12.7	0.0437	0.0000	OK
15 minute winter	S7	11	87.260	0.091	13.1	0.0307	0.0000	OK
15 minute winter	S8	9	87.978	0.018	0.5	0.0072	0.0000	OK
15 minute winter	S9	10	87.920	0.018	0.5	0.0050	0.0000	OK
15 minute winter	S10	11	87.846	0.017	0.5	0.0049	0.0000	OK
15 minute winter	S11	10	87.806	0.038	2.3	0.0225	0.0000	OK
15 minute winter	S12	10	87.739	0.035	3.1	0.0143	0.0000	OK
15 minute winter	S13	11	87.204	0.123	18.9	0.0784	0.0000	OK
15 minute summer	S14	10	87.172	0.086	10.2	0.1084	0.0000	OK
15 minute winter	TANK	12	86.642	0.142	27.7	4.0947	0.0000	OK
15 minute winter	S15	13	86.192	0.191	23.0	0.3384	0.0000	OK
15 minute winter	S16	13	82.064	0.064	22.9	0.0728	0.0000	OK
15 minute winter	OUT	13	81.596	0.056	22.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE1	1.000	S1	3.5	0.517	0.087	0.0797	
15 minute summer	S1	1.001	S2	5.9	0.627	0.147	0.2034	
15 minute winter	S2	1.002	S3	8.2	0.721	0.204	0.1791	
15 minute winter	S3	1.003	S4	9.1	0.793	0.227	0.1445	
15 minute winter	S4	1.004	S5	9.2	0.743	0.230	0.3309	
15 minute winter	S5	1.005	S6	11.2	0.776	0.278	0.2725	
15 minute winter	S6	1.006	S7	12.6	0.833	0.314	0.1819	
15 minute winter	S7	1.007	S13	12.9	0.703	0.320	0.2718	
15 minute winter	S8	2.000	S9	0.5	0.434	0.028	0.0067	
15 minute winter	S9	2.001	S10	0.5	0.451	0.028	0.0083	
15 minute winter	S10	2.002	S11	0.5	0.252	0.028	0.0141	
15 minute winter	S11	2.003	S12	2.3	0.692	0.128	0.0210	
15 minute winter	S12	2.004	S13	3.0	0.990	0.113	0.0796	
15 minute winter	S13	1.008	TANK	18.7	0.915	0.466	0.0553	
15 minute summer	S14	3.000	TANK	10.2	0.792	0.254	0.0451	
15 minute winter	TANK	1.009	S15	23.0	0.956	0.574	0.0361	
15 minute winter	S15	ACO Q-Brake	S16	22.9				
15 minute winter	S16	1.011	OUT	22.9	2.681	0.139	0.0394	13.4

