BUROHAPPOLD ENGINEERING

Mayfield

Site wide and Phase 1 Flood Risk Assessment

0042912

13 September 2019

Revision 00

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Revision	Description	Issued by	Date	Checked
00	Issue for planning	RG	13/09/19	NV

This report has been prepared for the sole benefit, use and information of Mayfield Partnership LP for the purposes set out in the report or instructions commissioning it. The liability of Buro Happold Limited in respect of the information contained in the report will not extend to any third party.

author	**Rodoula Gregoriou**
date	**13th September 2019**
approved	**Nilani Venn**
signature	
date	**13th September 2019**

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Contents

Executive Summary **11**

1 Introduction **12**

1.1 Purpose of the report 12

1.2 Existing site 12

1.3 Site visits and observations 13

1.4 Proposed development 15

1.4.1 The Mayfield Strategic Regeneration Framework (2018) 15

1.4.2 Site-wide development proposals 17

1.4.3 Phase 1 planning application (Autumn 2019) 19

2 Planning Context **21**

2.1 Overview 21

2.2 National Planning Policy Framework 21

2.2.1 Flood zones 21

2.2.2 Flood risk vulnerability 22

2.2.3 Flood zone compatibility 22

2.2.4 Climate Change 22

2.3 Strategic Flood Risk Assessment 23

2.4 Consultations 24

2.4.1 Consultations with the Environment Agency 24

2.4.2 Consultations with the LLFA 26

3 Appraisal of flood risk **27**

3.1 Flood risk from River Medlock 27

3.1.1 Baseline flood risk 27

3.1.2 Proposed flood risk 29

3.2 Groundwater flood risk 31

3.3 Surface water flood risk 32

3.3.1 Baseline flood risk 32

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

3.3.2 Proposed flood risk 33
3.4 Artificial sources 34
3.4.1 Reservoir flooding 34
3.4.2 Flooding from canals, ponds and small reservoirs 35
3.5 Hydraulic interaction (Fluvial and canals) 36
4 Managing and reducing flood risk 37
4.1 Proposed development levels 37
4.2 Residual risk – Phase 1 38
4.3 Resilience 39
4.4 Emergency planning 39
4.4.1 Flood hazard 39
4.4.2 Safe access and egress 40
4.5 Riparian ownership and riverside access 40
4.6 Surface water drainage 41
5 Conclusions 43
Appendix A Topographic surveys
Appendix B Development proposals
Appendix C Correspondence with stakeholders
Appendix D Hydraulic Modelling Report, BuroHappold 2019
Appendix E Surface water drainage strategy

Table of Tables

Table 1-1 - Site visit images 14
Table 2-1 - Flood Zone definition 21
Table 2-2 - Flood risk vulnerability and flood zone 'compatibility' 22
Table 2-3 - Peak river flow allowance for North West River Basin, for a development of more than 60 year design life 23
Table 2-4 - Peak river flow allowance for the proposed uses at Mayfield site 23
Table 2-5 - Consultations with the EA 25
Table 2-6 - Consultations with the Lead Local Flood Authority 26

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Table 3-1 - Flood levels within the site from the BHE Baseline 2019 model 28

Table 3-2 – Flood levels due to proposals for a range of flood events, Mayfield site 31

Table 4-1 – Recommended finished floor levels for the Mayfield development plots 38

Table of Figures

Figure 1-1 - Mayfield site - existing assets. Open watercourse shown in blue. 12

Figure 1-2 - Mayfield proposals and flood risk management principles 17

Figure 1-3 - Mayfield sitewide proposals (SEW Draft issue, March 2019) 17

Figure 1-4 - Cross sections through Mayfield site (SEW Draft issue, March 2019) 18

Figure 1-5 - Elevation of Northern footbridge (BuroHappold Engineering Draft issue, September 2019) 19

Figure 1-6 - Elevation of Southern footbridge (BuroHappold Engineering Draft issue, September 2019) 19

Figure 1-7 - Phase 1 Mayfield masterplan – September 2019 20

Figure 2-1 - Level 2 Hybrid SFRA: Significant sites (Mayfield site is under the M0001 Strategic Employment Site) 24

Figure 3-1- Environment Agency Flood Zone map at the site location, accessed 02/09/2019 27

Figure 3-2- BHE Baseline 2019 flood maps 28

Figure 3-3 - Flood extents due to the Mayfield proposals, Flood Zones 2 and 3 and DFE 30

Figure 3-4 - Environment Agency Surface water flood map at the site location, received 11/11/16. (Contains Environment Agency information ©Environment Agency and database right, 2016) 33

Figure 3-5 - Environment Agency Flood Risk from Reservoir at the site location and surroundings (Contains Environment Agency information ©Environment Agency and database right, 2019) 34

Figure 3-6 –Flood Risk from Canals, Ponds and Reservoirs at the site location and surroundings (Manchester City Council LFRMS, 2014) 35

Figure 4-1 – Expected flood levels within the Mayfield site 37

Figure 4-2 - Flood hazard map for the 1 in 100 year event+ 35%CC 39

Figure 4-3 - Access routes for emergency vehicles during a flood event (background: flood hazard map for the DFE) 40

Figure 4-4 - Access to river for maintenance 41

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Glossary

Term	Definition
Annual Exceedance Probability (AEP)	The Probability that a storm event will be exceeded in any given year
Attenuation	A method to reduce a flood peak to prevent flooding, often utilising temporary storage, but increasing the duration of the flow
Design Flood Event	A historic or notional flood event of a given annual flood probability, against which the suitability of a proposed development is assessed and mitigation measures, if any, are designed. This is typically the 1% AEP (1 in 100) flood level with appropriate allowance for climate change.
Design Flood Level	The maximum estimate water level during the design flood event
Discharge	The rate of flow of water measured in terms of volume per unit time
Flood Defence	A natural or man-made infrastructure used to prevent certain areas from inundation from flooding, and / or the provision of flood warning systems
Floodplain	Area of land adjacent to a water course which water flows or is stored during a flood event, or would otherwise be flooded in the absence of flood defences
Flood Resilience	Improving flood resistance, e.g. reducing the risk of properties against flooding events
Flood Risk	The level of risk to personal safety and damage to property resulting from flooding due to the frequency or likelihood of flood events
Flood Risk Assessment (FRA)	An assessment of the flood risks to the proposed development over its expected lifetime and the possible flood risks to the surrounding areas, assessing flood flows, flood storage capacity and runoff
Flood Warning Systems (FWS)	A system by which to warm the public of the potential of imminent flooding. This is typically linked to a flood forecasting system
Fluvial Flooding	Related or connected to a watercourse (river or stream)
Freeboard	Allowance made between the finished flood levels of a building or top of flood defence and the Design Flood Level, to accommodate modelling or other uncertainties
Groundwater Flooding	Water occurring below ground in natural formations (typically rocks, gravels and sands)
Impermeable Surface	A surface that does not permit the infiltration of water and, therefore, generates surface water runoff during periods of rainfall
Inundation	Flooding of land with water
Mitigation	Actions taken to reduce either the probability of flooding or the consequences of flooding or a combination of the two
Red line boundary	Boundary drawn to indicate the site area on which the planning application is based
Residual Risk	The risk that remains after risk management and mitigation measures have been implemented
Return Period	The average frequency of a specified condition. An 'n' year event is one that occurs on average over the long term, once every 'n' years
Risk	Risk is the probability that an event will occur and the impact (or consequences) associated with that event
Runoff	Water flow over surfaces to the drainage system. Runoff occurs if the ground is impermeable or if permeable ground is saturated.
Strategic Flood Risk Assessment (SFRA)	An SFRA is the assessment and 'categorisation' of flood risk on an area-wide basis in accordance with PPS25
Surface Water Flooding	Surface water flooding occurs when the volume of water is unable to filtrate through the ground to enter drainage systems, and therefore runs quickly off land and results in localised flooding. This type of flooding is usually associated with intense rainfall.
Sustainable Drainage Systems (SuDS)	SuDS are used as a strategy to manage surface water in a sustainable manner or least damaging solution through management practices and physical structures.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Abbreviations

Term	Definition
bgl	Below ground level
BGS	British Geological Survey
CC	Climate change
DFE / DFL	Design Flood Event / Level
EA	Environment Agency
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
MCC	Manchester City Council
nr	Number
m AOD	Metres above Ordnance Datum
NPPF	National Planning Policy Framework
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage System

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Executive Summary

This Flood Risk Assessment (FRA) has been prepared by BuroHappold Engineering for the proposed mixed-use development comprising office, Multi-Storey Car Park and amenity open space uses at Mayfield site, Manchester, approximate National Grid coordinates SJ851976.

The purpose of this FRA is to identify and assess the risk from all forms of flooding to and from the development site and to demonstrate how flood risk will be managed throughout the lifetime of the proposed development, taking the effects of climate change into account. The assessment has followed the current National Planning Policy Framework (NPPF) and the associated Planning Practice Guidance.

The key findings of this FRA are summarised in the table below.

Subject	Element	Findings
Site Flood Risk	Fluvial	The site is in Flood Zone 1, 2 and 3. Flood Zone 3 covers the centre of the site. Small parts of the site are within Flood Zone 2 and the majority of the site is in Flood Zone 1.
	Ground Water	Low risk.
	Surface Water	Very low to low risk of surface water flooding across the majority of the site. Local depressions at medium and high risk.
	Artificial sources	Low risk.
Mitigation measures	Floodplain compensation	Floodplain compensation has been provided as part of the development (Mayfield Park). Hydraulic modelling has been used to demonstrate that the development does not increase flood risk elsewhere based on the 1 in 100 year flood event + 35% climate change allowance.
	Finished Floor Levels	Residential and office development set at least 600mm above the 1 in 100 year flood event + 35% climate change allowance. Other uses set above the 1 in 1000 year flood event. The building development is located outside Flood Zones 2 and 3.
	Design Flood Event	1 in 100 year event with a 35% allowance for climate change.
	Residual risk	Additional freeboard above flood levels has been allowed to provide resilience against extreme flood events or a combined canal breach and fluvial flood event.
	Emergency planning	Emergency and Maintenance plans for the Mayfield Park should be put in place to ensure the public is at a low risk to any danger due to flooding. Safe access and egress are provided in flood risk areas for pedestrian and vehicular access in the event of flood.
	Riparian access	Easements of at least 5 metres are allowed for maintenance access and repair works.
	Permits	Environmental Permits will be required for works within 8 metres from the river banks.
	Surface water drainage strategy	No flooding for the 1 in 100 year with allowance for climate change. Hierarchy of drainage solutions to be followed, SuDS techniques to be implemented.

The development incorporates the Mayfield Park, a 6 acre green space that can be utilised for flood compensation during an extreme fluvial flood event. Flood risk modelling and general principles of mitigation have been undertaken for the wider SRF site, in line with consultations and recommendations from the EA.

This FRA demonstrates that through the careful design of the proposed development and the incorporation of the above mitigation measures, there is no significant change to the risk of flooding both on-site and off-site. The development is considered safe from flooding for its designed lifetime.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

1 Introduction

1.1 Purpose of the report

BuroHappold Engineering has been commissioned by Mayfield Partnership LP to prepare a site specific Flood Risk Assessment (FRA) for a mixed-use development comprising residential, commercial, park and public realm works at the Mayfield site, adjacent to and south of Manchester Piccadilly railway station. The FRA will be submitted to support a full planning application for the Mayfield Phase 1 development, including two commercial office blocks, a multi-storey car park and creation of a city centre park, in September and October 2019 and will become a reference document for other development within the Mayfield SRF 2018 area.

The purpose of the assessment is to identify current and potential future risks of flooding to the existing site, as well as outline the flood mitigation measures proposed to ensure the development is safe from flooding in line with national legislation. This report is in accordance with the National Planning Policy Framework (NPPF).

Hydraulic flood modelling has been undertaken to support this FRA; a summary and the outcomes of the modelling exercise are discussed herein. The full modelling report is included in Appendix D.

1.2 Existing site

The Site is located south of Piccadilly Station in Manchester. It is bounded by the Mayfield depot on the north, Mancunian Way on the south, Hoyle Street on the east and Baring Street on the west. The approximate National Grid Reference at the centre of the development is SJ851976.



Figure 1-1 - Mayfield site - existing assets. Open watercourse shown in blue.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

The site is predominantly impervious, currently occupied by low rise warehouses and industrial units, interspersed by open land and surface car park. Small areas of the site are vegetated, the majority of which lie adjacent to the River Medlock. The river flows from east to west through the centre of the site. It is generally contained within a rectangular brick walled channel. Parts of the river have been culverted to allow industrial development. Parts of the site are within Flood Zone 3 in accordance with the Environment Agency (EA) flood maps and EA consultations.

A topographic survey for the entire site, excluding the river channel, has been completed by Malcom Hughes in July 2017. From inspection of the topographic data, the levels onsite vary from approximately 34.4m AOD under Units 3+4 rising up to an average level of 37m AOD at the south and 39m AOD at the north. The full topographic survey of the site can be found in Appendix A.

A topographic survey of the in-channel structures was completed in 2008 by Atkins for the purposes of the River Medlock SFRM 1D-2D EA model.

More recently, the industrial units 3, 4, 7, 8 and 9 have been demolished.

1.3 Site visits and observations

Site visits were undertaken (24th November 2016, 28th June 2017 and 4th October 2017) to assess the nature and general condition of the river passing through the site as well as understand the site constraints and flood mechanism through the site. Most parts of River Medlock were inspected within the site, as well as accessible riverside areas upstream and downstream.

The condition of the river varies. At the site location, River Medlock is constrained within brick retaining walls, some of which are in a derelict state. Parts of these have collapsed into the river. In many locations, siltation has built up on one or both sides of the river bank. The silt deposits have enabled the dense growth of vegetation along almost the entire corridor. Japanese Knotweed is present along the riparian corridor within the site, as well as within the upstream section of the river.

In some sections of the channel the retaining walls also provide support to the external walls of buildings built up to the river's edge. Where this occurs, the river retaining walls are generally in a good condition (e.g. Photos D and I below). The river flows through a box culvert within the central part of the site (see Figure 1-1). This was viewed from upstream and downstream, but not accessed (Photos C and D).

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Table 1-1 - Site visit images

	
A. Dense vegetation has caused damage to the river walls (Photograph taken from Baring street bridge facing East, November 2016)	B. Significant vegetation growth within channel over summer months (Photograph taken from top of culvert facing West, June 2017)
	
C. View of culvert outlet (Photograph taken facing north-east, June 2017)	D. View of culvert inlet. Channel formed by external walls of buildings (Photograph taken facing west, October 2017)
	
E. Steel beam footbridge over River Medlock (Photograph taken facing South, October 2017)	F. Access footbridge over River Medlock (Photograph taken facing East, November 2016)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.



G. View of scrap yard (Photograph taken facing East, October 2017)



H. Siltation and dense vegetation present at upstream end (view from Fairfield street, November 2016)



I. Clear channel section downstream of the site, parallel to Baring street (Photograph taken facing East, November 2016)



J. Environment Agency river gauging station and downstream weir (view from London Road, November 2016)

At the downstream end of the river, there is a very clear river channel section, well maintained with no siltation building up or presence of vegetation. An Environment Agency (EA) river gauging station (London Road - Medlock) is located here that has been operating since 1969, recording river level and flow measurements.

1.4 Proposed development

1.4.1 The Mayfield Strategic Regeneration Framework (2018)

The proposals for Mayfield were set out in the Strategic Regeneration Framework (SRF) document issued in February 2018 and adopted by Manchester City Council later that year. The vision for Mayfield is to deliver a world class, transformational, distinctive and imaginative commercially-led neighbourhood, anchored by Mayfield Park. The Mayfield Partnership proposes to capitalise on the site's existing assets: the Mayfield Depot; the River Medlock; and its gateway location at the heart of an extensive transport network, to become a destination for work, play and living for all.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

The expansive Mayfield Park is proposed at the centre of the development with the building development located around it. The open space extends the full length of the Mayfield area, from Baring Street in the west to Hoyle Street in the east. The River Medlock that meanders through the centre of the site is proposed to be widened and returned to its natural form, providing opportunities for enhanced biodiversity. In addition to the Mayfield Park, smaller scale pocket parks and open spaces for residents are provided throughout the Masterplan, providing an important local amenity.

The EA has been consulted early on to provide advice on the Mayfield project. The EA has been very supportive of the proposals to naturalise the river Medlock and have set their aims for the project, as listed below (for more details refer to Section 2.4):

- Removal of culvert and daylighting of river to enhance biodiversity;
- Safe development around the site, with development levels raised above the Design Flood Event;
- Provision of flood compensation storage to manage impact of flood risk within and outside the site; and
- Provision of safe access and egress during extreme flood events.

A key consideration in the place making strategy has been to holistically consider the approach to flood management, within the site, but also other planned improvement works that are being progressing further upstream in the wider Medlock catchment.

By removing the old culvert and high-sided river walls and opening up the river, particularly on the north bank, natural river edges with a range of habitats can be created. Integrated flood storage will be provided in the park by allowing some parts of the park to flood during higher order flood events.

The river corridor and floodplain have been carefully re-profiled using the results of the hydraulic modelling work to ensure the proposed development does not increase flood risk elsewhere. The design ensures that there is no increase in flood risk upstream or downstream the site, with finished floor levels for development set at an appropriate margin above design flood levels with an allowance for uncertainty, as recommended by the EA. This will ensure the development is safe, with appropriate pedestrian and vehicular access during extreme flood events and adequate access to the river for maintenance or improvements works.

Safe public pedestrian access will be possible to the river directly from the park by providing features such as riverside walks and boardwalks. The river edges will be softened in places to allow marginal wetland areas to be created not only giving space for water, but space for recreation and wildlife as well. It will be a multi-use space offering significant social and environmental benefits, including increased biodiversity and flood resilience.

New pedestrian bridged links will be created to increase connectivity and accessibility across the park. Opening up the river will allow the floodplain to be clearly defined so that a safe environment for floodwater can be created at times when high river flows are expected.

Maintenance access will also be improved that will allow the river corridor to be managed effectively where necessary, and give access to the riparian owner and the EA for management of the Main River corridor. This access for inspection and maintenance would integrate with a landscape management plan setting out the requirements for maintaining the park and the riverside areas.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

1.4.2 Site-wide development proposals

The principles described above have been followed to deliver the Mayfield site wide proposals illustrated in the figures below.



Figure 1-2 - Mayfield proposals and flood risk management principles

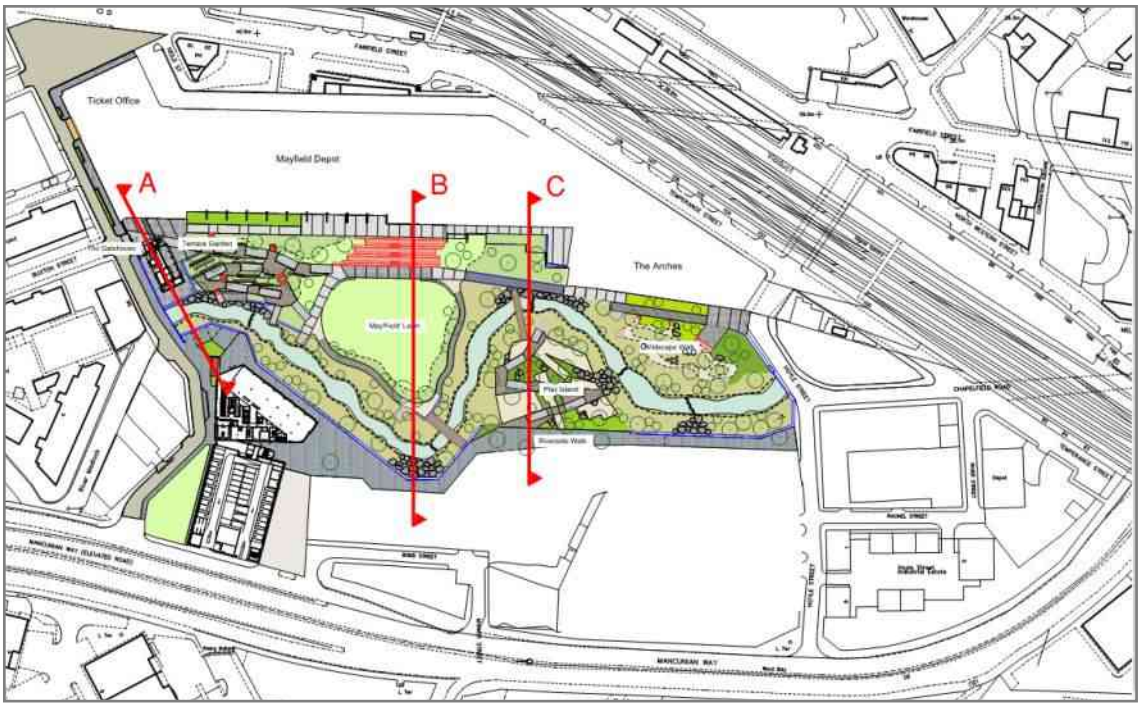
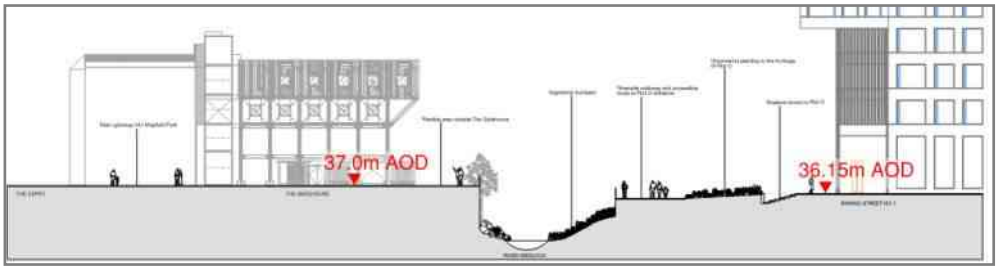


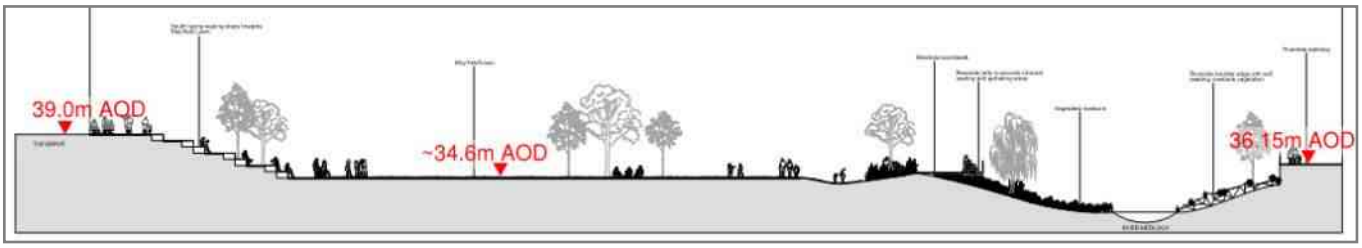
Figure 1-3 - Mayfield sitewide proposals (SEW Draft issue, March 2019)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Cross section A



Cross section B



Cross section C

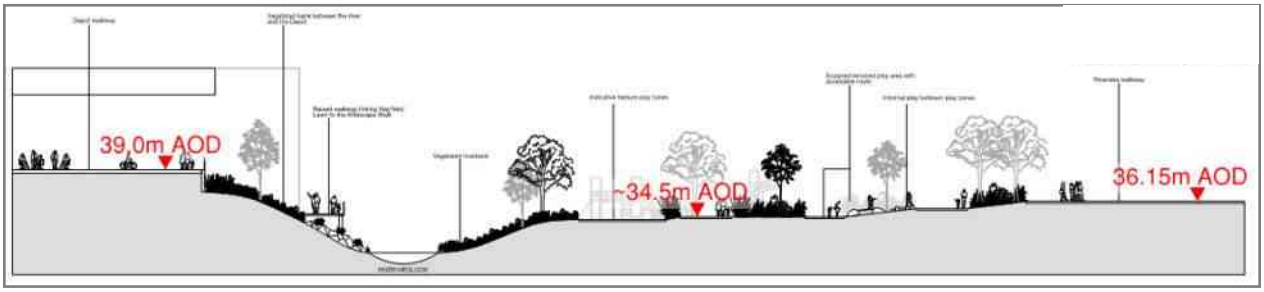


Figure 1-4 - Cross sections through Mayfield site (SEW Draft issue, March 2019)

Two new footbridges are proposed across river Medlock to replace the existing derelict footbridges and improve connectivity around the Mayfield site. A 600mm freeboard is normally recommended between the soffit level of a bridge and the design flood levels (DFL). However, in order for the two footbridges to tie in with the adjacent ground level and enable ramped access, the deck levels have been set below the expected DFLs at the locations (DFL: 35.39m AOD).

During consultations with the EA, the inundation of the footbridges by floodwater was discussed. The EA accepted the bridge design concept in principle. It was requested that hydraulic modelling was required to test the impact of the bridges in terms of flood risk. The bridges will be fixed to prevent them from floating off their bearings during a flood.

The impact of both bridges has been assessed through hydraulic modelling. Results are discussed in Section 3.1.2.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

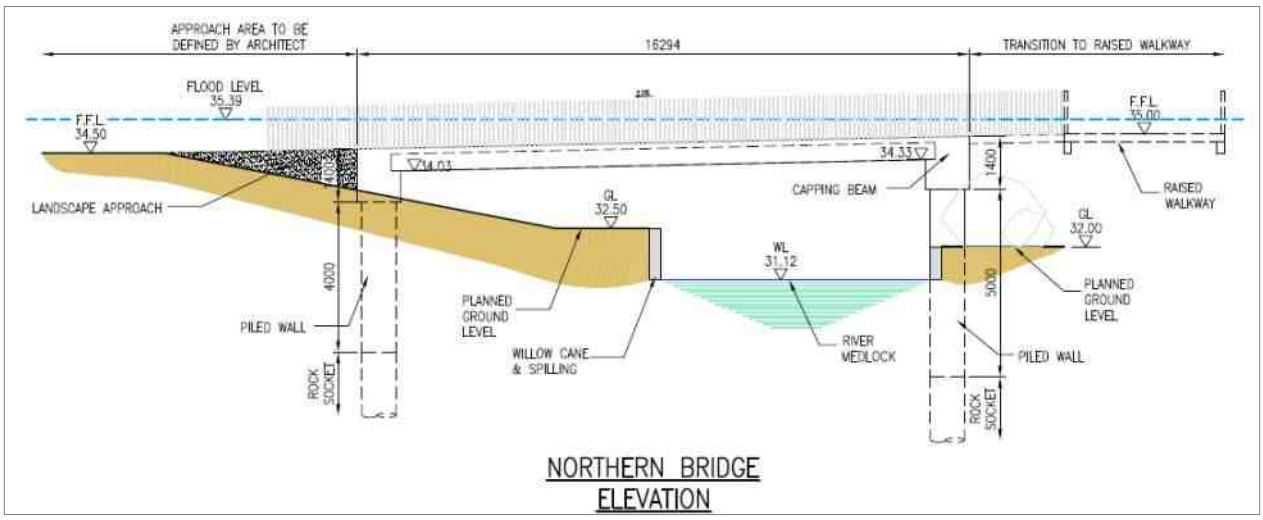


Figure 1-5 - Elevation of Northern footbridge (BuroHappold Engineering Draft issue, September 2019)

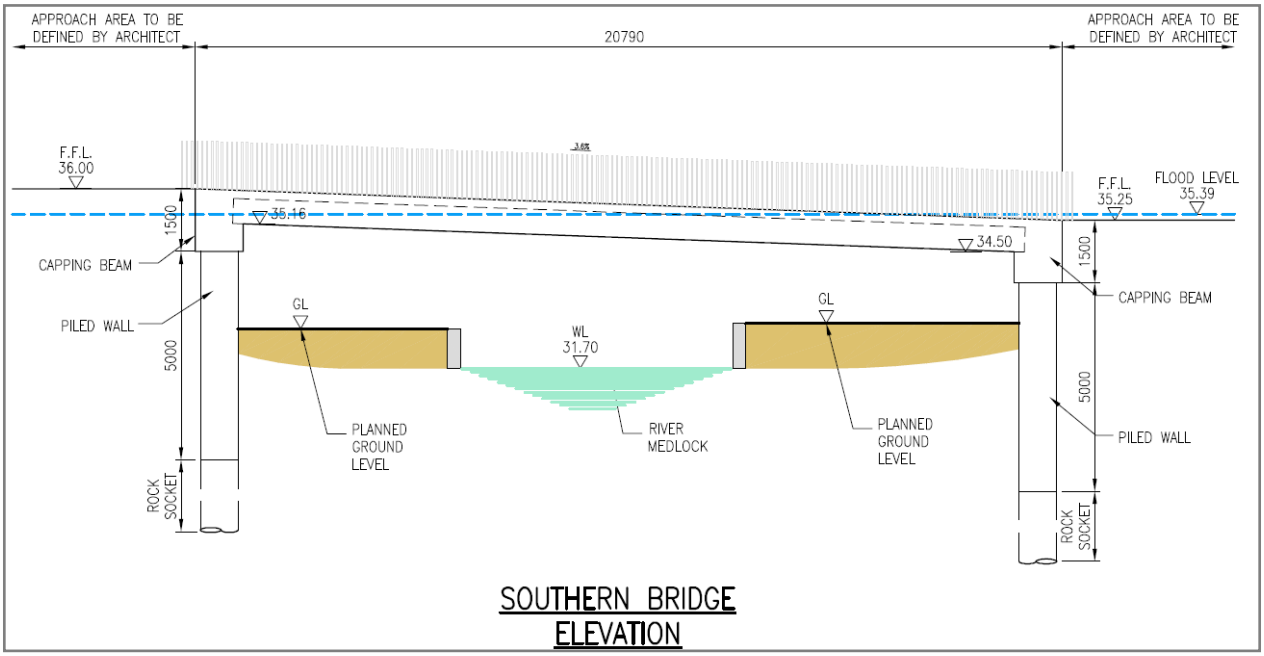


Figure 1-6 - Elevation of Southern footbridge (BuroHappold Engineering Draft issue, September 2019)

1.4.3 Phase 1 planning application (Autumn 2019)

The Phase 1 site is located entirely within the Mayfield SRF area as shown in Figure 1-7 below. Two planning applications will be submitted, including the proposals described below. The proposals are in line with the adopted Mayfield SRF 2018.

Application 1 (September 2019):

- Phased demolition and site clearance, earthworks including re-profiling and construction of retaining walls for the land bounded by the Mancunian Way to the south, Mayfield Depot to the north, Baring Street to the west and Hoyle Street to the east

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

- Mayfield Park: provision of circa 6 acres (2.4 ha) of public park, including hard and soft landscaping to be delivered in phases with new bridges across the River Medlock;
- Baring Street Office 1 – Plot O: 8 storey office development including ground, mezzanine and plant level comprising 9,987 sq. m. (GEA) including active ground floor uses (A1, A3, A4 or B1), public realm and riverside walkway;
- Baring Street Multi-Storey Car Park (MSCP) – Plot N: Ground plus 10 storey MSCP for circa 545 car parking spaces; and associated
- Highways and Infrastructure Works: creation of new junction from London Road with required access to the multi-storey car park and works to Baring Street, which will be delivered prior to the MSCP becoming operational.

Application 2 (October 2019):

- Baring Street Office 2 – Plot M: 13 storey office development including ground and mezzanine floors comprising circa 29,046 sq. m. (GIA) with active ground floor uses, highways and associated access and public realm.

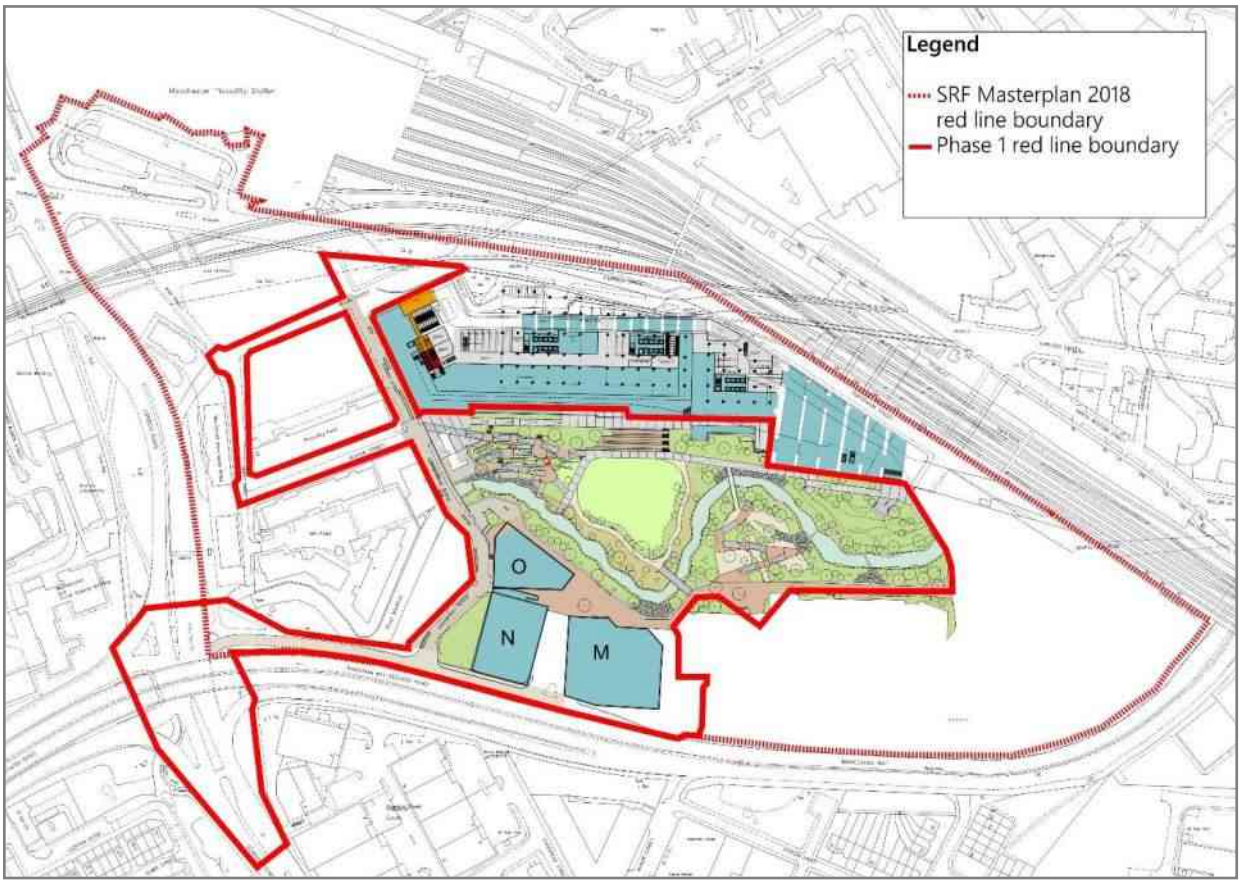


Figure 1-7 - Phase 1 Mayfield masterplan – September 2019

A list of drawings (plans and elevations) that should be reviewed with this FRA can be found in Appendix B.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

2 Planning Context

2.1 Overview

This site-specific FRA has been prepared in accordance with the policies and guidance applicable to the Proposed Development outlined within the following publications:

- National Planning Policy Framework (MHCLG, 2019);
- Planning Practice Guidance; Flood Risk and Coastal Change (2014);
- Flood Risk Assessments: Climate Change Allowances (Environment Agency 2016, updated 2017);
- Manchester City, Salford City and Trafford Councils Level 1 SFRA (2010)
- Manchester City, Salford City and Trafford Councils Level 2 SFRA (2011)

2.2 National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which people and councils can develop local plans and neighbourhood plans, which contribute to the achievement of sustainable development. It defines flood risk and aims to avoid development in areas most vulnerable to flooding. This is attained through the implementation of a Sequential Test, which directs development towards areas with lowest flood risk. Where this is not possible, the NPPF requires that all new developments in flood risk areas are appropriately flood resilient and resistant, include safe access and egress routes where required and that residual risks of flooding are adequately managed.

The Planning Practice Guidance provides a number of tables aiding the identification of the degree of risk of flooding to a development. This includes:

- Table 1: Flood Zones definition for probability of river and sea flooding;
- Table 2: Flood risk vulnerability classification for specific land uses and development types; and
- Table 3: Flood risk vulnerability and flood zone compatibility (signifies when the exception test is required).

2.2.1 Flood zones

The Flood Zones refer to the probability of river and sea flooding without the inclusion of flood defences, as shown in Table 2-1.

Table 2-1 - Flood Zone definition

Flood Zone	Probability	Definition
1	Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding
2	Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding
3a	High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or land having a 1 in 200 or greater annual probability of sea flooding
3b	The Functional Floodplain	This zone comprises of land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency

The Mayfield SRF 2018 and Mayfield Phase 1 developments lie in Flood Zones 1, 2 and 3 (refer to Section 3).

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

2.2.2 Flood risk vulnerability

The proposed land uses of the Mayfield Phase 1 development are offices (Baring Street Office 1 and Office 2), Baring Street Multi-storey Car Park (MSCP), amenity open space (Mayfield Park hard and soft landscaping) and highways and infrastructure access works. According to the NPPF Technical Guidance, buildings used for financial, professional and other services are classified as 'Less vulnerable' and amenity open space and recreation as 'Water-compatible' development.

Car parks are not specifically defined within the NPPF vulnerability classification. The flood risk vulnerability of the MSCP is considered low ('Less vulnerable') due to the non-residential nature of the development.

Other uses under the Mayfield SRF 2018 scheme include buildings with residential units. Residential development is considered 'More vulnerable' to the effects of flooding. Any future proposals set out in the Mayfield SRF will be subject to detailed design, testing and separate planning application, taking account the development proposed and any further flood mitigation that has taken place prior to those development proposals coming forward.

2.2.3 Flood zone compatibility

For each Flood Zone and flood risk vulnerability classification, NPPF categorises where development is appropriate and whether the Exception Test is required. The Exception Test is a method used to demonstrate how flood risk to people and property will be manages satisfactorily, while allowing necessary development to proceed when suitable sites with lower risk of flooding are not available. It is required for the proposed development to show that wider sustainability benefits, which outweigh the flood risk, will be provided to the community. It must also be shown that the development will be safe for its lifetime without increasing flood risk elsewhere and, where possible, reduce flood risk overall.

Table 2-2 - Flood risk vulnerability and flood zone 'compatibility'

Flood Zone classification		**More vulnerable - Residential**	**Less vulnerable – Offices and MSCP**	**Water-compatible – Park areas**
Flood Zones	FZ1	Compatible	Compatible	Compatible
	FZ2	Compatible	Compatible	Compatible
	FZ3a	Exception test required	Compatible	Compatible
	FZ3b	Not compatible	Not compatible	Compatible*

*Water compatible uses are permitted within the functional floodplain. They should however be designed to remain operational and safe for users in times of flood, result in no net loss of floodplain storage, not impede water flows and not increase flood risk elsewhere.

Based on the compatibility criteria and the appropriate siting of the proposed uses, the exception test is not required for this planning application.

2.2.4 Climate Change

National Planning Policy requires an allowance is made for the potential impact of climate change to help minimise vulnerability and provide resilience to flooding in the future. This is a critical part of any assessment of flood risk and assessment of design and mitigation measures.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

In February 2016 the Environment Agency published new climate change advice which sets out a range of allowances for peak river flow by river basin district and peak rainfall intensities for the design of surface water drainage. This allowance is a percentage that can be applied to the river flows to predict as accurately possible the increase in flows and levels due to climate change. The EA provides range of allowances; higher climate change allowance provides higher confidence that the real climate change increase will be within the allowance.

Table 2-3 - Peak river flow allowance for North West River Basin, for a development of more than 60 year design life

Confidence	Climate change allowance
Upper end – 90th percentile	70%
Higher Central – 70th percentile	35%
Central – 50th percentile	30%

Under the EA advice, designers should consider higher climate change allowances for sites within higher flood risk zones, and for developments of higher vulnerability. The EA is also advising to consider a range of allowances and understand the impact. For the proposed commercial (less vulnerable) and residential (more vulnerable) development the climate change allowances in Table 2-4 are advised for the developments design life (2070 – 2115).

Table 2-4 - Peak river flow allowance for the proposed uses at Mayfield site

	More vulnerable – Residential	Less vulnerable – Office and MSCP	Water-compatible – Park areas
Flood Zone 1	30%	30%	None
Flood Zone 2	30% - 35%	30%	None
Flood Zone 3a	35% - 70%	30% - 35%	30%

Site specific pre-application advice received by the EA recommends that the 35% and 70% climate change scenarios are taken into consideration for the type of development proposed.

For the design of the surface water drainage strategy, a 20-40% increase in rainfall intensity should be allowed.

2.3 Strategic Flood Risk Assessment

Manchester City Council (MCC) are the Lead Local Flood Authority (LLFA) for Manchester City. Under the Flood and Water Management Act 2010, the LLFA is responsible to lead in the management of flooding from surface water, groundwater and ordinary watercourses.

The Manchester City, Salford City and Trafford Councils commissioned JBA in March 2010 to produce a combined Level 2 Hybrid Strategic Flood Risk Assessments (SFRA) for the three councils. This includes both the Level 1 SFRA (2010) and Level 2 SFRA (2011).

These reports consider flooding from rivers, canals, reservoirs, surface water, groundwater and sewers for the Greater Manchester area; summarises existing and proposed flood risk management; looks at impacts of development on flood risk and can be used to inform a sequential approach to development allocation. The report provides more detailed information on strategic sites identified for development; the Mayfield site has been included in the study and is referred to as Manchester Strategic Employment site – Eastern Gateway (M0001) hatched in Figure 2-1. Findings from the SFRAs have been considered within this assessment.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

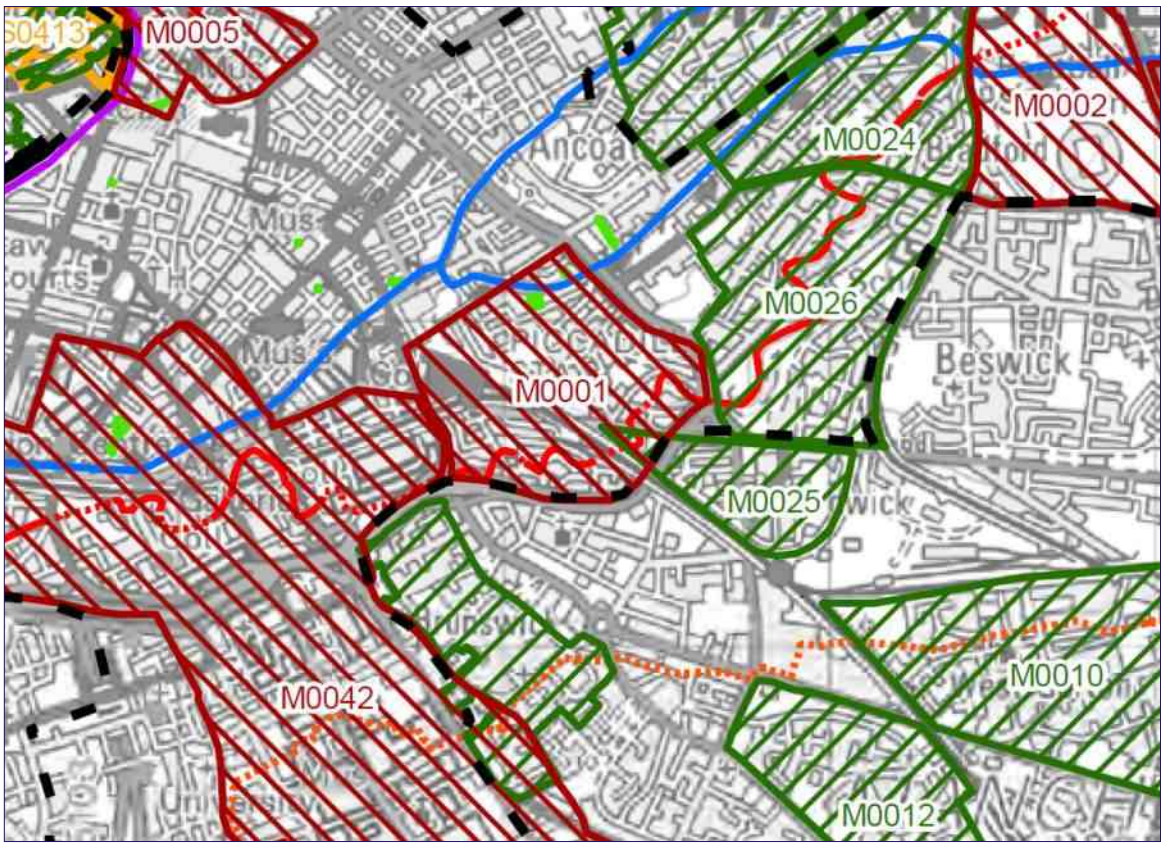


Figure 2-1 - Level 2 Hybrid SFRA: Significant sites (Mayfield site is under the M0001 Strategic Employment Site)

2.4 Consultations

Consultations have been undertaken with the statutory consultees to understand their requirements for the scheme and seek their in-principle agreement to the proposals. These include the EA and MCC as the LLFA.

2.4.1 Consultations with the Environment Agency

BuroHappold submitted a pre-application enquiry to the EA to request Product 4 information as well as preliminary advice on the proposed development in November 2016. Several meetings have been held since between the EA and the design team as part of a wider collaboration under a charged agreement. The EA has provide advice on flood modelling, river works, land contamination, surface water strategy and ecology for the masterplan. A summary of the outcomes relevant to flooding are summarised in Table 2-5.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Table 2-5 - Consultations with the EA

Subject	Item
Flood Zone	Part of the site lies in Flood Zones 2 & 3 and therefore the sequential test might need to be applied.
Finished Floor Levels – Residential development (SRF)	Climate change allowance should be made in accordance with the latest guidance (Feb 2016). Finished Floor Levels for residential development should be set at least 600mm above the 1 in 100 year flood event with 35% climate change (CC) allowance or at the 1 in 100 year flood event + 70% climate change allowance, whichever is highest. It should be demonstrated that the development is also safe under the 1 in 1000 year flood event. Flood resilient/resistant measures will need to be incorporated if the buildings are at risk.
Finished Floor Levels – Plot 0 levels	The Baring Street Office 1 building proposals are offices, and therefore considered less vulnerable to flooding. The ground floor use on the west side of the building is proposed to be only storage. The EA would not raise objection to floor levels used for cycle/bin storage that did not meet the 1 in 100 year flood event + 35% CC + 600mm requirement. However, it is recommended that the levels are raised as much as feasible and flood resilience measures are considered.
Electric substation	While the floor levels within a substation room can be set at the 1 in 100 year flood level +35% CC, the electric equipment sensitive to flooding should be raised on a plinth above the 1 in 1000 year flood event.
Safe access and egress	Safe access and egress should be provided for extreme flood events (1 in 1000 year flood event). Access routes should preferably be dry during the 1 in 1000 year flood event or if this is not possible be of a low hazard rating.
Compensatory storage	If the site levels are raised, compensatory storage is required. This can be done in the form of floodplain compensation works. The works should ensure risk is not increased elsewhere based on the 1 in 100 year flood event+ 35% CC (Design Flood Event – DFE)
EA hydraulic model	The model should be obtained by the EA. The model should be used to represent proposed levels along the river and re-run to ensure that flood levels are not increased upstream or downstream.
Riparian access	River Medlock is a Main River and EA has powers to curry out repair and maintenance of the bed, banks and any other structures. Access for repairs and maintenance should be considered throughout the masterplan development. Development under, over or within 8m of the top of the bank of the river may require a permit, under the Environmental Permitting Regulations 2010.
Masterplan development	The EA has inspected an early masterplan and provided the following general comments: • Removal of culverts and existing walls and creation of open areas is welcome; • The proposed buildings on the south bank are very close to the bank. Clear easements from both sides of the river for maintenance purposes would be preferred; and • A clear open space to one bank is still an improvement from the existing situation.
River restoration	Recommendations from river habitat, geomorphological and other ecological surveys should be integrated with the flood risk assessment recommendations to create a new improved riparian corridor and ecological network. Consideration should be given to the low flow conditions of the river and the aquatic habitat potential. Development to be set back from the river in both sides to allow pedestrian and maintenance access along the watercourse. Creation of high quality amenity and greenspace zones. River rehabilitation of the canalised River Medlock to enhance banksides through soft or bioengineering techniques.
Discharge to River Medlock	Discharge to river Medlock is acceptable.

Correspondence with the EA can be found in Appendix C.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

2.4.2 Consultations with the LLFA

Manchester City Council (MCC), as the Lead Local Flood Authority (LLFA) is the statutory consultee for surface water flood risk in relation to planning applications. They are the appropriate body to assess the proposed surface water drainage strategy for the development. The LLFA has been approached at an early stage for advice with regard to the site surface water drainage strategy and local flooding (groundwater and surface water).

MCC teams have provided the following information.

Table 2-6 - Consultations with the Lead Local Flood Authority

Subject	MCC response
Flood Risk	
Records of historic flooding on site	A number of historical flooding incidences of the Mancunian Way at entrance to the Railway bridge have affected Temperance Street due to a low spot under the bridge, drainage overwhelmed by rainfall intensity and overland flow routes towards Temperance Street.
Any groundwater issues within or at the vicinity of the site	No records of groundwater flooding or recorded groundwater levels on the site.
Critical drainage area	The site is within the Conurbation Core Critical Drainage Area. We are not aware of any existing drainage issues.
Drainage Strategy	
Discharge to River Medlock	The River Medlock is Main River and any new outfall locations will need to be agreed with the Environment Agency
Discharge rates	The area is situated within the Conurbation Core Critical Drainage Area and in accordance with the Manchester City Council SFRA at least a 50% reduction in surface water runoff should be provided through SUDS as part of any brownfield development with the aim of reducing to the Greenfield runoff rates. Proposed discharge rate is to be restricted to 50% of the existing brownfield runoff rate with 2l/s/ha to be subtracted from this peak 50% discharge rate.
Climate change allowance	Climate change allowance is to be 30%, however, attenuation volumes should also be checked against a 40% allowance.
Discharge volume	As the existing site is brownfield the 1 in 100 year, 6 hour rainfall runoff volume shall be constrained to a maximum of the existing brownfield runoff volume for the same event. Our aspiration is to better this where we can.
Overland flooding	No flooding of buildings occurs in 1 in 100 year rainfall event plus climate change allowance. Plot designers will need to accommodate all the necessary surface water attenuation within the plot demise. The attenuation will need to be designed to accommodate the 1 in 100 year storm events plus climate change allowance based on a 50% brownfield rate with a further reduction of 2l/s/ha for long-term storage. Surface flooding of open spaces is acceptable for short periods in events over 1 in 30 year return period rainfall events Overland flow routes for extreme events are diverted away from buildings.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

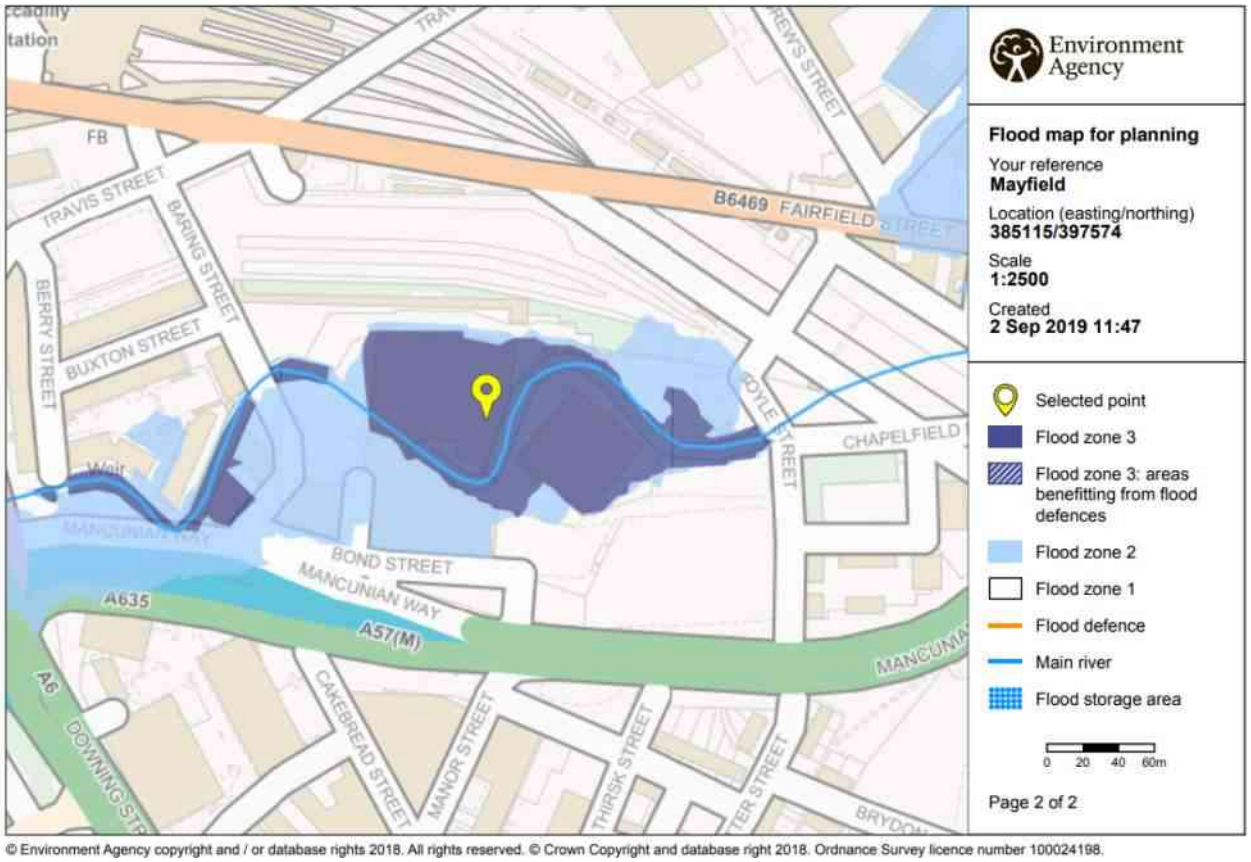
3 Appraisal of flood risk

3.1 Flood risk from River Medlock

3.1.1 Baseline flood risk

According to the historic flood maps shared by DEFRA under the Open Government Licence, there are no recorded historic flood extents around the site.

