Government Property Agency

AtkinsRéalis



MANCHESTER DIGITAL CAMPUS

Environmental Statement
Volume 4 - Appendix 19.2: Flood Risk Assessment

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1. Introduction

1.1. Purpose of this report

This report summarises the assessment of flood risk for a Proposed Development at the Government Property Agency's Manchester Digital Campus. This report presents the findings of the assessment of flood risk, to and from the Proposed Development, and where necessary provides an appraisal of possible mitigation measures to reduce the flood risks to acceptable levels. The following tasks have been undertaken:

- A review of existing data and information;
- An assessment of the flood risks to the Site, and the possible flood risks which could occur as a result of the Proposed Development; and
- Where necessary, an assessment of the proposed measures to reduce the flood risk to acceptable levels.

1.2. Background

This study has been carried out in accordance with the National Planning Policy Framework (NPPF)[1]. As part of the planning process, the NPPF requires a flood risk assessment (FRA) from proposed developments that are:

- Lies within flood zones 2 or 3 including minor development and change of use.
- More than 1 hectare (ha) in flood zone 1.
- Less than 1 ha in flood zone 1 with a change of use in development type to a more vulnerable class (for example, from commercial to residential), where the development could be affected by sources of flooding other than rivers and the sea (for example, surface water drains or reservoirs).
- In flood zone 1 with critical drainage problems as notified by the Environment Agency.

The Environment Agency flood maps have been reviewed and show that the Manchester Digital Campus sits within flood zone 1.

The broad aim of the NPPF is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages of any development.

Responsibility for this assessment lies with developers and they must demonstrate the following:

- Whether the Proposed Development is likely to be affected by flooding.
- Whether the Proposed Development will increase flood risk to adjacent properties.
- That the measures proposed to deal with any flood risk are sustainable.

The developer must demonstrate to the Local Planning Authority and the Environment Agency that the existing flood risk or the flood risk associated with the Proposed Development can be satisfactorily managed.

[1] Technical Guidance to the National Planning Policy Framework (publishing.service.gov.uk)

1.3. Environment Agency Requirements

The detail and complexity of an FRA should reflect the level of risk to the Proposed Development. Guidance is available on the EA's website[2]. The guidance is based on the requirements for different development scenarios, based on the size of the development and the location within the floodplain. The Proposed Development is more than 1 ha in size in flood zone 1; therefore, an FRA is required. The FRA should contain:

1. A location plan and a Site plan. The Site plan should show the existing Site, development proposals and identify any structures which may affect local hydraulics.
2. Surveys showing existing and proposed Site levels.
3. An assessment of the flood risk, including:

- Consideration of whether the Site falls within the functional floodplain.
- Details of any flood alleviation measures in place.
- Information on all potential sources of flooding and the impact of flooding on the Site
- An assessment of how users of the development can avoid exposure to flooding in and around the development, including whether safe access and exit can be provided for routine and emergency access under both frequent and extreme flood conditions.
- An assessment of how the layout and form of development can be used to reduce or minimise flood risk.
- An assessment of the capacity of any drains or sewers, existing or proposed, on the Site during various flood events.
- An assessment of the volume of surface water run-off likely to be generated from the Proposed Development, and proposals for surface water management according to sustainable drainage principles, with the aim of not increasing, and where practicable, reducing the rate of runoff from the Site as a result of the development.
- The likely impact of any displaced water on third parties caused by alterations to ground levels or raising flood embankments.
- The potential impact on rivers or coastal areas, and the likely longer-term stability and sustainability of existing defences.
- The potential impact of climate change which could affect the probability and intensity of events in the future.
- The remaining (known as residual) risks to the Site.
- Consideration of the proposal relative to any existing Strategic Flood Risk Assessment (SFRA) carried out by the local authority.

1.4. Flood Risk

Flood risk includes the statistical probability of an event occurring and the scale of the potential consequences. The risk is estimated from historical data and expressed in terms of the expected frequency (or 'return period') of a flood of a given magnitude. The 10-year, 50-year and 100-year floods have a respective 10%, 2% and 1% chance of occurring in any given year (this is termed the Annual Exceedance Probability [AEP]), however, over a longer period the probability of flooding is considerably greater. For example, for the 100-year return period flood, there is a:

- 1% chance of the 100-year flood occurring or being exceeded in any year.
- 26% chance of it occurring or being exceeded in a 30-year period.
- 51% chance of it occurring or being exceeded in a 70-year period.

[2] http://www.environment-agency.gov.uk/research/planning/93498.aspx

Table 1.1 provides a summary of the relevant AEP and corresponding return periods.

Table 1.1 Definition of AEP and 'return period' flood events.

AEP (%)	Return period (years)
50%	2
10%	10
5%	20
4%	25
2%	50
1%	100
0.5%	200
0.1%	1,000

2. Site Description

2.1 Existing Site

The Site forms the western portion (Phase 1) of the Former Central Retail Park (FCRP) Strategic Regeneration Framework (SRF) area bounded by Great Ancoats Street to the south, Old Mill Street to the east, Hugh Oldham Way to the north and the Rochdale Canal to the west. The Proposed Development area is approximately 2.98 ha.

The Site is part of the former retail park, which has since been demolished and is currently vacant. The Site is currently comprised of vacant brownfield land with a disused hardstanding carpark and other hardstanding areas, trees line around the edge of the Site, and patches of shrub and grass vegetation scattered across the Site. The Site has a main vehicular access point located off Great Ancoats Street. A secondary access to the Site is available leading from Old Mill Street via Phase 2 of the SRF site to the east, formerly used for deliveries and waste collections.

The Proposed Development – which falls within the Manchester, Salford and Trafford Critical Drainage Area – lies between two canal channels, the Rochdale Canal which is directly adjacent to the Site by <0.01 km to the northwest (the closet waterbody to the Proposed Development) and the Ashton Canal which is <0.30 km to the southeast. The two canals are connected by the New Islington Marina which is <0.03 km to the northeast. The River Medlock is located approximately 800m to the east of the Site and may be hydraulically connected to the two canal systems adjacent to the Site. The Rochdale Canal and Ashton Canals are hence hydraulically connected, as well as possibly in hydraulic connectivity with the River Medlock (see Appendix A). However, the River Medlock is considered to be sufficiently far enough downstream of the Proposed Development to eliminate any potential indirect impacts from it.

Prior to the construction of the Rochdale and Ashton Canals, there was a tributary of the River Medlock – the Shooters Brook, which was fed by Newton Brook. Historical maps indicate that the route of the former Shooters Brook was culverted through the Site. However, Shooters Brook is now largely considered a 'lost watercourse', with the upstream section of Newton Brook now diverted several kilometres upstream of the Site. A CCTV survey of the culverted Shooters Brook indicates no structure beneath the Site; instead, it runs in a southern direction adjacent to the eastern boundary outside the Site. Nevertheless, a culvert thought to be the former Shooters Brook is present downstream from the Site underneath Store Street, with CCTV providing evidence of it stopping upstream of the culvert at the junction of Store Street with Great Ancoats Street.

The approximate national grid reference for the Proposed Development is: SJ 85031 98455.

The postcode for the Proposed Development is: M4 5BA.

The location of the Proposed Development is shown in ES Volume 5 Figure 19.2.1.

2.2 Proposed Development

The Proposed Development entails two buildings:

- North Building
- South Building

The basement level will include accessible car parking of 50 spaces (plus 5 additional spaces associated with facilities management and operations) and access via Great Ancoats Street. The creation of new areas of public realm and landscaping includes street-scape frontage along Great Ancoats Street, a Canal Plaza area adjacent to the Rochdale Canal, a pedestrianised route or boulevard between the two buildings, and an area of private landscaping adjacent to the North Building enclosed by a boundary wall and a private garden adjacent to the east elevation of the South Building.

2.3 Topography

The Proposed Development is situated on a flat topographic terrain at an average elevation of 48 mAOD, with an approximately 4m ground level change across the Site (ES Volume 5 Figure 19.2.2 – Topographic Relief of the Manchester Digital Campus[3]). As a result there is a significant level change across the Site, descending from the northwest corner towards the southeast corner where Great Ancoats Street and Old Mill Street intersect.

2.4 Geology

A geotechnical desk study of the Site was undertaken using readily available information from online sources, published data, and historical information.

The Site is underlain by the bedrock geology Chester Formation Sandstone[4]. The Chester Formation Sandstone is described by the British Geological Survey (BGS) as “a formation that progressive change in lithology northwards, from coarse- to fine-grained. The gravel is composed of well-rounded pebbles, cobbles, and boulders in the coarse- to fine-granulestone and silty sandstone matrix”. The aquifer designation of the bedrock is classed as Principal.

The Site is underlain by the superficial geology of Till, Devensian. The Till, Devensian is referred to as diamicton, which is unsorted to poorly sorted terrigenous sediment matrix of mud or sand containing suspended particles of clay to boulder size materials. The aquifer designation of the superficial drift is classed as Secondary (undifferentiated)[5].

