

Echo Street, Manchester

Flood Risk Assessment and Detailed Drainage Strategy

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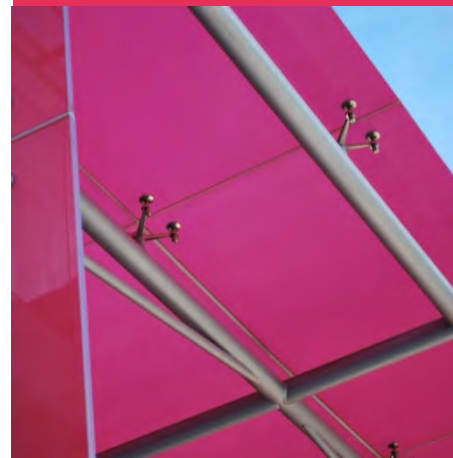
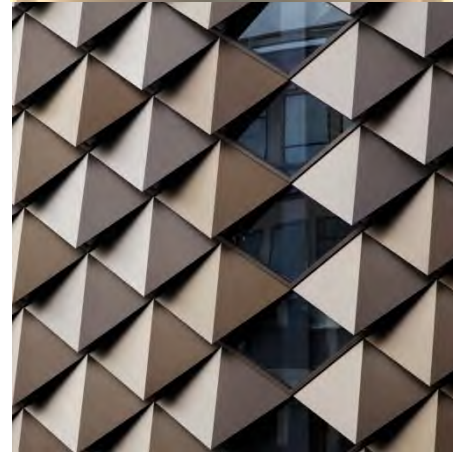
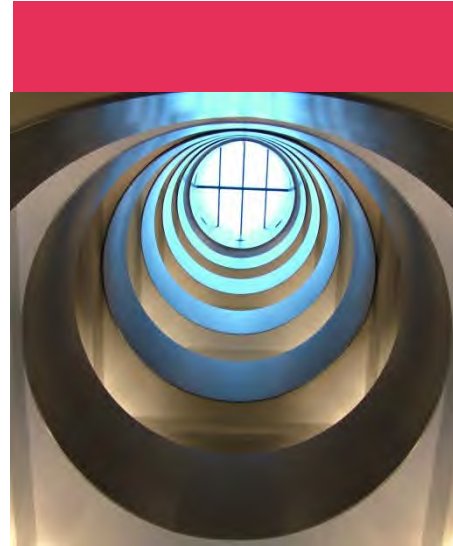
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Client Name: IQ Student Accommodation

Client Address: 7th Floor, Cottons Centre, Cottons Lane, London, SE1 2QG

Site Address: Echo Street / Granby Row, Manchester, M1 3QJ



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1.0 Introduction

1.1 Project Background

- 1.1.1 In April 2017 Curtins were instructed by IQ Student Accommodation to undertake a Flood Risk Assessment (FRA) and Detailed Drainage Strategy for the proposed redevelopment of land at Chandos House, Echo Street/Granby Row, Manchester. (Nearest post code M1 3QJ). However, project progression was halted in 2020 following the COVID 19 pandemic. In January 2023 Curtins have been instructed to undertake an updated Flood Risk Assessment (FRA) and Detailed Drainage Strategy of the subject site.
- 1.1.2 This amendments to development proposals include building heights, internal layouts and change from mixed use to 100% purpose-built student accommodation.
- 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. The report also takes into account the demolition works and construction that has taken place prior to the previous scheme stopping due to the pandemic.
- 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 site lies within the Conurbation Core Critical Drainage Area (as identified in the Manchester, Salford and Trafford Level 2 Hybrid SFRA).
- 1.2.4 The planning boundary area is approximately 0.498Ha, however this includes areas of existing public highway. The developable site area is approximately 0.29Ha.
- 1.2.5 Following scrutiny of the Environment Agency flood zone maps it has been identified that the existing site lies entirely within an area classified as Flood Zone 1 indicating that the risk of flooding from rivers and the sea is low (less than 0.1% each year). Following scrutiny of surface water flood maps and risk of flooding from reservoirs maps, it has been identified that the existing site lies within an area which is at very low to low risk of flooding from surface water, and at low risk from reservoir flooding.
- 1.2.6 Since the site is less than 1 hectare in Flood Zone 1, a Flood Risk Assessment (FRA) is not required to support a planning application. Manchester City Council have also confirmed that a FRA is not required even though the site lies within a critical drainage area (CDA). However, a combined Flood Risk Assessment and Drainage Strategy has been prepared to achieve the relevant BREEAM credits for the development.
- 1.2.7 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.
- 1.2.8 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.
- 1.2.9 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, Salford and Trafford Councils Level 1 Hybrid Strategic Flood Risk Assessment (SFRA) published in March 2010.
 - Manchester, Salford and Trafford Councils Level 2 Hybrid SFRA, User Guide, Final, dated May 2010.
 - Manchester, Salford and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment (SFRA) published in March 2011.
 - United Utilities Public Sewer Records dated July 2016.
 - Curtins Phase 1 Preliminary Site Assessment report for Chandos Hall
 - Topographical Survey by Malcolm Hughes dated 2017
 - Topographical Survey by Malcolm Hughes dated 2022.

1.3 Proposed Development

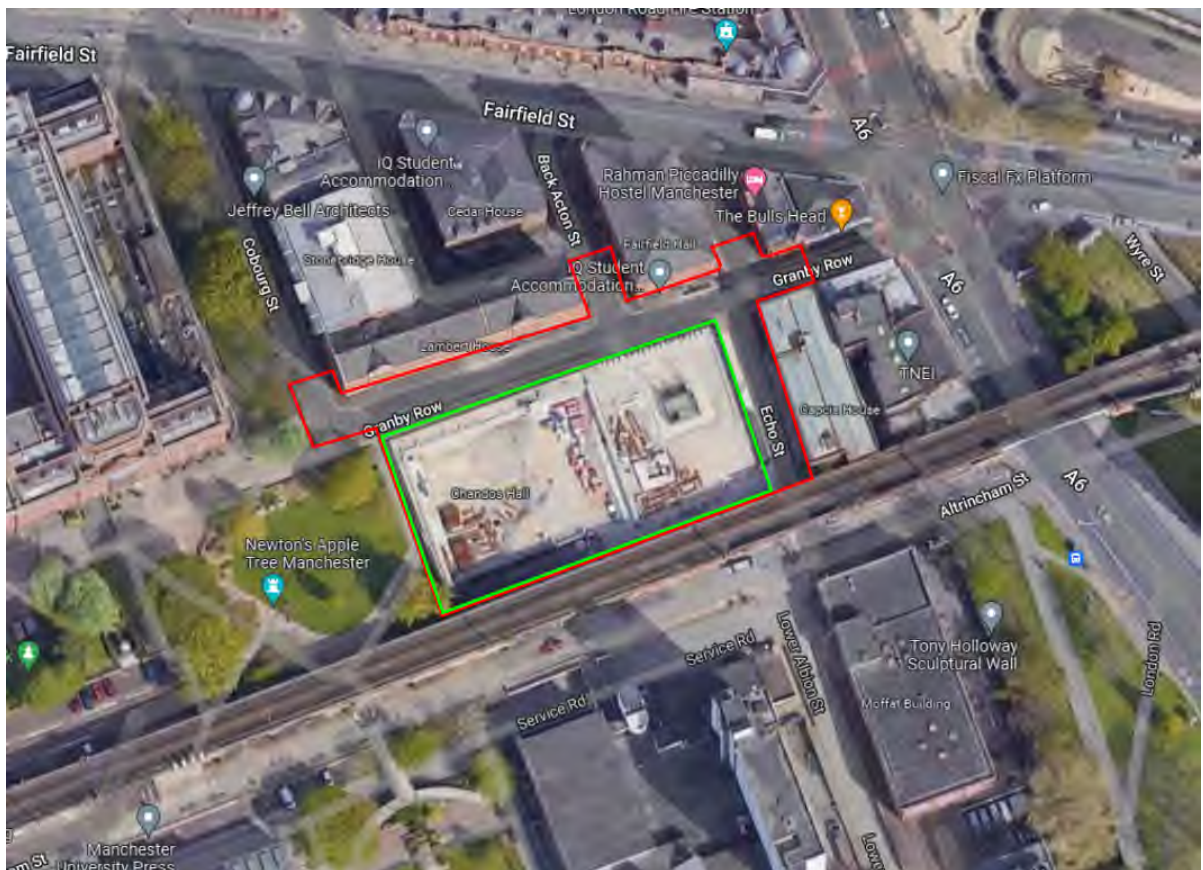
- 1.3.1 Development of purpose-built student accommodation (sui generis) comprising 3 interlinked tower blocks with intermediary linking block buildings, associated amenity space and external landscaping.
- 1.3.2 The development proposals are to comprise of up to 1224 purpose-built student accommodation units.
- 1.3.3 The Proposed site layout drawings, basement layout and ground floor layout drawings are enclosed in *Appendix A*.

2.0 Existing Site Details

2.1 History and Current Use

- 2.1.1 The site is located within Manchester City Centre near to Piccadilly train station. The site is bordered by Granby Row to the north, Echo Street to the East, Vimto Park to the West and Network Rail viaduct to the south (Oxford Road to Piccadilly line).
- 2.1.2 The approximate postcode of the application site is M1 3QJ and the approximate Ordnance Survey grid reference of the site is SJ846977.

Figure 1: Aerial Photograph (Google 2023)



- 2.1.3 The area proposed for development is considered to be brownfield. Prior to demolition, the land was formerly partly occupied by Chandos House, which was a purpose-built hall of residence within the former UMIST, now University of Manchester, campus. In addition to Chandos House, an existing nursery building, and garage was located on the eastern side of the application site. There was an area of artificial landscaping within the centre of the site with some evidence of grass and tree cover; this formed part of the nursery playground.

- 2.1.4 Access to the site is achievable on all sides although access from the south is dependent upon crossing third party land. Echo Street and Granby Row are public highways under the ownership of Manchester City Council.
- 2.1.5 The wider area surrounding the site consists of several University of Manchester buildings mostly to the South and East of the site, student accommodation buildings, offices, a public house, residential and commercial use buildings with Piccadilly train station to the northeast of the site. The A57(M) is approximately 230m south of the site.
- 2.1.6 The site is within the south-east corner of the Whitworth Street Conservation Area, and the existing buildings on the site are not considered to complement the surrounding historical buildings.

2.2 Existing Watercourses and Other Waterbodies

- 2.2.1 No above ground watercourses have been identified on the proposed site or in the immediate vicinity of the proposed site.
- 2.2.2 The River Medlock (which is a 'main river') is located approximately 200m south of the site, where it is culverted until it re-emerges above ground approximately 360m south-west of the site. The River Medlock continues to meander and flow through a number of culverts along its length until it joins the Bridgewater Canal (non-Canal and River Trust) approximately 1.4km west of the site.
- 2.2.3 The Rochdale Canal (Canal & River Trust) is located approximately 250m north-west of the site and runs along a south-west / north-east alignment.
- 2.2.4 The Ashton Canal (Canal and River Trust) begins approximately 370m north-east of the site, running in an east-west alignment.
- 2.2.5 The River Irwell is located approximately 1.28km north-west of the site, and it flows in a south-westerly direction towards the town of Runcorn. This downstream section of the River Irwell is known as the 'Manchester Ship Canal' and is privately maintained. Upstream, the River Irwell is a main river from its confluence with the River Irk (also a main river).

2.3 'Hidden' Watercourses

- 2.3.1 A hidden watercourse has been identified by records previously obtained from Manchester City Council (see Figure 2). The hidden watercourse is called Shooters Brook and it flows in a westerly direction as a public surface water sewer via a 1560 x 1400 brick culvert underneath Store Street to London Road (approximately 170m north of the site), where it flows into manhole ref: 6808. From manhole 6808, a public surface water sewer flows in a southerly direction, whilst Shooters Brook continues west from manhole 6808 as a public surface water sewer via a 1275mm brick culvert underneath buildings north of the site. Shooters Brook then crosses underneath Aytoun Street to the eastern edge of Manchester Metropolitan University (Aytoun Campus). From this point, Shooters Brook flows in a south-westerly

direction via a 600mm clay culvert (as identified on United Utilities sewer map) underneath the university campus in a south-westerly direction, turning south at Sackville Street and then turning south-west at the junction of Sackville Street and the railway viaduct (approximately 160m south-west of the site).

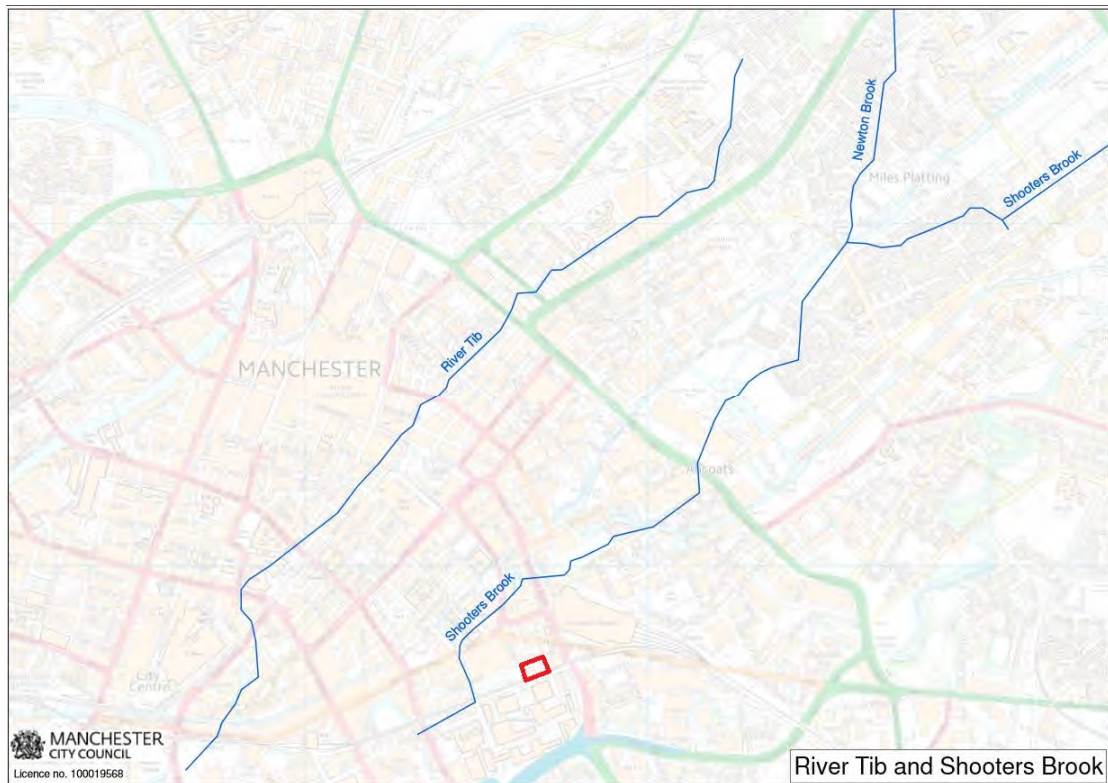


Figure 2: Hidden Watercourses (Courtesy of Manchester City Council)

2.4 Existing Drainage

2.4.1 The public sewer records have been obtained for the site and are enclosed in *Appendix B*.

2.4.2 The records indicate that the following public sewers are recorded within the site:

- In the north-west corner of the site, to the north of the existing Chandos Hall, there is a public combined sewer line which discharges into a public combined sewer to the north of the site within Granby Row.

2.4.3 However, United Utilities have since confirmed that “The 100mm pipe within the boundary is shown to be a private drain”.

2.4.4 The public sewer records indicate that the following public sewers are located within the vicinity of the site:

- There is a public combined gravity sewer adjacent to the north-west of the site within Granby Row. The sewer flows in a south-westerly direction, beginning at manhole 6711 to the north of

Chandos Hall, passing through manhole 6722 near to the north-west corner of the site where it is joined by a public combined gravity sewer within Cobourg Street, and continuing in a south-west direction within Granby Row as a 375mm clay culvert. A private surface water sewer appears to discharge into this 375mm public combined sewer from the south-east corner of the Sackville Street Building near to the junction of Granby Row with Cobourg Street.

- There is a public combined gravity sewer which flows from manhole 6705 (to the north of the existing nursery at the north-east corner of the site) in a northerly direction within Back Acton Street.
- Adjacent to the east of the site, within Echo Street, there is a public surface water sewer which begins adjacent to the existing nursery and flows in a southerly direction. Near to the south-east corner of the site, the surface water sewer becomes a combined sewer before then passing under the railway viaduct and turning to the east within Altrincham Street.
- A public surface water sewer flows in a westerly direction within Granby Row, adjacent to the northern site boundary, via manhole 6713 (near the north-east corner of the site) and manhole 6714 (near the north-west corner of the site). The surface water sewer continues away from the site within Granby Row.

2.4.5 The proposed site is brownfield, and prior to demolition works there was evidence of existing drainage within the site. A GPR Survey was carried out and the findings were reported in June 2017. The purpose of the surveys was to confirm the details of existing drainage within the site and to determine location, routes, depth, condition and connections.

2.4.6 The surveys identified a network of drains within the perimeter of the site, discharging into the public sewer system surrounding the site.

2.4.7 The GPR Survey findings are enclosed in *Appendix C*.

2.4.8 All private drainage features within the site will be abandoned and removed as part of the development apart from the existing public sewer connections.

2.4.9 Since demolition and construction progress of the previously approved scheme (LPA ref. 18267/FO/2017 and subsequent amendments), it is not clear to what extent existing drainage has been removed or whether any of the previous designed drainage has been installed. A CCTV Survey has been completed on site in February 2022, however access limitations have restricted the extent the camera can access drainage on site. The surrounding public sewers have been surveyed and this confirms that there are existing connections from site into the sewer in Granby Row. Suitability of the existing connections is to be confirmed.

2.4.10 The CCTV Survey layout is enclosed in *Appendix C*.

2.4.11 It is recommended that further investigation is completed on site in advance of detailed design work to expose existing drainage to determine the extent and condition of drainage on site and whether any drainage identified can be utilised for the proposed development drainage system.

2.4.12 Further recommendations for the proposed development are noted in section 6.

2.5 Topography

2.5.1 A topographical survey was completed by Malcom Hughes Surveys prior to the initial Flood Risk Assessment and Drainage Strategy Report in April 2017 and confirmed that:

- The perimeter of the site is generally flat with a high point to the Northeast of the site at 41.13m AOD and a low point in the Southwest corner of 38.39m AOD.
- There is a c.2m level difference between Granby Row footway level and the lower ground floor level of the exiting Chandos House. Granby Row is retained by an existing concrete wall to the North of the site and Vimto Park is retained by a concrete wall to the West.
- The East of the site is generally flat across the footprint of the Nursery and Garages. The external play area for the nursery slopes towards Chandos House to the West.

