

Intended for
First Street Developments Ltd

Document type
Report

Date
May 2023

Document no.
1620007819-RAM-XX-XX-RP-EV-00001

FIRST STREET PLOT 10A

FLOOD RISK

ASSESSMENT

FIRST STREET PLOT 10A FLOOD RISK ASSESSMENT

Project name **First Street - No 10a**
Project no. **1620007819**
Recipient **First Street Developments Ltd**
Document type **Report**
Version **0.1**
Date **03/05/23**
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Description **Flood Risk Assessment**
Document no. **1620007819-RAM-XX-XX-RP-EV-00001**

<https://uk.ramboll.com>

Revision	Date	Prepared by	Checked by	Approved by	Description
0.1	06/09/2022	Daniel Porteous	Trefor Hillas	Trefor Hillas	Issue for comment
1	16/09/2022	Daniel Porteous	Trefor Hillas	Trefor Hillas	Issue to client
2	21/11/2022	Daniel Porteous	Trefor Hillas	Trefor Hillas	Revised following client comments
3	12/01/2023	Daniel Porteous	Trefor Hillas	Trefor Hillas	Updated site boundary
4	03/05/23	Daniel Porteous	Trefor Hillas	Ant Guay	Updated FFL

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1. EXECUTIVE SUMMARY

- 1.1.1 A Flood Risk Assessment (FRA) is required to support a planning application for a Proposed Development comprising a 13-storey plus basement office building and associated facilities, landscaping, and associated works situated on First Street, Manchester.
- 1.1.2 The majority of the site is within Flood Zone 1 and has a low probability of flooding from rivers and the sea. The north-east corner of the site is within Flood Zone 2 and has a medium probability of flooding from rivers and the sea. An assessment of the hydraulic modelling results of the River Medlock indicates the site would not flood in a 1 in 100 year event, (with climate change taken into consideration), as the minimum site level is above the modelled flood level. The development does not require the exception test and is considered suitable under National Planning Policy Framework requirement.
- 1.1.3 This flood level data was obtained from a 1D-2D linked ISIS-TUFLOW model of the River Medlock produced by JBA in 2009. This model was accepted by the EA in 2010. As this flood model information is from 2009, no 35% climate change scenario is available, and the 20% allowance has been used due to being the only scenario available. However, this is considered in the assessment of flood levels and the associated freeboard.
- 1.1.4 A summary of the 1 in 100 year plus 20% climate change level, proposed Finished Floor Levels and existing road levels is summarised as follows:
- 1 in 100 year plus 20% climate change levels = 29.97 mAOD
 - Proposed Finished Floor Level = 30.93 mAOD
 - Existing road level along River Street = 30.74 mAOD
- 1.1.5 As such, the Finished Floor Level of the development has a +700 mm freeboard above the 1 in 100 year plus 20% climate change event, and +190 mm freeboard above the existing road level. It should be noted that the +190 mm freeboard above the road level is the highest that could be achieved, due to the requirement for the building ground floor level to tie into the existing kerb level and proposed public realm/external areas. It should be noted that the most vulnerable aspects of the ground floor level i.e. plant room and communications room are situated at 31.25 mAOD, giving +510 mm freeboard above the external road level.
- 1.1.6 Whilst the present-day requirement for the consideration of the climate change for the Medlock is 35%, given the 700mm freeboard between finished floor levels and site levels, this use of a 20% allowance does not materially change the assessment of fluvial flood risk.
- 1.1.7 The site is at a very low risk of flooding from surface water. While the Proposed Development will not increase the impermeable area, and as a result, the risk of surface water flooding significantly, a drainage strategy is proposed to reduce runoff to a greenfield rate of 5 l/s to satisfy best management practices. The restriction will be achieved by providing storage of surface water via a blue roof, and discharge to existing sewer systems, pending agreement from United Utilities.
- 1.1.8 While the site is identified as being in an area potentially at risk of flooding from reservoirs according to Environment Agency mapping, reservoir failure is a rare and unlikely occurrence, as the infrastructure is regularly inspected by the Environment Agency.
- 1.1.9 The proposed development is at a low risk of groundwater flooding occurring at the surface. The basement/lower ground level could be at risk of groundwater ingress when perched groundwater levels are high. However, assuming appropriate waterproofing and a warning and evacuation is implemented, the risk of groundwater flooding below ground can be managed.
- 1.1.10 No other significant sources of flood risk were identified in the assessment.

- 1.1.11 Based on the findings of this Flood Risk Assessment, and in consideration of the recommendations made, it is concluded that any flood risk to the site is manageable and within acceptable limits for the proposed site use.

2. INTRODUCTION

2.1 Appointment and Brief

- 2.1.1 Ramboll UK Limited (Ramboll) has been commissioned by First Street Developments Ltd to undertake a Flood Risk Assessment (FRA) to support a planning application for the construction of the Proposed Development consisting of a 13-storey plus basement office building and associated facilities, landscaping, and associated works situated on First Street, Manchester, M15 4GU.

