

Flood Risk Assessment and Drainage Strategy Report

St Gabriels

Final – 01 July 2022
2998-MHT-CV-RP-0001

Prepared For:



FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY REPORT

ST GABRIELS

FINAL FOR SUBMISSION

Quality Assurance Page

Issue	Date	Prepared By	Checked By	Approved By	Remarks
Draft	20.04.22	Mr. G. Bansal	Mr. G. Bansal	Mr. G. Bansal	Draft Planning Issue
Final	20.05.22	Mr. G. Bansal	Mr. G. Bansal	Mr. G. Bansal	Final Planning Issue
Final	01.07.22	Mr. G. Bansal	Mr. G. Bansal	Mr. G. Bansal	Final Planning Issue

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Executive Summary

Meinhardt have undertaken this Flood Risk Assessment (FRA) and prepared this Drainage Strategy (DS) on behalf of McLaren Property to support the detailed planning application (hereafter referred to as the 'Development') for the construction of a residential development located at 1 Oxford Pl, Rusholme, Manchester M14 5RP.

The proposed development will consist of four residential buildings comprising of 319 units located across the development.

This FRA investigates Flood Risk on site and in the area and outlines the mitigation measures proposed to ensure the sustainable and safe development of the Site in line with the requirements of the National Planning Policy Framework (NPPF), Environment Agency's (EA) Climate Change allowances guidance and Standing Advice, and the Flood Risk and Coastal Change Planning Practice Guidance (PPG).

The site is located entirely within Flood Zone 1 where the probability of river or sea flooding is less than 0.1% chance in any given year. Therefore, the probability of tidal or fluvial flooding for the site is assessed as negligible.

Available baseline information indicates that Site is also risk of flooding from surface water and is located within an area designated as a Critical Drainage Area (CDA). However, a drainage strategy has been designed in line with the Manchester local policy and the most recent EA Climate Change Guidance and is presented within this report. The proposed drainage strategies consider surface water runoff management: the solutions proposed ensure that for the 100 year plus 45% climate change allowance event, surface water will be accommodated within the Site. As such the risk of surface water is mitigated and deemed low risk.

Other potential sources of flooding have been investigated and have been deemed not to be significant.

The proposed drainage strategy for the development incorporates sustainable drainage systems (SuDS) features in the form of green roofs and underground geo-cellular attenuation tanks. Surface water will be attenuated in line with local policy to 50% compared to the existing rates before discharging into the local United Utilities (UU) combined sewer.

Consultation with the United Utilities (UU), Manchester City Council as the Lead Local Flood Authority (LLFA) has been carried out throughout the preparation of this FRA and DS to ensure their awareness of the proposals, their ability to advise on Flood Risk constraints and on the proposed drainage strategy.

1 Introduction

1.1 Project Brief

Meinhardt have been appointed by McLaren Property to undertake this Flood Risk Assessment (FRA) and Drainage Strategy (DS) to accompany the detailed planning application (hereafter referred to as the 'Development') which will comprise of four residential buildings comprising of 318 units located across the development.

The Site comprises an area of 0.7672 hectares (ha). The OS Grid Reference for the approximate centre of the Site is National Grid Reference 385209, 395767. This report relates solely to the above Site and should not be used for any other reasons other than for which the report was originally prepared.

1.2 Assessment Methodology

The below methodology has been carried out to investigate flood risk on Site and in the surrounding area and to identify suitable mitigation measures required to ensure the sustainability and safety of the Proposed Development over its lifetime.

The report has been produced in line with the requirements of the NPPF and the Environment Agency (EA) Standing Advice, as well as through consultation with the United Utilities (UU) and the Manchester City Council as the LLFA.

The following documents and policies have been reviewed to inform this report:

- Manchester City – Level 1 Strategic Flood Risk Assessment (March 2010) (SFRA1);
- Manchester City – Level 2 Strategic Flood Risk Assessment (March 2011) (SFRA2);
- Manchester City – Local Flood Risk Management Strategy (March 2014) (LFRMS);
- Manchester City – Manchester's Local Development Framework Core Strategy Development Plan Document (Adopted 11th July 2012)
- Water Research Centre (WRc) – Sewers for Adoption 8th Edition (2018);
- CIRIA 753 2015: The SuDS Manual (2015);
- EA – Flood Risk Assessments: Climate Change Allowances (2016)ⁱ;
- EA – Preparing a Flood Risk Assessment: Standing Advice (2022)ⁱⁱ;
- ND Oliver & Co – Topographical Survey (2021) (**Appendix A**);
- United Utilities Asset Records (2019) (**Appendix B**);
- Layer Surveys Ltd – CCTV Drainage Survey (2022) (**Appendix C**);
- RSK Phase 1 Desktop Study (2022);
- British Geological Society (BGS) Online Viewer, 1:50,000 Bedrock and Superficial deposits;
- DEFRA's online Magic Map; and
- GOV.UK's online Long Term Flood Maps.

The local policies discussed in Section 2 have also been considered to inform this assessment.

Meinhardt does not guarantee that the advice provided by this report will guarantee the availability of flood insurance. The insurance industry carry out their own assessments to properties in terms of determining the insurability for flood risk. Those intending to undertake development in areas which may be at risk of flooding are advised to contact their insurers or the Association of British Insurers (ABI) to seek further guidance prior to commencement.

Although this report was prepared using the degree of skill and care ordinarily exercised by engineers practicing under similar circumstances please note that Meinhardt cannot take responsibility for errors in the information provided by third parties.

2 Planning Policy and Guidance

The below policy and guidance are considered relevant to this FRA and DS and have been used to inform this assessment.

2.1 National and Regional Policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in February 2019 (updated in July 2021) with the aim of protecting the environment and to promote sustainable growth. There is an overarching objective to strive towards sustainable development and ensuring that this is a key element in every proposal.

The following paragraphs from the NPPF are considered relevant to this assessment:

Paragraph 159: Requires that “Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere”;

Paragraph 162: Explains that “the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source”;

Paragraph 167: Explains that “When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere.[...]; and

Paragraph 169: Recommends that “major development should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

- a) take account of advice from the lead local flood authority;
- b) have appropriate proposed minimum operational standards;
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and
- d) where possible, provide multifunctional benefits”.

2.2 Manchester’s Local Development Framework Core Strategy Development Plan Document (Adopted 11th July 2012)

The Core Strategy was adopted by Manchester City Council on 11th July 2012. It is the key document in Manchester's Local Development Framework and covers a period of 15 years from 2012 to 2027. It describes Manchester today and outlines the Council's vision for Manchester in 2027 along with the planning policies which will be used to deliver that vision.

Off relevance to this report is Policy EN 14 (Flood Risk), which states:

- In line with the risk-based sequential approach contained within PPS25, development should be directed away from sites at the greatest risk of flooding, and towards sites with little or no risk of flooding; this should take account of all sources of flooding identified in the Manchester-Salford-Trafford Strategic Flood Risk Assessment (SFRA).
- In addition to the requirements for site-specific Flood Risk Assessments (FRAs) set out in PPS25, an appropriate FRA will also be required for all development proposals, including changes of use, on sites greater than 0.5ha within Critical Drainage Areas (CDAs) and Canal Hazard Zones identified in the SFRA.

- All new development should minimise surface water run-off, including through Sustainable Drainage Systems (SUDS) and the appropriate use of Green Infrastructure.
- Developers should have regard to the surface water run-off rates in the SFRA User Guide. In CDAs, evidence to justify the surface water run-off approach / rates will be required.
- The City of Manchester contains many sections of rivers which are culverted or 'hidden'; where these are indicated in the SFRA beneath the proposed development site, further investigation will be required and the development proposal should take this into account, where feasible and appropriate development should seek to open up culverted/hidden rivers to reduce the associated flood risk and danger of collapse, taking advantage of opportunities to enhance biodiversity and Green Infrastructure.

2.3 Local Flood Risk Management Strategy (March 2014) (LFRMS);

The key policies from the LFRMS considered relevant to this assessment are detailed below:

LFRM Policy 6: Section 5.46: Within Critical Drainage Areas, and consistent with the Core Strategy Policy EN14 Flood Risk, developers should aim to minimise surface water runoff from the developments, and achieve at least the following runoff rates:

- Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, including consideration of climate change.
- 1 50% runoff rate reduction for Brownfield sites, with an aim of reducing to greenfield rates up to a 1 in 100 year storm event, including a consideration of climate change.

2.4 Climate Change Guidance

The EA guidance "Flood risk assessments: climate change allowances" was issued in 2016 (last updated 27th May 2022) and provides the most recent information on expected changes in rainfall, river flows and sea levels as a consequence of climate change.

Sea level allowances by river basin district for each epoch is provided in Table 2 of the guidance document.

The guidance provides peak river flow allowances by management catchments, the sub-catchments of the river basin districts. The peak flows are based on percentiles, a percentile is a measure used to describe the proportion of possible scenarios that fall below an allowance level (e.g. a 50% percentile means that the allowance has 50% chances of not being exceeded).

The most recent updates for Peak Rainfall Allowances, which takes into account UKCP Local 2.2km projections and supporting research FUTURE-DRAINAGE. These are also now provided by management catchments instead of at a national scale and an online "Peak Rainfall Allowances Map" is now provided. Peak rainfall allowances are provided for 1% annual exceedance probability (AEP) events and for 3.3% AEP events.

The guidance states how to apply peak rainfall allowances has changed, using the central allowance for development with a lifetime up to 2100 and the upper end allowance for development with a lifetime from 2100 to 2125. Residential development to have a minimum lifetime of a 100 years, whilst commercial a minimum of 60 years.

The following approach should be used for drainage design:

- Development with a lifetime beyond 2100 - Design your development so that for the upper end allowance in the 1% annual exceedance probability event:
 - There is no increase in flood risk elsewhere

- Your development will be safe from surface water flooding
- Development with a lifetime of between 2061 and 2100 - For development with a lifetime between 2061 and 2100 take the same approach but use the central allowance for the 2070s epoch (2061 to 2125).
- Development with a lifetime up to 2060 - For development with a lifetime up to 2060, take the same approach but use the central allowance for the 2050s epoch (2022 to 2060).

Exceptions:

In some locations the allowance for the 2050s epoch is higher than that for the 2070s epoch. If so, and development has a lifetime beyond 2061, use the higher of the two allowances.

Therefore following a review of the new climate change allowances, 45% has been used based on the "Irwell Management Catchment".

3 Existing Site

3.1 Site Location and Description

The Site is located southeast of Manchester city centre, along Oxford Place (M14 5RP).

The Site currently comprises of three buildings currently, St Gabriels Hall, Woodthorpe Hall and St. Davids Hall. The site currently comprises of 110 student beds across St Gabriels Hall and Woodthorpe Hall, plus a vacant former church (St Davids Hall).

Refer to **Figure 1** for the Site location plan.

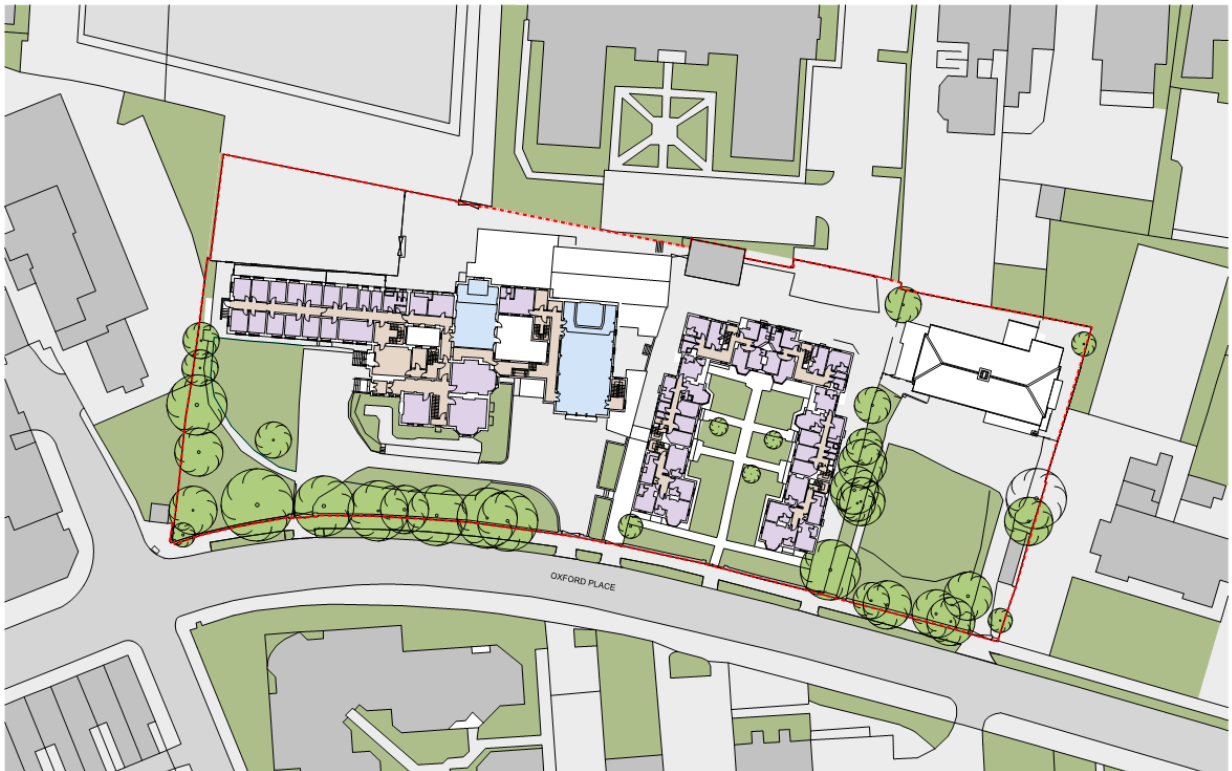


Figure 1: Indicative Site Location Plan

3.2 Topography

Based on the Topographical Survey carried out by ND Oliver & Co, the levels vary across the Site however generally the site is relatively flat, with levels varying between a high of 40.25m AOD to low of 38.81m AOD. Levels generally fall from south to north on site, with the lowest levels along the northern boundary of the site.

Refer to **Appendix A** for the Topographical Survey for further details.

3.3 Existing Drainage

3.3.1 Public Sewers

United Utilities asset records were obtained for the Site in 2021 (**Appendix B**) and a CCTV drainage survey was carried out by Layer Surveys Ltd in 2022 (**Appendix C**). From reviewing these resources it is shown that the Site is served by a combined sewer towards the north of the site.

There is a 1000mmØ sewer than runs along the northern boundary of the site. There is also a 375mmØ combined sewer within Oxford Place. Refer to **Appendix B** for further details as well as Figure 3 below.



Consultation with UU has taken place to agree that no formal Buildover agreement is required for the development in proximity to the 1000mmØ sewer, as all residential dwellings are located outside the 3m easement zone.

The CCTV survey, completed by Layer Surveys Ltd in January 2022, show that all foul and surface water on site drains to the 1000mmØ sewer than runs along the northern boundary of the site, via 4 existing saddle connections straight into the combined sewer.

Refer to **Appendix C** for further details.

3.3.3 Existing Watercourses, Waterbodies and Flood Defences

A review of available desktop mapping in particular the level 1 SFRA mapping, indicates a lost river culvert which passes below the site. Refer to Figure 4 below which is an extract from the SFRA Level 1 mapping. A review of desktop information indicates this was the Rush Brook Culvert (assumed to be the same as Malkin culvert). Historical mapping dates 1850, indicates this as an open channel but since 1893 mapping has been culverted.