2.5.2 However, as construction works had commenced on site under the previous approved application, the topographical data has changed and therefore an updated survey has been completed by Malcolm Hughes Surveys in September 2022 and confirms that:

- The high points on site are now along the north-western boundary varying between 41m to the north-east and 42.15m to the north-west.
- The western portion of the site where Chandos House has been demolished is now at a lower elevation to the previous survey and appears to be at two plateaus ranging between 37.15m and 38.7m.
- The eastern portion of the site where the former garages and nursery have been demolished appear to be at a marginally higher elevation to the previous survey ranging between 40.1 and 40.4m.

2.5.3 The Topographical Surveys are enclosed in *Appendix D*.

2.6 Geology

2.6.1 The Curtins Phase 1 Preliminary Site Assessment identifies the following geological succession underlying the site:

- Superficial deposits – Glacial Till (Diamicton).
- Bedrock – Chester Pebble Beds Formation (Sandstone).

- 2.6.2 A BGS borehole 150m south of the site recorded Made Ground to a depth of 5.48m below ground level, underlain by gravel to a depth of 6.55m bgl. This is further underlain by hard red sandstone to 68.96m bgl.
- 2.6.3 No BGS fault lines are recorded traversing the site, however the site is bound on each side by 2 faults along a south-east / north-west alignment.
- 2.6.4 The site is within an area which may be affected by coal mining. No identified coal outcrops or mine entries are located within 1km of the site. The site is not noted within an area that has been influenced by past shallow coal mine workings. There are no recorded mineral sites within 500m of the site. There is no Made Ground recorded on the site in the BGS maps.
- 2.6.5 The site is not situated 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 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.
- 3.1.2 Tables 1 to 3 show the reference tables taken from the NPPF to determine the vulnerability and test requirements for the Proposed Development. Section 3.2 and 3.3 assess the site-specific categorisation and compatibility based on the flood zone and references the tables where applicable.

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 !\[\]\(09a4f46fd00963d10017c74e09f87500_img.jpg\)](#)), 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 †	x	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	x	x	x	✓*

Key:

✓ Development is appropriate

x 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 report is enclosed in *Appendix E*, and it can be seen that the site is classified as entirely within Flood Zone 1.
- 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:
- Buildings used for dwelling houses, student halls of residence
- 3.3.2 Buildings used for dwellings are classed as 'More Vulnerable' Development in the Flood Risk Vulnerability Classification as per Table 2.
- 3.3.3 The site is located within Flood Zone 1 for which 'More Vulnerable' Development is deemed to be appropriate and neither the sequential nor the exception test is required, as per 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 3, taken from the UK Government's Long-Term Flood Risk Information.

Figure 3: Long Term Flood Risk – Flood Risk from Rivers or Sea (© Crown Copyright)



4.2.2 The whole site can be seen to be within 'Very low' risk Flood Zone 1 (No shading) which has less than a 0.1% chance of fluvial flooding each year. Therefore, regarded to be **low** risk from fluvial flooding.

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 largest area that might be flooded if a reservoir were to fail and release the water it holds (see Figure 4).

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



4.4.3 The site does not lie within the maximum extents of flooding due to reservoir breach; therefore, the site is considered to be at **low** risk from reservoir flooding.

4.5 Canal Flooding

- 4.5.1 The Rochdale Canal is located approximately 250m north-west of the site at its nearest point and runs south-west / north-east. The Ashton Canal begins approximately 370m north-east of the site, running eastwards. The Bridgewater Canal is approximately 1.4km west of the site and the Manchester Ship Canal (which is privately owned) is situated approximately 1.28km north-west of the site where it flows from the River Irwell south-west towards Runcorn.
- 4.5.2 The SFRA identifies that the Manchester Ship Canal is a canalised watercourse, and hence its flooding mechanisms have more in common with a watercourse than a typical canal. The other canals are identified as 'broad canals'.
- 4.5.3 The broad 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.
- 4.5.4 A lack of information results in an inability to quantify the risk of canal breach or overtopping but the SFRA describes the areas at potential risk of flooding from all canal sources. The development site, and its vicinity, are not in a canal overtop hazard zone or a canal breach zone.
- 4.5.5 Given the above information, it is considered that there is **very low** risk of canal flooding to the site.

4.6 Groundwater Flooding

- 4.6.1 Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than hours or days. Groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises; however, it can cause significant risk to property.
- 4.6.2 The Level 1 SFRA (Map 2.1) indicates that the site is not in an area at risk of groundwater flooding or groundwater rebound.
- 4.6.3 The Phase 1 Preliminary Site Assessment identifies that the site is underlain by a principal aquifer situated within the bedrock, and a secondary undifferentiated aquifer within the superficial deposits.
- 4.6.4 It is assumed based on the information available that there is no significant risk of groundwater flooding to the site.

4.7 Public Sewers or Highway Drainage Flooding (Infrastructure Failure)

- 4.7.1 United Utilities were requested to provide details of any historic flooding from public sewers within the vicinity of the site. United Utilities have confirmed in their response that they have no record of public sewer flooding of properties in this vicinity as a result of overloaded sewers.

- 4.7.2 The LLFA have confirmed that they do not currently hold any records of historic flooding in the vicinity of the site.
- 4.7.3 There may be a risk of flooding due to limitations of the existing sewer network to take any extra flows which may be generated by development on the site. A pre-development enquiry has been submitted to United Utilities in order to confirm re-use of existing connections. United Utilities have confirmed that foul water flows from the site will be allowed to drain freely in to the public combined water sewer. United Utilities also accept unrestricted surface water on the basis that it is discharged into the public surface water sewer (further details about surface water discharge are contained in section 6).
- 4.7.4 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 very low.

4.8 Surface Water Flooding to the site

- 4.8.1 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.
- 4.8.2 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.
- 4.8.3 The extent of flooding to the site from surface water is indicated in
- 4.8.4 Figure 5 and it can be seen that the majority of the site is identified as being at a 'very low' risk of flooding from surface water, with localised low risk within the surrounding highways.

Figure 5: Risk of Flooding from Surface Water - Extent of Flooding



- 4.8.5 The SFRA places the site within the Conurbation Core Critical Drainage Area (CDA). CDAs generally have local flooding problems associated with drainage and are particularly sensitive to an increase in the rate of surface water runoff and/or volume from new development. Specific drainage requirements are required in these areas to help reduce local flood risk.
- 4.8.6 The CDAs provided in the SFRA are identified as being “*extensive*” due to the lack of risk-based information for the sewer network and surface water flow paths in the Conurbation Core CDA are largely linked to the natural floodplains of ‘hidden’ or ‘lost’ culverted watercourses that run through this area.
- 4.8.7 Considering the above information, the general risk of surface water flooding to the site is considered **very low**. To ensure that the risk to the site remains very low, mitigation measures are proposed in section 5.

4.9 Surface Water Flooding from the site

- 4.9.1 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.

- 4.9.2 Additionally, because the site is located in a Critical Drainage Area, a 50% reduction in surface water runoff generated from within the site is required.
- 4.9.3 The development has the potential to increase flood risk where any increase in impermeable areas results in additional run-off from proposed roads, car parks and building roofs being 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.
- 4.9.4 An assessment of the proposed surface flows is carried out within the drainage strategy within section 6 of this report.

4.10 Historical Flooding

- 4.10.1 The SFRA does not address any specific flood events at the development site or immediately surrounding the area.
- 4.10.1 The LLFA have confirmed that they hold no records of historical flooding within close proximity to the site.

4.11 Summary of Flood Risk

- 4.11.1 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; and
 - Surface water flooding from the site.
- 4.11.2 Mitigation measures to control the risk of flooding are outlined in section 5.

5.0 Mitigation

5.1 Fluvial/Tidal Flood Mitigation

- 5.1.1 The development site lies entirely within Flood Zone 1 and is at **very low** risk of fluvial and/or tidal flooding. No specific measures are required at this location in order to mitigate against fluvial and tidal flooding.

5.2 Groundwater Flood Mitigation

- 5.2.1 Groundwater flooding tends to be more persistent than other sources of flooding, typically lasting for weeks or months rather than hours or days. Groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises; however, it can cause significant risk to property.
- 5.2.2 The existing site is not considered to be at risk of groundwater flooding, however the proposals for the site indicate that a lower ground level will be created. Therefore, the proposed site is considered to be at potential risk from groundwater flooding.
- 5.2.3 Based on the lack of site-specific groundwater levels it is recommended that groundwater levels are monitored during ground investigation works. Typically, groundwater levels are recorded during gas monitoring over a 3-month period. Fluctuations in groundwater levels should be assessed during ground investigation works and floor levels proposed based on being above the maximum levels recorded.
- 5.2.4 Finished floor levels for the development should be set above the highest groundwater level.
- 5.2.5 External ground levels across the site should fall away from the proposed buildings and ensure that the creation of low points are avoided (other than those used intentionally for drainage features) in order that in the unlikely event of groundwater flooding, the flood water is safely routed away from the buildings on site.
- 5.2.6 Providing the above mitigation measures were imposed, the risk from groundwater flooding would therefore be considered **very low** post development.

5.3 Surface Water Flooding to the site Mitigation

- 5.3.1 The UK Government Long Term Flood Risk Assessment surface water flood maps indicate that the site is at very low risk of surface water flooding. However, the site topography is likely to be 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.

- 5.3.2 Existing footway levels along the outside perimeter of the building are determined by the highway authority. It is recommended that these levels should be maintained in order that surface water shall fall away from the building line and into the highway gullies. It is assumed that the highway drainage will be subject to the local highway authority regular drainage maintenance schedule.
- 5.3.3 It is recommended that 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.
- 5.3.4 Providing the above measures are implemented the flooding risk to the development site from surface water is therefore considered low post development.

5.4 Surface Water Flooding from the site Mitigation

- 5.4.1 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 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.
- 5.4.2 For sites which are located within a CDA, the following guidance is provided in the SFRA:
- Development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change.
 - Development should be designed so that there is no flooding to the development in a 1 in 30-year event and so that there is no property flooding in a 1 in 100 year plus climate change event.
- 5.4.3 The SFRA requires that development proposals should look at opportunities to incorporate SuDS to reduce the risk of surface water flooding, and that surface water should not discharge into the combined sewer system. The risk of groundwater flooding should be considered when assessing suitable SuDS techniques.
- 5.4.4 Additionally, because the site is in a CDA, development should aim for a minimum reduction in surface water runoff rates of 50% for Brownfield sites, with an aim of reducing runoff to Greenfield rates up to a 1 in 100-year storm event, considering climate change.
- 5.4.5 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.
- 5.4.6 Section 6 reviews the surface water discharge options. Owing to the close proximity of building foundations within the limited space available on the site, and the existing site's current disposal of

surface water into the public sewer network, it is proposed that the surface water will continue to outfall into the public sewer network but at a restricted rate compared to existing.

- 5.4.7 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.
- 5.4.8 The surface water should be constrained within the site and proposed with sustainable techniques such as water reuse by rainwater harvesting/rainwater butts, permeable paving, enhanced landscaping features where suitable.
- 5.4.9 Flood water exceedance routes should be identified, both on and off site.
- 5.4.10 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:
- Any arrangements for adoption by an appropriate public body or statutory undertaker, management and maintenance by a Residents' Management Company
 - Arrangements concerning appropriate funding mechanisms for its on-going maintenance of all elements of the sustainable drainage system (i.e. inspections, regular maintenance)
 - Means of access for maintenance and easements where applicable
- 5.4.11 Assuming that the proposed drainage system is designed to provide adequate capacity, and that the private and adopted sewers will be maintained by their adopted authority, it can be assumed risk of flood from blockage or overloading is minimal.
- 5.4.12 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.

6.0 Drainage Strategy

6.1 Existing Drainage

- 6.1.1 The public sewer records have been obtained for the site as well as record obtained from the University of Manchester. In addition, a GPR survey and CCTV drainage survey has been carried out. All record information obtained is enclosed in *Appendix B*.
- 6.1.2 The records indicate that the following public sewers are recorded within the site:
- In the north-west corner of the site, to the north of the existing Chandos House, the sewer records indicate that there is a public combined sewer. UU have confirmed that this is a private drain.
- 6.1.3 The public sewer records indicate that the following public sewers are located within the vicinity of the site:
- There is a public combined gravity sewer adjacent to the north-west of the site within Granby Row. The sewer flows in a south-westerly direction, beginning at manhole 6711 to the north of Chandos Hall, passing through manhole 6722 near to the north-west corner of the site where it is joined by a public combined gravity sewer within Cobourg Street, and continuing in a south-west direction within Granby Row as a 375mm clay culvert. A private surface water sewer appears to discharge into this 375mm public combined sewer from the south-east corner of the Sackville Street Building near to the junction of Granby Row with Cobourg Street.
 - There is a public combined gravity sewer which flows from manhole 6705 (to the north of the existing nursery at the north-east corner of the site) in a northerly direction within Back Acton Street.
 - Adjacent to the east of the site, within Echo Street, there is a public surface water sewer which begins adjacent to the existing nursery and flows in a southerly direction. Near to the south-east corner of the site, the surface water sewer becomes a combined sewer before then passing under the railway viaduct and turning to the east within Altrincham Street.
 - A public surface water sewer flows in a westerly direction within Granby Row, adjacent to the northern site boundary, via manhole 6713 (near the north-east corner of the site) and manhole 6714 (near the north-west corner of the site). The surface water sewer continues away from the site within Granby Row.
- 6.1.4 It is assumed that all private drainage features within the site will be abandoned and removed as part of the development. The existing connection to the public sewer in Granby Row will be retained where the condition is acceptable. The proposed site is brownfield, and prior to demolition works there was

evidence of existing drainage within the site. A GPR Survey was carried out and the findings were reported in June 2017. The purpose of the surveys was to confirm the details of existing drainage within the site and to determine location, routes, depth, condition and connections.

- 6.1.5 The pre-demolition information and surveys identify two separate (assumed combined) drainage systems. An existing system to the West of the site appeared to serve Chandos House and perimeter surfacing with the eventual 225dia. outfall heading to the combined sewer in Granby Row. An existing system to the East appeared to serve the Nursery and Garages and this 225dia. pipe routed towards the public sewer in Echo Street.
- 6.1.6 The GPR Survey findings are enclosed in *Appendix C*.
- 6.1.7 All private drainage features within the site will be abandoned and removed as part of the development apart from the existing public sewer connections.
- 6.1.8 Since demolition and construction progress of the previously approved scheme, it is not clear to what extent existing drainage has been removed or whether any of the previous designed drainage has been installed. A CCTV Survey has been completed on site in February 2022, however access limitations have restricted the extent the camera can access drainage on site. The surrounding public sewers have been surveyed and this confirms that there are existing connections from site into the sewer in Granby Row. Suitability of the existing connections is to be confirmed.
- 6.1.9 The CCTV Survey layout is enclosed in *Appendix C*.
- 6.1.10 It is recommended that further investigation is completed on site in advance of detailed design work to expose existing drainage to determine the extent and condition of drainage on site and whether any drainage identified can be utilised for the proposed development drainage system.

6.2 Proposed Foul Water Drainage

- 6.2.1 A separate foul and surface water system is proposed up to the point where drainage leaves the site. There will be two foul connections into the combined public sewer, one to the East into Echo Street and one to the North into Granby Row.
- 6.2.2 Proposed drainage is largely based on the previous scheme design as it would be the intention to utilise any suitable drainage that has previously been installed. However, as it is not yet confirmed what has previously been installed the internal strategy may be subject to amendments.
- 6.2.3 United Utilities have confirmed that foul can be discharged to the combined public sewer. Therefore, it is proposed to utilise the existing combined connection to the public sewer in Granby Row for foul water discharge. This will serve the Western side of the building.
- 6.2.4 Due to invert level restriction, it will not be possible to connect all foul drainage to the existing 225dia. connection. Therefore, a connection is required to the public sewer in Echo Street. Drainage records

obtained from the University of Manchester show an existing connection from Echos Day Nursery in Echo Street and is assumed to connect to the existing combined sewer. However, the depth of the existing connection is insufficient to connect drainage from the new development. Therefore, there is a requirement for a new connection to the existing 500 x 700 combined brick sewer in Echo Street.

- 6.2.5 United Utilities have confirmed that proposals to connect to the public sewers in Granby Row and Echo Street are acceptable and the correspondence with United Utilities is enclosed in *Appendix F*.
- 6.2.6 It will be necessary to apply for individual Section 106 Agreements with United Utilities for each connection.
- 6.2.7 The proposed Drainage Strategy layout is enclosed in *Appendix H*.

6.3 Proposed Surface Water Drainage

- 6.3.1 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. Any flood water generated for up to the critical 1 in 100-year plus climate change storm event shall be contained within the curtilage of the site so not to cause damage to buildings, essential services or adjoining developments and services.
- 6.3.2 It is not possible to contain flood water on the site due to the topography and layout. There is limited opportunity to store water on the surface, so this is not a feasible approach for the 1 in 100 year event. Therefore, all storm water for up to the critical 1 in 100-year storm event plus an allowance for climate change must be contained within other forms of storage structure.
- 6.3.3 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

- 6.3.4 Although infiltration testing has not been completed on the site, infiltration is not likely to be an option for this site due to the footprint of the building taking up the majority of the site. Also, it is unlikely that ground conditions will be favourable with stiff clay encountered between 0.3m and 8.5m below ground level.

Watercourses

- 6.3.5 The nearest watercourse is approximately 0.2km from the site. Therefore, disposal of the development surface water to a watercourse is unviable and is unlikely to be a feasible option.

Surface Water Sewer

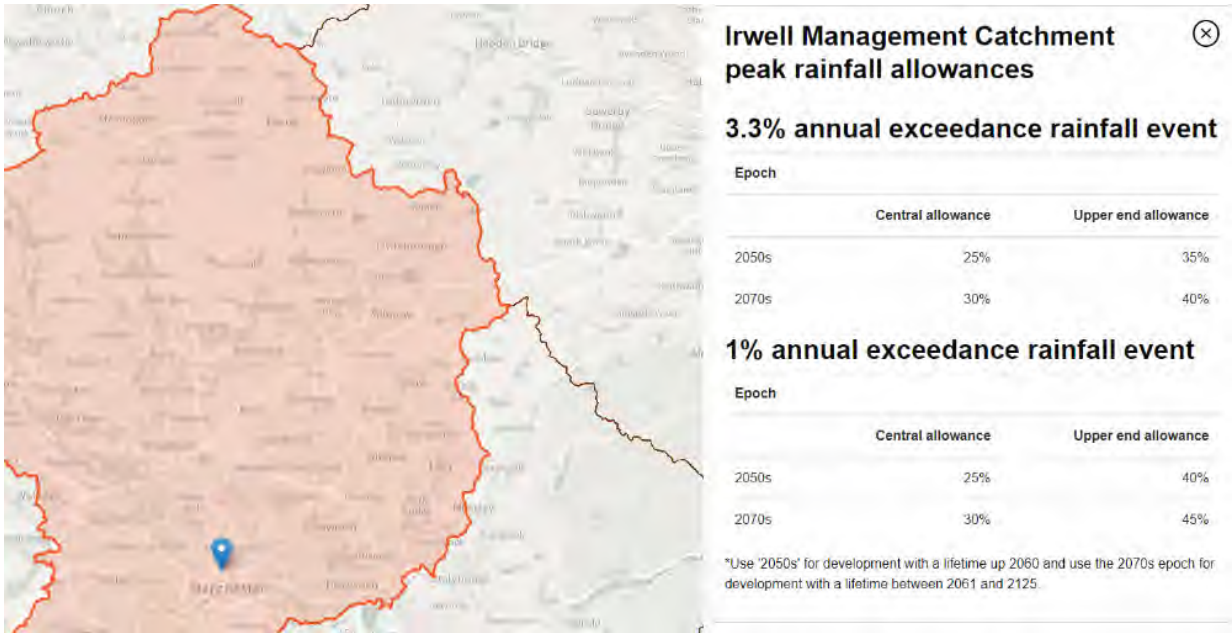
- 6.3.6 United Utilities have requested that they “would like to see” the development drain to the surface water sewer network. The only viable surface water public sewers are within Granby Row which are circa 13m deep.
- 6.3.7 United Utilities public sewer records identify that there is an existing surface water sewer within Granby Row and approximately 20m of existing brick sewer in Echo Street is surface water. No existing connections from the site have been identified to the surface water public sewer(s).
- 6.3.8 Providing a new connection to the Granby Row sewer would require extensive excavation within the existing highway, adjacent to buildings, retaining wall and around existing services. However, UU have previously confirmed that depending on size and layout of the manhole, they “would consider allowing an internal backdrop connection to the existing surface water sewer manhole” close to the site.

