OMEGA ZONE 8, ST HELENS

Omega St Helens Ltd / T. J. Morris Limited

Flood Risk Assessment
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OPP DOC.1 Flood Risk Assessment

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CONTENTS

TABLES

FIGURES

APPENDICES

APPENDIX A

TOPOGRAPHIC SURVEY

APPENDIX B

DETAILED PLANNING APPLICATION DETAILS

APPENDIX C

MASTERPLAN OF PROPOSED DEVELOPMENT

APPENDIX D

PRELIMINARY FLOOD RISK ASSESSMENT FLOOD MAPS

APPENDIX E

ENVIRONMENT AGENCY CONSULTATION DATA

APPENDIX F

HYDRAULIC MODELLING TECHNICAL NOTE

APPENDIX G

UNITED UTILITIES ASSET LOCATION PLANS

APPENDIX H

LOCAL FLOOD RISK MANAGEMENT STRATEGY GROUNDWATER FLOODING MAPS

APPENDIX I

DRAINAGE STRATEGY

1 INTRODUCTION

1.1 SCOPE

1.1.1. WSP has been commissioned by Omega St. Helens / T. J. Morris Limited (referred to as 'the Applicant') to undertake a Flood Risk Assessment (FRA) to support the hybrid planning application for the proposed westward expansion of the Omega Business Park into Zone 8 (referred to as the 'Proposed Development') in St. Helens. The aim of the assessment is to establish the flood risk associated with the Proposed Development and assess whether the Proposed Development will increase flood risk at the application site or elsewhere.

1.1.2. The FRA has been carried out with reference to the National Planning Policy Framework (NPPF), the Planning Practice Guidance (PPG), Sustainable Drainage Systems (SuDS) Manual C753, St. Helens Council Sustainable Drainage Systems Design and Technical Guidance and with Environment Agency information, including that readily available on the internet and site-specific consultation data.

1.1.3. The NPPF sets out the framework for planning decisions made by local, regional and national government and the Environment Agency. The NPPF advises that FRAs are required for all developments in Flood Zone 2, 3a, 3b and for all developments in Flood Zone which are 1 hectare or greater or that are at risk from another source (other than rivers or the sea) if less than 1 hectare. The Proposed Development is approximately 75ha and is to a minor extent located in Flood Zone 2. As such, a FRA is required to support this hybrid planning application.

1.1.4. The following tasks have been carried out for this FRA:

- Assessment of the current flood risk from all sources from Environment Agency data, previous studies and site-specific investigations. The sources included in this assessment are:
  - Rivers (fluvial)
  - Sea (tidal)
  - Surface water
  - Sewers
  - Groundwater
  - All artificial sources
- Establish whether the existing site and Proposed Development is likely to be affected by current and future flooding
- Assessment of the potential impacts of the Proposed Development on flood risk elsewhere
- Determine any necessary mitigation measure required to manage flooding post development in a sustainable way
- Highlight any residual risks
- Confirm the conclusions of the FRA.

1.2 INFORMATION PROVIDED

1.2.1. The following information was provided by the Applicant and wider project team for use in this assessment:

- Topographic Survey (**Appendix A**)
- Detailed drawings for detailed planning application (**Appendix B**)

- Masterplan of hybrid planning application (**Appendix C**)
- Hydraulic Modelling Technical Note (**Appendix F**)
- Drainage Strategy (**Appendix I**)

1.2.2. The following documents have been used to gather further information about the application site:

- River Basin Management Plan (RBMP) – North West River Basin (2015)
- Mersey Estuary Catchment Flood Management Plan (2009)
- Sankey Catchment Action Plan (2018)
- St. Helens Council Preliminary Flood Risk Assessment (2017)
- St. Helens Council Strategic Flood Risk Assessment (2014)
- St. Helens Council Local Flood Risk Management Strategy (2014)
- St. Helens Council Local Flood Risk Management Strategy 2019-2025 (2019)
- Warrington Strategic Flood Risk Assessment (2010)
- Warrington Surface Water Management Plan (2012)
- Environment Agency internet based data
- Environment Agency consultation data including 2008 hydraulic model (**Appendix E**)
- United Utilities Asset Location Plans (**Appendix G**)

2 EXISTING SITE

2.1.1. The application site is located approximately 2km west of Junction 8 of the M62 at its centre point. The application site is located at approximate National Grid Reference (NGR) 355146, 390396, approximately 5.6km north-west of Warrington centre. The location and extent of the application site is shown in **Figure 2-1**.

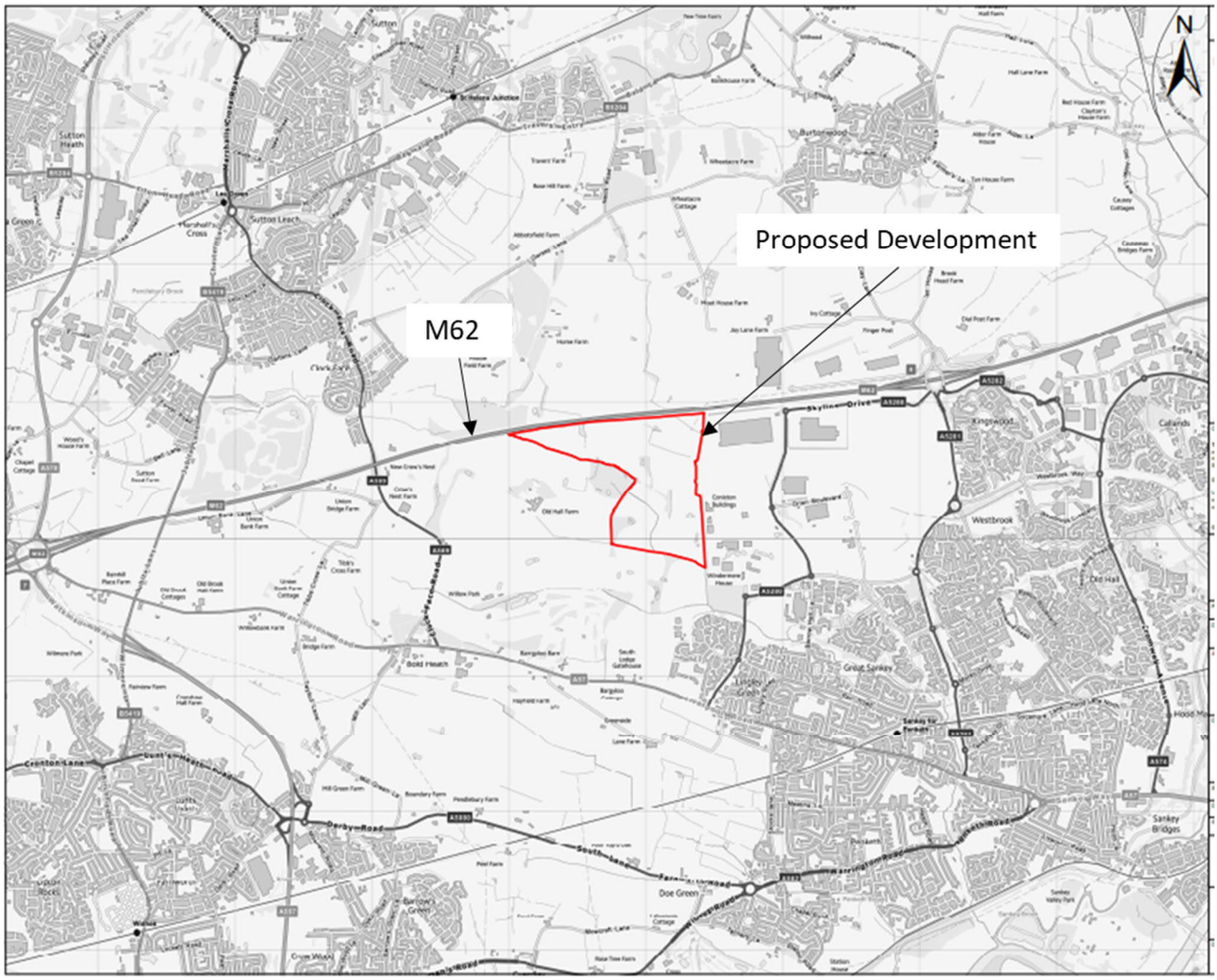


Figure 2-1 - Site Location

2.1.2. The application site is located in the area of St. Helens Council; however the eastern application site boundary lies directly on the boundary between St. Helens Council and the Warrington Borough Council (refer to **Figure 2-2**).

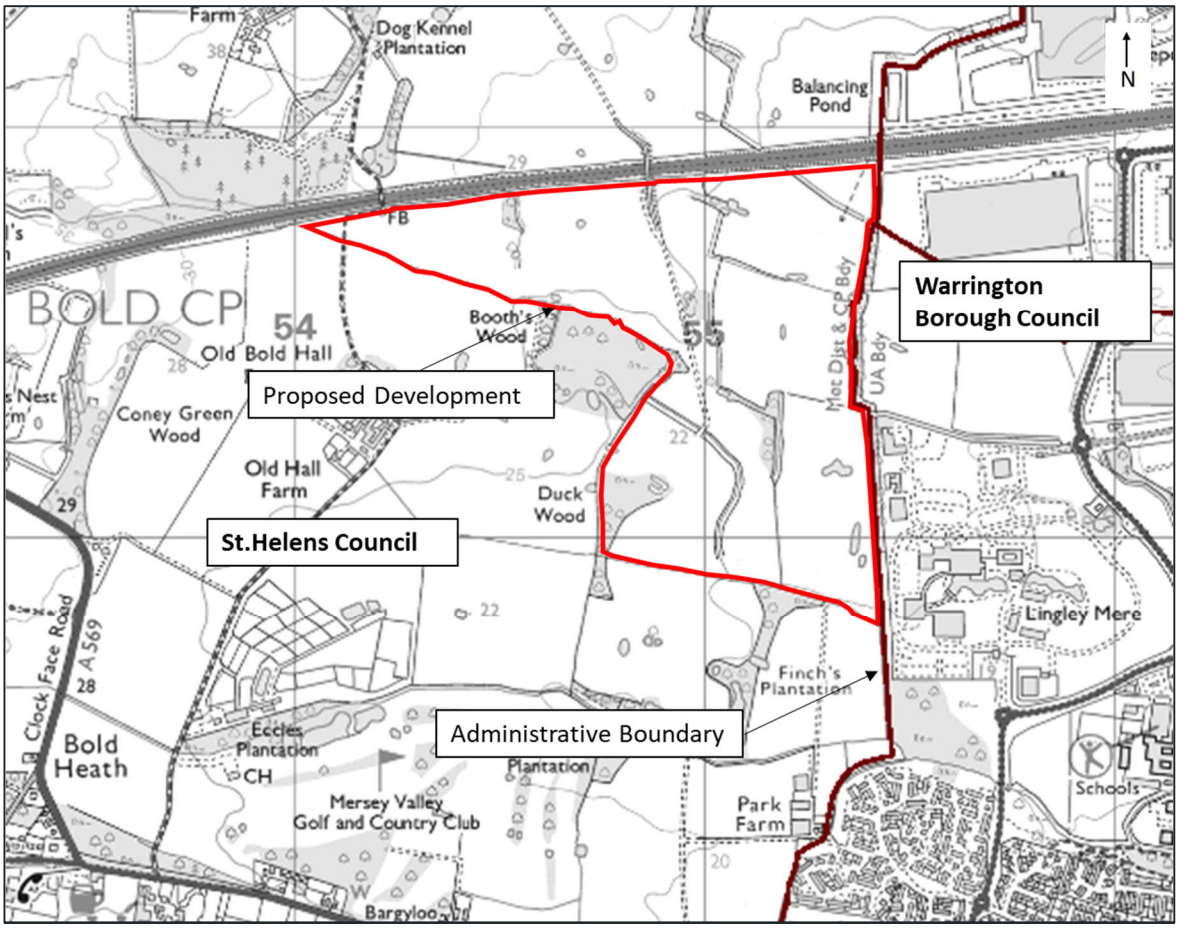


Figure 2-2 - Administrative Boundaries around the Application Site (Defra, 2019)

2.1.3. St. Helens is a Metropolitan Borough of Merseyside, covering 136km^2. It is bounded by the councils of West Lancashire, Wigan, Warrington, Halton and Knowsley. The borough has a mixture of rural and urban areas covering the towns of St. Helens, Rainford, Billinge, Rainhill, Haydock and Newton-le-Willows[1].

2.1.4. Currently, the application site is predominantly arable and is considered to be a greenfield (permeable) site with scattered areas of deciduous woodland priority habitats. Mersey Valley Golf and Country Club and the residential area of Lingley Green are located to the south of the application site.

2.1.5. The application site is immediately west of the existing The Omega Business Park and Lingley Mere Business Park. The Omega Business Park houses a variety of large scale warehousing and industrial businesses, with the Lingley Mere Business park comprising a mixture of office buildings and small local businesses.

2.1.6. The adjacent current land uses as observed are presented in **Table 2-1**.

[1] St. Helens Council Strategic Flood Risk Assessment (2014): https://www.sthelens.gov.uk/media/3259/st-helens-council-strategic-flood-risk-assessment-september-2014.pdf

Table 2-1 – Adjacent Land Uses to the Application Site

Direction	Description
North	Agricultural land and existing road network, including the M62
East	Omega Business Park and Lingley Mere Business Park (Warrington Borough Council)
South	Whittle Brook with existing road network including A57 and Lingley Green residential development
West	Agricultural land including Old Hall Farm and existing road network including A569

2.1.7. Topographic survey of the application site indicates a range of ground levels varying from approximately 19.63mAOD and 29.07mAOD. Full topographic survey of the application site can be found in **Appendix A**.

2.1.8. The nearest Environment Agency 'main river' to the application site is the Whittle Brook, running along the western boundary of the application site in the northern site area and directly through the southern extent of the application site. The Whittle Brook flows in a south easterly direction, flowing through Warrington and under St. Helens Canal before discharging in to Sankey Brook (also known as Dallam Brook) and outfalling to the River Mersey at Penketh Reach.

2.1.9. The non-tidal limit is located on the Whittle Brook on the downstream crossing culvert of the canal at approximate NGR: 357369, 387313. This is located approximately 324m upstream of the outfall of the Sankey Brook into the River Mersey. The application site is not tidally influenced as the non-tidal limit is significantly downstream from the application site.

2.1.10. The Whittle Brook is part of the Sankey Operational Catchment (refer to **Figure 2-3**) and has a total of 774m of raised defences along its course, with 564m of these owned by the Environment Agency and 210m with unknown ownership. None of these are located within the application site.

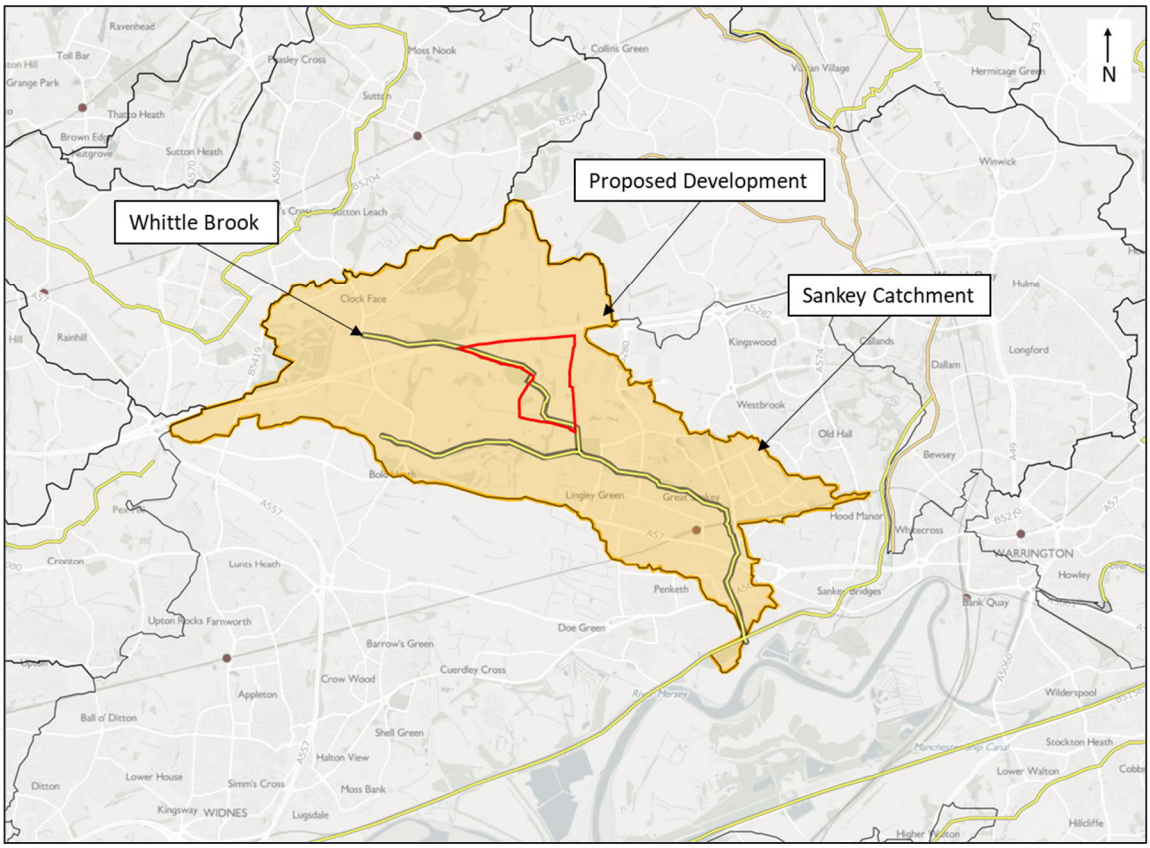


Figure 2-3 - Sankey Catchment (Environment Agency, 2019)

2.1.11. The Barrow Brook is an ordinary watercourse which flows under the M62 carriageway in the north-east corner of the application site. This flows in a southerly direction before flowing north and back out of the application site (refer to **Figure 2-4**).