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE1	10	87.959	0.074	8.6	0.0541	0.0000	OK
15 minute summer	S1	10	87.910	0.095	14.6	0.0698	0.0000	OK
15 minute winter	S2	10	87.808	0.123	20.6	0.0827	0.0000	OK
15 minute winter	S3	10	87.723	0.133	23.3	0.0584	0.0000	OK
15 minute winter	S4	10	87.640	0.125	23.0	0.0354	0.0000	OK
15 minute winter	S5	11	87.504	0.149	27.8	0.0801	0.0000	OK
15 minute winter	S6	11	87.426	0.185	31.5	0.0877	0.0000	OK
15 minute winter	S7	11	87.378	0.209	32.0	0.0707	0.0000	OK
15 minute winter	S8	10	87.988	0.028	1.3	0.0116	0.0000	OK
15 minute summer	S9	10	87.930	0.028	1.3	0.0080	0.0000	OK
15 minute winter	S10	10	87.856	0.027	1.3	0.0077	0.0000	OK
15 minute winter	S11	10	87.830	0.062	5.6	0.0366	0.0000	OK
15 minute winter	S12	10	87.759	0.055	7.6	0.0226	0.0000	OK
15 minute winter	S13	11	87.316	0.235	46.2	0.1493	0.0000	SURCHARGED
15 minute summer	S14	10	87.232	0.146	24.9	0.1854	0.0000	OK
15 minute winter	TANK	14	86.922	0.422	68.5	12.1323	0.0000	SURCHARGED
15 minute winter	S15	14	86.897	0.897	48.1	1.5855	0.0000	SURCHARGED
15 minute winter	S16	10	82.084	0.084	35.7	0.0948	0.0000	OK
15 minute winter	OUT	10	81.611	0.071	35.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE1	1.000	S1	8.6	0.635	0.214	0.1587	
15 minute summer	S1	1.001	S2	14.7	0.770	0.364	0.4093	
15 minute winter	S2	1.002	S3	20.6	0.883	0.511	0.3655	
15 minute winter	S3	1.003	S4	23.0	0.978	0.572	0.2937	
15 minute winter	S4	1.004	S5	22.9	0.907	0.570	0.6714	
15 minute winter	S5	1.005	S6	27.8	0.903	0.690	0.5942	
15 minute winter	S6	1.006	S7	30.9	0.913	0.767	0.4410	
15 minute winter	S7	1.007	S13	32.1	0.828	0.798	0.5714	
15 minute winter	S8	2.000	S9	1.3	0.562	0.073	0.0134	
15 minute summer	S9	2.001	S10	1.3	0.580	0.073	0.0163	
15 minute winter	S10	2.002	S11	1.3	0.304	0.072	0.0275	
15 minute winter	S11	2.003	S12	5.6	0.880	0.313	0.0404	
15 minute winter	S12	2.004	S13	7.5	1.028	0.282	0.2792	
15 minute winter	S13	1.008	TANK	46.2	1.207	1.148	0.0996	
15 minute summer	S14	3.000	TANK	24.9	0.988	0.620	0.0882	
15 minute winter	TANK	1.009	S15	48.1	1.240	1.199	0.0597	
15 minute winter	S15	ACO Q-Brake	S16	35.7				
15 minute winter	S16	1.011	OUT	35.7	2.964	0.216	0.0555	33.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.86%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	RE1	11	88.124	0.239	15.6	0.1754	0.0000	SURCHARGED
15 minute winter	S1	11	88.117	0.302	26.1	0.2222	0.0000	SURCHARGED
15 minute winter	S2	11	88.069	0.384	35.7	0.2579	0.0000	SURCHARGED
15 minute winter	S3	12	88.011	0.421	38.3	0.1851	0.0000	SURCHARGED
15 minute winter	S4	12	87.948	0.433	36.1	0.1226	0.0000	SURCHARGED
30 minute winter	S5	24	87.920	0.565	35.5	0.3042	0.0000	SURCHARGED
30 minute winter	S6	24	87.907	0.666	40.4	0.3149	0.0000	SURCHARGED
30 minute winter	S7	24	87.894	0.725	42.0	0.2450	0.0000	SURCHARGED
15 minute winter	S8	10	87.999	0.039	2.4	0.0159	0.0000	OK
15 minute summer	S9	10	87.941	0.039	2.4	0.0110	0.0000	OK
30 minute winter	S10	24	87.893	0.064	3.1	0.0182	0.0000	OK
30 minute winter	S11	24	87.891	0.123	8.1	0.0728	0.0000	OK
30 minute winter	S12	24	87.901	0.197	10.9	0.0818	0.0000	SURCHARGED
30 minute winter	S13	24	87.878	0.797	64.7	0.5068	0.0000	SURCHARGED
30 minute winter	S14	24	87.866	0.780	35.9	0.9886	0.0000	SURCHARGED
30 minute winter	TANK	24	87.863	1.363	99.5	28.9000	0.0000	SURCHARGED
30 minute winter	S15	24	87.837	1.837	46.7	3.2461	0.0000	SURCHARGED
60 minute winter	S16	71	82.084	0.084	35.7	0.0948	0.0000	OK
60 minute winter	OUT	71	81.611	0.071	35.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	RE1	1.000	S1	15.4	0.706	0.382	0.4653	
15 minute winter	S1	1.001	S2	24.9	0.840	0.619	0.8551	
15 minute winter	S2	1.002	S3	33.5	0.957	0.833	0.6244	
15 minute winter	S3	1.003	S4	36.1	1.032	0.898	0.4971	
15 minute winter	S4	1.004	S5	32.2	0.911	0.800	1.0579	
30 minute winter	S5	1.005	S6	34.9	0.890	0.868	0.7517	
30 minute winter	S6	1.006	S7	40.3	1.012	1.001	0.4773	
30 minute winter	S7	1.007	S13	41.4	1.041	1.029	0.5807	
15 minute winter	S8	2.000	S9	2.4	0.660	0.135	0.0211	
15 minute summer	S9	2.001	S10	2.4	0.686	0.135	0.0255	
30 minute winter	S10	2.002	S11	-2.1	0.332	-0.120	0.0692	
30 minute winter	S11	2.003	S12	8.0	0.965	0.453	0.1058	
30 minute winter	S12	2.004	S13	10.9	0.976	0.408	0.4260	
30 minute winter	S13	1.008	TANK	64.6	1.625	1.606	0.1074	
30 minute winter	S14	3.000	TANK	35.8	1.082	0.891	0.1392	
30 minute winter	TANK	1.009	S15	46.7	1.174	1.163	0.0597	
30 minute winter	S15	ACO Q-Brake	S16	35.6				
60 minute winter	S16	1.011	OUT	35.7	2.964	0.216	0.0555	108.5

