Civic Engineers

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Brunswick Place

Report Type
Flood Risk Assessment and Drainage Strategy Report

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Maryland Securities

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Contents

Flood Risk Assessment and Drainage Strategy Report

Prepared by	**Tom Clark**
Reviewed by	Rob Webster
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1. Introduction

This report has been produced to demonstrate the surface water management strategy for a new commercial and residential development at Brunswick Mill, Manchester.

This report has been prepared to demonstrate that the surface water run-off rate and volume for the new development site is managed so it adheres to current regulations and local authority requirements.

The surface water management report has been prepared to the requirements of the;

- National Planning Policy Framework, 2019 (NPPF)
- National Planning Practice Guidance (NPPG)
- Principles of Sustainable drainage systems (SuDS) set out by DEFRA (March 2011)
- Ciria SUDS Manual C753 (2015)
- Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015)
- Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA (March 2011)

2. Surface Water Management Principles

The surface water for the development site is to be managed so that it adheres to the current regulations and local authority requirements.

2.1 National Planning Policy Framework (NPPF)

Guidance set out in the NPPF to which the surface water management of the development is to conform to the following;

Paragraph 051 states *the drainage is to be designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible, will provide opportunities to reduce the causes and impacts of flooding and will remove pollutants from urban run-off at source.*

An assessment will be carried out as stated in Paragraph 079 on whether a sustainable drainage system should be considered depending on the proposed development and its location.

And Paragraph 080 *where the aim of the surface water management will be to dischard surface run off as high up the following hierarchy of drainage options as reasonably practicable into the ground (infiltrations), to a surface water body, to a surface water sewer, highway drain, or another drainage system, to a combined sewer.*

2.2 Run-Off Destination

Surface water run-off is to discharge to one or more of the following in the order of priority shown.

- Discharge into the ground (infiltration)
- Discharge to a surface water body
- Discharge to a surface water sewer, highway drain or other drain
- Discharge to a combined sewer

2.3 The Management Train

A concept fundamental to implementing a successful SuDS scheme is the management train. This is a sequence of SuDS components that serve to reduce run off rates and volumes and reduce pollution. The hierarchy of techniques that are to be used for the surface water management of the development are;

- Prevention, prevention of run off by good site design and reduction of impermeable areas
- Source Control, dealing with water where and when it falls (e.g. infiltration techniques)
- Site Control, management of water in the local area (e.g. swales, detention basins)
- Regional Control, management of run-off from sites (e.g. balancing ponds, wetlands)

2.4 Design Principles

The design principles for the surface water management of the development will be to:

- Ensure that people, property and critical infrastructure are protected from flooding
- Ensure that the development does not increase flood risk off site

- Ensure that SuDS can be economically maintained for the lifetime of the development

2.5 Flood Risk

The drainage system will be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur on any part of the site for a 1in30 year rainfall event.

The drainage system will also be designed so that, unless an area is designed to hold and/or convey water, flooding does not occur during a 1 in 100 year + climate change rainfall event in any part of a building (including a basement) or in any utility plan susceptible to water (e.g. pumping station or electricity substation) within the development.

The design of the site will ensure that flows resulting from rainfall more than a 1 in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

2.6 Peak Flow Control

The peak surface water flow from the post development site will adhere to the guidance Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA – March 2011, which states that;

"Development should aim for a minimum reduction in surface water rates of 50% from Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm even, considering climate change"

Parts of the development are considered brownfield and parts of the site are considered greenfield due to the derelict state of the former mill buildings. Based on the afore mentioned, the greenfield parts of the site will be restricted down to greenfield run off rates, due to minimum allowable orifice sizes this will be 5.0l/s.

The brownfield elements of the site will be reduced by 50% for the existing 1 in 1 year critical event up to and including the 100 year + 40% climate change event, by using feasible SuDS methods and maintaining those SuDS features so that they work effectively.

2.7 Volume Control

The runoff volume from the developed site for the 1 in 100 year + 40% climate change 6 hour rainfall will aim not to exceed the pre-development run off volume for the same event. Should infiltration methods not be suitable, and it is not possible to achieve pre-developemnt run off volume, then it will be demonstrated that the increased volume will not increase flood risk on or off site.

2.8 Pollution

The SuDS design for the development site will ensure that the quality of any receiving water body is not adversely affected and preferable enhanced in accordance with Ciria SuDS Manual C753 Chapter 4.