2.1.12. A further unnamed watercourse flows in to the application site under the M62 at Plain Plantation, joining the Whittle Brook near Booth's Wood. Two small unnamed tributaries arrive in to the Whittle Brook from Booth's Wood as shown in **Figure 2-4** from outside of the application site.

2.1.13. An unclassified ditch in the north-east corner of the application site is believed to flow in an easterly direction, following site visit confirmation. These flows join with the ditch running south along the eastern edge of the application site (refer to **Figure 2-4**). It is believed that this ditch flows through a culvert towards Lingley Mere, east of the Proposed Development.

2.1.14. Unconnected ditches are also present within the centre of the application site adjacent to Big Wood Belt, highlighted in **Figure 2-4**. A site visit confirmed that these do not flow in to the ordinary watercourses or main river within the application site.

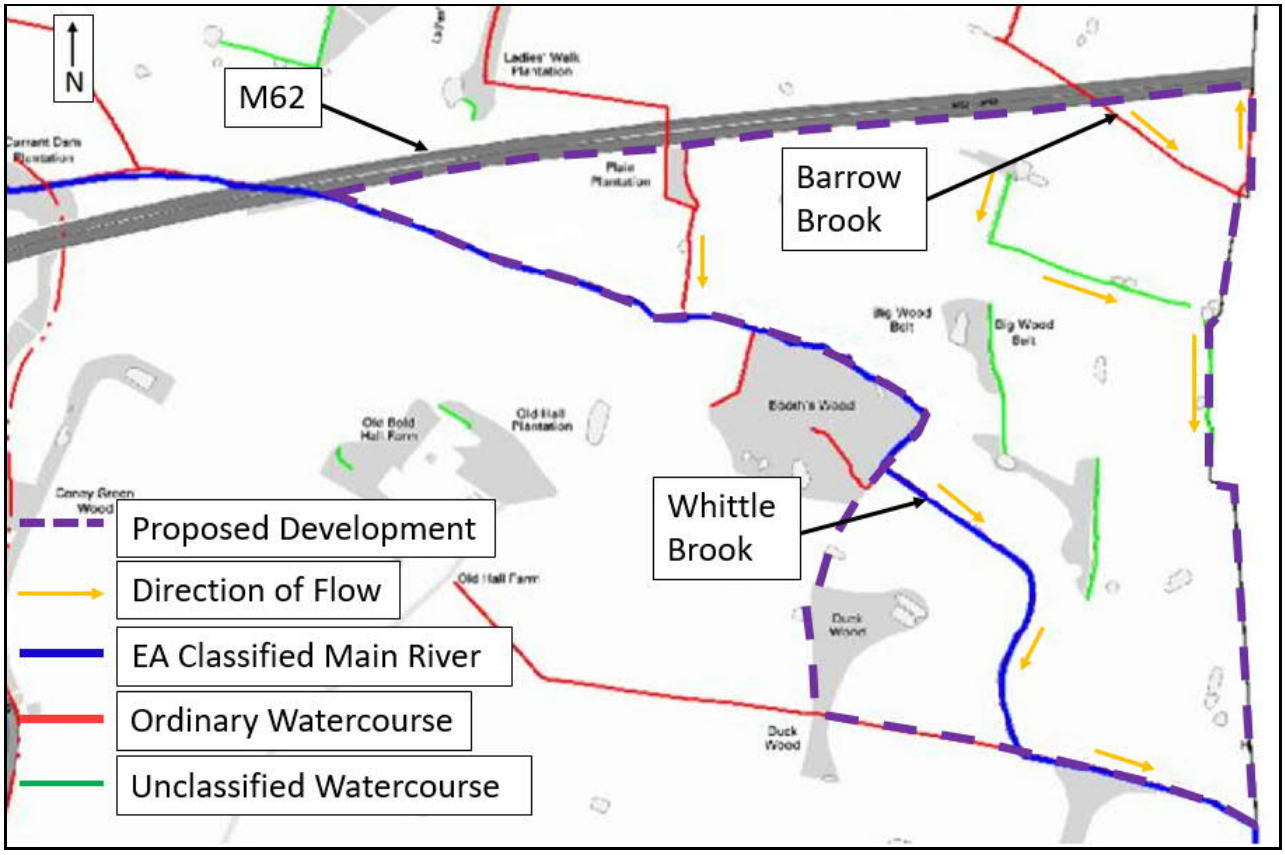


Figure 2-4 - Watercourse Networks within the Application Site

2.1.15. Asset location plans have been obtained from United Utilities who are the water company serving the area of the application site. There are no United Utilities surface water, foul water or combined sewers located within the application site, although directly to the east in Lingley Mere Business Park there are both foul and surface water networks. These are private assets and range in size from 150mm to 600mm.

2.1.16. The existing geological boundaries across the application site can be seen in Section 6.4.

3 PROPOSED DEVELOPMENT

3.1.1. The Applicant is seeking to build a westward expansion of the Omega Business Park south of the M62. The Proposed Development is subject to a hybrid planning application for both detailed and outline planning permission.

3.1.2. Detailed planning permission will include the erection of a B8 warehouse, with ancillary offices, associated parking, infrastructure and landscaping. This is referred to as Omega Zone 8 Unit 1 with external features including the following (refer to **Appendix B**):

- Overall total 81,570sq.m building
- A total of 576 car parking spaces
- 383 HGV parking spaces
- Service yards
- Attenuation ponds to the north-east and west of Unit 1
- Inbound and outbound gatehouse

3.1.3. The outline planning proposals extend to the south of Unit 1 and include an area of future expansion land for Unit 1 (to the east), are for up to 123,930sq.m of employment development, spread across the Unit 1 expansion land and three separate warehouse buildings to the south (Units 2, 3 and 4).

3.1.4. It is expected that the total Proposed Development would occupy an area of approximately 75ha consisting of (refer to **Figure 3-1** and **Appendix C**):

- Four units of general industrial (B2) and storage/ distribution (B8) development
- Ancillary office space
- 576 car parking spaces for Unit 1, additional parking to be determined for the outline area at its detailed application stage
- 383 HGV parking spaces for Unit 1, additional parking to be determined for the outline area at its detailed application stage
- Service yards
- Surface water drainage attenuation ponds

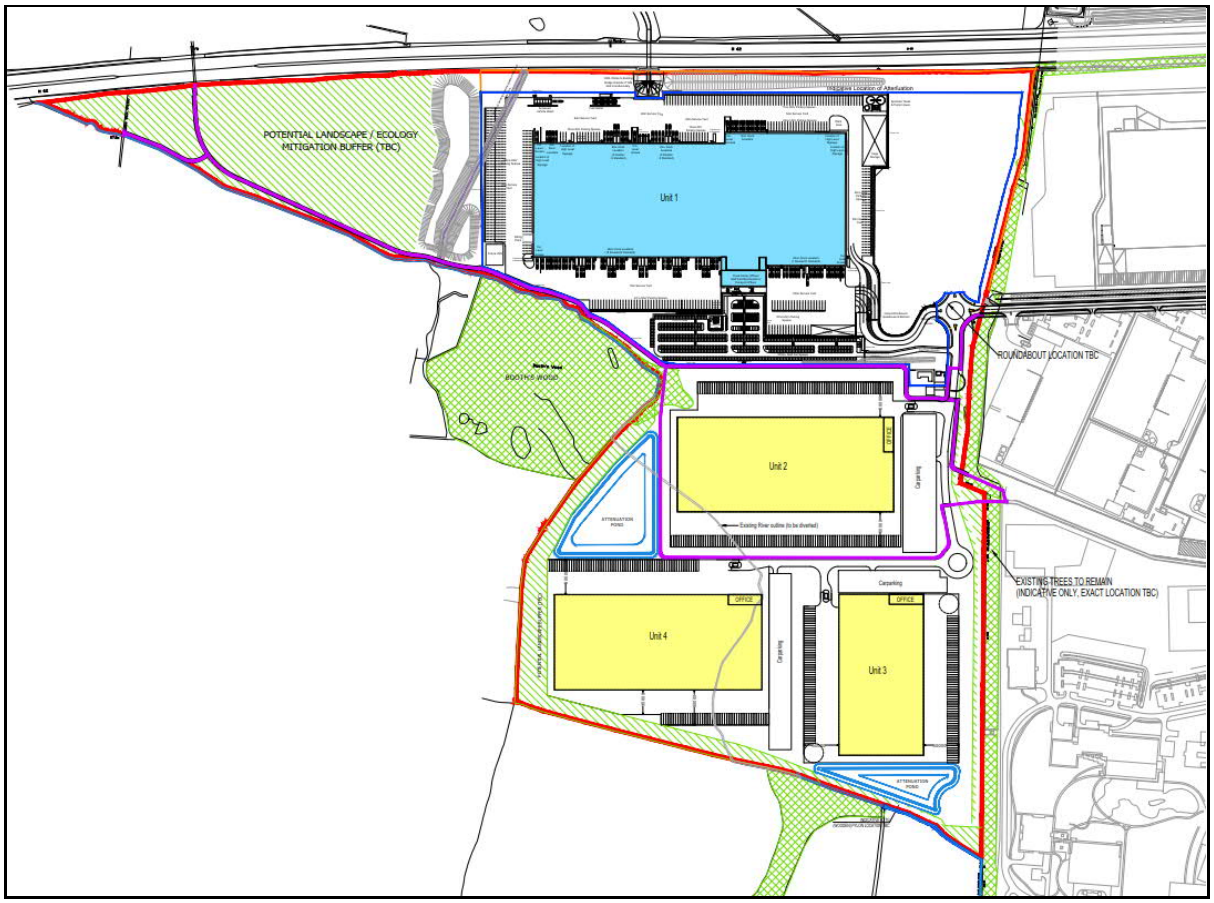


Figure 3-1 - Masterplan of Proposed Development

3.1.5. The proposed surface type areas for the Proposed Development are shown in **Table 3-1**.

Table 3-1 – Proposed Development Areas

Element	Approximate Area (ha)
Application site boundary	75
Extent of proposed impermeable area within application site boundary	41
Extent of proposed permeable area within application site boundary	34

3.1.6. The Proposed Development includes the realignment of the Whittle Brook. Details of this can be found in Section 6.1. The realignment diverts flow around the western and southern boundary of the application site, whereas currently the Whittle Brook flows through the centre of the southern area of the application site.

4 NATIONAL PLANNING POLICY FRAMEWORK

4.1 FLOOD ZONE DEFINITION

4.1.1. The NPPF promotes the use of the risk-based sequential test (which recognises that risk is a function of probability and consequence), in which new development is preferentially steered towards the areas at lowest probability of flooding. These areas are identified by Flood Zones as defined below:

- Flood Zone 1: Low probability of flooding – less than 0.1% (in 1,000) annual probability of river or sea flooding in any year
- Flood Zone 2: Medium probability of flooding – between 1% and 0.1% (1 in 100 and 1 in 1000) annual probability of river flooding and between 0.5% and 0.1% (1 in 200 and 1 in 1000) annual probability of sea flooding in any year
- Flood Zone 3a: High probability – 1% (1 in 100) or greater annual probability of river flooding or 0.5% (1 in 200) or greater annual probability of sea flooding in any year
- Flood Zone 3b: The functional floodplain – where water has to flow or be stored in times of flood, including flood conveyance routes and areas designed to flood as part of a flood defence scheme.

4.1.2. It should be noted that Flood Zones 1, 2, 3a ignore the presence of existing flood defences.

4.2 FLOOD RISK VULNERABILITY

4.2.1. In the NPPF PPG, developments are classified according to their 'Flood Risk Vulnerability' as presented in the extract from NPPF and PPG in **Figure 4-1**. The Proposed Development is classified as 'Less vulnerable', falling under the NPPF PPG category of buildings used for shops, financial, professional and other services.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Figure 4-1 - Flood Risk Vulnerability Classification

4.3 APPROPRIATE DEVELOPMENT

4.3.1. The appropriate uses and FRA requirements for land in each flood zone is described in the NPPF PPG. For the purposes of flood risk analysis, the Proposed Development is classified as 'Less vulnerable'. The majority of the application site is located within Flood Zone 1, although there are small areas which are located with Flood Zone 2 extents. Applying the flood risk vulnerability and flood zone compatibility table in the NPPF and PPG shows that the Proposed Development is appropriate in this location (refer to **Figure 4-2**).

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
× Development should not be permitted.

Figure 4-2 - Flood Risk Vulnerability and Flood Zone Compatibility

5 PREVIOUS STUDIES AND HISTORIC FLOODING

5.1 PREVIOUS STUDIES

5.1.1. Due to the application site being adjacent to the boundary of Warrington Borough Council, with the Whittle Brook and Sankey Brook downstream catchments being located in Warrington Borough Council area downstream of the application site, a number of relevant Warrington Borough Council documents have been reviewed for this FRA in addition to relevant St. Helens Council documents.

NORTH WEST RIVER BASIN MANAGEMENT PLAN

5.1.2. The North West River Basin Management Plan[2] covers approximately 13,200km^2. It extends from Cumbria in the north and includes parts of Staffordshire to the south. Parts of North Yorkshire are included to the east and Merseyside to the west (refer to **Figure 5-1**).

5.1.3. In total, nearly seven million people live and work in the North West and the district includes large urban areas such as Liverpool and Manchester.

5.1.4. The North West River Basin District is split in two 12 management catchments, including interconnected rivers, lakes, groundwater and coastal waters. The catchment of interest in relation to the Proposed Development lies within the Mersey Estuary catchment.

5.1.5. Around 80% of the river basin is rural, with the majority of land being used for agriculture. Livestock farming is the most common rural land use. The Lake District and Lancashire coast are tourism centres and make a significant contribution to the economy.

5.1.6. Physical modifications affect 50% of the water bodies in this river basin district, with people making physical changes to rivers, lakes and estuaries. These changes include flood defences, weirs and changes to the size and shape of natural flow paths, causing excessive build-up of sediment in surface water bodies and the loss of habitats and recreational uses.

5.1.7. Future aims for the Mersey Estuary catchment include the following:

- Development and implementation of catchment wide strategies to improve the water environment through a framework for individual operational catchments and water bodies
- Sustainable urban drainage systems project(s) with the potential to deliver benefits for the water environment and flood risk whilst addressing issues such as mine water contamination and highways run-off
- Cross-catchment concerted River Guardians programme including public, private and voluntary sectors to enable citizen science for local communities to monitor their own water environment and taken an active role in its stewardship.

[2] North West River Basin Management Plan (2015): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718335/North_West_RBD_Part_1_river_basin_management_plan.pdf

Figure 5-1 - Map of the North West River Basin District (RBMP, 2015)

MERSEY ESTUARY CATCHMENT FLOOD MANAGEMENT PLAN

5.1.8. The Mersey Estuary Catchment Flood Management Plan[3] establishes flood risk management policies to deliver sustainable flood risk management for the long term to assist all key decision makers in the catchment.

5.1.9. In the Mersey Estuary catchment, urban areas at risk from significant river flooding include Warrington, Wallasey, Birkenhead, St. Helens and Hindley. There are approximately 19,000 properties have a 1% chance of flooding in any one year from rivers.

[3] Mersey Estuary Catchment Flood Management Plan (2009): https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/293769/Mersey_Estuary_Catchment_Flood_Management_Plan.pdf

5.1.10. Approximately 40% of the Mersey Estuary catchment is heavily urbanised and is largely low lying with a few steeper areas in the headwaters of the Sankey Brook, of which Whittle Brook is a tributary. There is a general slow response to rainfall but is much faster for some of the smaller tributaries flowing through urbanised areas. The Sankey Brook is a major tributary of the catchment, with a tidal influence in its lower reaches.

5.1.11. Flood risk management across the catchment is provided by channel maintenance, raised defences and other flood defence structures such as sluice gates and pumping stations.

5.1.12. Much of the Mersey Estuary catchment is underlain by the Permo-Triassic Sandstone aquifer which supports groundwater abstractions and is moderately unresponsive to rainfall events.

5.1.13. The main sources of flooding in the Mersey catchment include river flooding from the Mersey's main tributaries. The Sankey Brook affects Warrington, St. Helens, Ashton-in-Markerfield and Rainford. According to the Catchment Flood Management Plan, surface water flooding occurs throughout the catchment but usually only causes a low level of risk. Some urban areas of Liverpool, Warrington and Ashton-in-Makerfield have a high surface water flood risk. Over 5,000 properties in Warrington and Sankey are at risk of river flooding (refer to **Figure 5-2**).

