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Flood Risk Assessment

Wilmslow Road, Manchester

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Executive Summary

The site would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FRA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable, and the development would be in accordance with the requirements of the NPPF.

This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The development should not therefore be precluded on the grounds of flood risk.



1. Introduction

1.1 Background

This Flood Risk Assessment (FRA) has been prepared by Tier Consult at the request of Watkin Jones & Son for the proposed development on Wilmslow Road, Manchester. This FRA has been carried out in accordance with guidance contained in the National Planning Policy Framework (NPPF)¹, associated National Planning Practice Guidance (NPPG)² and the NPPG 'Site-specific flood risk assessment checklist (para 068 Reference ID: 7-068-20140306. This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will be managed so that the development remains safe throughout the lifetime, taking climate change into account.

It is recognised that developments which are designed without regard to flood risk may endanger lives, damage property, cause disruption to the wider community, damage the environment, be difficult to insure and require additional expense on remedial works. The development design should be such that future users will not have difficulty obtaining insurance or mortgage finance, or in selling all or part of the development, as a result of flood risk issues.

A Drainage Strategy for the proposed development which proposes to reduce the surface water runoff rates by 50% compared to the existing situation has been developed (Ref: 892-TSY-ZZ-XX-RP-C-1001) and is contained within Appendix B.

1.2 National Planning Policy Framework (NPPF)

One of the key aims of the NPPF is to ensure that flood risk is taken into account at all stages of the planning process; to avoid inappropriate development in areas at risk of flooding and to direct development away from areas of highest risk. It advises that where new development is exceptionally necessary in areas of higher risk, this should be safe, without increasing flood risk elsewhere, and where possible, reduce flood risk overall.

A risk-based approach is adopted at stages of the planning process, applying a source pathway receptor model to planning and flood risk. To demonstrate this, an FRA is required and should include:

- whether a proposed development is likely to be affected by current or future flooding from all sources;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;

¹ Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework.

² Department for Communities and Local Government (2014) Planning Practice Guidance - Flood Risk and Coastal Change.



- if necessary, provide the evidence to the Local Planning Authority (LPA) that the Sequential Test can be applied; and
- whether the development will be safe and pass part c) of the Exception Test if this is appropriate.

1.3 Report Structure

This FRA has the following report structure:

- Section 2 details the sources of information that have been consulted;
- Section 3 describes the location area and the existing and proposed development;
- Section 4 outlines the flood risk to the existing and proposed development;
- Section 5 outlines the Sequential and Exception Tests;
- Section 6 details the proposed surface water drainage for the site and assesses the potential impacts of the proposed development on surface water drainage;
- Section 7 describes the risk management methods used to mitigate all sources of flood risk; and
- Section 8 presents a summary and conclusions.



2. Sources of Information

2.1 Discussion with Regulators

Consultation and discussions with the relevant regulators have been undertaken during this FRA including the Environment Agency, the Local Planning Authority (LPA), the Lead Local Flood Authority (LLFA) and Sewerage Undertakers.

2.2 Environment Agency

The Flood and Water Management Act 2010 gives the Environment Agency a strategic overview role for all forms of flooding and coastal erosion. They also have direct responsibility for the prevention, mitigation and remediation of flood damage for main rivers and coastal areas. The Environment Agency is the statutory consultee with regards to flood risk and planning. Information regarding the current flood risk at the application site, local flood defences and flood risk has been obtained from the Environment Agency.

2.3 Manchester City Council

Manchester City Council is the LPA, and the LLFA and has responsibilities for 'local flood risk', which includes surface runoff, groundwater and ordinary watercourses. Planning guidance written by Manchester City Council regarding flood risk was consulted to assess the mitigation policies in place. The Manchester City Council Strategic Flood Risk Assessments (SFRA) Level 1 and Level 2 and the Manchester City Council Preliminary Flood Risk Assessment (PFRA) which cover the site have been reviewed as part of this FRA.

2.4 United Utilities

United Utilities is responsible for the disposal of wastewater and supply of clean water for this area. Information with regards to sewer and water main flooding contained within the Manchester City Council SFRA and the Manchester City Council PFRA. All Water Companies have a statutory obligation to maintain a register of properties/areas which are at risk of flooding from the public sewerage system, and this is shown on the DG5 Flood Register.



