

# **Warrington Borough Council Local Plan Site Screening**

**Level 2 Strategic Flood Risk  
Assessment – Site Screening**

**Final Report**

**March 2019**

**[www.jbaconsulting.com](http://www.jbaconsulting.com)**

**WARRINGTON**  
Borough Council



**Warrington Borough Council**

**Planning Policy & Programmes Team**

**New Town House**

**Warrington**

**WA1 2NH**

## JBA Project Manager

Mike Williamson  
 Mersey Bank House  
 Barbould Street  
 WARRINGTON  
 Cheshire  
 UNITED KINGDOM  
 WA1 1WA

## Revision history

Revision Ref/Date	Amendments	Issued to
Version 1.0 Draft – Nov 18	JBA review	WBC Planning Policy
Version 2.0 Final – Jan 19	WBC and EA review	WBC Planning Policy
Version 3.0 Final – Mar 19	EA clarifications on sites	WBC Planning Policy

## Contract

This report describes work commissioned by Warrington Borough Council. Jack Pordham of JBA Consulting carried out this work.

Prepared by ..... Jack Pordham BSc MA

Assistant Analyst

Joseph Landells-Molloy MEng  
 Assistant Engineer

Reviewed by ..... Mike Williamson BSc MSc EADA FRGS CGeog

Principal Analyst

Approved by..... Howard Keeble MPhil BEng BSc CEng CEnv CSci CWEM  
 MICE MCIWEM MCMi IMAps

Technical Director

## **Purpose**

This document has been prepared as a Final Report for Warrington Borough Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Warrington Borough Council.

## **Copyright**

© Jeremy Benn Associates Limited 2019.

## **Carbon footprint**

A printed copy of the main text in this document will result in a carbon footprint of 553g if 100% post-consumer recycled paper is used and 703g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

## Abbreviations

ABD .....	Areas Benefitting from Defences
AEP .....	Annual Exceedance Probability
AOD .....	Above Ordnance Datum
CAM .....	Condition Assessment Manual
CC .....	Climate change
DRN .....	Detailed River Network
DTM .....	Digital Terrain Model
EA.....	Environment Agency
FEH.....	Flood Estimation Handbook
FRA.....	Flood Risk Assessment
FRCC - PPG .....	Flood Risk and Coastal Change - Planning Practice Guidance
FWA .....	Flood Warning Area
LIDAR.....	Light Detection and Ranging
LPA .....	Local Planning Authority
MSC .....	Manchester Ship Canal
NPPF .....	National Planning Policy Framework
OS .....	Ordnance Survey
RoFRS .....	Risk of Flooding from Rivers and Seas
RFM .....	Reservoir Flood Map
SFRA.....	Strategic Flood Risk Assessment
SuDS.....	Sustainable Urban Drainage System

## Contents

Abbreviations	3
1 Introduction	5
1.1 Local Plan potential development site screening	5
2 Exception Test Summary	7
3 Site Appraisal Tables	14
3.1 1041 – Harry Fairclough Ltd	14
3.2 1178 – Cardinal Newman High School	23
3.3 1707 – Alford Hall Social Club Overflow Car Park	33
3.4 1717 – Former Dairy Works	40
3.5 1831 – Land off Newcombe Avenue	48
3.6 1861 – Land North of Mayfair Close	53
3.7 1891 – Land Fronting Pool Lane	60
3.8 2273 – Motortrade	67
3.9 2482 – Wharf Industrial Estate	76
3.10 2603 – Land at Thelwall West	86
3.11 2657 – New Cut Lane Industrial Estate	94
3.12 2677 – Riverside Retail Park	104
3.13 1621 – Land immediately surrounding Pool Farm	114
3.14 Waterfront	120
4 Appendices	130
4.1 Appendix A –Original site list supplied in Data Request	130

# 1 Introduction

## 1.1 Local Plan potential development site screening

To inform the Sequential Approach to the allocation of development through Warrington Borough Council's (WBC) emerging Local Plan, JBA completed the Level 1 Strategic Flood Risk Assessment (SFRA) in mid-2018. Subsequently, 14 potential development sites were cited as requiring the application of and passing of the Exception Test, as per the July 2018 revision of the National Planning Policy Framework<sup>1</sup> (NPPF) and accompanying Flood Risk and Coastal Change Planning Practice Guidance<sup>2</sup> (FRCC-PPG).

*The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:*

- a) *the development would provide wider sustainability benefits to the community that outweigh the flood risk; and*
- b) *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

*Both elements of the exception test should be satisfied for development to be allocated or permitted. (NPPF paras 160 and 161).*

Following the Level 1 SFRA, WBC, as Local Planning Authority (LPA), decided that these 14 sites can satisfy part a) of the Exception Test. Government guidance states that a Level 2 SFRA should build on the information contained in the Level 1 assessment and should include enough information for the Exception Test to be applied.

This Level 2 SFRA will assess the **likelihood** of the sites passing part b) by providing further, more detailed, site-specific assessments based on the latest EA flood modelling.

Modelled outputs used to inform the assessments in this report were sourced from the Lower Mersey Estuary Model (accepted for submission by the EA in October 2018). This model provided tidal risk to the Warrington area and as such as only been used accordingly for that risk. Fluvial risk used in the assessments have been taken from existing EA flood zone mapping data.

This report provides an assessment table for each of the fourteen sites which incorporates the following:

- Screening Flood Risk Assessment (FRA);
- Outline drainage strategy;
- Level 2 site screening assessment.

Each assessment table that follows, describes the likely tidal, fluvial, surface water (both offsite impacts and estimated runoff post-development), groundwater, canal and reservoir flood risk. In addition, flood risk mitigation options including requirements for further assessment are provided.

Based on available flood modelling data, each assessment table includes an updated recommendation for the Council as to the suitability of development within each site, relative to flood risk.

Note: Following LPA and EA review of the draft Level 2 SFRA, in December 2018, it was found that Site 1041 Harry Fairclough Ltd was in fact proposed for an extension to an

<sup>1</sup> <https://www.gov.uk/government/collections/revised-national-planning-policy-framework>

<sup>2</sup> <https://www.gov.uk/guidance/flood-risk-and-coastal-change>

existing commercial unit, as opposed to a residential unit, as it was initially assessed as in the draft Level 2 SFRA. This site is therefore not requiring of the Exception Test though is still included in this Level 2 report given the level of information gathered.

## 2 Exception Test Summary

Proposed site	Level 2 recommendation	Barriers to passing test	Further work and options (following consultation with EA)	WBC response to recommendation
<b>1041 Harry Fairclough</b>	Should avoid FZ3a if possible	N/A	Modelling of 1% fluvial scenario (existing and climate change) also taking account of flood defences; further consultation after EA review on development suitability and possible resilience measures	The site had the benefit of (although never implemented) planning permission for residential development (2003/01249) and is adjacent to another new residential development. It is therefore considered that through a Flood Risk Assessment at the Planning Application stage, any potential flood risk can be mitigated.  <b>Recommendation:</b> Leave in the SHLAA as a site suitable for residential development.
<b>1178 Cardinal Newman</b>	Initially advised for removal from allocation, however, EA state confidence in defences which will be maintained by the EA	82% in FZ3a; predominantly fluvial risk; no room for on-site compensatory storage; 0.5% event tidal depths >300	Modelling of 1% fluvial scenario also taking account of flood defences to check ABDs; defence overtopping scenarios should be modelled; options for ground level retail, employment, car parking with first	In an area benefiting from flood defences, the site had the benefit of a previous (although never



Proposed site	Level 2 recommendation	Barriers to passing test	Further work and options (following consultation with EA)	WBC response to recommendation
	in future. Area of development to take place within ABD	mm, isolation of site during flood events, limited access/egress routes	floor residential could be considered; full options modelling would be required; dry access / egress routes a must; consultation with EA on possible resilience measures; detailed consultation with EA required; possible drainage strategy based on post-development	implemented) planning application approval (2003/01905) for residential development. It is considered that the site is in an existing sustainable residential area and any potential risk of flooding can be dealt with by a Flood Risk Assessment at the planning application stage. <b>Recommendation:</b> Leave in the SHLAA as a site suitable for residential development.
<b>1707 Alford Hall</b>	May be suitable for development	25% in FZ3a; Fluvial climate change may mean majority of site is at long term risk based on FZ2 proxy	Modelling of 1% fluvial scenario (existing and climate change) also taking account of flood defences to check ABDs; consultation with EA on possible resilience measures; ground investigation to assess storage options. Detailed consultation with EA required.	In an area benefiting from flood defences, it is considered that the site is in an existing sustainable residential area and any potential risk of flooding can be dealt with by a Flood Risk Assessment at the planning application stage.

Proposed site	Level 2 recommendation	Barriers to passing test	Further work and options (following consultation with EA)	WBC response to recommendation
				<b>Recommendation:</b> Leave in the SHLAA as a site suitable for residential development.
<b>1717 Former Dairy Works</b>	Initially advised for removal from allocation, however, EA state confidence in defences which will be maintained by the EA in future.	88% in FZ3a, site is small at 0.25 ha	Modelling of 1% fluvial/tidal scenario (existing and climate change) also taking account of flood defences to check ABDs, consultation with EA required on possible resilience measures	Site is in an area benefiting from flood defences and flood risk warnings, with some residual risk from breaching of defences possible. It is considered that the site is in an existing sustainable residential area and any potential risk of flooding can be dealt with by a Breach Assessment and Flood Risk Assessment at the planning application stage.  <b>Recommendation:</b> Leave in the SHLAA as a site suitable for residential development.
<b>1831 Land off Newcombe</b>	Initial JBA recommendation for removal from allocation, however EA confirms site is in Flood Zone 1, resulting from the modelling	None	Drainage strategy will be required, based on post-development layout	Site is in fact within Flood Zone 1 though not, at the time of writing, shown on the EA Flood Map (1 March 2019)

Proposed site	Level 2 recommendation	Barriers to passing test	Further work and options (following consultation with EA)	WBC response to recommendation
	carried out for the Warrington FAS. EA Flood Maps not yet, at the time of writing, been updated to reflect this			
<b>1861 Land North of Mayfair</b>	May be considered for development – assuming FZ3a areas can be left free of development	8.6% in FZ3b; +11% in FZ3a; all fluvial risk	Modelling of 1% fluvial scenario (existing and climate change) also taking account of flood defences to check ABDs; full options modelling would be required; dry access / egress routes a must; consultation with EA on possible resilience measures; detailed consultation with EA required; drainage strategy based on post-development	It is considered that the site is in an existing sustainable residential area and any potential risk of flooding can be dealt with by a Flood Risk Assessment at the planning application stage.
<b>1891 Pool Lane</b>	<b>Initial JBA recommendation for removal from allocation.</b>	85% in FZ3a; entirely fluvial risk; risk comes from MSC	Detailed consultation required with EA concerning risk from MSC; drainage strategy based on post-development, detailed fluvial modelling to assess fluvial risk more closely	The flood risk is from the Manchester Ship Canal. Any proposed development on this site would be subject to a FRA, to demonstrate how the flood risk is to be mitigated. Any loss of flood storage would require compensatory flood storage to be provided (1 March 2019)
<b>2273 Motortrade</b>	<b>Removal from allocation</b>	100% in FZ3a, site located within larger 'waterfront' site	Incorporate into layout and design of wider Waterfront site avoiding FZ3a; options for ground level retail, employment, car parking with first floor residential could be considered; full options modelling would be required; dry access / egress routes a must; consultation with EA on	It is considered the potential risk of flooding to future occupants of this site is too great. <b>Recommendation:</b> Remove site from the SHLAA as it is not

Proposed site	Level 2 recommendation	Barriers to passing test	Further work and options (following consultation with EA)	WBC response to recommendation
			possible resilience measures; detailed consultation with EA required	considered suitable for residential development.
<b>2482 Wharf Industrial Estate</b>	May be considered for development – (site defended from tidal which is main risk). EA state confidence in defences which will be maintained by the EA in future.	48% in FZ3a however defended from tidal risk	Modelling of 1% fluvial scenario (existing and climate change) including defences to check ABDs and overtopping scenarios; consultation with EA on possible resilience measures; drainage strategy based on post-development	In an area benefiting from flood defences, with some potential residual risk from over topping of defences. Any potential risk of flooding can be dealt with by a Breach Assessment and Flood Risk Assessment at the planning application stage.  <b>Recommendation:</b> Leave in the SHLAA as a site suitable for residential development.
<b>2603 Thelwall West</b>	Removal from allocation	45% in FZ3a; fluvial risk from MSC	Detailed consultation required with EA concerning risk from MSC; drainage strategy based on post-development, detailed fluvial modelling required for risks	It is considered the potential risk of flooding to future occupants of the site is too great.  <b>Recommendation:</b> Remove site from the SHLAA as it is not considered suitable for residential development.
<b>2657 New Cut Lane</b>	May be considered for development – assuming FZ3a areas	44% in FZ3a	Modelling of 1% fluvial scenario (existing and climate change) also taking account of flood defences to check ABDs; options for ground level	It is considered that any potential risk of flooding can be dealt with by a

Proposed site	Level 2 recommendation	Barriers to passing test	Further work and options (following consultation with EA)	WBC response to recommendation
	can be left free of development		retail, employment, car parking with first floor residential could be considered; full options modelling would be required; dry access / egress routes a must; consultation with EA on possible resilience measures; detailed consultation with EA required; drainage strategy based on post-development	Flood Risk Assessment at the planning application stage. <b>Recommendation:</b> Leave in the SHLAA as a site suitable for residential development.
<b>2677 Riverside Retail Park</b>	Site may be suitable for development – assuming FZ3a areas can be left free of development	14% in FZ3a	Modelling of 1% fluvial scenario (existing and climate change) also taking account of flood defences to check ABDs; drainage strategy based on post-development	In an area benefiting from flood defences, with some potential residual risk from over topping of defences. Any potential risk of flooding can be dealt with by a Breach Assessment and Flood Risk Assessment at the planning application stage. <b>Recommendation:</b> Leave in the SHLAA as a site suitable for residential development.
<b>1621 Pool Farm</b>	<b>Initial JBA recommendation for removal from allocation</b>	50% within FZ3a; risk is entirely fluvial; site area is small at 0.29 ha; risk comes from MSC	Detailed consultation required with EA concerning risk from MSC	The flood risk is from the Manchester Ship Canal. Any proposed development on this site would be subject to a FRA, to demonstrate how the flood risk is to be mitigated. Any

Proposed site	Level 2 recommendation	Barriers to passing test	Further work and options (following consultation with EA)	WBC response to recommendation
				loss of flood storage would require compensatory flood storage to be provided (1 March 2019)
<b>Waterfront</b>	A The site should be divided up into parcels of land based on development layout aspirations and proposed use. Residential area has already accounted for flood risk and has planning permission	N/A	Detailed design and layout considerations (including site-specific modelling on layout proposals) for proposed employment areas within FZ3a; consultation required between WBC, Peel Ports and EA as to parcels of land believed to be under Peel ownership; dry access / egress routes a must; consultation with EA on possible resilience measures; detailed consultation with EA required; drainage strategy based on post-development	The Exception Test has already been passed and the further work options can be dealt with and mitigated through the design and layout of the site and through planning conditions at the planning application stage.  <b>Recommendation:</b> Leave as an allocation in the Local Plan.

### 3 Site Appraisal Tables

#### 3.1 1041 – Harry Fairclough Ltd

Proposed Site	Harry Fairclough Ltd
Site area (ha)	0.54
Existing use	Employment
Existing flood risk vulnerability classification	Less Vulnerable
Proposed use	Commercial – extension to current building
Proposed development flood risk vulnerability classification	Less Vulnerable
Proposed development impermeable area (ha)	0.46

Flood outlines (current day)

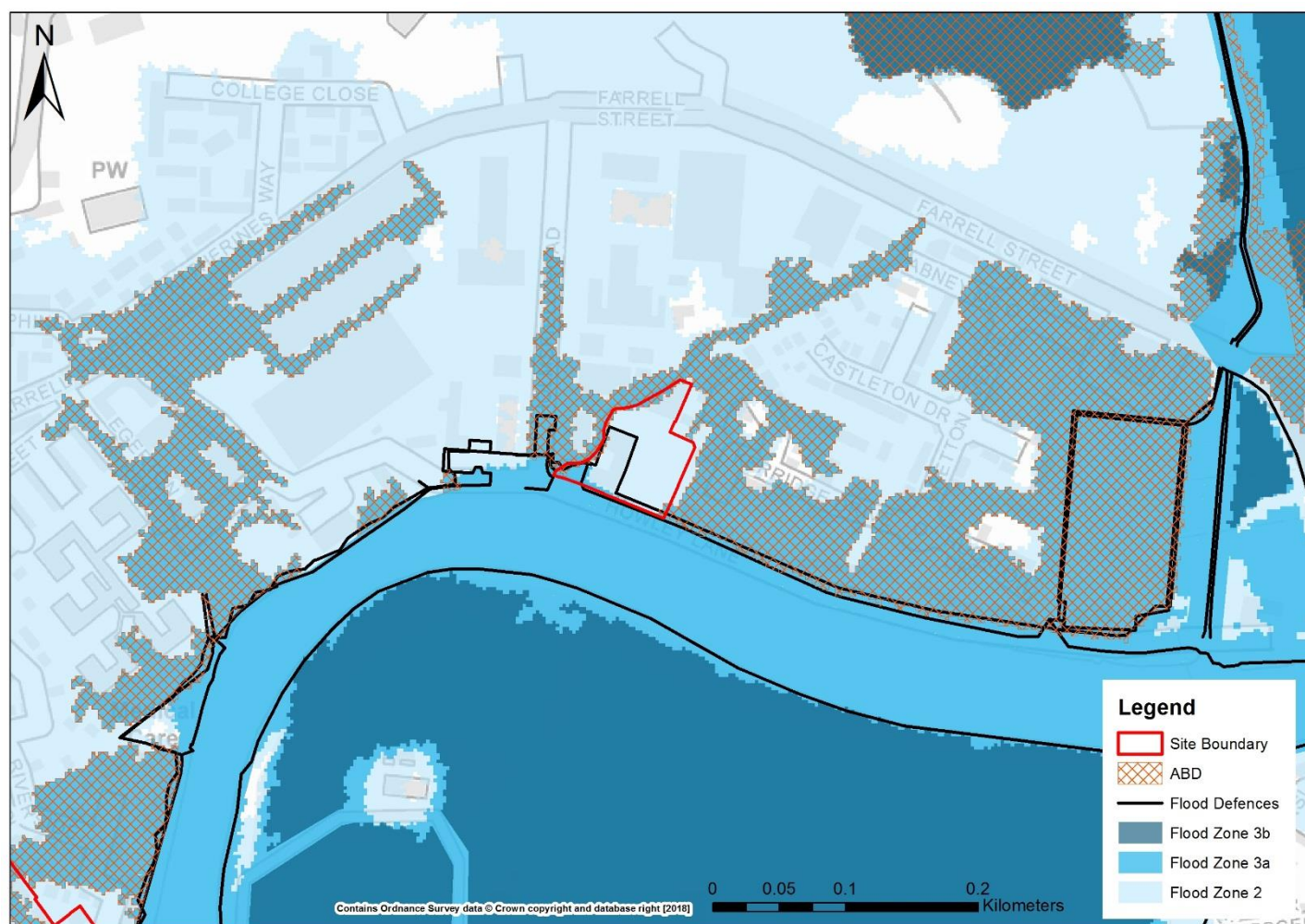


Figure 3.1.1 Flood Zone Mapping with Flood Defences and ABDs

- Due to placement of defences and ABD, site lies mainly within defended FZ2.

Proposed Site

Harry Fairclough Ltd

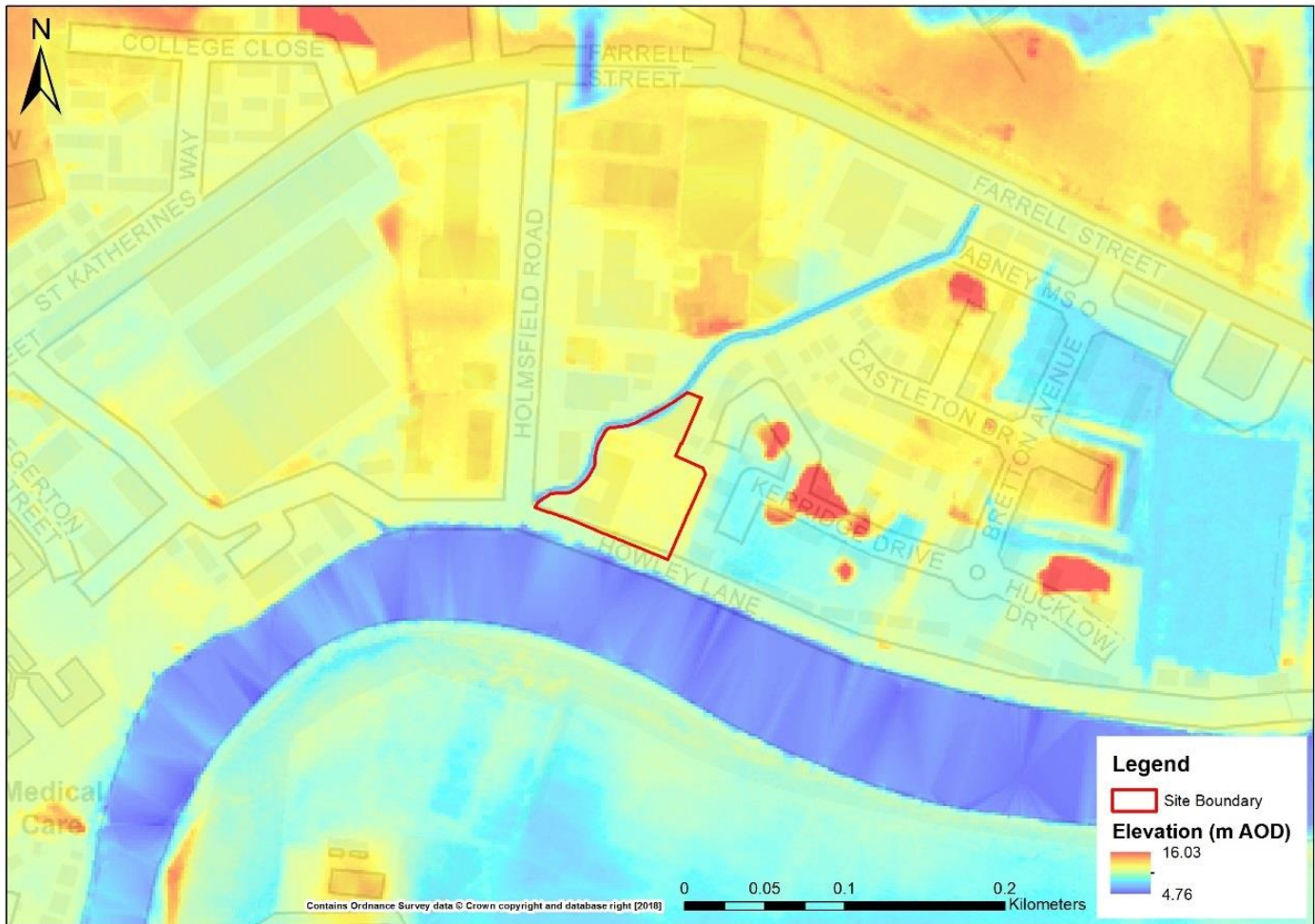


Figure 3.1.2 Site with 2m LIDAR (elevation data)

- The proposed site is located on relatively higher ground compared to the surrounding area, LIDAR (see Figure 3.1.2) indicates an average height of 8.1m AOD compared to surrounding ground levels of 7.5m AOD.
- From Figure 3.1.3, the site is still at risk of CC outlines despite the higher ground.

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019).  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The site is proposed for a commercial extension to an existing building and is therefore classified as Less Vulnerable (Table 2, FRCC-PPG).
- Nearly 15% of the site is within Flood Zone 3a.
- Padgate Brook bounds the West of the site from which there may also be fluvial flood risk.
- Modelling outputs and data were not available for Padgate Brook, as a result there may be residual risk from this watercourse.
- Fluvial modelling from the Mersey was not available for this study meaning any fluvial risk to the site has been assessed using current flood zone mapping.



**Proposed Site** **Harry Fairclough Ltd**

- Flood Zone 3a bounds the whole of the site footprint. This may have issues on access and egress requirements.
- Over 85% of the site is located within Flood Zone 2. This type of development is permitted in Flood Zone 2 though this is within a defended outline. As such, this needs to be considered for development.
- Fluvial flooding from the River Mersey is the primary source of flood risk.
- The site is at a low risk of tidal flooding within only the southern and western edges of the site are overlapped by flooding outlines.
- Risk of surface water flooding is very low and only associated with the adjacent Padgate Brook.

**Flood Source: Fluvial/Tidal**

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	85.41	14.59	0.00
Tidal: Depth (m)	0.01	0.1	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate Change

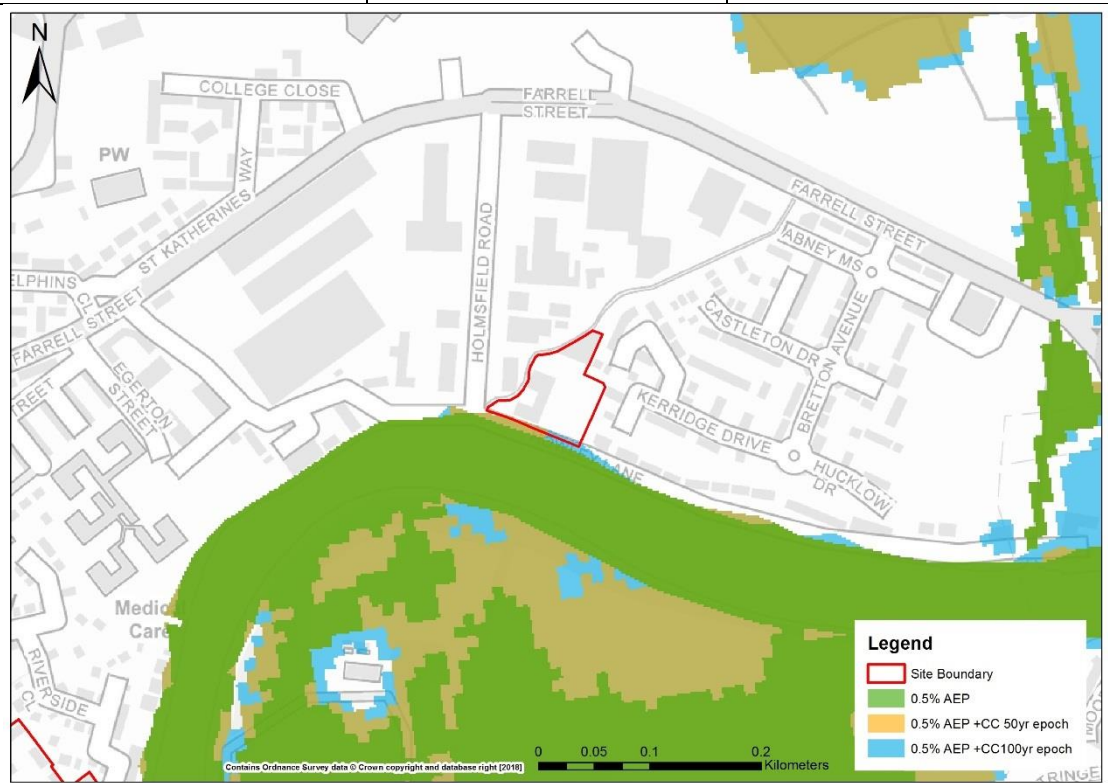


Figure 3.1.3 Defended tidal outlines for the present day 0.5% AEP, future risk 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases

Tidal (defended):

- According to the 2015 Mersey Estuary modelled extents (see Figure 3.1.3 the site is almost entirely free of tidal flooding during the 0.5% AEP 100yr-epoch (cumulative sea level rise for the next 100 years) climate change scenario

Proposed Site

Harry Fairclough Ltd

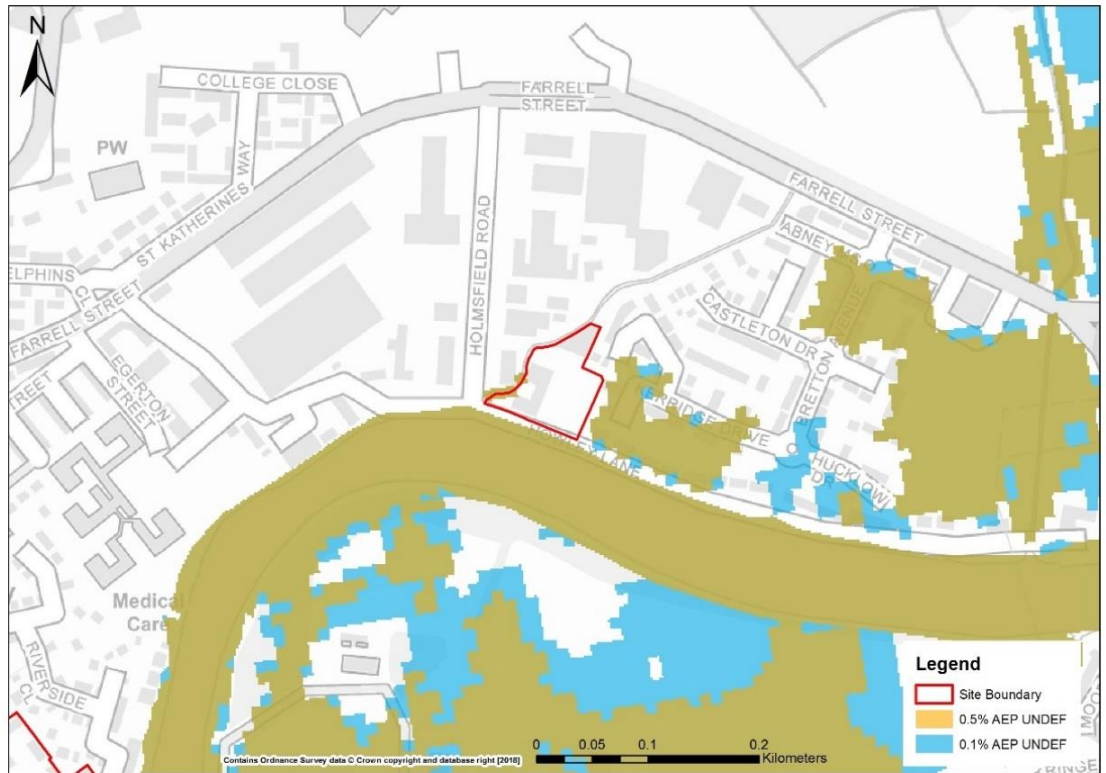


Figure 3.1.4 Tidal outlines for the undefended scenario, 0.5% and 0.1% AEP

Tidal:

- In an undefended tidal scenario, see above Figure 3.1.4, flooding extents, though increased in extent compared to the undefended scenario, still have a minimal effect on the site. However, there is some risk from Padgate Brook. It is unclear whether any risk exists from the culverted end of the watercourse or whether the Brook is tide-locked.

Fluvial Flood Risk and Climate Change

Fluvial:

- Fluvial modelling outputs not provided for this study. Current flood zone mapping used as substitute for modelled fluvial risk.
- Climate change outlines unavailable, however, Flood Zone 2 can be used as a proxy for what Flood Zone 3 may become in the longer term. Flood Zone 2 covers virtually the whole site though this appears to be defended.

Historic Flooding

- The site is located outside of any Environment Agency historic flood outlines.

Defences

- Available EA flood defence asset data indicates that the site benefits from flood defences running alongside the River Mersey. These defences are mainly high ground and earthen embankments of condition grade 3 (Table 1.1 Condition Assessment Manual 2012)<sup>3</sup>.

<sup>3</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/291126/scho0509bqat-e-e.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291126/scho0509bqat-e-e.pdf)

**Proposed Site**

**Harry Fairclough Ltd**

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

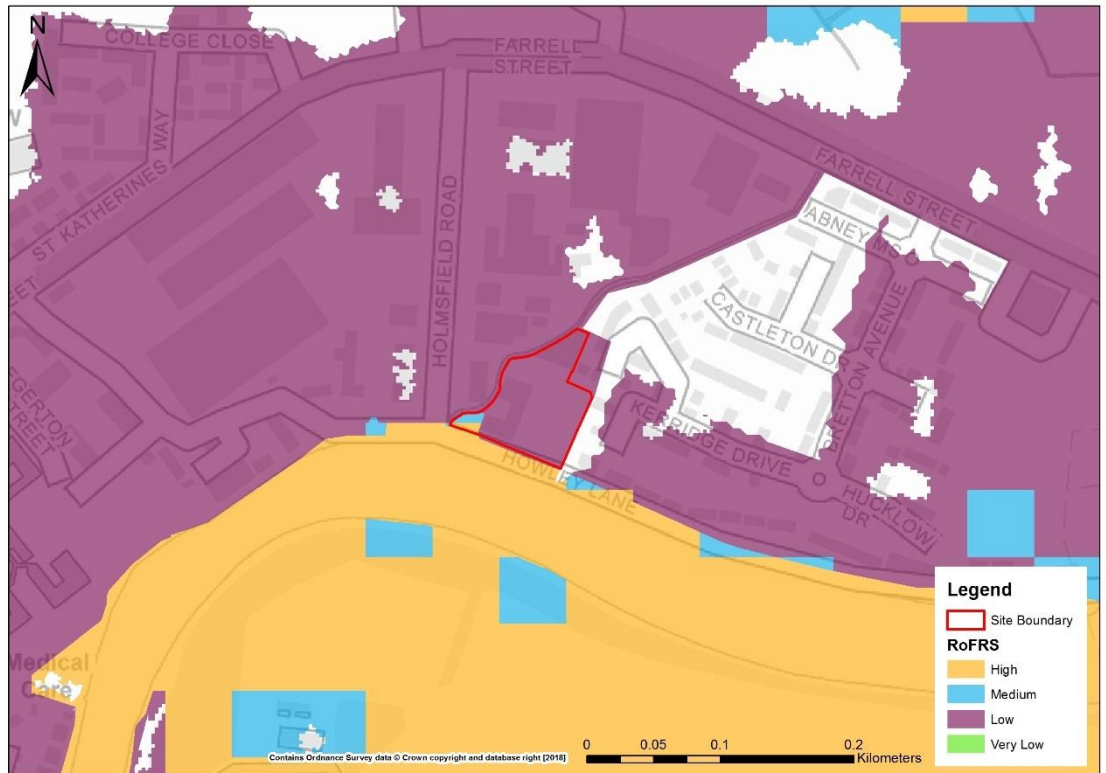


Figure 3.1.5 Site displaying flood risk from rivers and the sea

Risk of Flooding from Rivers and the Sea (RoFRS) – defended flood map:

- The site is almost wholly located in the low risk band, specified as being between a 1% and 0.1% AEP events.
- The provided risk has been supplied with a high level of confidence in the reliability of the data for a local area, suitable to the scale of streets to parcels of land.
- This would corroborate risk shown in the modelled outlines, Figure 3.1.3 and Figure 3.1.4.

Flood Warning Area (FWA)

- 100% of site is located within an EA FWA, described as "Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also, parts of Howley, Wilderspool, Latchford, Westy, Paddington, Woolston, Thelwall and Lymm"

Mitigation Options & Site Suitability

- The areas of Flood Zone 3a should be left free of development, i.e. used as public open space. This should be possible given the locations of the risk being confined to the site boundary.
- Due to this study using flood zone mapping as a substitute for non-available fluvial modelling, we cannot state whether the site is suitably free from fluvial risk during higher magnitude events.
- Additionally, fluvial climate change should be considered to be modelled as part of further work for this L2 or as a site specific FRA by a Developer, taking account of the defences to ascertain whether the site can be safe for its lifetime and therefore satisfy the requirements of the Exception Test. The central (+30%) and higher central (+35%) allowances should be applied to peak river flows.

<b>Proposed Site</b>		<b>Harry Fairclough Ltd</b>
	<p>Results should be discussed with the EA to determine suitable resilience measures to put in place.</p> <ul style="list-style-type: none"> <li>Any future development at this site should be considered sustainable without a continued reliance on flood defence investment and maintenance.</li> <li>Post-development surface water discharge rates should be better than the previous or equal to greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Safe and dry access/egress routes are present in tidal risk however with fluvial risk the surrounding roads are within FZ2 and FZ3a. These must be kept clear for all potential risks as part of an Emergency Plan.</li> <li>As recommended by the Environment Agency, there should be an 8m buffer strip between any proposed development and the River Mersey and Padgate Brook.</li> </ul>	
<b>Flood source: Groundwater</b>		
Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site's proximity to the River Mersey, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>	
<b>Flood Source: Infrastructure Failure – Reservoirs</b>		
Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents, according to the EA's Reservoir Flood Map (RFM).</li> </ul>	
<b>Flood Source: Infrastructure Failure – Canals</b>		
Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>	

**Proposed Site**

**Harry Fairclough Ltd**

**Flood Source: Surface Water**

Surface Water Flood Risk to Proposed Development Site

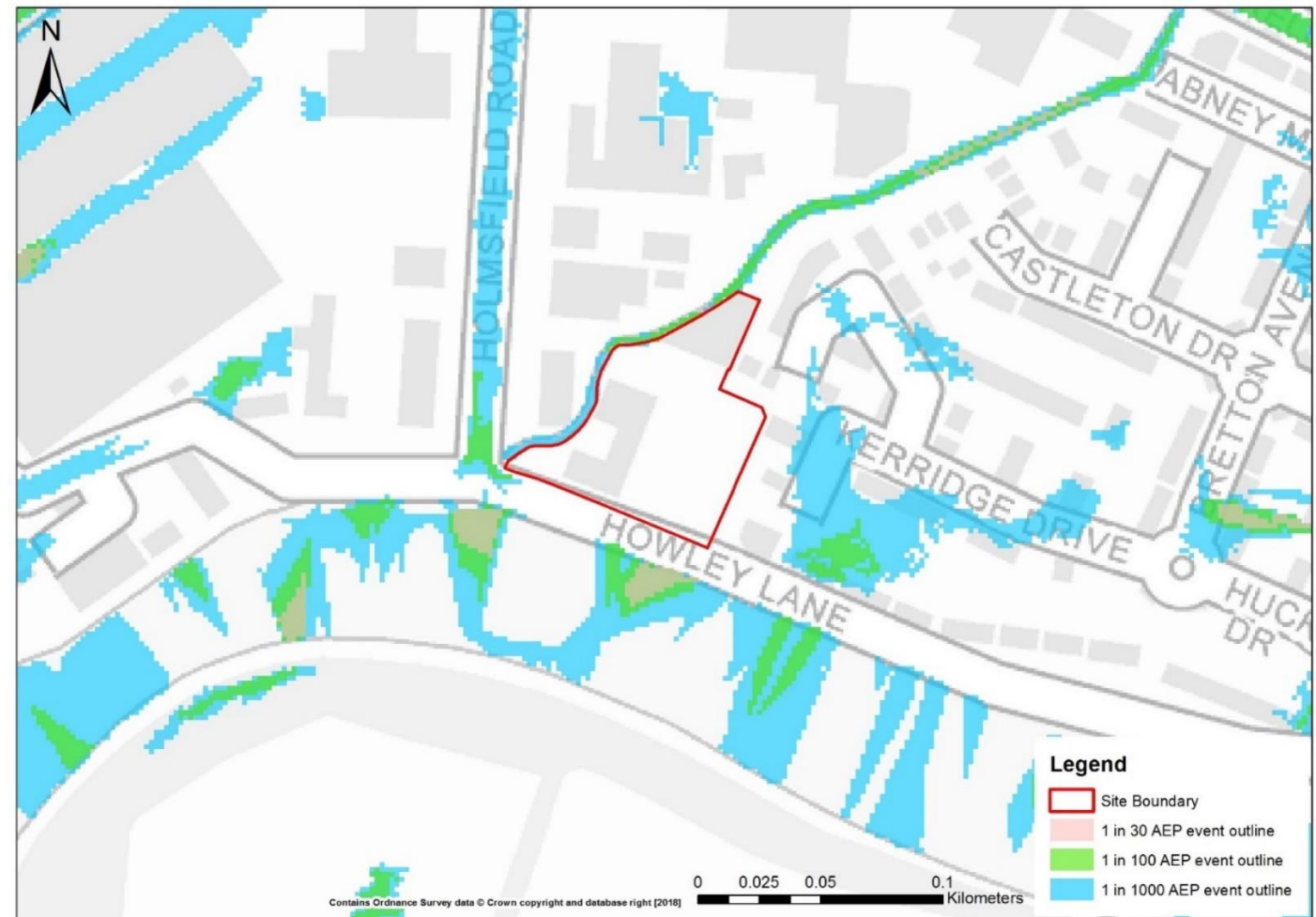


Figure 3.1.6 Surface Water Flood Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.00	0.24	0.79
Surface water flooding depths	N/A	Max: 0.90-1.20m Mean: 0.36m	Max: 0.90-1.20m Mean: 0.48m
Surface water hazards	N/A	Max: Significant Mean: Low	Max: Significant Mean: Moderate
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>Over 99% of the site is outside of the surface water flood extents and therefore is at very low risk from surface water flooding.</li> </ul>		

Proposed Site		Harry Fairclough Ltd
	<ul style="list-style-type: none"> <li>Possible blockage of the culverted end of Padgate Brook could in turn create areas of increased surface water depth at the south-western corner of the site.</li> <li>The volume of surface water runoff generated by the new development and volumes of attenuation required to ensure that runoff from the site does not increase surface water flood risk elsewhere has been calculated below.</li> <li>The areas of surface water within the site boundary are associated with the adjacent Padgate Brook which follows the Western boundary.</li> <li>Few of the roads around the site are inundated by surface water during the 1% AEP event with depths of flooding varying between 0.1-0.15m.</li> </ul>	
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>A safe access/egress route is maintained via Howley Lane along the southern boundary of the site in tidal events, fluvial risks sees inundation to these key roads.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Infiltration SuDS may not be feasible as the site is previously developed.</li> </ul>	

### Indicative Surface Water Flood Risk from Proposed Development (for Proposed Site in its Entirety)

Proposed Development limiting runoff rate: Greenfield – FEH Statistical		Qbar: 5 l/s Q30: 5 l/s Q100: 5 l/s				
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	6.5	265	59	207	22.9	0.01 ha 2.56 %
3.33% AEP Rainfall + 40%	8	324	72	252	27.9	0.02 ha 3.11 %
1% AEP Rainfall + 20%	8.25	380	74	306 (99 exceedance storage)	33.9	0.02 ha 3.78 %
1% AEP Rainfall + 40%	9.75	458	88	370 (118 exceedance storage)	41.0	0.02 ha 4.57 %

<b>Proposed Site</b>		<b>Harry Fairclough Ltd</b>
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>	
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> </ul>	

### 3.2 1178 – Cardinal Newman High School

Proposed Site	Cardinal Newman High School
Site area (ha)	15.48
Existing use	Educational establishment
Existing flood risk vulnerability classification	More Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	13.16

Flood outlines (current day)

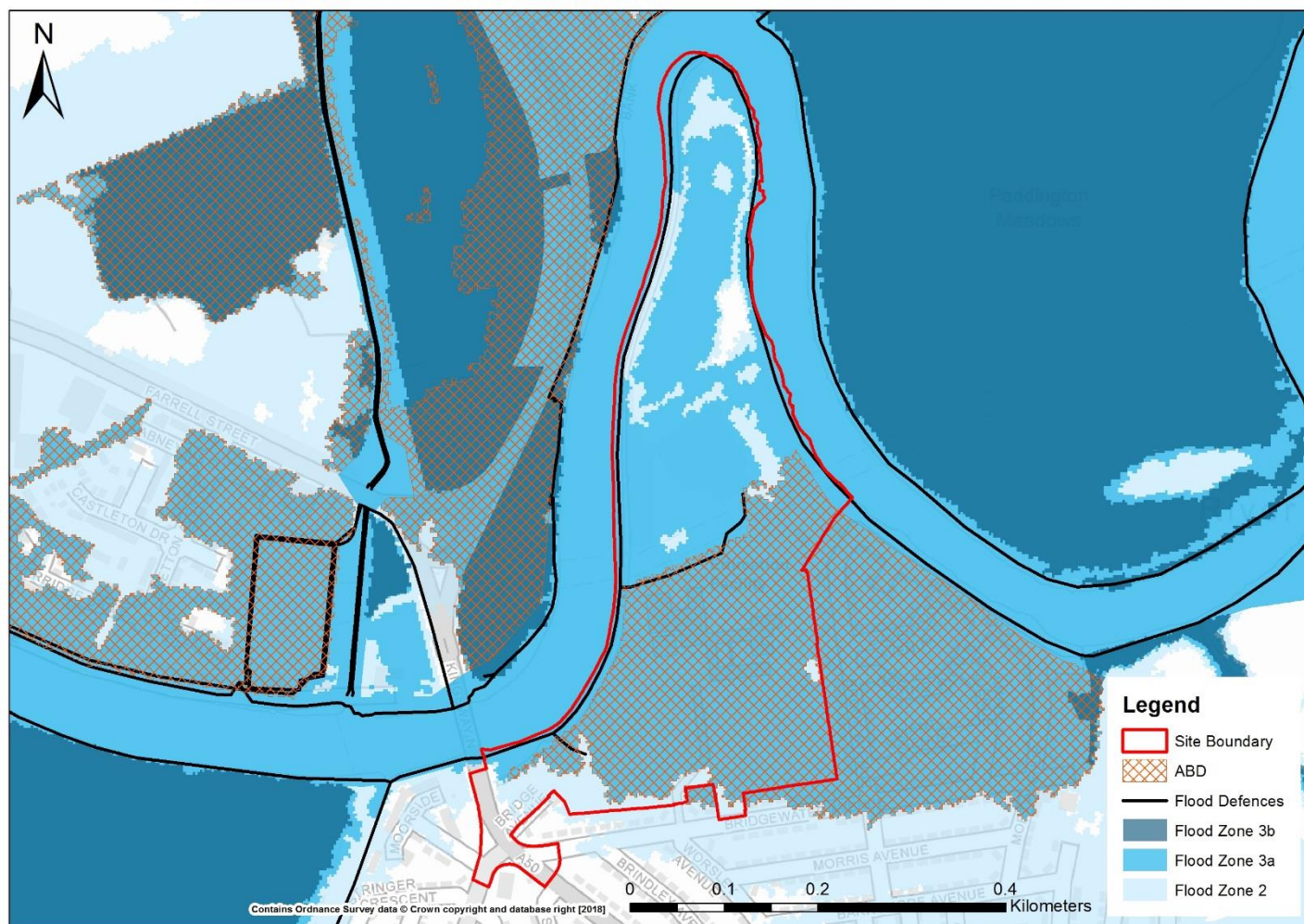


Figure 3.2.1 Flood Zone Mapping, Flood Defences and ABDs



Proposed Site

Cardinal Newman High School

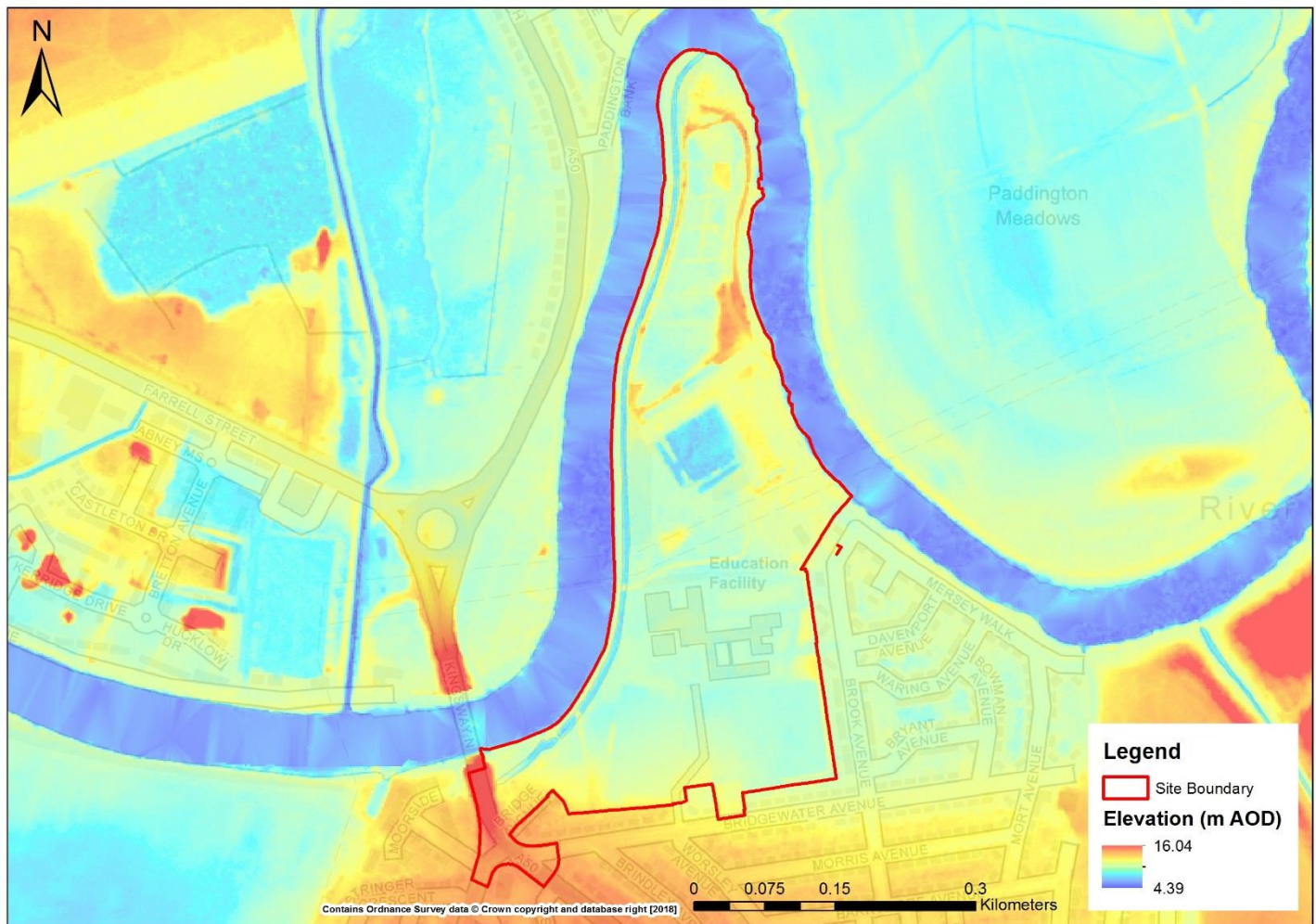


Figure 3.2.2 Proposed site with LIDAR (elevation data)

- The site is relatively low-lying (see Figure 2.2.2) compared to the surrounding residential areas.
- Flooding is likely to flow and pond within the site.