Source Protection Zones (SPZ) are areas close to drinking water sources where the risk associated with groundwater contamination is the greatest. SPZs are not statutory, but they do relate to distances and zones defined in legislation where certain activities are restricted. The Site is not within a SPZ[5].

[3] Defra Survey Data Download

[4] GeoIndex - British Geological Survey (bgs.ac.uk)

[5] Magic Map Application (defra.gov.uk)

2.5 Soils

Soil information was obtained from Soilscapes viewer[6]. The soil underlying the Proposed Development is Soil Type 17 which is described as slowly permeable, seasonally wet, acid, loamy and clayey soils with impeded drainage. This soil class tends to drain to the stream network. The main risk associated with Soil Type 17 is overland flow from compacted or poached fields. Organic slurry, dirty water, fertiliser, pathogens and fine sediment can move in suspension or solution with overland flow or drain water.

3. Existing Data and Information

3.1 Manchester Local Flood Risk Management Strategy (LFRMS)

The LFRMS's[7] overall aim is to ensure that local flood risk is properly managed by using the full range of options in a coordinated way. Local flood risk within Manchester is widespread and derives from a range of different sources that often interact with each other. For example, surface water flood risk often interacts with sewers, highway gullies, and non-main rivers of which many are culverted or partly culverted and form much of the drainage infrastructure in the city.

One of the two types of canals in Manchester is the broad canal. The Ashton, Rochdale, and Bridgewater Canals are broad canals that were initially built to serve the growing industrial centres of the North West including Manchester during the Industrial Revolution. The canals are fairly shallow with raised embankments in places and are today mainly used for tourism and carrying narrow boats and other small boats. The Bridgewater Canal is owned and operated by the Manchester Ship Canal Company in conjunction with the Bridgewater Canal Trust[8].

The two broad canals that extend from the City Centre and in proximity to the Proposed Development are the Ashton Canal and the Rochdale Canal; both are owned by the Canal & River Trust which is also the statutory Navigation Authority for both watercourses.

Under the Flood & Water Management Act 2010, Navigation Authorities do not have a flood risk management function, although they do have a statutory function to maintain their canal for navigation, which does overlap with local flood risk management functions of the Local Lead Flood Authority (LLFA).

The Ashton Canal extends eastwards into Tameside, whilst the Rochdale Canal extends north-eastwards into Oldham, Rochdale, and West Yorkshire. Both canals converge in the City Centre, where it continues for approximately a 4 km stretch until it converges again, with the Bridgewater Canal in Castlefield Basin. The Bridgewater Canal extends south-westwards into Trafford, although there is also an interaction with the River Medlock.

The broad canals do not pose a direct flood risk as they are controlled waterbodies with regulated flows, however, there is residual flood risk from overtopping and bank breaches. The probability of overtopping or a breach occurring is considered to be low, primarily due to the monitoring and maintenance activities of the Canal & River Trust. Nevertheless, should a flood event occur, the consequences could be significant, particularly for a breach. Both canals have a certain risk of overtopping due to the possibility of high inflows exceeding the capacity of the

[6] Soilscapes soil types viewer - Cranfield Environment Centre. Cranfield University (landis.org.uk)

[7] Manchester Local Flood Risk Management Strategy

[8] The Bridgewater Canal

canal during storm events, particularly the Bridgewater Canal – which the Ashton Canal and Rochdale Canal convey into - because of the interaction with the River Medlock.

The residual flood risk map from canals, ponds, and reservoirs (Figure 19.2.3) is derived from the best-modelled risk information that was currently available at the time it was produced; hence, there are limitations and caution is needed in the use of this information. As shown in Figure 19.2.3, the east of the Proposed Development partially falls within the Canals Breach Zone A.

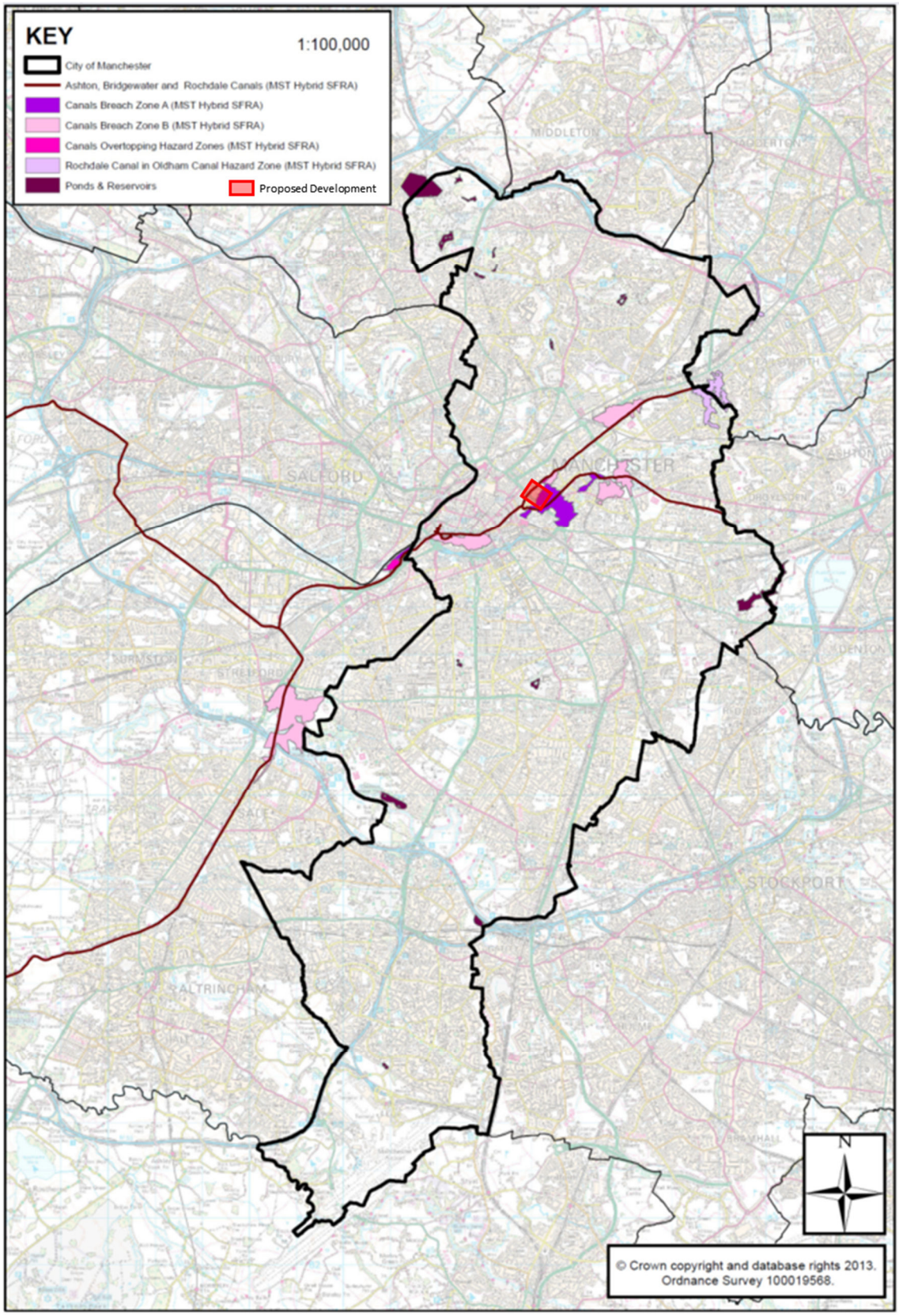


Figure 19.2.3 - Breach Zones of Canals, Ponds, and Reservoirs

Flood risk from groundwater has not been historically significant in Manchester, as there are no extensive records of historical flooding from groundwater. In recent years there has been an increasing number of flood incidents whereby groundwater and springs have reportedly been the primary source, especially in the areas where no

groundwater flooding has been recorded previously. The cause of this is not certain, but a combination of factors including increased rainfall events due to climate change and the upkeep of drainage infrastructure may be responsible for the increased incident of groundwater flooding.

The Environment Agency has identified areas at potential risk of groundwater flooding (Areas Susceptible to Groundwater Flooding) which is a very broad approach founded largely on geology. The detailed mapping of groundwater flood risk is very complex, but the Manchester Salford Trafford Hybrid Strategic Flood Risk Assessment (SFRA) has attempted to refine the risk within the city to some extent based on the best available information at the time it was produced. The SFRA includes information from a number of different sources, including the Environment Agency's potential groundwater rebound areas, groundwater emergence maps produced by the Department for the Environment, Food and Rural Affairs (DEFRA), data from the Coal Authority and drift geology mapping from the BGS. The information in the Hybrid SFRA should not, however, be viewed as fully comprehensive due to the complex nature of groundwater flooding and there are potentially additional areas of risk within the city.

