STM environmental

ENVIRONMENTAL CONSULTING , SOFTWARE & TRAINING

# FLOOD RISK ASSESSMENT

**Site Address**

246 Palatine Road
West Didsbury
Manchester
M20 2WF

**Client**

Affordable & Stylish

**Date**

13/12/2022

# 1 Document Control

## FLOOD RISK ASSESSMENT

| | |
|---|---|
| **Site Address:** | 246 Palatine Road<br>West Didsbury<br>Manchester<br>M20 2WF |
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# 2 Abbreviations

| Abbreviation | Description |
|---|---|
| STM | STM Environmental Consultants Limited |
| BGS | British Geological Survey |
| EA | Environment Agency |
| OS | Ordnance Survey of Great Britain |
| FRA | Flood Risk Assessment |
| NPPF | National Planning Policy Framework |
| FWD | Floodline Warning Direct |
| FRMS | Flood Risk Management Strategy |
| MCC | Manchester City Council |
| SWMP | Surface Water Management Plan |
| SFRA | Strategic Flood Risk Assessment |
| CDA | Critical Drainage Area |
| AEP | Annual Exceedance Probability |
| CC | Climate Change |
| SuDS | Sustainable Urban Drainage Systems |
| GWSPZ | Groundwater Source Protection Zone |
| LLFA | Lead Local Flood Authority |
| mbgl | metres below ground level |
| DCLG | Department for Communities and Local Government |
| PPGPS | Planning practice guidance and Planning system |

# 3 Disclaimer

This report and any information or advice which it contains, is provided by STM Environmental Consultants Ltd (STM) and can only be used and relied upon by Affordable & Stylish (Client).

STM has exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant when undertaking works of this nature. However, STM gives no warranty, representation or assurance as to the accuracy or completeness of any information, assessments or evaluations presented within this report. Furthermore, STM accepts no liability whatsoever for any loss or damage arising from the interpretation or use of the information contained within this report. Any party other than the Client using or placing reliance upon any information contained in this report, do so at their own risk.

# 4 Executive Summary

| SECTION | SUMMARY |
|---|---|
| **Location** | 246 Palatine Road, West Didsbury, Manchester, M20 2WF<br>Grid reference: 383676, 391107 |
| **Proposed Development** | The construction of a 5no. bedroom, 2-storey dwelling, following the demolition of the existing dwelling, car port and summer house. |
| **Flood Zone** | The site is located in Flood Zone 3a as defined by the LLFA's SFRA. |
| **Topography** | The 1m DTM LiDAR shows that the ground level at the site ranges from 28.95mAOD (N) to 29.33mAOD (central), with the area of the proposed dwelling sitting at an average of 29.20mAOD. |
| **Sequential and Exception Tests** | As the proposal will replace the existing dwelling and outbuildings with a new dwelling, the Sequential Test should not be required. It should be noted that the new proposal will provide a major betterment in flood safety and resilience upon the existing site. The Exception Test should not be required. |
| **Main Sources of Flooding** | The main sources of potential flooding to the site are the River Mersey and Fielden Park Brook which are located 133m west and 65m north of the site respectively. |
| **Flood Defences** | The site benefits from a range of defences along both the River Mersey and Fieden Brook. These defences include embankments, walls, engineered high ground and the Didsbury FSA. |
| **Records of Historic Flooding** | One historic fluvial flooding event was recorded at the site in 1964, with a further event recorded in 2021, although it cannot be determined whether this impacted the site area itself or remained just outside. Additionally, there has been one recorded incident of a sewer bursting in 1965 effecting the Northenden and Didsbury area. |
| **Fluvial (River) and Tidal (Sea) Flood Risk** | High – During the 1% AEP + 41% CC (extrapolated) event, the proposed dwelling will witness a maximum flood depth of 30.04mAOD. As such, flood depths can be expected to reach 0.83m during this event.<br><br>When assessing the Hazard Rating, the closest modelled 1D node point to the site was used, being node point 8 on the Fielden Park Brook. A HR of 1.73 was calculated corresponding to a significant risk which would be a hazard for most. Although, the actual HR on site is likely to be less given its more distant proximity from the brook. |
| **Pluvial (Surface Water) Flood Risk** | Low – The site remains dry during the 0.1% AEP pluvial event. |
| **Flood Risk from Artificial (Canals and Reservoirs) Sources** | Low – The site does lie within an area that is at risk of reservoir flooding, however the closest reservoir is over 10 km away. |

| SECTION | SUMMARY |
|---|---|
| **Groundwater Flood Risk** | Low to Medium – According to the BGS, the site is potentially susceptible to groundwater flooding. |
| **Development Impacts on Local Flood Risk** | The proposed development will reduce the impermeable area of the site by 53m$^2$. Which will have a positive impact on the surface water runoff rates. However, it will increase the onsite building footprint (50m$^2$), which will displace the flooding witnessed during the 1% AEP plus CC event. As such, it will have impact on local flood storage and flood flow routes/rates if mitigation measures are not included; |
| **Proposed Flood Risk Mitigation Measures** | • Finished floor levels will be raised 300mm above the 1% AEP + 41% CC flood level to 30.34mAOD;<br>• The proposal will be constructed upon stilts, the base of the pad foundation will be equal to the estimated 1% AEP plus 41% CC event at 30.04mAOD and will house voids below;<br>• The proposal will increase the building footprint by 50m$^2$; however, it mitigates the increase by removing all buildings which directly impact upon the flood plain storage area;<br>• The proposal will have voids to allow flood waters to freely flow below the building in the time of a flood event;<br>• The open link metal fence around the site line will allow for the free movement of water;<br>• The raising of the development out of the flood plain will increase its capacity by a minimum of 141m$^3$. This accounts for the building materials used within the flood plain and the swimming pool extruding below the raised pad foundation;<br>• Construction will utilise flood resistant materials and services will be placed as high as practicable to reduce impact of flooding;<br>• Occupants will sign up for EA Emergency Flood Warning Direct Service;<br>• Safe egress to Flood Zone 1 is available by a 6-minute walk north down Palatine Road;<br>• Safe refuge is available on upper floors;<br>• The proposed dwelling will locate all bedrooms on upper floors, providing an improvement upon existing which has 2no. ground floor bedrooms. |
| **Surface Water Management (SuDS)** | SuDS would reduce current surface water run off rates and given the small size of the site (834m$^2$), there is good potential for implementation. Consideration should be given to green roofs, rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or attenuation storage thanks. |
| **Conclusions** | Based on the information reviewed and taking into account the proposed mitigation measures, it is considered that overall flood risk to the proposed development, when comparing to the existing, will be vastly improved. Additionally, the development will have little to no change on current local flood risk. As such, the development is considered to be in compliance with local planning policy and the NPPF. |

# 5 Introduction

STM Environmental Consultants Limited (STM) has been appointed by Affordable & Stylish (Client) to provide a Flood Risk Assessment (FRA) at a site located at 246 Palatine Road, West Didsbury, Manchester, M20 2WF.

# 6 Development Proposal

The FRA is required to support a planning application for the construction of a 5no. bedroom, 2-storey dwelling following the demolition of the existing dwelling, car port and summer house.

Further details including drawings of the development plans are available in Appendix 2.

# 7 Report Aims and Objectives

The purpose of this report is to establish the flood risk to the site from all potential sources and, where possible, to propose suitable mitigation methods to reduce any risks to an acceptable level. It aims to make an assessment of whether the development will be safe for its lifetime, taking into account climate change and the vulnerability of its users, without increasing flood risk elsewhere.

The FRA assesses flood risk to the site from tidal, fluvial, surface water, groundwater, sewers and artificial sources. The FRA has been produced in accordance with the National Planning Policy Framework (NPPF) and its supporting guidance.

# 8 Summary of Data Review Undertaken

The following research has been undertaken as part of the FRA:

- Desktop assessment of topographical, hydrological and hydrogeological settings through review of the information sourced from the British Geological Survey (BGS), the Environment Agency (EA) and the Ordnance Survey (OS);
- Review of publicly available flood risk mapping provided by the EA;
- Review of the Preliminary Flood Risk Assessment (PFRA) and Level 1 Strategic Flood Risk Assessment (SFRA) produced by the LLFA outlining flood risk from various sources within the borough.

# 9 Legislative and Policy Context

## 9.1 Legislative Context

The Flood and Water Management Act was introduced in 2010. The Act defines the role of lead local flood authority (LLFA) for an area. All LLFA are required to develop, maintain, apply and monitor a strategy for local flood risk management in its area, called “local flood risk management strategy”.

Alongside the Act, Flood Risk Regulations (2009) outline the roles and responsibilities of the various authorities, which include preparing Flood Risk Management Plans and identifying how significant flood risks are to be mitigated.

## 9.2 Policy Context

### 9.2.1 National Planning Policy Framework (NPPF)

The NPPF (updated July 2021) sets out the government’s planning policies for England and how these are expected to be applied. It also provides a set of guidelines and philosophy with which local planning authorities (LPAs) can build their own unique policies to appropriately regulate development within their jurisdictions.

Section 14 entitled “Meeting the challenge of climate change, flooding and coastal change” deals specifically with flood risk.

Paragraph 159 states that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”.

In addition, Paragraph 161 outlines that “All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

- applying the sequential test and then, if necessary, the exception test as set out below;
- safeguarding land from development that is required, or likely to be required, for current or future flood management;
- using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management);
- where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations”.

The NPPF then states in Paragraph 163 that “if it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification”.

It further states that when determining any planning application, LPAs should "ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[55]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- development is appropriately flood resilient and resistant;
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
- any residual risk can be safely managed; and
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Applications for minor development and changes of use should not be subject to the Sequential or Exception Tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.

Footnote 55 states: "A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use."

The NPPF also lays out requirements for how LPAs should deal with planning applications in coastal areas. They should ensure that should they "reduce risk from coastal change by avoiding inappropriate development in vulnerable areas or adding to the impacts of physical changes to the coast."

Developments in Coastal Change Management Areas should only be considered appropriate where it is demonstrated that:

- it will be safe over its planned lifetime and will not have an unacceptable impact on coastal change;
- the character of the coast including designations is not compromised;
- the development provides wider sustainability benefits;
- the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast.

### 9.2.2 Local Planning Policy – Manchester City Council

Policy EN 14 states the following regarding flood risk:

- In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).

- In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.

- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.

- The City of Manchester contains many sections of rivers which are culverted or 'hidden'; where these are indicated in the SFRA beneath the proposed development site, further investigation will be required and the development

proposal should take this into account; where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green Infrastructure.

### 9.3 EA Standing Advice on Flood Risk

The Environment Agency's standing advice lays out the process that must be followed when carrying out flood risk assessments for developments.

Flood Risk Assessments are required for developments within one of the Flood Zones. This includes developments:

- in Flood Zone 2 or 3 including minor development and change of use more than 1 hectare (ha) in Flood Zone 1;
- less than 1 ha in Flood Zone 1, including a change of use in development type to a more vulnerable class (for example from commercial to residential), where they could be affected by sources of flooding other than rivers and the sea (for example surface water drains, reservoirs);
- in an area within Flood Zone 1 which has critical drainage problems as notified by the Environment Agency.

## 10 Site Description and Environmental Characteristics

### 10.1 Site Location and Area

The site is located at 246 Palatine Road, West Didsbury, Manchester, M20 2WF. It is centred at national grid reference 383494, 390846. The site has an area of 834m$^2$.

A site location map and aerial photo are shown below. Photographs of the site are available in Appendix 1.

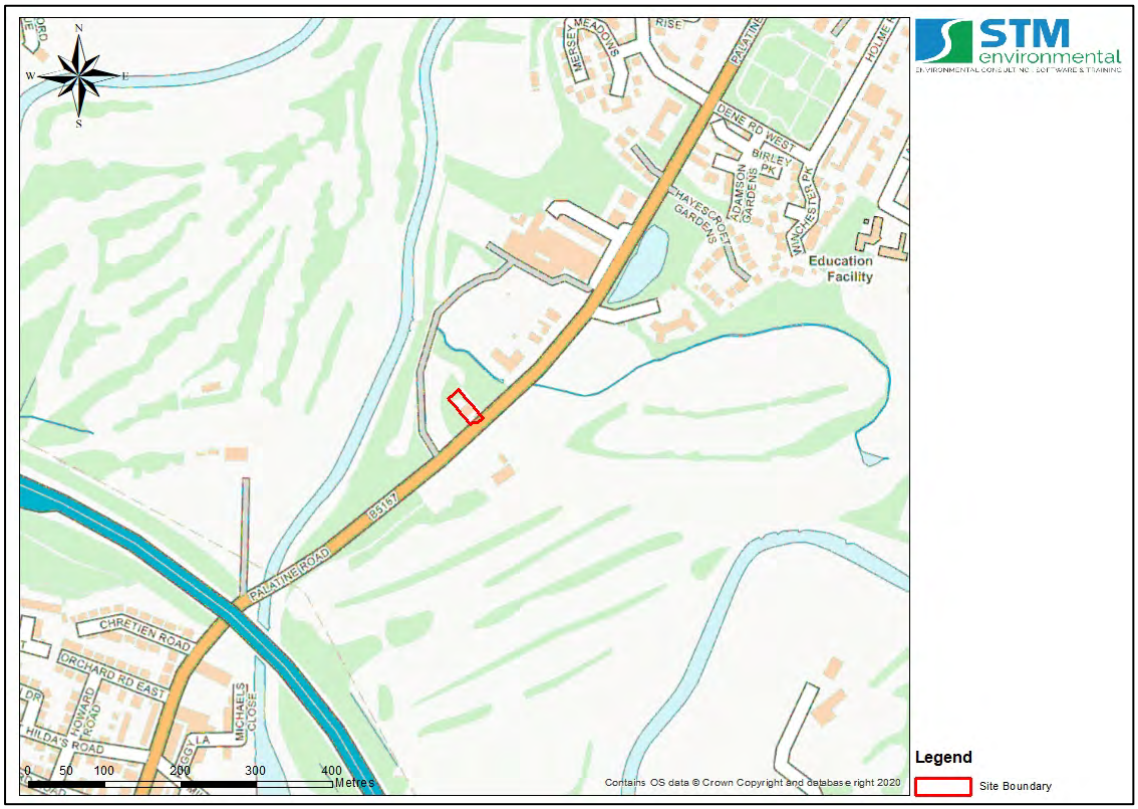



**Figure 1:** Site Location Map

**Figure 2:** Site Aerial Map

## 10.2 Site Access

The site is accessed via Palatine Road.

## 10.3 Local Planning Authority

The site falls within the jurisdiction of Manchester City Council in terms of the planning process.

## 10.4 Lead Local Flood Authority

Manchester City Council is also the Lead Local Flood Authority (LLFA).

## 10.5 Flood Zone

For planning purposes, the site is located in Flood Zone 3a as defined by the EA and LLFA.

## 10.6 Site and Surrounding Land Uses

### 10.6.1 Site Current Land Use

The site is currently a residential bungalow with a dormer upper floor.

### 10.6.2 Surrounding Land Uses

A description of the current and surrounding land uses of the site is given in

Table 1.

**Table 1:** Summary of surrounding land uses

| Boundary | Land Use Description | |
|---|---|---|
| | **Immediately Adjacent (Within 0 – 25m)** | **General Local Area (Within 25 – 250m)** |
| Northern | Residential | Residential, Commercial |
| Eastern | Green space | Residential |
| Southern | Palatine Road | Withington Golf Club |
| Western | Green space | River Mersey, City Gold Academy |

## 10.7 Hydrology

The nearest main watercourses are the River Mersey and Fielden Park Brook which are located 133m west and 65m north of the site respectively.

## 10.8 Geology

Data from the British Geological Survey indicates that the underlying superficial geology is characterised as Alluvium. The underlying bedrock geology is characterized as Wilmslow Sandstone Formation.

## 10.9 Hydrogeology

The site lies upon a Secondary A superficial aquifer and a Principal bedrock aquifer.

Appendix 3 provides BGS mapping showing the hydrogeology at the site location.

## 10.10 Topography

The site remains largely flat, with the surrounding adjacent areas to the north, west and east dropping down approximately 2m to lower elevations. The 1m DTM LiDAR shows that the ground level at the site ranges from 28.95mAOD (N) to 29.33mAOD (central), with the area of the proposed dwelling sitting at an average of 29.20mAOD. A LIDAR map showing the topography of the site and surrounding area is available in Appendix 3.

A topographic survey has been conducted and is also available in Appendix 3. It indicates that the average ground level at the site is 29.21mAOD.

When analysing ground level in relation to modelled flood levels, the LiDAR data will be used. The Environment Agency use LiDAR Data when producing fluvial models and as such the use of the topographic survey would give incorrect depths.

# 11 The Sequential and Exception Tests

## 11.1 The Sequential Test

The Sequential Test aims to steer developments and redevelopments to areas of lower flood risk. The test compares the proposed development site with other available sites, in terms of flood risk, to aid the steering process. The Sequential Test is not required if the proposed development is a minor development or if it involves a change of use unless the development is a caravan, camping chalet, mobile home or park home site.

Based on Government Guidance, Minor Development means:

- minor non-residential extensions: industrial/commercial/leisure etc extensions with a footprint less than 250 square metre.
- alterations: development that does not increase the size of buildings eg alterations to external appearance.
- householder development: For example; sheds, garages, games rooms etc within the curtilage of the existing dwelling, in addition to physical extensions to the existing dwelling itself. This definition excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling eg subdivision of houses into flats.

With regard to residential and commercial developments, major development, as defined by the Town and Country Planning (Development Management Procedure) means one or more of the following:

- c(i) - the number of dwelling houses to be provided is 10 or more; or
- c(ii) - the development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
- the provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more;

- or development carried out on a site having an area of 1 hectare or more.

As the proposal will replace the existing dwelling and outbuildings with a new dwelling, the Sequential Test should not be required. It should be noted that the new proposal will provide a betterment in flood safety and resilience upon the existing site. This is further explained in Section 14.2.

## 11.2 The Exception Test

Where the Sequential Test is undertaken and alternative sites of lower flood risk are not available, then the proposed development may require an Exception Test in order to be granted planning permission. Where the exception test is required, it should be applied as soon as possible to all local development document allocations for developments and all planning applications other than for minor developments. All three elements of the exception test have to be passed before development is allocated or permitted. For the exception test to be passed:

- It must demonstrate that the development provides wider sustainability benefits to the community that outweigh the flood risk, informed by an SFRA, where one has been prepared;
- The development should be on developed land or on previously developed land;
- A flood risk assessment must demonstrate that the development will be safe without increasing flood risk elsewhere, and where possible will reduce the overall flood risk.