© Crown Copyright, All rights reserved. 2019 License number 100019628.

Contains OS data © Crown copyright and database right (2019)

Contains public sector information licensed under the Open Government Licence v3.0.

Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The site is largely bound by the River Mersey.
- Fluvial and tidal are the primary sources of flood risk according to current flood zone mapping.
- The whole of the site is at risk from fluvial sources whilst the south of the site has additional tidal risks. Flood zone mapping has been used in lieu of fluvial modelling outputs which would provide greater detail.
- The risk of surface water flooding is significant during the 0.1% AEP event, only small pockets of flooding are seen in the 1% AEP event (see Figure 3.2.2). Surface water not only floods the site but also many of the main access/egress routes.

Proposed Site	Cardinal Newman High School
---------------	-----------------------------

- 82% of the site is located within Flood Zone 3a.
- There is no change in risk classification for the proposed development according to the NPPF.
- The northern half of the site is mostly isolated during flood events with flood outlines preventing sufficient access/egress routes to the site.

Following draft review with EA:

- EA confirmed current defences will protect the site, as per the ABD, from tidal and fluvial flooding up to a 200 / 100 AEP standard.
- EA assumption is that fluvial risk on the Mersey has not been modelled downstream of Howley Weir (tidal limit) as tidal risk is considered to be the dominant risk
- EA confirmed the defences will be maintained in the future as part of the EA's asset maintenance programme.
- WBC confirmed that the area for development will be within the current ABD.
- FRA must assess climate change impacts and show that the site will be safe for its lifetime. Defence overtopping scenario should also be modelled for climate change event

Flood Source: Fluvial/Tidal			
-----------------------------	--	--	--

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	13.16	82.03	0.00
Tidal: Depth (m)	0.41	0.37	Not available
Tidal: Hazard	Not available	Not available	Not available

**Proposed Site**

**Cardinal Newman High School**

**Modelled Flood Risk and Climate Change**

- Fluvial modelling was not available for this study and as such, current fluvial flood zone mapping has been used as indicators of risk.

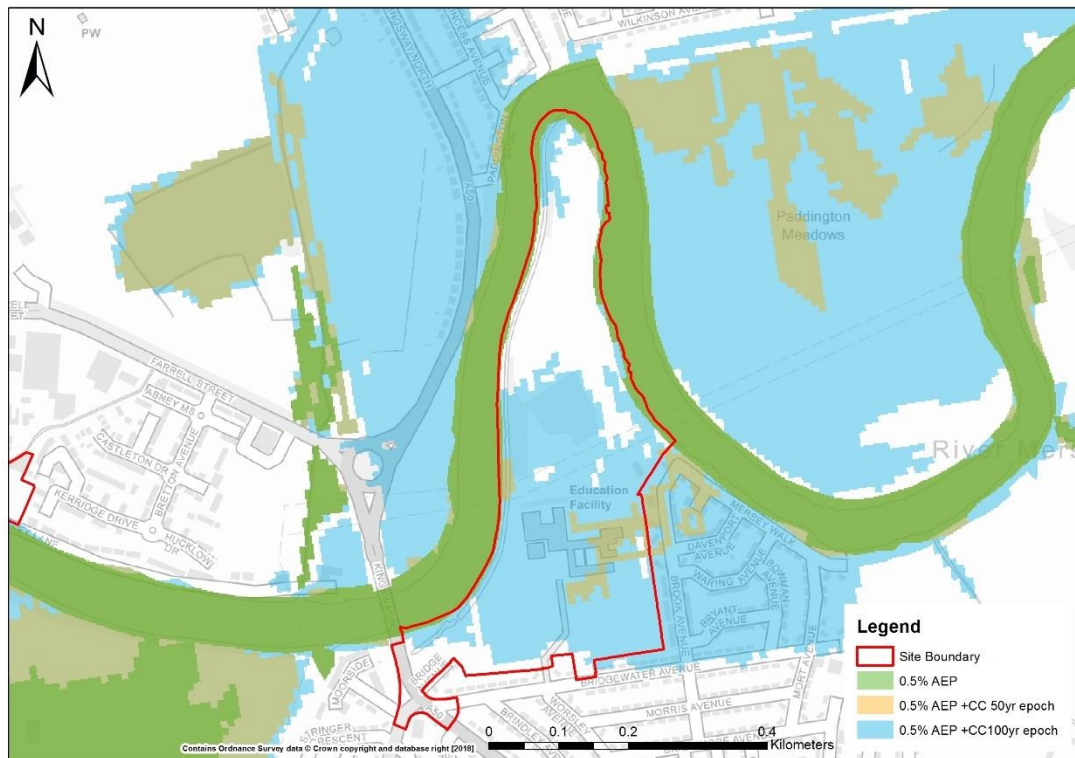


Figure 3.2.3 Defended tidal outlines for present day 0.5% AEP and future risk 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases

**Tidal (defended):**

- Present day defended tidal outline (1 in 200 AEP) show that the site is currently safe from tidal flood risk due to the flood defences in place on the Mersey.
- According to the 2015 Mersey Estuary modelled extents (see Figure 3.2.3), a flow path enters the site via Moxon Avenue during the 50yr-epoch (cumulative sea level rise for the next 50 years) outline.
- This would place the southern half of the site at risk of flooding with the northern half being isolated.
- During the 100yr-epoch outline, most of the site is inundated with tidal flooding.

Proposed Site

Cardinal Newman High School

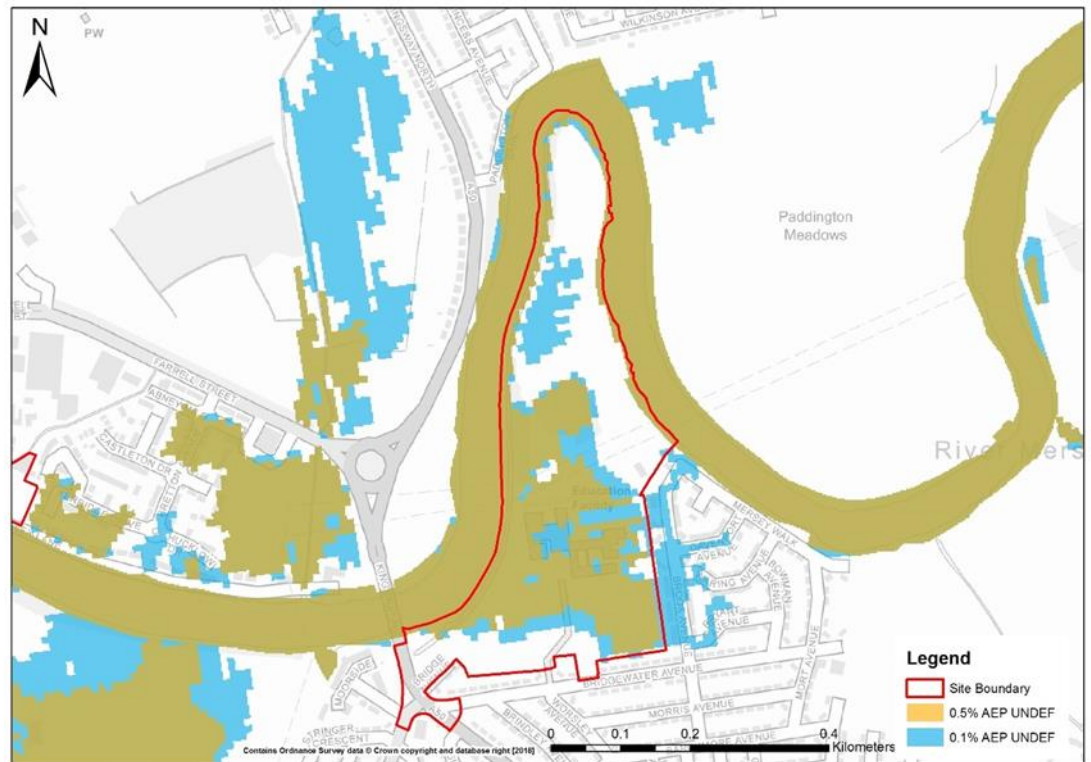


Figure 3.2.4 Tidal outlines for the undefended scenario 0.5% AEP and 0.1% AEP events

Tidal (Undefended):

- The baseline modelled extents indicate that the site floods extensively during both the 0.5% and 0.1% AEP undefended scenario.
- Flood water attenuates in the low-lying areas: the existing High School and playing fields.
- The depth of flooding within the site is approximately 0.2 – 0.4m.
- Areas of fluvial flooding shown in Figure 3.2.5 are seen in the north and south. Lidar levels in these areas are ~1m lower than surrounding roads so land raising could be an option.

**Proposed Site**

**Cardinal Newman High School**

Fluvial Flood Risk and Climate Change



Figure 3.2.5 Fluvial Flood Zone Mapping

- Showing only fluvial flood risks, much of the site is within defended flood zone 3a though this does mainly follow the underlying flood zone 2 outline.
- The defences act as an important barrier to fluvial risk though these cannot be counted on to be maintained for the life of the site.
- There is no room on the current site for flood storage.
- No parts of the site lie within flood zone 3b.

Historic flooding

- 34% of the site is contained within the historic flood map outline. This area is localised to the existing High School and playing fields.

Defences

- Available EA flood defence asset data indicates that the site benefits from flood defences running alongside the River Mersey. These are fluvial/tidal defences which are mainly high ground and raised earthen embankments of condition grade 3 (Table 1.1 Condition Assessment Manual 2012). The defended present day 1 in 200 AEP event outline is exhibited on Figure 3.2.3 by the green outline which is shown to stay in-bank.

**Proposed Site** **Cardinal Newman High School**

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

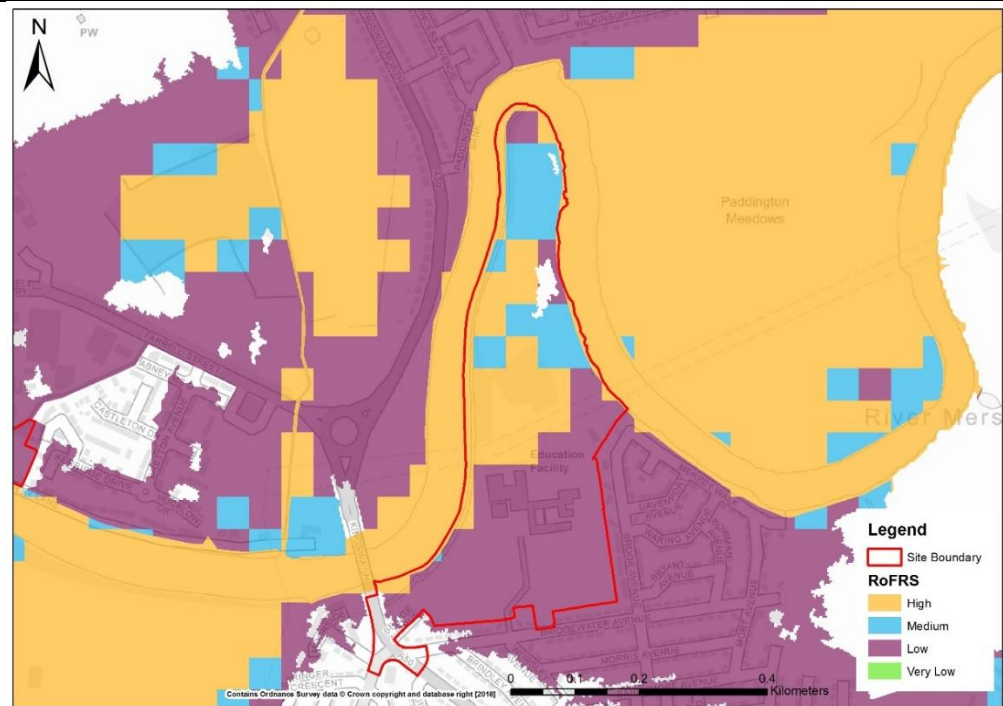


Figure 3.2.6 Risk of Flooding from Rivers and the Sea (defended)

Flood Warning Area

- 75% of proposed site located within two separate EA FWAs, described as "Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also parts of Howley, Wilderspool, Latchford, Westy, Paddington, Woolston, Thelwall and Lymm" and "Areas including Newman High School, Brook Ave, Davenport Ave, Waring Ave, Bryant Ave, Bowman Ave and Mort Ave are at risk of flooding from the Estuary due to high tides".

Mitigation options & site suitability

- Initially advised for removal from allocation, however, EA state confidence in defences which will be maintained by the EA in future. Area of development to take place within ABD. Following EA review, the site may be permitted subject to the outcomes of the FRA.
- The majority of the site is at fluvial risk (Figure 3.2.5) therefore any land raising would require compensatory storage. Judging by the large areas at fluvial risk, it does not appear feasible that any storage areas could be accommodated on-site.
- Present day defended tidal outlines show that the site is currently safe from tidal flood risk due to the flood defences in place on the Mersey. However, the site is shown to not be safe for its lifetime based on the climate change modelling (Figure 3.2.3).
- Fluvial modelling of the Mersey also accounting for defences to ascertain areas benefitting from defences. Full consultation required with the EA before doing this.
- Ultimately, access and egress roads cannot be considered safe/dry from all risks as the site is shown to be isolated in the flood zone mapping, Figure 3.2.1 and Figure 3.2.5. These routes must be accounted for and designated within an Emergency Plan for the site.

Proposed Site	Cardinal Newman High School
	<ul style="list-style-type: none"> <li>As recommended by the Environment Agency, there should be an 8 m buffer strip between any proposed development and the River Mersey.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>EA has confirmed confidence in defences and that the site may be permitted subject to the outcomes of the FRA.</li> </ul>

**Flood source: Groundwater**

Flood risk: groundwater	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>
-------------------------	--

**Flood Source: Infrastructure Failure – Reservoirs**

Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents</li> </ul>
-----------------------	--

**Flood Source: Infrastructure Failure – Canals**

Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>
-------------------	--

**Flood Source: Surface Water**

Surface Water Flood Risk to Proposed Development Site

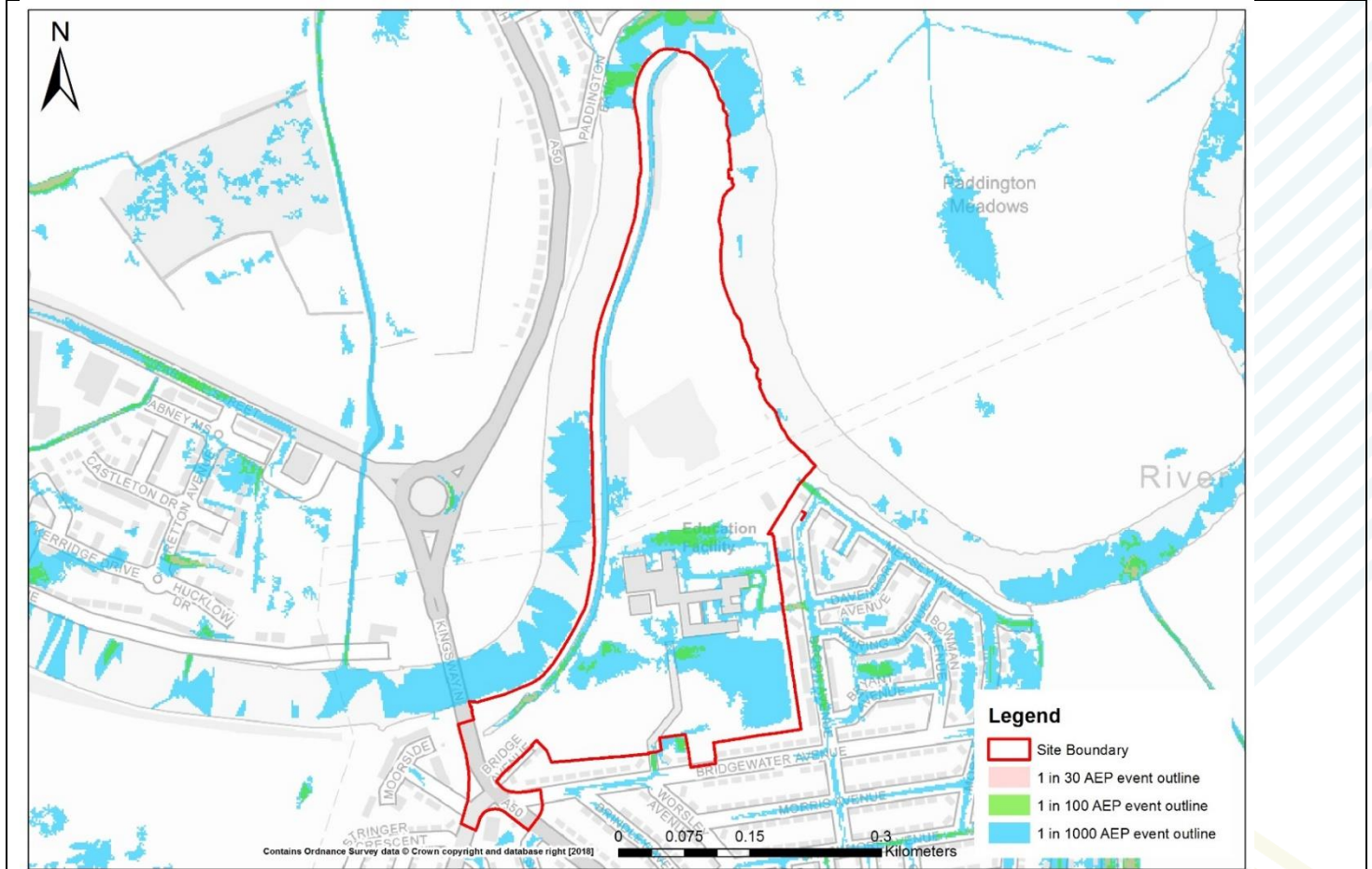


Figure 3.2.7 Surface Water Flood Risk

Proposed Site		Cardinal Newman High School	
Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.08	1.63	14.73
Surface water flooding depths	Max: 0.15-0.30m Mean: 0.21m	Max: 0.30-0.60m Mean: 0.34m	Max: >1.20m Mean: 0.61m
Surface water hazards	Max: Moderate Mean: Low	Max: Localised Significant Mean: Low	Max: Localised Significant Mean: Moderate
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>The site is at very low risk from surface water flooding during the 1% AEP event.</li> <li>Approximately 2% of site is at risk of surface water flooding during the 1% AEP event. Average depths of flooding of 0.34m are seen in isolated pockets of flooding within the site with this being focused at the southern part of the site, surrounding the top of Cardinal Newman High School.</li> <li>At the 1% AEP event, much of the access and egress roads to the site have little inundation by flooding so these routes remain mostly clear.</li> </ul>		
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>Site access/egress during a storm event is preferable via Bridgewater Avenue, however, there is limited flooding here during the 1% AEP event to a depth of 0.25m.</li> <li>Infiltration SuDS may not be suitable for attenuation uses here. Much of the land is located within the flood zones and so would not be suitable for storage.</li> <li>At present, the public footpath is situated at approximately 6.0-6.5m AOD where the earth either side of the path is &gt;7.0m AOD. The playing fields are situated at approximately 6.8m AOD and approximately 0.2-0.7m below the surrounding area.</li> <li>Development should be avoided in both the 1% and 0.1% AEP outline where possible and given that a large proportion of the site is greenfield, SuDS approaches could be adopted where localised flooding is indicated.</li> </ul>		



Proposed Site				Cardinal Newman High School		
Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical				Qbar: 35.95 l/s Q30: 61.12 l/s Q100: 74.78 l/s		
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	12	8721	1320	7400	67.1	0.49 ha 3.18 %
3.33% AEP Rainfall + 40%	12	10174	1320	8854	80.3	0.59 ha 3.81 %
1% AEP Rainfall + 20%	16	12376	2154	10223 (2823 exceedance storage)	75.7	0.68 ha 4.40 %
1% AEP Rainfall + 40%	20	15018	2692	12326 (3472 exceedance storage)	91.3	0.82 ha 5.30 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					

### 3.3 1707 – Alford Hall Social Club Overflow Car Park

Proposed Site	Alford Hall Social Club Overflow Car Park
Site area (ha)	0.39
Existing use	Mixed Use
Existing flood risk vulnerability classification	More Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	0.33

Flood outlines (current day)

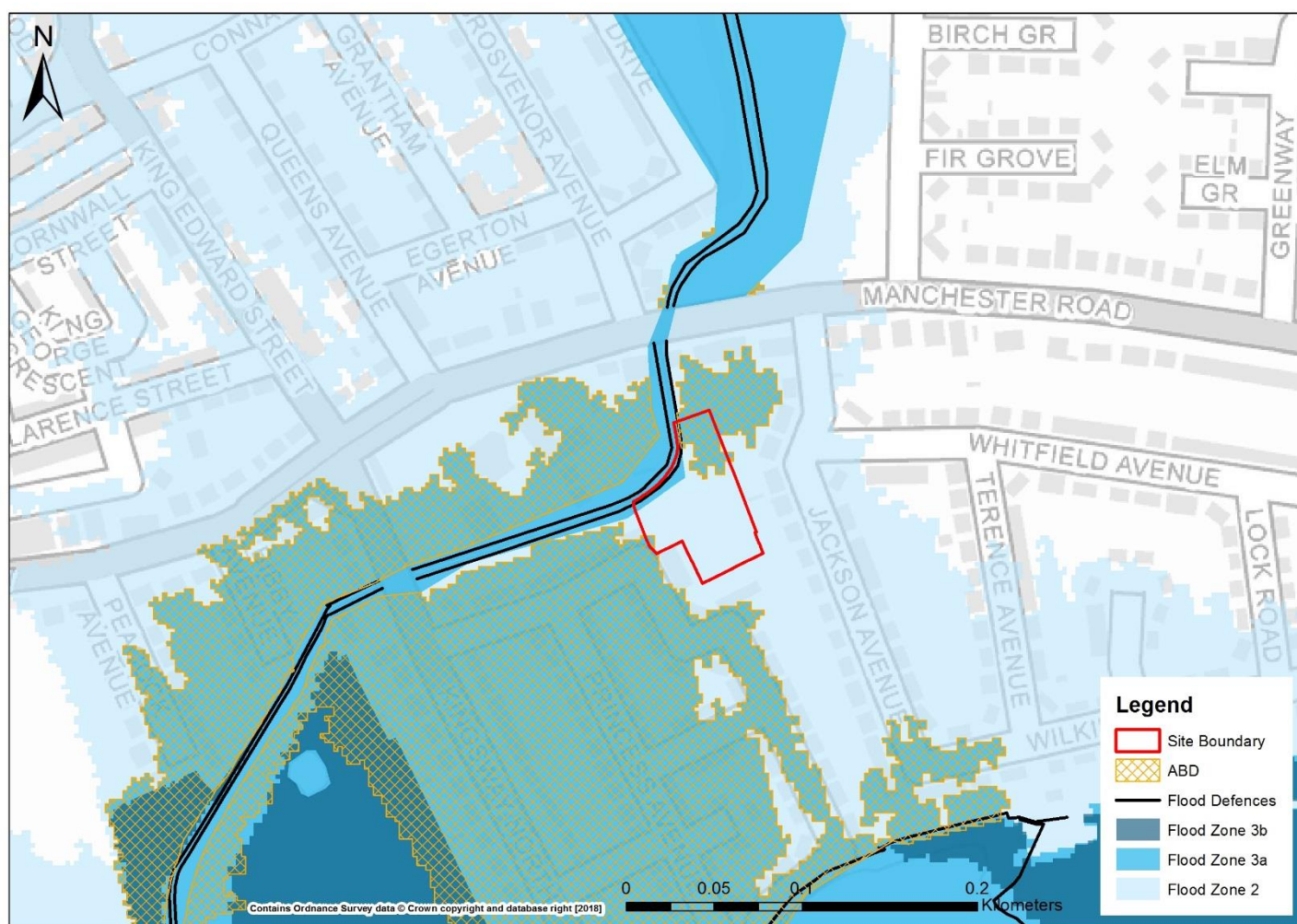


Figure 3.3.1 Flood Zone Mapping, Flood Defences and ABDs

© Crown Copyright, All rights reserved. 2019 License number 100019628.

Contains OS data © Crown copyright and database right (2019)

Contains public sector information licensed under the Open Government Licence v3.0.

Contains Environment Agency information © Environment Agency and/or database right.

#### Observations

- Fluvial and surface water are the primary sources of flood risk.
- 25% is in fluvial Flood Zone 3a (confined to north area of site, Figure 3.3.3).

**Proposed Site** **Alford Hall Social Club Overflow Car Park**

- Fluvial modelling was unavailable for the study, flood zone mapping has been used in lieu.
- Padgate Brook bounds the North-West of the site. Fluvial risk likely to be combination of the Mersey and Padgate Brook.
- There is no direct risk from tidal sources, corroborated by the modelled outputs.
- Surface water is shown to pond in the North of the site (see Figure 3.3.5).
- Main access routes to the site would need to be focused on roads east of the site due to the higher elevation here.
- The proposed development is More Vulnerable and due to a quarter of the site being within Flood Zone 3a the Exception Test must be undertaken and passed.
- There is no change in the stated risk use classification for the site.
- Although not at immediate risk of tidal flooding, the site is <5m from the modelled tidal flood outline at the closest limit and as such requires continued consideration.

**Flood Source: Fluvial/Tidal**

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	75.11	24.89	0.00
Tidal: Depth (m)	Not available	Not available	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate Change

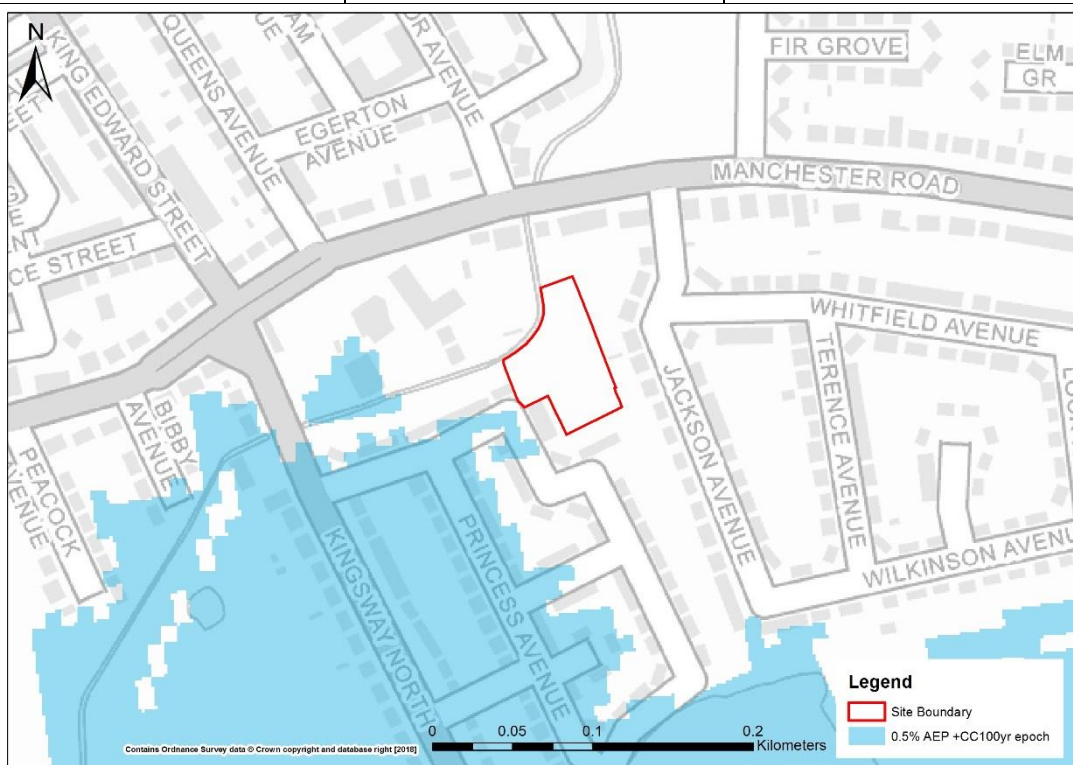


Figure 3.3.2 Modelled defended tidal outlines with the 0.5% AEP with 100yr (2115) epoch of climate change allowances

Tidal (defended):

- Figure 3.3.2 shows that the 0.5% 100yr-epoch (cumulative sea level rise for the next 100 years) climate change outline does not affect the site.

**Proposed Site**

**Alford Hall Social Club Overflow Car Park**

Fluvial Flood Risk and climate change

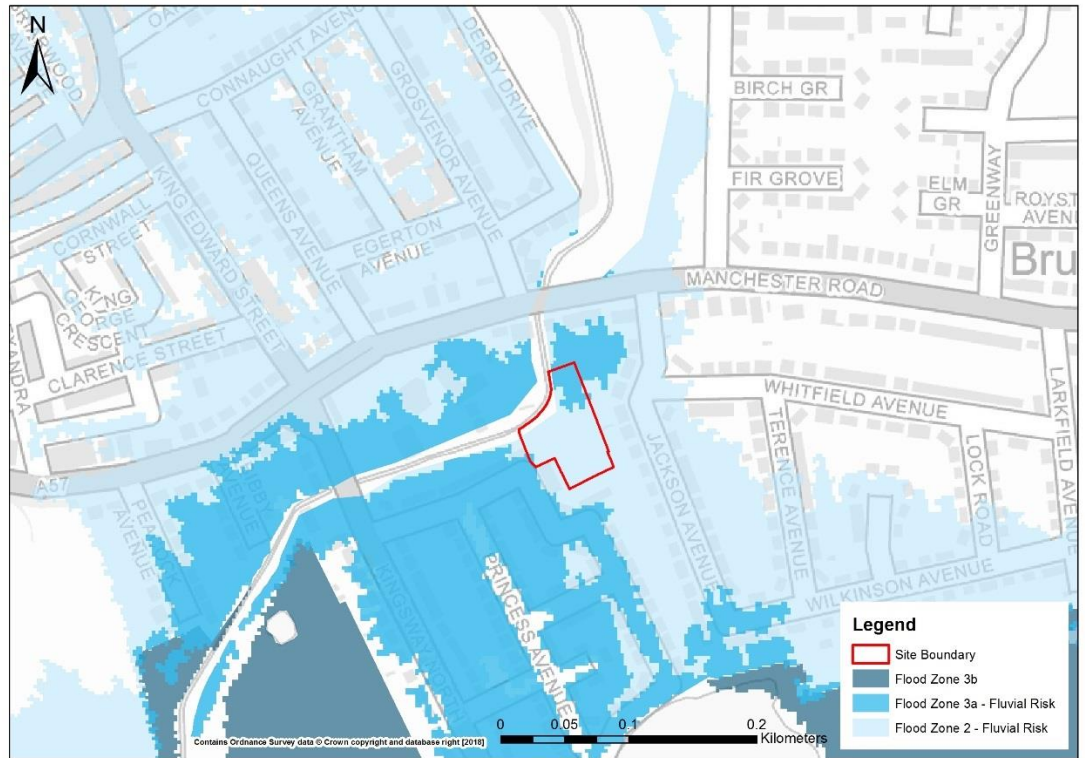


Figure 3.3.3 Fluvial only flood zone mapping

- With only fluvial flood risk, the risk is similar to the combine tidal/fluvial risk, see Figure 3.3.1, showing that fluvial provides the main risk of flooding at this site.
- The majority of the site is within flood zone 2 with the northern corner being in flood zone 3a, likely from Padgate Brook which bounds the northern edge of the site.

Historic flooding

- The site is located outside any Environment Agency historic flood outlines.

Defences

- Available EA flood defence asset data indicates that the site benefits from a series of regraded earth channels that have a condition grade of 3 (Table 1.1 Condition Assessment Manual 2012). These are located at the North of the site along Padgate Brook.

**Proposed Site**

**Alford Hall Social Club Overflow Car Park**

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

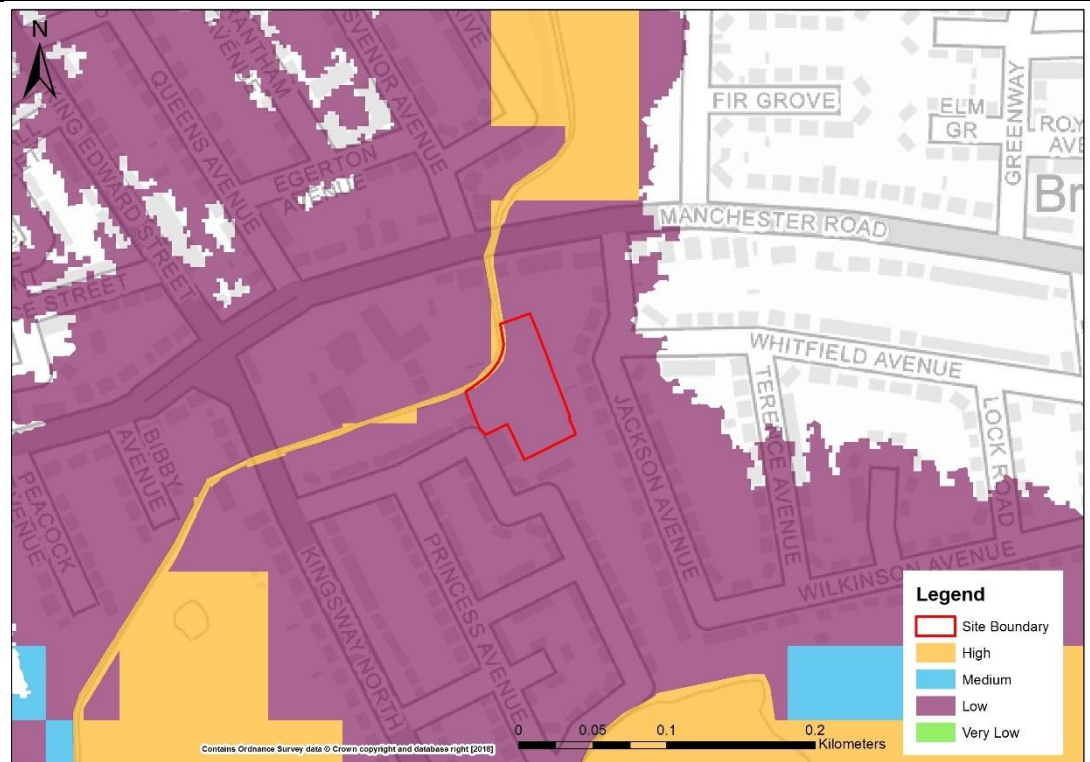


Figure 3.3.4 Risk of Flooding from Rivers and the Sea (defended)

- The RoFRS mapping accounts for defences in place and subsequent risks, here the risk to the site is classified as 'low', meaning the chance of flooding is <math><0.1\%</math> AEP design event.
- An area of high risk is located at the north of the site though again, this relates to Padgate Brook and not the site.

Flood Warning Area

- 30% of proposed site located within an EA FWA, described as "The Kingsway North area of Warrington is at risk of flooding from the Estuary due to high tides. Areas at risk include; Bennett Ave, Princess Ave, Bibby Ave; Peacock Ave; Kingsway North; the units behind Farrell St; the ambulance station and allotments"

Mitigation options & site suitability

- The areas of Flood Zone 3a should be left free of development. This should be possible given the locations of the risk being confined to the northern quarter of the site, however this would likely impact on unit densities. If this is not possible it is likely development will not be permitted.
- Residential development is permitted in Flood Zone 2.
- Fluvial risk should be modelled for the Mersey and Padgate Brook for present day – defended and undefended. Due to the absence of these modelling outputs we cannot state to greater detail which events is free from fluvial flooding.
- Fluvial climate change should be modelled for the Mersey and Padgate Brook as part of further work for this L2 or a site-specific FRA by a Developer, taking account of defences to ascertain whether the site can be safe for its lifetime and can therefore satisfy the requirements of the Exception Test.