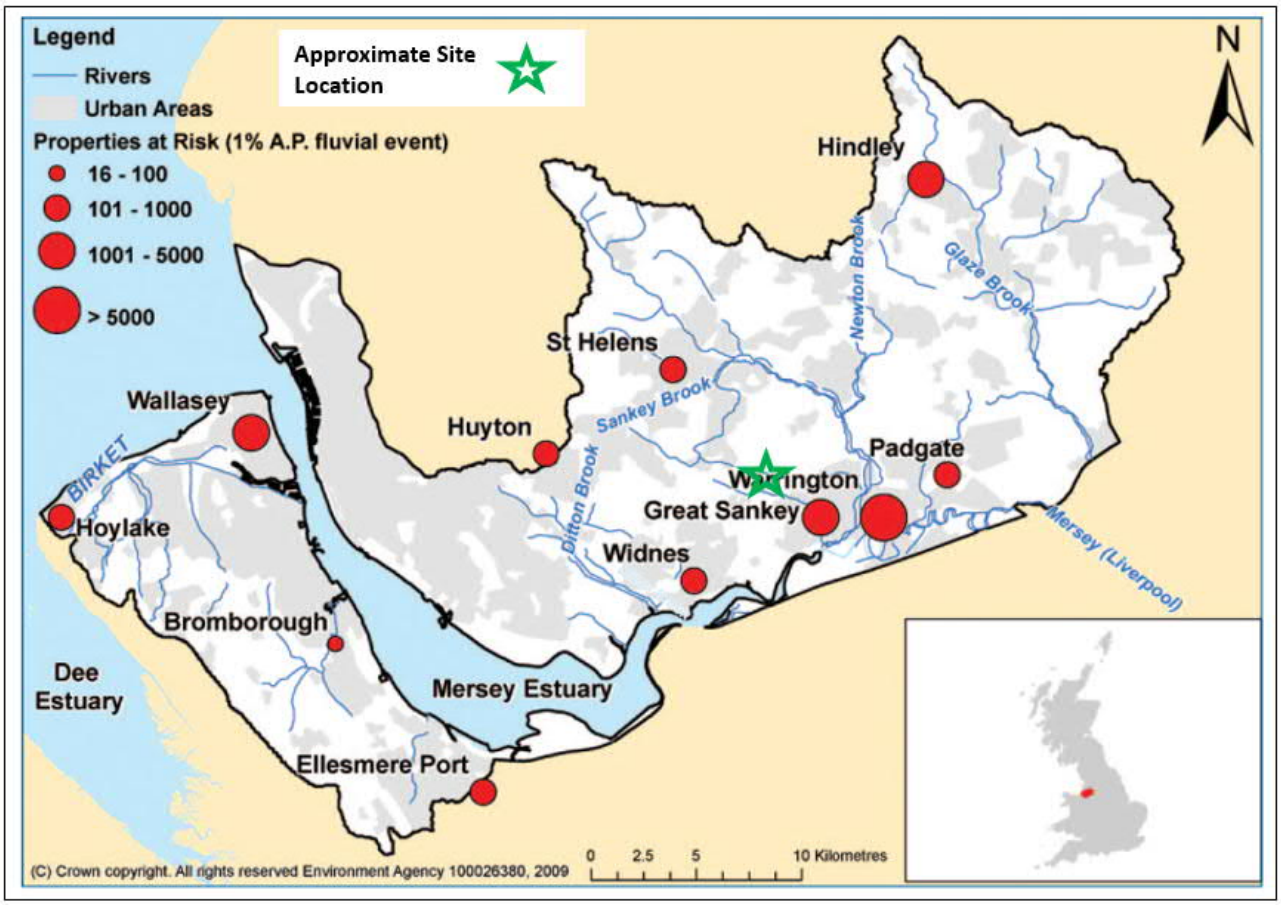


Figure 5-2 - Map Showing Number of Properties at Flood Risk in the Mersey Estuary Catchment (Catchment Flood Management Plan, 2009)

5.1.14. Current flood risk within the Mersey Estuary is managed through maintenance and improvements of existing flood defences, structures and watercourses. Identification and promotion of new flood alleviation schemes where appropriate, including land along the Sankey Brook. There are no flood defences associated with Whittle Brook along the reach adjacent or through the application site.

5.1.15. Activities that reduce the consequences of flooding include:

- Flood Risk Mapping to understand where flooding is likely to occur
- Operation of Floodline and flood warning services to nearly 600 people in 12 areas of the Mersey Estuary Catchment
- Providing flood incident management
- Promoting resilience and resistance measures for those properties already in the floodplain
- Promoting awareness of flooding so that organisations, communities and individuals are aware of the risk and are prepared in case they need to take action in time of flood.

5.1.16. The application site falls within the Widnes and Penketh sub-catchment within the Catchment Flood Management Plan. This sub-area is in two parts, one falling within the Whittle Brook catchment including Lingley Mere, Great Sankey and Penketh areas in the western parts of Warrington. The other areas cover the lower reaches of the Ditton Brook catchment and includes heavily urbanised area of Widnes.

5.1.17. There are approximately 324 properties at risk for a 1% annual probability fluvial flood event. There are also 3.2km of transport network and 13 vulnerable infrastructures including three power stations and waste management sties.

5.1.18. This area is supported by Policy Option 4. This relates to areas of low, moderate or high flood risk where the Environment Agency is already managing flood risk effectively but where further action may need to take place to keep pace with climate change.

5.1.19. Overall, the flood risk in the sub-area is low and current risks are managed to an appropriate level. The proposed actions to implement this policy are highlighted in **Figure 5-3**.

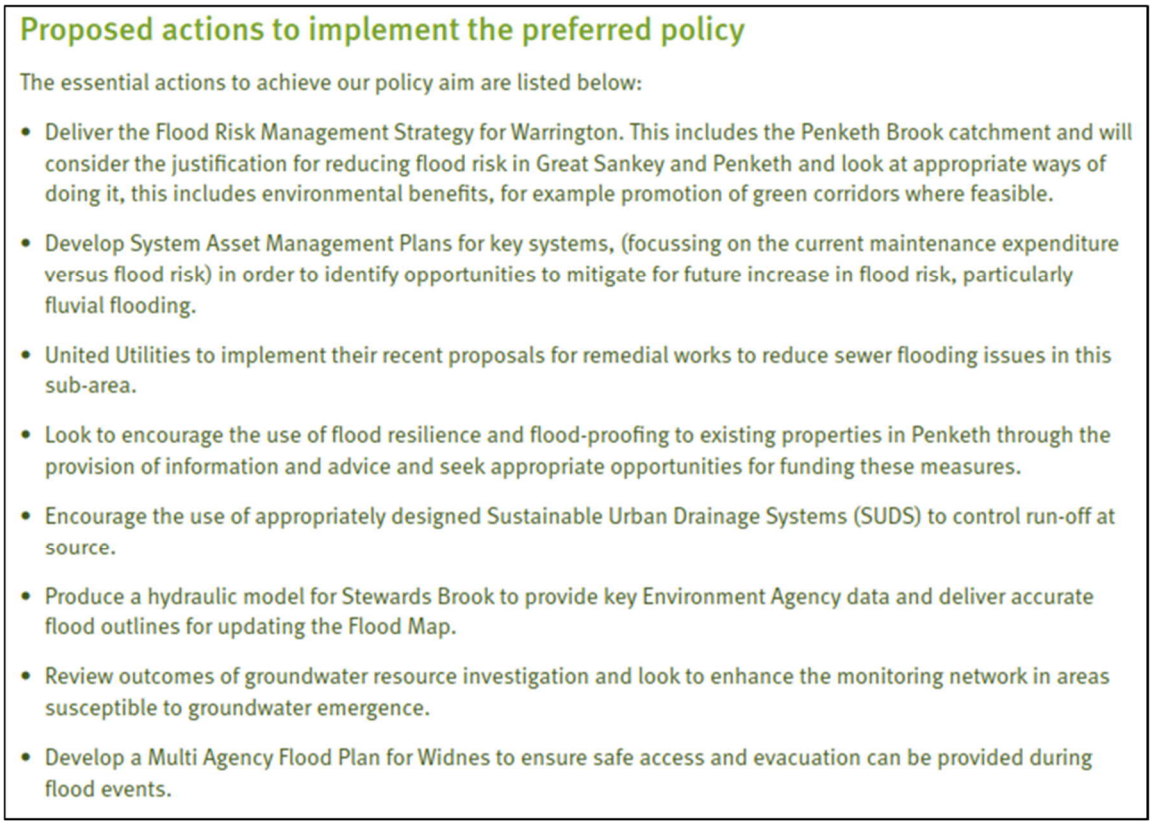


Figure 5-3 - Actions to Implement Policy Option 5 within the Mersey Estuary Catchment Flood Management Plan (2009)

SANKEY CATCHMENT ACTION PLAN

5.1.20. The Sankey Catchment Action Plan provides a framework for long-term integrated water management across the whole Sankey catchment[4]. This plan is self-standing and underpins a broader enhancement strategy for the strategically important Sankey Canal Corridor from Carr Mill in St. Helens through Warrington to Spike Island at Widnes.

5.1.21. The enhancement strategy for the canal corridor embraces the themes of biodiversity, economy, access, heritage, health and recreation and water management between Carr Mill in St. Helens and Spike Island in Halton.

5.1.22. The Sankey catchment covers 179km^2 and has 126km of Main River flowing, generally in a west to east orientation (refer to **Figure 5-4**). The Whittle Brook is a tributary feeding the Sankey Brook.

[4] Sankey Catchment Action Plan (2018): http://moderngov.sthelens.gov.uk/documents/s75485/Sankey%20Catchment%20Action%20Plan%20Final%20Version.pdf

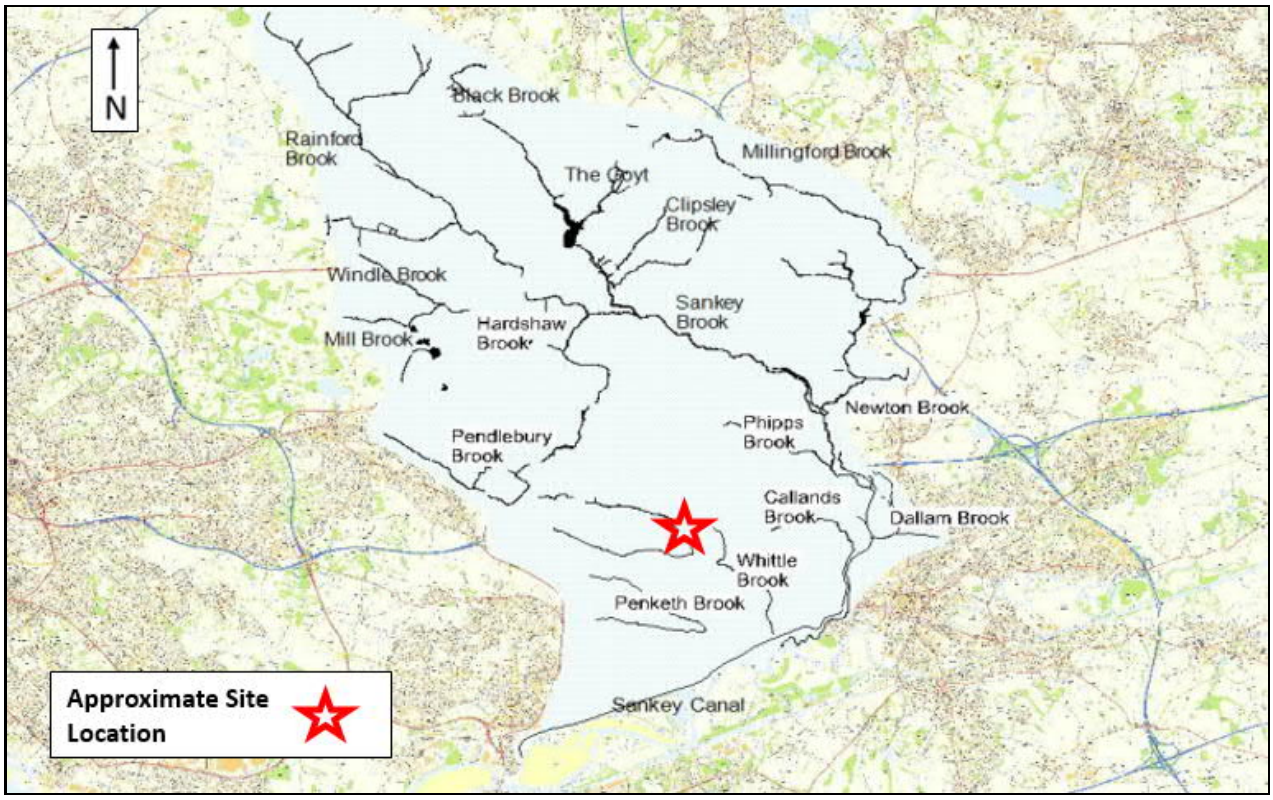


Figure 5-4 - The Sankey Catchment (Sankey Catchment Action Plan, 2018)

5.1.23. The Sankey Canal was officially abandoned in 1963 and was partially infilled. Halton, Warrington and St. Helens Council restored sections of the canal as part of land reclamation works in the 70s and 80s but the hydrology remains largely disconnected.

5.1.24. The current and potential role of the canal within flood management in the Sankey Catchment needs to be considered to understand how extra capacity for flood storage can be created and how hydraulic connectivity can be achieved to maintain cultural heritage and habitat.

5.1.25. The action plan highlights a strategic catchment approach to improve the catchment through the following interventions which work collectively to make an improvement:

- Slow the Flow – in the rural areas surrounding the headwaters of the catchment the plan seeks to slow and filter the flow to make the catchment less reactive or “flashy” in flood conditions. This would reduce channel siltation and nutrient enrichment from soil run-off. Slowing the flow would reduce damage to riverine and riparian habitats and particularly benefit vole populations. This can be done through:
  - Leaky dams to intercept overland flow or slow in-channel flow
  - Woodland planting to increase water infiltration and slow overland flow
  - Permanent grass buffer strips along river channel bank tops to filter overland flow
  - Swales to provide temporary water storage
  - Rough grassland areas designed to slow overland flow

- Urban Interventions – interventions in the urban areas will focus on water quality and water management issues. Likely interventions are likely to include:
  - Addressing misconnections
  - Urban Catchment Forestry
  - Reedbed Filtration
  - SuDS
  - Removing Culverts
  - Floodplain reconnections
  - Desilting of channels
- Biodiversity – all projects and routing maintenance should embrace the following principles:
  - Protecting and enhancing species
  - Increasing habitat quality and connectivity to reduces species population fragmentation through creation of new habitats
  - Reducing invasive species

5.1.26. The catchment action plan ensures new development contributes positively to catchment management objectives through positive planning and ensuring that climate change is considering during planning of new development.

5.1.27. The Sankey Catchment Action Plan provides a framework in which Local Authority planning policies can be harmonised, to maximise the benefits and minimise the negative effects on the water environment across the catchment.

ST. HELENS COUNCIL PRELIMINARY FLOOD RISK ASSESSMENT

5.1.28. The Preliminary Flood Risk Assessment[5] was carried out as a high-level screen exercise to identify areas in which the risk of local flooding is significant, requiring further investigation through the production of maps and management plans. It forms part of the local flood risk management strategy St. Helens is required to undertake as part of the Flood and Water Management Act 2010.

5.1.29. Using existing and available data, the Preliminary Flood Risk Assessment focuses on local flood risk sources. Local sources of flooding for the purposes of the Preliminary Flood Risk Assessment include:

- Groundwater – Water that flows out from the ground due to high water tables locally or regionally
- Ordinary Watercourses – Out of channel flows from watercourses (streams and ditches) not designated as main river
- Surface runoff – Water that flows overland following a heavy rainfall event before entering natural or artificial channels

5.1.30. The Preliminary Flood Risk Assessment highlights locally significant risk areas. The flood hazard would be analysed in these local areas and maps produced to show the likely extent, depth, direction, speed of flow and probability of possible floods and their consequences.

5.1.31. Following the above, flood risk management plans will identify the risk management objectives and the measures proposed to achieve those objectives and how the measures are to be implemented.

[5] St. Helens Council Preliminary Flood Risk Assessment (2017)
https://www.sthelens.gov.uk/media/8384/sth_pfra_2017_version_1_submitted_210617.pdf

5.1.32. The cluster method was used to identify areas above the flood risk threshold. These can be seen in **Figure 5-5**. The application site is not located within a flood risk threshold area.