2.2 Scope and Objectives

- 2.2.1 This report considers the risks of various sources of flooding to the site and the consequent risk of flooding to downstream receptors (such as people, property, habitats, infrastructure and statutory sites) from the proposed development as a result of surface water runoff. A comparison is made between the current situation and the proposed future development.
- 2.2.2 This FRA has been carried out in accordance with the National Planning Policy Framework (NPPF)¹. It is to be used to assist the Local Planning Authority (LPA) and relevant statutory consultees when considering the flooding issues of the proposed development, as part of a planning application.
- 2.2.3 This report provides the following information:
- A review of the flood risk to the site based upon flood data and the flood maps provided by the Environment Agency (EA) and the relevant Strategic Flood Risk Assessment (SFRA);
 - An assessment of flood risk from all sources including tidal, fluvial, pluvial, groundwater and infrastructure failure to the proposed development;
 - An assessment of the compatibility of the proposed development for its location based on flood risk and its proposed usage;
 - An assessment of the impact of the proposed development in terms of surface water runoff (taken from the drainage strategy report);
 - Proposals for measures to mitigate the generation of surface water runoff as a result of the proposed development (taken from the drainage strategy report); and,
 - Proposals to mitigate flood risk to the development.

2.3 General Limitations and Reliance

- 2.3.1 In preparation of the report and performance of any other services, Ramboll has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions reached in this report are valid only to the extent that the information provided to Ramboll was accurate, complete and available to Ramboll within the reporting schedule.
- 2.3.2 The key sources of information used to prepare this report are footnoted within the document. Ramboll is unable to accept liability for the accuracy or otherwise of any information derived from third party sources.
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¹ GOV.UK, National Planning Policy Framework (published June 2019) <https://www.gov.uk/government/publications/national-planning-policy-framework--2> (accessed 15 Sept 2020)

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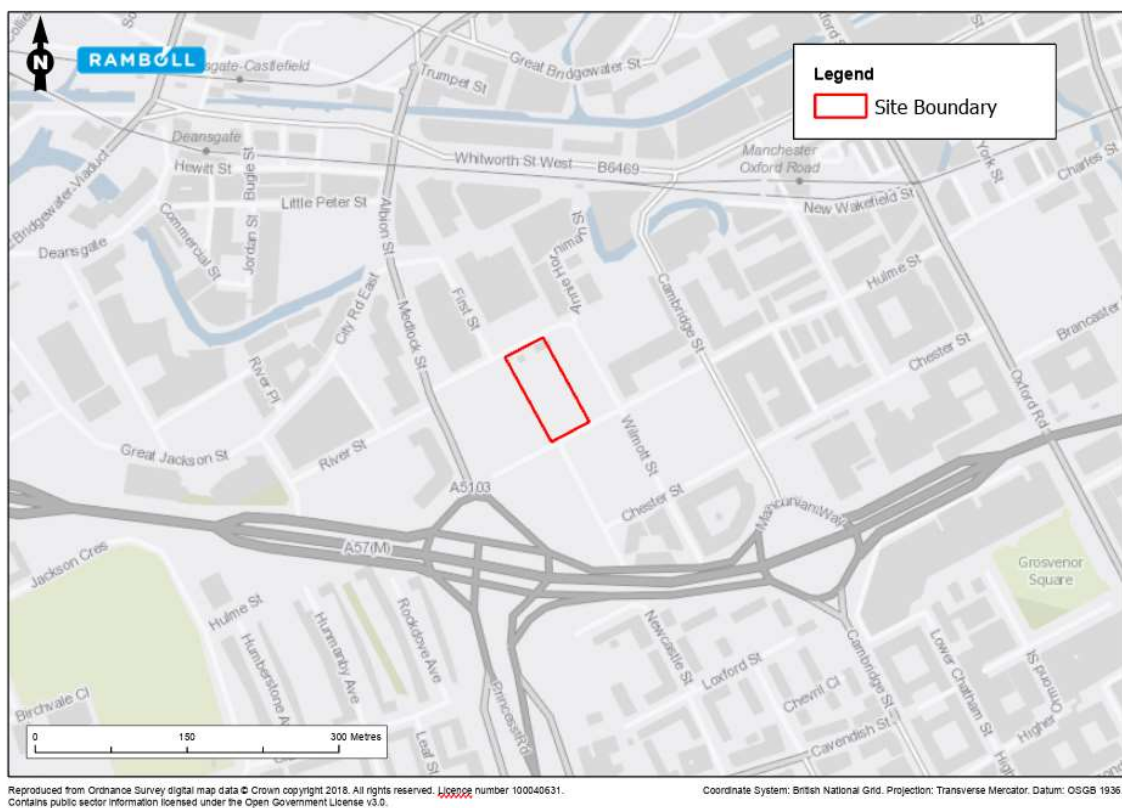
- 2.3.4 Unless otherwise stated in this report, the scope of services, assessment and conclusions made assume that the site will continue to be used for its current purpose and end-use without significant changes either on-site or off-site. Unless stated otherwise, the geological information provided is for general environmental interpretation and should not be used for geotechnical and/or design purposes.

3. SITE DESCRIPTION

3.1 Application Site Description

- 3.1.1 Plot 10a is approximately 0.3 Ha (hectares) in area, and rectangular in shape. Plot 10a is bounded by Plot 10b to the immediate east; Plot 9 to the immediate west, River Street to the north and Hulme Street to the south. The immediate surrounding area comprises mainly of brownfield and exterior storage areas, with mixed use residential and commercial properties in the wider area.
- 3.1.2 The site location is shown in Figure 1.