Proposed Site	Alford Hall Social Club Overflow Car Park
	<ul style="list-style-type: none"> <li>As a quarter of the site is within Flood Zone 3a, the EA would likely expect the upper end allowance of +70% to be added on to peak flows. This scenario would likely inundate the whole site akin to Flood Zone 2. Outcomes should be discussed with the EA to determine suitable resilience measures to put in place.</li> <li>Any future development at this site should be considered sustainable without a continued reliance on flood defence investment and maintenance along Padgate Brook.</li> <li>Existing low-lying areas (the North of the site) could be utilised for attenuation storage though further investigation into ground conditions would be required. The northern corner of the site is around ~1m lower than the rest of the site.</li> <li>As recommended by the Environment Agency, there should be an 8 m buffer strip between any proposed development and Padgate Brook.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Safe access/egress routes must be determined in a site-specific FRA and included within an Emergency Plan. Following the tidal/fluval risk to this site, these routes should be focused on roads and land to the east of the site, i.e. Whitefield Avenue or Manchester Road.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site's proximity to the Padgate Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
<b>Flood Source: Infrastructure Failure – Reservoirs</b>	
Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents</li> </ul>
<b>Flood Source: Infrastructure Failure – Canals</b>	
Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>

**Proposed Site** Alford Hall Social Club Overflow Car Park

**Flood Source: Surface Water**

Surface Water Flood Risk to Proposed Development Site

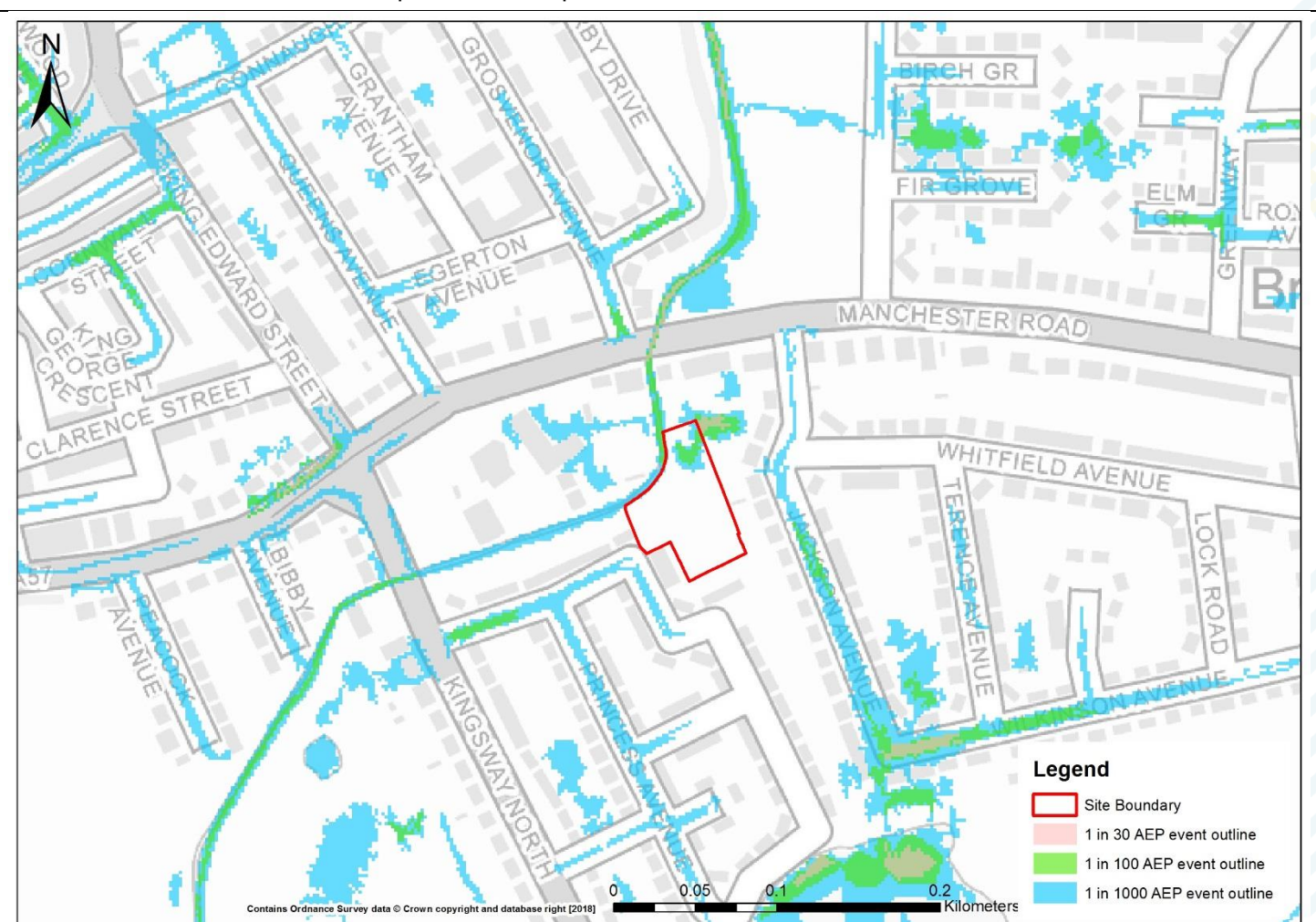


Figure 3.3.5 Surface Water Flood Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
		0.01	4.54
Surface water flooding depths	Max: 0.15-0.30m Mean: 0.13m	Max: 0.30-0.60m Mean: 0.23m	Max: 0.30-0.60m Mean: 0.25m
Surface water hazards	Max: Low Mean: Low	Max: Moderate Mean: Moderate	Max: Moderate Mean: Moderate
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to	<ul style="list-style-type: none"> <li>Approximately 5% of the site floods due to surface water during the 1% AEP event to a depth of 0.30-0.60m. This increases to 6.2% of the site during the 0.1% AEP event.</li> </ul>		

Proposed Site		Alford Hall Social Club Overflow Car Park				
development site	<ul style="list-style-type: none"> <li>The flooding is localised to a depression in the topography to the North of the site which is greenfield (much of the site is brownfield).</li> <li>Nearby main roads, Manchester Road and Kingsway North, remain largely free of flooding during the 1% AEP event.</li> </ul>					
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>A safe access/egress route is maintained via the unnamed road connecting the site to Manchester Road.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>SuDS may be designed into the greenfield area to the North of the site subject to Ground Investigation.</li> <li>The site has a South to North negative slope ranging from approximately 8.5-8.8m AOD along the Southern bound to approximately 7.3-7.5m AOD where the ponding is indicated.</li> </ul>					
Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical				Qbar: 5 l/s Q30: 5 l/s Q100: 5 l/s		
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	4.75	178	43	135	15.0	0.01 ha 2.31 %
3.33% AEP Rainfall + 40%	5.5	215	50	165	18.3	0.01 ha 2.82 %
1% AEP Rainfall + 20%	6	257	54	203 (68 exceedance storage)	22.5	0.01 ha 3.47 %
1% AEP Rainfall + 40%	6.75	307	61	246 (81 exceedance storage)	27.3	0.02 ha 4.21 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					



### 3.4 1717 – Former Dairy Works

Proposed Site	Former Dairy Works
Site area (ha)	0.25
Existing use	Employment
Existing flood risk vulnerability classification	Less Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	0.21

Flood outlines (current day)

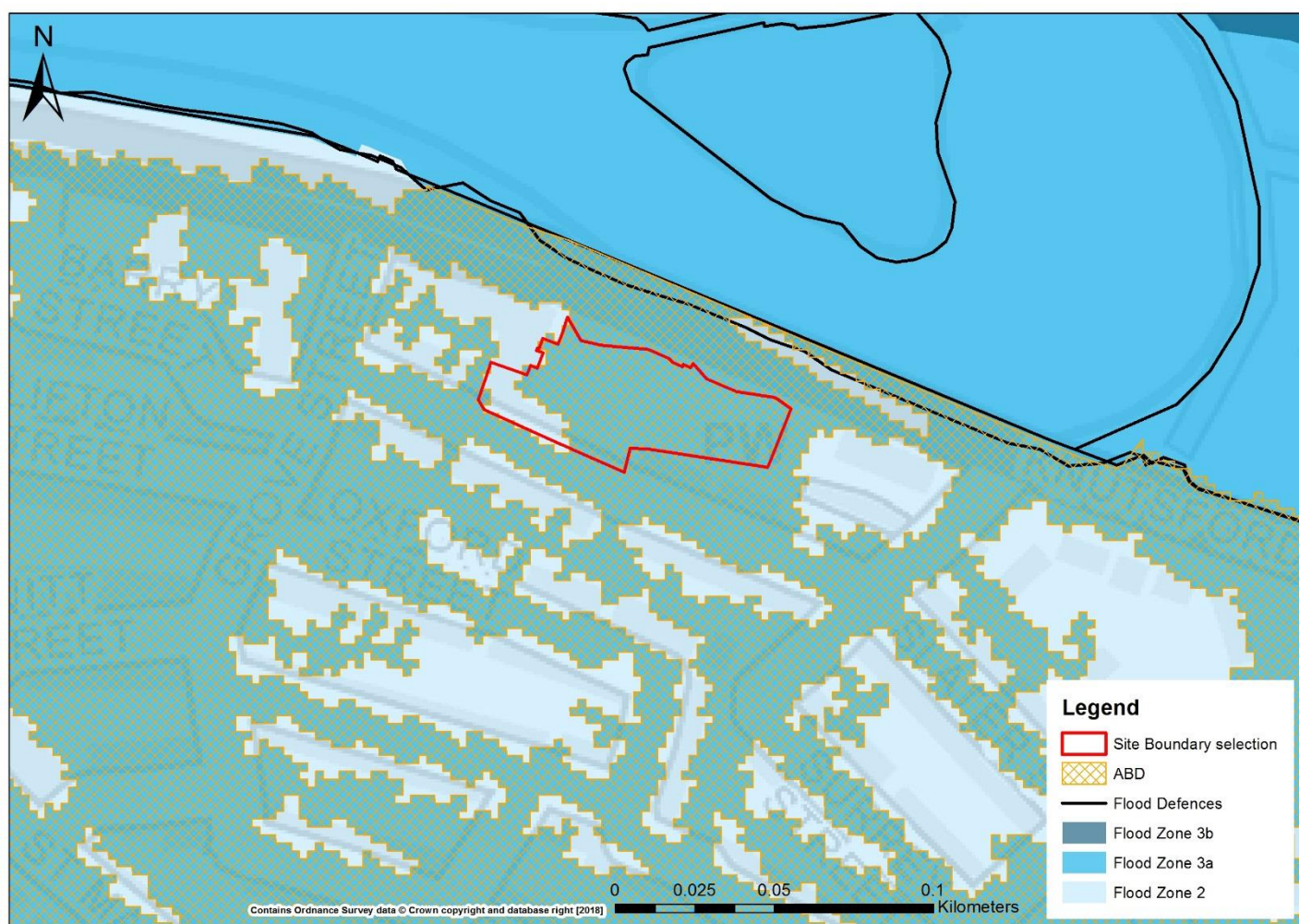


Figure 3.4.1 Flood Zone Mapping, Flood Defences and ABDs

- The site is almost entirely within ABD areas with the remainder in the defended FZ2.

© Crown Copyright, All rights reserved. 2019 License number 100019628.

Contains OS data © Crown copyright and database right (2019)

Contains public sector information licensed under the Open Government Licence v3.0.

Contains Environment Agency information © Environment Agency and/or database right.

Proposed Site	Former Dairy Works
<b>Observations and Recommendations</b>	
<ul style="list-style-type: none"> <li>• The River Mersey is located to the North of the site across Knutsford Road.</li> <li>• Fluvial and tidal joint risk are the primary sources of flooding based on current flood zone mapping.</li> <li>• Fluvial only mapping shows low risk to the site (Figure 3.4.4)</li> <li>• Flood Zone 3 therefore consists of joint probabilities of fluvial and tidal risk</li> <li>• Fluvial modelling of the site was not available, as such current flood zone mapping has been used as an indicator of risk.</li> <li>• 88% of the site is located within Flood Zone 3a, these including ABDs.</li> <li>• Updated modelling outputs shows very low risk from tidal sources during the current defended scenario at the site.</li> <li>• Updated tidal risk with climate change up to a 100yr epoch also shows no inundation to the site.</li> <li>• Flood defences in place protect site from tidal risk. Modelled undefended scenarios detail site inundation in a 0.5% AEP event therefore tidal risk is residual.</li> <li>• Current flood defences appear paramount to the site's protection from risk though the sustainability of the sites development cannot be wholly reliant on their continued maintenance and investment.</li> <li>• The risk of surface water flooding is deemed to be very low.</li> <li>• There is a change of risk classification at the site from Less Vulnerable to More Vulnerable.</li> <li>• With the proposed development's risk classification have been updated, the site must pass the Exception Test for development to be permitted.</li> </ul> <p>Following draft review with EA:</p> <ul style="list-style-type: none"> <li>• EA confirmed current defences will protect the site, as per the ABD, from tidal and fluvial flooding up to a 200 / 100 AEP standard.</li> <li>• EA assumption is that fluvial risk on the Mersey has not been modelled downstream of Howley Weir (tidal limit) as tidal risk is considered to be the dominant risk</li> <li>• EA confirmed the defences will be maintained in the future as part of the EA's asset maintenance programme.</li> <li>• Development to take place in an existing residential area.</li> <li>• FRA must assess climate change impacts and show that the site will be safe for its lifetime. Defence overtopping scenario should also be modelled for climate change event</li> </ul>	

<b>Proposed Site</b>	<b>Former Dairy Works</b>		
----------------------	---------------------------	--	--

<b>Flood Source: Fluvial/Tidal</b>			
------------------------------------	--	--	--

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	12.42	87.58	0.00
Tidal: Depth (m)	Not available	Not available	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate Change

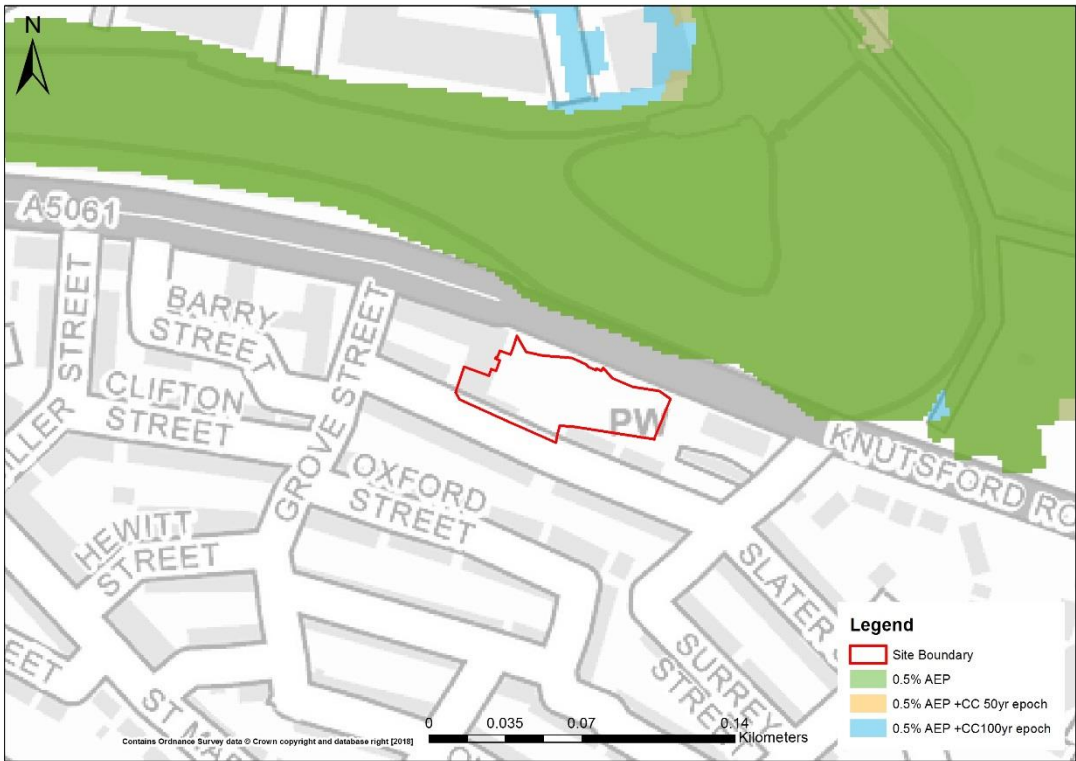


Figure 3.4.2 Modelled tidal outlines for the present day 0.5% AEP and future risk 0.5% AEP with 50yr (2065) and 100yr (2115) epoch of climate change allowances (defended)

Tidal (defended):

- Figure 2.4.3 shows that the 0.5% 100yr-epoch (cumulative sea level rise for the next 100 years) climate change outline does not affect the site.

Proposed Site

Former Dairy Works



Figure 3.4.3 Tidal outlines for the undefended scenario 0.5% AEP and 0.1% AEP events

Tidal (undefended)

- With the absence of defences, the site is at risk from tidal flooding during a 0.5% AEP event.
- Complete inundation is seen during a 0.1% AEP design event.

<b>Proposed Site</b>	<b>Former Dairy Works</b>
----------------------	---------------------------

Fluvial Flood Risk and Climate Change

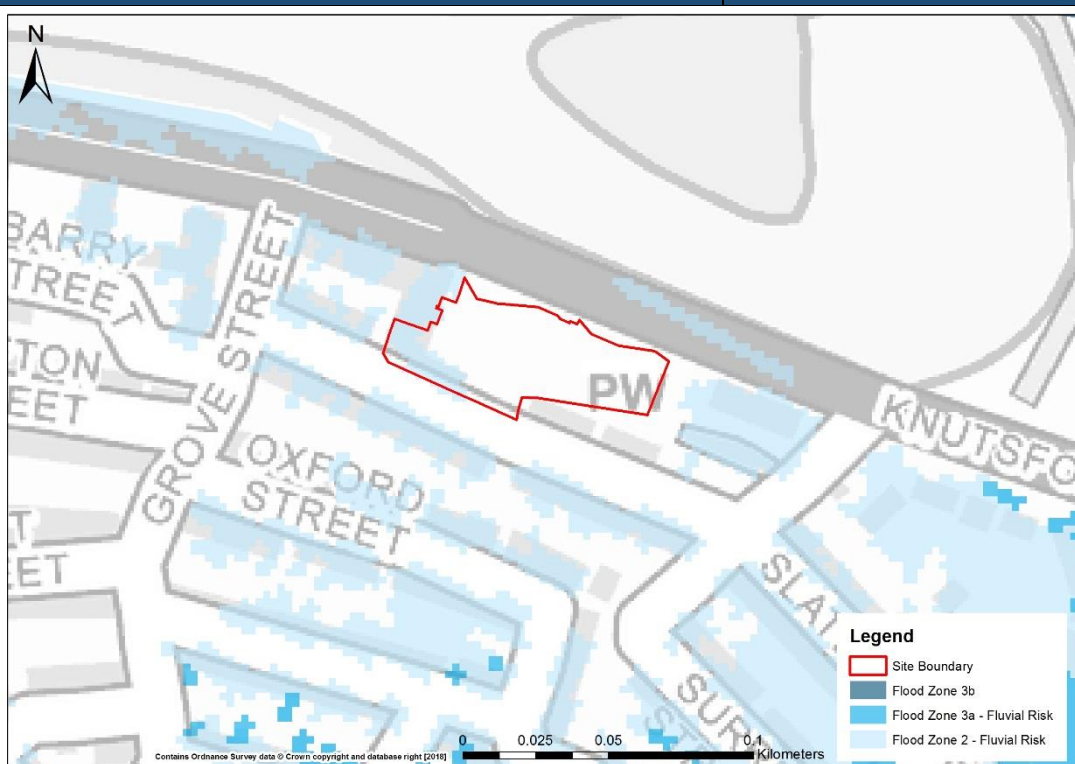


Figure 3.4.4 Fluvial only Flood Zone Mapping

- The western edge of the site lies within FZ2.
- Access and egress routes, namely Grove Street, remain free from flooding.
- The risk to the site from fluvial only flooding is deemed to be low.

Historic flooding

- The site is located outside any Environment Agency historic flood outlines.

Defended

- The site benefits from River Mersey flood defences to the North of the site. These defences are reinforced concrete walls that have been assessed to be at condition grade 1 (Table 1.1 Condition Assessment Manual 2012). There are also defences in place that were part of the Warrington FAS.

Flood Warning Area

- 100% of proposed site located within an EA FWA, described as "*The Knutsford Road area of Warrington is at risk of flooding from the Estuary due to high tides. Properties at risk extend from Knutsford Rd to the railway embankment behind St Mary's Street*"

Mitigation options & site suitability

- Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.
- Safe and dry access/egress routes along Grove Street and Slater Street are mainly free from fluvial and tidal risk.
- As recommended by the Environment Agency, there should be an 8m buffer strip between any proposed development and the River Mersey.

<b>Proposed Site</b>	<b>Former Dairy Works</b>
----------------------	---------------------------

**Flood source: Groundwater**

Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site’s proximity to the River Mersey, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
-------------------------	---

**Flood Source: Infrastructure Failure – Reservoirs**

Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents</li> </ul>
-----------------------	--

**Flood Source: Infrastructure Failure – Canals**

Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>
-------------------	--

**Flood Source: Surface Water**

Surface Water Flood Risk to Proposed Development Site



Figure 3.4.5 Surface Water Flood Risk

Existing development risk of flooding	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
---------------------------------------	-------------------------------	------------------------------	-----------------------------

Proposed Site			Former Dairy Works
from surface water (%)	0.00	0.00	0.11
Surface water flooding depths	Max: 0.00m Mean: 0.00m	Max: 0.00m Mean: 0.00m	Max: 0.15-0.30m Mean: 0.21m
Surface water hazards	Max: None Mean: None	Max: None Mean: None	Max: Low Mean: Low
Climate change	The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.		
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>The site is not within surface water flood extents and therefore is at very low risk from surface water flooding.</li> <li>Over 99% of the site does not fall within the available surface water flood extents and therefore, is very low risk from surface water flooding.</li> <li>The volume of surface water runoff generated by the new development and volumes of attenuation required to ensure that runoff from the site does not increase surface water flood risk elsewhere has been calculated below.</li> </ul>		
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>A safe access/egress route is maintained via Knutsford Road along the Northern bound of the site and Slater Street along the Southern bound of the site.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Infiltration SuDS may not be feasible as the site is previously developed. Ground investigation required.</li> <li>Development should avoid the 1% AEP outline. As this is 0.11% of the total site area, the effect on development is negligible.</li> <li>As recommended by the Environment Agency, there should be an 8 m buffer strip between any proposed development and the River Mersey.</li> </ul>		

### Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)

Proposed Development limiting runoff rate: Greenfield – FEH Statistical			Qbar: 5 l/s Q30: 5 l/s Q100: 5 l/s			
Design flood event (inc CC)	Critical storm duration Hrs	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	2.75	103	25	79	8.7	0.01 ha 2.11 %

Proposed Site					Former Dairy Works	
3.33% AEP Rainfall + 40%	3.5	128	32	96	10.7	0.01 ha 2.56 %
1% AEP Rainfall + 20%	4	156	36	120 (41 exceedance storage)	13.3	0.01 ha 3.20 %
1% AEP Rainfall + 40%	4.5	187	41	147 (51 exceedance storage)	16.3	0.01 ha 3.92 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					



### 3.5 1831 – Land off Newcombe Avenue

Proposed Site	Land off Newcombe Avenue
Site area (ha)	1.81
Existing use	Greenfield
Existing flood risk vulnerability classification	Water compatible
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	1.57

Flood outlines (current day)\*

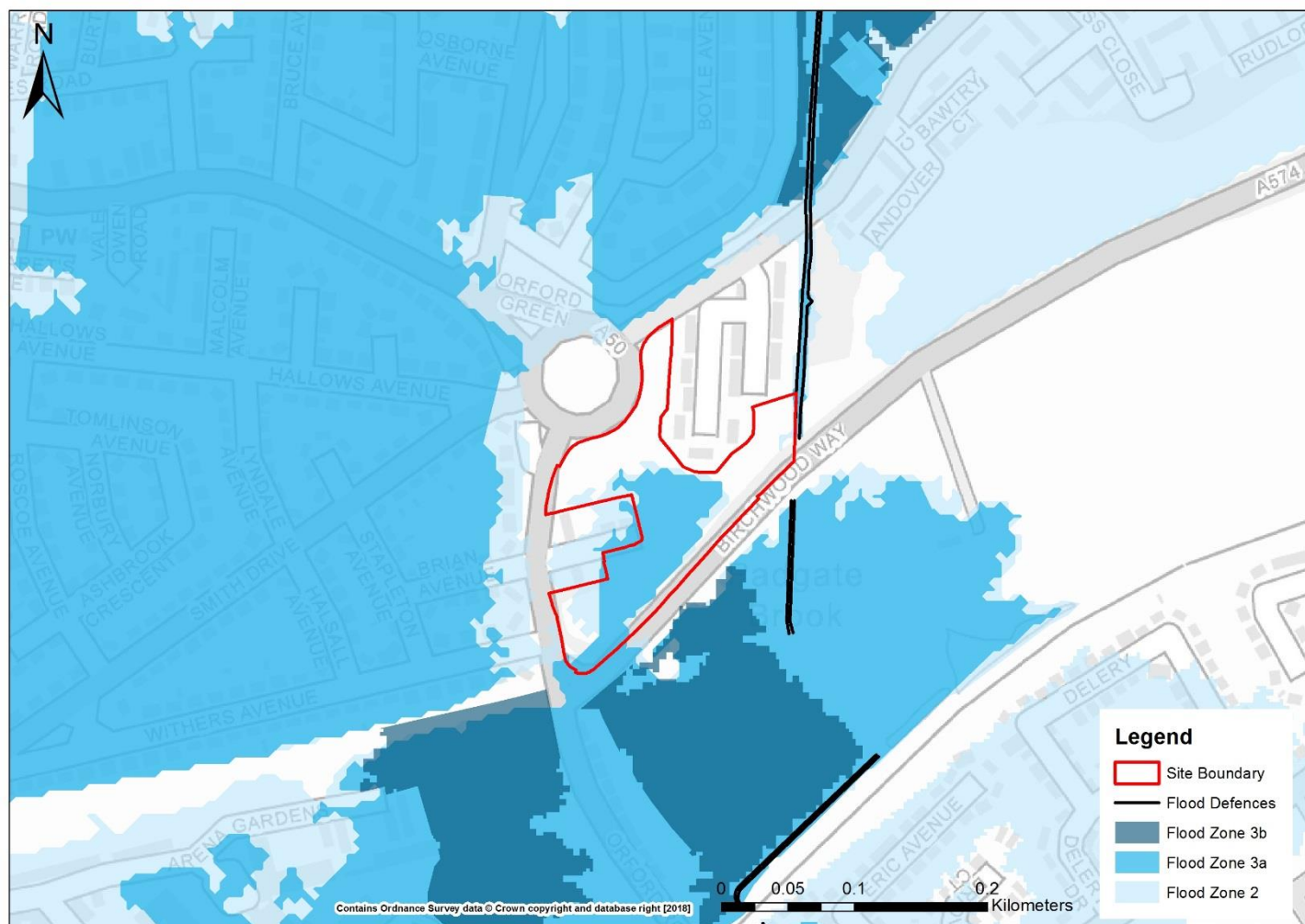


Figure 3.5.1 Flood Zone Mapping and Flood Defences

**\*EA confirms site is actually wholly within Flood Zone 1, resulting from the modelling carried out for the Warrington FAS. At the time of writing, the Flood Maps have not yet been updated to reflect this (1 March 2019)**

Proposed Site

Land off Newcombe Avenue

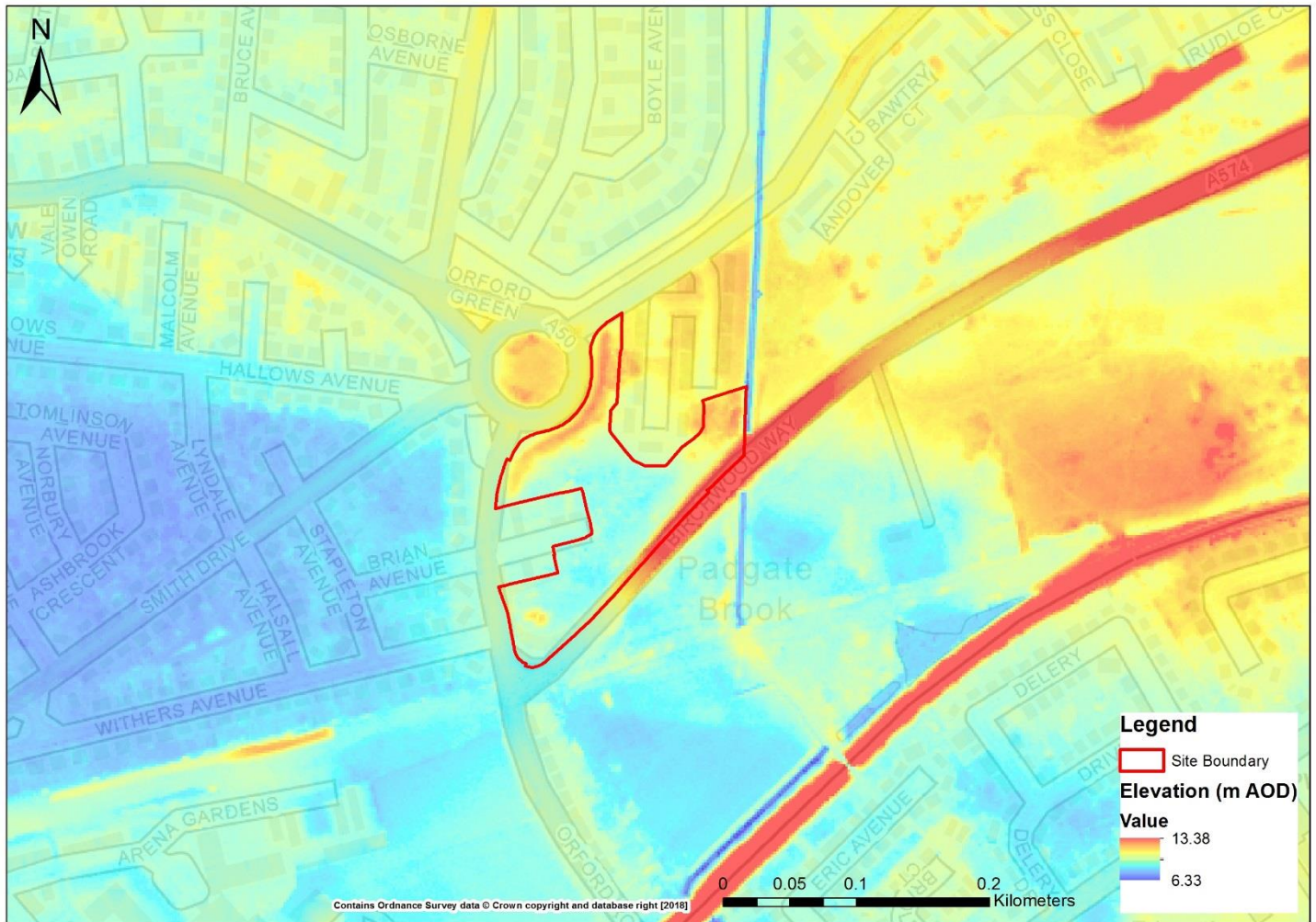


Figure 3.5.2 Site with 2m LIDAR (elevation data)

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- Figure 3.5.1 shows 36% of the site located within Flood Zone 3a, however, as caveated above, the EA confirms the site is wholly within Flood Zone 1, resulting from the modelling carried out for the Warrington FAS. At the time of writing, the Flood Maps have not yet been updated to reflect this (1 March 2019).
- The Exception Test is therefore not required to be undertaken for this site given it is within Flood Zone 1.
- Surface water is the primary sources of flood risk.
- Surface water is shown to pond within local depressions in the site topography (see Figure 3.5.3).
- There is a change of risk classification proposed at this site by development from water compatible to more vulnerable.

Proposed Site		Land off Newcombe Avenue	
<ul style="list-style-type: none"> <li>Multiple access and egress routes along roads the north, south and west of the site are free from risk of flooding.</li> </ul>			
Flood Source: Fluvial/Tidal			
	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	0.00	0.00	0.00
Tidal: Depth (m)	N/A	N/A	N/A
Tidal: Hazard	N/A	N/A	N/A
Modelled Flood Risk and Climate Change	Tidal (defended): <ul style="list-style-type: none"> <li>The site is not within modelled climate change flood outlines for the 0.5% AEP event with the 50 year-epoch or 100-year epoch (cumulative sea level rise for the next 100 years).</li> </ul> Tidal (undefended): <ul style="list-style-type: none"> <li>The site is not overlapped by any of the modelled undefended scenarios in the 0.5% AEP or 0.1% AEP events.</li> </ul>		
Historic flooding	<ul style="list-style-type: none"> <li>The site is located outside any Environment Agency historic flood outlines.</li> </ul>		
Defences	<ul style="list-style-type: none"> <li>Site benefits from EA Flood Alleviation Scheme.</li> <li>Available EA flood defence asset data indicates that the site benefits from regraded earth channels alongside Padgate Brook that have been assessed at a condition grade of 3 (Table 1.1 Condition Assessment Manual 2012).</li> </ul>		
Flood Warning Area	<ul style="list-style-type: none"> <li>45% of proposed site located within an EA FWA, described as <i>"Areas at risk include properties on Alder and Hall Lane. Also, Winwick Quay, Longford, Hawleys Business Park, Orford, Callands, Bewsey. Also, parts of Penketh and Sankey Bridges South of the A562 and A57 and Gatewarth Industrial Estate"</i></li> </ul>		
Mitigation options & site suitability	<ul style="list-style-type: none"> <li>Development should be permitted based on EA advice that the site is wholly within Flood Zone 1 as a result of the Warrington FAS.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>As recommended by the Environment Agency, there should be an 8 m buffer strip between any proposed development and the watercourse.</li> </ul>		
Flood source: Groundwater			
Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site's proximity to Padgate Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Groundwater will follow topography and is unlikely to be an issue in this instance.</li> </ul>		
Flood Source: Infrastructure Failure – Reservoirs			
Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents, according to the EA's Reservoir Flood Map (RFM).</li> </ul>		
Flood Source: Infrastructure Failure – Canals			
Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>		

Proposed Site

Land off Newcombe Avenue

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

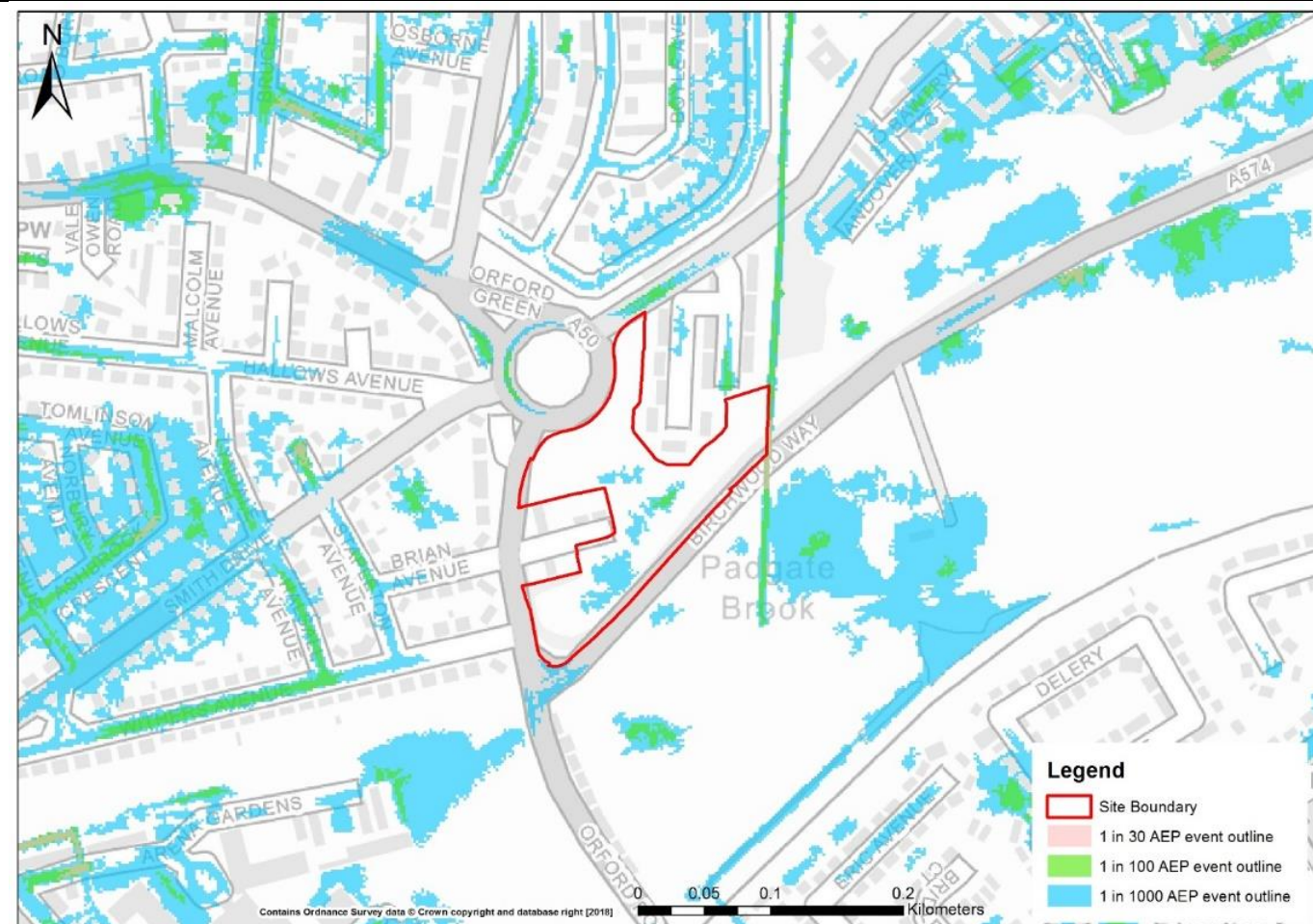


Figure 3.5.3 Surface Water Flood Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.05	0.65	8.79
Surface water flooding depths	Max: 0.15-0.30m Mean: 0.24m	Max: 0.15-0.30m Mean: 0.29m	Max: 0.30-0.60m Mean: 0.41m
Surface water hazards	Max: Moderate Mean: Moderate	Max: Moderate Mean: Low	Max: Moderate Mean: Low
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>The site is at very low risk (&lt;1% coverage) from surface water flooding during the 1% AEP event.</li> <li>Padgate Brook bounds the easternmost edge of the site for which there is some associated surface water.</li> </ul>		

Proposed Site		Land off Newcombe Avenue				
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>A safe access/egress route is maintained via the A50 along the west, Hilden Road along the north and Birchwood Way at the southern boundary of the site.</li> <li>The site is greenfield and therefore infiltration SuDS is feasible subject to Ground Investigation where existing low-lying areas that are currently showing ponding may be utilised for attenuation.</li> <li>Development should avoid the 1% AEP outline and given that the site is greenfield, SuDS approaches could be adopted where localised flooding is indicated.</li> </ul>					
Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical			Qbar: 9.93 l/s Q30: 16.89 l/s Q100: 20.66 l/s			
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	6.5	888	198	691	22.6	0.05 ha 2.56 %
3.33% AEP Rainfall + 40%	7.75	1077	236	841	27.6	0.06 ha 3.11 %
1% AEP Rainfall + 20%	6.5	1212	242	970 (279 exceedance storage)	26.0	0.06 ha 3.59 %
1% AEP Rainfall + 40%	7.25	1445	270	1175 (334 exceedance storage)	31.5	0.08 ha 4.35 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					

### 3.6 1861 – Land North of Mayfair Close

Proposed Site	Land North of Mayfair Close
Site area (ha)	1.58
Existing use	Greenfield
Existing flood risk vulnerability classification	Water Compatible
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	1.34

Flood outlines (current day)

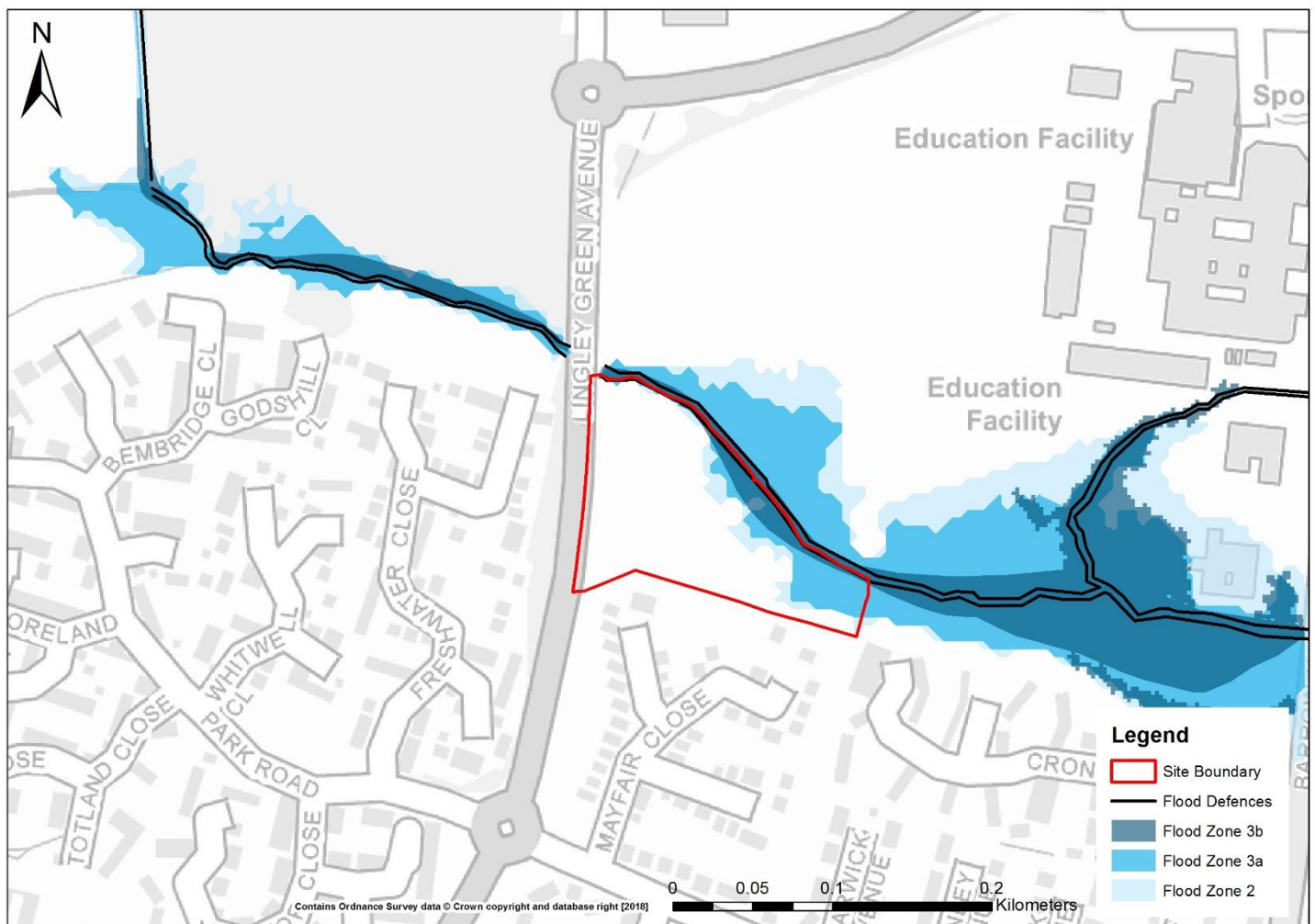


Figure 3.6.1 Flood Zone Mapping and Flood Defences

Proposed Site

Land North of Mayfair Close

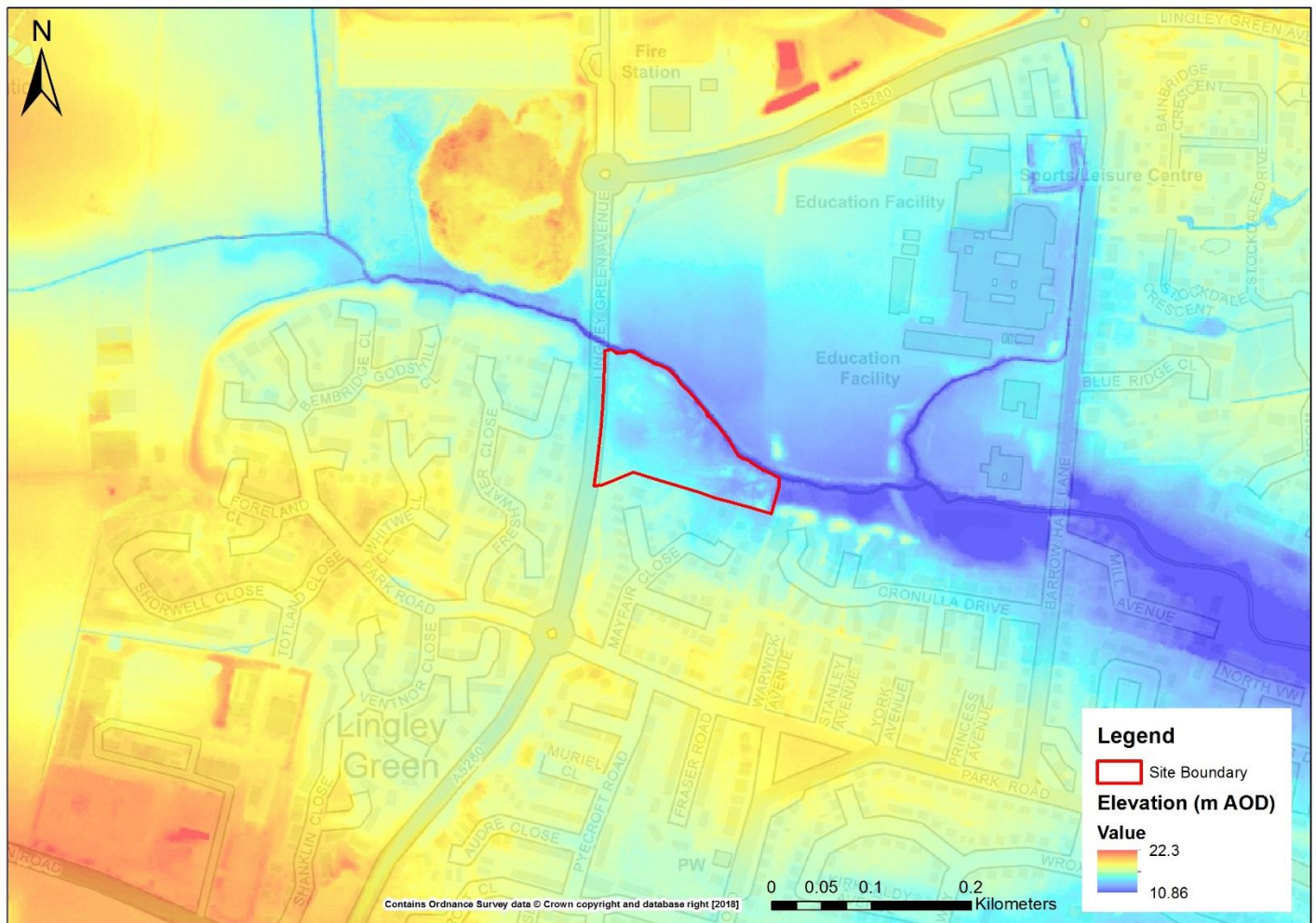


Figure 3.6.2 Site with 2m LIDAR (elevation data)

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- Fluvial and surface water are the primary sources of flood risk.
- Fluvial risk comes from Whittle Brook which bounds the north of the site.
- 8.6% of the site is within the functional floodplain. Development is not permitted in this part of the site. 11% in Flood Zone 3a should be kept clear of development if possible.
- Defences along the northern edge appear to prevent further inundation into the site, (see Figure 3.6.3).
- Surface water is shown to pond within local depressions in the site topography (see Figure 3.6.4).
- Safe access/egress routes have been identified along Mayfair Close and Lingley Green Avenue.