APPENDIX J

Business Flood Plan

Environment Agency

would your business stay afloat?

A guide to preparing your business for flooding

Flooding is the most common and widespread natural disaster in the UK. Since 1998 there has been at least one serious flood every year. Businesses like yours are more likely to be flooded than destroyed by fire. As our climate changes we can expect to see more extreme weather – and more floods.

We aim to reduce the likelihood of flooding by managing land, rivers, coastal systems and flood defences. While we do everything we can to reduce the chance of flooding, it is a natural process and can never be completely eliminated.

By taking action to prepare in advance for flooding, most businesses can save between 20 and 90 per cent on the cost of lost stock and movable equipment, as well as some of the trouble and stress that goes with such an event.

This is a simple guide to some of the easy actions that you can take to make sure that your business is as well prepared as possible.

It tells you about how to find out if your business is at risk, our flood warning service and what our flood warning codes mean. It also has a simple template to use to design a flood plan for your company.

For more information about flooding, visit our website at **www.gov.uk/flood** or call Floodline on **0345 988 1188**.

Make sure that your business is prepared for flooding.

How do I find out if my business is at risk from flooding?

There are two quick and easy ways for you to find out if you're at risk.

call us on
0345 988 1188

Our Floodline service is open 24 hours, calls are charged at local rate. By taking your postcode, our operators will check and see if your business is in a flood risk area.

Look at our website
www.gov.uk/flood

You need to be aware of flooding and keep an eye on the water levels and weather situation at all times. You can do this by checking the flood forecasts and the river and sea levels on our website.

Our online flood map uses the latest technology and data gathered over many years to give the most accurate view of flooding in your area.

By entering your postcode you can find out if your business is at risk. Areas at risk from flooding are shown in dark blue and areas at risk from extreme flooding in light blue.

My business is at risk from flooding. What should I do now?

Start preparing now. If the weather conditions are right, flooding can happen at any time.

Remember, floods can happen at any time and any day – make sure you provide a number that can be contacted at all times – even out of working hours.

Sign up for flood warnings.