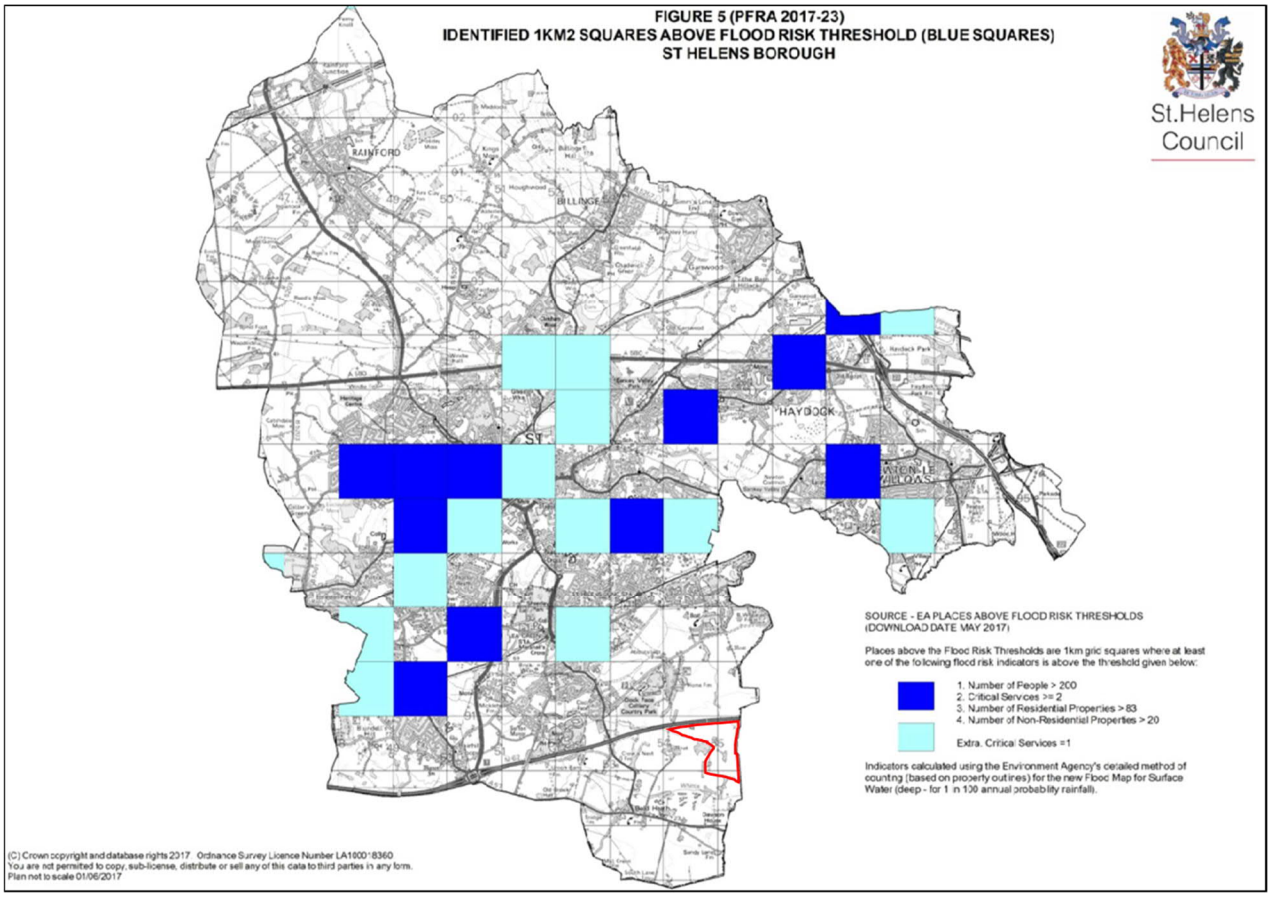


Figure 5-5 - Areas within St. Helen's Council above Flood Risk Threshold (Preliminary Flood Risk Assessment, 2017)

5.1.33. As part of the Preliminary Flood Risk Assessment, St. Helens Council has engaged with stakeholders representing the following organisations to ensure effective coordination and management of flood risk across the area:

- Environment Agency
- United Utilities
- Local Fire and Rescue Service
- Local Police Service

5.1.34. St. Helens Council has three records of local flooding locations with historically significant harmful consequences. The Council was aware of other flooding incidences; however, these were not recorded as significant. The records are not associated with the application site.

5.1.35. Maps produced as part of the Preliminary Flood Risk Assessment are reproduced in **Appendix D**, highlighting the areas at risk of groundwater flooding, ordinary watercourses and surface water runoff within the Preliminary Flood Risk Assessment study area. These maps illustrate St. Helens Council issues as a whole and a site-specific assessment for the application site is carried out for this report.

ST. HELENS COUNCIL STRATEGIC FLOOD RISK ASSESSMENT

5.1.36. St. Helens Council undertook a Strategic Flood Risk Assessment as an essential part of the Local Development Framework and in preparation of the Development Plan Documents[6]. The Strategic Flood Risk Assessment provides an overview of the key planning and flood risk policy documents that have shaped the current planning framework. The Strategic Flood Risk Assessment helps to provide information for the Local Plan and Flood Risk Assessments supporting planning applications.

5.1.37. The St. Helens Council Strategic Flood Risk Assessment highlights the Catchment Flood Management Plans within the St. Helens Council area; these were put in to place to develop long-term management of flood risk within the catchment. The majority of St. Helens lies within the Mersey Estuary Catchment Flood Management Plan, as highlighted above. The application site for the Proposed Development does not lie within the policy boundaries in St. Helens and is taken into consideration within the Warrington Borough Council Strategic Flood Risk Assessment below.

5.1.38. The St. Helens Council Strategic Flood Risk Assessment highlights that approximately 336 residential properties across St. Helens Council lie within Flood Zone 3 (refer to **Figure 5-6**). The application site lies within the Bold Ward where there are 75 properties in Flood Zone 3. It is worth noting that these figures cover the entire Bold Ward and do not represent the situation within the application site. There are no properties at risk within the application site as it is a greenfield site.

[6] St. Helens Council Strategic Flood Risk Assessment (2014) https://www.sthelens.gov.uk/media/3259/st-helens-council-strategic-flood-risk-assessment-september-2014.pdf

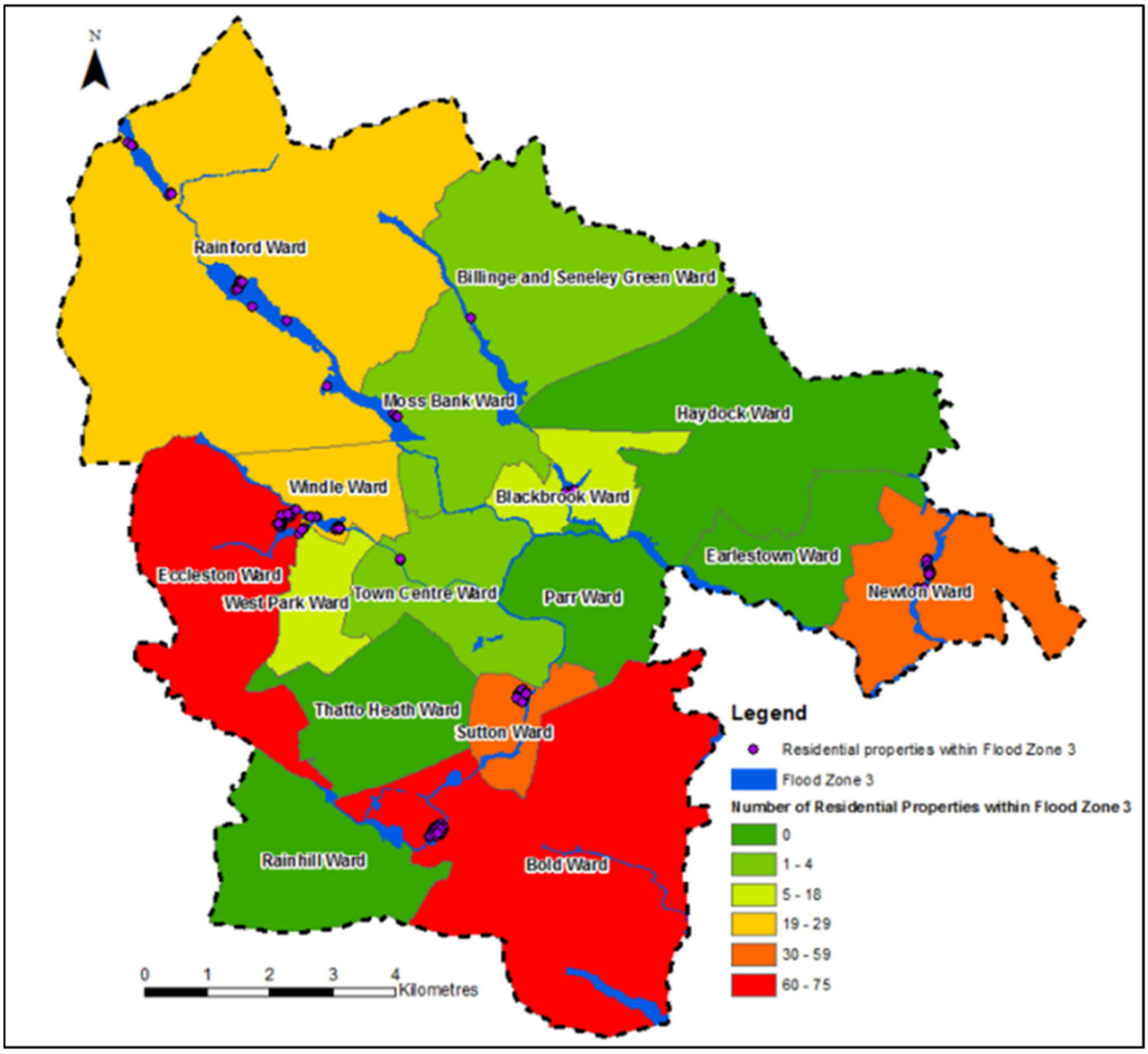


Figure 5-6 - Residential Properties within Flood Zone 3 Across St. Helens (Strategic Flood Risk Assessment (2014)

5.1.39. Critical Drainage Areas were designated to areas within Flood Zone 1 which have drainage problems that have been notified to the local planning authority by the Environment Agency. The application site does not lie within a Critical Drainage Areas in St. Helens Council's boundary.

ST. HELENS COUNCIL LEAD LOCAL FLOOD RISK MANAGEMENT STRATEGY

5.1.40. The objectives of the Local Flood Risk Management Strategy[7] comprise the following:

- Risk management authorities and responsibilities – clearly set out the different types of flooding, who is responsible and Governance arrangements
- Assessment of Flood Risk in St. Helens – assess the total risk of flooding from all sources in St. Helens
- Managing Local Flood Risk – manage flood risk and the impact of flooding through a range of activities and effective management
- Actions and Interventions to Reduce Flood Risk – develop actions and interventions to reduce flood risk
- Environment and Sustainability – to undertake flood risk management in a sustainable manner.

5.1.41. The Local Flood Risk Management Strategy indicates seven active Flood Warning Zones across St. Helens, covering 545 out of 931 properties at risk of flooding. These include the following watercourses:

- Mill Brook
- Rainford Brook
- Windle Brook
- Sutton Mill Brook
- Sutton Brook

5.1.42. St. Helens Council is a SuDS Approval Body, to approve drainage systems in new developments and redevelopments before construction commences. Currently, many of the urban drainage systems can contribute to flooding, pollution or damage to the environment and are not proving to be sustainable in the long term. SuDS are a range of techniques that aim to mimic the way rainfall drains in natural systems.

5.1.43. The Local Flood Risk Management Strategy identifies that it is often highways that are affected during periods of flooding, causing economic damage.

5.1.44. It is worth noting that an updated Local Flood Risk Management Strategy 2019-2025 is out for public consultation at the time of writing this FRA. No significant changes were noted for the application site.

WARRINGTON STRATEGIC FLOOD RISK ASSESSMENT

5.1.45. Warrington Borough Council undertook a Strategic Flood Risk Assessment[8] as an essential part of the Local Development Framework and in preparation of the Development Plan Documents. It is relevant to this FRA as the Warrington Borough Council administrative boundary forms the eastern boundary of the application site.

5.1.46. The Strategic Flood Risk Assessment provides baseline information for use in the preparation of the Sustainability Appraisal of Local Development Documents for the scoping and evaluation stages.

[7] St. Helens Council Lead Local Flood Risk Management Strategy (2014): https://www.sthelens.gov.uk/media/2676/sthelens_lfrms_2014.pdf
[8] Warrington Borough Council Strategic Flood Risk Assessment (2011) https://www.warrington.gov.uk/sites/default/files/2019-08/warrington_strategic_flood_risk_assessmement_ii_vol_2_2011.pdf

5.1.47. A National Assessment of Flood Risk identified Warrington Borough as having the 10th highest number of properties at significant risk of flooding in England and Wales. Warrington is mainly built on the floodplain of the River Mersey with three quarters of the urban areas lying between 5 and 12 metres above sea level (AOD).

5.1.48. Warrington is at risk of flooding from different sources including main rivers, ordinary watercourses, surface water runoff, sewer flooding and the residual risks associated with artificial water bodies such as the Bridgwater Canal, the Manchester Ship Canal and reservoirs.

5.1.49. The main sources of flooding in Warrington come from the River Mersey and its five tributaries which flow the centre of the borough. The Manchester Ship Canal plays a vital role in managing fluvial flood risk along the Mersey. Although the canal is principally used for navigation, it also provides a floodwater bypass channel for Warrington, significantly reduces the incidence of flooding from fluvial flows.

5.1.50. Locations within the Sankey catchment have been identified as areas which are at risk of groundwater flooding.

5.1.51. Certain locations within Warrington are at risk from surface water flooding, due to either insufficient capacity of the underlying drainage systems or their complex interaction with urban watercourses through both overland or combined sewer overflows. However, in most cases the source or mechanism of flooding is unknown and areas will be sensitive to large rainfall events.

5.1.52. The Whittle Brook originates in the borough of St. Helens, flowing in a south easterly direction through farmland before entering the Sankey Brook and then the River Mersey. The Whittle Brook is an open watercourse with urban development and structures restricting flow, particularly at Barrow Hall Bridge.

5.1.53. The Whittle Brook currently flows directly through the southern part of the application site. The proposed channel realignment will alter the course of the Whittle Brook to be around the western and southern boundaries of the application site.

WARRINGTON BOROUGH COUNCIL ENVIRONMENT AND REGENERATION SURFACE WATER EVIDENCE BASE

5.1.54. The Surface Water Management Plan for Warrington Borough Council was produced to provide evidence regarding the extent of surface water flooding across the borough[9].

5.1.55. The Surface Water Management Plan has undertaken a more detailed assessment of the risk of surface water flooding than that completed within the Strategic Flood Risk Assessment. The Surface Water Management Plan risk assessment has been undertaken on a strategic scale and is therefore suitable for gaining a broad understanding of surface water flood risk across the Borough and the likely impact that new development will have on surface water flood risk in surrounding areas.

5.1.56. The Warrington Surface Water Management Plan consisted of contributions from the following organisations:

- Warrington Borough Council
- The Environment Agency
- United Utilities

[9] Warrington Borough Council Environment and Regeneration Surface Water Evidence Base (2012): https://www.warrington.gov.uk/sites/default/files/2019-08/surface_water_management_plan_may_2012.pdf

- Jacobs (technical support and assistance).

5.1.57. The Surface Water Management Plan suggests that surface water flooding in Warrington is likely to have two main characteristics:

- Large-scale, shallow ponding areas affected by widespread flooding, with the potential to affect hundreds of properties during and after very high intensity rainfall events
- Small-scale, localised flooding issues, likely to affect few properties but potentially occurring with much greater frequency.

5.2 HISTORIC FLOODING

5.2.1. According to the St. Helens Council Strategic Flood Risk Assessment there has been incidents of flooding within the Borough, although none of these were recorded as "nationally significant" or "historical local significant". These were not identified as being within the application site.

5.2.2. The St. Helens Council Local Flood Risk Management Strategy highlights flooding incidences from September 2012, with 90mm of rain falling in 48 hours compared to the September normal average of 73.44mm. The resultant floods were the worst to have occurred in St. Helens since 2000. This is true for the borough of St. Helens Council and not solely for the application site.

5.2.3. According to the Warrington Borough Council Strategic Flood Risk Assessment, there is a history of fluvial and tidal flooding in central Warrington dating back to 1767. Fluvial flooding is associated with Mersey tributaries including the Dallam, Sankey and Whittle Brooks rather than the Mersey itself.

5.2.4. Significant historic flood events within the Sankey catchment have included:

- 1968 – Sankey Brook flooding the Dallam and Bewsey area
- 1978 – Sankey Brook around the Sankey Bridges area
- 2000 – Whittle Brook due to sewage pipe overflow.

6 FLOOD RISK ASSESSMENT

6.1 FLOOD RISK FROM RIVERS AND THE SEA

ENVIRONMENT AGENCY WEB BASED DATA

6.1.1. The Environment Agency holds the most up to date information on flood risk from main rivers and the sea at the location of the Proposed Development. Therefore, this information has been used to make an assessment of the flood risk for this FRA.

6.1.2. The Environment Agency Flood Map for Planning in **Figure 6-1** shows the application site boundary for the Proposed Development. The majority of the Proposed Development is located within Flood Zone 1. This is an area assessed as having a less than 1 in 1,000 annual probability of flooding from the rivers or the sea (<0.1% Annual Exceedance Probability (AEP)). This classifies the area at a low risk.