The requirements for an Exception Test are given in Table 2 and are defined in terms of Flood Zone and development vulnerability classification.

**Table 2:** NPPF Flood Zone vulnerability compatibility (source: NPPF).

| Flood Zones | Flood Risk Vulnerability Classification | | | | |
|---|---|---|---|---|---|
| | Essential infrastructure | Highly vulnerable | More vulnerable | Less vulnerable | Water compatible |
| Zone 1 | ✓ | ✓ | ✓ | ✓ | ✓ |
| Zone 2 | ✓ | Exception Test required | ✓ | ✓ | ✓ |
| Zone 3a | Exception Test required | ✗ | Exception Test required | ✓ | ✓ |
| Zone 3b | Exception Test required | ✗ | ✗ | ✗ | ✓ |

**Key:**

✓ Development is appropriate

✗ Development should not be permitted.

As the Sequential Test will not be required, the Exception Test will not be needed.

# 12 Site Specific Flood Risk Analysis

The PFRA and Level 1 SFRA produced by the LLFA and maps from the EA provide information regarding historic flooding events and incidents as well as predictions of flood extents and depths during extreme rainfall events.

## 12.1 Fluvial (River) Flood Risk

### 12.1.1 Mechanisms for Fluvial Flooding

Fluvial, or river flooding, occurs when excessive rainfall over an extended period of time or heavy snow melt causes a river to exceed its capacity. The damage from a fluvial flood can be widespread as the overflow may affect downstream tributaries, overtopping defences and flooding nearby inhabited areas. Fluvial flooding consists of two main types:

- Overbank flooding – this occurs when water rises steadily and overflows over the edges of a river or stream;
- Flash flooding – this is characterized by an intense, high velocity torrent of water that occurs in an existing river channel with little to no notice. Flash floods are very dangerous and destructive not only because of the force of the water, but also the hurtling debris that is often swept up in the flow.

### 12.1.2 Definition of EA Modelled Fluvial Flood Risk Zones

Fluvial flood risk is assessed using flooding maps produced by the Environment Agency. These maps use available historic data and hydraulic modelling to define zones of flood risk. The maps allow a site to be defined in terms of its flood zone (e.g. 1, 2, 3) and in terms of the overall flood risk (very low, low, medium or high). It is important to note that existing flood defences are not taken into account within the models or the maps. The EA fluvial flood zones are defined as follows:

- Flood zone 1: Less than 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 2: Between 1 in 100 (1%) and 1 in 1000 (0.1%) annual probability of flooding;
- Flood zone 3: Greater than 1 in 100 (1%) annual probability of fluvial flooding.

Flood zone 3 is split into two sub-categories (3a and 3b) by LLFAs depending on whether the land is considered to be a functional flood plain (i.e. an important storage area for flood waters in extreme events).

- Flood zone 3a: Greater than 1 in 100 (1%) annual probability of fluvial flooding and/or greater than 1 in 200 (0.5%) annual probability of tidal flooding;
- Flood zone 3b: Functional flood plain (definition specific to the LLFA). Less than a 1 in 20 (5%) annual probability of fluvial and/or tidal flooding.

### 12.1.3 Main Potential Sources of Local Fluvial Flooding

The River Mersey and Fielden Park Brook which are located 133m west and 65m north of the site respectively.

### 12.1.4 Records of Historic Fluvial Flooding Incidents

The EA's historic and recorded flood outline maps show the locations and extents of historic flooding. These maps indicate that there has been historic fluvial flooding at the site in 1964 which effected the entire site area. It should be mentioned that fluvial flooding has also occurred recently in 2021, although it cannot be determined whether this impacted the site area itself or remained just outside. This event was largely contained within the Didsbury FSA.

Copies of these maps are available in Appendix 4.

### 12.1.5 Designated Fluvial Flood Risk Zone for the Site

The site is considered to be located within Flood Zone 3a as defined by the Environment Agency and the LLFA indicating that it has a greater than 1% annual probability of fluvial flooding.

### 12.1.6 Flood Defences

The EA's flood defence map which is available in Appendix 7 shows that the site benefits from a range of defences along both the River Mersey and Fieden Brook. These defences include embankments, walls and engineered high ground.

Additionally, the site sits on the boundary of the Didsbury FSA which lies to the predominantly to the east of the site.

### 12.1.7 Climate Change - EA Modelled Predictions of Fluvial and Tidal Flood Levels and Extents

The EA Product 4 dataset which is presented in Appendix 11 provides modelled flood levels and flows for model node points close to the site. These are summarised in Table 3 and Table 4 below.

**Table 3:** EA modelled defended flood levels and expected flood depths for different return periods and scenarios.

| Node | Modelled Defended Fluvial Flood Level mAOD | | |
|---|---|---|---|
| | 1% AEP | 1% AEP + 35% CC | 0.1% AEP |
| 11 | 29.58 | 29.93 | 30.14 |
| 12 | 29.44 | 29.75 | 29.95 |
| 13 | 29.44 | 29.75 | 29.94 |

The area of the proposed dwelling sits at an average of 29.20mAOD. During the 1% AEP + 35% CC fluvial event, the proposed dwelling will witness a maximum flood depth of 29.93mAOD. As such, flood depths can be expected to reach 0.73m during this event.

**Table 4:** EA modelled undefended flood levels and expected flood depths for different return periods and scenarios.

| Node | Modelled Undefended Fluvial Flood Level mAOD | | |
|---|---|---|---|
| | 1% AEP | 1% AEP + 35% CC | 0.1% AEP |
| 11 | 29.69 | 29.93 | 30.13 |
| 12 | 29.11 | 29.46 | 29.70 |
| 13 | 27.90 | 28.83 | 29.66 |

During the modelled undefended fluvial scenarios, it should be noted that only during the 1% AEP fluvial event are flood depth greater than the defended scenario. For the other two more extreme events assessed, the modelled flood depths are comparatively less.

### 12.1.8 Climate Change Allowances – Upper Mersey Management Catchment

The EA's climate change allowances for peak river flow maps show that the site is considered to be in the Upper Mersey Management Catchment peak river flow allowances catchment. The climate change allowances for this catchment are available in .

**In flood zones 2 or 3a for:**

- essential infrastructure – use the higher central allowance

- highly vulnerable – use central allowance (development should not be permitted in flood zone 3a)
- more vulnerable – use the central allowance
- less vulnerable – use the central allowance
- water compatible – use the central allowance

**In flood zone 3b for**:

- essential infrastructure – use the higher central allowance
- highly vulnerable – development should not be permitted
- more vulnerable – development should not be permitted
- less vulnerable – development should not be permitted
- water compatible – use the central allowance

The central allowance for more vulnerable developments indicates a climate change allowance of 41% should be used.

To calculate the correct climate change allowance, extrapolation on the model runs already completed was undertaken. The calculations and extrapolated values are shown in Table 5 below.

**Table 5: Climate Change Allowance Peak Uplift in mAOD**

| Node | 1% AEP | 1% AEP + 30% CC | Difference (m) | ***1% AEP + 41% CC*** | 1% CC (m) | 0.41 (m) |
|---|---|---|---|---|---|---|
| 11 | 29.58 | 29.88 | 0.3 | 29.93 | 0.009 | 0.351 |
| 12 | 29.44 | 29.72 | 0.28 | 29.77 | 0.008 | 0.328 |
| 13 | 29.44 | 29.71 | 0.27 | 29.76 | 0.008 | 0.316 |

| Node | 1% AEP | 1% AEP + 35% CC | Difference (m) | ***1% AEP + 41% CC*** | 1% CC (m) | 0.41 (m) |
|---|---|---|---|---|---|---|
| 11 | 29.58 | 29.93 | 0.35 | 29.99 | 0.010 | 0.410 |
| 12 | 29.44 | 29.75 | 0.31 | 29.80 | 0.009 | 0.363 |
| 13 | 29.44 | 29.75 | 0.31 | 29.80 | 0.009 | 0.363 |

| Node | 1% AEP | 1% AEP + 70% CC | Difference (m) | ***1% AEP + 41% CC*** | 1% CC (m) | 0.41 (m) |
|---|---|---|---|---|---|---|
| 11 | 29.58 | 30.10 | 0.52 | 30.19 | 0.015 | 0.609 |
| 12 | 29.44 | 29.91 | 0.47 | 29.99 | 0.013 | 0.551 |
| 13 | 29.44 | 29.91 | 0.47 | 29.99 | 0.013 | 0.551 |

*** 1% AEP Plus 41% climate change allowance has been extrapolated. ***

| **Node** | **Average *1% AEP + 41% CC*** |
|---|---|
| 11 | 30.04 |
| 12 | 29.85 |
| 13 | 29.85 |

The area of the proposed dwelling sits at an average of 29.20mAOD.

During the 1% AEP + 41% CC fluvial event, the proposed dwelling will witness a maximum flood depth of 30.04mAOD – based on the average extrapolation calculated from node 11.

### 12.1.9 Long Term Fluvial Flood Risk Considering Flood Defences

The EA's long term flood risk maps give an indication of the actual risk associated with flooding after taking into account the effect of any flood defences in the area. Copies of maps for the site which are available in Appendix 9 indicate that the long-term risk from fluvial flooding to the site is medium.

## 12.2 Pluvial (Surface Water) Flood Risk

A pluvial, or surface water flood, is caused when heavy rainfall creates a flood event independent of an overflowing water body. Surface water flooding occurs when high intensity rainfall leads to run-off which flows over the ground surface, causing ponding in low-lying areas when the precipitation rate or overland flow rate is greater than the rate of infiltration, or return into watercourses. Surface water flooding can be exacerbated when the underlying soil and geology is saturated (as a result of prolonged precipitation or a high-water table) or when the drainage network has insufficient capacity.

### 12.2.1 Mechanisms of Pluvial Flooding

The chief mechanisms for surface water flooding can be divided into the following categories:

- Runoff from higher topography;
- Localised surface water runoff – as a result of localised ponding of surface water;
- Sewer Flooding – areas where extensive and deep surface water flooding is likely to be influenced by sewer flooding. Where the sewer network has reached capacity, and surcharged, this will exacerbate the flood risk in these areas;
- Low Lying Areas – areas such as underpasses, subways and lowered roads beneath railway lines are more susceptible to surface water flooding;
- Railway Cuttings –railway infrastructure cut into the natural geological formations can cause extra surface run off and pooling disrupting service and potentially affecting adjacent structures;
- Railway Embankments – discrete surface water flooding locations along the up-stream side of the raised network rail embankments where water flows are interrupted and ponding can occur;
- Failure of artificial sources (i.e. man-made structures) such as such as canals and reservoirs.

### 12.2.2 Main Potential Sources of Local Pluvial Flooding

The main potential source of pluvial flooding to the site is considered to be surface water ponding associated with heavy rainfall in the area of the site.

### 12.2.3 Records of Historic Pluvial Flooding Incidents

Examination of the LLFA's Level 1 SFRA revealed no evidence of pluvial flooding on or in the vicinity of the site.

A table showing the location of surface water flooding incidents is available in Appendix 4 .

### 12.2.4 Surface Water Flood Risk from Artificial Sources (Reservoirs and Canals)

The EA's reservoir flood risk map indicates that the site does lie within an area that is at risk of reservoir flooding. However, the closest reservoir is over 10 km away. It should also be noted that reservoir flooding is extremely unlikely and there has been no loss of life in the UK from reservoir flooding since 1925.

### 12.2.5 Sewer Flooding

Examination of the LLFA's Level 1 SFRA revealed there has been one recorded incident of a sewer bursting in 1965 effecting the Northenden and Didsbury area. The exact location of this event is unknown.

A table showing recorded incidents of sewer flooding is available in Appendix 4.

### 12.2.6 Climate Change - Modelled Predictions of Surface Water Run-off Flooding

Mapping of the predicted extent and depth of surface water flooding for the 1 in 100-year, and 1 in 1000-year rainfall return periods provided by the EA are available in Appendix 6.

During all modelled pluvial events the site remains dry.

### 12.2.7 Long Term Surface Water Flood Risk

The EA's long term flood risk maps which are available in Appendix 9 indicate that the long term risk of flooding from surface water is considered to be very low.

## 12.3 Risk of Flooding from Multiple Sources (ROFMS)

The Environment Agency provides a map which gives an indication of the overall flood risk to a site from fluvial, tidal and surface water sources after considering the presence of flood defences. This map indicates that there is a greater than 3.3% chance of flooding at the site in any year. A copy of the map is presented in Appendix 8.

## 12.4 Groundwater Flood Risk

Groundwater flooding occurs when water rises from an underlying aquifer (i.e. at the location of a spring) to such a level where it intersects the ground surface and inundates the surrounding land. Groundwater flooding tends to occur after long periods of intense precipitation, in often low-lying areas where the water table is likely to be at a shallow depth. Groundwater flooding is known to occur in areas underlain by principal aquifers, although increasingly it is also being associated with more localised floodplain sands and gravels. A high groundwater table also has the potential to exacerbate the risk of surface water and fluvial flooding by reducing rainfall infiltration capacity, and to increase the risk of sewer flooding through sewer/groundwater interactions.

### 12.4.1 Historic Records of Groundwater Flooding

On examination of the LLFA's Level 1 SFRA there is no information regarding historic groundwater events.

### 12.4.2 Susceptibility to Groundwater Flooding

The Groundwater Flood Susceptibility Map provided by BGS and presented in Appendix 10 indicates that the site has limited potential for groundwater flooding to occur at the surface. The Groundwater Depth map also provided by BGS indicates that the groundwater level may be at approximately less than 3mbgl.

## 12.5 Critical Drainage Area

A Critical Drainage Area (CDA) may be defined as "a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure". A CDA is defined in the Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006 as "an area within Flood Zone 1 which has critical drainage problems and which has been notified to the local planning authority by the Environment Agency".

The site sits within the Didsbury CDA as shown within the LLFA's SFRA mapping.

# 13 Potential Impacts of the Development on Local Flood Risk

## 13.1 Changes to Impermeable Area and Building Footprint

Changes in ground cover arising from the development are presented in Tables below.

**Table 5:** Existing and proposed site ground cover.

| | Impermeable Area | | Permeable Area | | Total Area |
|---|---|---|---|---|---|
| | **m²** | **%** | **m²** | **%** | **m²** |
| Existing Site | 488 | 59 | 346 | 41 | 834 |
| Proposed Site | 453 | 54 | 381 | 46 | 834 |
| Difference | -35 | -4 | 35 | 4 | |

The proposed development will reduce the overall impermeable area of the site by 35m$^2$.

**Table 6: Land Cover Detail Pre & Post development**

| Ground Cover | Existing Development Area | | Proposed Development Area | | Difference ($m^2$) |
|---|---|---|---|---|---|
| | $m^2$ | % | $m^2$ | % | |
| Buildings | 267 | 32 | 259 | 31 | -8 |
| Driveways/Patio | 221 | 26 | 194 | 23 | -27 |
| Gardens/ Soft landscaping | 346 | 41 | 381 | 46 | -35 |
| Total | 834 | 100 | 834 | 100 | |

However, as the proposed development will alter the building footprint which lies within the flood plain, it will have impact on local flood storage and flood flow routes/rates.

Although the total building footprint decreases in the proposed development scenario, the total building footprint which has potential to impact upon the flood plain increases. The table below shows the changes occurring on the site.

**Table 7: Changes in Built-up Areas of the site.**

| Existing | | | Proposed | | |
|---|---|---|---|---|---|
| **Building** | **Area ($M^2$)** | **Impact on Flood Plain** | **Building** | **Area ($M^2$)** | **Impact on Flood Plain / Comment** |
| **House** | 177 | Yes | House | 259 | Yes |
| **Container** | 32 | Yes | N/A | | Removed |
| **Car Port** | 61 | No | N/A | | Removed – Did not impact. |
| **Summer House** | 15 | No | N/A | | Removed – Did not impact. |
| **Total ($m^2$)** | 285 | 209 | Total | 259 | |
| **Displacement Volume ($m^3$)** | 173.47 | | Displacement Volume ($m^3$) | 214.97 | |

Even though the proposal reduces the total built up area through the removal of the car port, container and summer house, not all of these areas displace flood waters.

The proposal increases the built-up area of the site by 50$m^2$ within the 1% AEP plus 41% climate scenario if mitigation measures are not included. It should also be noted, that the proposal aims to include a ground floor swimming pool, which needs to be carefully considered when mitigation measures are proposed. In addition to this, all

building materials which remain within the flood plain need to be taken into account; this includes the perimeter wall, supporting pillars and steps. These measures and considerations are discussed in more detail in Section 14.2.2.

The fence line around the proposal will be formed from a metal free flow design. Similar to existing to ensure the free flow movement of water (See Appendix 1).

# 14 Flood Risk Mitigation Measures

## 14.1 SuDS

Planning practice guidance (PPG) which is prepared by the Ministry of Housing, Communities and Local Government (DCLG) states that developers and Local Authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

As such, the developer has the option to implement a SuDS strategy in line with the drainage hierarchy as outlined in Table 6 below to reduce surface water discharges from the site.

