

New Park House, Manchester

Flood Risk Assessment and Drainage Strategy

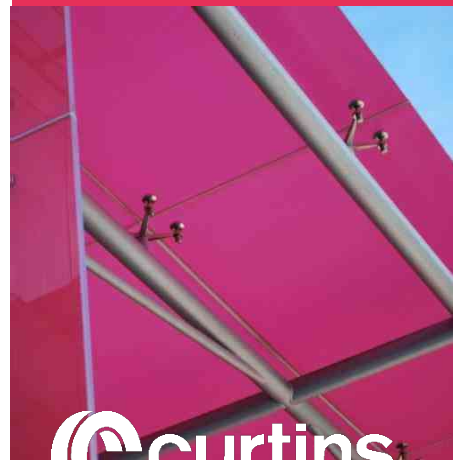
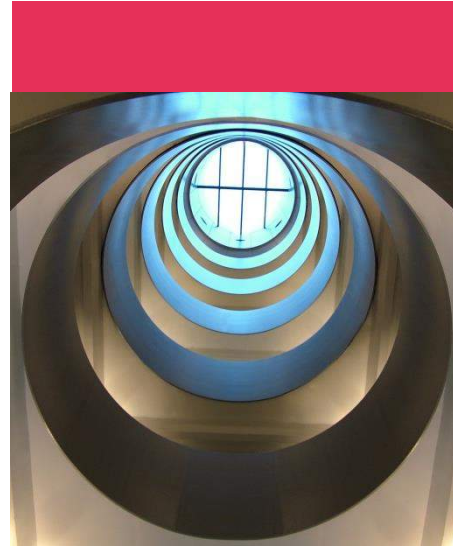
Curtins Ref: 075856-CUR-00-XX-RE-C-001

Revision: P03

Issue Date: 01 June 2022

Client Name: Greater Manchester Mental Health NHS Foundation Trust

Site Address: Delunays Road, Crumpsall, Manchester, M8 5RB.



Curtins
Merchant Exchange
17-19 Whitworth Street West
Manchester, M1 5WG
Tel: 0161 236 2394
www.curtins.com

STRUCTURES • TRANSPORT PLANNING • ENVIRONMENTAL • CIVILS & INFRASTRUCTURE • EXPERT ADVICE • SUSTAINABILITY • STAKEHOLDER ENGAGEMENT
Birmingham • Bristol • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Control Sheet

Rev	Description	Issued by	Checked	Date
P01	Issued for comments	ATL	MW	16/09/2020
P02	Revised in Line with Comments & Revised Site Layout	ATL	MW	02/10/2020
P03	Drainage updated to discharge condition	MW	CG	01/06/2022

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
Andrew Losty MEng (Hons) Project Engineer		01 June 2022

Reviewed	Signature	Date
Marta Wolska MEng (Hons) Senior Civil Engineer		01 June 2022

Authorised	Signature	Date
Chloé Grimsley BSc (Hons) Principal Engineer		01 June 2022

Table of contents

1.0 Introduction 1

1.1 Project Background 1

1.2 Scope of Assessment 1

2.0 Existing Site Details 3

2.1 History and Current Use..... 3

2.2 Existing Watercourses and Other Waterbodies 3

2.3 Existing Drainage 4

2.4 Topography 5

2.5 Geology 5

3.0 Development and Flood Risk 7

3.1 National Planning Policy Framework (NPPF) and Planning Practice Guidance 7

3.2 Site Specific NPPF Flood Risk Categorisation 11

3.3 Site Specific Flood Zone Compatibility 12

3.4 Sequential Test 12

4.0 Hydrological Assessment 13

4.1 Sources of Flood Risk 13

4.2 Fluvial Flooding (Rivers and Streams) 13

4.3 Tidal Flooding (Coastal or Estuarine)..... 14

4.4 Reservoir Flooding 14

4.5 Canal Flooding 15

4.6 Groundwater Flooding..... 15

4.7 Public Sewers or Highway Drainage Flooding (Infrastructure Failure) 16

4.8 Existing private drainage within North Manchester Hospital..... 17

4.9 Surface Water Flooding to the site..... 17

4.10 Surface Water Flooding from the site..... 19

4.11 Historical Flooding..... 19

4.12 Summary of Flood Risk..... 19

5.0 Mitigation 20

5.1 Surface Water Flooding to the site Mitigation 20

5.2 Surface Water Flooding from the site Mitigation 20

6.0 Drainage Strategy..... 22

6.1 Existing Drainage 22

6.2 Masterplan Drainage 22

6.3 Connection to Watercourse..... 23

6.4 Proposed Surface Water Drainage 24

ATTENUATION DETAILS									
REF	U/S MANHOLE	BASE LEVEL	MIN COVER LEVEL	MINIMUM COVER DEPTH	LOADING	LENGTH 'X'	WIDTH 'Y'	DEPTH 'Z'	VOLUME
TANK 1	SA7	70.94	75.15	2.21	PEDESTRIAN	10m	8.5m	2.0m	162m³
TANK 2	SB23	71.28	73.94	1.06	HEAVY VEHICLES	10m	9.5m	1.6m	144m³
TANK 3	N8A	71.52	72.32	0.80	PEDESTRIAN	10.81m	10.51	0.8m	87.3m³
ARBOCEL 1	N7	72.64	73.530	0.20	PEDESTRIAN	N/A	N/A	0.2m	15.6m³
ARBOCEL 2	N15	72.59	73.050	0.10	PEDESTRIAN	N/A	N/A	0.2	36.0m³

..... 30

6.5 Proposed Foul Water Drainage..... 33

7.0 Maintenance 34

7.2 Components 34

7.3 Inspection, Manhole and Catchpit Chambers 35

7.4 Pipes 35

7.5 Gullies 37

7.6 Permeable Pavements..... 38

7.7 Attenuation Tanks 40

7.8 Flow Control Units 41

Appendices

Appendix A

Site Layout

Appendix B

United Utilities Public Sewer Records

Appendix C

Topographical Survey

GRP survey

Plan of Existing Retaining Walls

Appendix D

Borehole records

Appendix E

Lead Local Flood Authority Correspondence

United Utilities Correspondence

Appendix F

Existing Impermeable Areas

Existing Drainage Calculations

Appendix G

Proposed Drainage Strategy

Proposed Impermeable Areas

Proposed drainage details

Proposed Drainage Calculations

Appendix H

Existing Side Wide Drainage Flooding Pre Development

Existing Side Wide Drainage Flooding Post development

1.0 Introduction

1.1 Project Background

- 1.1.1 Curtins was appointed by Greater Manchester Mental Health NHS Foundation Trust to provide a Flood Risk Assessment (FRA) and Drainage Strategy for a proposed development within the North Manchester General Hospital site in Crumpsall, Manchester.
- 1.1.2 The proposals comprise the demolition of the existing hospital buildings and car park on site, and the erection of a new part single / part two storey building to accommodate a new fit for purpose 150-bed adult mental health inpatient unit, with car park and associated soft and hard landscaped areas.
- 1.1.3 The report provides information on the nature of flood risk at the site and follows Government guidance regarding development and flood risk.
- 1.1.4 The report is based on currently available information and preliminary discussions.
- 1.1.5 Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material deviation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.
- 1.1.6 Where the proposed works to which this report refers are undertaken more than twelve months following the issue of this report, Curtins shall reserve the right to re-validate the findings and conclusions by undertaking appropriate further investigations at no cost to Curtins.

1.2 Scope of Assessment

- 1.2.1 The assessment is to be undertaken in accordance with the standing advice and requirements of the Environment Agency (EA) for Flood Risk Assessments as outlined in the Communities and Local Governments Planning Policy Guidance to the National Planning Policy Framework (NPPF).
- 1.2.2 The assessment will:
 - Investigate all potential risks of flooding to the site,
 - Consider the impact the development may have elsewhere with regards to flooding,
 - Consider design proposals to mitigate any potential risk of flooding determined to be present; and
 - Consider foul & surface water drainage proposals for the proposed development.

- 1.2.3 The total site area is approximately 3.69 hectares and following scrutiny of the Environment Agency flood maps it has been identified that site lies within Flood Zone 1. According to local council Strategic Flood Risk Assessment the site lies within a Critical Drainage area. A Flood Risk Assessment is therefore required to support a planning application.
- 1.2.4 In April 2015, the Government made changes to the National Planning Policy Framework which made Sustainable Urban Drainage Systems (SuDS) a material consideration in the determination of planning applications for 'major' developments.
- 1.2.5 A Drainage Strategy will therefore be required as part of the Planning Application for the development, as the site is considered to be 'major' development by the Town and Country Planning Order 2015.
- 1.2.6 This Flood Risk Assessment and Drainage Strategy reviews the following information:
- Environment Agency flood maps for rivers and sea flooding.
 - UK Government Flood Warning Information Service maps for surface water flooding and reservoir flooding.
 - Manchester City, Salford City and Trafford Councils Level 1 Hybrid Strategic Flood Risk Assessment (SFRA) published in March 2010.
 - Manchester City, Salford City and Trafford Councils Level 2 Hybrid SFRA, User Guide, Final, dated May 2010.
 - Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) published in March 2011.
 - Preliminary Flood Risk Assessment (PFRA) for Manchester County Council dated May 2011.
 - Manchester City Council SuDS Requirements for New Developments.
 - Sitewide Flood Risk Assessment GRM/P9200/DS.1 by GRM dated January 2020
 - Drainage & Flood Risk Constraints Report NMGH-AJP-ZZ-XX-RP-C-3000 by AJP dated January 2020.
 - Phase 1 Preliminary Risk Assessment (Site Investigation) 075856-CUR-00-XX-RP-GE-001 by Curtins dated March 2020
 - United Utilities Public Sewer Records Extract dated November 2018.
 - Topographical Survey 3654_GMMH by Axis Surveys dated February 2020.
 - Underground Services Survey 20B201/001-011 by Survey Operations dated May 2020.
- 1.2.7 The site is located on the North Manchester General Hospital Site, Delunays Road, Crumpsall, Manchester, M8 5RB, E 384930, N 402141.
- 1.2.8 The proposals comprise the demolition of the existing hospital buildings and car park on site, and the erection of a new part single / part two storey building to accommodate a new fit for purpose 150-bed adult mental health inpatient unit, with car park and associated soft and hard landscaped areas.
- 1.2.9 The Proposed Site Layout is enclosed in *Appendix A*.