The likelihood of groundwater flooding occurring in Manchester is generally low, but if it were to occur, groundwater flooding would generally not pose a significant risk due to the slow rate in which groundwater level rises. However, groundwater flooding can cause significant damage to property, especially in urban areas where water can rise through ground floors and basements, which the Proposed Development contains in the form of an basement carpark. As shown in Figure 19.2.4, the entire Site falls within an area at risk of groundwater flooding.

Utilising the Greater Manchester Surface Water Management Plan (SWMP), there are no extensive records of historical flooding from surface water runoff in Manchester, as the lists only contain five incidents between 1911–2012, all of which occurred in south Manchester and a number of which included interactions with rivers. This means before the Flood and Water Management Act 2010, incidents of surface water flooding were not well recorded unlike presently. Consequently, the SWMP is not reflective of the true occurrence of surface water flooding before 2012, and it is likely more than five incidents of surface water flooding occurred between 1911–2012. This is especially true since there are hundreds of cases of blocked highway gullies each year, some of which have resulted in properties being flooded. Nevertheless, since 2012, incidents of surface water flooding are now better recorded, which will help inform future maintenance and where necessary work to increase capacity or attenuation within the city's drainage system.

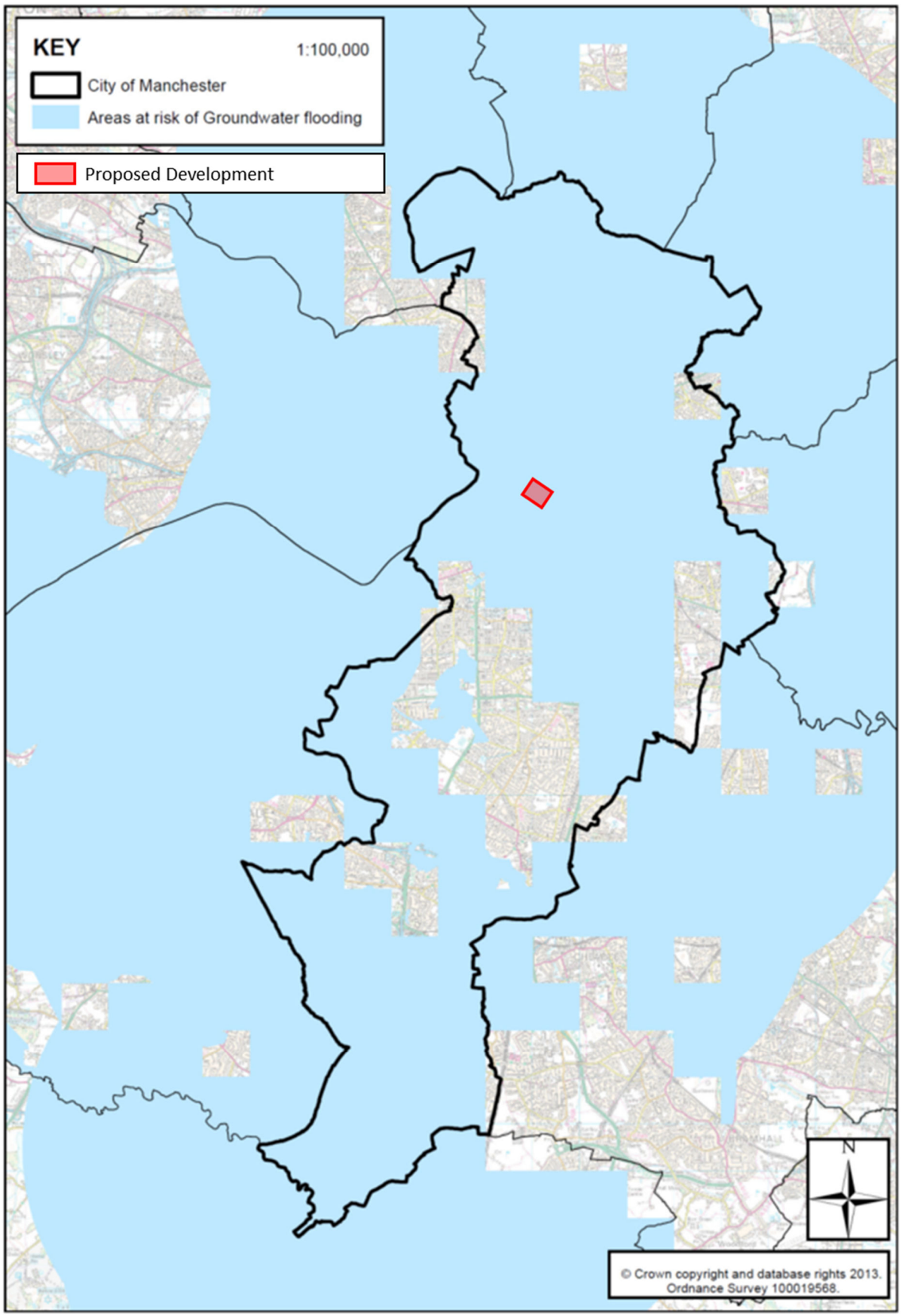


Figure 19.2.4 - Areas Susceptible to Groundwater Flooding in Manchester

3.2 Irwell Catchment Flood Management Plan

The River Medlock, which is 0.70 km away from the Proposed Development and may be hydraulically connected to the Rochdale and Ashton Canals, falls within the River Irwell Catchment Flood Management Plan[9]. The Plan is divided into ten distinct sub-areas that have similar physical characteristics, sources of flooding and levels of risk (see Appendix B). These sub-areas will allow the Environment Agency and Local Authorities to promote flood risk management approaches, policies and actions that are most appropriate to deliver the various Government and regional strategies. The most appropriate approach to managing flood risk for each sub-area has been identified and allocated one of the six generic flood risk management policies, as shown in Appendix C.

The Site falls within sub-area 1 – Manchester City Centre to Irlam. The vision and preferred flood risk management policy for this sub-area is Policy Option 4, which surrounds areas of low, moderate, or high flood risk with already effective flood management but may need further action to keep pace with the impact of climate change in the long term. The vision of Policy Option 4 includes taking further action to reduce flood risk which involves assessing socially and environmentally sustainable, technically viable and economically justified options. Future flood risk management activities will also target mitigating the impact of climate change, with a focus on more sustainable and effective methods.

3.3 Manchester Strategic Flood Risk Assessment

The Manchester Strategic Flood Risk Assessment (SFRA)[10] is a planning tool that enables the council to select and develop more vulnerable site allocations away from areas susceptible to flooding and provides a spatial assessment of flood risk within key urban areas. One of the main sources of flood risk in Manchester is the River Medlock, which flooded the centre of Manchester in 1991 and 2002. The River Medlock, which joins the River Irwell in central Manchester, is extensively culverted. Many culverts are now hidden below ground (referred to as the “hidden rivers of Manchester”) and their conditions are deteriorating, becoming blocked with debris and the cause of localised flooding following heavy rainfall. Many of the main rivers in Manchester including the River Medlock have been straightened and canalised to accelerate the flow of water as well as culverted over significant lengths. Furthermore, many of the channels and culverts have a limited hydraulic capacity and are prone to blockages, which can lead to flooding.

Surface water flooding is also a significant source of flooding, with residual flood risk coming from the Ashton, Rochdale, and Bridgewater Canals and several reservoirs. The interaction between canals and main rivers, particularly in Manchester City Centre, is integral to the understanding of flood risk. As the Rochdale Canal is directly adjacent to the Proposed Development, in the low probability that the embankment of the canal is overtopped the flood could spread beyond the towpath and into the Site. This would be as a result of breaks in the boundary of the fence that separate the canal towpath from the Site (see Appendix F). The risk of canal flooding is unknown as it depends on several factors including the source of water feeding into the canal, and the materials and condition of the canal embankments. However, the risk of the canals flooding is limited due to being controlled waterbodies with regulated flows that are continuously maintained by the Canal & River Trust.

The main flood hazard of the Rochdale Canal and Ashton Canal is the overtopping and/ or breach of the canal banks due to high inflow during storm events exceeding the canals’ capacity. The specific issues of overtopping the canal banks at the Rochdale Canal and Ashton Canal are respectively, possible failure of the raised embankment at Miles Platting and possible blockage of the bywash at Ancoats in flood conditions.

As part of the SFRA, a map was produced identifying areas that are potentially at risk from groundwater flooding, which should be used to scope mitigation measures in site-specific FRAs. The map is based on Environment

[9] River_Irwell_Catchment_Flood_Management_Plan.pdf (publishing.service.gov.uk)

[10] Manchester Strategic Flood Risk Assessment (SFRA)

Agency potential groundwater rebound areas, data from the Coal Authority, BGS drift geology mapping, and Defra Groundwater Emergence Maps. As shown in Figure 19.2.5, the Proposed Development does not fall within the potential issues of groundwater flooding.