**Table 6:** SuDS Options

| |
|---|
| ▪ Store rainwater for later use;<br>▪ Use infiltration techniques, such as porous surfaces in non-clay areas;<br>▪ Attenuate rainwater in ponds or open water features for gradual release;<br>▪ Attenuate rainwater by storing in tanks or sealed water features for gradual release;<br>▪ Discharge directly to a water course;<br>▪ Discharge rainwater directly to a surface water sewer/drain;<br>▪ Discharge to a combined sewer. |

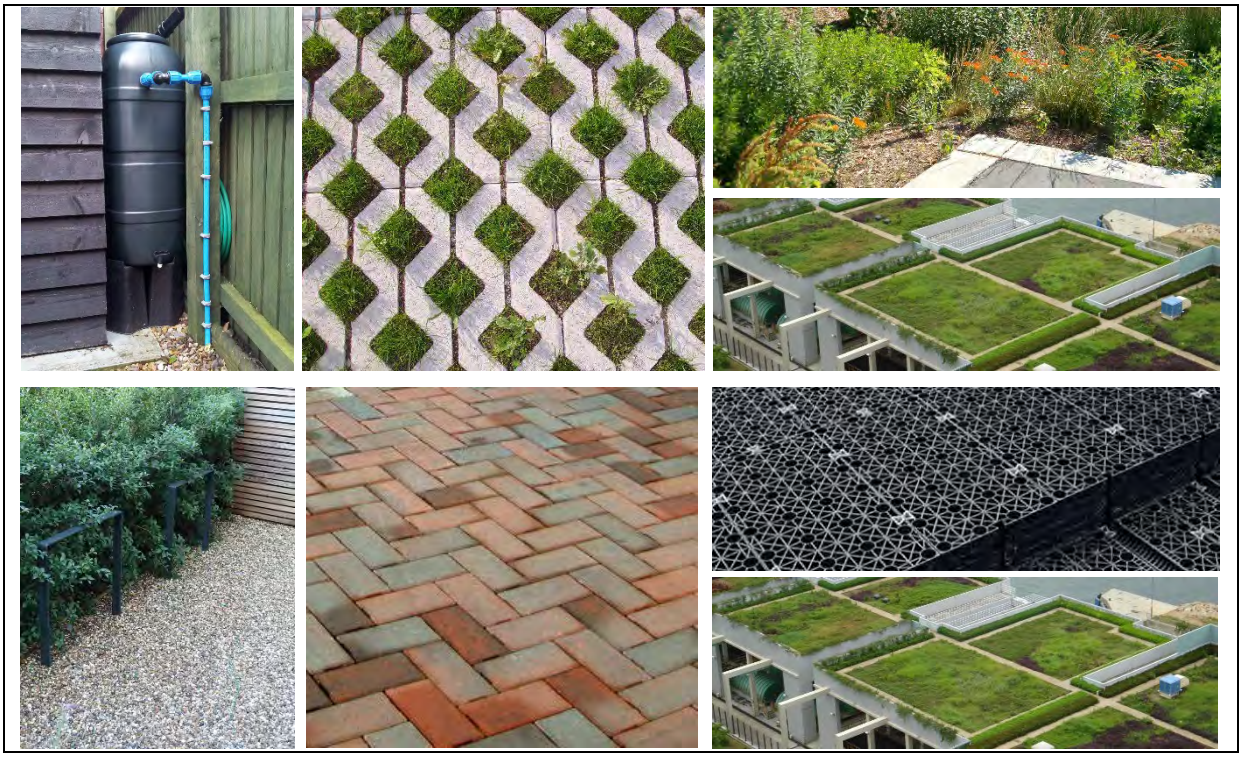


**Figure 3:** Surface water storage facilities and potential SuDS features - rainwater harvesting, on-site tank storage, rain garden soak-away and green roofs. (Source: UK SuDS Manual)

Given the nature of the development and the size of the site, it is considered that there are good opportunities for implementing SuDS. Measures such as green roofs, rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or attenuation storage tanks should be considered. A full SuDS strategy is outside the scope of works of this FRA.

## 14.2 Flood Resilience

Flood resilient construction uses methods and materials that reduce the impact from a flood, ensuring that structural integrity is maintained, and the drying out and cleaning required, following inundation and before reoccupation, is minimised.

### 14.2.1 Finished Floor Levels

The area of the proposed dwelling sits at an average of 29.20mAOD.

For **vulnerable developments,** the EA's Standing Advice states that finished floor level of the lowest habitable room in any building Ground floor levels should be a

minimum of 300 (mm) above the general ground level of the site, flood level or adjacent road level whichever is higher.

During the 1% AEP + 41% CC event, the proposed dwelling will witness a maximum flood depth of 30.04mAOD.

In alignment with EA Guidance FFL should be raised 300mm above this level to 30.34mAOD. This equates to the proposed dwelling being raised 1.14m.

### 14.2.2 Compensatory Flood Storage (CFS)

All new development within Flood Zone 3 must not result in a net loss of flood storage capacity. Where possible, opportunities should be sought to achieve an increase in the provision of floodplain storage.

As discussed in Section 13, the proposal increases the built-up area of the site by 50m$^2$. Based on the predicted flood level of 30.04mAOD and the associated flood depth of 0.83m, the proposal has potential to displace approximately 41.5m$^3$ additional flood plain water than the existing scenario.

Where the proposed development results in a change in building footprint, the developer must ensure that it does not impact upon the ability of the floodplain to store water, and should seek opportunities to provide a betterment with respect to floodplain storage.

The proposal will minimise the impacts to the flood plains storage and provide a betterment wherever possible.

The entirety of the new dwelling will be constructed upon stilts and the underside pad foundation, will be at the indicative flood level of 30.04mAOD. The large void below the pad will allow for the free flow of water below the dwelling during times of flood. Therefore, the majority of the new build will no longer be displacing flood waters, aside from the supporting stilts, perimeter wall and access steps. This will provide a

significant improvement to the flood plain storage when compared to current scenario, as the existing dwelling currently resides within the flood plain.

The existing buildings on site were calculated to displace 173m$^3$.

The raising the pad foundation above the flood level it will therefore provide this volume in flood plain storage within the development site. However, the stilts, perimeter wall (walls with voids), swimming pool and access steps reduce this, as inevitably some building materials will remain in the flood plain. These have been taken into account below.

#### *14.2.2.1 Swimming Pool*

The proposal will a introduce ground floor swimming pool. The 1.5m deep pool (1.8m construction height), will therefore extrude below the base of the pad foundation into the 1% AEP plus 41% CC flood level.

Therefore, the developer will raise the indoor swimming pool height 1m above the finished floor level to 31.34mAOD. This will result in the exterior concrete surround of the swimming pool having an invert level of approximately 29.54mAOD, thus displacing approximately 0.3m depth of flood water across its area and displacing 7.2m$^3$ of the flood plain storage below the foundation pad.

#### *14.2.2.2 Perimeter wall, Steps and Stilts*

The proposed dwelling will have a perimeter wall of 84m in length and will be formed from cavity walls and which will have a width of 0.3m. Based on the average ground level and flood depth, this structure will cause the displacement of 20.66m$^3$. This value does not take into account the cavity or the voids within the wall – it gives the worse case scenario.

The pillars will displace a further 0.84m$^3$ based on a minimum of 30 pillars each 0.2m$^2$ and the steps will displace a further a further 3.6m$^3$

In total, all building materials which will lie within in the flood plain will displace 32.2m$^3$.

**Table 8: Materials Causing Displacement**

| Materials | Volume (m$^3$) |
|---|---|
| Perimeter Wall | 20.66 |
| Swimming Pool | 7.2 |
| Steps | 3.6 |
| Pillars | 0.84 |
| **Total Displacement** | **32.3** |

#### *14.2.2.3 Changes in Flood Plain Storage*

When considering the flood plain storage volume pre and post development, including the displacement caused by all the materials which will remain within the flood plain, the proposal provides a 141m$^3$ increase in the flood plains storage capacity. We therefore do not believe compensatory flood storage should be required.

#### *14.2.2.4 Voids*

Void openings should be a minimum of 1m long and open from existing ground levels to at least the 1% annual probability (1 in 100-year) plus climate change flood level. By setting finished floor levels at 300mm above the design flood level, there is usually enough space provision for voids below. There should be a minimum of 1m of open void length per 5m length of wall. Void openings should be provided along all external walls of the proposed extension. If security is an issue, 10mm diameter vertical bars set at 100mm centres can be incorporated into the void openings.

Access will be provided to ensure cleaning and general maintenance tasks can be completed.

### 14.2.3 Flood Resilience Construction Measures

In terms of achieving resilience, there are two main strategies, whose applicability is dependent on the water depth the property is subjected to. These are:

- Water Exclusion (Flood Resistance) Strategy - should be employed where predicted flood depths are less than 0.3m and are likely to be for short duration.

Emphasis is placed on minimising water entry and giving occupants time to relocate ground floor contents, maintaining structural integrity, and on using materials and construction techniques to facilitate drying and cleaning;

- Water Entry (Flood Resilience) Strategy - Flood resilience measures are designed to allow water in but to limit damage and allow rapid re-occupancy. Resilience measures should be employed where flood depths are greater than 0.6m and where it is likely that structural damage will occur due to excessive water pressure.

Given that flood depths less than 0.6m are predicted in extreme scenarios, the entry strategy is considered most applicable for this site.

Water Entry Strategy:

There are a range of options for implementing the Water Entry Strategy including:

- Use materials with either good drying and cleaning properties, or, sacrificial materials that can easily be replaced;
- Designing for water to drain away;
- Designing access to all spaces to permit drying and cleaning;
- Raising the level of electric wiring, appliances and utility metres (0.1m above flood level);
- Ground supported floors with concrete slabs coated with impermeable membrane;
- Tank basements, cellars and ground floors with water resistant membranes;
- Plastic water-resistant internal doors.

Flood resilience design and measures that will be implemented are outlined below. Water-resistant and resilient materials will be utilized throughout the construction to minimize the flood risk and potential impacts.

Floor construction:

- Use of resilient flooring materials as ceramic tiles or stone floor finishes;
- Use of a concrete slab 150mm thick;
- Use of ceramic tiles or stone floor finishes is recommended;

- Maintain existing under floor ventilation by UPVC telescopic vents above 400 mm to external face of extension;
- Damp proof membrane of impermeable polythene at least 1200 gauge;
- Avoid the use of MDF carpentry.

Wall construction:

- Include in the external face of the extension a damp – proof course, 250 mm above ground level, to prevent damp rising through the wall;
- Use rigid closed – cell material for insulation above the DPC;
- Spread hardcore over the site within the external walls of the building to such thickness as required to raise the finished surface of the site concrete. The hardcore should be spread until it is roughly level and rammed until it forms a compact bed for the oversite concrete. This hardcore bed will be 100 mm thick and composed by well compacted inert material, blinded with fine inert material.

Doors:

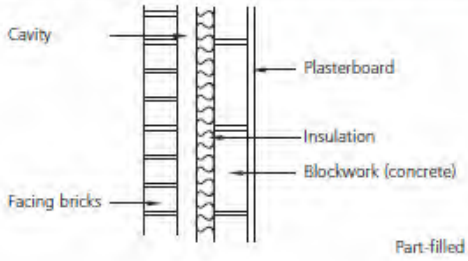
- Seal doors around edges and openings. UPVC or composite material will be used with passive protection meaning that minimal intervention will be required in the event of flooding.

Underground drainage:

- Avoid use of metal for any underground piping;
- Use closed cell insulation for pipes that are below the predicted flood level;
- Provide non – return valves for the drainage system to prevent back water flow;
- Use UPVC or clay pipework for fouls and surface water drainage.

**Figure 4: Cavity External Walls**

**Figure 6.10 Cavity External Walls – Part-filled cavity with sacrificial plasterboard**




Part-filled cavity

- External face consisting of engineering bricks up to required level for flood protection (up to d.p.c.). Other external facing materials can be used above this level, but ensure transition is watertight.
- Rigid insulation
- Internal cement based render, preferably with lime content. Composition depends on masonry; the following mix is effective:

  1 cement : 6 sand: 1 lime on concrete blocks.
- Stainless steel wall ties should be used to minimise corrosion and consequent staining.
- Sacrificial plasterboard can be used, but it needs to be removed between ground floor to flood level. The board should be laid horizontally to make removal easier.

As well as the above the following flood resilience features should be applied as part of the development:

- Electrical sockets should be installed above flood level for the ground floor;
- Utility services such as fuse boxes, meters, main cables, gas pipes, phone lines and sockets will be positioned as high as practicable;
- All external openings for pipes or vents below 400mm to be sealed around pipe or vent with expanding foam and mastic.

## 14.3 Emergency Plan

### 14.3.1 Assessment of Danger to People

The dangers associated with flood water to people are possible injury and/or death. This can occur as a result of drowning or being carried along by the waters into hard objects or vice versa. The risk to life is largely a function of the depth and velocity of the floodwater as it crosses the floodplain. Fast flowing deep water that contains debris would represent the greatest hazard.

The assessment of danger to people from walking in floodwater is described in the Flood Risks to People guidance documents (FD2321_TR1 and FD2321_TR2) by DEFRA/EA.

Danger can be estimated by the simple formula:

$$HR = d \times (v + 0.5) + DF$$

where, HR = (flood) hazard rating; d = depth of flooding (m); v = velocity of floodwaters (m/sec); and DF = debris factor.

The scoring methodology and calculation matrix for this is summarised in Appendix 13.

The EA data provided only modelled 1D in channel flows. The closest 1D node point to the site is node point 8 on the Fielden Park Brook. This node will be used to produce a speculative assessment of a potential HR on site during the 1% AEP + 35% CC fluvial event. Below shows the HR calculation.

$$HR = 0.73 \times (0.5 + 0.5) + 1$$

$$\mathbf{HR = 1.73}$$

A HR of 1.73 corresponds to a significant risk which would be a hazard for most. Although, the HR on site is likely to be less given its more distant proximity from the brook.

The use of a flood emergency plan is therefore sufficient for the proposed development. The key elements of the emergency plan are described below.

### 14.3.2 EA Flood Warnings Direct Service Subscription

The occupants will subscribe to the EA Flood Warnings Direct Service which is a free service offered by the EA providing flood warnings direct to people by telephone,

mobile, email, SMS text message and fax. The EA aims to provide 2 hours' notice of flood, day or night, allowing timely evacuation of the site.

The agency operates a 24-hour telephone service on 0345 988 1188 that provides frequently updated flood warnings and associated floodplain information. In addition, this information can also be found at https://fwd.environment-agency.gov.uk/app/olr/home along with recommendations on what steps should be taken to prepare for floods, what to do when warnings are issued, and how best to cope with the aftermath of floods.

### 14.3.3 Access and Safe Egress

Safe egress to Flood Zone 1 is available by a 6-minute walk north down Palatine Road. Directions of this route are presented in Appendix 12 .

### 14.3.4 Safe Refuge

The proposed development will have internal connections to upper floors in the property which will act to provide sufficient safe refuge in the event of an extreme flood event. The proposed dwelling will locate all bedrooms on upper floors, providing an improvement upon existing which has 2no. ground floor bedrooms.

# 15 Conclusions and Recommendations

This assessment has considered the potential risks to the application site associated with flooding from fluvial, tidal, surface water, artificial and groundwater sources and the potential impacts of climate change.

A review of LLFA's PFRA and SFRA as well as data provided by the EA was undertaken. The main findings of the review and assessment are provided below:

- As the proposal will replace the existing dwelling and outbuildings with a new dwelling, the Sequential Test should not be required;

- The Exception Test should not be required;
- The main sources of potential flooding to the site are the River Mersey and Fielden Park Brook which are located 133m west and 65m north of the site respectively;
- The EA define the site as being within Flood Zone 3a;
- The site is protected by multiple flood defences throughout the surround area. These defences include embankments, walls, engineered high ground and the Didsbury FSA;
- There has been one historic fluvial flooding event at the site in 1964, with a further event recorded in 2021, although it cannot be determined whether this impacted the site area itself or remained just outside;
- There has been one recorded incident of a sewer bursting in 1965 effecting the Northenden and Didsbury area;
- The site is located within the Didsbury CDA;
- The FFL will be raised 300mm above the 1% plus 41% Climate Change allowance to 30.34mAOD;
- The proposal development will be constructed upon stilts, the base of the pad foundation will be equal to the estimated 1% AEP plus 41% CC event at 30.04mAOD;
- The proposal will increase the building footprint by 50m$^2$; however, it mitigates the increase by removing all buildings which directly impact upon the flood plain storage area;
- The raising of the development out of the flood plain will increase its capacity by a minimum of 141m$^3$. This accounts for the building materials within the flood plain and the swimming pool extruding below the raised pad foundation;
- There is good opportunity for implementing SuDS mitigation measures. Consideration should be given to use of green roofs, rainwater harvesting, infiltration (soakaways, permeable paving, rain gardens) or attenuation storage tanks;
- Flood resilient materials and construction methods will be used so as to ensure that the impacts of any potential flooding are minimised as much as possible;
- Occupants will subscribe to the EA Flood Warnings Direct Service;

- Safe egress to Flood Zone 1 is available by a 6-minute walk north down Palatine Road;
- In the event that evacuation is not possible, safe refuge is available in the upper floors of the building which are accessible via an internal staircase.

As such it is considered that the proposed new dwelling is in compliance with local planning policy and the NPPF.

# 16 References


1. Communities and Local Government - National Planning Policy Framework NPPF, July, 2021.
2. Communities and Local Government - Planning Practice Guidance: Flood Risk and Coastal Change, Updated 06 March 2014.
3. Manchester City Council Core Strategy, 2012.
4. Preliminary Flood Risk Assessment – Manchester City Council, 2011
5. Manchester City Council Level 1 Strategic Flood Risk Assessment, 2010.
6. Manchester City Council Level 2 Strategic Flood Risk Assessment, 2011.
7. CIRIA, Defra, Environment Agency – UK SuDS Manual, 2015.