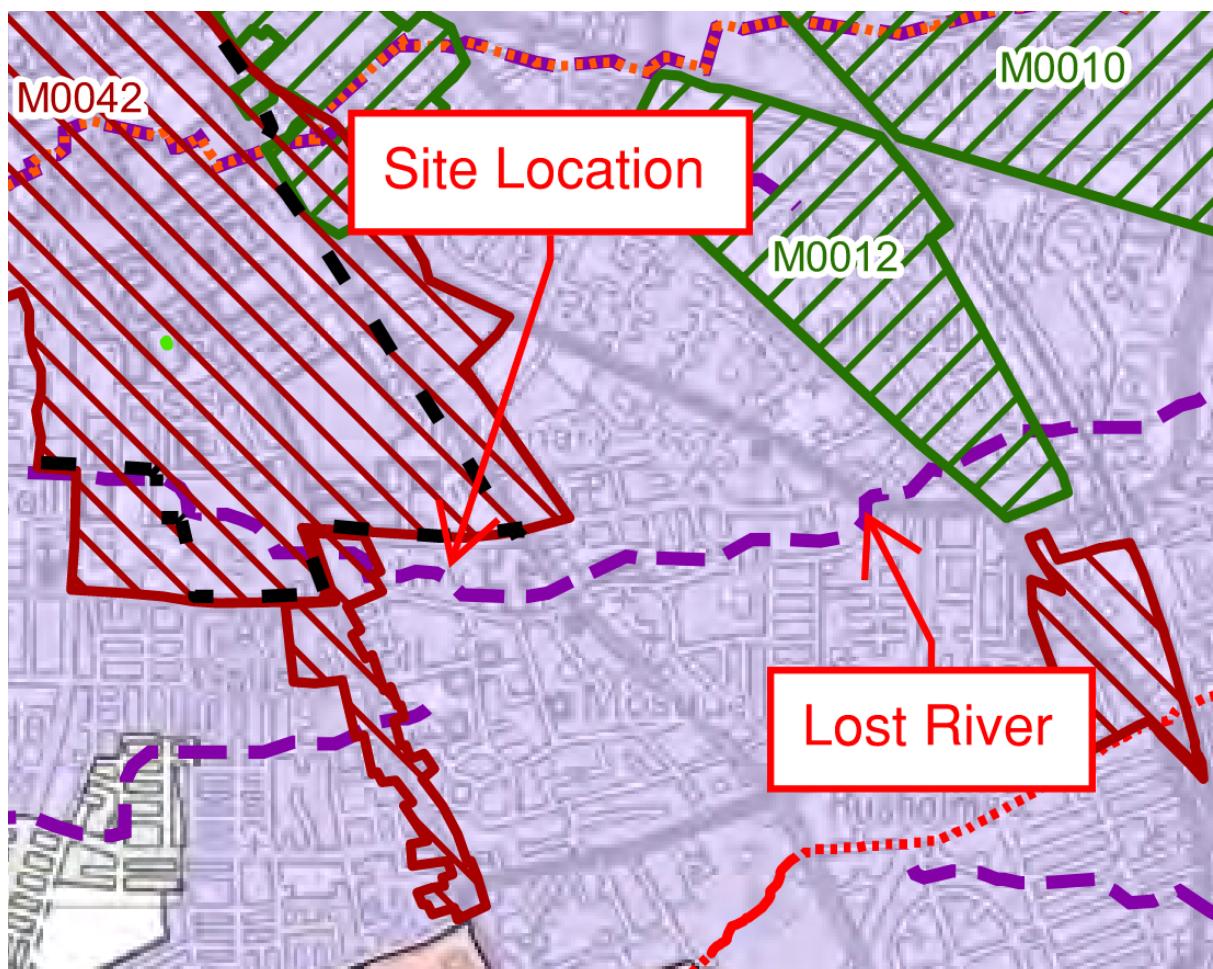


Figure 4: SFRA Lost River Mapping

Additionally historic drawings from the site indicates a culvert within the site along the northern boundary, however following drainage surveys (**Appendix C**) it's been determined that this culverted lost river is in fact the United Utilities combined 1000mm that runs along the northern boundary of the site.

There are no other waterbodies/existing water features in or within proximity of the site.

3.4 Geological and Hydrogeological Setting

A Phase 1 desktop study was undertaken by RSK in February 2022. A summary of the findings are indicated in Table 1 below.

The Site is underlain by Till (Devensian) over mudstone of the Manchester Marls Formation (east) and Sandstone of the Chester Formation (south west) according to published geological data and previous site investigation data of the surrounding areas. There is also likely to be made ground associated with the former development.

The southwestern area of the site lies within Zone 3 of groundwater Source Protection Zone (SPZ). An SPZ Zone 1 is located 1190m to the northwest of the site. Ground due to the nature of the site use and previous phases of construction and demolition that have taken place.

Groundwater within the Till superficial deposits are classified as a secondary undifferentiated aquifer. Groundwater within mudstone bedrock of the Manchester Marls Formation is classified as a Secondary B aquifer. Groundwater within sandstone bedrock of the Chester Formation is classified as a Principal A aquifer.

Table 1: Summary of Geological Distribution

Strata	Description	Estimated Thickness (m)	Permeability
Made Ground	Clay gravel of brick, cinders, ash	c. 0.75m to 2.20m	Low to Medium
Till, Devensian	Sedimentary deposits glaciogenic in origin. Stiff/very stiff brown silty sandy clay	c. 10.40m	Very Low to Low
Manchester Marls Formation (eastern area of the site)	Mudstone, generally fine grained but can include layers of courser material. Red marl (calcareous mudstone and siltstone) with thin beds of fossiliferous marine limestone and dolomite; locally green sandy in places especially in top part; local breccias and pebbly beds.	c. 45m to 60m	Low
Chester Formation (south western area of the site)	Sandstone ranging from coarse to fine grained.	Up to 220m	Medum to High

The anticipated depth of groundwater is unknown until further SI are undertaken on site. However as referenced in the RSK Phase 1 desktop study, ARUP produced a geotechnical report for the adjacent site which indicated that there was some perched groundwater within the Till deposits (between 3.24m blg and 3.64m bgl) as well as deeper groundwater (principle aquifer) approximately 12m bgl within the upper sandstone. It's anticipated that this development site will encounter groundwater at similar depths.

4 Proposed Development

4.1 Proposed Development Description

This report supports the Detailed Planning Application for St Gabriels. The development comprises of 319 units located across the development.

Refer to **Appendix D** for development plans.

4.2 Vulnerability Classification

According to Table 2 of the PPG guidance document: Flood Risk and Coastal Change, issued in 2014 (last updated August 2021) the Development will have a use classed as 'More Vulnerable'.

4.3 Sequential and Exception Tests

As stated in the NPPF, a sequential risk-based approach to determine the suitability of land for development in flood risk areas should be applied at all stages of the planning process giving precedence to low flood risk areas wherever possible.

Since the site is located entirely in Flood Zone 1 the development is considered appropriate and automatically meets the requirements of the sequential test.

4.4 Impact of Climate change on the Proposed Development

The typical lifespan for a residential development is 100 years. Climate change allowances have been considered based on this lifespan.

Based on the EA's climate change allowance guidance, the impact of climate change on surface water runoff at the Site and the surrounding areas could present a higher risk, however, the Drainage Strategy produced as part of this report has been designed to accommodate the risk of surface runoff during all events up to and including the 100 year plus a 45% climate change allowance.

5 Flood Risk

5.1 Relevant Maps and Data

Online UK Government Flood Maps have been used to identify flood risk from fluvial, tidal, surface water, and artificial sources.

The LLFA's Level 1 and 2 SFRA and LFRMS have also been reviewed and relevant maps are included in **Appendix E**.

Relevant correspondence with UU, the LLFA in relation to Flood Risk are included in **Appendix F**.

5.2 Tidal and Fluvial Flooding

Based on the online GOV.UK Flood Map for Planning, the Site is located in Flood Zone 1 where the land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%). As such the risk of Tida and Fluvial flooding is deemed **Negligible**.



Figure 5: Extract from GOV.UK's Long Term Flood Risk Map for Planning

5.3 Surface Water Flooding

The GOV.UK Long Term Flood Risk Maps provide a general indication of areas that may be at risk of surface water flooding. The maps take a broad account of underground drainage and typical storms which are likely to cause flooding.

The GOV.UK Long Term Flood Risk map identifies that the Site is generally at a very low risk of surface, however some areas are shown to be in low risk, refer to Figure 5

There is a low surface water flood flow path originating off site flowing from east to west, as well as some isolated low spots within the site that are due to local topology. Based on the available information and modelling, surface water flooding within the Site cannot be excluded and the probability of surface water flooding at the Site can be considered as **Low**.

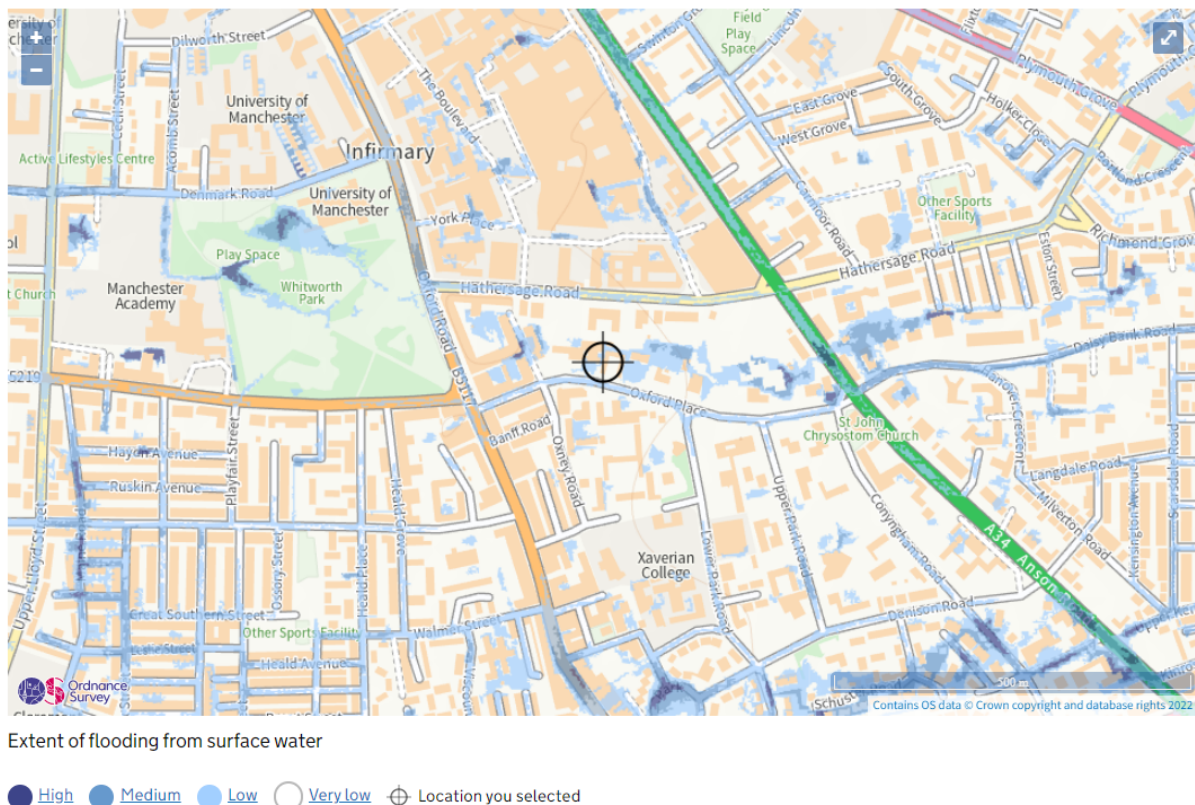
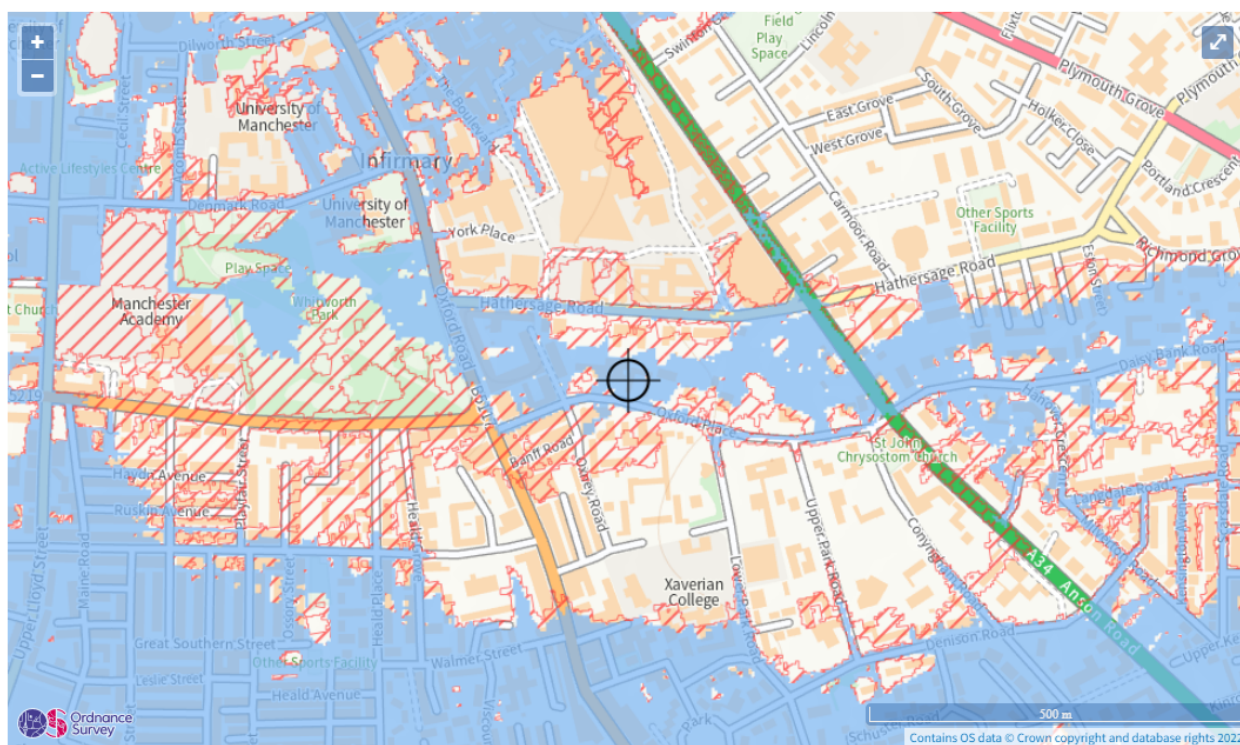


Figure 6: Extract from GOV.UK's Long Term Flood Risk Map for Surface Water Flooding

5.4 Artificial Sources of Flooding

According to the online GOV.UK's Long Term Flood Risk Map, the site is located in an area at risk of flooding from reservoirs. Refer to Figure 7.

Since spring 2009 all reservoirs, under the 1975 Reservoir Act, require the development of a Flood Plan and associated inundation mapping along with governing their maintenance and management. As such the risk of flooding from the local reservoirs is low and is being managed on a strategic level under the 1975 Reservoir Act.



Maximum extent of flooding from reservoirs:

● when river levels are normal ■ when there is also flooding from rivers ⊕ Location you selected

Figure 7: Extract from GOV.UK's Long Term Flood Risk Map for Reservoir Flooding

Based on the available information, the probability of flooding from artificial sources can be assessed as **Low**.

5.5 Groundwater Flooding

Groundwater flooding is caused by the emergence of water originating from sub-surface permeable strata. In a groundwater flooding event, water levels rise sufficiently to intersect the surface and inundate low lying land.

As discussed in Section 3.5, it is anticipated that shallow perched groundwater may be present within the Till deposits (between 3.24m blg and 3.64m bgl), with deeper groundwater within the principle aquifer related to the sandstone (circa 12m bgl). Given these depths are sufficiently below ground level the risk of emergence is unlikely. Furthermore, Figure GW_2.1 (Groundwater Flooding) of the Level 2 SFRA indicates that the site is not in an area of groundwater flooding or any historical groundwater flooding issues. Refer to **Appendix F** for mapping.

Based on the information available and the assessment undertaken, the probability of groundwater flooding impacting the Site can be assessed as **Negligible**.

5.6 Sewer Flooding

The Level 2 SFRA refers to potential sewer flooding in general terms, no specific issues are indicated from the DG5 register for the sites postcode within the Level 2 SFRA. Correspondence with United Utilities indicate that there have been no reports of sewer flooding. Refer to **Appendix E**.

Based on the information available the probability of sewer flooding impacting the Site can be assessed as **Low**.

6 Flood Risk Mitigation Measures

It is proposed that site levels fall away from building entrances where possible, no other mitigation apart from the proposed drainage strategy is required to reduce the impact of flooding for the site given the low to negligible nature of flooding sources across the site.

The proposed drainage strategy is designed to ensure no flooding on site for storm events up to and including the 1:100 year + 45% climate change event, and therefore the strategy will ensure that the site is at a very low risk of surface water flooding on site.

Additionally outfalls to the combined sewer, will have non-return valves to ensure no sewer surcharging impacts the site and causes flooding within the site itself.

7 Proposed Drainage Strategy

7.1 Existing Drainage/Impermeable Areas

Meinhardt have undertaken an assessment of both existing and proposed impermeable areas. These drawings can be found within **Appendix G**. Total Site Area is calculated as being 7672m².

In summary the Existing and Proposed Impermeable/Permeable Areas are shown in Table 2 below.

Table 2: Area Summary

Catchment	Existing	Proposed	Difference
Impermeable	5686m ²	4916m ²	-770m ²
Permeable	1986m ²	2756m ²	+770m ²

7.2 Proposed Drainage Strategy

The development falls within a Critical Drainage Area, and as per Manchester City Council Local Flood Risk Management Strategy and Core Strategy Policy EN14, extract below. The development should aim to reduce flows to greenfield rates however as the site is Brownfield a 50% betterment would be acceptable.