There are no known reports of groundwater flooding in Manchester. Nevertheless, past studies have identified 15 sites in England where groundwater levels were known to be rising including Trafford Park in Manchester, where groundwater levels rose by about 15m between 1970–1986[11]. This rise was due to a reduction in abstraction from the Permo-Triassic sandstone aquifer. While the Proposed Development is not within Trafford Park, it is noted that reduced abstraction has also led to groundwater rebound in central Manchester, although levels have now stabilised[12].

Historical records are often anecdotal and incomplete, and difficult to accurately determine the frequency and magnitude of flood events; nevertheless, useful for providing background information. Also, flood risk can change over time because of natural variations in climate, changes in flood risk management activity, and changes in land use as developments have been increasingly built on the floodplain. Due to these changes, flood risk might be higher today than it was in the past, which historical records may not reflect. Historical flood events that occurred in proximity to the Proposed Development include flooding in Ancoats by the Ashton Canal in 2007, flooding in the City Centre in 1991 by an unknown source, and the River Medlock on separate occasions.

[11] Brassington, F. C., (1990). 'Rising groundwater levels in the United Kingdom'. *Proceedings of the Institution of Civil Engineers*, vol. 88, part 1, p.1037-1057.

[12] Jacobs. (2004). *Strategy for Flood and Coastal Erosion Risk Management: Groundwater Flooding Scoping Study (LDS 23)*. Final Report produced for Defra, 2 Volumes.

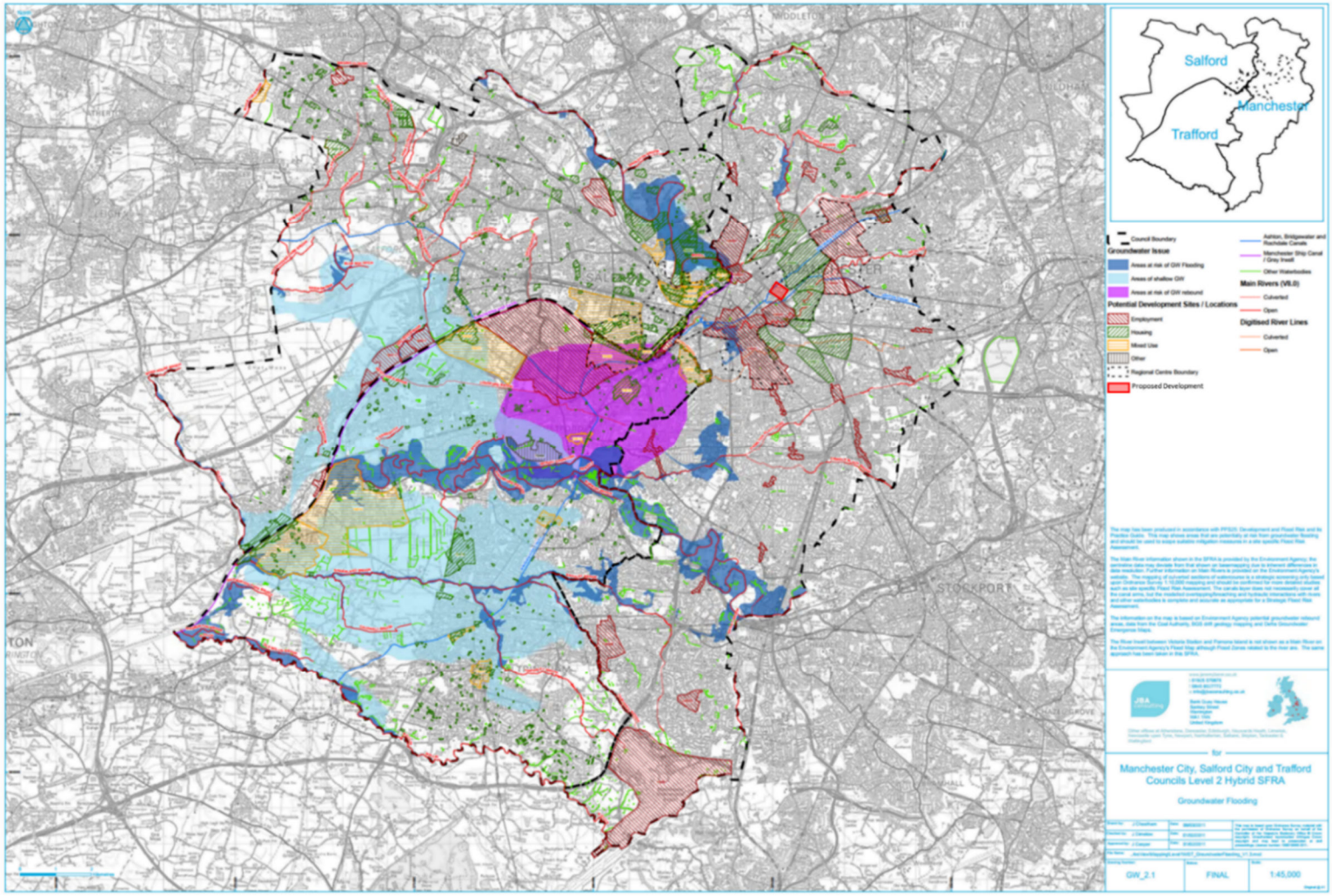


Figure 19.2.5 - Map of potential groundwater flooding in Greater Manchester

3.4 Environment Agency Flood Map (Flood Map for Planning)

The Flood Map published by the Environment Agency[13] contains flood zones for use in accordance with the NPPF and represents the risk of flooding from rivers and the sea. Flood zone 1 represents a low probability of flooding, which means there is less than 0.1% (1 in 1,000 years) annual probability of flooding from rivers or the sea. Flood zone 2 represents a medium probability of flooding, which means there is a 1% (1 in 100 years) to 0.1% (1 in 1,000 years) annual probability of flooding from rivers, or 0.5% (1 in 200 years) to 0.1% (1 in 1,000 years) annual probability of flooding from the sea. Flood zone 3 represents a high probability of flooding, which means there is a 1% (1 in 100 years) or more annual probability of flooding from rivers, or a 0.5% (1 in 200 years) or more annual probability of flooding from the sea.

The Flood Map for Planning is a high-level strategic illustration of the flood risk extent along main rivers and, therefore, does not consider ordinary watercourses including streams, ditches, and canals including the Rochdale Canal and Ashton Canal. In addition, the flood zone extent illustrated in the Flood Map for Planning does not consider the possible impacts of surface water flood risk, the probability of changing flood risk consequential to climate change, and fluvial or coastal flood defences.

The Environment Agency Flood Map for Planning shows the Proposed Development falls within flood zone 1 (ES Volume 5 Figure 19.2.6 – Environment Agency Flood Map for Planning).

3.5 Environment Agency Risk of Flooding from Rivers and Sea

The Flood Risk from Rivers and Sea map is a high-level strategic map of the extent of flood risk from main rivers[14]. The Flood Risk from Rivers and Sea map is based on predicted flood and ground levels and considers the presence and effect of flood defences, unlike the Flood Map for Planning. However, flood defences reduce but do not completely avert the chance of flooding as defences can be overtopped or fail.

High risk represents a greater than 3.3% annual probability of flooding. Medium risk represents between 1% to 3.3% annual probability of flooding. Low risk represents between 0.1% to 1% annual probability of flooding. Very low risk represents less than 0.1% annual probability of flooding.

The EA Risk of Flooding from Rivers and Sea map shows the Proposed Development does not fall within the risk of fluvial flood extent (ES Volume 5 Figure 19.2.7 Flood Risk From Rivers and Sea).

[13] Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)

[14] Learn more about this area's flood risk - Check your long term flood risk - GOV.UK (check-long-term-flood-risk.service.gov.uk)

3.6 Environment Agency Risk of Flooding from Surface Water

Surface water flooding – also known as flash flooding – occurs when rainwater cannot drain away through the normal drainage systems. This tends to affect areas with impermeable surfaces more severely. Therefore, the rainwater instead pools or flows overground. Surface water flooding can be difficult to predict as it is dependent on rainfall volume and location which are both difficult to forecast. In addition, local features can greatly affect the chances and severity of flooding.

The Environment Agency surface water flood risk maps[14] are a high-level strategic illustration of the surface water flood risk; it is thus not suitable for identifying whether an individual site will flood, as information regarding floor levels, construction characteristics, or designs is not considered but has been utilised to provide an overview of surface water risk within the surrounding area. The surface water flood risk maps consider the effect of flood defences in the area. Defences reduce but do not completely stop the chance of flooding as they can be overtopped or fail.

'High' risk of surface water flooding means that the Site has a chance of flooding of greater than 3.3% each year. 'Medium' risk of surface water flooding means that the area has a chance of flooding between 3.3% to 1% each year. 'Low' risk of surface water flooding means that the area has a chance of flooding of between 1% to 0.1% each year.