# 17 Appendices

## 17.1 Appendix 1 – Site Photographs

## 17.2 Appendix 2 – Development Plans

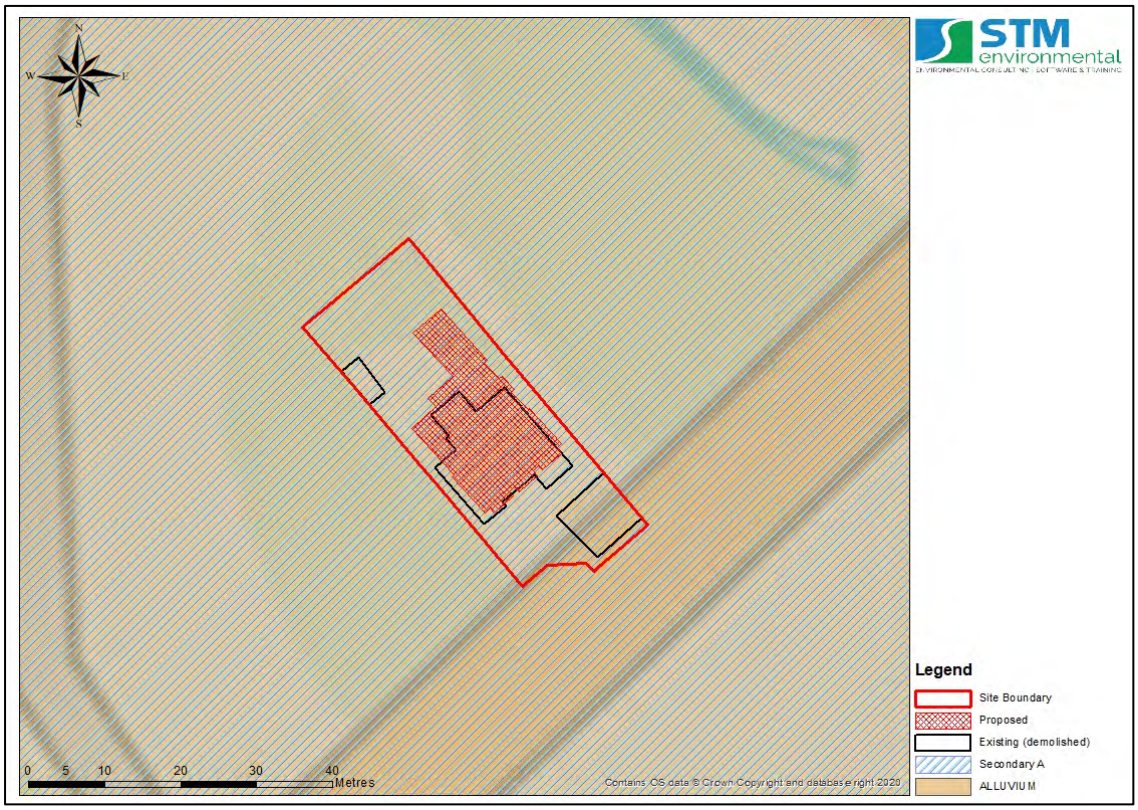
### 17.2.1 Development Plans

Please refer to development plans attached to the most recent planning application.

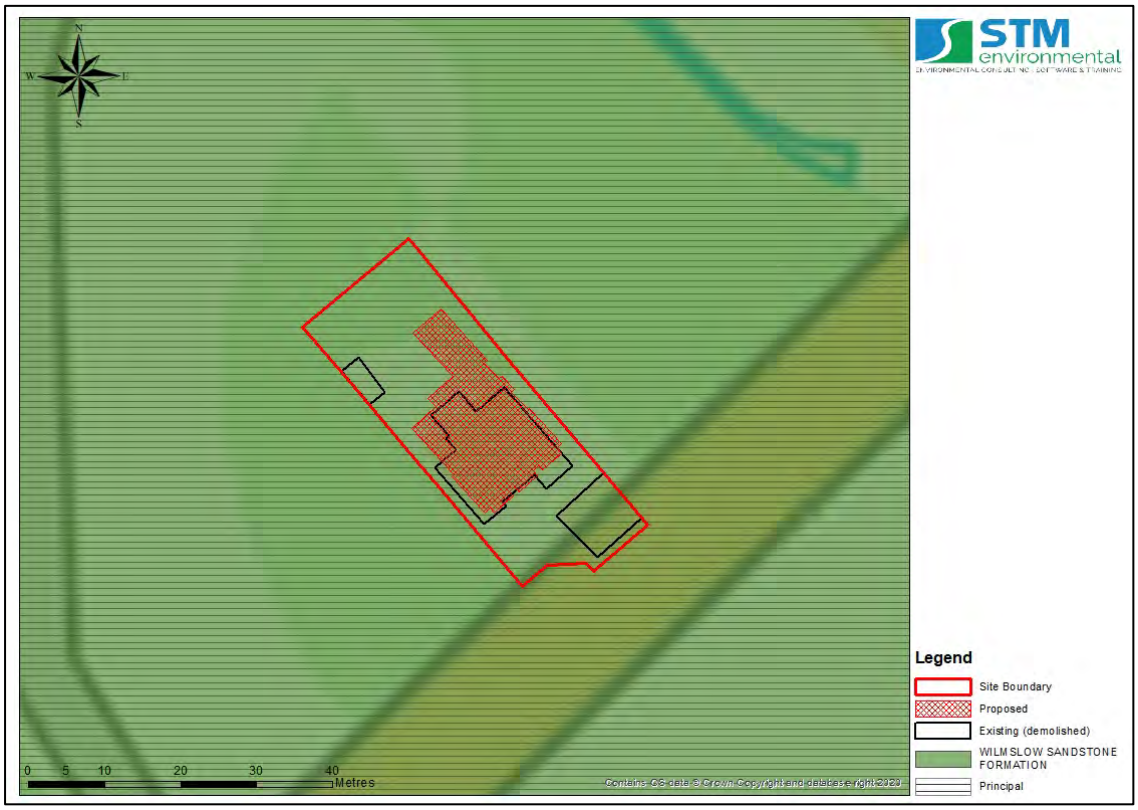
### 17.2.2 Changes in Ground Cover

## 17.3 Appendix 3 – Environmental Characteristics

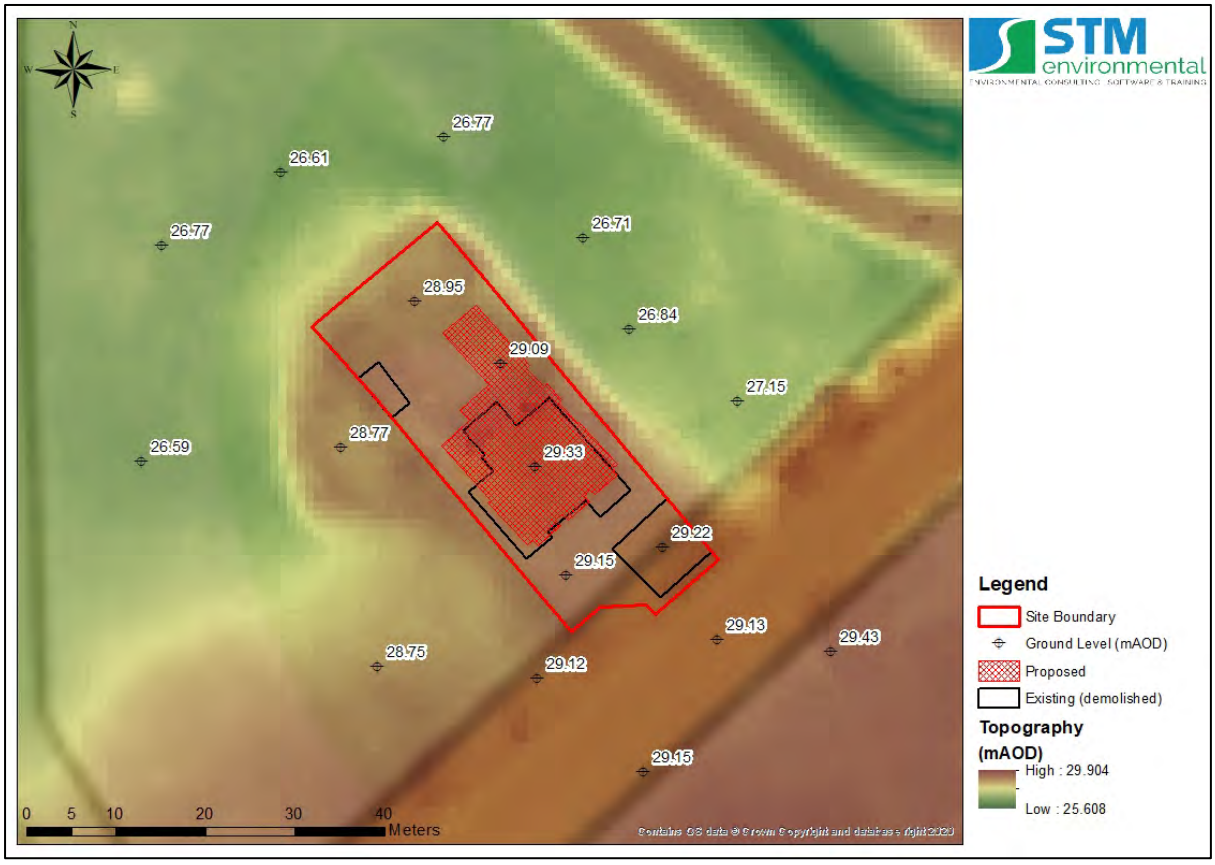
### 17.3.1 Superficial Hydrogeology Map

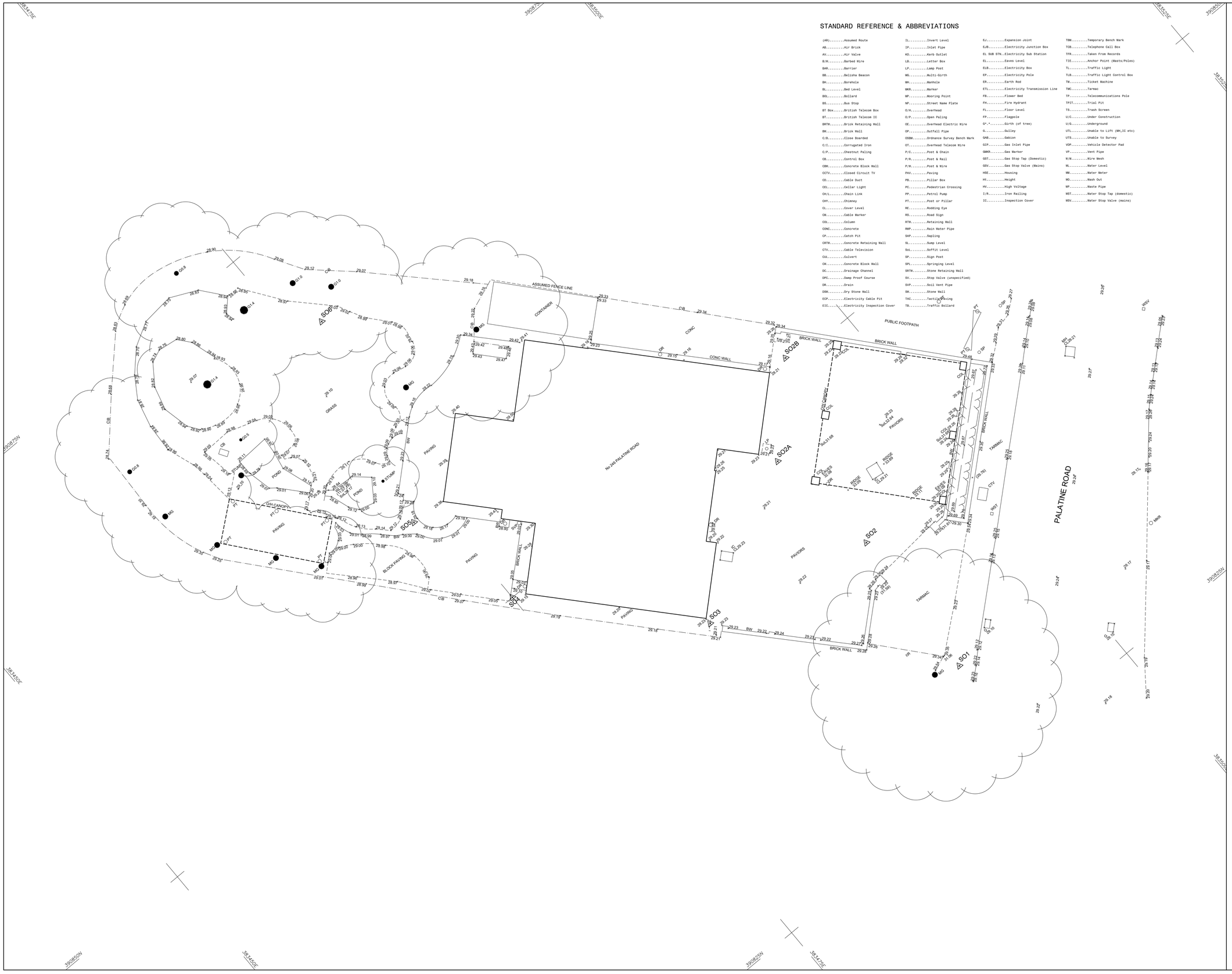



### 17.3.2 Bedrock Hydrogeology Map



### 17.3.3 Topography Map






## STANDARD REFERENCE & ABBREVIATIONS

(AR).....Assumed Route
AB.....Air Brick
AV.....Air Valve
B/W.....Barbed Wire
BAR.....Barrier
BB.....Belisha Beacon
BH.....Borehole
BL.....Bed Level
BOL.....Bollard
BS.....Bus Stop
BT Box.....British Telecom Box
BT.....British Telecom IC
BRTW.....Brick Retaining Wall
BW.....Brick Wall
C/B.....Close Boarded
C/I.....Corrugated Iron
C/P.....Chestnut Paling
CB.....Control Box
CBW.....Concrete Block Wall
CCTV.....Closed Circuit TV
CD.....Cable Duct
CEL.....Cellar Light
CH/L.....Chain Link
CHY.....Chimney
CL.....Cover Level
CM.....Cable Marker
COL.....Column
CONC.....Concrete
CP.....Catch Pit
CNTW.....Concrete Retaining Wall
CTV.....Cable Television
CUL.....Culvert
CW.....Concrete Block Wall
DC.....Drainage Channel
DPC.....Damp Proof Course
DR.....Drain
DSW.....Dry Stone Wall
ECP.....Electricity Cable Pit
EIC.....Electricity Inspection Cover
IL.....Invert Level
IP.....Inlet Pipe
KO.....Kerb Outlet
LB.....Letter Box
LP.....Lamp Post
MG.....Multi-Girth
MH.....Manhole
MKR.....Marker
MP.....Mooring Point
NP.....Street Name Plate
O/H.....Overhead
O/P.....Open Paling
OE.....Overhead Electric Wire
OP.....Outfall Pipe
OSBM.....Ordnance Survey Bench Mark
OT.....Overhead Telecom Wire
P/C.....Post & Chain
P/R.....Post & Rail
P/W.....Post & Wire
PAV.....Paving
PB.....Pillar Box
PC.....Pedestrian Crossing
PP.....Petrol Pump
PT.....Post or Pillar
RE.....Rodding Eye
RS.....Road Sign
RTW.....Retaining Wall
RWP.....Rain Water Pipe
SAP.....Sapling
SL.....Sump Level
SoL.....Soffit Level
SP.....Sign Post
SPL.....Springing Level
SRTW.....Stone Retaining Wall
SV.....Stop Valve (unspecified)
SVP.....Soil Vent Pipe
SW.....Stone Wall
TAC.....Tactile Paving
TB.....Traffic Bollard
EJ.....Expansion Joint
EJB.....Electricity Junction Box
EL SUB STN..Electricity Sub Station
EL.....Eaves Level
ELB.....Electricity Box
EP.....Electricity Pole
ER.....Earth Rod
ETL.....Electricity Transmission Line
FB.....Flower Bed
FH.....Fire Hydrant
FL.....Floor Level
FP.....Flagpole
G*.*.....Girth (of tree)
G.....Gulley
GAB.....Gabion
GIP.....Gas Inlet Pipe
GMKR.....Gas Marker
GST.....Gas Stop Tap (Domestic)
GSV.....Gas Stop Valve (Mains)
HSE.....Housing
Ht.....Height
HV.....High Voltage
I/R.....Iron Railing
IC.....Inspection Cover
TBW.....Temporary Bench Mark
TCB.....Telephone Call Box
TFR.....Taken from Records
TIE.....Anchor Point (Masts/Poles)
TL.....Traffic Light
TLB.....Traffic Light Control Box
TM.....Ticket Machine
TWC.....Tarmac
TP.....Telecommunications Pole
TRIT.....Trial Pit
TS.....Trash Screen
U/C.....Under Construction
U/G.....Underground
UTL.....Unable to Lift (MH,IC etc)
UTS.....Unable to Survey
VDP.....Vehicle Detector Pad
VP.....Vent Pipe
W/W.....Wire Mesh
WL.....Water Level
WM.....Water Meter
WO.....Wash Out
WP.....Waste Pipe
WST.....Water Stop Tap (domestic)
WSV.....Water Stop Valve (mains)

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Note:
The survey is plotted on a plane local Grid. Orientation to National Grid.
All levels relate to Ordnance Datum, achieved using the OS National GPS Network.
Survey Control Markers established for Mapping purposes only and should not be used for Construction without the written approval of Survey Operations Ltd.
Levels in parenthesis indicate tops of walls.