Combined water sewer

- 6.3.9 There is a combined public sewer in Granby Row and in Echo Street. The existing site surface water currently discharges to the existing combined sewer network via two separate connections one to the 375mm sewer in Granby Row and one to the 500 x 700 brick sewer in Echo Street.
- 6.3.10 As there is a surface water sewer network in proximity to the site, the site is proposed to connect to the surface water sewer network in accordance with the Sustainable Drainage hierarchy. It is also noted that the surface water sewer connects to the Shooters Brook Watercourse downstream of the site at Sackville Street, which then connects to the River Medlock at Charles Street.
- 6.3.11 United Utilities have confirmed that they would accept a flow rate of up to 24.91 l/s into the surface water sewer in Granby Row based on 50% of the 1 in 2-year brownfield run off rates calculated by the modified rational method.
- 6.3.12 Consultation response from Manchester Lead Local Flood Authority has not yet been received, however in general, the flood risk management strategy seeks to achieve a minimum 50% reduction on brownfield discharge rates.
- 6.3.13 The correspondence with United Utilities is enclosed in *Appendix F*.
- 6.3.14 Proposed drainage is largely based on the previous scheme design as it would be the intention to utilise any suitable drainage that has previously been installed. However, as it is not yet confirmed what has previously been installed the internal strategy may be subject to amendments.
- 6.3.15 In May 2022, the Environment Agency released updated climate change allowances by Management Catchment for peak rainfall intensities which should be applied to new Developments. Figure 6 demonstrates the climate change allowances with central and upper end allowances being considered.
- 6.3.16 Based on the nature of the Development, a lifespan of 100 years is anticipated (as defined by the current requirement for residential Development). Therefore, the potential climate change allowance in the

Irwell Management Catchment for the 2070s Epoch; 2061-2115 is 45% for the upper end allowance. Proposed design calculations will therefore need to consider +45% climate change allowances.

Figure 6: Irwell Management Catchment peak rainfall allowances



6.3.17 Therefore, the proposed surface water design should achieve a maximum off site discharge of 24.91 l/s with the capacity to accommodate the volumes generated up to the 1 in 100-year event plus and allowance of 45% for climate change increase.

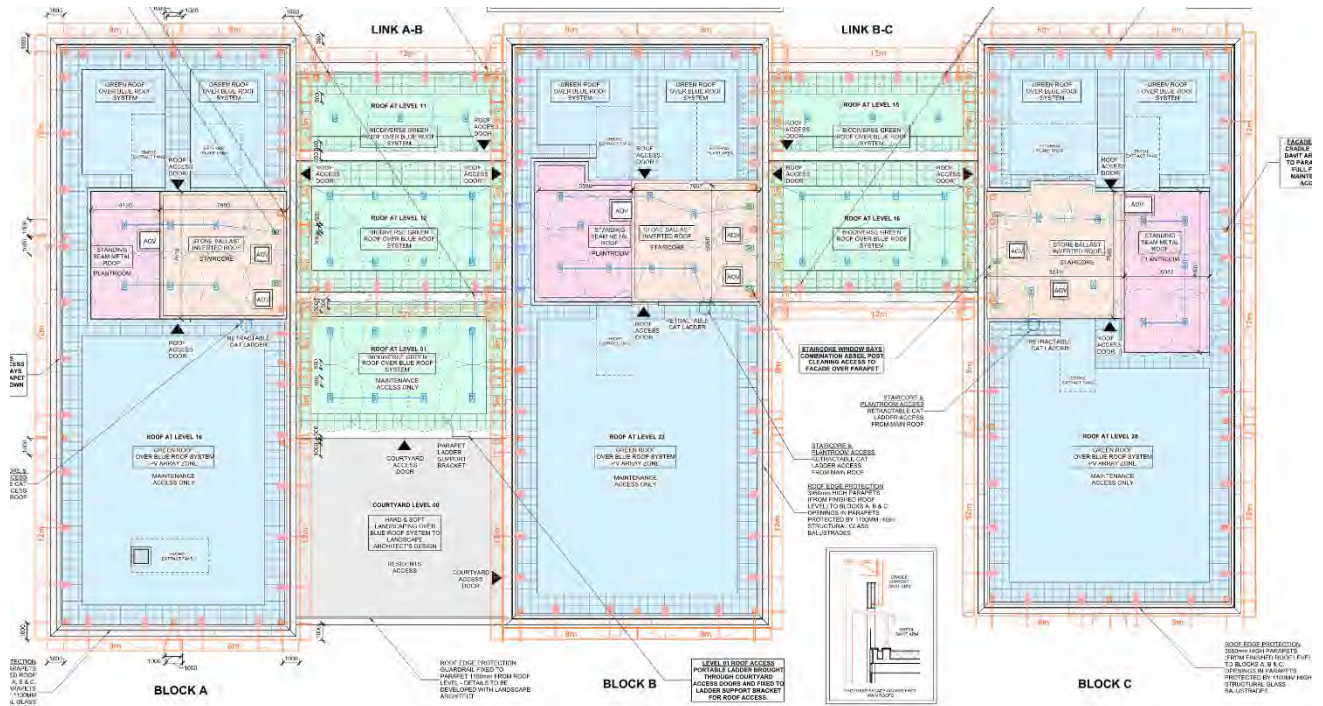
6.3.18 A surface water model has been created to determine attenuation requirements for the drainage system. The proposed drainage system has been split into three main contributing areas: the roof areas, the ground level courtyard area and the access road area along the southern elevation.

Roof Areas

6.3.19 The architectural and client aspirations are for several roof gardens which creates the opportunity to provide storage in the form of green/blue roofs with restricted outlets at roof level.

6.3.20 There are several green/blue roofs at different levels of the building (see figure 7). Each roof will have its own outlet(s) which will be restricted to limit flow to a designated rate. The total run-off from all roofs will be restricted to a maximum of 5.6 l/s.

Figure 7: Roof Plan



- 6.3.21 The attenuation volume provision and green/blue roof build up will be subject to specialist detailed design however, the current preliminary design calculations and details are included within *Appendix G*.

Courtyard Area

- 6.3.22 There is an external courtyard area at ground floor level in between Block B and Block C. Therefore, this area is proposed to be constructed in permeable paving with surface water discharge limited to a maximum of 4 l/s with attenuation provision within the sub-base layer. Attenuation capacity for the permeable paving catchment requires approximately 3.2m³. The minimum 150mm sub-base layer will provide up to 10m³.

Access Road Area

- 6.3.23 There is an external access road along the southern elevation of the building, however due to space and topographical constraints, sustainable drainage opportunities for this area are limited. Therefore, this area is proposed to be traditionally drained via channels and freely discharge into the piped network. The total discharge for the access road up to the 1 in 100 year +45%cc event is approximately 14.7 l/s.
- 6.3.24 The proposed Drainage Strategy layout is enclosed in *Appendix H*.
- 6.3.25 The proposed surface water calculations are enclosed in *Appendix J*.
- 6.3.26 Surface water run-off from hard paved areas at risk of contamination should receive water quality treatment. Low traffic access roads and car parking is considered low hazard in terms of contamination. Figure 8 illustrates the pollution hazard indices for different land use classifications from The CIRIA SuDS Manual C753 (2015).
- 6.3.27 Figure 9 illustrates the SuDS Component mitigation indices from The CIRIA SuDS Manual C753 (2015).

Figure 8: 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

Figure 9: 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 indices ¹		
	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	0.6	0.6	0.6
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond ³	0.7 ³	0.7	0.5
Wetland	0.8 ³	0.8	0.8
Proprietary treatment systems ^{4,5}	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.

- 6.3.28 The selection of treatment should ensure that the SuDS mitigation component index (Figure 9) exceeds the pollution hazard index (Figure 8). Where two stages of treatment are required, the second stage of treatment should account for reduced performance due to lower inflows; therefore 0.5 (mitigation index) should be used.
- 6.3.29 Due to the limited external space and limited vehicle accessibility, the risk of contamination to surface water run-off is considered to be low. This in conjunction with the use of blue/green roofs to all roof areas and permeable surfacing within the ground floor external courtyard will provide treatment and betterment beyond that of the existing site. The external access road is limited for SuDS options, however as it will require a form of pollution treatment to minimise risk of downstream contamination, we have proposed the use of smartgully adaptors or similar, within the channel outlet boxes.

6.4 Maintenance

- 6.4.1 A suitable maintenance strategy should be adopted to ensure the green roofs, permeable surfacing and general drainage network is cleaned regularly and the routine maintenance and cleansing regime should be documented.
- 6.4.2 It is assumed that the maintenance of the drainage network will be the responsibility of an on-site facilities management team.
- 6.4.3 A copy of the final construction drainage layout should be provided in the final Operations and Maintenance Manual.
- 6.4.4 The surface water network has been designed to accommodate the 1 in 100-year storm rainfall event plus an allowance for climate change to the requirements of the site. As the flows are generally being attenuated on site and may be within SuDS features; there will be a period after storm events where the network is still partially or fully surcharged and is draining down. Where this surcharging is still present after 48hrs, appropriate action should be taken.
- 6.4.5 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.
- 6.4.6 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.
- 6.4.7 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.
- 6.4.8 During the winter months, drainage features such as gullies and channels should be cleared of ice, snow, debris or litter.
- 6.4.9 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.

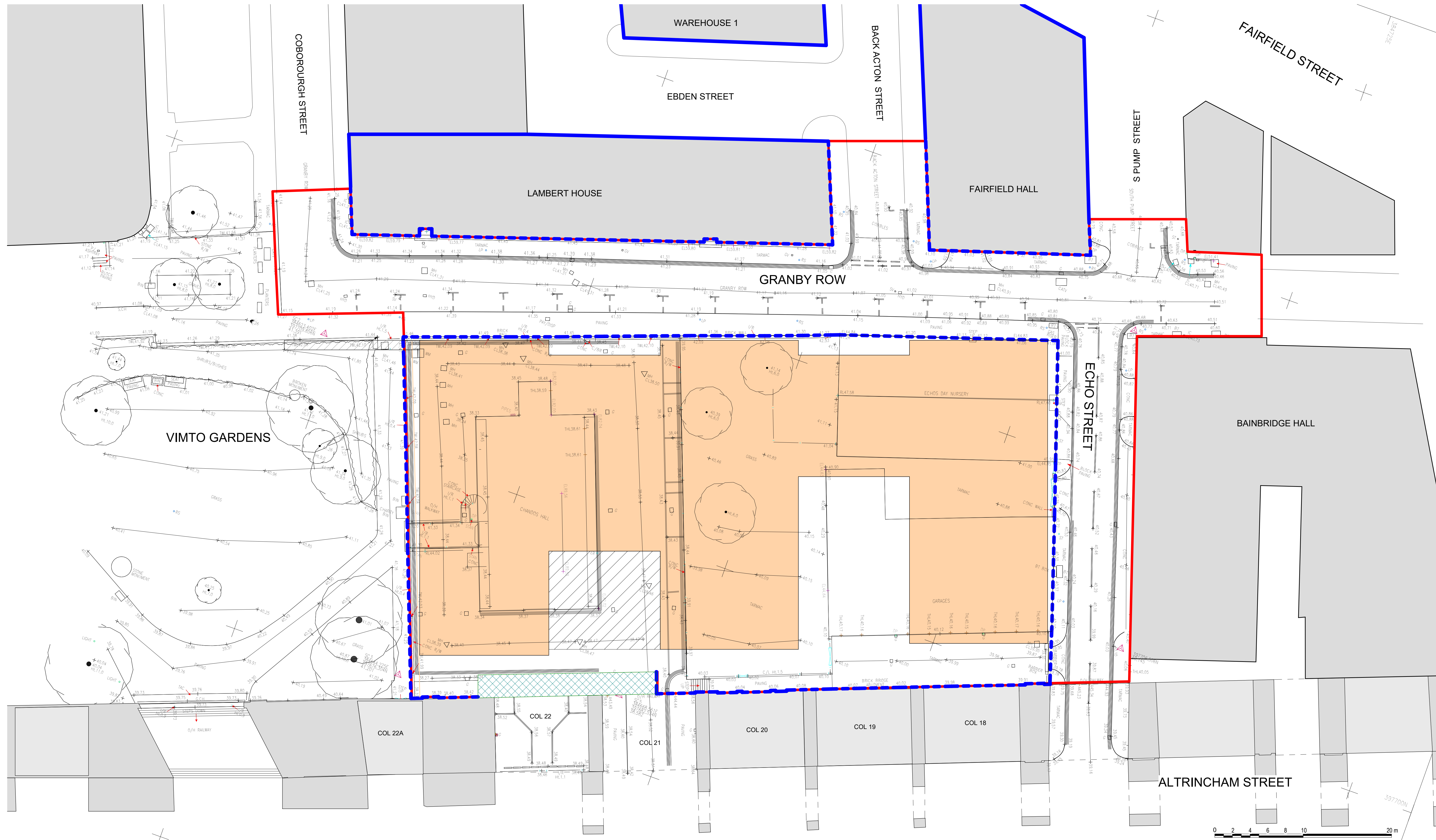
Appendix A

Proposed Building on existing site

Proposed Site Layout

Proposed Basement Layout

Proposed Ground Floor Layout



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FOR ELECTRONIC DATA ISSUE
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AREA MEASUREMENT
The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions, whether as to project viability, pre-letting, lease agreements or otherwise, should include due allowance for the increases and decreases inherent in the design development and building processes. Existing buildings may present anomalies in relation to surveyed/drawn plans that may also effect the stated areas. All areas are subject to Town Planning and Conservation Area Consent and detailed Rights to Light analysis.

Figures relate to the likely areas of the building at the current stage of the design and are calculated using one of the following (as stated in the accompanying areas schedule) IPMS1, IPMS2, IPMS 3, Gross External Area (GEA), Gross Internal Area (GIA) or Net Internal Area (NIA) methods of measurement from the RICS Property Measurement 1st edition.

- PLAN KEY
- Site Boundaries
- Applicant Ownership
 - Planning Application Boundary
 - Network Rail Ownership
 - Proposed Building Footprint
 - Ground Floor Courtyard - Slab between ground floor and lower ground floor

REV.	DATE	AMENDMENT	KEYPLAN
P01	24/01/23	First Issue - For Information	

CLIENT

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1 : 200

DATE
24/01/2023

ORIGINATOR
LG

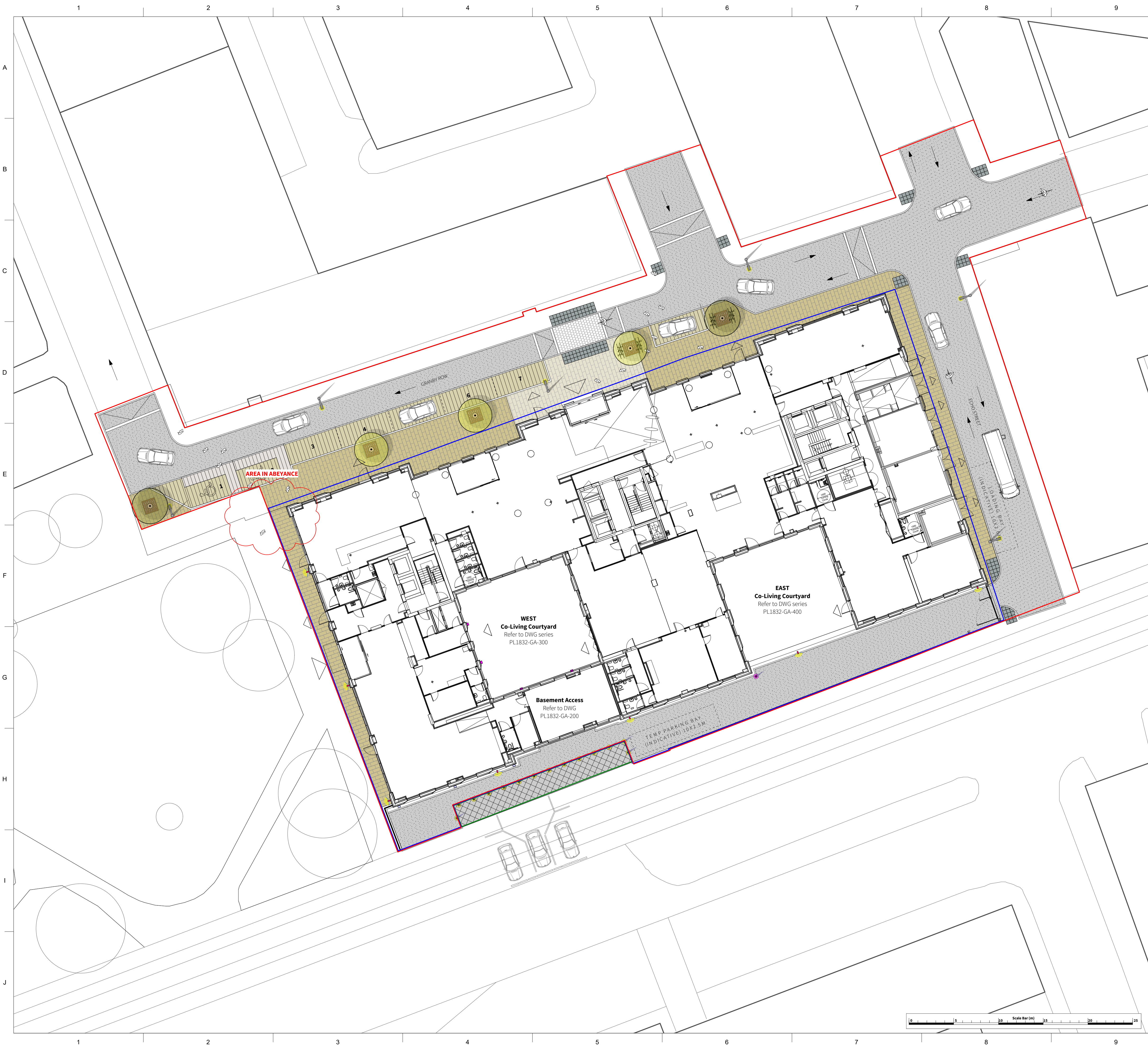
CHECKED
VC

AUTHORISED
RG

PROJECT
Echo Street

Existing Site Plan with Proposed Building Footprint

STATUS	PURPOSE FOR ISSUE	SR NO.	DRAWING NO.	REV.
S2	For Information	7054	ECHO- SRA- ZZ- XX- DR - A - 00803	P01



KEY	
	Planning Application Boundary
	Land Ownership Boundary
	Network Rail Ownership Boundary

HARDWORKS	
	PERFECTA PAVING Location: To Footpaths - As Shown Product: Marshalls 'Perfecta' Size: 450 x 450 x 20mm Laying: Stretcherbond - Rigid Buildup
	YORKSTONE PAVING Location: To Main Entrance to Building Product: Marshalls 'Scoutmoor' Size: 600 x 300 x 20mm Laying: Stretcherbond - Rigid Buildup
	YORKSTONE SETTS Location: To Granby Row Pedestrian Crossing Product: Marshalls 'Scoutmoor' Size: 200 x 100 x 40mm Laying: Stretcherbond - Rigid Buildup
	TEGULA SETTS Location: To Parking Bays on Granby Row Product: Marshalls 'Tegula Cobblets' Colour: Traditional Size: 80 x 80 x 40mm Laying: Stretcherbond - Rigid Buildup
	TEGULA SETTS Location: To demarcate parking bays + to hatched area of disabled bays Product: Marshalls 'Tegula Cobblets' Colour: Pennant Grey Size: 80 x 80 x 40mm Laying: Stretcherbond - Rigid Buildup
	HRA CARRIAGEWAY - TO BE RESURFACED Existing surface to be planned off. Tack coat & New Blacktop HRA surface to be laid. To Engineer's Specification. Re-lined as required to match existing highway arrangements.