2.0 Existing Site Details

2.1 History and Current Use

- 2.1.1 The site is currently occupied by the Trusts Headquarter and ancillary buildings, the Old Boiler House, Garages, HV Substation and a number of surface level car parking zones for hospital staff members.
- 2.1.2 The site is bounded by Central Drive to the North, Crescent Drive to the East, Eyam Road to the South/ West, and an unnamed private road the West.
- 2.1.3 There are 3 main accesses to the site: from Central Drive, Crescent Drive and Ellis Drive

Figure 1: Aerial Photograph (© Google 2019)



2.2 Existing Watercourses and Other Waterbodies

- 2.2.1 No above ground watercourses have been identified within the proposed site or immediately adjacent to the site.
- 2.2.2 The River Irk is located approximately 300m to the East from the site at its closest point.

2.2.3 Boggart Hole Brook is located approximately 970m to the Northeast from the site.

2.2.4 Moston Brook is located 1.7km to the Southeast from the site.

2.3 Existing Drainage

2.3.1 Based on records provided by United Utilities, there are no public sewers located within the development boundary.

2.3.2 The following sewers are recorded within the vicinity of the site:

- There is a 150mm diameter combined water sewer within Eyam Road, near the Ellis Drive entrance to the site, adjacent to the southwest boundary to the site. This runs in a south easterly direction along Eyam Road, increasing to a 225mm diameter.
- Once the combined sewer reaches Crescent Drive, it turns to run south and increases in size to 375mm & then 525mm diameter.

2.3.3 The public sewer records are enclosed in *Appendix B*. The provided public records do not include any invert levels for manholes within Eyam Road, except manhole ref 8003. The invert level for this manhole is given as 72.31m AOD.

2.3.4 There are further public sewers identified on the public sewer records within the wider vicinity of the site, but these are not considered relevant to the scheme.

2.3.5 The United Utilities manhole ref 8007 depth, located in Crescent Drive, at the southern end of the site has not been confirmed.

2.3.6 An underground utility and CCTV survey has been carried out on the proposed site, and is enclosed in *Appendix C*. This survey identified a number of private foul, surface water and combined drains within the site:

- A 700x450 mm brick combined drain runs across the southern end of the site. The drains run from manhole ref MH045, located in Ellis Drive to the South of the site, and runs to MH083, located in Crescent Drive, to the south of the site. It then connects into United Utilities Manhole Ref 8007.
- There is a 150mm foul drain within the site, which increases to 225mm diameter, and runs in a westerly direction within Ellis Drive, where it connects to manhole MH045.
- There is a 300mm combined foul drain which runs in a westerly direction from MH026, connecting to MH029 to the West of the site.
- There is a 225mm diameter combined drain which runs in a westerly direction from MH023, connecting to MH020 to the West of the site.
- There is a 300mm diameter foul drain, which enters the northern edge of the site, and runs in a westerly direction along the site boundary, increasing to 375mm diameter, exiting the northwest

corner of the site, and connecting to MH102. This drain will need to be retained to maintain connectivity.

2.3.7 The drains noted above are the main drains which exist the site. There are a number of surface water and foul drains identified, but these connect into the main drains noted above.

2.3.8 The survey identifies foul and surface water drains only; these are noted as combined above, as both foul and surface water is shown to connect.

2.4 Topography

2.4.1 A topographical survey has been carried out on the proposed site, and is enclosed in *Appendix C*.

2.4.2 The site levels vary greatly within the site, from a high point of approximately 79.44m AOD, in the eastern area of the site. Low points are found in the northwest corner (72.12m AOD), and the southern end of the site (72.10m AOD).

2.4.3 The existing site levels are stepped along the northern wing of the existing headquarters building with a storey height step provide with the lower storey accessed from the eastern side of the building.

2.4.4 There are a number of retaining walls identified within the existing site, most of which are incorporated within the existing structures. These are shown on drawing 075856-CUR-00-XX-SK-40001, which is enclosed in *Appendix C*

2.5 Geology

2.5.1 The summary of the ground condition encountered during site investigation works have been presented in figure 2 . The boreholes and trial excavation logs are available in *Appendix D*.

Figure 2 Table 5.1 Summary of Ground Condition (Phase 2 Site investigation report)

Stratum	Depth to top of strata, m bgl (m AOD)	Thickness (m)		Description
		Min	Max	
TOPSOIL/ MADE GROUND	0.00 (78.81 – 73.31)	0.40	1.60*	MADE GROUND: Tarmacadam or paving slab <i>OR</i> TOPSOIL: Brown to grey gravelly fine to coarse sand or slightly gravelly very sandy clay, both with frequent rootlets. <i>Overlying</i> Brown to grey slightly gravelly to very gravelly fine to coarse sand with low cobble content. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of mixed lithologies. Cobbles are angular to subangular of brick and concrete. <i>And Or</i> Dark grey to brown slightly sandy to very sandy slightly clayey angular to subrounded fine to coarse gravel of mixed lithologies. <i>And Or</i> Brown slightly sandy slightly gravelly clay with low to moderate cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of brick, ceramics and dolomite hardcore. Cobbles are angular of brick and concrete.
SUPERFICIAL DEPOSITS – Granular Glaciofluvial	0.70 – 1.65 (77.93 – 71.81)	12.20	19.30*	Medium dense to very dense brown slightly gravelly slightly clayey or silty fine to coarse SAND with occasional interlaminated clay. Gravel is angular to subangular fine to medium of sandstone and rare coal.
SUPERFICIAL DEPOSITS – Cohesive Glaciofluvial	0.40 – 7.00 (77.56 – 71.63)	0.30	2.50	Firm grey to brown slightly sandy to sandy slightly gravelly to gravelly CLAY with interaminations of sand. Sand is fine to coarse. Gravel is angular to subangular fine to coarse of sandstone. <i>And</i> Soft to very stiff brownish grey slightly sandy to sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subrounded fine to medium of mudstone.
SUPERFICIAL DEPOSITS – Cohesive Glacial Till	13.70 – 23.00 (56.91 – 55.55)	2.00*	11.30*	Very stiff grey to brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is angular to subrounded, fine to coarse of sandstone.

* Thickness not proved

2.5.2 The report advised the risk of contamination is very low.

2.5.3 The site is not located within a Groundwater Source Protection Zone.

3.0 Development and Flood Risk

3.1 National Planning Policy Framework (NPPF) and Planning Practice Guidance

- 3.1.1 In July 2021 the Department of Communities and Local Government published the updated National Planning Policy Framework document (NPPF) and the Planning Practice Guidance was published in March 2014 and updated in August 2021, which provides guidance on how flood risk should be assessed during the planning and development process.

Table 1: (Extract from Planning Practice Guidance) Flood Zone Classifications

These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's [Flood Map for Planning \(Rivers and Sea !\[\]\(f1ee6d81bdeaf50ad3989e9a2b0d9b21_img.jpg\)](#)), available on the Environment Agency's web site, as indicated in the table below.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Table 2: (Extract from Planning Practice Guidance) Flood Risk Vulnerability Classification

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

Less Vulnerable

- Police, ambulance and fire stations which are **not** required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'More Vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-Compatible Development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

Table 3: (Extract from Planning Practice Guidance) Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