Figure 1: Site Location



3.2 Proposed Development

- 3.2.1 Detailed planning permission is sought for the erection of a 13-storey plus basement office building for use Class E (c). No car parking spaces are included, however, approximately 120 cycle parking spaces are proposed. There will be landscaping included within the development. The internal space of the office building is 20,155 sqm (square metres). The basement is to be a plant room.
- 3.2.2 A ground floor level of 30.93 metres above ordnance datum (mAOD) and basement level of 28.45 m AOD is proposed.
- 3.2.3 The Proposed Development site plan is included in Appendix 1, this includes an architect's plan indicating the proposed Finished Floor Level of each aspect of the ground floor development.

4. REVIEW OF BASELINE DATA

4.1 Existing Site Topography

- 4.1.1 Survey Operations performed a topographical survey for the Plot 10 in April 2022.
- 4.1.2 The site elevation measures approximately 33.2 m AOD in the south, falling to approximately 30.80 in the north of the site. An elevation of 33.2 m AOD is indicated where Hulme Street meets the proposed Plot 9a boundary to 33.1 where Hulme Street meets the application site boundary
- 4.1.3 The topographic survey is included in Appendix 2.

4.2 Geological Setting

- 4.2.1 British Geological Society (BGS) mapping of the area (1:50,000 scale map series) was accessed via the online BGS Onshore GeoIndex digital mapping database². The map indicates that bedrock geology beneath the site consists of the Chester Formation – Sandstone. Superficial deposits are indicated to consist of Glaciofluvial Sheet Deposits, Devensian - Sand and Gravel. There is also Till indicated to the immediate east.
- 4.2.2 A 2016 and 2017 Ground Investigations by Cundall and Ramboll respectively determined the following ground profile for the site, shown in Table 1:

Table 1: Site Ground Profile

Stratum	From (m AOD)	To (m AOD)	Thickness (m)
Hard Surfacing	GL or 30.9	30.9 to 30.5	0.1 to 0.4
Made Ground (Granular)	GL	32.8 to 27.8	0.5 to 3.7
Made Ground (Cohesive)	GL or 30.8	32.5 to 28.4	0.5 to 2.3
Alluvium	31.6 to 28.4	30.7 to 26.4	1.3 to 3.0
Glaciofluvial Deposits	30.7 to 26.4	29.8 to 23.9	0.8 to 4.3
Glacial Till	29.8 to 25.4	28.8 to 25.3	1.0 to 2.8
Weathered Bedrock	25.6 to 23.8	25.2 to 21.5	0.4 to 3.0
Intact Bedrock	25.2 to 21.5	8.9 to 5.9	Base not Proven

4.3 Hydrological Setting

- 4.3.1 Ordnance Survey mapping shows the River Medlock is situated 150 m north of the site, where it is culverted for 225 m and flows west and into the Bridgewater Canal. The Bridgewater Canal is situated 270 m north, running east to west. The River Irwell is situated approximately 1 km north-west, and flows west. No other surface watercourses are indicated within 1 km of the site.

² The British Geological Survey (BGS) Onshore GeoIndex. <http://mapapps2.bgs.ac.uk/geoindex/home.html> (accessed July 2022)

4.4 Hydrogeological Setting

- 4.4.1 The Onshore GeoIndex 1:625,000 scale hydrogeology map indicates the site is underlain by the Triassic Rocks (undifferentiated) rock unit. This is characterised as a 'highly productive aquifer' and principal sandstone aquifer. Additionally, Defra's online MAGIC map³ indicates 'Medium - High' groundwater vulnerability in the general area, but the resolution of this mapping is low and not specific to the site.
- 4.4.2 Groundwater monitoring at the site by Ramboll was conducted winter 2017/18 and winter 2019/20 at boreholes excavated in 2017 and 2019. Perched groundwater was observed at shallow depth within superficial deposits, and at greater depth within the bedrock aquifer. The highest recorded water level within the superficial deposits was 28.35 m AOD in Plot 9 and 29.4 m AOD in Plot 10. The deeper body of groundwater present in the bedrock aquifer is persistent over time with typical fluctuation within a range of one metre (25-26 m AOD).
- 4.4.3 The site is situated partially within a Source Protection Zone (SPZ) 3 (total catchment) according to the EA's mapping. A SPZ3 is defined as the total area needed to support the abstraction, or discharge from the protected groundwater source.

4.5 Existing Drainage

- 4.5.1 United Utilities public sewer records indicate an existing 600 x 500 mm vitrified clay sewer within Hulme Street. CCTV surveys identified that this sewer appears to start within Hulme Street adjacent to the Plot 10 site. This is different from what is indicated on the sewer records.
- 4.5.2 A combined public sewer is located within Plot 10 flowing from manhole 7201 to 7203. This runs north-east along River Street within the Plot 10 boundary and connects into a large storage chamber at the corner of River Street and Wilmott Street.
- 4.5.3 There is a 300 mm diameter outfall from the storage tank, and sewer records indicate a high level 300 mm diameter overflow from the storage tank into the River Medlock.
- 4.5.4 There is minimal private drainage within the application site, consisting of a small system for collection of foul drainage from toilet facilities. Several connections from the site into the public sewer systems were identified during the survey, but due to the demolition of the existing buildings, the connections have been severed within the boundary.

4.6 Flood risk from Rivers and the Sea

- 4.6.1 The EA identifies areas in England and Wales at risk of flooding by allocating them into flood risk zones. The flood risk zones shown on the flood maps are defined in Table 1 (Flood Zones) of online government guidance⁴:

Zone 1: Low Probability. According to the NPPG, land in this zone is considered to have less than 1-in-1000 annual probability of river or sea flooding in any year. This is <0.1%.