2.9 Designing for Exceedance

The development site design will be such that when SuDS features fail or are exceeded, exceedance flows do not cause flooding of properties on or off site. The design of the site ensures

that flows from rainfall more than a 1 in 100-year rainfall event are managed in exceedance routes that avoid risk to people and property both on and off site.

3. Development Site Setting and Details

3.1 Site Location

The development site is located on Bradford Road, Manchester, M40 7EZ. To the rear the site is constructed up to the tow path of The Ashton Canal.

The development site is approximately 9,200m²/0.92 ha in area. Note that the orange bound area is not under the ownership of this Client and is not considered as part of this report.

Figure 1: Site Location Plan

The approximate OS coordinates of the site are 393530E 398720N

3.2 Existing Site Description

The development is currently a mixture of brownfield and greenfield due to the derelict state some of the existing site is in and currently consists of a seven-storey quadrangle shaped former mill building with an area of cleared land to the south west which was also formerly occupied by a mill building.

3.3 Topography

Topographical information (Appendix A) indicates that the site is generally flat. Across the site the level is approximately 53.70AOD with some variance in areas.

3.4 Ground Conditions

A Geo-Environmental Phase 1 Desk Study was prepared in June 2018 by The LK Group to determine the history of the site, to assess the potential for contamination and to provide preliminary information on foundation options with regards to the proposed development. This document will be provided as supplementary information.

The Desk Study shows potential, due to local boreholes, of significant made ground overlying clay. Potential contamination sources affecting the site were identified as heavy metals, PAH's, sulphate, asbestos, solvents, hydrocarbons and gas.

3.5 Waterbodies

The nearest waterbody to the development is The Ashton Canal, which runs directly to the rear of the site.

3.6 Existing Drainage and Public Sewers

The operation of the existing site is currently unknown however a CCTV survey will be undertaken prior following planning to confirm

UU sewer maps (Appendix B) indicate a 525x600mm combined sewer along Bradford Road running south. There is a 300mm surface water sewer located in Layton Street which runs perpendicular to the development site and a 1200mm surface water sewer which is in Beswick Street.

It is presumed that the site currently has a connection to the existing combined water sewer though there is evidence of discharge into the Ashton Canal via rainwater pipes on the tow path elevation of the mill. These discharge directly onto the towpath.

3.7 Proposed Development

The proposed site plans are shown in Appendix D.

The proposed development involves the conversion of the existing mill to residential apartments with commercial units to the ground floor. Within the central space of the existing mill a courtyard space is proposed.

A further residential and commercial development is proposed to the southern end of the site where a former mill once stood. Externally it is proposed to construct a parcel of hardstanding providing car parking for occupants.

4. Flood Risk

4.1 River and Sea Flooding

The current Environment Agency flood maps show that the site falls within Flood Zone 1, as shown in the figure below. This indicates the site has a less than 1 in 1,000 annual probability of river or sea flooding.