SOFTWARES	
	PROPOSED TREE PLANTING - IN HARD Tree P/L Details: [DWG PL1832-GA-400] Tree Specifications: [DWG PL1832-GA-400] Planted in imported topsoil, underground gully & connected to drainage system as required.

LIGHTING	
Note: - List level requirements and design subject to discussion with MEP Engineer	
	Lighting Columns - Approximate existing positions & numbers - Luminaires & Column to be replaced with MCC Adoptable standard (Philips Slim Lume or similar). - Strategy & Specification to be developed
	Proposed Wall Mounted Lighting - To Building facade - Iguzzini Lander Wall 2000 or acceptable equivalent. - Mounted at 4m Height. - Subject to discussion & co-ordination with architects.

FURNITURE	
	CYCLE STAND - Steel flatbar square profile. Finish: Powdercoated (matte), Colour: TBC. Product: Elaflex, by Runge or similar. Subject to further design.
	TREE FRAME [DWG PL1832-GA-400] Type: Arborist Recessed Metal Tree Frame laid flush to adjacent paving Material: Stainless Steel Size: 1.8 x 1.8 m Lower area gravel infill - 6mm Aggregate
	PERFORATED METAL GATED SCREEN [Echo Street Entrance: DWG PL1832-GA-300] Freestanding Steel Portal Frame. Echo Street entrance to incorporate wind screen. To include set of doors for vehicular / cycle access. Subject to further design. Material: Galvanised Steel, flatbar. Finish: Powdercoated (matte), Colour: TBC. Size: Varies
	BALUSTRADE [DWG PL1832-GA-300] Location: To Vimto Park interface wall Material: Galvanised Steel, flatbar. Finish: Powdercoated (matte), Colour: TBC. Size: Approx 4.5m x 1.5m "RETAINING WALL TO MOTT McDONALD DETAIL"
	ACCESS CONTROL BOLLARD Location: To MWR Boundary / Maintenance Zones Product: BM47080-PO Supplier: Broxap or acceptable equivalent. Material: Steel Control: Telescopic / Fold-down TBC.
	STATIC BOLLARD Location: To Gated Access Point + Maintenance Ramp off Echo Street Product: 'Charm' Supplier: Marshalls or acceptable equivalent. Material: Galvanised Steel. Powdercoated RAL TBC.
	BAT BOX Location: Installed 3m above ground on building facade as shown Product: Slimline Wooden Bat Box Supplier: NHHS Wildlife & Ecology Material: Redwood bat box
	RUSH BOX

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NOTE:

- Do not scale from this drawing. Always work to noted dimensions.
- All dimensions are in millimetres unless otherwise stated.
- All setting out, levels and dimensions to be agreed on site. The dimensions of all materials must be checked on site before being laid out.
- This drawing must be read with the relevant specification clauses and detail drawings.
- Order of construction and setting out to be agreed on site.

07	19-03-20	Crosspoint and road amended	JTO	RM
06	01-03-19	STAGE 4	JH	RM
05	22-01-19	STAGE 4	JH	RM
04	08-01-19	STAGE 4	JH	RM
03	13-11-18	Pack Amended following VE	JH	RM
02	18-07-18	Planning Condition Discharge	JT	RM
01	13-04-18	Stage-3	JT	RM
00	22-03-18	PLANNING SUBMISSION	JH	MW

Issue	Date	Status	Drawn	Apprvd.
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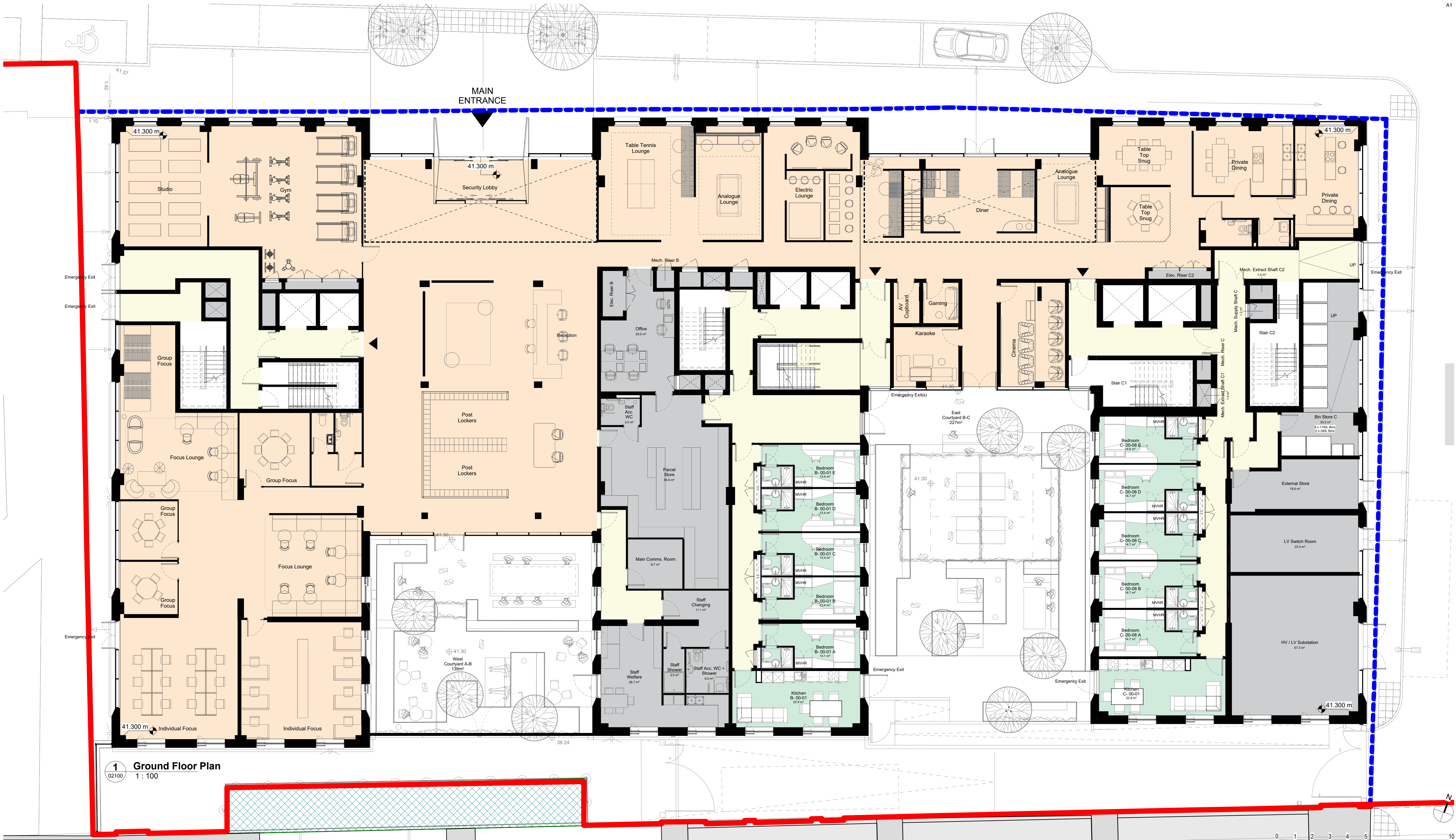
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Client	IQ Student Accommodation				
Project	Echo Street				
Drg Title	External Envelope GENERAL ARRANGEMENT				
Created on	13-04-18	Created by	JH	Approved by	RM
Scale	1:200	Size	A1	Status	Stage 4
Drg No.	PL1832-GA-100	Issue No.	07		

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AREA MEASUREMENT
The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions, whether as to project viability, pre-letting, lease agreements or otherwise, should include due allowance for the increases and decreases inherent in the design development and building processes. Existing buildings may present anomalies in relation to surveyed/drawn plans that may also effect the stated areas. All areas are subject to Town Planning and Conservation Area Consent and detailed Rights to Light analysis. Figures relate to the likely areas of the building at the current stage of the design and are calculated using one of the following (as stated in the accompanying areas schedule) IPMS1, IPMS2, IPMS3, Gross External Area (GEA), Gross Internal Area (GIA) or Net Internal Area (NIA) methods of measurement from the RICS Property Measurement 1st edition.

PLEASE NOTE:

- The measured areas shown for all en-suite clusters, studios and kitchens do not yet account for any protruding columns and will therefore reduce accordingly to account for these once locations and sizes are fully known.
- Wall lining has been allowed for to solid core walls, shears walls and other structural items however depth of wall lining subject to change dependent on acoustic requirements. This may result in room sizes reducing.
- Areas of ensuite bedrooms and studios include the area of the bathroom and the separating wall between bedroom and pod, but exclude the riser.
- Cluster kitchens will require a riser to provide drainage etc and will reduce the area stated accordingly. The location of this is as yet unknown until full fit outs have been progressed.
- Studio layouts shown are design intent only and follow Client's brief. Escape routes' distance from hobs to be tested and validated by Fire Strategy with fire suppression measures as necessary. Studio layouts in abeyance until signed-off by Building Safety Regulator (HSE), Building Control Officer, and Building Insurer.
- Ground Floor amenity space layout completed by Manalo + White Architects design intent only and follow Client's brief. Subject to further review and co-ordination with SRA and specialist consultants (incl. MEP, structure and fire engineer)

Department Legend

- Amenity Space
- Studios
- 5 Bedroom Cluster (incl Kitchen / Living)
- 6 Bedroom Cluster (incl Kitchen / Living)
- BOH Areas (incl Plant, Services, Stores etc)
- Circulation
- Preferred Structural Column Locations (WIP / Indicative only and subject to change)

REV.	DATE	AMENDMENT
P01	18/01/23	First Issue - Issued for Information
P02	23/01/23	Cores updated following comments from fire engineer (as clouded)
P03	03/02/23	Layouts amended following client + design team comments
P04	27/02/23	Layouts updated following client + design team comments. Preliminary internal fitout layouts included
P05	10/03/23	Minor amendments to layouts to suit DT comments. Bedroom + Studio room tags updated.
P06	24/03/23	Draft Issue for Planning (Incl. minor updates)
P07	11/04/23	Proposed M+W amenity space layout updated
P08	14/04/23	Planning Issue
P09	26/04/23	Planning Issue (minor updates)

KEYPLAN

Plan Key

- Site Boundaries
- Planning Application Boundary
- Applicant Ownership
- Network Rail Ownership

CLIENT

IQ Student Accommodation

ic Student Accommodation

STATUS

S2

PURPOSE FOR ISSUE

Planning

SHEPPARD ROBSON

27th Floor City Tower Piccadilly Plaza Manchester M1 4BT
T: +44 (0)161 233 8900 E: enquiries@sheppardrobson.com

SCALE@A1 DATE 28/04/23 ORIGINATOR LK CHECKED VC AUTHORISED RG

PROJECT **Echo Street**

General Arrangement

Ground Floor Plan

Stage 2

DRAWING NO.

ECHO- SRA- ZZ- 00- DR- A- 02100

SR NO.

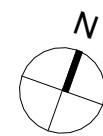
7054

REV.

P09



1 Basement Floor Plan
02099 1 : 100



0 1 2 3 4 5 10 m

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AREA MEASUREMENT
The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions, whether as to project viability, pre-letting, lease agreements or otherwise, should include due allowance for the increases and decreases inherent in the design development and building processes. Existing buildings may present anomalies in relation to surveyed/drawn plans that may also effect the stated areas. All areas are subject to Town Planning and Conservation Area Consent and detailed Rights to Light analysis. Figures relate to the likely areas of the building at the current stage of the design and are calculated using one of the following (as stated in the accompanying areas schedule) IPMS1, IPMS2, IPMS3, Gross External Area (GEA), Gross Internal Area (GIA) or Net Internal Area (NIA) methods of measurement from the RICS Property Measurement 1st edition.

PLEASE NOTE:

1. The measured areas shown for all en-suite clusters, studios and kitchens do not yet account for any protruding columns and will therefore reduce accordingly to account for these once locations and sizes are fully known.

2. Wall lining has been allowed for to solid core walls, shears walls and other structural items however depth of wall lining subject to change dependent on acoustic requirements. This may result in room sizes reducing.

3. Areas of ensuite bedrooms and studios include the area of the bathroom and the separating wall between bedroom and pod, but exclude the riser.

4. Cluster kitchens will require a riser to provide drainage etc and will reduce the area stated accordingly. The location of this is as yet unknown until full fit outs have been progressed.

5. Studio layouts shown are design intent only and follow Clients brief. Escape routes' distance from hols to be tested and validated by Fire Strategy with fire suppression measures as necessary. Studio layouts in abeyance until signed-off by Building Safety Regulator (HSE), Building Control Officer, and Building Insurer.

Department Legend

- Water Tanks (incl. Domestic, Commercial & Wet Riser)
- Cycle Stores (313 spaces)
- BOH Areas (incl Plant, Services, Stores etc)
- Circulation
- Preferred Structural Column Locations (WIP / Indicative only and subject to change)

REV.	DATE	AMENDMENT
P01	23/01/23	First Issue - Issued for Information
P02	03/02/23	Layouts amended following client + design team comments
P03	27/02/23	Layouts updated following client + design team comments. Preliminary internal fitout layouts included
P04	24/03/23	Draft Issue for Planning (Incl. minor updates)
P05	14/04/23	Planning Issue

KEYPLAN

CLIENT

IQ Student Accommodation



STATUS **PURPOSE FOR ISSUE**
S2 **Planning**

SHEPPARD ROBSON

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SCALE@A1 DATE ORIGINATOR CHECKED AUTHORISED
1 : 100 14/04/23 LK VC RG

PROJECT
Echo Street
General Arrangement
Basement Plan

Stage 2 **SR NO. 7054**
DRAWING NO. ECHO- SRA- ZZ- B1- DR - A - 02099 **REV. P05**

Appendix B

United Utilities Public Sewer Records

WASTE WATER SYMOLOGY

Combined	Foul	Surface	Overflow	
				Manhole
				Manhole, side entry
				Public sewer
				Private sewer
				S104 sewer
				Rising Main, public
				Rising Mian, private
				Rising main, S104
				Highway Drain, private
				WW Pumping Station
				Inspection Chamber
				Extent of Survey
				Head of System
				Soakaway
				Rodding Eye
				Lamp Hole
				T Junction/Saddle
				Gully
				Air Valve
				Non Return Valve
				Sewer Overflow
				Cascade
				Flow Meter
				Hatch Box
				Hydrobrake
				Inlet
				Bifurcation
				Catchpit
				Oil Interceptor
				Penstock
				Summit
				Valve
				Valve chamber
				Washout Chamber
				Drop Shaft
				WW Treatment Works
				Septic Tank
				Vent Column
				Network Storage Tank
				Orifice Plate
				Vortex Chamber
				Penstock Chamber
				Screen Chamber
				Discharge Point
				Outfall

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	SQ	Square
EG	Egg	TR	Trapezoidal
OV	Oval	AR	Arch
FT	Flat Top	BA	Barrel
RE	Rectangular	HO	Horse Shoe
		U	Unspecified

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	VC	Vitrified Clay
CO	Concrete	PP	Polypropylene
CSB	Concrete Segment	PF	Pitched Fibre
CSU	Concrete Segment	MA	Masonary, Coursed
CC	Concrete Box Culverted	MA	Masonary, Random
PSC	Plastic	RP	Reinforced Plastic
GR	Glass Reinforced	CI	Cast Iron
GRP	Glass Reinforced	SI	Spun Iron
PVC	Polyvinyl Chloride	ST	Steel
PE	Polyeththlene	U	Unspecified