Zone 2: Medium Probability. According to the NPPG, land in this zone is considered to have between a 1-in-100 and 1-in-1000 annual probability of river flooding in any year (between 1% and 0.1%) or between a 1-in-200 and 1-in-1000 annual probability of sea flooding in any year (0.5% to 0.1%).

³ DEFRA MAGIC Map, available at: <https://magic.defra.gov.uk/MagicMap.aspx> (accessed September 2021)

⁴ Flood risk and coastal change guidance, available at: <https://www.gov.uk/guidance/flood-risk-and-coastal-change> (accessed September 2021)

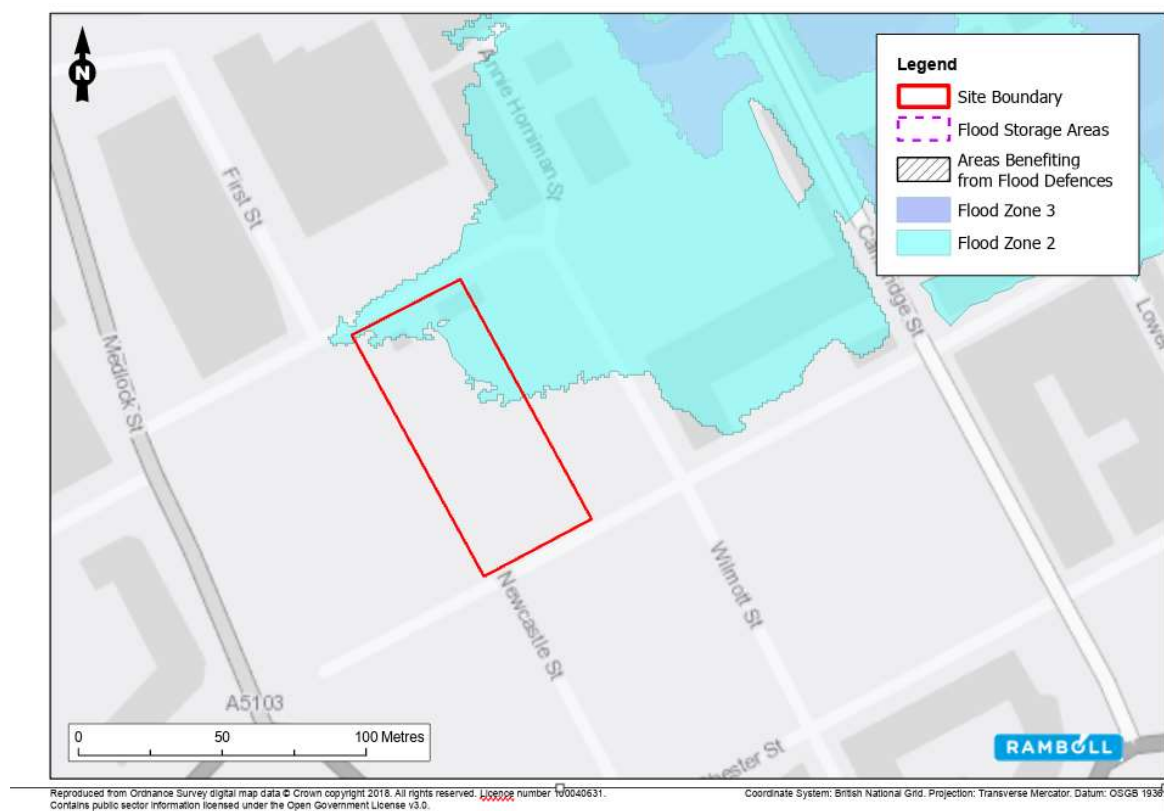
Zone 3a: High Probability. According to the NPPG, land in this zone is considered to have a 1-in-100 or greater annual probability of river flooding in any year ($>1\%$) or a 1-in-200 or greater annual probability of flooding from the sea in any year ($>0.5\%$).

Zone 3b: The Functional Floodplain. According to the NPPG, land in this zone is used for water flow or storage in times of flood. This flood zone should be identified by a Strategic Flood Risk Assessment (SFRA). It is considered to have a 1-in-20 or greater chance of river flooding in any year which is $>5\%$. Another probability, however, can also be agreed between the Local Planning Authority (LPA) and the EA.

4.6.2 According to the EA's online Flood Map for Planning⁵ and associated geo-spatial data, the site is shown to be partially within Flood Zone 2. Tidal and fluvial flood risk to the site is therefore considered to be medium (between 1% and 0.1% chance per year. This flood zone is associated with the floodplain of the River Medlock.

4.6.3 The Flood Map for Planning is shown in Figure 2:

Figure 2: Flood Map for Planning



⁵ EA Flood Map for Planning, available at: <https://flood-map-for-planning.service.gov.uk/> (accessed September 2021)

4.7 River Medlock Hydraulic Model

- 4.7.1 This flood level data was obtained from a 1D-2D linked ISIS-TUFLOW model of the River Medlock produced by JBA in 2009. This model was accepted by the EA in 2010. The accompanying flood model report does not specify the climate change percentage. However, following detailed inspection of the model output files, it appears that at the most upstream model node peak flow for the climate change scenario represents a 20% increase in flow when compared to the 1 in 100 annual probability event.
- 4.7.2 It is acknowledged that this is not the 35% allowance which would be required if revised modelling were to be undertaken under current guidance for a Less Vulnerable land use. However, due to the scale of flood risk (with waters only reaching the corner of the site in the 1 in 1,000 annual probability event) revised detailed modelling was not considered appropriate.