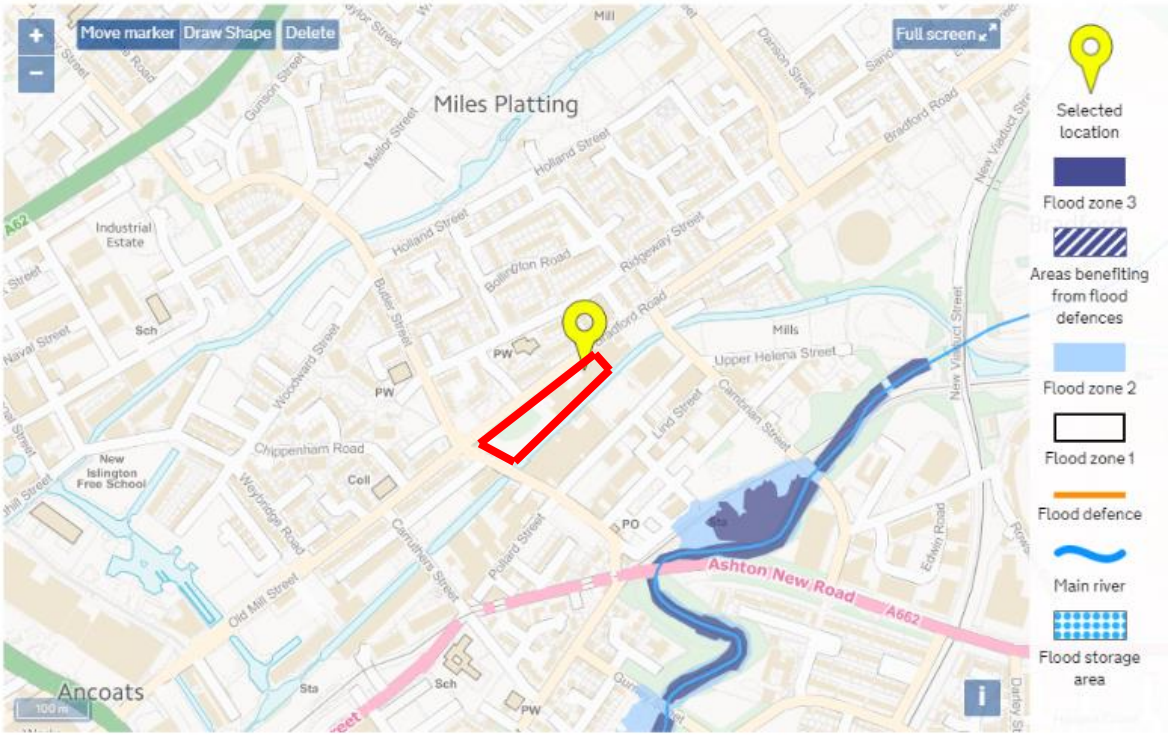

Figure 2: EA River and Sea Flood Map

4.2 Flood Risk from Groundwater

The SFRA map GW 2.1 identifies areas which are at risk from groundwater flooding. The site is not shown within an area at risk.