From inspection of the Environment Agency's online flood map for planning (Figure 3-1) the site lies partly within Flood Zones (FZ) 1, 2 and 3, which are defined as having a low, medium and high risk of flooding respectively.



© Environment Agency copyright and / or database rights 2018. All rights reserved. © Crown Copyright and database right 2018. Ordnance Survey licence number 100024198.

Figure 3-1- Environment Agency Flood Zone map at the site location, accessed 02/09/2019

The flood extents and levels for the River Medlock are based on the River Medlock SFRM 1D-2D (ISIS – TUFLOW) model developed by the EA in 2009 and updated in 2011. BuroHappold has attained the model from the EA, reviewed and updated the model with the current best practice methodologies and hydrology data as per 2019. Additional topographic information within the site boundary was added, as per the topographic survey completed by Malcom Hughes in July 2017. The updated flood model is referred to as the BHE Baseline 2019 model.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Changes undertaken to create the BHE Baseline 2019 model have been recorded in the Hydraulic Modelling report issued to the EA for review on 15th August 2019. The report demonstrates that the BHE Baseline 2019 model has been adequately updated for use as a flood risk assessment tool for the design of the Mayfield Park development. The Hydraulic Modelling report can be found in Appendix D. Following review of the Hydraulic Modelling report, the EA had minor comments and accepted in principle the negligible impact shown by the proposals compared to the baseline model. The EA response can be found in Appendix C.

The updated flood extents for Flood Zones 1, 2 and 3 can be seen in Figure 3-2.



Figure 3-2- BHE Baseline 2019 flood maps

The equivalent flood levels for different flood events during the baseline scenario (existing flood risk) can be seen in Table 3-1.

Table 3-1 - Flood levels within the site from the BHE Baseline 2019 model

Node	Description	1 in 100 year (m AOD)	1 in 1000 year (m AOD)	1 in 100 year +35%CC (m AOD)	1 in 100 year+70%CC (m AOD)
1	D/S Hoyle Street culvert	35.18	35.94	35.83	36.03
2a	U/S Hoyle Street Industrial estate access footbridge	34.64	36.00	35.84	36.12
2b	D/S Hoyle Street Industrial estate access footbridge	34.63	35.87	35.70	36.00
3	Steel beam footbridge (not represented in model)	34.57	35.79	35.61	35.92
4	D/S Baring street culvert	33.89	35.13	34.96	35.26

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

3.1.2 Proposed flood risk

As part of the development of the Mayfield design, the Mayfield proposals were represented in the updated hydraulic model to assess their impact to flood risk compared to the baseline scenario. The impact of the proposals and design of the development compensation areas was based on the Design Flood Event (DFE), the 1 in 100 year flood event with 35% climate change allowance. This is in line with guidance provided by the EA.

For the purposes of the Mayfield 2019 modelling assessment, the areas within the 1 in 100 +35% flood extents have been represented as accurately possible in terms of proposed levels, channel profile and roughness. The building development sites (outlined in orange) have been modelled as raised well above the DFE flood risk levels and above flood zone 2 levels (1 in 1000) to ensure no flood compensation is provided within these areas. The Mayfield 2019 flood extents and levels are presented in Figure 3-3 and Table 3-2.

They Hydraulic Modelling work undertaken demonstrates that the Mayfield development has negligible impact in terms of flood risk from the River Medlock to areas outside the site boundary and a positive impact in decreasing flood risk within the site. Please refer to Appendix D for further details.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

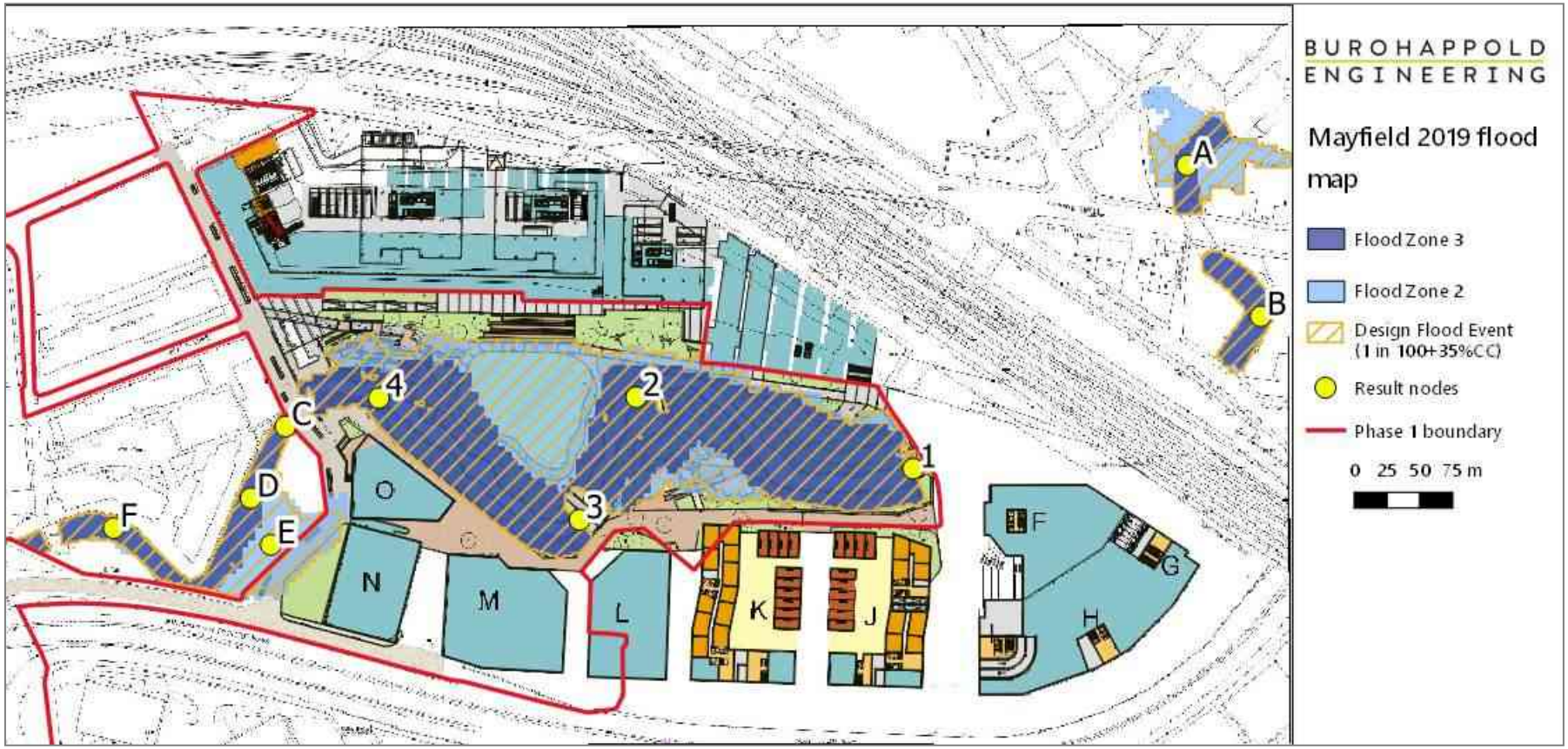


Figure 3-3 - Flood extents due to the Mayfield proposals, Flood Zones 2 and 3 and DFE

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Table 3-2 – Flood levels due to proposals for a range of flood events, Mayfield site

No.	Modelling Node	Description of node location (current assets)	1 in 100 year (m AOD)	1 in 1000 year (m AOD)	1 in 100 year +35%CC (m AOD)	1 in 100 year+70%CC (m AOD)
Upstream the site						
A	MEDL01_2934	U/S Fairfield Street bridge	36.58	37.58	37.38	37.81
B	MEDL01_2855B	D/S Fairfield Street bridge	36.34	37.21	37.02	37.40
On site						
1	MEDL01_2647	D/S Hoyle Street culvert	34.79	35.48	35.38	35.56
2	MEDL01_2492A (data for Mayfield 2019 taken from 2D)	U/S Hoyle Street Industrial estate access footbridge	34.52	35.53	35.40	35.64
3	MEDL01_2429	Steel beam bridge	34.27	35.45	35.26	35.58
4	MEDL01_2315	D/S Baring street culvert	34.04	35.33	35.15	35.46
Downstream the site						
C	MEDL01_2279E	D/S Baring street bridge	33.77	34.61	34.47	34.68
D	MEDL01_2227	Logic site (in channel)	33.56	34.47	34.32	34.56
E	n/a	Logic site (floodplain)	N/A	34.46	34.31	34.54
F	MEDL01_2131	U/S London Road EA station	33.24	34.28	34.13	34.36

It is considered that through the flood compensation works, removal of culvert and raising of plot levels above flood levels, the flood risk to the plots can be reduced to low.

The flood levels estimated by the Mayfield 2019 model are summarised in Table 3-2 are used to set the finished floor levels for the development plots. These are outlined in Section 4.1.

3.2 Groundwater flood risk

Groundwater flooding can occur where the water levels in rock and soil become high enough for the water to appear near to or above the ground surface. This may happen where there are underlying gravels, or porous or fractured rocks, sufficiently permeable to allow water to pass through. It also occurs more slowly than river flooding and tends to be more persistent, typically lasting for weeks or months rather than for hours or days. Groundwater flooding does not normally impose risk to life; however, it can still pose a risk to development and can cause a change in the structural properties of rocks and soils which may cause damage to foundations of structures.

According to the Greater Manchester sub-regional SFRA[1] there are no known reports of groundwater flooding within Manchester City Council area.

[1] Strategic Flood Risk Assessment for Greater Manchester Sub-regional assessment, Scott Wilson, June 2008

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

A groundwater flood risk assessment has been performed for Manchester, Trafford and Salford that investigated various mechanisms of groundwater flooding and assessed the likelihood of occurrence. A map has been developed and appended in the Level 2 SFRA. The site is not shown to be at risk of groundwater flooding, nor does it have shallow groundwater or be at risk of groundwater rebound due to decreased groundwater abstraction.

It is therefore considered that the site is at low risk of groundwater flooding.

3.3 Surface water flood risk

Surface water flooding occurs when intense, often short duration rainfall is unable to infiltrate into the ground or enter the stormwater drainage system. Increase in impermeable areas due to development and heavy urbanisation, as observed in Manchester city centre, can cause an increase in surface water runoff rates and volumes and consequently, increase in localised and downstream flood risk due to overloading of drainage infrastructure.

3.3.1 Baseline flood risk

According to the Manchester City Council SFRA, the site is situated with the Conurbation Core Critical Drainage Area. As such at least a 50% reduction in surface water runoff should be provided through SUDS as part of any brownfield development with the aim of reducing to the Greenfield runoff rates.

The MCC have records for a number of historical surface water flooding incidences. According to MCC, flooding of the Mancunian Way at entrance to the Railway bridge have affected Temperance Street due to a low spot under the bridge, drainage overwhelmed by rainfall intensity and overland flow routes towards Temperance Street.

The EA has provided surface water flood risk maps in response to the pre-application information request. The flood map shows that there are areas within the site at very low (less than 1 in 1000 annual probability), low (between 1 in 1000 and 1 in 100 annual probability), medium (between 1 in 100 and 1 in 30 annual probability) and high (more than 1 in 30 annual probability) risk of surface water flooding. The map is shown in Figure 3-4.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

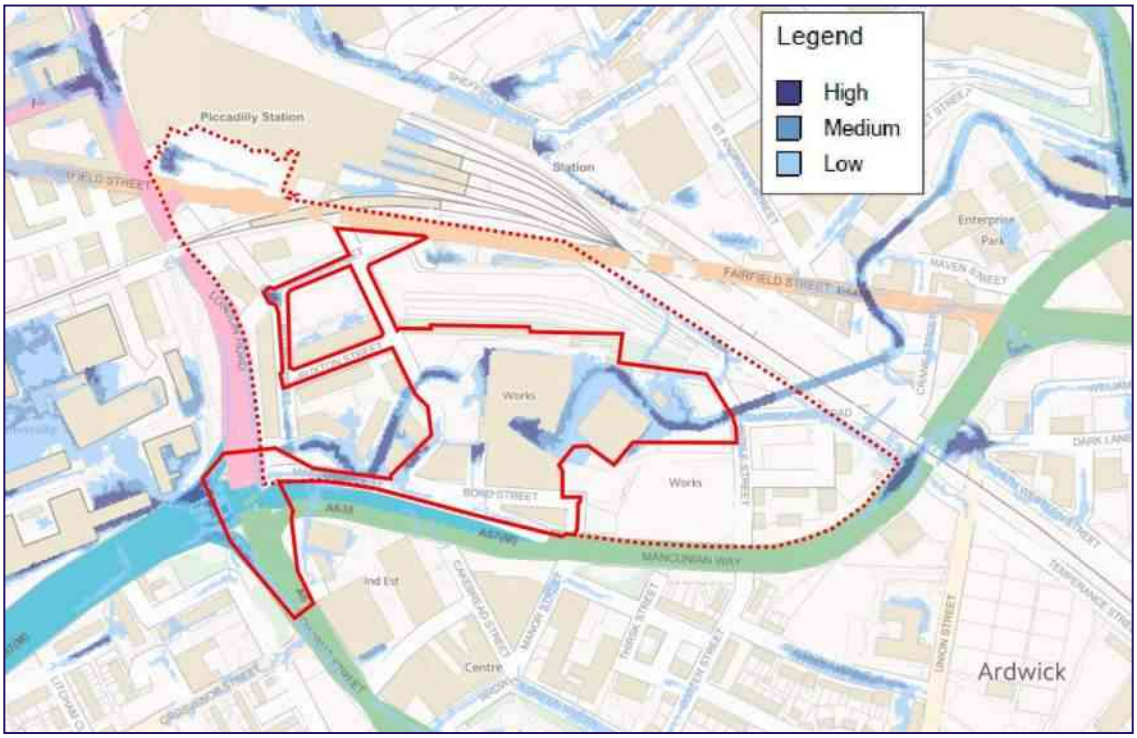


Figure 3-4 - Environment Agency Surface water flood map at the site location, received 11/11/16. (Contains Environment Agency information ©Environment Agency and database right, 2016)

The EA has used the 2-dimensional modelling software JFLOW to route rainfall over a surface elevation map that has been modified to include roads and buildings in order to help define potential flow paths. The three modelled flood scenarios are the 1 in 30 year flood event (high flood risk), 1 in 100 year (medium) and 1 in 1000 year (low).

As expected, the high risk areas are mostly within the River Medlock channel, which is the primary drainage path for the site. Other high risk areas are identified along the west edge of the main buildings at the centre of the site. Those points seem to be localised depressions that allow ponding of surface water behind major obstructions. Similarly, the medium risk zones are shown to be at locations where buildings are obstructing the flow.

From inspection of the site topographic information, the areas at low risk of flooding are lower lying areas around River Medlock, where surface water runoff from the north and south sides of the site could pond before entering the river. The ponding could also be exacerbated due to the presence of informal flood defences such as river walls that would not allow excess surface water into the river system.

A surface water runoff flow path seems to form at Temperance Street during the 1 in 1000 year event, and enter the site from the north (via an underpass and along Hoyle Street).

It is considered that the existing site is mainly at low to very low risk of surface water flooding, with localised areas at medium to high risk.

3.3.2 Proposed flood risk

The areas at surface water flood risk are mainly shown to be at the north of River Medlock or within the extents of the Mayfield Park. The proposals include demolition works and re-profiling the landscape to achieve the desirable compensation storage. As such, the park areas will be graded towards the River Medlock to allow quick drainage of the surface water runoff from the park.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

To the south of the river, the removal of the buildings and the new stormwater drainage system put in place will ensure no flooding of buildings during the 1 in 100 year rainfall event with climate change.

The above measures are anticipated to reduce risk from surface water flooding to low.

3.4 Artificial sources

3.4.1 Reservoir flooding

The EA is currently responsible for leading on flood risk management from reservoirs over 25,000 cubic metres in capacity. The reservoirs under the EA's responsibility will increase to include any reservoirs with capacity larger than 10,000 cubic metres once the Flood & Water Management Act 2010 is fully implemented.

The EA have recently published maps showing areas that could flood in the event of a reservoir failure. Their purpose is not to discourage development but to help authorities and emergency services plan for reservoir flooding. The map shown in Figure 3-5 was obtained from the EA website on long term flood risk (https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?map=Reservoirs). According to this map, only very small part of the site might be affected by a sudden reservoir failure. The reservoirs that could affect the site are: Gorton Lower, Gorton Upper and Audenshaw No. 1, 2 and 3. The owner of the reservoirs is United Utilities.

The risk of reservoir failure is extremely unlikely and the impact of such an event to the site is considered low.

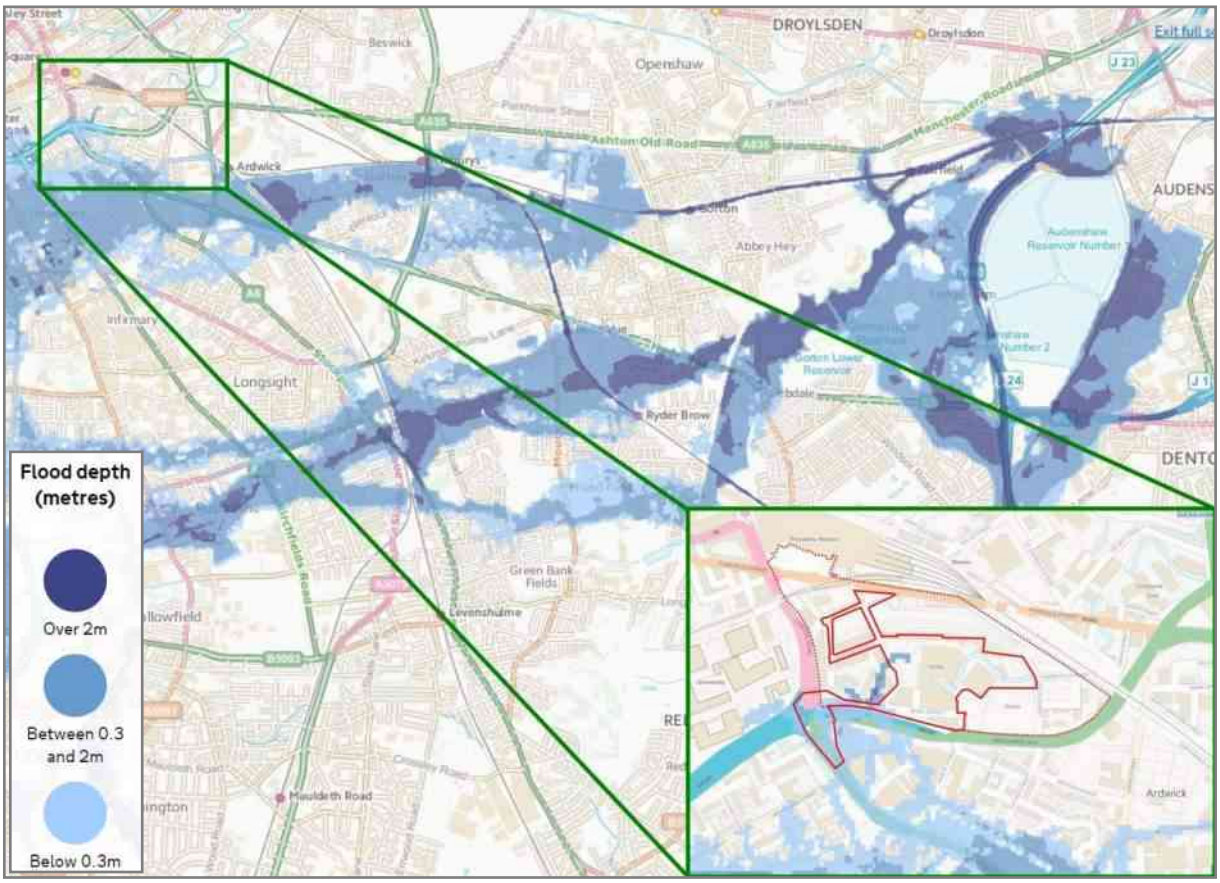


Figure 3-5 - Environment Agency Flood Risk from Reservoir at the site location and surroundings (Contains Environment Agency information ©Environment Agency and database right, 2019)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

3.4.2 Flooding from canals, ponds and small reservoirs

The Lead Local Flood Authority (LLFA) is responsible for leading the management of risk of flooding from ordinary watercourses, canals, ponds and reservoirs smaller than 25,000 cubic metres. Manchester City Council has therefore prepared a Local Flood Risk Management Strategy (LFRMS)[2] to ensure a coordinated way of properly managing local flood risk. The LFRMS has been informed by the Level 2 SFRA prepared in 2011 to produce a map with combined information of the canals breach zones and locations of ponds and small reservoirs, as shown in Figure 3-6.

The Ashton Canal is in closest proximity to the site, passing 500m north of the centre of the development. According to the Level 2 SFRA, the Ashton Canal is at some risk of overtopping due to high inflows exceeding the canal capacity during flood conditions, as well as due to possible blockages of the bywash (an outlet for diverting canal water) at Ancoats upstream of the site. Similarly, the Bridgewater canal is located 2km downstream from the site and could be overtopped as a result of increase flows from River Medlock.

The extents of flooding due to overtopping or breach of these canals are shown in Figure 3-6. None of the canals are shown to impose flood risk to the site.

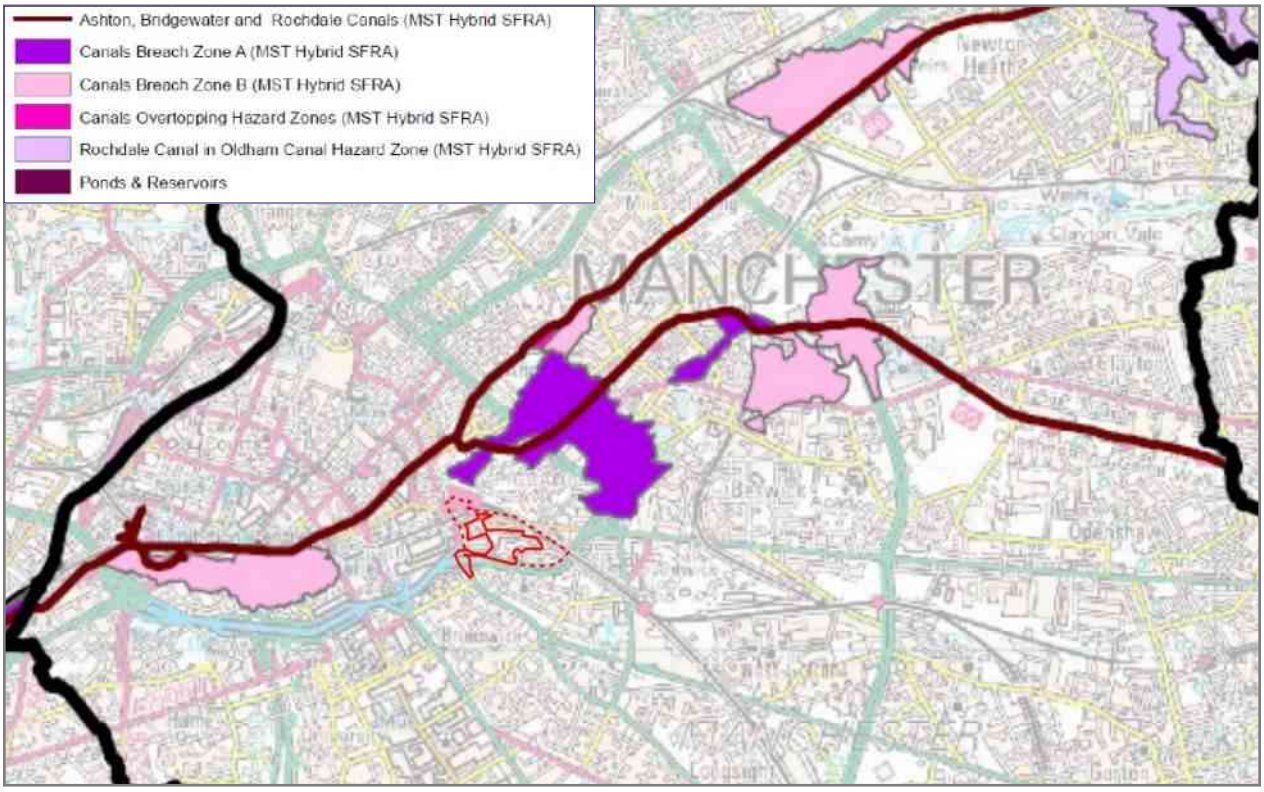


Figure 3-6 –Flood Risk from Canals, Ponds and Reservoirs at the site location and surroundings (Manchester City Council LFRMS, 2014)

[2] Local Flood Risk Management Strategy, Manchester City Council, March 2014

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

3.5 Hydraulic interaction (Fluvial and canals)

As part of the Level 2 SFRA, a hydraulic interaction map has been produced that identifies interactions between different sources of flooding, such as canals, ordinary watercourses and open or culverted rivers. The map highlights areas where flooding could be exacerbated by overspill from other sources (please refer to Level 2 SFRA, map H1_5.1).

According to the Level 2 SFRA (Table 7-1 Canal River Interaction), in the event of flood waters overtopping the Ashton canal during a flood event, there is a risk of erosion of embankments and the possibility of this resulting in breach of the canal banks. Should this situation arise, the flow into the River Medlock may result in an increase to flood risk downstream.

Three locations upstream of the site have been identified as areas where breach of the Ashton canal may result in additional flows entering the River Medlock. These are at Philips Park (upstream of the Etihad campus culvert), downstream of the Etihad campus culvert and in the area between Ashton New Road and Temperance Street (immediately upstream of the Mayfield site).

While there is no further information on the potential levels of risk to the site from such an occurrence, flood resilience measures should be considered to reduce and manage the risk to the site.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

4 Managing and reducing flood risk

4.1 Proposed development levels

The EA has stipulated that the finished floor levels (FFL) for residential developments should be set at least 600mm above the 1 in 100 year flood event with 35% allowance for climate change or the 1 in 100 year event with 70% allowance for climate change (with no freeboard), whichever is higher. As the SRF proposals include residential units, the entire podium level south of the river Medlock has been raised to satisfy the above criteria.

Where the proposed development is for uses such as storage refuse areas and car parks, the levels should be set higher than the 1 in 100 year flood event with 35% climate change.

The table below outlines the minimum recommended finished floor levels for the development plots within the Mayfield SRF area. For residential uses, the levels are strictly set above the 1 in 100 +35% CC +600mm, whereas offices can be set above the 1 in 100 +35% CC with some additional freeboard (less vulnerable uses). The recommended freeboard allowance is 600mm as per residential. The energy substation/plant room is set above the 1 in 1000 year flood event to provide resilience during an extreme flood event.

As a general rule, the development levels have also been set above the 1 in 1000 year flood event to remove the development from Flood Zone 2. Please refer to Figure 4-1, Table 3-2 and Table 4-1.

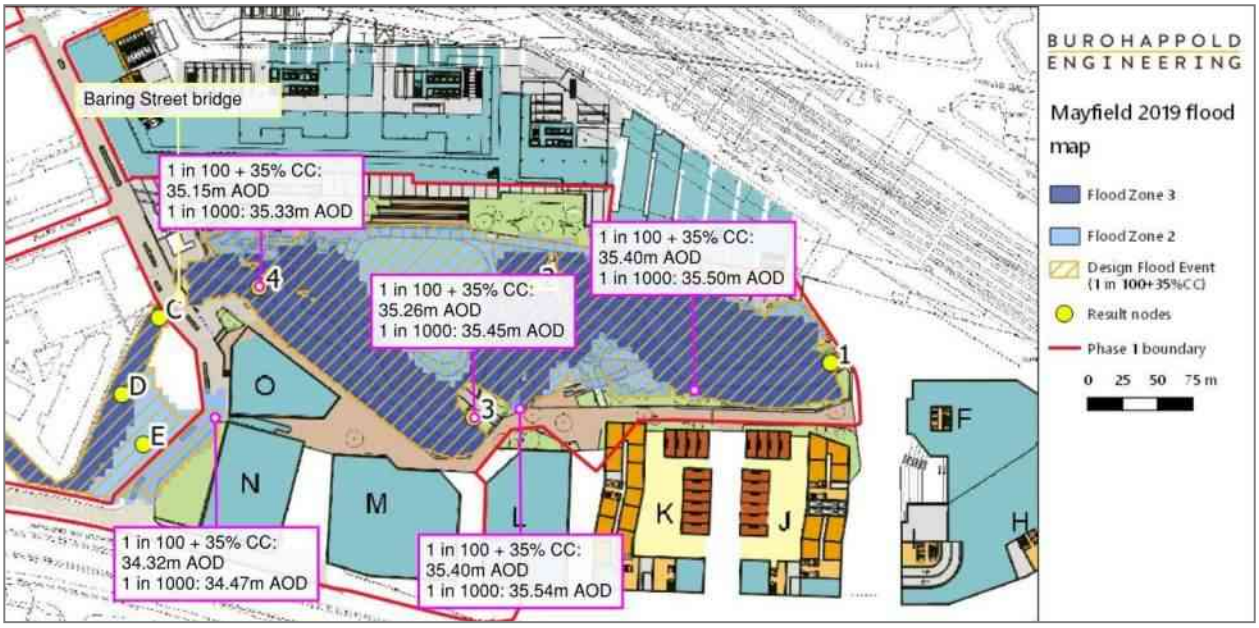


Figure 4-1 – Expected flood levels within the Mayfield site

It is observed that the culvert within the site acts as a throttle to the flows and the restriction causes levels downstream to significantly reduce (see levels for node 4 and E in Figure 4-1). As the levels along the entire length of the River Medlock within the site will be set above the DFL, it is considered that the FFL at the west face of Baring Street Office 1 (Plot O) and the FFL of Baring Street MSCP (Plot N) can be set at lower levels. This will allow tying in with the existing levels at Baring Street (34.5m AOD at the location).

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Therefore, the recommended finished floor levels for the west face of Baring Street Office1 (Plot O) and Baring Street MSCP (Plot N) are based on model node E.

Table 4-1 – Recommended finished floor levels for the Mayfield development plots

Relevant plots	Model node	Proposed uses	Minimum recommended FFL	Event	Proposed FFL	Freeboard allowed above DFE (1 in 100 +35%CC)
Plots F, G, H, I, J, K, L	1	Residential	36.00m AOD (includes 600mm minimum freeboard)	1 in100yr+35%CC with freeboard (600mm minimum)	TBC	TBC
Phase 1 plots						
Plot M	3	Offices	35.86m AOD (includes 600mm minimum freeboard)	1 in100yr+35%CC with freeboard (600mm minimum)	36.15m AOD	890mm
Plot O (east facing)	3	Offices	35.86m AOD (includes 600mm minimum freeboard)	1 in100yr+35%CC with freeboard (600mm minimum)	36.15m AOD	890mm
Plot O (west facing)	E	Refuse storage	34.47m AOD	1 in 1000	34.55m AOD	230mm
Plot O west substation	E	Energy substation/ plant room	34.47m AOD	1 in 1000	35.45m AOD	980mm
Plot N	E	Car park	34.47m AOD	1 in 1000	34.9m AOD	580mm

In order to enable design development for planning, the levels of the Phase 1 plots were initially set based on the EA Medlock hydraulic model levels. The hydraulic modelling exercise undertaken by BuroHappold has demonstrated that by providing the Mayfield Park flood compensation areas, levels within the site are significantly lowered. There is therefore potential for the plot levels to be set lower during detailed design stage, as outlined below:

- Baring Street Office 1 and Office 2 (Plot O (east facing) and Plot M) are recommended to be set above the minimum level of 35.86m AOD (1 in 100 +35%+600mm);
- The energy substation/plant room could be lowered to 34.47m AOD (1 in 1000 year flood level); and
- Similarly, ground floor levels of Baring Street Office 1 (Plot O_ refuse storage and the Baring Street MSCP (Plot N) can be lowered to 34.47m AOD (1 in 1000 year flood level).

If a change in levels is proposed following planning submission, this will be based on the above assumptions and will be discussed with the EA for approval.

4.2 Residual risk – Phase 1

The east face of Baring Street Office 1 (Plot O) and Baring Street Office 2 (Plot M) have been set well above the DFL (+870mm). Baring Street Office 1 (Plot O) west face is set +200mm and Baring Street MSCP (Plot N) +550mm above the DFL. This allowance could reduce the risk of flooding to the properties from the following residual risks:

- Flooding due to flows entering the river during the unlikely event of a breach of Ashton canal (see Section 3.5);
- Higher fluvial flows due to a higher climate change emission scenario;

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

- Uncertainties in flood modelling; and
- Exceedance flood events (higher intensity than the DFE).

4.3 Resilience

Key services including electricity and water will need to continue to be provided under flood conditions. As the entire development is proposed above the DFL it is considered to remain safe and operational under a flood scenario. No basement development is proposed for Mayfield Phase 1.

The energy substation/ plant room is located on the ground floor of Baring Street Office 1 (Plot O) are set above the 1 in 1000 year flood event (above 34.50m AOD).

If basements or other development for the future Mayfield phases is proposed under the DFL, the principles described within *'BS 85500: Flood resistant and resilient construction'* will be followed to ensure swift recovery of basement and key services following a flood.

4.4 Emergency planning

4.4.1 Flood hazard

The changes to the levels within the site and the creation of large compensation areas within the site could cause an increase to the exposure of the public to flood hazard. Refer to Figure 4-2 for the maximum flood hazard classification within the site, in accordance with FD2320/TR2 produced by DEFRA/EA). The hazard rating depends on the depth and velocity of floodwater. Danger for some includes children, the elderly and the infirm, danger for most includes the general public and danger for all includes the emergency services.

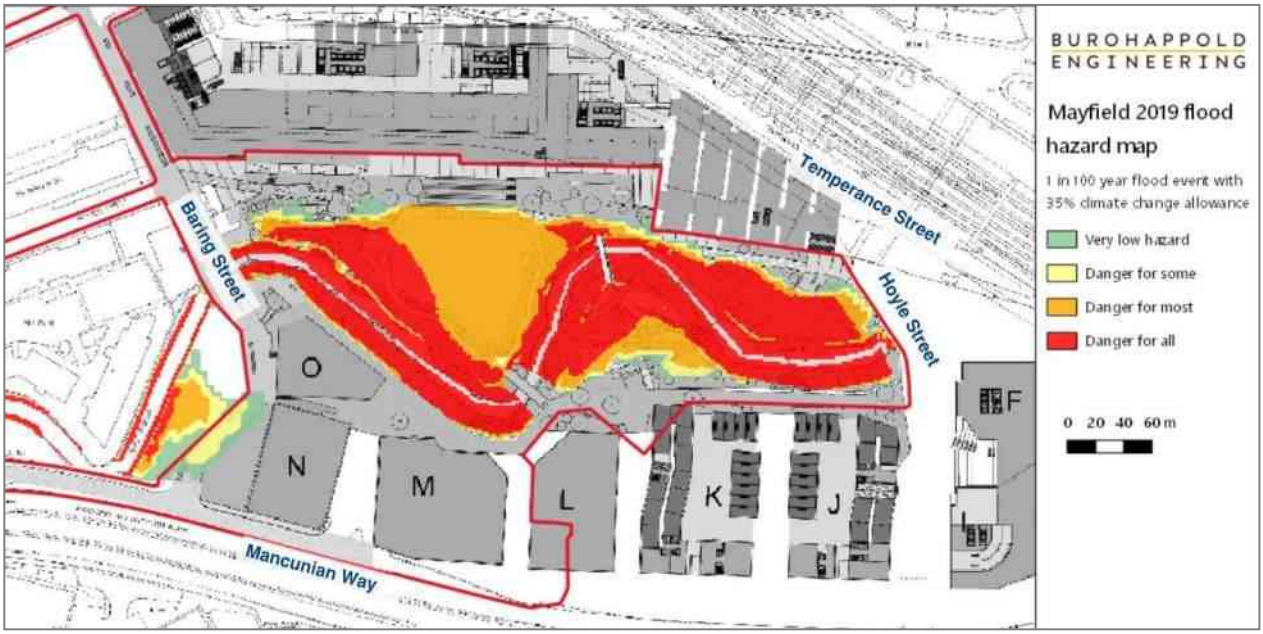


Figure 4-2 - Flood hazard map for the 1 in 100 year event+ 35%CC

As demonstrated in Figure 4-2, the general public should not have access to Mayfield Park during the DFE. In some areas shown in red, the fast and deep flowing water could also prove dangerous to the emergency services.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

An Emergency Plan should be put in place prior to the opening of the Mayfield Park to the public. The plan will outline the responsibilities for the closure of the park to the public during a range of rainfall events, the trigger levels for the closure of different areas, the appropriate measures and signage to be put in place to ensure safe use of the park. A maintenance plan will outline the responsibilities for the maintenance of the park areas during normal operation and following a flood event, to ensure the park can function as a floodplain as designed as well as return to use following a flood event.

4.4.2 Safe access and egress

During the event of flood, safe access and egress to and from the buildings is provided for pedestrians and emergency vehicles from the south boundary of the Mayfield site. The routes shown in blue arrows can be accessed via emergency vehicles.

Parts of Baring Street are shown to be under water during the design flood event. It is not possible to raise Baring Street above the DFL due to the existing levels of surrounding plots. The street can be accessed by all from Fairfield Street and only by emergency vehicles via Mancunian way. Hoyle Street is well above the flood levels; access to Hoyle Street can be achieved via Mancunian Way and Temperance Street.

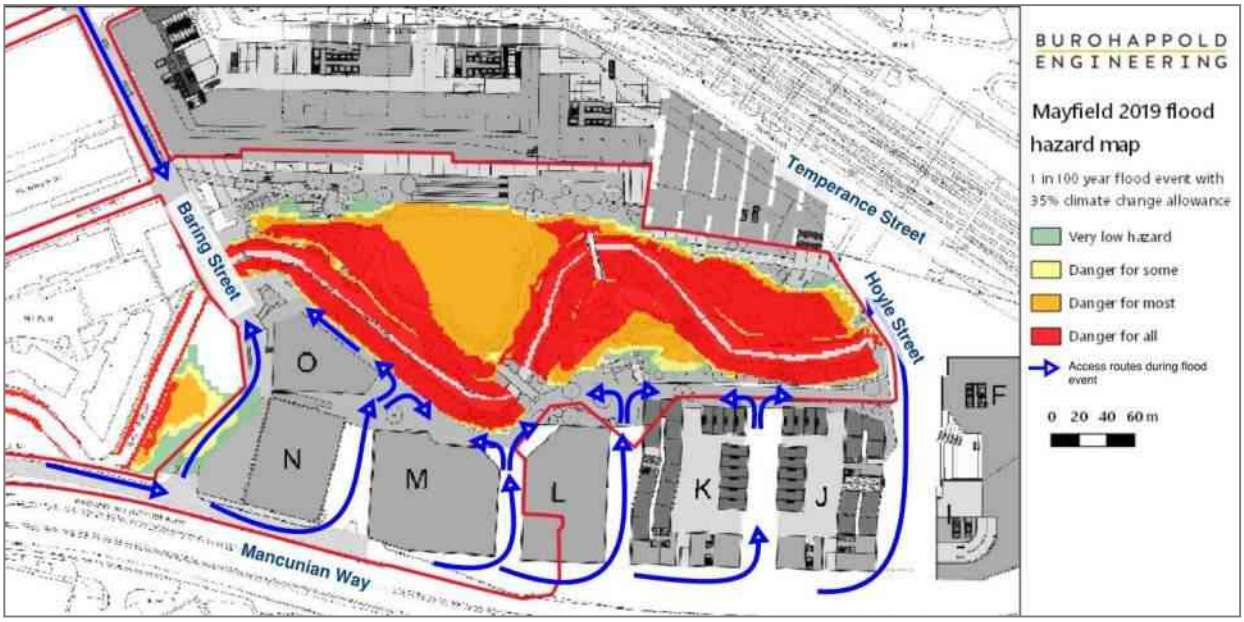


Figure 4-3 - Access routes for emergency vehicles during a flood event (background: flood hazard map for the DFE)

4.5 Riparian ownership and riverside access

The River Medlock is a designated as a 'Main River' and therefore the EA has powers to carry out maintenance or improvements works to the river and banks. The ultimate responsibility for the repair and maintenance of the bed, banks and any structure rests with the riparian owner.

All buildings have been set back at least 5m from the top of bank to allow clear and unobstructed access for maintenance, as previously discussed and agreed with the EA. The riverside walkway along the south podium will consist of a retaining wall, designed to accommodate loads from emergency vehicles and other potential maintenance equipment. This will provide clear access to most parts of the river from the south bank.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.



Figure 4-4 - Access to river for maintenance

Vehicular access (4x4 car) can also be achieved through the ramps along the terraced garden down to the Mayfield Park. The wildscape walk will consist of a narrow boardwalk and therefore vehicular access is restricted to the eastern entrance. Access to the river can also be achieved via Hoyle Street culvert and Baring Street Bridge.

In addition to gaining planning approval for the overall development through the normal planning process, an Environmental Permit will be required from the EA prior to the construction of the proposed works or structures within 8 metres of the top of the bank of the river. This is an entirely separate and additional procedure to the planning process.

4.6 Surface water drainage

According to Planning Policy EN 14 of the Manchester Core Strategy (2012), all new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure. The storm water drainage will be designed in accordance with current best practice to provide adequate capacity so as not to flood for the critical 1 in 30 year storm event, and flood water generated for up to the critical 1 in 100 year plus climate change (30%) storm event shall be contained within the areas on site so not to cause damage to buildings, essential services or adjoining developments and services. The pipe network will be designed for no surcharge up to the 1 in 2 year event.

The design of the surface water drainage strategy will follow the hierarchy of drainage solutions, as recommended by the CIRIA C753. Sustainable Drainage Systems (SuDS) will be implemented where possible to enable discharge, volume and water quality control of the surface water runoff and reduce flood risk on site. Not all SuDS systems are appropriate for Mayfield site. Please refer to the drainage strategy in Appendix E.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

The new below ground drainage network shall replace the existing and convey water to outfalls into the River Medlock, as agreed with the EA. It is proposed that all new sewers will drain by gravity, wherever possible however pumping stations may be required to keep the attenuation storage above modelled flood levels. Due to the existing ground conditions, infiltration and other source controls are generally unlikely to be achievable.

The majority of the green space proposed in the landscape masterplan is within the park and therefore lies within the flood plain and is not available to use for storm water attenuation. The strategy therefore proposes to discharge all surface water that falls within the park to the river without first attenuating flows. Surface water may still pass through a variety of SuDS prior to discharge to provide a water quality benefit. These could include filter strips and swales to reduce suspended solids within the surface water runoff.

All surface water which falls on the surrounding buildings and their associated public realm will be attenuated on plot. This surface water will then be discharged via a series of pipes into the River Medlock. Buildings will utilise a range of SuDS systems including green, blue and brown roofs, rainwater harvesting, raingardens and below ground storage. These measures will designed to meet the required surface water discharge rates for the development.

MCC has stipulated that the surface water discharge from the plots will need to be restricted to 50% of the peak brownfield discharge rate (1 in 100 year storm event) minus 2l/s/ha. Brownfield runoff rates for the proposed buildings have been calculated based on the catchment areas of the buildings using the Modified Rational Method. These rates and more detail on the surface water drainage strategy can be found in Appendix E.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

5 Conclusions

This Flood Risk Assessment demonstrates that the development proposals and proposed mitigation measures will reduce the flood risk to the site and surrounding areas for a 1 in 100 year flood event for the design life of the development, taking into account the effects of climate change. The proposed mitigation measures are listed below:

- Development levels: Residential and office development set at least 600mm above the 1 in 100 year flood event + 35% climate change allowance. Other uses set above the 1 in 1000 year flood event. The building development is raised above Flood Zones 2 and 3.
- Floodplain compensation: Floodplain compensation has been provided as part of the development (Mayfield Park). Hydraulic modelling has been used to demonstrate that the development does not increase risk elsewhere based on the 1 in 100 year flood event + 35% climate change allowance.
- Residual risk: Additional freeboard above flood levels has been allowed to provide resilience against extreme flood events or a combined canal breach and fluvial flood event.
- Emergency planning: Emergency and Maintenance plans for the Mayfield Park should be put in place to ensure the public is not exposed to any danger due to flooding. Safe access and egress are provided in flood risk areas for pedestrian and vehicular access in the event of flood.
- Riparian maintenance and ownership: The developer has riparian owner maintenance responsibilities. Environmental Access for maintenance have been allowed on both banks, with at least 5m between the buildings and the top of bank. EA Permits will be required for works within 8 metres from the top of bank.
- Drainage strategy: The drainage strategy will ensure no flooding of buildings for up to the 1 in 100 year event (will allowance for climate change). The hierarchy of SuDS solutions will be followed.

This Flood Risk Assessment demonstrates that through the careful design of the proposed development and the incorporation of the above mitigation measures there is no significant change to the flood risk both on-site and off-site and the development is safe from flooding for its designed lifetime. It is proposed that the above detailed mitigation measures will be submitted to the Local Planning Authority for approval prior to development commencing via the Condition Discharge process subject to achieving planning approval.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Appendix A Topographic surveys

A.1 Site topographic survey (Malcom Hughes, July 2017)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.



Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- : Mains consumer unit/Trustbox/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pullcord
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

SECURITY SERVICES

- : CCTV
- : Passive infra-red detector
- : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Cloak
- : Alarm Siren
- : Panic button

MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Brickline between stairs from floor to floor

WATER SERVICES

- : Incoming water point
- : Stop tap
- : Water meter
- : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- : Radiator
- : Central heating boiler
- : Electricity storage heater
- : Hot water tank
- : Cold water tank
- : Air conditioning unit
- : Ventilation duct (ceiling)
- : Air conditioning vent (wall)
- : Central heating thermostat

FIRE PRECAUTION SERVICES

- : Smoke detector
- : Sprinkler
- : Fire alarm
- : Fire alarm push
- : Fire extinguisher (Carbon dioxide)
- : Fire extinguisher (Water)
- : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BUW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAIRS	Stairs/risers
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/BT	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
CWL	Cill of wall level
GL	General Level
JB	Junction Box
BL	Beam level
DHL	Door head level

Sheet Index

Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF, Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations: RICS, ICES, THE SURVEY ASSOCIATION, FLVAS

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By	JW 25/08/17	Survey Date	August 2017
Checked by	MER 25/08/17	Scale	A0@1:200scale

Drawing No: 19479/1 Revision:

Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- : Mains consumer unit/Fusebox/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pullcord
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

WATER SERVICES

- : Incoming water point
- : Stop tap
- : Water meter
- : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- : Radiator
- : Central heating boiler
- : Electricity storage heater
- : Hot water tank
- : Cold water tank
- : Air conditioning unit
- : Ventilation duct (ceiling)
- : Air conditioning vent (wall)
- : Central heating thermostat

FIRE PRECAUTION SERVICES

- : Smoke detector
- : Sprinkler
- : Fire alarm
- : Fire alarm push
- : Fire extinguisher (Carbon dioxide)
- : Fire extinguisher (Water)
- : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

SECURITY SERVICES

- : CCTV
- : Passive infra-red detector
- : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Chook
- : Alarm Siren
- : Panic button

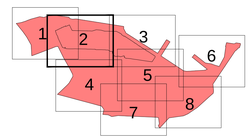
MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Brasoline between stairs from floor to floor

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BUW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAN	Stanchions
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/SP	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
DHL	Door arch level
GL	General access
JB	Junction Box
BL	Beam level
DHL	Door head level

Sheet Index



Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF. Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

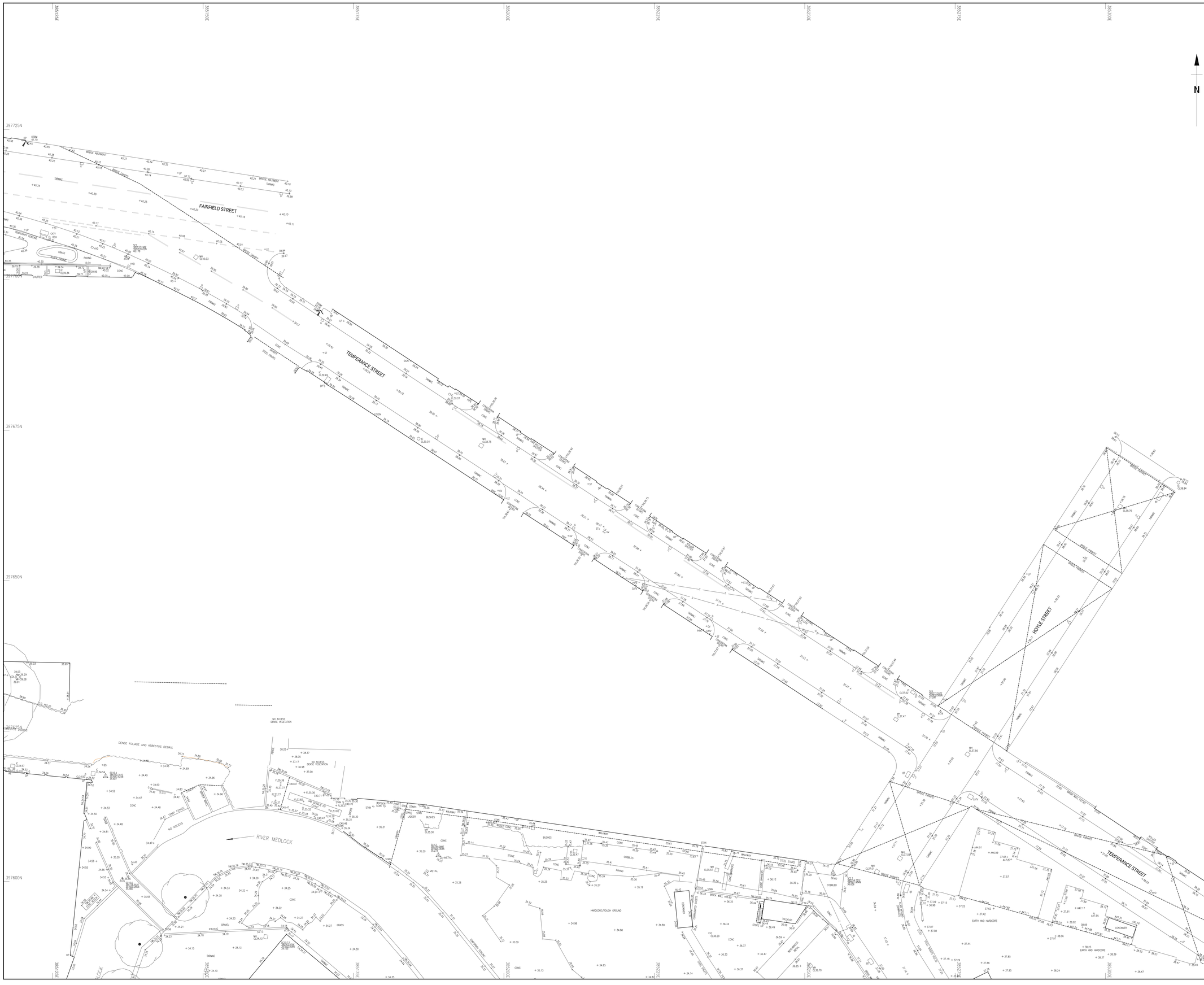
Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By	JW	25/08/17	Survey Date: August 2017
Checked by	MER	25/08/17	Scale: A0@1:200scale

Drawing No: 19479/2

Revision:



Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- : Mains consumer unit/Fusebox/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pullcord
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

WATER SERVICES

- : Incoming water point
- : Stop tap
- : Water meter
- : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- : Radiator
- : Central heating boiler
- : Electricity storage heater
- : Hot water tank
- : Cold water tank
- : Air conditioning unit
- : Ventilation duct (ceiling)
- : Air conditioning vent (wall)
- : Central heating thermostat

FIRE PRECAUTION SERVICES

- : Smoke detector
- : Sprinkler
- : Fire alarm
- : Fire alarm push
- : Fire extinguisher (Carbon dioxide)
- : Fire extinguisher (Water)
- : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

SECURITY SERVICES

- : CCTV
- : Passive infra-red detector
- : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Cloak
- : Alarm Siren
- : Panic button

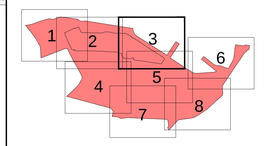
MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Breakline between stairs from floor to floor

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BOW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAN	Stanchions
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/SP	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
CHL	Chimney top level
GL	General access
JB	Junction Box
BL	Beam level
DHL	Door head level

Sheet Index



Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF, Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