3. Location & Description

3.1 Site Location

The site is located at 188 Wilmslow Road, Fallowfield, Manchester, M14 6LJ (see Drawing TE/1279/FRA/1). The National Grid Reference of the site is 385527, 394307.

3.2 Existing Development

The existing site is currently used as offices.

3.3 Proposed Development

The proposed development is for the partial demolition of existing buildings, conversion and extension of retained building and new development to accommodate student residential accommodation and amenity / management facilities, with hard and soft landscaping, parking and access arrangements (see Appendix C).

3.4 Ground Levels

The site is relatively flat with ground levels of approximately 42 metres Above Ordnance Datum (mAOD).

3.5 Catchment Hydrology / Drainage

A small drainage ditch is located approximately 200m to the north of the site and the Chorlton Platt Gore Brook is located approximately 500m to the north of the site. The site is situated in the Fallowfield and Levenshulme Critical Drainage area.

Fallowfield Brook historically flowed approximately 300m to the south of the site however; it is understood this was culverted around 1892 to facilitate development. The culverted section of the watercourse is not identified on any current river mapping but it is shown on United Utilities Sewer Records within Moseley Road. The Bowling Lake is located approximately 300m to the west of the site.

Public combined sewers are located within Wilmslow Road to the east and Langley Road to the south of the site.

3.6 Ground Conditions

The British Geological Survey (BGS) Map indicates that the superficial deposits underlying the site consists of the Till, Devensian - Diamicton. Superficial deposits formed up to 2 million years ago in the Quaternary Period. The bedrock deposits consist of the Chester Formation - Sandstone. Sedimentary bedrock formed approximately 247 to 250 million years ago in the Triassic Period. Information from



the National Soil Resources Institute³ details the site area as being situated on slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage.

³ National Soil Resources Institute (NSRI) 2013. The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. Last accessed 11/02/2020.



4. Flood Risk

4.1 Sources of Flooding

All sources of flooding have been considered, these are; fluvial (river) flooding, tidal (coastal) flooding, groundwater flooding, surface water (pluvial) flooding, sewer flooding and flooding from artificial drainage systems/infrastructure failure.

4.2 Historic Flooding

There are no records of anecdotal information of flooding at the site including within the British Hydrological Society "Chronology of British Hydrological Events⁴". No other historical records of flooding for the site have been recorded. Therefore, it has been assumed that the site has not flooded within the recent past.

4.3 Existing and Planned Flood Defence Measures

It is understood that there are no maintained defences in this area. Further risk management measures will be used to protect the site from flooding these are discussed in Section 7.0.

4.4 Environment Agency Flood Zones

A review of the Environment Agency's flood map indicates that the site is located within Flood Zone 1 and therefore has a 'low probability' of fluvial flooding as shown in see Drawing TE/1279/FRA/2. Flood Zone 1 has less than a 1 in 1000 annual probability of river flooding in any year (<0.1%).

The Flood Zones are the current best information on the extent of the extremes of flooding from rivers or the sea that would occur without the presence of flood defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. The Environment Agency Flood Zones and acceptable development types are explained in Table 4.1. Table 4.1 shows that all development types are generally acceptable in Flood Zone 1.

In the Planning Practice Guidance to the NPPF (Table 1) appropriate uses have been identified for the Flood Zones. Applying the Flood Risk Vulnerability Classification in Table 2 and 3 of the Planning Practice Guidance to the NPPF, the proposed development is classified as 'more vulnerable'. Table 4.2 of this report and Table 3 of the Planning Practice Guidance to the NPPF states that 'more vulnerable' uses are appropriate within Flood Zone 1.

4.5 Manchester City Council SFRA Flood Zones

The Manchester City Council Level 2 SFRA confirms that the site is located within Flood Zone 1 (see Drawing FL_1.2 J of the SFRA).



Table 4.1 - Environment Agency Flood Zones and Appropriate Land Use

Flood Zone	Probability	Explanation	Appropriate Land Use
Zone 1	Low	Less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%)	All development types generally acceptable
Zone 2	Medium	Between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% - 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% 0.1%) in any year	Most development type are generally acceptable
Zone 3a	High	A 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year	Some development types not acceptable
Zone 3b	'Functional Floodplain'	Land where water has to be flow or be stored in times of flood. SFRAs should identify this zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1% flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes)	Some development types not acceptable

Table 4.2 - Flood Risk Vulnerability and Flood Zone 'Compatibility' as identified in Table 3 of the Planning Practice Guidance to the NPPF

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	✗	Exception test required	✓
Zone 3b 'Functional Floodplain'	Exception test required	✓	✗	✗	✗

Key: ✓: Development is appropriate, ✗: Development should not be permitted.