- 5.46 Within Critical Drainage Areas, and consistent with Core Strategy policy EN14 Flood Risk, developers should aim to minimise surface water runoff from developments, and achieve at least the following runoff rates:
- Greenfield runoff on Greenfield sites up to a 1 in 100 year storm event, including consideration of climate change
 - A 50% runoff rate reduction for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, including consideration of climate change

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It is therefore proposed that the site will discharge at a 50% reduction of the existing discharge rate on site.

The existing impermeable area is 0.5686ha. However following discussions with UU, it was agreed that some existing impermeable areas on site had no positive drainage outfall, and therefore it was agreed that a total existing positive drainage areas is 0.36ha. Therefore the existing discharge rate can be calculated based on this by using the Modified Rational Method.

$Q = 2.78 \times i \times A$ where Q = discharge in l/s, i is rainfall intensity in mm/hr and A is drained area in Ha. Micro Drainage was used to determine the rainfall intensity for the 1 in 30 year 30 minute storm as 50mm/hr. surface water discharge rates. Results are summarised in **Table 3** below.

Table 3: Exiting Surface Water Discharge Rates

Return Period (years)	Existing Surface Water Discharge Rates (l/s)
1 in 30 (30min Storm)	50.00

Therefore, the maximum discharge rate for the 1:100 year + 45% climate change would be **25.0 l/s**. This has been accepted by United Utilities and the LLFA, refer to **Appendix E** for consultation confirming this rate was acceptable.

7.3 Surface Water Drainage

7.3.1 Drainage Design Parameters

The industry standards along with the Design and Construction Guidance (DSG) dictate for below ground surface water drainage that:

- There will be no surcharging of the drainage system for a 1 in 2-year storm;
- The drainage can be surcharged with no flooding for a 1 in 30-year storm; and
- The drainage can flood on-site for a 1 in a 100-year storm with a 45% climate change allowance provided the flood water remains on site and does not flood habitable areas or affect safe ingress and egress to the site for occupiers.

All surface water drainage options outlined in this report adhere to these principles. Hydraulic calculations have been carried out using the hydraulic modelling software Micro Drainage unless otherwise specified.

FEH 2013 rainfall data has been used for the below ground drainage calculations

7.4 Consultation

7.4.1 LLFA – Manchester City Council

Meinhardt have been in contact with the Manchester City Council via emails, who are the LLFA.

During the email dialogues, it was agreed that a 50% reduction in discharge rates would be acceptable in line with local policy and the LFRMS, subject to UU confirming rates would be acceptable.

Refer to **Appendix E** for Consultation

7.4.2 United Utilities

A pre-development enquiry was submitted to UU on the May 2022. UU confirmed that foul and surface water discharge rates were acceptable for discharge into the 1000mm diameter combined sewer to the north of the site.

Refer to **Appendix E** for Consultation.

7.5 Sustainable Surface Water Drainage Strategy

The scheme in line with local policy will aim to utilise SuDS where possible, the strategy as detailed in the drawings is to utilise blue/green roofs and a traditional below ground attenuation to meet the required discharge rates. Also as noted the scheme introduces more landscape areas compared to the existing scenario and therefore naturally aids in reducing runoff from the site.

There are no proposed watercourses near the site, and infiltration would not be a viable option given the low permeability of the underlying strata and as perched groundwater is present this solution would not be appropriate.

Therefore, it is proposed that the site discharge surface water to the existing UU combined sewer to the north of the site, where the sites currently drains surface water.

7.5.1 Proposed Surface Water Dischagre Rates

As per the LLFA Flood Risk Policy EN14, the proposed surface water drainage strategy has been designed to discharge surface water runoff at a 50% reduction when compared to the existing discharge rate on site.

The existing and proposed runoff rates are shown in the Table 4 below.

Table 4: Greenfield and Proposed Discharge Rates

	Total Rate
Existing Brownfield Rate	50.00 l/s
Proposed Surface Water Discharge rate (1:100 Year + 45% CC)	25.00 l/s

7.5.2 Surface Water Modelling

When undertaking the modelling for the surface water drainage strategy for the site, the following assumptions were made:

- Micro-Drainage software has been used for all hydraulic design;
- FEH 2013 rainfall data has been used for the proposed surface water drainage calculations;
- The proposed drainage networks have been designed for the 1 in 100 year plus 45% climate change event;
- Soft landscaping areas are not actively drained;
- CV values of 0.950 have been used;

The results of this modelling are provided within **Appendix H**, summary provided in Table 9 below.

Table 5: Proposed Surface Water Discharge Rates

Return Period (years)	Proposed Surface Water Discharge Rates (l/s)
1:2	17.00
1:30	21.90
1:100	23.90
1 in 100 + 45%	25.00

Based on this and the use of FEH rainfall and the drainage modelling undertaken the total attenuation required on site would be **205.2m³**. Refer to **Appendix H** for complete attenuation calculations. The site is restricted by two hydrobreaks, equating to 6.0 l/s (Pipe Reference 1.003) and 18.4 l/s (Pipe Reference 4.006), equating to 24.4 l/s which is slightly less then the proposed 25.00 l/s.

This attenuation volume will be achieved via a combination of green roofs and below ground attenuation tank. Please refer to **Appendix I**, for proposed surface water strategy GA's.

7.6 Foul Water Drainage Strategy

7.6.1 Design Parameters

The below-ground foul drainage system will be designed to DCG, BS EN 752 Parts 3 and 4, and the Building Regulations Document H where appropriate.

7.6.2 Foul Water Drainage Strategy

The proposed foul water drainage strategy for the site would be to drain all foul water to the combined sewer to the north of the site. A pre-development capacity check has been issued to UU and they have confirmed that capacity for foul water exists. Refer to **Appendix E**.

8 Drainage Maintenance and Management Strategy

The Drainage Maintenance and Management Strategy (**Table 6**) has been produced based on the information provided within the SUDS Manual; it is expected that the maintenance for the entire Proposed Development will be under the management of the estate managers, who will appoint a suitably qualified maintenance specialist to undertake the work.

Table 6: Proposed Drainage Maintenance Strategy

Drainage Feature	Regular Maintenance	Occasional Maintenance	Monitoring
Drainage Channels	Inspections will be frequent and regular, depending on local conditions, but at least annually by Site management. Inspections will include gratings; covers including their locking bolts; sumps and sump buckets; exposed concrete surround and adjacent paving. Channels will be flushed with water or high-pressure jetting (no boiling water or cleaning agent will be used). All silt buckets and sumps will be cleaned out replaced back into the units ensuring they are correctly fitted.	All channel surfaces and joints will be checked and repaired as necessary.	Inspected every 6 months or after large storm.
Geo-Cellular Attenuation Tanks	Inspection chambers will be checked every 6 months for the accumulation of debris and silt and cleaned as necessary. Remove debris from the catchment surface where it may cause risk to performance (monthly).		Inspect every 6 months or after large storm.
Green Roofs	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes, integrity of waterproofing and structural stability. Inspect drain inlets to ensure unrestricted runoff from the drainage layer. Remove debris and litter to prevent clogging of inlet drains and inference with plant growth.	Replace dead plants as required Remove invasive and nuisance vegetation including weeds.	Inspected every 6 months or after large storm.
Manholes / Inspection Chambers	Inspection chambers will be checked every 6 months for the accumulation of debris and silt and cleaned as necessary.		Inspect every 6 months or after large storm.

9 Conclusion

This FRA and DS has been prepared on behalf of McLaren to support the detailed planning application for the site referred to as St Gabriels.

The site is located in Flood Zone 1 where the probability of river or sea flooding is less than 0.1% chance in any given year. Therefore, the probability of tidal or fluvial flooding is assessed as negligible.

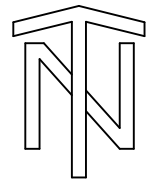
Other potential sources of flooding have been investigated and are deemed negligible to low.

The proposed surface water drainage strategy optimises the use of SuDS in line with best practice, national and local policy and has been developed in discussion with the relevant stakeholders. It is proposed that the surface water from the site be reduced by 50% compared to existing discharge rate to the local UU combined sewer (25.0 l/s). The total attenuation required would be 205.2m³ to cater for all storm events up to and including the 1:100 year + 45% climate change event.

The drainage strategy aims to utilise green roofs and below ground attenuation tanks to limit surface water rates to 25.0 l/s for the 1:100 year + 45% climate change event. This rate has been agreed with by UU and the LLFA/

Following submission of Pre-development enquiry, UU have confirmed that there is also sufficient capacity in the local combined sewer to accept the proposed foul water flows from the site.

Appendix A – Topographical Survey



NOTES

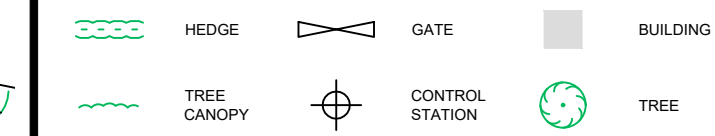
KEY

Grid & Datum - Local Plane Grid related to OS National Grid & Datum
By GNSS RTK Observations

STANDARD ABBREVIATIONS

[illegible]

SYMBOLS



Rev.	Date	Drawn	Description	CHKD	APPD



Jupiter House, 21 Roebuck Lane, Sale, Manchester, M33 7SY
T: 0161 973 3495 F: 0161 962 6819
E: mail@ndoliver.com www.ndoliver.com

Client

Client

ARCADIS
SUITE 1A
PICCADILLY PLACE
MANCHESTER
M1 3BN

Title

Title

ST GABRIELS
1 OXFORD PLACE
RUSHOLME, MANCHESTER, M14 5RP

TOPOGRAPHICAL SURVEY
SHEET 1 OF 2

Surveyed	JH	Drawn	BW	Drawn Date:
Checked	AM	Approved	NDO	22/09/2021
Scale	Project 11424			Status
1:200 @ A1	CAD File \\NDO-585\Projects\11424\CDRAW\NDO511424_001.DWG			ORI
Drawing No	11424 / 001 / 1			Rev 0

Appendix B – United Utilities Asset Records

Gurdeep Bansal

**10
Aldersgate Street,
London,
EC1A 4HJ**

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: 2998 - St Gabriels
Our Ref: UUPS-ORD-330612
Date: 30/09/2021**

Dear Sirs

Location: 2998 - St Gabriels 1 Oxford Place, Manchester, M14 5RP

I acknowledge with thanks your request dated 29/09/2021 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



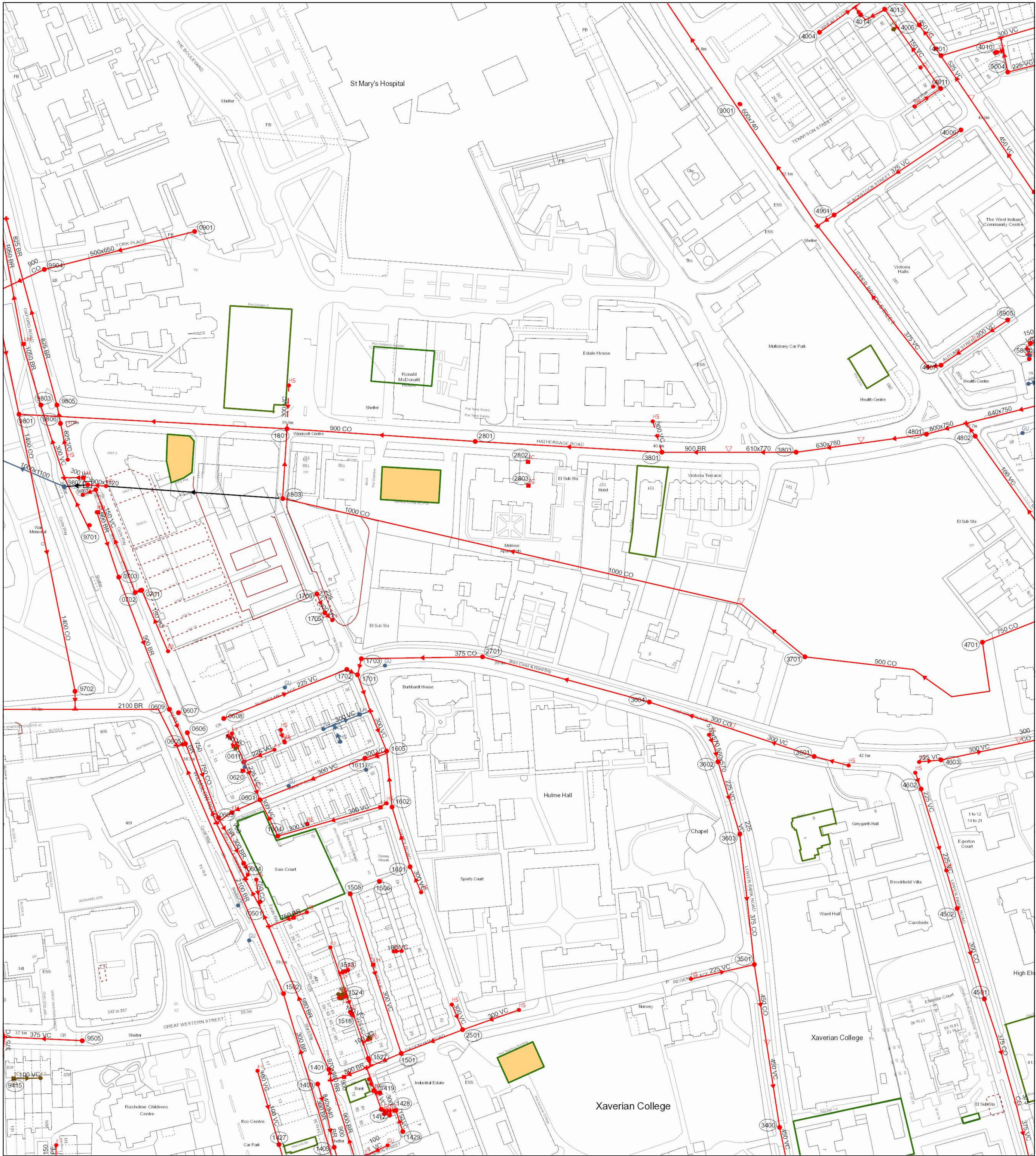
Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.



Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
3901	40.36	CO	37.9	450			CO	45.54119	1 in 130
4801	42.17	CO	36.85	600			BR	36.34556	1 in 260
3901	41.21	CO	39.33	300			VC	47.43417	1 in 79
1429		CO		150			VC	12.27009	
4501	41.55	CO	38.69	375			CO	62.65814	
5804		CO		150			VC	1.641514	
3604	40.43	CO	38.12	375			CO	95.33625	1 in 173
2801	39.82	CO	35.25	900			CO	104.2353	1 in 139
4701	40.54	CO	38.42	900			CO	134.7218	
1412		CO	0	300			VC	25.24308	
1419		CO	0	300			VC	25.95159	
1419	38.99	CO	29.09	750			BR	2.519278	
3701		CO	0	900			VC	45.45327	
1803		CO	0	1000			CO	38.58722	
1601	39.85	CO	37.45	300			VC	34.48188	1 in 64
1602	39.75	CO	36.91	300			VC	31.14482	1 in 519
0611		CO	0	225			VC	14.22878	
3803	40.82	CO	38.57	375			CO	72.44308	1 in 108
4802	42.41	CO	37.01	600			BR	6.602325	
0606	38.63	CO	0	750			CO	49.98	
1405	38.61	CO	0	900			BR	46.08326	
0701		CO	0	150			VC	3.885027	
5905		CO	0	300			VC	21.78548	1 in 43
0702	42.64	CO	39.72	300			VC	60.80894	
4014		CO	0	150			VC	5.3323	
3400	39.84	CO	37.19	450			VC	54.12847	1 in 193
0703	38.22	CO	28.76	900			BR	78.18568	1 in 889
1705		CO	0	300			VC	5.734523	
4011	40.91	CO	35.83	900			VC	53.54744	1 in 178
9801	37.37	CO	27.27	1400			CO	156.1089	1 in 115
4602	41.78	CO	39.86	225			VC	68.96762	
1501	39.48	CO	35.88	300			VC	20.61553	
9702		CO	0	1400			CO	10	
9806	37.86	CO	0	625			BR	10.18604	
9802	37.86	SW	36.17	1000			BR	51.07837	1 in 139
0603	38.53	CO	35.56	750			BR	13.86244	
0901		CO	0	500			VC	85.61542	
4001	42.8	CO	37.92	525			VC	10.81665	
4006	42.78	CO	39.81	375			VC	84.31489	1 in 91
0809	38.63	CO	28.67	900			BR	21.0239	1 in 10
4803	41.87	CO	39.57	300			VC	43.83177	1 in 83
9803	37.88	CO	0	1050			BR	122.9148	1 in 133
0608	38.76	CO	37.55	225			VC	73.15442	
1605	39.7	CO	36.55	300			VC	12.64911	1 in 90
0905	38.71	CO	28.54	750			BR	5.09902	
9904	37.99	CO	0	900			CO	30.8707	
1604	38.15	CO	0	300			VC	22.36568	
1703	39.53	CO	37.05	375			CO	6.216544	1 in 132
1706		CO	0	225			VC	11.399	
4005	42.74	CO	38.31	450			VC	87.69489	1 in 132
1505	39.72	CO	37.58	300			VC	92.35051	1 in 59
3602	40.71	CO	38.84	225			VC	41.76123	1 in 155
4807	42.27	CO	38.69	375			VC	7.090267	
1701	39.35	CO	36.61	300			VC	21.18692	
0604	38.94	CO	35.35	300			BR	5.830962	
1801	38.93	CO	34.5	900			CO	148.2161	1 in 32
4502	41.84	CO	39.3	300			CO	52.20153	1 in 86
0601	39.09	CO	34.93	300			VC	27.46425	
5905		CO	0	375			VC	43.04649	
0802		CO	0	150			VC	7.67872	
1702	39.28	CO	35.99	225			VC	6.708204	
1605	39.7	CO	36.85	300			VC	13.69339	1 in 31
3001	41.69	CO	36.86	600			BR	91.52596	1 in 254
4013		CO	0	150			VC	16.96999	
3803	41.57	CO	36.54	610			BR	37	1 in 185
4004	42.54	CO	40.49	225			VC	39.40612	1 in 41
2701	39.68	CO	37.57	375			CO	67.00746	1 in 137
9805	37.86	CO	34.39	825			BR	108.138	
5004	43.78	CO	42.23	225			VC	19.41649	
1502	39.1	CO	26.69	2100			BR	298.520	1 in 15.7427666
1403	38.9	CO	34.74	840			BR	17.72005	
2501	39.84	CO	36.61	300			VC	36.40005	1 in 51
9701	38.03	CO	34.18	300			VC	32.25048	
1401	38.98	CO	0	980			BR	85.61542	
4901	41.86	CO	38.86	375			VC	10.81665	
1518		CO	0	100			VC	1.522833	
1611	39.57	CO	36.35	225			VC	62.38951	1 in 44
1527		CO	0	225			VC	4.421142	

Refo	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
3901	40.36	CO	37.9	450			CO	45.54119	1 in 130
4801	42.17	CO	36.85	600			BR	36.34556	1 in 260
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4802	42.41	CO	37.01	600			BR	6.602325	
0606	38.63	CO	0	750			CO	49.98	
1405	38.61	CO	0	900			BR	46.08326	
0701		CO	0	150			VC	3.885027	
5905		CO	0	300			VC	21.78548	1 in 43
0702	42.64	CO	39.72	300			VC	60.80894	
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3400	39.84	CO	37.19	450			VC	54.12847	1 in 193
0703	38.22	CO	28.76	900			BR	78.18568	1 in 889
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4011	40.91	CO	35.83	900			VC	53.54744	1 in 178
9801	37.37	CO	27.27	1400			CO	156.1089	1 in 115
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9702		CO	0	1400			CO	10	
9806	37.86	CO	0	625			BR	10.18604	
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0901		CO	0	500			VC	85.61542	
4001	42.8	CO	37.92	525			VC	10.81665	
4006	42.78	CO	39.81	375			VC	84.31489	1 in 91
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1605	39.7	CO	36.55	300			VC	12.64911	1 in 90
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1703	39.53	CO	37.05	375			CO	6.216544	1 in 132
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4005	42.74	CO	38.31	450			VC	87.69489	1 in 132
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1701	39.35	CO	36.61	300			VC	21.18692	
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1801	38.93	CO	34.5	900			CO	148.2161	1 in 32
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0601	39.09	CO	34.93	300			VC	27.46425	
5905		CO	0	375			VC	43.04649	
0802		CO	0	150			VC	7.67872	
1702	39.28	CO	35.99	225			VC	6.708204	
1605	39.7	CO	36.85	300			VC	13.69339	1 in 31
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3803	41.57	CO	36.54	610			BR	37	1 in 185
4004	42.54	CO	40.49	225			VC	39.40612	1 in 41
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1502	39.1	CO	26.69	2100			BR	298.520	1 in 15.7427666
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1518		CO	0	100			VC	1.522833	
1611	39.57	CO	36.35	225			VC	62.38951	1 in 44
1527		CO	0	225			VC	4.42	

Appendix C – CCTV Drainage Survey

Appendix D – Proposed Development Plans



This drawing is copyright.
Do not scale off dimensions.

All dimensions to be checked on site by contractor.

Contractor to report any dimensional discrepancies, errors or omissions prior to commencing on site.

KEY:

Lawn	Green Roof	Cluster Bedrooms	Ancillary Space
Block paving 01	Mixed Ornamental Planting	Accessible Studio Bedrooms	Store
Block Paving 02	Existing Tree	Plant	Riser
Tarmac with Chippings	Proposed Tree	Cluster Kitchen	Smoke Shaft
Green Roof	Studio Bedrooms	Amenity Space	

NORTH

Rev	Date	Description
P01	2022-07-08	Planning Issue

Project Title
St Gabriel's Manchester

Status
PLANNING

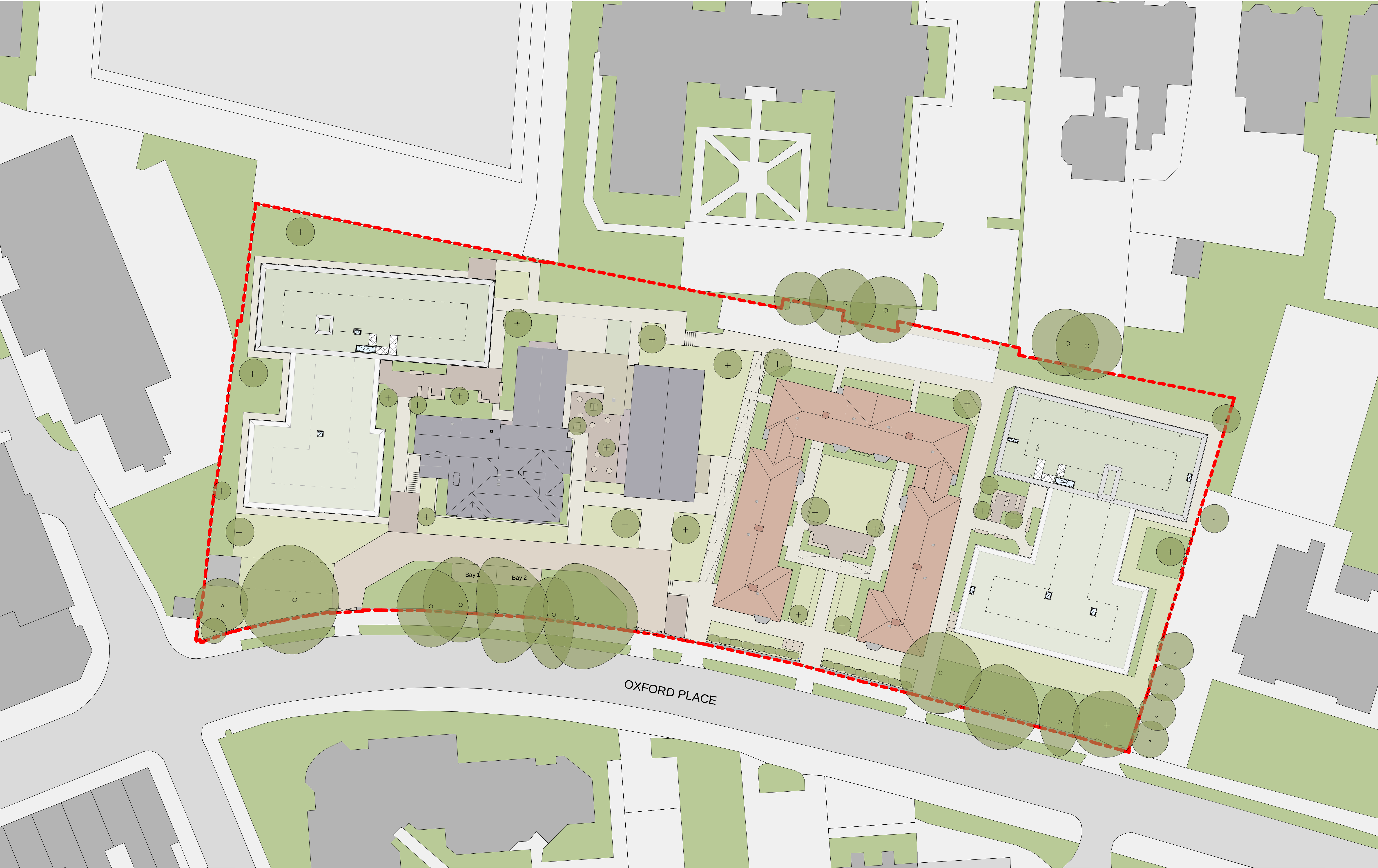
Drawing Title
**Proposed Site Plan
Ground Floor Plan
(St Gabriel's Lower Ground Floor)**

Project No 10349	Scale 1:250 @ A1
Revision 10349-SHP-Z0-A-B5D8-G100-PL-00-001 P01	

simpsonhaugh

Manchester
+44 (0)161 835 2345

London
+44 (0)20 7549 4000



This drawing is copyright.
Do not scale off dimensions.

All dimensions to be checked on site by contractor.

Contractor to report any dimensional discrepancies, errors or omissions prior to commencing on site.

KEY:

Lawn	Green Roof	Cluster Bedrooms	Ancillary Space
Block paving 01	Mixed Ornamental Planting	Accessible Studio Bedrooms	Store
Block Paving 02	Existing Tree	Plant	Riser
Tarmac with Chippings	Proposed Tree	Cluster Kitchen	Smoke Shaft
Green Roof	Studio Bedrooms	Amenity Space	

NORTH

Rev	Date	Planning Issue	Description
P01	2022-07-08		

Project Title
St Gabriel's Manchester

Status
PLANNING

Drawing Title
**Proposed Site Plan
Roof Plan**

Project No 10349	Scale 1:250 @ A1
Revision 10349-SHP-Z0-A-B5D8-G100-PL-RF-001 P01	

simpsonhaugh

Manchester
+44 (0)161 835 2345

London
+44 (0)20 7549 4000

Appendix E – LLFA and UU Consultation

Gurdeep Bansal

From: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Sent: 11 May 2022 15:58
To: Gurdeep Bansal
Subject: RE: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

Hi Gurdeep,

As United Utilities have confirmed that the maximum discharge rate should not exceed 25l/s we would have no objection to this, on the basis that having followed the drainage hierarchy the sites proposed drainage network outfalls to the 1000mm diameter combined sewer located to the North.

Regards,

Oliver

Oliver Timmins
Engineer (Flood Risk Management)

Lead Local Flood Authority
Highways
Growth & Development and Neighbourhoods Directorate
Manchester City Council
PO Box 532 Town Hall
Manchester
M60 2LA

Web: <http://www.manchester.gov.uk>

From: Gurdeep Bansal <Gurdeep.Bansal@meinhardt.co.uk>
Sent: 10 May 2022 15:54
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Subject: RE: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

Hi Oliver,

Further to my email, please find attached email from UU confirming acceptance of a max of 25l/s to their network.

Regards

Gurdeep Bansal
Associate Director Civils Team



Meinhardt (UK) Ltd, 10 Aldersgate Street, London, EC1A 4HJ
TEL: 02078317969
Mob: 07584023124

Infrastructure & Environment | Structures | MEP | Project Management | Planning & Urban Development | Façade Engineering | Environmentally Sustainable Design | Specialist and Architectural Lighting | Fire Performance Engineering | Integrated Design Management | Mission Critical Facility Design

E: gurdeep.bansal@meinhardt.co.uk | **W:** www.meinhardt.co.uk



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From: Gurdeep Bansal
Sent: 03 May 2022 11:56
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Subject: RE: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

Hi Oliver,

Thanks for the email, apologies for the delay just returned from leave.

I'm awaiting a formal response from UU, however as per the attached email UU seem to be happy with 25l/s as a maximum discharge rate based on a revised positive drainage area calculation. I'm just awaiting for UU to send a formal update to their pre-development capacity enquiry to ensure this is stated clearly.

I trust that as UU has agreed with 25 l/s and the methodology used, the LLFA are happy with this rate?

Kind Regards

Gurdeep Bansal
Associate Director Civils Team



Meinhardt (UK) Ltd, 10 Aldersgate Street, London, EC1A 4HJ

TEL: 02078317969
Mob: 07584023124

Infrastructure & Environment | Structures | MEP | Project Management | Planning & Urban Development | Façade Engineering | Environmentally Sustainable Design | Specialist and Architectural Lighting | Fire Performance Engineering | Integrated Design Management | Mission Critical Facility Design

E: gurdeep.bansal@meinhardt.co.uk | W: www.meinhardt.co.uk



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From: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Sent: 28 April 2022 11:31
To: Gurdeep Bansal <Gurdeep.Bansal@meinhardt.co.uk>
Subject: RE: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

Good Morning Gurdeep,

As the outfall is combined, I would encourage you to estimate the foul discharge rate (if possible) and incorporate this into the model along with the surface water flow rates based on the existing drainage network. Note, that when seeking confirmation of flow rates into the public sewer UU may request that a surcharged outfall is incorporated into the existing network model, if this is requested they will be able to advise on what the level of surcharge should be.

While the modified rational method is useful, the most effective way of identifying the existing brownfield rate is to model the existing drainage network where there is a positive connection (if this information is available).

If the modified rational method was to be accepted we would expect to see an assessment/evidence of the average rainfall intensities for the site (this could be calculations from Windes software), rather than the standard assumption of 50mm/hr, unless further evidence is presented.

Again, I emphasise that if a connection to the United Utilities network is proposed then we would need to have evidence of up to date correspondence, which confirms that in principle the proposed point of connection and discharge rates are acceptable to UU.

Kind Regards,

Oliver

Oliver Timmins
Engineer (Flood Risk Management)

Lead Local Flood Authority
Highways
Growth & Development and Neighbourhoods Directorate
Manchester City Council
PO Box 532 Town Hall
Manchester
M60 2LA

Web: <http://www.manchester.gov.uk>

From: Gurdeep Bansal <Gurdeep.Bansal@meinhardt.co.uk>
Sent: 27 April 2022 08:49
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Subject: Re: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

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Hi Oliver,

Can you confirm this is an acceptable approach?

Kind Regards

Gurdeep

Sent from my iPhone

On 19 Apr 2022, at 14:47, Gurdeep Bansal <Gurdeep.Bansal@meinhardt.co.uk> wrote:

Hi Oliver,

Thanks for the prompt response, very much appreciated.

I've attached the existing drainage survey we have, from review the site currently discharges both surface and foul water to the combined sewer to the north, via 4 150mm outfalls. Given that some outfalls are combined, its not fully possible to model the network accurately to differentiate what the surface water network would discharge.

However, what I've agreed with other brownfield development sites, is to calculate the existing via the use of the Wallingford Procedure based on the existing impermeable areas and a rainfall intensity of only 50mm/hr which represents the average 1:30 year rainfall intensity (30mins), which tends to be

what most historic drainage systems were designed to its what is stated a design rainfall in Part H building regulations (i.e. 0.014 litres/sec/m²) for many years.

The Wallingford Procedure states;

$Q(\text{discharge}) = 2.78 \times A(\text{Area in ha}) \times I(\text{Average Rainfall Intensity})$.

Based on an existing impermeable area of 5674m² (0.5674ha), please find attached existing impermeable/permeable area drawing SK001, and a rainfall intensity of 50mm/hr, the following is calculated;

$Q = 2.78 \times 0.5674 \times 50$

$Q = 78.9 \text{ l/s}$

Therefore, we have calculated the existing maximum discharge rate of the site as being 78.9 l/s, and in line with guidance set out in paragraph 5.46 of the MCC Local Flood Risk Management Strategy for brownfield sites, we intend to reduce the sites maximum discharge rate to 50% of this rate. i.e. the maximum discharge rate for the 1:100 year + 40% climate change would be 39.45 l/s.

Below shows the proposed discharge rates for storm events based on a linear discharge rate curve on the hydrobreak.

- 1:2 Year = 18.4 l/s
- 1:30 Year = 27.5 l/s
- 1:100 Year = 32.9 l/s
- 1:100 year + 40% CC = 39.45 l/s

Noted regarding United Utilities, we are awaiting their response to our pre-development. However please confirm this above approach is acceptable to the LLFA.