SURVEY STATIONS

| Name | Easting | Northing | Height |
|---|---|---|---|
| SO2 | 383492.60 | 390839.42 | 29.23 |
| SO3 | 383482.76 | 390841.60 | 29.24 |
| SO4 | 383475.00 | 390850.01 | 29.14 |
| SO5 | 383473.42 | 390856.92 | 29.18 |
| SO6 | 383476.72 | 390869.14 | 29.08 |
| SO2B | 383495.81 | 390850.52 | 29.25 |
| SO2A | 383491.67 | 390846.25 | 29.22 |
| SO1 | 383492.18 | 390830.59 | 29.30 |

Survey Operations
Smith Street, Skelmersdale, Lancs. WN8 8LN
Tel: 01695 725662 Fax: 01695 51816
Email: mail@survops.co.uk – www.survops.co.uk

Client
APL Architecture and Design

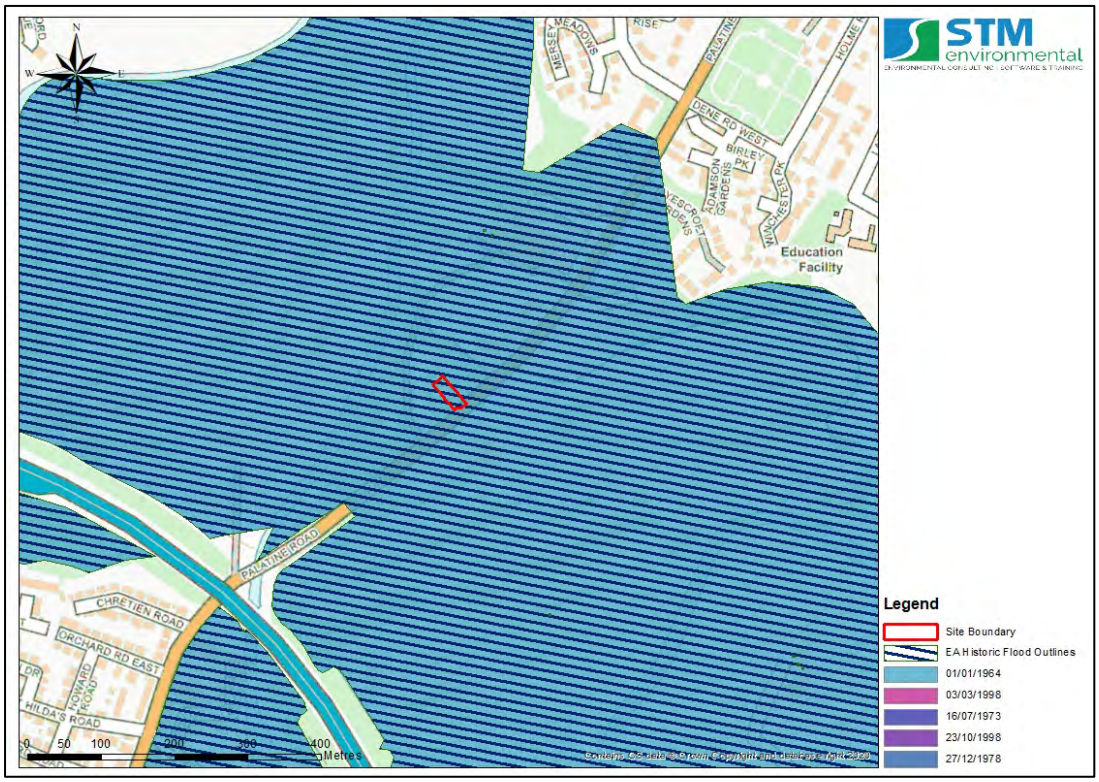
Drawing Title
Topographical Survey of Land at:
246 Palatine Road
West Didsbury

| | | | |
|---|---|---|---|
| Scale(s) | 1:100 | Surveyor | MW |
| Date | Jul 19 | Drawn | OKS |
| Job Number | 19F150 | Checked | MG |

Sheet Size & Drg Number & Revision
A1 19F150/001

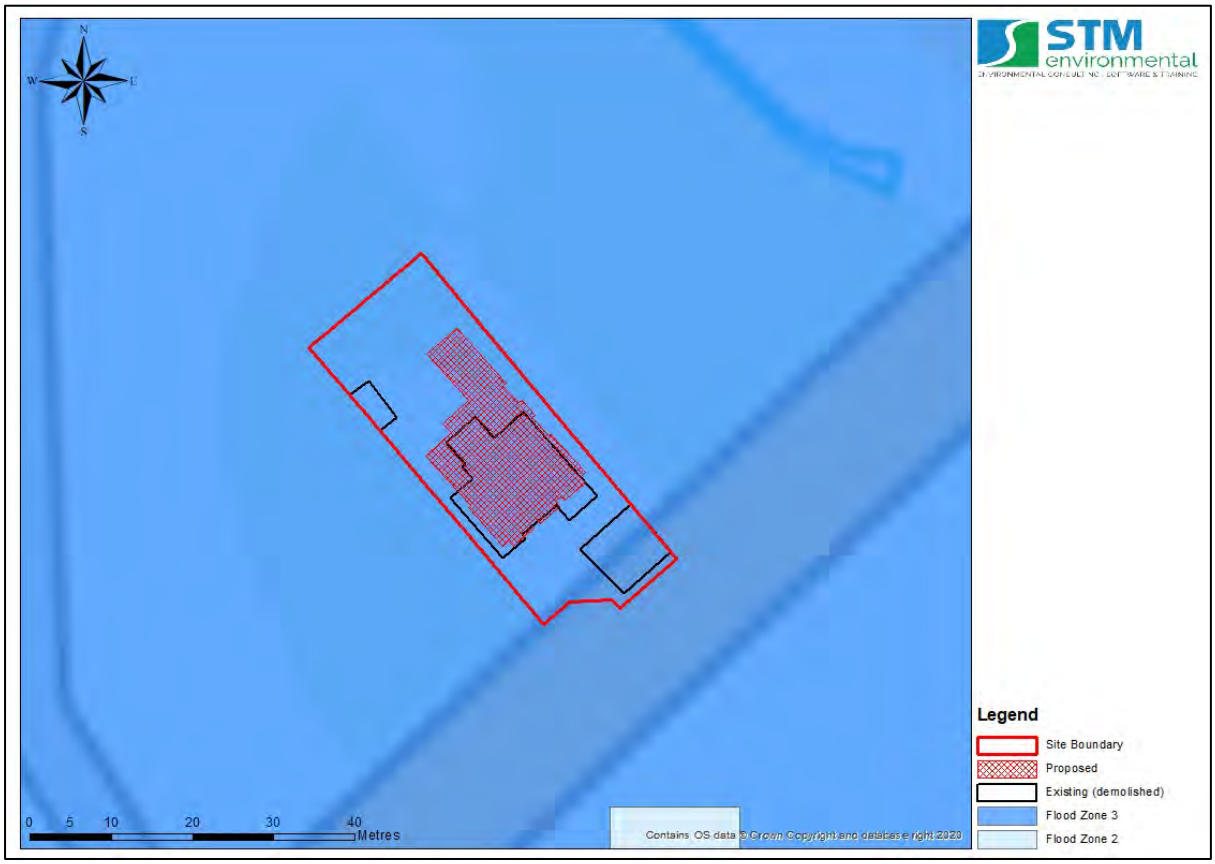
## 17.4 Appendix 4 – Historical Flood Incident Maps

### 17.4.1 EA Historic Flood Outlines and SFRA Historic Flood Records



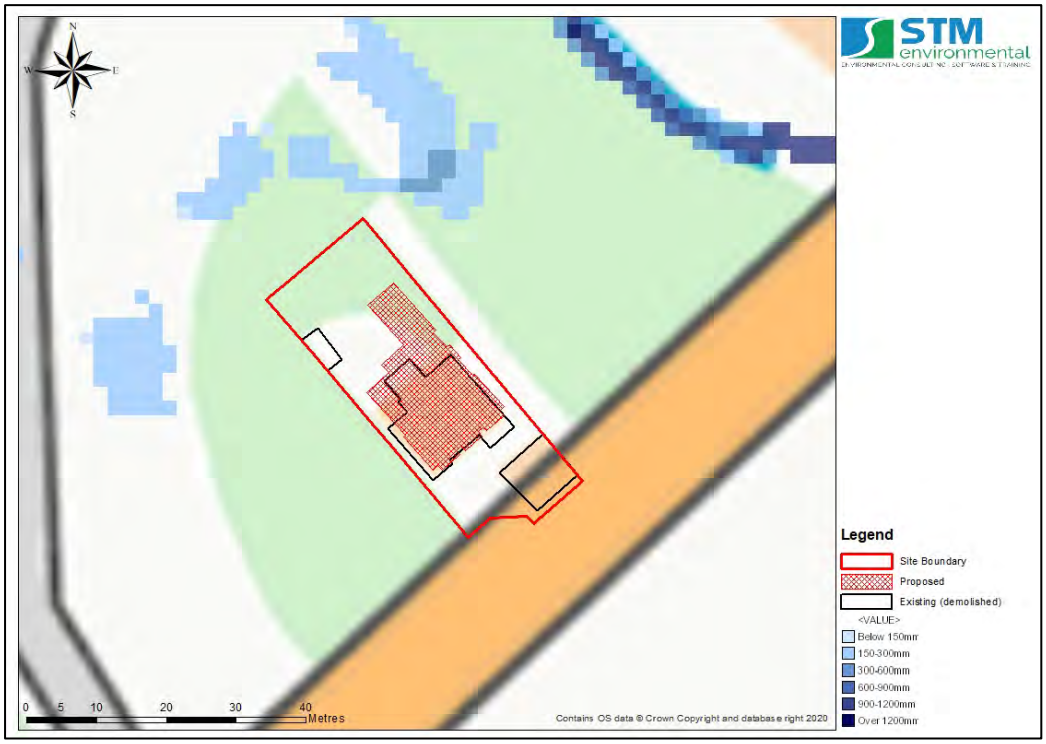

| Date | Source | Description | Data source |
|---|---|---|---|
| 2007 | Ashton Canal | Flooding reported at Ancoats | EA Flood Event Outline |
| 2004 | Chorlton Brook | Flooded Halls of Residence, Manchester University, Fallowfield | AGMA Sub-regional SFRA |
| 2001 | Medlock / Bridgewater Canal | Overtopping of canal at Castlefield hotel area | Manchester Evening News |
| 1991 | Unknown | Flooding in Castlefield, Manchester City Centre, Great Lever, Ramsbottom, Radcliffe, Marple Bridge, Didsbury, Hollingworth, Stretford and Bury | Manchester Evening News |
| 1981 | Chorlton, Baguley, Sinderland and Timperley Brook | Over 280 properties flooded in Fallowfield, Withington, Gorton, Sale, and Altrincham | Upper Mersey CFMP |
| 1965 | Sewer | Sewer burst and surface water flooding to properties in Northenden and Didsbury | BHS Database |
| 1958 | Surface water and sewer | Flooded rail station. Wilbraham (Fallowfield), Ardwick and Fallowfield | BHS Database |
| 1947 | Surface water and sewer | Flooded rail station and line. Wilbraham (Fallowfield) | BHS Database |
| 1911 | Mersey, surface water, sewage | Flooded sewage works affecting Moss Side, Withington and Fallowfield | BHS Database |
| 1872 | Medlock, Mersey, Irk, Bridgewater Canal | Extensive flooding to properties in lower lying areas along:<br>Mersey (Northenden, Didsbury)<br>Medlock (North Manchester)<br>Medlock overtopping into Bridgewater Canal. Barges in canal lifted out | BHS Database |