Control Kiosk



Sludge Main

ABANDONED PIPE



Public Sewer



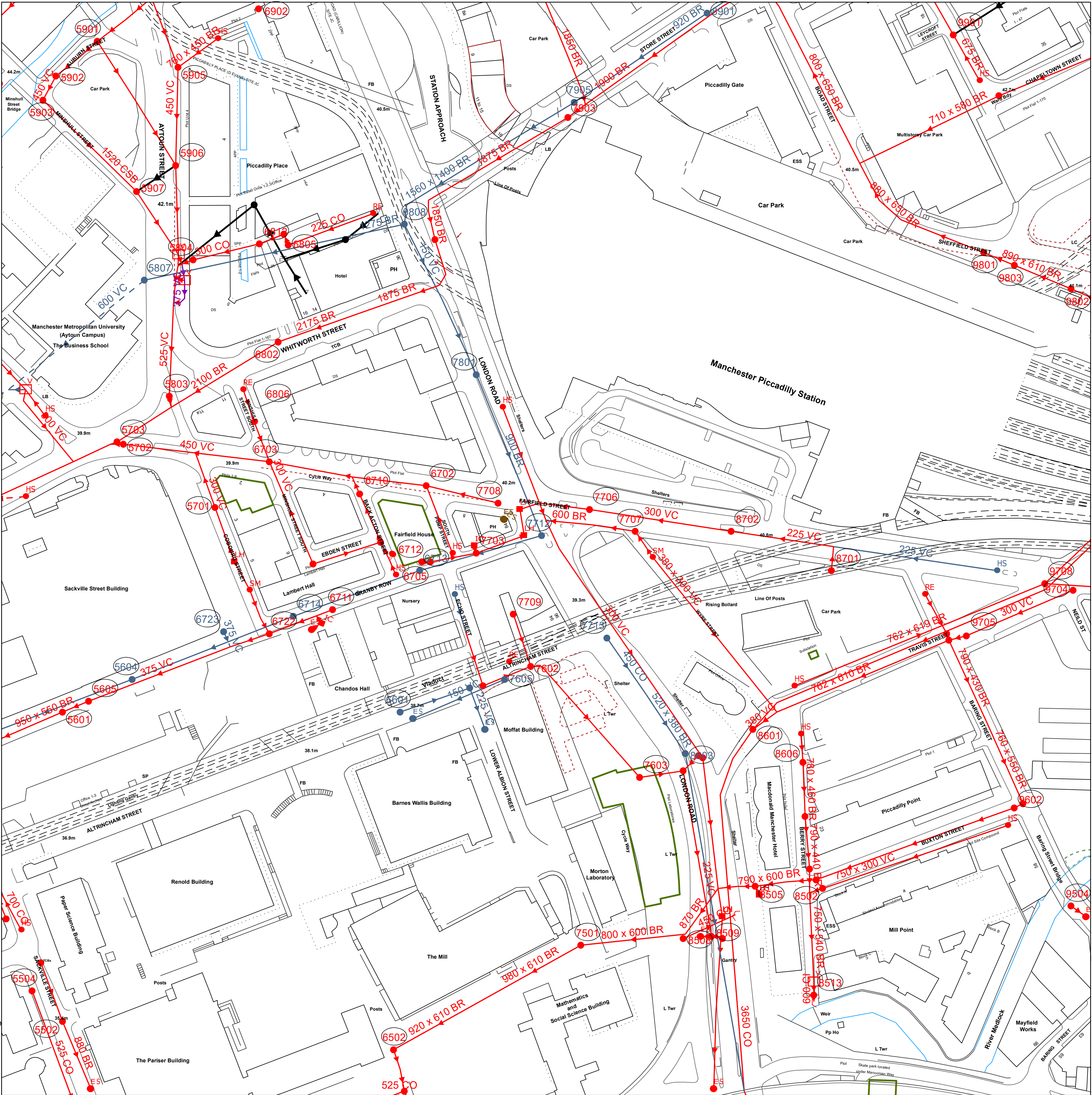
Rising Main



Private Sewer



Sludge Main

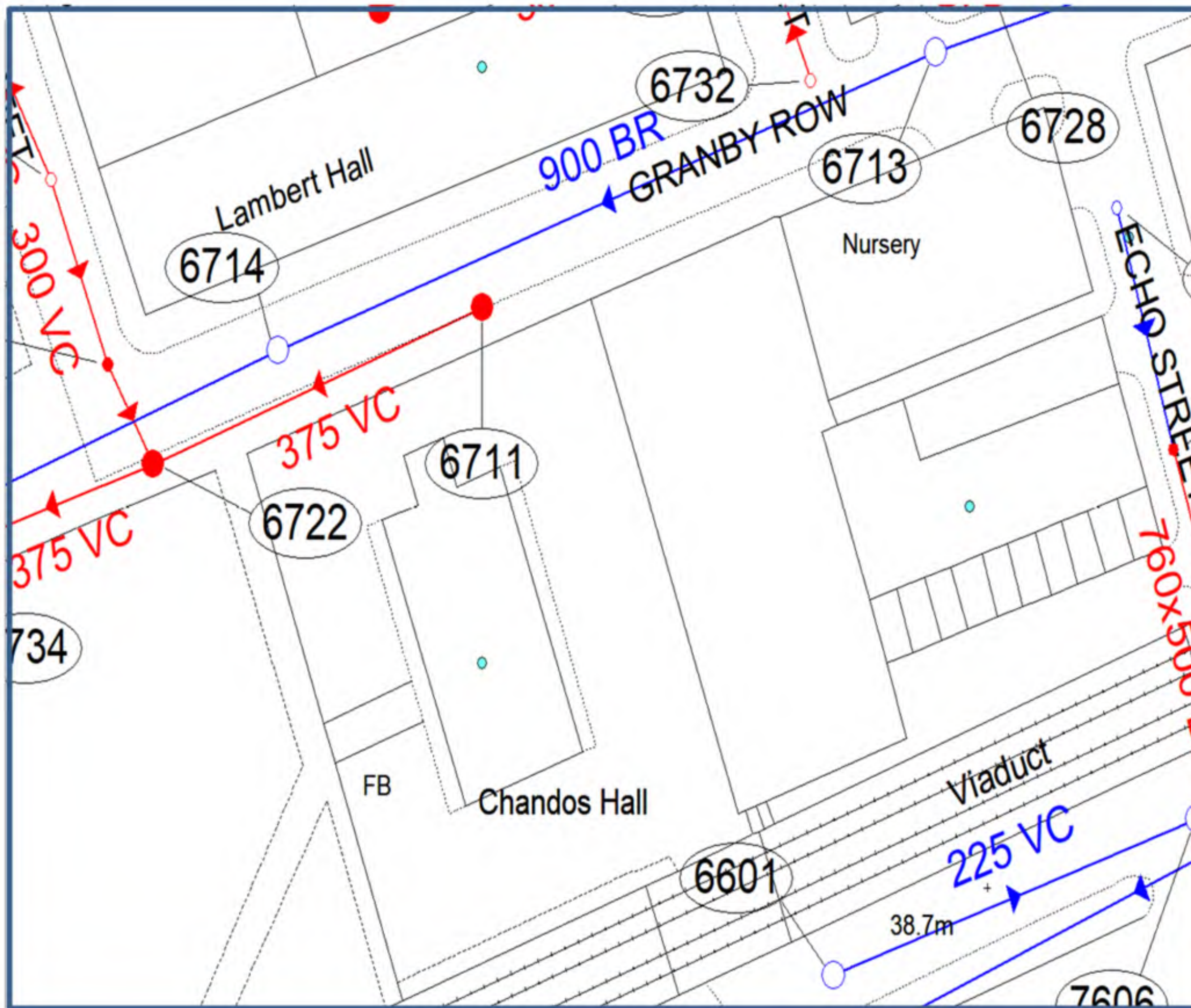


Refo	Cover	Func	Invert	Size	xSize	yShape	Matl	Length	Grad	Refo	Cover	Func	Invert	Size	xSize	yShape	Matl	Length	Grad	
5501	35.75	CO	31.79	880	580	EG	BR	28.79	10	7704		CO								
5502	35.23	CO								7705		CO								
5503		CO								7710		CO								
5504		CO	0	525		CI	CO	103.46		7716		CO	0	760	500	EG	BR	26.25		
5501	38.85	CO	0	850	550	EG	BR	55.54		7718		CO								
5504	40.27	SW	27.99	900		CI	BR	84.5	352	7807		CO								
5505	39.89	CO	35.27	950	550	EG	BR	13		8501		CO	0	750	540	EG	BR	41		
5701	39.98	CO								8504		CO								
5702	39.97	CO	30.46	2100		CI	BR	132.02		8507		CO								
5703	39.99	CO	31.83	525		CI	VC	5.1		8510		CO	0	300		CI	VC	57.26		
5803	40.47	CO								8525		CO								
5804	41.18	SW	33.25	600		CI	VC	5.1		8528		CO								
5807	41.18	SW	33.25	600		CI	VC	5.1		8535		CO								
5901	43.76	CO	39	320		CI	CI	12.04	241	8605		CO	0	380		CI	VC	13.6		
5902	43.51	CO	37.55	450		CI	VC	12.53	45	8703		CO								
5903	43.62	CO	36.7	1520		CI	CSB	60.11	118	8903		CO	0	800	650	EG	BR	90.95		
5905	43.72	CO								8904		CO	0	1900		EG	BR	77.42		
5906	42.37	CO								9604		CO								
5907	42.2	CO	35.78	1520		CI	CSB	34.75	29	9607	33.99	CO								
6501		CO	0	525		CI	CO	36.4		9807		CO								
6502	33.79	CO	27	850	530	EG	BR	9.49		9811		CO								
6602	38.42	SW	36.88	225		CI	VC	33.54	113	9814	36.93	SW								
6702	40.11	CO	32.69	450		CI	VC	72.87		9810		CO								
6703	40.03	CO	36.24	450		CI	VC	21.38	17	9801		CO								
6705	40.96	CO	38.14	300		CI	VC	8.94	2	9802		CO								
6706	40.88	CO	33.28	300		CI	VC	51.08		9802		CO	40.14	225		CI	VC	8.05		
6707	40.67	CO								8515		CO								
6710		CO	0	375		CI	VC	31.02												
6711	41	CO	38.02	939		CI	CO	4												
6713	40.85	SW	28.46	900		CI	BR	61.68	411											
6714	41.23	SW	28.31	900		CI	BR	79.48	248											
6722	41.18	CO	28.31	900		CI	BR	79.48												
6723	41.09	SW	36.07	375		CI	VC	7.62												
6728	40.96	CO	38.41	300		CI	VC	21.38	5											
6801	39.58	CO	38.08	2100		CI	BR	67.14	11											
6802	40	CO																		
6805	33.93	CO																		
6806	40.2	CO																		
6808	39.59	SW																		
6809	33.25	CO																		
6812	33.25	CO																		
6902	33.92	CO																		
7501	38.99	CO																		
7601	38.99	CO																		
7602	39.03	CO																		
7603	37.18	CO	29.21	225		CI	VC	20.22	144											
7605	38.94	SW	33.91	150		CI	VC	45.69												
7606	38.91	SW	36.58	225		CI	VC	20.25												
7706	40.38	CO																		
7707	40.38	CO																		
7708	40.02	CO	37.69	590	510	FT	BR	20.22												
7709	39.81	CO	32.88	450		CI	VC	33.96	179											
7712	40.01	SW	35.3	225		CI	VC	25.3	7											
7713	38.95	SW	34.32	450		CI	CO	31.62	34											
7801	39.93	SW	29	900		CI	BR	79.85												
7903	38.9	CO																		
7905	38.95	SW	31.17	1330	1430	EG	BR	44.42												
8502	36.08	CO																		
8505	36.03	CO																		
8506	36.07	CO	31.29	760	470	FT	BR	14.04	10											
8508	34.72	CO	28.31	450		CI	CO	26.4												
8509	35.45	CO	28.37	930	600	EG	BR	5												
8513	35.32	CO																		
8519	35.51	CO	31.51	300		CI	CO	2.24	1											
8601	37.44	CO	32.42	520	380	EG	BR	157.33												
8606	38.34	CO	37.17	780	460	EG	BR	25.02	6											
8607	37.43	CO																		
8608	36.28	CO	31.5	740	450	FT	BR	11												
8609	37.27	CO	29.05	225		CI	VC	77.1	203											
8610	37.29	CO	0	300		CI	VC	33.96												
8612	37.1	CO	0	300		CI	VC	60.41												
8701	40.61	CO	36.62	225		CI	VC	11.05												
8702	40.77	CO	36.51	300		CI	VC	65.76	120											
8901	38.41	CO																		
9504	35.39	CO	32.18	225		CI	VC	8.6												
9601	37.07	CO	32.81	225		CI	VC	2.24	1											
9602	37.01	CO	28.78	780	610	EG	BR	32.89												
9702	38.84	CO	34.18	780	510	FT	BR	1.41												
9703	39.84	CO	34.21	780	430	FT	BR	40.72	59											
9704	40.88	CO	35.04	300		CI	VC	53.31												
9705		CO																		
9708	40.85	CO																		
9801	40.8	CO	36.49	890	650	EG	BR	40.85												
9802		CO																		
9803	41.09	CO	36.97	890	610	EG	BR	15.25	32											
9901	42.08	CO																		
9902	42.3	CO	36.35	710	580	EG	BR	71.11												
5505		CO																		
5506		CO	0	700		CI	CO	27.29												
5705		CO																		
5808		CO	0	225		CI	VC	14.97												
5810		CO	0	760	450	EG	BR	22.56												
5818		CO																		
5904		CO																		
5909		CO																		
5910		CO																		
5911		CO																		
6503		CO																		
6709		CO	0	300		CI	VC	13.93												
6724		CO	0	300		CI	VC	7.62												
6732		CO																		
6803		CO																		
6906		CO																		
7502		CO																		
7609		CO	0	600		CI	BR	35.41												
7701		CO	0	300		CI	VC	116.5												
7702		CO	0	300		CI	VC	33.24												
7719		CO	0	600	530	EG	BR	7.21												
7720		CO	0																	

Appendix C

GPR Utility Survey drawing

Drainage CCTV Survey Layout



Client:	Malcolm Hughes
Job No:	PJ00470626

- MH - Unknown type
- MH - Foul Water
- MH - Surface Water
- MH - Combined Water
- Grease Trap
- Surface Gully or Rainwater Pipe
- Toilet, Soil Pipe or Foul Gully
- Foul Drain/Sewer
- Surface Drain/Sewer
- Combined Sewer
- Area of Major Damage
- ACO Channel/Kerb Drains
- Petrol Interceptor
- Culvert
- Large Trees or Bushes
- Septic Tank

Site Address:

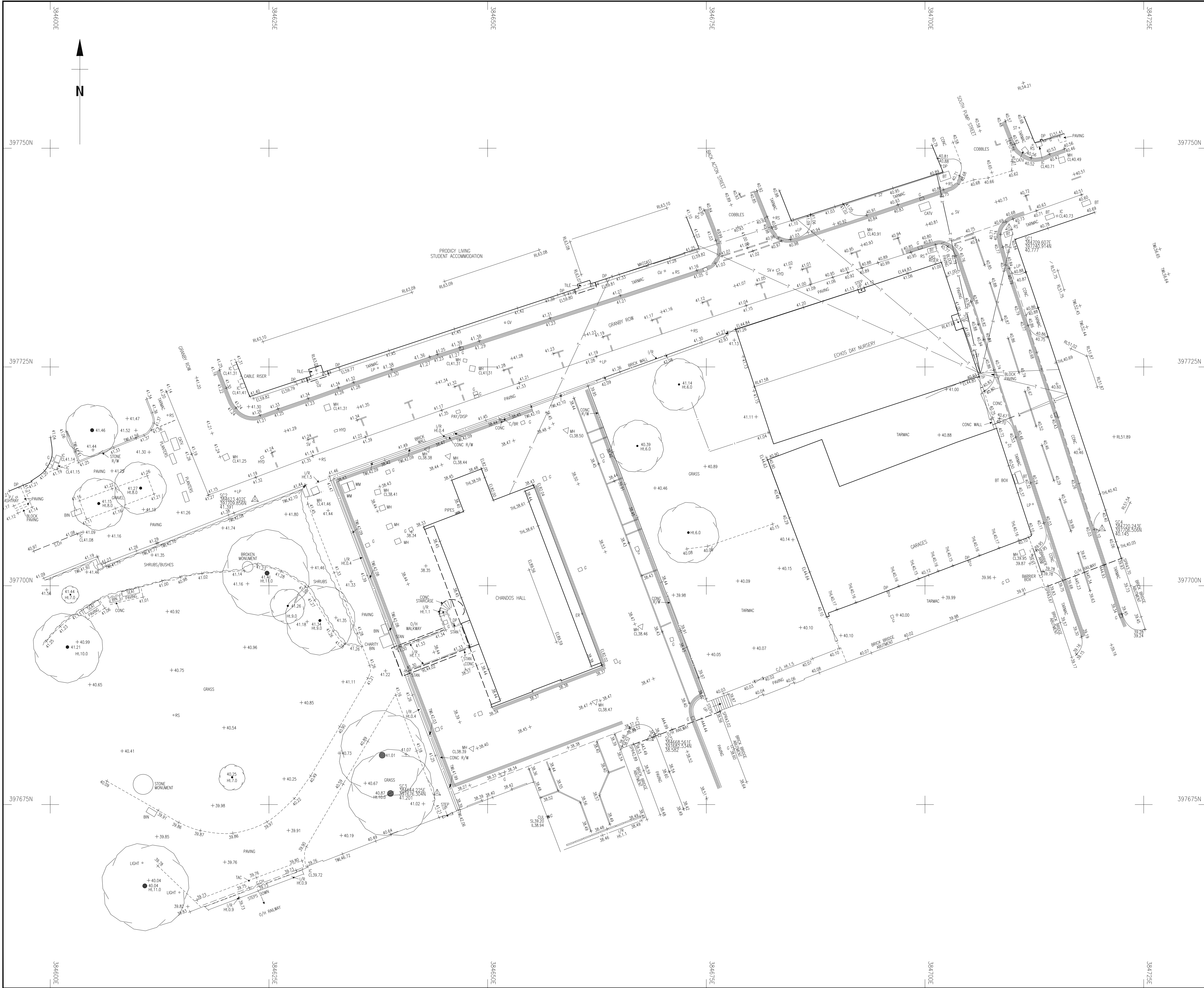
Echo Street Manchester M60 7LH

This drawing is not to scale and is only intended to show assumed drainage assets and layout.
This is not a topographical drawing.

Appendix D

Topographical Survey 2017

Topographical Survey 2022



Survey Notes

Grid: Local, Plane, Metric. Related to National Grid at SC2

Levels: Related to OS datum from GNSS positioning, converted using the National Geoid Model OSGM15.