Kind Regards

Gurdeep Bansal
Associate Director Civils Team

Meinhardt (UK) Ltd, 10 Aldersgate Street, London, EC1A 4HJ
TEL: 02078317969
Mob: 07584023124

Advance Notice on leave from 21st April till the 3rd May 2022.

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E: gurdeep.bansal@meinhardt.co.uk | **W:** www.meinhardt.co.uk

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From: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Sent: 19 April 2022 13:20
To: Gurdeep Bansal <Gurdeep.Bansal@meinhardt.co.uk>
Subject: RE: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

Good Afternoon Gurdeep,

Thanks for your email.

In order to agree discharge rates we would need to see evidence of the existing and proposed discharge rate calculations from the site, to ensure that this is in line with MCC local policy. As the site has been identified as positively draining, we would expect the existing network to be modelled appropriately to give a more accurate existing discharge rate.

I would recommend that you follow the guidance set out in paragraph 5.46 of the MCC Local Flood Risk Management Strategy regarding how proposed discharge rates should be calculated.

In addition, if a connection to the United Utilities network is proposed then we would need to have evidence of up to date correspondence, which confirms that in principle the proposed point of connection and discharge rates are acceptable to UU.

Kind Regards,

Oliver

Oliver Timmins
Engineer (Flood Risk Management)

Lead Local Flood Authority
Highways
Growth & Development and Neighbourhoods Directorate
Manchester City Council
PO Box 532 Town Hall

Manchester
M60 2LA

Web: <http://www.manchester.gov.uk>

From: Gurdeep Bansal <Gurdeep.Bansal@meinhardt.co.uk>
Sent: 18 April 2022 16:02
To: Flood Risk Management <floodriskmanagement@manchester.gov.uk>
Subject: RE: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

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Dear Sirs/Madam,

I would be grateful if you could confirm the discharge rate proposed is an acceptable approach.

Kind Regards

Gurdeep Bansal
Associate Director Civils Team

Meinhardt (UK) Ltd, 10 Aldersgate Street, London, EC1A 4HJ
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Mob: 07584023124

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From: Gurdeep Bansal
Sent: 07 April 2022 11:55
To: floodriskmanagement@manchester.gov.uk
Subject: RE: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

Dear Sirs/Madam,

Apologies I've realised that the site is located in the Conurbation Core Critical Drainage Area, and therefore we will include an FRA for the planning application.

However, we would appreciate comment back on the 50% reduce discharge rate.

Kind Regards

Gurdeep Bansal
Associate Director Civils Team

Meinhardt (UK) Ltd, 10 Aldersgate Street, London, EC1A 4HJ
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From: Gurdeep Bansal
Sent: 06 April 2022 21:23
To: floodriskmanagement@manchester.gov.uk
Subject: St Gabriels - Redevelopment (1 Oxford Pl, Rusholme, Manchester M14 5RP)

Dear Sirs/Madam

We are currently working on a proposed redevelopment at 1 Oxford Pl, Rusholme, Manchester M14 5RP. The scheme is residential led and aims to build new residential developments but also refurbish listed buildings on site.

The site is located in Flood Zone 1, and is less then 1ha and doesn't appear to be in a Critical Drainage Area (CDA), can you confirm an FRA isn't required to validate the application.

Additionally in line with Manchester City policy and Local Flood Risk Management Strategy, as the scheme is currently a brownfield site, we plan to reduce flows by 50% compared to existing surface water discharge rates and cater for all storm events up to the 1:100 year + 40% climate change allowance, and include for SuDS measures where possible within the scheme. Can you please confirm this is an acceptable approach.

Infiltration isn't a viable option as the site is situated above mudstone, and given the nature of the development and building proximity there are no locations which allows for soakaways to be located 5m away from building foundations. There are also no surface water sewers or watercourses near the site as such the development will discharge surface water to the local combined sewer located to the north of the site, where it currently drains unrestricted following receipt of drainage surveys

Kind Regards

Gurdeep Bansal
Associate Director Civils Team

Meinhardt (UK) Ltd, 10 Aldersgate Street, London, EC1A 4HJ
TEL: 02078317969
Mob: 07584023124

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Gurdeep Bansal

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 10 May 2022 14:22
To: Gurdeep Bansal
Cc: Wastewater Developer Services
Subject: V2 PDE for: 1 Oxford PI Rushholme Manchester M14 5RP UU Ref : 4200048757

Good morning Gurdeep,

Pre Development Enquiry for: 1 Oxford PI Rushholme Manchester M14 5RP UU Reference Number : 4200048757

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 3723223 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 1000mm diameter public combined sewer located to the North of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

Please ensure all proposed manhole chambers cover levels and finished floor levels are higher than the receiving public sewer.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

1. into the ground (infiltration);
2. to a surface waterbody;
3. to a surface water sewer or highway drain;
4. to a combined sewer.

For guidance, The [North West SuDS Pro-Forma](#) provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

United Utilities acknowledge that the nearest watercourse is a significant distance off-site.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 1000mm diameter public combined sewer located North of the proposed site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 25l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the pubic sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

We have reviewed our records and can confirm that there does not appear to be any charted public sewers located within the boundary of proposed development. However, due to the accuracy of the records and the public sewer transfer legislation in 2011, not all public sewers are shown on our records so we would ask that you proceed with caution and carry out your own site investigation works. If any uncharted sewers are identified while carrying out your works we would ask that you contact United Utilities at the earliest opportunity so that we can offer guidance and update our records.

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: **DeveloperServicesWater@uuplc.co.uk**. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,



Mohammed Aljafarawi
Developer Engineer
Developer Services & Metering
Customer Services
Email: Mohammed.Aljafarawi@uuplc.co.uk
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From: Gurdeep Bansal [<mailto:Gurdeep.Bansal@meinhardt.co.uk>]
Sent: 08 April 2022 08:39
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: 2998 - St Gabriels - Waste and Surface Water Capacity Check

EXTERNAL EMAIL This email originated outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Dear Sirs/Madam

Please can the attached pre-development enquiry be processed please.

Kind Regards

Gurdeep Bansal
Associate Director Civils Team



Meinhardt (UK) Ltd, 10 Aldersgate Street, London, EC1A 4HJ
TEL: 02078317969
Mob: 07584023124

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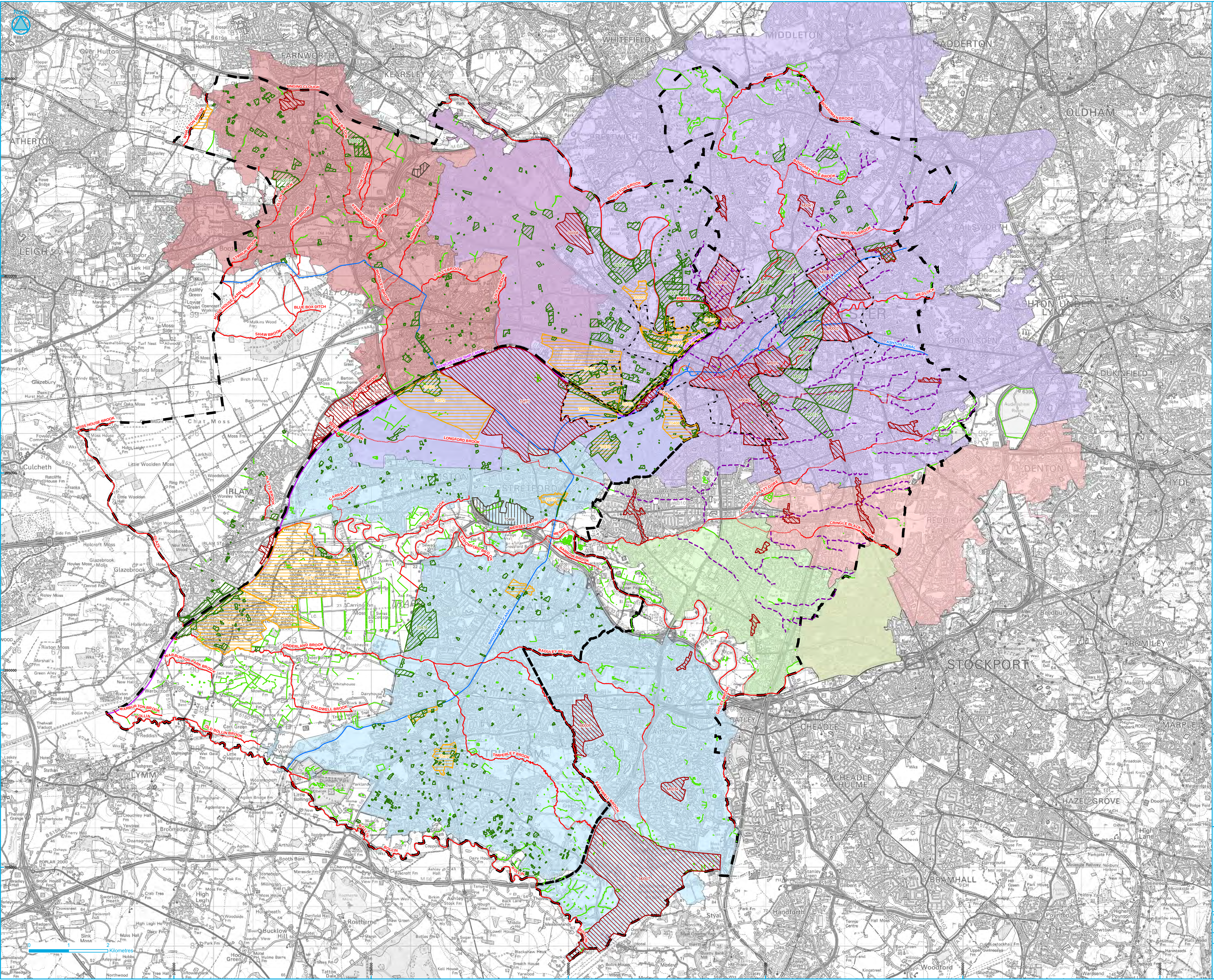
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Appendix F – Mapping



- Council Boundary
- - - Lost Watercourses
- Critical Drainage Areas**
- Conurbation Core
- Didsbury
- Levenshulme and Fallowfield
- Manchester and Trafford South
- Salford North West
- Main Rivers (V8.0)**
- Culverted
- Open
- Digitised River Lines**
- Culverted
- Open
- Potential Development Sites / Locations**
- Employment
- Housing
- Mixed Use
- Other
- - - Regional Centre Boundary
- Ashton, Bridgewater and Rochdale Canals
- Manchester Ship Canal / Grey Inwell
- Other Waterbodies

This map has been produced in accordance with PPS25: Development and Flood Risk.

Certain locations are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. There are generally known local flooding problems associated with these areas. These areas have been defined as Critical Drainage Areas in the SFRA. Specific drainage requirements are required in these areas to help reduce local flood risk.

Chapter 5 of the Level 2 SFRA covers the flooding from surface water and sewers and how Critical Drainage Areas have been defined.

The Main River information shown in the SFRA is provided by the Environment Agency; the centreline data may deviate from that shown on basemapping due to inherent differences in data resolution. Further information on Main Rivers is provided on the Environment Agency's website. The mapping of culverted sections of watercourse is a strategic screening only based upon Ordnance Survey 1:10,000 mapping and should be confirmed for more detailed studies such as site specific Flood Risk Assessment. The canals layer does not necessarily cover all the canal arms, but the modelled overtopping/breaching and hydraulic interactions with rivers and other waterbodies is complete and accurate as appropriate for a Strategic Flood Risk Assessment.

The River Irwell between Victoria Station and Pomona Island is not shown as a Main River on the Environment Agency's Flood Map although Flood Zones related to the river are. The same approach has been taken in this SFRA.



www.jeremybenn.co.uk
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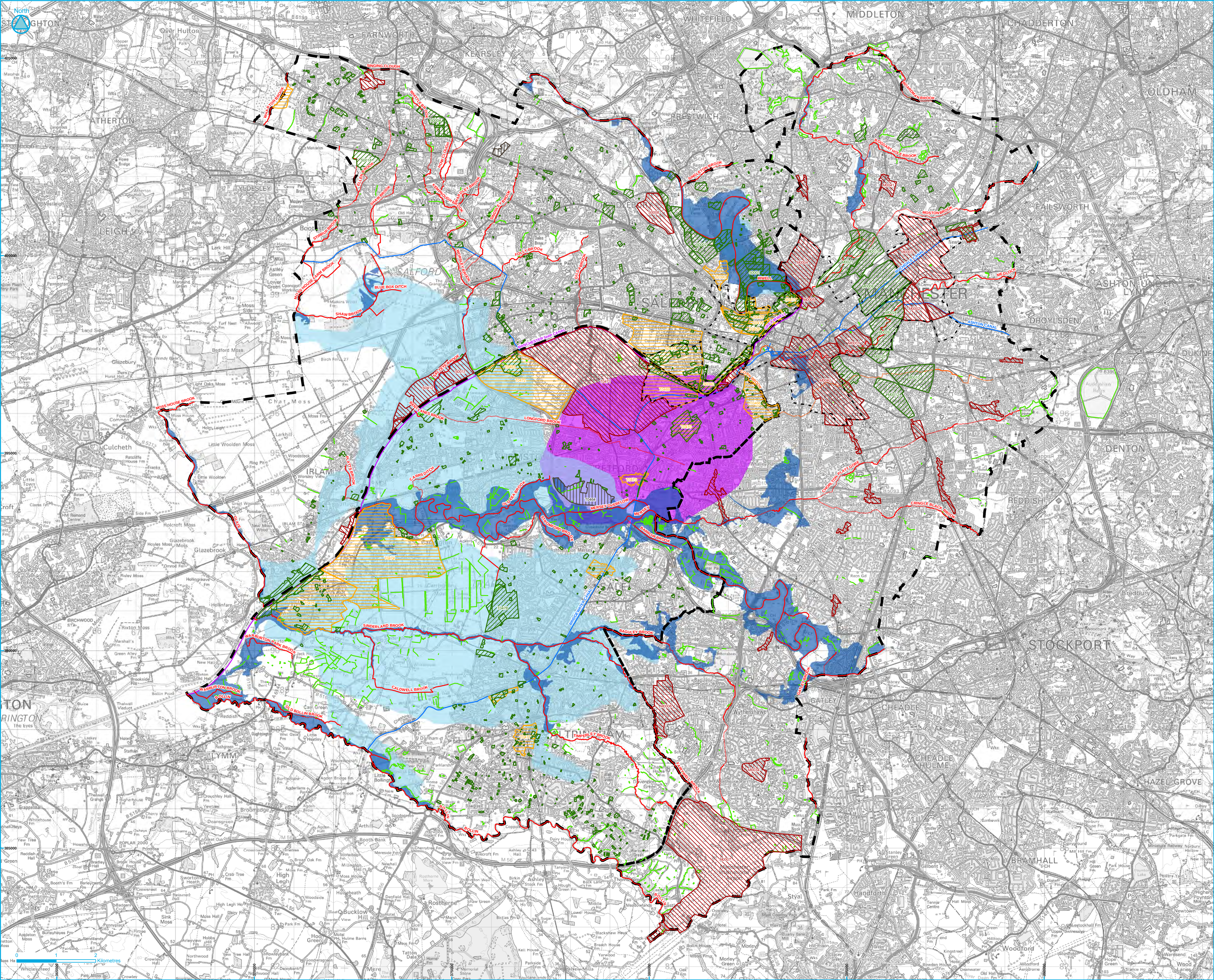


Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

Critical Drainage Areas

Drawn by: J Chestham	Date: 16/03/2011	This map is based upon Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office. © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Licence number: 100016568/2011.
Checked by: J Dimelow	Date: 01/02/2011	
Approved by: J Cooper	Date: 01/02/2011	
File Name: ...ArcViewMapping\Level2\MST_CDA_Current_V1.2.mxd		
Drawing Number: SS_4.5	Status: FINAL	Scale: 1:45,000

Original @ A



- Council Boundary
- Ashton, Bridgewater and Rochdale Canals
- Manchester Ship Canal / Grey Inwell
- Other Waterbodies
- Main Rivers (V8.0)**
 - Culverted
 - Open
- Digitised River Lines**
 - Culverted
 - Open
- Potential Development Sites / Locations**
 - Employment
 - Housing
 - Mixed Use
 - Other
- Regional Centre Boundary

The map has been produced in accordance with PPS25: Development and Flood Risk and its Practice Guide. This map shows areas that are potentially at risk from groundwater flooding and should be used to scope suitable mitigation measures in a site specific Flood Risk Assessment.