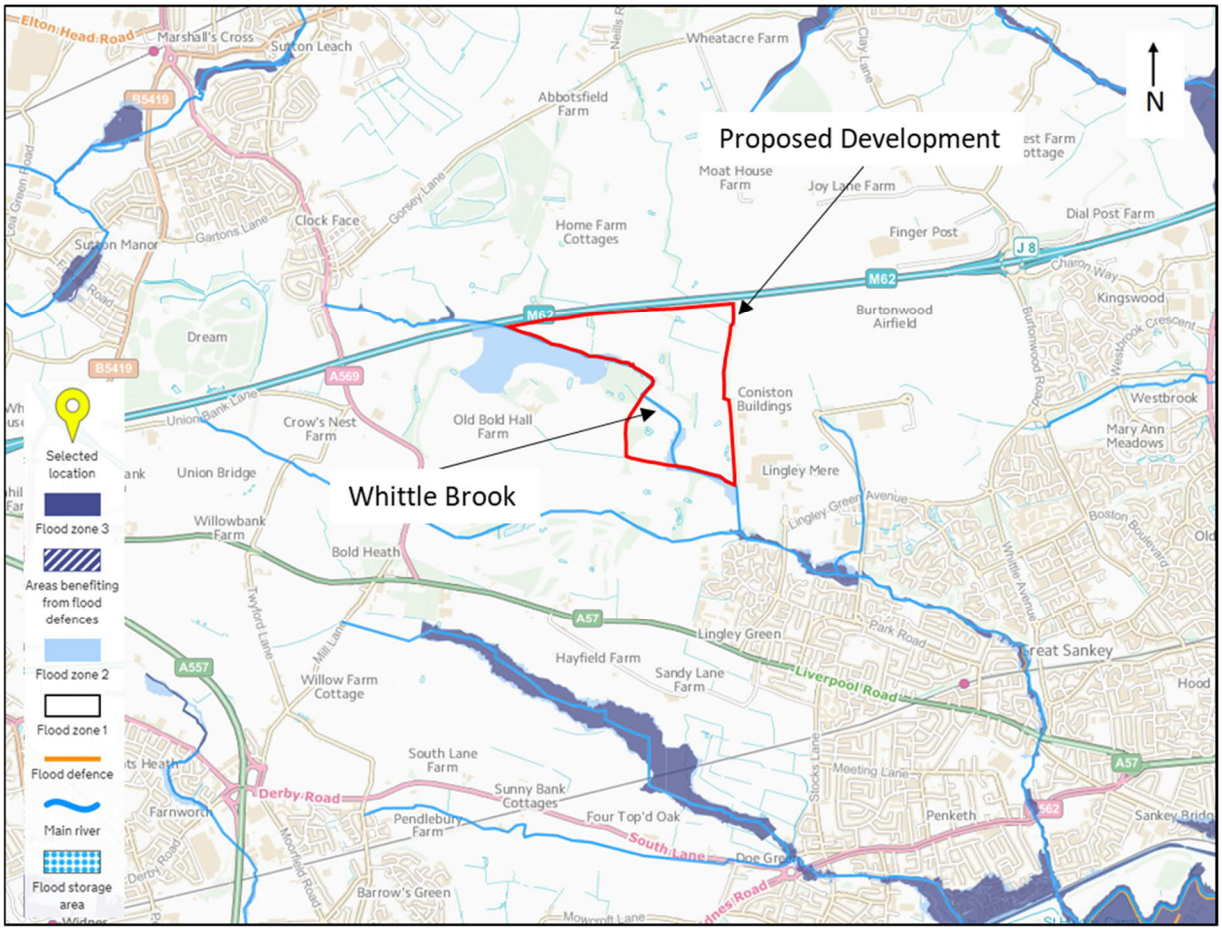


Figure 6-1 - Flood Map for Planning with Application Site Boundary (Environment Agency, 2019)

6.1.3. Where the Whittle Brook currently flows adjacent to and through the application site, there are areas of land which lie within Flood Zone 2 (refer to **Figure 6-2**). These are areas which are assessed as having between a 1 in 100 and a 1 in 1,000 annual probability of river flooding or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. This classifies these areas at medium risk.

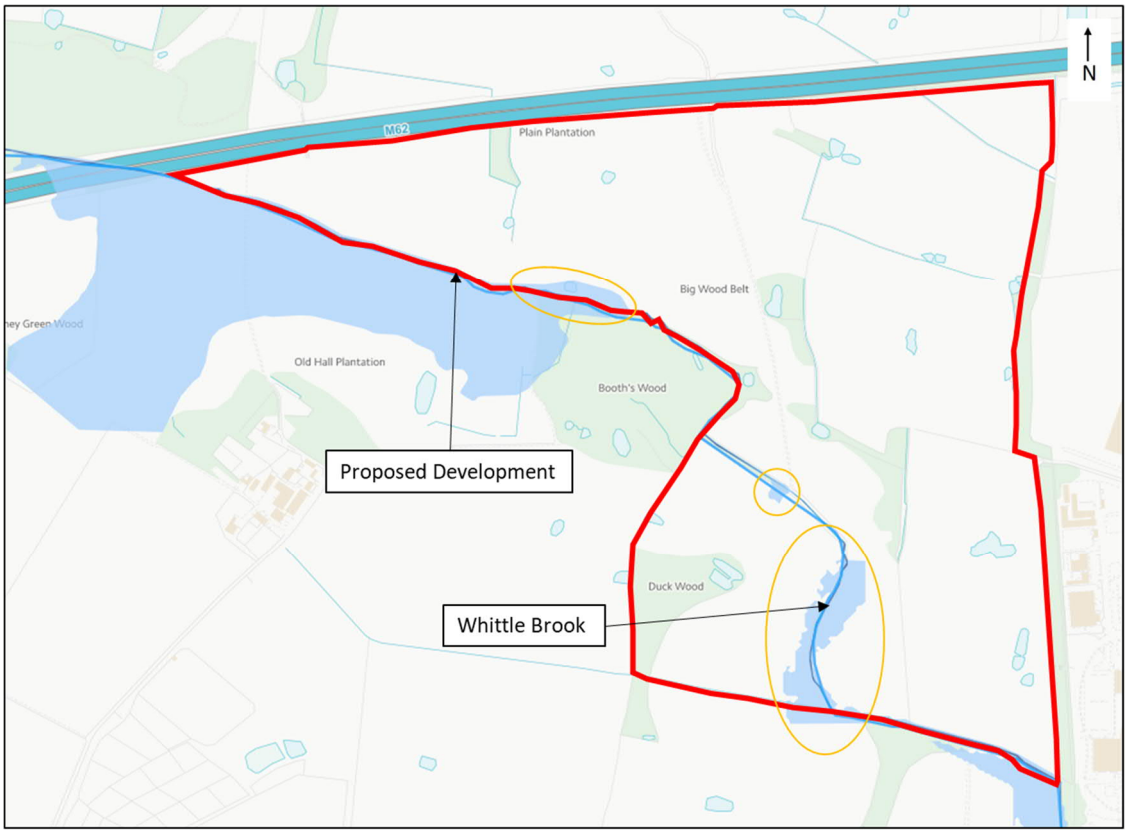


Figure 6-2 - Flood Map for Planning with Application Site Boundary with Flood Zone 2 designated land circled

6.1.4. The Whittle Brook is to be realigned as part of the Proposed Development and provides an opportunity to reduce flood risk associated with the Whittle Brook within the application site. With suitable drainage design this would increase the capacity of the channel, retaining flows in channel and therefore remove the Flood Zone 2 risk associated with the Whittle Brook in the southern site area.

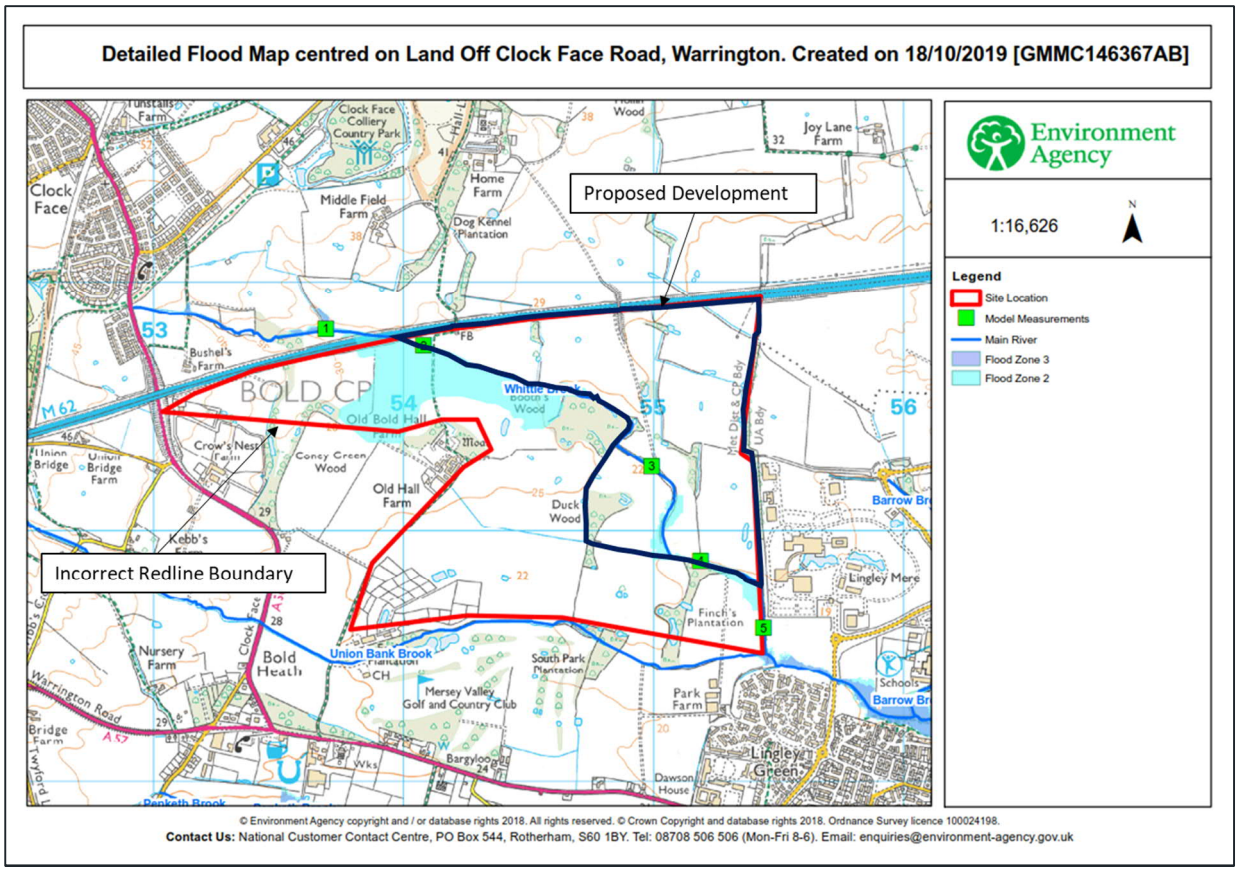
6.1.5. It is worth noting that there are further Flood Zone 2 designations immediately west of the northern part of the application site. The Proposed Development is not impacted by and will not impact these areas.

6.1.6. There are no flood defences within the vicinity of the application site boundary.

6.1.7. Based on the Environment Agency internet information available at the time of assessment, the overall flood risk from rivers is assessed as being low within the application site.

ENVIRONMENT AGENCY CONSULTATION DATA

6.1.8. The Environment Agency provided the site-specific Flood Zone map in **Figure 6-3** highlighting the current flood risk around the application site.



N.B. The correct application site boundary is shown in dark blue. The red boundary has been incorrectly applied.

Figure 6-3 - Detailed Flood Map around the Application Site Boundary (Environment Agency, 2019)

6.1.9. Consultation with the Environment Agency indicated there was 2008 hydraulic model along the Whittle Brook suitable for use for this FRA. The modelled flows and levels at points of interest immediately upstream, within and immediately downstream of the Proposed Development, are presented in **Table 6-1**. The node references can be located on the detailed flood map above in **Figure 6-3**.

6.1.10. All Environment Agency site specific consultation data can be found in **Appendix E**.

Table 6-1 – Environment Agency Baseline Modelled Water Levels

Map Reference	Model Node Reference	1% AEP without defences	1% AEP + 20 % Climate Change without defences	0.1% AEP without defences
1	WHIT02_4849	28.223	28.298	28.479
2	WHIT02_4449	26.531	26.606	26.856
3	WHIT02_3266u	21.002	21.152	21.606
4	WHIT02_2721	18.866	18.998	19.400
5	WHIT02_2280	16.565	16.652	16.859

HYDRAULIC MODELLING UNDERTAKEN

6.1.11. Using the Environment Agency 2008 model, hydraulic modelling was carried out along the Whittle Brook for the baseline and Proposed Development scenario.

6.1.12. The modelling was carried out in Flood Modeller Pro version 4.2.

6.1.13. The following outputs were produced as part of the Environment Agency study and have been updated for the current study. An additional climate change scenario was added to reflect the updated Environment Agency guidance[10] for climate change.

- 0.1% AEP 'without defences'
- 1% AEP 'with defences'
- 1% AEP 'without defences'
- 1% AEP 'without defences' plus 20% climate change
- 1% AEP 'without defences' plus 35%[11] climate change (not included in the original Environment Agency study).

6.1.14. All the baseline scenarios were rerun with a newer version of Flood Modeller (version 4.2) in steady mode and checks made between the 2008 results and the results from the newer version of Flood Modeller.

6.1.15. The results have been compared with the 2008 results from the Environment Agency model and they compared relatively well, particularly around the location of the proposed realigned channel (cross section WHIT02_3559 to WHIT02_2721). The largest discrepancy is noted in the climate change scenario which is run in Steady Timestep mode chosen as a result in instabilities in the model. The only way to improve the model would be to make changes to the geometry; however the model would not be comparable with the 2008 model results which opposes the purpose of this test.

6.1.16. The channel realignment was designed using the principle of a two-stage channel, whereby low-flows are accommodated by a primary channel, and higher flows, generally those exceeding a 50% AEP event, inundate the wider, secondary zone of the channel cross-section.

6.1.17. **Figure 6-4** below shows the proposed realignment of the Whittle Brook watercourse as part of the Proposed Development.

[10] https://www.gov.uk/environment/climate-change-adaptation

[11] The climate change uplift of 35% applied to the 1% AEP is that for peak river flow for the North West river basin district for the 2080s (2070-2115) higher central allowance category as a precaution. The allowance category for less vulnerable development in Flood Zone 2 is the central allowance category with an uplift of 30%.

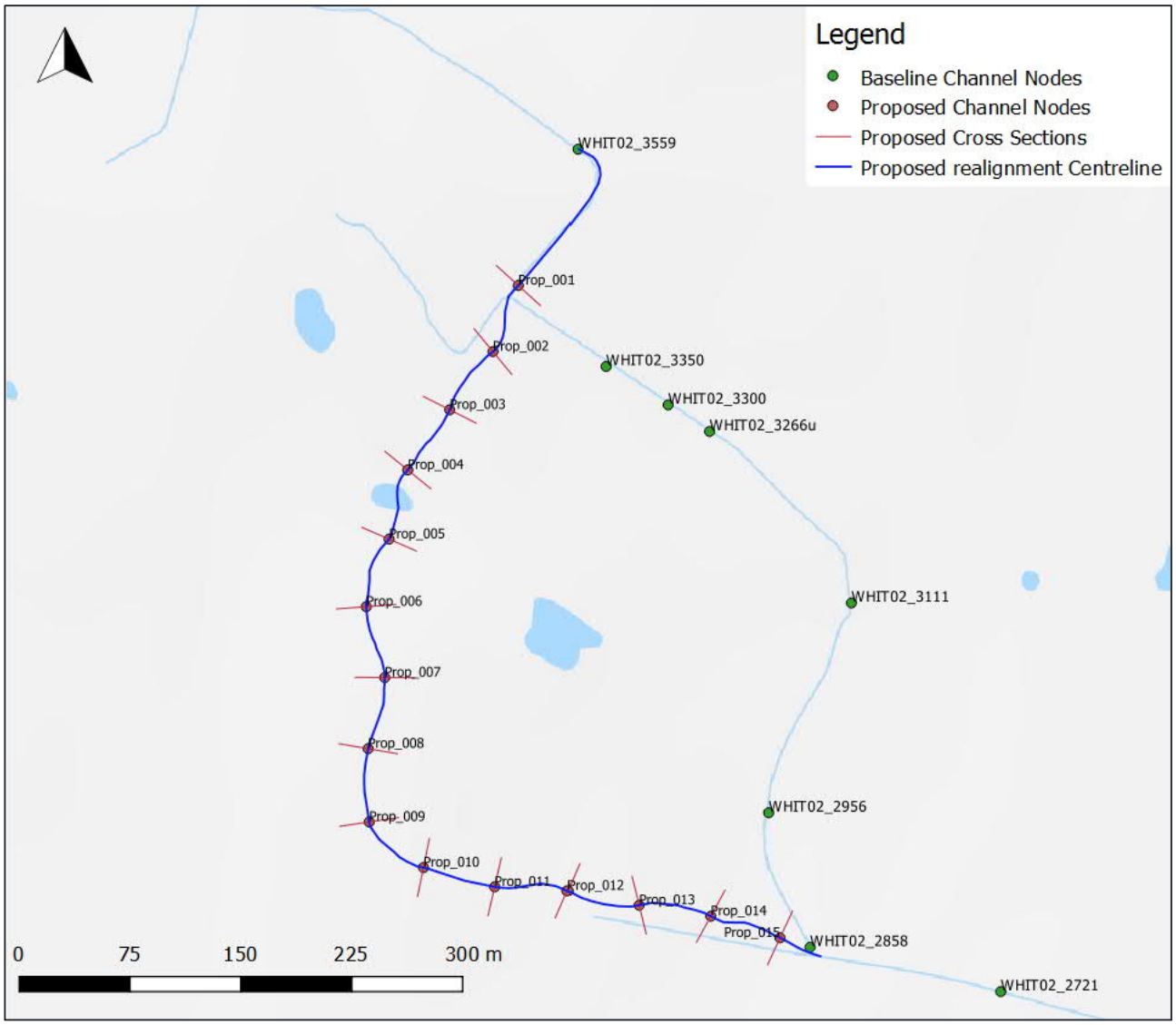


Figure 6-4 - Proposed Realignment of Whittle Brook

6.1.18. In addition, glass walling was observed at several cross sections in both the baseline and proposed model due to poor cross section data.