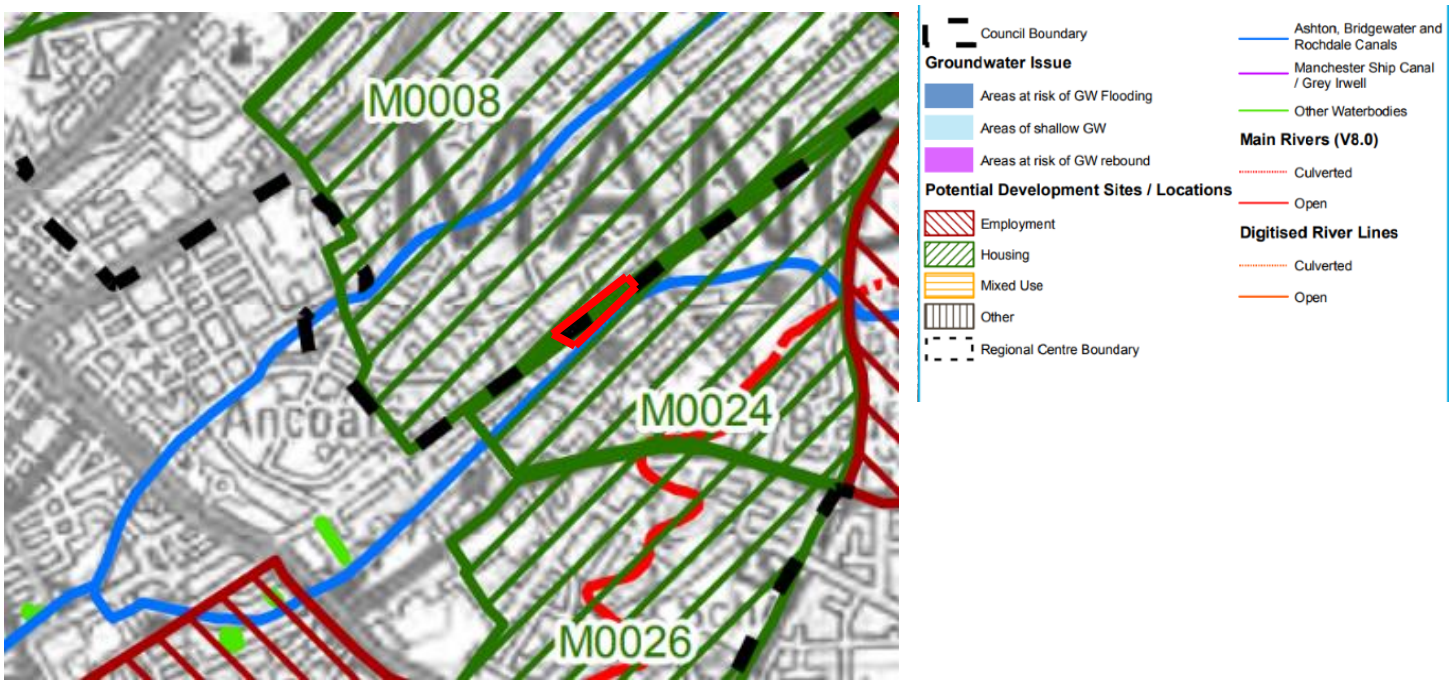

Figure 3:SFRA Map GW_2,1

4.3 Flood Risk from Surface Water

Surface water flooding is a result of surface water run off and or ponding normally due to heavy or prolonged rainfall or snow melt, where the large water volume is unable to soak into the ground or enter drainage systems. The run off travels overland, following the contours of the land until reaching low lying areas in the topography causing ponding. Such events normally have a short duration and depend on several factors such as geology, topography, rainfall, saturation extent of urbanisation and vegetation.

The Environment Agency has undertaken national scale surface water flood modelling identifying areas at risk of surface water flooding. These risk categories can be classified as

- Very low flood probability – Zone has a less than a 1 in 1000 annual probability of a surface water flood event
- Low flood probability – Zone has a between 1 in 100 and 1 in 1000 annual probability of surface water flood event
- Medium flood probability – Zone has between a 1 in 30 and 1 in 100 annual probability of a surface water flood event
- High flood probability – Zone has a greater than 1 in 30 annual probability of a surface water floor event.

Figure 4: EA SW Flood Map

The EA Surface water flood map in figure 3 above indicate that some areas of the site are at low risk of surface water flooding.

4.4 Flood Risk from Reservoirs

The Environment Agency map of the extent of flood risk from reservoirs (fig 4 below) shows that the site does not fall within an area which will flood in the event of a reservoir failure.