Notes

Measured Building Survey Legend

ELECTRICAL SERVICES	SECURITY SERVICES
- MCU: Mains consumer unit/Fusebox/Meter - SW: Single wall socket - DSW: Double wall socket - SWS: Single wall socket and switch - DSWS: Double wall socket and switch - FS: Single floor socket - DFS: Double floor socket 1WS: 1-way lighting switch 2WS: 2-way lighting switch - CL: Ceiling point lighting - FL: Fluorescent light fittings - LP: Lighting Pultond - SL: Spot lighting - WL: Wall lighting - EL: Emergency lighting - ELI: Emergency lighting - FSU: Fused spur connection box with switch - USU: Unfused spur connection box - EP: Earth point - IEP: Incoming Electrical point - SWL: Strobe Warning Light	- CCV: CCTV - PIRD: Passive Infra-red detector - SWP: Security alarm panel - SDS: Security Door Swipe - ICIS: Intergrated CCTV & Intercom - EDR: Emergency Door Release - DR: Door Release - SC: Smoke Clock - AS: Alarm Siren - PB: Panic button
WATER SERVICES	MISCELLANEOUS INTERNAL FIXTURES
- IWP: Incoming water point - SLP: Stop tap - WM: Water meter - HWH: Hot water heater	- D: Dooropening - U: Urinal - T: Toilet - S&D: Sink & Drainer - DS: Double Sink - HB: Hand Basin - HDY: Hand Dryer - S: Shower - B: Bath - BS: Breakdown between stairs from floor to floor
GAS SERVICES	GENERAL ABBREVIATIONS
- IGP: Incoming gas point - GM: Gas meter	- F/A: Floor to Arch Height or Apex - F/B: Floor to Beam Height - F/C: Floor to Ceiling Height - F/FC: Floor to False Ceiling Height - F/H: Floor to Head Height - F/SP: Floor to Springing Height - F/S: Floor to Sill Height - F/L: Floor to Understore Height - FL: Floor Level - HT: General Height - BUW: Broken Up Window - COL: Column - P: Partition - RSJ: Rolled Steel Joist - STAN: Stanchions - MH: Manhole - IC: Inspection Chamber - CL: Cover Level - S: Invert Level - F/BT: Floor to beam top - FFL: Finished floor level - FCL: Faster ceiling level - SCL: Structural ceiling level - WAL: Window arch level - VSL: Window sill level - VHL: Window head level - WASL: Window arch Springing level - SPL: Springing level - AL: Arch level - TWL: Top of wall level - DHL: Door head level - GL: General level - JB: Junction Box
HEATING / AIR CONDITIONING SERVICES	FIRE PRECAUTION SERVICES
- R: Radiator - CHB: Central heating boiler - ESB: Electricity storage heater - HTW: Hot water tank - CWT: Cold water tank - ACU: Air conditioning unit - V: Ventilation duct (ceiling) - ACV: Air conditioning vent (wall) - CT: Central heating thermostat	- SD: Smoke detector - SP: Sprinkler - FS: Fire alarm - FSP: Fire alarm push - CD2: Fire extinguisher (Carbon dioxide) - W: Fire extinguisher (Water) - P: Fire extinguisher (Powder)
COMMUNICATION SERVICES	COMMUNICATION SERVICES
- TO: Telephone outlet - CO: Comms outlet - INT: Intercom - TCO: Television co-axial outlet - B: Bell push - PB: Panic Button - S: Speaker - SG: Sensor (general) - LANB: LAN Box - R: Router - DHB: Disabled Help Button	

Rev.	Date	Description

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survey@mhsls.co.uk

Accreditations

RICS **THE SURVEY ASSOCIATION** **ICES**

CRS **ISO 9001**

Client

IQ STUDENT ACCOMMODATION

SUITE 8A, MANCHESTER ONE

53 PORTLAND STREET, MANCHESTER M1 3LD

Project

CHANDOS HALL

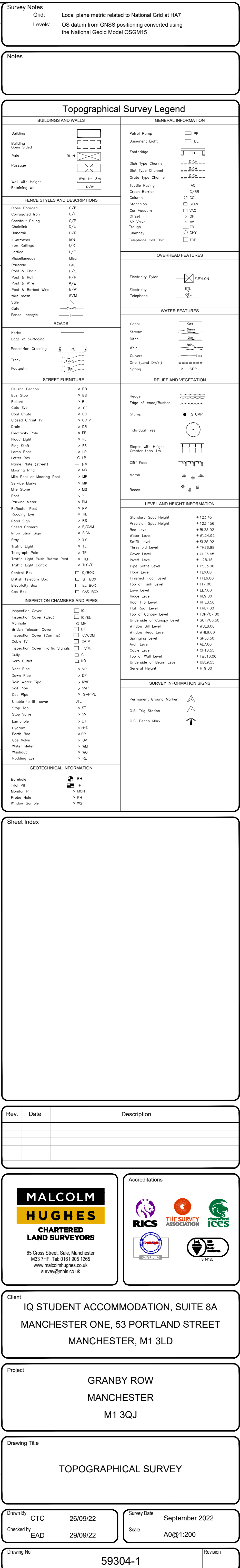
GANBY ROW, MANCHESTER

M1 3QJ

Drawing Title

TOPOGRAPHICAL SURVEY

Drawn By	KH	28/04/2017	Survey Date	APRIL 2017
Checked by	BM	28/04/2017	Scale	A1@1:100scale
Drawing No	19268-1			Revision



Appendix E

Flood Map for Planning

Flood map for planning

Your reference
Echo Street

Location (easting/northing)
384672/397703

Created
26 Jan 2023 22:24

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

Echo Street

Location (easting/northing)

384672/397703

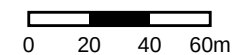
Scale

1:2500

Created

26 Jan 2023 22:24

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



Appendix F

United Utilities Correspondence

Chloé Grimsley

From: seweradoptions@uuplc.co.uk
Sent: 03 March 2023 16:53
To: Chloé Grimsley
Subject: Land at Granby Row/Echo Street, Manchester 03600603

Follow Up Flag: Follow up
Flag Status: Flagged

Good afternoon Chloe,

Thank you for sending everything over.

I am happy with the proposals of 24.95 l/s to the surface water sewer and removing all existing surface water flows from the combined network.

I also have no objections to the foul water proposals.

If I can be of any further assistance please do get in touch.

Kind regards



Ashleigh Bellerby
Assistant Developer Engineer
Developer Services & Metering
Customer Services
T: 07826891650
unitedutilities.com

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----- Original Message -----

From: Chloé Grimsley [chloe.grimsley@curtins.com]
Sent: 28/02/2023 20:04
To: seweradoptions@uuplc.co.uk
Subject: RE: Land at Granby Row/Echo Street, Manchester 03600603

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.

Hi Ashleigh,

As discussed last week, please could you confirm if you have had chance to review the flows as agreed under the previous s106 approval?

If you need any further information, please let me know.

Kind Regards,

Chloé

Chloé Grimsley Principal Civil Engineer
Curtins
T. 0161 236 2394 | chloe.grimsley@curtins.com

From: Chloé Grimsley
Sent: 22 February 2023 12:25
To: seweradoptions@uuplc.co.uk
Subject: RE: Land at Granby Row/Echo Street, Manchester 03600603

Hi Ashleigh,

Thank you for your time just now.

As discussed, please could you review the proposal to discharge at 24.95 l/s based on the S106 Part 1 approval that is in place.

I have attached a link below the correspondence which was issued in 2019 for the S106 application which shows the flows were based on the Wallingford method 1 in 2-year rate which equated to 49.91 l/s reduced by 50% to allow 24.95 l/s.

This is proposed to connect into the surface water sewer in Granby Row.

<https://we.tl/t-z3cQ6fw9Is>

Kind Regards,

Chloé

From: seweradoptions@uuplc.co.uk <seweradoptions@uuplc.co.uk>
Sent: 22 February 2023 11:45
To: Chloé Grimsley <Chloe.Grimmsley@curtins.com>
Subject: RE: Land at Granby Row/Echo Street, Manchester 03600603

Good morning Chloe,

Thank you for your email.

In line with new guidance and policy changes we would request that a new section 106 is applied for please.

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

Prior to any surface water connections being approved the surface water hierarchy should be thoroughly investigated and evidence should be provided when discounting each stage.

Regarding the proposed flow rates, in line with Ciria guidance and the North West Suds proforma we are looking for developers to strive for a sustainable drainage approach, and greenfield rates.

As such, in line the HR Wallingford IH124 Method we would request a rate of 5 l/s.

If you would like a full technical assessment of this site please do submit a pre development enquiry.

<https://www.unitedutilities.com/builders-developers/your-development/planning/pre-development-guidance/wastewater-pre-dev/>

If I can be of any further assistance please do get in touch.

Kind regards



Ashleigh Bellerby
Assistant Developer Engineer
Developer Services & Metering
Customer Services
T: 07826891650
[unitedutilities.com](https://www.unitedutilities.com)

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----- Original Message -----

From: seweradoptions@uuplc.co.uk [seweradoptions@uuplc.co.uk]
Sent: 14/02/2023 12:02
To: chloe.grimsley@curtins.com

Subject: RE: Land at Granby Row/Echo Street, Manchester

Good Afternoon

Your enquiry has been logged and sent to an engineer to respond your reference is 03600603. Our service Level agreement is to respond to you within 10 working days.

Many thanks



Lucie Gaskell
Customer Advisor Advanced
Developer Services & Metering
Customer Services
Direct Tel: 01925 233050
Tel: 0345 072 6067
[unitedutilities.com](https://www.unitedutilities.com)

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Did you know we now have a live chat facility available to you Mon to Friday 8 -5pm. You just click on the orange live chat box on our webpage and one of our advisors will be ready to chat to you and help you with your enquiry <https://www.unitedutilities.com/builders-developers/> or you can email us at WastewaterDeveloperServices@uuplc.co.uk

----- Original Message -----

From: Chloé Grimsley [chloe.grimsley@curtins.com]

Sent: 10/02/2023 08:53

To: wastewaterdeveloperservices@uuplc.co.uk

Subject: Land at Granby Row/Echo Street, Manchester

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.

Good Morning,

We are currently preparing a Flood Risk Assessment and Drainage Strategy for a new development on land at Granby Row/Echo Street, Manchester.

The site location is shown in green below with the redline indicating the planning boundary:



The proposed development is to comprise of up to 1225 purpose-built student accommodation units (Use Class Sui Generis) with associated access. The building includes a basement.

It is noted that the site has been subject to previous planning approvals:

A detailed application was submitted in 2017 permission for:

Full planning permission for the demolition of existing buildings on site and their replacement with a mixed use (sui generis) development comprising 3 towers ranging in height (from 14, 20 and to 25 storeys (including lower ground floor level) and intermediary link buildings and providing: 403 units of Co-Living residential accommodation with associated shared amenity spaces; 94 units of purpose-built student accommodation with associated shared amenity spaces; ground floor commercial floor space and children's day nursery together with cycle parking, recycling and refuse bin storage, associated plant and public realm enhancements to Granby Row, Echo Street, Cobourg Street and Back Acton Street.

The 2017 application was granted by Manchester City Council (MCC) in 2018.

The 2017 application was then subject to subsequent applications in 2019, comprising two Section 73 (S73) minor material amendment applications.

These two applications were granted in May 2019 and March 2020 respectively.

Works commenced on site but were halted in 2020 due to the Coronavirus Pandemic. The works that have commenced on site include demolition and installation of the foundations and some of the drainage penetrations through the basement structure.

The current development proposals therefore generally follow a similar arrangement to the previous scheme, with the main changes being internally within the building, however the intention is to utilise the foundations and drainage as installed to date.

Based on the previous planning approval, the FRA and Drainage Strategy confirmed that the existing site discharged unrestricted to the combined sewer network in Granby Row and proposals were to discharge to the surface water sewer in Granby Row. United Utilities confirmed they would accept unrestricted surface water flows into the surface water sewer; however, Manchester City Council Lead Local Flood Authority (LLFA) confirmed any new developments should refer to the SFRA and apply a 50% flow reduction on existing discharge rates. The report concluded that the scheme would implement a 50% reduction in surface water flows.

It was noted from the FRA and Drainage Strategy report that existing flows based on the existing drainage survey model were anticipated to be 41.2 l/s in the 1 in 2 year event, 86.9 l/s in the 1 in 30 year event and 111.6 l/s in the 1 in 100 year event with a 50% reduction being applied.

However, it is noted that a section 106 application was submitted for the surface water sewer outfall into the sewer in Granby Row at a restricted rate of 24.9 l/s, which was based on the 1 in 2 year flows calculated by the modified rational method. On this basis it is anticipated that the drainage installed to date was based on an allowable discharge rate of 24.9 l/s up to the 1 in 100 year +30% cc event.

Based on the above, please could you advise whether surface water flows are acceptable as per the previous section 106 application are acceptable.

For foul drainage, the proposals were to discharge via two connections – one to the combined sewer in Granby Row and one to the combined sewer in Echo Street with Section 106 applications being submitted on this basis. **Please could you also advise on acceptability of foul discharge following the same principles.**

If you require any further information, please let me know.

Kind Regards,

Chloé

Chloé Grimsley
Principal Civil Engineer
T. 0161 236 2394
chloe.grimsley@curtins.com



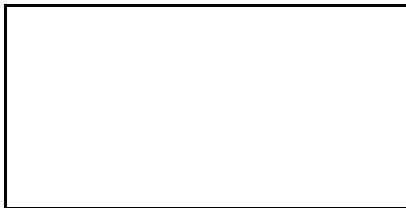
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Manchester M1 5WG

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Appendix G

Preliminary Green/Blue Roof Design (Radmat)



Blue Roof Calculation Summary

Project Name: Echo Street
Location: Manchester

Client:
Completed By: N.Todd

Reference: BR-5111-02
Date: 17/02/2023

Roof ID:	Catchment Area (m ²)	Area of Blue Roof Storage (m ²)	Area of other roofs draining onto Blue Roof (m ²)	Max allowable depth of water (mm)	Hmax (mm)	Allowable discharge (l/s)	Achievable discharge (l/s)	Minimum number of outlets
Block A	533	385	148	100	99		1.49	3
Link A-B (level 11)	67	60	7	100	96		0.10	1
Link A-B (level 12)	110	98	12	100	98		0.15	1
Block B	558	398	160	100	100		1.60	3
Link B-C (Level 15)	67	60	7	100	96		0.10	1
Link B-C (Level 16)	110	98	12	100	98		0.15	1
Block C	548	377	171	100	99		1.83	3
Over Level 0	102	96	6	100	98		0.11	1
Over Level -01	139	133	6	100	100		0.13	1
TOTAL discharge						0.00	5.66	

Notes:	Areas of Blue Roof Storage taken from Data Capture Form completed by A.Rubinstein & D.Burrows. Blue Roof Calculations based on FEH data with a 45% percentage increase for Climate Change. Radmat Blue Roof outlet restrictors incorporate an integral overflow unless otherwise specified. Radmat recommend that at least one additional 'tell-tale' overflow is installed to alert building users of maintenance issues.
--------	---

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Block A

Roof Details:

BlueRoof	385 m ²	x 100 %
Additional Area	148 m ²	x 100 %
Effective Area	533 m ²	

Storage Details:

Length	385 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity mm	Intensity mm/h	Required storage(m ³)
5 min	20.9	250.6	11.0
10 min	30.6	183.7	16.0
15 min	38.3	153.2	19.8
30 min	51.1	102.3	25.9
45 min	59.2	78.9	29.4
60 min	65.2	65.2	31.7
2 hours	78.2	39.1	35.2
6 hours	101.8	17.0	36.2
24 hours	134.9	5.6	27.7

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	27 mm
Sump Depth	None
Discharge rate	1.49 l/s
Outlet	3 No
Flow Per Outlet	0.5 l/s

Result:

Outcome	Pass
Critical Storm Duration	4.47 hrs
Hmax	99 mm
Required Volume	36.4 m ³
Time to half empty	3.4 hrs
Roof Loading	94.55 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Link A-B (Level 11)

Roof Details:

BlueRoof	60 m ²	x 100 %
Additional Area	7 m ²	x 100 %
Effective Area	67 m ²	

Storage Details:

Length	60 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity		Required storage(m ³)
	mm	mm/h	
5 min	20.9	250.6	1.4
10 min	30.6	183.7	2.0
15 min	38.3	153.2	2.5
30 min	51.1	102.3	3.3
45 min	59.2	78.9	3.8
60 min	65.2	65.2	4.2
2 hours	78.2	39.1	4.8
6 hours	101.8	17.0	5.5
24 hours	134.9	5.6	5.0

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	12 mm
Sump Depth	None
Discharge rate	0.1 l/s
Outlet	1 No

Result:

Outcome	Pass
Critical Storm Duration	6.22 hrs
Hmax	96 mm
Required Volume	5.5 m ³
Time to half empty	7.9 hrs
Roof Loading	91.67 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Link A-B (Level 12)

Roof Details:

BlueRoof	98 m ²	x 100 %
Additional Area	12 m ²	x 100 %
Effective Area	110 m ²	

Storage Details:

Length	98 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity		Required storage(m ³)
	mm	mm/h	
5 min	20.9	250.6	2.3
10 min	30.6	183.7	3.3
15 min	38.3	153.2	4.2
30 min	51.1	102.3	5.5
45 min	59.2	78.9	6.3
60 min	65.2	65.2	6.9
2 hours	78.2	39.1	8.0
6 hours	101.8	17.0	9.1
24 hours	134.9	5.6	8.5

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	15 mm
Sump Depth	None
Discharge rate	0.15 l/s
Outlet	1 No

Result:

Outcome	Pass
Critical Storm Duration	6.58 hrs
Hmax	98 mm
Required Volume	9.1 m ³
Time to half empty	8.3 hrs
Roof Loading	92.86 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Block B

Roof Details:

BlueRoof	398 m ²	x 100 %
Additional Area	160 m ²	x 100 %
Effective Area	558 m ²	

Storage Details:

Length	398 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity mm	Intensity mm/h	Required storage(m ³)
5 min	20.9	250.6	11.5
10 min	30.6	183.7	16.7
15 min	38.3	153.2	20.8
30 min	51.1	102.3	27.1
45 min	59.2	78.9	30.7
60 min	65.2	65.2	33.1
2 hours	78.2	39.1	36.6
6 hours	101.8	17.0	37.6
24 hours	134.9	5.6	28.5

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	28 mm
Sump Depth	None
Discharge rate	1.6 l/s
Outlet	3 No
Flow Per Outlet	0.53 l/s

Result:

Outcome	Pass
Critical Storm Duration	4.3 hrs
Hmax	100 mm
Required Volume	37.8 m ³
Time to half empty	3.3 hrs
Roof Loading	94.97 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Link B-C (Level 15)

Roof Details:

BlueRoof	60 m ²	x 100 %
Additional Area	7 m ²	x 100 %
Effective Area	67 m ²	

Storage Details:

Length	60 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity		Required storage(m ³)
	mm	mm/h	
5 min	20.9	250.6	1.4
10 min	30.6	183.7	2.0
15 min	38.3	153.2	2.5
30 min	51.1	102.3	3.3
45 min	59.2	78.9	3.8
60 min	65.2	65.2	4.2
2 hours	78.2	39.1	4.8
6 hours	101.8	17.0	5.5
24 hours	134.9	5.6	5.0

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	12 mm
Sump Depth	None
Discharge rate	0.1 l/s
Outlet	1 No

Result:

Outcome	Pass
Critical Storm Duration	6.22 hrs
Hmax	96 mm
Required Volume	5.5 m ³
Time to half empty	7.9 hrs
Roof Loading	91.67 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Link B-C (Level 16)

Roof Details:

BlueRoof	98 m ²	x 100 %
Additional Area	12 m ²	x 100 %
Effective Area	110 m ²	

Storage Details:

Length	98 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity		Required storage(m ³)
	mm	mm/h	
5 min	20.9	250.6	2.3
10 min	30.6	183.7	3.3
15 min	38.3	153.2	4.2
30 min	51.1	102.3	5.5
45 min	59.2	78.9	6.3
60 min	65.2	65.2	6.9
2 hours	78.2	39.1	8.0
6 hours	101.8	17.0	9.1
24 hours	134.9	5.6	8.5

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	15 mm
Sump Depth	None
Discharge rate	0.15 l/s
Outlet	1 No

Result:

Outcome	Pass
Critical Storm Duration	6.58 hrs
Hmax	98 mm
Required Volume	9.1 m ³
Time to half empty	8.3 hrs
Roof Loading	92.86 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Block C

Roof Details:

BlueRoof	377 m ²	x 100 %
Additional Area	171 m ²	x 100 %
Effective Area	548 m ²	

Storage Details:

Length	377 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity mm	Intensity mm/h	Required storage(m ³)
5 min	20.9	250.6	11.3
10 min	30.6	183.7	16.4
15 min	38.3	153.2	20.3
30 min	51.1	102.3	26.3
45 min	59.2	78.9	29.7
60 min	65.2	65.2	31.9
2 hours	78.2	39.1	34.7
6 hours	101.8	17.0	35.1
24 hours	134.9	5.6	24.9

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	30 mm
Sump Depth	None
Discharge rate	1.83 l/s
Outlet	3 No
Flow Per Outlet	0.61 l/s

Result:

Outcome	Pass
Critical Storm Duration	4 hrs
Hmax	99 mm
Required Volume	35.5 m ³
Time to half empty	2.7 hrs
Roof Loading	94.16 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Over Level 0

Roof Details:

BlueRoof	96 m ²	x 100 %
Additional Area	6 m ²	x 100 %
Effective Area	102 m ²	

Storage Details:

Length	96 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity		Required storage(m ³)
	mm	mm/h	
5 min	20.9	250.6	2.1
10 min	30.6	183.7	3.1
15 min	38.3	153.2	3.9
30 min	51.1	102.3	5.1
45 min	59.2	78.9	5.9
60 min	65.2	65.2	6.4
2 hours	78.2	39.1	7.5
6 hours	101.8	17.0	8.8
24 hours	134.9	5.6	8.5

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	13 mm
Sump Depth	None
Discharge rate	0.11 l/s
Outlet	1 No

Result:

Outcome	Pass
Critical Storm Duration	8.53 hrs
Hmax	98 mm
Required Volume	8.9 m ³
Time to half empty	10.9 hrs
Roof Loading	92.71 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Client:

Project: Echo Street

Reference: BR-5111-02 Designer: N.Todd Date: 17/02/2023

Location: Manchester

Roof Location: Over Level -01

Roof Details:

BlueRoof	133 m ²	x 100 %
Additional Area	6 m ²	x 100 %
Effective Area	139 m ²	

Storage Details:

Length	133 m
Width	1 m
Depth	100 mm
Porosity	95 %
Slope	none

Rainfall Details - FEH Method:

Return Period	100 years
Climate Change Factor	45 %

Summer Storm Profile

Duration	Intensity		Required storage(m ³)
	mm	mm/h	
5 min	20.9	250.6	2.9
10 min	30.6	183.7	4.2
15 min	38.3	153.2	5.3
30 min	51.1	102.3	7.0
45 min	59.2	78.9	8.1
60 min	65.2	65.2	8.8
2 hours	78.2	39.1	10.3
6 hours	101.8	17.0	12.3
24 hours	134.9	5.6	12.3

Outflow Details:

Attenuation Control	Orifice Plate
Control Diameter	14 mm
Sump Depth	None
Discharge rate	0.13 l/s
Outlet	1 No

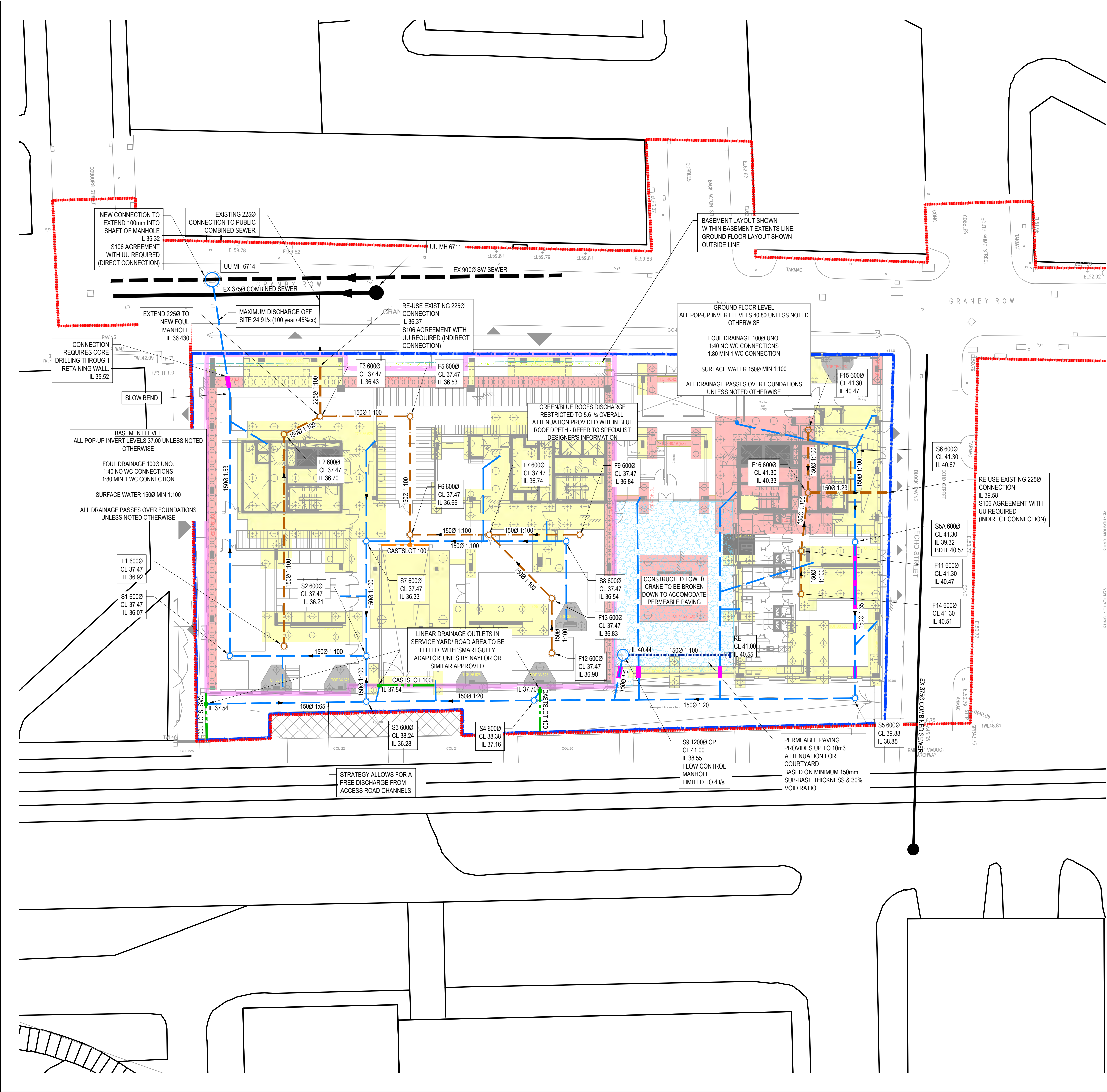
Result:

Outcome	Fail
Critical Storm Duration	10.35 hrs
Hmax	100 mm
Required Volume	12.7 m ³
Time to half empty	13.1 hrs
Roof Loading	95.49 Kg/m ²

Blue Roof calculation service is provided in good faith using the information supplied to us in the brief and the stated parameters in the calculation. If any of these parameters are incorrect or have been superseded, Radmat should be contacted to provide updated calculations. References should be made to any relevant codes of practice. Final determination of the suitability of any system is the sole responsibility of the user. Radmat obligations in respect of any sale of its products are governed by the respective sales contract.

Appendix H

Proposed Drainage Strategy Layout



DRAINAGE DESIGN PHILOSOPHY

SURFACE WATER DRAINAGE

PROPOSED FLOW RATES:
AN ALLOWABLE DISCHARGE RATE OF 24.9 l/s HAS BEEN AGREED WITH THE LLFA AND UU

SW DRAINAGE DISCHARGES TO THE EXISTING SURFACE WATER SEWER WITHIN GRANBY ROW.
A S106 AGREEMENT (DIRECT CONNECTION) WITH UU WILL BE REQUIRED.

GREEN/BLUE ROOFS
ROOF DRAINAGE IS RESTRICTED TO A TOTAL OF 5.6 l/s.
ATTENUATION STORAGE IS TO BE PROVIDED BY THE BLUE ROOF SYSTEM.
GREEN/BLUE ROOFS TO BE DESIGNED BY SPECIALIST DESIGNER. REFER TO PRELIMINARY DESIGN FOR DETAILS.

COURTYARD AREA
THE COURTYARD AREA IS TO BE PAVED USING PERMEABLE PAVING. THE FLOW FROM THIS AREA IS RESTRICTED TO 4 l/s.
ATTENUATION IS PROVIDED BY THE PERMEABLE SUB-BASE.

SERVICE YARD/ ROAD
THE SERVICE YARD IS SERVED BY A SERIES OF LINEAR DRAINAGE CHANNELS. THE FLOW FROM THIS AREA IS UNRESTRICTED AND INDICATES A PASS FORWARD FLOW OF APPROXIMATELY 14.7 l/s WITHOUT ADDITIONAL ATTENUATION.

SUSTAINABLE DRAINAGE
GREEN/BLUE ROOF PROVIDES QUALITY TREATMENT FOR ROOF AREAS.
PERMEABLE PAVING PROVIDES TREATMENT FOR COURTYARD AREA.
SMARTGULLY ADAPTOR UNITS TO ALL LINEAR DRAINS PROVIDES TREATMENT WITHIN THE ACCESS ROAD.

FOUL WATER DESIGN
FOUL DRAINAGE DISCHARGES TO PUBLIC SEWER IN TWO LOCATIONS:
THE EXISTING COMBINED SEWER IN GRANBY ROW.
THE EXISTING COMBINED SEWER IN ECHO STREET.

IN BOTH CASES, IT IS PROPOSED TO RE-USE EXISTING PRIVATE CONNECTIONS TO THE PUBLIC SEWER.
2 No. S106 AGREEMENTS (INDIRECT CONNECTIONS) WITH UU WILL BE REQUIRED.

THE FW PEAK FLOW RATE FOR BOTH CONNECTIONS IS TBC, SUBJECT TO RECEIPT OF M&E DESIGN.

DRAINAGE BASED ON:

ARCHITECT'S PLANS

- ECHO-SRA-ZZ-00-DR-A-02100 REV P04 GENERAL ARRANGEMENT GROUND FLOOR PLAN
- ECHO-SRA-ZZ-B1-DR-A-02099 REV P03 GENERAL ARRANGEMENT BASEMENT PLAN
- ECHO-SRA-ZZ-XX-DR-A-00801 REV P01 EXISTING SITE PLAN WITH PLANNING APPLICATION BOUNDARY
- ECHO-SRA-ZZ-XX-DR-A-00803 REV P01 EXISTING SITE PLAN WITH PROPOSED BUILDING FOOTPRINT

LANDSCAPE ARCHITECT'S PLANS

- ECHO-SRA-ZZ-00-DR-A-02100 REV P04 GENERAL ARRANGEMENT GROUND FLOOR PLAN

STRUCTURAL ENGINEER'S PLANS

- 1196-ACE-ZZ-00-DR-S-1000 REV P02 LEVEL 00 SUPERSTRUCTURE - GENERAL ARRANGEMENT
- 1196-ACE-ZZ-B1-DR-S-0999 REV P02 LEVEL B1 SUPERSTRUCTURE - GENERAL ARRANGEMENT
- 1196-ACE-ZZ-FN-DR-S-9001 REV P02 FOUNDATION GENERAL ARRANGEMENT

TOPO SURVEY

- 53904-1 TOPO SURVEY BY MALCOLM HUGHES DATED SEP 2022.

M&E DESIGN

- THERE IS NO CURRENT M&E DESIGN, THEREFORE REFERENCE HAS BEEN MADE TO THE PREVIOUS 2020 SCHEME M&E DESIGN.

BLUE ROOF DESIGN

- ECHO-SRA-ZZ-XX-DR-A-SK035 PROPOSED ROOF TYPES.

GENERAL

- REFERENCE HAS BEEN MADE TO THE PREVIOUS 2020 SCHEME BELOW GROUND DRAINAGE DESIGN.
- IT IS CURRENTLY UNCONFIRMED IF ANY OF THE PREVIOUS SCHEME DRAINAGE HAS BEEN INSTALLED THEREFORE, WHERE INSTALLED AND SUITABLE, PROPOSALS MAY BENEFIT FROM UTILISING DRAINAGE. EXISTING DRAINAGE SHOULD BE CONFIRMED.

THE CURRENT STRATEGY IS BASED ON A SIMILAR STRATEGY TO THE PREVIOUS 2020 SCHEME AS IT IS NOT CONFIRMED OF THE EXTENT (IF ANY) OF DRAINAGE PREVIOUSLY INSTALLED.

DRAINAGE INSTALLED TO DATE SHOULD BE CONFIRMED.

GENERAL NOTES:

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
- DESIGN BASED ON TOPOGRAPHICAL SURVEY AND CCTV SURVEY INFORMATION AVAILABLE AT THE TIME OF DESIGN.
- ALL EXISTING SEWERS, CONNECTIONS, PIPE SIZES AND INVERT LEVELS TO BE CONFIRMED BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS TO ENSURE CONNECTIVITY. ANY VARIANCE FROM THE INFORMATION SHOWN SHOULD BE REPORTED TO THE ENGINEER FOR REVIEW.
- DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
- ALL DIMENSIONS ARE IN METRES AND LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS OTHERWISE NOTED.
- WHERE EXISTING DRAINAGE IS BEING USED, ALLOWANCES SHOULD BE MADE TO REMEDIATE THIS DRAINAGE IN LINE WITH AVAILABLE CCTV SURVEY INFORMATION. IF NO SURVEY IS AVAILABLE, IT IS ADVISED TO OBTAIN ONE PRIOR TO COMMENCEMENT OF WORKS.
- ALL EXISTING SERVICES TO BE LOCATED PRIOR TO COMMENCEMENT OF ANY DRAINAGE WORKS, AND WHERE NECESSARY PROTECTION OR DIVERSIONS TO BE UNDERTAKEN TO AVOID CONFLICT WITH THE PROPOSED WORK.
- ALL RAINWATER AND FOUL POP UPS LOCATIONS AND SIZES TO BE CONFIRMED BY THE ARCHITECT AND M&E ENGINEER.
- COVER LEVELS, GULLY POSITIONS, AND BUILDINGS LOCATION ARE APPROXIMATE AND SHALL BE CONFIRMED BY ARCHITECT/ LANDSCAPE ARCHITECT.
- ALL PIPE DIAMETERS GIVEN ARE NOMINAL INTERNAL PIPE DIAMETERS. THESE ARE TO BE CONFIRMED ONCE A DETAILED CAPACITY CHECK HAS BEEN UNDERTAKEN AT A LATER DESIGN STAGE.
- OUTFALL CONNECTION(S) SUBJECT TO AGREEMENT WITH THE APPROVING AUTHORITY.

KEY:

- PLANNING APPLICATION BOUNDARY
- OWNERSHIP BOUNDARY
- EXISTING PUBLIC COMBINED DRAINAGE
- EXISTING PRIVATE COMBINED DRAINAGE CONNECTIONS
- EXISTING PUBLIC SW SEWER
- PROPOSED SW DRAINAGE
- PROPOSED FW DRAINAGE
- PROPOSED SW LINEAR DRAIN
- SMART FILTER DRAINS BY NAYLOR OSA TO BE INSTALLED ON ALL OUTLETS.
- PROPOSED FW LINEAR DRAIN

LINEAR DRAINAGE IS GATIC CASTSLOT TREADSAFE D400. SIZES AS NOTED

- PROPOSED PERMEABLE PAVING
- PERFORATED SW DRAIN IN PERMEABLE PAVING
- BASEMENT EXTENT
- CONSTRUCTED FOUNDATION
- PROPOSED FOUNDATION
- PIPEWORK PASSES THROUGH FOUNDATION

P02	ISSUED FOR PLANNING	23/03/23	ATL	CG
P01	DRAFT PLANNING ISSUE	10/03/23	ATL	CG
Rev:	Description:	Date:	By:	Chkd:

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Civils & Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Principal Designer
Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kander • Leeds • Liverpool • London • Manchester • Nottingham

Status: **PRELIMINARY**

Project: **ECHO STREET, MANCHESTER**

Orig Title: **PROPOSED DRAINAGE STRATEGY**

Drawn By	Designed By	Checked By
ATL	ATL	CG
Date	10/03/23	Scales @ A1
1:200		Revision

064987 - CUR - XX - XX - D - C - 92000 P02

Appendix J

Proposed Surface Water Drainage Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	18.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.357	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Diameter (mm)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
S6		5.00	0.8	41.300	600		384701.408	397726.109	0.630
S5A			0.8	41.300	600		384704.644	397717.014	1.980
S5			0.8	39.900	600		384710.146	397701.554	1.049
RE9A	0.012	5.00		41.000	150		384696.239	397701.459	0.450
S9	0.011	5.00		41.000	1200		384685.629	397697.683	2.450
JUN4A				38.710			384686.346	397692.897	1.125
LD1	0.026	5.00		38.400	350	350	384678.683	397691.190	0.700
S4				38.380	600		384678.406	397690.009	1.217
LD2	0.007	5.00		38.240	350	350	384646.221	397678.172	0.700
S3				38.240	600		384661.843	397683.985	1.958
S8		5.00	1.9	37.470	600		384675.999	397706.923	0.930
S7			0.5	37.470	600		384656.189	397699.873	1.140
S2			0.5	37.470	600		384660.230	397688.518	1.261
S1			0.5	37.470	600		384646.688	397683.709	1.405
BEND1A				37.470			384637.483	397709.630	1.924
OF				41.300	1500		384631.683	397720.358	5.984

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	S6	S5A	9.654	0.600	40.670	40.573	0.097	100.0	150	5.16	50.0
1.001	S5A	S5	16.410	0.600	39.320	38.851	0.469	35.0	150	5.32	50.0
1.002	S5	JUN4A	25.326	0.600	38.851	37.585	1.266	20.0	150	5.51	50.0
2.000	RE9A	S9	11.262	0.600	40.550	40.437	0.113	100.0	150	5.19	50.0
2.001	S9	JUN4A	4.839	0.600	38.550	37.585	0.965	5.0	150	5.20	50.0
1.003	JUN4A	S4	8.449	0.600	37.585	37.163	0.422	20.0	150	5.57	50.0
3.000	LD1	S4	1.213	0.600	37.700	37.163	0.537	2.3	150	5.00	50.0
1.004	S4	S3	17.624	0.600	37.163	36.282	0.881	20.0	150	5.70	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.005	17.8	0.8	0.480	0.577	0.000	0.8	22	0.510
1.001	1.707	30.2	1.6	1.830	0.899	0.000	1.6	24	0.913
1.002	2.262	40.0	2.4	0.899	0.975	0.000	2.4	25	1.249
2.000	1.005	17.8	1.6	0.300	0.413	0.012	0.0	31	0.628
2.001	4.530	80.1	3.1	2.300	0.975	0.023	0.0	20	2.202
1.003	2.262	40.0	5.5	0.975	1.067	0.023	2.4	38	1.600
3.000	6.757	119.4	3.5	0.550	1.067	0.026	0.0	18	3.040
1.004	2.262	40.0	9.0	1.067	1.808	0.049	2.4	48	1.833