The surface water flood risk extent shows there is a small pocket of 'low' risk of flooding within the Site (ES Volume 5 Figure 19.2.8 – Surface Water Flood Risk Extent).

The surface water flood map of the high-risk scenario shows there are no surface water flood depths at the Site (ES Volume 5 Figure 19.2.9 – High Risk Scenario Surface Water Flood Depth).

The surface water flood map of the medium-risk scenario shows there are no surface water flood depths at the Site (ES Volume 5 Figure 19.2.10 – Medium Risk Scenario Surface Water Flood Depth).

3.7 Environment Agency Risk of Flooding from Reservoirs

The reservoir flood risk map[14] shows the Proposed Development does not fall into the risk of flooding in the unlikely event of a reservoir failure when there is flooding from rivers.

3.8 Groundwater Flooding

There are no recorded incidents of groundwater flooding within Manchester; however, the Proposed Development does fall within the Areas at risk of Groundwater flooding as shown in Figure 19.2.4. This is considered a worst case scenario as Figure 19.2.5 shows the Proposed Development does not fall within the potential issues of groundwater flooding. It is recognised that the risk of groundwater flooding is highly variable, as it is heavily dependent upon local ground conditions at any time and the built environment constructed on the land. The occurrence of groundwater flooding is usually local, unlike fluvial and surface water flooding; hence, does not generally pose a significant risk due to the slow rate at which groundwater flow rises from underground to aboveground as overland flow.

Although no incident of specific groundwater flooding has been identified, this does not eliminate the risk of groundwater flooding at the Site, especially as the risk associated with groundwater flooding is not well understood. It is important to ensure the Proposed Development is not placed at unnecessary risk; hence measures should be in

place to ensure no worsening of the existing flood issue within the area. For example, employing Sustainable Drainage Systems (SuDS) that divert runoff to groundwater storage. However, increased use of infiltration SuDS may have the potential to increase groundwater flood risk locally, therefore, careful consideration and design are required which has been considered as part of the SuDs and the drainage strategy proposed in ES (Volume 4) Appendix 19.3.

3.9 Historical Flooding

The Historic Flood Map[15] shows the maximum extent of individual Recorded Flood Outlines of areas of land that have previously flooded in England from the river, sea, and groundwater springs that meet a set criterion. This, however, excludes flooding from surface water – except in areas where it is impossible to determine whether the source is fluvial or surface water, but the dominant source is fluvial.

Most records began in 1946, hence, there are limited details about flooding incidents prior to this date. If an area is not covered by the Historic Flood Map, it does not mean that the area has never flooded, only that there are currently no records of flooding in this area that meet the criteria for inclusion. It is also possible that the pattern of flooding in the area has changed and thus the area would now flood or not flood under different circumstances.

The Environment Agency Historic Flood Map shows the Site has not historically experienced flooding.

3.10 Site Drainage

Artificial drainage systems within or near the Site may present a risk of flooding through the capacity exceedance or the structural, hydraulic, geotechnical, mechanical, or operational failure of the infrastructure system or engineering installations. For example, land drainage pumps (their power supplies), sluice gates (the mechanism raising or lowering them), or outfall flap valves. Blockage and structural failure incidents are by nature isolated and unpredictable, occurring as a result of various reasons including poor design, faulty manufacture, inadequate maintenance, improper operation, unforeseen accident, vandalism or sabotage. In the urban areas, the drainage is facilitated by a sewer system.

In Manchester City Centre, rainwater is frequently drained into surface water sewers or sewers, containing both surface and wastewater (combined sewers). Flooding can occur when the sewer is overwhelmed by heavy rainfall, becomes blocked, or there is inadequate capacity to deal with the volume of rainfall draining into it. The Office of Water Trading (Ofwat), Water, and Sewerage companies are required to record internal and external flooding incidents arising from the sewer network either lack of capacity or operational problems. The ‘DG5 register’ defines internal flooding as ‘flooding that enters a building or passes below a suspended floor’. There are currently 229 properties on the DG5 Register in Manchester[16].

3.11 Flood Warning

The Environment Agency operates a Flood Warning service[17] in areas at risk of flooding from rivers by using the latest available technology to monitor rainfall and river levels 24 hours a day to forecast the possibility of flooding.

[15] Defra Data Services Platform

[16] Manchester City Council Preliminary Flood Risk Assessment

[17] Flood Warning Areas - data.gov.uk

The Site is situated within a larger geographical area of the River Medlock catchment where the Environment Agency provides general early notification of possible flooding, known as Flood Alert[18]. The Proposed development is not within an Environment Agency Flood Warning Area.

3.12 Climate Change

Climate change is expected to have a major influence on future flood risk. The expectations are that winter floods will occur more often, and in urban areas flooding from thunderstorms will be more frequent and of increased magnitude.

The EA Flood Map does not currently take account of future climate change. The NPPF advises that the effects of climate change at a regional level are likely to increase rainfall intensities and river peak flows; therefore, these impacts should be considered in the preparation of site-specific FRAs.

The EA Climate Change allowances have been adopted for the use of this study[19]. As shown in Figure 19.2.11, the Irwell Management Catchment peak river flow allowances were used for the Proposed Development, using the 2080s Central 35%, Higher 46%, and Upper 75% climate change allowance.

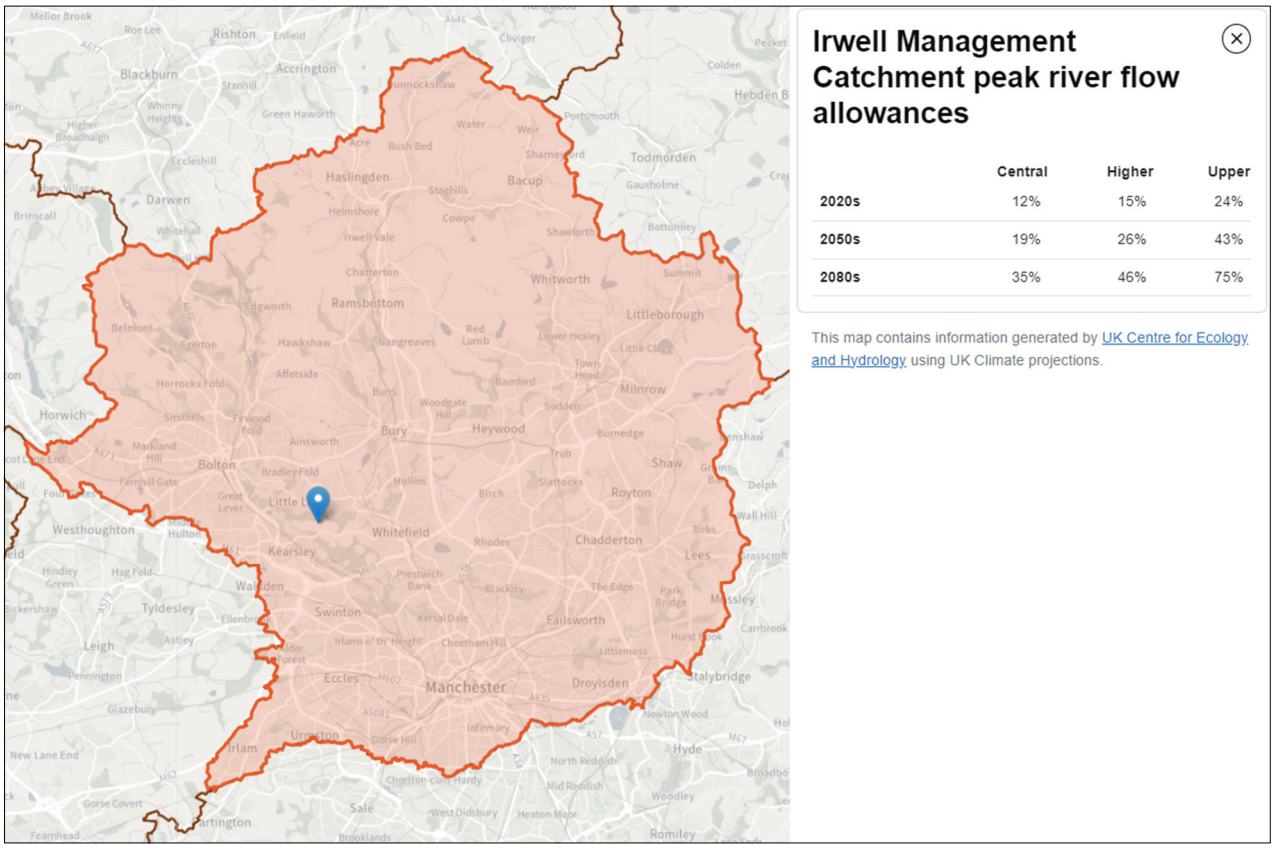


Figure 19.2.11- The Irwell Management Catchment peak river flow climate change allowances

[18] Flood Alert Areas - data.gov.uk

[19] Climate change allowances for peak river flow in England (data.gov.uk)

4. Assessment of Flood Risk

4.1 Overview

This Flood Risk Assessment has included the following tasks:

- Identification of the site-specific requirements for a flood risk assessment for the development of the Site.
- Data collection.
- Assessment of potential risk of flooding to or from the Site.
- Requirements for mitigation measures.