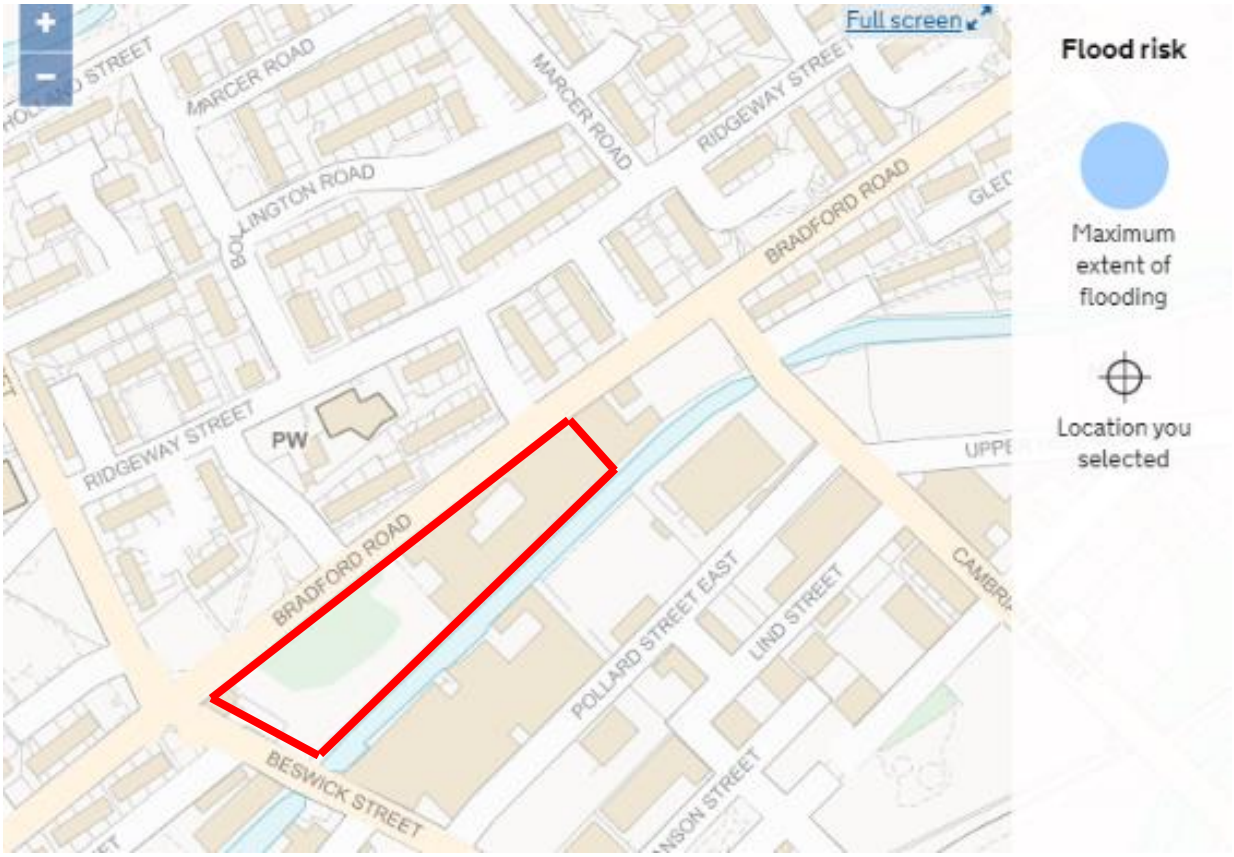

Figure 5: EA Reservoir Flood Map

5. Proposed Drainage Strategy

5.1 Surface Water Management

The post development surface water run off is to be reduced to as low as possible to adhere to the requirements described above, to reduce the risk of flooding, based on the development type a mixture of greenfield and brownfield run off rates will give a combined post development surface water discharge rate.

The preferred destination for the surface water run off from the post development site would be to the ground via infiltration, but as the ground is not viable for infiltration due to the presence of made ground and significant depths of clay as indicated in the PH1 desk study, discharging via infiltration has been ruled out. Existing below ground strata will be confirmed by a Phase 2 Site Investigation.

Following the hierarchy indicated in Section 2.2 of this report, the proposed surface water should discharge to a waterbody. The Ashton canal is located at the rear of the site and runs along the south eastern boundary, based on the existing topographical information and the proposed development layout, constructing an outfall into the Ashton canal will not be feasible as the invert level of the proposed outfall will be lower than the water level of the canal due to the presence of a towpath which runs adjacent to the canal.

The next solution would be to discharge the surface water to the existing surface water network running adjacent to the site.

Following pre-development discussions with United Utilities it was confirmed that the existing mill can continue to drain to the existing combined water sewer in Bradford Road at a 50% betterment to the current discharge rate. Correspondence from United Utilities can be found in Appendix B.

Following the modified rational method and using an existing catchment area of 0.56ha the current surface water discharge rate for the mill development is 77.84l/s.

Providing a 50% betterment to the above gives a proposed discharge rate of 39l/s into the existing combined water sewer for the mill development.

For the greenfield aspects of the development these will restricted down to the minimum allowable based on minimum orifice plate sizes, this achieves a 5.0l/s for both sites.

Figure 6 below identifies brownfield/greenfield aspect of the development.