Proposed Site		Land North of Mayfair Close	
<ul style="list-style-type: none"> <li>There is a change of risk classification at this site from water compatible to more vulnerable.</li> <li>74% of the site is located within Flood Zone 1 and therefore residential development is permissible.</li> </ul>			
Flood Source: Fluvial/Tidal			
	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	6.06	11.22	8.61
Tidal: Depth (m)	Not available	Not available	Not available
Tidal: Hazard	Not available	Not available	Not available
Modelled Flood Risk and Climate change	Tidal (defended): <ul style="list-style-type: none"> <li>The site is not at risk from the modelled flood outlines of the 0.5% AEP event with 50yr (2065) and 100yr (2115) epochs (cumulative sea level rise for the next 100 years) of climate change allowances.</li> </ul> Tidal (undefended): <ul style="list-style-type: none"> <li>The site lies outside any of the modelled undefended scenarios from the Mersey Estuary 2015 model.</li> </ul>		
Fluvial Flood Risk and Climate Change	<ul style="list-style-type: none"> <li>Fluvial only risk from Flood Zone Mapping can be viewed in Figure 3.6.1</li> <li>Fluvial is a primary source of risk, with the main source being from Whittle Brook bordering the north of site.</li> </ul>		
Historic flooding	<ul style="list-style-type: none"> <li>The site is located outside any Environment Agency historic flood outlines.</li> </ul>		
Defences	<ul style="list-style-type: none"> <li>Available EA flood defence asset data indicates that the site benefits from high ground alongside Whittle Brook that has been assessed at a condition grade of 2 (Table 1.1 Condition Assessment Manual 2012).</li> </ul>		



**Proposed Site**

**Land North of Mayfair Close**

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

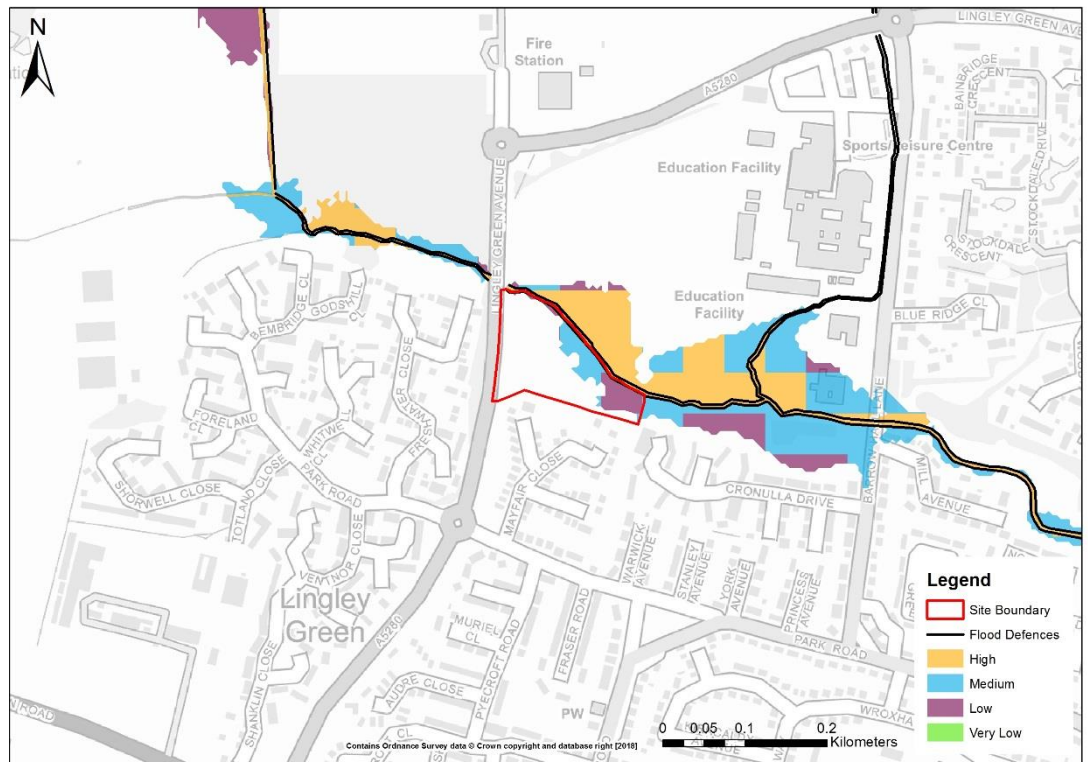


Figure 3.6.3 Risk of Flooding from Rivers and the Sea (defended) and Flood Defences

- The site has areas of medium and high risk, with areas of higher risk focused along Whittle Brook.
- Defences in place along this watercourse appear to prevent further inundation into the site.

Flood Warning Area

- The site lies outside of any current EA FWAs.

**Mitigation options & site suitability**

- The area within the functional floodplain should remain free from development as open amenity space / greenspace (i.e. blue corridor) or the site boundary altered to remove the site footprint from the functional floodplain. Flood Zone 3a is entirely fluvial risk therefore any land raising would have to be compensated for with flood storage areas.
- 80% of the site (Flood Zones 1 and 2) is permitted for residential development.
- The Flood Zone 3a areas should be left free of development if possible. This should be achievable given the location of Flood Zone 3a remaining along Whittle Brook. If this is not possible it is likely development will not be permitted.
- Fluvial modelling of Whittle Brook for present day, also taking account of flood defences to ascertain areas benefitting from defences would provide greater detail and confidence in the fluvial risk.
- Additionally, fluvial climate change should be modelled for Whittle Brook as part of further work for this L2 or as a site-specific assessment, taking account of the defences to ascertain whether the site can be safe for its lifetime and can therefore satisfy the

Proposed Site	Land North of Mayfair Close
	<p>requirements of the Exception Test. The EA would likely expect the upper end allowance of +70% to be added on to peak flows given the risk from Flood Zone 3a. Outcomes should be discussed with the EA to determine suitable resilience measures to put in place.</p> <ul style="list-style-type: none"> <li>As recommended by the Environment Agency, there should be an 8 m buffer strip between any proposed development and the watercourse.</li> <li>Safe access/egress routes are available to the west and south of the site. These must be determined and included within an Emergency Plan.</li> <li>Flood defences at this site are key for flood prevention at this site. They are currently constructed to a design standard of a 20% AEP event. Figure 3.6.3 shows the risk of flooding being at medium/high with the defences in place, meaning that the defences should be maintained to keep according this level of protection.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site's proximity to Whittle Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
<b>Flood Source: Infrastructure Failure – Reservoirs</b>	
Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents.</li> </ul>
<b>Flood Source: Infrastructure Failure – Canals</b>	
Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>

Proposed Site

Land North of Mayfair Close

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

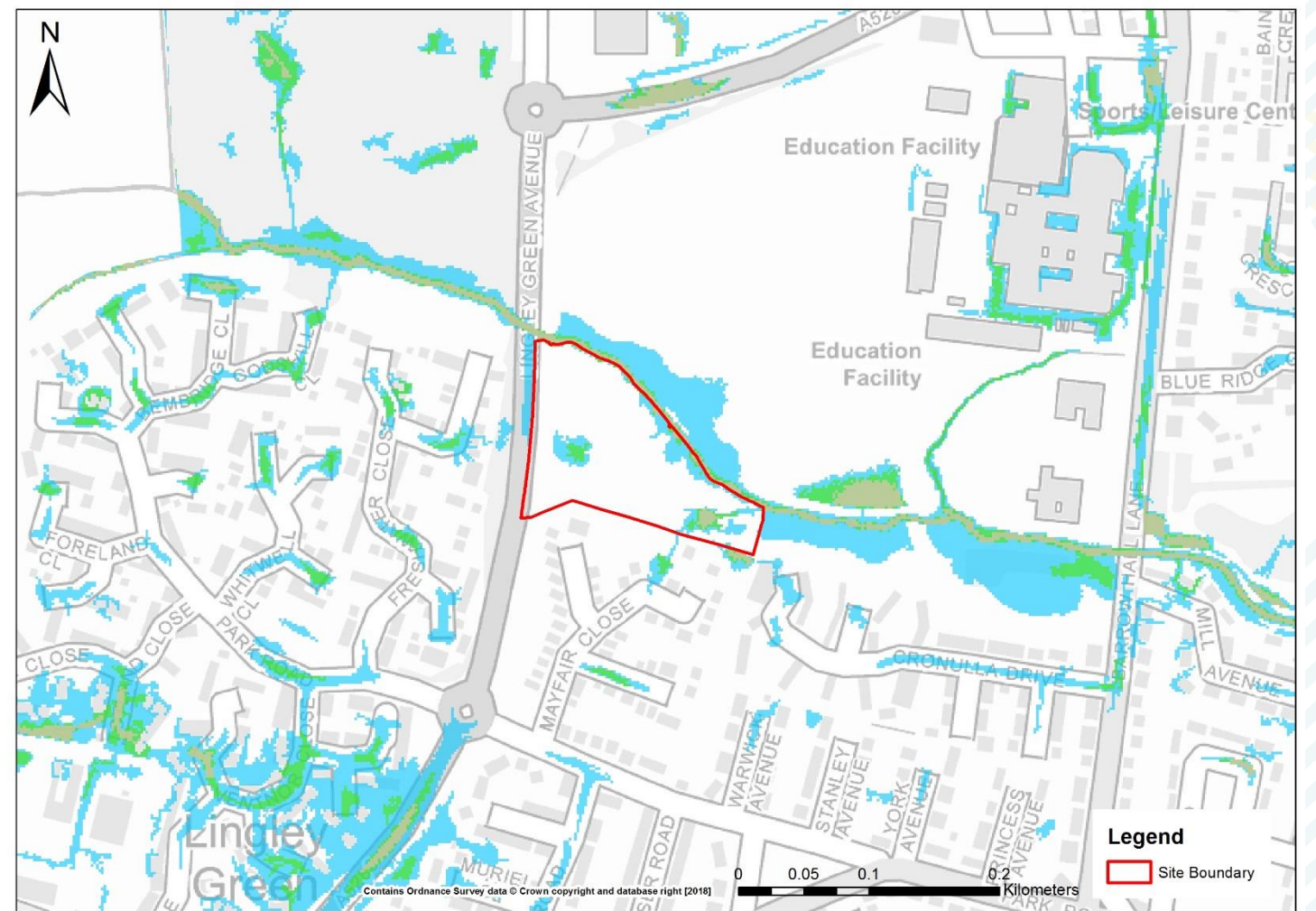


Figure 3.6.4 Surface Water Flood Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	2.72	3.06	10.01
Surface water flooding depths	Max: 0.30-0.60m Mean: 0.26m	Max: 0.30-0.60m Mean: 0.31m	Max: 0.60-0.90m Mean: 0.4m
Surface water hazards	Max: Moderate Mean: Moderate	Max: Moderate Mean: Moderate	Max: Significant Mean: Moderate
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to	<ul style="list-style-type: none"> <li>Approximately 3% of the site is at risk of surface water flooding during the 1% AEP event up to a depth of 0.30-0.60m. The flooding is generally confined to localised areas of ponding within</li> </ul>		

Proposed Site		Land North of Mayfair Close				
development site	depressions in the topography to the far East and Midwest of the site.					
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>A safe access/egress route is maintained via Mayfair Close. Minimal flooding of 0-0.15m is indicated on Lingley Green Avenue along the Western bound of the site.</li> <li>The site is greenfield and therefore infiltration SuDS may be feasible subject to Ground Investigation where existing low-lying areas that are currently showing ponding may be utilised for attenuation. It is noted that the ponding in the far East of the site is indicated during the 3.33% AEP to a depth of 0.30-0.60m.</li> <li>Development should avoid the 1% AEP outline and focus away from the northern edge of the site that borders Whittle Brook.</li> <li>Given that the site is greenfield, SuDS approaches could be adopted where localised flooding is indicated.</li> </ul>					
Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical			Qbar: 11.32 l/s Q30: 19.25 l/s Q100: 23.56 l/s			
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	4.5	676	156	520	15.0	0.03 ha 2.19 %
3.33% AEP Rainfall + 40%	5.25	816	182	634	18.3	0.04 ha 2.68 %
1% AEP Rainfall + 20%	4.75	927	201	726 (206 exceedance storage)	17.2	0.05 ha 3.06 %
1% AEP Rainfall + 40%	5.5	1117	233	884 (2504 exceedance storage)	20.8	0.06 ha 3.73 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					

### 3.7 1891 – Land Fronting Pool Lane

Proposed Site	Land Fronting Pool Lane
Site area (ha)	1.85
Existing use	Greenfield
Existing flood risk vulnerability classification	Water Compatible
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	1.57

Flood outlines (current day)

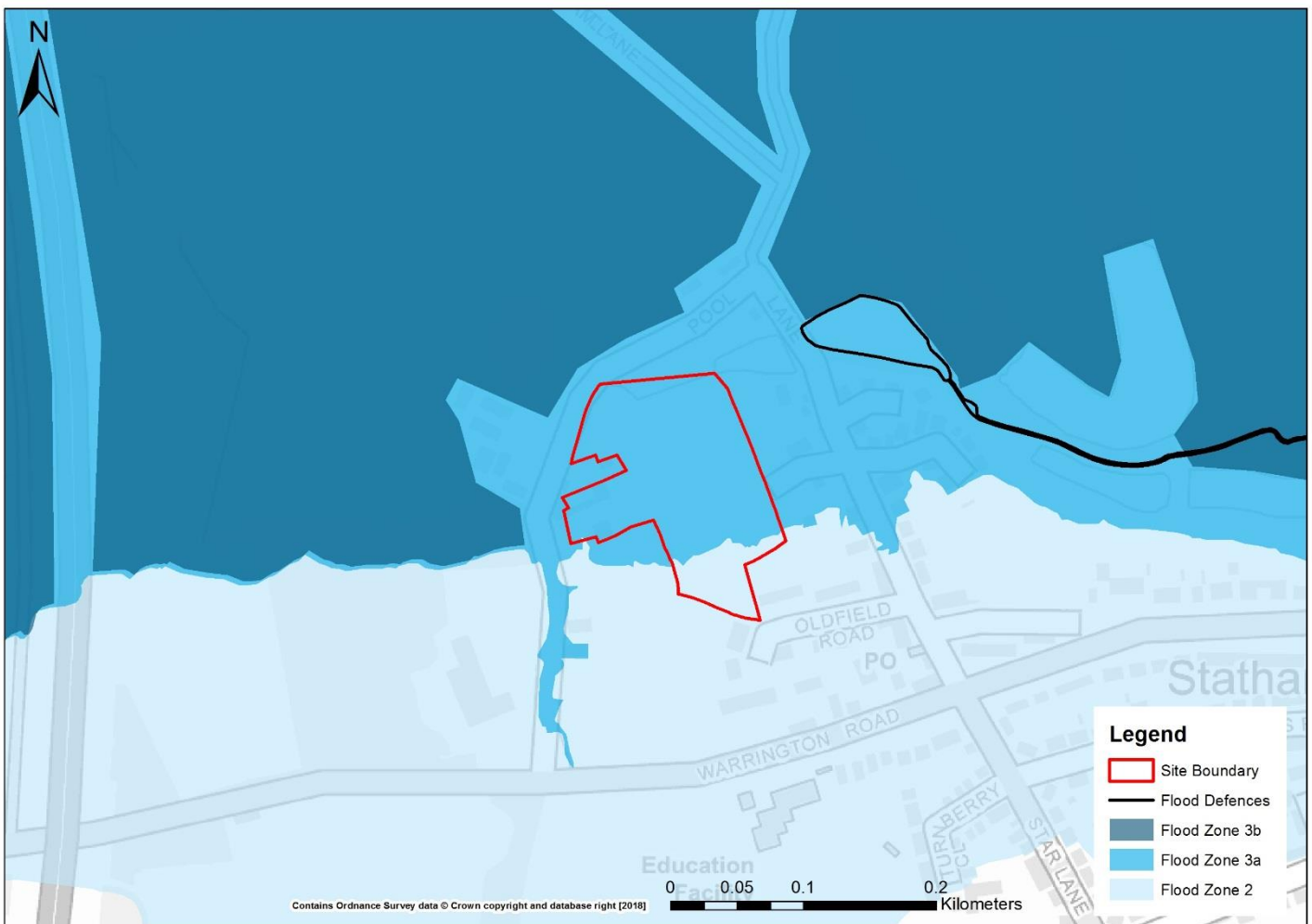


Figure 3.7.1 Flood Zone Mapping and Flood Defences

Proposed Site

Land Fronting Pool Lane

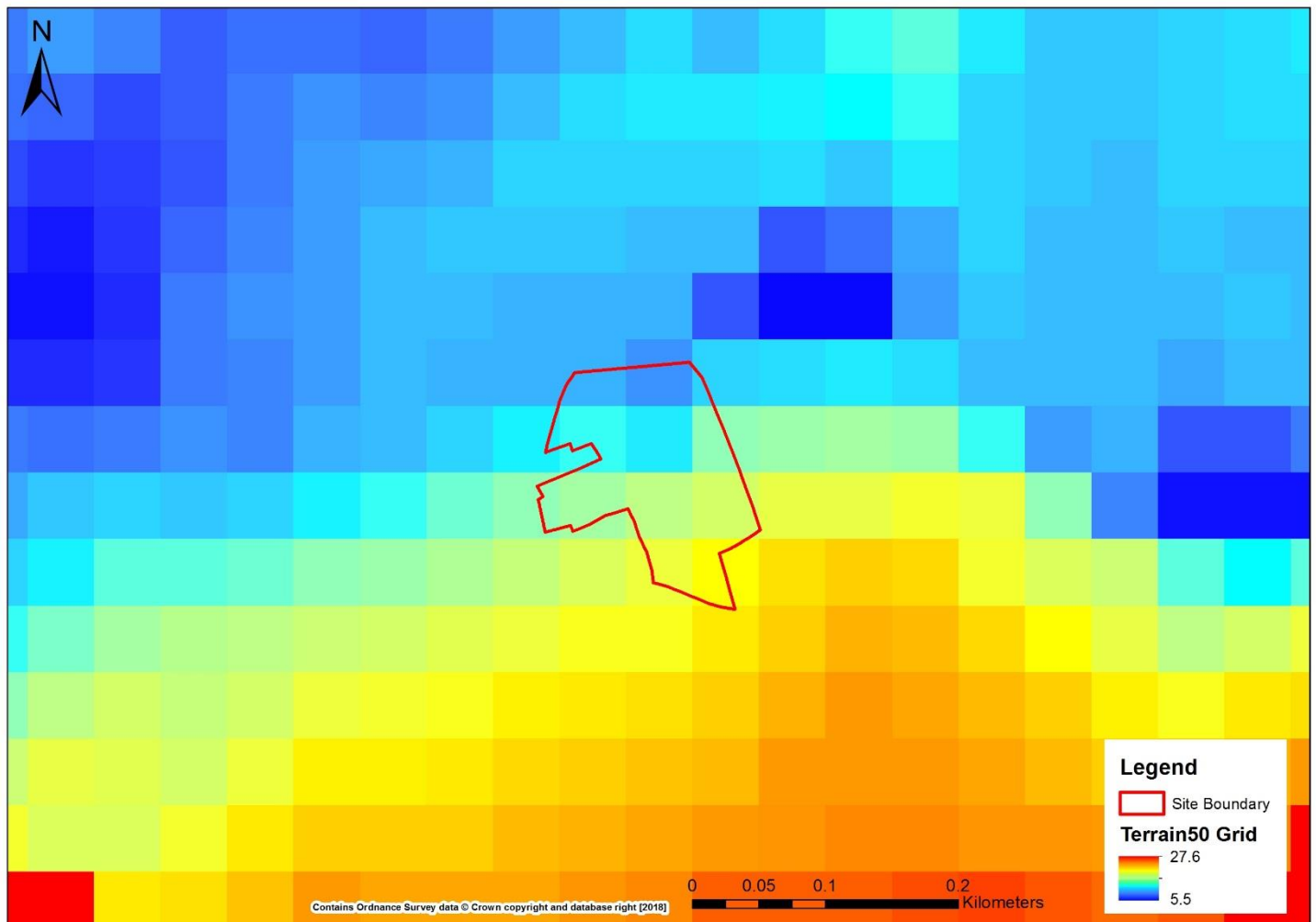


Figure 3.7.2 Site with 50m OS Terrain 50 (elevation data)

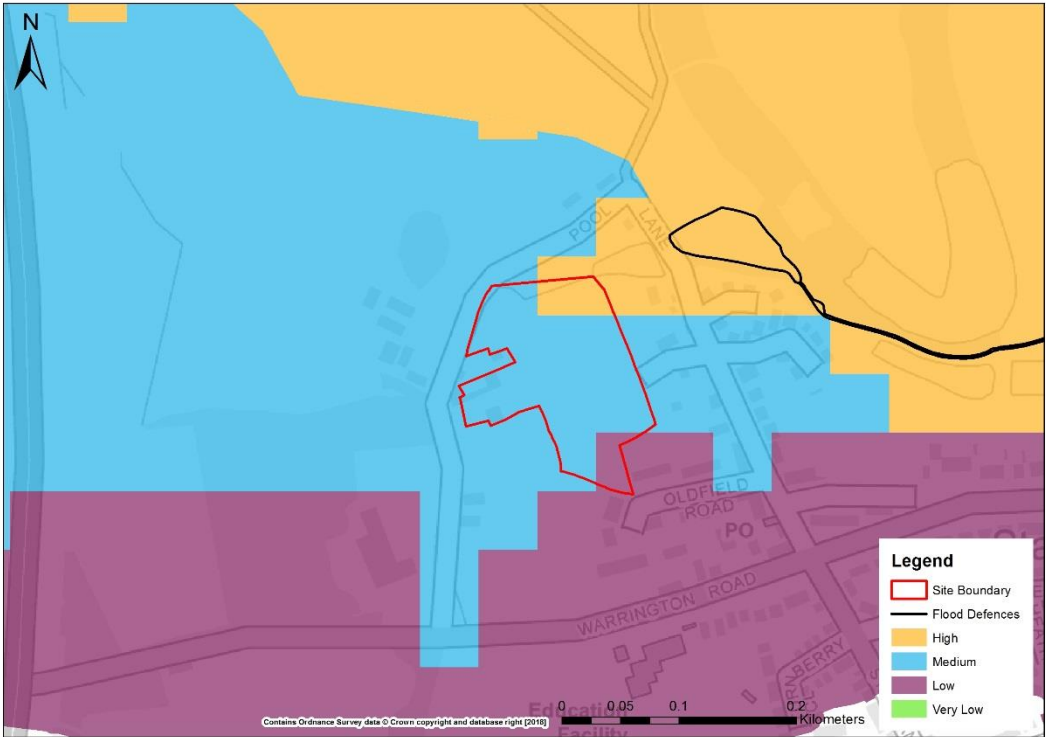
- Provided LIDAR coverage does not extend over the site location, for this figure OS Terrain 50m mapping grids have been used, hence the lower grid resolution.

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The EA confirms that any proposed development on this site would be subject to a FRA, to demonstrate how the flood risk is to be mitigated. Any loss of flood storage would require compensatory flood storage to be provided (1 March 2019).
- Fluvial risk is predominantly from the MSC which flows to the north of the site – over 85% of the site is located within Flood Zone 3a.
- Satham Pools Brook flows along the northern boundary of the site along with several ponds from which there may be additional fluvial flood risk.
- There are no fluvial flood defences in place on Satham Pool Beck.
- Fluvial modelling of Satham Pools Brook was not able to be provided (see Appendix A – Original site list supplied in Data Request) so current EA flood zone mapping was used.

Proposed Site	Land Fronting Pool Lane		
<ul style="list-style-type: none"> <li>No direct tidal risk from the updated modelling.</li> <li>Risk of surface water flooding is very low.</li> <li>There is a change in risk classification at this site from water compatible to more vulnerable.</li> <li>The proposed development is More Vulnerable and due to over 85% of the site being within Flood Zone 3a the Exception Test must be undertaken and passed.</li> </ul>			
Flood Source: Fluvial/Tidal			
	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	14.59	85.41	0.00
Tidal: Depth (m)	Not available	Not available	Not available
Tidal: Hazard	Not available	Not available	Not available
Modelled Flood Risk and Climate change	<ul style="list-style-type: none"> <li>No existing or future tidal risk according to latest modelling, site is located from any tidal extents.</li> </ul>		
Fluvial Flood Risk	<ul style="list-style-type: none"> <li>Risk from fluvial only sources is shown in Figure 3.7.1 which consists of the current Flood Zone Mapping, as a result fluvial and not tidal is a risk here.</li> <li>85% of the site is located within Flood Zone 3a with the southern corner in Flood Zone 2.</li> <li>Access and egress routes are additionally located within these zones.</li> </ul>		
Historic flooding	<ul style="list-style-type: none"> <li>The site is located outside any Environment Agency historic flood outlines.</li> </ul>		
Defences	<ul style="list-style-type: none"> <li>Available EA flood defence asset data indicates that the site benefits from fluvial flood defences that are regraded earth channels to the East of the site and have been assessed at a condition grade of 3 (Table 1.1 Condition Assessment Manual 2012).</li> </ul>		

Proposed Site	Land Fronting Pool Lane
<p>Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map</p>	 <p>Figure 3.7.3 Risk of Flooding from Rivers and the Sea (defended)</p> <ul style="list-style-type: none"> <li>• The risk classifications shown in the above figure correlate with the Flood Zone Mapping risks in Figure 3.7.1.</li> <li>• There are flood defences located east of the site though these appear to have little effect on the risk classifications shown in the mapping.</li> </ul>
<p>Flood Warning Area</p>	<ul style="list-style-type: none"> <li>• 85% of the proposed site lies within an EA FWA, described as "Areas potentially at risk from Manchester Ship Canal. Including properties between the Ship Canal and Thelwall New Road, Lymm Road and Warrington Road. Also includes properties along Ferry Lane"</li> </ul>
<p>Mitigation options &amp; site suitability</p>	<ul style="list-style-type: none"> <li>• Residential development should not be allocated on this site. The EA confirms that the source of flood risk comes from the Manchester Ship Canal. Any proposed development would be subject to a FRA, to demonstrate how the flood risk is to be mitigated. Any loss of flood storage would require compensatory flood storage to be provided (1 March 2019).</li> <li>• All risk is fluvial. Severely limited on-site space available for storage areas.</li> <li>• Possible Options for ground level retail, employment, car parking with first floor residential could be considered, though would require consultation between the EA, LLFA and LPA. Elevation levels in the north of the site are ~2m lower than the land in the south of the site. Detailed fluvial modelling would provide greater confidence in this option.</li> </ul>



Proposed Site	Land Fronting Pool Lane
	<ul style="list-style-type: none"> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site's proximity to Statham Pools Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
<b>Flood Source: Infrastructure Failure – Reservoirs</b>	
Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents.</li> </ul>
<b>Flood Source: Infrastructure Failure – Canals</b>	
Flood risk: canal	<ul style="list-style-type: none"> <li>From MSC (risk included in Flood Map)</li> </ul>
<b>Flood Source: Surface Water</b>	

Surface Water Flood Risk to Proposed Development Site

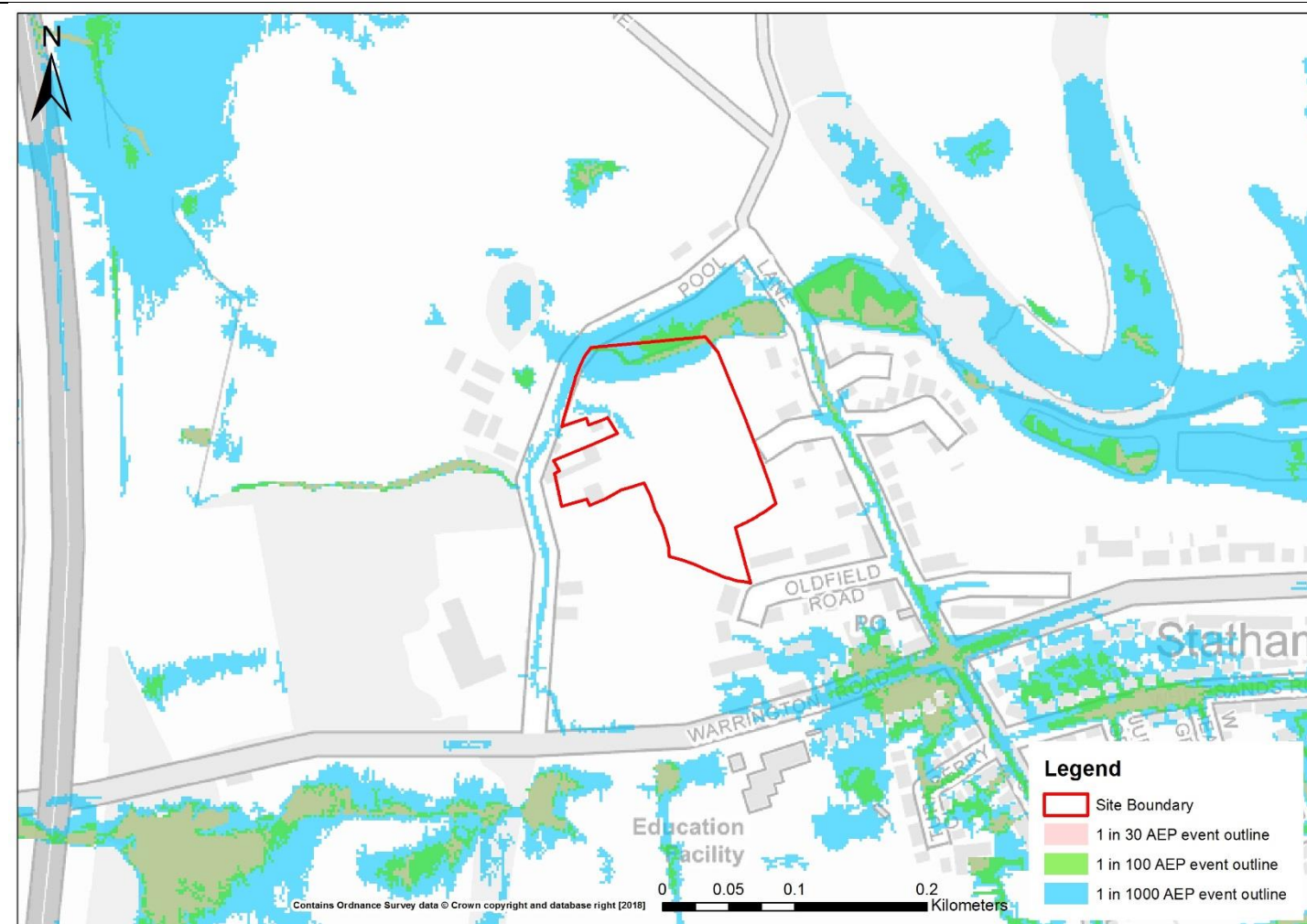


Figure 3.7.4 Surface Water Flood Risk

Proposed Site		Land Fronting Pool Lane	
Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.94	2.86	10.35
Surface water flooding depths	Max: 0.60-0.90m Mean: 0.42m	Max: 0.60-0.90m Mean: 0.45m	Max: >1.20m Mean: 0.65m
Surface water hazards	Max: Significant Mean: Moderate	Max: Moderate Mean: Low	Max: Significant Mean: Significant
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>Approximately 3% is at risk of surface water flooding during the 1% AEP event. Surface water attenuates within a watercourse to the North of the site where the depth reaches 0.60-0.90m.</li> <li>There is a relatively small, shallow area of localised ponding surrounding Pool Farm at the north of the site during the 0.1% AEP event.</li> </ul>		
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>Access issues arise during the 1% AEP event along Pool Lane on the site's western side, with flooding also inundating the roads to the south of the site. At present, Pool Lane is the only access route to the site. During the 1% AEP, access routes will be focused on moving west along Warrington Road.</li> <li>A safe access/egress route will need to be determined during the 0.1% AEP.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>The site is greenfield and therefore infiltration SuDS is feasible subject to Ground Investigation where existing low-lying areas that are currently showing ponding may be utilised for attenuation. In this case, the capacity of the existing watercourse may be increased.</li> <li>The site has a South to North negative slope ranging from approximately 12m AOD along the Southern bound to approximately 8m AOD at the watercourse.</li> <li>Development should avoid the 1% AEP outline.</li> </ul>		

Proposed Site			Land Fronting Pool Lane			
<b>Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)</b>						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical			Qbar: 7.38 l/s Q30: 12.55 l/s Q100: 15.36 l/s			
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	9.5	984	215	770	34.0	0.05 ha 2.77 %
3.33% AEP Rainfall + 40%	11.25	1190	254	936	41.3	0.06 ha 3.37 %
1% AEP Rainfall + 20%	8.75	1314	242	1072 (302 exceedance storage)	38.7	0.07 ha 3.86 %
1% AEP Rainfall + 40%	10.25	1578	283	1294 (358 exceedance storage)	46.7	0.09 ha 4.66 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					

**3.8 2273 – Motortrade**

Proposed Site	Motortrade
Site area (ha)	0.52
Existing use	Commercial
Existing flood risk vulnerability classification	Less Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	0.44

Flood outlines (current day)

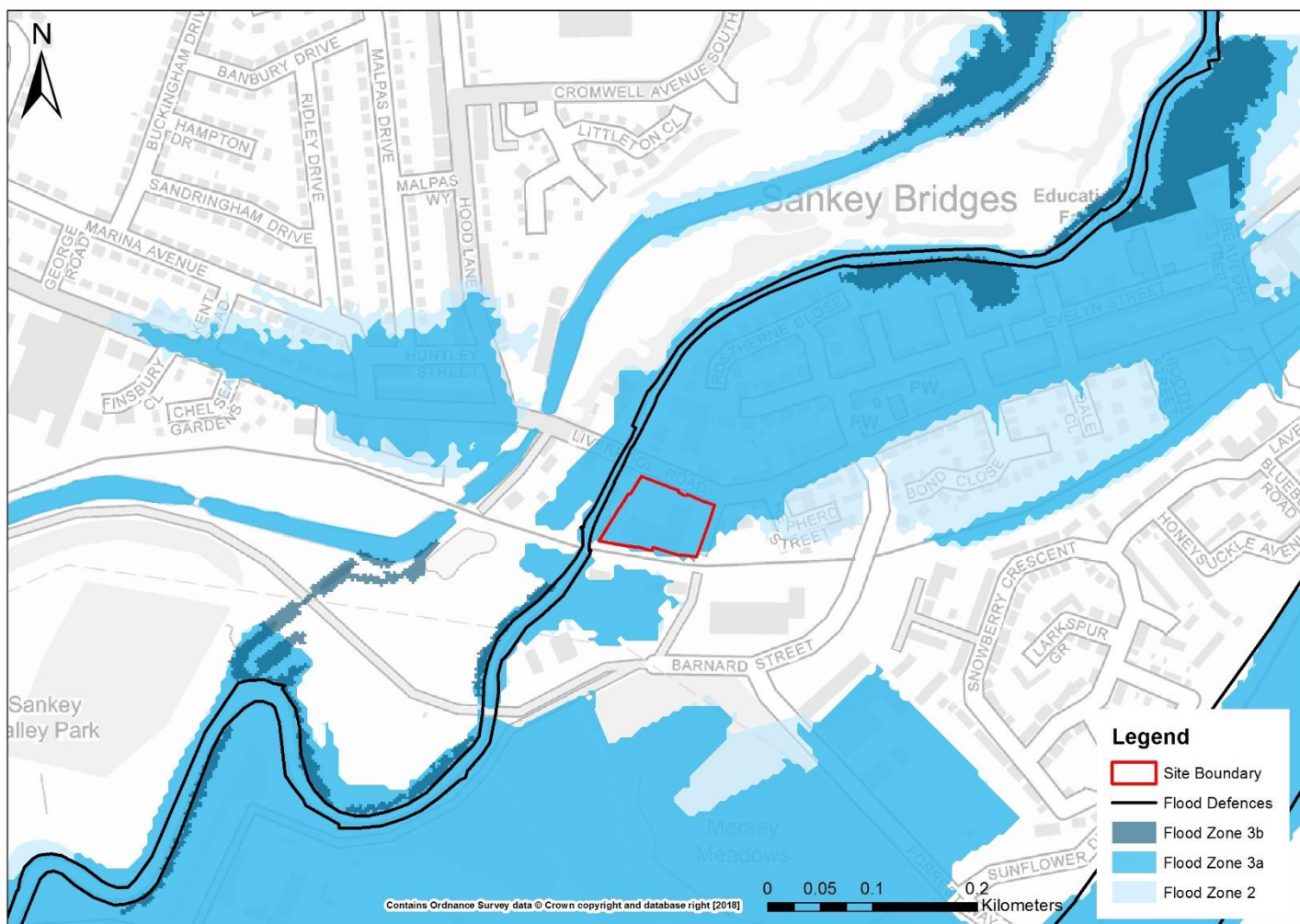


Figure 3.8.1 Flood Zone Mapping and Flood Defences

Proposed Site

Motortrade

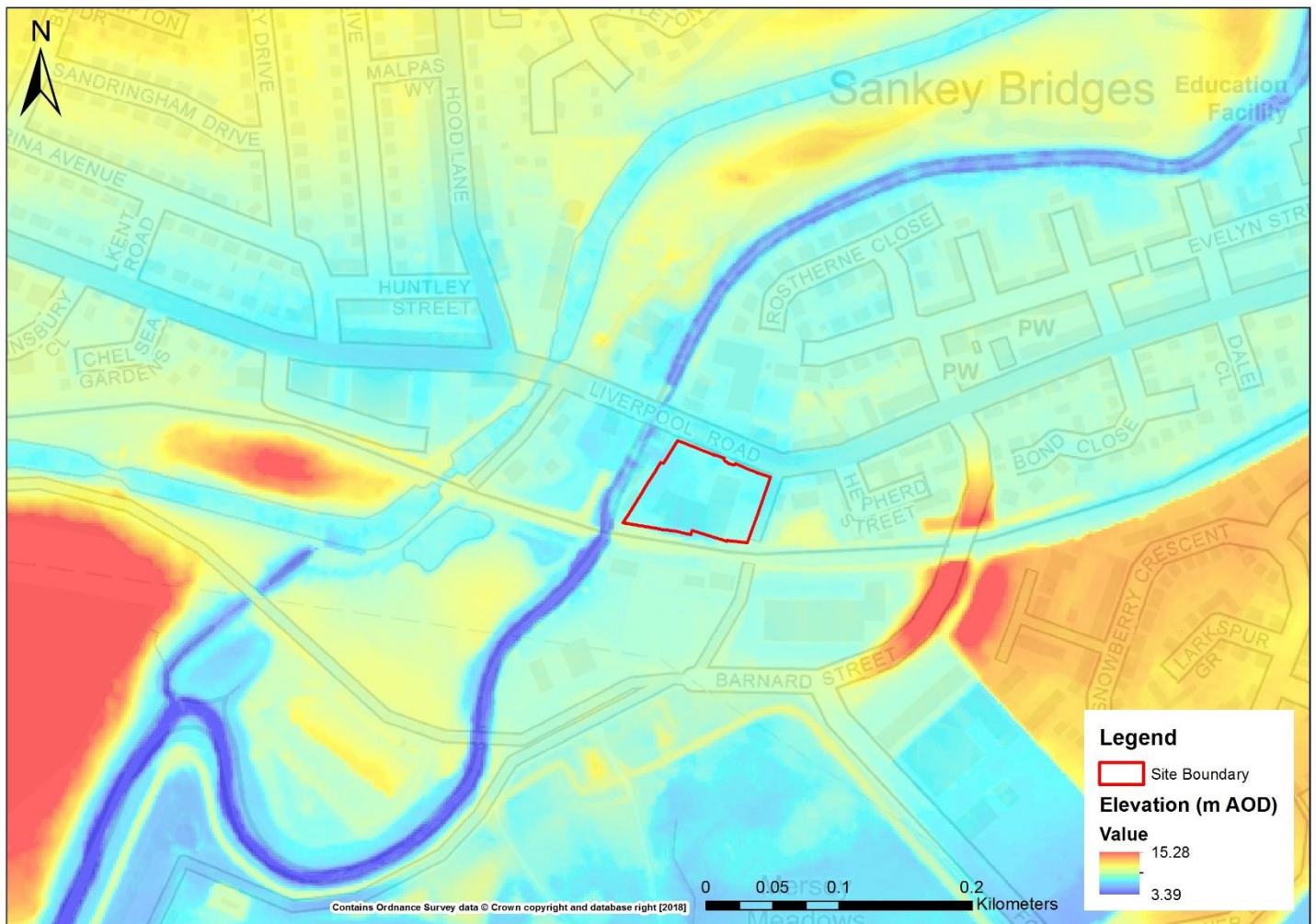


Figure 3.8.2 Site with 2m LIDAR (elevation data)

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- 100% within Flood Zone 3a
- Fluvial and tidal are the primary sources of flood risk.
- Sankey Brook runs adjacent to the West of the site and the Mersey Meadows floodplain is situated to the south.
- Fluvial modelling from Sankey Brook was not available, current EA flood zone mapping was used in lieu.
- The site is at risk of flooding from tidal sources from a 0.5% AEP design event.
- The risk of surface water flooding is low.
- The site is changing risk classification from less vulnerable to more vulnerable.
- The proposed development is More Vulnerable and due to 100% of the site being within Flood Zone 3a the Exception Test must be undertaken and passed.

**Proposed Site** **Motortrade**

- This site is also located within the larger strategic Waterfront site, see section 3.14.

**Flood Source: Fluvial/Tidal**

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	0.00	99.70	0.00
Tidal: Depth (m)	0.19	0.14	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Tidal Flood Risk and Climate change

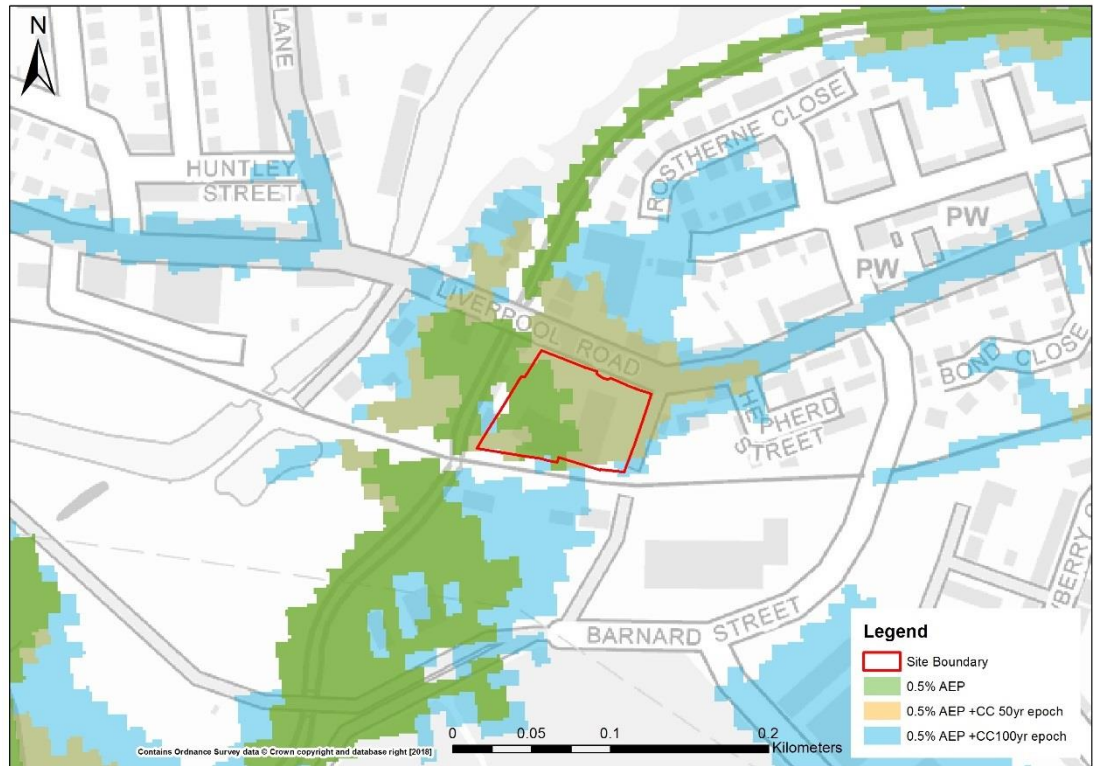


Figure 3.8.3 Defended Tidal outlines for present day 0.5% AEP and future risk 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases

Tidal (defended):

- According to the 2015 Mersey Estuary modelled extents (see Figure 3.8.3), the site sees flooding during the 0.5% AEP design event, from a flow path originating from Sankey Brook.
- Additionally, the site is almost entirely inundated with tidal flooding during the 0.5% AEP 50yr epoch (cumulative sea level rise for the next 50 years) climate change outline.

Proposed Site

Motortrade

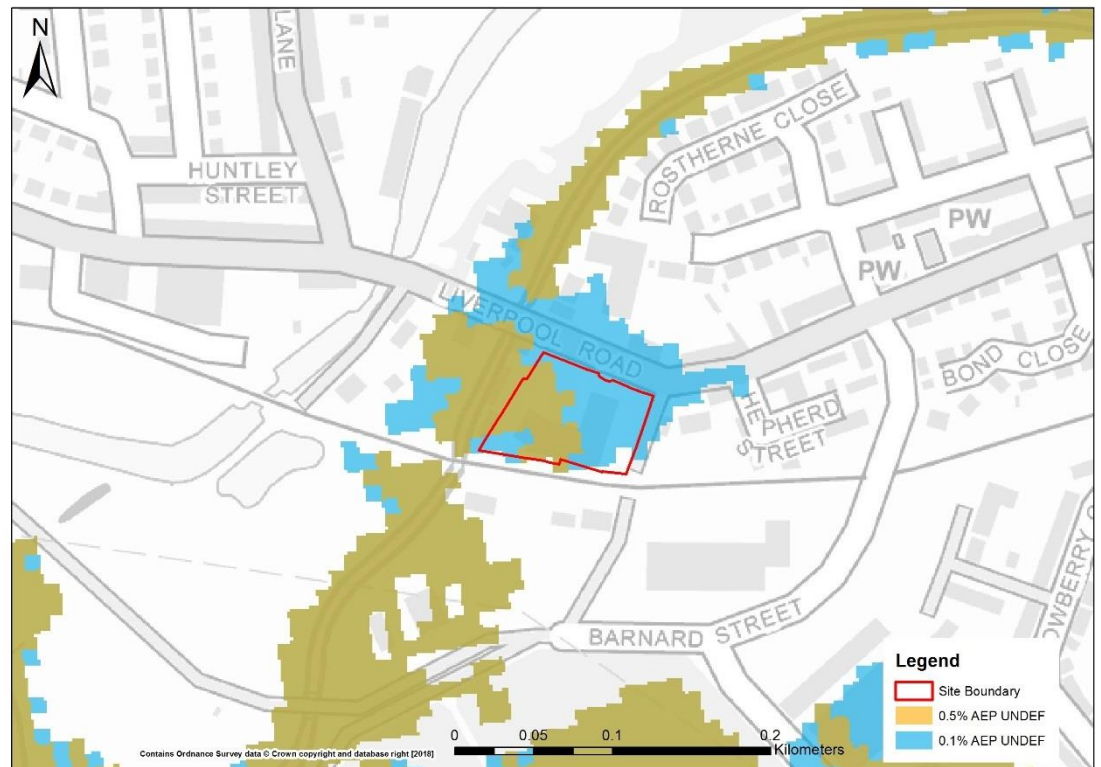


Figure 3.8.4 Tidal outlines for the undefended scenario 0.5% AEP and 0.1% AEP events

Tidal (undefended):

- The baseline modelled extents indicate that the site floods extensively during both the 0.5% and 0.1% AEP undefended scenario.
- For this site, the modelled defended and undefended scenarios look similar to one another.
- The site is relatively flat and therefore flooding is almost uniform across the site.