## 17.5 Appendix 5 - EA Flood Zone Map

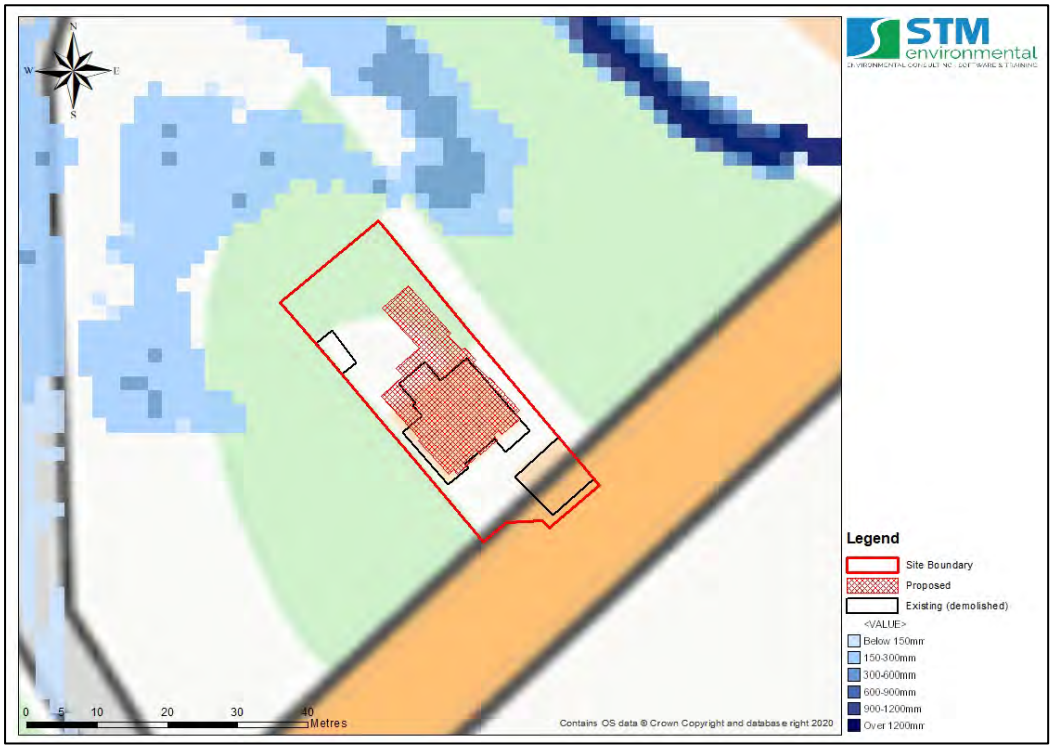


## 17.6 Appendix 6 – Surface Water Flood Extent and Depth Maps

17.6.1 Predicted surface water flood depth for the 1 in 100-year return period (Source: EA, 2016).

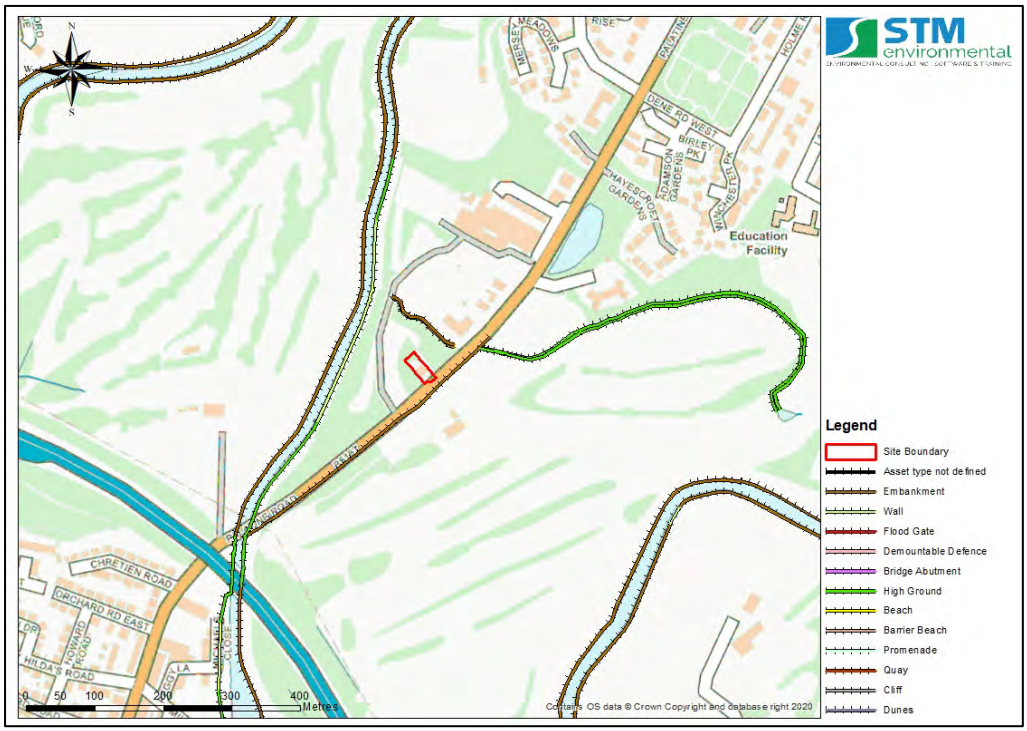



17.6.2 Predicted surface water flood depth for the 1 in 1000-year return period (Source: EA, 2016).

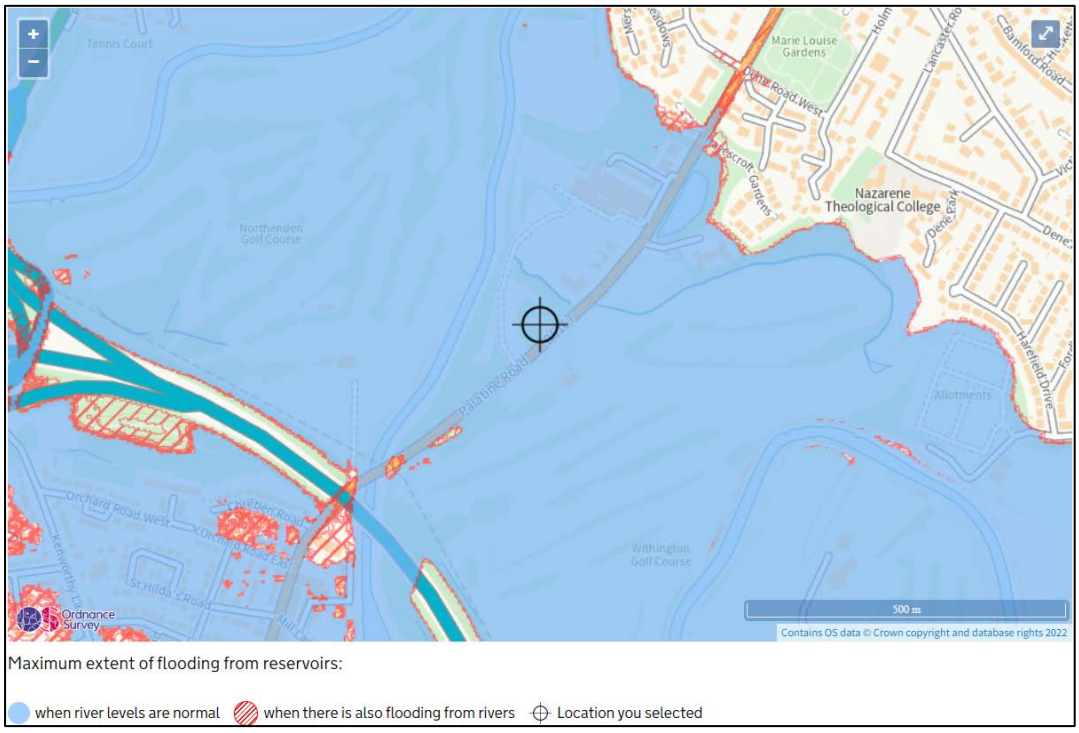


## 17.7 Appendix 7 –Flood Defence and Reservoir Flood Risk Maps

### 17.7.1 EA flood defence map

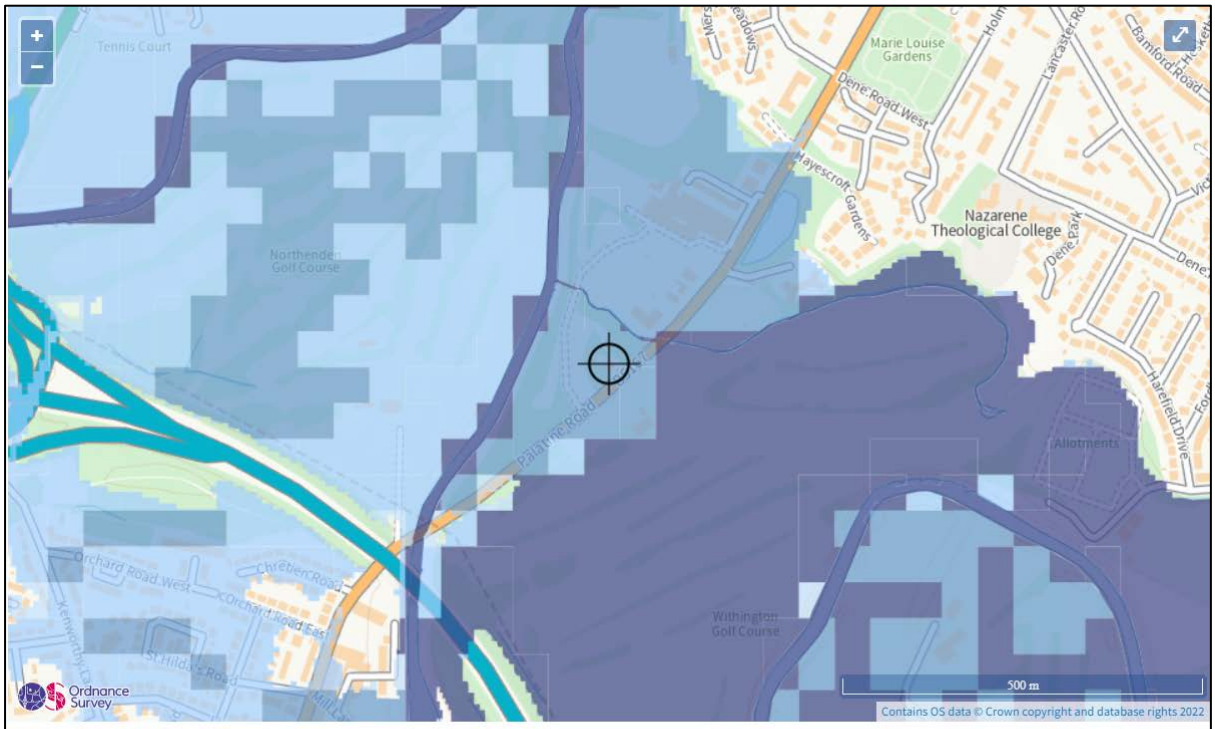



### 17.7.2 Reservoir Flood Risk Map



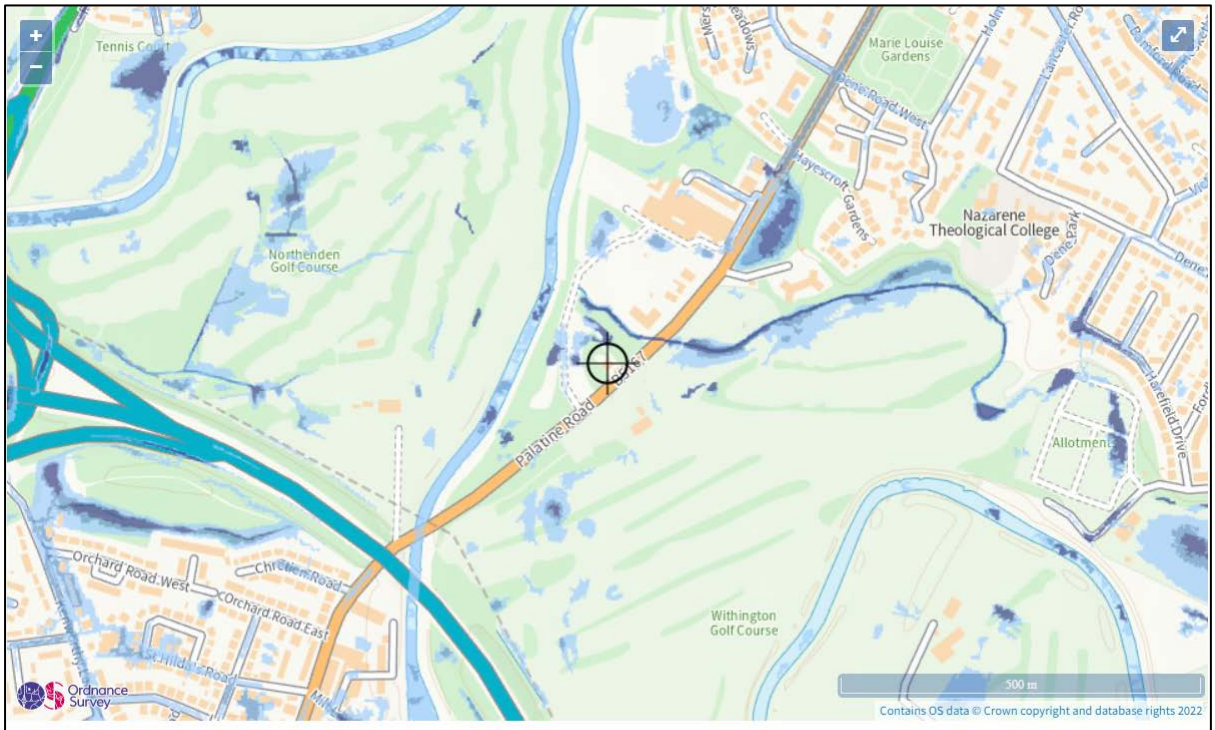
## 17.8 Appendix 8 – Risk of Flooding from Multiple Sources Map

## 17.9 Appendix 9 – EA's Long Term Flood Risk Maps




Extent of flooding from rivers or the sea

High Medium Low Very low Location you selected

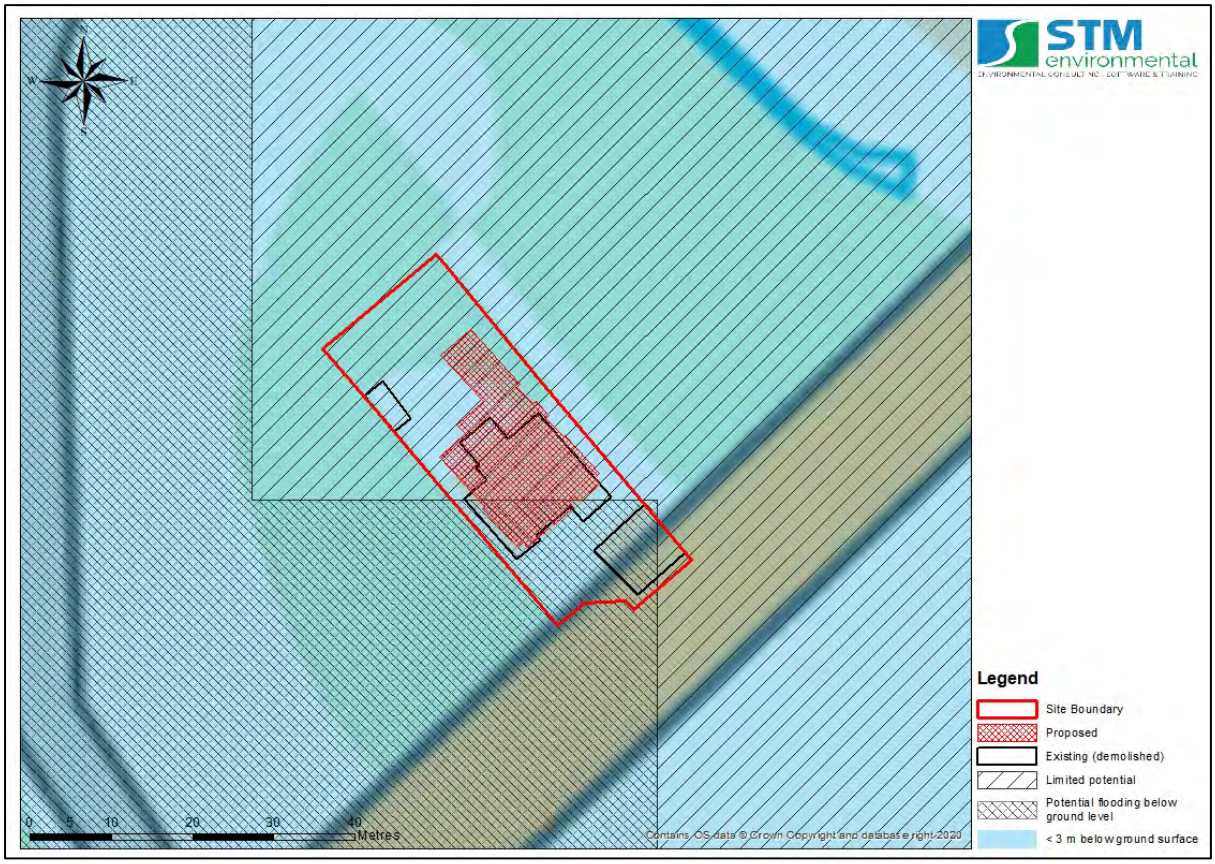



Extent of flooding from surface water

High Medium Low Very low Location you selected

## 17.10 Appendix 10 – Groundwater Flood Maps

### 17.10.1 Groundwater Flooding (Susceptibility) Map (BGS) and Potential Depth to the Groundwater Water Map (BGS)



## 17.11 Appendix 11 - EA Product 4 (Detailed Flood Risk) Data

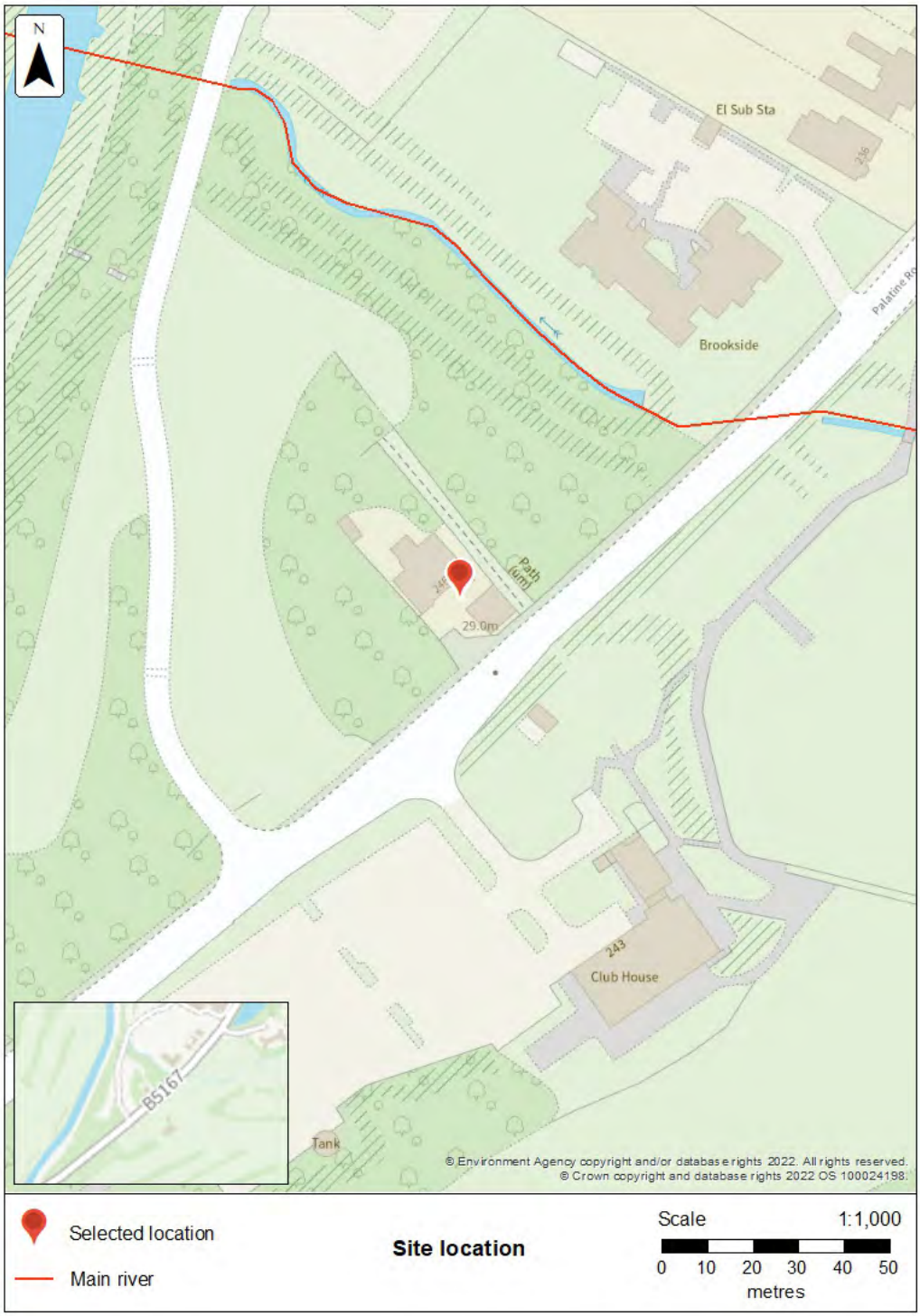
### 17.11.1 Product 4 Data

See next page.

# Flood risk assessment data

**Location of site:** 383491 / 390846 (shown as easting and northing coordinates)
**Document created on:** 25 April 2022
**This information was previously known as a product 4.**
**Customer reference number:** GMMC259427AB / 92F9R8EGEAPN

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
- flood defences and attributes
- 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 Greater Manchester Merseyside and Cheshire Environment Agency team at inforequests.gmmc@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: Upper Mersey Model Update - Defended
Scenario(s): Defended fluvial
Date:

Model name: Upper Mersey Model Update - Undefended
Scenario(s): No defences exist fluvial
Date:

These models contain 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

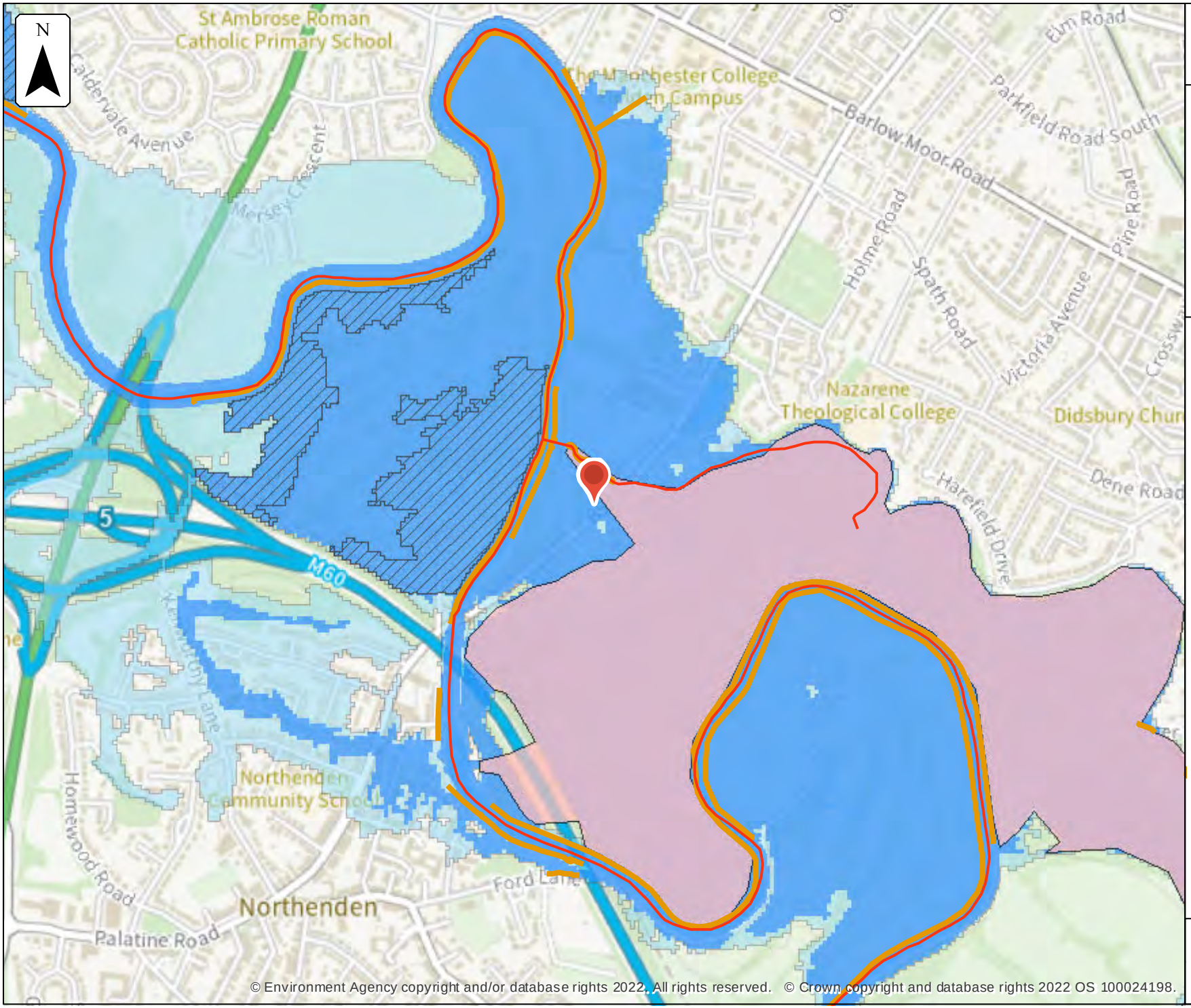
This data is updated on a quarterly basis as better data becomes available.