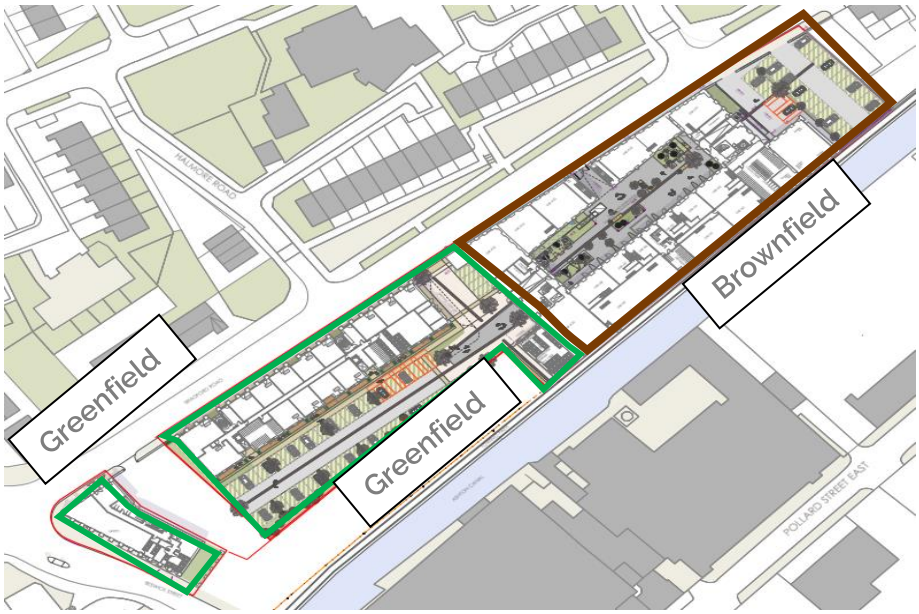

Figure 6: Brownfield/Greenfield Aspects of the Development

5.2 Proposed Surface Water Drainage Strategy

5.2.1 Existing Mill Development Site

Following the principles set out above it is proposed to discharge the proposed surface water flows into the existing combined water sewer at a 50% betterment.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100-year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst-case impacts of climate change. This is in accordance with Table 5 of the Technical Guidance to the National Planning Policy Framework.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30-year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100-year (+40%) event, will be retained on-site.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

Prior to the commencement of any works a CCTV survey should be undertaken of the existing combined water sewer to validate the proposed design.

The surface water drainage strategy and discharge rates are subject to approval from United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

The proposed surface water is to utilise buried geo-cellular tanks to store up to the 100yr + 40% climate change event utilising a vortex flow control to restrict the proposed flows to a rate no higher than 39l/s, the entire drainage system is to remain in private ownership, a maintenance schedule can be found in Section 7.

5.2.2 Mid Building Development

Following the principles set out above it is proposed to restrict the site to Greenfield run off rates and discharge the proposed flows into the existing surface water sewer in Beswick Street.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100-year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst-case impacts of climate change. This is in accordance with Table 5 of the Technical Guidance to the National Planning Policy Framework.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30-year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100-year (+40%) event, will be retained on-site.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

Prior to the commencement of any works a CCTV survey should be undertaken of the existing surface water sewer to validate the proposed design.

The surface water drainage strategy and discharge rates are subject to approval from United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

The proposed surface water is to utilise a tanked sub-base attenuation system to store up to the 100yr + 40% climate change event utilising a vortex flow control to restrict the proposed flows to a rate no higher than 5l/s, the entire drainage system within the site boundary is to remain in private ownership.

As this part of the development is to discharge into the existing surface water sewer in Beswick Street it is proposed to construct a new public sewer in Bradford Road subject to confirmation that the existing highway can take the construction of a new public sewer in reference to space available within the existing highway. This will enable the proposed surface water flows from the development to discharge into the existing surface water sewer.

5.2.3 Corner Building

Following the principles set out above it is proposed to restrict the site to Greenfield run off rates and discharge the proposed flows into the existing surface water sewer in Beswick Street.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100-year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst-case impacts of climate change. This is in accordance with Table 5 of the Technical Guidance to the National Planning Policy Framework.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30-year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100-year (+40%) event, will be retained on-site.

In line with common practice, it is proposed the surface water discharge from the proposed development should mimic that from the existing site.

Prior to the commencement of any works a CCTV survey should be undertaken of the existing surface water sewer to validate the proposed design.

The surface water drainage strategy and discharge rates are subject to approval from United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

The proposed surface water is to utilise buried geo-cellular tanks to store up to the 100yr + 40% climate change event utilising a vortex flow control to restrict the proposed flows to a rate no higher than 39l/s, the entire drainage system is to remain in private ownership, a maintenance schedule can be found in Section 7.

5.3 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer

2. Septic tank

3. Cesspool.

The foul water system shall be designed in accordance with;

- BS EN 752:2008 (Drain and sewer systems outside buildings)
- Sewers for Adoption (7th Edition)
- Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).
- BS EN 12056-2:2000 (Drainage systems inside buildings)
- Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2010).

United Utilities have confirmed in their predevelopment advice that the proposed foul water for each site can discharge at an unrestricted rate into the combined water sewer in Bradford Road.

6. SuDS Proposals

SuDS are to be incorporated into the post development design to reduce the surface water run-off rates and to aid the above proposed the 50% betterment of the pre-development rates; reducing the volume of formal attenuation required.

Various SuDS methods have been explored and implemented where viable such a permeable paving solutions along with a tanked sub-base attenuation system for the car parking aspects of the development, this has allowed for the geo-cellular tanks utilised onsite due to site constraints to be kept down to a minimum Due to the site constraints geo-cellular tanks have also been utilised.