**Proposed Site** | **Motortrade**

Fluvial Flood Risk and Climate Change

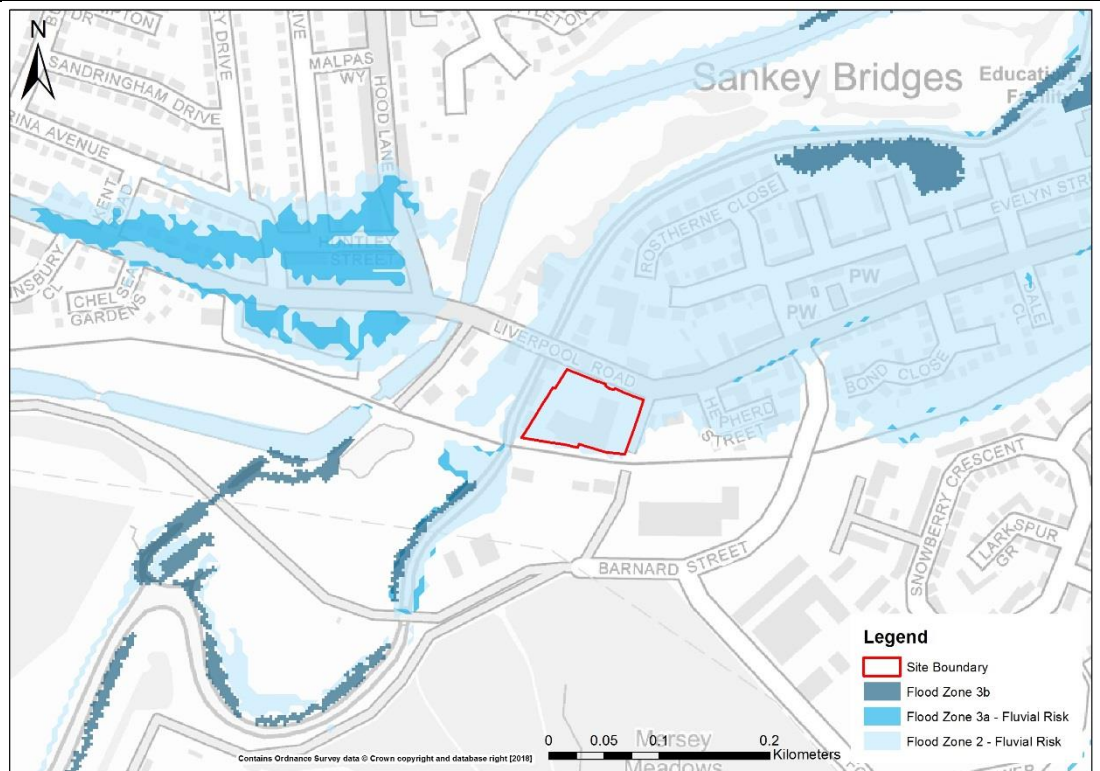


Figure 3.8.5 Fluvial only Flood Zone Mapping

- Looking at only fluvial risk, the site lies almost completely within Flood Zone 2.
- Access and egress roads, namely Liverpool Road, are similarly within Flood Zone 2 also.

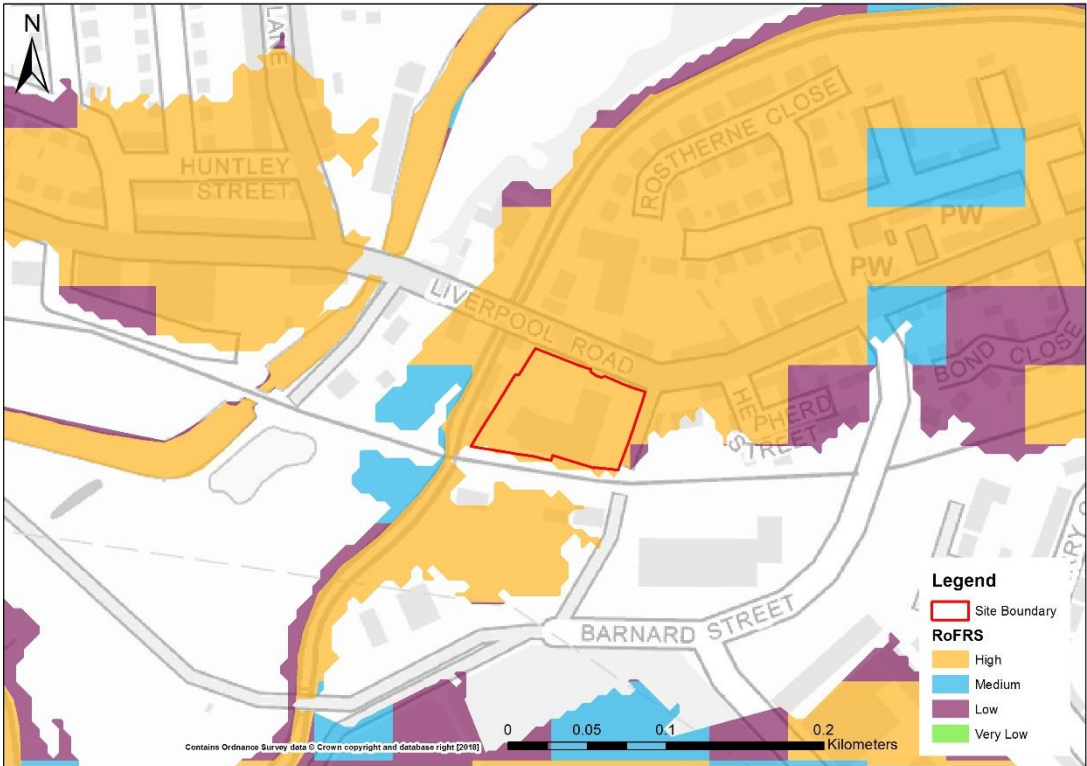
Historic flooding

- The site is located outside any Environment Agency historic flood outlines.

Defences

- Available EA flood defence asset data indicates that the adjacent Sankey Brook is contained by a regraded earth and masonry lined channel (high ground) which has a condition grade of 2 and 3 for different sections (Table 1.1 Condition Assessment Manual 2012).



Proposed Site	Motortrade
<p>Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map</p>	 <p>Figure 3.8.6 Site displaying flood risk from rivers and the sea</p> <p>Risk of Flooding from Rivers and the Sea (RoFRS) – defended flood map:</p> <ul style="list-style-type: none"> <li>• The site is wholly within the high-risk classification, meaning a chance of flooding in &gt;3.33% AEP events.</li> <li>• Despite this, the data shown here has only been classified as suitable to a county or town scale and is likely to not be reliable for either local areas or individual properties.</li> </ul>
<p>Flood Warning Area</p>	<ul style="list-style-type: none"> <li>• 100% of the designation area lies within an EA FWA, described as “Areas at risk include Liverpool Road from Kent Road to Beaufort Street, Rostherne Close, Evelyn Street and Huntley Street”.</li> </ul>
<p>Mitigation options &amp; site suitability</p>	<ul style="list-style-type: none"> <li>• This site is not recommended for residential development.</li> <li>• As this site is within the larger Waterfront development boundary, it may be that this site can be incorporated within the Waterfront layout and design i.e. relocating the planned development to elsewhere within the wider Waterfront site, outside of Flood Zone 3a.</li> <li>• During a high magnitude event the site becomes isolated due to flooding.</li> <li>• Access and egress routes become similarly inundated and can not provide safe/dry access as must be defined in a site’s emergency plan.</li> <li>• Post-development surface water discharge rates should be better than the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> </ul>

**Proposed Site** **Motortrade**

**Flood source: Groundwater**

Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site's proximity to Sankey Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
-------------------------	---

**Flood Source: Infrastructure Failure – Reservoirs**

Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents.</li> </ul>
-----------------------	---

**Flood Source: Infrastructure Failure – Canals**

Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>
-------------------	--

**Flood Source: Surface Water**

Surface Water Flood Risk to Proposed Development Site

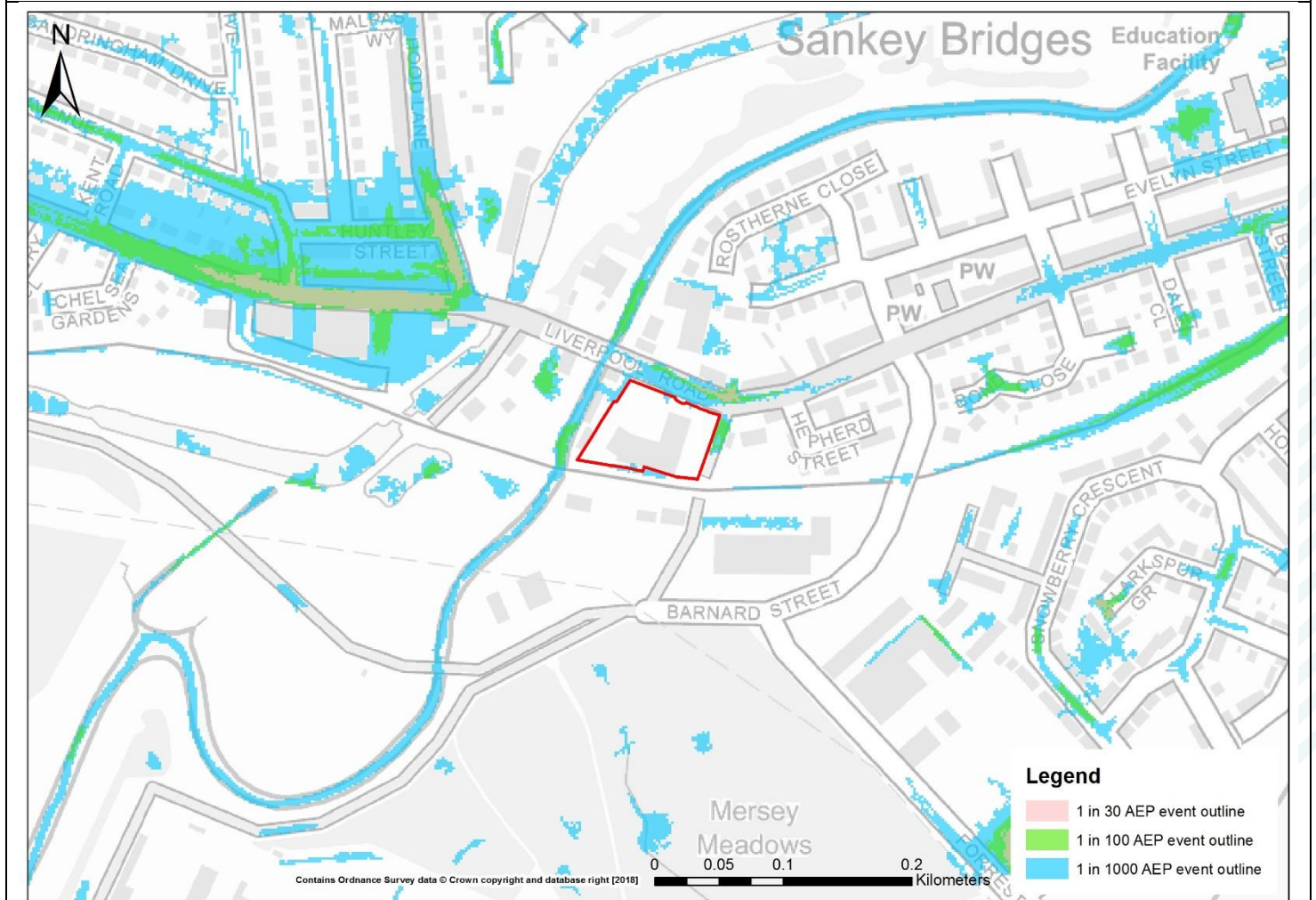


Figure 3.8.7 Surface Water Flood Risk

Existing development risk of flooding	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
---------------------------------------	-------------------------------	------------------------------	-----------------------------

Proposed Site		Motortrade				
from surface water (%)	0.00	0.00			1.66	
Surface water flooding depths	Max: 0.00m Mean: 0.00m	Max: 0.00m Mean: 0.00m			Max: 0.15-0.30m Mean: 0.24m	
Surface water hazards	Max: None Mean: None	Max: None Mean: None			Max: Moderate Mean: Low	
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>					
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>Over 98% of the site is outside of surface water flood extents and therefore is at very low risk from surface water flooding.</li> <li>The site is at very low risk from surface water flooding during the 1% AEP event.</li> <li>Both access routes: Old Liverpool Road and Gate Warth Street are inundated by surface water during the 0.1% AEP event with depths of flooding up to 0.60m.</li> <li>Over 98% of the site does not fall within the available surface water flood extents and therefore, is at very low risk from surface water flooding. However, as the site is within Flood Zone 3a, an FRA will be required. The FRA should quantify the volume surface water runoff generated by development and provide volumes of attenuation required to ensure that runoff from the site does not increase surface water flood risk elsewhere.</li> </ul>					
<b>Surface water: mitigation options &amp; site suitability</b>	<ul style="list-style-type: none"> <li><b>A safe access/egress route will need to be determined during the 0.1% AEP. Current modelled outlines and mapping show no clear routes.</b></li> <li><b>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</b></li> <li><b>Infiltration SuDS may not be feasible as the site is previously developed. Ground investigation would be required.</b></li> </ul>					
Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical				Qbar: 5 l/s Q30: 5 l/s Q100: 5 l/s		
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	6.25	247	56	191	21.1	0.01 ha 2.45 %

Proposed Site				Motortrade		
3.33% AEP Rainfall + 40%	7.25	298	65	232	25.8	0.02 ha 2.97 %
1% AEP Rainfall + 20%	7.75	352	70	282 (91 exceedance storage)	31.3	0.02 ha 3.62 %
1% AEP Rainfall + 40%	9.25	425	83	342 (110 exceedance storage)	37.9	0.02 ha 4.38 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					

### 3.9 2482 – Wharf Industrial Estate

Proposed Site	Wharf Industrial Estate
Site area (ha)	4.88
Existing use	Industrial
Existing flood risk vulnerability classification	Less Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	4.15

Flood outlines (current day)

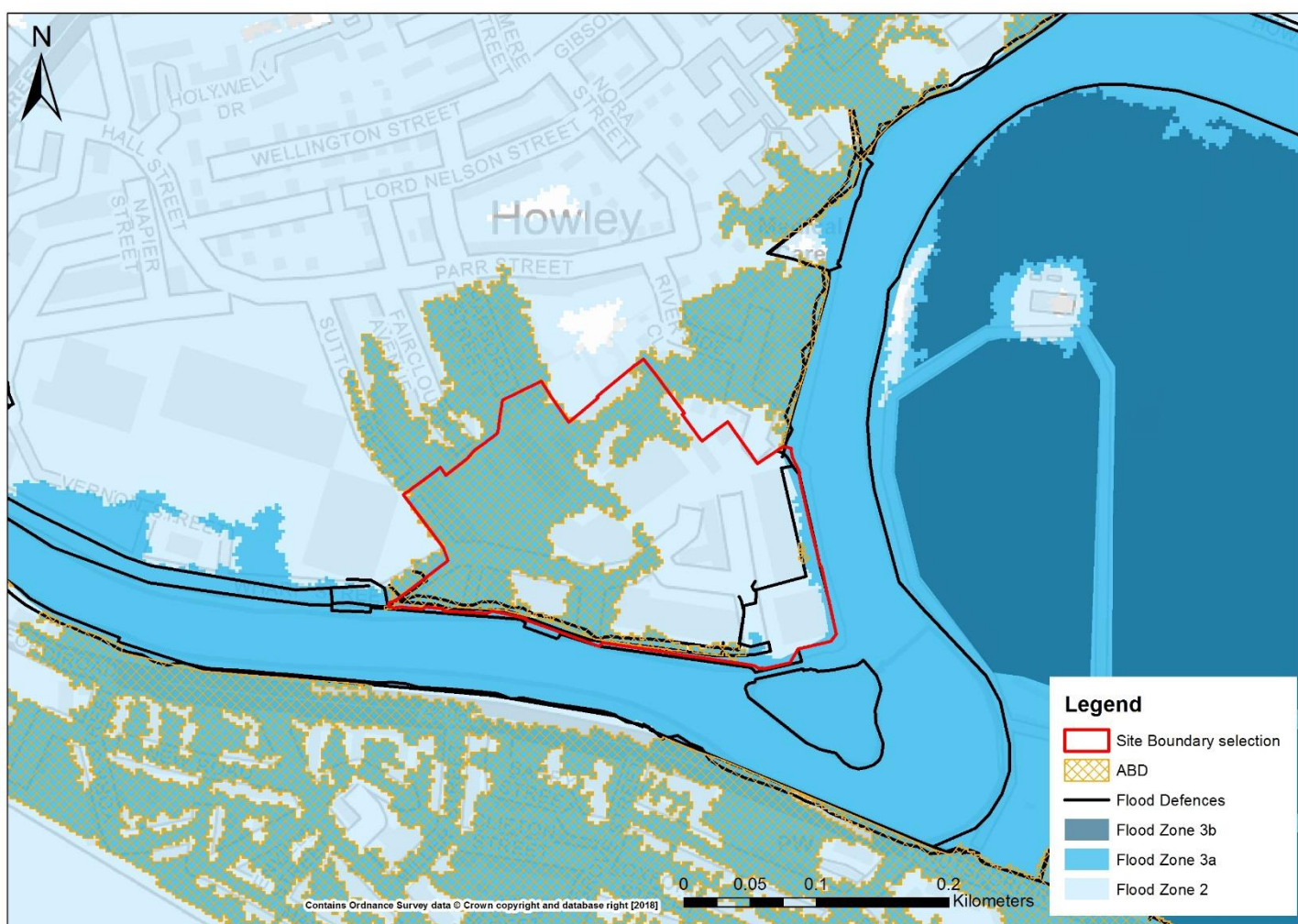


Figure 3.9.1 Flood Zone Mapping, Flood Defences and ABDs

Proposed Site

Wharf Industrial Estate

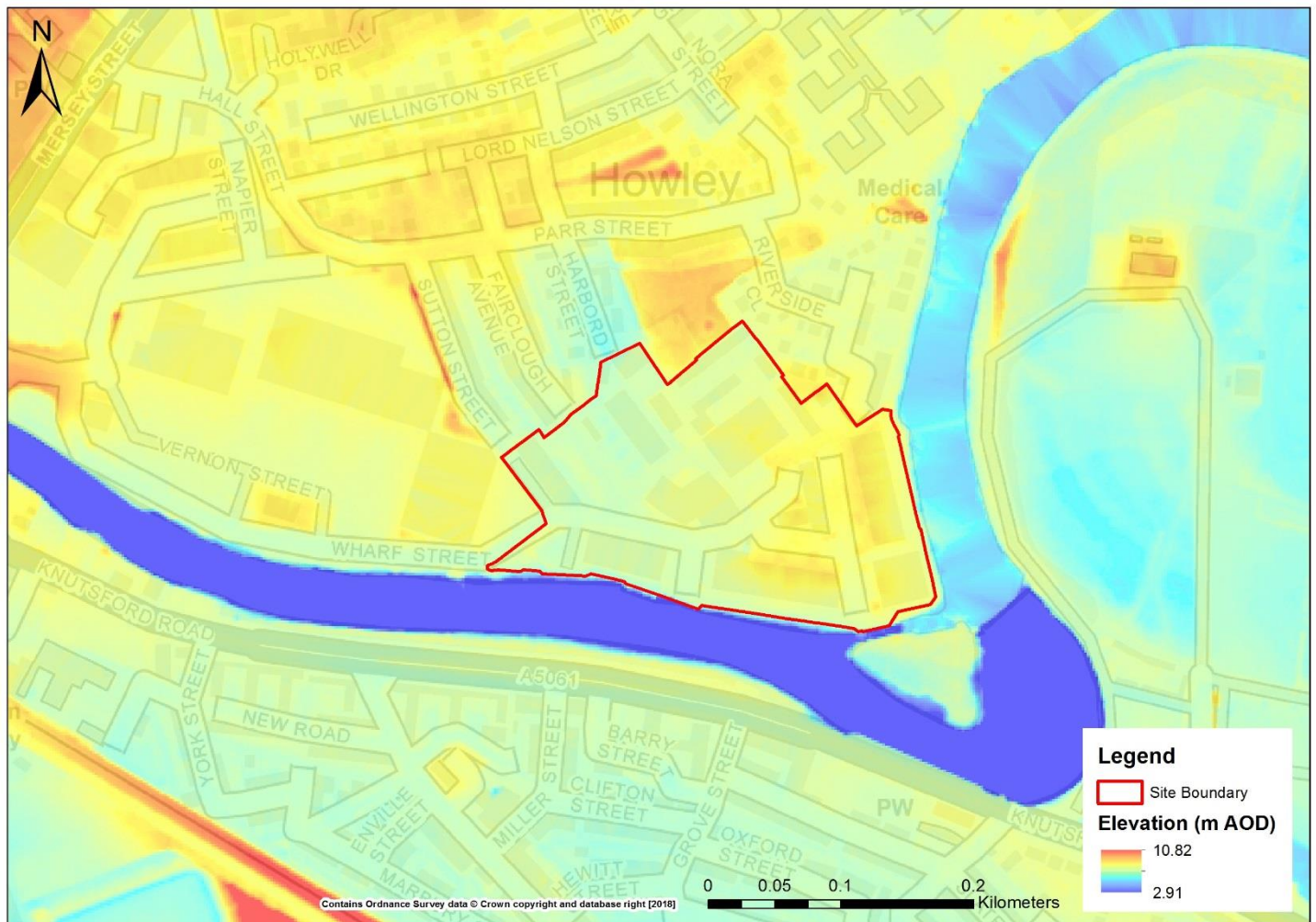


Figure 3.9.2 Site with 2m LIDAR (elevation data)

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The site is situated on a meander of the River Mersey.
- Nearly half of the site is within Flood Zone 3a – mainly on the western half.
- Tidal is the predominant source of flood risk, though fluvial is also an issue.
- Fluvial modelling was unavailable for this study, current flood zone mapping has been used as a substitute.
- Tidal flooding risks are mitigated heavily by the defences in place, these being part of the Warrington FAS. This is shown by the modelled defended tidal scenario in Figure 3.9.3. Tidal risk is therefore residual.
- The risk of surface water flooding is low.
- The site risk classification is changing from less vulnerable to more vulnerable.

Following draft review with EA:

**Proposed Site** **Wharf Industrial Estate**

- EA confirmed current defences will protect the site, as per the ABD, from tidal and fluvial flooding up to a 200 / 100 AEP standard.
- EA confirmed the defences will be maintained in the future as part of the EA’s asset maintenance programme.
- WBC confirmed that the area for development will be within the current ABD.
- FRA must assess climate change impacts and show that the site will be safe for its lifetime. Defence overtopping scenario should also be modelled for climate change event.

**Flood Source: Fluvial/Tidal**

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	52.09	47.91	0.00
Tidal: Depth (m)	0.67	0.7	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate change



Figure 3.9.3 Defended tidal outlines for 0.5% AEP and 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases

Tidal (defended):

- Using the 2015 Mersey Estuary modelled extents, the 100yr (2115) epoch (cumulative sea level rise for the next 100 years) outline is within the site. This indicates that the River Mersey flood defences have been overtopped along the Eastern and South-Eastern boundaries of the site.

Proposed Site

Wharf Industrial Estate

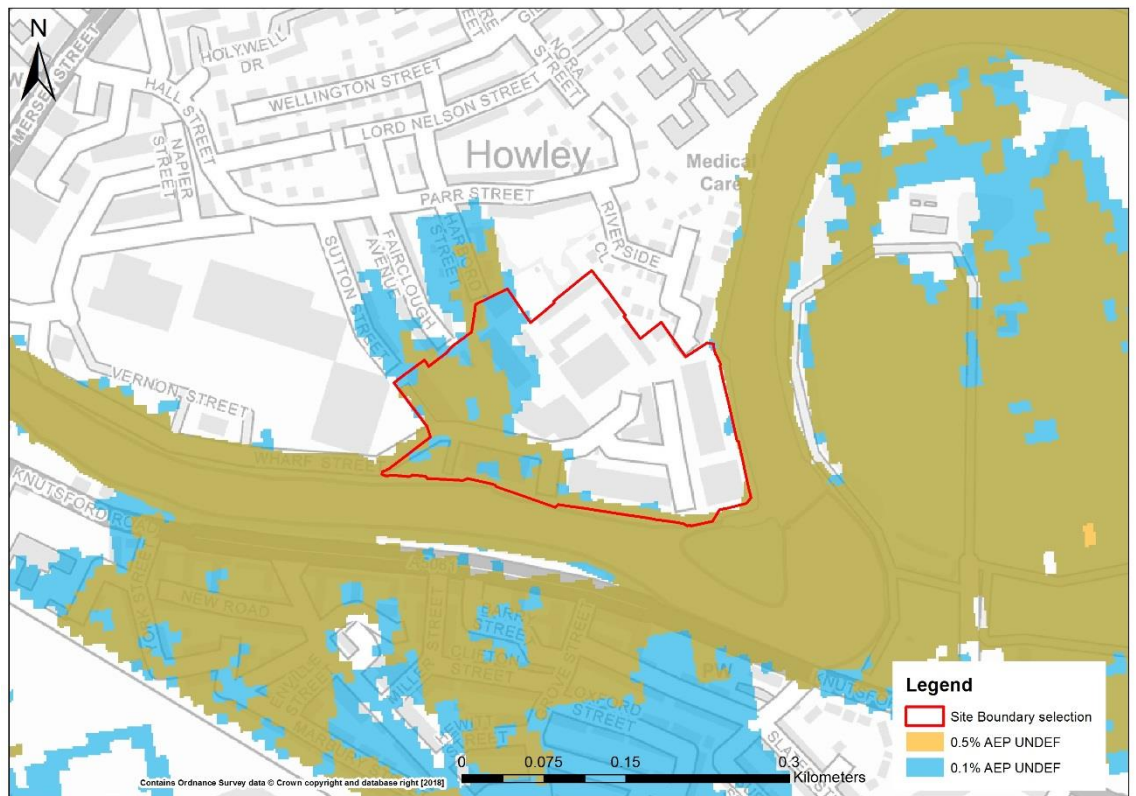


Figure 3.9.4 Tidal outlines for the undefended scenario 0.5% AEP and 0.1% AEP events

Tidal (undefended):

- The baseline modelled extents (Figure 3.9.4) indicate that during the 0.5% AEP undefended scenario, tidal flooding attenuates in the West of the site.
- The topography of the site (Figure 3.9.2) indicates that the West of the site, where the tidal flooding attenuates during the undefended scenario, is approximately 0.5m lower than the rest of the site.



**Proposed Site**

**Wharf Industrial Estate**

Fluvial Flood Risk and climate change

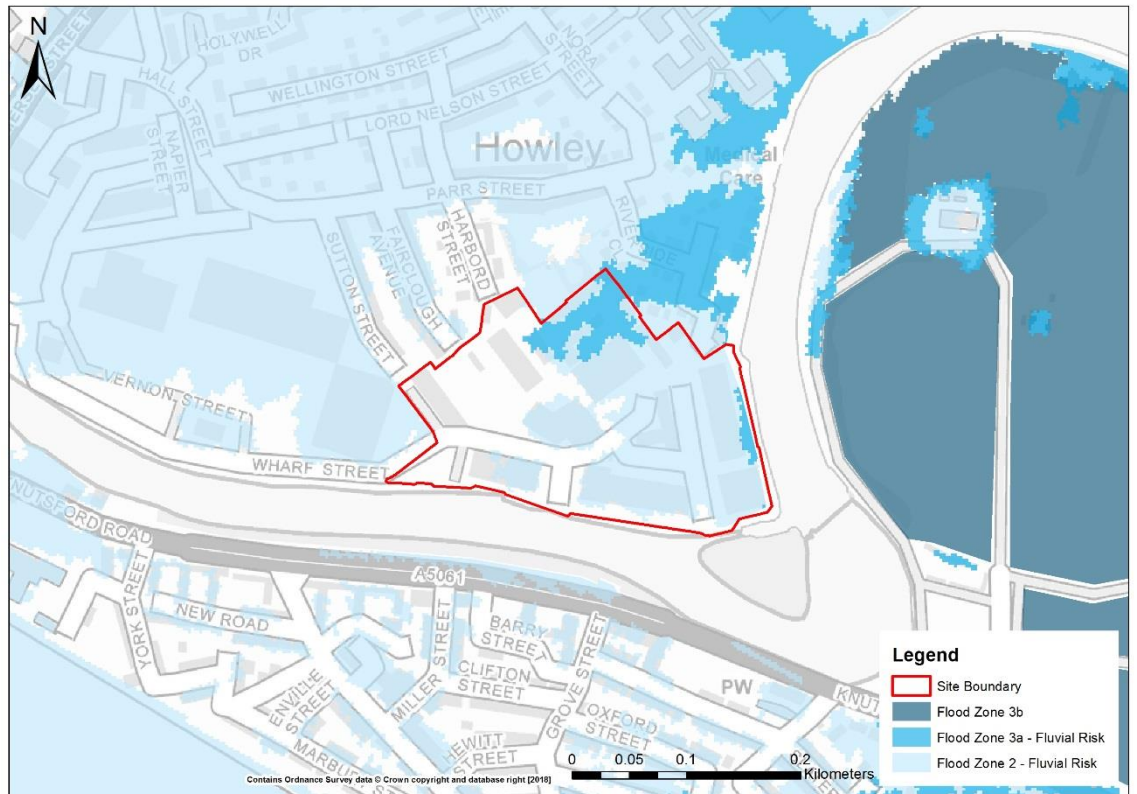


Figure 3.9.5 Site displaying fluvial flood zone mapping

- For fluvial-only events, the site is mostly within flood zone 2 with the northern tip seeing some overlap of flood zone 3a.
- Multiple access and egress routes are inundated by flooding.
- Using Flood Zone 2 as a proxy for climate change, it is clear the site could be at long term fluvial risk.

Proposed Site

Wharf Industrial Estate

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

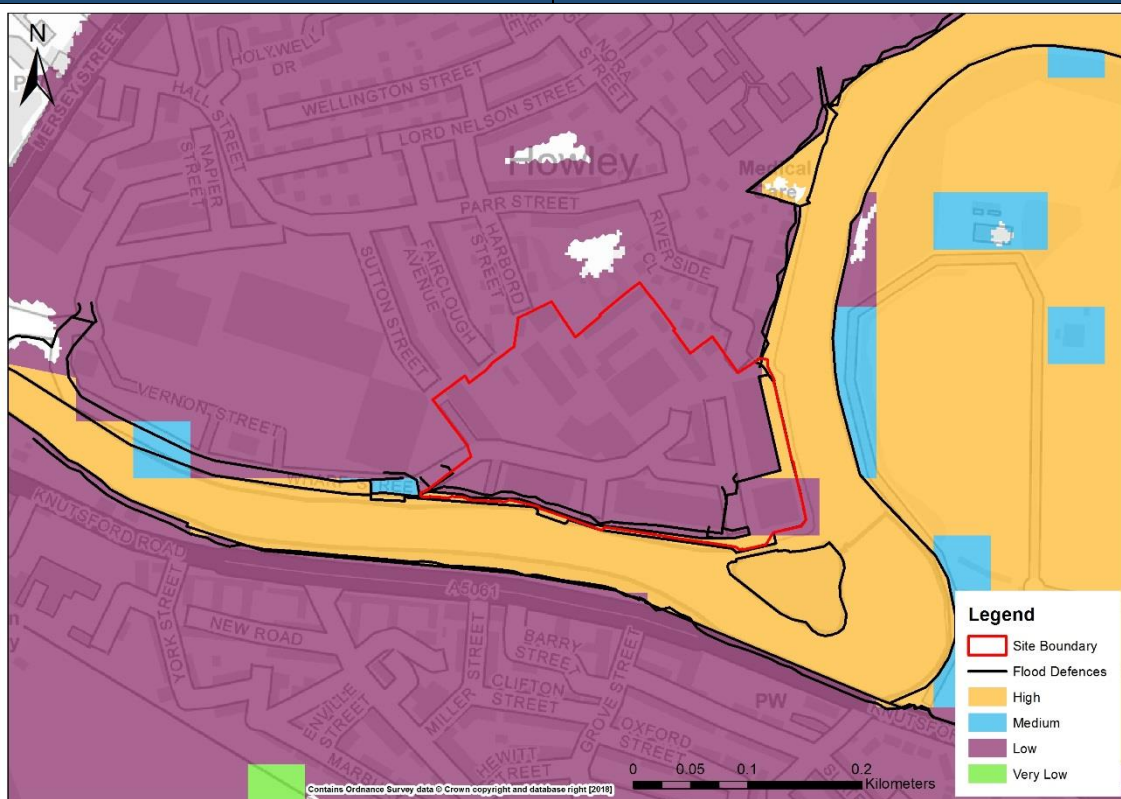


Figure 3.9.6 Site displaying flood risk from rivers and the sea

- Much of the site is classified as being low risk (between 1% and 0.1% AEP design event), most likely due to the placement of the flood defences on the edges of the River Mersey.
- Areas of high risk (>3.33% AEP event) are seen on the western bank of the river supporting the importance of the defences to preventing the site from inundation.

Historic flooding

- 34% of the site is contained within the historic flood map outline. This is localised to low-lying ground in the Western area of the site.

Defences

- Available EA flood defence asset data indicates that for this stretch of the River Mersey, it is contained by high ground which largely has a condition grade of 2, however, the Eastern bound of the site has a condition grade of 3 (Table 1.1 Condition Assessment Manual 2012).

Flood Warning Area

- 51% of the proposed site lies within an EA FWA, described as “The Howley area of Warrington is at risk of flooding from the Estuary due to high tides. Areas at risk include the Riverside Retail Park; Wharf St; Wharf St industrial estate; Riverside Cl, Parr St; Cleaves Cl; Harbord St; Fairclough Ave & Sutton St”.
- 21% of the proposed site lies within a FWA, described as “Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also, parts of Howley, Wilderspool, Latchford, Westy, Paddington and Woolston”.
- 4% of the designation area overlaps both local FWAs.

Proposed Site	Wharf Industrial Estate
Mitigation options & site suitability	<ul style="list-style-type: none"> <li>• Flood Zone 3a should be left clear of development, following expected demolition of current buildings. This would however impact on the number of developable residential units. If Flood Zone 3a cannot be used for open space, then development of this part of the site may not be permitted.</li> <li>• Options for ground level retail, employment, car parking with first floor residential could be considered. This would require further detailed modelling after consultation with the EA as discussed below.</li> <li>• Fluvial risk should be modelled for the Mersey for present day, defended and undefended. Defended scenario to ascertain residual risk from fluvial sources. If site is shown to be safe from fluvial as well as tidal risk, then EA may consider permitting development</li> <li>• The EA would also expect fluvial climate change to be modelled for the Mersey, taking account of defences to ascertain whether the site can be safe for its lifetime and can therefore satisfy the requirements of the Exception Test. As half of the site is within Flood Zone 3a, the EA would likely expect the upper end allowance of +70% to be added on to peak flows. Outcomes should be discussed with the EA to determine suitable resilience measures to put in place.</li> <li>• Safe / dry access and egress routes are safe from tidal risk and fluvial risk as these have to be accounted for and designated within an Emergency Plan for the site.</li> <li>• As recommended by the EA, there should be an 8 m buffer strip between any proposed development and the River Mersey.</li> <li>• Any future development at this site should be considered sustainable without a continued reliance on flood defence investment and maintenance.</li> <li>• Existing low-lying areas within the site may be utilised for attenuation storage for fluvial flooding.</li> <li>• Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>• EA has confirmed confidence in defences and that the site may be permitted subject to the outcomes of the FRA.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>• Due to the site's proximity to the River Mersey, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
<b>Flood Source: Infrastructure Failure – Reservoirs</b>	
Flood risk: reservoir	<ul style="list-style-type: none"> <li>• The site is not located within reservoir flood extents.</li> </ul>
<b>Flood Source: Infrastructure Failure – Canals</b>	
Flood risk: canal	<ul style="list-style-type: none"> <li>• Data unavailable.</li> </ul>

Proposed Site

Wharf Industrial Estate

**Flood Source: Surface Water**

Surface Water Flood Risk to Proposed Development Site

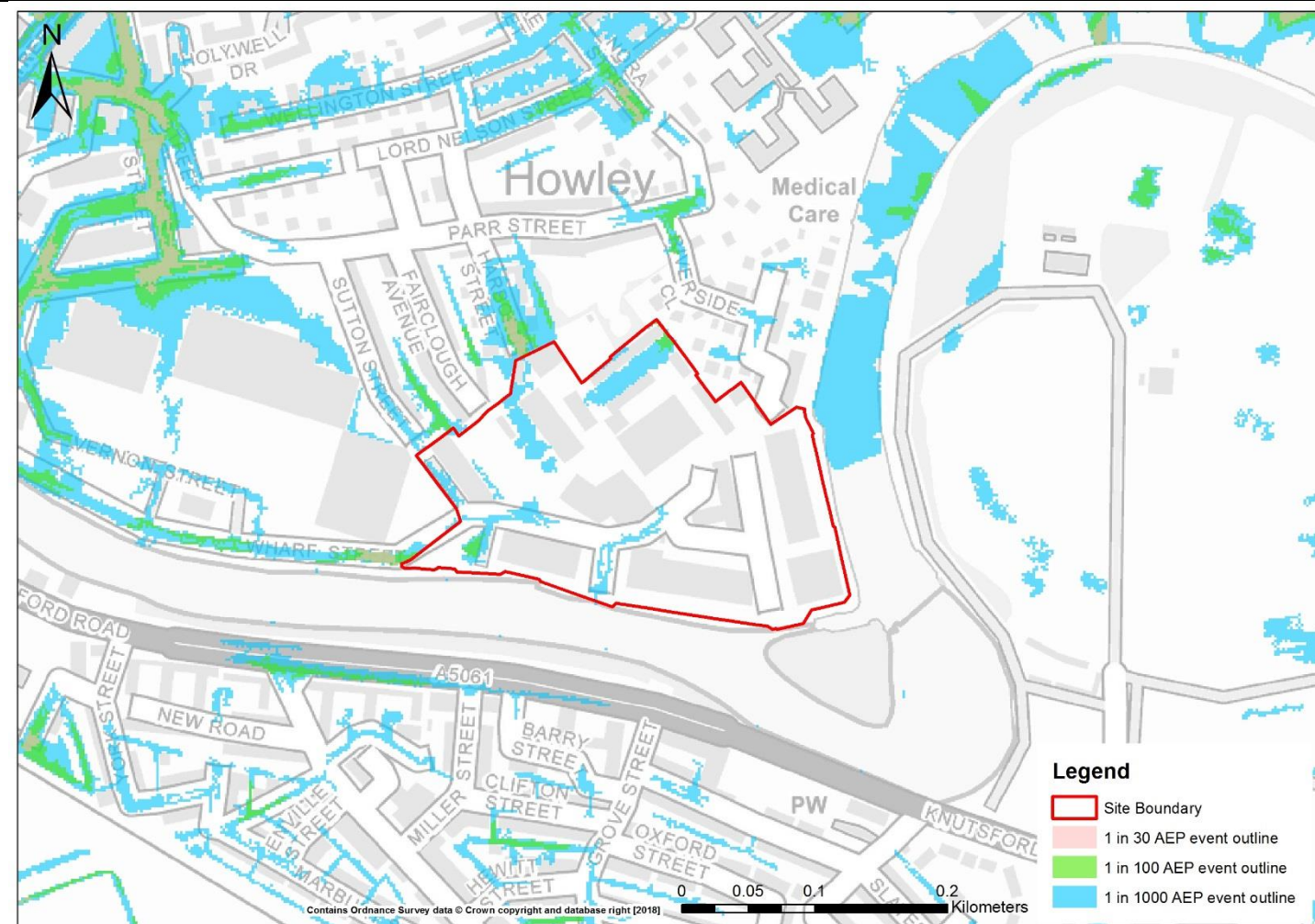


Figure 3.9.7 Surface Water Flood Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.00	0.55	7.68
Surface water flooding depths	Max: 0.00m Mean: 0.00m	Max: 0.15-0.30m Mean: 0.260m	Max: 0.30-0.60m Mean: 0.28m
Surface water hazards	Max: None Mean: None	Max: Moderate Mean: Low	Max: Moderate Mean: Low
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		

Proposed Site	Wharf Industrial Estate
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>The site is at very low risk from surface water during the 1% AEP event. The extent of the flooding is contained by existing development and has a mean depth of 0.260 m.</li> <li>The site is at a greater risk during the 0.1% AEP event where approximately 8% of the site is at risk of surface water. Much of the flooding is contained by existing development, specifically, large areas of impermeable surface between units for which the impermeable areas are situated approximately 0.25m below the unit floor level.</li> <li>There are some site access/egress issues during the 1% AEP event due to Wharf Street being flooded.</li> <li>The main access route along Wharf Street is flooded to a depth of 0.15-0.30m during the 0.1% AEP event.</li> </ul>
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>Wharf Street is currently the primary access route to the site, however for the 1% AEP event, it is inundated by surface water flooding. Fairclough Avenue (North of the site) is at very low risk from surface water flooding and could be utilised for access/egress instead.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Infiltration SuDS may not be feasible as the site is previously developed.</li> <li>Development should avoid the 0.1% AEP outline, however, as much of the flooding is contained by existing development, redevelopment of the site may significantly change the behaviour of the surface water and this must be accounted for in an FRA.</li> </ul>

### Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)

Proposed Development limiting runoff rate: Greenfield – FEH Statistical			Qbar: 14.35 l/s Q30: 24.39 l/s Q100: 29.85 l/s			
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation 84equ (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	12	2733	527	2206	50.1	0.15 ha 3.01 %
3.33% AEP Rainfall + 40%	12	3189	527	2662	60.5	0.18 ha 3.64 %
1% AEP Rainfall + 20%	13	3736	698	3038 (832 exceedance storage)	56.4	0.20 ha 4.15 %

Proposed Site					Wharf Industrial Estate	
1% AEP Rainfall + 40%	15	4473	806	3667 (1005 exceedance storage)	68.1	0.24 ha 5.01 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					

### 3.10 2603 – Land at Thelwall West

Proposed Site	Land at Thelwall West
Site area (ha)	2.37
Existing use	Commercial
Existing flood risk vulnerability classification	Less Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	2.01

Flood outlines (current day)

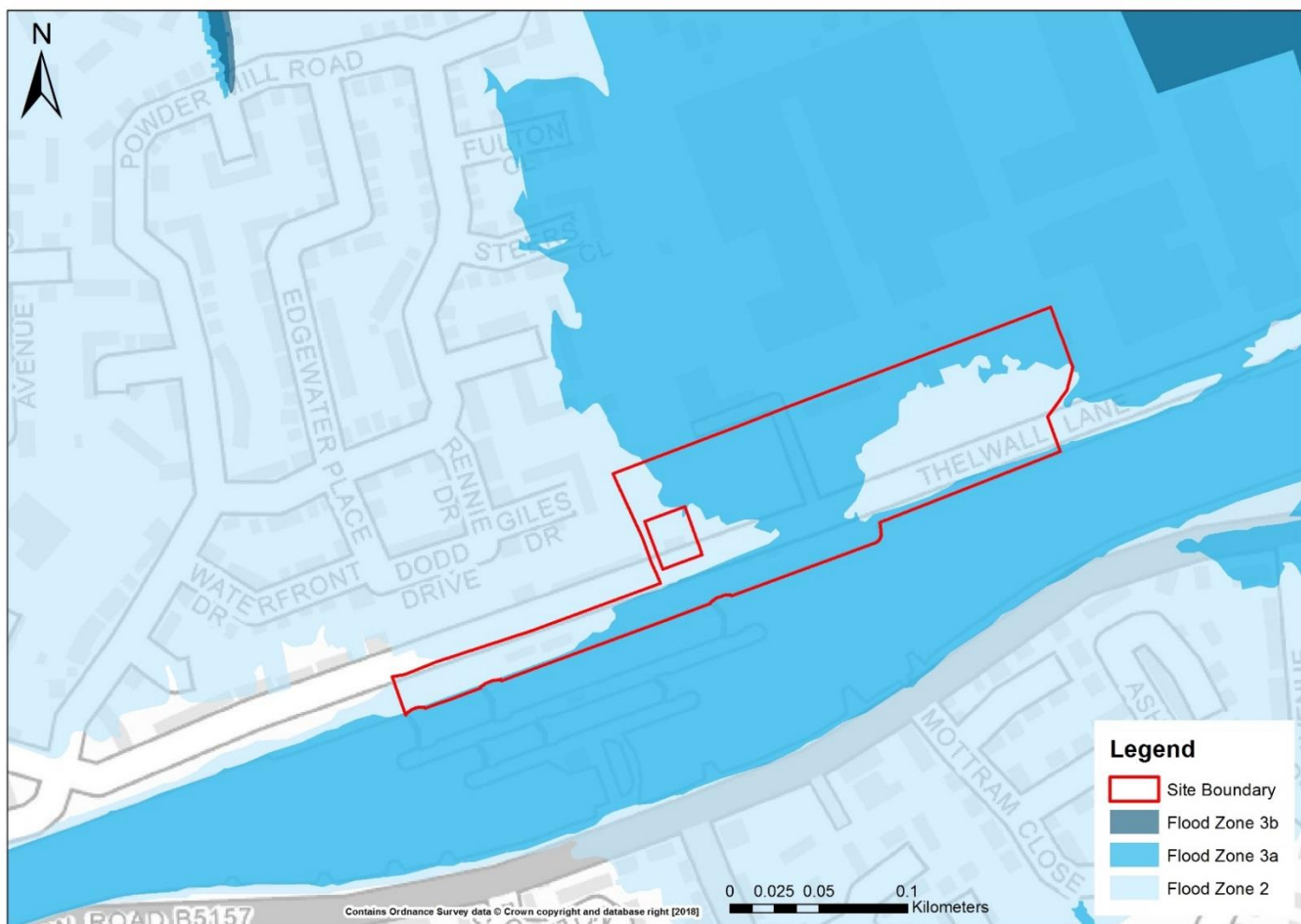


Figure 3.10.1 Flood Zone Mapping

- Flood zone mapping shows a flow path from the MSC into the centre of the site.