Drawing Title

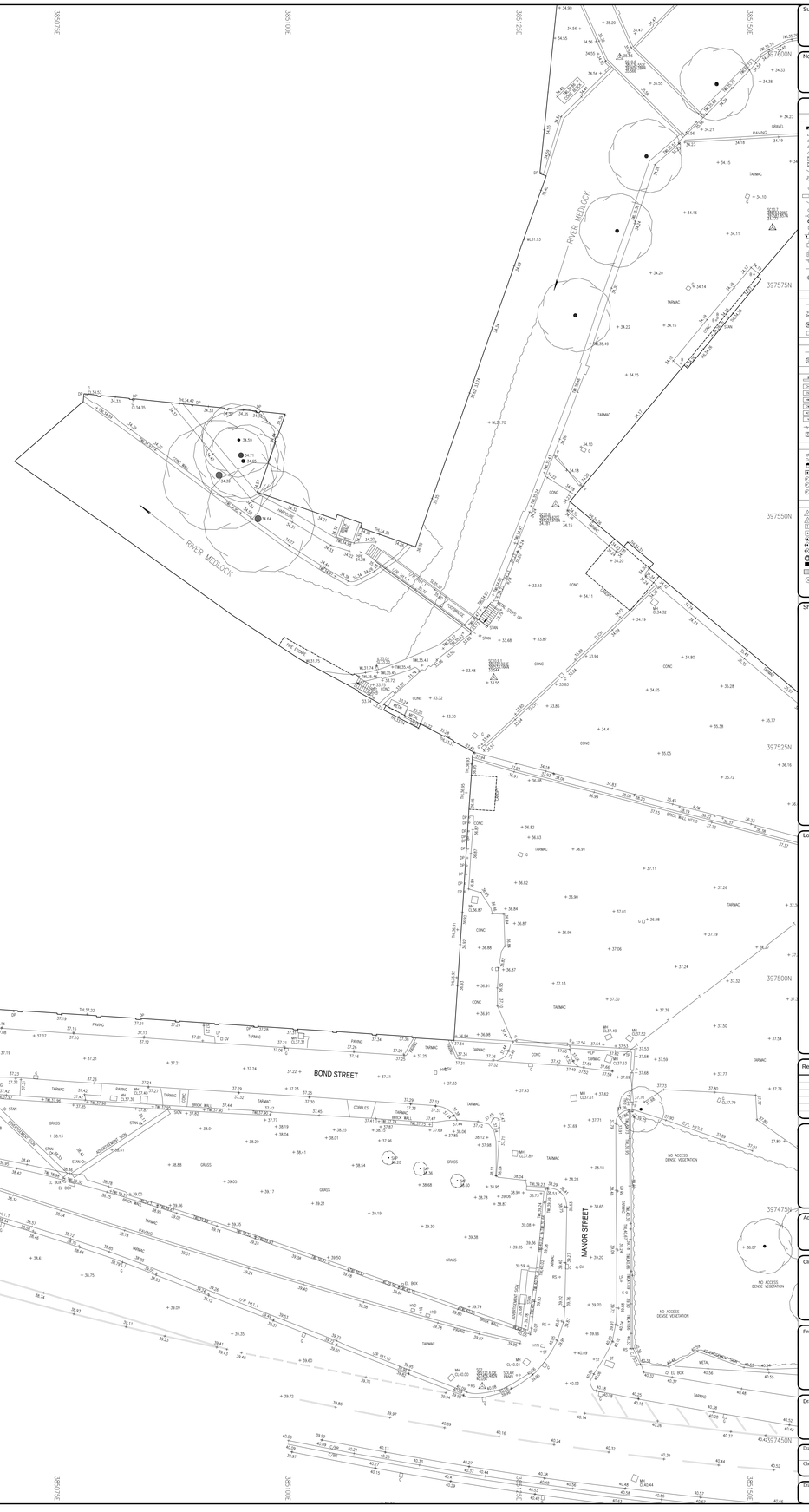
TOPOGRAPHICAL SURVEY

Drawn By	JW 25/08/17	Survey Date	August 2017
Checked by	MER 25/08/17	Scale	A0@1:200scale

Drawing No: 19479/3

Revision:





Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- MCU : Mains consumer unit/Fuseboix/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pictured
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

WATER SERVICES

- : Incoming water point
- : Stop tap
- : Water meter
- HWC : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- : Radiator
- CHB : Central heating boiler
- EHH : Electricity storage heater
- HWT : Hot water tank
- CWT : Cold water tank
- ACU : Air conditioning unit
- : Ventilation duct (ceiling)
- : Air conditioning vent (wall)
- : Ceiling heating thermostat

FIRE PRECAUTION SERVICES

- : Smoke detector
- CPU : Sprinkler
- : Fire alarm
- : Fire alarm push
- : Fire extinguisher (Carbon dioxide)
- : Fire extinguisher (Water)
- : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

SECURITY SERVICES

- : CCTV
- : Passive Infra-red detector
- SAP : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Cloak
- : Alarm Siren
- : Panic button

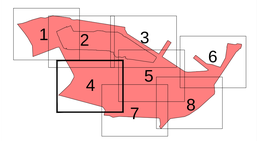
MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Straddle between stairs from floor to floor

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BUW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAN	Stanchions
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/BT	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
DHL	Door arch level
GL	General access
JB	Junction Box
BL	Beam level
DHL	Door head level

Sheet Index



Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF, Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations

RICS · Member ICES · THE SURVEY ASSOCIATION · ISO 9001 · RICS CPD Certified

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By	JW	25/08/17	Survey Date: August 2017
Checked by	MER	25/08/17	Scale: A0@1:200scale

Drawing No: 19479/4

Revision:



Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- MCU : Mains consumer unit/Fusebox/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pullcord
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

SECURITY SERVICES

- : CCTV
- : Passive Infra-red detector
- CIE : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Cloak
- : Alarm Siren
- : Panic button

MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Brookline between stairs from floor to floor

WATER SERVICES

- : Incoming water point
- : Stop tap
- : Water meter
- HWH : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- : Radiator
- CHB : Central heating boiler
- EWH : Electricity storage heater
- HWT : Hot water tank
- CWT : Cold water tank
- ACU : Air conditioning unit
- : Ventilation duct (ceiling)
- : Air conditioning vent (wall)
- : Ceiling heating thermostat

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BUW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAIR	Stairs/Ions
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/BT	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
CL	Ceiling level
GL	General access
JB	Junction Box
BL	Beam level
DHL	Door head level

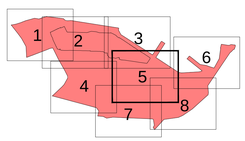
FIRE PRECAUTION SERVICES

- : Smoke detector
- : Sprinkler
- : Fire alarm
- : Fire alarm push
- : Fire extinguisher (Carbon dioxide)
- : Fire extinguisher (Water)
- : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

Sheet Index



Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF, Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations: RICS, RICS, The Survey Association, FIS Mark, Property Mark

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

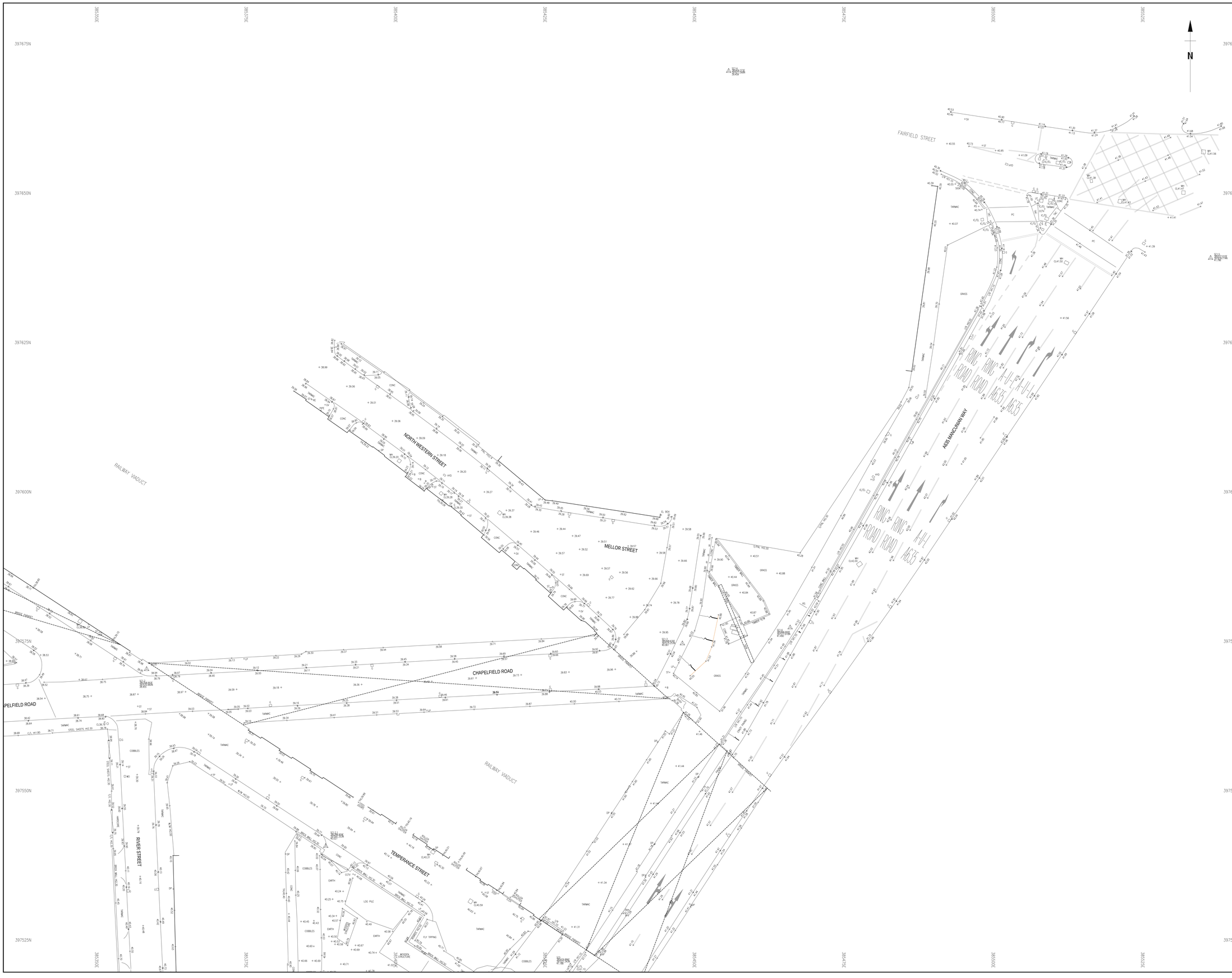
MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By	JW 25/08/17	Survey Date	August 2017
Checked by	MER 25/08/17	Scale	A0@1:200scale

Drawing No: 19479/5 Revision:



Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- MCU : Mains consumer unit/Fuseboix/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- Ch : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pictrure
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

WATER SERVICES

- : Incoming water point
- ST : Stop Tap
- : Water meter
- HWC : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- RAD : Radiator
- CHB : Central heating boiler
- EHW : Electricity storage heater
- HWT : Hot water tank
- CWT : Cold water tank
- ACU : Air conditioning unit
- : Ventilation duct (ceiling)
- : Air conditioning vent (wall)
- : Central heating thermostat

FIRE PRECAUTION SERVICES

- : Smoke detector
- SPR : Sprinkler
- : Fire alarm
- : Fire alarm push
- FE CO_2 : Fire extinguisher (Carbon dioxide)
- FE W : Fire extinguisher (Water)
- FE P : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

SECURITY SERVICES

- : CCTV
- : Passive Infra-red detector
- SAP : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Cloak
- : Alarm Siren
- : Panic button

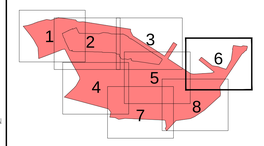
MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Breakline between stairs from floor to floor

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BUW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAN	Stanchions
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/SP	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
GFL	Ground floor level
GL	General level
JB	Junction Box
BL	Beam level
DHL	Door head level

Sheet Index



Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF. Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations: RICS · ICES · The Survey Association · FSI Data · RICS Consultancy

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By	JW	25/08/17	Survey Date: August 2017
Checked by	MER	25/08/17	Scale: A0@1:200scale

Drawing No: 19479/6

Revision:

Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- : Mains consumer unit/Fuseboix/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pullcord
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

WATER SERVICES

- : Incoming water point
- : Stop tap
- : Water meter
- : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- : Radiator
- : Central heating boiler
- : Electricity storage heater
- : Hot water tank
- : Cold water tank
- : Air conditioning unit
- : Ventilation duct Ceiling)
- : Air conditioning vent (wall)
- : Central heating thermostat

FIRE PRECAUTION SERVICES

- : Smoke detector
- : Sprinkler
- : Fire alarm
- : Fire alarm push
- : Fire extinguisher (Carbon dioxide)
- : Fire extinguisher (Water)
- : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

SECURITY SERVICES

- : CCTV
- : Passive infra-red detector
- : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Chook
- : Alarm Siren
- : Panic button

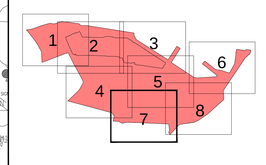
MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Brickline between stairs from floor to floor

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BUW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAIR	Stairs/Ions
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/SP	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
CHL	Chimney level
GL	General access
JB	Junction Box
BL	Beam level
DHL	Door head level

Sheet Index



Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF. Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By		Survey Date	
JW	25/08/17	August 2017	
Checked by		Scale	
MER	25/08/17	A0@1:200scale	

Drawing No: 19479/7

Revision:



Survey Notes

Grid: Local plane metric related to National Grid fixed at Stn SC10

Levels: OS datum from GNSS positioning converted using the National Geoid Model OSGM02

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES

- : Mains consumer unit/Fusebox/Meter
- : Single wall socket
- : Double wall socket
- : Single wall socket and switch
- : Double wall socket and switch
- : Single floor socket
- : Double floor socket
- : 1-way lighting switch
- : 2-way lighting switch
- : Ceiling point lighting
- : Fluorescent light fittings
- : Lighting Pullcord
- : Spot lighting
- : Wall lighting
- : Emergency lighting
- : Emergency lighting
- : Fused spur connection box with switch
- : Unfused spur connection box
- : Cooker connection box
- : Earth point
- : Incoming Electrical point
- : Strobe Warning Light

WATER SERVICES

- : Incoming water point
- : Stop tap
- : Water meter
- : Hot water heater

GAS SERVICES

- : Incoming gas point
- : Gas meter

HEATING / AIR CONDITIONING SERVICES

- : Radiator
- : Central heating boiler
- : Electricity storage heater
- : Hot water tank
- : Cold water tank
- : Air conditioning unit
- : Ventilation duct (ceiling)
- : Air conditioning vent (wall)
- : Central heating thermostat

FIRE PRECAUTION SERVICES

- : Smoke detector
- : Sprinkler
- : Fire alarm
- : Fire alarm push
- : Fire extinguisher (Carbon dioxide)
- : Fire extinguisher (Water)
- : Fire extinguisher (Powder)

COMMUNICATION SERVICES

- : Telephone outlet
- : Comms outlet
- : Intercom
- : Television co-axial outlet
- : Bell push
- : Panic Button
- : Speaker
- : Sensor (general)
- : Lift Box
- : Router
- : Disabled Help Button

SECURITY SERVICES

- : CCTV
- : Passive infra-red detector
- : Security alarm panel
- : Security Door Swipe
- : Integrated CCTV & Intercom
- : Emergency Door Release
- : Door Release
- : Smoke Chook
- : Alarm Siren
- : Panic button

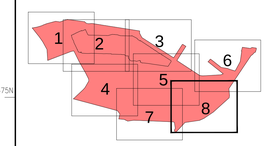
MISCELLANEOUS INTERNAL FIXTURES

- : Doorswing
- : Urinal
- : Toilet
- : Sink & Drainer
- : Double Sink
- : Sink
- : Hand Basin
- : Hand Dryer
- : Showerhead
- : Shower
- : Bath
- : Brookline between stairs from floor to floor

GENERAL ABBREVIATIONS

F/A	Floor to Arch Height or Apex
F/B	Floor to Beam Height
F/C	Floor to Ceiling Height
F/FC	Floor to False Ceiling Height
F/H	Floor to Head Height
F/SP	Floor to Springing Height
F/S	Floor to Sill Height
F/U	Floor to Underside Height
FL	Floor Level
HT	General Height
BUW	Bricked Up Window
COL	Column
P	Partition
RSJ	Rolled Steel Joist
STAIR	Stairs/Ions
MH	Manhole
IC	Inspection Chamber
CL	Cover Level
IL	Invert Level
F/ST	Floor to beam top
FFL	Finished floor level
FCL	False ceiling level
SCL	Structural ceiling level
WHL	Window arch level
WSL	Window sill level
WHL	Window head level
WASL	Window arch springing level
SPL	Springing level
AL	Arch level
TWL	Top of wall level
CHL	Chimney pot level
GL	General access
JB	Junction Box
BL	Beam level
DHL	Door head level

Sheet Index



Location Plan

Rev.	Date	Description

MALCOLM HUGHES
LAND SURVEYORS
Chartered Land Surveyors
65 Cross Street, Sale, Manchester
M33 7HF, Tel: 0161 905 1265
www.malcolmhughes.co.uk
survey@mhls.co.uk

Accreditations: RICS, ICES, The Survey Association, Pas128, CQMS

Client

BURO HAPPOLD LTD
CAMDEN MILL, LOWER BRISTOL ROAD
BATH, BA2 3DQ

Project

MANCHESTER MAYFIELD STATION
FAIRFIELD STREET, MANCHESTER,
M1 2QF.

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By	JW 25/08/17	Survey Date	August 2017
Checked by	MER 25/08/17	Scale	A0@1:200scale

Drawing No: 19479/8

Revision:

Appendix B Development proposals

B.1 Mayfield Phase 1 drawings list

SEW – Landscape and park design:

0345-SEW-ZZ-00-DR-L-007101 – Overall GA Context Plan

0344-SEW-ZZ-00-DR-L-001710 – Plot O (Baring Street Office 1) Landscape General Arrangement

0344-SEW-ZZ-ZZ-DR-L-001700 – Plot N (Baring Street MSCP) Landscape General Arrangement

0345-SEW-ZZ-00-DR-L-007200 – Site Sections Location Plan

0345-SEW-ZZ-00-DR-L-007201 – Illustrative Site Sections Section A & B

0345-SEW-ZZ-00-DR-L-007202 – Illustrative Site Sections Section C & D

0345-SEW-ZZ-00-DR-L-007203 – Illustrative Site Sections Section E & F

0345-SEW-ZZ-00-DR-L-007204 – Illustrative Site Sections Section G, H & I

SEW – Baring Street MSCP (Plot N) designers:

0344-SEW-ZZ-00-DR-A-001100 - Ground floor plan

0344-SEW-ZZ-ZZ-DR-A-001304 - West elevation

0344-SEW-ZZ-ZZ-DR-A-001305 - South Elevation

0344-SEW-ZZ-ZZ-DR-A-001306 - East Elevation

0344-SEW-ZZ-ZZ-DR-A-001307 - North Elevation

Bennetts Associates– Baring Street Office 1 (Plot O) designers:

1811-BA-XX-00-DR-A-P-0100 – Ground floor plan

1811-BA-XX-NN-DR-A-P-0310 – North elevation

1811-BA-XX-EE-DR-A-P-0320 – East elevation

1811-BA-XX-SS-DR-A-P-0330 – South elevation

1811-BA-XX-WW-DR-A-P-0340 – West elevation

MORRIS & COMPANY – Basing Street Office 2 (Plot M) designers:

A283-MCO-XX-ZZ-DR-A-01001 – Site location plan

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

A283-MCO-XX-00-DR-A-01101 – Ground floor plan

A283-MCO-XX-ZZ-DR-A-01201 – North elevation

A283-MCO-XX-ZZ-DR-A-01202 – East elevation

A283-MCO-XX-ZZ-DR-A-01203 – South elevation

A283-MCO-XX-ZZ-DR-A-01204 – West elevation

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Appendix C Correspondence with stakeholders

C.1 Correspondence with the EA

C.2 Correspondence with the LLFA

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Ms Rodoula Gregoriou
Buro Happold Limited
230 Lower Bristol Road
Bath
Avon
BA2 3DQ

Our ref: SO/2016/116601/01-L01
Your ref: GMMC28626AB

Date: 17 November 2016

Dear Ms Gregoriou

PRE DEVELOPMENT ENQUIRY - THE MIXED DEVELOPMENT WILL CONSIST OF GOVERNMENT OFFICE BUILDINGS TO THE SOUTH OF THE RIVER, NEW RESIDENTIAL BLOCKS TO THE EAST, OPEN SPACE AREAS TO ACT AS FLOODPLAINS AND MAKE SPACE FOR WATER IMMEDIATELY TO THE NORTH OF THE RIVER AND THE RENOVATION OF THE MAYFIELD STATION AND RE-PURPOSE TO FUNCTION AS A MARKET PLACE.
MANCHESTER MAYFIELD

Thank you for submitting the above enquiry which was received on 9th November 2016.

We would like to make the following comments to the proposed development.

Flood Risk

From our flood risk mapping the site is within Flood Zones 2 & 3. Any planning application would need to address the requirements of the National Planning Policy Framework (NPPF) sequential test. Flood zone 3 is shown to affect a portion of the site before the impacts of climate change are considered. The latest climate change guidance (Feb 2016) must be considered as part of any Flood Risk Assessment (FRA).

For a residential development the “upper end” climate change allowances should be considered in the assessment as well as the “higher central” figures.
We would recommend that floor levels (especially residential units) are set at least 600mm above the 1% AEP + 35% flood level and/or at the 1%AEP + 70%cc flood level whichever is the highest whilst also considering 0.1% AEP flood levels. You will also need to show the development is safe under these circumstances.

The development must not increase flood risk elsewhere. If site levels are proposed to be raised to mitigate risks, compensatory storage is likely to be needed. Flood plain compensation works should be based on the 1%AEP + 35%cc defended levels as a minimum to ensure risk is not increased elsewhere as the impacts of climate change occur. We note your comment to create flood plain storage areas and this would be

welcomed together with any proposals to reduce or remove the existing walls that form the river channel.

Modelled flood levels are available for the River Medlock from the EA's customer services team inforequests.gmmc@environment-agency.gov.uk

As you intend to change levels considerably we would advise that you obtain the EA's river model and re-run this with the changes proposed to the river to ensure flood levels are not increased upstream or downstream.

The River Medlock is designated "main river" and the EA has powers to carry out maintenance or improvement works on all "main river". These powers are discretionary and the ultimate responsibility for the repair and maintenance of the bed, banks and any structure thereon rests with the riparian landowner. It is the EA's policy to utilise the Environmental Permitting (England and Wales) Regulations 2010 to control development in order to ensure access is available for future maintenance.

With reference to the submitted masterplan layout, the removal of culverted sections and the creation of open areas adjoining the river would be welcomed. The proposed buildings on the south bank appear very close to the river and creation of clear easements to both banks would be preferable. However, from the viewpoint of accessing the river for maintenance, a clear open space to one bank would be better than what exists currently. Open areas adjoining the river should be kept free of structures and other obstacles that would impede vehicular access along the bank top.

The development may require a permit under the Environmental Permitting (England and Wales) Regulations 2010 from the Environment Agency for any proposed works or structures, in, under, over or within eight metres of the top of the bank of the River Medlock. This was formerly called a Flood Defence Consent. Some activities are also now excluded or exempt. A permit is separate to and in addition to any planning permission granted. Further details and guidance are available on the GOV.UK website: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.

With regard to the additional questions in your email of the 15th Nov 2016, the EA river model can be provided with no charge. However, use of it will still need to be licensed and this will be done through our customer services team as noted above.
With regard to surface water drainage, from April 2015 Lead Local Flood Authorities became the statutory consultee for surface water flood risk in relation to planning applications. They are now the appropriate body to assess applicants/developers surface water drainage proposals and the Local Planning Authority should consult the LLFA as necessary during determination of applications.

If new surface water outfalls were required to the river, these may require a flood risk activity permit as noted above. However, the rate of discharge would be agreed through the planning process and the LLFA.

Ecology

The proposed Mayfield development site sits in close proximity to River Medlock waterbody (River Medlock (Lumb Brook to Irwell) GB112069061152), which is currently identified as a watercourse that is heavily modified and failing it's ecological objectives as outlined in statutory North West River Basin Management Plan
(https://www.gov.uk/government/publications/north-west-river-basin-district-river-basin-management-plan)

Cont/d..

The Agency would request based on the proximity of development to the River Medlock WFD waterbody, key green infrastructure asset and ecological receptor, that as part of Environmental Impact Assessment to assess any potential impacts and opportunities on the waterbody and key ecological network, and ensure appropriate mitigation measures to protect and where feasible enhance ecological quality of currently failing WFD waterbody as part of scheme proposals.

We are generally supportive of the Mayfield Strategic Regeneration Framework, which is based around the creation of a new public park and greenspace located along a restored River Medlock corridor, and skylighting sections of existing culverted channel and thereby continue earlier river restoration works on the River Medlock http://www.bbc.co.uk/news/uk-england-manchester-29680074; hopefully creating a new riparian development that sets new design standards in respect to sustainability, and one that will provide an exemplar for future riparian development in the Manchester area and beyond.

We support a development that proposes to rejuvenate the heavily canalised River Medlock here, and would recommend any site based flood risk assessment and ecological survey recommendations i.e. River Habitat Survey, and Geomorphological survey be integrated, enabling the creation of a valuable new riparian corridor and ecological network, that has much improved and safe riverine amenity access, whilst reducing overall flood risk.

Any river restoration scheme should be well designed i.e., be robust in terms of flood risk but also work in dominant low flow conditions, and provides improved riparian and aquatic habitat potential compared to the existing watercourse, that is preferably based on using a mixture of soft and hard revetment options.

We would seek that all new riparian development be set back from both banks of the River Medlock channel, enabling more a more environmentally beneficial channel to be restored, and better integrated in wider development, enable continuous pedestrian and maintenance access along watercourse, and create a more climate change resilient riparian corridor to be designed and constructed. It is sought in areas like the southern development zone that an adequate undeveloped buffer be provided between new build and the restored River Medlock, providing greater ability to create a high quality amenity/greenspace zone as well as improved maintenance access as and when required. The Agency would seek that river rehabilitation of heavily cannalised River Medlock look to enhance both channel, banksides where required, and preferably use soft or bioengineering techniques where feasible to create a valuable ecological network for resident riverine flora and fauna.

We would not support new riparian development that directly abuts the river channel or seeks to build on top of existing culverted sections of river channel.
The Agency would recommend reference to the following river restoration strategy documents, and the River Restoration Centre and European River Restoration websites sites for advice and guidance for urban river restoration projects and how to positively integrate rivers as part of new urban riparian development.
Rivers By Design
(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/297315/LIT8146_7024a9.pdf)
http://www.ecrr.org/RiverRestoration/UrbanRiverRestoration/tabid/3177/Default.aspx
http://www.therrc.co.uk/pdf/References/southriver_combined_2up.pdf
http://www.therrc.co.uk/MOT/Final_Versions_%28Secure%29/8.5_Marden.pdf

Cont/d..

We trust you find these comments useful.

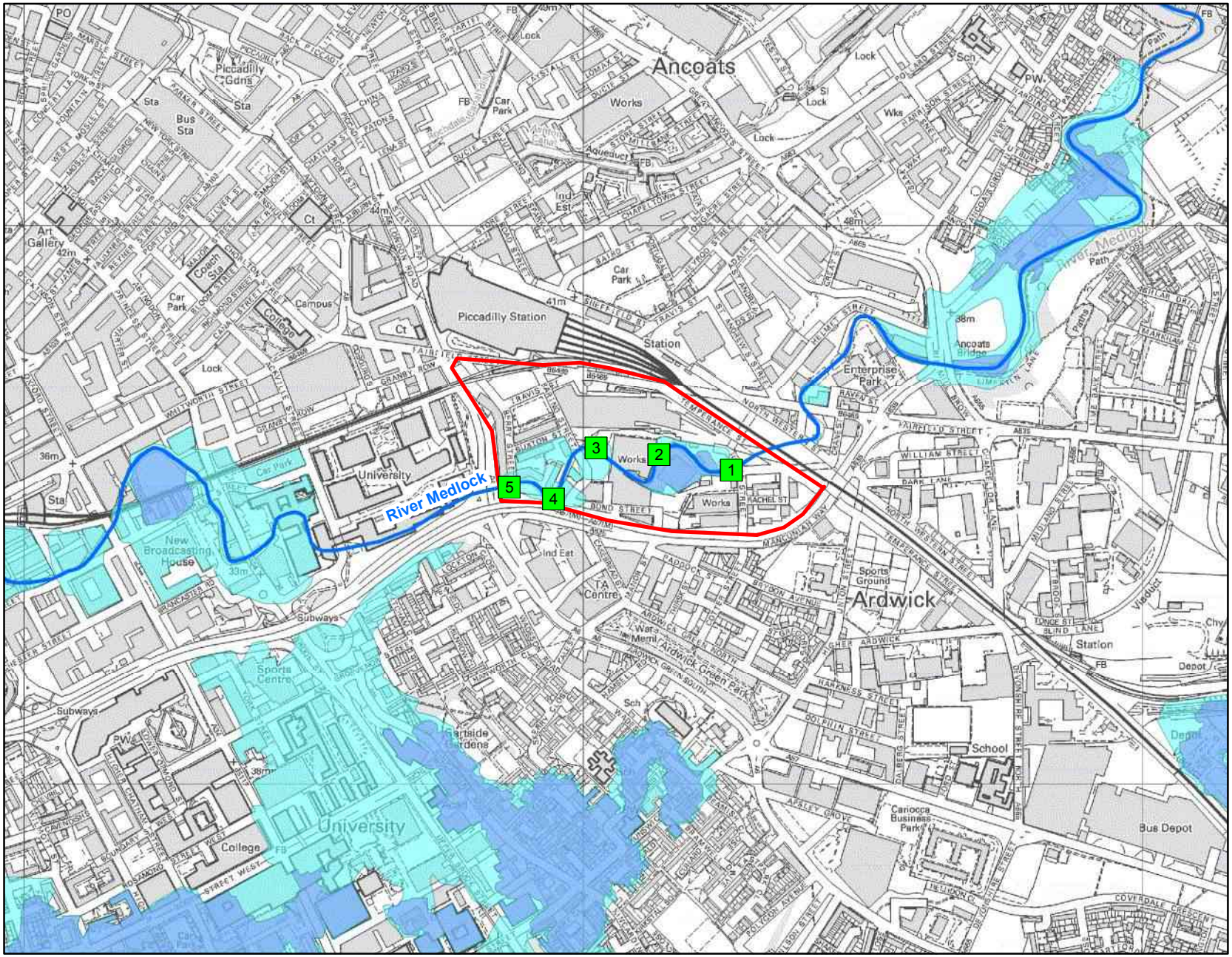
Yours sincerely

Mrs LAILA BERRY
Planning Advisor

Direct dial 02030250761
Direct fax
Direct e-mail laila.smith@environment-agency.gov.uk

End

Detailed Flood Map centred on Mayfield area, Manchester. Created 10/11/2016 [GMMC28626AB]



Environment Agency

1:10,001

N

Legend

- Model_Measurements
- Site_Location
- Main River
- Flood Zone 3
- Flood Zone 2

© Environment Agency copyright and / or database rights 2016. All rights reserved. © Crown Copyright and database right. All rights reserved. Environment Agency, 100026380, 2016.

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

					Undefended			
Map Reference	Model Node Reference	Easting	Northing	Data	1 % AEP (1 in 100 year)	0.1 % AEP (1 in 1000 year)	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow
1	ea013_Model_MEDL01_00044	385265	397561	Modelled Water Level (m aodN)	35.21	36.12	35.64	36.01
				Modelled Flow (cumecs)	60.14	96.43	74.70	87.25
2	ea013_Model_MEDL01_00041	385136	397589	Modelled Water Level (m aodN)	34.65	36.44	35.55	36.03
				Modelled Flow (cumecs)	57.48	62.37	61.40	62.27
3	ea013_Model_MEDL01_00038	385023	397601	Modelled Water Level (m aodN)	33.90	35.67	34.75	35.30
				Modelled Flow (cumecs)	59.71	75.48	72.96	74.93
4	ea013_Model_MEDL01_00035	384947	397510	Modelled Water Level (m aodN)	33.40	35.22	34.42	34.83
				Modelled Flow (cumecs)	59.98	88.19	73.76	85.87
5	ea013_Model_MEDL01_00032	384874	397535	Modelled Water Level (m aodN)	32.45	34.82	34.02	34.41
				Modelled Flow (cumecs)	59.99	93.61	73.74	86.60

Model data taken from Medlock SFRA 2011 Study

Notes:

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

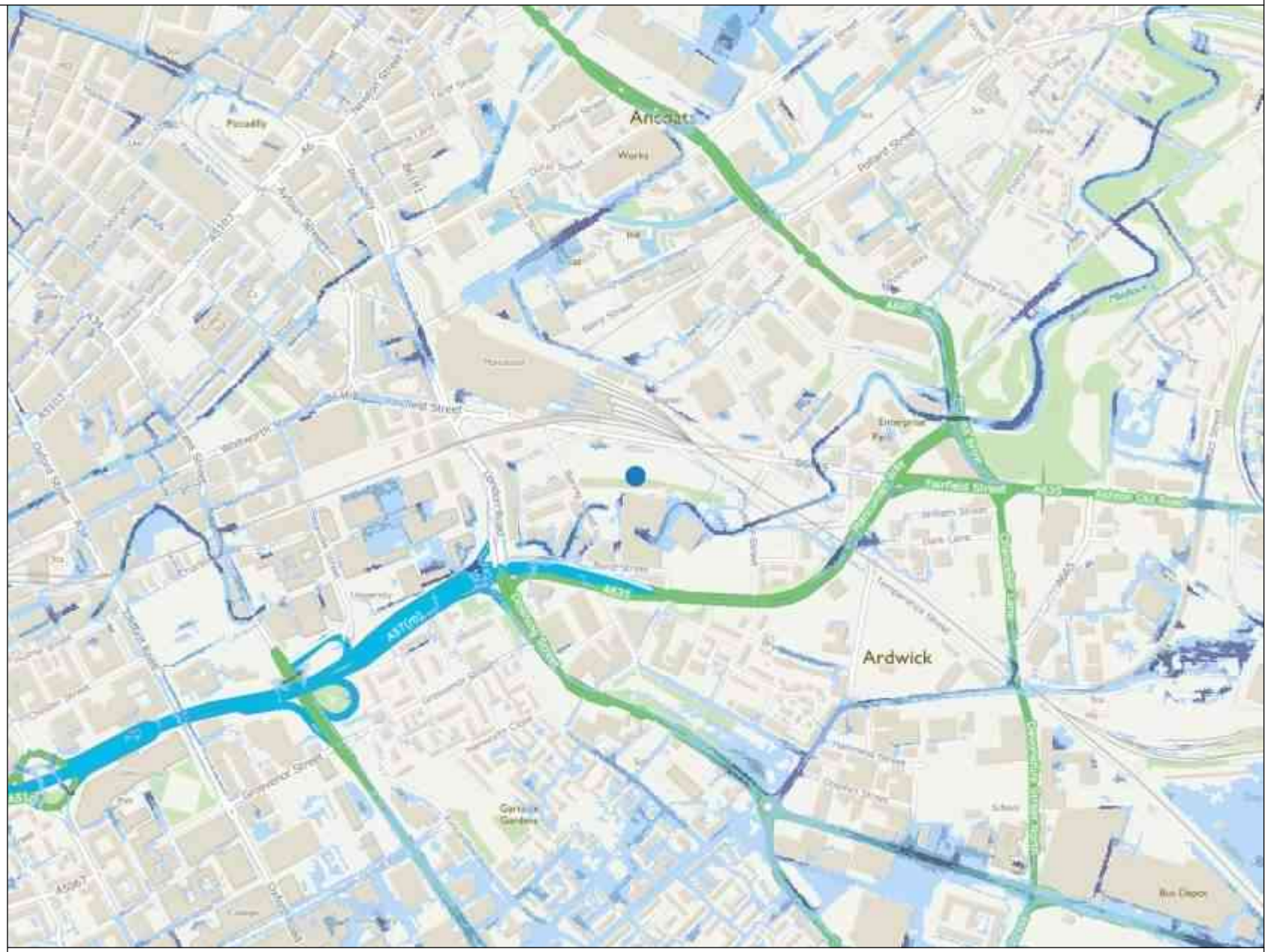
*Climate Change Scenario based on - 35% and 70% increase in flow.

Surface Water Map - GMMC28626AB

Environment Agency

Legend

- High
- Medium
- Low



0 100 200 300

Metres

N
W E
S

© Crown Copyright and database rights 2016 . Ordnance Survey 100024198.

Buro Happold Ltd
230 Lower
Bristol Road
Bath
Avon
BA2 3DQ

Our ref: SO/2017/117286/01-L01
Your ref: Manchester Mayfield

Date: 13 July 2017

Dear Mr Dannatt

PRELIMINARY OPINION - RIVER CORRIDOR SURVEY.
MANCHESTER MAYFIELD

Thank you for your enquiry regarding the matter of channel survey information which we received on 30th June 2017.

We would like to make the following comments.

Flood Risk

The 2011 Medlock model was based on an earlier version of the EAs River Medlock model. This was built using a survey from various earlier studies. We would have no objections to the use of the model in its existing state as the baseline case. However, we would recommend that you identify any obvious visual changes in the channel that depart from the current sections used in the model. These could be structures that have been removed or changed e.g. weirs, bridges etc.

If there are any changes, we suggest that sufficient information is gathered to represent these in the baseline model with an explanation of the changes provided in the model report.

Biodiversity

We would seek any such survey work adheres to the health and safety measures outlined in River Corridor Survey manual (1992, Section 5). However we would still recommend some form of river corridor survey of the current heavily modified River Medlock corridor to help inform future river rehabilitation proposals and provide a baseline to measure river corridor improvements proposed as part of any new riparian development. As a potential alternative, the survey of the urban channel corridor may be feasible using the River Habitat Survey methodology (http://www.riverhabitatsurvey.org/rhs-doc/the-survey/) to assess current riverine habitat quality, and could be potentially conducted later in season when vegetation has died

back, thereby allowing better and safer views of River Medlock corridor.

We trust you find these comments useful.

We now offer a voluntary charged for service where we can provide more detailed pre-application advice. More information can be found on our website: http://webarchive.nationalarchives.gov.uk/20140328084622/http://www.environment-agency.gov.uk/research/planning/33580.aspx

Yours sincerely

MRS LAILA BERRY
Planning Advisor

Direct dial 02030250761
Direct e-mail laila.berry@environment-agency.gov.uk

End

Rodoula Gregoriou

From: Telfer, Helen <helen.telfer@environment-agency.gov.uk>
Sent: 16 November 2017 12:07
To: Rodoula Gregoriou
Cc: Andrew Dannatt; 035548 Mayfield Regeneration Development
Subject: RE: Mayfield recommended floor levels

** External E-Mail **

Hi Rodoula

Thanks for the email – the regular catch up sessions are useful for us also.

I can confirm that we agree with your conclusion in relation to the flood resilience/resistance.

In terms of access/egress we suggest reference to the methodology for calculating UK flood hazard rating defined in the EA/ Defra research Flood Risk Assessment Guidance for New Development (FD2320) and the supporting Explanatory Note for FD2320 and FD2321. Access routes should preferably be dry or if this is not possible be of low hazard rating (white cells) in the matrix table.

HR	Depth of flooding - d (m)												
	DF = 0.5				DF = 1								
Velocity v (m/s)	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.0	0.03 + 0.5 = 0.53	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.13 + 0.5 = 0.63	0.15 + 1.0 = 1.15	0.20 + 1.0 = 1.20	0.25 + 1.0 = 1.25	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	
0.1	0.03 + 0.5 = 0.53	0.06 + 0.5 = 0.56	0.12 + 0.5 = 0.62	0.15 + 0.5 = 0.65	0.18 + 1.0 = 1.18	0.24 + 1.0 = 1.24	0.30 + 1.0 = 1.30	0.36 + 1.0 = 1.36	0.48 + 1.0 = 1.48	0.60 + 1.0 = 1.60	0.90 + 1.0 = 1.90		
0.3	0.04 + 0.5 = 0.54	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.19 + 0.5 = 0.69	0.23 + 1.0 = 1.23	0.30 + 1.0 = 1.30	0.38 + 1.0 = 1.38	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75			
0.5	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.25 + 0.5 = 0.75	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00			
1.0	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.38 + 0.5 = 0.88	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	0.90 + 1.0 = 1.90					
1.5	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.50 + 0.5 = 1.00	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00						
2.0	0.13 + 0.5 = 0.63	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	0.63 + 0.5 = 1.13	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00							
2.5	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.60 + 0.5 = 1.10	0.75 + 0.5 = 1.25	0.90 + 1.0 = 1.90								
3.0	0.18 + 0.5 = 0.68	0.35 + 0.5 = 0.85	0.70 + 0.5 = 1.20	0.88 + 0.5 = 1.38									
3.5	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.80 + 0.5 = 1.30	1.00 + 0.5 = 1.50									
4.0	0.23 + 0.5 = 0.73	0.45 + 0.5 = 0.95	0.90 + 0.5 = 1.40	1.13 + 0.5 = 1.63									
4.5	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	1.00 + 0.5 = 1.50	1.25 + 0.5 = 1.75									
5.0	0.28 + 0.5 = 0.78	0.60 + 0.5 = 1.10	1.10 + 0.5 = 1.60	1.38 + 0.5 = 1.88									

Thanks

Helen

From: Rodoula Gregoriou [mailto:Rodoula.Gregoriou@BuroHappold.com]
Sent: 16 November 2017 09:40
To: Telfer, Helen <helen.telfer@environment-agency.gov.uk>
Cc: Andrew Dannatt <Andrew.Dannatt@Burohappold.com>; 035548 Mayfield Regeneration Development <035548MayfieldRegenerationDevelopment@BuroHappold.com>
Subject: Mayfield recommended floor levels

Hello Helen,

How are you? Nice to talk to you and Matt a couple of weeks ago.

We are now considering the flood levels in more detail as the design progresses. I thought you might be able to help us on providing clarification on the EA advice with regard to finished floor levels. The following preliminary advice was given early in the design (as per attached document):

"We would recommend that floor levels (especially residential units) are set at least 600mm above the 1% AEP + 35% flood level and/or at the 1%AEP + 70%cc flood level whichever is the highest whilst also considering 0.1% AEP flood levels."

We will be setting the levels as per advice. Could you please clarify whether there is a requirement to raise levels to the 0.1% or what kind of consideration/ approach we should be following for up to those levels? Is the EA seeking for flood resilience/flood resistant approach to be followed between FFL and 0.1%, while ensuring safe access and egress to and from the site?

Kind Regards,
Rodoula

Rodoula Gregoriou
Engineer
BuroHappold Engineering
T: +44 (0)1225 320600
www.burohappold.com | @burohappold



This transmission is confidential and intended solely for the person or organization to whom it is correctly addressed. If you are not the intended recipient of this transmission, you should not take any action in reliance on it. Further, this transmission may contain confidential design and other information owned by Buro Happold Ltd. You should not copy, distribute, use, offer for sale or hire such information or in any way infringe the design and intellectual property rights of Buro Happold Ltd. It is intended that communication by email from Buro Happold Ltd or its employees is limited to communications connected to the services provided by Buro Happold Ltd. Buro Happold Ltd accepts no liability for any communications not connected to the services it provides. Computer viruses may be transmitted or downloaded onto your computer system via email communication. It is the recipient's responsibility to take any action necessary to prevent computer viruses being transmitted in this way. Accordingly, Buro Happold Ltd disclaims all responsibility which arises directly or indirectly from such transmission of computer viruses. Buro Happold Ltd. Registered in England: 2049511

This message has been scanned and no issues were discovered.
Click here to report this email as spam

Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else.

We have checked this email and its attachments for viruses. But you should still check any attachment before opening it.
We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.
Click here to report this email as spam

Meeting Notes

Project:	Mayfield Park and Associated Public Realm		
Subject:	Environment Agency Review Meeting		
Meeting place:	Deloitte Offices, 2 Hardman Street Manchester, M60 2AT	Meeting no:	001
Date and time:	07 February 2019 at 14:30	Minutes by:	Andreas Panourgias
Present:	Lalia Berry (LB) John Ruckledge (JR) Gary Morris (GM) Ian Austin (IA) Rodoula Gregoriou (RG) Max Aughton (MA) Carol Sutton (CS) Andreas Panourgias (AP) Michael Percival (MP) Hannah Graham (HG)	Representing:	Environment Agency (EA) Environment Agency (EA) Environment Agency (EA) BuroHappold (BH) BuroHappold (BH) Studio Egret West (SEW) Faithful+Gould (F+G) Faithful+Gould (F+G) Deloitte (Del) Deloitte (Del)
Apologies:	-	Representing:	-

ITEM	DESCRIPTION AND ACTION	RESPONSIBLE
1.	**Introductions and Apologies**	
1.1	Introductions were made.	Note
1.2	EA provided contact sheets of the team involved with Mayfield.	Note
1.3	F+G to provide contact sheets of the project team to the EA.	F+G

Next meeting:	TBA		
Distribution:	All present plus apologies		
Date issued:	15/02/2019	File Ref:	Job Number: 516 1138

NOTE TO RECIPIENTS:
These meeting notes record F+G understanding of the meeting and intended actions arising therefrom.
Your agreement that the notes form a true record of the discussion will be assumed unless adverse comments are received in writing within five days of receipt.

ITEM	DESCRIPTION AND ACTION	RESPONSIBLE
1.4	It was advised that the appointment documentation and contract has been signed and returned by Mayfield. All invoices should be issued in accordance with the Mayfield invoice procedure and copied to Carol Sutton at F+G for approval.	Note
2.	**Design Update**	
2.1	SEW presented a summary of the current design and BH provided Flood Risk Modelling update.	Note
2.2	Summary of the proposed programme for delivery of the scheme was provided by F+G.	Note
3.	**River Structures**	
3.1	Two new bridges are proposed across the river to replace the two existing, derelict structures. It was explained that the deck of the bridges will need to be below the Design Flood Level (DFL) for accessibility. While the EA normally require a 600mm freeboard above the DFL, the concept was accepted in principle. Hydraulic modelling is required to test the impact of the bridges. To ensure that design is open (i.e railings) as the two bridges are within the flood plain.	Note BH
3.2	The EA have no objection to the Baring Street Square proposals. Encourage the idea of large openings or transparent deck at locations to allow light through to the river.	Note / SEW
3.3	The Flood Modelling presented by BH was accepted by the EA with tolerances at +/- 10mm to 20mm. RG mentioned no change in extends. The development to be tested against the 1 in 100 +35%CC. The Baseline modelling files and hydraulic note have been prepared and will be issued for review w/c 11th of February 2019. This will take 4 weeks to validate.	BH
3.4	With regards to the proposal of stepping stones across the river, EA accepted this concept, but would not prefer installation of weirs. Accumulation of debris behind stones should be considered and to ensure it does not impact flood risk, this needs to be the subject of a management strategy.	SEW / BH
3.5	In terms of breaking the height of Retaining Walls, EA stated that a Bioengineered solution at both levels would be preferred, if it is possible to make it work. Plan showing the current versus the proposed design to be provided to the EA. *Post-meeting note:* To invite the EA team for a site walk to gain better appreciation of the improvements.	BH F+G
3.6	Hard Edge Walls result in high energy flows, which would impede introduction of intertidal planting. To consider smoothening the edges to more natural edges.	SEW / BH
3.7	Any outfalls to the Medlock would be approved by Manchester City Council (MCC) but would need a permit from EA to install.	Note
3.8	EA would like to see more detail about the improvement and ecological aspects with regards to the river corridor.	BH
3.9	Safety around river is the owners responsibility.	Note

ITEM	DESCRIPTION AND ACTION	RESPONSIBLE
3.10	In terms of the access for maintenance, a 5m vehicular access is required. The Design Team to issue marked up access plan for EA. Plan to be provided for further discussion.	Note SEW / BH
3.11	The concept of building on Plot F, over the culvert, would not be the preferred option by the EA, since this might cause issues for stability and maintenance of culvert if new structures are built over. The Project Team is to send a pack of information to explain the above concept further to the EA, including access for maintenance arrangements. The pack is to include the historic building over the culvert. *Post-meeting note:* GM was taken on site on 14/02/2019. GM explained there is no biodiversity benefit from the proposed landscaping at Hoyle Street East compared to opening up the culvert.	Note SEW / BH SEW / BH
3.12	Gabions would not be the preferred option from an EA perspective. This is due to previous failure of baskets and infill.	Note
4.	**Next Meeting**	
4.1	Next meeting to be arranged.	Note

U and I Group Plc
7a Howick Place
London
City of Westminster
SW1P 1DZ

Our ref: SO/2019/119024/03-L01
Your ref: Mayfield

Date: 08 March 2019

Dear Sir/Madam

CHARGED ADVICE MAYFIELD STRATEGIC SITE - COMMENTS TO MEETING NOTES.
BARING STREET, MAYFIELD.

Thank you for accepting our offer to meet with you on 7th February 2019 to discuss the Mayfield development.

We are providing this advice under Agreement No. ENVPAC/1/GMC/00126. Please note we have taken 6 hours to attend the meeting and provision of the following meeting notes.

With regard to flood risk we would make the following comments in relation to the minutes.

3.1 – Where construction of new footbridges is not feasible above design flood level, flood flow routes around the footbridges must be considered. It would be preferable to have the soffit at least 600mm higher than the top of the bank on both sides of the river where possible. The bridges must also be fixed to prevent them floating off their bearings during a flood.

3.2 – We would generally seek the minimum amount of structures crossing the river. However, we would not object to the Baring St square pedestrian crossing subject to soffit being at least 600mm above design flood level (1 % AEP + 35% CC allowance). There will always be an Agency preference to keeping new river crossings to as short as possible to retain as much open channel.

3.6 - Any opportunities to open up River Medlock corridor and remove existing canalisation would be welcome, as this would reduce in channel flow rates and scour risk, and provide greater ability for any new marginal planting to persist.

3.7 – The principles of surface water drainage, discharge rates and provision of SuDS is within the remit of the Lead Local Flood Authority. Construction of outfalls to the river

may require a permit from the EA. These can be included with details of the wider channel proposals that will require a “bespoke” flood risk activity permit.

3.11 – As discussed in the meeting, we would encourage you to avoid proposals that included buildings sited above the existing culverted sections of the river. Whilst you could look to show that flood risk would not be made worse by such proposals we would not consider this to be a sustainable approach to development. It would also seem a departure from the principles of the wider scheme which is seeking to open up the River Medlock and create a new city park. The Agency seeks to avoid construction of buildings or carrying out other development over culverts for a number of good reasons including:

(i) Access for maintenance would be prevented, or further restricted
(ii) Building may block overland flood routes which are important in the event of culvert blockage
(iii) In the event of structural problems, or insufficient hydraulic capacity, re-building of a culvert that has been built over could be impossible or not economically viable
(iv) A building might impose loads on a culvert beneath it, which could lead to collapse of the culvert and flooding of property
(v) Collapse of a culvert could seriously affect the stability of the building over or next to it
(vi) Such a development could be a precedent, leading further riparian development wanting build over existing culverted sections of river.
(vii) Would not be in adherence with SRF objectives for Mayfield

We would also clarify that any development within 8 metres of the River Medlock (including building over the culvert) will require a flood risk activity permit from the Environment Agency.

Gary Morris has met with the scheme ecologist on site to discuss ecological matters, and undertook a brief tour of site on 14th February. It was suggested, based on this visit, instead of revised options of putting plot F over the River Medlock, that there may be opportunity to re-align the current Hoyle Street crossing; which is as Agency understands to be just for occasional emergency vehicle access; closer to existing railway arches – thereby allowing for a continuous and uninterrupted river park area, and relocating the plot F site back to the original left hand bank area (as per SRF), whilst retaining pedestrian access under viaduct via existing Chapelfield Road. Buro Happold said they would also relay this potential option to design team.

We have previously outlined our overall support for the aspirations of the Mayfield development. That view may change if we are asked to agree to proposals that depart from our general principles and given our positive engagements with the project team, we are keen to work with you to find a solution.

I hope the above advice is helpful. If there is any further work you anticipate needing our detailed advice on in relation to this project please let me know so it can be incorporated into this charging agreement.

Yours faithfully

Cont/d..

MRS LAILA BERRY
Planning Advisor

Direct dial 02030250761
Direct e-mail laila.berry@environment-agency.gov.uk

Disclaimer
Our opinion is based on the information available to us at the time of the enquiry. When the formal planning application is submitted, our position may change if there have been changes to environmental risk or evidence, and/or planning policy

End

Buro Happold Limited
230 Lower Bristol Road
Bath
Avon
BA2 3DQ

Our ref: SO/2019/119024/05-L01
Your ref: Mayfield

Date: 17 July 2019

FAO: Rodoula Gregoriou

Dear Ms Gregoriou

ENVPAC/1/GMC/00126 - MAYFIELD STRATEGIC SITE - DOCUMENTATION REVIEW - HYDROLOGY ASSESSMENT. BARING STREET, MAYFIELD.

Thank you for your email of the 26th June 2019 and your hydrology review report dated 25th June 2019.

It has not been possible at the time of writing this letter to confirm the time used under ENVPAC/1/GMC/00126 as part of this review and response however, I will forward details regarding this matter in due course.

Our modelling and forecasting team have reviewed the report and most of the main queries regarding hydrology, raised in the previous baseline model review, have been addressed.

Our hydrology reviewers have commented that Paul Garrad seems to have done a thorough review of the inflows to the modelled reach but they have also made a few comments on the downstream inflows to the modelled reach. Based on our colleagues' comments, it would appear the updated hydrology assessment would be acceptable for use in the hydraulic modelling of the development proposals.

Our reviewers observations are as follows however, please note that the queries raised could be answered within the overall FRA especially in relation to potential risk to the development from sewer exceedance.

--
Reviewer Comments

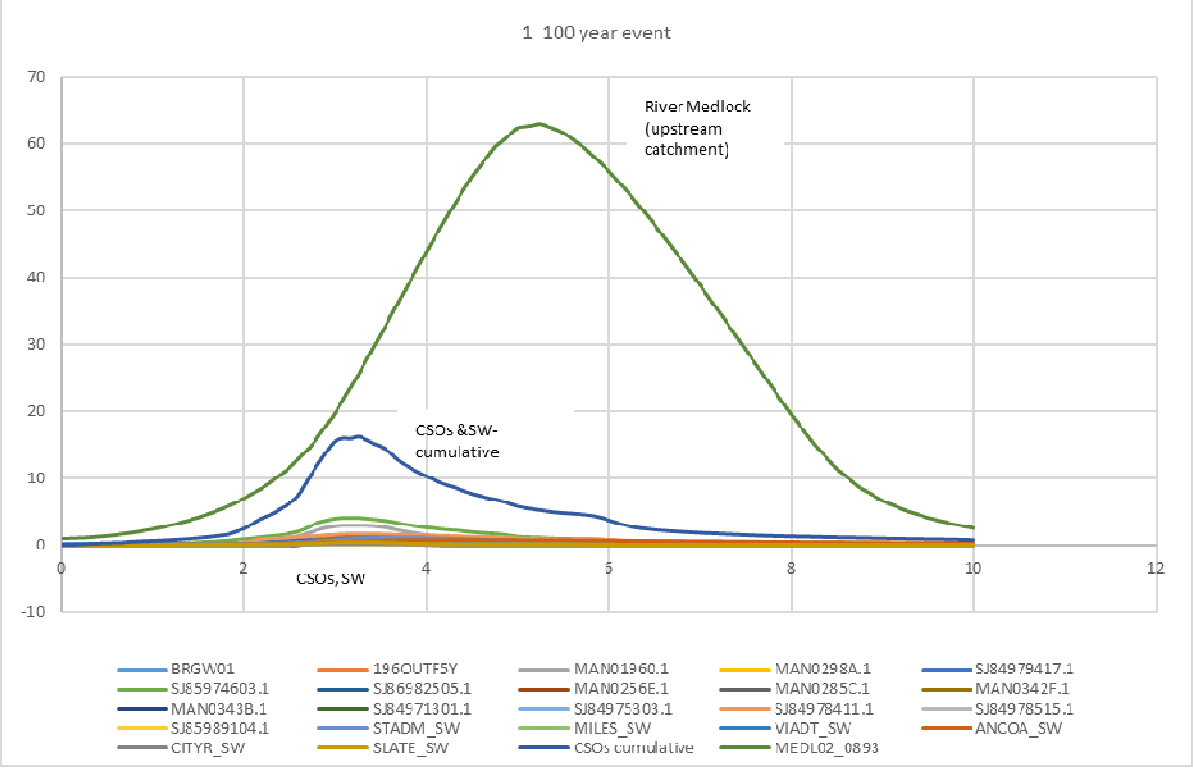
Paul Garrad has provided a thorough review of the estimation of the inflow hydrographs at the upstream end of the modelled reach.
The queries Paul Garrad raised in his review have been addressed in the following attachment.