* In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

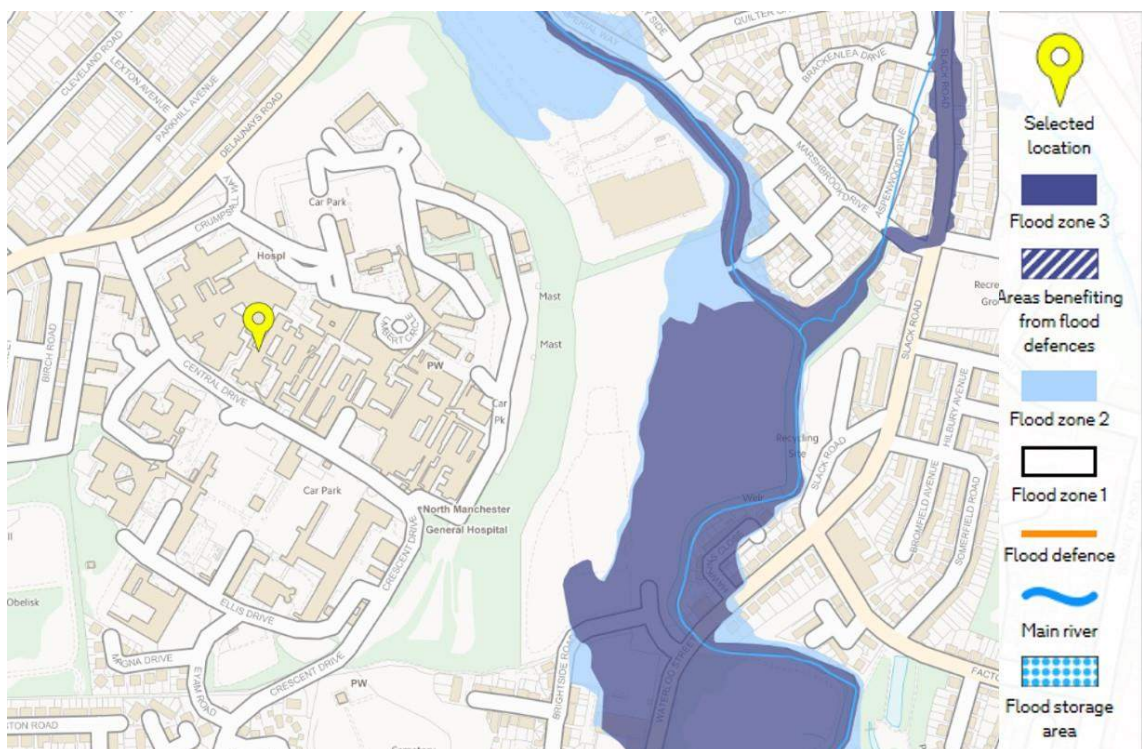
- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

3.2 Site Specific NPPF Flood Risk Categorisation

3.2.1 To assess the NPPF flood risk classification for the site, the first step was to inspect the UK Government web based 'Flood Map for Planning' which is used to inform planning of a site's Flood Zone(s) and the probability of flooding from rivers or sea (not taking into account the presence of flood defences or climate change). However, the web based 'Long Term Flood Risk Assessment for Locations in England' should also be used to identify the long-term flood risks from rivers and seas, surface water and reservoirs.

3.2.2 The Flood Map for Planning is shown below in Figure 3, and it can be seen that the pre-development site is located within an area classified as Flood Zone1 (low probability of flooding from rivers or sea).

Figure 3: Flood Map for Planning (© Crown Copyright)



3.2.3 Further site-specific review of the flood risk to the site is provided in section 4.

3.3 Site Specific Flood Zone Compatibility

3.3.1 The proposals for the development site are likely to fall within the following category:

- Hospitals

3.3.2 Buildings used for dwellings are classed as 'More Vulnerable' development in the Flood Risk Vulnerability Classification (Table).

3.3.3 The site is located within Flood Zone 1 for which 'More Vulnerable' development is deemed to be appropriate. Therefore, the development passes the sequential test and an exception test is not required (refer to the Flood Zone compatibility table in the NPPF technical guidance).

3.4 Sequential Test

3.4.1 The site is categorised as a 'More Vulnerable' development (shown in table 2) and is within Flood Zone 1 therefore the sequential test is not required to be applied (see table 3).

4.0 Hydrological Assessment

4.1 Sources of Flood Risk

- 4.1.1 This study assesses the risk from different types of flooding to the development and the risk of flooding from the development, taking into consideration climate change, as well as how flood risks should be managed. The approach to assessing flood risk at the development site was informed by the requirements of NPPF in conjunction with the client and Environment Agency requirements.

4.2 Fluvial Flooding (Rivers and Streams)

- 4.2.1 Flooding to the site from rivers and sea is indicated below in Figure 4, taken from the UK Government's Long-Term Flood Risk Information.

Figure 4: Long Term Flood Risk Assessment Map – Flood Risk from Rivers or Sea (© Crown Copyright)



It can be seen that the entire area of the site is at a 'Very Low' risk of fluvial flooding. The site is not shown to be in an area which benefits from flood defences. The site has less than a 0.1% chance of fluvial flooding each year. Therefore, the proposed site is considered to be at a very low residual risk from fluvial flooding.

Figure 5: Long Term Flood Risk Assessment (Detailed Information) – Flood Risk from Rivers or Sea (© Crown Copyright)

Flood risk from rivers or the sea

Very low risk means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

4.3 Tidal Flooding (Coastal or Estuarine)

- 4.3.1 There is currently no flood risk identified on the Environment Agency flood maps for the site and it is therefore regarded to be at low risk from tidal flooding.

4.4 Reservoir Flooding

- 4.4.1 Reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The Environment Agency is the enforcement authority and ensures that reservoirs are inspected regularly and essential safety work is carried out.
- 4.4.2 The Long-Term Flood Risk Assessment (Flood Risk from Reservoirs) map shows the site will not be flooded if a reservoir were to fail and release the water it holds (see Figure 6).

Figure 6: Long Term Flood Risk Assessment Map – Flood Risk from Reservoirs (© Crown Copyright)



4.5 Canal Flooding

- 4.5.1 The nearest canal to the site is the Rochdale Canal which is located approximately 2.8 km southeast of the site.
- 4.5.2 The canals are identified in the SFRA as not generally posing a direct flood risk as they are a controlled water body. Therefore, the residual risk of canal flooding is usually associated with lower probability events such as overtopping and/or the breaching of embankments.
- 4.5.3 Given the above information, it is considered that there is low risk of canal flooding to the site.

4.6 Groundwater Flooding

- 4.6.1 The Phase 2 site investigation report indicates groundwater strikes were recorded in four of the boreholes between 2.20 and 18.80m bgl during site investigation. This corresponds to groundwater levels ranging between 72.73 m and 56.15m AOD. The report indicates that the groundwater encountered at shallower depth is perched groundwater within the granular deposits.

Figure 7. Table 5.7a Groundwater Noted during site investigation(Phase 2 Site investigation report)

Borehole Ref.	Water Strikes			
	Strike Depth m bgl (m AOD)	Water Depth after 20 mins m bgl (m AOD)	Strata	Notes
BH01	16.50 (56.81)	14.00 (58.31)	Cohesive Glacial Till	Rising
BH02	14.50 (64.05)	14.50 (64.05)	Granular Glaciofluvial	Stable
BH03	18.80 (56.15)	18.00 (56.95)	Cohesive Glacial Till	Rising
BH05	18.00 (58.51)	17.30 (59.21)	Cohesive Glacial Till	Rising
WS01	2.30 (73.44)	2.30 (73.44)	Granular Glaciofluvial	Stable
WS02	2.20 (72.73)	2.20 (72.73)	Granular Glaciofluvial	Stable

Figure 8. Table 5.7b Groundwater Monitoring Results(Phase 2 Site investigation report)

Borehole Ref.	Installation Strata	Response Zone m bgl (m AOD)	01/09/20	08/09/20	17/09/20	25/09/20	01/10/20	05/10/20
			Depth m bgl (m AOD)	Depth m bgl (m AOD)	Depth m bgl (m AOD)	Depth m bgl (m AOD)	Depth m bgl (m AOD)	Depth m bgl (m AOD)
BH01	Cohesive Glacial Till	15.00 – 18.00 (58.31 – 55.31)	8.45 (64.86)	8.18 (65.13)	*	8.39 (64.92)	*	*
BH02	Granular Glaciofluvial Deposits	14.50 – 17.50 (64.05 – 61.05)	11.00 (67.55)	10.92 (67.63)	11.03 (67.52)	*	*	10.90 (67.65)
BH03	Granular Glaciofluvial Deposits and Cohesive Glacial Till	17.00 – 20.00 (57.95 – 54.95)	6.05 (68.90)	5.60 (69.35)	6.25 (68.70)	4.91 (70.04)	4.58 (70.37)	4.39 (70.56)
BH04	Granular Glaciofluvial Deposits	15.00 – 20.00 (63.63 – 58.63)	9.69 (68.94)	10.40 (68.23)	11.25 (67.38)	11.21 (67.42)	11.18 (67.45)	10.94 (67.69)
BH05	Cohesive Glacial Till	17.00 – 20.00 (59.51 – 56.51)	10.22 (66.29)	10.90 (65.61)	10.63 (65.88)	10.54 (65.97)	10.58 (65.93)	10.22 (66.29)
WS02	Granular Glaciofluvial Deposits	1.00 – 3.00 (71.93 – 71.93)	1.94 (72.99)	1.80 (73.13)	2.00 (72.93)	2.02 (72.91)	2.04 (72.89)	1.97 (72.96)
WS05	Cohesive and Granular	1.00 – 4.00 (77.56 – 74.56)	Dry	Dry	Dry	Dry	Dry	Dry

- 4.6.2 The lowest location of the site is the north corner where the site ties in with Central Drive at 72.74m AoD. The groundwater monitoring Figure 3 for the BH01, which has been carried out in adjacent location, indicates BH01 perched groundwater has been found at levels up to 65.13m AoD. Therefore risk of ground water flooding is considered very low.
- 4.6.3 The proposed buildings lowest finish floor levels are set at 75.5m AoD and 79.775m AoD, External levels are also set higher than the recorded groundwater level.
- 4.6.4 According to the Manchester, Salford and Trafford SFRA, there are no known reports of groundwater flooding in the Manchester, Trafford and Salford authorities.
- 4.6.5 The site is not shown to be within an area at risk of groundwater flooding according to the groundwater flooding map shown within the Manchester, Salford and Trafford SFRA.
- 4.6.6 Based on the current information it is overall assumed that the site is at a low risk of groundwater flooding.