Proposed Site

Land at Thelwall West

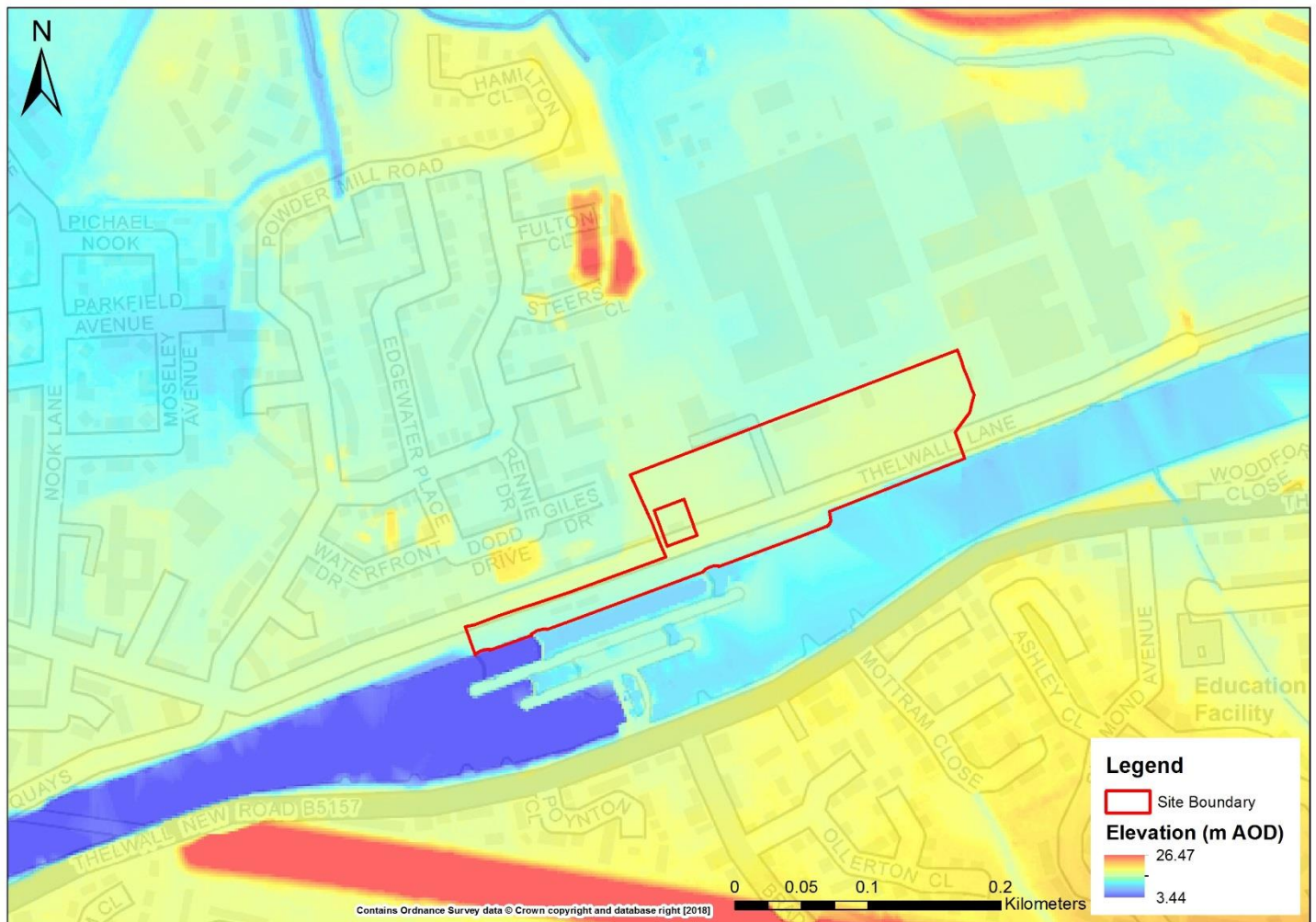


Figure 3.10.2 Site with 2m LIDAR (elevation data)

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The site is bound by the Manchester Ship Canal to the South, this in itself may have implications on development. Consultation should be had with the EA.
- 55% of the site is within Flood Zone 3a.
- Fluvial is the primary source of flood risk.
- Flood zone mapping was used as a substitute for fluvial modelling not being able for this study.
- There is no direct risk of tidal flooding from current flood zones or with newly modelled outputs from the Mersey Estuary model.
- The risk of surface water flooding is very low.
- The site is changing risk classification from being less vulnerable to more vulnerable.
- The proposed development is more vulnerable and due to over 50% of the site being within Flood Zone 3a the Exception Test must be undertaken and passed.



Proposed Site	Land at Thelwall West		
Flood Source: Fluvial/Tidal			
	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	44.65	55.18	0.00
Tidal: Depth (m)	Not available	Not available	Not available
Tidal: Hazard	Not available	Not available	Not available

Flood Risk Modelling and Climate Change

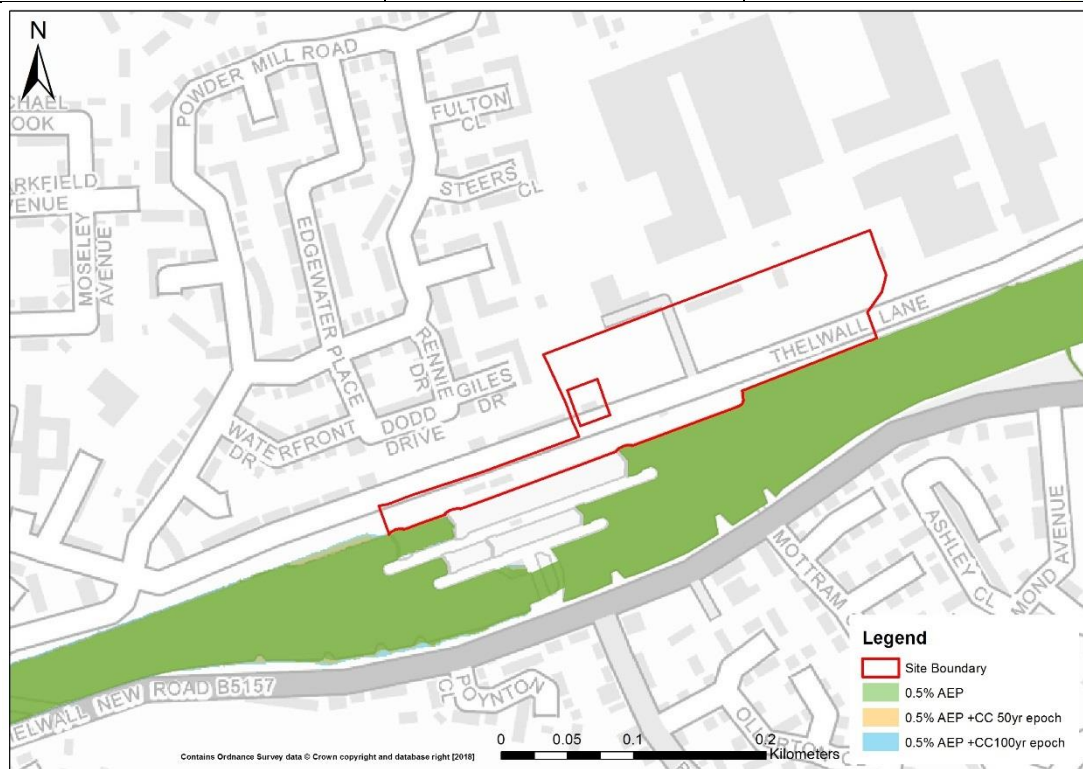


Figure 3.10.3 Tidal outlines for present day 0.5% AEP and future risk 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases

Tidal (defended):

- Outputs taken from the 2015 Mersey Estuary model show that in the 0.5% AEP 100yr-epoch (cumulative sea level rise for the next 100 years) climate change outline, the designation area is located outside of the modelled extents.
- The 0.5% EP outline is overlaid the future risk outlines demonstrating that any risk against is safeguarded into the future, at least for the 100yr-epoch.

Proposed Site

Land at Thelwall West

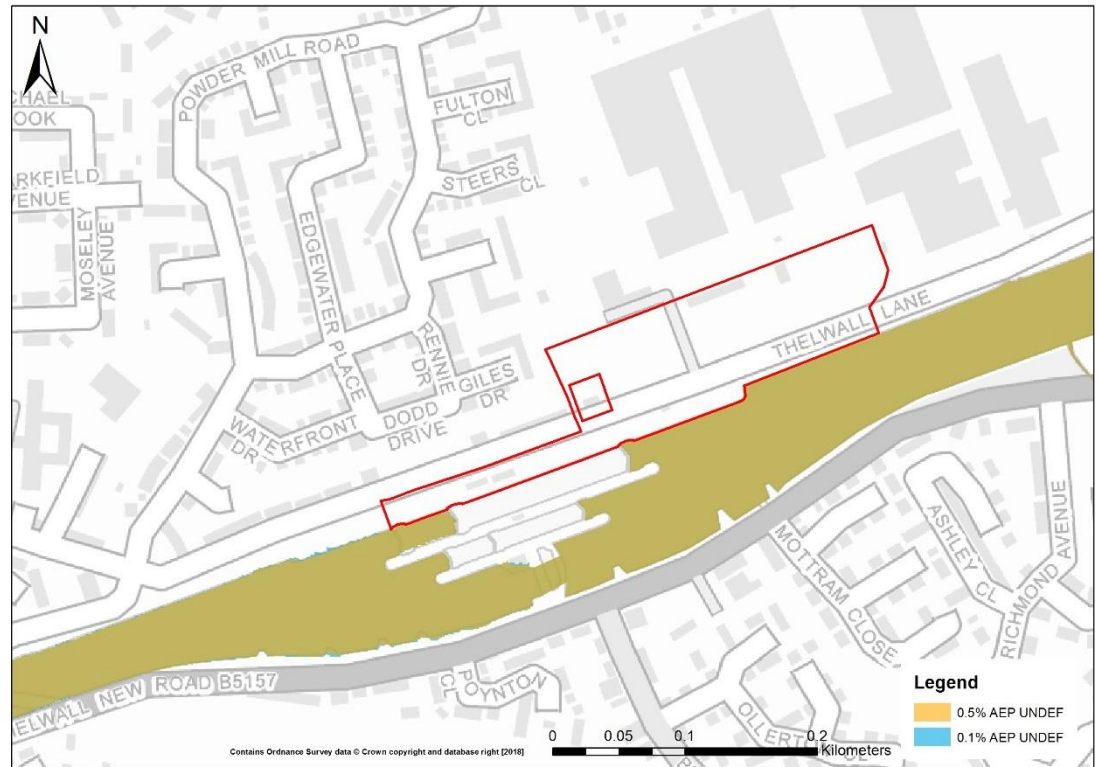


Figure 3.10.4 Tidal outlines for the undefended scenario 0.5% AEP and 0.1% AEP events

Tidal (undefended):

The baseline modelled extents indicate that the site is free from flooding during the 0.5% AEP undefended scenario.

Fluvial Flood Risk and Climate Change

- Fluvial only risk can be viewed in Figure 3.10.1 due to the lack of tidal flooding risk.
- Over 50% of the site is within Flood Zone 3a with the remainder of the site being in Flood Zone 2.
- There are currently no spatial flood defences situated on the southern edge of the site on the banks of the River Mersey.
- Using Figure 3.10.2, there are two areas of slightly raised land with an associated depression in the centre, this is shown in the Flood Zone Mapping by a flow path through the site where water floods and ponds in areas north of the site.
- Land raising here could provide further protection for the site and for areas located above the site area.
- Updated fluvial modelling could be undertaken rather than using Flood Zone Mapping for this assessment.

Historic flooding

- The site is located outside any Environment Agency historic flood outlines.

Defences

- The site does not currently have any formal defences.
- The Manchester Ship Canal (MSC) may be considered a defence asset if levels remain below canal threshold to prevent overtopping.

<b>Proposed Site</b>		<b>Land at Thelwall West</b>
Flood Warning Area	<ul style="list-style-type: none"> <li>76% of the proposed area lies within an EA FWA, described as "Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also, parts of Howley, Wilderspool, Latchford, Westy, Paddington and Woolston".</li> </ul>	
Mitigation options & site suitability	<ul style="list-style-type: none"> <li>Risk is entirely fluvial therefore any land raising would have to be compensated for with flood storage areas though elevation remains mainly uniform across the site.</li> <li>If possible, Flood Zone 3a areas should be left free of development, however this may prove difficult given the location of the risk area and the fact that this entails over half of the site. If avoidance is not possible the development may not be permitted.</li> <li>Following EA consultation, it was agreed that the risk was too great. Site therefore removed from the SHLAA.</li> </ul>	
<b>Flood source: Groundwater</b>		
Flood risk: groundwater	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>	
<b>Flood Source: Infrastructure Failure – Reservoirs</b>		
Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents.</li> </ul>	
<b>Flood Source: Infrastructure Failure – Canals</b>		
Flood risk: canal	<ul style="list-style-type: none"> <li>The site directly borders the MSC with the Flood Zone Mapping so consultation with the EA may be required to ascertain possible risk.</li> </ul>	

Proposed Site

Land at Thelwall West

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

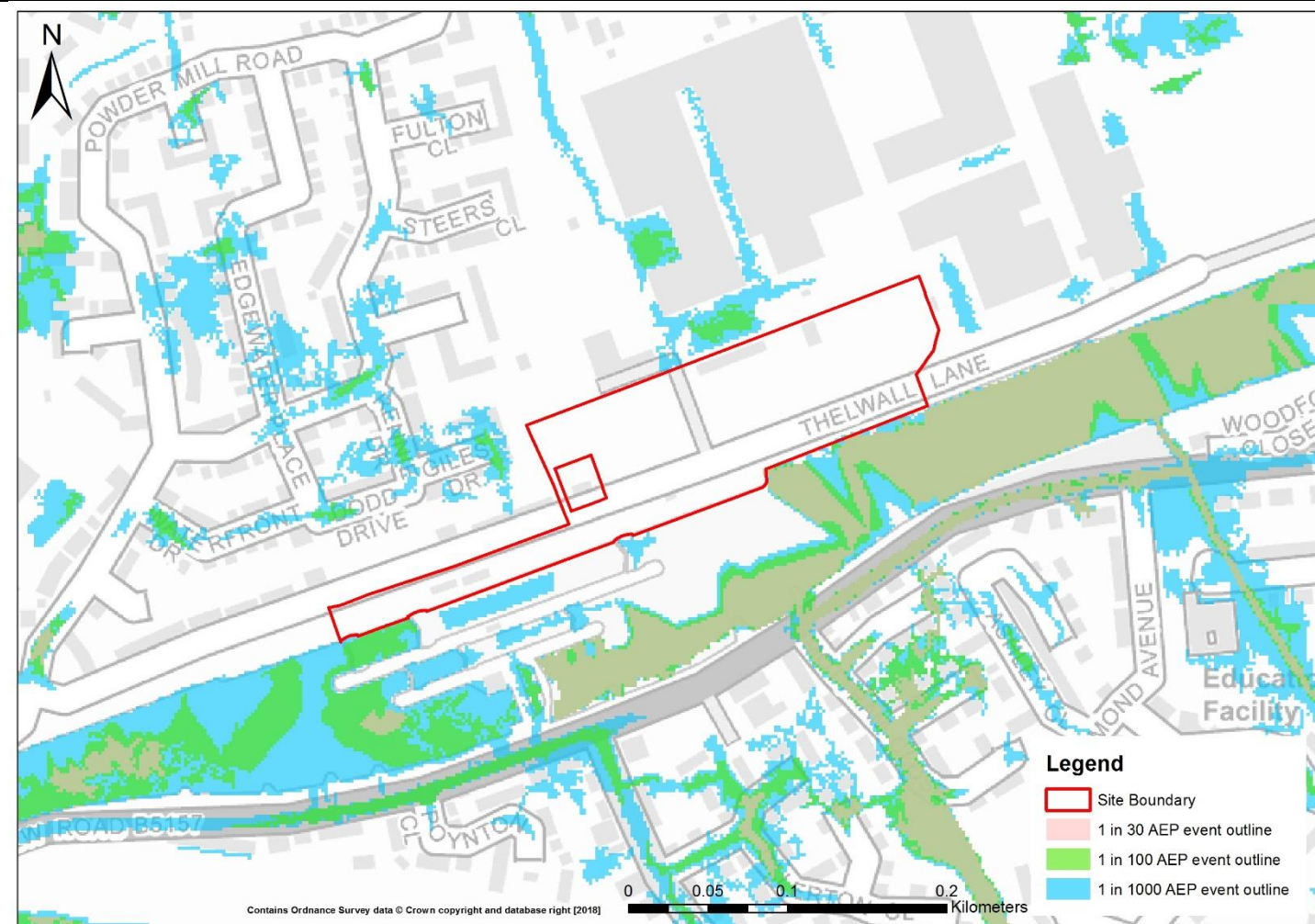


Figure 3.10.5 Surface Water Flood Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.03	0.03	0.20
Surface water flooding depths	Max: 0.30-0.60m Mean: 0.25m	Max: 0.30-0.60m Mean: 0.26m	Max: >1.20m Mean: 0.42m
Surface water hazards	Max: Moderate Mean: Low	Max: Moderate Mean: Moderate	Max: Significant Mean: Moderate
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to	<ul style="list-style-type: none"> <li>Over 99% of the site is outside of surface water flood extents and therefore is at very low risk from surface water flooding.</li> </ul>		

Proposed Site		Land at Thelwall West				
development site	<ul style="list-style-type: none"> <li>Over 99% of the site does not fall within the available surface water flood extents and therefore, is at very low risk from surface water flooding. However, as the site is within Flood Zones 2 and 3a, an FRA will be required. The FRA should quantify the volume of surface water runoff generated by development and provide volumes of attenuation required to ensure that runoff from the site does not increase surface water flood risk elsewhere.</li> </ul>					
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>A safe access/egress route exists as Thelwall Lane is unaffected by surface water flooding.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Infiltration SuDS may not be feasible as the site is previously developed.</li> <li>Development should avoid the 0.1% AEP outline. As this is 0.2% of the total site area, the effect on development is nominal.</li> </ul>					
Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical				Qbar: 8.89 l/s Q30: 15.11 l/s Q100: 18.49 l/s		
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	10	1273	272	1001	36.7	0.07 ha 2.82 %
3.33% AEP Rainfall + 40%	12	1545	326	1219	44.7	0.08 ha 3.43 %
1% AEP Rainfall + 20%	9.75	1718	324	1393 (392 exceedance storage)	41.7	0.09 ha 3.92 %
1% AEP Rainfall + 40%	11.5	2066	383	1684 (465 exceedance storage)	50.4	0.11 ha 4.74 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					

Proposed Site	Land at Thelwall West
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>• Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>

**3.11 2657 – New Cut Lane Industrial Estate**

Proposed Site	New Cut Lane Industrial Estate
Site area (ha)	15.07
Existing use	Industrial
Existing flood risk vulnerability classification	Less Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	12.81

Flood outlines (current day)

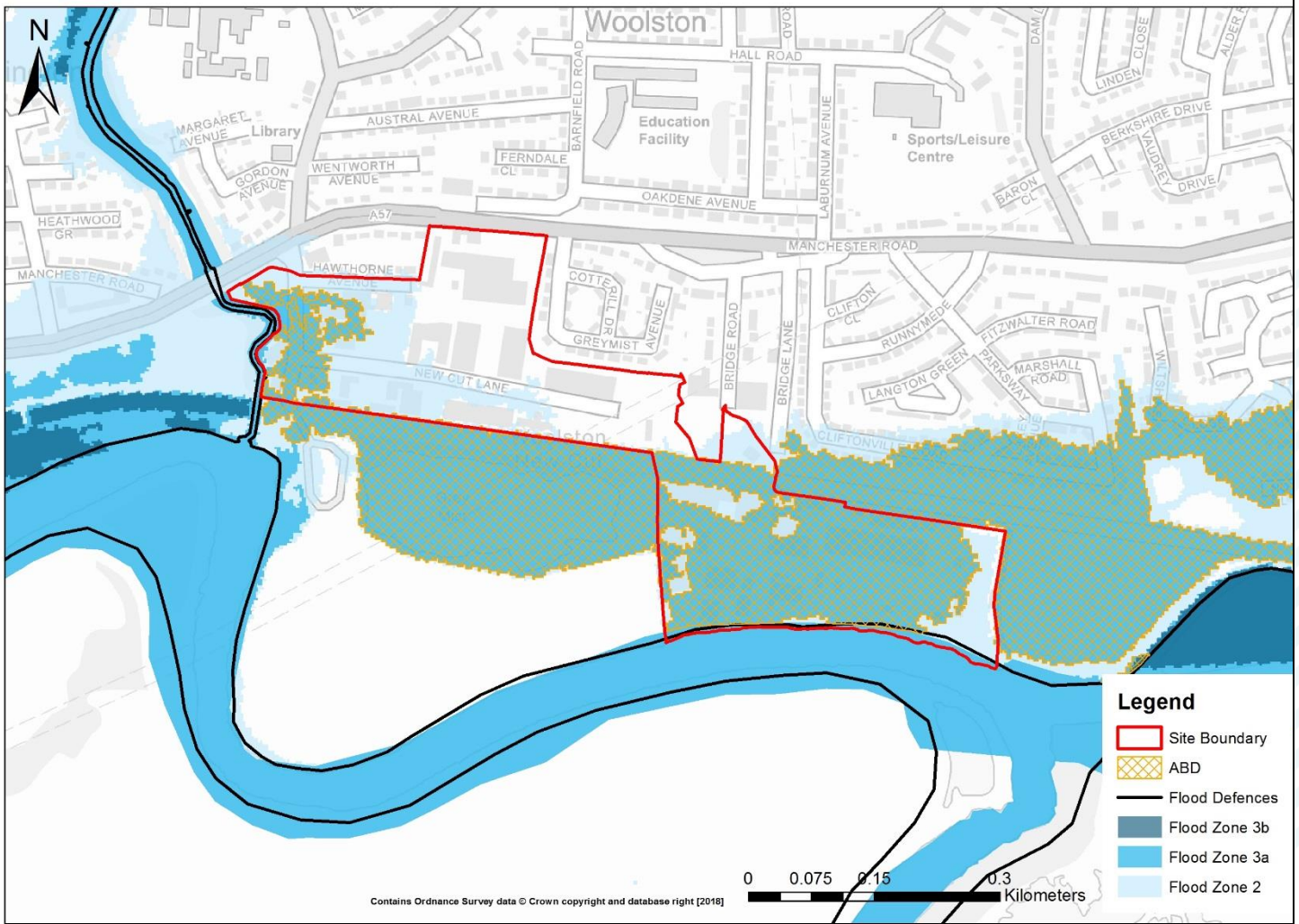


Figure 3.11.1 Flood Zone Mapping, Flood Defences and ABDs

Proposed Site

New Cut Lane Industrial Estate

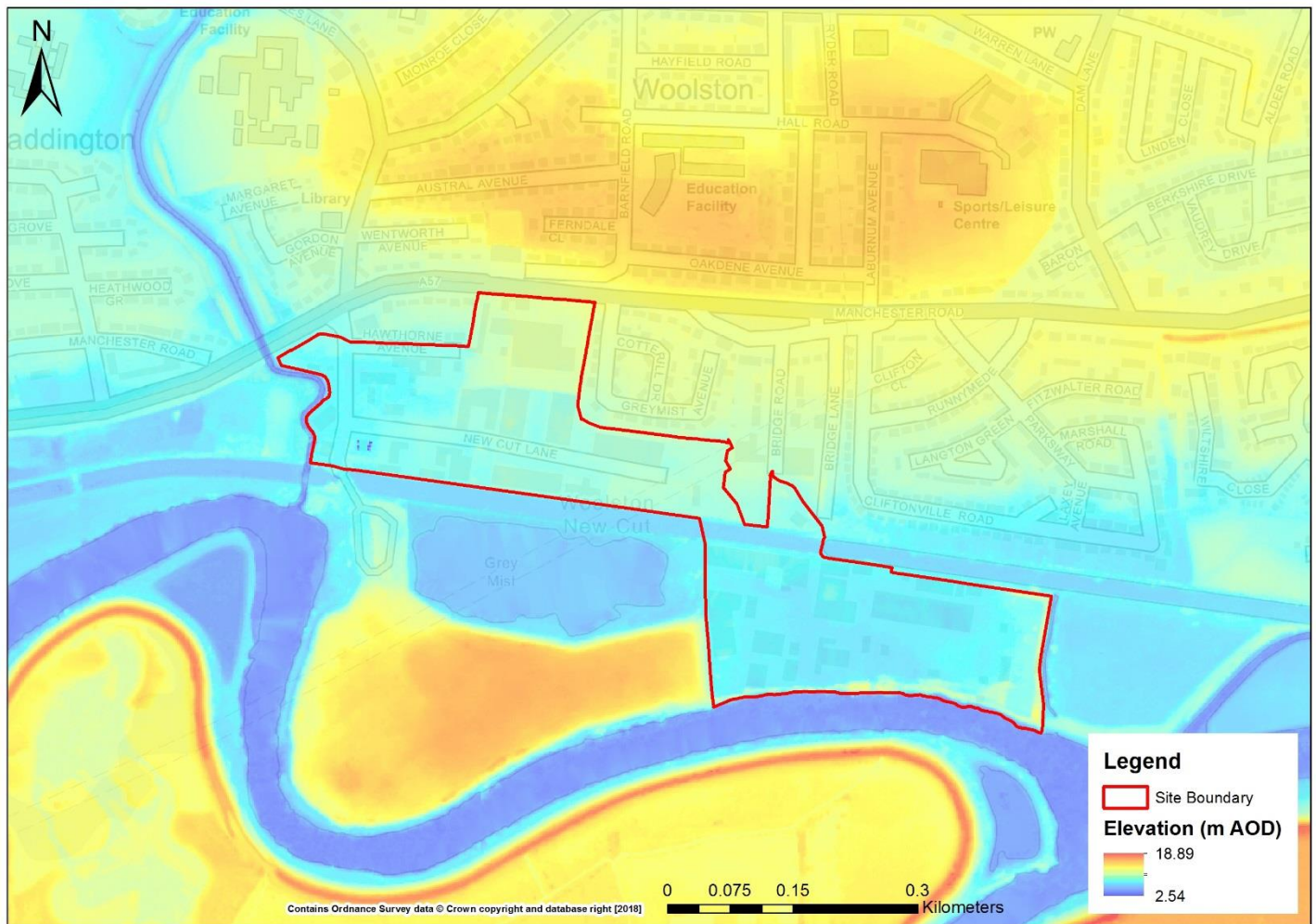


Figure 3.11.2 Site with 2m LIDAR (elevation data)

© Crown Copyright, All rights reserved. 2019 License number 100019628.

Contains OS data © Crown copyright and database right (2019)

Contains public sector information licensed under the Open Government Licence v3.0.

Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The site is bound by the River Mersey to the South and Birchwood Brook to the West. The Woolston New Cut ordinary watercourse also runs through the centre of the site, according to the EA's Detailed River Network (DRN) dataset.
- Fluvial is the primary source of flood risk.
- Fluvial modelling was not provided for this study (Appendix A –Original site list supplied in Data Request), as such flood zone mapping was used instead as an indicator of risk.
- Risk from tidal flooding is low, tidal risk is seen to be contained within the Mersey channel.
- The risk of surface water flooding is low.
- Much of the surface water flooding is contained by existing development. There is significant surface water risk to a public footpath that splits the site horizontally.
- 44% of the site area is within Flood Zone 3a with another 26% being in defended FZ2.



Proposed Site	New Cut Lane Industrial Estate
---------------	--------------------------------

- Approximately 56% of the site is in Flood Zone 1 and 2 and for these areas, residential development is permitted.
- The site is changing risk classification from less vulnerable to more vulnerable.

Flood Source: Fluvial/Tidal			
-----------------------------	--	--	--

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	26.03	43.81	0.00
Tidal: Depth (m)	0.47	0.53	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate Change

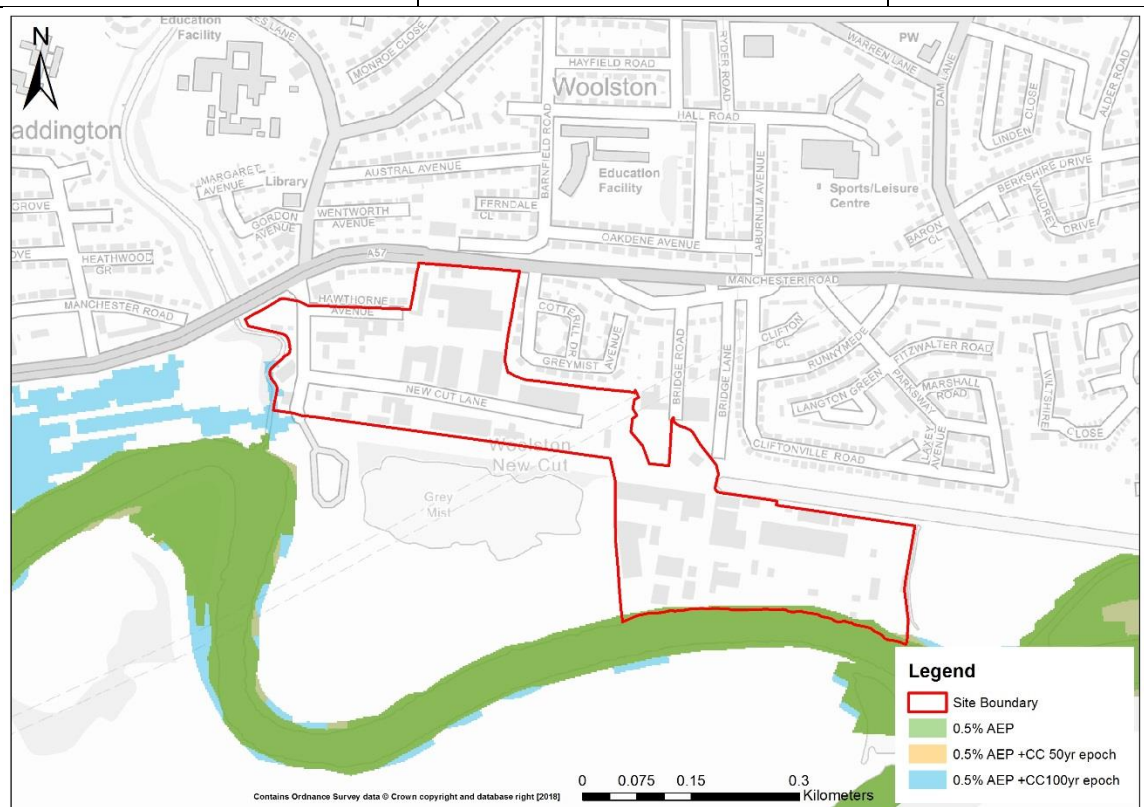


Figure 3.11.3 Tidal outlines for present day 0.5% AEP and future risk 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases

Tidal (defended):

- There is minimal tidal risk to the site based on the modelled flood outlines of the 0.5% AEP event with 50yr (2065) and 100yr (2115) epochs (cumulative sea level rise for the next 100 years) of climate change allowances.
- Only at the most southern end and westerly corner is there encroachment into the site of flooding.

Proposed Site

New Cut Lane Industrial Estate

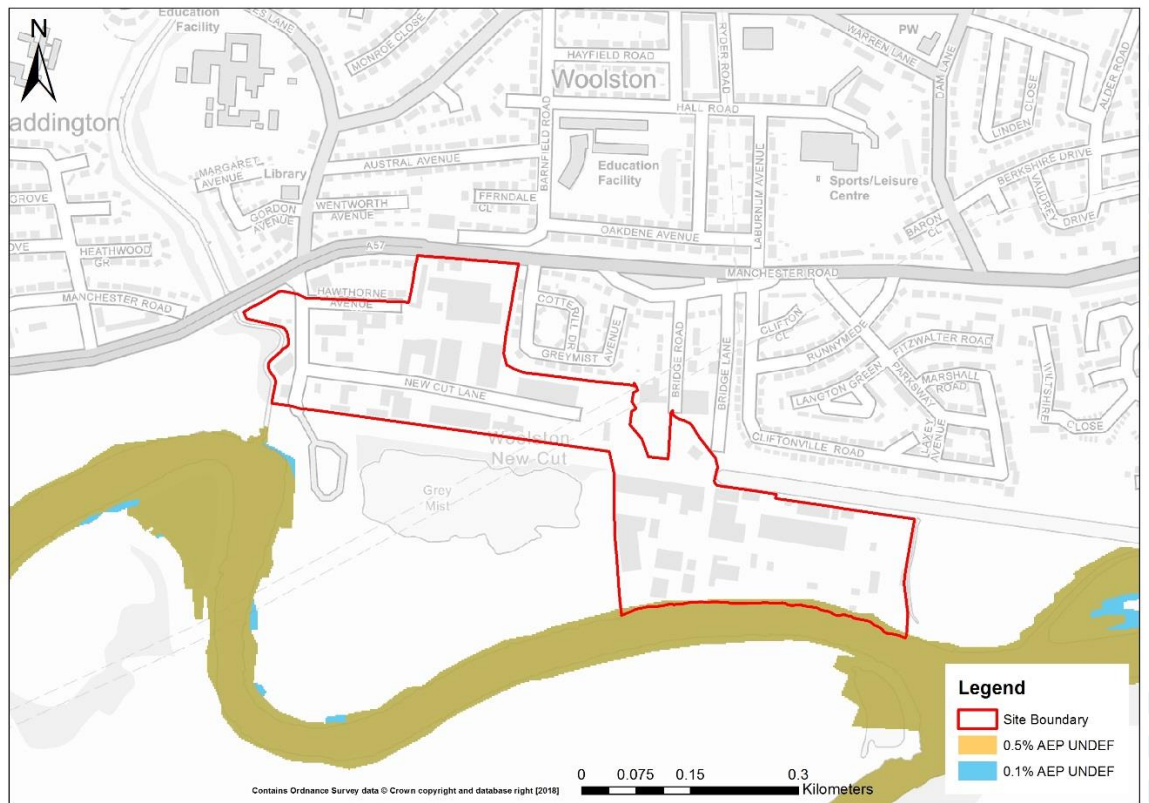


Figure 3.11.4 Tidal outlines for the undefended scenario 0.5% AEP and 0.1% AEP events

Tidal (undefended):

- There is minimal tidal risk to the site based on the modelled undefended scenarios in the 0.5% AEP or 0.1% AEP events.
- Despite the absence of defences in this scenario, risk from tidal flooding is still limited to the channel.

There are spatial flood defences in place along the banks of the River Mersey which prevent flooding, see Figure 3.11.6. The southern edge of the site borders directly onto the Mersey, here you can see some overlap with the modelled outlines into the site.

Proposed Site

New Cut Lane Industrial Estate

Fluvial Flood Risk and Climate Change

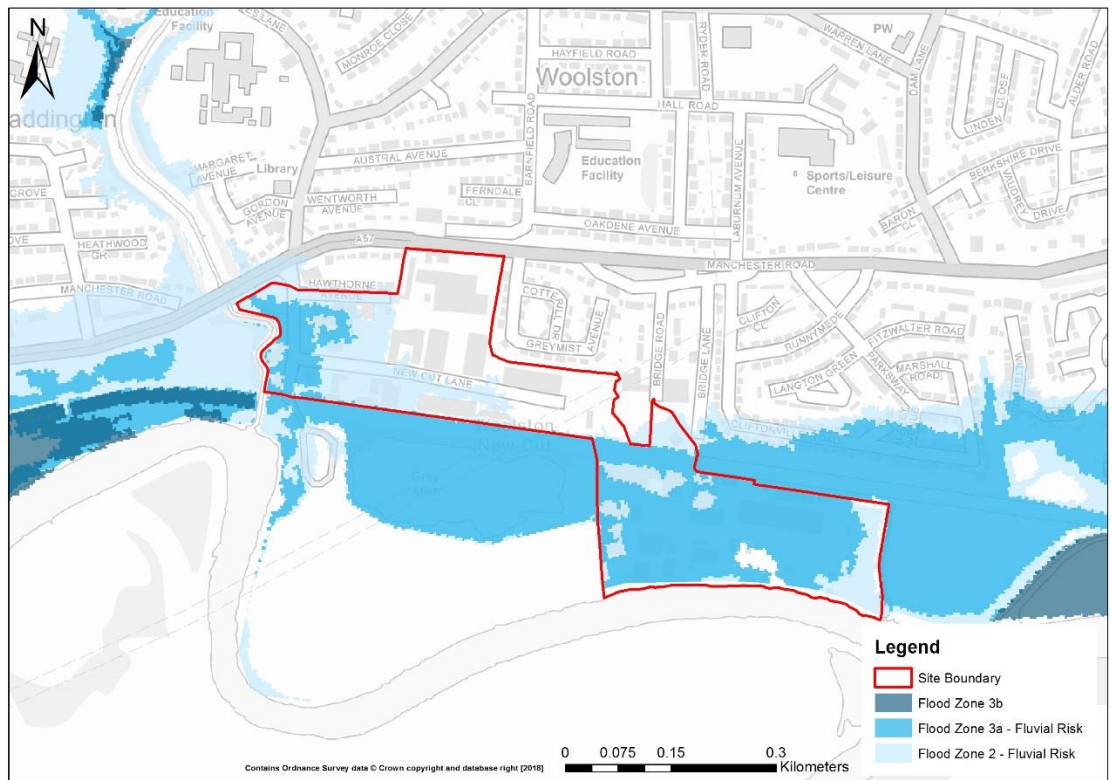
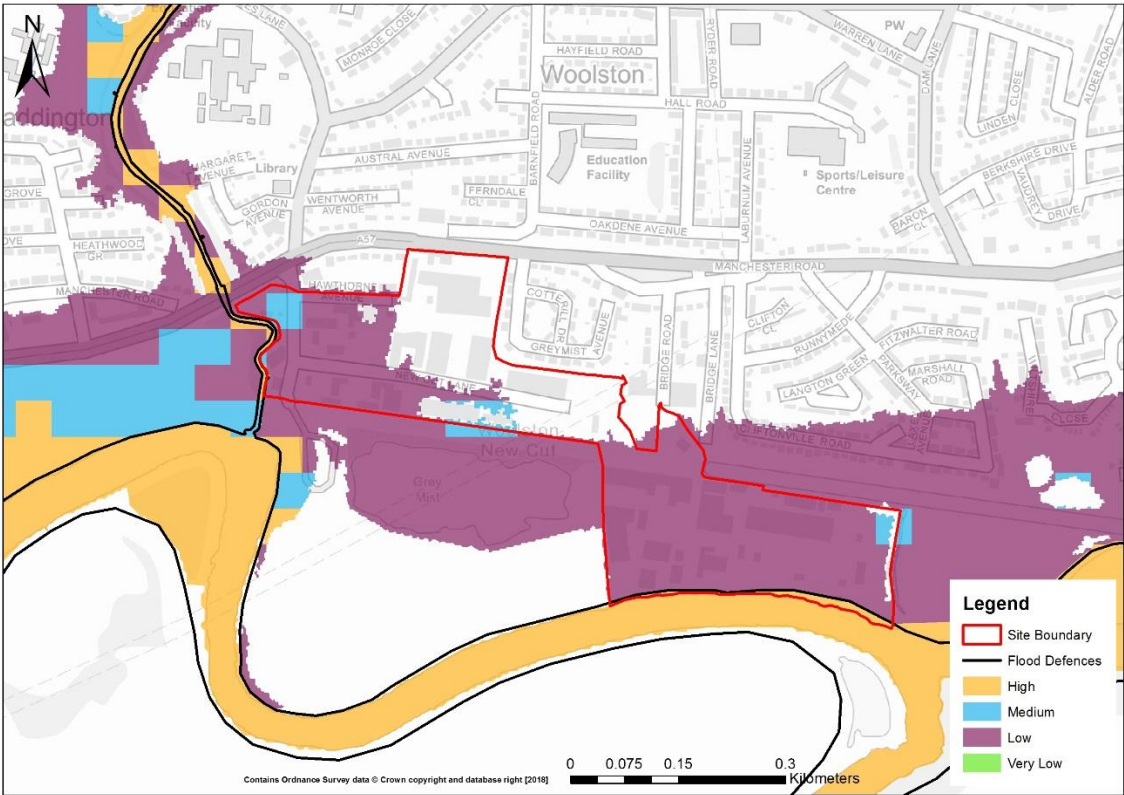


Figure 3.11.5 Fluvial only Flood Zone Mapping

- Fluvial only flood risk is similar to Figure 3.11.1. Additionally, noting the removal of the defences in Figure 3.11.4 with minimal flooding to the site, these both conclude that fluvial is a primary means of flooding at this site.
- The southern areas of the site are most susceptible to flooding and are located within Flood Zone 3a, the northern parts of the site lie within Flood Zone 2 or outside flood zones.
- No parts of the site are within fluvial Flood Zone 3b.
- There remains no clear access/egress route as New Cut Lane is inundated with flooding.

Proposed Site	New Cut Lane Industrial Estate
<p>Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map</p>	 <p>Figure 3.11.6 Site displaying flood risk from rivers and the sea</p> <ul style="list-style-type: none"> <li>• The majority of the site is classified as low risk (between 1% and 0.1% AEP design event) of flooding occurring in a year.</li> <li>• The placement of the defences suggests an important role in flood prevention due to the high risk classification in the channel (&gt;3.33% AEP) though this is most likely related to fluvial risk and not tidal.</li> </ul>
<p>Historic flooding</p>	<ul style="list-style-type: none"> <li>• The site is located outside any Environment Agency historic flood outlines though there is a recorded flood incident from United Utilities within the site.</li> </ul>
<p>Defences</p>	<ul style="list-style-type: none"> <li>• Available EA flood defence asset data indicates that the site is defended along its Southern boundary with the River Mersey by high ground that has a condition grade of 5. This defence should be reviewed by the EA based on Table 1.1 of the Condition Assessment Manual 2012.</li> <li>• There are additional defences along the Western boundary with Birchwood Brook by high ground with condition grade 2/3.</li> </ul>
<p>Flood Warning Area</p>	<ul style="list-style-type: none"> <li>• 82% of the proposed site lies within an EA FWA, described as “Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also parts of Howley, Wilderspool, Latchford, Westy, Paddington and Woolston”.</li> </ul>

Proposed Site	New Cut Lane Industrial Estate
Mitigation options & site suitability	<ul style="list-style-type: none"> <li>• Much of the Flood Zone 3a risk area is confined to the area south of the Woolston New Cut watercourse and to the western boundary of the site. Development in these areas should be avoided if possible. If not, redevelopment of the site may not be permitted.</li> <li>• The southern boundary should be shifted northwards to remove the tidal risk from the site. As recommended by the EA, there should always be an 8m buffer strip between any proposed development and watercourse.</li> <li>• Fluvial risk from the Mersey and Birchwood Brook could be provided for the present day, also taking account of flood defences to ascertain areas benefitting from defences.</li> <li>• Fluvial climate change should be modelled for the Mersey and Birchwood Brook as part of a site-specific assessment, taking account of defences to ascertain whether the site can be safe for its lifetime and can therefore satisfy the requirements of the Exception Test. As nearly half of the site is within Flood Zone 3a, the EA would likely expect the upper end allowance of +70% to be added on to peak flows. Outcomes should be discussed with the EA to determine suitable resilience measures to put in place.</li> <li>• As risk is fluvial, compensatory storage areas would be required for any land raising. As nearly half the site is at risk, the existing 3a areas should be used for storage, once current buildings have been demolished.</li> <li>• Possible options for ground level retail, employment, car parking with first floor residential could be considered. Elevation levels in the south of the site (where there is fluvial inundation) are ~1.5m lower than the north of the site. Further detailed fluvial modelling would provide more information and confidence for this option.</li> <li>• The River Mersey flood defence with its condition grading of 5 should be discussed with the EA to ascertain the consequences of this. Any future development at this site should be considered sustainable without a continued reliance on flood defence investment and maintenance.</li> <li>• Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>• Safe access/egress routes should be focused on Bridge Lane and Bridge Road in the centre of the site as these remain free from tidal and fluvial risk. Safe routes must be determined in a development sites emergency plan.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>• Due to the site's proximity to the River Mersey, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>

**Proposed Site** **New Cut Lane Industrial Estate**

**Flood Source: Infrastructure Failure – Reservoirs**

Flood risk: reservoir

- The site is not located within reservoir flood extents.

**Flood Source: Infrastructure Failure – Canals**

Flood risk: canal

- The site is not located within canal flood extents.