4.2 Sources of Flood Risk

There are several sources of flood risk and flood mechanisms which have been investigated as part of this FRA. The sources of flood risk are:

- Fluvial flooding.
- Surface water flooding.
- Groundwater flooding.
- Sewer flooding.
- Other sources, e.g. reservoir, canal.

4.3 Fluvial Flood Risk

Based on the Environment Agency Flood Map for Planning, the Site falls within flood zone 1 which represents less than 0.1% (1 in 1,000 years) annual probability of flooding from rivers or the sea (see ES Volume 5 Figure 19.2.6 – Environment Agency Flood Map for Planning). Furthermore, based on the Environment Agency Historic Flood Map – the Proposed Development is located in an area which has not previously experienced flooding.

In line with the Flood Risk Assessment, a Sequential Test is not required as the Proposed Development falls outside of flood zones 2 or 3[20]. Furthermore, in accordance with Table 2: Flood Risk Vulnerability Classifications (Appendix D) and Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility' (Appendix E) in the NPPF[1], because the Proposed Development is classed as a 'Less Vulnerable' ("Buildings used for shops, financial, professional and other services") that is situated within flood zone 1, an Exception Test is not required.

4.4 Surface Water Flood Risk

Based on the Environment Agency surface water flood risk extent map (see ES Volume 5 Figure 19.2.8 – Surface Water Flood Risk Extent) there are small pockets of 'low' risk of flooding within the Site, and no surface water flood depth in the medium-risk scenario (see ES Volume 5 Figure 19.2.10 – Medium Risk Scenario Surface Water Flood Depth). The Environment Agency surface water flood maps are not suitable for identifying whether an individual site

[20] Flood risk assessment: the sequential test for applicants - GOV.UK (www.gov.uk)

will flood, as information regarding floor levels, construction characteristics, or designs of structures are not considered, but have been utilised to provide an overview of surface water risk within the surrounding area.

Based on collated information, there is no recorded incident of surface water flooding within the Proposed Development. From this, in conjunction with the Environment Agency surface water flood maps and hydrogeological conditions, it can be deduced that high-intensity rainfall is unlikely to result in surface water ponding within the Proposed Development. If rainfall intensity exceeds the infiltration capacity of the ground or waterlog the ground beneath, small pockets of surface water ponding may arise. However, high-intensity rainfall is unlikely to result in consequential surface water flooding within the Proposed Development based on historical records.

4.5 Groundwater Flood Risk

There is no recorded incident of groundwater flooding at or within the vicinity of the Proposed Development. However, this does not mean there is no risk of groundwater flooding.

Prolonged periods of rainfall in the surrounding catchment can lead to an increase in groundwater levels and cause groundwater flooding. As the groundwater is likely to be in hydraulic continuity with the Rochdale Canal, Ashton Canal, and New Islington Marina – the main influence of groundwater levels in the Proposed Development will be river canals.

It is difficult to confirm the possible extent of groundwater flooding within the Site without understanding the local processes and undertaking groundwater monitoring. However, the extent of flooding from groundwater is likely to be masked by flooding from the canals. Therefore, further assessment is not required.

4.6 Sewer Flooding

Artificial drainage systems and infrastructure within or in close proximity to the Proposed Development may present a risk of flooding through the capacity of the system network being exceeded or the structural, hydraulic, geotechnical, mechanical, or operational failure of the system infrastructure. It is considered the risk from surcharged sewer flooding is low; nevertheless, residual risk remains during extreme events and incidents of sewer blockage.

4.7 Other Sources

The Rochdale Canal, Ashton Canal, and New Islington Marina are adjacent to the Proposed Development. The risk of flooding from the canals is dependent on several factors. Canals are manmade structures that are heavily controlled and thus unlikely to respond in the same way as a natural watercourse during storm events; the risk of canal flooding is instead more likely associated with residual risks. The residual risks of canal flooding include asset (gate) failure, overtopping of canal banks or breaching of embanked reaches. Canals have significant interaction with other water sources including watercourses that feed into them or drains that cross underneath the canals. There are no records of historic canal flooding or other artificial infrastructure to or within the vicinity of the Proposed Development. The risk of canal flooding to the Proposed Development is low based on historical records and the diligent, continued inspection and maintenance by the Canal & River Trust.

Based on the Environment Agency Risk of Flooding from Reservoirs, the Proposed Development is not at risk of flooding in the unlikely event of a reservoir failure when in conjunction with river flooding. Furthermore, the risk of flooding from reservoir failure is low based on historical flood records and the diligent, continued inspection and

maintenance by the operating authority. Reservoirs in the UK have an extremely good safety record with no reservoir failure incidents that resulted in the loss of life since 1925[21].

[21] Biennial report on reservoir safety: 1 January 2019 to 31 December 2020 - GOV.UK (www.gov.uk)

5. Mitigation of Flood Risk

Section 4 identified the potential flood risks to the Proposed Development. This section sets out the principles of how these risks will be mitigated through appropriate design and operation of the Proposed Development.

5.1 Fluvial Flooding

On the EA Flood Map for Planning, the Proposed Development is situated in flood zone 1: low probability of flooding (see ES Volume 5 Figure 19.2.6 – Environment Agency Flood Map for Planning), and therefore a Sequential Test is not required. In conjunction, because the Proposed Development work is also classed as 'Less Vulnerable' ("Buildings used for shops, financial, professional and other services"), an Exception Test is not required. Nevertheless, all earthworks associated with this development should be undertaken outside the surface water flood extent (see ES Volume 5 Figure 19.2.8 – Surface Water Flood Risk Extent).

5.2 Pluvial / Surface Water Flooding

The NPPF requires new developments to neither exacerbate flood risk due to reduction of the current flood storage capacity at the Site nor increase runoff from the Proposed Development.

Any surface water flood risk should be managed by directing overland flow away from the infrastructure and assets, then contained/conveyed within the Proposed Development or a drainage system that is appropriately designed to ensure there is no increased off-site overland flow.

A separate detailed surface water Drainage Strategy ES (Volume 4) Appendix 19.3 has been completed for the Proposed Development, which demonstrates how additional surface water runoff associated with the Proposed Development will be managed. The Drainage Strategy will be updated further as the design of the Proposed Development matures and becomes more detailed.

In accordance with the Flood and Water Management Act 2010: Schedule 3, the LLFA can make it a requirement for new developments in England to incorporate SuDS, not merely recommend it[22]. The Government Property Agency (GPA) should confirm with the Manchester City Council (the LLFA) regarding the incorporation of SuDS as a result of the Proposed Development. As detailed in the Drainage Strategy, ES (Volume 4) Appendix 19.3, SuDS will be implemented to reduce the rate and quality of the surface water runoff from the Site. In supplement to the Drainage Strategy, an initial SuDS assessment identifying viable SuDS features as part of the drainage design has been carried out. The potentially suitable SuDS techniques include sub-surface storage, pocket wetland, perimeter sand filter, filter trench/drain, green roof, rainwater harvesting, and permeable paving.

5.3 Flooding from Sewers

All new surface water runoff collection and conveyance systems that service the Proposed Development should be designed and installed in accordance with current guidance and regulations. Therefore, the risks of failure of the new onsite drainage systems are not considered significant.

[22] Sustainable drainage systems review - GOV.UK (www.gov.uk)

5.4 Flooding from Groundwater

Upon the evaluation of potential groundwater flood mechanisms and the geological and hydrogeological characteristics of the Proposed Development area, there are no characteristics that suggest any significant propensity toward groundwater flooding.

As groundwater is likely to be in hydraulic continuity with the Rochdale Canal and Ashton Canal, the main influence of groundwater levels on the Proposed Development will be the canal levels. There is no planned mitigation measure to alleviate fluvial flood risk – as the Proposed Development is not within the fluvial flood risk extent – that would correspondingly manage the groundwater flood risk at the Site.

5.5 Flooding from Other Sources

The Proposed Development is at low risk of flooding from Rochdale and Ashton Canals or the New Islington Marina (despite proximity), or other any additional artificial sources. This is a result of canals being controlled waterbodies with regulated flows that are continuously maintained by the Canal & River Trust. In the limited likelihood the Rochdale canal is overtopped or breached, the flood could spread beyond the towpath and into the Site.