The first thing you should do is find out if you can receive flood warnings. In areas of high flood risk, we offer a service called Floodline Warnings Direct. This is a free, 24 hour service that sends automated flood warnings by telephone, SMS text, email, fax or pager.

To find out if you can receive this service, call Floodline on 0345 988 1188.

If your business isn't in an area covered by our warnings you can still check the latest flood warnings in force on our website.

When the situation is serious, flood warnings will also be broadcast on local television and radio news.

What practical steps can I take to protect my business?

Now that you've checked your risk and found out about flood warnings, it's time to start thinking about preparing a flood plan specifically for your business.

Taking simple steps can go a long way to protecting your business from flooding. Preparing a flood plan could:

- Significantly reduce financial losses, damage to property and business interruption;
- Help compliance with regulatory requirements (for example, Occupier's Liability Act 1984);
- Reduce exposure to civil or criminal liability;
- Enhance your company's image and credibility with employees, customers, suppliers and the community;
- Help fulfil your moral responsibility to protect employees, the community and the environment;
- Help you to obtain insurance cover.

What is a flood plan?

Just as many businesses have health and safety policies and contingency plans for an emergency, they should also have flood plans.

A flood plan is a written document that outlines how your business will respond to a flood.

This might include a list of steps you will take in case of a flood and the order you will take them in. It could also include the purchase of flood products and insurance.

A written plan can make information **easy** to access during a flood, **easy** to communicate to staff, and **easy** to remember.

Small businesses should make sure there is a plan of action in case of flooding. As the business owner, this may be your responsibility.

If your business is **medium sized**, flood preparation might be the responsibility of a team of people from different areas of the business.

If your business decides to have a flood planning team, this could be led by the business owner or Managing Director.

The leader of the flood planning team will need to let staff know about the plan once it is finished.

All members of the team should also keep a copy of important flood contacts at home for easy access.

Key areas to consider in your flood plan are:

- human resources;
- maintenance/facilities;
- finance and purchasing.

Once you have completed your plan don't forget about it. Look at it regularly and make sure it is up to date and in the event of a flood **use it**.

business flood plan

A written flood plan is recommended for businesses.

It should include:

- A list of important contacts, including Floodline, building services, suppliers and evacuation contacts for staff;
- A description or map showing locations of key property, protective materials and service shut-off points;
- Basic strategies for protecting property, preventing business disruption and assisting recovery;
- Checklists of procedures that can be quickly accessed by staff during a flood.

If a flood is imminent, your main priority is to make sure that your staff are safe. However there may be other actions that you can take to prepare your building and it's contents to minimise damage and post-flood repair and restoration costs.

Business flood plan

Flood plan for _____ dated _____

Registered address _____

_____

Postcode _____

Staff contact list

Name	Address	Telephone/mobile	Emergency contact	Emergency telephone and address

Note staff who may require assistance in the event of a flood.

Name	Office location

Key locations

Service cut-off	Description of location
Electricity	
Gas	
Water	

Answer the following if applicable

	Description of location	How to protect from a flood (for example, move, cover, tie down)
First Aid Kit		
Oil based products (gasoline, oil, cooking oil etc.)		
Chemicals (including cleaning products)		

Protective actions

Identify stock, equipment and possessions that may need special protective measures, and describe the actions you will take to prevent damage in the event of a flood. We have suggested items and ways to protect them, but make sure you follow through on your plans.

think about:

- Computers;
- Tables / heavy furniture;
- Vehicles;
- Paper files;
- Electrical items;
- Chairs / stools;
- Databases;
- Soft furnishings;
- Computer files;
- Staff files.

ways to protect items

- Make a copy of important documentation and store in safe location;
- Raise items above ground level;
- Buy flood protection products;
- Buy new flood-resistant items;
- Move items to a safer location if possible – to an upper level of the building or off site.