The upstream catchment is 48 sq km, which is the larger part of the whole Medlock catchment, which has a total area of 58 sq km. Section 4.7.1 of the 2009 report states design flows from the CSO's and surface water sewers were estimated using InfoWorks and the United Utilities models, with design UCWI and rainfall profiles critical to the River Medlock used as inputs.

Flows were not estimated for the downstream limit of the study reach using a lumped catchment approach. This is because the downstream reaches of the catchment are significantly urbanised. It was considered more accurate to estimate the flows from the

urban area using InfoWorks, rather than to scale lateral inflows to match flow estimates at the downstream extent of the model reach. Presumably the flow from the upper catchment dominates the flows in the modelled reach, but it would be useful to know whether these inflows have been generated from the same design rainfall events that have been used to generate the river inflow hydrograph. This would be the logical approach to ensure that the two sets of hydrographs interact in a realistic way.
BuroHappold did not review the Atkins/UU model that derived the combined sewer inflows. Details of the rainfall events used in the analysis is not known, but assumed to correlate with the different return periods. To allow for the latest guidance on climate change, the 1 in 100 year inflows were increased by 35%, similarly to the river inflow hydrograph.

Rainfall profiles might have been developed independently for the Infoworks catchments, although the report says that Atkins provided the rainfall profiles to United Utilities in order to run their model, and so it is likely that they would have provided profiles appropriate to the whole catchment, as implied by the extract above. It may be that the downstream inflows have little impact on the peak flows, as they may have peaked and receded before the upstream peak arrives; it would be good to confirm if this is the case.
Inspection of the river inflow hydrograph indicates that the peak flow occurs at approximately 5 hours after the start of the storm event. The CSOs and stormwater inflows peak at approximately 3 hours as shown in the chart below:



Section 13.14 of the 2009 report, 'Limitations of the model and potential future use', states that *'this model on its own does not adequately represent the total risk of flooding to properties in the area, as it ignores the impact of the sewerage network except in so far as it contributes flow to Corn Brook.'*

The Corn Brook south of the Medlock seems to produce a large area of flooding, and so perhaps the risk from other sources of flooding needs to be considered in the Mayfield Masterplan area, if it isn't being considered already.
This will be considered within the Flood Risk Assessment.

Cont/d..

If much of the catchment is drained by combined sewers, then presumably flows in the river will be lower than might otherwise be expected, as runoff from less intense rainfall will be carried away to the STWs, and the considerable combined sewered areas will only start to make a contribution when the CSOs start to spill? Could this affect the growth curve derived from gauged data?
The growth curve for the river inflow was derived using pooling group from many gauging stations rather than using one station. It is not known how the CSO flows were derived in the UU model. It is assumed that for the Design Flood Event the CSOs drain into the river at full capacity.

When sewer capacity is exceeded, will excess water be able to make its way overland to the river or will built obstructions keep much of it in storage until sewer capacity becomes available? In that is the case then extreme flood peaks in the river might be reduced.
For the Design Flood Event it has been assumed that if the sewers surcharge they will become overland flow and follow the topography. As a result, LiDAR data was used to define the overland runoff area to the upstream river inflow point, and did not include the area served by the sewer system. It is not known whether built obstructions may attenuate overland flood flows.
--

Further to above, should you have any queries regarding this response then please do not hesitate to contact me.

Yours faithfully

Mr Andy Davies
Sustainable Places Advisor

Direct dial 02077140640
Direct e-mail andy.davies1@environment-agency.gov.uk

End

Buro Happold Limited
230 Lower Bristol Road
Bath
Avon
BA2 3DQ

Our ref: SO/2019/119024/06-L01
Your ref: Mayfield

Date: 05 September 2019

FAO: Nilani Venn / Rodoula Gregoriou

Dear Nilani / Rodoula

ENVPAC/1/GMC/00126 - MAYFIELD DEVELOPMENT - MASTERPLAN PROPOSAL – REVIEW - HYDRAULIC MODELLING REPORT

BARING STREET, MAYFIELD.

Thank you for forwarding your modelling report (ref: 042912 issue 00) for review. Please be aware that we have used 3.5 hours of charge agreement ENVPAC/1/GMC/00126 in order to review the submitted report and provide this response.

It should also be noted that we have reviewed the content of the report only, based on our most recent review of the detail for the baseline model.

Environment Agency Commentary – Hydraulic Modelling Report

With regard to the modelled return periods, we agree that the design flood event for assessing compensation and floor levels would be the 1% AEP 35%cc event. However, we would strongly recommend that the FRA supporting the development should also consider the impact of the extreme 0.1% AEP event, as advised in our earlier response to you, see letter ref: SO/2016/116601/01-L01 dated 17/11/2016 for details. The FRA must show that development would be safe in these events. We also note from your previous hydrology update report that you have the flows for the extreme event and suggest the model is run for this to also refer to in the FRA.

Tables E.2A and 2B set out the changes made to model files to represent the development. Reference is made to the changes at the “downstream end of the site to enforce constriction at Baring Street bridge”. Some further explanation of what this consists of in relation to the proposals would be useful. Presumably this is to off-set the impact of removing the building culvert within the site and will be covered in more detail within the FRA.

We note the adjustment of the mannings ‘n’ value for banks in the masterplan proposal based on them being well maintained. Without seeing the overall proposals for the new channel this is difficult to comment on but it may be more appropriate to leave it consistent with the baseline model for comparison purposes. Additionally, if the proposals are to reduce the extent of walled channel and introduce more natural planting to the river margins and corridor, reducing the roughness may not be appropriate.

With regard to the modelled changes in flood levels resulting from the development, these appear negligible upstream and downstream of the development site. We therefore would be unlikely to raise objection, subject to seeing full details and the FRA

at the planning application stage.

Should you have any queries regarding this response or wish to discuss the matters raised further, then please do not hesitate to contact me.

Yours faithfully

Mr Andy Davies
Sustainable Places Advisor

Direct dial 02077140640
Direct e-mail andy.davies1@environment-agency.gov.uk

End

Appendix D Hydraulic Modelling Report, BuroHappold 2019

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

BUROHAPPOLD ENGINEERING

Mayfield Park, Manchester

Hydraulic modelling report

042912

13 September 2019

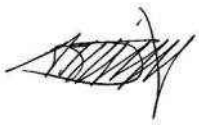
Revision 01

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Revision	Description	Issued by	Date	Checked
00	Final for review	RG	15/08/2019	AT
01	Final *(EA comments addressed)*	RG	16/09/2019	AT

O:\0042912 Mayfield Park Manchester - GE\F34 Water\03 Reports\190729 Modelling report to EA\Issue 01\190916 RG 042912 Modelling report 01.docx

This report has been prepared for the sole benefit, use and information of Mayfield Development Partnership LP for the purposes set out in the report or instructions commissioning it. The liability of Buro Happold Limited in respect of the information contained in the report will not extend to any third party.

author	**Rodoula Gregoriou**
date	**16th September 2019**
approved	**Alan Travers**
signature	
date	**16th September 2019**

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Contents

1 Executive Summary 10

2 Introduction 11

2.1 Introduction 11

2.2 Summary of Hydraulic Model Development 11

2.3 Structure of report 12

3 Hydrological Assessment 13

3.1 EA Medlock Model overview 13

3.2 Summary of Hydrological Assessment 14

3.3 Design Flood Event 14

3.4 Peak Flow 14

4 BHE Baseline 2019 model 15

4.1 Summary of review and changes 15

4.2 Updates in topography 16

4.3 Review of section widths and bank levels 17

4.4 Addition of bank markers 19

4.5 Review of structures 19

4.5.1 Unaccounted structures 19

4.5.2 Invert levels, orifice setting and spills 20

4.6 Existing site layout 22

4.7 Results 23

5 Mayfield 2019 model 27

5.1 The Mayfield Vision 27

5.1.1 Client objectives 27

5.1.2 Stakeholder objectives 27

5.1.3 The design response 27

5.2 Proposed development 28

5.3 Modelling the Mayfield proposals 29

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

5.3.1 Representation of hydraulic structures 29

5.3.2 Representation of river channel 30

5.3.3 River and floodplain roughness 31

5.4 Results 32

5.4.1 Design Flood Event 32

5.4.2 Other flood events 37

5.5 Sensitivity Testing 38

6 Conclusion 39

Appendix A EA Medlock model documentation

Appendix B Hydrology

Appendix C Site Surveys

Appendix D Modelling changes

Table of Tables

Table 4-1 - Summary of key differences between the EA Medlock 2011 model and the BHE Baseline 2019 model 15

Table 4-2 - Bridge checks and changes 21

Table 4-3 – Culvert checks and changes 22

Table 4-4 – Flood levels for the DFE (u/s – upstream, d/s – downstream) 25

Table 5-1 - Structures in the Mayfield site and their representation in the Mayfield 2019 model 29

Table 5-2 – Flood level changes due to proposals for the DFE, Mayfield site *(results based on updated model, following EA review)* 33

Table 5-3 – Flood level changes due to proposals for the DFE, upstream of the Mayfield site *(results based on updated model, following EA review)* 36

Table 5-4 – Flood level changes due to proposals for the DFE, downstream of the Mayfield site *(results based on updated model, following EA review)* 37

Table of Figures

Figure 3.1 Hydraulic modelled watercourse and associated catchment extents (source: River Medlock SFRM, 2009) 13

Figure 4.1 - Photos from past site visits 16

Figure 4.2 - 1D space at Mayfield site (blue – Medlock 2008 model, yellow – BHE Baseline 2019) 17

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Figure 4.3 - 1D space around Pin Mill Brow area (blue – Medlock 2008 model, yellow – BHE Baseline 2019) 18

Figure 4.4 - MEDL01_3562 1D cross section (left - Medlock 2008, right - BHE Baseline) 18

Figure 4.5 - Channel section at Helmet Street Industrial Park access bridge (Atkins, 2008) 19

Figure 4.6 - Channel section at Hoyle Street Industrial Estate access bridge (Atkins, 2008) 20

Figure 4.7 - Mayfield site - existing assets. Open watercourse shown in blue. 23

Figure 4.8 – BHE Baseline 2019 flood extents for the 1 in 100yr event +35% climate change, modelling area. Site location indicated in red circle. 24

Figure 4.9 – BHE Baseline 2019 flood extents for the 1 in 100yr event + 35%CC, Mayfield site showing direction of flow and location of existing culvert (in green). 25

Figure 4.10 – Flooding mechanism across Mayfield site, existing flow condition at various timesteps following start of storm event. Light blue to red indiates relative increase in flow rate. 26

Figure 5.1 – Development flood risk management principles 28

Figure 5.2 – Changes in levels across the site due to the Mayfield development proposals (proposal outlines shown above) 29

Figure 5.3 – Example cross section illustrating difference in Baseline and with proposals scenario at MEDL01_2429. 30

Figure 5.4 – Flooding mechanism across Mayfield site, proposed flow condition at various timesteps following start of storm event. Light blue to red indiates relative increase in flow rate. 32

Figure 5.5 - Changes in flood extents due to the Mayfield proposals during the DFE, site surroundings 33

Figure 5.6 - Comparison of change in peak flood level and flow due to proposals shown approximately 1km upstream and downstream of the site (data taken between 1D Nodes MEDL01_3301L to MEDL01_1377A). 35

Figure 5.7 – Comparison of Mayfield 2019 model to the BHE Baseline 2019 model, flood extent changes for the DFE, upstream of site. 36

Figure 5.8 - Comparison of Mayfield 2019 model to the BHE Baseline 2019 model, flood extent changes for the DFE downstream of site. 37

Figure 5.9 - Changes in flood extents due to the Mayfield proposals during the 1 in 25 year event, site surroundings 38

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Glossary/Abbreviations

Term	Definition
BHE Baseline 2019	The up-to-date hydraulic model for River Medlock developed by BuroHappold Engineering in 2019
DFE	Design Flood Event (1 in 100 year flood event with an allowance for climate change)
EA	Environment Agency
EA Medlock 2009 / 2011	The hydraulic model developed by the EA in 2009 and updated in 2011 for the assessment of flood risk from River Medlock.
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
m AOD	Metres Above Ordnance Datum
Mayfield 2019	The hydraulic model used to assess the impact of the Mayfield proposals in term of flood risk. Based on the BHE Baseline 2019 model.
MCC	Manchester City Council
SFRA	Strategic Flood Risk Assessment

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

1 Executive Summary

This hydraulic modelling report describes the process followed by BuroHappold Engineering (BuroHappold) to assess the proposals for the redevelopment of the Mayfield area in Central Manchester in terms of flood risk, and to test and inform appropriate mitigation options. The intended use of the models described in this report are for planning purposes for Mayfield site only.

The proposals for Mayfield were set out in the a Strategic Regeneration Framework document issued in February 2018 and adopted by Manchester City Council later that year. At the centre of the area it is proposed to create a new urban park. The River Medlock flows from east to west at the centre of Mayfield and the Park will be created either side of the river. The vision is to regenerate the river by removing a culvert and the high river walls where possible and replacing them with natural banks to create a blue green ecological corridor through Mayfield. The park will also create a remodelled flood plain for the River.

The changes to the river and its floodplain need to be assessed through hydraulic modelling to ensure the development proposals have no adverse impact in terms of flood risk, in and off site.

The model developed for this study has been based on the River Medlock SFRM 1D-2D model developed by the EA in 2009 and updated in 2011 (referred to as the EA Medlock 2011 model). BuroHappold has previously updated the EA Medlock 2011 model with the site topography to create a new baseline for Mayfield site. The EA reviewed this baseline model and provided comments, some relating to the hydrology. This report presents the new updated baseline model (referred to as the BHE Baseline 2019 model), following the recommendations by the EA and a review of the hydrology.

The BHE Baseline 2019 model has incorporated an updated topography for Manchester centre, amendments to hydraulic structures according to the latest guidance and use of latest software and methodologies.

The Mayfield proposals have been represented in the 'with scheme' model, the Mayfield 2019 model. This model is based on the BHE Baseline 2019 model. The proposals have been represented in both 1D (in-channel) and 2D (floodplain) spaces as appropriate.

The impact of the proposals in terms of flood risk to upstream and downstream areas during the Design Flood Event (DFE) was found to be negligible. The peak flood levels are shown to change by <1mm within channel in the upstream extent, and less than 10mm downstream. These changes in flood peak levels in the areas outside the site are attributed to modelling tolerances.

The model demonstrates a general decrease in levels within the Mayfield site by approximately 400mm. This decrease in level is due to the wider river channel and extensive floodplain created within the site. Local increase in levels is observed downstream of the removed culvert due to the changes in the flood mechanism within and at the proximity of the site. Other flood events have also been modelled, demonstrating negligible changes in peak levels outside the site.

The analysis described in this report demonstrates that the Mayfield development has negligible impact in terms of flood risk from River Medlock to areas outside the site boundary and positive impact in decreasing flood risk within the site. Further, it provides significant benefit in terms of a naturalised urban river channel, environmental, ecological and amenity improvements.

Assessment of flood risk from other sources and exceedance events, provision of safe access and egress, and other site specific flood mitigation measures will be discussed in the FRA that will be submitted for planning in September 2019.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

2 Introduction

2.1 Introduction

BuroHappold has been commissioned by Mayfield Development Partnership LP to undertake hydraulic flood modelling to assess the impact of the proposed Mayfield Masterplan with regard to flood risk within the site and elsewhere in Manchester. The proposed development is for a mixed-use scheme including residential and commercial whilst regenerating the site to provide green, open space, integrating the river corridor for public recreational land use.

A Strategic Regeneration Framework was submitted by Mayfield Development Partnership LP to Manchester City Council (MCC) in February 2018. As part of the SRF feasibility study, initial hydraulic modelling work was undertaken by BuroHappold to provide a preliminary assessment of the hydraulic flood impacts of the proposed masterplan by testing various potential mitigation measures. This was based on updating an existing EA hydraulic flood model for the River Medlock (see reports in Appendix A). The principle and strategy was discussed with MCC following their review and with the Environment Agency. The recommendations and strategy as agreed by all parties has been further developed and used to inform the detailed design for the site.

The detailed planning application has now been developed and is scheduled to be submitted to MCC in September 2019. To assist the planning decision process, the EA have agreed to review the hydraulic flood model and the proposed masterplan ahead of the planning submission.

The EA have to date reviewed the baseline hydraulic model and provided comments to BuroHappold. Subsequently, it was suggested that the hydrology was also reviewed and updated. A hydrological analysis was therefore undertaken by BuroHappold and this has also now been reviewed and accepted in principle by the EA. This report summarises both the amendments that were made to the baseline hydraulic model and the hydrological analysis with a description of how the EA comments have been addressed.

This report also describes the proposed masterplan hydraulic model build and comparison of the outputs to the baseline model. The results of the proposed hydraulic model have been used to inform the masterplan design and therefore approval is sought from the EA on the appropriateness of the model build to ensure the masterplan is safe for all users now and in the future.

2.2 Summary of Hydraulic Model Development

To ensure the development proposals were appropriately represented and assessed, the following steps have been undertaken since receiving the EA River Medlock hydraulic flood model:

- Creating an up-to-date baseline hydraulic flood model by:
    - Reviewing the hydrology using the latest recorded data and methodologies, as well as incorporating the latest recommended allowances for impact of future climate change.
    - Obtaining and incorporating the latest topographic data for the site.
    - Reviewing representation of hydraulic structures within the model based on latest best practice.
    - Simulations set up to run using the latest versions of software and most appropriate 2D grid resolution.
- Initial consultation with Mayfield Development Partnership LP to ascertain vision for the site and identify how the site can be developed to maximise flood mitigation options.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

- Consultation with the EA to establish their objectives and concerns with re-development with regard to environmental impacts and flood risk to surrounding area and establish Design Flood Event to inform design levels.
- Creating proposed masterplan hydraulic model by:
    - Using results of the baseline hydraulic flood model to inform the setting of building levels.
    - Amending the topography within the site area to provide appropriate flood compensation areas whilst keeping development safe.
    - Review of the change in flood mechanism to ensure that the proposals do not have an adverse impact on surrounding areas.
    - Sensitivity tests to ascertain model suitability.
- *Final refinement of the masterplan model, following review of the Hydraulic modelling report v00. The comments were received on 05/09/2018. Changes to the model and report as a response to the review are indicated in red italics text. In addition, the spill level of the new bridge at MEDL01_2510H was corrected.*

2.3 Structure of report

This report structure is as follows:

- Section 3 – Hydrological Assessment
- Section 4 – Baseline 2019 model build and results
- Section 5 – Masterplan 2019 model build and results
- Section 6 – Summary and conclusion

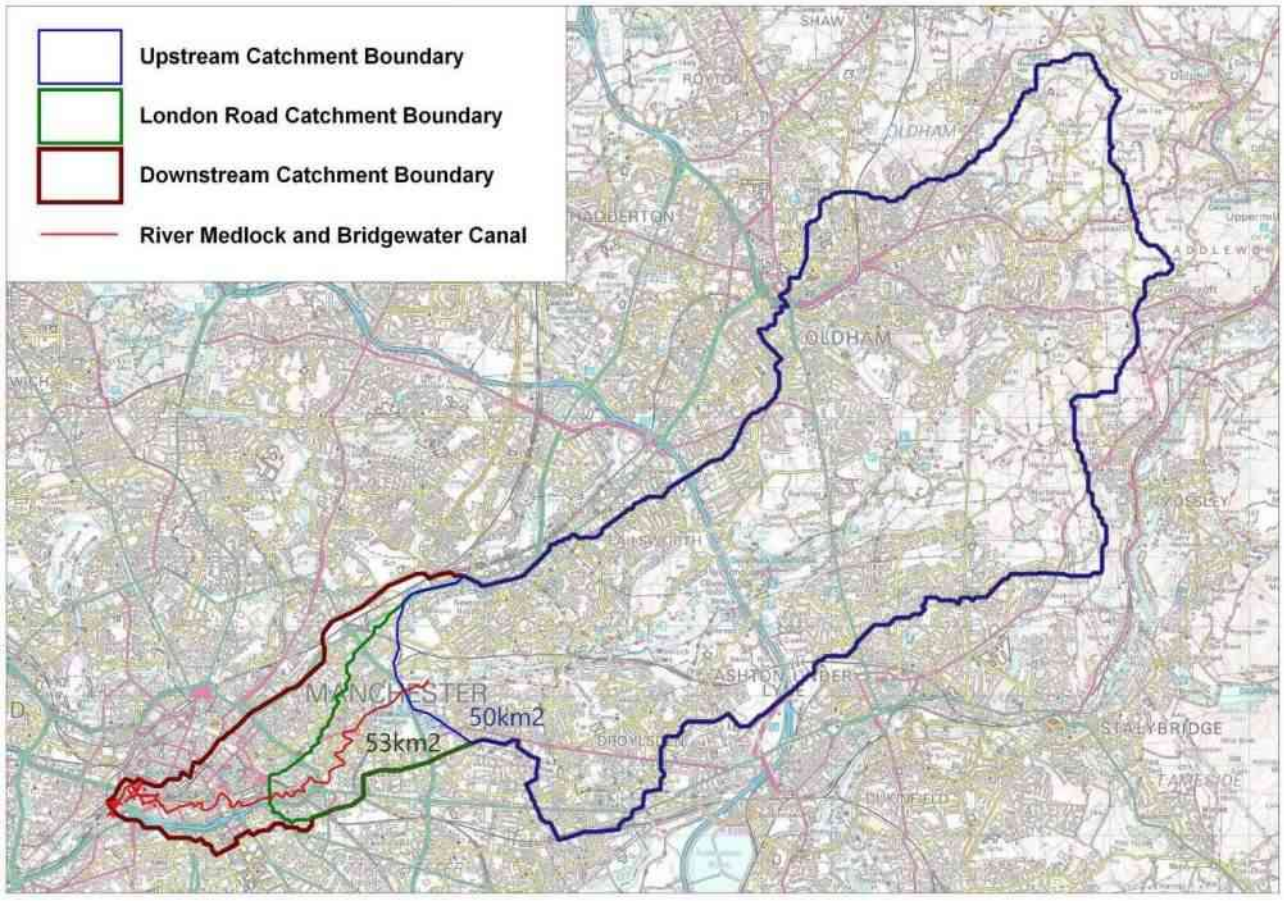
Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

3 Hydrological Assessment

3.1 EA Medlock Model overview

In 2009 the EA created a 1D hydraulic model as part of the River Medlock Strategic Flood Risk Mapping Study. The hydraulic model was subsequently updated in 2011 to include the 2D domain for the purpose of estimating flood extents from the River Medlock and Corn Brook to inform the Manchester Strategic Flood Risk Assessment (SFRA) (referred to in this report as the EA Medlock 2011 model). The 1D model and the hydrology remained the same between both the 2009 and 2011 models.

The upstream inflow of the model drains a catchment area of approximately 50km^2(see figure below). The catchment drains both rural agricultural areas and some urban areas. An existing gauging station is located in the catchment at London Road.



This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the controller of Her Majesty's Stationary Office © Crown copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Environment Agency, 100026380, 2009.

Figure 3.1 Hydraulic modelled watercourse and associated catchment extents (source: River Medlock SFRM, 2009)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

The flows from the upstream catchment (blue) are applied as an FEH Inflow Boundary in Flood Modeller (previously ISIS software) at the upstream extent of the River Medlock model. Sewer outfalls to the river are represented as 15 lateral inflows, with 6 additional inflows representing surface water runoff inflows. It is understood that these inflows were estimated from the Unitied Utilities' (UU) InfoWorks model which appears to have been adjusted for each modelled rainfall event.

An artificial baseflow was applied at the upstream end of Bridgewater Canal to enable the model to run. A minimum flow of 0.25 m^3/s was used for all modelled events. The model reports are included in Appendix A.

3.2 Summary of Hydrological Assessment

A hydrological assessment of the methodology and data used by the EA in 2009 was undertaken by BuroHappold in June 2019. The assessment reviewed the estimation of flows from the 50km^2 upstream catchment Details of the hydrological assessment as well as comments made by a third party reviewer and the EA's review can be found in Appendix B. Comments have been provided in the appendix to any queries raised during the reviews.

Analysis of the preferred method outlined for the EA Model 2009 has been undertaken as part of the study. An analysis of the FEH statistical method was carried out for the purposes of comparison using the latest data available, software versions, and methodologies. The assessment included the following:

- Derivation of upstream catchment area based on latest LiDAR topographic data.
- Obtaining FEH catchment characteristics.
- Review of donor site applicability for QMED estimation.
- QMED estimation.
- Derivation of flood frequency growth curve.
- Estimation of Design Flood Event.
- Derivation of inflow hydrograph.

A full description of the hydrological analysis can be found in Appendix B.

3.3 Design Flood Event

To ensure the proposed development is safe for uses now and in the future, the 1 in 100 year return period has been adopted to define the Design Flood Event (DFE).

Based on the EA's latest guidance on climate change, 2016, an increase in flows of 35% has also been made to account for climate change. This is the allowance outlined for the 'Higher Central' category for development with a design life up to 2115. This allowance has been agreed with the EA through early consultation.

3.4 Peak Flow

The hydrological analysis estimated the peak flow at the upstream point of the model to be **85.2m^3/s** for the DFE. The hydrograph used in the EA Medlock 2011 model was scaled to this peak flow. The hydrograph shape was not amended as it had been calibrated as part of the 2009 study and is still considered appropriate.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

4 BHE Baseline 2019 model

4.1 Summary of review and changes

Following receipt of the EA comments in March 2019, the following changes were applied to the EA Medlock 2011 model to improve its quality.

Table 4-1 - Summary of key differences between the EA Medlock 2011 model and the BHE Baseline 2019 model

Model element	EA Medlock 2011	BHE Baseline 2019 model
Model reference	Medlock_SFRA_v0e_MM_002	Medlock_SFRA_v0e_MM_002_BH_305
Software	ISIS 3.3.0.88 TUFLOW 2009-07-AE-iSP	Flood Modeller 4.4.1 TUFLOW 2018-03-AD-iSP
Grid cell size	4m x 4m	3m x 3m - smaller grids (1m or 2m) proved to be problematic due to the quality of the EA LiDAR data outside of the site area
Model timestep	1D timestep: 2s 2D timestep: 1s	1D timestep: 1s 2D timestep: 2s
Model simulation time period	Start time: 0hrs Finish time: 10hrs	Start time: 0hrs Finish time: 10hrs
Modelled return periods	1 in 25, 100, 100+25%, 1000 year flood events	1 in 25, 75, 100, 100+35% year flood events
Digital terrain model	Filtered 1m resolution LiDAR data (unknown date of survey)	Updated 1m resolution LiDAR data provided by the EA in 2019 Mayfield site topographic survey completed by Malcom Hughes, July 2017 (Mayfield survey 2017)
Channel survey	Data not received from EA	No further survey was undertaken due to accessibility issues
Information on hydraulic structures	Survey completed by Atkins consultants Ltd, July 2008 (Atkins, 2008)	No additional data made available

Other recommended minor improvements have been made to the Baseline model, as listed below:

Changes done in 2D space:

- Removal of demolished buildings within and around site
- Amended materials to reflect removal of buildings

Reviews between 1D and 2D spaces:

- Improve bank height consistency between 1D and 2D inherited from 2011 model
- Improve channel width consistency between 1D and 2D inherited from 2011 model

Changes in 1D space:

- Adjust bank heights based on updated topographic data
- Add bank markers to upstream sections
- Apply orifice setting to surcharged bridges

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

4.2 Updates in topography

A topographic survey for the site was conducted by Malcom Hughes in July 2017 (referred to hereafter as Mayfield survey 2017) and the elevation information has been provided to BHE in 3D format. The data was processed in earthworks package 12d to create the 2d_zpt_MayfieldSite.12da surface which has been read directly into the BH baseline model to represent the site topography in greater detail. A DEM version has now been produced and shared with the EA to enable external reviews. Please find the topographic survey in Appendix C

Since the EA Medlock 2011 model was issued, some buildings near the site have been demolished. Changes to the materials have been applied to amend the roughness coefficient of the buildings to manmade surfaces.

The levels at the top of bank recorded during the Mayfield survey 2017 were used to adjust the bank levels in the 1D and 2D spaces within the site, as well as the width of the 1D space.

Site walkovers along the channel and within the site have been undertaken during the past 3 year. There were no noticeable changes to the river channel and hydraulic structures within the site since the EA Medlock 2011 model. Therefore the channel data within the 1D domain of the BH Baseline model are mainly maintained as per the existing model. Photographs of the River Medlock within the Mayfield site can be seen below.



A. Siltation and vegetation building up on one side of the river (Photograph taken facing West)



B. Dense vegetation has caused damage to the river walls (Photograph taken facing East)



C. Access footbridge over River Medlock



D. Steel beam footbridge over River Medlock located

Figure 4.1 - Photos from past site visits

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

An up to date LiDAR dataset was provided by the EA in March 2019 for hydraulic modelling purposes. The new DEM (New_DTM_Mosaic_for_Manchester.TIF) has been used to replace the surface previously used in the EA Medlock 2011 model (2d_zpt_Medlock_F4m.MID).

4.3 Review of section widths and bank levels

A review of the channel width within the 1D nodes against the 2D inactive space was undertaken for the areas upstream and within the site. These were reviewed against the new Lidar data, the original structures topographic survey completed by Atkins in 2008 and the site-specific topographic survey.

The focus of the review was around the areas where the flood levels overtop the 1D banks and enter the 2D domain. The following areas were found to require amending.

Mayfield site

Following the review of the 1D nodes against the 2D inactive space and using the Mayfield topographic survey, minor adjustments were carried out to the 2D inactive space shape file, as shown in Figure 4.2. These adjustments had negligible impact in terms of flood levels or extents.

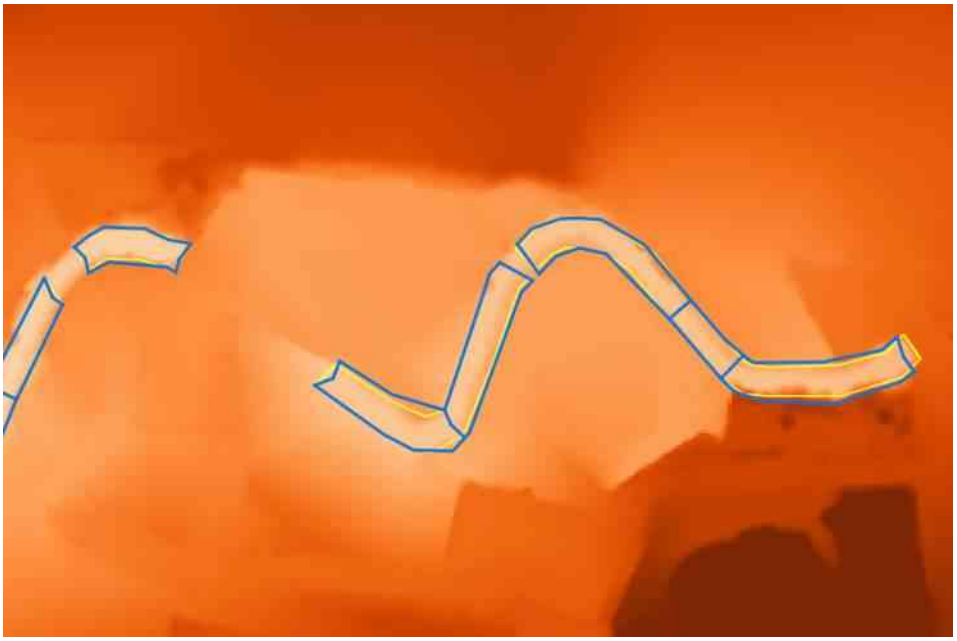


Figure 4.2 - 1D space at Mayfield site (blue – Medlock 2008 model, yellow – BHE Baseline 2019)

Pin Mill Brow to Helmet street culvert:

The stretch of the River Medlock between Pin Mill Brow and Helmet Street Culvert was found to have some inconsistencies between the widths indicated in the 1D space and the areas set as inactive in 2D. Some of the cross sections were found to be wider in 1D (MEDL01_3435 is 85m wide in 1D compared to 48m in 2D) and other areas narrower (MEDL01_3093 is 10m in 1D and 20m in 2D). The following cross sections were corrected by adjusting the 2D inactive space to match the width of the cross sections in 1D:

MEDL01_3435, MEDL01_3301L, MEDL01_3134, MEDL01_3093, MEDL01_3032L.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.



Figure 4.3 - 1D space around Pin Mill Brow area (blue – Medlock 2008 model, yellow – BHE Baseline 2019)

The above changes resulted in negligible impact in areas downstream of Pin Mill Brow (less than 5mm). The changes have caused increase in levels within Pin Mill Brow area of approx. 20mm.

MEDL01_3562

The cross section at MEDL01_3562 (within Pin Mill Brow area) was found to be represented as 58m wide in 1D and 74m in 2D. The latest Lidar data provided by the EA in 2019 were referred to when widening the Left Bank of the section in 1D space, as shown below.

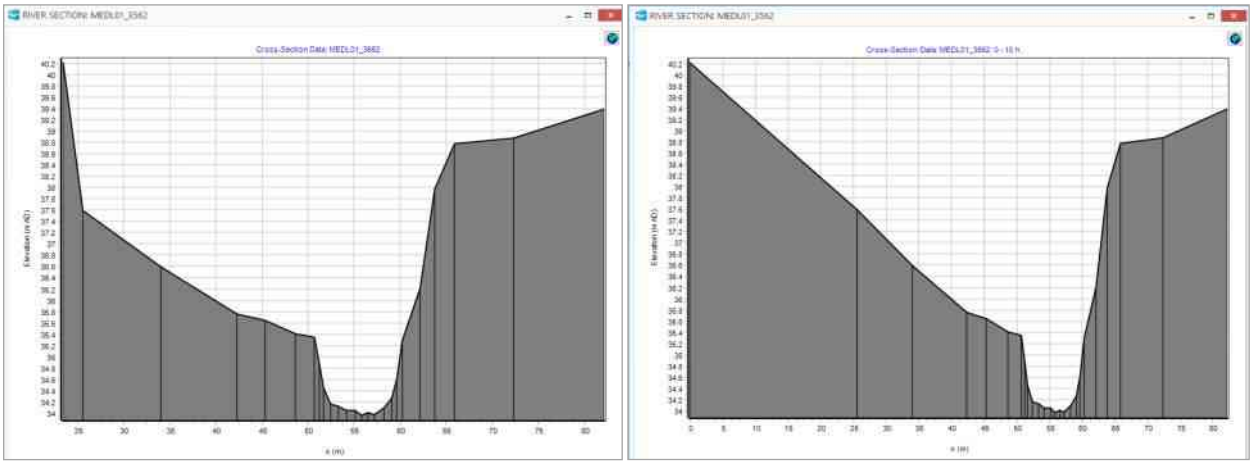


Figure 4.4 - MEDL01_3562 1D cross section (left - Medlock 2008, right - BHE Baseline)

The above change had negligible impact in terms of levels or extents (<5mm increase/decrease).

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

4.4 Addition of bank markers

It has been noted that many channel sections did not have bank markers on either side of the channels in the EA Medlock 2008 model. Bank markers can help with stability of the 1D model and it is advised that they should be used if possible.

Bank markers were therefore added to the following sections:

MEDL02_0893, MEDL02_0816J, MEDL02_0059, MEDL01_4746, MEDL01_4689A, MEDL01_4689B, MEDL01_4639, MEDL01_4310, MEDL01_4286, MEDL01_4261, MEDL01_4235, MEDL01_4188, MEDL01_4160, MEDL01_4065, MEDL01_4040, MEDL01_4014, MEDL01_3992, MEDL01_3967A, MEDL01_3967B, MEDL01_3134.

4.5 Review of structures

4.5.1 Unaccounted structures

It is noted that some structures along the River Medlock were not represented in the EA Medlock 2011 model. Specifically, six bridges have been left out of the model, one of which is upstream of the site and one within the site. As the model is being updated for the purposes of the Mayfield site FRA, only these two structures are considered below, as per advice from the EA.

Helmet Street Industrial Park Access Bridge (located 500m upstream Mayfield site):

According to the channel surveys, the access bridge at Helmet Street Industrial park is a steel sloping deck bridge with soffit levels sloping from 39.51m AOD to 39.88m AOD. The flood level for the DFE is at 38.986m AOD.

Therefore, as the peak flood level is below the soffit of the bridge, there is no requirement for the bridge to be added to the model. Please see Figure 4.5.

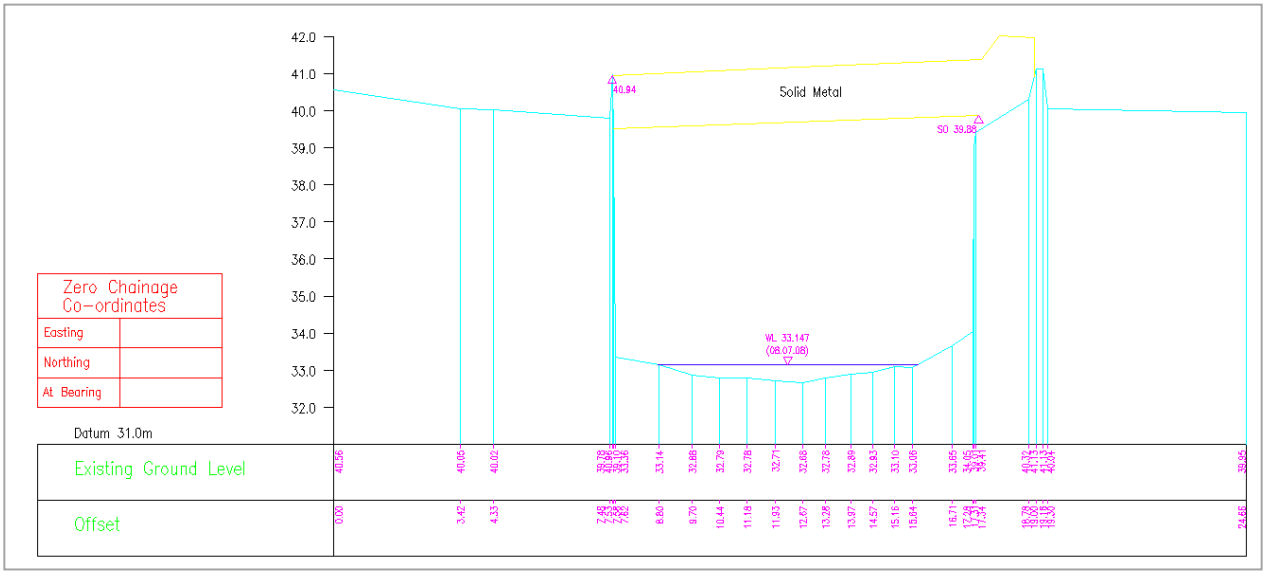


Figure 4.5 - Channel section at Helmet Street Industrial Park access bridge (Atkins, 2008)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Steel Beam Bridge at Hoyle Street Industrial Estate (within Mayfield site, photo):

The steel access bridge at Hoyle Street Industrial Estate is a portal frame steel bridge, with thin deck (430mm), raised approximately 1-1.5m above the surrounding banks. The soffit level is at 35.28m AOD, with the deck level at 35.70m AOD. The flood level for the DFE is at 35.621m AOD, reaching the bridge soffit. However, as the deck is raised above the surrounding floodplain and the abutments are set back from the channel edge, it was discussed with the EA that adding the bridge to the model was lower priority and could be omitted. Please refer to Figure 4.6.

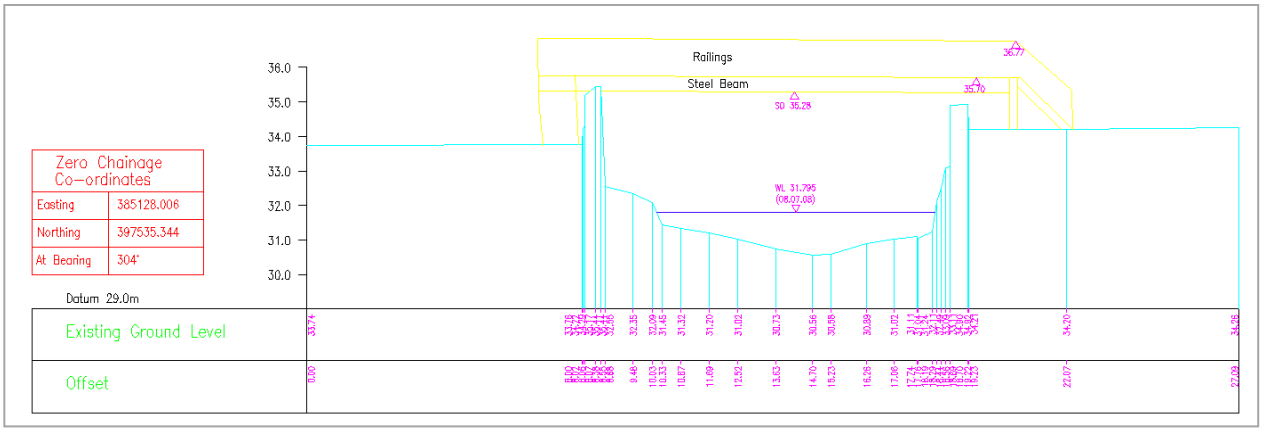


Figure 4.6 - Channel section at Hoyle Street Industrial Estate access bridge (Atkins, 2008)

4.5.2 Invert levels, orifice setting and spills

The bridges upstream and within the site that were represented in the model were reviewed against the structure survey data (Atkins 2008 survey) as well as the flood levels. A check was completed to ensure that the invert levels are correctly represented in the model. All the upstream and on site bridges passed the check.

The USBPR and Arch bridge units are generally regarded appropriate for unsubmerged subcritical flow; applying them to surcharged flow is outside of their calibration range. For this reason in surcharged situations, it is advised that the orifice flow option is often used. The option has the benefit of representing surcharged flow as an orifice, which may be more representative, whilst retaining the bridge afflux calculations when not surcharged.

The EA Medlock 2011 model did not use the orifice flow option for any of the bridge structures. The soffit levels of the upstream and onsite structures was compared with the flood levels for the DFE; in the case that a bridge was found to be surcharged (soffit level ≤ flood level), the orifice flow option was selected. The lower transition level for the orifice was set to 0.5m and the discharge coefficient (used to scale orifice losses) was set to 1. No adjustment of the coefficient is possible as there is no suitable calibration data available.

Finally, a spill bypass around or over the top of structures is required when the structure is likely to be overtopped. A spill can be created either in 1D space as a parallel spill unit to the structure or in 2D as HX lines. Some bridges have been modelled with a 1D spill unit in the EA Medlock 2011 model. Bridges that are now found to be overtopped or surcharged have been modelled with a spill in 2D space. Please see **Table 4-2**. In these instances, and where the deck of a bridge has been removed from the LiDAR survey for Manchester, a shape file (2d_zsh_bridge-deck) was used to add the bridge decks in 2D space.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Table 4-2 - Bridge checks and changes

Node name	EA Medlock 2011	Represented as per Atkins 2008 survey?	Surcharged or overtopped?	BHE Baseline amendments – 1D	BHE Baseline amendments – 2D
MEDL02_0845D	USBPR bridge unit, no spill	Correctly represented in 1D and 2D	No surcharge for DFE	None	None
MEDL02_0260D	Culvert, modelled using USBPR Bridge because of short length	Correctly represented in 1D and 2D	No surcharge for DFE	None	None
MEDL02_003D	USBPR bridge unit, no spill	Correctly represented in 1D and 2D	No surcharge for DFE	None	HX lines added to allow spill in 2D.
MEDL01_4540J	Arch bridge unit, no spill.	Correctly represented in 1D	Partially surcharged for DFE	Orifice setting on	HX lines added to allow spill in 2D. Deck added in 2D space
MEDL01_4373D	USBPR bridge unit with a spill to model flow over and around structure	Correctly represented in 1D and 2D	Surcharged under DFE	Orifice setting on	None
MEDL01_4213D	USBPR bridge unit, no spill	Correctly represented in 1D	Surcharged under DFE	Orifice setting on	HX lines added to allow spill in 2D. Deck added in 2D space
MEDL01_3941D	USBPR bridge unit, no spill	Correctly represented in 1D	Surcharged and inundated under DFE	Orifice setting on	HX lines added to allow spill in 2D. Deck added in 2D space
MEDL01_2913D	Arch bridge, no spill	Correctly represented in 1D	Surcharged under DFE	Orifice setting on	HX lines added to allow spill in 2D. Deck added in 2D space
MEDL01_2492D	USBPR bridge unit with a spill to model flow over and around structure	Correctly represented in 1D and 2D	Surcharged and inundated under DFE	Orifice setting on	None
MEDL01_2279D	USBPR bridge unit, no spill	Correctly represented in 1D and 2D	Surcharged under DFE	Orifice setting on	None

Similar to the bridge structures, checks were made for the culverts. The width, length, invert and soffit levels modelled in 1D were checked against the Atkins 2008 survey. All upstream and on site culverts were represented correctly in 1D. At the locations where culverts were surcharged, inundated or overtopped, HX lines were added to allow spill of flood water from the 1D domain to the 2D domain. Please refer to **Table 4-3**.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Table 4-3 – Culvert checks and changes

Node name	EA Medlock 2011	Represented as per Atkins 2008 survey?	Surcharged or overtopped?	BHE Baseline amendments – 1D	BHE Baseline amendments – 2D
MEDL02_0816C / MEDL01_0282C	Orifice unit and sprung arch conduit sections, with a culvert outlet unit, no spill	Correctly represented in 1D	No surcharge for DFE	None	None
MEDL01_3301C / MEDL01_3258C	Culvert inlet unit and sprung arch conduit sections, with a culvert outlet unit, no spill	Correctly represented in 1D	Surcharged under DFE	None	HX lines added to allow spill in 2D. Deck added in 2D space and added z-line for stability.
MEDL01_3032L / MEDL01_2962C	Culvert Inlet unit and sprung arch conduit sections, with a culvert outlet unit, no spill	Correctly represented in 1D	Surcharged under DFE	None	HX lines added to allow spill in 2D.
MEDL01_2829L / MEDL2647C	Culvert Inlet unit and conduit sections, no spill. A weir is used as outlet	Correctly represented in 1D	Partially surcharged under DFE	None	HX lines added to allow spill in 2D.
MEDL01_2380L/ MEDL01_2315C	Culvert Inlet unit and conduit sections, with a culvert outlet unit, no spill	Correctly represented in 1D	Surcharged under DFE	None	HX lines added to allow spill in 2D.
MEDL01_2090L /MEDL01_1554C	Culvert Inlet unit and symmetrical conduit sections, with a culvert outlet unit, no spill	Correctly represented in 1D	Surcharged under DFE	None	HX lines added to allow spill in 2D.

More details on the file modelling changes and the limitations of the model can be found in Appendix D.

4.6 Existing site layout

The Mayfield site currently consists of a number of industrial, storage and distribution units at the centre of the site and the Mayfield train depot along the north of the site. River Medlock meanders through the centre of the site. The 65m Baring street culvert covers parts of the river within the site. Two footbridges currently provide access across the river. As discussed earlier, the Baring Street culvert and access footbridge have been represented in the model; the steel beam bridge has not been included.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

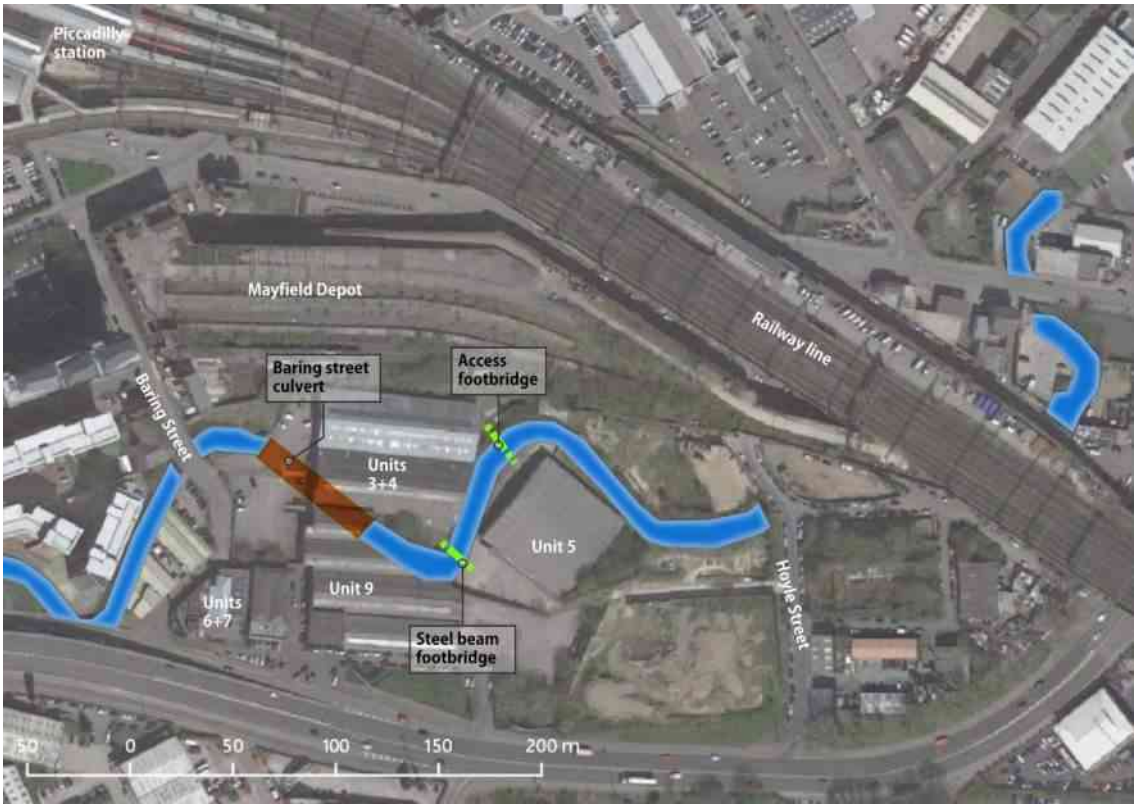


Figure 4.7 - Mayfield site - existing assets. Open watercourse shown in blue.

4.7 Results

The modelling changes described above have resulted in changes in flood extents and flood levels throughout the modelling area. These changes are mainly attributed to the application of the orifice setting to the upstream and onsite bridges. As the purpose of this study is the assessment of the impact the proposals have to the baseline, comparison of the flood levels and extents between the EA Medlock 2011 model and BHE Baseline 2019 model are not included.

The BHE Baseline model flood levels for the DFE can be seen in Figure 4.8.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

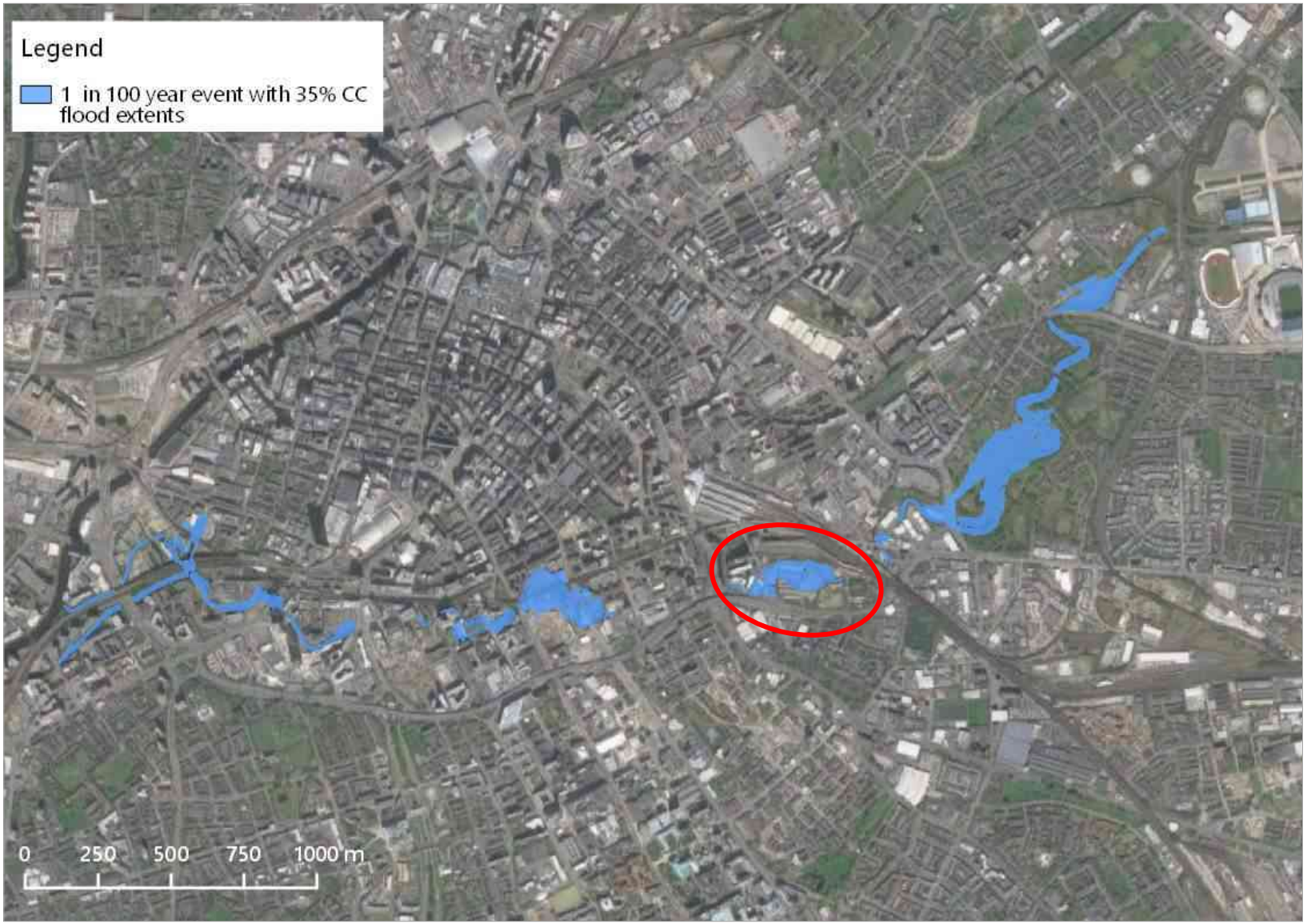


Figure 4.8 – BHE Baseline 2019 flood extents for the 1 in 100yr event +35% climate change, modelling area. Site location indicated in red circle.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

The flood extents map of the site can be seen in Figure 4.9.