**Flood Source: Surface Water**

Surface Water Flood Risk to Proposed Development Site

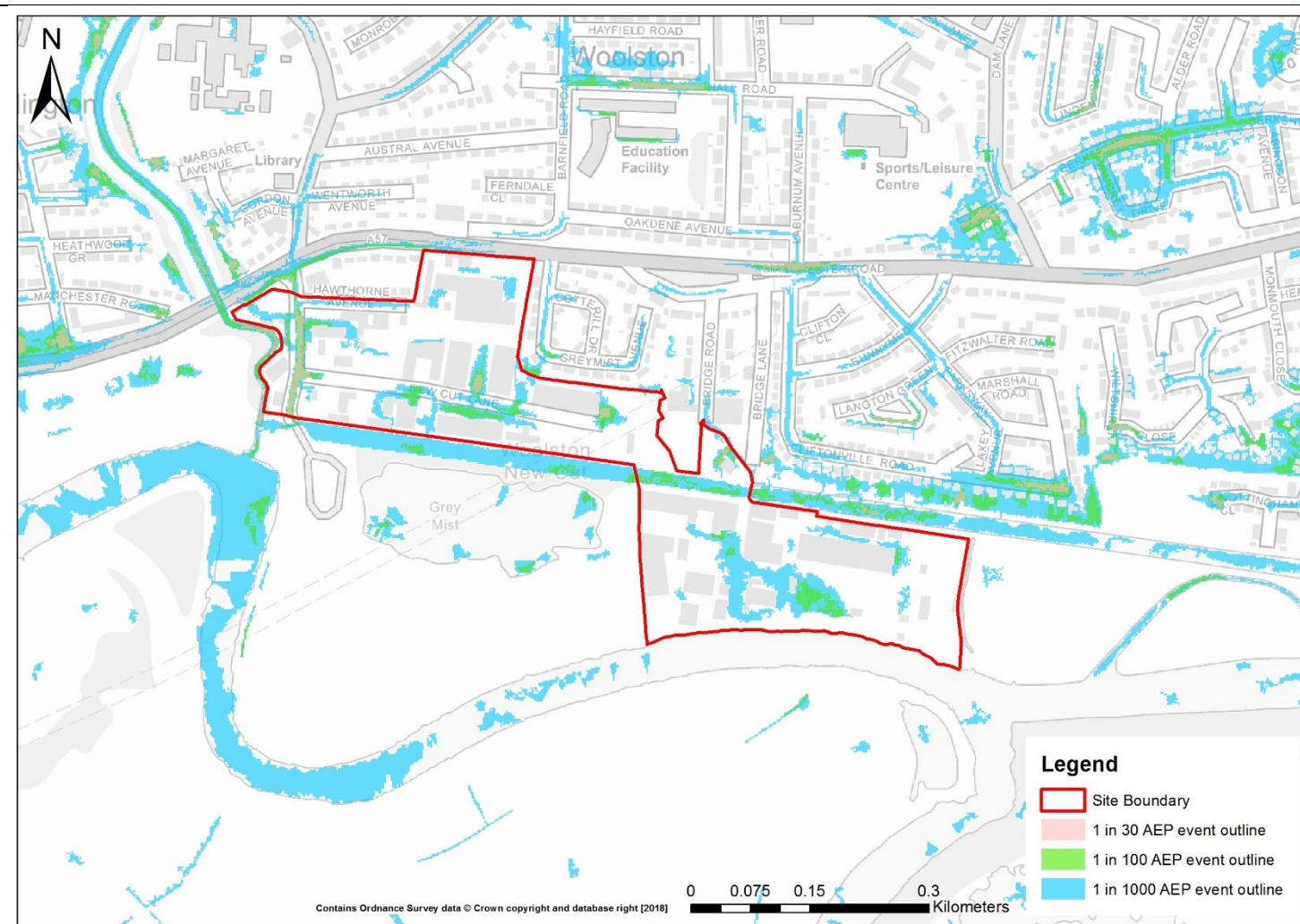


Figure 3.11.7 Surface Water Flood Mapping

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
		1.14	3.33
Surface water flooding depths	Max: 0.30-0.60m Mean: 0.2m	Max: 0.30-0.60m Mean: 0.25m	Max: >1.20m Mean: 0.39m

Proposed Site		New Cut Lane Industrial Estate	
Surface water hazards	Max: Moderate Mean: Low	Max: Significant Mean: Low	Max: Significant Mean: Moderate
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>The site is at very low risk from surface water during the 1% AEP event. The extent of the flooding is contained by existing development and has a mean depth of 0.25 m.</li> <li>There are no significant site access/egress issues during the 1% AEP event.</li> <li>To the northern edge of the site, the A57 does see some flooding during the 1%AEP event though this is localised and is not extensive.</li> <li>The main access route along New Cut Lane is flooded to a depth of 0.30-0.60m during the 0.1% AEP event.</li> </ul>		
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>New Cut Lane is currently the primary access route to the site, however for the 1% AEP event, it is inundated by surface water flooding. The A57 (North of the site) is at very low risk from surface water flooding and could be utilised for access/egress instead if accessible without using New Cut Lane.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Infiltration SuDS may not be feasible as the site is previously developed.</li> <li>Development should avoid the 0.1% AEP outline, however, as much of the flooding is contained by existing development, redevelopment of the site may significantly change the behaviour of the surface water and this must be accounted for in an FRA.</li> </ul>		

### Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)

Proposed Development limiting runoff rate: Greenfield – FEH Statistical				Qbar: 42.39 l/s Q30: 72.06 l/s Q100: 88.17 l/s		
Design flood event (inc CC)	Critical storm duration Hrs	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	12	8466	1556	6909	53.1	0.46 ha 3.05 %
3.33% AEP Rainfall + 40%	12	9876	1556	8320	64.0	0.55 ha 4.67 %
1% AEP Rainfall + 20%	17	12139	2205	9934 (3025 exceedance storage)	76.4	0.66 ha 4.39 %

Proposed Site				New Cut Lane Industrial Estate		
1% AEP Rainfall + 40%	19	14439	2464	11974 (3654 exceedance storage)	92.1	0.80 ha 5.29 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					



### 3.12 2677 – Riverside Retail Park

Proposed Site	Riverside Retail Park
Site area (ha)	5.46
Existing use	Commercial
Existing flood risk vulnerability classification	Less Vulnerable
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	4.64

Flood outlines (current day)

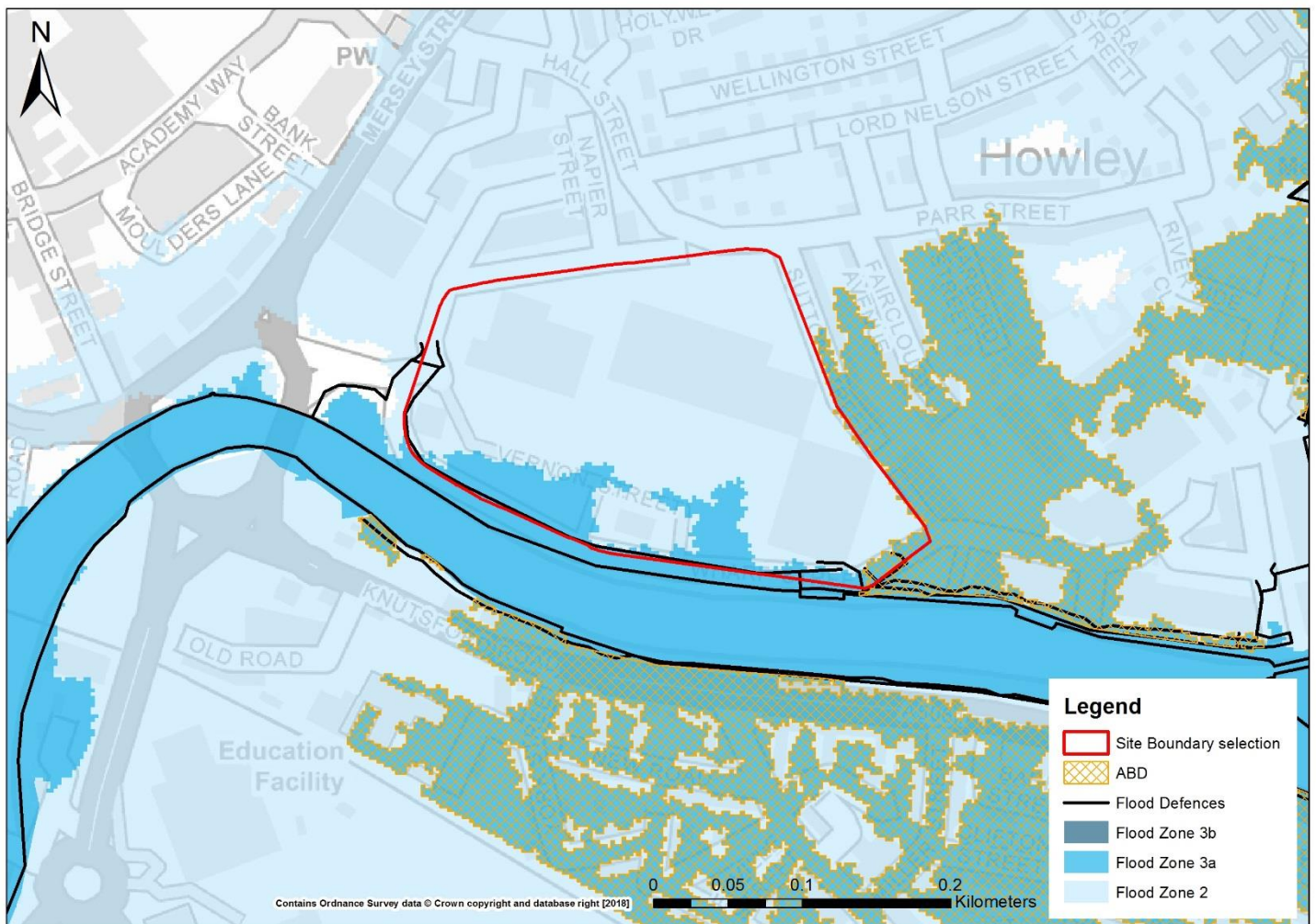


Figure 3.12.1 Flood Zone Mapping, Flood Defences and ABDs

Proposed Site

Riverside Retail Park

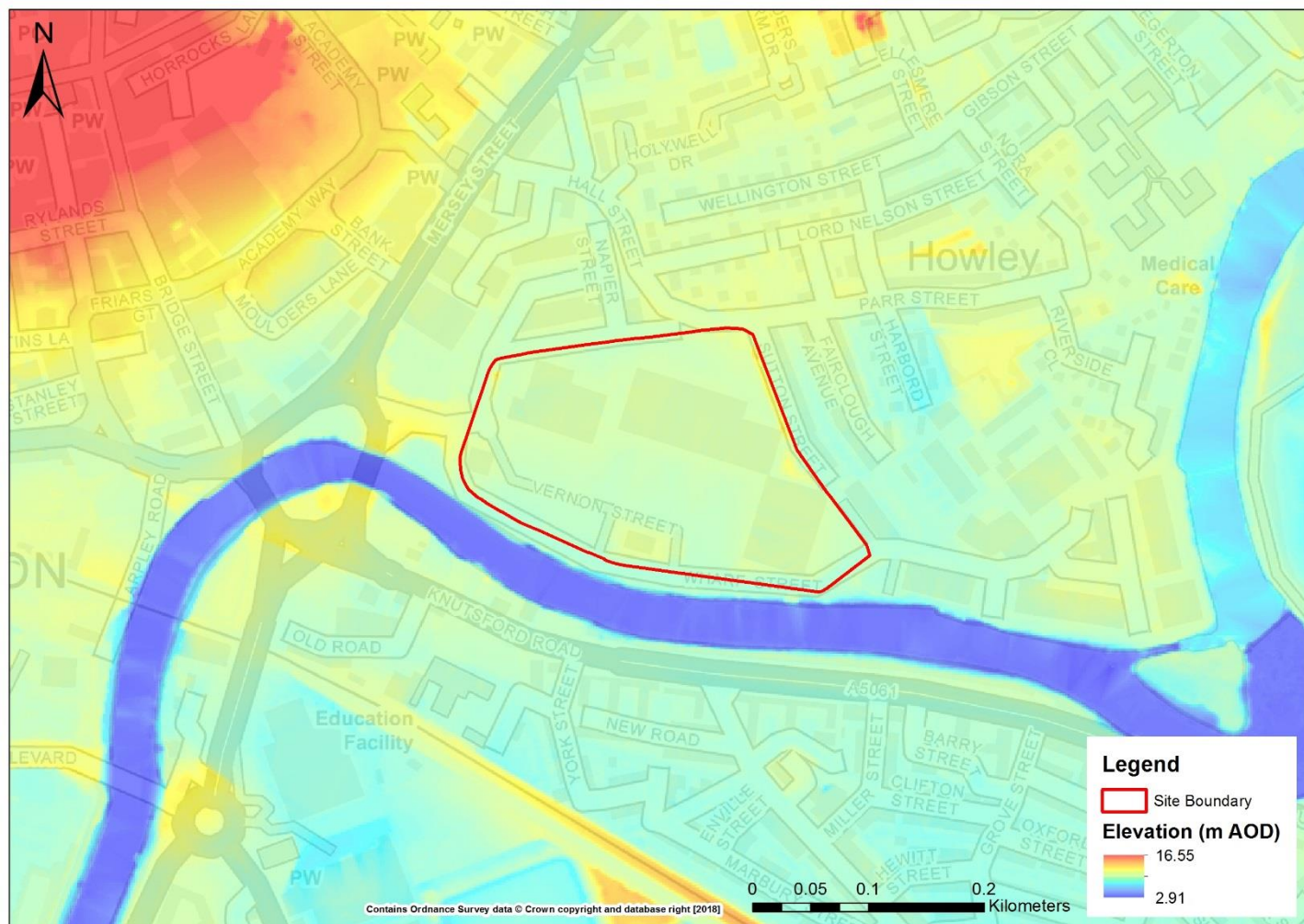


Figure 3.12.2 Site with 2m LIDAR (elevation data)

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The River Mersey bounds the South of the site for which there is both a fluvial and tidal flood risk.
- Fluvial and tidal are the primary sources of flood risk.
- Over 85% of the site is in Flood Zone 2 and approximately 14% is in Flood Zone 3a.
- Fluvial modelling of the Mersey was unavailable for the study (Appendix A –Original site list supplied in Data Request), current flood zone mapping was used in place.
- Flood defences in place prevent tidal risk to the site in a 0.5% AEP current day event. Climate change increases see flooding to the site during a 50yr and 100yr epoch, see Figure 3.12.3.
- The risk of surface water flooding is predominantly low and appears to be generally limited to areas of car parking, hardstanding and internal distributor roads.
- The Wharf Industrial Estate is adjacent to this site in the east.

**Proposed Site** Riverside Retail Park

- The site is changing risk classification from less vulnerable to more vulnerable.

**Flood Source: Fluvial/Tidal**

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	85.88	14.12	0.00
Tidal: Depth (m)	0.17	0.18	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate change

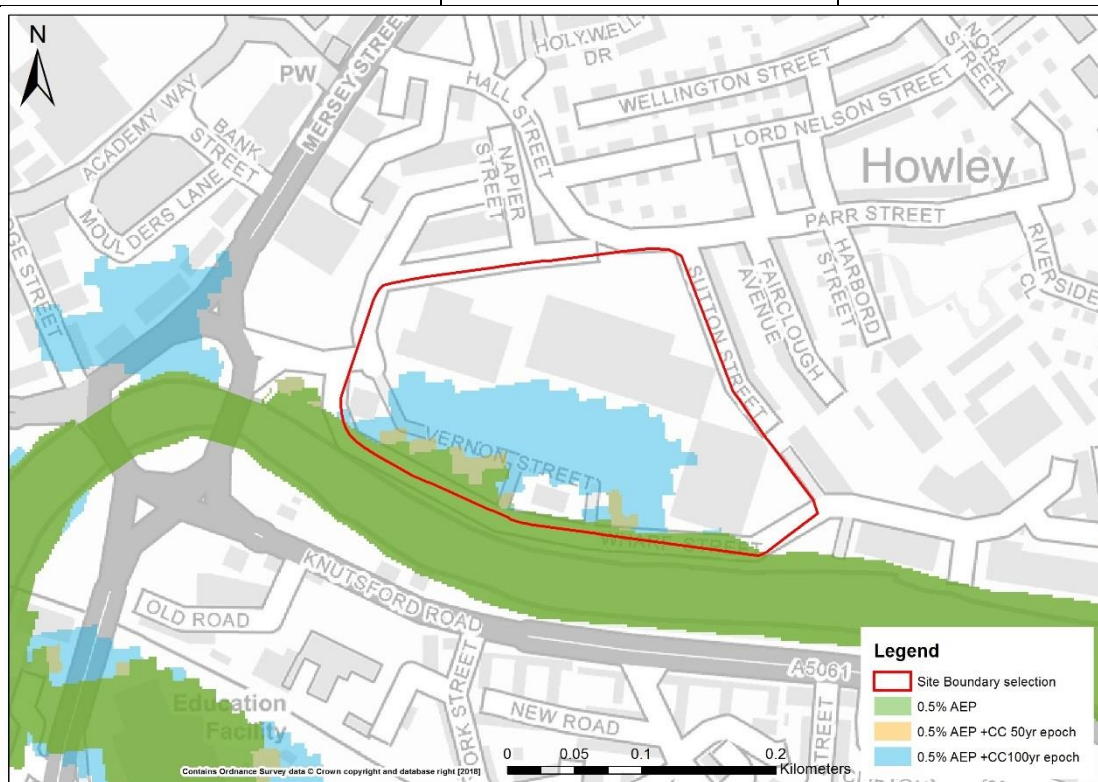


Figure 3.12.3 Defended Tidal outlines for present day 0.5% and future risk 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases

Tidal (defended):

- The 2015 Mersey Estuary model indicates that the 0.5% AEP 100-year epoch (cumulative sea level rise for the next 100 years) climate change extents inundate the South of the site due to overtopping of the existing River Mersey flood defences. The 0.5% AEP 50-year epoch also inundates the site, but the overall volume of flood water is reduced.

Proposed Site

Riverside Retail Park

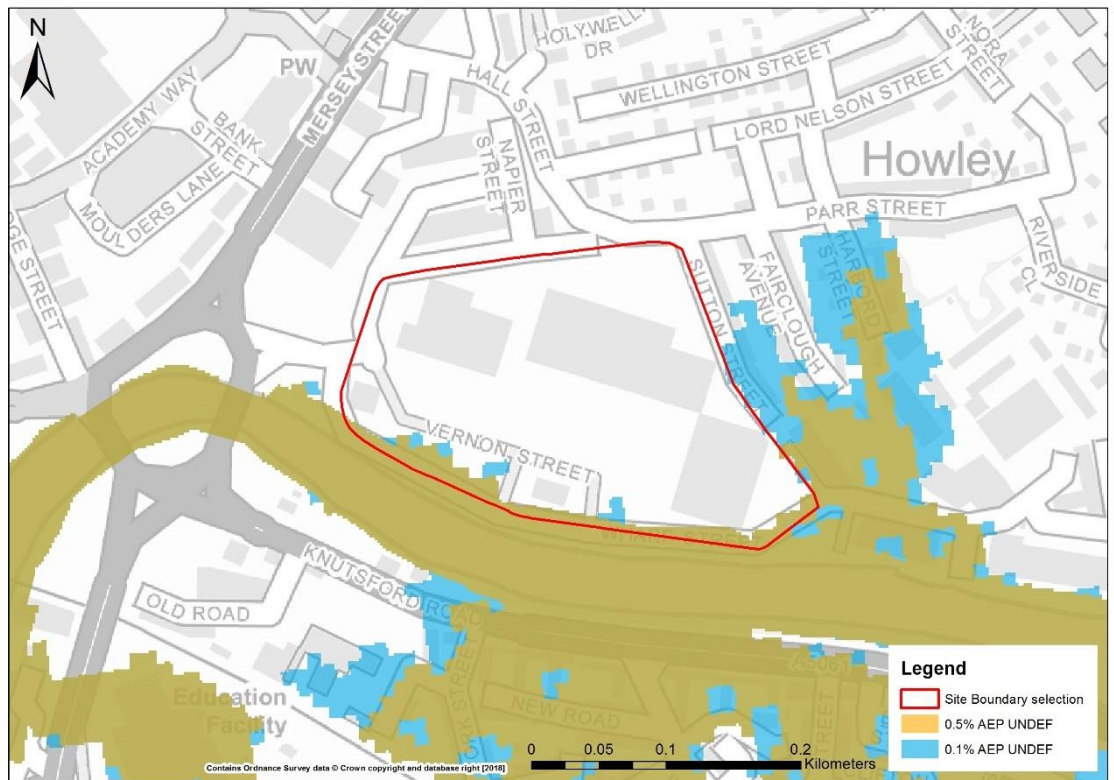


Figure 3.12.4 Tidal outlines for the undefended scenario 0.5% AEP and 0.1% AEP events

Tidal (undefended):

- The baseline modelled extents indicate that much of the site is free from flooding during the 0.5% and 0.1% AEP undefended scenario (Figure 3.12.4).
- The tidal flooding that is indicated is local to the Southern bound of the site.

Proposed Site

Riverside Retail Park

Fluvial Risk and  
Climate Change

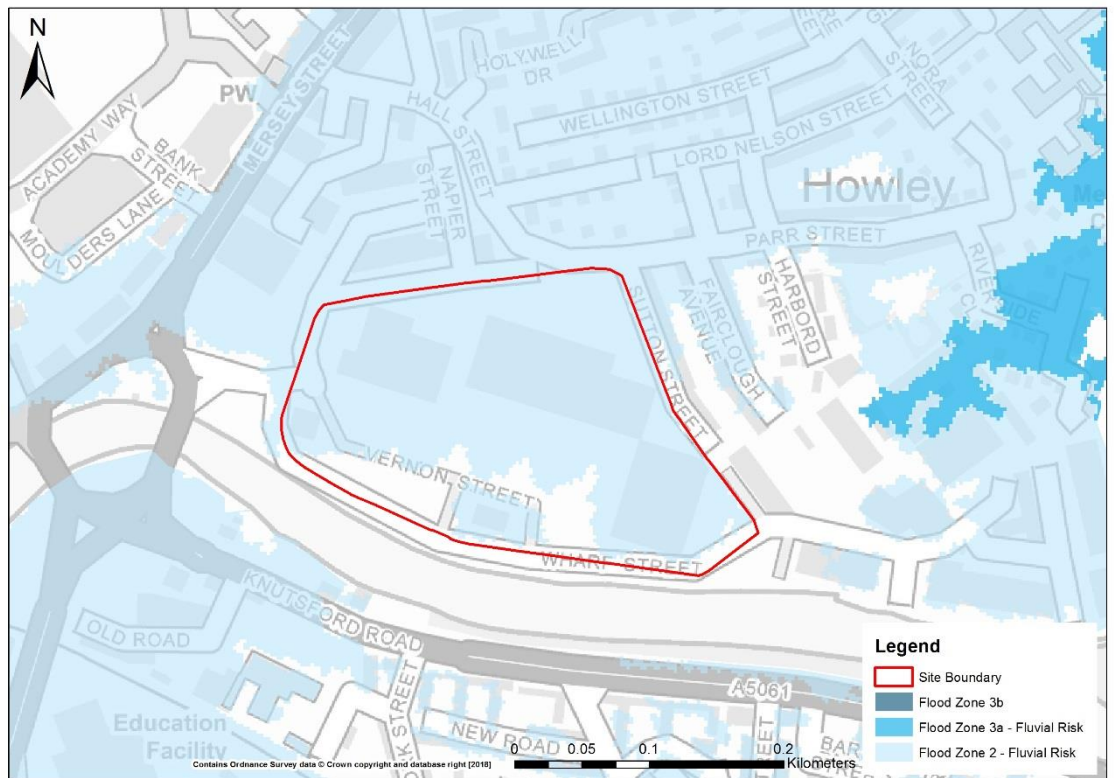


Figure 3.12.5 Fluvial only Flood Risk

- With fluvial only risk, the site is no longer within Flood Zone 3a, with it within Flood Zone 2 only.
- Much of the surrounding area is also within Flood Zone 2 and as such would be inundated with water.
- Flood defences are present alongside the banks of the River Mersey though there is an absence of flooding along Wharf Street. This could suggest that flooding may be originating further upstream and moving into the site through its northern boundary.

**Proposed Site** | **Riverside Retail Park**

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

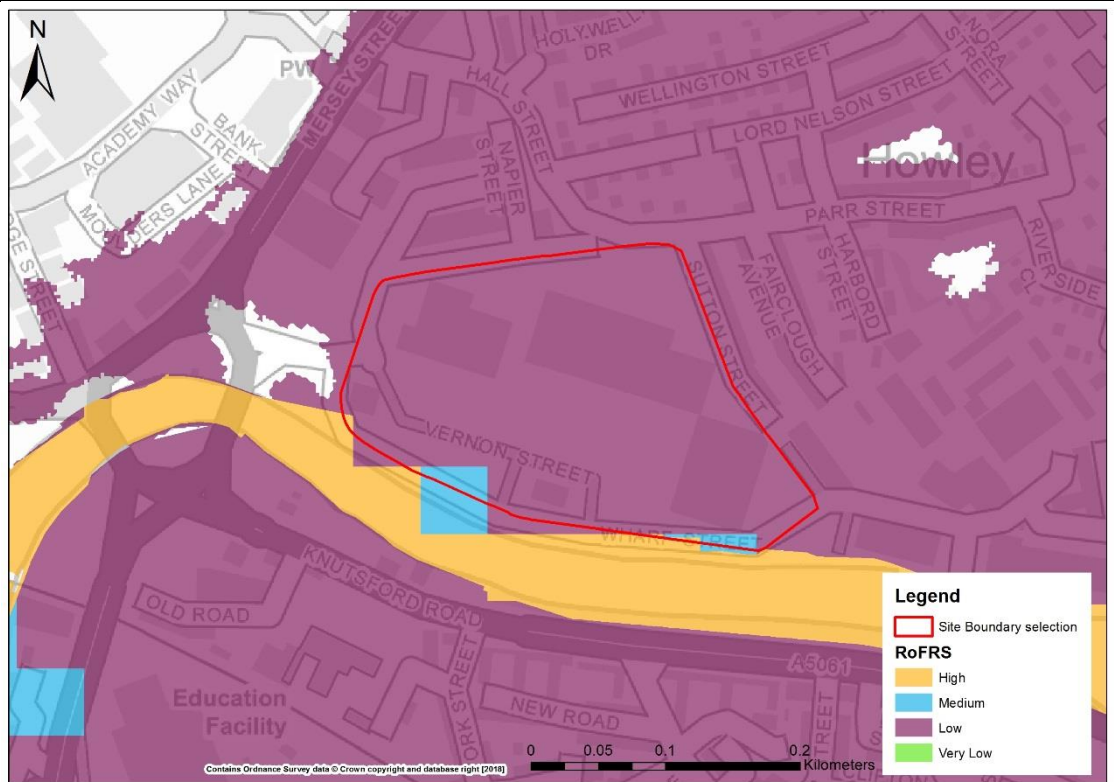


Figure 3.12.6 Site displaying flood risk from rivers and the sea

- The risk at this site is highly similar to risk seen at the Wharf Industrial Estate, which borders this site immediately to the right. This being a low risk of flooding and a high reliability of data at a street to parcels of land scale.

Historic flooding	<ul style="list-style-type: none"> <li>• 33% of the site is contained within the historic flood map outline.</li> </ul>
Defences	<ul style="list-style-type: none"> <li>• Available EA flood defence asset data indicates that Riverside Retail Park benefits from two lines of high ground that have a condition grade of ½ (Table 1.1 Condition Assessment Manual 2012).</li> </ul>
Flood Warning Area	<ul style="list-style-type: none"> <li>• 55% of the proposed site lies within an EA FWA, described as “Areas at risk include parts of Manor Park and Sandymoor Runcorn. Also parts of Howley, Wilderspool, Latchford, Westy, Paddington and Woolston”.</li> <li>• 10% of the proposed site lies within an EA FWA, described as “The Howley area of Warrington is at risk of flooding from the Estuary due to high tides. Areas at risk include the Riverside Retail Park; Wharf St; Wharf St industrial estate; Riverside Cl, Parr St; Cleeves Cl; Harbord St; Fairclough Ave &amp; Sutton St”.</li> <li>• 3% of the proposed site overlaps both local FWAs.</li> </ul>
Mitigation options & site suitability	<ul style="list-style-type: none"> <li>• Flood Zone 3a should be left clear of development. This should be possible given only 14% of the site is at risk and that the risk area is generally confined to the southern boundary along the River Mersey. If Flood Zone 3a cannot be kept clear, then development of this part of the site may not be permitted.</li> <li>• The southern boundary of the proposed site could be shifted further north to take the site out of the current day 0.5% AEP tidal outline.</li> </ul>

Proposed Site	Riverside Retail Park
	<ul style="list-style-type: none"> <li>• As recommended by the EA, there should be an 8 m buffer strip between any proposed development and a watercourse.</li> <li>• Fluvial risk should be modelled for the Mersey for present day, defended and undefended. Defended scenario to ascertain residual risk from fluvial sources.</li> <li>• The EA would also expect fluvial climate change to be modelled for the Mersey, taking account of defences to ascertain whether the site can be safe for its lifetime and can therefore satisfy the requirements of the Exception Test. As half of the site is within Flood Zone 3a, the EA would likely expect the upper end allowance of +70% to be added on to peak flows. Outcomes should be discussed with the EA to determine suitable resilience measures to put in place.</li> <li>• Options for ground level retail, employment, car parking with first floor residential could be considered.</li> <li>• Wharf Street could be a safe/dry access and egress route, lying outside present-day tidal risk, at a low fluvial risk at low risk of surface water inundation. These routes need to be accounted for and designated within an Emergency Plan for the site.</li> <li>• Any future development at this site should be considered sustainable without a continued reliance on flood defence investment and maintenance.</li> <li>• Existing low-lying areas along the Mersey within the site could be utilised for attenuation storage.</li> <li>• Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>• Data unavailable</li> </ul>
<b>Flood Source: Infrastructure Failure – Reservoirs</b>	
Flood risk: reservoir	<ul style="list-style-type: none"> <li>• The site is not located within reservoir flood extents</li> </ul>
<b>Flood Source: Infrastructure Failure – Canals</b>	
Flood risk: canal	<ul style="list-style-type: none"> <li>• Data unavailable</li> </ul>

Proposed Site

Riverside Retail Park

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

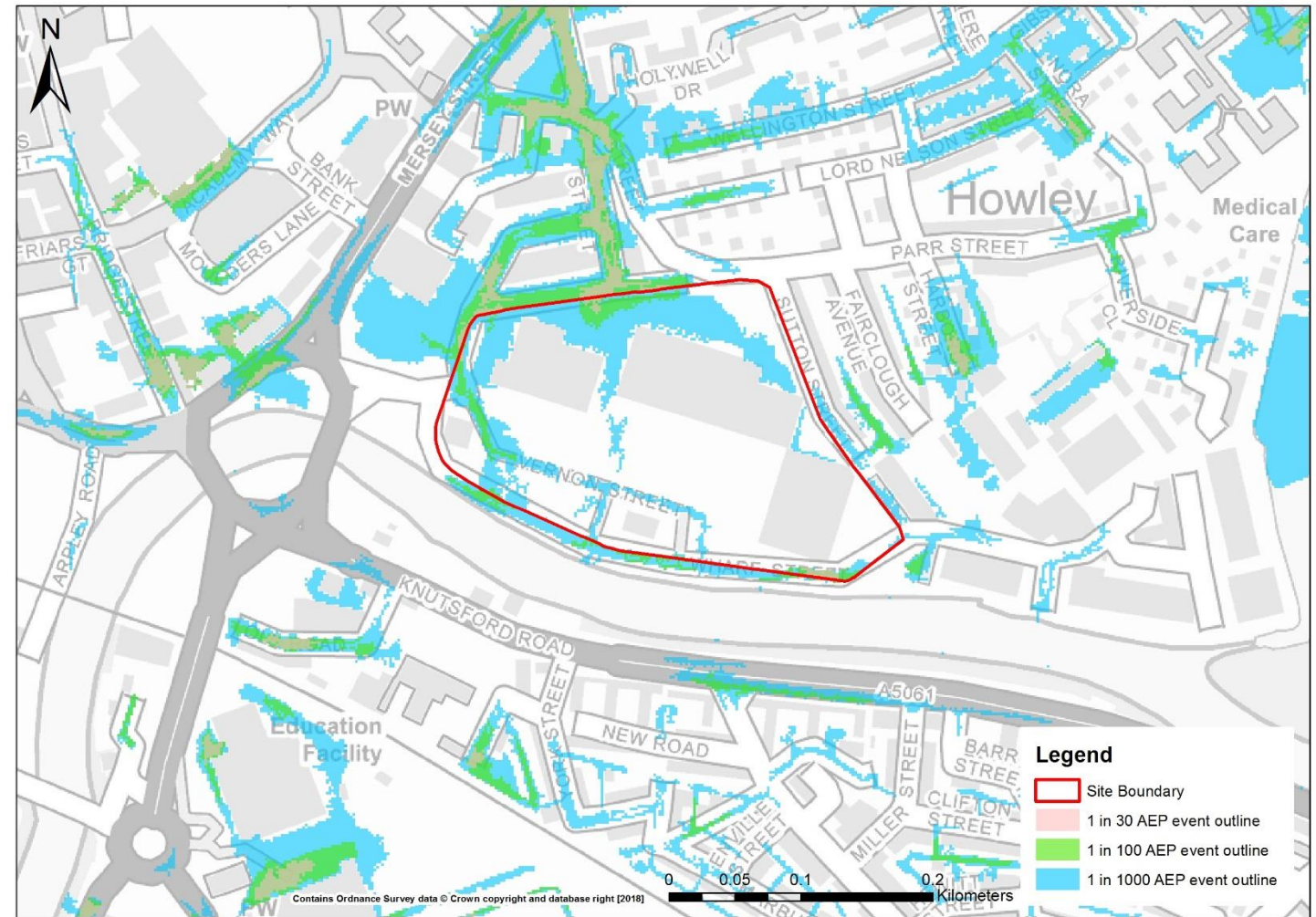


Figure 3.12.7 Surface Water Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.57	2.86	18.30
Surface water flooding depths	Max: 0.15-0.30m Mean: 0.18m	Max: 0.30-0.60m Mean: 0.22m	Max: 0.30-0.60m Mean: 0.37m
Surface water hazards	Max: Low Mean: Low	Max: Moderate Mean: Low	Max: Significant Mean: Low
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to	<ul style="list-style-type: none"> <li>Approximately 3% of the site is at risk of surface water flooding during the 1% AEP event. Much of the flooding is contained by existing development, specifically, large areas of impermeable</li> </ul>		



Proposed Site	Riverside Retail Park
development site	<p>surface immediately North of the retail units. In addition to this area, the flooding is generally limited to access roads and car parks.</p> <ul style="list-style-type: none"> <li>• There are no significant site access/egress issues during the 1% AEP event.</li> <li>• Significant hazards are present during the 0.1% AEP where surface water inundates to the North and West of the site.</li> </ul>
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>• A safe access/egress route will need to be determined during the 0.1% AEP.</li> <li>• Whilst surface water depths are on average 0.30-0.60m in the 0.1% AEP, they are lower in the 1% AEP and 3.33% AEP events (mean: 0.15-0.30m). This flooding appears to be generally limited to areas of car parking, hardstanding and internal distributor roads.</li> <li>• Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>• Infiltration SuDS may not be feasible as the site is previously developed.</li> <li>• Development should avoid the 0.1% AEP outline, however, as much of the flooding is contained by existing development (large areas of impermeable surface), redevelopment of the site may significantly change the behaviour of the surface water and this must be accounted for in an FRA. Surface water attenuation may be desirable where large volumes flood Parr Street and into the Northern bound of the site during the 0.1% AEP event.</li> </ul>

### Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)

Proposed Development limiting runoff rate: Greenfield – FEH Statistical				Qbar: 16.05 l/s Q30: 27.29 l/s Q100: 33.39 l/s		
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	12	3056	589	2466	50.1	0.16 ha 3.01 %
3.33% AEP Rainfall + 40%	12	3565	589	2976	60.4	0.20 ha 3.63 %
1% AEP Rainfall + 20%	16	4336	786	3551 (1085 exceedance storage)	72.1	0.24 ha 4.34 %
1% AEP Rainfall + 40%	19	5215	933	4282 (1306 exceedance storage)	86.9	0.29 ha 5.23 %

Proposed Site	Riverside Retail Park
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>

### 3.13 1621 – Land immediately surrounding Pool Farm

Proposed Site	Land immediately surrounding Pool Farm
Site area (ha)	0.29
Existing use	Greenfield
Existing flood risk vulnerability classification	Water Compatible
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	0.25

Flood outlines (current day)

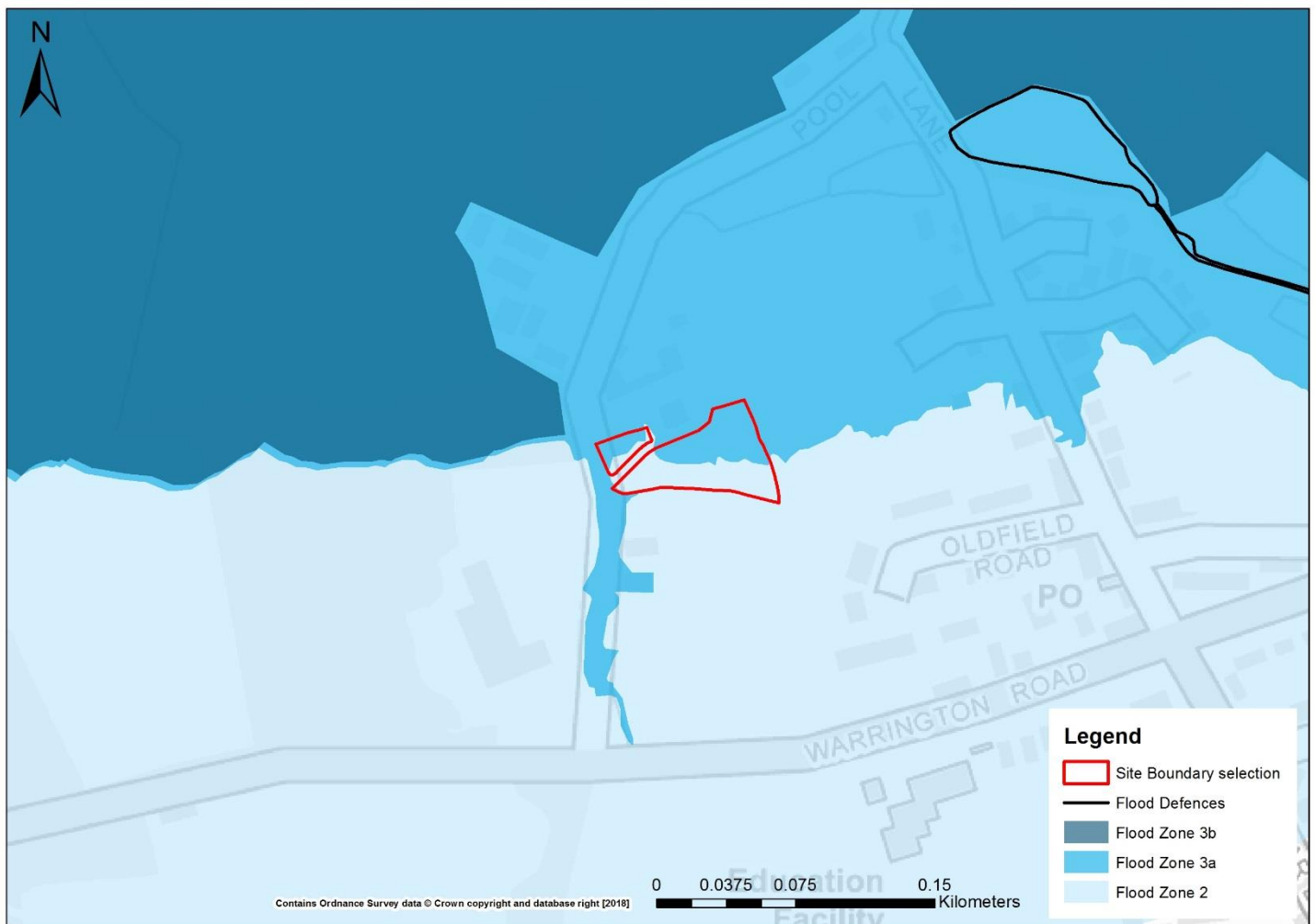


Figure 3.13.1 Flood Zone Mapping and Flood Defences

Proposed Site

Land immediately surrounding Pool Farm

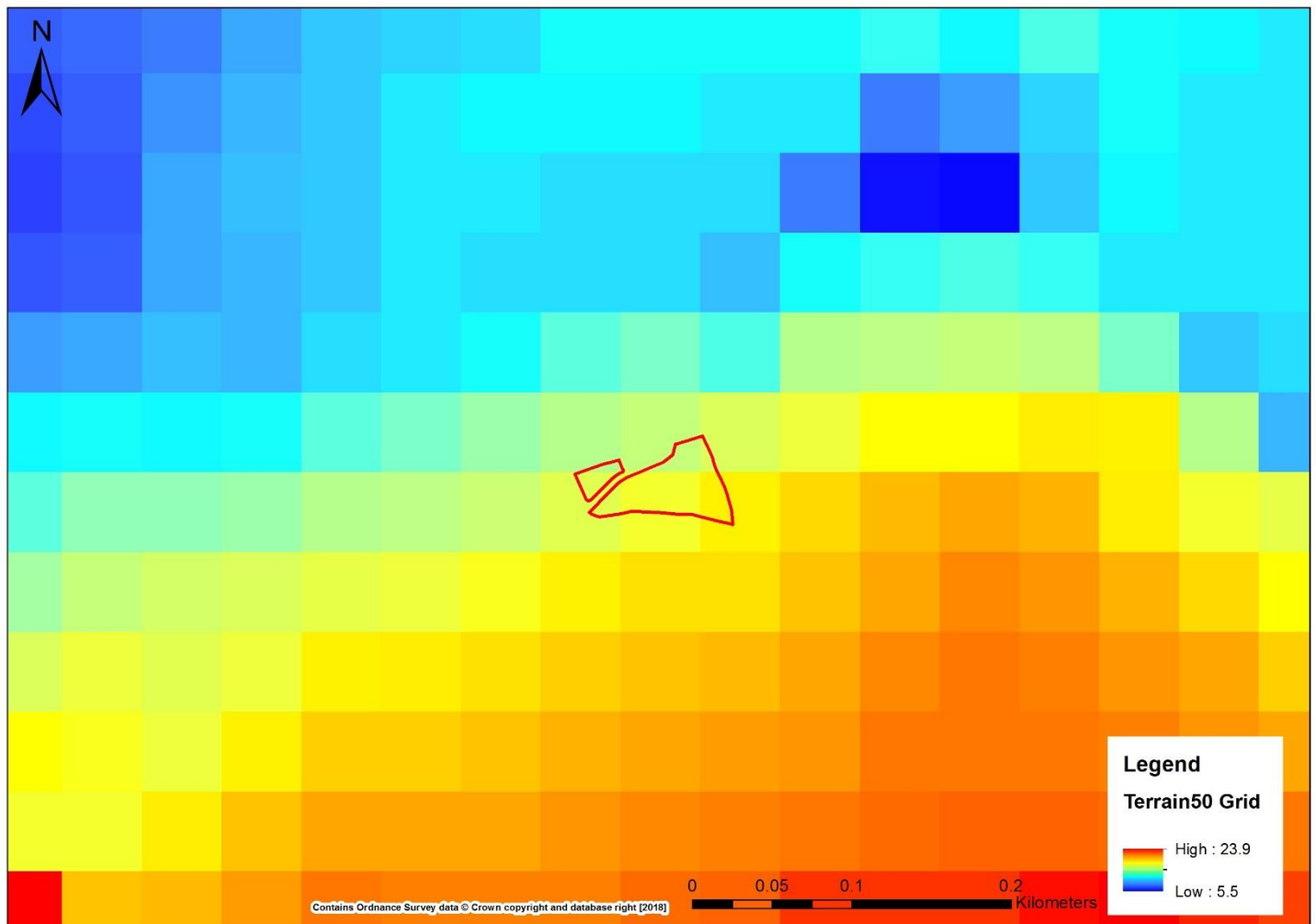


Figure 3.13.2 Site with 50m OS Terrain 50 (elevation data)

- LIDAR coverage does not extend over the site location, for this figure OS Terrain 50 mapping grids have been used.

© Crown Copyright, All rights reserved. 2019 License number 100019628.

Contains OS data © Crown copyright and database right (2019)

Contains public sector information licensed under the Open Government Licence v3.0.

Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The EA confirms that the source of flood risk is from the Manchester Ship Canal which flows to the north of the site. Any proposed development on this site would be subject to a FRA, to demonstrate how the flood risk is to be mitigated. Any loss of flood storage would require compensatory flood storage to be provided (1 March 2019).
- 50% of the site is located within Flood Zone 3a. Fluvial is the primary source of flood risk.
- Fluvial modelling was not available for this study, current flood zone mapping was used as a substitute.
- Statham Pools Brook flows along the northern boundary of the site along with several ponds from which there may be additional fluvial flood risk.
- The site is very small, being 0.29ha in size.

Proposed Site	Land immediately surrounding Pool Farm		
---------------	--	--	--

- There are no fluvial flood defences in place on Statham Pool Beck.
- No direct tidal risk is shown from the updated tidal modelling.
- The site is changing risk classification from water compatible to more vulnerable.
- Risk of surface water flooding is very low.

**Flood Source: Fluvial/Tidal**

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	49.59	50.41	0.00
Tidal: Depth (m)	Not available	Not available	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate Change

- No existing or future tidal risk according to newly updated modelled outputs.

Fluvial Flood Risk and Climate Change

- Due to the close proximity to Site 1891 – Land Fronting Pool Lane, much of the same comments for this section apply.