4.8 Assessment of Flood Levels

- 4.8.1 A comparison of the 1 in 100 year plus 20% climate change flood level to the development FFL is summarised in Table 2 below. The 100-year event plus climate change (Q100+CC) flood level is 29.97 m AOD east of Cambridge Street, which is the scenario's closest extent to the application site.

Table 3 – Assessment of Development Freeboard Levels

Development Aspect	Finished Floor Level (mAOD)	1 in 100 + 20% climate change flood level (mAOD)	Freeboard +/- mm
Ground Floor	30.93	29.97	0.96
Substation, LV Switch room and Communications room	31.25		1.28

- 4.8.2 In their role as Lead Local Flood Authority, Manchester City Council stated that along with consideration of the flood level, a freeboard of +300mm above average ground level & adjacent road levels should be provided.
- 4.0.2 A review of the topographic survey (Appendix 2) indicates the typical road level along River Street immediately to the north is 30.74 mAOD (higher levels of 30.82mAOD can be found further east, but these do not directly adjoin the site). Based on a ground level of 30.74 mAOD, a total of +190 mm freeboard will be provided for the majority of the ground floor, which consists of the reception, café and co-working space. Whilst this is below the +300 mm stated in the Manchester City Council response, it should also be noted that the most vulnerable aspects of the ground floor including the Substation, LV Switch room and Communications room are all located at 31.25 mAOD, providing +510 mm freeboard above the surrounding road level. It should also be noted that due to requirements for the building levels to tie into existing kerb and ground levels along Water Street, there is limited raising of FFL that can be undertaken for the reception, café and co-working space. However, by ensuring that the vulnerable aspects of the development have additional freeboard above the +190 mm, it is considered that this risk has been adequately managed.

4.0.3 The model data provided by the EA is presented in Figures 3, 4 and 5:

Figure 3: River Medlock Modelled Flood Extents



Figure 4: River Medlock Modelled Q1000 Flood Depths

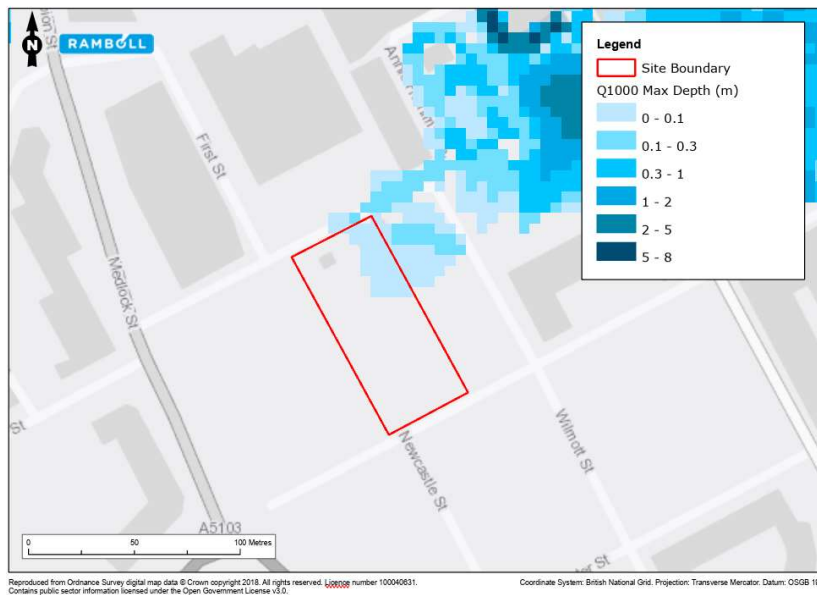


Figure 5: River Medlock Modelled Q1000 Flood Height



4.9 Flood Defences

- 4.9.1 The EA Flood Map for Planning does not designate the area as benefiting from flood defences.

4.10 Surface Water Flood Risk

- 4.10.1 The Flood and Water Management Act 2010 defines surface water flooding as flooding that takes place when surface runoff generated by rainwater falls on the surface of the ground and has not yet entered a watercourse, drainage system or public sewer.
- 4.10.2 The EA's online Long-Term Flood Risk Map⁶ identifies areas in England and Wales at potential risk of surface water (pluvial) flooding. The surface water flood maps define flood risk as follows:

High Risk. Considered to have a greater than 1-in-30 annual probability of surface water flooding in any year (>3.3%).

Medium Risk. Considered to have between a 1-in-30 and 1-in-100 annual probability of surface water flooding in any year (between 3.3% and 1%).

Low Risk. Considered to have between a 1-in-100 and 1-in-1000 annual probability of surface water flooding in any year (between 1% and 0.1%).