6.1.19. For the purpose of this study, the original Environment Agency 'fit for purpose' baseline model was not improved since the scope was to provide a comparison between the existing baseline model and incorporate the proposed channel realignment to inform the likely post-development flood risk and to provide information for the Water Framework Directive assessment.

6.1.20. The results show that the proposed realignment conveys all the estimated flow for all return periods apart from the last cross section where there is glass-wall for the 0.1% AEP which is most likely because of the glass-wall at the cross sections downstream of the realignment.

6.1.21. In addition, the comparison between the baseline and the proposed models showed that the impact is negligible for most of the cross sections and the water levels have decreased at these sections. This is because the capacity of the channel has increased due to the altered bed levels, the two-stage and wide cross sections and the increased length of the channel by 137m.

6.1.22. Based on the results of this study, the proposed realignment is an acceptable solution as it does not have an adverse impact on water levels in the watercourse or increase flooding elsewhere. The capacity is sufficient to convey the estimated flows for all return periods tested without overtopping of the watercourse channel.

6.1.23. There are a number of limitations associated with the model and it is recommended that a full model review is undertaken with associated improvements and updates made to the model at the detailed design stage of the proposed realigned channel. The main limitations are listed below:

- The hydrology data has not been reviewed since the original model was developed in 2008. It is recommended that a full review and update is made to the hydrology
- Update the model from steady mode to unsteady using full flow hydrographs
- Extend the cross sections with glass-walling at the baseline model, check if the floodplain needs to be represented in a 2D domain by converting the model to 1D-2D Flood modeller – Tuflow or trim the model at the downstream part to avoid a 2D model
- Check if the possible flooding at the area downstream of the realignment has any impact at the Proposed Development with the updated model.

6.1.24. A Technical Note with full details from the hydraulic modelling can be found in **Appendix F**.

6.2 FLOOD RISK FROM OVERLAND SURFACE WATER RUNOFF

SURFACE WATER MAPPING

6.2.1. The Environment Agency internet based mapping showing the flood risk from surface water at the application site is presented in **Figure 6-5**. It should be noted that flood risk from surface water is difficult to predict as rainfall location and volume are difficult to forecast.

6.2.2. The mapping shows that the majority of the application site is at very low risk with areas at low, medium and high risk from surface water flooding scattered across the application site. The definitions of surface water flood risk are outlined as follows:

- **High risk** means that each year this area has a chance of flooding of greater than 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- **Medium risk** means that each year this area has a chance of flooding of between 1% and 3.3%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- **Low risk** means that each year this area has a chance of flooding of between 0.1% and 1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.
- **Very low risk** means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast. In addition, local features can greatly affect the chance and severity of flooding.

6.2.3. The overland flow paths across the application site indicate the presence of field drains within the application site.

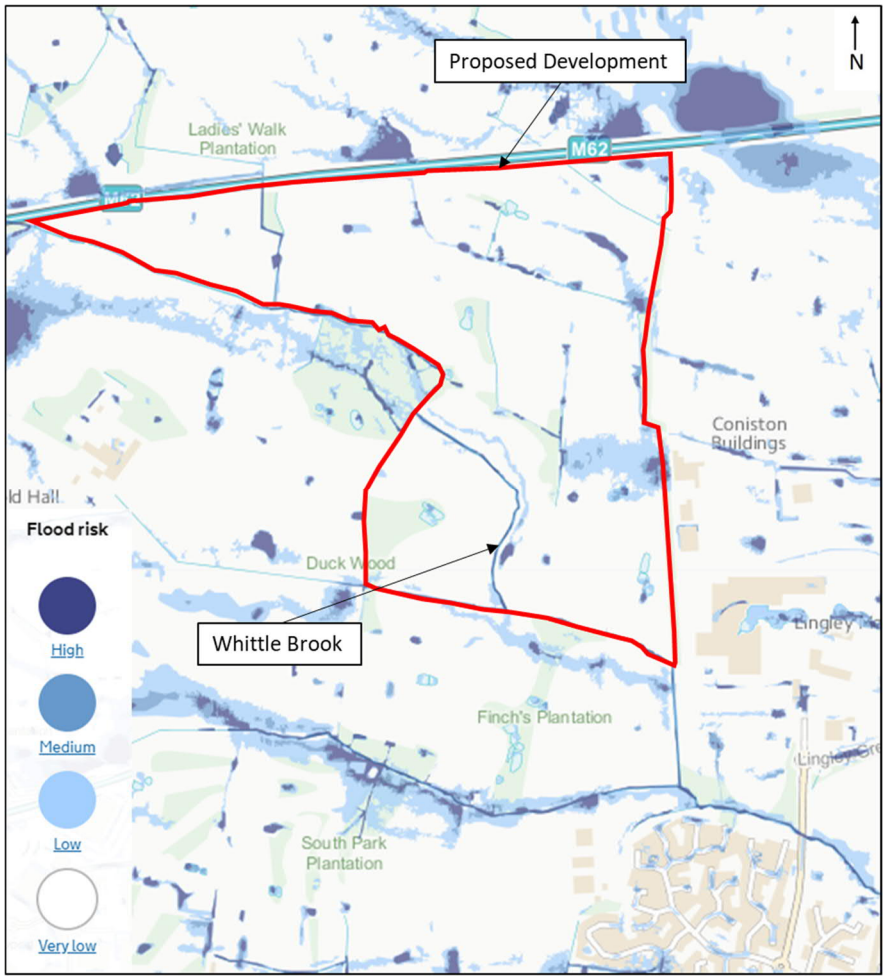


Figure 6-5 - Long Term Flood Risk Map from Surface Water with Application Site Boundary (Environment Agency, 2019)

6.2.4. Areas at low risk of flooding from surface water are classified as areas that each year have between 0.1% and 1% chance of flooding from surface water.

6.2.5. When looking at the flood risk from surface water in more detail, the areas classified at low risk are generally at risk of flood depths between 0mm and 900mm (refer to **Figure 6-6**), although there are small areas of land which are at risk of over 900mm of surface water flooding in a low risk scenario.

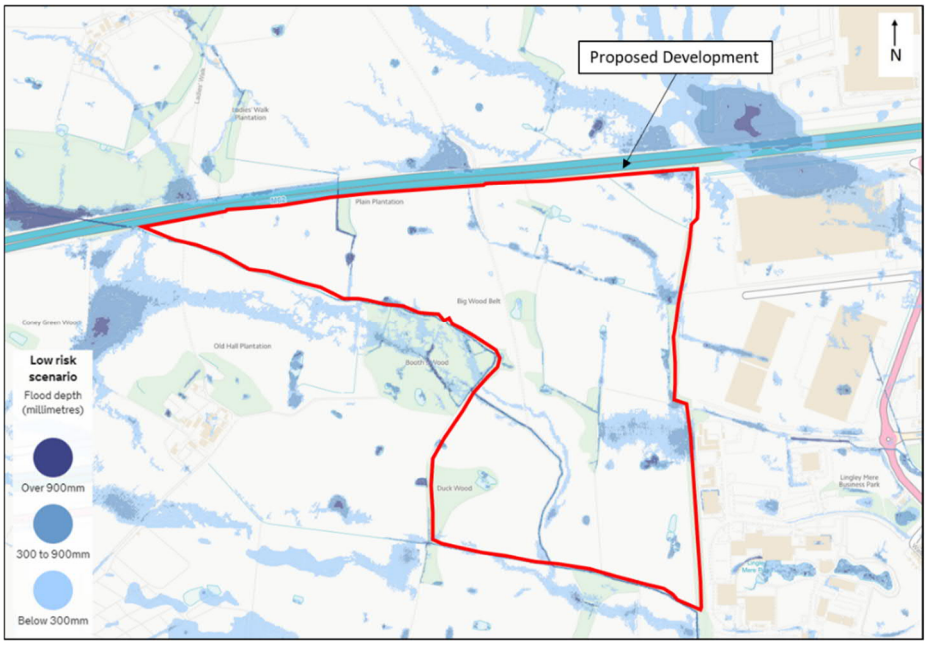


Figure 6-6 - Long Term Flood Risk Map from Surface Water (Depth) with Application Site Boundary Low Risk Scenario (Environment Agency, 2019)

6.2.6. Towards the eastern boundary of the application site, there is an area of surface water flooding at low risk which is significantly larger than the others which is worth addressing with depths ranging from 0mm to 900mm (refer to **Figure 6-7**).

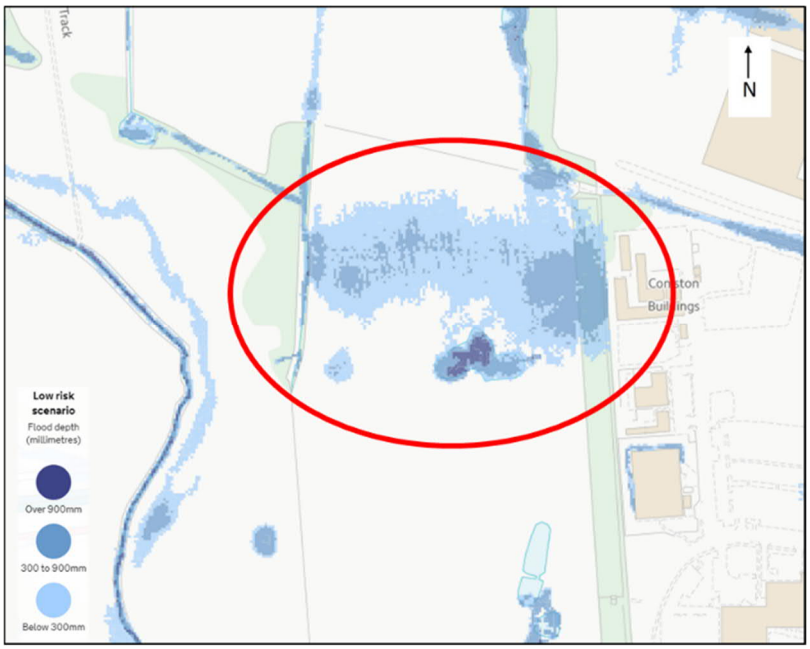


Figure 6-7 - Area of Low Risk of Surface Water Flooding with Ranging Depths (Environment Agency, 2019)

6.2.7. Areas at medium risk of flooding from surface water are classified as areas that each year have between 1% and 3.3% chance of flooding from surface water. The medium risk scenario is presented in **Figure 6-8**, with depths ranging between 0mm and 900mm.

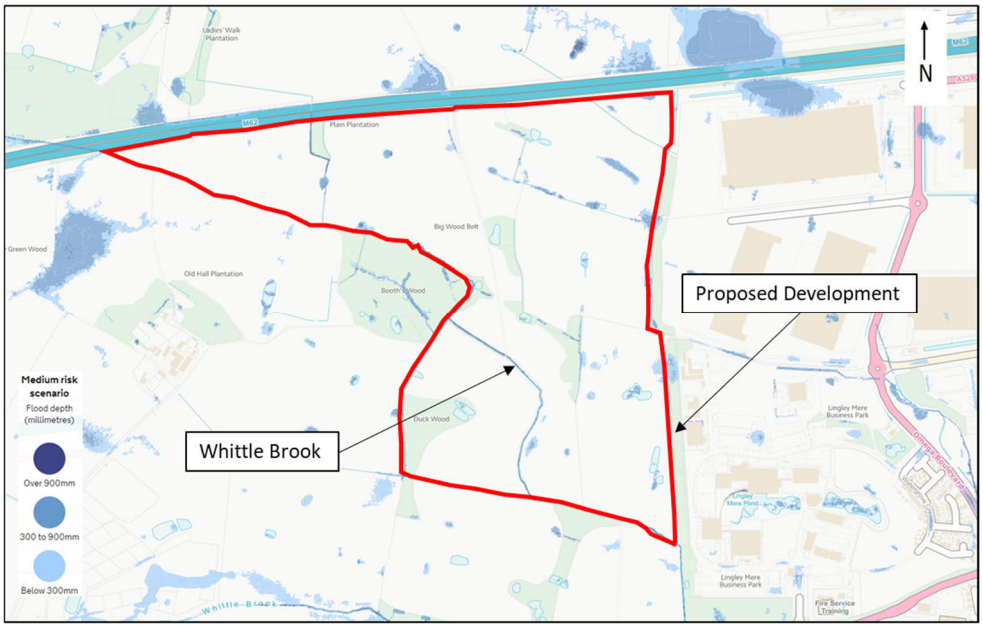


Figure 6-8 - Long Term Flood Risk Map from Surface Water with Application Site Boundary Medium Risk Scenario (Environment Agency, 2019)

6.2.8. Areas at high risk of flooding from surface water are classified as areas that each year have a chance of flooding greater than 3.3%. Within the application site, there are few areas at a high risk of flooding from surface water. Areas which are at a high risk of surface water flooding generally have low depths, under 300mm. Very few areas at risk of surface water flooding with depths of between 300mm to 900mm (refer to **Figure 6-9**).

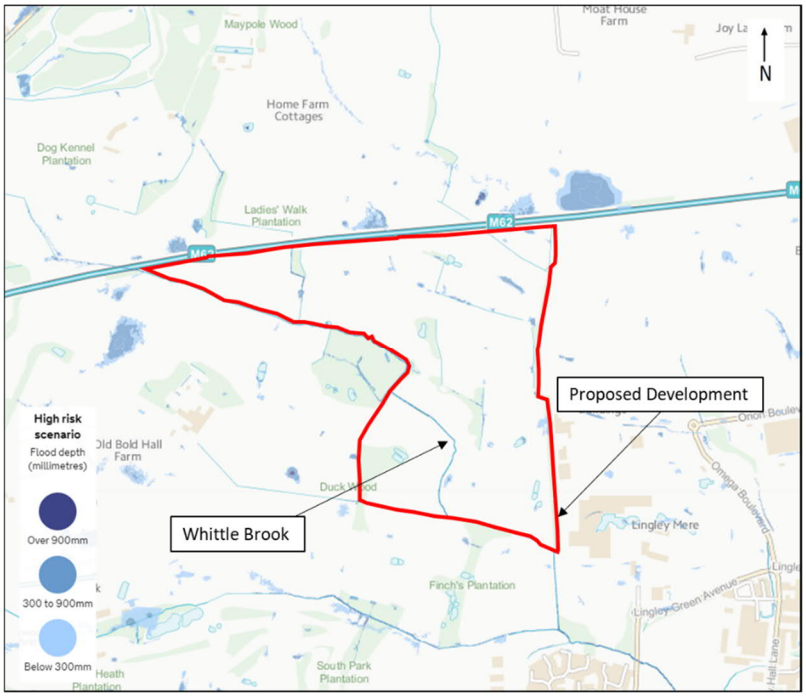


Figure 6-9 - Long Term Flood Risk Map from Surface Water with Application Site Boundary High Risk Scenario (Environment Agency, 2019)

6.2.9. Based on the information available regarding surface water flooding within the application site, the majority of the application site is at a very low risk of surface water flooding (each year this area has less than 0.1% chance of flooding). The areas of existing high risk surface water flooding are associated with existing watercourse and drainage channels. In addition, there are small areas of medium and low risk flooding which reflect that there is low lying land within the application site. The areas of surface water flood risk will not be present post-development as surface water runoff from the Proposed Development is to be sustainably managed through the proposed surface water drainage provision for the application site.

SURFACE WATER RUNOFF RATES

6.2.10. The NPPF requires that the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of development on surface water is incorporated in a FRA. An increase in hard standing surfaces can potentially increase the rate of surface water runoff from the application site. In turn, this could increase flood risk elsewhere if mitigation is not provided.

PRE-DEVELOPMENT SCENARIO (GREENFIELD)

6.2.11. This scenario considers that prior to development, the application site is wholly greenfield with no impermeable areas identified. The pre-developed runoff values from the Proposed Development in a 1 in 2.3 (Qbar), 1 in 30 and 1 in 100 year rainfall event, calculated based on the IH124 method, are summarised in **Table 6-2**. Flood Estimation Handbook catchment descriptors for the catchment were used for the IH124 method.

Table 6-2 – Pre-Development Greenfield Runoff

Rainfall Event (return period)	Pre-development (greenfield) runoff (l/s)
Qbar	430.6
1:30	730.1
1:100	895.7

CLIMATE CHANGE

6.2.12. Climate change within the UK over the upcoming decades is likely to result in changes to observed weather patterns, subject to regional variation. This could include milder, wetter winter periods and hotter, drier summers. Short duration, high intensity rainfall and more periods of long duration rainfall are expected, in addition to rising sea levels.

6.2.13. These factors can increase the risk of flooding within an application site and need to be accounted for and mitigated appropriately.