4.6 Climate Change

Projections of future climate change, in the UK, indicate more frequent, short-duration, high intensity rainfall and more frequent periods of long duration rainfall. Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRA. Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows are outlined in the associated Planning Practice Guidance to the NPPF⁴.

Table 4.3 shows peak river flow climate change allowances by river basin district. The flood risk assessments: climate change allowances guidance recommends that for 'more vulnerable' uses in Flood Zone 1 that the central allowances are used. Therefore, the design flood level for the site is the 1 in 100 year (+30%) event.

Table 4.3 - Peak River Flow Allowances by River Basin District (use 1961 to 1990 baseline)

River Basin District	Allowance Category	2015 to 2039	2040 to 2059	2060 to 2115
North West	H++	+25%	+45%	+95%
	Upper end	+20%	+35%	+70%
	High central	+20%	+30%	+35%
	Central	+15%	+25%	+30%

4.7 Fluvial (river) Flooding

There are no open watercourses evident on, or within the vicinity of the site. The Manchester City Council Level 2 SFRA shows that the site is located outside the 1 in 100 year (+20%) and 1 in 1000 year (+20%) flood outlines (see Drawings FL_1.3J and FL_1.4J of the SFRA). The site is not located within the vicinity of fluvial flooding sources and the risk of fluvial flooding is considered to be not significant.

4.8 Tidal (coastal) Flooding

The site is not located within the vicinity of tidal flooding sources and the risk of tidal flooding is considered to be not significant.

4.9 Groundwater Flooding

Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded. Groundwater flooding tends to occur sporadically in both location and time. When groundwater flooding does occur, it tends to mostly affect low-lying areas, below surface infrastructure and buildings (for example, tunnels, basements and car parks) underlain by permeable rocks (aquifers).

The susceptibility of the site to groundwater flooding, based on the underlying geological conditions, is low. There are no records of groundwater flooding at or near to the site. The Manchester City

⁴ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#high-allowances>.



Council Level 2 SFRA shows that the site is not at risk of groundwater flooding (see Drawing GW_2.1 of the SFRA). It can therefore be concluded that the risk of groundwater flooding is not significant.

4.10 Surface Water (pluvial) Flooding

The soil condition at the site and within the vicinity of the site and the topography of the site suggest that the site is relatively well drained and surface water flooding would not be expected to accumulate to any significant depths. Surface water flooding tends to occur sporadically in both location and time such surface water would tend to be confined to the streets around the development.

Drawing TE/1279/3 confirms that the site has a very low risk of surface water flooding with a chance of flooding of less than 1 in 1000 years (0.1%). The Manchester City Council Level 2 SFRA shows that the majority of the site is not at risk of surface water flooding during the current and future scenarios however, a small proportion of the site has a low susceptibility of surface water flooding during the current and future scenarios (see Drawings SS_4.1 J and SS_4.2 J of the SFRA).

It can therefore be concluded that the risk of surface water flooding is of low significance. The risk from the surface water sources will be managed and mitigated by using a number of risk management measures to manage and reduce the overall flood risk at the site (see Section 7.0).

4.11 Sewer Flooding

Sewer flooding occurs when urban drainage networks become overwhelmed and maximum capacity is reached. This can occur if there is a blockage in the network causing water to back up behind it or if the sheer volume of water draining into the system is too great to be handled. Sewer flooding tends to occur sporadically in both location and time such flood flows would tend to be confined to the streets around the development.

There are existing public sewers within roads adjacent to the site these will inevitably have a limited capacity so in extreme conditions there would be surcharges, which may in turn cause flooding. Flood flows could also be generated by burst water mains, but these would tend to be of a restricted and much lower volume than weather generated events and so can be discounted for the purposes of this assessment. Given the design parameters normally used for drainage design in recent times and allowing for some deterioration in the performance of the installed systems, which are likely to have been in place for many years, an appropriate flood risk probability from this source could be assumed to have a return period in the order of 1 in 10 to 1 in 30 years.

The provision of adequate level difference between the ground floors and adjacent ground level would reduce the annual probability of damage to property from this source to 1 in 100 years or less. Therefore, sewer flooding poses a low flood risk to the site. It can therefore be concluded that the risk of sewer flooding is of low significance. The risk from the sewer sources will be managed and mitigated by using a number of risk management measures to manage and reduce the overall flood risk at the site (see Section 7.0).