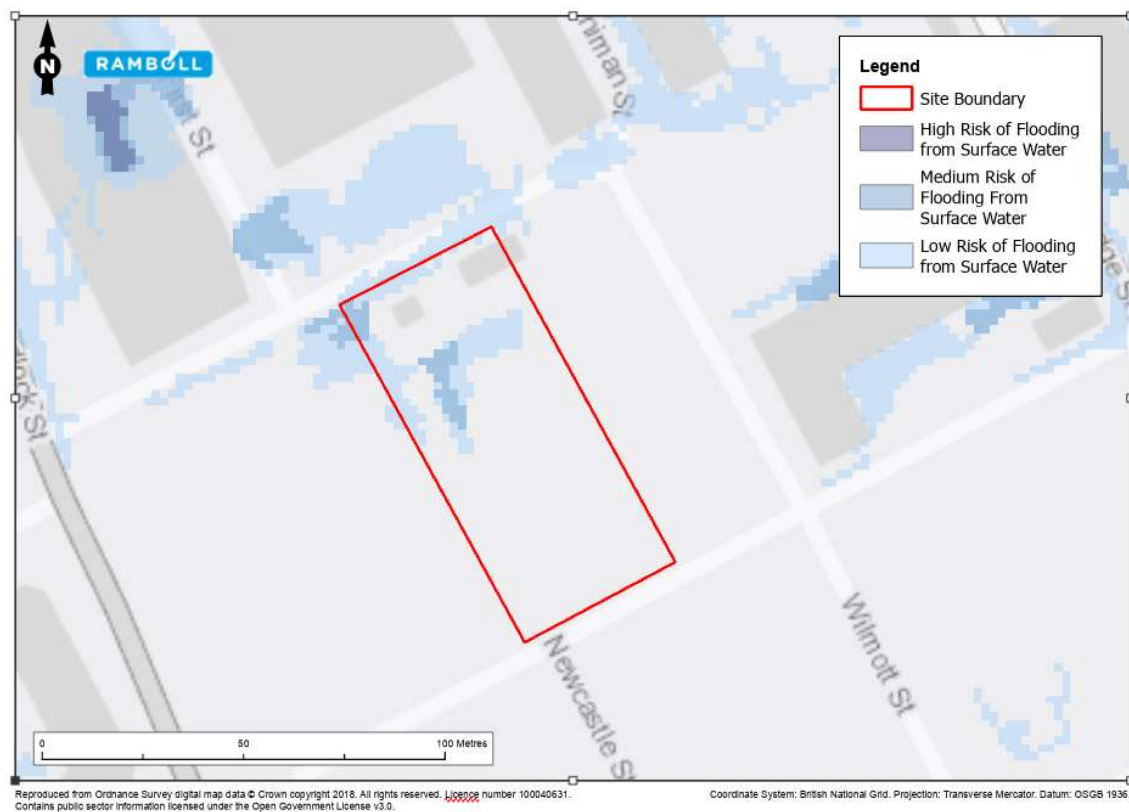
Very Low Risk. Considered to have a less than 1-in-1000 annual probability surface water flooding in any year (<0.1%).

- 4.10.3 The EA's mapping indicates most of the site is at 'Very Low' risk of surface water flooding. There are some areas in the north-west site corner indicated be at 'Low' and 'Medium' risk. Other extents of elevated risk in the immediate area are isolated and would not appear likely to be conveyed to the site.

- 4.0.2 The EA Surface water flood mapping data are presented in Figure 6:

⁶ EA Long-Term Flood Risk Map, available at: <https://flood-warning-information.service.gov.uk/long-term-flood-risk/map> (accessed September 2021)

Figure 6: Risk of Flooding from Surface Water



4.11 Risk from Reservoirs and Other Artificial Sources

- 4.11.1 The EA's long term flood risk map indicates the site is within the extent of flooding from reservoirs when river levels are normal. However, reservoir flooding incidents are infrequent occurrences and reservoirs are regularly inspected by the EA for damage. Whilst the site occupant should be aware of this risk and be cognisant of future flood warnings, ultimately the risk of flooding from reservoirs is considered to be low.

4.12 Groundwater Flooding

- 4.12.1 Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. A groundwater flood event results from a rise in groundwater level sufficient for the water table to intersect the ground surface and inundate low lying land and/or infrastructure below ground. Groundwater floods may emerge from either point or diffuse locations. They tend to be long in duration developing over weeks or months and prevailing for days or weeks.
- 4.12.2 According to the Manchester City, Salford City and Trafford Councils Level 1 SFRA⁷, groundwater flood risk in Manchester city is generally low, or low-moderate. However, Map 2.1 of the SFRA indicates the site is within or close to an area at risk of groundwater flooding.
- 4.12.3 According to DEFRA spatial data⁸ the site is not situated within an area where there are records of historic flooding. There is no historic flooding recorded by the EA with at least 1 km of the site.

⁷ Manchester City Council (2010), Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, Level 1 SFRA, available at: https://www.manchester.gov.uk/downloads/download/3871/strategic_flood_risk_assessment_sfra (accessed August 2022)

⁸ DEFRA Spatial Data Services Platform, Historic Flood Map, available at: <https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/HistoricFloodMap&Mode=spatial> (accessed September 2022)

- 4.12.4 The previous on-site groundwater monitoring by Ramboll indicted a maximum measured height of 29.4 m AOD. This is approximately 1.4 m lower than the site's current lowest point. The groundwater was perched within the superficial deposits and a deeper groundwater body was identified within the bedrock at 25-26 m AOD. Additionally, these measurements were taken during the wettest season of the year over two years. With this site-specific data considered, the risk of flooding at the surface is considered to be low. However, mitigation will be required to manage the risk to the proposed basement aspect of the development.

4.13 Existing Flood Risk Summary

- 4.13.1 A summary of the existing risk of flooding from all sources is provided in Table 3 below.