The Main River information shown in the SFRA is provided by the Environment Agency; the centreline data may deviate from that shown on basemapping due to inherent differences in data resolution. Further information on Main Rivers is provided on the Environment Agency's website. The mapping of culverted sections of watercourse is a strategic screening only based upon Ordnance Survey 1:10,000 mapping and should be confirmed for more detailed studies such as site specific Flood Risk Assessment. The canals layer does not necessarily cover all the canal arms, but the modelled overtopping/breaching and hydraulic interactions with rivers and other waterbodies is complete and accurate as appropriate for a Strategic Flood Risk Assessment.

The information on the map is based on Environment Agency potential groundwater rebound areas, data from the Coal Authority, BGS drift geology mapping and Defra Groundwater Emergence Maps.

The River Inwell between Victoria Station and Pomona Island is not shown as a Main River on the Environment Agency's Flood Map although Flood Zones related to the river are. The same approach has been taken in this SFRA.

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e info@jbaconsulting.co.uk

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WA1 1NN
United Kingdom

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for

Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA

Groundwater Flooding

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Checked by: J Dimelow	Date: 01/02/2011	
Approved by: J Cooper	Date: 01/02/2011	
File Name: ..\ArcViewMapping\Level1\MS2_GroundwaterFlooding_V1.3.mxd		
Drawing Number:	Status:	Scale:
GW_2.1	FINAL	1:45,000
Original © A1		

Appendix G – Existing and Proposed Areas

[illegible]

NOTES

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5. THIS DRAWING IS BASED ON:

- ND OLIVER & CO TOPOGRAPHICAL SURVEY DATED SEPTEMBER 2021 - 114/001/1 - RECEIVED 23/09.21 REV 0
- SIMPSONHAUGH AND PARTNERS ARCHITECTURAL DRAWING - PROPOSED GROUND FLOOR PLAN DATED MARCH 2022 - 10349-SHP-Z1-A-G200-PL-00-001 P03 - RECEIVED 08/03/22.

KEY:

- SITE BOUNDARY = 7672m²
 EXISTING PERMEABLE AREA = 1986m²
 EXISTING IMPERMEABLE AREA = 5674m²

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PROJECT
ST GABRIEL'S
1 OXFORD PLACE
MANCHESTER
M14 5RP

CLIENT
ARCADIS

TITLE
EXISTING CATCHMENT PLAN

DISCIPLINE CIVIL			SCALE 1:250
DRAWN SA	DESIGNED SA	CHECKED GB	APPROVED GB
DRAWING No 2998-MHT-XX-XX-DR-C-SK001			ISSUE 101

[illegible]

NOTES:

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. THIS DRAWING IS FOR INFORMATION ONLY.
4. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND CONSULTANTS DRAWINGS AND SPECIFICATIONS.
5. THIS DRAWING IS BASED ON:
 - SIMPSONHAUGH AND PARTNERS ARCHITECTURAL DRAWING - PROPOSED GROUND FLOOR PLAN DATED MARCH 2022 - 10349-SHP-Z1-A-G200-PL-00-001 P05 - RECEIVED 23/03/22.
 - RE-FORM LANDSCAPE ARCHITECTURAL DRAWING - WORKING DRAWING DATED APRIL 2022 - 0919-RFM-XX-00-M2-L-0001-P01 - RECEIVED 12/04/22.

KEY:

- SITE BOUNDARY = 7672m²
 PROPOSED PERMEABLE AREA = 2756m²
 PROPOSED IMPERMEABLE AREA = 4916m²

CDM RESIDUAL CIVIL / STRUCTURAL DESIGN RISKS



PROJECT
ST GABRIEL'S
1 OXFORD PLACE
MANCHESTER
M14 5RP

CLIENT
ARCADIS

TITLE	PROPOSED CATCHMENT PLAN
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DISCIPLINE CIVIL			SCALE 1:250
DRAWN SA	DESIGNED SA	CHECKED GB	APPROVED GB
DRAWING No 2998-MHT-XX-XX-DR-C-SK002			ISSUE 103

Appendix H – Proposed Drainage Calculations

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10 Aldersgate Street London EC1A 4HJ	ST GABRIELS 2998 PROPOSED DRAINAGE MODEL	
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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model	
Return Period (years)	100
FEH Rainfall Version	2013
Site Location GB 385241 395742 SJ 85241 95742	
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm at outfall S (pipe S1.003)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.092	4-8	0.028

Total Area Contributing (ha) = 0.120

Total Pipe Volume (m³) = 7.305

Time Area Diagram at outfall S (pipe S4.006)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.178	4-8	0.050

Total Area Contributing (ha) = 0.228

Total Pipe Volume (m³) = 5.589

Network Design Table for Storm

PN Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
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Network Design Table for Storm

Network Results Table

PN	Rain	T.C.	US/IL	Σ I	Area	Σ Base	Foul	Add Flow	Vel	Cap	Flow
	(mm/hr)	(mins)	(m)		(ha)	Flow (l/s)	(l/s)	(l/s)	(m/s)	(l/s)	(l/s)

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London
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ST GABRIELS
2998
PROPOSED DRAINAGE MODEL

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
S1.000	30.799	0.184	167.4	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit		
S1.001	41.101	0.246	167.1	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit		
S2.000	29.674	0.178	166.7	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit		
S2.001	3.909	0.023	170.0	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit		
S1.002	34.250	0.205	167.1	0.030	0.00	0.0	0.600	o	225	Pipe/Conduit		
S3.000	40.833	0.510	80.1	0.030	5.00	0.0	0.600	o	225	Pipe/Conduit		
S1.003	3.168	0.045	70.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
S4.000	25.146	0.151	166.5	0.037	5.00	0.0	0.600	o	225	Pipe/Conduit		
S4.001	17.653	0.106	166.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit		
S4.002	13.691	0.082	167.0	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit		
S4.003	11.957	0.072	166.1	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit		
S5.000	28.303	0.169	167.5	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit		
S5.001	5.956	0.642	9.3	0.039	0.00	0.0	0.600	o	225	Pipe/Conduit		
S4.004	19.292	0.154	125.3	0.037	0.00	0.0	0.600	o	225	Pipe/Conduit		
S4.005	16.367	0.131	124.9	0.037	0.00	0.0	0.600	o	225	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	0.00	5.51	39.555	0.000		0.0	0.0	0.0	1.01	40.1
S1.001	0.00	6.19	39.371	0.030		0.0	0.0	0.0	1.01	40.1
S2.000	0.00	5.49	38.223	0.000		0.0	0.0	0.0	1.01	40.2
S2.001	0.00	5.55	38.045	0.030		0.0	0.0	0.0	1.00	39.8
S1.002	0.00	6.75	38.022	0.090		0.0	0.0	0.0	1.01	40.1
S3.000	0.00	5.47	38.475	0.030		0.0	0.0	0.0	1.46	58.2
S1.003	0.00	6.79	37.817	0.120		0.0	0.0	0.0	1.56	62.1
S4.000	0.00	5.41	38.475	0.037		0.0	0.0	0.0	1.01	40.2
S4.001	0.00	5.71	38.324	0.037		0.0	0.0	0.0	1.01	40.2
S4.002	0.00	5.93	38.218	0.076		0.0	0.0	0.0	1.01	40.1
S4.003	0.00	6.13	38.136	0.115		0.0	0.0	0.0	1.01	40.2
S5.000	0.00	5.47	38.875	0.000		0.0	0.0	0.0	1.01	40.1
S5.001	0.00	5.49	38.706	0.039		0.0	0.0	0.0	4.32	171.8
S4.004	0.00	6.40	38.064	0.191		0.0	0.0	0.0	1.17	46.4
S4.005	0.00	6.64	37.910	0.228		0.0	0.0	0.0	1.17	46.5

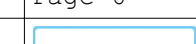
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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SMH1	40.380	0.825	Open Manhole	1200	S1.000	39.555	225				
SMH2	39.990	0.619	Open Manhole	1200	S1.001	39.371	225	S1.000	39.371	225	
SMH4	39.610	1.387	Open Manhole	1200	S2.000	38.223	225				
SMH5	39.880	1.835	Open Manhole	1200	S2.001	38.045	225	S2.000	38.045	225	
SMH3	39.820	1.798	Open Manhole	1200	S1.002	38.022	225	S1.001	39.125	225	1103
								S2.001	38.022	225	
SMH6	39.900	1.425	Open Manhole	1200	S3.000	38.475	225				
SMH7	39.990	2.173	Open Manhole	1200	S1.003	37.817	225	S1.002	37.817	225	
								S3.000	37.965	225	148
S	39.910	2.138	Open Manhole	0		OUTFALL		S1.003	37.772	225	
SMH10	39.500	1.025	Open Manhole	1200	S4.000	38.475	225				
SMH11	39.700	1.376	Open Manhole	1200	S4.001	38.324	225	S4.000	38.324	225	
SMH12	39.900	1.682	Open Manhole	1200	S4.002	38.218	225	S4.001	38.218	225	
SMH13	39.900	1.764	Open Manhole	1200	S4.003	38.136	225	S4.002	38.136	225	
SMH8	39.900	1.025	Open Manhole	1200	S5.000	38.875	225				
SMH9	39.900	1.194	Open Manhole	1200	S5.001	38.706	225	S5.000	38.706	225	
SMH14	39.900	1.836	Open Manhole	1200	S4.004	38.064	225	S4.003	38.064	225	
								S5.001	38.064	225	
SMH15	39.900	1.990	Open Manhole	1200	S4.005	37.910	225	S4.004	37.910	225	
SMH16	39.920	2.141	Open Manhole	1200	S4.006	37.779	225	S4.005	37.779	225	
S	39.920	2.154	Open Manhole	0		OUTFALL		S4.006	37.766	225	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SMH1	385286.260	395714.822	385286.260	395714.822	Required	
SMH2	385256.551	395722.940	385256.551	395722.940	Required	
SMH4	385298.581	395758.292	385298.581	395758.292	Required	
SMH5	385269.793	395765.489	385269.793	395765.489	Required	
SMH3	385267.087	395762.668	385267.087	395762.668	Required	

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Manhole Schedules for Storm

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SMH6	385223.344	395730.221	385223.344	395730.221	Required	
SMH7	385233.577	395769.750	385233.577	395769.750	Required	
S	385234.614	395772.744			No Entry	
SMH10	385154.400	395744.005	385154.400	395744.005	Required	
SMH11	385179.501	395742.506	385179.501	395742.506	Required	
SMH12	385180.843	395760.108	385180.843	395760.108	Required	
SMH13	385194.183	395763.187	385194.183	395763.187	Required	
SMH8	385165.531	395783.318	385165.531	395783.318	Required	
SMH9	385193.730	395780.894	385193.730	395780.894	Required	
SMH14	385195.130	395775.106	385195.130	395775.106	Required	
SMH15	385214.390	395774.001	385214.390	395774.001	Required	
SMH16	385230.738	395773.204	385230.738	395773.204	Required	
S	385232.929	395773.297			No Entry	

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.030	0.030	0.030
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.030	0.030	0.030
1.002	-	-	100	0.030	0.030	0.030
3.000	-	-	100	0.030	0.030	0.030
1.003	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.037	0.037	0.037
4.001	-	-	100	0.000	0.000	0.000
4.002	-	-	100	0.039	0.039	0.039
4.003	-	-	100	0.039	0.039	0.039
5.000	-	-	100	0.000	0.000	0.000
5.001	-	-	100	0.039	0.039	0.039
4.004	-	-	100	0.037	0.037	0.037
4.005	-	-	100	0.037	0.037	0.037
4.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.348	0.348	0.348

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
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S1.003	S	39.910	37.772	37.770	0	0
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Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
---------------------	--------------	--------------	--------------	------------------	----------	--------

S4.006	S	39.920	37.766	37.760	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	2	Number of Time/Area Diagrams	4
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

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Simulation Criteria for Storm <table><tr><td>Rainfall Model</td><td>FEH</td></tr><tr><td>Return Period (years)</td><td>100</td></tr><tr><td>FEH Rainfall Version</td><td>2013</td></tr><tr><td>Site Location</td><td>GB 385241 395742 SJ 85241 95742</td></tr><tr><td>Data Type</td><td>Point</td></tr><tr><td>Summer Storms</td><td>Yes</td></tr><tr><td>Winter Storms</td><td>Yes</td></tr><tr><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>Storm Duration (mins)</td><td>30</td></tr></table>			Rainfall Model	FEH	Return Period (years)	100	FEH Rainfall Version	2013	Site Location	GB 385241 395742 SJ 85241 95742	Data Type	Point	Summer Storms	Yes	Winter Storms	Yes	Cv (Summer)	0.750	Cv (Winter)	0.840	Storm Duration (mins)	30
Rainfall Model	FEH																					
Return Period (years)	100																					
FEH Rainfall Version	2013																					
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Data Type	Point																					
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Winter Storms	Yes																					
Cv (Summer)	0.750																					
Cv (Winter)	0.840																					
Storm Duration (mins)	30																					
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: SMH7, DS/PN: S1.003, Volume (m³): 5.3

Unit Reference	MD-SCU-0073-6000-1200-6000
Design Head (m)	1.200
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Linear discharge profile
Application	Surface
Sump Available	Yes
Diameter (mm)	73
Invert Level (m)	37.817
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	6.0
Flush-Flo™	0.100	2.0
Kick-Flo®	0.110	2.0
Mean Flow over Head Range	-	4.1

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	2.0	1.200	6.0	3.000	9.3	7.000	13.9
0.200	2.6	1.400	6.5	3.500	10.0	7.500	14.3
0.300	3.2	1.600	6.9	4.000	10.6	8.000	14.8
0.400	3.6	1.800	7.3	4.500	11.2	8.500	15.2
0.500	4.0	2.000	7.6	5.000	11.8	9.000	15.7
0.600	4.3	2.200	8.0	5.500	12.4	9.500	16.1
0.800	5.0	2.400	8.3	6.000	12.9		
1.000	5.5	2.600	8.6	6.500	13.4		

Hydro-Brake® Optimum Manhole: SMH16, DS/PN: S4.006, Volume (m³): 3.0

Unit Reference	MD-SHE-0182-1800-1500-1800
Design Head (m)	1.500
Design Flow (l/s)	18.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	182
Invert Level (m)	37.779
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

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<u>Hydro-Brake® Optimum Manhole: SMH16, DS/PN: S4.006, Volume (m³): 3.0</u> <table><tr><th>Control Points</th><th>Head (m)</th><th>Flow (l/s)</th></tr><tr><td>Design Point (Calculated)</td><td>1.500</td><td>18.0</td></tr><tr><td>Flush-Flo™</td><td>0.443</td><td>18.0</td></tr><tr><td>Kick-Flo®</td><td>0.967</td><td>14.6</td></tr><tr><td>Mean Flow over Head Range</td><td>-</td><td>15.6</td></tr></table> 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 <table><tr><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th><th>Depth (m)</th><th>Flow (l/s)</th></tr><tr><td>0.100</td><td>6.4</td><td>1.200</td><td>16.2</td><td>3.000</td><td>25.1</td><td>7.000</td><td>37.7</td></tr><tr><td>0.200</td><td>16.2</td><td>1.400</td><td>17.4</td><td>3.500</td><td>27.0</td><td>7.500</td><td>39.0</td></tr><tr><td>0.300</td><td>17.5</td><td>1.600</td><td>18.6</td><td>4.000</td><td>28.8</td><td>8.000</td><td>40.2</td></tr><tr><td>0.400</td><td>17.9</td><td>1.800</td><td>19.6</td><td>4.500</td><td>30.4</td><td>8.500</td><td>41.4</td></tr><tr><td>0.500</td><td>17.9</td><td>2.000</td><td>20.6</td><td>5.000</td><td>32.0</td><td>9.000</td><td>42.5</td></tr><tr><td>0.600</td><td>17.7</td><td>2.200</td><td>21.6</td><td>5.500</td><td>33.5</td><td>9.500</td><td>43.7</td></tr><tr><td>0.800</td><td>16.8</td><td>2.400</td><td>22.5</td><td>6.000</td><td>35.0</td><td></td><td></td></tr><tr><td>1.000</td><td>14.9</td><td>2.600</td><td>23.4</td><td>6.500</td><td>36.3</td><td></td><td></td></tr></table>			Control Points	Head (m)	Flow (l/s)	Design Point (Calculated)	1.500	18.0	Flush-Flo™	0.443	18.0	Kick-Flo®	0.967	14.6	Mean Flow over Head Range	-	15.6	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	6.4	1.200	16.2	3.000	25.1	7.000	37.7	0.200	16.2	1.400	17.4	3.500	27.0	7.500	39.0	0.300	17.5	1.600	18.6	4.000	28.8	8.000	40.2	0.400	17.9	1.800	19.6	4.500	30.4	8.500	41.4	0.500	17.9	2.000	20.6	5.000	32.0	9.000	42.5	0.600	17.7	2.200	21.6	5.500	33.5	9.500	43.7	0.800	16.8	2.400	22.5	6.000	35.0			1.000	14.9	2.600	23.4	6.500	36.3		
Control Points	Head (m)	Flow (l/s)																																																																																							
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0.500	17.9	2.000	20.6	5.000	32.0	9.000	42.5																																																																																		
0.600	17.7	2.200	21.6	5.500	33.5	9.500	43.7																																																																																		
0.800	16.8	2.400	22.5	6.000	35.0																																																																																				
1.000	14.9	2.600	23.4	6.500	36.3																																																																																				
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Storage Structures for Storm