Figure 4.9 – BHE Baseline 2019 flood extents for the 1 in 100yr event + 35%CC, Mayfield site showing direction of flow and location of existing culvert (in green).

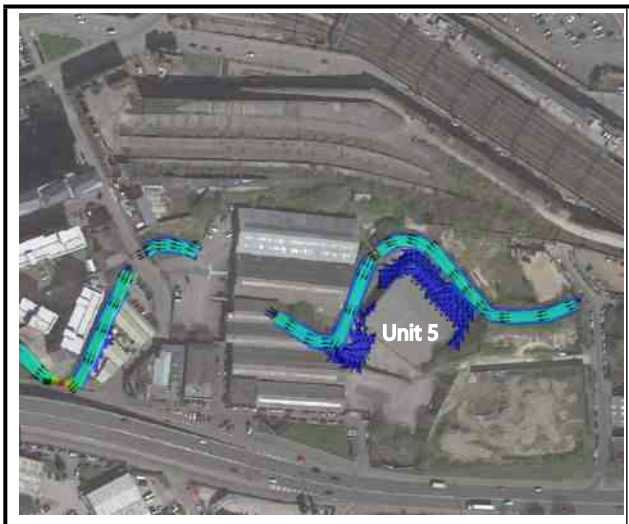
Table 4-4 – Flood levels for the DFE (u/s – upstream, d/s – downstream)

Node	Description	BHE Baseline 2019 model Flood levels (m AOD)
1	D/S Hoyle Street culvert	35.83
2 u/s	U/S Hoyle Street Industrial estate access footbridge	35.84
2 d/s	D/S Hoyle Street Industrial estate access footbridge	35.70
3	Steel beam footbridge (not represented in model)	35.61
4	D/S Baring street culvert	34.96

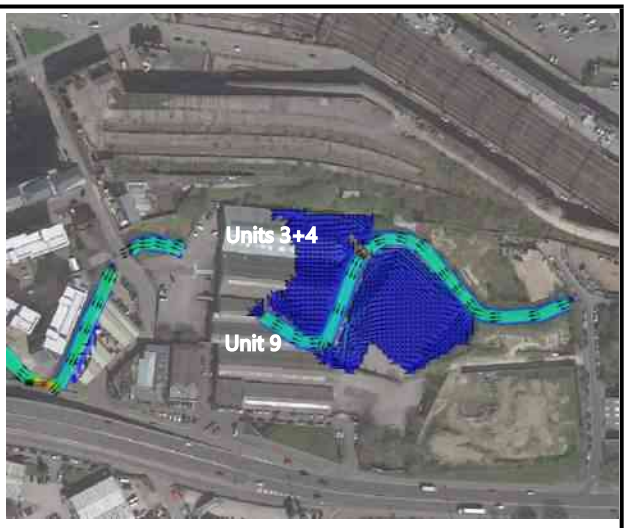
The following observations on the existing flood mechanism within the site are given below (please refer to Figure 4.10 below):

a) Flood water overtops the banks east and west of Unit 5. Most of the overland flows re-enter the channel west of the unit.
b) Flood water overtops the banks upstream of the Hoyle Street access footbridge.
c) The existing 65m length culvert constricts the flow of the river. Overland flow routes generated north of the river flow southwards above the culvert and flow back into the river downstream of the site.
d) The overland flows enter Logic site and re-enter the river channel outside the Mayfield site.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.



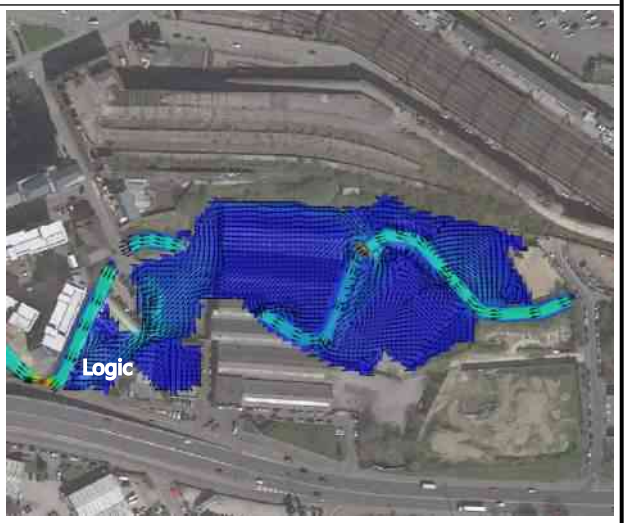
A) Flood water first overtops the banks east and west of Unit 5 (Time: 04:10)



B) Flood water overtops the banks upstream the access footbridge, entering units 3 + 4. Unit 5 is flooded and overland flows re-enter the river south-west of Unit 5. (Time: 04:50)



C) Flooding overtops the banks to the scrap yard. Units 3+4 are flooded. The culvert is surcharged. (Time: 05:40)



D) Overland flow routes direct flows across to Logic site, before re-entering the river channel. (Time: 06:50)

Figure 4.10 – Flooding mechanism across Mayfield site, existing flow condition at various timesteps following start of storm event. Light blue to red indiates relative increase in flow rate.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

5 Mayfield 2019 model

5.1 The Mayfield Vision

5.1.1 Client objectives

The Mayfield masterplan development is proposing to deliver a series of significant regeneration benefits in order to create a new neighbourhood, generate new jobs and drive wide economic growth within Manchester city centre. The Partnership proposes to capitalise on existing natural assets such as the River Medlock, as well as the creation of new natural capital. They are investing in a new 6.5acre city centre park and additional 6.5acre areas of public realm and the environmental rehabilitation of River Medlock, increasing biodiversity and public access to green space.

The expansive Mayfield Park is proposed at the centre of the development with the building development located around it. The open space extends the full length of the Mayfield area, from Baring Street in the west to Hoyle Street in the east. The River Medlock that meanders through the centre of the site is proposed to be widened and returned to its natural form, providing opportunities for enhanced biodiversity. In addition to the Mayfield Park, smaller scale pocket parks and open spaces for residents are provided throughout the Masterplan, providing an important local amenity.

More information on the vision for Mayfield as well as the approved Mayfield 2018 SRF scheme can be found here: https://secure.manchester.gov.uk/downloads/download/6851/mayfield_strategic_regeneration_framework.

5.1.2 Stakeholder objectives

The EA has been consulted early on to provide advice on the Mayfield project. The EA has been very supportive of the proposals to naturalise the river Medlock and have set their aims for the project, as listed below:

- Removal of culvert and daylighting of river to enhance biodiversity;
- Safe development around the site, with development levels raised above the Design Flood Event;
- Provision of flood compensation storage to manage impact of flood risk within and outside the site;
- Provision of safe access and egress during extreme flood events.

5.1.3 The design response

A key consideration in the place making strategy has been to holistically consider the approach to flood management, within the site, but also other planned improvement works that are being progressing further upstream in the wider Medlock catchment.

By removing the old culvert and high-sided river walls and opening up the river, particularly on the north bank, natural river edges with a range of habitats can be created. Integrated flood storage will be provided in the park by allowing some parts of the park to flood during higher order flood events.

The river corridor and floodplain have been carefully re-profiled using the results of the hydraulic modelling work described here to ensure development does not increase flood risk elsewhere. The design ensures that there is no increase in flood risk upstream or downstream the site, with finished floor levels for development set at an appropriate margin above design flood levels with an allowance for uncertainty, as recommended by the EA. This will ensure the development is safe, with appropriate pedestrian and vehicular access during extreme flood events and adequate access to the river for maintenance or improvements works.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Safe public pedestrian access will be possible to the river directly from the park by providing features such as riverside walks and boardwalks. The river edges will be softened in places to allow marginal wetland areas to be created not only giving space for water, but space for recreation and wildlife as well. It will be a multi-use space offering significant social and environmental benefits, including increased biodiversity and flood resilience.

New pedestrian bridged links will be created to increase connectivity and accessibility across the park. Opening up the river will allow the floodplain to be clearly defined so that a safe environment for floodwater can be created at times when high river flows are expected.

Maintenance access will also be improved that will allow the river corridor to be managed effectively where necessary, and give access to the Environment Agency to allow them to manage the Main River corridor. This access for inspection and maintenance would integrate with a landscape management plan setting out the requirements for maintaining the park and the riverside areas, reduced through the use of low maintenance planting of the natural features.

5.2 Proposed development

The principles described above are illustrated in Figure 5.1.



Figure 5.1 – Development flood risk management principles

The changes in levels between the baseline and masterplan proposal are illustrated in Figure 5.2.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

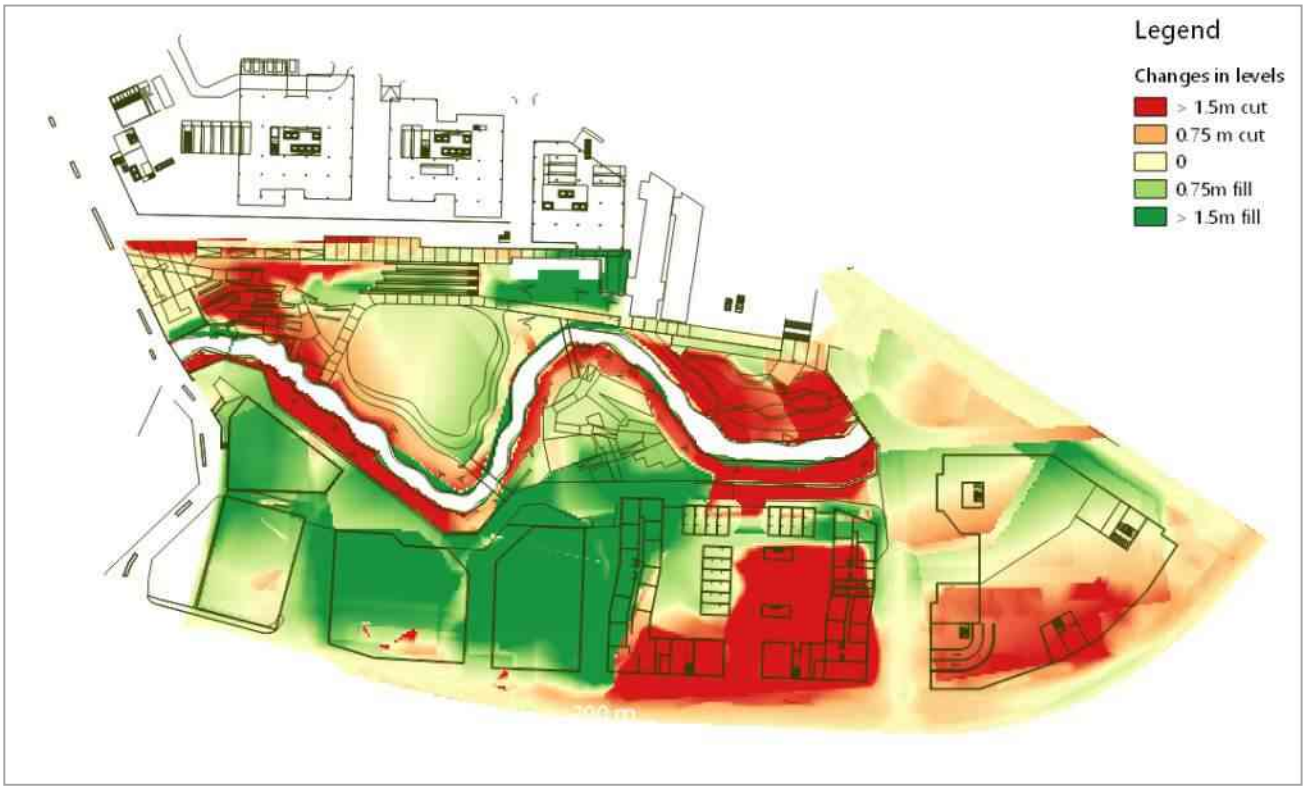


Figure 5.2 – Changes in levels across the site due to the Mayfield development proposals (proposal outlines shown above)

5.3 Modelling the Mayfield proposals

5.3.1 Representation of hydraulic structures

The Baring Street culvert as well as the two existing footbridges within the site are proposed to be demolished. The footbridges will be replaced with two new footbridges at similar locations as illustrated in Figure 5.1.

The table below summarises the structures removed and added and their representation within the Mayfield 2019 model.

Table 5-1 - Structures in the Mayfield site and their representation in the Mayfield 2019 model

Structure	Model representation
Removed structures	
Hoyle Street Industrial Estate access footbridge	The footbridge is represented by a series of nodes with the prefix MEDL01_2492 as a USBPR bridge unit with a spill to model flow over and around the structure. The structure has been removed as it will be demolished. The modelling nodes have been removed entirely and not replaced by a river channel, as a new footbridge is added 18m downstream.
Steel beam access footbridge	No model representation (see Section 4.5)
Baring street culvert	The culvert is represented by a series of nodes with the prefix MEDL01_2380 and MEDL01_2315. The conduits, inlet and outlet units have been replaced with river channel sections.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Added structures	
Footbridge to Mayfield depot (north)	The new structure has been represented by a series of nodes with the prefix MEDL01_2510. The bridge is modelled as a USBPR bridge unit with a spill to model flow over and around the structure.
Footbridge to Mayfield park (south)	The new structure has been represented by a series of nodes with the prefix MEDL01_2429. The bridge is modelled as a USBPR bridge unit with a spill to model flow over and around the structure.

No piers are anticipated to be required to support the two bridges.

5.3.2 Representation of river channel

As part of the rehabilitation of the River Medlock it is proposed that the high hard edges will be broken down to 2 levels were possible. The width of the lower channel is maintained as per existing channel width to maintain the depth of water during daily flows, whereas the higher channel is widened to accommodate flood flows. A typical cross section is shown below.

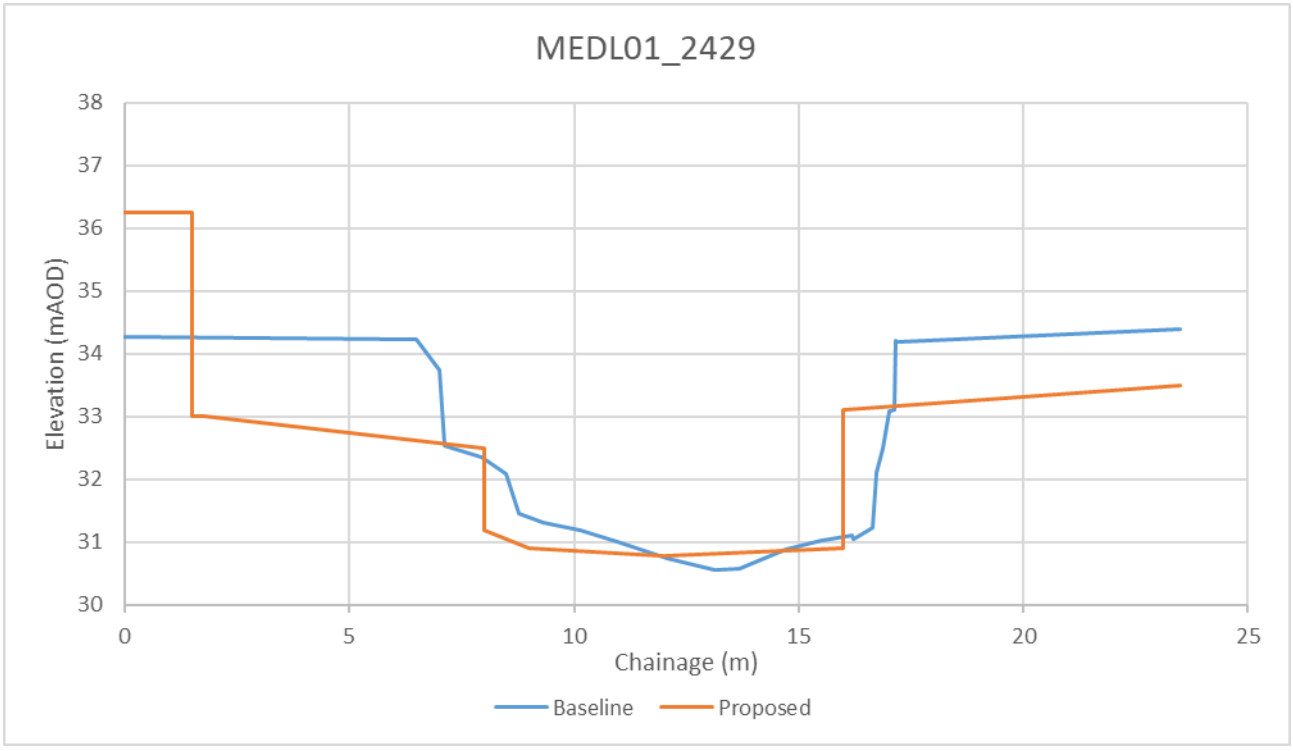


Figure 5.3 – Example cross section illustrating difference in Baseline and with proposals scenario at MEDL01_2429.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

5.3.3 River and floodplain roughness

The different ground types within channel and out of bank can be represented by varying the roughness of the model surface by using the Manning's 'n' value. The roughness can impact on the conveyance of floodwater within the watercourses and over the floodplain, which in turn will have an impact on the flood extent.

The degree of vegetation and sinuosity of the river channel has an impact on in-bank conveyance, whereas the degree of development of adjacent land can impact on floodplain conveyance.

The Manning's values used for the BHE Baseline 2019 model in the 1D domain were based on the EA Medlock 2011 model. The values of 0.04 and 0.06 have been used to represent the roughness along the channel bed and banks respectively. The EA commented in the past that the values are relatively high for an urban centre; however, the EA Medlock model has been calibrated using these values and their use is therefore considered acceptable for the modelling purposes of this assessment. For the Mayfield 2019 model, the banks within the park area have been modelled using a value of 0.05 instead of 0.06 to represent well maintained marginal vegetation.

The Manning's values used within the 2D domain are based on the values shown in Table D.3B in Appendix D. The 2d_mat_Medlock.shp file has been modified for the BHE Baseline model to incorporate demolition of buildings around the site. For the Mayfield 2019 model, the shape file is further amended only within the masterplan area to represent the landscaping proposals.

Buildings are represented in the model by an increased Manning's roughness to slow the movement of water. Although buildings can impede the spread of flood water it is not bet practice to consider them impermeable as water is usually able to enter buildings through openings such as doors and vents. By increasing the roughness of the building footprint the flow through the building will be reduced to better represent the resistance to the spread of water provided by the building.

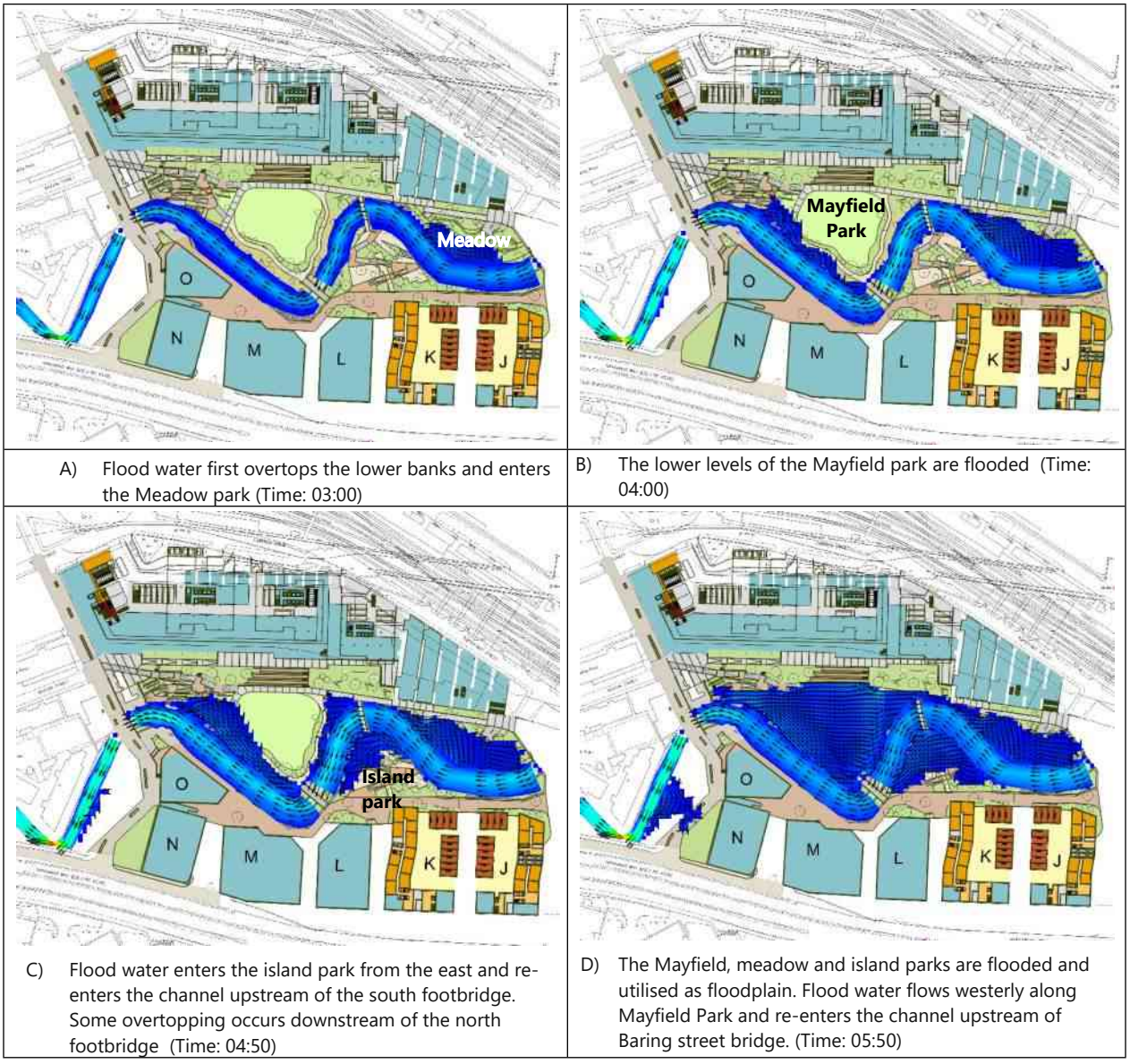
More details on the file modelling changes and manning's coefficients used can be found in Appendix D.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

5.4 Results

5.4.1 Design Flood Event

The Mayfield 2019 model has been simulated for the DFE, the 1 in 100 year flood event, with an allowance for climate change. The flood mechanism is illustrated in Figure 5.4.



A) Flood water first overtops the lower banks and enters the Meadow park (Time: 03:00)

B) The lower levels of the Mayfield park are flooded (Time: 04:00)

C) Flood water enters the island park from the east and re-enters the channel upstream of the south footbridge. Some overtopping occurs downstream of the north footbridge (Time: 04:50)

D) The Mayfield, meadow and island parks are flooded and utilised as floodplain. Flood water flows westerly along Mayfield Park and re-enters the channel upstream of Baring street bridge. (Time: 05:50)

Figure 5.4 – Flooding mechanism across Mayfield site, proposed flow condition at various timesteps following start of storm event. Light blue to red indiates relative increase in flow rate.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

The results have been compared to the BHE Baseline 2019 model to assess the impact the proposals have to areas within the modelling domain and are described below. Areas in red indicate increase in flood extents compared to the BHE Baseline 2019 model whereas areas in blue indicate decrease in flood extents (area no longer at risk of flooding during the DFE). Areas shaded purple indicate no change in extent.

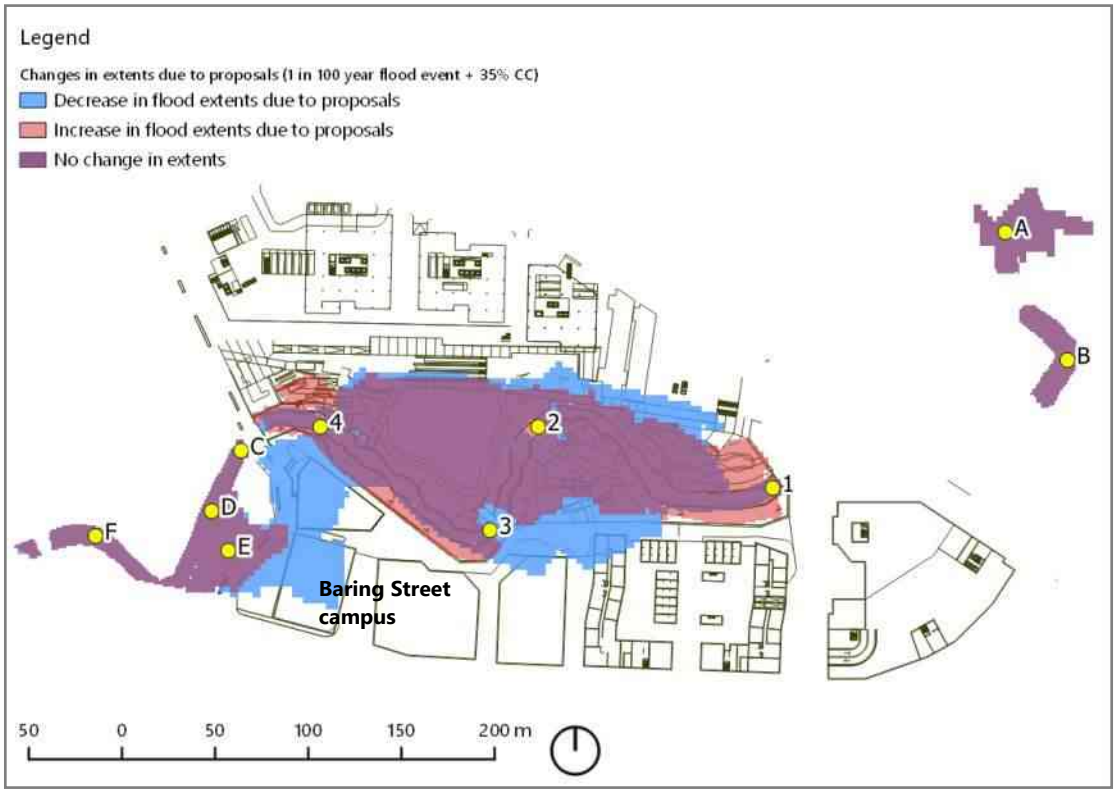


Figure 5.5 - Changes in flood extents due to the Mayfield proposals during the DFE, site surroundings

Table 5-2 – Flood level changes due to proposals for the DFE, Mayfield site *(results based on updated model, following EA review)*

No.	Node	Description of node location (current assets)	BHE Baseline 2019 model (m AOD)	*Mayfield 2019 model (m AOD)*	*Difference in Mayfield 2019 levels compared to BHE Baseline 2019 (mm)*
A	MEDL01_2934	U/S Fairfield Street bridge	37.384	*37.384*	*<1mm*
B	MEDL01_2855B	D/S Fairfield Street bridge	37.023	*37.022*	*-1mm*
1	MEDL01_2647	D/S Hoyle Street culvert	35.830	*35.377*	*-453mm*
2	MEDL01_2492A (data for Mayfield 2019 taken from 2D)	U/S Hoyle Street Industrial estate access footbridge	35.841	*35.401*	*-440mm*
3	MEDL01_2429	Steel beam bridge	35.605	*35.261*	*-344mm*
4	MEDL01_2315	D/S Baring street culvert	34.957	*35.147*	*+190mm*
C	MEDL01_2279E	D/S Baring street bridge	34.503	*34.468*	*-17mm*
D	MEDL01_2227	Logic site (in channel)	34.395	*34.325*	*-70mm*
E	n/a	Logic site (floodplain)	34.373	*34.311*	*-62mm*
F	MEDL01_2131	U/S London Road EA station	34.147	*24.131*	*-16mm*

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

The removal of the Baring Street culvert has caused the most noticeable change in the flood mechanism by removing the overland flow path that previously flowed over the culvert is now captured within the channel. Opening of the river channel and the proposed park flood storage areas capture overland flow reducing overall flood levels within the site.

By removing the culvert and increasing ground levels south of the river at Baring Street campus, allows overland flow from the north to drain into the river and reduce the flood extent in this area compared to baseline. Although flood levels within the river increase in this location compared to baseline (No. 4 in Figure 5.2 and Table 5-2), peak flows and levels downstream of the bridge at Baring Street Road decrease (<0.5m^3/s) , reducing any potential flood risk impact elsewhere (see Figure 5.6).

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

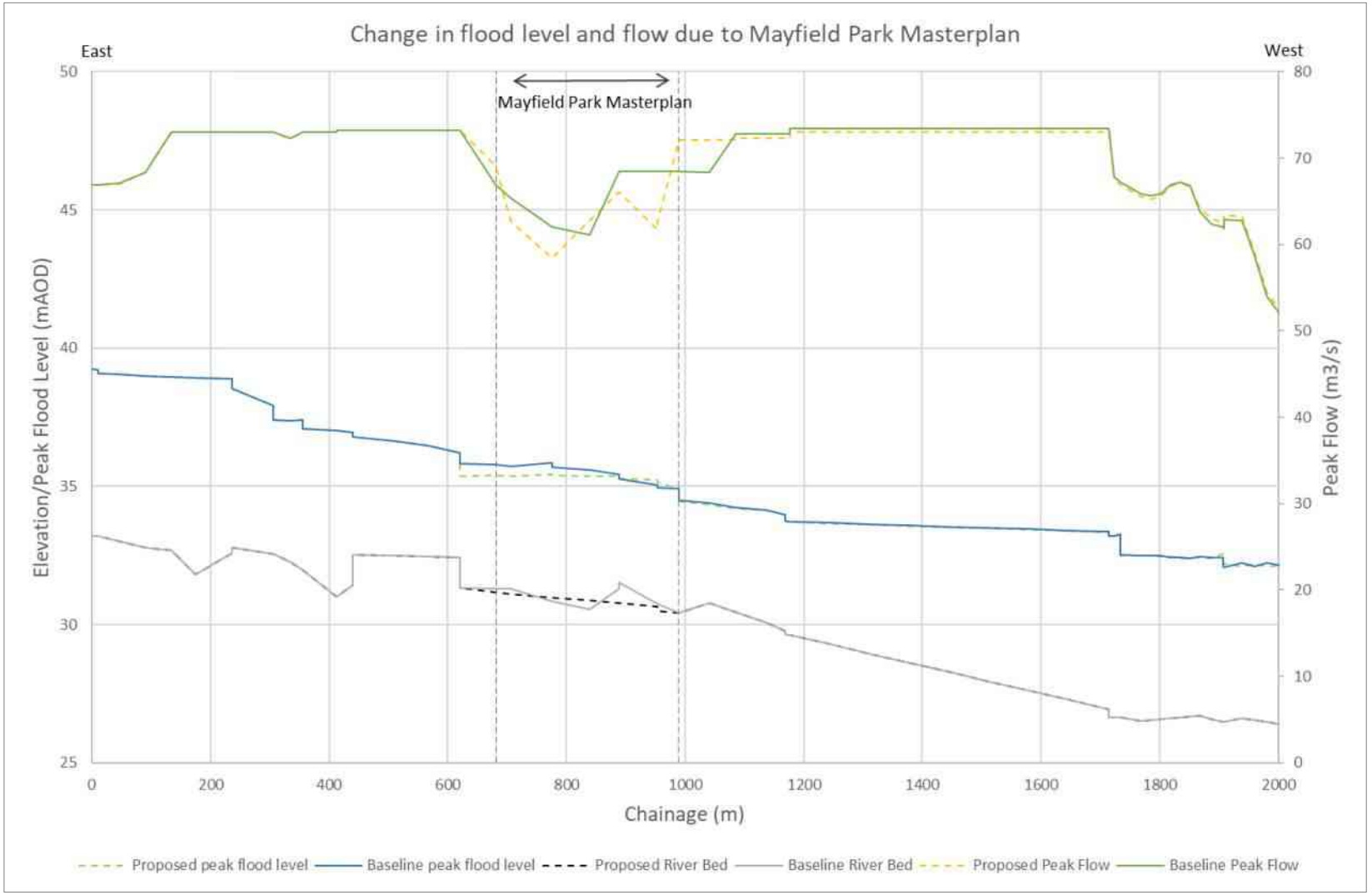


Figure 5.6 - Comparison of change in peak flood level and flow due to proposals shown approximately 1km upstream and downstream of the site (data taken between 1D Nodes MEDL01_3301L to MEDL01_1377A).

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Changes in flood level upstream and downstream of the site were not significant (<1mm decrease upstream and generally less than 10mm change in levels downstream), which is considered within modelling tolerances rather than as a result of impacts of the proposals. No additional properties are at risk of flooding due to the proposals.

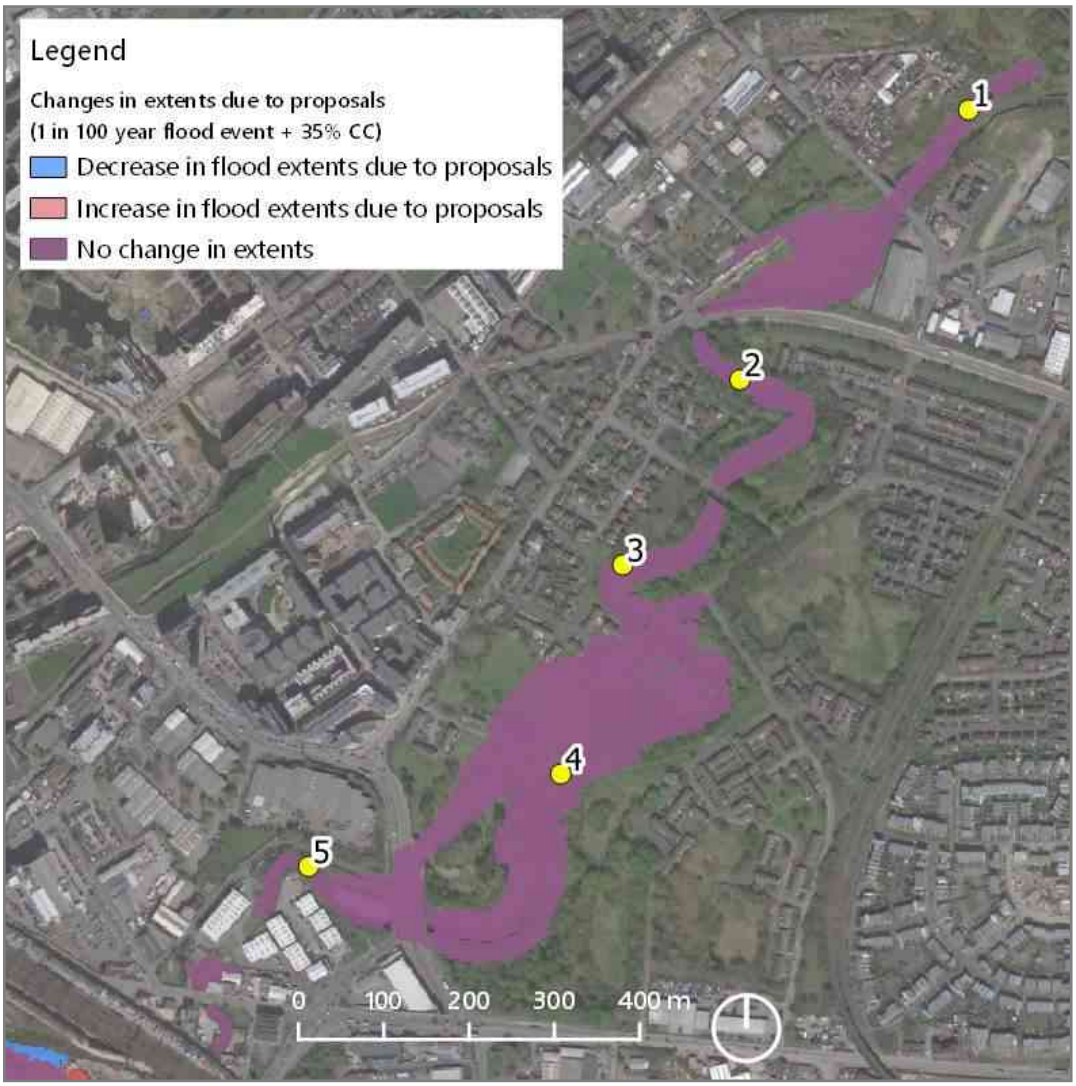


Figure 5.7 – Comparison of Mayfield 2019 model to the BHE Baseline 2019 model, flood extent changes for the DFE, upstream of site.

Table 5-3 – Flood level changes due to proposals for the DFE, upstream of the Mayfield site *(results based on updated model, following EA review)*

No.	Node	BHE Baseline 2019 model (m AOD)	*Mayfield 2019 model (m AOD)*	*Difference in Mayfield 2019 levels compared to BHE Baseline 2019 (mm)*
1	MEDL02_0158	41.931	*41.931*	*<1mm*
2	MEDL01_4433	40.705	*40.705*	*<1mm*
3	MEDL01_4065	39.563	*39.563*	*<1mm*
4	MEDL01_3615	39.526	*39.526*	*<1mm*
5	MEDL01_3134	38.951	*38.951*	*<1mm*

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

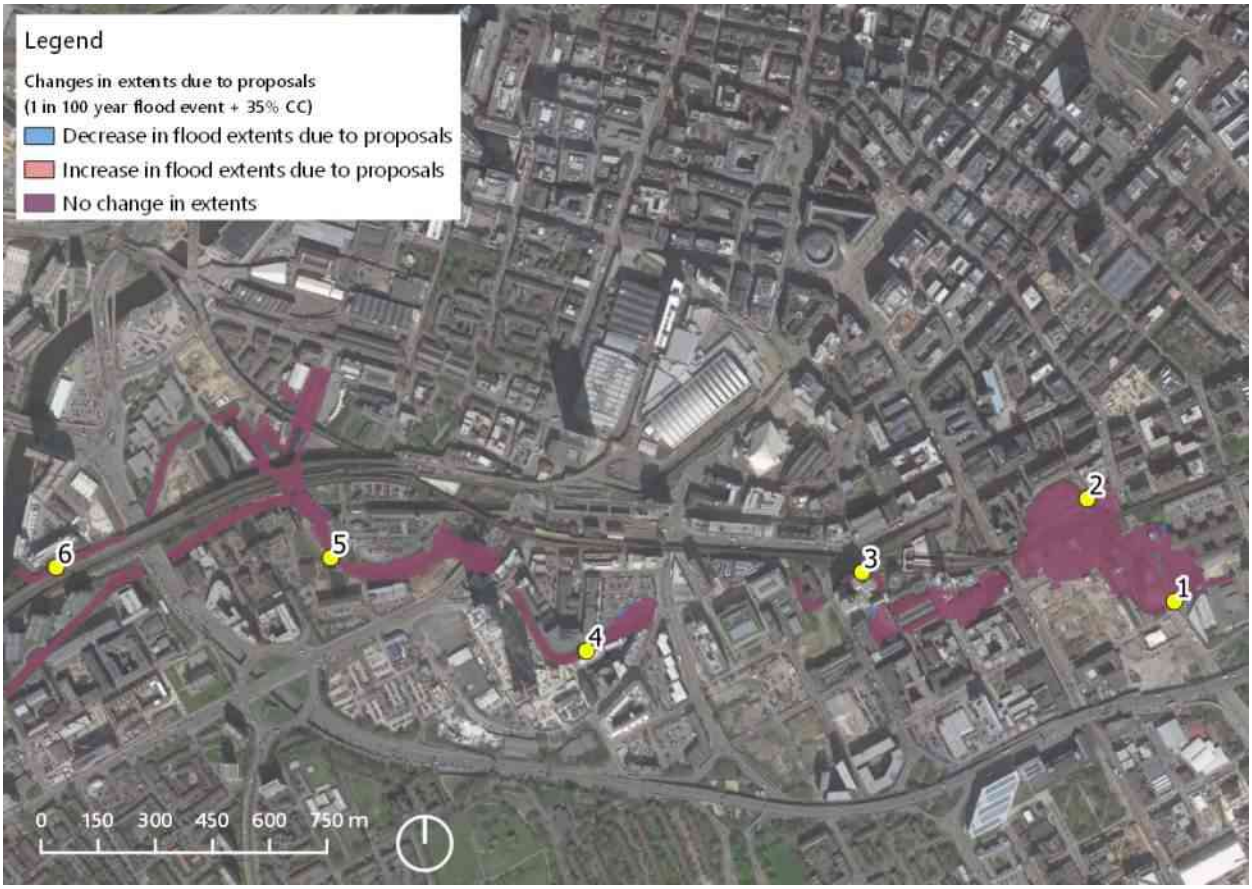


Figure 5.8 - Comparison of Mayfield 2019 model to the BHE Baseline 2019 model, flood extent changes for the DFE downstream of site.

Table 5-4 – Flood level changes due to proposals for the DFE, downstream of the Mayfield site *(results based on updated model, following EA review)*

No.	Node	BHE Baseline 2019 model (m AOD)	*Mayfield 2019 model (m AOD)*	*Difference in levels (mm)*
1	MEDL01_1534A	33.270	*33.258*	*-12mm*
2	MEDL01_1304	32.221	*32.204*	*-17mm*
3	MEDL01_0703	29.656	*29.646*	*-10mm*
4	MEDL01_0170	28.510	*28.501*	*-9mm*
5	BRGW01_0678	25.853	*25.850*	*-3mm*
6	MEDZ01_0107	23.718	*23.717*	*-1mm*

5.4.2 Other flood events

The following additional flood events have been modelled for both the BHE Baseline 2019 model and the Mayfield 2019 model:

- 1 in 25 year event – Model inflow: 49.92m^3/s (70% less than the DFE)
- 1 in 100 year event – Model inflow: 63.09m^3/s (35% less than the DFE)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

A comparison of the peak level model results from the BHE Baseline 2019 and the Mayfield 2019 models for the 1 in 25 year event demonstrates that the proposals have no adverse impact to levels. The levels decrease due to the proposals by up to 12mm. Within the site, the levels decrease on average by 150mm due to the wider, open channel.

A similar comparison of peak levels for the 1 in 100 year event indicates less than 1mm changes in levels at the upstream and downstream ends. This is attributed to modelling tolerances. Within the site, the peak levels decrease by approximately 150mm.

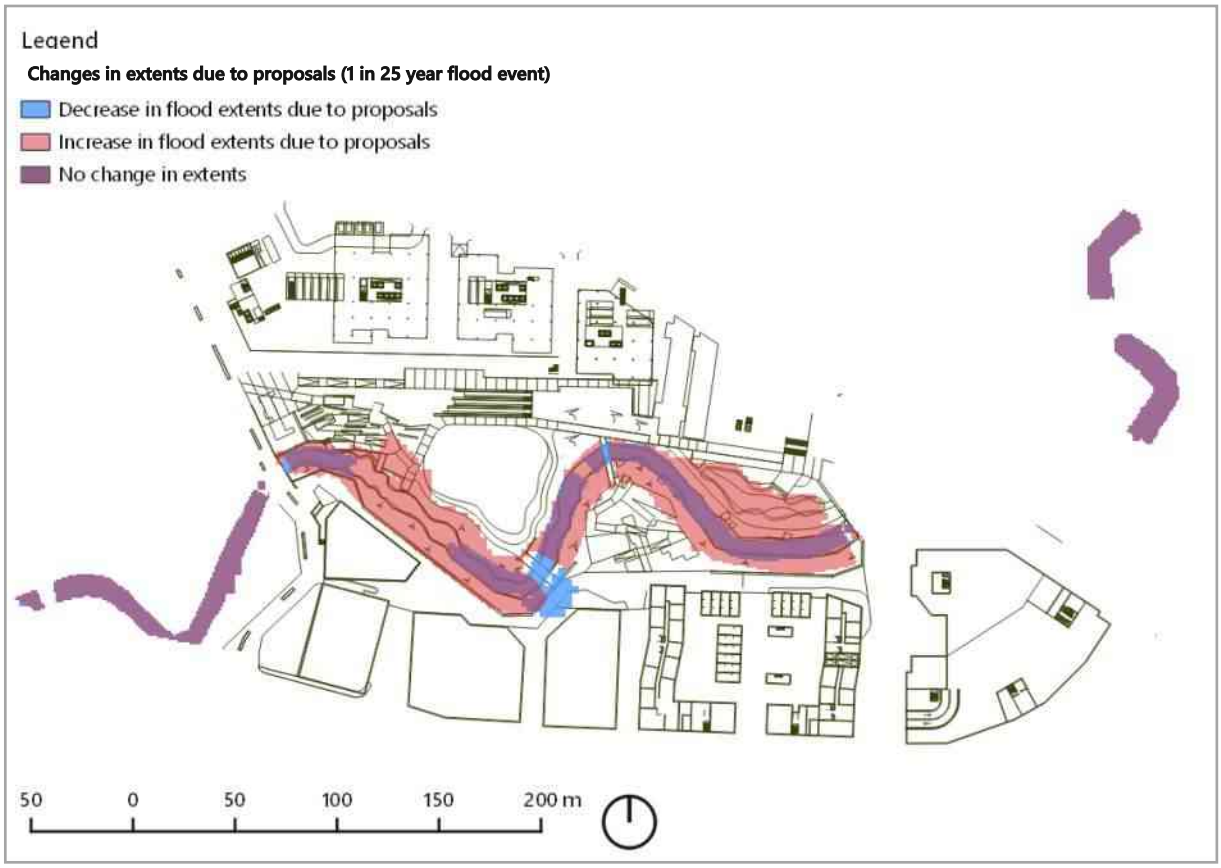


Figure 5.9 - Changes in flood extents due to the Mayfield proposals during the 1 in 25 year event, site surroundings

5.5 Sensitivity Testing

Sensitivity testing on roughness was carried out for the Mayfield 2019 model DFE 100-year event with 35% climate change allowance. Sensitivity to roughness was tested by increasing /decreasing all roughness coefficients by +/-10% in both the 1D and 2D domain of the Medlock model. The decrease in roughness caused model instabilities and model run did not complete.

Increasing Manning's 'n' by 10% generally resulted in increases in stage throughout the model domain between 100-200mm. The largest increase in stage was 219mm upstream of Ashton New Road Bridge, 2km upstream from the site extents. Within the site the levels increased by approximately 115mm.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Without further recorded data it is not possible to assess whether these changes are more applicable. It is considered that the manning's roughness value used in the original model was at the higher end of the range, and therefore, to be consistent with the set-up of that model, the Manning's values currently used are considered appropriate.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

6 Conclusion

The redevelopment of the Mayfield area in Central Manchester aims to rehabilitate a heavily modified and constrained river into a naturalised channel, surrounded by green open spaces. It is the vision that the rehabilitation of the River Medlock will lead to increased biodiversity around the corridor, allow the creation of an attractive public park and provide opportunities for quality accommodation and workplace.

The above analysis has demonstrated that the BHE Baseline 2019 model has been adequately updated for use as a flood risk assessment tool for the design of the Mayfield Park development. When modelling the proposals, it has been demonstrated that the Mayfield development has negligible impact in terms of flood risk from the River Medlock to areas outside the site boundary and a positive impact in decreasing flood risk within the site.

The EA has reviewed the Hydraulic modelling report v00 and provided comments on 05/09/2019. The comments were addressed and the results in this report have been updated to reflect the latest model. The conclusions of this report have not changed as a result of these changes.

Assessment of flood risk from other sources and exceedance events, provision of safe access and egress, and other site specific flood mitigation measure will be discussed in the FRA that will be submitted for planning in September 2019.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Appendix A EA Medlock model documentation

A.1 River Medlock SFRM (2009)

A.2 River Medlock ISIS-TUFLOW model (2010)

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Appendix B Hydrology

B.1 Hydrological analysis – BuroHappold 2019

B.2 Review by Paul Garrad and BuroHappold response

B.3 EA review of Hydrological Analysis and BuroHappold response

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Appendix C Site Surveys

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Appendix D Modelling changes

D.1 BHE Baseline 2019 model changes

D.2 Mayfield 2019 model changes

D.3 Manning's values

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

D.1 BHE Baseline 2019 model

Modelling files

The BHE Baseline 2019 model is run through the following simulation files:

- Medlock_SFRA_v0e_MM_002_BH_305.ief – 1D
- Medlock_SFRA_v0e_MM_002_BH_305.tcf and – 2D

The following files called in the above simulations have been amended as described in the tables below.

Table D.1A – 1D file changes

New/amended files/nodes	Removed files/ nodes	Reason for change
Medlock_SFRA_v0e_MM_002_BH_305.dat		
Added bank markers to upstream and onsite nodes (see Section 4.4)		Improve model stability
Amended LB of MEDL01_3562 to match LiDAR (see Section 4.3)		Ensure consistency between 1D and 2D models
Applied orifice setting to surcharged bridges (see Section 4.5.2)		Improve modelling representation of surcharged bridges
Medlock_SFRA_v0e_MM_002_BH_305.ied		
Amended peak flows for upstream flows (MEDL02_0893) with the developed BHE Model 2019 hydrology, as per **Error! Reference source not found.**		

Table D.1B – 2D file changes

New/amended files	Removed files	Reason for change
Medlock_ER_3m_BH_303.tgc		
2d_bc_inactive_Medlock_BH_303.shp	2d_bc_inactive_Medlock.MIF	Widened 2D inactive space locally to match 1D space
New_DTM_Mosaic_for_Manchester.asc	2d_zpt_Medlock_F4m.MID	
2d_zpt_MayfieldSite.12da		Site topographic information
2d_zsh_DEM_adjustments_R_002.SHP; 2d_zsh_DEM_adjustments_P_001.SHP	2d_zsh_DEM_adjustments.MIF	Removed adjustments within site,
2d_zpt_mean_building_elevation_074.shp	2d_zpt_mean_building_elevation.MIF	Removal of demolished buildings.
2d_zpt_building_threshold_074.shp	2d_zpt_building_threshold.MIF	Removed the additional threshold for the buildings within site and removal of demolished buildings.
2d_zlr_bank_heights_303_L.shp; 2d_zlr_bank_heights_303_P.shp	2d_zlr_bank_heights.MIF	Adjusted bank heights to match site topographic survey.
2d_zsh_bridge-deck_005.SHP; 2d_zsh_bridge-deck_P_007.SHP		Added the deck levels on surcharged upstream bridges
2d_zln_bridge_L_001.shp		A z-line was added for stability
2d_mat_Medlock_BH_074.shp	2d_mat_Medlock.MIF	Material changes within the Mayfield masterplan due to demolitions of buildings
Medlock_Common_Commands_BH_303.trd		

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

1d_isis_nodes_Medlock_BH_072.shp	1d_isis_nodes_Medlock.MIF	Moved nodes MELD01_2647, MEDL01_2492A and MEDL01_2380L to match topographic surveys and 1D space
1d_nwk_Medlock_BH_072.shp	1d_nwk_Medlock.MIF	Amended within site as per above
1d_WLL_Medlock_BH_303.shp	1d_WLL_Medlock.MIF	Amended to match 2d_bc_inactive_Medlock_BH_303.shp
Medlock_BH_303.tbc		
2d_bc_Medlock_HX_BH_303.shp	2d_bc_Medlock_HX.MIF	Amended to allow overspill of structures and match 2d_bc_inactive_Medlock_BH_303.shp
Manchester_Roughness.tmf		No change on material designation

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Limitations

There are some outstanding items that were raised by the EA during their review but could not be addressed in the BHE Baseline 2019 model as shown in the table below.

Item	Comments	Action	BuroHappold response
3.2 Have appropriate distances between sections and/or nodes been used (dx)?	Explain why the spacing between some nodes does not follow the name node convention? (distances between nodes should be reflected in the name of nodes)	Rectify node spacing.	The spacing convention is inherited from the EA Medlock 2019 model. The nodes within the site boundary were checked against the 2018 Mayfield site topographic survey and the distance applied in 1D is correct. Nodes outside the topographic survey boundaries cannot be checked, as the channel survey was not provided and new channel surveys have not been undertaken. This comment is therefore partially actioned.
3.6 Chainage – compared to surveyed sections	No survey provided so cannot be properly checked.	Fix chainage issues.	Same as above. The original channel survey was not provided to BuroHappold and therefore this check cannot be completed.
4.1 What manning's n value(s) have been used for the channel?	Manning n value of 0.04 for the river bed and 0.06 for the banks. This is acceptable for the upper part of the river but for the downstream part (in the city) the river is very urbanised and the manning n value of those sections does not reflect reality.	Change the roughness values to reflect reality.	Information inherited from the EA's Medlock 2011 Model. Calibrations of the EA Medlock 2011 model have been done following sensitivity testing on the Manning's coefficient. The values of 0.04 and 0.06 seem to produce modelled results that match best the actual records. This was explained to the EA during a phone conversation and was accepted. Within the site, the 0.06 value seems to better represent the heavily vegetated banks. This has been replaced by a value of 0.05 in the 'with scheme' scenario to represent natural surfaces that are well maintained. BHE has undertaken sensitivity testing using +10%, as higher values caused model instabilities.
7.4 What grid resolution has been used? Is it suitable to accurately represent flow paths, e.g. between buildings?	4m cell size. This is too coarse for an FRA application. This should be reduce at least to 2m and at best 1m. LiDAR data is available for this area.	Change grid resolution.	A 1m and 2m cell resolution model run was attempted, however, errors in the new Lidar data provided in March 2019 caused errors in the model outputs. A 3m resolution has been used. This has been discussed with the EA during the 3rd April conference call and was accepted.
7.8 How have buildings been represented within the DTM?	Raised by 0.3m and a manning n value of 1.	Explain why an elevation of 0.3m has been chosen. Why this value?	The building values were inherited from EA Medlock 2011 model. This is a value to account for building thresholds normally raised above the surrounding ground levels. Buildings within site have been amended to match topographic survey. The threshold level of buildings outside the site is not known and therefore checks cannot be carried out.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

D.2 Mayfield 2019 model

Modelling files

The Mayfield 2019 model is run through the following simulation files:

- Medlock_SFRA_v0e_MM_002_BH_127.ief – 1D
- Medlock_SFRA_v0e_MM_002_BH_127.tcf and – 2D

The following files called in the above simulations have been amended from the BHE Baseline to create the Mayfield 2019 model as described in the tables below.