Table 3 – Assessment of Development Freeboard Levels

Sources of Flooding	High	Medium	Low	Comments
Tidal / fluvial		x		The site is situated partially within Flood Zone 2, initially suggesting a moderate risk. However, JBA modelling of the River Medlock, approved and provided by the EA, suggests the site would not be flooded up to and including a 100 year plus 20% climate change event. The site would be partially flooded in a 1 in 1,000 year event to a depth up to 0.1 m. Modelled 1 in 1,000 year flood levels are below the proposed ground floor finished floor level and above basement/lower ground level.
Surface water and sewer flooding			x	Ramboll has not been made aware of a history of sewer or surface water flooding at the site. Furthermore, the surface water drainage strategy will reduce the loading on the public sewer network, providing a betterment compared to the existing situation. EA flood mapping indicates the site is at 'Very low' risk of surface water flooding overall. Some limited areas at a slightly elevated risk are present in the north-west of the site.
Groundwater		x		Measured groundwater elevations were at least 1.4 m below the surface during seasonal highs. The groundwater was perched. Groundwater within the underlying bedrock aquifer at greater depths of around 5 m below ground. The risk of groundwater flooding at the surface is therefore low. However, there is a moderate risk of flooding to areas greater than 1m below ground due to perched groundwater.
Artificial Sources			x	The site is at risk of flooding from reservoirs when water levels are normal. However, reservoir flooding is an infrequent occurrence and reservoirs are regularly inspected by the EA.

5. MITIGATION MEASURES

5.1 Flood Warning and Evacuation Plan (FWEP);

- 5.1.1 To manage the risk of flooding to the basement level, a plan for warning and evacuation should be compiled into a single document to be used as a basis for a flood plan. The flood plan is to be used by the building manager to make occupants aware of the flood risk and the procedures for responding to a flooding incident. The flood plan should include reference to each of the following:
- Subscription to the Environment Agency flood alert and warning system;
 - A procedure for communicating flood warnings;
 - A system to indicate out of bounds areas of the development when flooding is expected i.e. basement floor which could suffer inundation; and
 - Details of the lower floor evacuation procedure in the event of a flooding event. Similar to a fire drill, this should indicate safe routes of access to upper floors, roles, and responsibilities etc.
- 5.1.2 More information and guidance on the process for writing a flood plan is available within the EA document Flood Plan Guidance for Communities and Groups. The FWEP would cover both the risk of fluvial flooding from the Medlock, and also flooding in the unlikely event of a reservoir failure.

5.2 Basement Level Development

- 5.2.1 The following mitigation measures should be included to manage the risk of flooding to the basement, both from groundwater and fluvial flooding:
- Appropriate waterproofing should be incorporated into the foundation design and below ground structures including service trench installations, especially those which are water sensitive;
 - Ensuring basement access threshold levels are above the 1 in 100 year flood level with 20% climate change (29.97 m AOD);
 - Ensuring all basements include provision of internal staircases to upper floors;
 - Assess the requirements for pumping away of any groundwater which manages to infiltrate the waterproof foundation layer; and
 - Use of flood resistant and resilient construction techniques.

5.3 Sequential Test and Exception Test

- 5.3.1 According to Annex 3 (Flood Risk Vulnerability Classification) in the Planning Practice Guidance to NPPF⁹, offices and commercial spaces are classified as 'Less vulnerable'.
- 5.3.2 The site is at least partially situated in Flood Zone 2. Table 2 (Flood risk vulnerability and flood zone 'incompatibility') in the planning guidance ('Flood risk and coastal change') ¹⁰indicates 'Less vulnerable' developments are acceptable in Flood Zone 2. Therefore, the sequential test finds the development suitable and the Exception Test is not required.

⁹ Department for Levelling Up, Housing and Communities (2012), National Planning Policy Framework Annex 3: Flood risk vulnerability classification, available at: <https://www.gov.uk/guidance/national-planning-policy-framework/annex-3-flood-risk-vulnerability-classification> (accessed August 2022)

¹⁰ GOV.uk (2014) Planning Practice Guidance, Flood Risk and Coastal Change, available at: <https://www.gov.uk/guidance/flood-risk-and-coastal-change> (accessed August 2022)