## 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

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**Flood map for planning**

Location (easting/northing)
**383491/390846**

Scale
**1:10,000**

Created
**25 Apr 2022**

Selected location
Main river
Flood defence
Water storage area
Areas benefiting from flood defence
Flood zone 3
Flood zone 2

0 100 200 300 400 500
metres

## 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.

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## Flood defences

Location (easting/northing)
**383491/390846**

Scale
**1:2,500**

Created
**25 Apr 2022**

Selected location

Main river

Flood defence

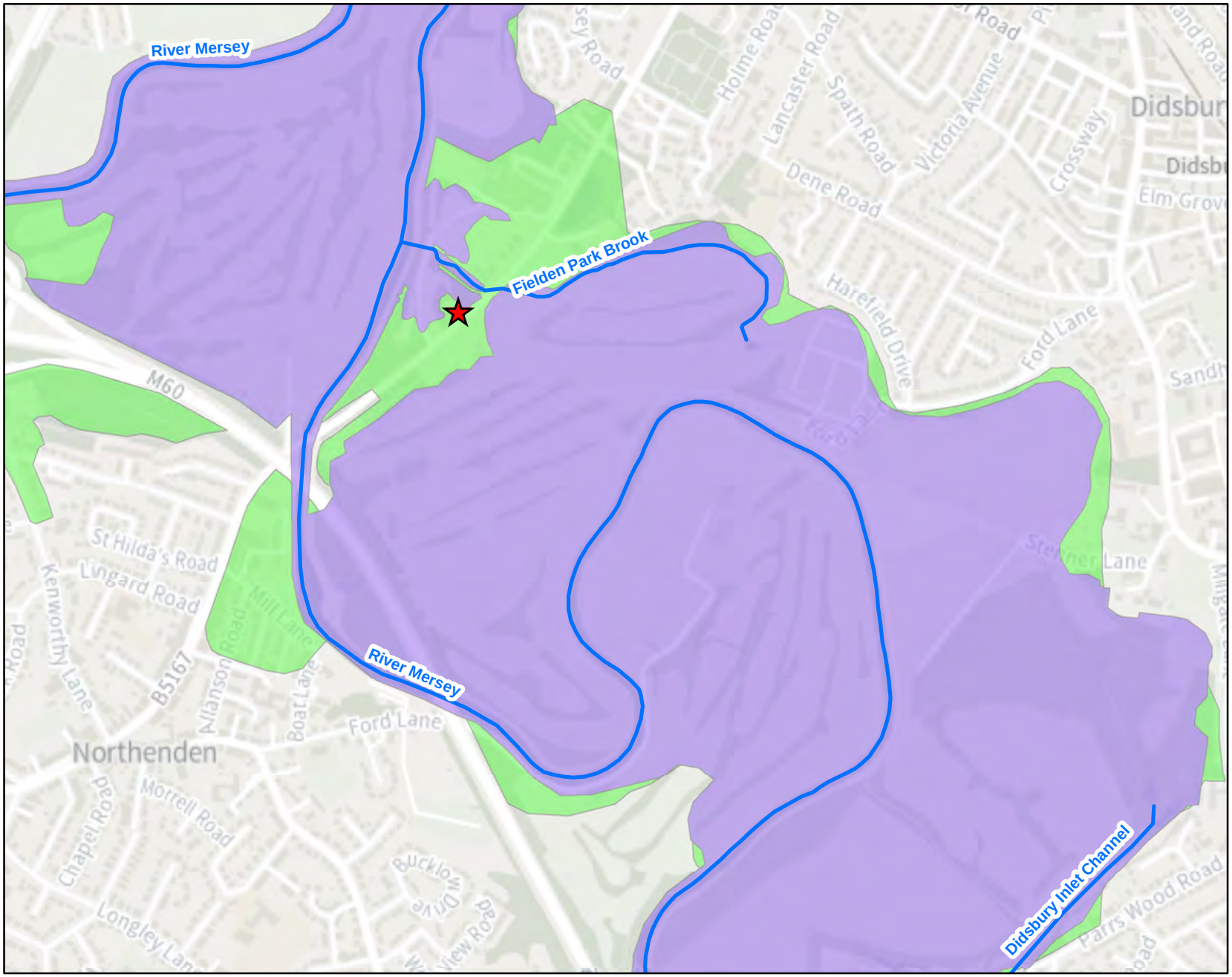
0 25 50 75 100
metres

## 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 | 121972 | Engineered High Ground | 100 | | 29.69 | 31.11 | |
| 2 | 121971 | Engineered High Ground | 100 | | 31.11 | 25.26 | |
| 3 | 120551 | Embankment | 100 | Fair | 27.48 | 29.16 | |
| 4 | 121970 | Wall | 100 | | 29.49 | 29.06 | |
| 5 | 416020 | Embankment | 150 | | 29.10 | 29.07 | |
| 6 | 47388 | Embankment | 75 | | 29.22 | 28.45 | |
| 7 | 47387 | Embankment | 75 | | 29.0 | 28.33 | |
| 8 | 98766 | Engineered High Ground | 75 | | 26.39 | 25.46 | |
| 9 | 98767 | Engineered High Ground | 75 | | 26.02 | 25.40 | |
| 10 | 47394 | Engineered High Ground | 75 | | 25.71 | 26.39 | |
| 11 | 47395 | Engineered High Ground | 75 | | 25.60 | 26.02 | |
| 12 | 47125 | Engineered High Ground | 75 | | 25.60 | 25.38 | |
| 13 | 47124 | Engineered High Ground | 75 | | 25.81 | 25.71 | |
| 14 | 47148 | Engineered High Ground | 75 | | 25.38 | 26.07 | |
| 15 | 47126 | Engineered High Ground | 75 | | 26.21 | 25.81 | |

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

# Recorded Flood Outline Map




Environment Agency

1:10,001

N

## Legend

Site Location

Main River

**Recorded Flood Outlines**

**Start Date**

01/01/1964

20/01/2021

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**Contact Us:** National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

**Recorded Flood Outlines**

| Flood Event Code | Name | Start Date | End Date | Source of Flooding | Cause of Flooding |
|---|---|---|---|---|---|
| 18122 | MERS | 01/01/1964 | 02/01/1964 | Unknown | Other |
| 4094956 | Didsbury | 20/01/2021 | 20/01/2021 | Main River | Overtopping of Defences |

# Modelled data

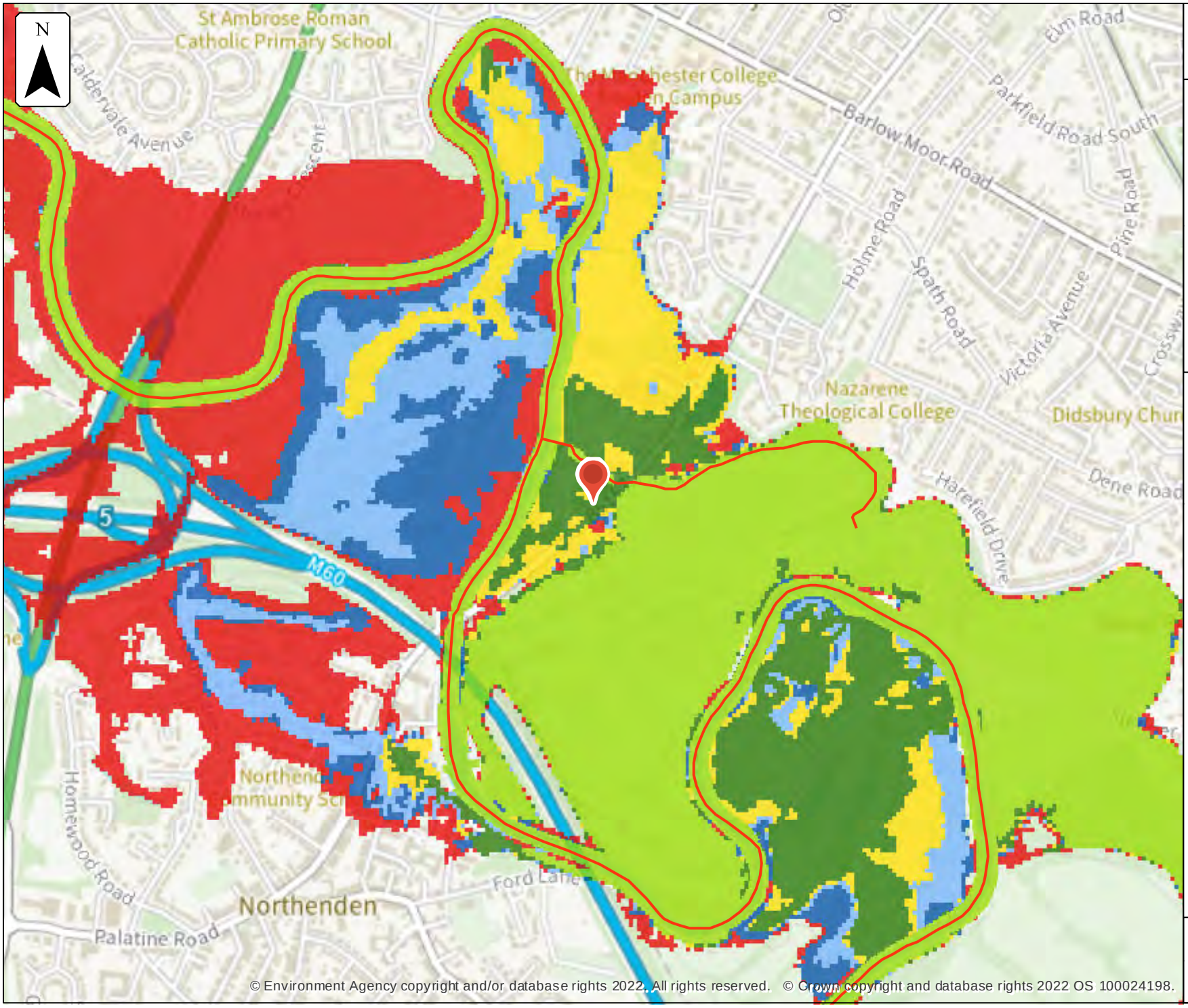
This section provides details of different scenarios we have modelled and includes the following (where available):

- 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

## Modelled scenarios

The following scenarios are included:

- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- No defences exist modelled fluvial: risk of flooding from rivers where there are no flood defences

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## Defended modelled fluvial extent

Location (easting/northing)
**383491/390846**

Scale
**1:10,000**

Created
**25 Apr 2022**

Model name
**Upper Mersey Model Update - Defended**

Selected location

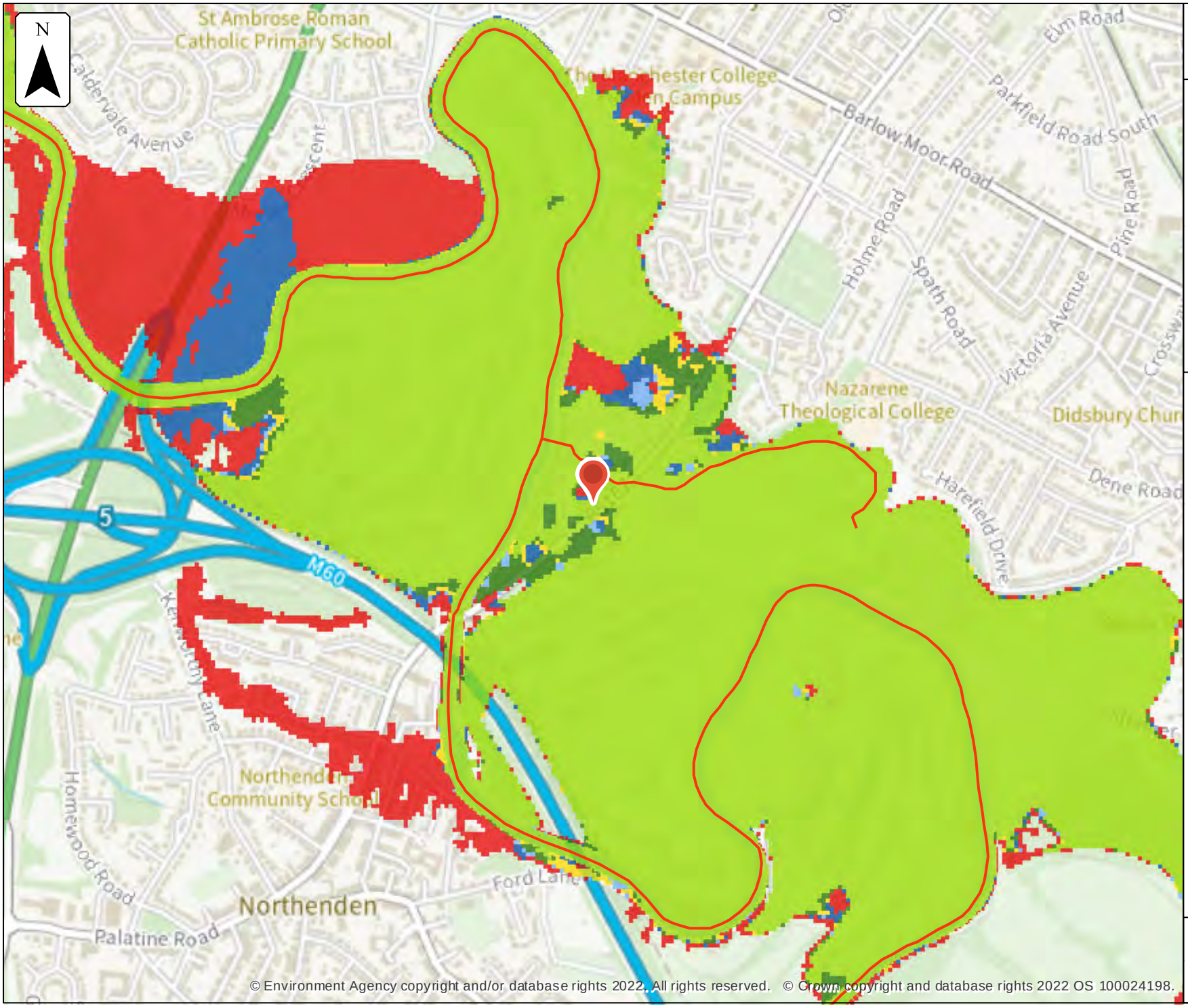
Main river

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

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## No defences exist modelled fluvial extent