Table D.2A – 1D file changes

New/amended files/nodes	Removed files/ nodes	Reason for change
~~**Medlock_SFRA_v0e_MM_002_BH_102.dat**~~ ***Medlock_SFRA_v0e_MM_002_BH_126.dat (to amend manning's n banks value within site and correct spill levels at MEDL01_2510H)***		
	Removed MEDL01_2380L, MEDL01_2380C, MEDL01_2315C	Removed existing culvert
Added MEDL01_2510A, MEDL01_2510D, MEDL01_2510H, MEDL01_2510E, MEDL01_2510B	Removed MEDL01_2492A,MEDL01_2492D, MEDL01_2492H, MEDL01_2492E, MEDL01_2492B	Removed footbridge at MEDL01_2492 and added new footbridge further upstream with spill and orifice setting *(spill level corrected)*
Added MEDL01_2429A, MEDL01_2429D, MEDL01_2429H, MEDL01_2429E, MEDL01_2429B	Removed MEDL01_2429	Removed river section and added new footbridge bridge section with spill and orifice setting
MEDL01_2470		New section between two footbridges for better channel representation
Amended MEDL01_2647, MEDL01_2587, MEDL01_2561, MEDL01_2380, MEDL01_2315		Amended sections within site to represent new masterplan levels. Widened 1D space within site

Table D.2B – 2D file changes

New/amended files	Removed files	Reason for change
~~**Medlock_ER_3m_BH_114.tgc**~~ ***Medlock_ER_3m_BH_127.tgc (removed constriction at Baring Street bridge)***		
2d_bc_inactive_Medlock_BH_102.shp	2d_bc_inactive_Medlock_BH_303.shp	Widened channel corridor and representation in 1D
2d_zpt_mean_building_elevation_080.shp	2d_zpt_mean_building_elevation_074.shp	Removed all building from within the site
2d_zpt_building_threshold_080.shp	2d_zpt_building_threshold_074.shp	Removed all building from within the site
2d_zlr_bank_heights_102_L.shp; 2d_zlr_bank_heights_102_P.shp	2d_zlr_bank_heights_303_L.shp; 2d_zlr_bank_heights_303_P.shp	Adjusted bank heights to match proposals
Optimised Earthworks DES 1m grid_240719.dem		Landscaping proposals across the site
~~2d_zsh_DEM_additional_adjustments_R_003.shp~~ ~~2d_zsh_DEM_additional_adjustments_P_003.shp~~		~~Amendments to the Landscaping DEM at the downstream end of the site to enforce constriction at Baring Street bridge.~~ – *Removed following EA review, as not required*

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

2d_mat_Medlock_BH_113.shp	2d_mat_Medlock_BH_074.shp	Material changes within the Mayfield masterplan
Medlock_Common_Commands_BH_102.trd		
1d_isis_nodes_Medlock_BH_098.shp	1d_isis_nodes_Medlock_BH_072.shp	Amended as per .dat file
1d_nwk_Medlock_BH_098.shp	1d_nwk_Medlock_BH_072.shp	Amended within site as per above
1d_WLL_Medlock_BH_098.shp	1d_WLL_Medlock_BH_303.shp	Amended to match 2d_bc_inactive_Medlock_BH_102.shp
Medlock_BH_102.tbc		
2d_bc_Medlock_HX_BH_102.shp	2d_bc_Medlock_HX_BH_303.shp	Amended to suit proposals
Manchester_Roughness.tmf		No change on material designation

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

D.3 Manning's values

Table D.3A Material roughness values used in the BHE Baseline model and Mayfield 2019 model in 1D model

Model	Manning's 'n' value bed	Manning's 'n' value banks	Comments
EA Medlock 2011 model	0.040	0.060	Model calibrated using the manning's 'n' value
BHE Baseline 2019 model	0.040	0.060	Inherited from EA model
Mayfield 2019 model	0.040	~~0.050~~ *0.060*	*It was recommended by the EA that the manning's for the banks is kept to 0.06 for consistency with the Baseline model. Furthermore, the walled channel is replaced by rough vegetation, therefore reducing manning's is not appropriate.*

Table D.3B Material roughness values used in the BHE Baseline model and Mayfield 2019 model (inherited from original EA Medlock 2011 model) in 2D model

TUFLOW material code	Manning's 'n' value	Description
1	0.050	General Natural Surfaces
2	1.000	Buildings
3	0.025	Inland Water
4	0.050	General mixed (manmade/natural) surfaces
5	0.025	Roads, tracks, paths & pavements
6	0.100	Railway
7	0.100	Non-coniferous woodland & Scrubland
8	0.075	Rough Grassland
9	0.150	Coniferous Trees
10	0.040	General Manmade Surfaces
11	0.065	Marsh Reeds Or Saltmarsh

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Appendix E Surface water drainage strategy

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

BUROHAPPOLD ENGINEERING

Mayfield Phase 1 Foul and Surface Drainage Strategy

0042912

13 September 2019

Revision P02

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved.

Revision	Description	Issued by	Date	Checked
P01	Drainage Strategy	JS	02/09/2019	AG
P02	Drainage Strategy Amendments	JS	13/09/2019	AG

O:\0042912 Mayfield Park Manchester Infrastructure\F8 Civils - Infrastructure\03 Reports\Planning\Drainage\190912 JS 004912 Drainage Strategy P02.docx

This report has been prepared for the sole benefit, use and information of Mayfield Partnership for the purposes set out in the report or instructions commissioning it. The liability of Buro Happold in respect of the information contained in the report will not extend to any third party.

author	**John Scandrett**
date	**13/09/2019**
approved	**Alasdair Gray**
signature	
date	**13/09/2019**

..

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

Contents

1	**Introduction**		**7**
2	**Legislation, Policy and Guidelines**		**8**
	2.1	Planning Context	8
	2.1.1	Planning Policies and the Guidance	8
3	**Consultation with Manchester City Council and the Environment Agency**		**9**
	3.1	Manchester City Council (MCC)	9
	3.2	Environment Agency (EA)	9
	3.3	Scoping Opinion Response	9
4	**Existing Site Existing Site**		**10**
	4.1	Existing Flood Zones	10
5	**Existing Surface Water Drainage**		**11**
	5.1	Existing Drainage and Outfalls	11
	5.2	Exiting Discharge Rates and Volumes	11
6	**Existing Foul Water Drainage**		**12**
7	**Proposed Surface Water Drainage**		**13**
	7.1	Proposed Strategy	13
	7.2	Drainage Design Hierarchy for Sustainable Drainage	13
	7.2.1	Rainwater Harvesting	13
	7.2.2	Infiltration Techniques	13
	7.2.3	Rainwater attenuation in open water features for gradual release	13
	7.2.4	Rainwater discharge direct to a watercourse	14
	7.2.5	Rainwater attenuation above ground	14
	7.2.6	Rainwater attenuation below ground	14
	7.2.7	Rainwater discharge to a surface water sewer or drain	14
	7.2.8	Rainwater discharge to a combined sewer	14
	7.3	Design Parameters	14
	7.4	Catchment Areas	14
	7.5	Building Runoff Rates and Discharge Points	16
	7.6	Proposed Outfalls	17
	7.7	Proposed Layout	18
8	**Proposed Foul Water Drainage**		**19**
9	**Next Steps**		**20**
	Appendix A Existing Foul/Combined Sewer Network		21

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

Appendix B Proposed Foul Network 22

Appendix C Proposed Catchment Areas 23

Appendix D Proposed Storm Water Layouts 24

Appendix E Microdrainage Results 25

Appendix F Drainage Strategy Statements from Plot Teams of Building Plots O, N and M 26

Table of Tables

Table 5—1 Pre-Development Peak Greenfield and Existing Brownfield Discharge Rates 11

Table 7—1 Catchment Areas 15

Table 7—2 Existing Catchment Areas 16

Table 7—3 Brownfield Runoff Rates 16

Table of Figures

Figure 1-1 Proposed Mayfield Masterplan 7

Figure 4-1 Existing Site with the Phase 1 Site Boundary 10

Figure 4-2 Mayfield 2019 Flood Map extract from the Flood Risk Assessment 10

Figure 5-1 Existing Outfall Observed During Site Visit 11

Figure 5-2 Location of the 150mm Combined Sewer on United Utilities Record Drawing (Image courtesy of the United Utilities © United Utilities Water PLC 2017) 11

Figure 6-1 United Utilities Sewer Asset Record. (Image courtesy of the United Utilities © United Utilities Water PLC 2017) 12

Figure 6-2 Known private site sewerage (Image courtesy of the United Utilities © United Utilities Water PLC 2017) 12

Figure 7-1 SuDS Design Hierarchy 13

Figure 7-2 Infiltration Trench Example (Left); Swale Example (Right) 14

Figure 7-3 Catchment Areas Plan 15

Figure 7-4 Civic Proposed Surface Water Sewer Run 15

Figure 7-5 Surface Water Plot Connection Points into proposed surface water sewer 16

Figure 7-6 1 in 25 Year fluvial flood levels and Average Water Levels near proposed outfalls 17

Figure 7-7 Proposed Surface Water Drainage Layout Plan 18

Figure 8-1 Proposed Foul Network 19

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

1 Introduction

BuroHappold Engineering has been appointed by U+I Group PLC on behalf of the Mayfield Development Partnership LP to prepare a drainage strategy for Mayfield Phase 1 Development, including two commercial office blocks, a multi-storey car park and creation of a city centre park, in September and October 2019 and will become a reference document for other development within the Mayfield SRF 2018 area. . The Phase 1 site is 7 Ha and is bounded by the Mayfield Depot building to the north, Hoyle Street to the east, the Mancunian Way ring road (A635) to the south and Baring Street (inclusive) to the west. The Site boundary also extends to the London Road junction and access to Baring Street to facilitate road improvements proposed ("the Site").

This report has been prepared to describe the proposed surface water and foul water drainage strategy for the new development, a high-quality urban neighbourhood with residential buildings and public spaces just south of the Manchester Piccadilly Railway Station.



Figure 1-1 Proposed Mayfield Masterplan

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

2 Legislation, Policy and Guidelines

2.1 Planning Context

The management of water resources is governed by a range of legislative guidance set out within international, national and regional policies and plans. The stormwater strategy has been prepared with due regard to the plans and policies set out in this section.

2.1.1 Planning Policies and the Guidance

The Drainage Strategy has been developed in accordance with the following policies and guidelines:

- National Planning Policy Framework – March 2012
- Water Resources Act 1991 – December 1991
- Flooding and Water Management Act 2010 – April 2010
- Guide to Development in Manchester Supplementary Planning Document and Planning Guidance Adopted - April 2007
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA User Guide Final – May 2010
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Level 2 SFRA Final – March 2011
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA Canal Hazard Zones, Drawing Number MM_3.2B, Final – March 2011
- Manchester City, Salford City and Trafford Councils (March 2011) Level 2 Hybrid SFRA Critical Drainage Areas, Drawing Number SS_4.5, Final – March 2011
- Manchester City, Salford City and Trafford Councils (March 2011) Level 2 Hybrid SFRA Flood Risk Management, Drawing Number FL_1.1 F, Final – March 2011
- Manchester City Council SuDS Requirements for New Developments
- Manchester Green and Blue Strategy – July 2015
- Manchester Green and Blue Action Plan – July 2015
- Northwest River Basin Management Plan – February 2015
- Environment Agency (EA) Guidelines

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

3 Consultation with Manchester City Council and the Environment Agency

3.1 Manchester City Council (MCC)

Following conversations and meetings with MCC the below parameters were agreed:

- Proposed discharge rate is to be restricted to 50% of the existing brownfield runoff rate with 2l/s/ha to be subtracted from this peak 50% discharge rate.
- Climate change allowance is to be 30%, however, attenuation volumes should also be checked against a 40% allowance.
- No flooding of buildings occurs in 1 in 100 year rainfall event plus climate change allowance. Plot designers will need to accommodate all the necessary surface water attenuation within the plot demise. The attenuation will need to be designed to accommodate the 1 in 100 year storm events plus climate change allowance based on a 50% brownfield rate with a further reduction of 2l/s/ha for long-term storage.
- Surface flooding of open spaces is acceptable for short periods in events over 1 in 30 year return period rainfall events
- Overland flow routes for extreme events are diverted away from buildings
- As the existing site is brownfield the 1 in 100 year, 6 hour rainfall runoff volume shall be constrained to a maximum of the existing brownfield runoff volume for the same event. Our aspiration is to better this where we can
- For surface car parks (>50 spaces) and areas of unusual pollution risk pollution control measures will be provided (likely to be a combination of petrol interceptors and SuDS features where applicable)

3.2 Environment Agency (EA)

After consultation with the EA it was agreed that discharge of surface water into the Medlock River would be acceptable.

3.3 Scoping Opinion Response

A scoping opinion was submitted to MCC in July 2019 the comments returned highlighted two key issues for the drainage strategy to address:

The area is situated within the Conurbation Core Critical Drainage Area and in accordance with the Manchester City Council SFRA at least a 50% reduction in surface water runoff should be provided through SUDS as part of any brownfield development with the aim of reducing to the Greenfield runoff rates.

Surface water should be managed to ensure there is no increased surface water from the proposed development and runoff from extreme events should be retained within the site such that the adjacent third party land is not affected.

And;

The suitability of sustainable drainage systems should be assessed in accordance with paragraphs 051, 079 and 080 of the revised NPPF Planning Practice Guidance for Flood Risk and Coastal Change Sustainable drainage systems should be designed in line with national Non-Statutory Technical Standards for SuDS and local policies EN08, EN14 and EN17 of the Core Strategy.

Hydraulic calculations and drawings to support the design need to be provided along with proposed standards of operation and maintenance in accordance with paragraph 081 of NPPF Planning Practice Guidance.

Both of these points are addressed as part of the proposed surface water strategy.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

4 Existing Site Existing Site

The Mayfield Phase 1 Development Site is a 7ha and is located in Manchester City Centre to the immediate south/southeast of Piccadilly Railway Station, centred at NGR 385006 397717. The River Medlock meanders through the central area of the Site, flowing from east to west within a deep rectangular brick/stone walled channel. It is culverted beneath Hoyle Street.

The Site is currently occupied by existing and historical urban development comprising the former (now abandoned) Mayfield Railway Station and associated railway lines, numerous works/factories, a scrap yard, a depot, Hoyle Street Industrial Estate, derelict land and car parking. The immediate surrounding area comprises urban development including residential (student accommodation/private rental), offices, commercial and industrial facilities.

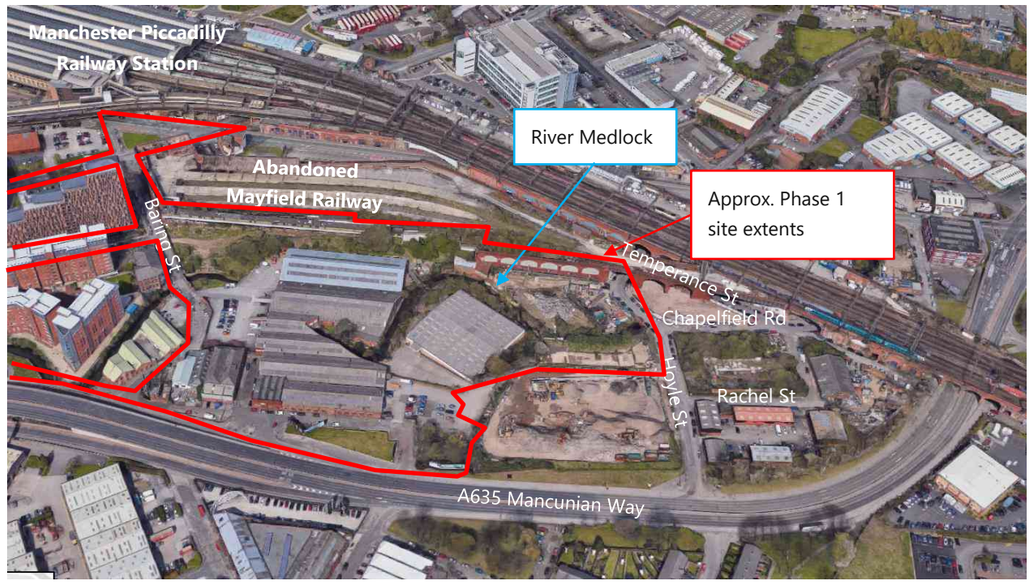


Figure 4-1 Existing Site with the Phase 1 Site Boundary

The condition of the river varies. The river wall is generally in a poor derelict state of repair with parts collapsed into the river. It is assumed that some stormwater is seeping through cracks into the River Medlock. In many locations, siltation has built up on one or both sides of the river bank. The silt deposits have enabled the dense growth of vegetation along almost the entire corridor. Japanese Knotweed is currently present along the riparian corridor within the site.

The site is heavily overgrown in areas and is largely covered in impermeable hardstanding and buildings in various states of condition with hardscaping in areas being cracked and deteriorated.

4.1 Existing Flood Zones

Extract from River Strategy Report and water chapter of Strategic Regeneration Framework dated 12/10/2017:

"The Environment Agency's flood risk mapping shows parts of the existing site to be highly susceptible to flooding with the River Medlock canalised between the high walls and under industrial buildings. Flooding of the site is concentrated around the Medlock in the central area (Flood Zone 3 High risk) with some Flood Zone 2 (Medium risk) on the margins. However, the majority of the site is situated within Flood Zone 1 (Low risk) with a flood risk less than 0.1% (on average one occurrence in 1000 years). Flood risk from ground water, surface water and artificial sources is currently considered low to very low at the site.

The regeneration of Mayfield will allow the river corridor and floodplain to be carefully reprofiled using the results of detailed hydraulic modelling, that will ensure the park can reduce the risk of flooding and mitigate for the effects of climate change. The well-considered design will ensure that there will be no detrimental effects upstream or downstream, with finished floor levels for property set well above design flood levels as recommended by the Environment Agency (EA). This will ensure the development is safe, with appropriate pedestrian and vehicular access, even during the 0.1% AEP event for maintenance or improvements works."

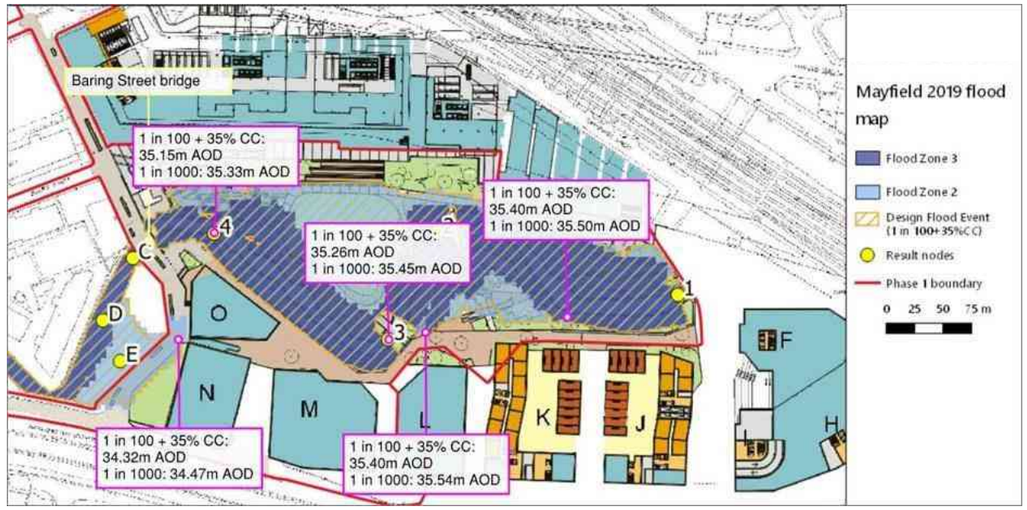


Figure 4-2 Mayfield 2019 Flood Map extract from the Flood Risk Assessment

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

5 Existing Surface Water Drainage

5.1 Existing Drainage and Outfalls

It is unclear from public sewer records how the current site is drained however the lack of available information would suggest that the vast majority of the site is served by private drainage networks. It is likely that the buildings are served by individual connections to the United Utilities combined sewers that surround the site.

The site generally slopes towards the River Medlock and it is assumed that it drains into the river. Only one outfall is shown on the topographic survey conducted by Malcolm Hughes. Visual inspection of the river bank on a site visit (conducted 01/10/2017) highlighted one existing drainage outfall to the River Medlock (Figure 5-1). It is assumed that this is a stormwater only outfall however this has not been confirmed at this stage. It is assumed that there are more outfalls along both banks however due to the overgrown and inaccessible nature of the river banks these are not currently observable. Responsibility for managing these systems is assumed split due to the wide array of site situations.



Figure 5-1 Existing Outfall Observed During Site Visit

The existing drainage is assumed to have been designed and installed in accordance with national standards. It is assumed that the existing below ground stormwater drainage system discharges at an uncontrolled rate and no on-site storage exists or is anticipated.

There is a short length of 150mm diameter United Utilities combined sewer just to the south of the southwest end of the abandoned Mayfield train station. The sewer does not appear to drain to an obvious discharge point on the sewer records so this sewer alignment and depth needs to be confirmed via a site-wide utility survey, however, it is assumed to connect to the combined sewer along Amory Street. Other combined sewers within the site and the site's proximity are discussed in section 6 regarding the existing foul water drainage.

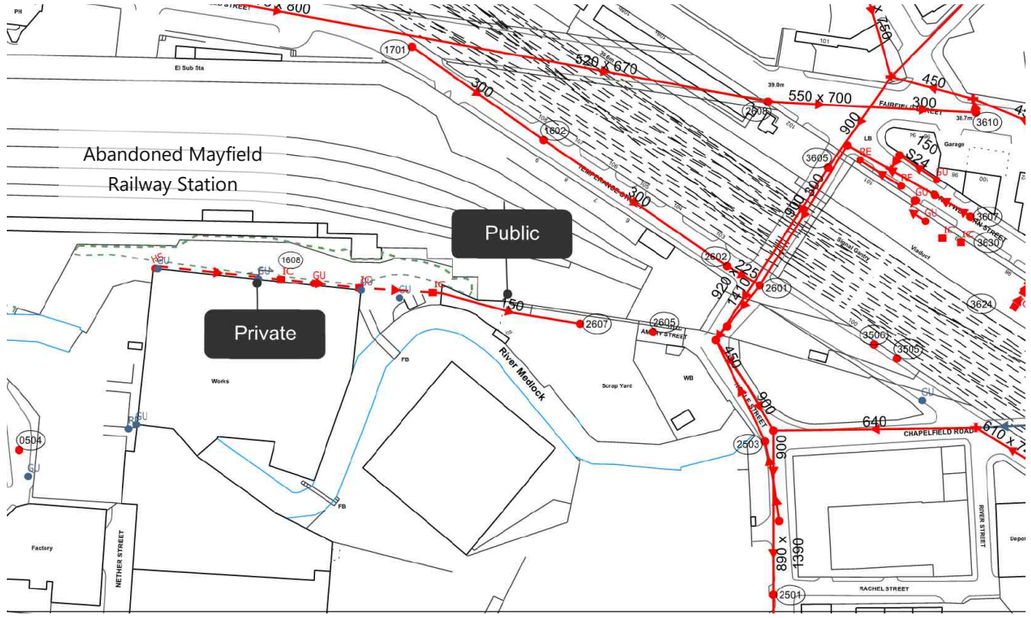


Figure 5-2 Location of the 150mm Combined Sewer on United Utilities Record Drawing (Image courtesy of the United Utilities © United Utilities Water PLC 2017)

Existing topographic surveys show gullies within Hoyle Street, Baring Street, Temperance Street and Chapelfield Road however the condition and exact layout of these stormwater drains are unknown at this stage. It is proposed to retain these drains throughout the resurfacing of these roads and reuse them in the final masterplan.

5.2 Exiting Discharge Rates and Volumes

Table 5—1 Pre-Development Peak Greenfield and Existing Brownfield Discharge Rates

Annual Probability	Greenfield Peak Discharge (l/s)	Existing Brownfield Peak Discharge (l/s)
2	34.8 l/s	61.6 l/s
30	63.5 l/s	139.9 l/s
100	77.75 l/s	188.4 l/s

It should be noted that the values in Table 5—1 have been calculated using the area of the proposed park and Baring Street within the application boundary as this area relates to the area that will be captured and discharged by the storm water system within this application. This area is 3.68 ha.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

6 Existing Foul Water Drainage

Mayfield is served by a network of public combined sewers (conveying both foul and surface water together) situated beneath the principal roads both within the masterplan (Hoyle Street, Baring Street and Chaplefield Road) and immediately beyond its perimeter (Mancunian Way, Fairfield Street and Temperance Street). United Utilities (UU) records show one number site sewer as having been adopted, situated in Amory Street, site of the proposed park.

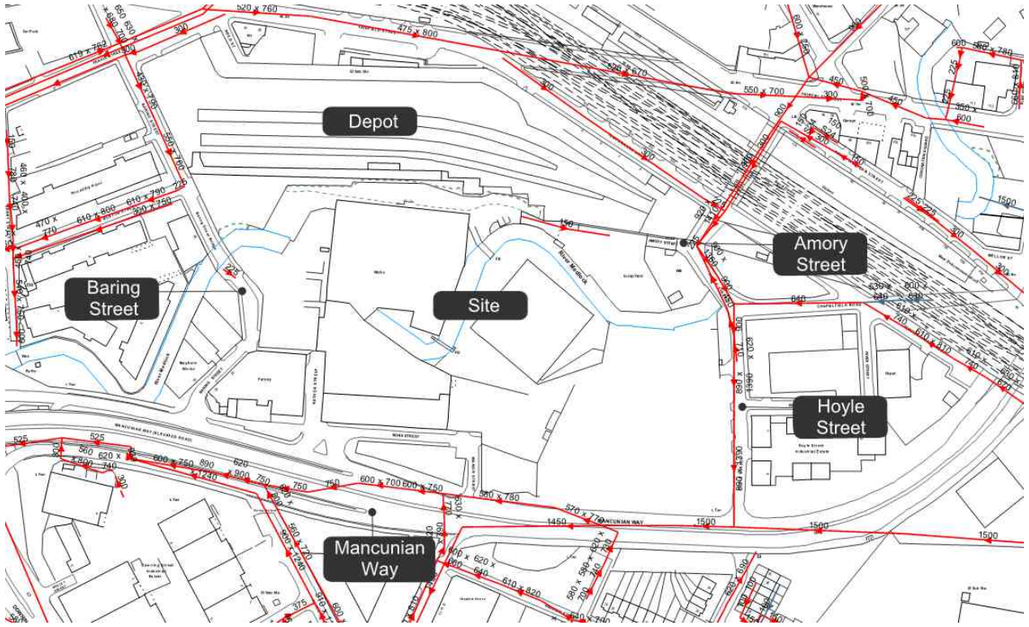


Figure 6-1 United Utilities Sewer Asset Record. (Image courtesy of the United Utilities © United Utilities Water PLC 2017)

UU network pipes sizes vary from 150mm diameter to 1500mm in Mancunian Way. Pipe materials are a mix of vitrified clay and brick and sewer shape varies from circular to egg. Sewer depths appear significant, up to 10m in places, suggesting that they have excavated in rock or possibly constructed within a tunnel heading. UU sewer levels and exact manhole locations are unknown in the majority of cases. A line and level survey at probable points of connection will be required at the next stage.

Information pertaining to the private site foul drainage is limited, and no as-built data is available. UU asset records record a length north of the river serving the Fedex building, does not appear to drain to an obvious discharge point on the sewer records, however, it is assumed to connect to the public sewer in Amory Street. A known private combined sewer is connected to this run.

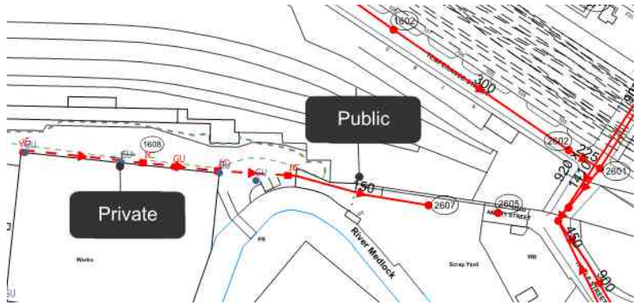


Figure 6-2 Known private site sewerage (Image courtesy of the United Utilities © United Utilities Water PLC 2017)

Localised private sewerage is also known to have been installed as part of the Mayfield Masterplan development, accessed from Baring Street. The new public connection is not shown on the UU record drawings.

The sewers that run underneath Chapelfield Road and Hoyle Street are both assumed to be Victorian era, egg-shaped brick combined sewers of unknown condition and are owned by UU. The sewer that runs beneath Chapelfield Road is buried approximately 2-3m deep based on incomplete UU sewer records and is recorded as a 640mm "diameter". There are two sewers that run down Hoyle Street in opposite directions. There is a 450mm diameter combined sewer draining northwards at approximately 5m depth that runs for roughly a third of the length of the section of Hoyle Street that is within the site boundary. A much larger and deeper 900mm "diameter" combined sewer flows southwards beneath this sewer at a depth of between 8-14m. It is assumed based on limited ground information that this deep sewer is within rock. The other two sewers may be partly within rock but are likely to be buried within the made ground on site. Based on guidance provided by UU no-build easements have been calculated for the existing sewers

UU records show a short length of sewer south of the river within Baring Street. Investigation is recommended to ascertain the extent and suitability of this sewer to receive flows in this area.

This review of existing below ground foul drainage information concludes that a drainage survey is required to confirm the on-site private sewerage network and key points of probable connection to the public UU network beneath the adjacent roads.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

7 Proposed Surface Water Drainage

7.1 Proposed Strategy

The proposed drainage strategy shall be designed:

- To protect against flooding
- To collect and convey surface water away from developed areas in a safe and controlled manner
- To protect surface receiving waters, in both quality and hydraulic terms
- To be sustainable and maintainable; and
- To ensure structural integrity over the duration of the development design life

The new below ground drainage network shall replace the existing and convey water to outfall into the River Medlock. It is proposed that all new sewers will drain by gravity, wherever possible however pumping stations may be required to keep the attenuation storage above modelled flood levels. Due to the existing ground conditions, infiltration and other source controls are generally unlikely to be achievable.

The majority of the green space proposed in the landscape masterplan is within the park and therefore lies within the flood plain and is not available to use for storm water attenuation. The strategy therefore proposes to discharge all surface water that falls within the park to the river without first attenuating flows. Surface water may still pass through a variety of Sustainable Urban Drainage Systems (SuDs) prior to discharge to provide a water quality benefit. These could include filter strips and swales to reduce suspended solids within the surface water runoff.

All surface water which falls on the surrounding buildings will be attenuated on plot. This surface water will then be discharged via a series of pipes into the River Medlock. Buildings will utilise a range of SuDs systems including green, blue and brown roofs, rainwater harvesting, raingardens and below ground storage. These measures will designed to meet the required surface water discharge rates for the development.

7.2 Drainage Design Hierarchy for Sustainable Drainage

Not all SuDS features are appropriate for the Mayfield site. This is mainly due to the restricted site area available in the masterplan outside of the flood plain and the contaminated ground conditions that preclude the use of methods that rely on infiltration. In developing the storm water strategy for the masterplan, the following design hierarchy has been adopted.

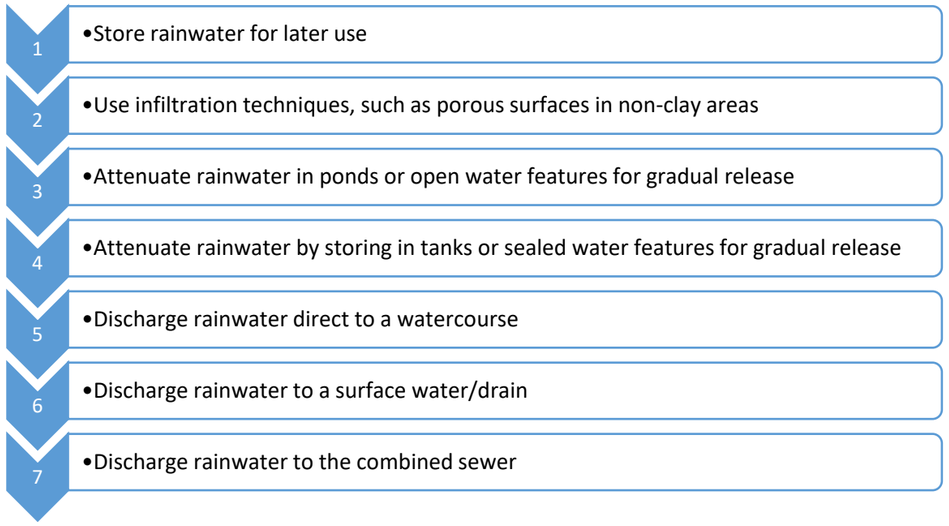


Figure 7-1 SuDS Design Hierarchy

7.2.1 Rainwater Harvesting

Rainwater harvesting could be proposed as part of the on plot water strategy but has not been decided at this stage. This could be developed further by the plot designers at the detailed design stages subject to technical feasibility and cost viability.

7.2.2 Infiltration Techniques

Permeable paving is unlikely to be compatible with proposals for the resurfacing of Hoyle Street, Baring Street and Temperance Street and is unsuitable for use in areas where tight HGV manoeuvring would occur due to wheel loads and tyre scrub. The paving along the footpaths that are within the flood zones are proposed to be permeable.

Areas of the park will use infiltration techniques for storms up to 1 in 30 years plus climate change via swales/infiltration trenches. See section 7.2.3 below.

7.2.3 Rainwater attenuation in open water features for gradual release

There is insufficient space for large open water features such as lakes outside of the flood zone, however, in some areas within the flood zone, swales/infiltration trenches will be introduced to contain 1 in 30 year storm event runoff from neighbouring softscape and footpaths. The remaining runoff from a 1 in 100 year storm event will overflow into the River Medlock. There is no need to generate enough hydraulic head to push the water into the River Medlock during a flood event as these areas will have flooded. Examples of a swale and an infiltration trench are shown below.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved



Figure 7-2 Infiltration Trench Example (Left); Swale Example (Right)

7.2.4 Rainwater discharge direct to a watercourse

It has been agreed with the EA to discharge surface water runoff into the River Medlock that runs through the centre of the site. Areas of hardstanding outside of the fluvial flood zone will discharge into the river.

7.2.5 Rainwater attenuation above ground

Buildings will utilise a range of SuDs systems including green, blue and brown roofs, rainwater harvesting and raingardens. These will be designed and determined by the plot designers.

7.2.6 Rainwater attenuation below ground

Rainwater attenuation below ground is not required for areas in the public realm. Plot designers will be required to attenuate their surface water runoff at 50% of the 1 in 100 year storm brownfield runoff rate minus 2l/s/ha as agreed with MCC.

The discharge of the plot designers' attenuation will be discharged into the proposed surface water network that transfers surface water to the River Medlock.

7.2.7 Rainwater discharge to a surface water sewer or drain

There are no public surface water sewers. Currently it is assumed that the majority of the site is connected to a private surface water network that drains into the River Medlock. The intention is to discharge all surface water into the River Medlock as agreed with the EA. This will replicate the existing conditions for the majority of the site.

7.2.8 Rainwater discharge to a combined sewer

Part of the site currently drains into public combined sewers situated around the site. However, to improve the situation with regards to sustainable urban drainage, it is propose to discharge surface water into the River Medlock as agreed with the EA.

7.3 Design Parameters

We propose that all new buried drainage provides the following levels of service:

- No surcharge within the pipe network up to and including a 1:2 year storm event;
- No flooding of the drainage system up to and including a 1:30 year storm event;
- Management of flood water up to the 1:100 year storm event.
- Climate change allowance included in the infrastructure design shall be 30%; and
- Proposed discharge rate for plot attenuation shall be restricted to 50% of the existing peak brownfield runoff rate with 2l/s/ha subtracted from this 50% peak discharge rate (1 in 100 year) as per discussions with MCC and the EA.

7.4 Catchment Areas

Indicative surface water sewer runs were created within the masterplan. Catchment areas were then created based on the sewer runs and the landscaping layout. Catchment areas are shown in Table 7—1. The effective areas for each catchment have been calculated using the runoff coefficients of 0.95 for hardscaping and buildings and 0.3 for softscape landscaped areas. The locations of the catchment areas can be seen in Figure 7-3.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

Table 7—1 Catchment Areas

Catchment Type	Catchment Ref.	Catchment Area (m^2)	Catchment Area (ha)	Hardscape (%)	Softscape (%)	Effective Hardscape Area (ha)	Effective Softscape Area (ha)	Total Effective Area (ha)
Landscape	C1	2439	0.24	60%	40%	0.14	0.03	0.17
Landscape	C2	4200	0.42	65%	35%	0.26	0.04	0.30
Landscape	C3	3108	0.31	10%	90%	0.03	0.08	0.11
Landscape	C4	3619	0.36	68%	32%	0.23	0.03	0.27
Landscape	C5	430	0.04	55%	45%	0.02	0.01	0.03
Landscape	C6	929	0.09	95%	5%	0.08	0.00	0.09
Landscape	C7	598	0.06	70%	30%	0.04	0.01	0.05
Landscape	C8	966	0.10	90%	10%	0.08	0.00	0.09
Landscape	C9	323	0.03	100%	0%	0.03	0.00	0.03
Landscape	C10	1054	0.11	15%	85%	0.02	0.03	0.04
Landscape	C11	670	0.07	97%	3%	0.06	0.00	0.06
Landscape	C12	44	0.00	100%	0%	0.00	0.00	0.00
Building	B1a	1126	0.11	100%	0%	0.11	0.00	0.11
Building	B1b	1784	0.18	100%	0%	0.17	0.00	0.17
Building	B2	2609	0.26	100%	0%	0.25	0.00	0.25



Figure 7-3 Catchment Areas Plan

Catchment area C13 shown in the plan is to be drained by the surface water system that runs along Baring Street and is design by Civic Engineers and therefore has not been included in the surface water sewer design. Catchment area C14 is to be drained via the same method as it currently drains. It's drain paths are to be unaffected.

There is potential for rainwater runoff in catchment area C1 to fall into the planting areas between the hardscaping during low rainfall intensities, however, during higher rainfall return periods, this area will need to be provided with a flow path to the Medlock to avoid localised flooding.

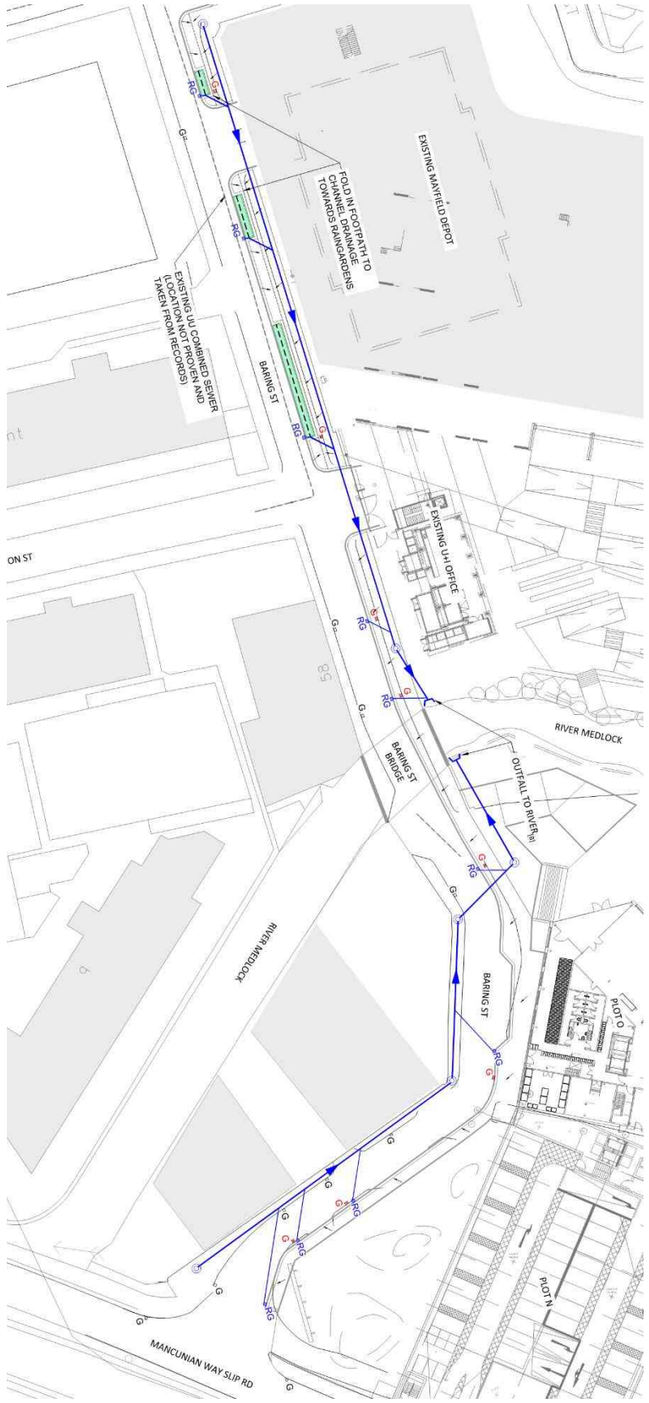


Figure 7-4 Civic Proposed Surface Water Sewer Run

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

The existing runoff rates within these catchments have been calculated using the topographical survey. The difference between the existing and proposed effective areas within each catchment can be seen in the table below.

Table 7—2 Existing Catchment Areas

Catchment Ref.	Hardscape (ha)	Softscape (ha)	Effective Hardscape Area (ha)	Effective Softscape Area (ha)	Total Effective Area (ha)
C1	0.05	0.19	0.05	0.06	0.11
C2	0.28	0.14	0.26	0.04	0.31
C3	0.31	0.00	0.29	0.00	0.29
C4	0.34	0.02	0.33	0.01	0.33
C5	0.03	0.01	0.03	0.00	0.03
C6	0.09	0.00	0.09	0.00	0.09
C7	0.06	0.00	0.05	0.00	0.06
C8	0.06	0.03	0.06	0.01	0.07
C9	0.02	0.01	0.02	0.00	0.03
C10	0.11	0.00	0.10	0.00	0.10
C11	0.06	0.01	0.05	0.00	0.06
C12	0.00	0.00	0.00	0.00	0.00
B1a	0.11	0.00	0.11	0.00	0.11
B1b	0.18	0.00	0.17	0.00	0.17
B2	0.22	0.05	0.20	0.01	0.22

7.5 Building Runoff Rates and Discharge Points

The MCC has stipulated that the surface water discharge from the plots will need to be restricted to 50% of the peak brownfield discharge rate (1 in 100 year storm event) minus 2l/s/ha. Brownfield runoff rates for the proposed buildings have been calculated based on the catchment areas of the buildings using the Modified Rational Method. The plot teams have provided flow rates with further reductions for discharging the buildings' surface water into the proposed surface water sewer. These discharge rates have been used in the design of the surface water sewer.

Table 7—3 Brownfield Runoff Rates

Building Catchment Ref.	Effective Area (ha)	1 in 100 year storm event 50% Brownfield Runoff Rate minus 2l/s/ha (l/s)	Discharge Rates from Plot Teams (l/s)
B1a	0.11	10.10	7.50
B1b	0.17	16.00	10.70
B2	0.25	23.40	15.80

The surface water system will also need to take into account future runoff from the proposed buildings around the site. Points of connection to the proposed external surface water system for the on plot attenuation tanks at the required maximum discharge rates are shown in the figure below. See Appendix F for drainage strategies from the plot teams.



Figure 7-5 Surface Water Plot Connection Points into proposed surface water sewer

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

7.6 Proposed Outfalls

Due to the high river flood levels during high return-period river flooding events the stormwater outfalls into the River Medlock will become surcharged and thus submerged. This can mean that water is unable to discharge unless there is sufficient hydraulic head in the network to force the water out of the outfall. For most buildings/plot this is unlikely to be a problem as the invert levels of the proposed storage features will be above the high river flood levels and therefore provide enough hydraulic head to discharge into the River Medlock.

However, where invert levels of any attenuation within the proposed buildings are below the 1in 5 year flood levels, it is proposed that these are drained via a pumping or lifting station to provide sufficient hydraulic head.

Where possible, the invert levels of the outfalls have been proposed to be above the 1 in 25 year flood event. However, due to the levels and gradients around the site in some locations it is not possible to achieve this. Instead the average river level has been used as the minimum outfall invert level. There are three outfalls where this occurs, two of which are within the river bank areas of the Phase 1 site. However, it is deemed unlikely that a high intensity fluvial event will coincide with a high intensity rainfall event. If a convergence occurs, there is sufficient hydraulic head within the surface water network to prevent flooding to the buildings/plots if the outfalls are submerged.

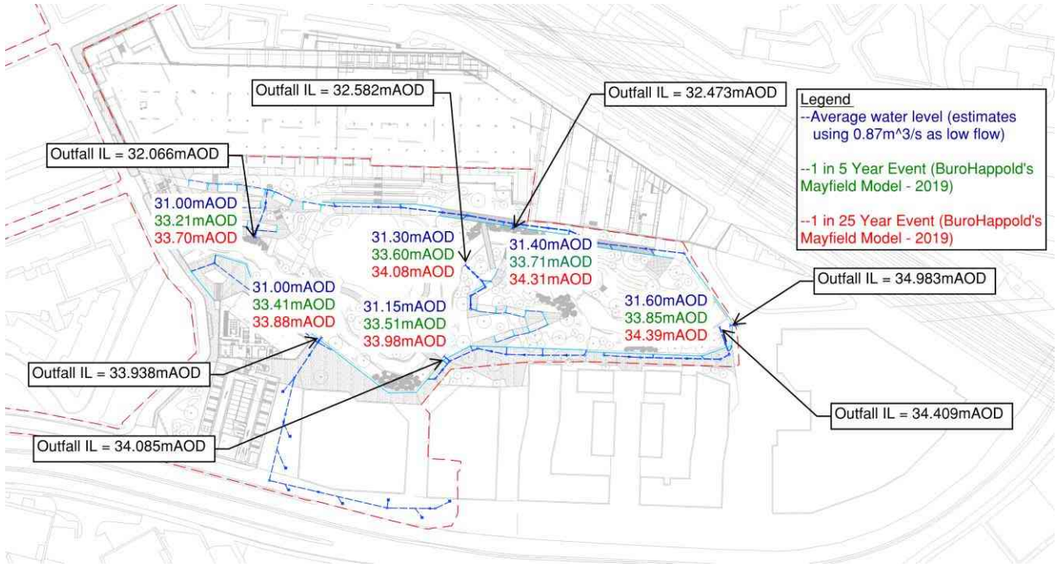


Figure 7-6 1 in 25 Year fluvial flood levels and Average Water Levels near proposed outfalls

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

7.7 Proposed Layout

After hydraulic analysis using the catchment areas and brownfield runoff rates of the buildings the layout shown below is proposed. For more detail including pipe sizes and manhole sizes see Appendix D.

Swales/Infiltration trenches have been proposed in some areas of the flood zone to contain 1 in 30 year storm event runoff from neighbouring softscape and hardstanding. The remaining runoff from a 1 in 100 year storm event will overflow into the River Medlock. Footpaths within the river bank areas are proposed to be permeable and include a SuDS system geotextile between its foundations and subgrade that will filter any potential contaminates.

Any flooding from a 1 in 100 year storm that occur within the surface water network will be contained on site and flow towards the River Medlock as the site slopes towards the river.

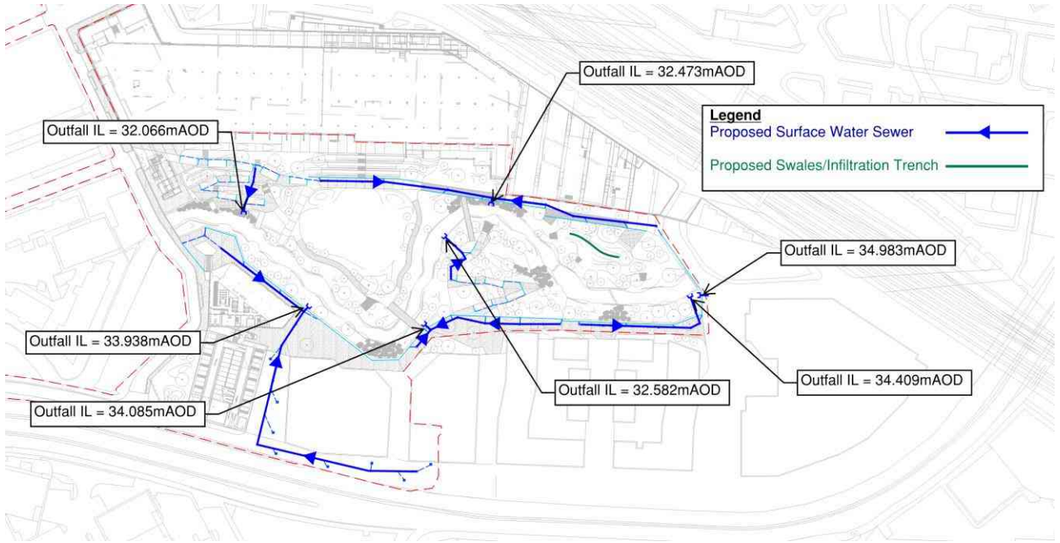


Figure 7-7 Proposed Surface Water Drainage Layout Plan

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

8 Proposed Foul Water Drainage

A proposed foul network has been provided to allow plot teams to connect. The proposed network will then connect into the existing UU combined sewer network to the south of the site. Plot connections to the proposed foul water sewer are shown below.

A description of the individual plot drainage strategies and details for plot foul water networks can be found in Appendix F.

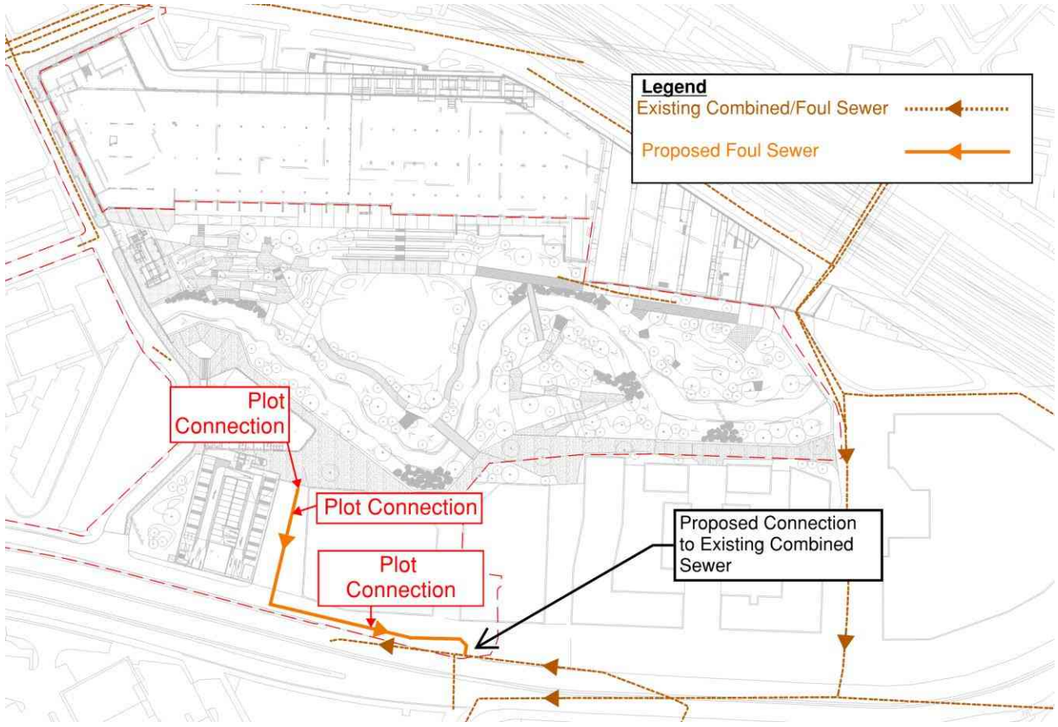


Figure 8-1 Proposed Foul Network

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

9 Next Steps

This Foul and Surface Water Drainage Strategy has been prepared to support the planning application for the Mayfield Phase 1 Development.

The strategy has provided calculations of the volume of storage that could be necessary to support the proposed development, using the illustrative masterplan to demonstrate how the proposed approach could be accommodated within the parameters established by the planning application.

Overall, it has demonstrated that as the Proposed Development progresses, the approach to foul and surface water could deliver a sustainable method for managing surface water, which would satisfy both national and local planning policy requirements.

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

Appendix A Existing Foul/Combined Sewer Network

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

© Buro Happold Limited or its group companies.
All Rights reserved. Buro Happold and its group companies assert (unless otherwise agreed in writing) their rights under s.77 to 89 of the Copyright, Designs and Patents Act 1988.

DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

Notes

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

LEGEND

EXISTING

- EXISTING COMBINED/FOUL WATER SEWER
- APPLICATION BOUNDARY

N

ST ANDREW'S STREET

FAIRFIELD STREET

CORONATION SQUARE

MELLOR ST

FAIRFIELD ROAD

River Medlock

BARING STREET

MANCUNIAN WAY (SLIP ROAD)

MANCUNIAN WAY (ELEVATED ROAD)

MANCUNIAN WAY

INVERT LEVEL = 29.63m AOD

900mmØ

300mmØ

OWNERSHIP BEING CONFIRMED WITH UNITED UTILITIES

APPROX DEPTH TO CROWN OF PIPE = 8.0m

IL APPROX 29.13m AOD

300mmØ

IL APPROX 29.08m AOD

400mmØ

IL APPROX 32.48m AOD

APPROX DEPTH TO CROWN OF PIPE = 8.5m

APPROX DEPTH TO CROWN OF PIPE = 2.5m

640mmØ

IL APPROX 35.5m AOD

INVERT LEVEL = 32.08m AOD

900mmØ

810mm x 740mmØ

610mm x 810mmØ

UNITED UTILITIES COMBINED SEWER

930mm x 870mmØ

APPROX DEPTH TO CROWN OF PIPE = 10.0m

800mm x 1300mmØ

890mmØ

APPROX DEPTH TO CROWN OF PIPE = 14.0m

10 5 0 10 20 30 40

1 : 500

SCALE BEFORE REDUCTION

Rev	Description	Date	Drn	Chkd
B	FOR INFORMATION	30.08.19	JS	AG
A	FOR INFORMATION	29.03.19	RH	AG

INFORMATION

Status of drawing

BUROHAPPOLD ENGINEERING

17 Newman Street
London
W1T 1PD
UK

Tel: +44 (0)20 7927 9700
Fax: +44 (0)870 787 4145
Email: 0042912@burohappold.com
Web: www.burohappold.com

Architect SEW

Project MAYFIELD DEVELOPMENT PARTNERSHIP

Drg Title EXISTING SITE
FOUL WATER DRAINAGE AND
PROPSED LAYOUT

Scales@A1 1:500
Drawn by RH
Checked by

Job No. 0042912
Date MARCH 2019
Rev B

Drawing No. 0042912-BHE-XX-XX-DR-C-0201

Jobs Stored in F:\0042912 Mayfield Park Manchester\4 Models\Civil\3 Drawings\0042912-BHE-XX-XX-DR-C-0201.dwg

Appendix B Proposed Foul Network

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

© Buro Happold Limited or its group companies.
All Rights reserved. Buro Happold and its group companies assert (unless otherwise agreed in writing) their rights under s.77 to 89 of the Copyright, Designs and Patents Act 1988.

DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

Notes
1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

N

ST ANDREW'S STREET

FAIRFIELD STREET

CORONATION SQUARE

MELLOR ST

MAYFIELD ROAD

River Medlock

BARING STREET

MANCUNIAN WAY (SLIP ROAD)

MANCUNIAN WAY (ELEVATED ROAD)

MANCUNIAN WAY

FWMH1
1200mmØ
CL 36.150m
IL 34.600m

300mmØ @ 1:150

FWMH2
1200mmØ
CL 36.150m
IL 34.523m

300mmØ @ 1:150

FWMH3
1200mmØ
CL 36.755m
IL 34.384m

300mmØ @ 1:150

FWMH4
1200mmØ
CL 37.360m
IL 34.192m

300mmØ @ 1:150

300mmØ @ 1:150

FWMH5
1200mmØ
CL 39.370m
IL 33.769m

300mmØ @ 1:150

FWMH6
1200mmØ
CL 40.000m
IL 33.649m

FWMH7
1200mmØ
CL 40.000m
IL 33.600m

CONNECTION TO EXISTING NETWORK
IL 33.600m

EXISTING

EXISTING COMBINED/FOUL WATER SEWER

PROPOSED DRAINAGE

FOUL WATER SEWER

FOUL WATER MH

APPLICATION BOUNDARY

10 5 0 10 20 30 40
1 : 500
SCALE BEFORE REDUCTION

Rev	Description	Date	Drn	Chkd
B	FOR INFORMATION	13.09.19	JS	AG
A	FOR INFORMATION	30.08.19	JS	AG

INFORMATION

Status of drawing

BUROHAPPOLD ENGINEERING

17 Newman Street
London
W1T 1PD
UK

Tel: +44 (0)20 7927 9700
Fax: +44 (0)870 787 4145
Email: 0042912@burohappold.com
Web: www.burohappold.com

Architect SEW

Project MAYFIELD DEVELOPMENT PARTNERSHIP

Drg Title PROPOSED SITE WIDE FOUL WATER PLAN

Scales@A0 1:500
Drawn by JS
Checked by AG

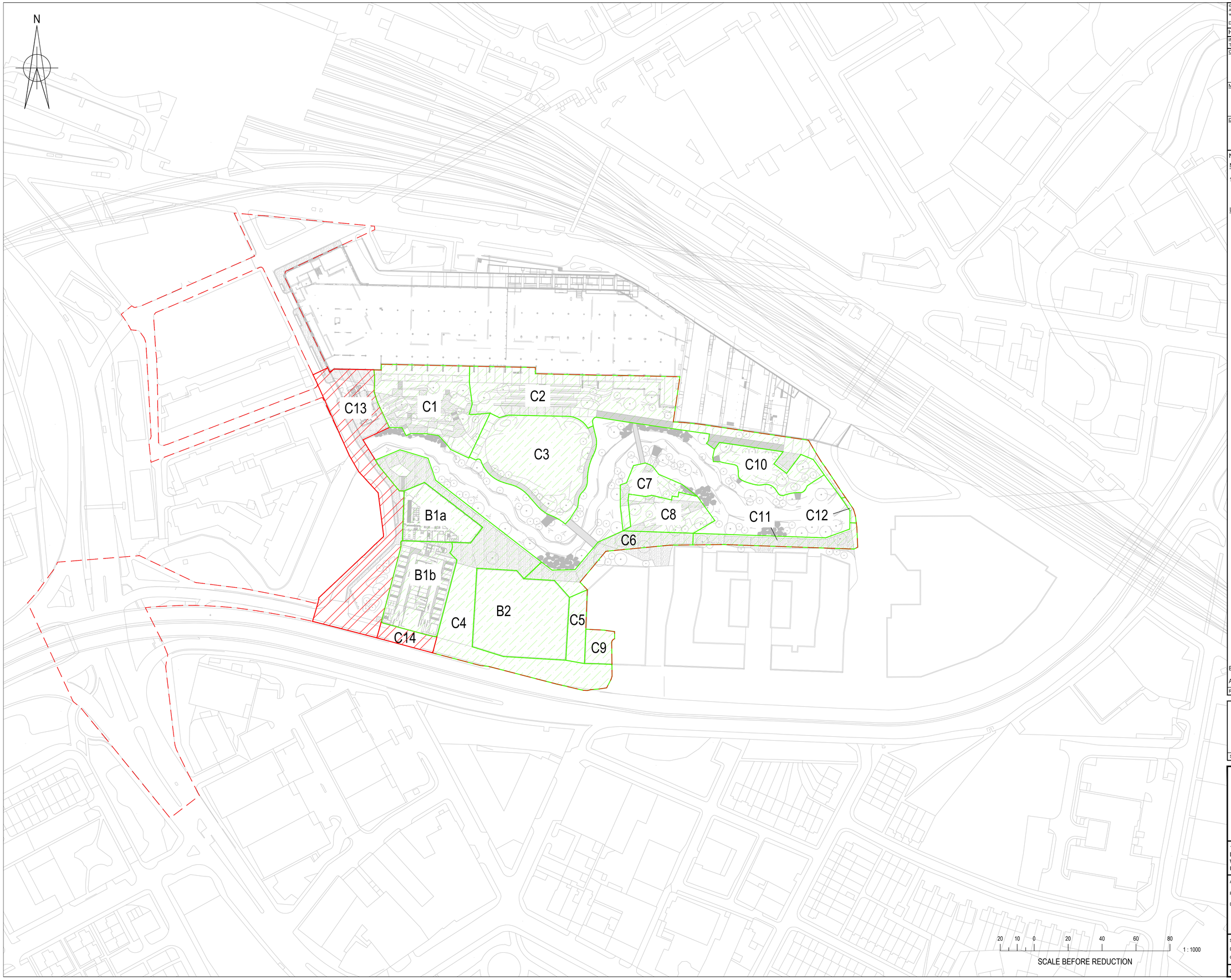
Job No. 0042912
Date AUGUST 2019
Rev B

Drawing No. 0042912-BHE-XX-XX-DR-C-3200

Job: Scheme\17-05\0017 Mayfield Park Manchester\Models\BIM\17-05-BHE-XX-XX-DR-C-3200.dwg

Appendix C Proposed Catchment Areas

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved



© Buro Happold Limited or its group companies.
All Rights reserved. Buro Happold and its group companies assert (unless otherwise agreed in writing) their rights under s.77 to 89 of the Copyright, Designs and Patents Act 1988.

DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

Notes

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

LEGEND

CATCHMENT AREA

APPLICATION BOUNDARY

Rev	Description	Date	Drn	Ch'd
B	FOR INFORMATION	30.08.19	JS	AG
A	FOR INFORMATION	29.03.19	RH	AG

INFORMATION

Status of drawing

BUROHAPPOLD ENGINEERING

17 Newman Street
London
W1T 1PD
UK

Tel: +44 (0)20 7927 9700
Fax: +44 (0)870 787 4145
Email: 0042912@burohappold.com
Web: www.burohappold.com

Architect *SEW*

Project **MAYFIELD DEVELOPMENT PARTNERSHIP**

Drg Title PROPOSED CATCHMENT AREAS

Scales@A0 1:1000
Drawn by RH
Checked by AG

Job No. 0042912
Date MARCH 2019
Rev B

Drawing No. 0042912-BHE-XX-XX-SK-C-0019

John Sansbrook P:\0042912 Mayfield Park Manchester Infrastructure\Sheet\Sketches\0042912-BHE-XX-XX-SK-C-0019 - Catchments.dwg

Appendix D Proposed Storm Water Layouts

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

© Buro Happold Limited or its group companies.
All Rights reserved. Buro Happold and its group companies assert (unless otherwise agreed in writing) their rights under s.77 to 89 of the Copyright, Designs and Patents Act 1988.

DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

Notes
1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

LEGEND

EXISTING

EXISTING COMBINED/FOUL WATER SEWER

PROPOSED DRAINAGE

375mmØ SURFACE WATER

SURFACE WATER MH

OUTFALL

GULLEY

SWALE/INFILTRATION TRENCH

ACO MULTIDRAIN LINEAR DRAIN (UNLESS OTHERWISE STATED)

LINEAR DRAIN SUMP

APPLICATION BOUNDARY

Rev	Description	Date	Drn	Ch'd
D	FOR INFORMATION	13.09.19	JS	AG
C	FOR INFORMATION	30.08.19	JS	AG
B	SECONDARY DRAINAGE RUNS ADDED	02.04.19	JS	AG
A	FOR INFORMATION	18.03.19	RJL	CH

INFORMATION

Status of drawing

BUROHAPPOLD ENGINEERING

17 Newman Street
London
W1T 1PD
UK

Tel: +44 (0)20 7927 9700
Fax: +44 (0)870 787 4145
Email: 0042912@burohappold.com
Web: www.burohappold.com

Architect SEW

Project MAYFIELD DEVELOPMENT PARTNERSHIP

Drg Title PROPOSED SITE WIDE SURFACE WATER PLAN

Scales@A0 1:500
Drawn by RJL
Checked by CH

Job No. 0042912
Date MARCH 2019
Rev D

Drawing No. 0042912-BHE-XX-XX-DR-C-3120

10 5 0 10 20 30 40 1 : 500

SCALE BEFORE REDUCTION

© Buro Happold Limited or its group companies.
All Rights reserved. Buro Happold and its group companies assert (unless otherwise agreed in writing) their rights under s.77 to 89 of the Copyright, Designs and Patents Act 1988.

DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

Notes

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

LEGEND

EXISTING

- EXISTING COMBINED/FOUL WATER SEWER

PROPOSED DRAINAGE

- SURFACE WATER
- SURFACE WATER MH
- OUTFALL
- GULLEY
- SWALE/INFILTRATION TRENCH
- ACO MULTIDRAIN LINEAR DRAIN (UNLESS OTHERWISE STATED)
- LINEAR DRAIN SUMP
- APPLICATION BOUNDARY

Rev	Description	Date	Drn	Ch'd
D	FOR INFORMATION	13.09.19	JS	AG
C	FOR INFORMATION	30.08.19	JS	AG
B	SECONDARY DRAINAGE RUNS ADDED	02.04.19	JS	AG
A	FOR INFORMATION	29.03.19	RH	AG

INFORMATION

Status of drawing

BUROHAPPOLD ENGINEERING

17 Newman Street
London
W1T 1PD
UK

Tel: +44 (0)20 7927 9700
Fax: +44 (0)870 787 4145
Email: 0042912@burohappold.com
Web: www.burohappold.com

Architect SEW

Project **MAYFIELD DEVELOPMENT PARTNERSHIP**

Drg Title PROPOSED SURFACE WATER PLAN SHEET 1 OF 2

Scales@A1 1:500
Drawn by RH
Checked by AG

Job No. 0042912
Date MARCH 2019
Rev D

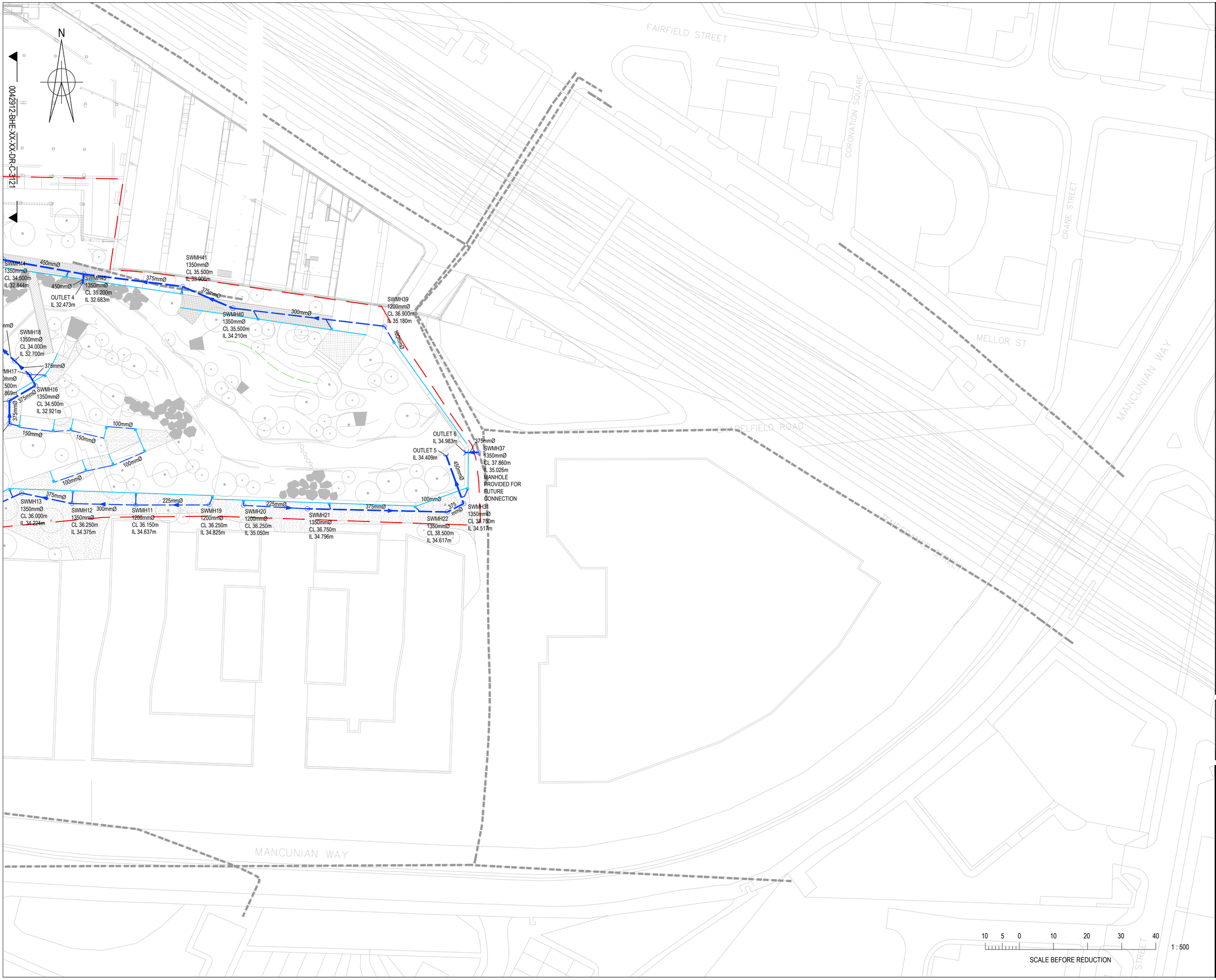
Drawing No. 0042912-BHE-XX-XX-DR-C-3121

0042912-BHE-XX-XX-DR-C-3122

1 : 500

SCALE BEFORE REDUCTION

John Sandbrook P:\0042912 Mayfield Park Manchester\Infrastructure\Sheet\0042912-BHE-XX-XX-DR-C-3121.dwg



© Buro Happold Limited or its group companies.
All Rights reserved. Buro Happold and its group companies assert (unless otherwise agreed in writing) their rights under s.77 to 89 of the Copyright, Designs and Patents Act 1988.

DO NOT SCALE THIS DRAWING.

HEALTH AND SAFETY INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING

CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

Notes

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

LEGEND

EXISTING

- EXISTING COMBINED/FOUL WATER SEWER

PROPOSED DRAINAGE

- 375mmØ — SURFACE WATER
- SURFACE WATER MH
- OUTFALL
- GULLEY
- SWALE/INFILTRATION TRENCH
- ACO MULTIDRAIN LINEAR DRAIN (UNLESS OTHERWISE STATED)
- LINEAR DRAIN SUMP
- APPLICATION BOUNDARY

Rev	Description	Date	Drn	Ch'd
D	FOR INFORMATION	13.09.19	JS	AG
C	FOR INFORMATION	30.08.19	JS	AG
B	SECONDARY DRAINAGE RUNS ADDED	02.04.19	JS	AG
A	FOR INFORMATION	29.03.19	RH	AG

INFORMATION

Status of drawing

BUROHAPPOLD ENGINEERING

17 Newman Street
London
W1T 1PD
UK

Tel: +44 (0)20 7927 9700
Fax: +44 (0)870 787 4145
Email: 0042912@burohappold.com
Web: www.burohappold.com

Architect SEW

Project **MAYFIELD DEVELOPMENT PARTNERSHIP**

Drg Title PROPOSED SURFACE WATER PLAN SHEET 2 OF 2

Scales@A1 1:500
Drawn by RH
Checked by AG

Job No. 0042912
Date MARCH 2019
Rev D

Drawing No. 0042912-BHE-XX-XX-DR-C-3122

John Stansfield P:\0042912\Mayfield Park Manchester Infrastructure\Shared\00\01\2-BHE-XX-XX-DR-C-3122.dwg

Appendix E Microdrainage Results

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	11
Number of Online Controls	11	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 392244 401697 SD 92244 01697
C (1km)	-0.026
D1 (1km)	0.364
D2 (1km)	0.417
D3 (1km)	0.292
E (1km)	0.305
F (1km)	2.479
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	30, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Summer	2	+30%	30/15 Summer	100/15 Summer		
1.001	2	15 Summer	2	+30%	30/15 Summer	100/15 Summer		
1.002	3	15 Summer	2	+30%	30/15 Summer	100/15 Summer		
1.003	4	15 Summer	2	+30%	30/15 Summer			
1.004	5	15 Summer	2	+30%	30/15 Summer			
5.000	6	15 Summer	2	+30%	30/15 Summer			
5.001	7	15 Summer	2	+30%	30/15 Summer			
1.005	8	15 Summer	2	+30%	30/15 Summer			
6.000	14	15 Summer	2	+30%				
6.001	15	15 Summer	2	+30%	100/15 Summer			
6.002	16	15 Summer	2	+30%	100/15 Summer			
6.003	17	15 Summer	2	+30%				

©1982-2018 Innovyze

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	38.644	-0.156	0.000	0.20		16.9	OK	1
1.001	2	37.395	-0.122	0.000	0.42		35.9	OK	3
1.002	3	35.631	-0.106	0.000	0.54		42.9	OK	3
1.003	4	34.779	-0.051	0.000	0.95		49.7	OK	
1.004	5	34.397	-0.190	0.000	0.49		85.1	OK	
5.000	6	34.657	-0.133	0.000	0.34		11.9	OK	
5.001	7	34.473	-0.122	0.000	0.42		18.9	OK	
1.005	8	34.282	-0.074	0.000	0.99		106.2	OK	
6.000	14	33.314	-0.261	0.000	0.20		30.6	OK	
6.001	15	33.172	-0.252	0.000	0.23		32.4	OK	
6.002	16	33.066	-0.231	0.000	0.31		33.6	OK	
6.003	17	32.987	-0.257	0.000	0.22		35.0	OK	

©1982-2018 Innovyze

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
6.004	18	15 Summer	2	+30%					32.829
7.000	20	15 Summer	2	+30%	30/15 Summer				35.123
7.001	21	15 Summer	2	+30%	30/15 Summer				34.965
7.002	22	15 Summer	2	+30%	30/15 Summer				34.873
7.003	31	15 Summer	2	+30%	30/15 Summer				34.861
12.005	37	15 Summer	2	+30%	30/15 Summer				35.344
14.000	38	15 Summer	2	+30%					36.147
14.001	39	15 Summer	2	+30%	100/15 Summer				35.423
14.002	40	15 Summer	2	+30%	100/15 Summer				34.373
14.003	41	15 Summer	2	+30%	100/15 Summer				34.082
16.000	42	15 Summer	2	+30%	30/15 Summer				33.595
16.001	43	15 Summer	2	+30%	30/15 Summer				33.206
16.002	44	30 Summer	2	+30%	30/15 Summer				33.058
14.004	45	30 Summer	2	+30%	30/15 Summer				33.007
19.000	46	15 Summer	2	+30%	100/15 Summer				33.562
19.001	47	15 Summer	2	+30%	100/15 Summer				32.945
19.002	48	15 Summer	2	+30%	30/15 Summer				32.303
20.002	9	15 Summer	2	+30%	30/15 Summer				34.680
22.000	19	15 Summer	2	+30%	30/15 Summer				34.908
21.002	11	15 Summer	2	+30%	30/15 Summer				34.783
21.003	12	15 Summer	2	+30%	30/15 Summer				34.534
21.004	13	30 Summer	2	+30%	30/15 Summer				34.423
20.003	10	30 Summer	2	+30%	30/15 Summer				34.389

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.004	18	-0.246	0.000	0.26		35.0	OK	
7.000	20	-0.152	0.000	0.22		7.8	OK	
7.001	21	-0.206	0.000	0.41		49.0	OK	
7.002	22	-0.119	0.000	0.60		51.1	OK	
7.003	31	-0.106	0.000	0.94		172.7	OK	
12.005	37	-0.130	0.000	0.74		99.2	OK	
14.000	38	-0.163	0.000	0.17		12.7	OK	
14.001	39	-0.204	0.000	0.22		32.6	OK	
14.002	40	-0.212	0.000	0.39		83.1	OK	
14.003	41	-0.198	0.000	0.44		93.5	OK	
16.000	42	-0.130	0.000	0.36		15.6	OK	
16.001	43	-0.259	0.000	0.37		73.8	OK	
16.002	44	-0.235	0.000	0.37		80.9	OK	
14.004	45	-0.126	0.000	0.86		223.3	OK	
19.000	46	-0.088	0.000	0.36		14.1	OK	
19.001	47	-0.214	0.000	0.18		37.9	OK	
19.002	48	-0.120	0.000	0.66		40.3	OK	
20.002	9	-0.120	0.000	0.44		24.0	OK	
22.000	19	-0.142	0.000	0.29		9.6	OK	

©1982-2018 Innovyze

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
21.002	11	-0.154	0.000	0.47		45.2	OK	
21.003	12	-0.215	0.000	0.37		56.2	OK	
21.004	13	-0.176	0.000	0.47		56.0	OK	
20.003	10	-0.117	0.000	0.81		86.6	OK	

©1982-2018 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	11
Number of Online Controls	11	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 392244 401697 SD 92244 01697
C (1km)	-0.026
D1 (1km)	0.364
D2 (1km)	0.417
D3 (1km)	0.292
E (1km)	0.305
F (1km)	2.479
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	30, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Summer	30	+30%	30/15 Summer	100/15 Summer		
1.001	2	15 Summer	30	+30%	30/15 Summer	100/15 Summer		
1.002	3	15 Summer	30	+30%	30/15 Summer	100/15 Summer		
1.003	4	15 Summer	30	+30%	30/15 Summer			
1.004	5	15 Summer	30	+30%	30/15 Summer			
5.000	6	15 Summer	30	+30%	30/15 Summer			
5.001	7	15 Summer	30	+30%	30/15 Summer			
1.005	8	15 Summer	30	+30%	30/15 Summer			
6.000	14	15 Summer	30	+30%				
6.001	15	15 Summer	30	+30%	100/15 Summer			
6.002	16	15 Summer	30	+30%	100/15 Summer			
6.003	17	15 Summer	30	+30%				

©1982-2018 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	38.812	0.012	0.000	0.50		42.4	SURCHARGED	1
1.001	2	38.586	1.069	0.000	0.95		80.9	SURCHARGED	3
1.002	3	36.980	1.242	0.000	1.18		93.1	SURCHARGED	3
1.003	4	35.765	0.934	0.000	2.03		106.6	SURCHARGED	
1.004	5	34.741	0.154	0.000	0.85		149.0	SURCHARGED	
5.000	6	34.957	0.167	0.000	0.80		27.8	SURCHARGED	
5.001	7	34.828	0.233	0.000	1.01		44.8	SURCHARGED	
1.005	8	34.567	0.210	0.000	1.87		200.7	SURCHARGED	
6.000	14	33.389	-0.186	0.000	0.50		76.6	OK	
6.001	15	33.259	-0.164	0.000	0.59		82.8	OK	
6.002	16	33.180	-0.116	0.000	0.80		85.8	OK	
6.003	17	33.071	-0.172	0.000	0.56		90.2	OK	

©1982-2018 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
6.004	18	15 Summer	30	+30%					32.925
7.000	20	15 Summer	30	+30%	30/15 Summer				35.363
7.001	21	15 Summer	30	+30%	30/15 Summer				35.326
7.002	22	15 Summer	30	+30%	30/15 Summer				35.231
7.003	31	15 Summer	30	+30%	30/15 Summer				35.202
12.005	37	15 Summer	30	+30%	30/15 Summer				35.696
14.000	38	15 Summer	30	+30%					36.187
14.001	39	15 Summer	30	+30%	100/15 Summer				35.507
14.002	40	15 Summer	30	+30%	100/15 Summer				34.462
14.003	41	15 Summer	30	+30%	100/15 Summer				34.204
16.000	42	15 Summer	30	+30%	30/15 Summer				33.761
16.001	43	15 Summer	30	+30%	30/15 Summer				33.574
16.002	44	15 Summer	30	+30%	30/15 Summer				33.507
14.004	45	15 Summer	30	+30%	30/15 Summer				33.432
19.000	46	15 Summer	30	+30%	100/15 Summer				33.611
19.001	47	15 Summer	30	+30%	100/15 Summer				33.018
19.002	48	15 Summer	30	+30%	30/15 Summer				32.596
20.002	9	15 Summer	30	+30%	30/15 Summer				34.827
22.000	19	15 Summer	30	+30%	30/15 Summer				35.056
21.002	11	15 Summer	30	+30%	30/15 Summer				35.004
21.003	12	15 Summer	30	+30%	30/15 Summer				34.867
21.004	13	15 Summer	30	+30%	30/15 Summer				34.771
20.003	10	15 Summer	30	+30%	30/15 Summer				34.677

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.004	18	-0.150	0.000	0.67		90.5	OK	
7.000	20	0.088	0.000	0.51		17.9	SURCHARGED	
7.001	21	0.155	0.000	0.73		87.6	SURCHARGED	
7.002	22	0.239	0.000	1.07		91.3	SURCHARGED	
7.003	31	0.236	0.000	1.81		334.8	SURCHARGED	
12.005	37	0.222	0.000	1.73		230.4	SURCHARGED	
14.000	38	-0.123	0.000	0.42		31.9	OK	
14.001	39	-0.120	0.000	0.66		98.5	OK	
14.002	40	-0.122	0.000	0.78		168.9	OK	
14.003	41	-0.077	0.000	0.98		206.3	OK	
16.000	42	0.036	0.000	0.88		37.7	SURCHARGED	
16.001	43	0.109	0.000	0.63		125.0	SURCHARGED	
16.002	44	0.213	0.000	0.69		151.4	SURCHARGED	
14.004	45	0.299	0.000	1.57		406.2	SURCHARGED	
19.000	46	-0.039	0.000	0.89		35.3	OK	
19.001	47	-0.141	0.000	0.55		114.3	OK	
19.002	48	0.174	0.000	2.01		123.1	SURCHARGED	
20.002	9	0.027	0.000	0.86		47.0	SURCHARGED	
22.000	19	0.006	0.000	0.70		23.3	SURCHARGED	

©1982-2018 Innovyze

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
21.002	11	0.067	0.000	0.86		82.2	SURCHARGED	
21.003	12	0.118	0.000	0.79		119.7	SURCHARGED	
21.004	13	0.171	0.000	1.01		119.8	SURCHARGED	
20.003	10	0.171	0.000	1.75		187.3	SURCHARGED	

©1982-2018 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	11
Number of Online Controls	11	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
FEH Rainfall Version	1999
Site Location	GB 392244 401697 SD 92244 01697
C (1km)	-0.026
D1 (1km)	0.364
D2 (1km)	0.417
D3 (1km)	0.292
E (1km)	0.305
F (1km)	2.479
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	2, 30, 100
Climate Change (%)	30, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Summer	100	+30%	30/15 Summer	100/15 Summer		
1.001	2	15 Summer	100	+30%	30/15 Summer	100/15 Summer		
1.002	3	15 Summer	100	+30%	30/15 Summer	100/15 Summer		
1.003	4	15 Summer	100	+30%	30/15 Summer			
1.004	5	15 Summer	100	+30%	30/15 Summer			
5.000	6	15 Summer	100	+30%	30/15 Summer			
5.001	7	15 Summer	100	+30%	30/15 Summer			
1.005	8	15 Summer	100	+30%	30/15 Summer			
6.000	14	15 Summer	100	+30%				
6.001	15	15 Summer	100	+30%	100/15 Summer			
6.002	16	15 Summer	100	+30%	100/15 Summer			
6.003	17	15 Summer	100	+30%				

©1982-2018 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	40.000	1.200	0.152	0.69		58.0	FLOOD	1
1.001	2	39.376	1.860	6.389	1.06		90.7	FLOOD	3
1.002	3	37.365	1.627	4.627	1.33		105.4	FLOOD	3
1.003	4	36.292	1.462	0.000	2.28		120.0	SURCHARGED	
1.004	5	34.992	0.405	0.000	1.03		179.3	SURCHARGED	
5.000	6	35.613	0.823	0.000	1.21		42.1	FLOOD RISK	
5.001	7	35.321	0.726	0.000	1.51		67.2	SURCHARGED	
1.005	8	34.741	0.384	0.000	2.40		257.8	SURCHARGED	
6.000	14	33.526	-0.049	0.000	0.74		113.6	OK	
6.001	15	33.438	0.014	0.000	0.89		123.5	SURCHARGED	
6.002	16	33.335	0.038	0.000	1.19		127.8	SURCHARGED	
6.003	17	33.132	-0.112	0.000	0.83		133.6	OK	

©1982-2018 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
6.004	18	15 Summer	100	+30%					32.998
7.000	20	15 Summer	100	+30%	30/15 Summer				35.790
7.001	21	15 Summer	100	+30%	30/15 Summer				35.718
7.002	22	15 Summer	100	+30%	30/15 Summer				35.539
7.003	31	15 Summer	100	+30%	30/15 Summer				35.435
12.005	37	15 Summer	100	+30%	30/15 Summer				35.751
14.000	38	15 Summer	100	+30%					36.216
14.001	39	15 Summer	100	+30%	100/15 Summer				35.798
14.002	40	15 Summer	100	+30%	100/15 Summer				34.832
14.003	41	15 Summer	100	+30%	100/15 Summer				34.534
16.000	42	15 Summer	100	+30%	30/15 Summer				34.403
16.001	43	15 Summer	100	+30%	30/15 Summer				33.952
16.002	44	15 Summer	100	+30%	30/15 Summer				33.850
14.004	45	15 Summer	100	+30%	30/15 Summer				33.721
19.000	46	15 Summer	100	+30%	100/15 Summer				34.136
19.001	47	15 Summer	100	+30%	100/15 Summer				33.345
19.002	48	15 Summer	100	+30%	30/15 Summer				32.866
20.002	9	15 Summer	100	+30%	30/15 Summer				35.125
22.000	19	15 Summer	100	+30%	30/15 Summer				35.592
21.002	11	15 Summer	100	+30%	30/15 Summer				35.482
21.003	12	15 Summer	100	+30%	30/15 Summer				35.248
21.004	13	15 Summer	100	+30%	30/15 Summer				35.063
20.003	10	15 Summer	100	+30%	30/15 Summer				34.884

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.004	18	-0.078	0.000	0.98		132.8	OK	
7.000	20	0.515	0.000	0.86		29.9	SURCHARGED	
7.001	21	0.547	0.000	0.98		117.4	SURCHARGED	
7.002	22	0.547	0.000	1.45		124.3	SURCHARGED	
7.003	31	0.468	0.000	2.36		434.8	SURCHARGED	
12.005	37	0.277	0.000	1.86		248.6	SURCHARGED	
14.000	38	-0.094	0.000	0.63		48.3	OK	
14.001	39	0.171	0.000	0.95		141.3	SURCHARGED	
14.002	40	0.247	0.000	0.99		214.6	SURCHARGED	
14.003	41	0.253	0.000	1.26		266.2	SURCHARGED	
16.000	42	0.678	0.000	1.30		55.5	FLOOD RISK	
16.001	43	0.487	0.000	0.77		153.1	SURCHARGED	
16.002	44	0.557	0.000	0.88		192.9	SURCHARGED	
14.004	45	0.588	0.000	1.97		510.2	SURCHARGED	
19.000	46	0.486	0.000	1.32		52.2	SURCHARGED	
19.001	47	0.186	0.000	0.79		163.9	SURCHARGED	
19.002	48	0.444	0.000	2.86		175.5	FLOOD RISK	
20.002	9	0.325	0.000	1.07		58.2	SURCHARGED	
22.000	19	0.542	0.000	1.11		37.2	SURCHARGED	

©1982-2018 Innovyze

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
21.002	11	0.546	0.000	1.11		106.9	SURCHARGED	
21.003	12	0.499	0.000	1.08		163.6	SURCHARGED	
21.004	13	0.463	0.000	1.38		164.4	SURCHARGED	
20.003	10	0.378	0.000	2.39		256.4	SURCHARGED	

©1982-2018 Innovyze

Appendix F Drainage Strategy Statements from Plot Teams of Building Plots O, N and M

Copyright © 1976 - 2019 BuroHappold Engineering. All Rights Reserved

1. Introduction

Civic Engineers has been appointed by Mayfield Partnership to provide a Drainage Statement and Strategy for the proposed development of Baring St Office 1, Mayfield.

The purpose of this statement is to:

- Provide information on the existing site's topography and drainage,
- Establish the pre-development peak 1 in 1-year surface water run-off rate,
- Calculate the required attenuation volume; and
- Summarise the proposed drainage strategy (including the feasibility of SUDS features)

This statement is based on currently available information. Proposals contained or forming part of this statement represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project.

2. Existing Site Details

Baring St Office 1 occupies 0.123ha and is located in the south west corner of the Mayfield Development Site, with Baring Street adjacent the west boundary and the proposed Baring St MSCP adjacent the south boundary. The plot is centred around an approximate National Grid Reference of SJ850975.

The proposed area has a history of industrial use during the 18th and 19th century as well as providing areas of terraced workers' housing and a primary community focal point in the form of the Mayfield Bath House. Within the latter half of the 20th century, there was a general reduction in the scale of industrial development of the site and the removal of previous workers' accommodation and the bathhouse. In 1977 a portion of the previous India Rubber building was demolished, leaving an area of open land in the majority of plot.

2.1 Existing Topography

A topographical survey was undertaken by Malcolm Hughes Surveyors in September 2017 and indicates the plot generally grades from the south east, with an approximate level of 35.79m AOD, to the north, with an approximate level of 35.15m AOD. The majority of the plot is currently used as a carpark with a tarmac surface finish, which has localised falls towards a central road gully.

The eastern side of the plot is occupied by a building and there is a small section of grass and trees (31m^2) adjacent the south east plot boundary.

For the purpose of drainage calculations, the plot is considered to be 100% impermeable

2.2 Existing Drainage

No above ground watercourses have been identified within the proposed plot boundary. The River Medlock is generally a culverted watercourse, however an exposed section is present approximately 15m north of Baring St Office 1.

Public Sewer records have been obtained from United Utilities which indicate there are no adopted sewers within the proposed plot boundary.

The following public sewer infrastructure has been identified within the vicinity of the plot:

- A varying large diameter combined water sewer runs within the Mancunian Way approximately 90m south of the proposed plot
- A 225mm diameter combined water sewers runs within Baring St. The sewer is believed to run the length of Baring St, however the United Utilities Asset Map only displays a short section.

The following private sewer infrastructure is believed to be in the vicinity of and within the proposed plot:

- From site observations it is anticipated that a private surface water sewer runs below the existing surface car park and discharges into the River Medlock, north of Baring St Office 1
- A private combined water sewer is anticipated within Nether St

A CCTV Survey has not been undertaken for the proposed plot.

3. Proposed Development

Baring St Office 1 is included within the Phase 1 proposal of the Mayfield Development and comprises an 8 storey office development including ground, mezzanine and plant level comprising 9, 987 sq.m. (GEA) including active ground floor uses (A1, A3, A4 or B1), public realm and riverside walkway.

The Phase 1 Site is located entirely within the Mayfield Strategic Regeneration Framework (SRF) area, which lies to the south of Fairfield Street in Manchester city centre, in close proximity to Piccadilly mainline railway station.

4. Surface Water Calculations

4.1 Catchment/Impermeable Areas

Site Drainage Area	=	1227m^2 / 0.123 ha
Pre-Development Impermeable Area	=	1227m^2 / 0.123 ha (100% Impermeable)
Post-Development Impermeable Area	=	1223m^2 / 0.123 ha (100% impermeable)

4.2 Surface Water Calculation Variables

Data to calculate the pre-development 1 in 1-year surface water run-off rates and attenuation volumes are based on figures from the Flood Studies Report (FSR) data and Wallingford Procedure, which have been sourced from HR Wallingford.

The variables used to calculate the surface water run-off rates and required attenuation volumes are as follows:

M5 – 60 (mm)	=	17.000		
Ratio R	=	0.4		
Cv (Summer)	=	0.750		
Cv (Winter)	=	0.840		
Time of Entry	=	4 minutes		
Climate Change	=	0	-	Pre-Development
	=	30%	-	Post Development

4.3 Pre-Development Peak 1 in 1 Year Surface Water Run-Off

Based on the above variables, and calculations undertaken using a two-pipe simulated network within Micro Drainage computer software, the pre-development surface water run-off rate is as follows:

Pre-Development 1 in 1-Year Rate	=	15.5 l/s	(15-minute critical storm)

4.4 Post Development Restricted Surface Water Run-Off Rate

The Buro Happold Surface Water Design Note requires each plot to discharge at a rate at 50% of the existing runoff rate, minus 2 L/s/ha (per plot boundary) to account for long term storage.

The surface water from the proposed development is to be restricted by a flow control, in this case a vortex flow control devise will be used, to give:

Post Development SW Run-Off Rate	=	7.5 L/s	(50% of 15.5l/s – 2 l/s/ha)

4.5 Surface Water Attenuation Volumes

The surface water attenuation volume has been calculated using the above variables within the Source Control module of Micro Drainage.

1 in 100 Year Event + CC (30%)	=	26.4m^3	(7.5 l/s)

5. Surface Water Drainage Strategy

The site wide drainage strategy, prepared by Buro Happold, proposes that the surface water runoff from each plot be collected within a main sewer run and then outfall to the River Medlock at a restricted rate.

Based on the current proposed layout, runoff collected by the green roof will be conveyed through the building to a traditional below ground system of pipes and manholes which will then convey flows to a underground attenuation tank, before discharging to the proposed Buro Happold Surface Water sewer at a restricted rate of 7.5 L/s.

The proposed drainage strategy is enclosed within Appendix A.

5.1 Potential Sustainable Drainage Systems (SUDS) Features Feasibility

Where possible SuDS are to be incorporated into the post development design to provide attenuation and ensure that runoff from the site does not exceed predevelopment runoff rates.

Varied SuDS methods have been summarised in the table below to assess and establish which are most feasible for the proposed post development site.

SuDS Method	Feasibility, Given Site and Project
Green & Blue Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insultation. A green roof is currently proposed for the building, however it should be noted that the use of brown/green roofs should be for betterment purposes and not to be counted towards the provision of on-site storage for surface water. This is due to their hydraulic performance during extreme events being similar to a standard roof (CIRIA C697)
Basins and Ponds – Above Ground storage	Basins and ponds increase biodiversity and amenity of the area; provide attenuation; and improve water quality. This method does however occupy large areas of developable land and requires suitable offsets from buildings. Due to the proposed structure occupying the entire site and the urban location, basins and ponds are not a feasible option.
Rain Gardens & Tree Pits	The current layout proposes 100% of the plot be occupied by the residential building and as such there is no area available for a Rain Gardens or Tree Pits
Filter Strips and Swales	Filter strips and swales are generally used adjacent highways to reduce and treat runoff. The current layout proposed for Baring St Office 1 does not involve highways and as such there is no available area for filter strips or swales
Rainwater Harvesting	Storage and use of rainwater for non-potable uses within a building (eg. Toilet flushing). Is should be noted that storage in these types of systems is not usually considered to count towards the provision of on-site storage for surface water balancing because, given the sporadic nature of the use of harvester water, it cannot be guaranteed that the tanks are available to provide sufficient attenuation during storm events.

	Rainwater harvesting is not a viable option due to the rainfall yield on the roof area being significantly less than the water demand for the residential units.
Infiltration Devices	Borehole testing conducted on site identified the presence of made ground and the BGS drift maps indicate the site is underlain by a Secondary Aquifer within the Superficial drift and a Primary Aquifer within the bedrock. The historic use of the site as a tannery, factories and bathhouse also present a high risk to groundwater contamination. For these reasons it is recommended that infiltration not be incorporated into the drainage strategy.
Permeable surfaces	Permeable surfaces allow rainwater to infiltrate through the surface into an underlying storage layer. As the proposed building occupies 100% of the plot there are no surface areas available for this method.
Vortex Control and Tanked Attenuation systems	A vortex flow control device is to be used to restrict the surface water flow from the site to proposed runoff rates. Tanked attenuation systems provide high storage capacity and can be incorporated within road pavements and under structural slabs and landscaping.

6. Foul Water Drainage Strategy

The site wide drainage strategy, prepared by Buro Happold, proposes that the foul water discharge from each plot be collected within a main sewer run and then outfall to the existing public combined water sewer within the Mancunian Way.

Based on the current proposed layout, foul drainage from each residence is be collected via a piped system, before discharging to the proposed Buro Happold Foul Water sewer at an unrestricted rate.

The proposed drainage strategy is enclosed within Appendix A.

Appendix A – Drainage Strategy (1076-01-CE-YY-XX-DR-C-0001)

HEALTH & SAFETY: The works shall be carried out by specialist competent and experienced contractors. All operatives shall have received full and appropriate training with appropriate qualifications for the operations they are required to undertake. All work shall be carried out in accordance with the relevant Health & Safety Regulations.

DRAINAGE NOTES

All discrepancies shall be reported to the engineer for action prior to any new construction

All drainage works shall be carried out in accordance with the requirement of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

All drainage shall comply with the typical drainage construction details and the requirements of BS EN 752.

Access covers and frames shall comply with the loadings specified and to BS EN 124 and kitemarked or if recessed covers are specified then in accordance with FACTA association equivalent. Allow for recess manhole covers to accept landscape architect finishes to all landscaped areas (total 9No. covers)

The proposed building outlines shown on this drawing are for information only. Refer to Architects plans for precise location setting out information and details. For setting out dimensions of SS's, SVP's, RWP's, Floor Gully & other drainage 'pop up' locations, refer to Architects or Mechanical & Electrical Engineers drawings.

All underslab drainage shall be laid at gradients of 1:80 min. for foul pipework and 1:100 min. for surface water unless noted otherwise. All pipework to be: Foul 100mm and Surface Water 150mm unless otherwise stated.

All underslab drainage shall be clear of foundations unless shown otherwise with long radius bends kept to a minimum and used where unavoidable.
All surface water drop down positions shall have a bend set at invert level no greater than 1.3m below finish floor level.

At least one soil pipe at the head of each foul run shall be vented to the atmosphere. All rainwater downpipes shall be accessible above ground for rodding purposes.

All existing drainage levels to which the the proposed drainage is to connect is to be clarified on site. Proposed drainage shown on this drawing subject to change once existing drainage levels are known.

Surface water connections to existing drainage are subject to local planners and statutory organisation approvals.
Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.
All drainage works shall be carried out in accordance with the requirements of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

Cover levels shown on this drawing are approximate and shall be adjusted to suit finished pavement levels on site by Contractor. Covers shall be orientated to suit pavement finishes where appropriate.

All private drainage pipework for foul and surface water systems have been designed on the basis of UPVC to BS EN 1401-1, unless noted otherwise.

All drainage pipework shall be laid soffit to soffit unless noted otherwise.

Where new drainage is situated within 5 metres of new or existing trees the pipework shall be encased in concrete to reduce the risk of root ingress.

Concrete encasement of the pipework shall be required where the vertical clearance between two pipes crossing is less than 300mm.

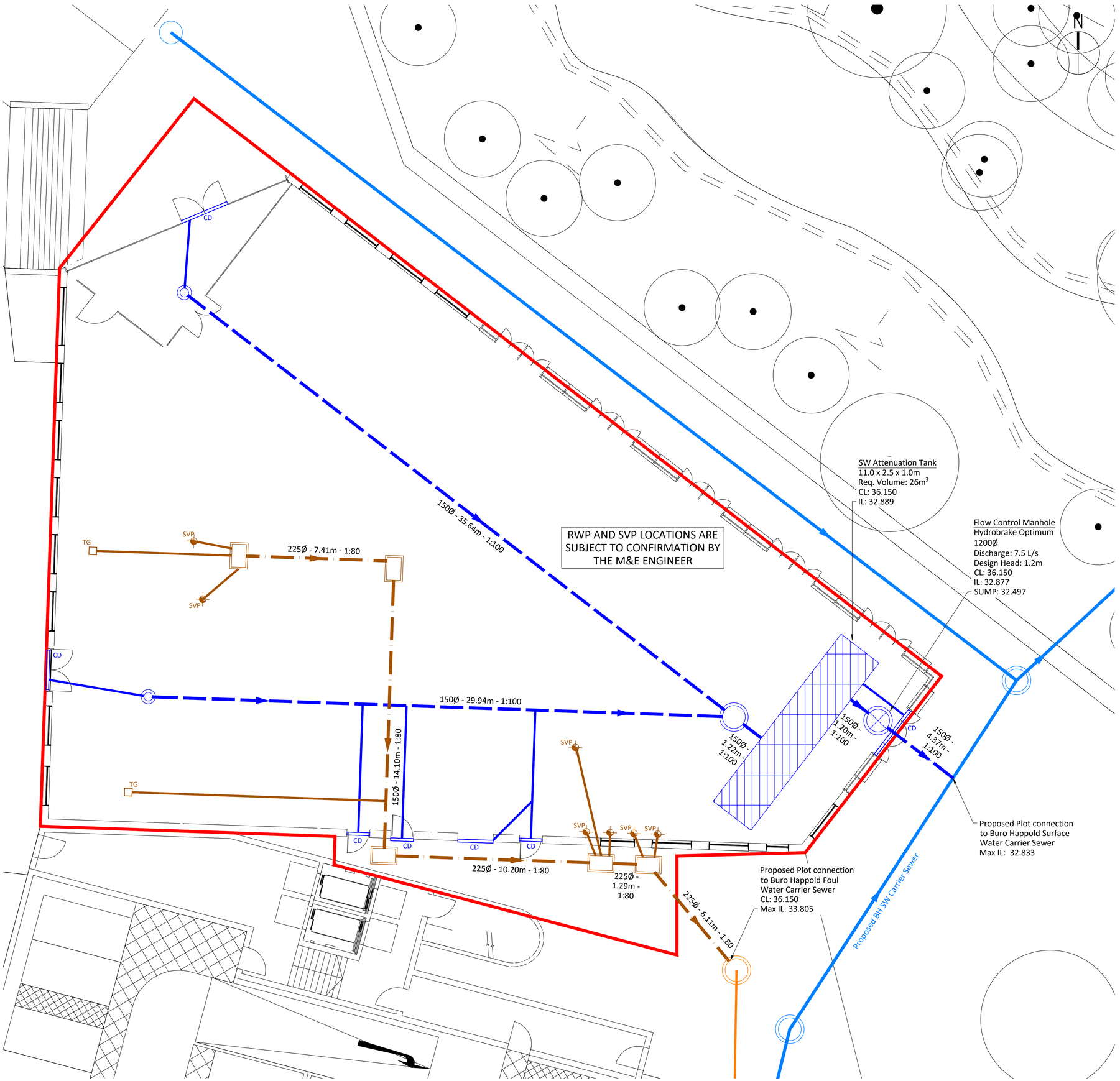
All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

All drainage connecting to the public sewer network shall not commence until receipt of the approval from the drainage authority and shall comply with requirements using vitrified clay pipework to BS EN 295 with plain sleeved or socketed flexible joints subject to their approval.
Where drainage works are carried out in the public highway the relevant necessary approvals and road opening notices shall be obtained from the highway authority and utility companies.

Prior to construction the flow control manufacturer's drawing and hydraulic table shall be provided to the engineer for approval

Prior to construction the attenuation tank manufacturer's drawings shall be provided to the engineer for approval

Upon completion all new drainage installation together with any existing drainage retained shall be jetted and CCTV surveyed upon completion. Contractor to ensure that the drainage system is fully operational, free of excess debris/silt and all identified faults rectified.

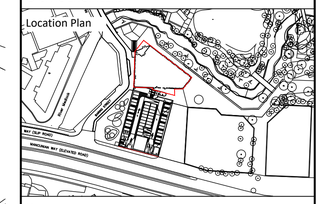


Standard Notes

1. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and the specification.
2. This drawing should not be scaled.
3. All dimensions are to be verified by the contractor on site.
4. All discrepancies should be reported to the C.A. prior to the commencement of the works.