Valuable item	Protective action	New location (if applicable)	Done
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐
			☐

Suggested basic building materials to help protect your property

If materials are not needed, leave the relevant section blank

Materials	Used for	Items to protect / where to use	Storage location	Done
Sand and sand bags (unfilled), shovel	Creating flood barriers (used with plastic sheeting)			☐
Tools – hammer, nails, saw	Boarding up doors, windows and openings, creating shelves			☐
Wood – plywood, blocks of wood	Boarding up doors, windows and openings, creating shelves			☐
Sturdy plastic sheeting	Sandbag barriers, pulling up around furniture and appliances			☐
Strong plastic bags	Putting around legs of tables and chairs			☐
Pallets	Raising stored stock above flood level			☐
Emergency power generator	Maintaining function of air conditioning units (can help dry out a building), running fridges and freezers, medical equipment if appropriate			☐

Identify people who can help you before, during and after a flood, and what they can do.

We have suggested ways they might be able to help, but you'll need to discuss this with them.

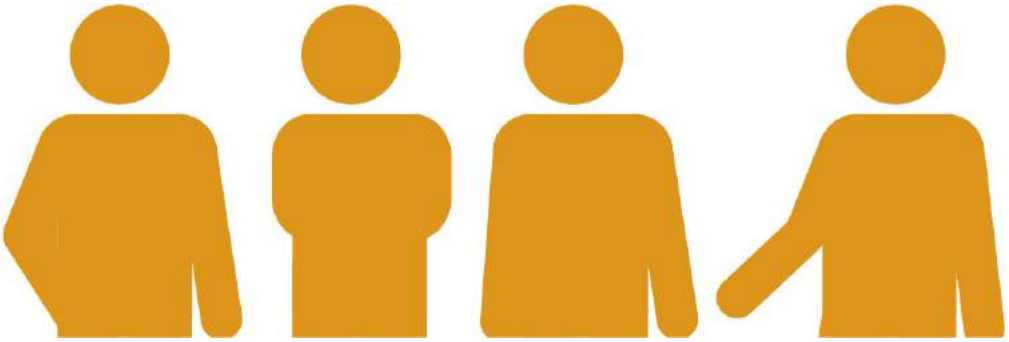
Name	Address	Telephone day	Telephone evening	Mobile

Ways people can help

- assistance with installing flood products;
- assistance with transporting stock/materials to new location if possible;
- provision of emergency storage;
- provision of emergency supplies or medical support if required.

discussion guide

This discussion guide sums up the key areas of flood planning. Some of this information can be found in this pack to help get you started.



Research

- Look at your existing business policies, and think about whether they are appropriate in the event of a flood.

Staff

- Make a list of **employees' contact details in the event of an evacuation**. This might include mobile telephone numbers, or numbers for their home or the home of a friend or relative;
- Think about staff who **may need special assistance** in the event of a flood (for example, elderly, deaf, blind etc.)

Security procedures

- **Locking windows, doors** and **setting the alarm**. You might need more than one person to help do this;
- Insurance policies – **Are you insured for flood damage**, business interruption and lost revenue?
- Employee manuals – You might **add flood safety to staff information packs**, or adapt job descriptions to include flood warden duties;
- Hazardous materials plan – You must ensure that **chemicals, oils** and other **substances in your possession are kept safe** and do not contaminate flood water;
- Health and safety assessment – Plan to **check the functioning of flood products and flood warning systems regularly**, just as you do for fire safety equipment.

Check codes and regulations that might apply to your business in the event of a flood. The following could provide guidance on the right actions to take:

- Occupational health and safety regulations;
- Environmental regulations.

Important contacts

Make a list of important telephone numbers, including contacts for gas, electricity, water and telephone providers.

Key locations

- **Know the location** of cut-off points for gas, electricity and water. Ideally, these should be marked on a map that is stored with your flood plan;
- Know the location of chemicals, oils or other materials that could be dangerous or contaminate flood water. These should be stored safe from floods and other damage.