Location (easting/northing)
**383491/390846**

Scale
**1:10,000**

Created
**25 Apr 2022**

Model name
**Upper Mersey Model Update - Undefended**

Selected location

Main river

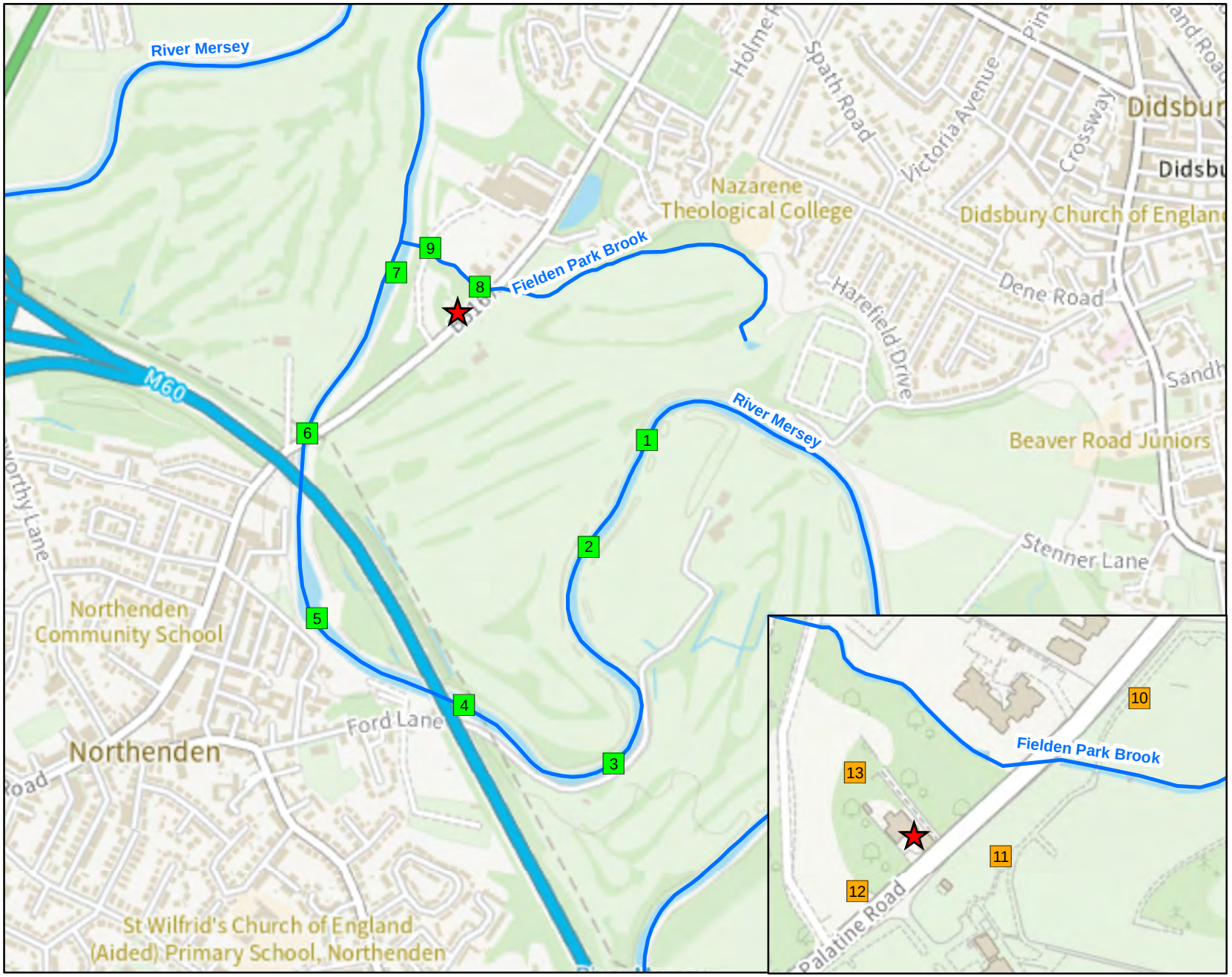
Modelled flood extent

- 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

# Model Measurement Map - Upper Mersey 2017




Environment Agency

1:10,001

N

## Legend

- Site Location
- Model Measurements
- 2D Measurements
- Main River

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| | | | | | Undefended | | | | | | | | | | | | | | Defended | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map Reference | Model Node Reference | Easting | Northing | Data | 50 % AEP (1 in 2 year) | 20 % AEP (1 in 5 year) | 10 % AEP (1 in 10 year) | 5 % AEP (1 in 20 year) | 4 % AEP (1 in 25 year) | 2 % AEP (1 in 50 year) | 1.33 % AEP (1 in 75 year) | 1 % AEP (1 in 100 year) | 1 % AEP (1 in 100 year) + 30% Increase in flow | 1 % AEP (1 in 100 year) + 35% Increase in flow | 1 % AEP (1 in 100 year) + 70% Increase in flow | 0.5 % AEP (1 in 200 year) | 0.1 % AEP (1 in 1000 year) | 0.1 % AEP (1 in 1000 year) + 30% Increase in flow | 50 % AEP (1 in 2 year) | 20 % AEP (1 in 5 year) | 10 % AEP (1 in 10 year) | 5 % AEP (1 in 20 year) | 4 % AEP (1 in 25 year) | 2 % AEP (1 in 50 year) | 1.33 % AEP (1 in 75 year) | 1 % AEP (1 in 100 year) | 1 % AEP (1 in 100 year) + 30% Increase in flow | 1 % AEP (1 in 100 year) + 35% Increase in flow | 1 % AEP (1 in 100 year) + 70% Increase in flow | 0.5 % AEP (1 in 200 year) | 0.1 % AEP (1 in 1000 year) | 0.1 % AEP (1 in 1000 year) + 30% Increase in flow |
| 1 | ea013_0243_MERS04_1304 | 383826 | 390613 | Modelled Water Level (m asd%) | 28.74 | 29.01 | 29.24 | 29.41 | 29.45 | 29.58 | 29.64 | 29.68 | 29.91 | 29.94 | 30.23 | 29.79 | 30.27 | 30.53 | 29.48 | 29.98 | 30.11 | 30.40 | 30.45 | 30.54 | 30.57 | 30.58 | 30.72 | 30.72 | 30.76 | 30.76 | 30.63 | 30.77 | 31.06 |
| | | | | Modelled Flow (cumecs) | 109.90 | 111.92 | 112.58 | 113.04 | 113.20 | 113.70 | 114.16 | 114.36 | 118.78 | 121.17 | 179.65 | 114.85 | 199.13 | 232.16 | 164.65 | 234.57 | 247.62 | 280.03 | 288.83 | 304.22 | 311.53 | 318.03 | 351.67 | 359.58 | 367.90 | 332.68 | 370.81 | 382.24 |
| 2 | ea013_0243_MERS04_1086 | 383728 | 390431 | Modelled Water Level (m asd%) | 28.67 | 29.02 | 29.27 | 29.43 | 29.48 | 29.60 | 29.66 | 29.70 | 29.82 | 29.95 | 30.19 | 29.79 | 30.23 | 30.48 | 29.34 | 29.84 | 29.96 | 30.25 | 30.31 | 30.40 | 30.42 | 30.44 | 30.69 | 30.70 | 30.76 | 30.52 | 30.77 | 30.86 |
| | | | | Modelled Flow (cumecs) | 110.85 | 113.95 | 115.18 | 116.28 | 116.59 | 117.56 | 118.15 | 118.49 | 120.08 | 120.27 | 173.74 | 119.43 | 179.42 | 220.24 | 184.82 | 234.11 | 247.90 | 280.29 | 286.96 | 302.76 | 308.73 | 312.62 | 342.42 | 345.83 | 352.32 | 326.42 | 352.85 | 390.45 |
| 3 | ea013_0243_MERS04_0629 | 383765 | 390042 | Modelled Water Level (m asd%) | 28.70 | 28.92 | 29.18 | 29.34 | 29.39 | 29.52 | 29.58 | 29.63 | 29.89 | 29.93 | 30.24 | 29.74 | 30.27 | 30.50 | 29.61 | 29.48 | 29.61 | 29.90 | 29.95 | 30.04 | 30.06 | 30.11 | 30.26 | 30.27 | 30.29 | 30.18 | 30.30 | 30.41 |
| | | | | Modelled Flow (cumecs) | 98.33 | 99.95 | 100.64 | 101.05 | 101.17 | 101.43 | 101.56 | 101.65 | 102.25 | 102.22 | 144.81 | 101.85 | 146.29 | 148.32 | 184.66 | 234.10 | 247.84 | 280.36 | 286.75 | 298.59 | 302.41 | 304.73 | 332.04 | 335.38 | 349.81 | 310.27 | 352.80 | 359.68 |
| 4 | ea013_0243_MERS04_0311 | 383501 | 390134 | Modelled Water Level (m asd%) | 28.19 | 28.68 | 28.99 | 29.20 | 29.25 | 29.41 | 29.48 | 29.54 | 29.83 | 29.87 | 29.96 | 29.66 | 30.01 | 30.33 | 28.50 | 29.01 | 29.15 | 29.45 | 29.50 | 29.61 | 29.64 | 29.73 | 30.08 | 30.12 | 30.25 | 29.82 | 30.28 | 30.51 |
| | | | | Modelled Flow (cumecs) | 137.50 | 162.83 | 170.22 | 175.08 | 176.76 | 178.78 | 179.89 | 180.56 | 184.09 | 184.42 | 220.03 | 182.28 | 221.63 | 224.76 | 184.79 | 233.83 | 247.49 | 279.27 | 285.88 | 296.75 | 299.96 | 301.91 | 309.34 | 310.87 | 317.04 | 306.44 | 321.55 | 330.17 |
| 5 | ea013_0243_MERS04_0000 | 383247 | 390298 | Modelled Water Level (m asd%) | 27.66 | 27.96 | 28.14 | 28.31 | 28.37 | 28.55 | 28.65 | 28.73 | 29.28 | 29.35 | 29.63 | 28.94 | 29.70 | 30.11 | 28.26 | 28.78 | 28.93 | 29.23 | 29.29 | 29.39 | 29.42 | 29.56 | 29.95 | 30.00 | 30.20 | 29.64 | 30.24 | 30.46 |
| | | | | Modelled Flow (cumecs) | 171.91 | 221.24 | 253.58 | 274.15 | 279.06 | 291.39 | 296.27 | 299.06 | 310.52 | 311.64 | 297.90 | 305.12 | 300.83 | 306.38 | 164.98 | 233.78 | 247.52 | 279.47 | 285.87 | 297.13 | 300.53 | 302.49 | 309.79 | 310.89 | 316.81 | 306.95 | 318.90 | 328.01 |
| 6 | ea013_0243_MERS03_34594 | 383220 | 390024 | Modelled Water Level (m asd%) | 26.95 | 27.02 | 27.05 | 27.24 | 27.32 | 27.59 | 27.76 | 27.89 | 28.71 | 28.82 | 29.26 | 28.21 | 29.35 | 29.83 | 27.82 | 28.33 | 28.48 | 28.75 | 28.80 | 28.90 | 28.98 | 29.13 | 29.57 | 29.63 | 29.81 | 29.23 | 29.84 | 29.95 |
| | | | | Modelled Flow (cumecs) | 171.82 | 220.93 | 253.54 | 273.88 | 278.63 | 290.86 | 295.86 | 299.09 | 314.51 | 316.08 | 300.07 | 306.32 | 302.94 | 309.64 | 184.36 | 233.49 | 247.32 | 279.59 | 285.58 | 297.11 | 300.42 | 302.44 | 311.77 | 313.47 | 318.25 | 306.92 | 321.20 | 379.48 |
| 7 | ea013_0243_MERS03_31274 | 383387 | 390012 | Modelled Water Level (m asd%) | 26.70 | 26.77 | 26.97 | 27.23 | 27.32 | 27.58 | 27.76 | 27.89 | 28.71 | 28.82 | 29.39 | 28.21 | 29.48 | 29.84 | 27.57 | 28.08 | 28.22 | 28.52 | 28.57 | 28.67 | 28.77 | 28.90 | 29.27 | 29.32 | 29.56 | 29.00 | 29.62 | 30.01 |
| | | | | Modelled Flow (cumecs) | 138.95 | 165.17 | 176.59 | 182.12 | 183.49 | 195.72 | 202.22 | 207.00 | 233.22 | 236.11 | 220.55 | 217.68 | 222.09 | 224.83 | 184.45 | 233.20 | 247.34 | 279.38 | 285.54 | 297.09 | 300.51 | 308.03 | 360.06 | 365.99 | 382.87 | 320.14 | 385.56 | 403.99 |
| 8 | ea013_0243_DIDS01_2382 | 383522 | 390886 | Modelled Water Level (m asd%) | 26.74 | 26.81 | 27.05 | 27.33 | 27.41 | 27.66 | 27.81 | 27.92 | 28.73 | 28.85 | 29.57 | 28.23 | 29.66 | 30.62 | 25.44 | 27.42 | 27.66 | 28.21 | 28.33 | 28.98 | 29.39 | 29.45 | 29.71 | 29.75 | 29.90 | 29.52 | 29.93 | 30.21 |
| | | | | Modelled Flow (cumecs) | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| 9 | ea013_0243_DIDS01_2428 | 383443 | 390960 | Modelled Water Level (m asd%) | 26.71 | 26.78 | 27.00 | 27.28 | 27.37 | 27.64 | 27.80 | 27.92 | 28.73 | 28.84 | 29.57 | 28.23 | 29.65 | 30.27 | 25.39 | 27.45 | 27.79 | 28.18 | 28.38 | 28.96 | 29.38 | 29.44 | 29.71 | 29.74 | 29.89 | 29.51 | 29.93 | 30.21 |
| | | | | Modelled Flow (cumecs) | 1.94 | 2.03 | 3.94 | 5.61 | 6.09 | 7.24 | 7.71 | 8.03 | 9.54 | 9.72 | 13.63 | 8.70 | 13.84 | 14.21 | 0.50 | 2.04 | 1.93 | 1.97 | 1.98 | 14.23 | 16.47 | 12.65 | 12.84 | 12.86 | 13.14 | 12.76 | 13.37 | 13.82 |

| | | | | | Undefended | | | | | Defended | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Map Reference | Model Node Reference | Easting | Northing | Data | 1 % AEP (1 in 100 year) | 1 % AEP (1 in 100 year) + 30% Increase in flow | 1 % AEP (1 in 100 year) + 35% Increase in flow | 1 % AEP (1 in 100 year) + 70% Increase in flow | 0.1 % AEP (1 in 1000 year) | 1 % AEP (1 in 100 year) | 1 % AEP (1 in 100 year) + 30% Increase in flow | 1 % AEP (1 in 100 year) + 35% Increase in flow | 1 % AEP (1 in 100 year) + 70% Increase in flow | 0.1 % AEP (1 in 1000 year) |
| 10 | 2D Level | 383615 | 390919 | Modelled Water Level (m asd%) | 29.64 | 29.84 | 28.87 | 30.04 | 30.07 | 29.55 | 29.84 | 29.89 | 30.06 | 30.09 |
| 11 | | 383535 | 390834 | Modelled Water Level (m asd%) | 29.69 | 29.90 | 29.93 | 30.10 | 30.13 | 29.58 | 29.88 | 29.93 | 30.10 | 30.14 |
| 12 | | 383456 | 390818 | Modelled Water Level (m asd%) | 29.11 | 29.23 | 29.46 | 29.64 | 29.70 | 29.44 | 29.72 | 29.75 | 29.91 | 29.95 |
| 13 | | 383459 | 390877 | Modelled Water Level (m asd%) | 27.90 | 28.72 | 28.83 | 29.56 | 29.66 | 29.44 | 29.71 | 29.75 | 29.91 | 29.94 |

Model data taken from Upper Mersey 2017 Study

AEP - Annual Exceedence Probability

m asd% - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes: Climate Change Scenario - 30%, 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

## 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 Greater Manchester Merseyside and Cheshire Environment Agency team at inforequests.gmmc@environment-agency.gov.uk for:

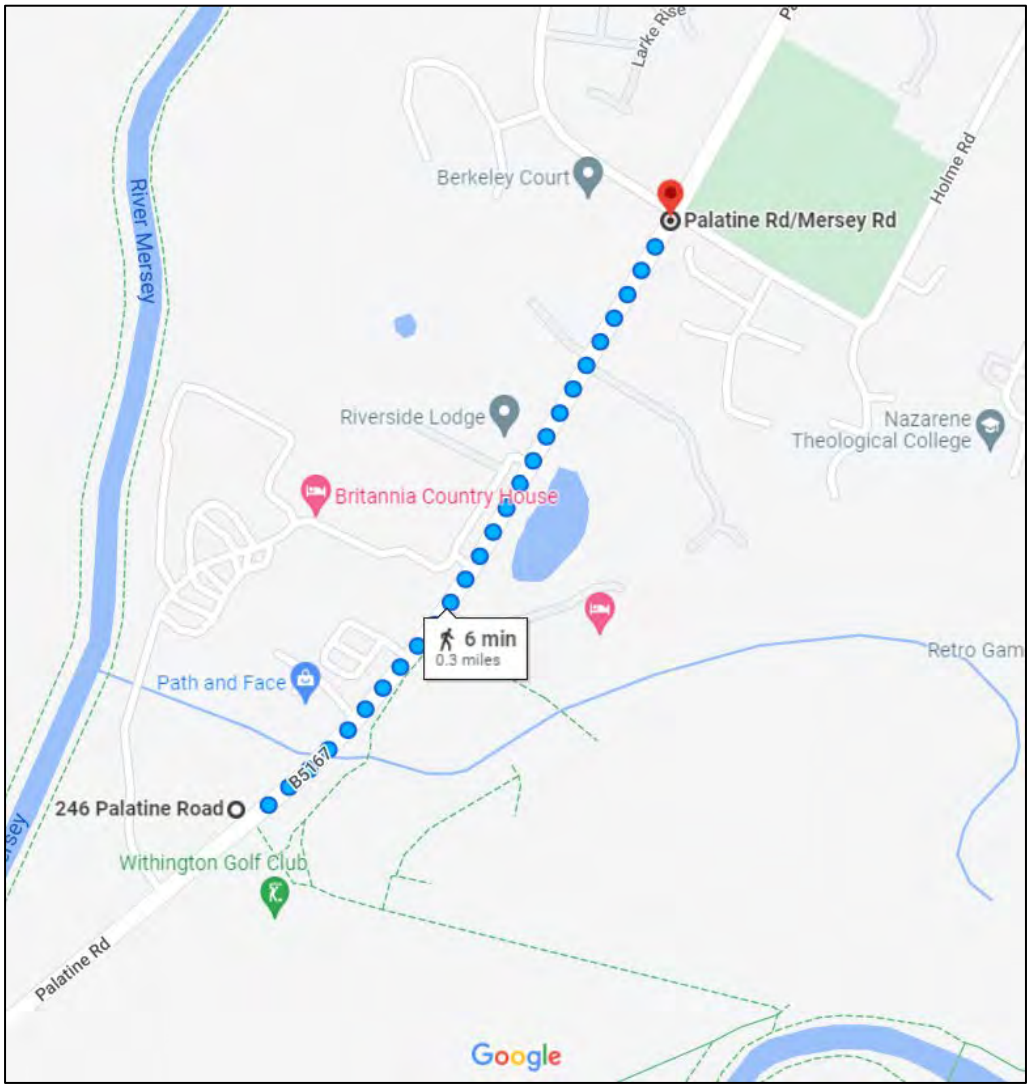
- more information about getting a product 5, 6, 7 or 8
- general help and advice about the site you're requesting data for

### 17.11.2 Climate Change Allowances

**Upper Mersey Management Catchment peak river flow allowances**

| | Central | Higher | Upper |
|---|---|---|---|
| 2020s | 13% | 17% | 27% |
| 2050s | 22% | 31% | 51% |
| 2080s | 41% | 53% | 85% |

## 17.12 Appendix 12 – Safe Egress to Flood Zone 1 Map



## 17.13 Appendix 13 – Calculation of Flood Hazard Rating

**Flood Hazard Rating Scores – based on DF score of 0**

| Velocity | Depth | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **0.25** | **0.50** | **0.75** | **1.00** | **1.25** | **1.50** | **1.75** | **2.0** | **2.25** | **2.50** |
| **0.0** | 0.13 | 0.25 | 0.38 | 0.50 | 0.63 | 0.75 | 0.88 | 1.00 | 1.13 | 1.25 |
| **0.5** | 0.25 | 0.50 | 0.75 | 1.00 | 1.25 | 1.50 | 1.75 | 2.00 | 2.25 | 2.50 |
| **1.0** | 0.38 | 0.75 | 1.13 | 1.50 | 1.88 | 2.25 | 2.63 | 3.00 | 3.38 | 3.75 |
| **1.5** | 0.50 | 1.00 | 1.50 | 2.00 | 2.50 | 3.00 | 3.50 | 4.00 | 4.50 | 5.00 |
| **2.0** | 0.63 | 1.25 | 1.88 | 2.50 | 3.13 | 3.75 | 4.38 | 5.00 | 5.63 | 6.25 |
| **2.5** | 0.75 | 1.50 | 2.25 | 3.00 | 3.75 | 4.50 | 5.25 | 6.00 | 6.75 | 7.50 |
| **3.0** | 0.88 | 1.75 | 2.63 | 3.50 | 4.38 | 5.25 | 6.13 | 7.00 | 7.88 | 8.75 |
| **3.5** | 1.00 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 |
| **4.0** | 1.13 | 2.25 | 3.38 | 4.50 | 5.63 | 6.75 | 7.88 | 9.00 | 10.13 | 11.25 |
| **4.5** | 1.25 | 2.50 | 3.75 | 5.00 | 6.25 | 7.50 | 8.75 | 10.00 | 11.25 | 12.50 |
| **5.0** | 1.38 | 2.75 | 4.13 | 5.50 | 6.88 | 8.25 | 9.63 | 11.00 | 12.38 | 13.75 |

**Summary of Scores**

| | Score From | Score To | Flood Hazard | Description |
|---|---|---|---|---|
| | <0.75 | 0.75 | Low | Exercise Caution |
| **Class 1** | 0.75 | 1.5 | Moderate | Danger for some |
| **Class 2** | 1.5 | 2.5 | Significant | Danger for most |
| **Class 3** | 2.5 | 20.0 | Extreme | Danger for all |

**Values for Debris Factor for different flood depths**

| Depths | Pasture/Arable Land | Woodland | Urban |
|---|---|---|---|
| 0 to 0.25 | 0 | 0 | 0 |
| 0.25 to 0.75 | 0.5 | 1 | 1 |
| d>0.75 and/or v > 2 | 0.5 | 1 | 1 |

- The “danger to some” category includes vulnerable groups such as children, the elderly and infirm. “Danger: Flood zone with deep or fast
- flowing water”
- The “danger to most” category includes the general public.

- The danger to all category includes the emergency services.

A flood emergency plan is considered to be an acceptable way of managing flood risk where the flood hazard has been given a “very low hazard” rating. In some instances, flood emergency plans may also be acceptable where the rating is “danger for some”. However, it is unlikely to be an acceptable way of managing residual flood risk where the hazard to people classification is “danger for most” or “danger for all”.