5.4 Surface Water

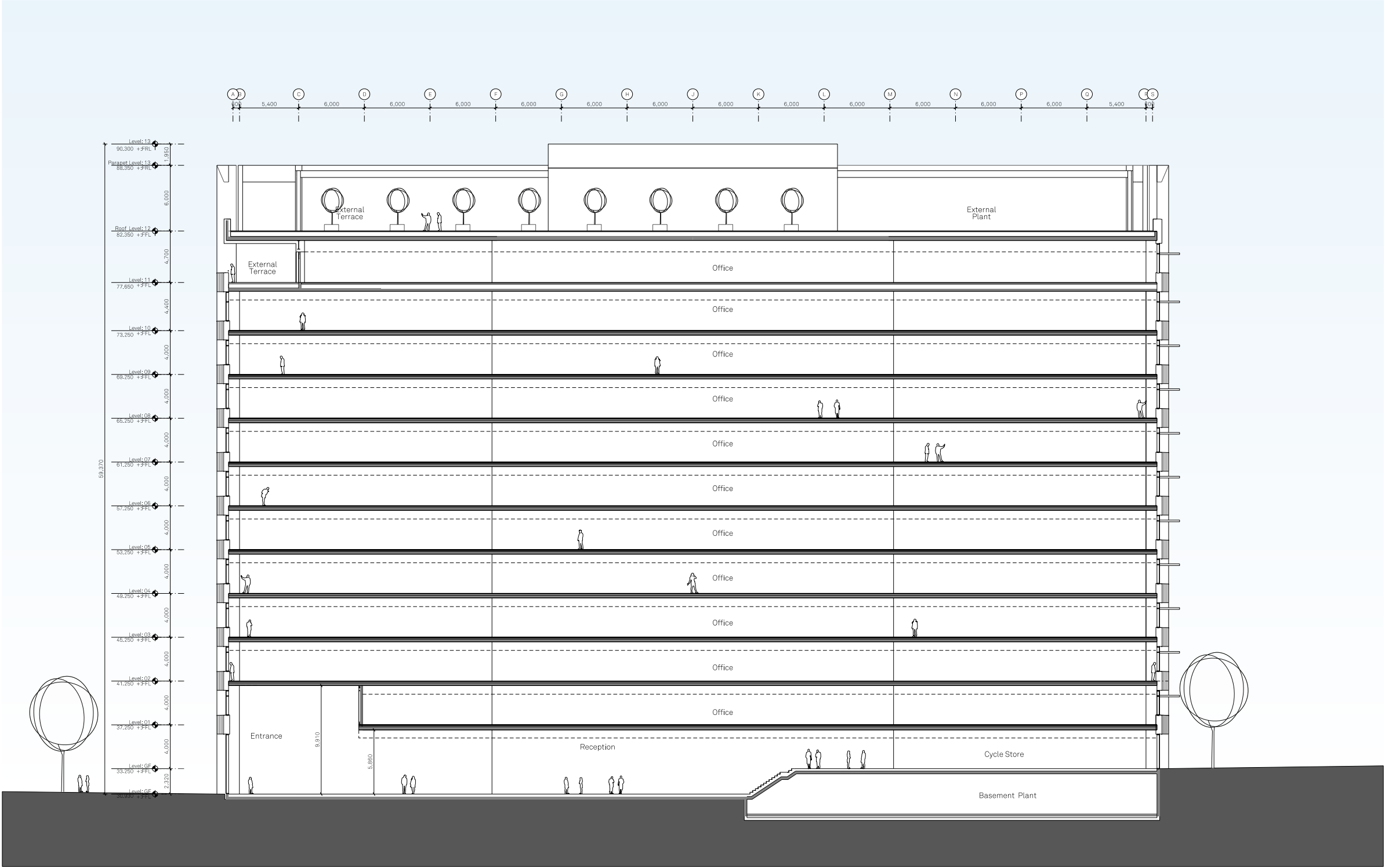
- 5.4.1 At present the site primarily consists of bare soil and aggregates (likely compacted) and variable extents of hardstanding. The impermeable surface area of the site would therefore increase marginally following development. While the risk of surface water flooding would therefore not be expected to increase substantially, post-development runoff discharge limited to greenfield rate is preferred.
- 5.4.2 A drainage strategy produced by Ramboll (document no. 1620007819-RAM-XX-XX-RP-CX-00001) has been developed which proposes methods for the storage and disposal of surface water generated on site. The following hierarchy was reviewed regarding discharge of surface water from the Plot 10a site:
- To Ground/Infiltration
 - To Watercourse
 - To Sewer
- 5.4.3 Although existing around conditions suggest it is possible to infiltrate some of the water, the development proposals indicate minimal external space between the proposed substructure, future buildings, and from restrictions due to existing gas services and public sewers.
- 5.4.4 A review was undertaken to determine whether a gravity connection to the River Medlock could be installed to discharge directly to the watercourse. However, pipework would need to cross existing infrastructure. Based on what is known about the existing services, routing to the watercourse would be complex and require significant service diversions outside of the redline boundary, or a pumped system to be installed on-site.
- 5.4.5 There are combined public sewers within Plot 10. An S185 package is due to be undertaken to divert the public sewer to allow for the application proposals. It is proposed that surface water from Plot 10a will be discharged into this diverted combined public sewer, pending agreement with United Utilities
- 5.4.6 Although not greenfield, discharge close greenfield rates is preferred in line with the LLFA policies and guidance. This rate was calculated to be 5.0 l/s. To meet this discharge restriction surface water discharge attenuation will be incorporated within the design of the proposed development application site.
- 5.4.7 Under the drainage strategy prepared by Ramboll, it is proposed to install surface water attenuation within a blue roof, small areas of permeable surfacing with collection pipework for drainage that will not infiltrate, SuDS enabled tree pit systems to capture low rainfall events and underground geocellular storage tanks. Based on site area and the proposed discharge rate, a total on-site storage volume between 165m³ to 238m³ will be required.

6. CONCLUSIONS

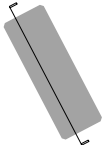
- 6.0.1 Based on the findings of this Flood Risk Assessment and in consideration of the recommendations made, it is concluded that any flood risk is appropriately managed by the development proposals over the lifetime of the development, taking climate change into account and fittingly for the vulnerability of proposed users.
- 6.0.2 No further flood risk assessment is deemed necessary.

APPENDIX 1 DEVELOPMENT PLANS





Notes:



Project Name: Plot 10a First Street		Title: Proposed Section (A)		Scale: 1:200 @ A1 1:400 @ A3	
Drawn: IB	Checked: JC	Status: Information	Project: 105	Drawing No: B1_05_2200	Rev: E
Details: 13.01.23 Issued for Planning					

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APPENDIX 2

TOPOGRAPHIC SURVEY