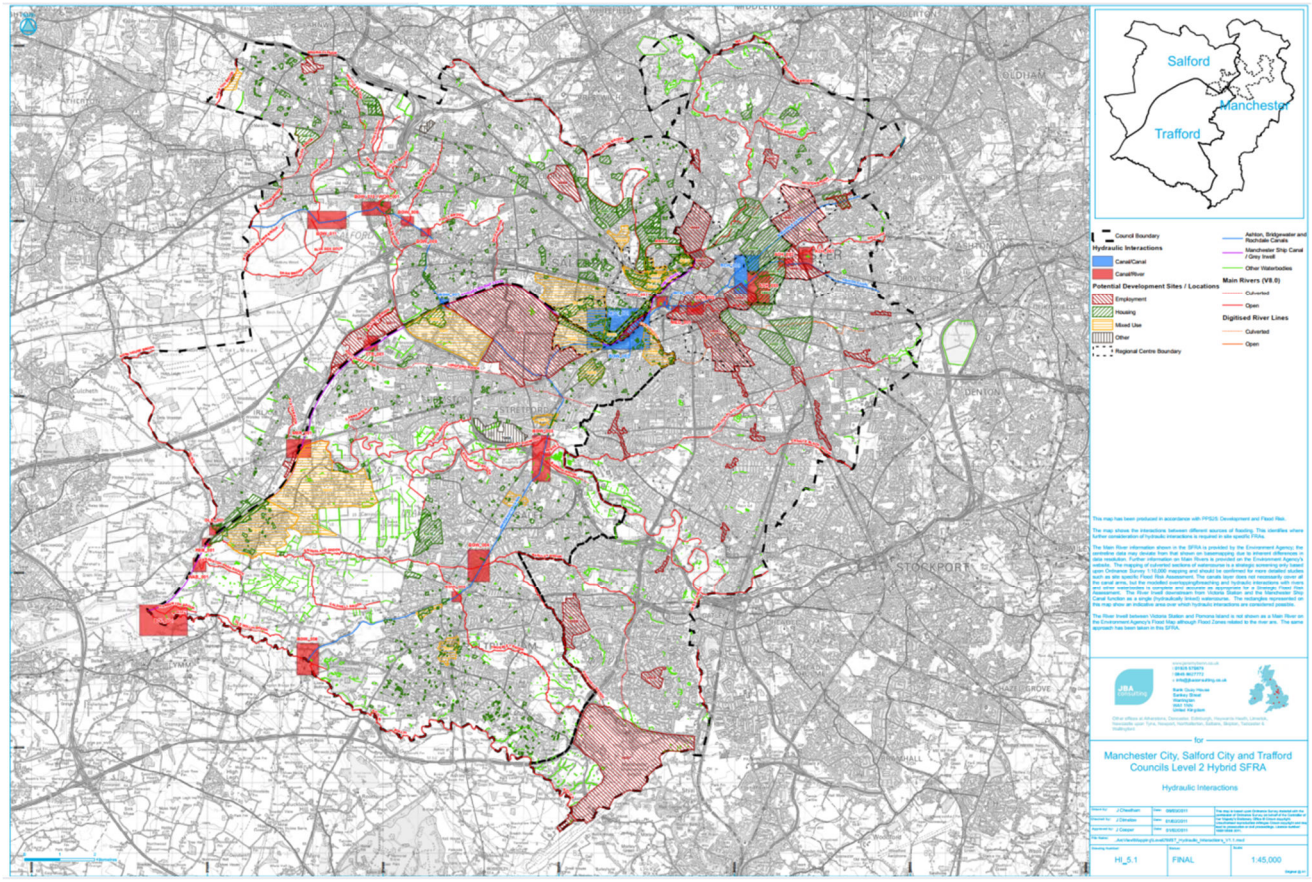
The Proposed Development is not at risk of inundation in the unlikely event of a reservoir failure, coinciding with elevated river levels. Due to regular inspection, survey, and maintenance by the operating authorities and the extremely good safety record of no reservoir failure incidents resulting in the loss of life in the UK since 1925 – no mitigating action is deemed necessary.

6. Conclusions and Recommendations

- This FRA assesses the potential flood risks to and from the Proposed Developments at Manchester Digital Campus in accordance with the NPPF.
- The EA Flood Map for Planning, and EA Risk of Flooding from Rivers and Sea map, respectively, show the Proposed Development is located in flood zone 1 and does not fall within the risk of flooding from the river (and sea). Hence, no mitigation measures are required.
- According to the NPPF, the Proposed Development is categorised as ‘Less Vulnerable’ (“Buildings used for shops, financial, professional and other services”). As such, because it falls within flood zone 1, an Exception Test is not required in accordance with the Flood Risk Vulnerability and Flood Zone Compatibility table.
- In line with the Flood Risk Assessment, a Sequential Test is also not required as the Proposed Development falls within flood zone 1.
- The Risk of Flooding from Surface Water map shows there are small pockets of ‘low’ risk of surface water flooding at the Proposed Development, with no flood depths in a medium-risk scenario.
- In accordance with the Flood and Water Management Act 2010: Schedule 3, the LLFA can make it a requirement for new developments in England to incorporate SuDS. SuDS requirements will be confirmed with Manchester City Council (the LLFA).
- Climate change is expected to increase rainfall intensity, which may result in increased surface water runoff and consequently flood risk to the Proposed Development. The drainage design, as detailed in the Drainage Strategy, see ES (Volume 4) Appendix 19.3, considers climate change by designing the surface water storage to accommodate flow attenuation for rainfall events of up to and including the 1% AEP + 45% climate change event.
- A residual risk of flooding from the potential failure of the artificial drainage system within the Site will always remain. Nevertheless, the Proposed Development will incorporate features that can mitigate any residual risk of flooding. As detailed in the Drainage Strategy, it is proposed that the surface water drainage system

will comprise a conventional pipe network alongside SuDS components. In addition, a Hydrobrake flow control limiting the flow to the maximum permitted flow rate for the Site is proposed to be used before outfall into the culvert. At the detailed design stage, the use of complex flow control will be explored so that the discharge rate for a particular rainfall event can be limited to the greenfield run-off rate for the same rainfall event.

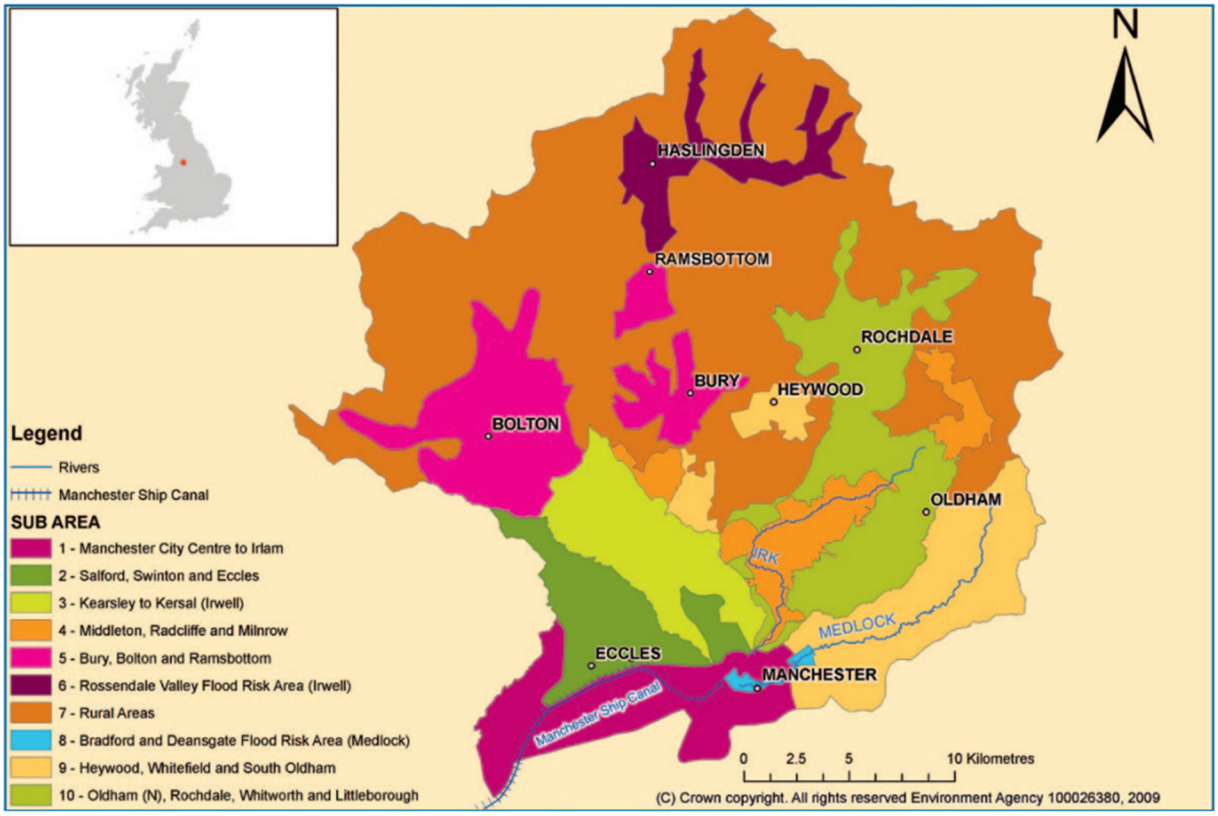
Appendix A. Hydraulic Interactions



Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA[23]