© CIVIC ENGINEERS

Location Plan



Notes
1. This Drawing has been based on the following;
   - Masterplan layout (0345-SEW-ZZ-00-DR-L-007102) provided by Studio Egret West on 21/08/19
   - Plot Boundaries (0343-SEW-ZZ-ZZ-DR-Z-000050) provided by Studio Egret West on 04/03/19
   - Site Wide Surface Water Drainage Strategy (0042912-BHE-XX -XX-DR-C-3120-A) provided by Buro Happold on 21/03/19
   - Site Wide FW Drainage Strategy (0292-SEW-ZZ-03 -SK1009) provided by Buro Happold on 21/03/19
   - Topographic Survey (170929 Utilities and Topo) provided by Faithful & Gould on 18/08/18

Key

- PLOT BOUNDARY
- PROPOSED BURO HAPPOLD FOUL WATER CARRIER SEWER
- PROPOSED BURO HAPPOLD SURFACE WATER CARRIER SEWER
- PROPOSED FOUL WATER DRAINAGE
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED BURO HAPPOLD SURFACE WATER CARRIER MANHOLE
- PROPOSED BURO HAPPOLD FOUL WATER CARRIER MANHOLE
- PROPOSED FOUL WATER INSPECTION CHAMBER (RECTANGULAR)
- PROPOSED SURFACE WATER MANHOLE WITH FLOW RESTRICTION
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED SURFACE WATER INSPECTION CHAMBER (TYPE 2)
- SVP - ASSUMED SOIL VENT PIPE. LOCATION SUBJECT TO CONFIRMATION WITH M&E
- TG - PROPOSED FOUL WATER TRAPPED GULLY
- CD - PROPOSED LINEAR CHANNEL DRAIN
- PROPOSED ATTENUATION TANK
- VP - PROPOSED VENT PIPE

Date	Rev	Description	Drawn	Chkd
05.09.19	P01	ISSUED FOR INFORMATION	EMM	PM

Civic Engineers
MANCHESTER Carver's Warehouse, 77 Dale Street, Manchester, M1 2HG. Tel: 0161 228 6757
LONDON Reeds Wharf, 33 Mill Street, London SE1 2AX. Tel: 020 7253 2977
LEEDS Tower Works, Unit D2-02, Water Road, Leeds, LS11 5QG. Tel: 0113 3191 138
GLASGOW Grenfell Chambers, 45 West Nile St, Glasgow, G1 2PT. Tel: 0141 370 1829
www.civicengineers.com

Project
MAYFIELD DEVELOPMENT
BARING STREET OFFICE 1

Title
DRAINAGE STRATEGY
GENERAL ARRANGEMENT

Status
INFORMATION

Scale @ A1	Date Created	Drawn	Checked
1:100	05/09/19	EMM	PM

Project Number	Originator	Discipline	Drawing Number	Revision
1076-01	CE	C	0001	P01

Appendix B – Micro Drainage Readouts

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

©1982-2018 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Summer	1	+0%					8.119
1.001	2	15 Summer	1	+0%					8.018

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.031	0.000	0.98		15.5	OK	
1.001	2	-0.032	0.000	0.98		15.5	OK	

©1982-2018 Innovyze

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 33 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	34.876	0.826	0.0	7.5	7.5	17.3	O K
30 min Summer	35.065	1.015	0.0	7.5	7.5	21.2	O K
60 min Summer	35.093	1.043	0.0	7.5	7.5	21.8	O K
120 min Summer	34.994	0.944	0.0	7.5	7.5	19.7	O K
180 min Summer	34.842	0.792	0.0	7.5	7.5	16.6	O K
240 min Summer	34.677	0.627	0.0	7.5	7.5	13.1	O K
360 min Summer	34.433	0.383	0.0	7.5	7.5	8.0	O K
480 min Summer	34.284	0.234	0.0	7.3	7.3	4.9	O K
600 min Summer	34.200	0.150	0.0	6.9	6.9	3.1	O K
720 min Summer	34.153	0.103	0.0	6.4	6.4	2.2	O K
960 min Summer	34.120	0.070	0.0	5.3	5.3	1.5	O K
1440 min Summer	34.093	0.043	0.0	3.9	3.9	0.9	O K
2160 min Summer	34.076	0.026	0.0	2.9	2.9	0.5	O K
2880 min Summer	34.066	0.016	0.0	2.3	2.3	0.3	O K
4320 min Summer	34.055	0.005	0.0	1.6	1.6	0.1	O K
5760 min Summer	34.050	0.000	0.0	1.3	1.3	0.0	O K
7200 min Summer	34.050	0.000	0.0	1.1	1.1	0.0	O K
8640 min Summer	34.050	0.000	0.0	0.9	0.9	0.0	O K
10080 min Summer	34.050	0.000	0.0	0.8	0.8	0.0	O K
15 min Winter	35.009	0.959	0.0	7.5	7.5	20.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.328	0.0	24.7	22
30 min Summer	70.622	0.0	32.5	32
60 min Summer	44.405	0.0	40.9	50
120 min Summer	27.084	0.0	50.0	86
180 min Summer	20.061	0.0	55.5	120
240 min Summer	16.138	0.0	59.5	148
360 min Summer	11.797	0.0	65.3	206
480 min Summer	9.396	0.0	69.3	262
600 min Summer	7.872	0.0	72.6	318
720 min Summer	6.816	0.0	75.4	376
960 min Summer	5.426	0.0	80.1	492
1440 min Summer	3.929	0.0	87.0	734
2160 min Summer	2.841	0.0	94.3	1092
2880 min Summer	2.255	0.0	99.8	1468
4320 min Summer	1.626	0.0	108.0	2184
5760 min Summer	1.288	0.0	114.1	0
7200 min Summer	1.075	0.0	118.9	0
8640 min Summer	0.926	0.0	123.0	0
10080 min Summer	0.817	0.0	126.6	0
15 min Winter	107.328	0.0	27.7	22

©1982-2018 Innovyze

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	35.227	1.177	0.0	7.5	7.5	24.6	O K
60 min Winter	35.396	1.346	0.0	7.5	7.5	25.2	O K
120 min Winter	35.100	1.050	0.0	7.5	7.5	21.9	O K
180 min Winter	34.867	0.817	0.0	7.5	7.5	17.1	O K
240 min Winter	34.601	0.551	0.0	7.5	7.5	11.5	O K
360 min Winter	34.291	0.241	0.0	7.3	7.3	5.0	O K
480 min Winter	34.163	0.113	0.0	6.5	6.5	2.4	O K
600 min Winter	34.127	0.077	0.0	5.7	5.7	1.6	O K
720 min Winter	34.111	0.061	0.0	4.9	4.9	1.3	O K
960 min Winter	34.093	0.043	0.0	3.9	3.9	0.9	O K
1440 min Winter	34.076	0.026	0.0	2.9	2.9	0.5	O K
2160 min Winter	34.063	0.013	0.0	2.1	2.1	0.3	O K
2880 min Winter	34.055	0.005	0.0	1.6	1.6	0.1	O K
4320 min Winter	34.050	0.000	0.0	1.2	1.2	0.0	O K
5760 min Winter	34.050	0.000	0.0	0.9	0.9	0.0	O K
7200 min Winter	34.050	0.000	0.0	0.8	0.8	0.0	O K
8640 min Winter	34.050	0.000	0.0	0.7	0.7	0.0	O K
10080 min Winter	34.050	0.000	0.0	0.6	0.6	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	70.622	0.0	36.5	33
60 min Winter	44.405	0.0	45.9	54
120 min Winter	27.084	0.0	56.0	92
180 min Winter	20.061	0.0	62.2	130
240 min Winter	16.138	0.0	66.7	156
360 min Winter	11.797	0.0	73.1	210
480 min Winter	9.396	0.0	77.7	260
600 min Winter	7.872	0.0	81.3	314
720 min Winter	6.816	0.0	84.5	372
960 min Winter	5.426	0.0	89.7	490
1440 min Winter	3.929	0.0	97.4	728
2160 min Winter	2.841	0.0	105.7	1096
2880 min Winter	2.255	0.0	111.8	1432
4320 min Winter	1.626	0.0	120.9	0
5760 min Winter	1.288	0.0	127.8	0
7200 min Winter	1.075	0.0	133.2	0
8640 min Winter	0.926	0.0	137.8	0
10080 min Winter	0.817	0.0	141.8	0

©1982-2018 Innovyze

Model Details

Storage is Online Cover Level (m) 36.150

Cellular Storage Structure

Invert Level (m) 34.050 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	22.0	0.0	1.201	0.0	0.0
1.200	22.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-7500-1400-7500
Design Head (m)	1.400
Design Flow (l/s)	7.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	34.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	7.5
Flush-Flo™	0.413	7.5
Kick-Flo®	0.868	6.0
Mean Flow over Head Range	-	6.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	1.200	7.0	3.000	10.7	7.000	16.1
0.200	6.9	1.400	7.5	3.500	11.5	7.500	16.6
0.300	7.4	1.600	8.0	4.000	12.3	8.000	17.1
0.400	7.5	1.800	8.4	4.500	13.0	8.500	17.6
0.500	7.4	2.000	8.9	5.000	13.7	9.000	18.1
0.600	7.3	2.200	9.3	5.500	14.3	9.500	18.6
0.800	6.6	2.400	9.7	6.000	14.9		
1.000	6.4	2.600	10.0	6.500	15.5		

©1982-2018 Innovyze

Manchester

Carver's Warehouse
77 Dale Street
Manchester M1 2HG

+44 (0)161 228 6757

London

Reeds Wharf
33 Mill Street
London SE1 2AX

+44 (0)20 7253 2977

Leeds

Unit 02/01 Tower Works
Globe Road
Leeds LS11 5QG

+44 (0)113 2025 130

Glasgow

Gresham Chambers
45 West Nile Street
Glasgow G1 2PT

+44 (0)141 370 1829

civicengineers.com

1. Introduction

Civic Engineers has been appointed by Mayfield Partnership to provide a Drainage Statement and Strategy for the proposed development of Baring St MSCP, Mayfield.

The purpose of this statement is to:

- Provide information on the existing site's topography and drainage,
- Establish the pre-development peak 1 in 1-year surface water run-off rate,
- Calculate the required attenuation volume; and
- Summaries the proposed drainage strategy (including the feasibility of SUDS features)

This statement is based on currently available information. Proposals contained or forming part of this statement represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project.

2. Existing Site Details

Baring St MSCP occupies 0.176ha and is located in the south west corner of the Mayfield Development Site. It is bounded by Baring Street to the west; the proposed Baring St Office 1 plot to the north; and the Mancunian Way to the south. The plot is centred around an approximate National Grid Reference of SJ850975.

The proposed area has a history of industrial use during the 18th and 19th century as well as providing areas of terraced workers' housing and a primary community focal point in the form of the Mayfield Bath House. Within the latter half of the 20th century, there was a general reduction in the scale of industrial development of the site and the removal of previous workers' accommodation and the bathhouse. Low-level industrial units remained and following the construction of the Mancunian Way to the south in 1986, the site has been consistent with the current day layout

2.1 Existing Topography

A topographical survey was undertaken by Malcolm Hughes Surveyors in September 2017 and shows the majority of the plot is occupied by industrial units. Topographical levels were obtained around the edges of these existing buildings and indicate the plot generally grades from the south east, with an approximate level of 36.75m AOD, to the north, with an approximate level of 35.20m AOD.

Sections of the southern and eastern boundary are occupied by Bond St and Nether St, respectively, and a small section of grass and trees (46m^2) is present, adjacent the northern plot boundary.

For the purpose of drainage calculations, the plot is considered to be 100% impermeable

2.2 Existing Drainage

No above ground watercourses have been identified within the proposed plot boundary. The River Medlock is generally a culverted watercourse, however an exposed section is present approximately 50m north of the proposed plot.

Public Sewer records have been obtained from United Utilities which indicate there are no adopted sewers within the proposed plot boundary.

The following public sewer infrastructure has been identified within the vicinity of the plot:

- A varying large diameter combined water sewer runs within the Mancunian Way approximately 35m south of the proposed plot
- A 225mm diameter combined water sewers runs within Baring St. The sewer is believed to run the length of Baring St, however the United Utilities Asset Map only displays a short section.

The following private sewer infrastructure is believed to be in the vicinity of and within the proposed plot:

- From site observations it is anticipated that a private surface water sewer runs below the existing surface car park within the adjacent plot, Baring St Office 1, and discharges into the River Medlock,
- A private combined water sewer is anticipated within Nether St

A CCTV Survey has not been undertaken for the proposed plot.

3. Proposed Development

Baring St MSCP is included within the Phase 1 proposal of the Mayfield Development and comprises ground plus 10 storey MSCP for circa 545 car parking spaces.

The Phase 1 Site is located entirely within the Mayfield Strategic Regeneration Framework (SRF) area, which lies to the south of Fairfield Street in Manchester city centre, in close proximity to Piccadilly mainline railway station.

4. Surface Water Calculations

4.1 Catchment/Impermeable Areas

Site Drainage Area	=	1756m^2 / 0.176 ha
Pre-Development Impermeable Area	=	1756m^2 / 0.176 ha (100% impermeable)
Post-Development Impermeable Area	=	1756m^2 / 0.176 ha (100% impermeable)

4.2 Surface Water Calculation Variables

Data to calculate the pre-development 1 in 1-year surface water run-off rates and attenuation volumes are based on figures from the Flood Studies Report (FSR) data and Wallingford Procedure, which have been sourced from HR Wallingford.

The variables used to calculate the surface water run-off rates and required attenuation volumes are as follows:

M5 – 60 (mm)	=	17.000		
Ratio R	=	0.4		
Cv (Summer)	=	0.750		
Cv (Winter)	=	0.840		
Time of Entry	=	4 minutes		
Climate Change	=	0	-	Pre-Development
	=	30%	-	Post Development

4.3 Pre-Development Peak 1 in 1 Year Surface Water Run-Off

Based on the above variables, and calculations undertaken using a two-pipe simulated network within Micro Drainage computer software, the pre-development surface water run-off rates are as follows:

Pre-Development 1 in 1-Year Rate	=	22.2 l/s	(15-minute critical storm)

4.4 Post Development Restricted Surface Water Run-Off Rate

The Buro Happold Surface Water Design Note requires each plot to discharge at a rate at 50% of the existing runoff rate, minus 2 L/s/ha (per plot boundary) to account for long term storage.

The surface water from the proposed development is to be restricted by a flow control, in this case a vortex flow control devise will be used, to give:

Post Development SW Run-Off Rate	=	10.7 L/s	(50% of 22.2l/s – 2 l/s/ha)

4.5 Surface Water Attenuation Volumes

The surface water attenuation volumes have been calculated using the above variables within the Source Control module of Micro Drainage.

1 in 100 Year Event + CC (30%)	=	36 m^3	(10.7 l/s)

5. Surface Water Drainage Strategy

The site wide drainage strategy, prepared by Buro Happold, proposes that the surface water runoff from each plot be collected within a main sewer run and then outfall to the River Medlock at a restricted rate.

Based on the current proposed layout, runoff will be collected by rainwater pipes, gullies and channels and conveyed via a traditional below ground system of pipes and manholes before being treated by a Class I Bypass Separator (NSBP003 Kingspan or approved equivalent). Runoff will then flow to a underground attenuation tank, before discharging to the proposed Buro Happold Surface Water sewer at a restricted rate of 10.7 L/s.

Surface water runoff from hard paved areas at risk of contamination should receive water quality treatment. Low traffic access roads and car parking is considered low hazard in terms of contamination, therefore a bypass separator has been recommended.

The proposed drainage strategy is enclosed within Appendix A.

5.1 Potential Sustainable Drainage Systems (SUDS) Features Feasibility

Where possible SuDS are to be incorporated into the post development design to provide attenuation and ensure that runoff from the site does not exceed predevelopment runoff rates.

Varied SuDS methods have been summarised in the table below to assess and establish which are most feasible for the proposed post development site

SuDS Method	Feasibility, Given Site and Project
Green & Blue Roofs	Green roofs are systems which cover a building's roof with vegetation. They are laid over a drainage layer, with other layers providing protection, waterproofing and insultation. As the current layout proposes 100% of the plot be occupied by carparking facilities there is no area available for a Green or Blue roof.
Basins and Ponds – Above Ground storage	Basins and ponds increase biodiversity and amenity of the area; provide attenuation; and improve water quality. This method does however occupy large areas of developable land and requires suitable offsets from buildings. Due to the proposed structure occupying the entire plot and the urban location, basins and ponds are not a feasible option.
Rain Gardens & Tree Pits	The current layout proposes 100% of the plot be occupied by carparking facilities and as such there is no area available for a Rain Gardens or Tree Pits
Filter Strips and Swales	Filter strips and swales are generally used adjacent highways to reduce and treat runoff. The current layout proposed does not involve highways and as such there is no available area for filter strips or swales.
Rainwater Harvesting	Storage and use of rainwater for non-potable uses within a building (eg. Toilet flushing). Is should be noted that storage in these types of systems is not usually considered to count towards the provision of on-site storage for surface water balancing

	because, given the sporadic nature of the use of harvester water, it cannot be guaranteed that the tanks are available to provide sufficient attenuation during storm events. Rainwater harvesting is not a viable option as the current layout is a carparking facility and has no use for non-potable water.
Infiltration Devices	Borehole testing conducted on site identified the presence of made ground and the BGS drift maps indicate the site is underlain by a Secondary Aquifer within the Superficial drift and a Primary Aquifer within the bedrock. The historic use of the site as a tannery, factories and bathhouse also present a high risk to groundwater contamination. For these reasons it is recommended that infiltration not be incorporated into the drainage strategy.
Permeable surfaces	Permeable surfaces allow rainwater to infiltrate through the surface into an underlying storage layer. There are no external landscape areas associated with the carpark and whilst the top storey of the carpark will be open to the elements, the structural slab will form the surface of the carpark. As such there is no opportunity for permeable surfacing within the plot.
Vortex Control and Tanked Attenuation systems	A vortex flow control device is to be used to restrict the surface water flow from the site to proposed runoff rates. Tanked attenuation systems provide high storage capacity and can be incorporated within road pavements and under structural slabs and landscaping.

Appendix A – Drainage Strategy (1076-02-CE-YY-XX-DR-C-0001)

HEALTH & SAFETY: The works shall be carried out by specialist competent and experienced contractors. All operatives shall have received full and appropriate training with appropriate qualifications for the operations they are required to undertake. All work shall be carried out in accordance with the relevant Health & Safety Regulations.

DRAINAGE NOTES

All discrepancies shall be reported to the engineer for action prior to any new construction

All drainage works shall be carried out in accordance with the requirement of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

All drainage shall comply with the typical drainage construction details and the requirements of BS EN 752.

Access covers and frames shall comply with the loadings specified and to BS EN 124 and kitemarked or if recessed covers are specified then in accordance with FACTA association equivalent. Allow for recess manhole covers to accept landscape architect finishes to all landscaped areas (total 9No. covers)

The proposed building outlines shown on this drawing are for information only. Refer to Architects plans for precise location setting out information and details. For setting out dimensions of SS's, SVP's, RWP's, Floor Gully & other drainage 'pop up' locations, refer to Architects or Mechanical & Electrical Engineers drawings.

All underslab drainage shall be laid at gradients of 1:80 min. for foul pipework and 1:100 min. for surface water unless noted otherwise. All pipework to be: Foul 100mm and Surface Water 150mm unless otherwise stated.

All underslab drainage shall be clear of foundations unless shown otherwise with long radius bends kept to a minimum and used where unavoidable.
All surface water drop down positions shall have a bend set at invert level no greater than 1.3m below finish floor level.

At least one soil pipe at the head of each foul run shall be vented to the atmosphere. All rainwater downpipes shall be accessible above ground for rodding purposes.

All existing drainage levels to which the the proposed drainage is to connect is to be clarified on site. Proposed drainage shown on this drawing subject to change once existing drainage levels are known.

Surface water connections to existing drainage are subject to local planners and statutory organisation approvals.
Existing details shown on this drawing including kerblines, existing drains, chambers, sewers, pipework, stub connections where new connections, diversions or abandonment are shown, invert levels and pipe sizes shall be checked and confirmed to the engineer prior to the commencement of any works. Any discrepancies shall be reported to the engineer for action prior to any new construction.
All drainage works shall be carried out in accordance with the requirements of the local authority and in conjunction with all relevant British Standards, Codes of Practice and 'Sewers for Adoption' 7th Edition and addendums as appropriate.

Cover levels shown on this drawing are approximate and shall be adjusted to suit finished pavement levels on site by Contractor. Covers shall be orientated to suit pavement finishes where appropriate.

All private drainage pipework for foul and surface water systems have been designed on the basis of UPVC to BS EN 1401-1, unless noted otherwise.

All drainage pipework shall be laid soffit to soffit unless noted otherwise.

Where new drainage is situated within 5 metres of new or existing trees the pipework shall be encased in concrete to reduce the risk of root ingress.

Concrete encasement of the pipework shall be required where the vertical clearance between two pipes crossing is less than 300mm.

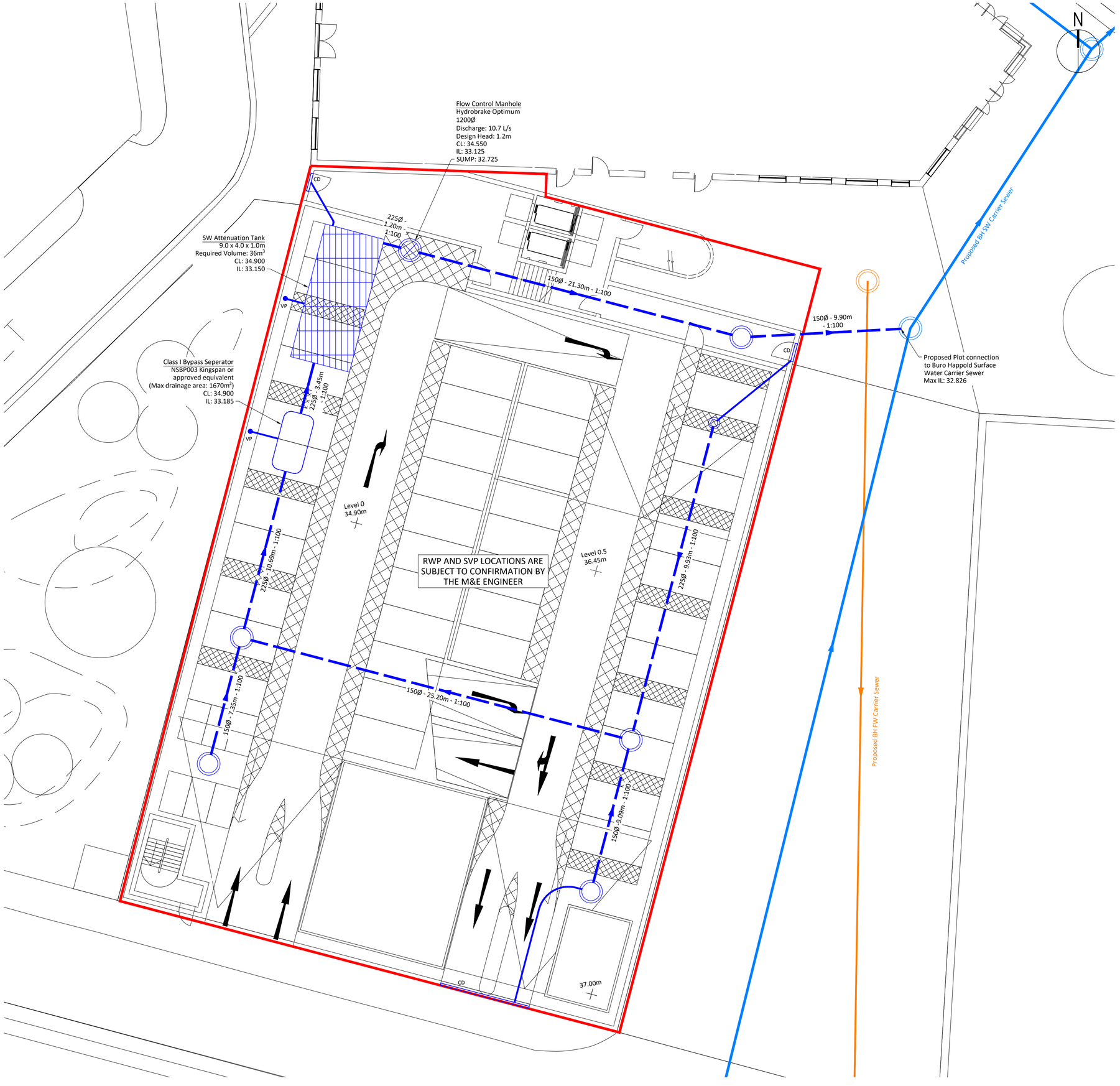
All existing drainage shall be assumed to be 'live' and shall be maintained at all times during the works. Existing drainage shall be reconnected to the new drainage system unless proven to be redundant for abandonment. All existing drainage to be abandoned shall be sealed by appropriate means.

All drainage connecting to the public sewer network shall not commence until receipt of the approval from the drainage authority and shall comply with requirements using vitrified clay pipework to BS EN 295 with plain sleeved or socketed flexible joints subject to their approval.
Where drainage works are carried out in the public highway the relevant necessary approvals and road opening notices shall be obtained from the highway authority and utility companies.

Prior to construction the flow control manufacturer's drawing and hydraulic table shall be provided to the engineer for approval

Prior to construction the attenuation tank manufacturer's drawings shall be provided to the engineer for approval

Upon completion all new drainage installation together with any existing drainage retained shall be jetted and CCTV surveyed upon completion. Contractor to ensure that the drainage system is fully operational, free of excess debris/silt and all identified faults rectified.

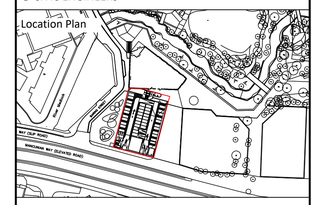


Standard Notes

1. This drawing is to be read in conjunction with all relevant Architect's and Engineer's drawings and the specification.
2. This drawing should not be scaled.
3. All dimensions are to be verified by the contractor on site.
4. All discrepancies should be reported to the C.A. prior to the commencement of the works.

© CIVIC ENGINEERS

Location Plan



Notes
1. This Drawing has been based on the following;
   - Masterplan layout (0345-SEW-ZZ-00-DR-L-007102) provided by Studio Egret West on 21/08/19
   - Plot Boundaries (0343-SEW-ZZ-ZZ-DR-Z-000050) provided by Studio Egret West on 04/03/19
   - Site Wide Surface Water Drainage Strategy (0042912-BHE-XX -XX-DR-C-3120-A) provided by Buro Happold on 21/03/19
   - Site Wide FW Drainage Strategy (0292-SEW-ZZ-03 -SK1009) provided by Buro Happold on 21/03/19
   - Topographic Survey (170929 Utilities and Topo) provided by Faithful & Gould on 18/08/18

Key

- PLOT BOUNDARY
- PROPOSED BURO HAPPOLD FOUL WATER CARRIER SEWER
- PROPOSED BURO HAPPOLD SURFACE WATER CARRIER SEWER
- PROPOSED SURFACE WATER DRAINAGE
- PROPOSED BURO HAPPOLD SURFACE WATER CARRIER MANHOLE
- PROPOSED BURO HAPPOLD FOUL WATER CARRIER MANHOLE
- PROPOSED SURFACE WATER MANHOLE WITH FLOW RESTRICTION
- PROPOSED SURFACE WATER MANHOLE
- PROPOSED SURFACE WATER INSPECTION CHAMBER (TYPE 2)
- CD — PROPOSED LINEAR CHANNEL DRAIN
- PROPOSED ATTENUATION TANK
- VP — PROPOSED VENT PIPE

Date	Rev	Description	Drawn	Chkd
05.09.19	P01	ISSUED FOR INFORMATION	EMM	PM

Civic Engineers
MANCHESTER Carver's Warehouse, 77 Dale Street, Manchester, M1 2HG. Tel: 0161 228 6757
LONDON Reeds Wharf, 33 Mill Street, London SE1 2AX. Tel: 020 7253 2977
LEEDS Tower Works, Unit D2-01, Globe Road, Leeds, LS11 5QG. Tel: 01174 2155 138
GLASGOW Grinham Chambers, 45 West Nile St, Glasgow, G1 2PT. Tel: 0141 370 1829
www.civicengineers.com

Project
MAYFIELD DEVELOPMENT
BARING STREET MSCP

Title
DRAINAGE STRATEGY
GENERAL ARRANGEMENT

Status
INFORMATION

Scale @ A1	Date Created	Drawn	Checked
1:125	05/09/19	EMM	PM

Project Number	Originator	Discipline	Drawing Number	Revision
1076-02	CE	C	0001	P01

Appendix B – Micro Drainage Readouts

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	17.000	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

©1982-2018 Innovyze

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	17.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Summer	1	+0%					8.119
1.001	2	15 Summer	1	+0%					8.018

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.031	0.000	0.98		15.5	OK	
1.001	2	-0.032	0.000	0.98		15.5	OK	

©1982-2018 Innovyze

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 33 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	34.876	0.826	0.0	7.5	7.5	17.3	O K
30 min Summer	35.065	1.015	0.0	7.5	7.5	21.2	O K
60 min Summer	35.093	1.043	0.0	7.5	7.5	21.8	O K
120 min Summer	34.994	0.944	0.0	7.5	7.5	19.7	O K
180 min Summer	34.842	0.792	0.0	7.5	7.5	16.6	O K
240 min Summer	34.677	0.627	0.0	7.5	7.5	13.1	O K
360 min Summer	34.433	0.383	0.0	7.5	7.5	8.0	O K
480 min Summer	34.284	0.234	0.0	7.3	7.3	4.9	O K
600 min Summer	34.200	0.150	0.0	6.9	6.9	3.1	O K
720 min Summer	34.153	0.103	0.0	6.4	6.4	2.2	O K
960 min Summer	34.120	0.070	0.0	5.3	5.3	1.5	O K
1440 min Summer	34.093	0.043	0.0	3.9	3.9	0.9	O K
2160 min Summer	34.076	0.026	0.0	2.9	2.9	0.5	O K
2880 min Summer	34.066	0.016	0.0	2.3	2.3	0.3	O K
4320 min Summer	34.055	0.005	0.0	1.6	1.6	0.1	O K
5760 min Summer	34.050	0.000	0.0	1.3	1.3	0.0	O K
7200 min Summer	34.050	0.000	0.0	1.1	1.1	0.0	O K
8640 min Summer	34.050	0.000	0.0	0.9	0.9	0.0	O K
10080 min Summer	34.050	0.000	0.0	0.8	0.8	0.0	O K
15 min Winter	35.009	0.959	0.0	7.5	7.5	20.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	107.328	0.0	24.7	22
30 min Summer	70.622	0.0	32.5	32
60 min Summer	44.405	0.0	40.9	50
120 min Summer	27.084	0.0	50.0	86
180 min Summer	20.061	0.0	55.5	120
240 min Summer	16.138	0.0	59.5	148
360 min Summer	11.797	0.0	65.3	206
480 min Summer	9.396	0.0	69.3	262
600 min Summer	7.872	0.0	72.6	318
720 min Summer	6.816	0.0	75.4	376
960 min Summer	5.426	0.0	80.1	492
1440 min Summer	3.929	0.0	87.0	734
2160 min Summer	2.841	0.0	94.3	1092
2880 min Summer	2.255	0.0	99.8	1468
4320 min Summer	1.626	0.0	108.0	2184
5760 min Summer	1.288	0.0	114.1	0
7200 min Summer	1.075	0.0	118.9	0
8640 min Summer	0.926	0.0	123.0	0
10080 min Summer	0.817	0.0	126.6	0
15 min Winter	107.328	0.0	27.7	22

©1982-2018 Innovyze

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	35.227	1.177	0.0	7.5	7.5	24.6	O K
60 min Winter	35.396	1.346	0.0	7.5	7.5	25.2	O K
120 min Winter	35.100	1.050	0.0	7.5	7.5	21.9	O K
180 min Winter	34.867	0.817	0.0	7.5	7.5	17.1	O K
240 min Winter	34.601	0.551	0.0	7.5	7.5	11.5	O K
360 min Winter	34.291	0.241	0.0	7.3	7.3	5.0	O K
480 min Winter	34.163	0.113	0.0	6.5	6.5	2.4	O K
600 min Winter	34.127	0.077	0.0	5.7	5.7	1.6	O K
720 min Winter	34.111	0.061	0.0	4.9	4.9	1.3	O K
960 min Winter	34.093	0.043	0.0	3.9	3.9	0.9	O K
1440 min Winter	34.076	0.026	0.0	2.9	2.9	0.5	O K
2160 min Winter	34.063	0.013	0.0	2.1	2.1	0.3	O K
2880 min Winter	34.055	0.005	0.0	1.6	1.6	0.1	O K
4320 min Winter	34.050	0.000	0.0	1.2	1.2	0.0	O K
5760 min Winter	34.050	0.000	0.0	0.9	0.9	0.0	O K
7200 min Winter	34.050	0.000	0.0	0.8	0.8	0.0	O K
8640 min Winter	34.050	0.000	0.0	0.7	0.7	0.0	O K
10080 min Winter	34.050	0.000	0.0	0.6	0.6	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	70.622	0.0	36.5	33
60 min Winter	44.405	0.0	45.9	54
120 min Winter	27.084	0.0	56.0	92
180 min Winter	20.061	0.0	62.2	130
240 min Winter	16.138	0.0	66.7	156
360 min Winter	11.797	0.0	73.1	210
480 min Winter	9.396	0.0	77.7	260
600 min Winter	7.872	0.0	81.3	314
720 min Winter	6.816	0.0	84.5	372
960 min Winter	5.426	0.0	89.7	490
1440 min Winter	3.929	0.0	97.4	728
2160 min Winter	2.841	0.0	105.7	1096
2880 min Winter	2.255	0.0	111.8	1432
4320 min Winter	1.626	0.0	120.9	0
5760 min Winter	1.288	0.0	127.8	0
7200 min Winter	1.075	0.0	133.2	0
8640 min Winter	0.926	0.0	137.8	0
10080 min Winter	0.817	0.0	141.8	0

©1982-2018 Innovyze

Model Details

Storage is Online Cover Level (m) 36.150

Cellular Storage Structure

Invert Level (m) 34.050 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	22.0	0.0	1.201	0.0	0.0
1.200	22.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0122-7500-1400-7500
Design Head (m)	1.400
Design Flow (l/s)	7.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	34.000
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	7.5
Flush-Flo™	0.413	7.5
Kick-Flo®	0.868	6.0
Mean Flow over Head Range	-	6.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	4.3	1.200	7.0	3.000	10.7	7.000	16.1
0.200	6.9	1.400	7.5	3.500	11.5	7.500	16.6
0.300	7.4	1.600	8.0	4.000	12.3	8.000	17.1
0.400	7.5	1.800	8.4	4.500	13.0	8.500	17.6
0.500	7.4	2.000	8.9	5.000	13.7	9.000	18.1
0.600	7.3	2.200	9.3	5.500	14.3	9.500	18.6
0.800	6.6	2.400	9.7	6.000	14.9		
1.000	6.4	2.600	10.0	6.500	15.5		

©1982-2018 Innovyze

Manchester

Carver's Warehouse
77 Dale Street
Manchester M1 2HG

+44 (0)161 228 6757

London

Reeds Wharf
33 Mill Street
London SE1 2AX

+44 (0)20 7253 2977

Leeds

Unit 02/01 Tower Works
Globe Road
Leeds LS11 5QG

+44 (0)113 2025 130

Glasgow

Gresham Chambers
45 West Nile Street
Glasgow G1 2PT

+44 (0)141 370 1829

civicengineers.com

Mayfield Baring Street No.2
Design Note

Drainage Strategy Supplementary Note

The proposed B1 Office development site referenced as Baring Street No.2 (Plot M) sits within the Mayfield Strategic Regeneration Framework (SRF) Phase 1 Boundary. The site comprises the building footprint only and excludes all adjoining external areas.

This Drainage Strategy Supplementary Note represents a plot implementation within the Buro Happold Mayfield Drainage Strategy Design Note dated 11.03.2019 ref:0042912. It does not compromise the requirements of the Drainage Strategy Design Note or fully implement the intended drainage strategy for the Mayfield SRF.

Investigation of the existing site drainage was undertaken during demolition and site clearance and whilst not being able to positively prove the connectivity of the whole existing drainage system, it gives an indication that the existing buildings, yards roads were positively drained to either sewer or to the nearby watercourse (River Medlock).

National and local planning guidance sets out the National Planning Policy Framework (NPPF), Planning Policy Guidance (PPG) and the Non-Statutory Technical Standards for Sustainable Drainage aim to protect and control the risk of flooding downstream of development sites by recommending the management of surface water as close to source.

From the CIRIA SuDS Manual C753 guidance in the form of hierarchy of drainage is indicated below;

Runoff Destinations

See the Planning Practice Guidance

This states:

"Generally the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

1. **Into the ground (infiltration)**
2. **To a surface water body;**
3. **To a surface water sewer, highway drain or another drainage system;**
4. **To a combined sewer."**

1. As the drainage strategy for this site is on a plot only basis, it is not practical to provide infiltraion to ground beneath the building footprint. Also, the indicative ground conditions of made ground overlaying fluvial deposits together with the sites previous use for industrial purposes; would increase the risk of mobilising potential ground contamination which is unacceptable.

2. The Mayfield SRF is providing new separate foul and surface water infracture drainage for the development area, with surface water discharging to the nearby River Medlock and the foul water to nearby United Utilties public sewerage network.

This is considered to be the most practical solution for draining the foul and surface water runoff generated from this site.

Drainage Strategy & Design Criteria

The drainage strategy for this site is to;

1. Discharge the foul water unrestricted by gravity to the adjoining new foul water infrastructure being provided, which will discharge to the public sewerage system.
2. Discharge the surface water at a minimum 50% reduced discharge rate from the existing by gravity to the adjoining new surface water infrastructure being provided, which discharges to the the nearby River Medlock.The design criteria being;
   - No Surcharge for a 1 in 1 year return period storm
   - No Flooding for a 1 in 30 year return period storm
   - Flood check and management for a 1 in 100 year return period storm + 40% rainfall allowance for climate chainge.

Foul Water

Foul water to drain unrestricted to nearest appropriate foul water infrastructure drain provided, prior to discharging to public sewerage system.

Based on the current Architects floor plans and utilising the Unit Discharge Unit Method from BS EN12056-2 System III Table 2 with a Typical Frequency of K – 0.5 'Intermittent Use' from Table 3 an estimated design discharge rate of 11.3 litres per second can be expected, requiring a 150dia connection at a minimum gradient of 1 in 125.

Localised sump pumping is required to the plant room basement area, restricted to a maximum of 10 litres per second to the above ground drainage at off-peak times to reduce the risk of overloading the drainage system.

Grease treatment is not considered a requirement due to the 'Office use' of the building. However, should grease treatment be required to any food or bar areas, this will be provided locally at source above ground.

Surface Water

The surface water drainage takes into account the requirements of the Buro Happold Mayfield Drainage Strategy Design Note dated 11.03.2019 ref:0042912. However, due to the age and condition of the existing site drainage, insufficient information was obtained and as such, it is not practical to model the existing site drainage.

In order to set a peak discharge rate for the site, It is proposed to use a flat rainfall rate of 50mm/hr to set the peak Q100 runoff rate from the existing site. Due to age of the site and drainage, it is a reasonable assumption for the original design of the sewers. This approach has been accepted by United Utilities Plc and Manchester City Council as Lead Local Flood Authority on similar urban re-development sites in Manchester. This approximately equates to a 15min duration 30yr RP storm.

- From a review of the current drawings, the site's drained plan area is estimated to be 2,610m² (0.261ha) made up of;
  - 2,185m² Hardstanding (Roof/Yards and Roads)
  - 425m² soft landscaping
- Taking the runoff from the hardstanding areas at 100% and 20% equivalent area from the soft landscaping a catchment area of 2,770m² (0.227ha) is derived
- Thus, the peak flow rate (existing) = 2.78 x 0.227 x 50 = 31.6 l/s (for a 15min 30yr RP event)
- To comply with the Drainage Strategy Design Note and National/Local Planning Guidance, a 50% reduction is applied which reduces peak discharge rate of Q = 31.6 x 0.5 = 15.8 l/s
- This is equivalent to the existing run off from a 25mm/hr flat rainfall rate which equates to less than a 15min 1yr RP Storm
- Micro Drainage Quick storage estimate, subject to design and based on the above for the 100yr+40% climate change allowance is in the order of 80m³, without allowance for the effects of a surcharged outlet
- Utilising MicroDrainage Network and simulating the surface water design for a development area of 2,610m² (0.261ha) as indicated on RoC drawing 3986-DR-201 for the 1yr, 30yr and 100yr +40% free discharge and again the 30yr and 100yr +40% against a 1m surcharged outfall, the required attenuation volume has been adjusted to 120.2m³ net storage resulting in no surface flooding to the building and the peak discharge rate of 15.8 l/s is not exceeded.
- As noted on RoC drawing 3986-DR-201 the attenuation is to be provided by means of a geocellular tank 50.05m long x 4.55m wide x 0.55m deep fully tanked with a fully welded waterproof membrane beneath the building footprint. The discharge rate is to be controlled in a downstream manhole chamber by a vortex flow control rated at 15.8 l/s at a design head of 1.2m

Applying a limit of 15.8 l/s to the Q100+40%CC event will inherently give a greater than 50% reduction in run-off because the limiting flow rate is similar to the existing run off rate for a 1yr RP storm of 15-30mim duration. As such it is not consider that there is a need to provide the further reduction in run-off rate of 2 l/s/ha stipulated in the Buro Happold Drainage Strategy Design Note or to carry out a flood check on the long term storage volume.

The above surface water drainage strategy meets the requirements outlined in the Buro Happold Mayfield Drainage Strategy Design Note dated 11.03.2019 ref:0042912, subject to confirmation from Buro Happold and further development from this RIBA Stage 2 design.

NOTE:
SERVICES INFORMATION TAKEN FROM MALCOLM HUGHES DRAWING 19749_UG01 AND BASED ON A DESKTOP REVIEW OF UTILITY RECORDS AND SHOULD NOTE BE CONSIDERED TO REPRESENT ACTUAL ALIGNMENTS ON SITE.
BUILDING FOOTPRINTS & RETAINING WALL LOCATIONS TAKEN FROM MORRIS & COMPANY DRAWING 190708 MASTERPLAN STAGE 1.
FLOOD RISK ZONES TAKEN FROM MORRIS & COMPANY DRAWING A283MMPM-00-A1-200
PROPOSED DRAINAGE/POWER/ COMMUNICATIONS LAYOUT FROM BUROHAPPOLD ENGINEERING DRAWINGS 0042912-3120, 5100 & 6100

KEY TO SERVICES

- A — Abandoned
- AD — Acid drain
- BT — British telecom
- TV — Cable TV
- CM — Communication cables
- C — Sewer combined
- S — Sewer surface water
- F — Sewer foul
- DU — Ducting
- E — Electric cables
- EF — Effluent pipes
- FU — Fuel line
- GA — Fuel gauge line
- V — Fuel vent line
- Gas pipes
- H — Heating pipes
- TL — Traffic light cables
- VR — Vapour recovery pipes
- W — Water pipes
- U — Unidentified GPR or electro location trace
- Rising main
- Scar trace
- AC — Alarm cables
- CC — CCTV cables
- CH — Chemical pipes
- CA — Compressed air pipes
- CU — Culvert
- CO — Sewer combined overflow
- HV — Electric HV cables
- P — Electric pilot cables
- EA — Earth cables
- FO — Fibre optic cables
- LG — LPG pipes
- OP — Oil pipes
- SM — Sludge main
- T — Telemetry cables
- VD — Vehicle detection pad
- W W — Wash water pipes
- End of trace
- E — Group of services representation
- E — Taken from records (Not proven on site)
- Assumed route
- Services survey boundary

KEY TO CONSTRAINTS

- RIVER MEDLOCK (ASSUMED LINE OF CULVERT)
- RIVER MEDLOCK (OPEN CHANNEL)
- HIGHWAYS
- ADJACENT BUILDING FOOTPRINT
- PLOT M BUILDING FOOTPRINT
- RETAINING WALL
- 35.55 / 36.85 — EXISTING TOPOGHRAPHY
- PROPOSED TOPOGHRAPHY
- FLOOD RISK ZONE 2
- FLOOD RISK ZONE 3

FLOOD RISK BASED ON EXISTING TOPOGRAPHY

Park retaining wall form TBC, possible interface with foundations

Presumed line of existing basement subject to survey. Assumed to be removed by part of park earthworks.

Existing advertisement signs

225mmØ

RIVER MEDLOCK

MANCUNIAN WAY SLIP ROAD

BOND STREET

NETHER STREET

MANOR STREET

THIS DRAWING IS THE PROPERTY OF RoCp. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON EITHER WHOLLY OR IN PART WITHOUT THE WRITTEN CONSENT OF RoCp

NOTES

PROPOSED SERVICES

- SURFACE WATER
- SURFACE WATER MH
- OUTFALL
- GULLEY
- SWALE/INFILTRATION TRENCH
- ACO MULTIDRAIN M100D0.0
- LINEAR DRAIN (UNLESS STATED OTHERWISE)
- LINEAR DRAIN SUMP
- LOW VOLTAGE DUCTS
- LOW VOLTAGE PITS
- COMMUNICATIONS DUCTS
- COMMUNICATIONS PITS

REV.	DATE	DETAILS	DRN.	CHK.
P02	30-08-19	PLOT M BOUNDARY UPDATED	DAE	MJN
P01	09.07.19	FIRST ISSUE	JB	MJN

DRAWING STATUS
STAGE 2

RoC CONSULTING
Commercial Wharf
6 Commercial Street
Manchester M15 4PZ
T 0161 214 5390
W rocconsulting.com

DRAWN	JB	DATE	09/07/2019
CHECKED	MN	DATE	09/07/2019
APPRVD.	MN	DATE	09/07/2019

SCALES 1:250
THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE. --DO NOT SCALE--
EMAIL FOR DRAWINGS info@rocconsulting.com

CLIENT
U & I LTD

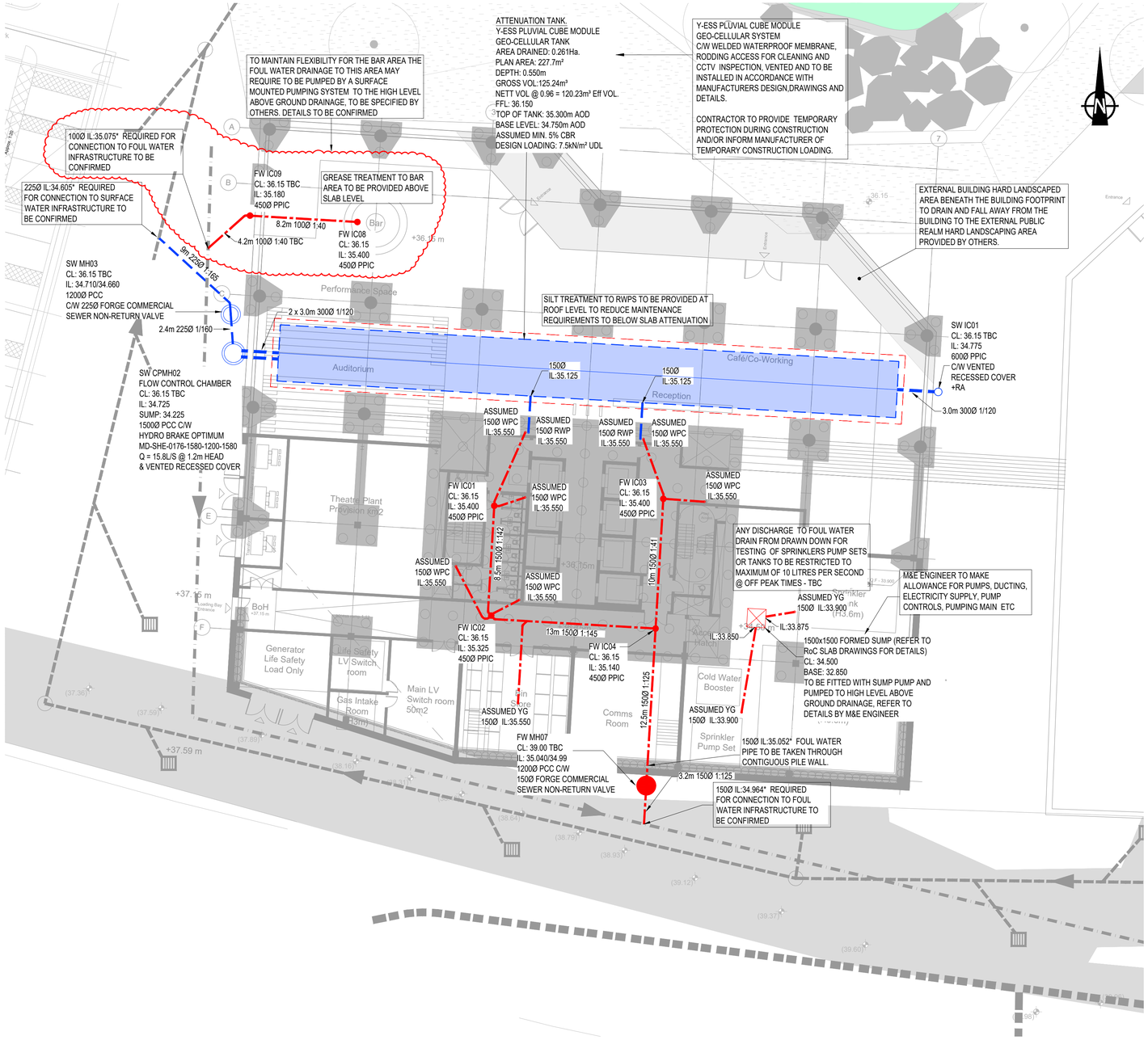
PROJECT TITLE
MAYFIELD
PLOTS L & M

DRAWING TITLE
SITE CONSTRAINTS (WITH PROPOSED BUILDING FOOTPRINTS)

PROJECT No.	DRAWING No.	REV.
3986	CON-1	P02

© RoCp Ltd.

ACADFILE PLOTDATE



DRAINAGE STRATEGY & ASSUMPTIONS:

SURFACE WATER

1. THE DRAINAGE STRATEGY ASSUMES THAT THE DRAINAGE FROM PLOT M WILL BE BY GRAVITY AND BE PRIVATELY OWNED AND MAINTAINED.
2. PLOT M DISCHARGE IS TO BE RESTRICTED TO A MAXIMUM PASS ON FLOW RATE OF 15.8 LITRES PER SECOND, OUTFALLING TO THE NEW SURFACE WATER INFRASTRUCTURE BEING PROVIDED. DETAILS TO BE CONFIRMED
3. ATTENUATION IS PROVIDED ON PLOT TO PROTECT THE BUILDING FROM FLOODING. NO FLOODING FOR A 1 IN 30YR RP STORM OF CRITICAL DURATION AND A FLOOD CHECK FOR A 1 IN 100YR RP STORM OF CRITICAL DURATION WITH A +40% RAINFALL ALLOWANCE FOR CLIMATE CHANGE AGAINST A 1m SURCHARGED OUTFALL.
4. A NON RETURN VALVE WILL BE PROVIDED IN THE LAST MANHOLE ON THE SURFACE WATER SYSTEM PRIOR TO CONNECTION TO THE SURFACE WATER INFRASTRUCTURE DRAINAGE TO PROTECT THE PLOT DRAINAGE FROM BACKFLOW AND POTENTIAL FLOODING FROM THE SURFACE WATER INFRASTRUCTURE DRAINAGE SYSTEM.

FOUL WATER

1. THE DRAINAGE STRATEGY ASSUMES THAT THE DRAINAGE FROM PLOT WILL BE BY GRAVITY AND BE PRIVATELY OWNED AND MAINTAINED.
2. THE PLOT WILL BE DRAINED AND DISCHARGE AT AN UN-RESTRICTED RATE VIA A NEW 150Ø CONNECTION AT A GRADIENT OF 1 IN 125 AND, SUBJECT TO CONFIRMATION A 100Ø AT 1IN 40 FOR THE BAR AREA TO THE NEW FOUL WATER INFRASTRUCTURE BEING PROVIDED. DETAILS TO BE CONFIRMED.
3. THE PUMPED DISCHARGE FROM THE PLANT ROOM BASEMENT TO THE SUSPENDED DRAINAGE WILL BE RESTRICTED TO A MAXIMUM RATE OF 10 LITRES PER SECOND AT OFF-PEAK TIMES TO PREVENT OVERLOADING THE ABOVE AND BELOW GROUND FOUL WATER DRAINAGE.
4. A SEWERAGE NON RETURN VALVE WILL PROVIDED IN THE LAST MANHOLE ON THE FOUL WATER SYSTEM PRIOR TO CONNECTION TO THE FOUL WATER INFRASTRUCTURE DRAINAGE TO PROTECT THE BUILDING FOUL WATER SYSTEM AND BASEMENT FROM BACKFLOW AND POTENTIAL FLOODING FROM THE FOUL WATER INFRASTRUCTURE DRAINAGE SYSTEM.

EXISTING DRAINAGE:

1. EXISTING PUBLIC SEWER INFORMATION IS BASED ON SEWER RECORD MAPS.
2. PRELIMINARY FOUL AND SURFACE WATER INFRASTRUCTURE DRAINAGE HAS BEEN PROVIDED BY BURO HAPPOLD

RISKS:

1. ALL FOUL AND SURFACE WATER CONNECTION SIZES (150Ø) AND LOCATIONS HAVE BEEN ASSUMED WITH ABOVE GROUND RODDING ACCESS PROVIDED AND REQUIRE COORDINATION WITH THE ARCHITECTS AND M&E ENGINEERS INFORMATION.
2. THE CURRENT SURFACE WATER DRAINAGE SCHEME IS BASED ON THE CURRENT INTERNAL GROUND FLOOR AND CENTRAL CORE LAYOUT AND FLOOR LEVELS AND ARE SUBJECT TO CONFIRMATION AND COORDINATION WITH THE ARCHITECTS FINAL INFORMATION.
3. ALL INTERNAL DRAINAGE RUNS NEED TO BE COORDINATED WITH THE FINAL STRUCTURAL ENGINEERS FOUNDATION DESIGN INFORMATION AND DETAILS.
4. ATTENUATION VOLUMES HAVE BEEN BASED ON THE CURRENT HARD ROOF AREA AND IS SUBJECT TO CONFIRMATION.
5. FOUL AND SURFACE WATER DRAINAGE PROPOSALS ARE SUBJECT TO THE APPROVAL OF THE LOCAL TO PLANNING AUTHORITY AND LEAD LOCAL FLOOD AUTHORITY.
6. ALL FOUL AND SURFACE WATER DRAINAGE IS TO OUTFALL SEPARATELY TO THE NEW INFRASTRUCTURE DRAINAGE TO BE PROVIDED AND IS SUBJECT TO CONFIRMATION.

LEGEND

- SURFACE WATER ATTENUATION TANK + WORKING ZONE
- PROPOSED SURFACE WATER
- PROPOSED SURFACE WATER CHAMBER
- RWP — RAINWATER PIPE (ASSUMED 150Ø)
- PROPOSED FOUL WATER
- PROPOSED FOUL WATER CHAMBER
- WPC — WASTE PIPE CONNECTION (ASSUMED 150Ø)
- YG — YARD GULLY CONNECTION (ASSUMED 150Ø + RISER PIECE + SILT BUCKET)
- PROPOSED SURFACE WATER INFRASTRUCTURE DRAINAGE BY BURO HAPPOLD - TBC
- PROPOSED FOUL WATER INFRASTRUCTURE DRAINAGE BY BURO HAPPOLD - TBC
- EXISTING COMBINED PUBLIC SEWERS

THIS DRAWING IS THE PROPERTY OF RoCp. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON EITHER WHOLLY OR IN PART WITHOUT THE WRITTEN CONSENT OF RoCp

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. DO NOT SCALE OFF THIS DRAWING. USE DOCUMENTED DIMENSIONS ONLY. IF IN DOUBT SEEK CONFIRMATION FROM THE ENGINEER.
3. ALL LEVELS ARE IN METERS ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE.
4. CURRENT GROUND FLOOR AND EXTERNAL LAYOUT DETAILS ARE BASED ON ARCHITECTS' CURRENT LAYOUTS RECEIVED ON 06.08.2019

W.I.P NOTE

THE FOUL AND SURFACE WATER DRAINAGE DESIGN IS SUBJECT TO DESIGN DEVELOPMENT AND COORDINATION WITH THE LATEST INFORMATION FROM THE ARCHITECT, M&E ENGINEER, STRUCTURAL ENGINEER AND LANDSCAPE ARCHITECT.

REV.	DATE	DETAILS	DRN.	CHK.
P01	30.08.19	INITIAL ISSUE	DAE	MJN

DRAWING STATUS
FOR INFORMATION

RIBA STAGE
STAGE 2

RoC CONSULTING
Commercial Wharf
6 Commercial Street
Manchester M15 4PZ
T 0161 214 5390
W rocconsulting.com

DRAWN	DATE	SCALES
DAE	AUG 19	1:200
CHECKED: DAE	DATE: AUG 19	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE --DO NOT SCALE--
APPRVD.: MN	DATE: AUG 19	EMAIL FOR DRAWINGS: info@rocconsulting.com

CLIENT
U+I

PROJECT TITLE
MAYFIELD PLOT M

DRAWING TITLE
DRAINAGE LAYOUT PLAN

PROJECT No.	DRAWING No.	REV.
3986	DR-201	P01

© RoCp Ltd.

John Scandrett
Buro Happold
17 Newman Street
London
W1T 1PD
UK

T: +44 (0)207 927 9700
F: +44 (0)870 787 4145
Email: John.Scandrett@BuroHappold.com

Rodoula Gregoriou
Buro Happold Limited
Camden Mill
Lower Bristol Road
Bath
BA2 3DQ
UK

T: +44 (0)1225 320 600
F: +44 (0)870 787 4148
Email: Rodoula.Gregoriou@burohappold.com