4.7 Public Sewers or Highway Drainage Flooding (Infrastructure Failure)

- 4.7.1 There are no highway drains or public sewer recorded within the site.
- 4.7.2 United Utilities and Manchester City Council have not provided any records of flooding to the site or the vicinity.

- 4.7.3 Providing United Utilities and Manchester City Council maintain their drainage assets in the vicinity of the site, the risk of flooding to the proposed development site from public sewers or highway drainage is considered as low.

4.8 Existing private drainage within North Manchester Hospital

- 4.8.1 The existing hospital site wide drainage has been modelled based on the CCTV survey findings. The modelling indicates that the existing hospital site wide drainage does not have sufficient capacity to accommodate current flows and it is likely that existing flooding problems may be experienced as a result, in Central Drive (north of the proposed development). The modelling indicates that flooding of approximately 17m³ occurs during a 1 in 100 year storm event in the pre-development scenario. The proposed development will result in reduced flows discharging into Central Drive and will therefore reduce the risk of flooding within Central Drive. The majority of the site will discharge surface water to the south of the site.
- 4.8.2 The proposed surface water connection in Central Drive will be limited to 5l/s and attenuation has been sized to accommodate the surface water volumes for the up to the 1 in 100 year +40%cc design event, including an allowance for a surcharged outfall scenario.
- 4.8.3 The Central Drive slopes from east 72.71mAOD (where the flooding is likely) to west 71.06m AOD, therefore any residual flooding risk, as a result of the existing infrastructure (and not as a result of development) will flow towards lowest point in the public highway, away from the development.
- 4.8.4 Overall, the proposed surface water will reduce the risk of flooding to the sitewide drainage network as proposals are to restrict flows by a minimum of 50% of existing discharge rates.
- 4.8.5 The predevelopment and post development site wide drainage capacity assessment has been included in Appendix H.

4.9 Surface Water Flooding to the site

- 4.9.1 Surface water flooding can be caused when rainwater during extreme rainfall events does not drain away through the normal drainage system or soak into the ground with flooding occurring, principally from manholes and gullies. Surcharging sewers can result in overland flows, which, if originating at a higher elevation than a development site, can potentially pose a flood risk.
- 4.9.2 From the UK Government's Flood Risk from Surface Water (extent of flooding) map;
- Where a site is located in a dark blue shaded zone, this indicates that the site is at high risk of flooding, where flooding occurs as a result of rainfall with a greater than 1 in 30 (3.3%) chance in any given year.

- Where a site is located in a mid-blue shaded zone, this indicates that the site is at medium risk of flooding, where flooding occurs as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
- Where a site is located in a light blue shaded zone, this indicates that the site is at low risk of flooding, where flooding occurs as a result of rainfall of between 1 in 1000 (0.1%) and 1 in 100 (1%) chance in any given year.
- Where a site is located in a clear (unshaded) area; this indicates that the site is at very low risk of flooding, where flooding occurs as a result of rainfall with less than 1 in 1000 (0.1%) chance in any given year.

4.9.3 The extent of flooding to the site from surface water is indicated in Figure 9.

4.9.4 The surface water flood maps suggest there is a very low risk of surface water flooding on the vast majority of the site. There is a small area of low risk adjacent to the western boundary of the site, to the north of Ellis Drive.

Figure 9: Risk of Flooding from Surface Water - Extent of Flooding



4.9.5 Considering the above information, the risk of surface water flooding to the site is generally considered very low, with a localised region considered to be at low risk. As such, mitigation measures are proposed in Section 5 in order to account for the low risk of surface water flooding to the site and to ensure that the 'very low' risk can be maintained through development.

4.10 Surface Water Flooding from the site

- 4.10.1 Developers are responsible for ensuring that new development does not increase the flood risk elsewhere. Where new development is proposed, the proposed surface water drainage network shall be designed to not flood for the critical 1 in 30-year storm event and flood water generated up to the critical 1 in 100-year plus climate change storm event shall be constrained within areas on site so as not to cause damage to buildings, essential services or adjoining developments and services.
- 4.10.2 The development has the potential to increase flood risk where additional run-off from proposed roads, paved areas and building roofs are discharged freely into the downstream drainage network. It is therefore encouraged to propose permeable areas, landscaping areas and incorporate sustainable drainage features utilising infiltration or attenuation where possible.
- 4.10.3 The proposed site levels fall towards the site boundary across the vast majority of the site. Therefore, any flooding within the site has the potential to flood the adjacent carriageway.
- 4.10.4 An assessment of the proposed surface flows is carried out within the drainage strategy within Section 7 of this report.

4.11 Historical Flooding

- 4.11.1 United Utilities and Manchester City Council have not provided any records of flooding to the site or the vicinity.

4.12 Summary of Flood Risk

- 4.12.1 From the evidence collated and subsequent negotiations the main types of flooding that may apply to the proposed development site are as follows:
- Surface water flooding to the site
 - Surface water flooding from the site

5.0 Mitigation

5.1 Surface Water Flooding to the site Mitigation

- 5.1.1 The UK Government Long Term Flood Risk Assessment surface water flood maps indicate that the site is at very low to low risk of surface water flooding. However, the site topography is partially reprofiled as part of the development proposals. Therefore, measures outlined in this section are recommended in order to ensure that the risk of surface water flooding to the post-development site shall not be increased and shall be reduced where possible.
- 5.1.2 It is proposed external ground levels across the site should fall away from the proposed buildings in a manner which does not create low points, where water might collect unintentionally. This will ensure that any surface water will not flow towards the proposed buildings. The proposed surface water drainage network shall be designed to accommodate flows generated from within the site.
- 5.1.3 It is assumed that the surface water drainage outside of the site boundary will be subject to the regular existing drainage maintenance schedule.
- 5.1.4 Providing the above measures are implemented the flooding risk to the development site from surface water is therefore considered low post development.
- 5.1.5 A detailed assessment of the proposed surface flows is carried out within the drainage strategy within section 6 of this report.

5.2 Surface Water Flooding from the site Mitigation

- 5.2.1 Any new development site drainage should be designed in accordance with current best practice to provide adequate capacity not to flood for the critical 1 in 30-year storm event and flood water generated from up to the critical 1 in 100-year plus climate change storm event shall be constrained within the areas on site so not to cause damage to buildings, essential services or adjoining developments & services.
- 5.2.2 Section 6 reviews the surface water discharge options, and it is proposed (in accordance with United Utilities Pre-Development Enquiry response) that the surface water will outfall into the public combined water sewer within Crescent Drive.
- 5.2.3 To minimise localised flooding within the site, the drainage design should ensure that gullies, drainage channels and drains are all suitably sized to accommodate peak storm flows. Also, all inlet features should have suitably sized sumps to catch silts and should be subject to a documented routine maintenance and cleansing regime.
- 5.2.4 Flood water exceedance routes should be identified, both on and off site.

5.2.5 For any sustainable drainage systems employed in the development, an appropriate management and maintenance plan for the sustainable drainage system for the lifetime of the development should be submitted which should include:

- Arrangements concerning appropriate funding mechanisms for its on-going maintenance of all elements of the sustainable drainage system (i.e. inspections, regular maintenance)

5.2.6 Assuming that the proposed drainage system is designed to provide adequate capacity, and that the private drains will be maintained, it can be assumed risk of flood from blockage or overloading is minimal.

6.0 Drainage Strategy

6.1 Existing Drainage

- 6.1.1 There are no public sewers recorded within the site. There is an existing combined surface water sewer located in Eyam Street, adjacent to the southwestern boundary of the site. (Manhole Refs 8001 -8007)

Figure 8: Extract from UU Sewer Records



- 6.1.2 The Underground Utility Survey Records provides invert levels for these manholes. The existing drainage 8001-8006 is too shallow to proposed new connection from the development, therefore it is proposed to re-use the existing connection from the site to UU manhole 8007.