Protective actions

- Note key stock, equipment and possessions that may need special protection from flood water;
- Consider things you may need during or after a flood (for example, sandbags, plastic sheeting, loudspeaker);
- See if it's **possible to move key operations**, such as shipping or customer services, to another building.

Suppliers and external links

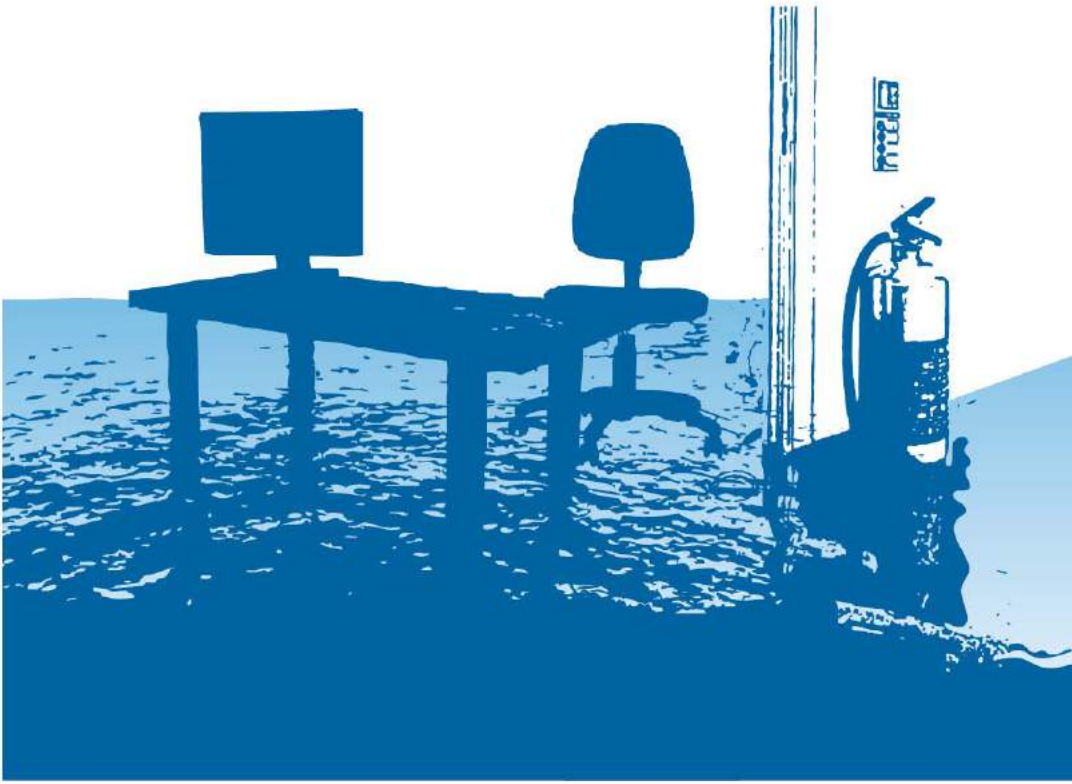
- Identify products and services you won't need in the event of a flood, or which suppliers may not be able to provide. **Make back-up plans** or arrangements for short-notice cancellation of deliveries;
- Consider contracting in advance with companies whose help you may need after a flood.

business checklist

Are you prepared for flooding?

If you answer no to any of the questions overleaf, there may be more you can do to protect your business.

The individual sections will give you valuable information on effective actions you can take to prepare for a flood.



If you can answer yes, please ☒, otherwise leave blank for no.

Know if you're at risk

- ☐ Do you know if you're at risk of flooding?
- ☐ Are flood warnings available in your area?
- ☐ Do you know how you can receive flood warnings?

Preparing a flood plan

- ☐ Do you know how your business will respond to a flood?
- ☐ Do you have a list of useful numbers including Floodline, local authority and insurance company?
- ☐ Do you know how to shut off your gas/electric/water supplies?
- ☐ Are your stock, fittings and valuable equipment stored above flood level?
- ☐ Have you developed flood contingency plans with suppliers and/or clients?
- ☐ Can you call someone to help you in the event of a flood?