6.2.14. The Environment Agency Flood Risk Assessment: Climate Change Allowances[12] highlights the importance of taking in to consideration climate change. For FRAs, this guidance suggests the assessment of both the central and upper end allowances to understand the range of impact.

[12] Flood Risk Assessments: Climate Change Allowances (2017) https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

6.2.15. Based on a 100 year design life, the 2070-2115 peak rainfall intensity increase for both the 20% (central) and 40% (upper end) are used.

6.2.16. The climate change precautionary sensitivity ranges recommended for peak river flow for the North West river basin district, based on a 100 year design life for less vulnerable infrastructure, for the 2070-2115 epoch set out peak river flow increases of 30% (central) and 35% (higher central).

6.2.17. Surface water runoff was assessed, accounting for climate change, to ensure that an increased risk of flooding and the consequences of climate change are anticipated and mitigated. Accounting for this, the revised pre-development runoff values are presented in **Table 6-3**.

Table 6-3 - Pre-Development (Greenfield) Runoff with Central and Higher Central Climate Change Allowances

Rainfall Event (return period)	Pre-development (greenfield) runoff (l/s) with climate change allowances
1:100 + Climate Change (central)	1074.8
1:100 + Climate Change (upper central)	1254.0

6.2.18. The impacts of climate change need to be taken in to account when designing the drainage infrastructure. Surface water needs to be managed in a way that does not increase flood risk on or offsite. This has been achieved by installing sustainable drainage which includes attenuation features with a restricted discharge rate. Further information is provided in Section 8.

POST-DEVELOPMENT SCENARIO

6.2.19. The Proposed Development includes warehouses, car parks and required office space. This development will significantly increase the impermeable surface at the application site. The breakdown of the existing and proposed surface areas is presented in **Table 6-4**.

Table 6-4 - Existing and Proposed Development Areas

Surface type	Existing Area (ha)	Proposed Area (ha)
Impermeable surface (roof/ road/paving)	0	40.593
Permeable surface (garden/landscaping/ public open space)	74.112	33.519
Total	74.112	74.112

6.2.20. The area of impermeable surfacing will increase to occupy approximately 55% of the current greenfield scenario as a result of the Proposed Development.

6.2.21. The Proposed Development will have a greenfield mean annual flow (Qbar) restriction rate of 5.81l/s/ha. This is in line with the SuDS guidance from St. Helens Council[13].

[13] St. Helens Council SuDS Design and Technical Guidance: https://www.sthelens.gov.uk/media/10941/sth_suds_2019_consultation_draft.pdf

6.2.22. Section 8 sets out the surface water drainage strategy for the Proposed Development, including the application of SuDS to sustainably manage and mitigate surface water flood risk.

6.3 FLOOD RISK FROM SEWERS

SURFACE WATER AND FOUL SEWERS

6.3.1. Asset location plans have been obtained from United Utilities for the application site and are provided in **Appendix G**.

6.3.2. United Utility plans indicate that there are no foul or surface water assets located within the application site.

6.3.3. There are private surface water and foul water assets to the east of the application site within Lingley Mere Business Park. These are located on the eastern boundary of the application site and range in size from 150mm to 600mm.

6.3.4. Based on the information available and assuming a suitable surface water and foul water drainage system is designed for the Proposed Development to manage flows, the flood risk from sewers to the application site is considered to be low.

6.4 FLOOD RISK FROM GROUNDWATER

GEOLOGY AND GROUNDWATER

6.4.1. The St. Helens Council Local Flood Risk Management Strategy indicates that there is a risk of groundwater flooding in flat low-lying areas across St. Helens relating to groundwater rebound following termination of de-watering after the closures of mines. However, this is generalised across the borough of St. Helens and risk is not considered likely within the Proposed Development (refer to **Appendix H**).

6.4.2. Based on British Geological Survey (BGS) online mapping[14], the bedrock geology at 1: 625,000 scale is described as Triassic Rocks with Sandstone and Conglomerate, Interbedded (refer to **Figure 6-10**).

[14] British Geological Survey: http://mapapps.bgs.ac.uk/geologyofbritain/home.html

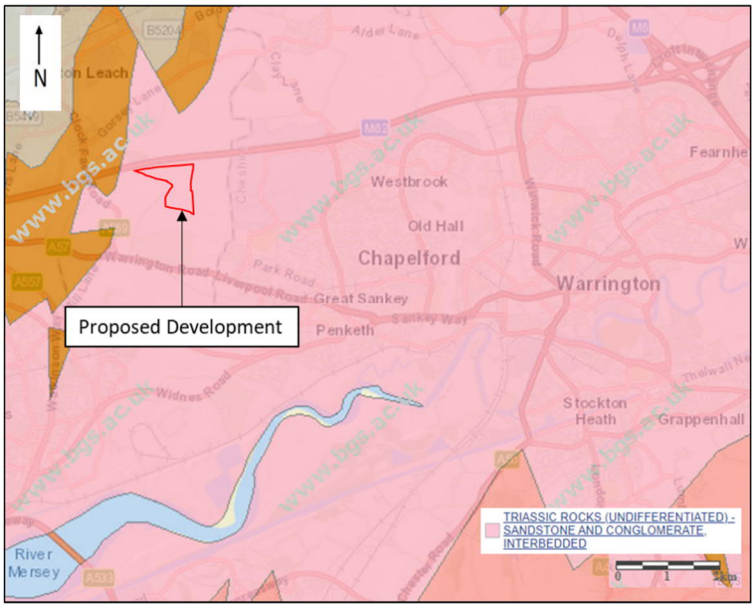


Figure 6-10 – British Geological Survey Bedrock Geology at 1: 625,000 Scale (British Geological Survey, 2019)

6.4.3. The bedrock geology underlying the application site at 1: 50,000 scale is Chester Formation sandstone with pebbly features (refer to **Figure 6-11**). These sedimentary rocks are fluvial in origin ranging from coarse to fine grained and form beds and lenses of deposits reflecting the channels and floodplains.

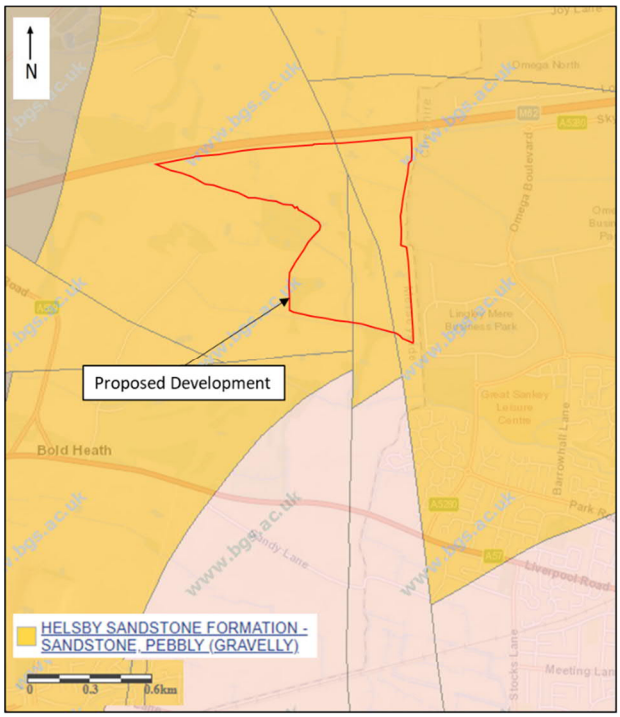


Figure 6-11 - British Geological Survey Bedrock Geology within the Application Site Boundary at 1: 50,000 Scale (British Geological Survey, 2019)

6.4.4. The superficial geology underlying the application site is described as till, Devensian – Diamicton. These are superficial deposits formed up to 2 million years ago (refer to **Figure 6-12**).

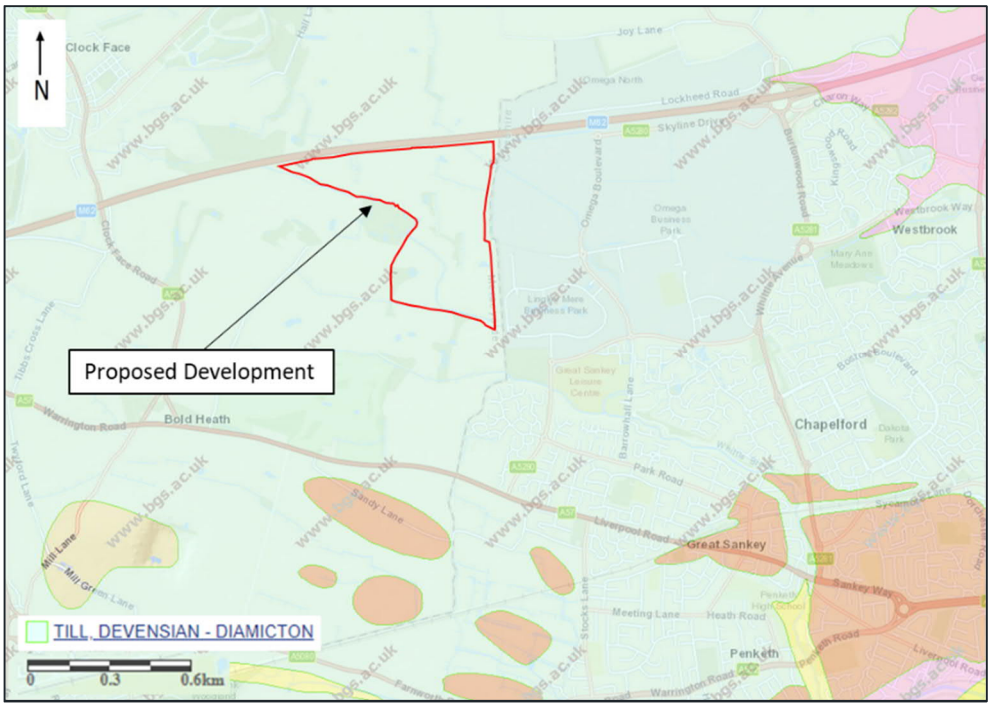


Figure 6-12 - British Geological Survey Superficial Deposits within the Application Site Boundary (British Geological Survey, 2019)

6.4.5. According to the Environment Agency bedrock aquifer classifications shown on the Defra MAGIC Mapping[15], the application site is located on Principal Aquifer bedrock. This represents geology that exhibits high permeability and water storage. These areas may support water supply and/or river base flows on a strategic scale (refer to **Figure 6-13**).

[15] Defra MAGIC Mapping: https://magic.defra.gov.uk/MagicMap.aspx

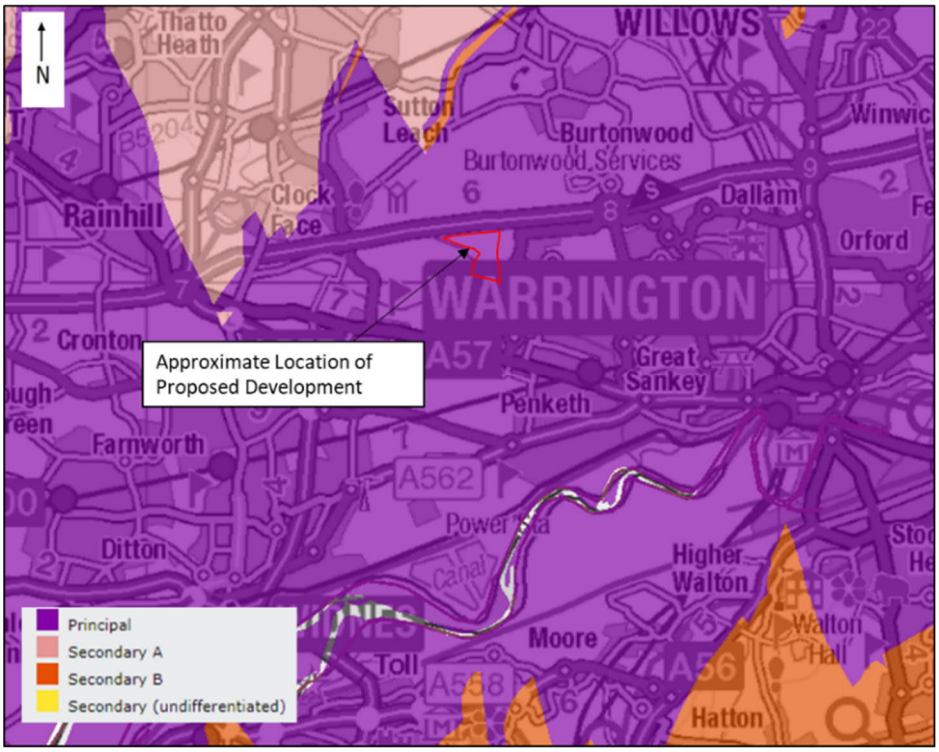


Figure 6-13 - Bedrock Aquifer Geology Map with Application Site Boundary (Environment Agency, 2019)

6.4.6. According to the Environment Agency superficial drift aquifer classifications shown on Defra MAGIC Mapping, the application site lies within a Secondary (undifferentiated) zone. Secondary undifferentiated rocks are those where it is not possible to classify rocks as Secondary A or B rock types. In most cases, it means that the layer of rock in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type (refer to **Figure 6-14**).

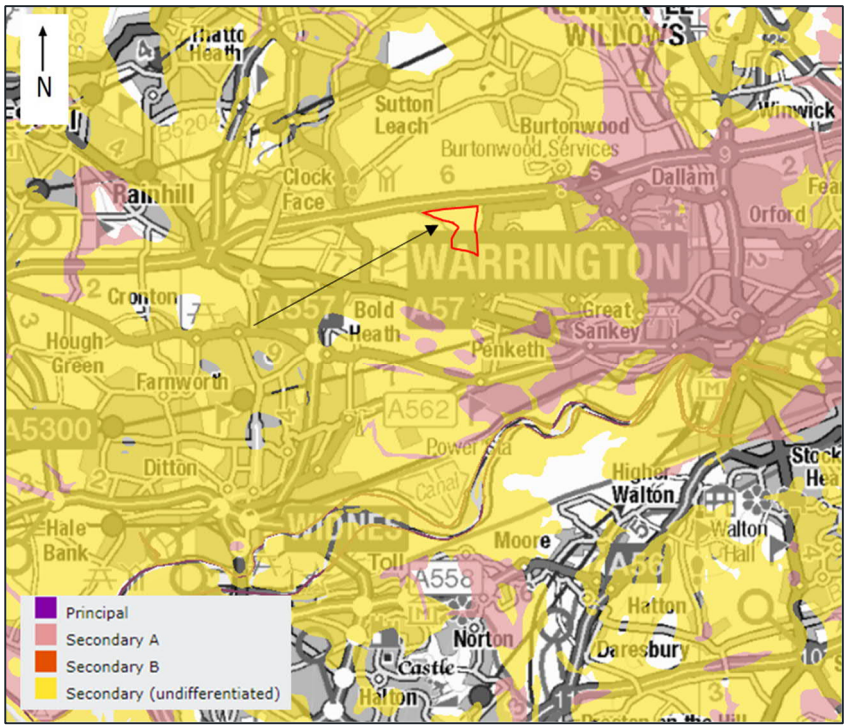


Figure 6-14 - Superficial Drift Aquifer Geology Map with Application Site Boundary (Environment Agency, 2019)

6.4.7. The Proposed Development is located within Zone III (Total Catchment) of the Environment Agency Groundwater Source Protection Zone Mapping (refer to **Figure 6-15**). This zone is defined as the total area needed to support an abstraction point from the protected groundwater sources.

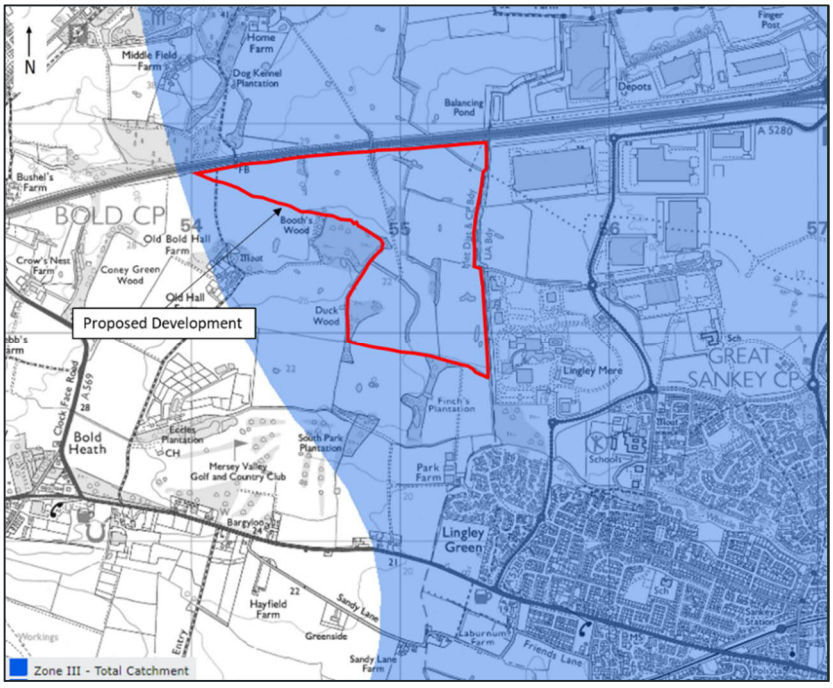


Figure 6-15 - Source Protection Zone with Application Site Boundary (Environment Agency, 2019)

6.4.8. Defra MAGIC Mapping indicates that the Proposed Development lies across Major Aquifer High Vulnerability and Major Aquifer Low Vulnerability designations (refer to **Figure 6-16**). The high vulnerability areas indicate the ability to transmit pollution easily to groundwater and are characterised by high leaching soils and the absence of low permeability drift deposits. These are areas which are likely to be vulnerable to activities carried out on the surface. In areas of high vulnerability, drainage infrastructure will need to be sealed and attenuation features lined to prevent adverse impact on the underlying aquifer.