6.2 Masterplan Drainage

- 6.2.1 The scheme forms part of a wider development across the hospital site. A drainage masterplan is currently under development to provide drainage, including SuDs features to this wider area. The details of the masterplan were not available at the time of writing this report.
- 6.2.2 Consideration has been made regarding connection of the proposed site drainage into the masterplan drainage.
- 6.2.3 The wider development will be constructed in a number of phases; the full masterplan drainage will not be fully developed until after the proposed site has been constructed. The proposed drainage is currently considered as a standalone scheme, with consideration to existing drainage only.
- 6.2.4 As noted in section 4.8.1 the hospital site wide network in Central Drive does not have sufficient capacity to accommodate current flows and it is likely that existing flooding problems may be experienced as a result. Therefore, the drainage proposals are to limit the flows to Central Drive as far

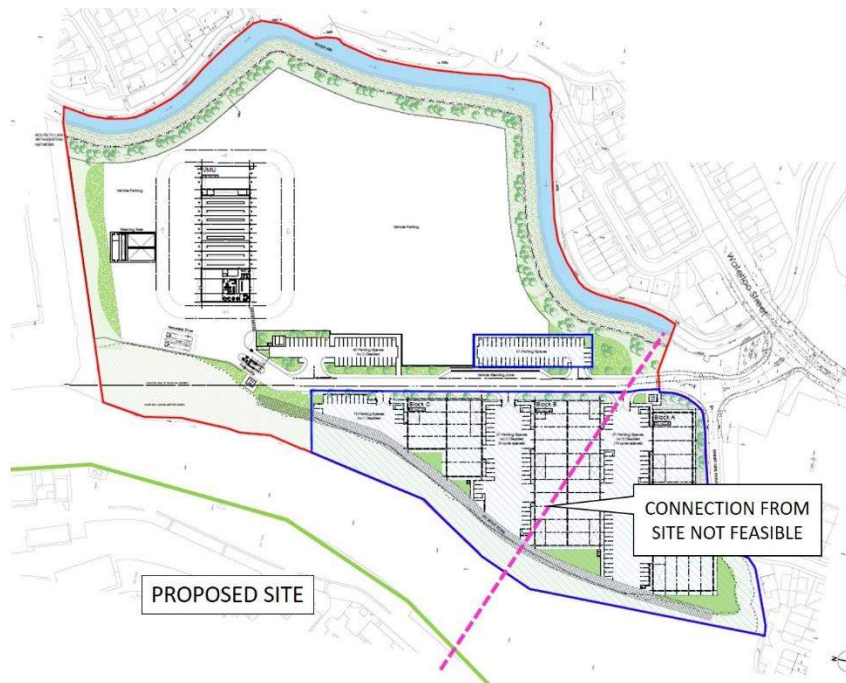
as practicable and connect the majority of flows into the existing drainage which discharges to the UU combined sewer to the south of the site.

- 6.2.5 As noted above, flows will be limited as far as possible into Central Drive, however as the lowest area of the site is the north corner where the site ties in with Central Drive at 72.74m AOD, it will be necessary to discharge some of the site catchment into Central Drive to provide a rationalised overall drainage network. This will in turn, decrease the excavation for proposed western drainage network, which will be discharged to the south of the site. It has been proposed that lowest external area near the access will be connected to existing drainage in Central Drive and will be limited to a maximum of 5l/s and attenuation has been sized to accommodate the surface water volumes for the up to the 1 in 100 year +40%cc design event, including an allowance for a surcharged outfall scenario. It is proposed that the pipe will be reconnected to wider masterplan newly constructed drainage system when it is built.
- 6.2.6 Due to the levels of the site, the proposed drains within Crescent Drive are too high to accept drainage from the eastern part of the site, and also does not have sufficient capacity for the proposed flows.

6.3 Connection to Watercourse

- 6.3.1 The closest watercourse is the River Irk, located approximately 300m to the east from the site at its closest point.
- 6.3.2 The LLFA were contacted regarding the discharge rate and outfall options. A connection to the watercourse was stated as the preferred option.
- 6.3.3 A connection to the watercourse has been considered. Received level information indicates that a gravity connection to the river is possible. However, there is a large amount of third party land between the site and the river. There are currently proposals for the area to the east of the site, which does not provide any space to construct a drainage connection.
- 6.3.4 Figure 9 shows the proposed development in relation to the site and watercourse.

Figure 9: Extract from Proposed Adjacent Works



6.3.5 Considering the above, a connection to the watercourse is not considered to be a feasible option

6.4 Proposed Surface Water Drainage

6.4.1 Any new development site drainage should be designed in accordance with current best practice to provide adequate capacity not to flood for the critical 1 in 30-year storm event and flood water generated for up to the critical 1 in 100-year plus climate change storm event shall be constrained within the areas on site so not to cause damage to buildings, essential services or adjoining developments and services.

6.4.2 In following the standard hierarchy of drainage solutions, consideration should firstly be given to the discharge of surface water runoff by sustainable methods such as infiltration.

Infiltration

6.4.3 Infiltration features are not permitted to be constructed within 5m of a structure. The site layout, and the extensive requirement for retaining structures, means that there is not sufficient space to construct large infiltration features.

6.4.4 Preliminary indications from the boreholes logs, and the on-site investigation works, are that the ground is made up of sand, with thick and thin clay bands. This could lead to issues with infiltrated water becoming trapped within the bands of sand, and causing flooding within the site.

6.4.5 The Phase 2 site investigation report also indicates that contamination risk is very low.

- 6.4.6 Falling head tests were undertaken within 2 window samples shown in figure 10. The results suggest soakaway drainage may be feasible in parts of the site within shallow granular Glaciofluvial deposit, however the extent of this is unlikely to accommodate the sitewide drainage volumes.

Figure 10. Table 11 Falling test Results(Phase 2 Site investigation report)

Location	Test 1 Permeability Coefficient	Test 2 Permeability Coefficient	Test 3 Permeability Coefficient
WS02	1.78 x 10 ⁻¹ m/s	1.38 x 10 ⁻¹ m/s	1.68 x 10 ⁻¹ m/s
WS05	2.43 x 10 ⁻¹ m/s	3.60 x 10 ⁻² m/s	2.38 x 10 ⁻² m/s

- 6.4.7 Based on the above, localised small soakaways have been included in landscape areas to allow some localised infiltration.
- 6.4.8 Shallow Arbocells have been proposed under the soft landscape/trees in the entrance area to the north. It is recommended that soakaway tests should be carried out at the bottom of designed Arbocells to investigate if partial infiltration is feasible, which may reduce the volumes to the existing drainage in Central Drive.
- 6.4.9 Therefore, it is considered that infiltration is not a feasible option for whole site, however infiltration method will be used where suitable.

Watercourse

- 6.4.10 A connection to the watercourse has been considered in section 6.3, and is not considered to be a feasible option.
- 6.4.11 **Surface Water Sewer**
- 6.4.12 There are no main surface water sewers located in the vicinity of the site.

Combined Water sewer

- 6.4.13 There are 2 connection from site proposed
- It is proposed to connect the surface water from west and east to the public sewer in the south utilising the existing private combined connection from site. The private existing combined drainage is connected to UU Manhole Ref. 8007 Eyam Road/ Crescent Drive.
 - It is proposed to connect the North external area near the entrance to the existing drainage within Central Drive. It is noted that partial infiltration will be utilised if confirmed sufficient.
- 6.4.14 Table 6 summarises the options for surface water disposal.

Table 6: Surface Water Disposal

SURFACE WATER DISPOSAL	POTENTIAL	DESCRIPTION
Infiltration	X	There is will not be sufficient space for infiltration SuDS features, and ground conditions. Partial infiltration has been proposed.
Watercourse	X	A new connection to the watercourse is not considered a viable option as it too great a distance and would have to pass through third-party land.
Surface Water Public Sewer	X	There is no surface water sewer within the vicinity of the site.
Combined Public Sewer	✓	Discharge to combined water sewer within Crescent Drive, utilising existing connection and to the public sewer system via the existing network in Central Drive via a new connection.

Existing & proposed flow rates

- 6.4.15 Models of the existing on-site drainage networks have been produced, based on the information provided in the Underground Utility Survey and CCTV survey. Using Microdrainage software, these models have been analysed to provided estimates of the existing flow rates for the 1, 30 and 100-Year period storm events.
- 6.4.16 The model created required some interpolation from the Utility Survey, as there were some unconfirmed conenctions within the information.
- 6.4.17 The existing impermeable area within the site has been estimated at approximately 23,359m². This is served by four drainage catchments within the site.
- Catchment A (approx. 2,710m²) is served by a combined drain, which exits the site via a 475mm diameter drain, connecting into the private public sewer in Central Drive, at Manhole MH102.
 - Catchment B (approx. 5,540m²) is served by a combined drain, which exits the site via a 225mm diameter drain, connecting into the private drainage network to the west of the site, at Manhole MH020.
 - Catchment C (approx. 8,075m²) is served by a combined drain, which exits the site via a 300mm diameter drain, connecting into the private drainage network to the west of the site, at Manhole MH169.

- Catchment D (approx. 7,034m²) is served by a combined drain, which exits the site via a 375mm diameter drain, connecting into the public sewer in Central Drive, at UU Manhole Ref 8007.

6.4.18 The existing and proposed allowable flow rates, including a 50% reduction in flow, are summarised in Table 7.

Table 7: Existing and Proposed Rates

Existing Drainage Area	2-Year Event (l/s)	30-Year Event (1m Surcharge) (l/s)	100-Year Event (1m Surcharge) (l/s)
Area A	38.4	71.5	92.3
Area B	78.1	117.4	132.4
Area C	60.5	71.5	80.3
Area D	84.5	171.5	190.8
Site Total	262	432	496
Total Allowable Discharge (50% Reduction)	131	216	248

6.4.19 The LLFA have been consulted regarding discharge rates (refer to *Appendix E*). They have recommended that the site drains at brownfield with 50% reduction from existing discharge rates.