Cellular Storage Manhole: SMH7, DS/PN: S1.003

Invert Level (m) 37.817 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	90.0	0.0	1.201	0.0	0.0
1.200	90.0	0.0			

Cellular Storage Manhole: SMH13, DS/PN: S4.003

Invert Level (m) 38.136 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	85.0	0.0	0.801	0.0	0.0
0.800	85.0	0.0			

Cellular Storage Manhole: SMH15, DS/PN: S4.005

Invert Level (m) 37.910 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	100.0	0.0	0.401	0.0	0.0
0.400	100.0	0.0			

Time Area Diagram for Green Roof at Pipe Number S1.000 (Storm)

Area (m³) 375 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:	From:	To:
(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)
0	4 0.006814	32	36 0.001376	64	68 0.000278	96	100 0.000056
4	8 0.005579	36	40 0.001126	68	72 0.000227	100	104 0.000046
8	12 0.004568	40	44 0.000922	72	76 0.000186	104	108 0.000038
12	16 0.003740	44	48 0.000755	76	80 0.000152	108	112 0.000031
16	20 0.003062	48	52 0.000618	80	84 0.000125	112	116 0.000025
20	24 0.002507	52	56 0.000506	84	88 0.000102	116	120 0.000021
24	28 0.002052	56	60 0.000414	88	92 0.000084		
28	32 0.001680	60	64 0.000339	92	96 0.000068		

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Time Area Diagram for Green Roof at Pipe Number S2.000 (Storm)

Area (m³) 375 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.006814	32	36	0.001376	64	68	0.000278	96	100	0.000056
4	8	0.005579	36	40	0.001126	68	72	0.000227	100	104	0.000046
8	12	0.004568	40	44	0.000922	72	76	0.000186	104	108	0.000038
12	16	0.003740	44	48	0.000755	76	80	0.000152	108	112	0.000031
16	20	0.003062	48	52	0.000618	80	84	0.000125	112	116	0.000025
20	24	0.002507	52	56	0.000506	84	88	0.000102	116	120	0.000021
24	28	0.002052	56	60	0.000414	88	92	0.000084			
28	32	0.001680	60	64	0.000339	92	96	0.000068			

Time Area Diagram for Green Roof at Pipe Number S4.001 (Storm)

Area (m³) 337 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.006124	32	36	0.001236	64	68	0.000250	96	100	0.000050
4	8	0.005014	36	40	0.001012	68	72	0.000204	100	104	0.000041
8	12	0.004105	40	44	0.000829	72	76	0.000167	104	108	0.000034
12	16	0.003361	44	48	0.000679	76	80	0.000137	108	112	0.000028
16	20	0.002752	48	52	0.000556	80	84	0.000112	112	116	0.000023
20	24	0.002253	52	56	0.000455	84	88	0.000092	116	120	0.000019
24	28	0.001844	56	60	0.000372	88	92	0.000075			
28	32	0.001510	60	64	0.000305	92	96	0.000062			

Time Area Diagram for Green Roof at Pipe Number S5.000 (Storm)

Area (m³) 340 Evaporation (mm/day) 3
Depression Storage (mm) 5 Decay Coefficient 0.050

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.006178	32	36	0.001247	64	68	0.000252	96	100	0.000051
4	8	0.005059	36	40	0.001021	68	72	0.000206	100	104	0.000042
8	12	0.004142	40	44	0.000836	72	76	0.000169	104	108	0.000034
12	16	0.003391	44	48	0.000685	76	80	0.000138	108	112	0.000028
16	20	0.002776	48	52	0.000560	80	84	0.000113	112	116	0.000023
20	24	0.002273	52	56	0.000459	84	88	0.000093	116	120	0.000019
24	28	0.001861	56	60	0.000376	88	92	0.000076			
28	32	0.001524	60	64	0.000308	92	96	0.000062			

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)

for Storm

Simulation Criteria

Areal Reduction Factor 1.000

Hot Start (mins) 0

Hot Start Level (mm) 0

Manhole Headloss Coeff (Global) 0.500

Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000

MADD Factor * 10m³/ha Storage 2.000

Inlet Coeffiecient 0.800

Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0

Number of Online Controls 2

Number of Offline Controls 0

Number of Storage Structures 3

Number of Time/Area Diagrams 4

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH

FEH Rainfall Version 2013

Site Location GB 385241 395742 SJ 85241 95742

Data Type Point

Cv (Summer) 0.950

Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status OFF

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

Return Period(s) (years) 2, 30, 100, 101

Climate Change (%) 0, 0, 0, 45

Water

Level

(m)

PN

US/MH

Name

Storm

Return Period

Climate Change

First (X) Surge

First (Y) Flood

First (Z) Overflow

Overflow Act.

S1.000

SMH1

120 Summer

2

+0%

S1.001

SMH2

15 Summer

2

+0%

S2.000

SMH4

120 Summer

2

+0%

100/60 Summer

S2.001

SMH5

15 Summer

2

+0%

30/60 Summer

S1.002

SMH3

15 Summer

2

+0%

30/60 Summer

S3.000

SMH6

15 Summer

2

+0%

101/60 Summer

S1.003

SMH7

360 Summer

2

+0%

30/15 Summer

S4.000

SMH10

15 Summer

2

+0%

101/15 Summer

S4.001

SMH11

15 Summer

2

+0%

101/15 Summer

S4.002

SMH12

15 Summer

2

+0%

100/15 Summer

S4.003

SMH13

30 Summer

2

+0%

100/15 Summer

S5.000

SMH8

120 Summer

2

+0%

101/60 Summer

S5.001

SMH9

15 Summer

2

+0%

101/60 Summer

S4.004

SMH14

30 Summer

2

+0%

100/15 Summer

S4.005

SMH15

120 Summer

2

+0%

30/30 Summer

S4.006

SMH16

120 Summer

2

+0%

30/15 Summer

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2 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Half Drain	Pipe	Status	Level Exceeded
		Depth (m)	Volume (m³)	Cap.	(l/s)	Time (mins)	Flow (l/s)		
S1.000	SMH1	-0.193	0.000	0.05			1.9	OK	
S1.001	SMH2	-0.173	0.000	0.12			4.7	OK	
S2.000	SMH4	-0.193	0.000	0.05			1.9	OK	
S2.001	SMH5	-0.148	0.000	0.17			4.6	OK	
S1.002	SMH3	-0.130	0.000	0.36			13.6	OK	
S3.000	SMH6	-0.177	0.000	0.10			5.5	OK	
S1.003	SMH7	-0.010	0.000	0.09		132	2.7	OK	
S4.000	SMH10	-0.160	0.000	0.18			6.8	OK	
S4.001	SMH11	-0.159	0.000	0.19			6.7	OK	
S4.002	SMH12	-0.131	0.000	0.36			12.6	OK	
S4.003	SMH13	-0.146	0.000	0.27		22	9.2	OK	
S5.000	SMH8	-0.195	0.000	0.05			1.7	OK	
S5.001	SMH9	-0.191	0.000	0.05			6.1	OK	
S4.004	SMH14	-0.126	0.000	0.40			16.7	OK	
S4.005	SMH15	-0.128	0.000	0.35		44	14.3	OK	
S4.006	SMH16	-0.035	0.000	0.50			14.3	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor 1.000

Hot Start (mins) 0

Hot Start Level (mm) 0

Manhole Headloss Coeff (Global) 0.500

Foul Sewage per hectare (l/s) 0.000

Additional Flow - % of Total Flow 0.000

MADD Factor * 10m³/ha Storage 2.000

Inlet Coeffiecient 0.800

Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0

Number of Storage Structures 3

Number of Online Controls 2

Number of Time/Area Diagrams 4

Number of Offline Controls 0

Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH

FEH Rainfall Version 2013

Site Location GB 385241 395742 SJ 85241 95742

Data Type Point

Cv (Summer) 0.950

Cv (Winter) 0.950

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status OFF

DVD Status ON

Inertia Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

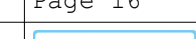
Return Period(s) (years) 2, 30, 100, 101

Climate Change (%) 0, 0, 0, 45

	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Water
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	Level
									(m)
S1.000	SMH1	60 Summer	30	+0%					39.607
S1.001	SMH2	15 Summer	30	+0%					39.465
S2.000	SMH4	240 Summer	30	+0%	100/60 Summer				38.342
S2.001	SMH5	240 Summer	30	+0%	30/60 Summer				38.339
S1.002	SMH3	240 Summer	30	+0%	30/60 Summer				38.338
S3.000	SMH6	15 Summer	30	+0%	101/60 Summer				38.548
S1.003	SMH7	240 Summer	30	+0%	30/15 Summer				38.329
S4.000	SMH10	15 Summer	30	+0%	101/15 Summer				38.576
S4.001	SMH11	15 Summer	30	+0%	101/15 Summer				38.430
S4.002	SMH12	15 Summer	30	+0%	100/15 Summer				38.390
S4.003	SMH13	30 Summer	30	+0%	100/15 Summer				38.311
S5.000	SMH8	60 Summer	30	+0%	101/60 Summer				38.925
S5.001	SMH9	15 Summer	30	+0%	101/60 Summer				38.766
S4.004	SMH14	60 Summer	30	+0%	100/15 Summer				38.281
S4.005	SMH15	60 Summer	30	+0%	30/30 Summer				38.229
S4.006	SMH16	60 Summer	30	+0%	30/15 Summer				38.196

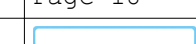
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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)						
S1.000	SMH1	-0.173	0.000	0.12			4.7	OK	
S1.001	SMH2	-0.131	0.000	0.37			13.9	OK	
S2.000	SMH4	-0.106	0.000	0.08			3.1	OK	
S2.001	SMH5	0.069	0.000	0.23			6.1	SURCHARGED	
S1.002	SMH3	0.091	0.000	0.42			15.7	SURCHARGED	
S3.000	SMH6	-0.152	0.000	0.22			12.4	OK	
S1.003	SMH7	0.287	0.000	0.13		166	4.0	SURCHARGED	
S4.000	SMH10	-0.124	0.000	0.41			15.2	OK	
S4.001	SMH11	-0.119	0.000	0.43			15.4	OK	
S4.002	SMH12	-0.053	0.000	0.90			31.5	OK	
S4.003	SMH13	-0.050	0.000	0.77		20	26.6	OK	
S5.000	SMH8	-0.175	0.000	0.11			4.2	OK	
S5.001	SMH9	-0.165	0.000	0.16			18.3	OK	
S4.004	SMH14	-0.008	0.000	1.00			41.8	OK	
S4.005	SMH15	0.094	0.000	0.44		38	18.3	SURCHARGED	
S4.006	SMH16	0.192	0.000	0.63			17.9	SURCHARGED	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)						
S1.000	SMH1	-0.162	0.000	0.17			6.6	OK	
S1.001	SMH2	-0.111	0.000	0.50			19.2	OK	
S2.000	SMH4	0.142	0.000	0.11			3.9	SURCHARGED	
S2.001	SMH5	0.316	0.000	0.26			7.2	SURCHARGED	
S1.002	SMH3	0.338	0.000	0.53			20.2	SURCHARGED	
S3.000	SMH6	-0.125	0.000	0.09			4.8	OK	
S1.003	SMH7	0.531	0.000	0.16		192	4.8	SURCHARGED	
S4.000	SMH10	-0.101	0.000	0.57			21.1	OK	
S4.001	SMH11	-0.013	0.000	0.63			22.8	OK	
S4.002	SMH12	0.059	0.000	0.96			33.6	SURCHARGED	
S4.003	SMH13	0.128	0.000	0.57		32	19.8	SURCHARGED	
S5.000	SMH8	-0.165	0.000	0.16			5.9	OK	
S5.001	SMH9	-0.152	0.000	0.20			23.0	OK	
S4.004	SMH14	0.190	0.000	1.12			46.8	SURCHARGED	
S4.005	SMH15	0.333	0.000	0.51		72	21.2	SURCHARGED	
S4.006	SMH16	0.447	0.000	0.63			17.9	SURCHARGED	

Meinhardt (UK) Ltd								Page 19																																																																																																																																																																											
10 Aldersgate Street London EC1A 4HJ				ST GABRIELS 2998 PROPOSED DRAINAGE MODEL																																																																																																																																																																															
Date 30/06/2022 12:44 File Proposed Model Final.MDX				Designed by GB Checked by GB																																																																																																																																																																															
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<u>Simulation Criteria</u>																																																																																																																																																																																			
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 Coefficient 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 3 Number of Online Controls 2 Number of Time/Area Diagrams 4 Number of Offline Controls 0 Number of Real Time Controls 0																																																																																																																																																																																			
<u>Synthetic Rainfall Details</u>																																																																																																																																																																																			
Rainfall Model FEH FEH Rainfall Version 2013 Site Location GB 385241 395742 SJ 85241 95742 Data Type Point Cv (Summer) 0.950 Cv (Winter) 0.950																																																																																																																																																																																			
Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status OFF DVD Status ON Inertia Status ON																																																																																																																																																																																			
Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440 Return Period(s) (years) 2, 30, 100, 101 Climate Change (%) 0, 0, 0, 45																																																																																																																																																																																			
<table><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Water Level (m)</th></tr><tr><td>S1.000</td><td>SMH1</td><td>60 Summer</td><td>101</td><td>+45%</td><td></td><td></td><td></td><td></td><td>39.632</td></tr><tr><td>S1.001</td><td>SMH2</td><td>30 Summer</td><td>101</td><td>+45%</td><td></td><td></td><td></td><td></td><td>39.531</td></tr><tr><td>S2.000</td><td>SMH4</td><td>240 Summer</td><td>101</td><td>+45%</td><td>100/60 Summer</td><td></td><td></td><td></td><td>39.027</td></tr><tr><td>S2.001</td><td>SMH5</td><td>240 Summer</td><td>101</td><td>+45%</td><td>30/60 Summer</td><td></td><td></td><td></td><td>39.023</td></tr><tr><td>S1.002</td><td>SMH3</td><td>240 Summer</td><td>101</td><td>+45%</td><td>30/60 Summer</td><td></td><td></td><td></td><td>39.021</td></tr><tr><td>S3.000</td><td>SMH6</td><td>240 Summer</td><td>101</td><td>+45%</td><td>101/60 Summer</td><td></td><td></td><td></td><td>39.009</td></tr><tr><td>S1.003</td><td>SMH7</td><td>240 Summer</td><td>101</td><td>+45%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>39.007</td></tr><tr><td>S4.000</td><td>SMH10</td><td>60 Summer</td><td>101</td><td>+45%</td><td>101/15 Summer</td><td></td><td></td><td></td><td>39.457</td></tr><tr><td>S4.001</td><td>SMH11</td><td>60 Summer</td><td>101</td><td>+45%</td><td>101/15 Summer</td><td></td><td></td><td></td><td>39.453</td></tr><tr><td>S4.002</td><td>SMH12</td><td>60 Summer</td><td>101</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>39.441</td></tr><tr><td>S4.003</td><td>SMH13</td><td>60 Summer</td><td>101</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>39.428</td></tr><tr><td>S5.000</td><td>SMH8</td><td>60 Summer</td><td>101</td><td>+45%</td><td>101/60 Summer</td><td></td><td></td><td></td><td>39.429</td></tr><tr><td>S5.001</td><td>SMH9</td><td>60 Summer</td><td>101</td><td>+45%</td><td>101/60 Summer</td><td></td><td></td><td></td><td>39.418</td></tr><tr><td>S4.004</td><td>SMH14</td><td>60 Summer</td><td>101</td><td>+45%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>39.413</td></tr><tr><td>S4.005</td><td>SMH15</td><td>60 Summer</td><td>101</td><td>+45%</td><td>30/30 Summer</td><td></td><td></td><td></td><td>39.379</td></tr><tr><td>S4.006</td><td>SMH16</td><td>60 Summer</td><td>101</td><td>+45%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>39.340</td></tr></table>										PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	S1.000	SMH1	60 Summer	101	+45%					39.632	S1.001	SMH2	30 Summer	101	+45%					39.531	S2.000	SMH4	240 Summer	101	+45%	100/60 Summer				39.027	S2.001	SMH5	240 Summer	101	+45%	30/60 Summer				39.023	S1.002	SMH3	240 Summer	101	+45%	30/60 Summer				39.021	S3.000	SMH6	240 Summer	101	+45%	101/60 Summer				39.009	S1.003	SMH7	240 Summer	101	+45%	30/15 Summer				39.007	S4.000	SMH10	60 Summer	101	+45%	101/15 Summer				39.457	S4.001	SMH11	60 Summer	101	+45%	101/15 Summer				39.453	S4.002	SMH12	60 Summer	101	+45%	100/15 Summer				39.441	S4.003	SMH13	60 Summer	101	+45%	100/15 Summer				39.428	S5.000	SMH8	60 Summer	101	+45%	101/60 Summer				39.429	S5.001	SMH9	60 Summer	101	+45%	101/60 Summer				39.418	S4.004	SMH14	60 Summer	101	+45%	100/15 Summer				39.413	S4.005	SMH15	60 Summer	101	+45%	30/30 Summer				39.379	S4.006	SMH16	60 Summer	101	+45%	30/15 Summer				39.340
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)																																																																																																																																																																										
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Meinhardt (UK) Ltd		Page 20
10 Aldersgate Street London EC1A 4HJ	ST GABRIELS 2998 PROPOSED DRAINAGE MODEL	
Date 30/06/2022 12:44 File Proposed Model Final.MDX	Designed by GB Checked by GB	
Innovyze	Network 2020.1.3	