6.4.9. The low vulnerability areas are less likely to be vulnerable to activities carried out on the surface with less ability to transmit pollution easily to groundwater. These are areas likely to be characterised by low leaching soils. In areas of low vulnerability, it is likely that less stringent controls would be required on drainage infrastructure given the low leaching characteristics of the underlying geology.

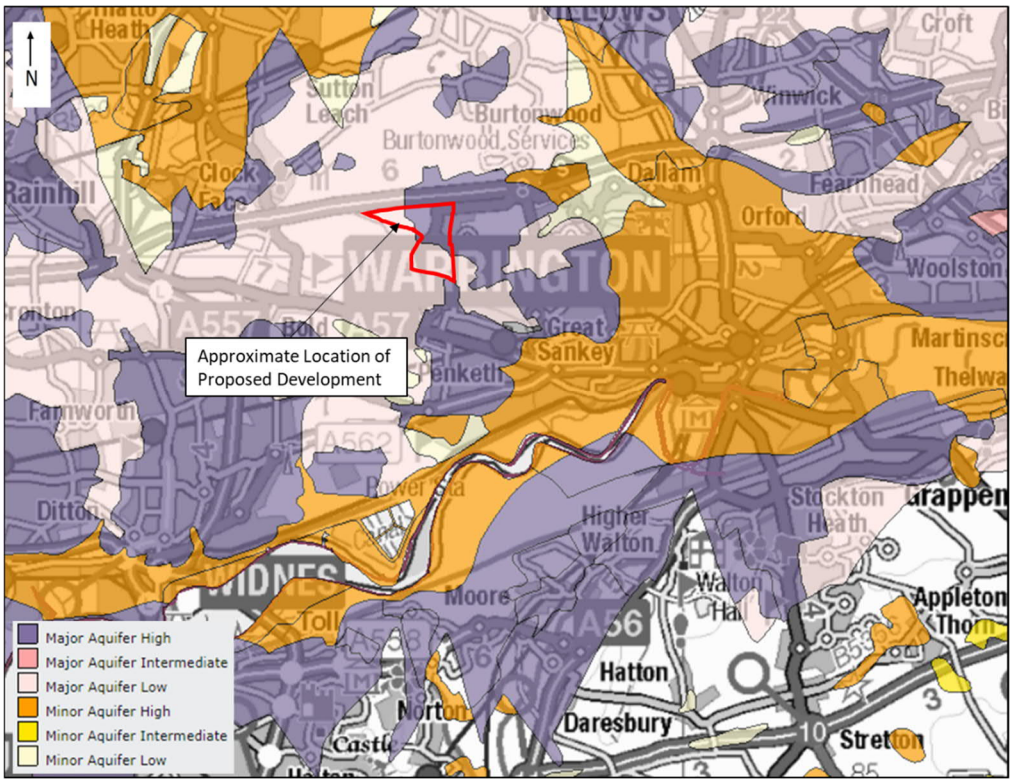


Figure 6-16 - Groundwater Vulnerability Map with Application Site Boundary (Environment Agency, 2019)

6.4.10. Based on all the information available relating to groundwater, it is believed that there is a low risk of groundwater flooding within the application site. There remains a potential of pollution to the groundwater from drainage infrastructure and the drainage design must ensure suitable mitigation is provided as required.

6.5 FLOOD RISK FROM ARTIFICIAL SOURCES

FLOOD RISK FROM RESERVOIRS

6.5.1. The application site is not located within the maximum flood extent of flooding from reservoirs as indicated by the Environment Agency internet based mapping (refer to **Figure 6-17**). Based on information available, the application site is not considered to be at risk of flooding from reservoirs.

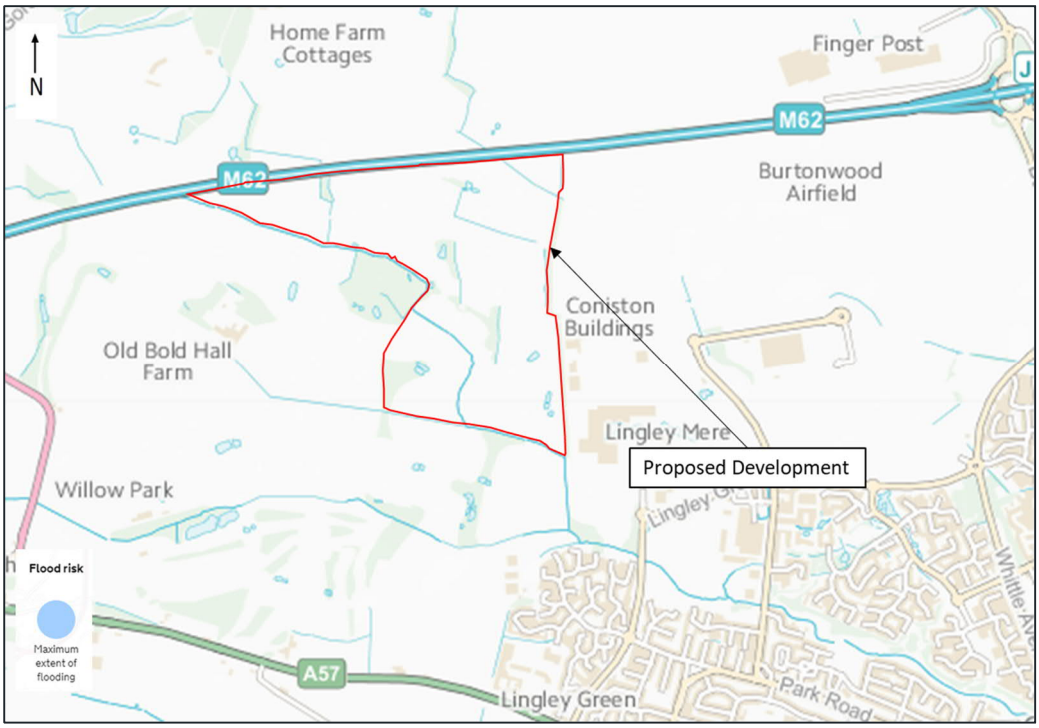


Figure 6-17 - Long Term Flood Risk from Reservoirs (Environment Agency, 2019)

FLOOD RISK FROM OTHER ARTIFICIAL SOURCES

6.5.2. The application site is not located within an Internal Drainage Board district.

6.5.3. The application site is not located near any canals or pumper watercourses/systems.

6.5.4. As such, based on the information available, the application site is not considered to be at risk of flooding from other artificial sources.

7 FLOOD RISK MITIGATION

7.1 FLOOD RISKS REQUIRING MITIGATION

7.1.1. With reference to Section 6, the application site has been identified as being at risk of surface water flooding due to the increase in impermeable surfaces post-development.

7.1.2. The Proposed Development may also be susceptible to elevated groundwater levels although the likelihood of groundwater flood risk is considered to be low.

7.1.3. This chapter sets out the proposed mitigation for these issues.

7.2 FLOOD RISK FROM SURFACE WATER MITIGATION

7.2.1. The increase in impermeable surfaces will increase the surface water flows and volumes from the application site compared to the pre-developed greenfield scenario. The drainage design for Unit 1 and the masterplan for Units 2 - 4 for the Proposed Development proposes siting of SuDS attenuation features located to mimic the natural runoff catchments that will attenuate flows prior to discharge at a restricted rate of 5.81l/s/ha. Discharge is proposed to be to either the Barrow Brook or Whittle Brook in line with the natural existing catchments.

7.2.2. The attenuation features will be sufficient to hold surface water in excess of the pre-development greenfield runoff, including a 40% allowance for climate change.

7.2.3. The proposed strategy for the surface water SuDS is provided in Section 8.

7.2.4. Ground floor finished floor levels (FFL) are required to be set to a minimum of 300mm freeboard above the anticipated flood levels in 1% AEP event plus climate change from any source of flooding. Any source of flooding would also include an assessment to ensure there is 300mm above anticipated flood levels within the drainage system, to provide protection in the event of an exceedance event. Where there is uncertainty in flood levels, this freeboard level should be increased up to 600mm. Additionally, in areas where no flooding is anticipated there should be a minimum of at least 150mm freeboard between proposed external ground levels and building ground floor FFL. External ground levels should always slope away from any building, especially entrances to avoid ponding of water against or within a structure.

7.2.5. The FFL for Unit 1 should be the greater of:

- 26.93mAOD (based on the 1% AEP plus 35% climate change fluvial water level of 26.63mAOD)
- 300mm above the 1% AEP plus 40% climate change flood level from the drainage system
- 150mm above proposed external ground levels.

7.2.6. The FFL for Unit 2 - 4 should be the greater of:

- 21.78mAOD (based on the 1% AEP plus 35% climate change fluvial water level of 21.48mAOD)
- 300mm above the 1% AEP plus 40% climate change flood level from the drainage system
- 150mm above proposed external ground levels.

7.3 FLOOD RISK FROM GROUNDWATER

7.3.1. The design of the Proposed Development should consider the potential presence of elevated groundwater levels on the application site and the corresponding impact on structural stability and safety during construction, use and future maintenance.

7.3.2. It is recommended that further ground investigations and water level monitoring is undertaken, to determine the depth of the groundwater below the application site and inform the ongoing design.

7.3.3. The residual potential for overland flow from emerging groundwater should also be considered with flows directed away from buildings to areas where ponding can occur as safely as required.

7.4 RESIDUAL RISKS

7.4.1. No residual risks have been identified providing the mitigations outlined above are appropriately implemented into the Proposed Development design.

8 DRAINAGE STRATEGY

8.1 SURFACE WATER DRAINAGE

8.1.1. The drainage strategy proposes the use of a combination of gravity pipe network and swales to convey flows to SuDS attenuation features. The proposed surface water drainage provision reflects the existing natural drainage regime. It is therefore proposed that surface water flows from the Proposed Development will discharge in to the watercourses which pass adjacent and through the existing site as the primary means of surface water disposal. The Whittle Brook and Barrow Brook pass through the application site and it is therefore proposed to make surface water drainage discharge connections from the attenuation features to these watercourses to mimic the natural drainage catchments.

8.1.2. In accordance with the St. Helens Council Lead Local Flood Authority design and technical guidance, it is proposed to restrict the Proposed Development surface water runoff to the Mean Annual Peak Flow Rate, Qbar. The figure for Qbar has been calculated using the Institute of Hydrology Report 124 and has been calculated as 5.81l/s/ha. A summary of the existing greenfield runoff rates is provided in **Table 8-1** below.

Table 8-1 - Existing Catchment Runoff Rates

	Catchment Area (ha)	Existing Runoff Rates (l/s)			
		Qbar	1 In 30 Year	1 In 100 Year	1 In 100 Year +40%
Total Site Area	74.112	430.6	730.1	895.7	1254.0

8.1.3. Further information for the surface water detailed design associated with Unit 1 including attenuation feature locations, volumes and discharge rates and locations is provided in the Drainage Strategy Report (**Appendix I**).

8.1.4. The proposed discharge rate and storage volumes for Units 2 to 4 are provided in **Table 8-2** with further information provided in the Drainage Strategy Report (**Appendix I**).

Table 8-2 – Summary of Storage Requirements for Units 2 - 4

Catchment	Proposed Impermeable Area (including highways) (ha)	Limited Discharge Rate (l/s)	Storage Volume (m^3) *
Unit 2 – Whittle Brook	9.01	52.3	6,455
Unit 3 – Whittle Brook	6.24	36.2	4,460
Unit 4 – Whittle Brook	8.02	46.5	5,745
Total	**23.3**	**135.0**	**16,660**

* storage is provided to allow for attenuation up to the 1 in 100 year plus 40% climate change event

8.1.5. The proposed swales and attenuation features will provide a multi-stage treatment train for surface water runoff to enhance the quality of surface water leaving the application site. It is outside of the remit of this FRA to assess the surface water quality treatment extent of the proposed drainage elements.

8.2 FOUL WATER DRAINAGE

8.2.1. It is proposed to install a new foul water sewer system to serve the application site which will be offered for adoption by United Utilities. The foul sewer system for the application site will be designed and constructed in accordance with Sewers for Adoption 7th Edition.

8.2.2. A foul water pumping station will be required to service the Proposed Development. This will be located adjacent to the main site access point with a single new connection to the public sewer network.

8.2.3. Discharge will be at a rate to be specified by United Utilities.

9 CONCLUSIONS

9.1 CONCLUSIONS

9.1.1. The flood risk to the Proposed Development has been assessed with reference to the National Planning Policy Framework, the Planning Practice Guidance, the Sustainable Drainage Systems (SuDS) Manual C753, St. Helens Council Sustainable Drainage Systems Design and Technical Guidance and with Environment Agency information including that readily available on the internet and site-specific consultation data. The following published documents have been reviewed to gather information for this study:

- River Basin Management Plan (North West River Basin)
- Mersey Estuary Catchment Flood Management Plan
- Sankey Catchment Action Plan
- St. Helens Council Preliminary Flood Risk Assessment
- St. Helens Council Strategic Flood Risk Assessment
- St. Helens Council Local Flood Risk Management Strategy
- Warrington Borough Council Strategic Flood Risk Assessment
- Warrington Borough Council Environment and Regeneration Surface Water Evidence Base.

9.1.2. The Proposed Development is located to the west of industrial areas, covering an area of approximately 75ha and consisting of industrial warehouses and manufacturing units along with the associated offices and car parks. The Whittle Brook is a main river flowing around the edge of the application site and directly through the south of the application site. It is proposed that the Whittle Brook is realigned to the western and southern boundary of the southern part of the application site. It currently flows through the centre of the southern part of the application site.

9.1.3. The Proposed Development is classified as a less vulnerable and is predominantly located within Flood Zone 1, indicating land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1% Annual Exceedance Probability) ignoring the presence of existing formal defences. There are small areas of land within the application site which are located within Flood Zone 2, highlighting land assumed to have between a 1 in 100 and a 1 in 1,000 annual probability of river flooding or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. A Flood Risk Assessment is required due to the application site area being greater than 1ha.

9.1.4. Results from the hydraulic modelling indicate that the proposed realignment of the Whittle Brook is suitable for the Proposed Development and does not increase flood risk on the application site or elsewhere.

9.1.5. Based on the information available, the Proposed Development is considered to be at a low risk of flooding from rivers. The Proposed Development is not at flood risk from the sea as it is in a non-coastal location and is upstream of the tidal influence limit of the Mersey Estuary.

9.1.6. The majority of the application site is at a very low risk of surface water flooding (each year this area has less than 0.1% chance of flooding). The areas of existing high risk surface water flooding are associated with existing watercourse and drainage channels. In addition, there are small areas of medium and low risk flooding which reflect that there is low lying land within the application site.

9.1.7. The area of impermeable surfacing will increase from the current scenario to 55% of the application site area. However, the Proposed Development will not increase flood risk off site as it is proposed that surface water will be intercepted and attenuated with a restricted discharge of 5.81l/s/ha (greenfield Qbar) to the existing watercourses within or adjacent to the application site to mitigate the effects of the increased surface water runoff.

9.1.8. The Environment Agency in general promotes the use of SuDS to manage surface water runoff, maximise water quality improvements and incorporate environmental enhancements where ground conditions are suitable. For the area of the application site of Units 2-4, further ground investigation will be undertaken to identify constraints to the drainage infrastructure prior to and including the detailed design of the proposed attenuation features to confirm the viability of infiltration SuDS measures. Consultation with the Environment Agency and United Utilities (as required) should be undertaken as the Proposed Development design progresses.

9.1.9. From the asset records obtained from United Utilities, there are minimal surface water or foul water drainage networks flowing through the application site. Therefore, based on the information available, the Proposed Development is considered to be at a low risk of flooding from sewers.

9.1.10. The Proposed Development is underlain by bedrock with a Principal Aquifer designation and lies within Source Protection Zone III. However, due to the presence of superficial clay based till deposits, the overall flood risk from groundwater is considered to be low. Further ground investigations and consultation with the Environment Agency is required to determine how this affects the provision of drainage infrastructure for the Proposed Development of Units 2-4.

9.1.11. The Proposed Development will increase the impermeable area and therefore surface water runoff from the application site. Therefore, the surface water drainage system of the application site has been designed, and should maintain this design approach, to sustainably manage the additional surface water runoff from the Proposed Development.

9.1.12. The design of the Proposed Development should also consider the likely presence of elevated groundwater levels on the application site and the corresponding impact on structural stability and safety during construction, use and future maintenance.

9.1.13. An appropriate process has been followed to identify the likely flood risk at the application site. Assessment of the impacts on flood risk posed has been undertaken and suitable and adequate mitigation measures have been included in the proposals to prevent flood risk being increased to the application site or elsewhere.