6.4.20 The proposed flow rates has been reduced 50% from the existing and agreed with United Utilities coorespondance has been included in *Appendix E*, the existing network model and existing catchments have been included in *Appendix F*.

Climate change

6.4.21 In February 2016, the Environment Agency released updated climate change allowances for peak rainfall intensities which should be applied to new developments. Table 8 demonstrates the climate change allowances with central and upper end allowances being considered.

6.4.22 Based on the nature of the development, a lifespan in excess of 60 years is anticipated. An allowance of 40% for climate change on peak rainfall intensity will be included in calculations.

Table 8: (Extract Environment Agency Guidance) Peak Rainfall Intensity Allowance in small and urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

6.4.23 The proposed drainage system will require attenuation storage for the 30-Year and 100-Year (including 30% climate change) return period storm events.

6.4.24 The proposed surface water drainage is served by four surface water systems:

- The western side of the site (approx. 10,000m²) connects into the proposed combined drainage at Manhole C1 (Outfall 1).
- The eastern portion of the site (approx. 7,500m²) connects into the proposed drainage at Manhole C1. (Outfall 2).
- The north entrance area (approx 2,500m²) connects into the existing drainage in Central Drive (Outfall 3).
- The proposed car park (approx 1,935m²) connects into the existing surface water drainage in Central Drive at manhole MH90. (Outfall 4).

- 6.4.25 The car park (Outfall 4) contains approximately 933m² of existing impermeable area, which is 4% of the total existing impermeable area. The allowable discharge rates for this area have been calculated on a pro rata basis, based on the total allowable discharge rates.
- 6.4.26 The discharges from the western, eastern and north side of the site are subject to separate flow controls.
- 6.4.27 The north external entrance area of the site will be connected to the existing drainage within Central Drive. As the greenfield rate for the area is lower 2l/s, to prevent from blockages using a small flow control the surface water has been limited to 5l/s.
- 6.4.28 The remaining allowable discharge rates have been split between outfalls 1&2 on a pro-rata basis.
- 6.4.29 The western side of the site includes an allowance for part of the proposed road (approx. 0.17 Ha) to the western boundary of the site. The drainage for the road may be connected to the masterplan drainage, however this is to be still confirmed.
- 6.4.30 The allowable overall discharge flow rates are given in Table 7 and outfall specific included in in table 9.
- 6.4.31 Surface water drainage networks have been modelled using Microdrainage software for Outfalls 1,2&3 to estimate the required attenuation volumes. The calculations have been included in *Appendix G*.
- 6.4.32 The storage requirement for Outfall 4 has been calculated using a Quick Storage estimate in MicroDrainage software, and the storage requirement is between 47-82m³.
- 6.4.33 It is assumed that the car park will incorporate permeable paving; given the gradient of the car park, this will provide approximately 12m³ of storage within the sub-base. Therefore, it is assumed that approximately 70m³ of cellular storage. It may be possible to increase the storage volume within the permeable sub-base using check dams within the sub-base, but this should be confirmed at detailed design.
- 6.4.34 These volumes are estimates and will be subject to change through the detailed design process. The attenuation volumes are provided by two cellular storage tanks: The required attenuation volumes are given in Table 9.

Table 9: Attenuation Volumes:

ATTENUATION DETAILS									
REF	U/S MANHOLE	BASE LEVEL	MIN COVER LEVEL	MINIMUM COVER DEPTH	LOADING	LENGTH 'X'	WIDTH 'Y'	DEPTH 'Z'	VOLUME
TANK 1	SA7	70.94	75.15	2.21	PEDESTRIAN	10m	8.5m	2.0m	162m ³
TANK 2	SB23	71.28	73.94	1.06	HEAVY VEHICLES	10m	9.5m	1.6m	144m ³
TANK 3	N8A	71.52	72.32	0.80	PEDESTRIAN	10.81m	10.51	0.8m	87.3m ³
ARBOCEL 1	N7	72.64	73.530	0.20	PEDESTRIAN	N/A	N/A	0.2m	15.6m ³
ARBOCEL 2	N15	72.59	73.050	0.10	PEDESTRIAN	N/A	N/A	0.2	36.0m ³

- 6.4.35 The modelling for the 30 and 100-year events have been calculated with a 1m surcharge to the outfalls, in accordance with UU's requirements.
- 6.4.36 The proposed drainage strategy, proposed catchment plan, and the results of the Microdrainage modelling are available in *Appendix G*.
- 6.4.37 The proposed drainage network sits within a single curtilage, and it is not possible to put this drainage forward for adoption by UU. The site owner will be responsible for maintenance, either directly, or through an appointed site management provider.
- 6.4.38 Section 106 agreements (indirect connection) will be required for the proposed surface water connections.
- 6.4.39 All external areas have been designed to fall away from the proposed buildings. If a storm event in exceedance of the 1 in 100-year event occurs, water will flow either towards a carriageway or soft landscaped area.
- 6.4.40 Surface water run-off from hard paved areas at risk of contamination should receive water quality treatment. Figure 10 illustrates the pollution hazard indices for different land use classifications from The CIRIA SuDS Manual C753 (2015).

Figure 11: Pollution Hazard indices for land use classification (Table 26.2 the CIRIA SuDS manual 2015)

TABLE 26.2 Pollution hazard indices for different land use classifications				
Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways ¹	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways ¹	High	0.8 ²	0.8 ²	0.9 ²

6.4.41 Figure 12 illustrates the SuDS Component mitigation indices from The CIRIA SuDS Manual C753 (2015).

Figure 12: Indicative SuDS mitigation indices (Table 26.3 the CIRIA SuDS manual 2015)

TABLE 26.3 Indicative SuDS mitigation indices for discharges to surface waters				
Type of SuDS component	Mitigation indices¹			
	TSS	Metals	Hydrocarbons	
Filter strip	0.4	0.4	0.5	
Filter drain	0.4 ²	0.4	0.4	
Swale	0.5	0.6	0.6	
Bioretention system	0.8	0.8	0.8	
Permeable pavement	0.7	0.6	0.7	
Detention basin	0.5	0.5	0.6	
Pond ⁴	0.7 ³	0.7	0.5	
Wetland	0.8 ³	0.8	0.8	
Proprietary treatment systems ^{5,6}	These must demonstrate that they can address each of the contaminant types to acceptable levels for frequent events up to approximately the 1 in 1 year return period event, for inflow concentrations relevant to the contributing drainage area.			

Notes

- 1 SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters.
- 2 Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements, and this should be taken into account in the design and Maintenance Plan.
- 3 Ponds and wetlands can remove coarse sediments, but their use for this purpose will have significant implications with respect to the maintenance requirements and amenity value of the system. Sediment should normally be removed upstream, unless they are specifically designed to retain sediment in a separate part of the component, where it cannot easily migrate to the main body of water.
- 4 Where a wetland is not specifically designed to provide significantly enhanced treatment, it should be considered as having the same mitigation indices as a pond.
- 5 See **Chapter 14** for approaches to demonstrate product performance. A British Water/Environment Agency assessment code of practice is currently under development that will allow manufacturers to complete an agreed test protocol for systems intended to treat contaminated surface water runoff. Full details can be found at: <http://tinyurl.com/qf7yuj7>
- 6 SEPA only considers proprietary treatment systems as appropriate in exceptional circumstances where other types of SuDS component are not practicable. Proprietary treatment systems may also be considered appropriate for existing sites that are causing pollution where there is a requirement to retrofit treatment. SEPA (2014) also provides a flowchart with a summary of checks on suitability of a proprietary system.

- 6.4.42 The selection of treatment should ensure that the SuDS mitigation component index (Figure 10) exceeds the pollution hazard index (Figure 9).
- 6.4.43 Roof gardens are proposed for the buildings, these are shown on the roof plan, enclosed in *Appendix A*.
- 6.4.44 Pedestrian hard landscaping fall towards soft landscaping areas, where will be collected by land drains. Small soakaways have been proposed by Landscape Architect within soft landscape area to allow water to infiltrate where possible.
- 6.4.45 The facilities management yard area and access ramp is subject to HGV access. A class 2 full retention interceptor has been proposed.
- 6.4.46 The proposals for pollution protection should be agreed with The Environment Agency and Manchester City Council.
- 6.4.47 The final design of the drainage networks shall be in accordance with the legislation set by the Environment Agency, Manchester City Council and United Utilities.

6.5 Proposed Foul Water Drainage

6.5.1 A separate foul and surface water system is proposed.

6.5.2 The proposed foul water drainage is served by foul water systems:

- The western side of the site (Outfall 1 – 17.5 l/s) connects into the proposed combined drainage diversion at Manhole C1.
- The eastern portion of the site (Outfall 2 – 15.7 l/s) connects into the proposed drainage diversion at Manhole C3.

6.5.3 United Utilities have confirmed in their pre-development enquiry response that foul water flows from the development can be accommodated within the public combined sewer within the vicinity of the site and can be connected at convenient locations. Refer to the United Utilities correspondence enclosed in *Appendix E*.