Staff training and evacuation

- ☐ Are you aware of correct flood safety procedures for you and your staff?
- ☐ Have you trained your staff on flood safety procedures?
- ☐ Can your staff work quickly and efficiently to protect your business in the event of a flood?

Protecting your property

- ☐ Have you installed flood protection products?
- ☐ Do you have a stockpile of useful materials including plywood, plastic sheeting, sandbags (unfilled), sand, nails, hammer, shovel, blocks of wood and a saw?
- ☐ Have you installed non return valves in your toilets and drains?
- ☐ Do you and your staff have high ground where you can park your cars?
- ☐ Are your electrical sockets above flood level?
- ☐ Do you have computer equipment in the basement?

Flood insurance

- ☐ Do you have sufficient insurance cover in the event of a flood situation?
- ☐ Do you know what information your insurer will require to support a claim?

Evacuation

- ☐ Do you have an easy way to let your staff know about an evacuation?
- ☐ Do you know which roads will stay open in your area during a flood?
- ☐ Have you identified where staff can shelter in the event of a flood?
- ☐ Could you control staff panic during a flood?

understand your flood warning codes

Our warning service has three types of warnings - Flood Alert, Flood Warning and Severe Flood Warning - that will help you prepare for flooding and take necessary actions.

ONLINE FLOOD RISK FORECAST

What it means

Be aware.
Keep an eye on the weather situation.

When it's used

Forecasts of flooding on the Environment Agency website are updated a least once a day.

What to do

- Check weather conditions.
- Check for updated flood forecasts on our website.

FLOOD ALERT

What it means

Flooding is possible.
Be prepared.

When it's used

Two hours to two days in advance of flooding.

What to do

- Be prepared to act on your flood plan.
- Prepare a flood kit of essential items.
- Monitor local water levels and the flood forecast on our website.

FLOOD WARNING

What it means

Flooding is expected. Immediate action required.

When it's used

Half an hour to one day in advance of flooding.

What to do

- Move staff, stock and valuables to a safe place.
- Turn off gas, electricity and water supplies if safe to do so.
- Put flood protection equipment in place.

SEVERE FLOOD WARNING

What it means

Severe flooding. Danger to life.

When it's used

When flooding poses a significant risk to life.

What to do

- Stay in a safe place with means of escape.
- Be ready should you need to evacuate.
- Co-operate with the emergency services.
- Call 999 if you are in immediate danger.

WARNING NO LONGER IN FORCE

What it means

No further flooding is currently expected in you area.

When it's used

When river or sea conditions begin to return to normal.

What to do

- Be careful. Flood water may still be around for several days.
- If you've been flooded, ring your insurance company as soon as possible.

useful contacts

Fill in the contact details you may need if your business floods. Keep it in a safe place, where you can hold of it quickly.

	Company name	Telephone number/s
Environment Agency Floodline		0345 988 1188
Electricity supplier and meter number		
Gas supplier and meter number		
Water supplier and meter number		
Telephone provider		
Local authority emergency services		
Insurance company 24-hour number and policy number		
Insurance agent		
Local radio station for news alerts and weather updates		
Companies that may be able to help you after a flood		
Electrician		
Plumber		
Builder		
Equipment repair/suppliers		
Security services		
Water pumping services		
Emergency power suppliers		

Would you like to find out more about us, or about your environment?

Then call us on
08708 506 506* **(Mon-Fri 8-6)**

email
enquiries@environment-agency.gov.uk

or visit our website
www.gov.uk/environment-agency

incident hotline **0800 80 70 60** (24hrs)
floodline **0345 988 1188** (24hrs)

*** Weekday Daytime calls cost 8p plus up to 6p/min from BT Weekend Unlimited. Mobile and other providers' charges may vary.**

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