101 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)						
S1.000	SMH1	-0.148	0.000	0.25			9.5		OK
S1.001	SMH2	-0.065	0.000	0.84			32.0		OK
S2.000	SMH4	0.579	0.000	0.15			5.8	SURCHARGED	
S2.001	SMH5	0.753	0.000	0.42			11.5	SURCHARGED	
S1.002	SMH3	0.774	0.000	0.80			30.4	SURCHARGED	
S3.000	SMH6	0.309	0.000	0.13			7.0	SURCHARGED	
S1.003	SMH7	0.965	0.000	0.20		224	6.0	SURCHARGED	
S4.000	SMH10	0.757	0.000	0.52			19.3	FLOOD RISK	
S4.001	SMH11	0.904	0.000	0.74			26.5	FLOOD RISK	
S4.002	SMH12	0.998	0.000	1.30			45.3	SURCHARGED	
S4.003	SMH13	1.067	0.000	0.49		58	16.8	SURCHARGED	
S5.000	SMH8	0.329	0.000	0.23			8.7	SURCHARGED	
S5.001	SMH9	0.487	0.000	0.27			31.0	SURCHARGED	
S4.004	SMH14	1.124	0.000	1.27			53.2	SURCHARGED	
S4.005	SMH15	1.244	0.000	0.70		108	28.7	SURCHARGED	
S4.006	SMH16	1.336	0.000	0.64			18.4	SURCHARGED	

Appendix I – Drainage Strategy Drawings

[illegible]

1. DO NOT SCALE FROM THIS DRAWING
2. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
3. THIS DRAWING IS FOR INFORMATION ONLY.
4. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND CONSULTANTS DRAWINGS AND SPECIFICATIONS.
5. THIS DRAWING IS BASED ON:
 - SIMPSON HAUGH ARCHITECTURAL DRAWING 10349-SHP-ZA-G100-PL-00-001 PROPOSED SITE PLAN GROUND FLOOR PLAN ST GABRIEL'S LOWER GROUND FLOOR REVISION 03/ - RECEIVED 01/02/22
 - LASER SURVEYS TOPOGRAPHICAL SURVEY DATED JANUARY 2022 - 1116 01 REV A - RECEIVED 02/02/22

 SITE BOUNDARY
 PRIVATE DRAINAGE
 UNITED UTILITIES PUBLIC SEWER
 3M EASEMENT

CDM RESIDUAL CIVIL / STRUCTURAL DESIGN RISKS



PROJECT

ST GABRIEL'S
1 OXFORD PLACE
MANCHESTER
M14 5RP

CLIENT	ARCADIS
TITLE	DRAINAGE CONSTRAINTS PLAN

DISCIPLINE CIVIL			SCALE 1:250
DRAWN SA	DESIGNED SA	CHECKED	APPROVED
DRAWING No 2998-MHT-CV-BG-XX-050			ISSUE 101

[illegible]

NOTES

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3. THIS DRAWING IS FOR INFORMATION ONLY.
4. DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, ENGINEERS AND CONSULTANTS DRAWINGS AND SPECIFICATIONS.
5. THIS DRAWING IS BASED ON:

- ND OLIVER & CO TOPOGRAPHICAL SURVEY DATED SEPTEMBER 2021 - 114/001/1 - RECEIVED 23/09.21 REV 0
- SIMPSONHAUGH AND PARTNERS ARCHITECTURAL DRAWING - PROPOSED GROUND FLOOR PLAN DATED MARCH 2022 - 10349-SHP-Z1-A-G200-PL-00-001 P03 - RECEIVED 08/03/22.

KEY:

- SITE BOUNDARY = 7672m²
 EXISTING PERMEABLE AREA = 1986m²
 EXISTING IMPERMEABLE AREA = 5674m²

CDM RESIDUAL CIVIL / STRUCTURAL DESIGN RISKS



PROJECT
ST GABRIEL'S
1 OXFORD PLACE
MANCHESTER
M14 5RP

CLIENT
ARCADIS

TITLE	EXISTING CATCHMENT PLAN
-------	-------------------------

DISCIPLINE CIVIL			SCALE 1:250
DRAWN	DESIGNED	CHECKED	APPROVED
SA	GB	GB	
DRAWING No 2998-MHT-XX-XX-DR-C-SK001			ISSUE I01

[illegible]

NOTES

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5. THIS DRAWING IS BASED ON:
 - SIMPSONHAUGH AND PARTNERS ARCHITECTURAL DRAWING - PROPOSED GROUND FLOOR PLAN DATED MARCH 2022 - 10349-SHP-Z1-A-G200-PL-00-001 P05 - RECEIVED 23/03/22.
 - RE-FORM LANDSCAPE ARCHITECTURAL DRAWING - WORKING DRAWING DATED APRIL 2022 - 0919-RFM-XX-00-M2-L-0001-P01 - RECEIVED 12/04/22

KEY:

- SITE BOUNDARY = 7672m²
 PROPOSED PERMEABLE AREA = 2756m²
 PROPOSED IMPERMEABLE AREA = 4916m²

CDM RESIDUAL CIVIL / STRUCTURAL DESIGN RISKS



PROJECT
ST GABRIEL'S
1 OXFORD PLACE
MANCHESTER
M14 5RP

CLIENT
ARCADIS

TITLE
PROPOSED CATCHMENT PLAN

DISCIPLINE CIVIL			SCALE 1:250
DRAWN SA	DESIGNED SA	CHECKED GB	APPROVED GB
DRAWING No 2998-MHT-XX-XX-DR-C-SK002			ISSUE 103

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5. THIS DRAWING IS BASED ON:
 - SIMPSONHAUGH AND PARTNERS ARCHITECTURAL DRAWING - PROPOSED ROOF FLOOR PLAN DATED MARCH 2022 - 10349-SHP-Z0-A-G100-PL-RF-001 P04 - RECEIVED 23/03/22.

 SITE BOUNDARY = 7672m²
 PROPOSED GREEN ROOF AREA = 1427m²

CDM RESIDUAL CIVIL / STRUCTURAL DESIGN RISKS

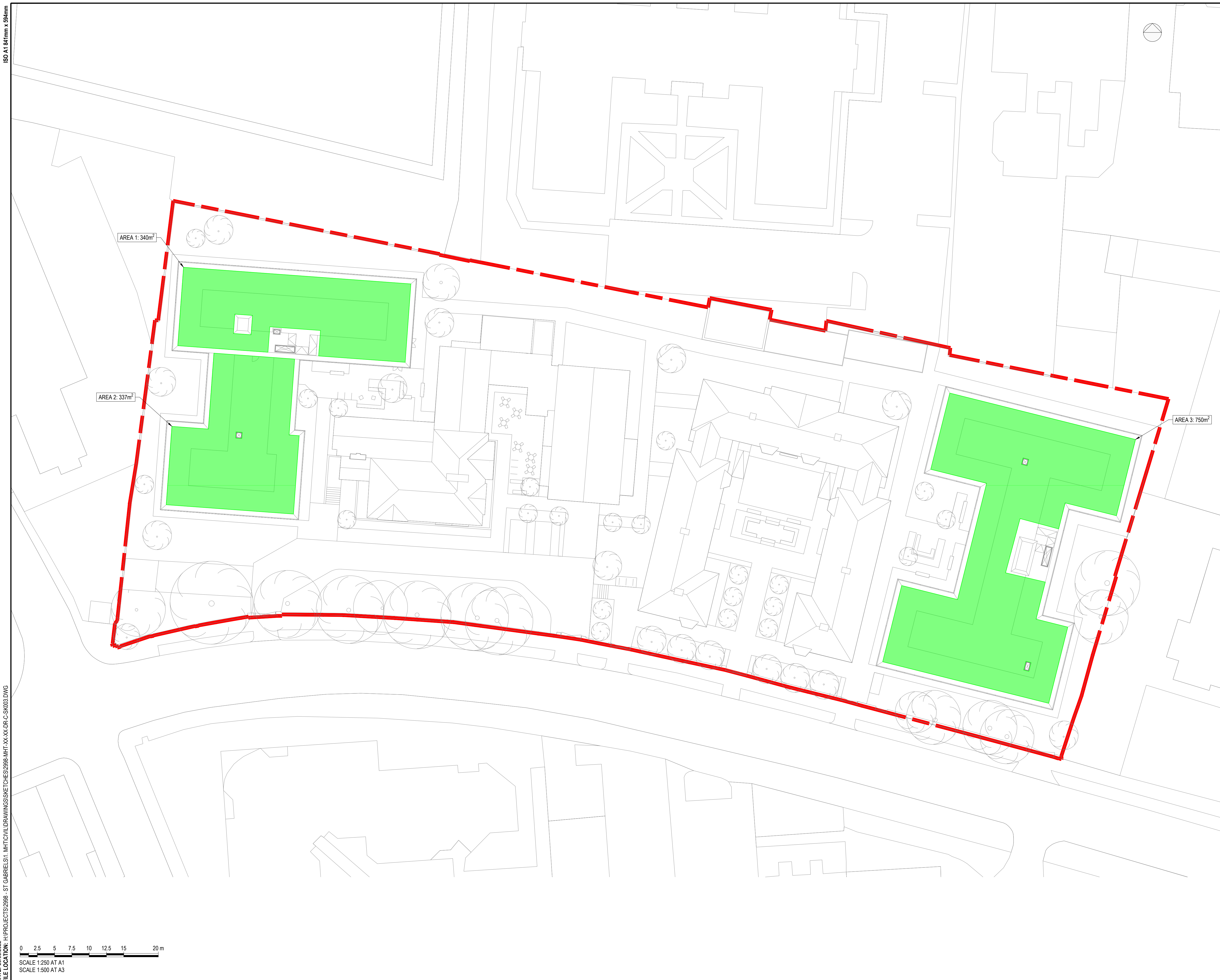


PROJECT
ST GABRIEL'S
1 OXFORD PLACE
MANCHESTER
M14 5RP

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TITLE
PROPOSED CATCHMENT PLAN

DISCIPLINE CIVIL			SCALE 1:250
DRAWN SA	DESIGNED SA	CHECKED GB	APPROVED GB
DRAWING No 2998-MHT-XX-XX-DR-C-SK002			ISSUE I01



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5. THIS DRAWING IS BASED ON:
 - SIMPSONHAUGH AND PARTNERS ARCHITECTURAL DRAWING - PROPOSED GROUND FLOOR PLAN DATED MARCH 2022 - 10349-SHP-Z1-A-G200-PL-00-001 P05 - RECEIVED 23/03/22.

 SITE BOUNDARY
 PROPOSED SURFACE WATER SYSTEM
 POLYPIPE ATTENUATION TANK

CDM RESIDUAL CIVIL / STRUCTURAL DESIGN RISKS

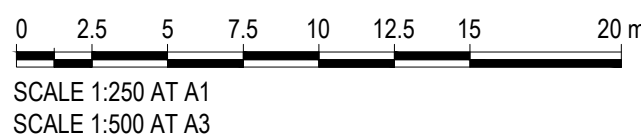
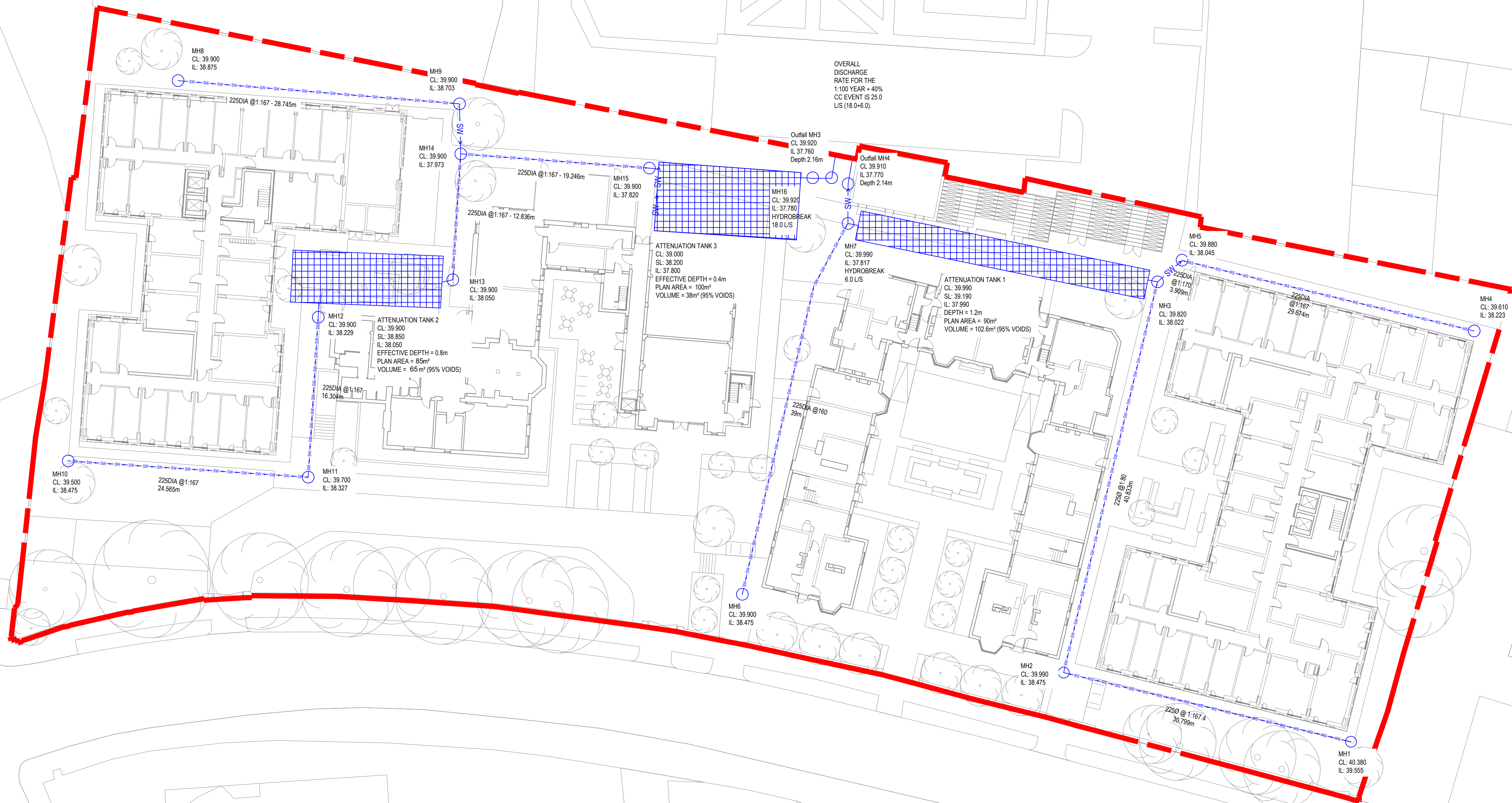


PROJECT
ST GABRIEL'S
1 OXFORD PLACE
MANCHESTER
M14 5RP

CLIENT
ARCADIS

TITLE
PROPOSED SURFACE WATER
DRAINAGE STRATEGY

DISCIPLINE CIVIL			SCALE 1:250
DRAWN SA	DESIGNED SA	CHECKED GB	APPROVED GB
DRAWING No 2998-MHT-XX-XX-DR-C-SK00			ISSUE 10





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