6.5.4 A Section 106 agreement will be required for the proposed foul connections.

6.5.5 The proposed drainage strategy is enclosed in *Appendix G*.

7.0 Maintenance

- 7.1.1 This section is intended to give an overview of the operation and maintenance for the drainage features included with the drainage strategy and in relation to typical details. Where proprietary products are specified, the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.
- 7.1.2 The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

7.2 Components

- 7.2.1 The following components have been included within the drainage design for the proposed development:
- Pipes
 - Gullies
 - Attenuation Tank
 - Flow Control Unit
- 7.2.2 The maintenance strategy should be implemented to ensure the drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.
- 7.2.3 Maintenance of the private drainage network will be the responsibility of an on-site facilities management team.
- 7.2.4 It is recommended that the drainage system is inspected as a minimum twice a year, with the system also being inspected after any major storm event.
- 7.2.5 Significant sediment deposition is likely in areas used for storage, so a post clean-up operation may be required including the removal of litter, vegetation, sewerage debris and larger objects.
- 7.2.6 Long-term management practices include monthly sweeping of external paved areas. The sweeping program will remove sand and contaminants directly from paved surfaces before they become mobilised during storm events and transported to the drainage system.
- 7.2.7 During the winter months, drainage features such as gullies and channels should be cleared of ice, snow, debris or litter
- 7.2.8 Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as the filter drains and the upstream/downstream chambers.

7.3 Inspection, Manhole and Catchpit Chambers

- 7.3.1 Access points have been located at the head of each run, at a change in direction and at a change of pipe size in accordance with Building Regulations Part H.
- 7.3.2 The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained from the Maintenance Manager prior to any access.

7.4 Pipes

- 7.4.1 Pipes are proprietary products and the materials can vary across the site and as such where used the manufacture's recommendations should be followed. Regardless of the product used the pipes will be fully compliant with the Curtins drainage specification.
- 7.4.2 Pipes are intended to be the main conveyance across the development and where oversized they form the attenuation volume required by the limitation of the discharge rate. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.
- 7.4.3 Access for maintenance is provided through access chambers and manholes.

- 7.4.4 Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Initial Inspection should be provided as post construction CCTV survey.	N/A
Regular maintenance\ inspection	Inspect for evidence of poor operation via water level in chambers. If required take remedial action.	3-monthly, 48 hours after large storms.
	Check and remove large vegetation growth near pipe runs.	Monthly or as required
Remedial Action	Rod through poorly performing runs as initial remediation.	As required.
	If continued poor performance jet and CCTV survey poorly performing runs.	As required.
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required If above does not improve performance.

7.5 Gullies

- 7.5.1 Channels and gullies should be inspected and cleaned in accordance with the manufacturer's details. Channel units can be cleaned through the use of a high-pressure hose; this can be fed into the channel system through access units strategically placed along the channel run. The throat section of channel units should be kept clear at all times to ensure uninterrupted flow of surface water into the drainage channel and any debris within the throat should be removed.
- 7.5.2 Locking bolts should be replaced and sufficiently tightened, taking care that the bolt heads do not stand above the top surface of the cover or grate. If covers are allowed to move within their frame, this may cause damage to the frame or seating.
- 7.5.3 Sediment/material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols; especially where run-off is taken from potentially contaminated areas such as the car park channels.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Initial Inspection.	Half yearly and after large storms.
Regular maintenance\ inspection	Litter and debris removal	Monthly or as required.
	Check and remove large vegetation growth near gully gratings.	Monthly or as required
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies. Silt can also be caused by adjacent	3-monthly, 48 hours after large storms.

	landscaping areas which should be reprofiled to provide a flat area or berm adjacent to the paving.	
Remedial Action	Inspect sumps and outlet pipes and rod through poorly performing channels and outlets as initial remediation.	As required.

7.6 Permeable Pavements

- 7.6.1 Permeable pavements contain proprietary products and as such, where used, the manufacturer's recommendations should be followed.
- 7.6.2 The permeable pavements are intended to be water quality and attenuation storage features. These features are intended to be dry except during rainfall events.
- 7.6.3 The surface has been designed to contain gaps where rain can flow through the upper construction layers into the voided stone which makes up the subbase. Where these features are intended to be used as infiltration devices or soakaways any capping also needs to be permeable to permit the flows to the formation.
- 7.6.4 Access for maintenance is provided as this is a surface feature only.
- 7.6.5 Regular inspection and maintenance are important for the effective operation of the pervious pavement.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Initial Inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action.	3-monthly, 48 hours after large storms.

	Inspect silt accumulation rates and establish appropriate brushing frequencies. Silt can also be caused by adjacent landscaping areas which should be reprofiled to provide a flat area or berm adjacent to the paving.	
Regular maintenance\ inspection	Brushing and Vacuuming	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required and as per landscape architect's specification.
	Removal of weeds	As required.
Remedial Action	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required.
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required.
	Rehabilitation of surface and upper sub-structure. This could include replacement of the jointing and bedding material. The upper geotextiles layer may also need replacing if clogged	As required (if infiltration performance is reduced as a result of significant clogging).

	and Terram 1000 has a life span of 25 years.	
--	--	--

7.7 Attenuation Tanks

- 7.7.1 The attenuation tanks are currently specified as geocellular units, which are wrapped in a geotextile blanket.
- 7.7.2 The geocellular units and geotextile are proprietary products and therefore manufacturer's recommendations should also be taken in to consideration.
- 7.7.3 Access for maintenance should be provided by an access shaft located on the tank and from the manhole chambers downstream of the tank.
- 7.7.4 Regular inspection and maintenance is important for the effective operation of attenuation tanks as designed. As the feature is buried, a regular inspection regime is very important to ensure the correction functionality of the surface water drainage network.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets, outlets and overflows for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
Regular maintenance\ inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly

	Remove sediment from pre-treatment structures.	Annually (or as required after heavy rainfall events)
Remedial Actions	Repair/rehabilitation of inlets, outlets and overflows.	As required.

7.8 Flow Control Units

7.8.1 The flow control units are intended for flood control and flow restriction.

7.8.2 The flow control is specified as Hydro-brake and is a proprietary product; therefore, manufacturer's recommendations should also be taken in to consideration.

7.8.3 Access for maintenance has been provided by locating within manhole chambers.

Maintenance Schedule	Required Action	Frequency
Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required).	Inspect inlets for blockages, and clear if required. If faults persist jetting and CCTV survey may be required.	Monthly and after large storms.
Regular maintenance\ inspection	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly.
	Debris removal from catchment surface (where may cause risks to performance).	Monthly



	Remove sediment from pre-treatment structures and flow control chambers.	Annually (or as required after heavy rainfall events)
Remedial Actions	Repair/rehabilitation of inlets.	As required.

Appendix A

Site Layout

Roof Plan



KEY	
NBS	FM Service Yard (Macadam)
Q22.107J	Black Macadam Footpaths
Q22.175J	1.5m width Macadam Maintenance MEWP Path to Building Perimeter with upstand kerb
Q22.175J	Coloured Macadam (buff) to Private Courtyards & Gardens
Q22.176J	Coloured Macadam (Buff) to Main Arrival Space (Vehicular Load)
Q22.178J	Timber Effect Paving (Concrete) to Arrival Space Seating Niches, Cafe Terrace, Circular Terraces & Courtyards
Q25.120A	Soft Rubber Surfacing to Courtyards & Gardens
Q26.360A	Modular Flag Surfacing to Roof Gardens (Pedestrian Load)
Q25.120C	Timber Decking Effect Paving to Roof Gardens
Q25.120A	White Decorative Loose Gravel, Pebbles & Cobbles to Visual Courtyards
Q23.165J	Concrete Stepping Stone Paving in Sedum Planting
Q25.121J	Grass Lawns to Arrival Space, Gardens & Courtyards
Q30.400	Wildflower & Grass Seed Mix to Perimeter Areas
Q30.400	Vehicle Overrun Edge Reinforcement at Arrival Space norm 640mm wide
Q25.185J	Low/Ground Cover Native & Ornamental Perimeter Planting
Q31	Sensory Ornamental Planting Within Courtyards, Gardens & Arrival Space with Specimen Shrubs & Grasses
Q31	Screen Hedge to Inside of Security Fence Single row
Q31	Native Hedge - Double Staggered Row with Post & Wire Fence (F5) to Centre-line
Q40.150	300mm Sedum Edge to Building at Ground Level Inner Courtyards/Gardens Only
Q31.440	Native / Ornamental Trees
Q37.400	Arrival Space Seating Niches with Feature Pines See Tree pit detail TP2/D411 on Drg 0411
Q31	Bamboo / Medium Feature Shrub to Gardens & Courtyards
Q31	Low Level Feature Shrubs to Gardens, Courtyards & Roof Gardens
D41.211J	Gabion wall (height varies)
Q10.195J	Low Ribbon Wall / Seating Walls to Arrival Space Seating Niches & Planting Beds
D41.520A	PL1 Timber Sleeper Raised Planter to Cafe Terrace
Q10.196J	PL2 Powder Coated Steel raised planters (450mm high) to Cafe Terrace
Q10.197J	PL3 Powder Coated Steel raised planters (450mm high) to Roof Gardens
Q40.125A	4.0m Security Weld-mesh Fencing to Outer Courtyards & Gardens
Q40.560A	3.5m Security Weld-mesh Fencing to Inner Courtyards & Gardens
Q40.125A	2.4m Security Weld-mesh Fencing to FM Yard Compounds
Q40.560A	2.4m Timber palisade Fence to PICU Garden & FM Yard
Q40.310J	1.2m Post & Wire Fence to Centre-line of Hedge
Q40.150	Balustrade to top of Retaining Wall (L37.160 to Part K). Step Handrail (L37.150 to Part M requirements)
L37.110	Sloping Roof / Flat Roof
L37.150	Proposed 0.5m Contours
L37.160	GROUP 1 FURNITURE
Q50.190A	Stainless Steel Ballards
Q50.196	Drop Ballard Variant
Q50.210	Cycle Stands
Q50.219A	B1A Curved Segment Timber Bench to Arrival Space
Q50.220A	B2 Linear Bench to Arrival Space
Q50.220C	B4 Timber Bench's with Arm & Backrest
Q50.225A	B5 Solid Bench's (coloured)
Q50.225B	B6 Coloured Stools/Tub Seats
Q50.240	Litter Bins to Arrival Space
GROUP 2 FURNITURE	
External Gym Equipment	to be Supplied by GMMHT
Refuse Collection Bins	to be Supplied by GMMHT
GROUP 3 FURNITURE	
Dining Tables & Picnic Benches	to be Supplied by GMMHT
GMMHT trust to provide own fitness equipment that will be located and fixed in various gardens by contractor. Exact equipment to be positioned on detailed plans.	