4.12 Flooding from Artificial Drainage Systems/Infrastructure Failure

There are no other nearby artificial water bodies, water channels and artificial drainage systems that could be considered a flood risk to the site. The Environment Agency Reservoir flood map shows that the site is not at risk of reservoir flooding (see Drawing TE/1279/FRA/4). The risk of flooding from reservoir failure is considered to be not significant.

4.13 Effects of the Development on Flood Risk

The site is located within Flood Zone 1, there will be no net loss of floodplain storage capacity and the proposed development will have no impact on the movement of water.

4.14 Summary of Site-Specific Flood Risk Assessment

A summary of the sources of flooding and a review of the risk posed by each source at the site is shown in Table 4.3.

Table 4.3 - Risk Posed by Flooding Sources

Sources of Flooding	Potential Flood Risk	Potential Source	Probability/Significance
Fluvial (river) Flooding	No	None Reported	Not significant
Tidal (coastal) Flooding	No	None Reported	Not significant
Groundwater Flooding	No	None Reported	Not significant
Surface Water (pluvial) Flooding	Yes	Poor Permeability	Low
Sewer Flooding	Yes	Local Sewers	Low
Flooding from Artificial Drainage Systems/Infrastructure Failure	No	None Reported	Not significant

The site is not at risk of flooding from a major source (e.g. fluvial and/or tidal). The site has a 'low probability' of fluvial flooding as the site is located within Flood Zone 1 with less than a 1 in 1000 annual probability of river flooding in any year (<0.1%). A number of secondary flooding sources have been identified which may pose a low risk to the site. These are:

- Surface Water (pluvial) Flooding
- Sewer Flooding

The risk of flooding from all sources is considered to be low or not significant. The flooding sources will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the proposed development site.

The proposed development is classified as 'more vulnerable', 'more vulnerable' uses are appropriate within Flood Zone 1 after the completion of a satisfactory FRA. The flood risk at the site, will be further



managed and mitigated by using a number of risk management techniques, and mitigation strategies to manage and reduce the overall flood risk at the site.

In conclusion, the flood risk to the site can be considered to be limited; the site is situated in Flood Zone 1, with a low annual probability of flooding and from all sources. The site is unlikely to flood except in very extreme conditions.



5. Sequential Approach

5.1 Sequential Test

The risk-based Sequential Test in accordance with the NPPF aims to steer new development to areas at the lowest probability of flooding (i.e. Flood Zone 1). The proposed development site complies with the sequential approach which should be applied at all stages of planning. Therefore, the Sequential Test will not need to be undertaken as part of this planning application.

5.2 Exception Test

Applications located within Flood Zone 1 are not subject to the Exception Test as confirmed within Table 4.2 of this report and Table 3 of the Planning Practice Guidance to the NPPF.



6. Surface Water Management

6.1 Surface Water Drainage Overview

A Surface Water Drainage Strategy for the site proposals should be developed to manage and reduce the flood risk posed by the surface water runoff from the site. An assessment of the surface water runoff rates should be undertaken, in order to determine the surface water options and attenuation requirements for the site. The assessment considers the impact of the development compared to current conditions. Therefore, the surface water attenuation requirement for the developed site can be determined and reviewed against existing arrangements.

The surface water drainage arrangements for any development site should be such that the volumes and peak flow rates of surface water leaving a developed site are no greater than the rates prior to the proposed development unless specific off-site arrangements are made and result in the same net effect.

It should be acknowledged that the satisfactory collection, control and discharge of surface water runoff are now a principle planning and design consideration. This is reflected in recently implemented guidance and released National Sustainable Drainage Systems (SuDS) Standards.

6.2 Discharge of Surface Water

There are three possible options to discharge the surface water runoff in accordance with requirement H3 of the Building Regulations, this hierarchy is also promoted within the NPPF. Rainwater shall discharge to one of the following, listed in order of priority:

- an adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,
- a watercourse; or where that is not reasonably practicable,
- a sewer.

It is necessary to identify the most appropriate method of controlling and discharging surface water. The design should seek to improve the local runoff profile by using systems that can either attenuate runoff and reduce peak flow rates or positively impact on the existing surface water runoff.