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

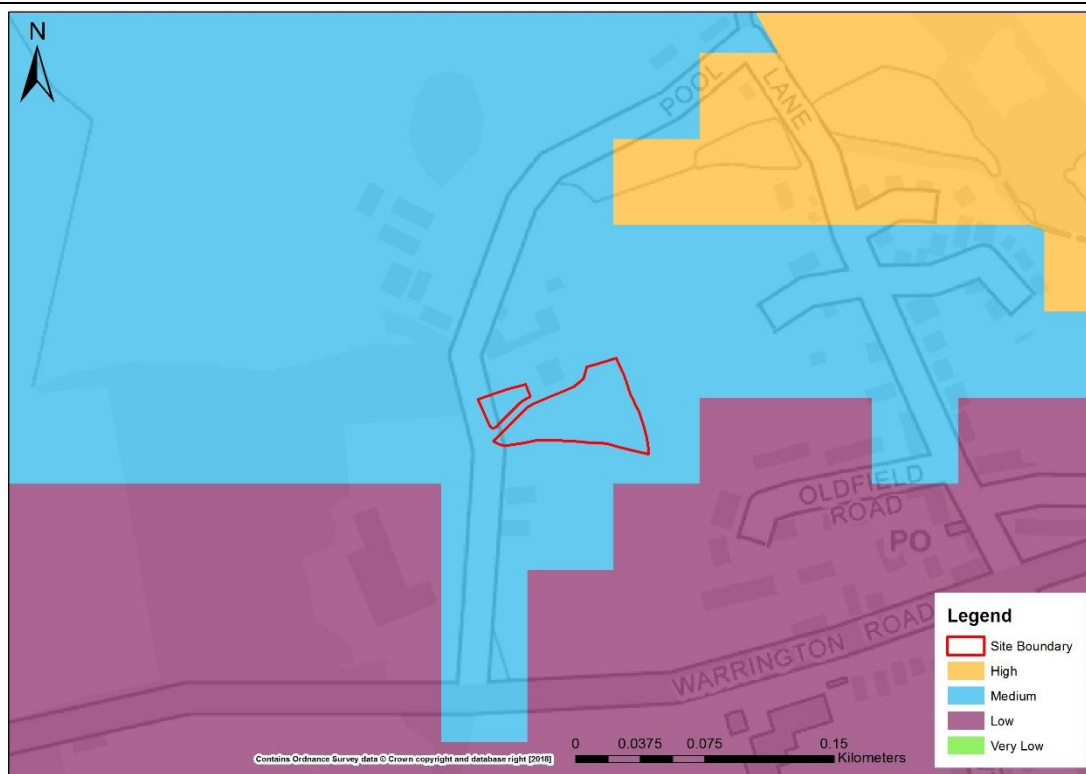


Figure 3.13.3 Site displaying flood risk from rivers and the sea

- The site is wholly located within the medium risk classification (between 3.33% and 1% AEP design event).
- As stated previously in section 3.7, the RoFRS are comparable with the general outlines in the current Flood Zone Mapping.

Proposed Site	Land immediately surrounding Pool Farm
Historic flooding	<ul style="list-style-type: none"> <li>The site is located outside any Environment Agency historic flood outlines.</li> </ul>
Defences	<ul style="list-style-type: none"> <li>Available EA flood defence asset data indicates that there are regraded earth channels to the North-East of the site alongside a small brook feeding Statham Pool. These have been assessed at a condition grade of 3 (Table 1.1 Condition Assessment Manual 2012).</li> </ul>
Flood Warning Area	<ul style="list-style-type: none"> <li>55% of the proposed site lies within an EA FWA, described as "Areas potentially at risk from Manchester Ship Canal. Including properties between the Ship Canal and Thelwall New Road, Lymm Road and Warrington Road. Also includes properties along Ferry Lane".</li> </ul>
Mitigation options & site suitability	<ul style="list-style-type: none"> <li>The EA confirms that the source of flood risk is from the MSC. Any proposed development on this site would be subject to a FRA, to demonstrate how the flood risk is to be mitigated. Any loss of flood storage would require compensatory flood storage to be provided (1 March 2019).</li> <li>Half of the site should be left free of development (northern half in Flood Zone 3a) though this will impact on housing yields. If avoidance is not possible the development may not be permitted.</li> <li>Risk is entirely fluvial therefore any land raising would have to be compensated for with flood storage areas.</li> <li>Detailed consultation required with the EA regarding actual risk, given that the risk comes from the MSC. The risk may be considered lower coming from a controlled structure such as a canal, compared to a Main River or ordinary watercourse. EA must formally advise.</li> <li>EA to confirm risk and advise on whether development is acceptable.</li> <li>As recommended by the Environment Agency, there should be an 8 m buffer strip between any proposed development and the watercourse.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>Due to the site's proximity to Statham Pools Brook, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
<b>Flood Source: Infrastructure Failure - Reservoirs</b>	
Flood risk: reservoir	<ul style="list-style-type: none"> <li>The site is not located within reservoir flood extents.</li> </ul>
<b>Flood Source: Infrastructure Failure - Canals</b>	
Flood risk: canal	<ul style="list-style-type: none"> <li>Data unavailable</li> </ul>

Proposed Site

Land immediately surrounding Pool Farm

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

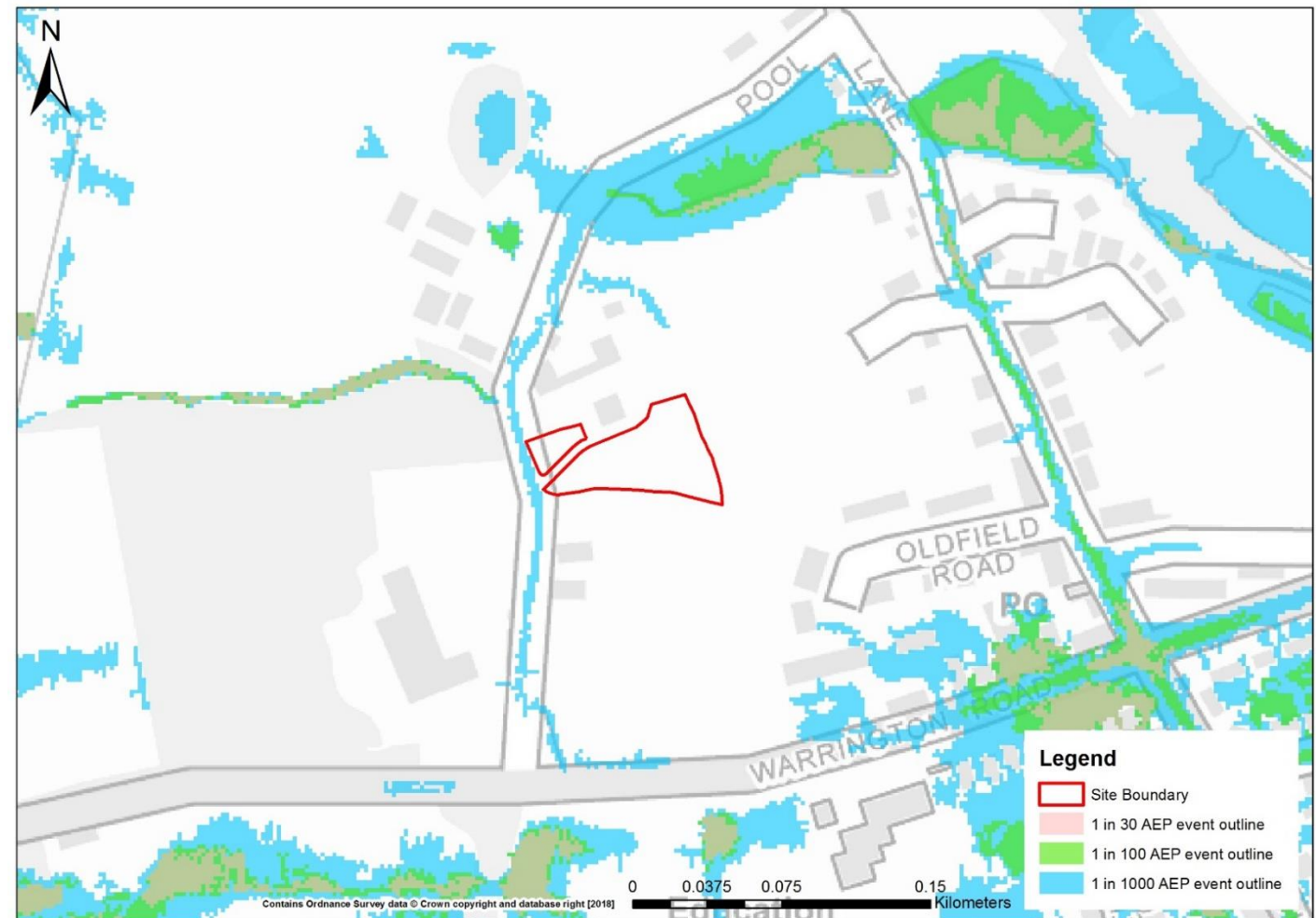


Figure 3.13.4 Surface Water Flood Mapping

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.00	0.00	0.00
Surface water flooding depths	Max: 0.00m Mean: 0.00m	Max: 0.00m Mean: 0.00m	Max: 0.00m Mean: 0.00m
Surface water hazards	Max: None Mean: None	Max: None Mean: None	Max: None Mean: None
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to development site	<ul style="list-style-type: none"> <li>The site is not within surface water flood extents and therefore is at very low risk from surface water flooding.</li> <li>As half of the site is located within Flood Zone 3a and therefore an FRA will be required, the FRA should also quantify the volume</li> </ul>		

Proposed Site		Land immediately surrounding Pool Farm				
	surface water runoff generated by development and provide volumes of attenuation required to ensure that runoff from the site does not increase surface water flood risk elsewhere.					
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>Access issues arise during the 1% AEP event along Pool Lane on the site's western side, with flooding also inundating the roads to the south of the site. At present, Pool Lane is the only access route to the site. During the 1% AEP, access routes will be focused on moving west along Warrington Road.</li> <li>A safe access/egress route will need to be determined during the 0.1% AEP.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>The site is at a very low risk from surface water flooding.</li> </ul>					
Indicative Surface Water Flood Risk from Proposed Development (for Designation Area in its Entirety)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical				QBar: 5 l/s Q30: 5 l/s Q100: 5 l/s		
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	3.25	123	29	94	10.4	0.01 ha 2.16 %
3.33% AEP Rainfall + 40%	4	151	36	115	12.7	0.01 ha 2.64 %
1% AEP Rainfall + 20%	4.5	183	41	143 (49 exceedance storage)	15.8	0.01 ha 3.29 %
1% AEP Rainfall + 40%	5	219	45	174 (59 exceedance storage)	19.3	0.01 ha 4.00 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</li> </ul>					
Surface water: flood risk impacts from development site & mitigation	<ul style="list-style-type: none"> <li>As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>					



### 3.14 Waterfront

Proposed Site	Waterfront
Site area (ha)	725
Existing use	Mixed use
Existing flood risk vulnerability classification	Unknown
Proposed use	Residential
Proposed development flood risk vulnerability classification	More Vulnerable
Proposed development impermeable area (ha)	616

Flood outlines (current day)

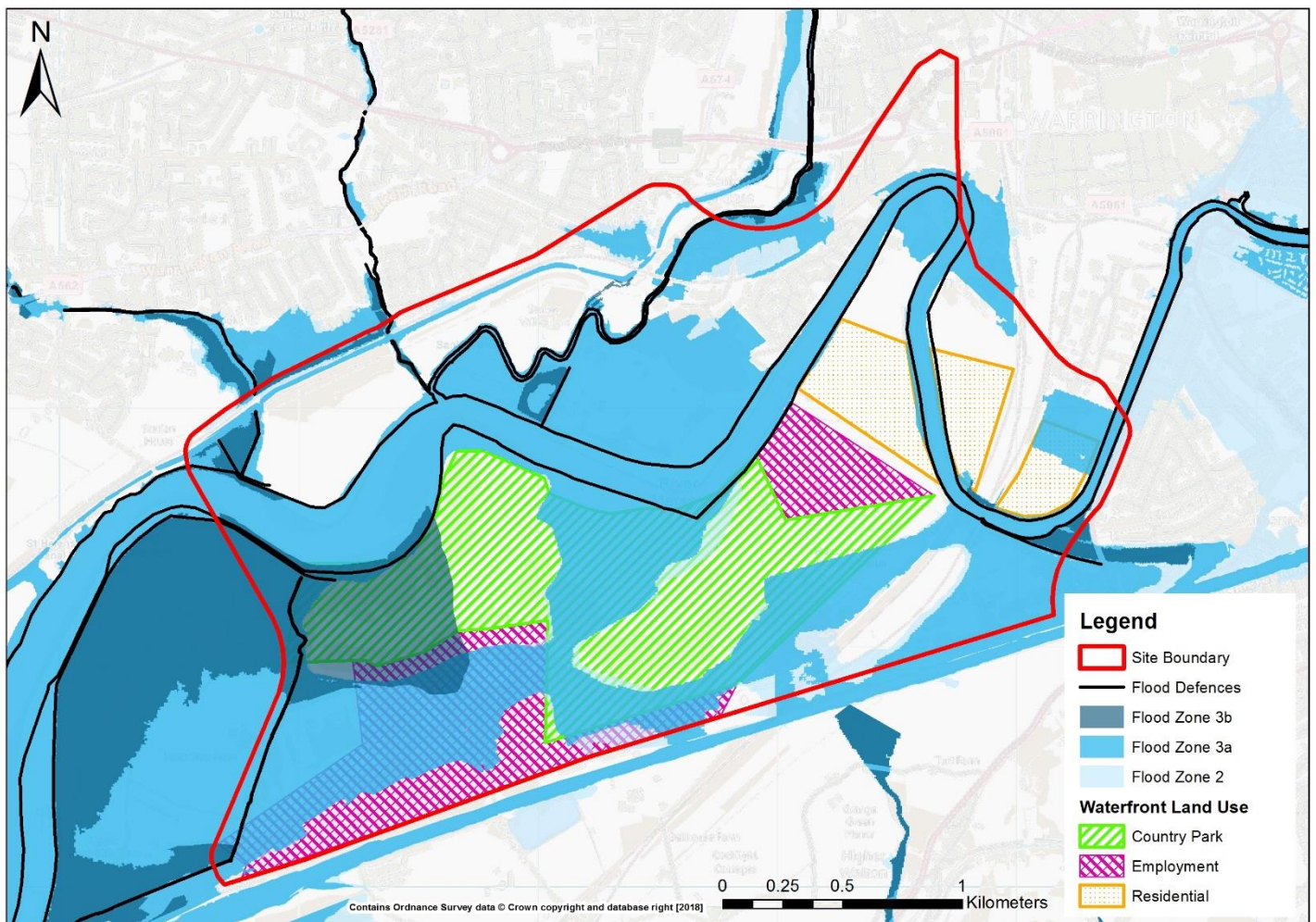


Figure 3.14.1 Flood Zone Mapping, Flood Defences and Proposed Land Use Developments

Proposed Site

Waterfront

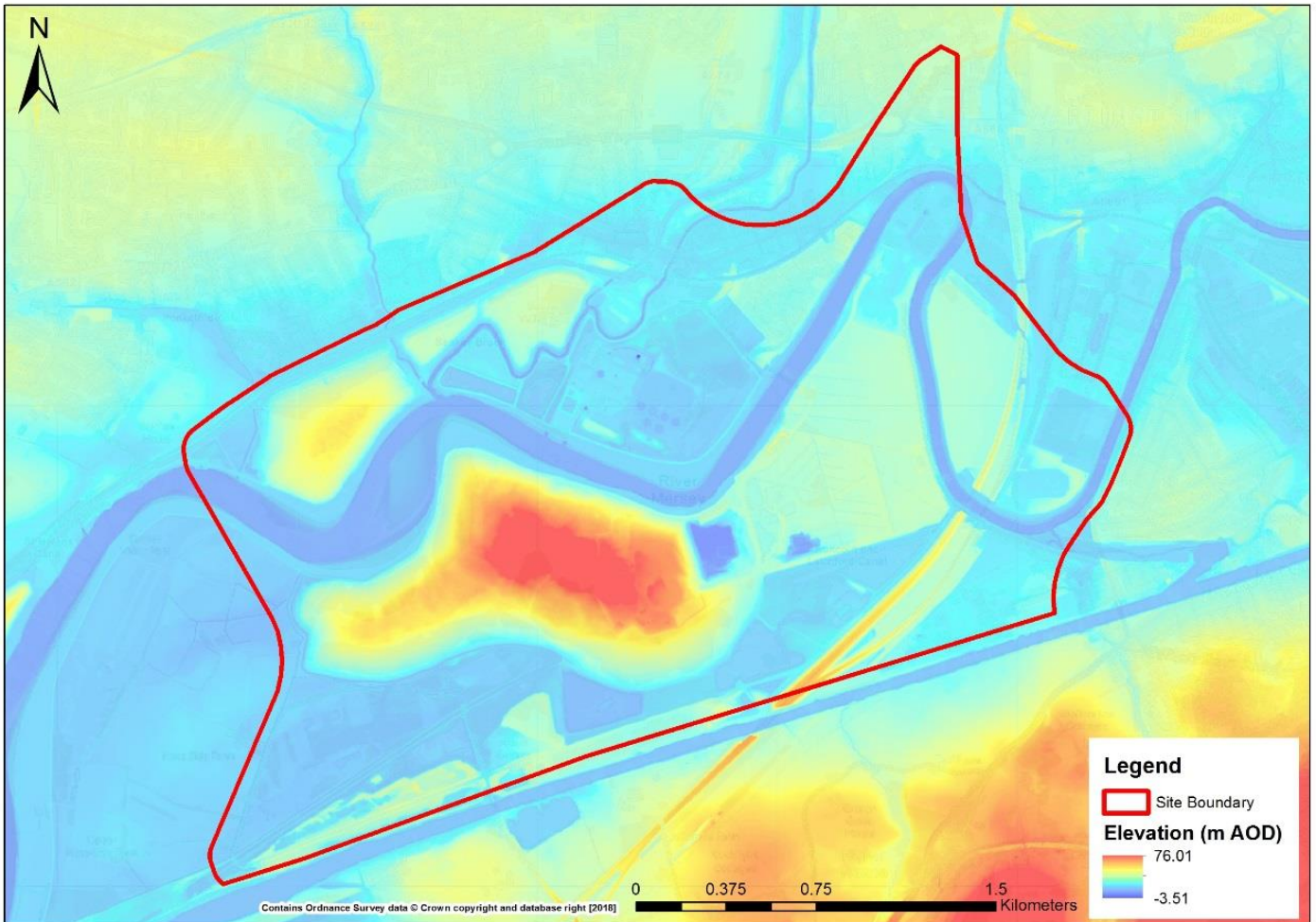


Figure 3.14.2 Proposed site with LIDAR

© Crown Copyright, All rights reserved. 2019 License number 100019628.  
 Contains OS data © Crown copyright and database right (2019)  
 Contains public sector information licensed under the Open Government Licence v3.0.  
 Contains Environment Agency information © Environment Agency and/or database right.

**Observations**

- The site is bisected by the River Mersey and bound on its southern edge by the MSC. The site also contains several smaller watercourses.
- Fluvial and tidal are the primary sources of flood risk.
- Fluvial modelled risk was not available for this study (Appendix A –Original site list supplied in Data Request, current EA flood zone mapping was used).
- 8% of the site (west) is within the functional floodplain.
- Half of the site is additionally within Flood Zone 3a. The River Mersey provides mostly tidal risk to the site with fluvial risk coming from the MSC.
- Areas of the site designated for residential development are located in the north-east of the site, currently outside current flood zone mapping and modelled outputs and have already been through the exception test.

Proposed Site	Waterfront
---------------	------------

- The remainder of the site has been primarily assigned to employment areas and a country park, the former subject to further investigation into site layout and design.
- Access and egress roads must be planned in line with current flood risk outlines, to mitigate any potential for development areas to become isolated by flooding.

Flood Source: Fluvial/Tidal			
-----------------------------	--	--	--

	Flood Zone 2	Flood Zone 3a	Flood Zone 3b
Flood Zones (%)	3.25	45.77	8.21
Tidal: Depth (m)	1.28	2.25	Not available
Tidal: Hazard	Not available	Not available	Not available

Modelled Flood Risk and Climate Change

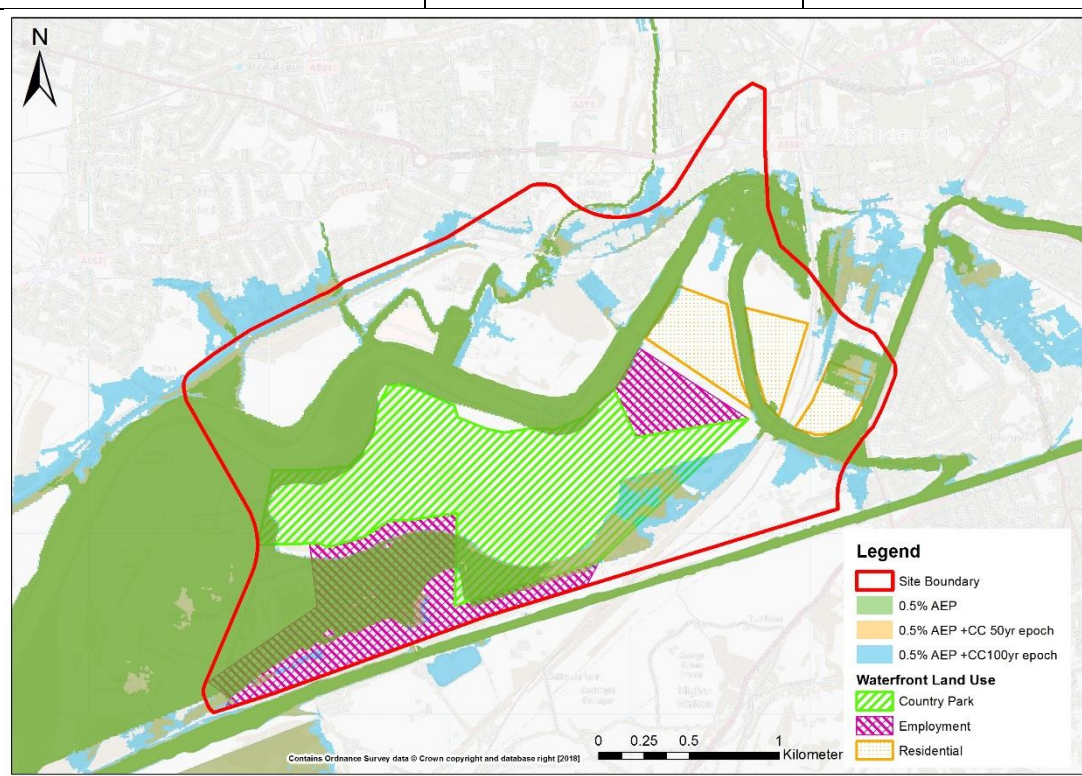


Figure 3.14.3 Tidal outlines for present day 0.5% AEP and future risk 0.5% AEP with 50yr (2065) and 100yr (2115) climate change increases and proposed land use development

Tidal (defended):

- According to the 2015 Mersey Estuary modelled extents (see Figure 3.14.3), there is significant flooding during the 0.5% AEP 50yr-epoch (water levels increased respective of the change over the next 50 years) outline.
- The flooding is largely associated with the River Mersey, however, much of the South of the site is inundated due to its low-lying elevation (see Figure 3.14.2).
- The proposed residential development zones lie mostly outside any areas of flooding. The far-right residential development site sees flooding at the northern end during events as low as a 1.3% AEP design event.

Proposed Site

Waterfront

- Similarly, the southern proposed employment zone sees flooding at a 4% AEP event though being commercial; it is classed as less vulnerable when compared to the more vulnerable areas of residential development.

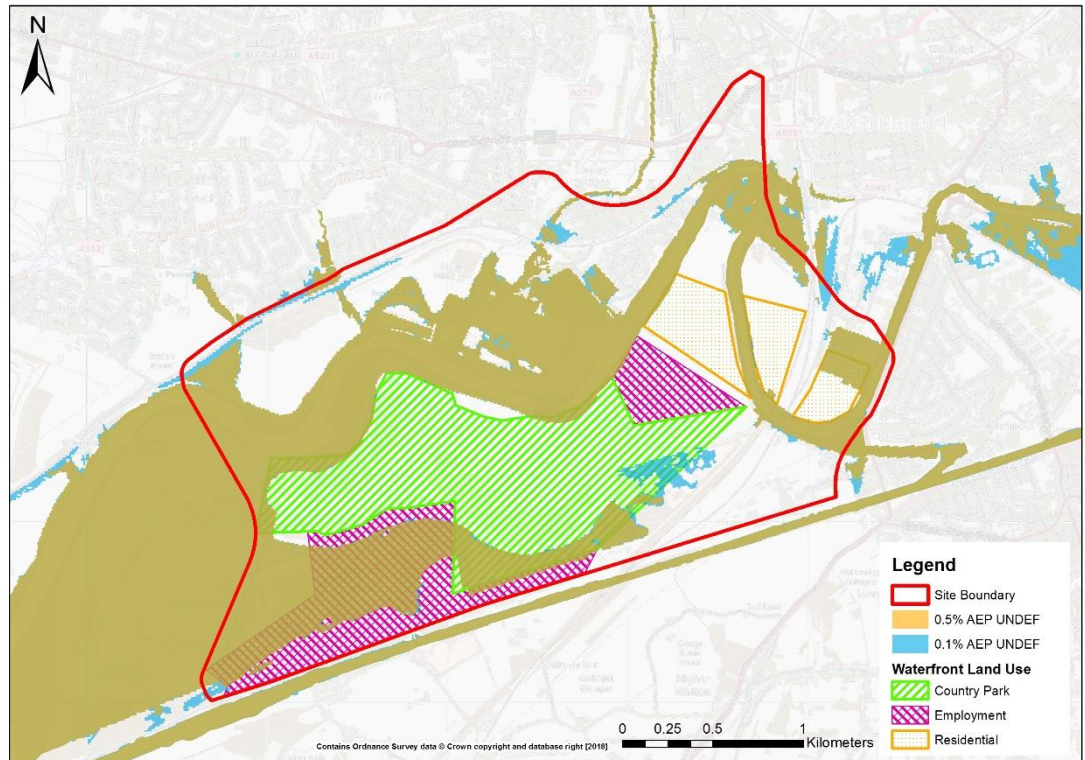


Figure 3.14.4 Tidal outlines for the undefended scenario 0.5% AEP, 0.1% AEP events and proposed land use developments

Tidal (undefended):

- The baseline modelled extents for the 0.5% AEP event (see Figure 3.14.3) indicates that the site floods in a very similar manner to Figure 3.14.4 during both the 0.5% and 0.1% AEP undefended scenario.
- The flooding is largely associated with the River Mersey, however, much of the South of the site is inundated due to its low-lying elevation (see Figure 3.14.2).
- Compared to the defended with climate change allowances in Figure 3.14.3, the main differences can be seen in the centre of site, above a meander in the River Mersey. Here there is increased flooding onto the land though there is no proposed development site there currently.

Proposed Site

Waterfront

Fluvial Risk and  
Climate Change

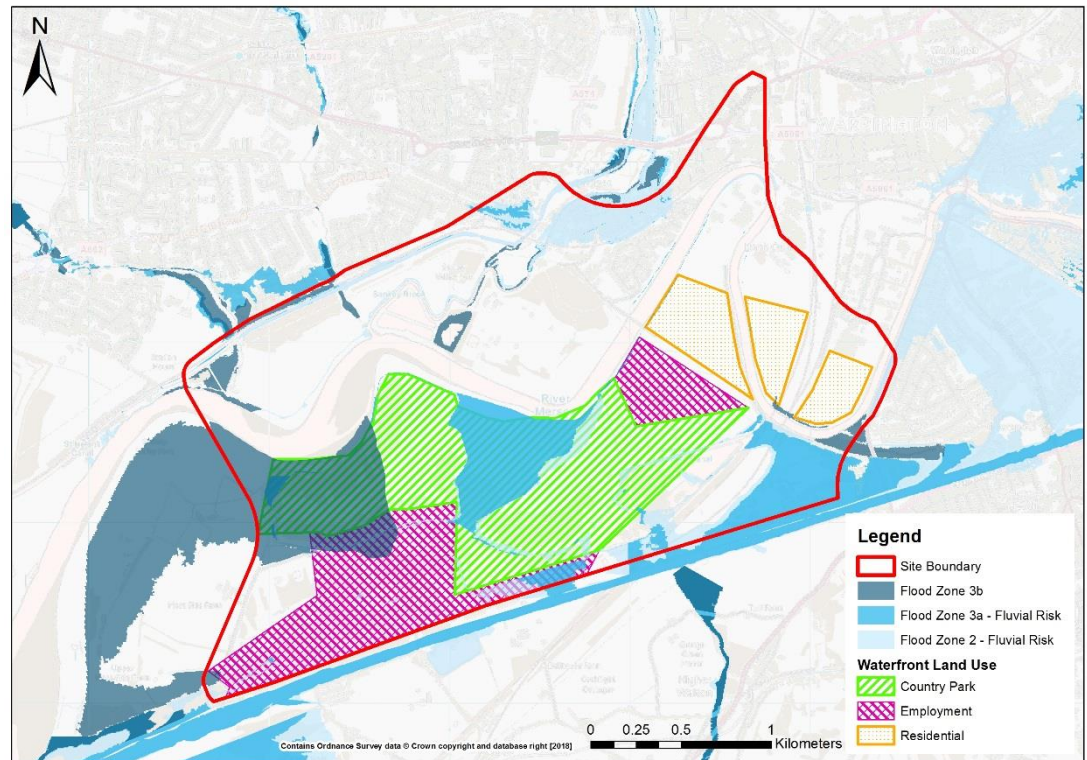


Figure 3.14.5 Fluvial only Flood Zone Mapping with proposed land use developments

- Viewing only fluvial flood risk alongside the proposed development areas shows three areas of flooding.
- There are two areas within Flood Zone 3a, one of these being outside any development sites and the other being in the country park. This being a greenfield site is water compatible and therefore at less risk from water inundation.
- A final main area of flooding lies within Flood Zone 3b at the westerly end of the country park though the previous comment applies as before. The country park would theoretically also act as a buffer of sorts between the River Mersey and the proposed employment sites.

**Proposed Site** **Waterfront**

Accounting for Defences – EA Risk of Flooding from Rivers and the Sea map

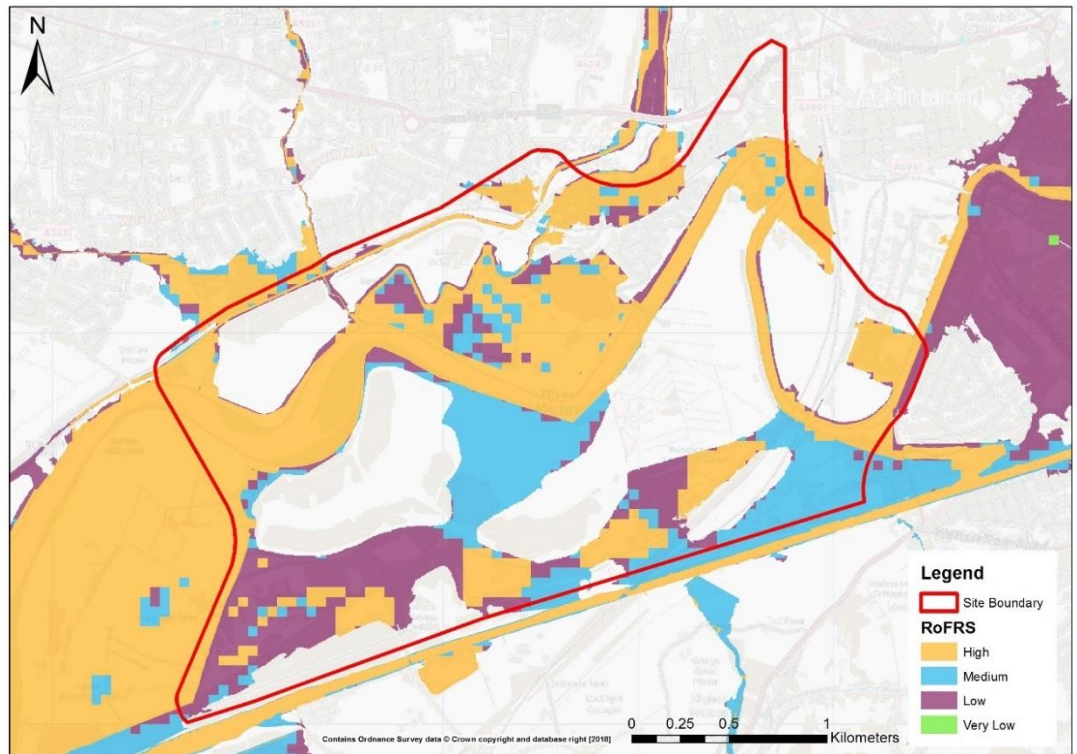


Figure 3.14.6 Site displaying flood risk from rivers and the sea

Risk of Flooding from Rivers and the Sea (RoFRS) – defended flood map:

- The site has multiple areas at low, medium and high risk of flooding.
- Much of the high-risk (>3.33 AEP events) areas are concentrated around the Mersey and directly north of a meander in the centre of the site with areas bordering the south of the site being at a medium to low risk (3.33% - 1% and 1% - 0.1% AEP events).
- These flooded areas have been classified as only reliable to a county or town level i.e. unsuitable for streets or individual properties.

Historic flooding

- 7% of the site is contained within the historic flood map outline.
- The historic flood outline is localised to two areas immediately surrounding the River Mersey at the Eastern and Western bounds of the site.

Defended

- Available EA flood defence asset data indicates that the site is defended along the River Mersey by a combination of high ground and embankments that have an average condition grade of 3 (Table 1.1 Condition Assessment Manual 2012).

Flood Warning Area

- Approximately 35% of the site is located within multiple FWAs.

Proposed Site	Waterfront
Mitigation options & site suitability	<ul style="list-style-type: none"> <li>• Areas of the site designated for residential development are located in the north-east of the site, currently outside current flood zone mapping and modelled outputs and have already been through the exception test.</li> <li>• It is understood that Peel Ports own parcels of land within south western areas of the site along the MSC. Consultation with Peel Ports will be required before any further planning of layouts and designs.</li> <li>• Currently, the areas of the site immediately surrounding the River Mersey are not recommended for residential development unless improved flood risk management measures are put in place.</li> <li>• Tidal grid depths indicate that the site is at extensive risk of flooding from the River Mersey. During the 1000yr event, much of the South West area of the site bound by the River Mersey and as far Eastward as the Moore Lane, Manchester Ship Canal crossing is flooded to a depth &gt;1.20m.</li> <li>• Any future development at this site should be considered sustainable without a continued reliance on flood defence investment and maintenance.</li> <li>• Further country park designated areas could be developed in the centre of the site above a meander in the Mersey. Both Figure 3.14.4 and Figure 3.14.6 show this area being at risk of flooding with green space acting as an additional buffer.</li> <li>• Existing low-lying areas within the site may be utilised for attenuation storage.</li> <li>• Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>• Safe access/egress routes must be determined in a site-specific FRA.</li> </ul>
<b>Flood source: Groundwater</b>	
Flood risk: groundwater	<ul style="list-style-type: none"> <li>• Due to the site's proximity to the River Mersey, groundwater levels are expected to be similar to the corresponding levels in the river. Ground water will follow topography and is unlikely to be an issue in this instance.</li> </ul>
<b>Flood Source: Infrastructure Failure - Reservoirs</b>	
Flood risk: reservoir	<ul style="list-style-type: none"> <li>• The site is not located within reservoir flood extents.</li> </ul>
<b>Flood Source: Infrastructure Failure - Canals</b>	
Flood risk: canal	<ul style="list-style-type: none"> <li>• Data unavailable</li> </ul>

Proposed Site

Waterfront

Flood Source: Surface Water

Surface Water Flood Risk to Proposed Development Site

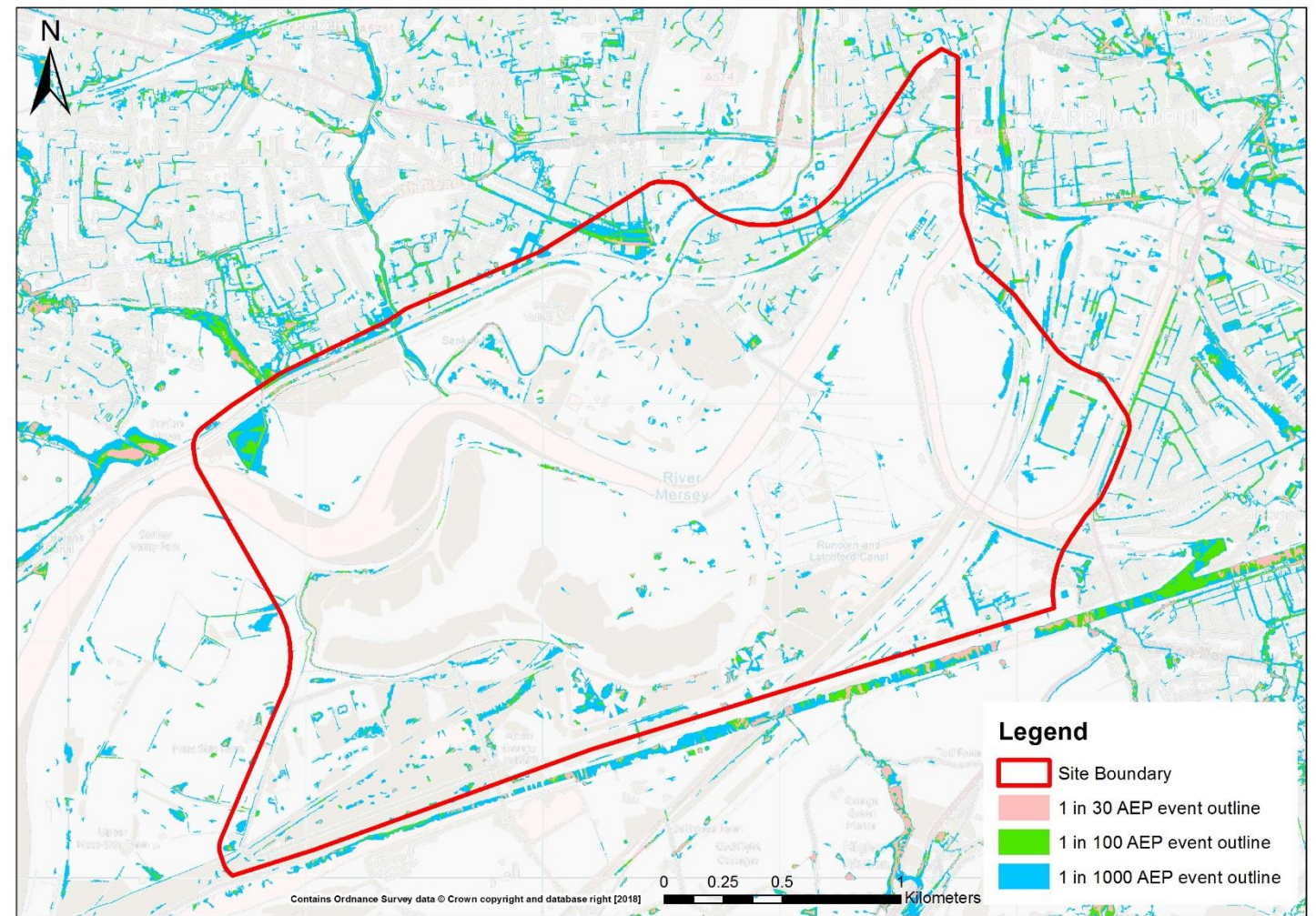


Figure 3.14.7 Surface Water Flood Risk

Existing development risk of flooding from surface water (%)	High Risk (3.33% AEP outline)	Medium Risk (1% AEP outline)	Low Risk (0.1% AEP outline)
	0.41	1.31	6.09
Surface water flooding depths	Max: 0.60-0.90m Mean: 0.27m	Max: 0.90-1.20m Mean: 0.64m	Max: >1.20m Mean: 0.96m
Surface water hazards	Max: Localised Significant Mean: Low	Max: Localised Significant Mean: Moderate	Max: Localised Extreme Mean: Moderate
Climate change	<ul style="list-style-type: none"> <li>The current day 0.1% AEP outline provides an indication of the likely increase in extent of the more frequent events.</li> </ul>		
Surface water: flood risk to	<ul style="list-style-type: none"> <li>Approximately 1.3% of the site is at risk of surface water flooding during the 1% AEP event. Much of the flooding attenuates within</li> </ul>		



Proposed Site		Waterfront				
development site	<p>local depressions in the site topography. Areas of localised significant hazards are associated with Penketh Brook, Whittle Brook and Sankey Brook.</p> <ul style="list-style-type: none"> <li>A significant hazard is indicated during the 0.1% AEP where surface water inundates an area to the West of the site where Penketh Brook flows into the River Mersey. The flooding has a depth of &gt;1.20m in places.</li> <li>Access routes to the South of the site remain relatively safe during the 1% AEP event.</li> </ul>					
Surface water: mitigation options & site suitability	<ul style="list-style-type: none"> <li>Surface water flooding appears to be generally limited to areas of local depressions in the site topography.</li> <li>Existing low-lying areas within the site may be utilised for attenuation storage.</li> <li>Post-development surface water discharge rates should better the previous or equal greenfield runoff rates to avoid increasing flood risk elsewhere.</li> <li>Development should avoid the 0.1% AEP outline, however, as much of the flooding is contained by local depressions, redevelopment of the site may significantly change the behaviour of the surface water and this must be accounted for in an FRA.</li> </ul>					
Indicative Surface Water Flood Risk from Proposed Development (for 25% of the Designation Area)						
Proposed Development limiting runoff rate: Greenfield – FEH Statistical			QBar: 348.16 l/s Q30: 591.87 l/s Q100: 724.17 l/s			
Design flood event (inc CC)	Critical storm duration (Hrs)	Inflow volume (m <sup>3</sup> )	Outflow volume (m <sup>3</sup> )	Attenuation required (m <sup>3</sup> )	Time to empty assuming no infiltration (Hrs)	Total storage required: Area (ha) and % of site area
3.33% AEP Rainfall + 20%	12	101407	12784	88623	83.0	5.91 ha 3.26 %
3.33% AEP Rainfall + 40%	12	118308	12784	105524	98.8	7.04 ha 3.89 %
1% AEP Rainfall + 20%	20	149253	26070	123183 (34560 exceedance storage)	94.2	8.21 ha 4.54 %
1% AEP Rainfall + 40%	30 (limited to)	187075	39105	147970 (42446 exceedance storage)	113.2	9.86 ha 5.45 %
Climate change	<ul style="list-style-type: none"> <li>Application of the central (20%) and upper band (40%) potential change anticipated for climate change in the table above shows</li> </ul>					

Proposed Site	Waterfront
	<p>the estimated attenuation volumes for the 1% AEP and 3.33% AEP rainfall events.</p>
<p>Surface water: flood risk impacts from development site &amp; mitigation</p>	<ul style="list-style-type: none"> <li>• As part of this Level 2 Screening we have included calculations to provide an estimated land take if a pond with an assumed depth of 1.5m was included as part of the development.</li> <li>• Attenuation volumes are presented for the critical storm duration for the 1 in 30-year events with exceedance flows quantified up to the 1 in 100-year event. To prevent development worsening flood risk elsewhere, surface water runoff must be managed on site.</li> </ul>

## 4 Appendices

### 4.1 Appendix A –Original site list supplied in Data Request

Site Refer	Name	Proposed Use	Area (ha)	Modelling	Defended	EA river model required
1041	Harry Fairclough Ltd	Residential	0.54	Fluvial and tidal	Yes- high ground	Padgate Brook and River Mersey
1178	Cardinal Newman High School	Residential	15.48	Fluvial and tidal	Yes - embankment	River Mersey
1621	Land immediately surrounding Pool Farm	Residential	0.29	Fluvial	No	Statham Pools Brook
1707	Alford Hall Social Club Overflow Car Park	Residential	0.39	Fluvial	Yes- high ground	Padgate Brook
1717	Former Dairy Works	Residential	0.25	Fluvial and tidal	Yes - wall	River Mersey
1831	Land off Newcombe Avenue	Residential	1.81	Fluvial	Yes- high ground	Padgate Brook
1861	Land north of Mayfair Close	Residential	1.58	Fluvial	Yes - high ground	Middle Lower Mersey
1891	Land fronting Pool Lane	Residential	1.85	Fluvial	No	Middle Lower Mersey
2273	Motortrade	Residential	0.52	Fluvial and tidal	Yes – concrete inner wall	Sankey brook
2482	Wharf Industrial Estate	Residential	4.88	Fluvial and tidal	Yes - high ground	River Mersey
2603	Land at Thelwall Lane West	Residential	2.37	Fluvial	Manchester Ship Canal	Along the ship canal
2657	New Cut Lane Industrial Estate	Residential	15.07	Fluvial	Yes – high ground	River Mersey
2677	Riverside Retail Park	Residential	5.46	Fluvial and tidal	Yes – high ground	River Mersey

Offices at:

Coleshill  
Doncaster  
Dublin  
Edinburgh  
Exeter  
Glasgow  
Haywards Heath  
Isle of Man  
Limerick  
Newcastle upon Tyne  
Newport  
Peterborough  
Saltaire  
Skipton  
Tadcaster  
Thirsk  
Wallingford  
Warrington

Registered Office  
South Barn  
Broughton Hall  
SKIPTON  
North Yorkshire  
BD23 3AE  
United Kingdom

+44(0)1756 799919  
info@JBA - consulting.com  
www.JBA - consulting.com  
Follow us:  

Jeremy Benn Associates Limited

Registered in England 3246693

JBA - Group Ltd is certified to:  
ISO 9001:2015  
ISO 14001:2015  
OHSAS 18001:2007