SuDS Method	Site Specific Feasibility
Living Roofs	There is no proposal to accommodate living roofs within the scheme due to the preferred construction makeup of the buildings
Basins and Ponds – Above Ground Storage	Due to most of the site being occupied by a building, basins and ponds are not a feasible option.
Filter Strips and Swales	Due to most of the site being occupied by a building, filter strips and swales are not a feasible option.
Store water for later use	Rainwater harvesting is not a viable option for the development due to the rainfall yield on the roof area being less than the water demand for the residential units.
Infiltration Devices	The underlying strata of the development site consists of made ground and clay which is not feasible for infiltration. Also, most of the site is occupied by a building, meaning infiltration is not a feasible option.
Permeable Surfaces and Filter Drains	Permeable surfaces can be utilised in the car parking areas of the development, this have been utilised with a tanked sub-base to form an attenuation system.
Vortex Control and Tanked Attenuation Systems	A control is to be used to restrict the surface water to the 50% betterment rate. Subject to the identification and agreement of a point of connection to outfall, a tanked attenuation system will be provided in the service yard area to accommodate the restricted volume of water up to and including the 1 in 100-year storm event.
Discharge to a Sewer	It is intended to discharge the surface water to the local sewer

7. Future Maintenance

Any drainage that remains private will require a maintenance schedule in accordance with the CIRIA SUDS Manual C753. Accordingly, as stated in the SUDS Manual the operation and maintenance of pervious pavements and buried attenuation shall be as the modified version of table 21.3 below.

Table 21.3 (modified) : Operation and maintenance requirements for attenuation storage tanks

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas not opertaing correctly. If required take remedial action	Monthly for 3 months, then annually as minimum
	Remove debris from the catchment surface / ACO Channels	Monthly
	Remove sediment from upstream catchpit chambers	Annually, or as required
Remedial Action	Repair inlets, outlets, vents and cellular storage units	As required
Monitoring	Inspect / check all inlets, outlets and vents to ensure they are in good condition and operating as designed	Annually
	CCTV Survey inside of cellular system for sedimentation build-up and remove if necessary	Every 5 years minimum or as required

The remaining drainage systems (hydro-brake unit) will be maintained in accordance with manufacturer's requirements which will be provided within the O&M manual which will be issued as a compliance requirement to the maintenance contractor on completion of the works.

The hard surfaces proposed for the development shall require regular annual sweep and suction brush following leaf fall in autumn. An annual inspection of flow control chamber, ACO channels and the inspection chambers shall be necessary to remove any silt build up and check the free flow use of the hydro-brake.

8. Conclusion

The post development surface water rates from the brownfield part of the site are to be reduced to 50% of the existing critical 1 in 1 year pre-development surface water run-off rates.

The post development surface water rates from the greenfield parts of the site will be restricted down to the minimum allowable discharge rates in relation minimum allowable orifice plate sizes.

The feasibility of the surface water run-off destination and SuDS method hierarchy has been established for the site, in order to adhere to NPPF, Paragraph 080 and Non-Statutory Technical Standards for Sustainable Drainage Systems – March 2015'.

In line with Building Regs Part H the surface water hierarchy has been assessed. With discharge via infiltration ruled out based on the Phase 1 desk study due to the presence of made ground and clay. Discharge to a waterbody has been ruled out due to the impracticality of constructing a surface water headwall underneath the existing canal towpath with the proposed outfall being constructed well below the canal water level.

The drainage network and storage structures have been designed so that no flooding occurs in the site during the 1 in 30-year storm event, and 1 in 100-year storm event including 40% Climate Change.

There will be very little pollutants discharging to the existing surface water network from the development site, and in storm events exceeding the 1 in 100-year event the surface water flow will not increase the flood probability to the buildings within the site, or to any properties / buildings within the vicinity of the development site.

An indicative drainage strategy has been included in Appendix C.

This report has demonstrated that the surface water management of the post development site adheres to the requirement of the NPPF; NPPG and Manchester City Council guidance.

A CCTV survey of the surrounding sewers is to be conducted to validate the proposed drainage strategy.

Discussion with United Utilities has been undertaken to confirm proposed discharge rates (see Appendix B)

Appendix A Topographical Survey

Appendix B UU Sewer Maps and Correspondence

Appendix C Outline Drainage Layout and Calculations

Appendix D Proposed Development Site Plan

Civic Engineers

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