NOTES:

DO NOT SCALE. Use figured dimensions only. The contractor is requested to check all dimensions before the work is put in hand. Copyright of this drawing belongs solely to Iteriad Ltd ©. This drawing must only be used for the purpose for which it is supplied and its contents must not be reproduced for any purpose without written permission. Areas indicated, or areas calculated from this drawing should be used for valuation purposes or as the basis for development contracts. Iteriad Ltd is a limited liability company registered in England and Wales. Number 7966573

NOTES:

Based on GDA Building floor plans:
NMGNPH-GDA-VV-00-DR-A-0001 - Lower GF
NMGNPH-GDA-VV-01-DR-A-0001 - Upper GF

To be read in conjunction with Landscape Series GA's:
NMGNPH-ITR-00-XX-DR-L-0010
NMGNPH-ITR-XX-XX-DR-L-0100 (Lower GL West)
NMGNPH-ITR-XX-XX-DR-L-0200 (Upper GL East)
NMGNPH-ITR-XX-XX-DR-L-0300 (Roof Gardens)

Construction Details series:
NMGNPH-ITR-XX-XX-DR-L-0400

NBS Specification:
NMGNPH-ITR-VV-XX-SP-L-2001

Schedules:
NMGNPH-ITR-VV-XX-SH-L-1000 (Planting)
NMGNPH-ITR-VV-XX-SH-L-1001 (Components)

P11	Updates for planning	AP	KH	08.12.21
P10	Design coordination	AP	KH	04.10.21
P09	Updated to latest floor & roof plans	AP	KH	08.09.21
P07	Bench numbers reduced	AP	KH	16.03.21
P06	Grass reinforcement to arrival sp added	AP	KH	17.02.21
P05	Minor updates	AP	KH	05.02.21
P04	Layout updated	AP	KH	14.01.21
P03	Furniture updated & minor adjustments	AP	KH	17.11.20
P02	Issue for Information	AP	KH	03.11.20
P01	Issue for Planning	AP	KH	29.09.20

REV	DETAILS	DRAWN BY	CHECKED BY	CHECKED DATE
CLIENT				

Greater Manchester
MH NHS FT

MASTERPLANNERSLANDSCAPE ARCHITECTS

Studio
2 Crayford Cottages,
Worsley,
Greater Manchester,
M28 9LQ
T: (+44) 15394 43018
E: studio@iteriad.com
W: www.iteriad.com

PROJECT TITLE

New Park House NMGH

DRAWING TITLE

OVERALL LANDSCAPE SITE PLAN
WITH ROOF PLAN

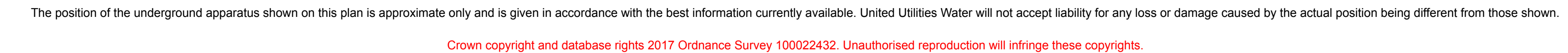
SCALE	DRAWN BY	DATE
1:500@A1	AP	29.09.20

PURPOSE	STATUS
For Review & Comment	S3

JOB/DRAWING NUMBER	REVISION
NMGNPH-ITR-00-XX-DR-L-0010	P11

Appendix B

United Utilities Public Sewer Records



SEWER RECORDS United Utilities

Appendix C

Topographical Survey

GRP survey

Plan of Existing Retaining Walls



LEGEND			
Buildings	Overhead Cable	Inspection chamber	Bollard
Wall	Concrete edge	Pipe insert	Buried bollard
Kerb line	Traffic edge	Gully	Busstop box
Line marking	Green verge	Down pipe	Vent pipe
Drop kerb	Carriageway	Pipe above ground	Groundlight
Carriageway	Footpath	Manhole	Cable box
Bus Top	Top Boundary	Water level	Side
Station and Name	Station Level	Flood light	Internal floor level
Area of Undergrowth	Telegraph post	Lamp post	Threshold level
Hedge	Electricity post	Traffic light	Sign post
Ridge Level	Stop sign	Stop sign	Traffic
Even Level	Gas valve	Gas valve	Control box
Flat Roof Level	Wash out	Wash out	Retaining wall
Gully	Gas valve	Gas valve	Unable to lift
Intervenor	Wash out	Wash out	Tree canopy level
Wall Mark	Road & Rail	Road & Rail	Multi Road
Road & Rail	Cable to	Cable to	Tree Stump
Road & Wire	Cable to	Cable to	Corner level
Chain Link	Gas meter post	Gas meter post	Invert level
Wooden Panels	Split	Split	
Concrete Panels			
Steel Palisade			

NOTES

This plan should only be used for its original purpose. Axis Surveys accepts no responsibility for the plan if applied to any party other than the original client. Do not scale. All dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore no allowance has been made for any sub surface entry into manholes, channels or voids. Therefore any details relating to depths, sizes, etc will be approximate only.

The contractor is to check and verify all building and site dimensions, levels and street invert levels at connection points before work starts.

Should there be any conflict between the details indicated on this drawing and those indicated on other drawings, the engineer should be informed prior to construction on site.

It is important to note that the same accuracies implied by the plotting scale are equally applicable to digital data supplied for CAD.

Every effort is made to identify all visible above ground features, however it is should be borne in mind that there may be items obscured at the time of survey.

Visible features in the vicinity of the boundaries, as shown on this survey may not represent the extent of legally conveyed ownership.

THIS SURVEY HAS BEEN ORIENTATED TO THE ORDNANCE SURVEY (O.S.) NATIONAL GRID COORDINATE (NVA 40) GLOBAL POSITION SYSTEM (GPS) AND THE U.S. ACTIVE NETWORK (S.S. NET).

A TRUE COORDINATE HAS BEEN ESTABLISHED NEAR TO THE SITE CENTRE VIA A TRANSPORTATION USING THE O.S. GRID & ORDNANCE TRANSFORMATION MODELS. THE SURVEY HAS BEEN CORRELATED TO THIS POINT AND A FURTHER ONE OR MORE COORDINATE POINTS ESTABLISHED TO CREATE A TRUE O.S. BEARING FOR ANGLE ORIENTATION.

SURVEY STATION INFORMATION			
Station	Easting	Northing	Level
AX1	384558.311	402242.528	73.746
AX2	384587.000	402210.983	73.141
AX3	384555.325	402175.382	74.827
AX4	384548.685	402169.794	73.081
AX5	384537.389	402125.329	74.827
AX6	384776.706	402171.443	74.120
AX7	384586.000	402125.281	77.611
AX8	384533.658	402095.152	75.793
AX9	384511.522	402093.872	73.589
AX10	384542.201	401998.478	71.707
AX11	384521.955	402053.794	74.585
AX12	384543.111	402098.633	75.631
AX14	384599.203	402114.816	77.270
AX15	384543.111	402098.633	76.797
AX16	384556.526	402108.892	76.854
AX17	384579.730	402147.375	77.918
JL1	384526.413	402290.217	71.687
JL2	384587.219	402277.382	72.352
JL3	384581.510	402295.266	73.817
JL4	385011.622	402226.202	74.488
JL5	385054.724	402231.363	73.762
JL6	385052.009	402114.432	71.189
JL7	385071.937	402170.480	72.628
JL8	385055.611	402109.870	70.818
JL9	385022.741	402114.500	78.120
JL10	384773.664	402151.930	78.421
JLBA	384997.330	402127.823	77.287



Bretby Business Park Burton on Trent
Staffordshire DE15 0YZ
T: 01283 550969
E: info@axis-surveys.com
www.axis-surveys.com

CLIENT
GRM Development Solutions

PROJECT
North Manchester General Hospital
GMMH Target Area

TITLE
Topographical Survey

SCALE 1:500 **DATE** February 2020

DRAWN LB **CHECKED** MB

REF NO. 3654_GMMH **STATUS** PRELIM **SHEET** n/s