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.000	LD2	S3	16.668	0.600	37.540	37.282	0.258	64.6	150	5.22	50.0
1.005	S3	S2	4.811	0.600	36.282	36.234	0.048	100.0	150	5.78	50.0
5.000	S8	S7	21.027	0.600	36.540	36.330	0.210	100.0	150	5.35	50.0
5.001	S7	S2	12.053	0.600	36.330	36.209	0.121	100.0	150	5.55	50.0
1.006	S2	S1	14.371	0.600	36.209	36.065	0.144	100.0	150	6.02	50.0
1.007	S1	BEND1A	27.507	0.600	36.065	35.546	0.519	53.0	150	6.35	50.0
1.008	BEND1A	OF	12.195	0.600	35.546	35.316	0.230	53.0	150	6.50	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.000	1.253	22.1	0.9	0.550	0.808	0.007	0.0	21	0.627
1.005	1.005	17.8	10.0	1.808	1.086	0.056	2.4	81	1.034
5.000	1.005	17.8	1.9	0.780	0.990	0.000	1.9	33	0.656
5.001	1.005	17.8	2.4	0.990	1.111	0.000	2.4	37	0.702
1.006	1.005	17.8	12.9	1.111	1.255	0.056	5.3	95	1.093
1.007	1.385	24.5	13.4	1.255	1.774	0.056	5.8	79	1.417
1.008	1.385	24.5	13.4	1.774	5.834	0.056	5.8	79	1.417

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	9.654	100.0	150	1 STANDARD	41.300	40.670	0.480	41.300	40.573	0.577
1.001	16.410	35.0	150	1 STANDARD	41.300	39.320	1.830	39.900	38.851	0.899
1.002	25.326	20.0	150	1 STANDARD	39.900	38.851	0.899	38.710	37.585	0.975
2.000	11.262	100.0	150	1 STANDARD	41.000	40.550	0.300	41.000	40.437	0.413
2.001	4.839	5.0	150	1 STANDARD	41.000	38.550	2.300	38.710	37.585	0.975
1.003	8.449	20.0	150	1 STANDARD	38.710	37.585	0.975	38.380	37.163	1.067
3.000	1.213	2.3	150	1 STANDARD	38.400	37.700	0.550	38.380	37.163	1.067
1.004	17.624	20.0	150	1 STANDARD	38.380	37.163	1.067	38.240	36.282	1.808
4.000	16.668	64.6	150	1 STANDARD	38.240	37.540	0.550	38.240	37.282	0.808
1.005	4.811	100.0	150	1 STANDARD	38.240	36.282	1.808	37.470	36.234	1.086
5.000	21.027	100.0	150	1 STANDARD	37.470	36.540	0.780	37.470	36.330	0.990
5.001	12.053	100.0	150	1 STANDARD	37.470	36.330	0.990	37.470	36.209	1.111
1.006	14.371	100.0	150	1 STANDARD	37.470	36.209	1.111	37.470	36.065	1.255

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	S6	600		Manhole	1 STANDARD	S5A	600	Manhole	1 STANDARD
1.001	S5A	600		Manhole	1 STANDARD	S5	600	Manhole	1 STANDARD
1.002	S5	600		Manhole	1 STANDARD	JUN4A		Junction	
2.000	RE9A	150		Manhole	1 STANDARD	S9	1200	Manhole	1 STANDARD
2.001	S9	1200		Manhole	1 STANDARD	JUN4A		Junction	
1.003	JUN4A			Junction		S4	600	Manhole	1 STANDARD
3.000	LD1	350	350	Manhole	1 STANDARD	S4	600	Manhole	1 STANDARD
1.004	S4	600		Manhole	1 STANDARD	S3	600	Manhole	1 STANDARD
4.000	LD2	350	350	Manhole	1 STANDARD	S3	600	Manhole	1 STANDARD
1.005	S3	600		Manhole	1 STANDARD	S2	600	Manhole	1 STANDARD
5.000	S8	600		Manhole	1 STANDARD	S7	600	Manhole	1 STANDARD
5.001	S7	600		Manhole	1 STANDARD	S2	600	Manhole	1 STANDARD
1.006	S2	600		Manhole	1 STANDARD	S1	600	Manhole	1 STANDARD

Pipeline Schedule

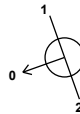
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	27.507	53.0	150	1 STANDARD	37.470	36.065	1.255	37.470	35.546	1.774
1.008	12.195	53.0	150	1 STANDARD	37.470	35.546	1.774	41.300	35.316	5.834

Link	US Node	Dia (mm)	Width (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	S1	600		Manhole	1 STANDARD	BEND1A		Junction	
1.008	BEND1A			Junction		OF	1500	Manhole	1 STANDARD

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)	
S6	384701.408	397726.109	41.300	0.630	600			0	1.000	40.670	150
S5A	384704.644	397717.014	41.300	1.980	600			1	1.000	40.573	150
S5	384710.146	397701.554	39.900	1.049	600			0	1.001	39.320	150
								1	1.001	38.851	150
								0	1.002	38.851	150
RE9A	384696.239	397701.459	41.000	0.450	150			0	2.000	40.550	150
S9	384685.629	397697.683	41.000	2.450	1200			1	2.000	40.437	150
JUN4A	384686.346	397692.897	38.710	1.125				0	2.001	38.550	150
								1	2.001	37.585	150
								2	1.002	37.585	150
								0	1.003	37.585	150
LD1	384678.683	397691.190	38.400	0.700	350	350		0	3.000	37.700	150
S4	384678.406	397690.009	38.380	1.217	600			1	3.000	37.163	150
								2	1.003	37.163	150
								0	1.004	37.163	150
LD2	384646.221	397678.172	38.240	0.700	350	350		0	4.000	37.540	150
S3	384661.843	397683.985	38.240	1.958	600			1	4.000	37.282	150
								2	1.004	36.282	150
								0	1.005	36.282	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Width (mm)	Connections	Link	IL (m)	Dia (mm)	
S8	384675.999	397706.923	37.470	0.930	600			0	5.000	36.540	150
S7	384656.189	397699.873	37.470	1.140	600			1	5.000	36.330	150
S2	384660.230	397688.518	37.470	1.261	600		0	5.001	36.330	150	
							1	5.001	36.209	150	
							2	1.005	36.234	150	
S1	384646.688	397683.709	37.470	1.405	600		0	1.006	36.209	150	
							1	1.006	36.065	150	
							0	1.007	36.065	150	
BEND1A	384637.483	397709.630	37.470	1.924			1	1.007	35.546	150	
							0	1.008	35.546	150	
OF	384631.683	397720.358	41.300	5.984	1500			1	1.008	35.316	150

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	18.000	Drain Down Time (mins)	240
Ratio-R	0.357	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	45	0	0

Node S9 Online Hydro-Brake® Control

Flap Valve	✓	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	38.550	Product Number	CTL-SHE-0077-4000-2500-4000
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	4.0	Min Node Diameter (mm)	1200

Node S9 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	40.750	Slope (1:X)	1000.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.150
Safety Factor	2.0	Width (m)	12.500	Inf Depth (m)	
Porosity	0.30	Length (m)	17.500		

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.76%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S6	7	40.692	0.022	0.8	0.0062	0.0000	OK
30 minute winter	S5A	7	39.344	0.024	1.6	0.0067	0.0000	OK
180 minute summer	S5	12	38.876	0.025	2.4	0.0071	0.0000	OK
15 minute winter	RE9A	10	40.580	0.030	1.5	0.0164	0.0000	OK
15 minute winter	S9	12	38.688	0.138	2.8	0.1689	0.0000	OK
15 minute winter	JUN4A	12	37.620	0.035	4.8	0.0000	0.0000	OK
15 minute winter	LD1	10	37.717	0.017	3.2	0.0144	0.0000	OK
15 minute winter	S4	10	37.208	0.045	7.9	0.0128	0.0000	OK
15 minute winter	LD2	10	37.560	0.020	0.9	0.0065	0.0000	OK
15 minute winter	S3	11	36.365	0.083	8.7	0.0234	0.0000	OK
15 minute summer	S8	1	36.574	0.034	1.9	0.0096	0.0000	OK
30 minute winter	S7	2	36.368	0.038	2.4	0.0107	0.0000	OK
15 minute winter	S2	11	36.303	0.094	11.6	0.0267	0.0000	OK
15 minute winter	S1	11	36.140	0.075	12.1	0.0213	0.0000	OK
15 minute winter	BEND1A	12	35.623	0.077	12.1	0.0000	0.0000	OK
15 minute winter	OF	12	35.390	0.074	12.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S6	1.000	S5A	0.8	0.505	0.045	0.0153	
30 minute winter	S5A	1.001	S5	1.6	0.869	0.053	0.0303	
180 minute summer	S5	1.002	JUN4A	2.4	1.236	0.060	0.0555	
15 minute winter	RE9A	2.000	S9	1.5	0.600	0.082	0.0273	
15 minute winter	S9	Hydro-Brake®	JUN4A	2.4				
15 minute winter	JUN4A	1.003	S4	4.8	1.344	0.121	0.0320	
15 minute winter	LD1	3.000	S4	3.2	1.227	0.027	0.0033	
15 minute winter	S4	1.004	S3	7.8	1.301	0.196	0.1266	
15 minute winter	LD2	4.000	S3	0.8	0.601	0.038	0.0235	
15 minute winter	S3	1.005	S2	8.7	0.937	0.490	0.0447	
15 minute summer	S8	5.000	S7	1.9	0.693	0.108	0.0673	
30 minute winter	S7	5.001	S2	2.4	0.643	0.136	0.0852	
15 minute winter	S2	1.006	S1	11.6	1.133	0.654	0.1472	
15 minute winter	S1	1.007	BEND1A	12.1	1.350	0.494	0.2463	
15 minute winter	BEND1A	1.008	OF	12.1	1.357	0.493	0.1084	91.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.76%

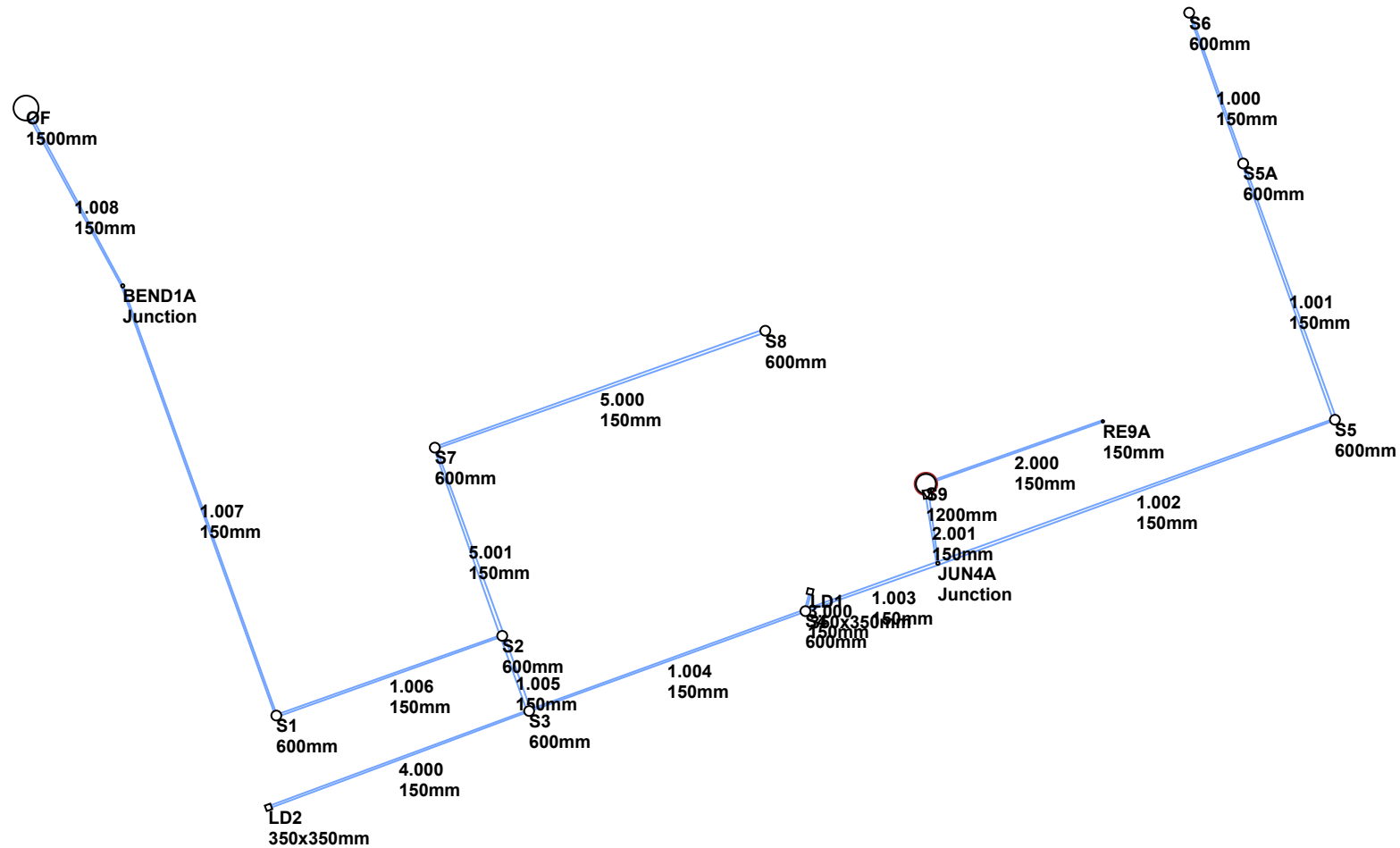
Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S6	7	40.692	0.022	0.8	0.0062	0.0000	OK
60 minute winter	S5A	7	39.344	0.024	1.6	0.0067	0.0000	OK
30 minute winter	S5	3	38.876	0.025	2.4	0.0071	0.0000	OK
15 minute winter	RE9A	10	40.597	0.047	3.6	0.0260	0.0000	OK
15 minute winter	S9	14	39.653	1.103	6.8	1.3469	0.0000	SURCHARGED
15 minute winter	JUN4A	23	37.622	0.037	5.2	0.0000	0.0000	OK
15 minute winter	LD1	10	37.726	0.026	7.7	0.0225	0.0000	OK
15 minute winter	S4	10	37.221	0.058	12.7	0.0165	0.0000	OK
15 minute winter	LD2	10	37.571	0.031	2.1	0.0101	0.0000	OK
15 minute winter	S3	10	36.401	0.119	14.8	0.0336	0.0000	OK
15 minute summer	S8	1	36.574	0.034	1.9	0.0096	0.0000	OK
60 minute winter	S7	2	36.368	0.038	2.4	0.0107	0.0000	OK
15 minute winter	S2	11	36.338	0.129	17.5	0.0366	0.0000	OK
15 minute winter	S1	11	36.162	0.097	17.9	0.0274	0.0000	OK
15 minute winter	BEND1A	11	35.646	0.100	18.0	0.0000	0.0000	OK
15 minute winter	OF	11	35.411	0.095	18.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S6	1.000	S5A	0.8	0.505	0.045	0.0153	
60 minute winter	S5A	1.001	S5	1.6	0.869	0.053	0.0303	
30 minute winter	S5	1.002	JUN4A	2.4	1.296	0.060	0.0672	
15 minute winter	RE9A	2.000	S9	3.5	0.769	0.199	0.0519	
15 minute winter	S9	Hydro-Brake®	JUN4A	2.8				
15 minute winter	JUN4A	1.003	S4	5.2	1.538	0.129	0.0404	
15 minute winter	LD1	3.000	S4	7.7	1.899	0.064	0.0051	
15 minute winter	S4	1.004	S3	12.7	1.325	0.318	0.1875	
15 minute winter	LD2	4.000	S3	2.1	0.778	0.093	0.0440	
15 minute winter	S3	1.005	S2	14.6	1.041	0.823	0.0674	
15 minute summer	S8	5.000	S7	1.9	0.693	0.108	0.0672	
60 minute winter	S7	5.001	S2	2.4	0.643	0.136	0.0982	
15 minute winter	S2	1.006	S1	17.4	1.221	0.981	0.2026	
15 minute winter	S1	1.007	BEND1A	18.0	1.469	0.735	0.3370	
15 minute winter	BEND1A	1.008	OF	18.0	1.480	0.735	0.1481	95.5

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.76%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	S6	7	40.692	0.022	0.8	0.0062	0.0000	OK
15 minute summer	S5A	8	39.344	0.024	1.6	0.0067	0.0000	OK
1440 minute summer	S5	60	38.876	0.025	2.4	0.0071	0.0000	OK
30 minute winter	RE9A	23	40.767	0.217	5.3	0.1198	0.0000	FLOOD RISK
30 minute winter	S9	24	40.766	2.216	10.2	3.1478	0.0000	FLOOD RISK
15 minute winter	JUN4A	20	37.625	0.040	6.2	0.0000	0.0000	OK
15 minute winter	LD1	10	37.739	0.039	14.5	0.0338	0.0000	OK
15 minute winter	S4	10	37.238	0.075	19.9	0.0211	0.0000	OK
15 minute winter	LD2	10	37.583	0.043	3.9	0.0140	0.0000	OK
15 minute winter	S3	12	36.621	0.339	23.6	0.0958	0.0000	SURCHARGED
15 minute summer	S8	1	36.574	0.034	1.9	0.0096	0.0000	OK
15 minute winter	S7	12	36.513	0.183	3.1	0.0518	0.0000	SURCHARGED
15 minute winter	S2	12	36.509	0.300	24.2	0.0849	0.0000	SURCHARGED
15 minute winter	S1	12	36.192	0.127	24.7	0.0359	0.0000	OK
15 minute winter	BEND1A	13	35.682	0.136	24.5	0.0000	0.0000	OK
15 minute winter	OF	13	35.454	0.138	24.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	S6	1.000	S5A	0.8	0.505	0.045	0.0153	
15 minute summer	S5A	1.001	S5	1.6	0.869	0.053	0.0303	
1440 minute summer	S5	1.002	JUN4A	2.4	1.236	0.060	0.0548	
30 minute winter	RE9A	2.000	S9	5.3	0.856	0.299	0.1983	
30 minute winter	S9	Hydro-Brake®	JUN4A	3.8				
15 minute winter	JUN4A	1.003	S4	6.2	1.603	0.155	0.0519	
15 minute winter	LD1	3.000	S4	14.5	2.368	0.121	0.0075	
15 minute winter	S4	1.004	S3	19.8	1.336	0.495	0.2322	
15 minute winter	LD2	4.000	S3	3.8	0.927	0.173	0.0689	
15 minute winter	S3	1.005	S2	22.3	1.268	1.257	0.0847	
15 minute summer	S8	5.000	S7	1.9	0.693	0.108	0.2153	
15 minute winter	S7	5.001	S2	4.9	0.627	0.278	0.2122	
15 minute winter	S2	1.006	S1	24.2	1.383	1.361	0.2408	
15 minute winter	S1	1.007	BEND1A	24.5	1.523	0.999	0.4468	
15 minute winter	BEND1A	1.008	OF	24.5	1.528	1.002	0.2057	102.2



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