[23] https://www.manchester.gov.uk/download/downloads/id/26467/map_-_mst_hydraulic_interactions_hi_51.pdf

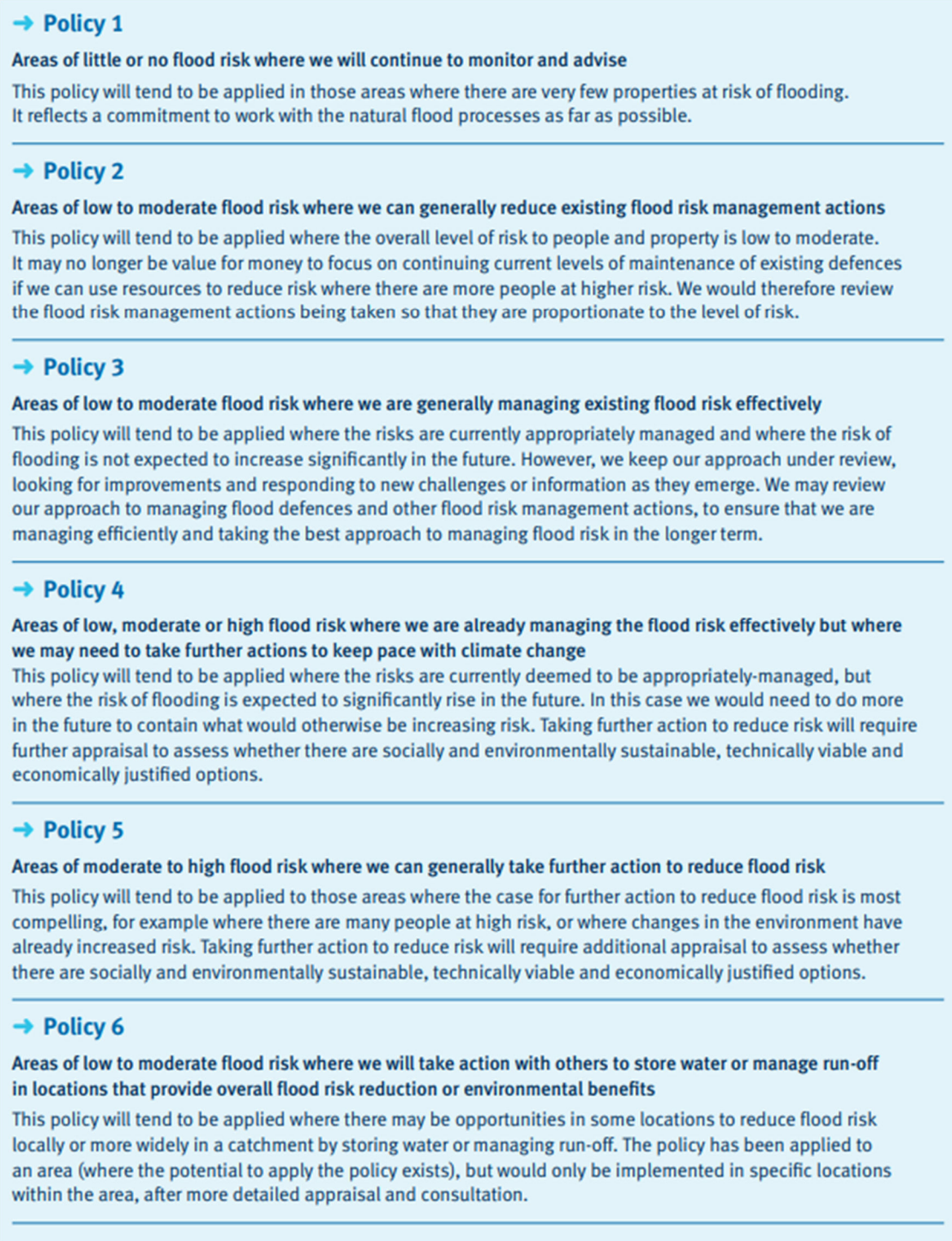
Appendix B. River Irwell 10 sub-areas



Irwell Catchment Flood Management Plan[24]

[24] River_Irwell_Catchment_Flood_Management_Plan.pdf (publishing.service.gov.uk)

Appendix C. The six generic flood risk management policy options



→ Policy 1

Areas of little or no flood risk where we will continue to monitor and advise

This policy will tend to be applied in those areas where there are very few properties at risk of flooding. It reflects a commitment to work with the natural flood processes as far as possible.

→ Policy 2

Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions

This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk.

→ Policy 3

Areas of low to moderate flood risk where we are generally managing existing flood risk effectively

This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review, looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

→ Policy 4

Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change

This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

→ Policy 5

Areas of moderate to high flood risk where we can generally take further action to reduce flood risk

This policy will tend to be applied to those areas where the case for further action to reduce flood risk is most compelling, for example where there are many people at high risk, or where changes in the environment have already increased risk. Taking further action to reduce risk will require additional appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

→ Policy 6

Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits

This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Flood risk management policy options[25]

[25] River_Irwell_Catchment_Flood_Management_Plan.pdf (publishing.service.gov.uk)

Appendix D. Flood Risk Vulnerability Classification

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use[3]. • Installations requiring hazardous substances consent[4]. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")[5].
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste[6]. • Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan.*[7]
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,

NPPF Flood Risk Vulnerability Classification[26]

[26] Technical Guidance to the National Planning Policy Framework (publishing.service.gov.uk)

Appendix E. Flood Risk Vulnerability and Flood Zone Compatibility

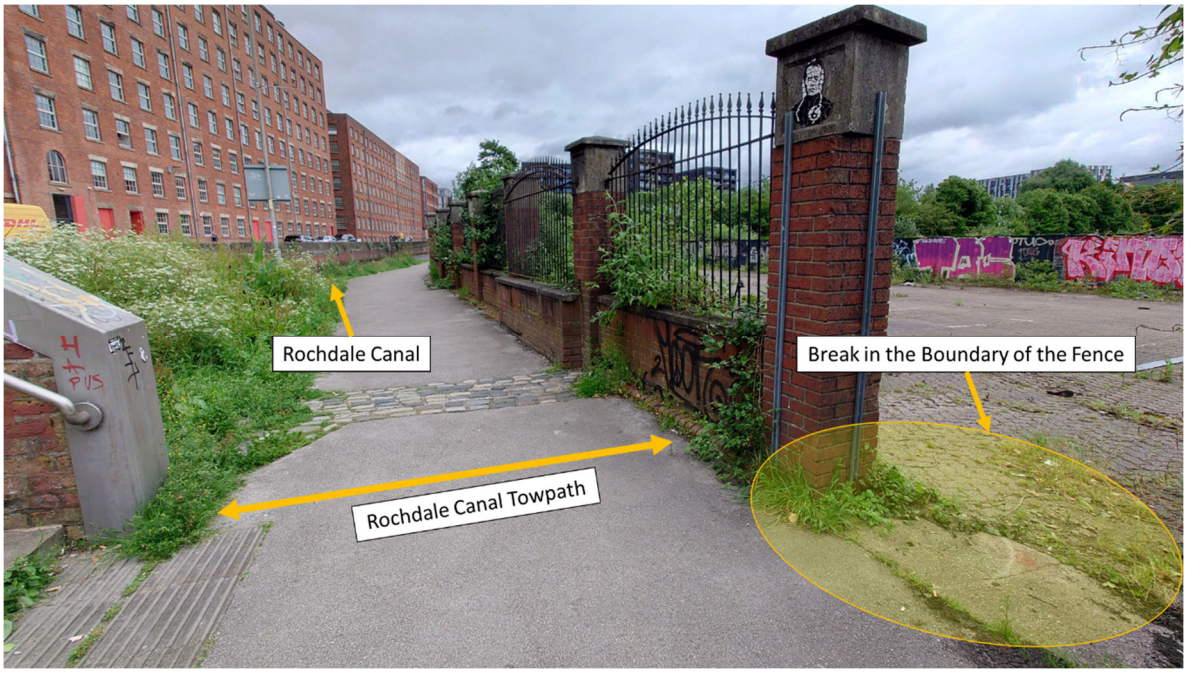
Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b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

NPPF Flood Risk Vulnerability and Flood Zone Compatibility[27]

[27] Technical Guidance to the National Planning Policy Framework (publishing.service.gov.uk)

Appendix F. Photographs of the Rochdale Canal Towpath





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