6.3 Soakaway/Infiltration System

The preferred method for the disposal of surface water in the hierarchy is infiltration to ground. In determining the future surface runoff from the site, the potential of using infiltration would need to be assessed for feasibility by undertaking soakaway tests to BRE Digest 365. However, upon review of the Tier Environmental Ground Investigation report ref. TE1279GIR1.1, the site is built on made ground and glacial till deposits up to 2m deep. This is deemed as very poor infiltration media, therefore soakaways can be considered an unlikely option for the disposal of surface water.



6.4 Watercourse

The second consideration in the SuDS hierarchy is discharge to watercourse. The nearest receiving watercourse is the Platt Brook which is located over 400m away. This distance makes it an impracticable solution and therefore will not be considered an option.

6.5 Sewer

In this instance the discharge of surface water via infiltration and to a watercourse is deemed unsuitable, therefore discharge to the public sewer is proposed. Surface water runoff from the new development will be collected by way of rainwater pipes into a dedicated below ground surface water drainage system which will discharge from the site and connect into the combined sewer at Manhole 5201 in Langley Road. The site is classed as brownfield and is currently in use by the existing USDAW offices, but a positive drainage system is yet to be identified. A full CCTV survey will be undertaken to confirm pipe depths and condition.

6.6 SuDS and Water Quality

Current guidance promotes sustainable water management through the use of SUDS. SUDS measures should be used to control the surface water runoff from the proposed development site therefore, managing the flood risk to the site and surrounding areas from surface water runoff.

1. A hierarchy of techniques is identified⁵:
2. Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
3. Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting, permeable paving, soakaways and/or green roofs).
4. Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site, swales and/or infiltration trenches).
5. Regional Control – management of runoff from several sites, typically in a detention pond, basins, tanks and/or wetland.

It is generally accepted that the implementation of SUDS as opposed to conventional drainage systems, provides several benefits by:

- reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;

⁵ CIRIA (2004) Report C609, Sustainable Drainage Systems – Hydraulic, Structural and Water Quality advice.



- reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
- improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- reducing potable water demand through rainwater harvesting;
- improving amenity through the provision of public open spaces and wildlife habitat; and
- replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

The most appropriate attenuation system will need to satisfy three main characteristics, firstly, provide the required volume of storage, secondly, minimise the loss of developable land and thirdly, where possible provide local amenity. The application of the SuDS Manual requires that the runoff from sites is not only restricted to meet the pre-development runoff characteristics but also that SuDS systems are utilised to improve the quality of the runoff prior to outfall to watercourses. The SuDS Manual and Environment Agency guidance applies a sustainability hierarchy to the various types of SuDS systems, this is summarised in Table 6.1.

Table 6.1 - Sustainability Hierarchy

Most Sustainable	SuDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife
	Green / Living Roofs / Living Walls	✓	✓	✓
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales	✓	✓	✓
	Infiltration Devices - Soakaways	✓	✓	✓
	Permeable Surfaces and Filter Drains - Gravelled areas - Solid paving blocks - Permeable paving	✓	✓	
	Tanked systems - Over-sized pipes/tanks - Cellular storage	✓		
Least Sustainable				

Systems at the top of the hierarchy provide a combination of attenuation, treatment and ecology and are deemed the most sustainable options. There are always specific scenarios where systems are more



suitable than others and at this stage it is not possible to guide the development towards a particular strategy.

The usual approach is to consider the 'SUDS train' where each of the above options are considered in turn until a suitable solution is found. Thus source control techniques such as soakaways, rainwater harvesting and/or infiltration trenches, if suitable on a site, are considered preferable to permeable conveyance and passive treatment systems such as tanks or ponds. The various options are considered in outlined in Table 6.2.

Table 6.2 - SuDS Techniques

SuDS Technique	Comments	Suitability for Development
Green / Living Roofs / Living Wall	A green roof is a multi-layered system that covers the top of a building with soil and vegetation and which can provide a degree of rain storm attenuation and a reduction in site runoff. Can be used to reduce the volume and rate of runoff so that other SUDS techniques in the scheme can be significantly reduced in size.	A blue/green roof/living wall has been deemed as not suitable and would not provide the required attenuation storage
Basins / Ponds	Provides storage of runoff and flow attenuation. Vegetated surfaces can be used to support the prevention of runoff from the site for small rainfall events (interception) and improve water quality associated with the removal of sediment and buoyant materials.	A basin in the form of a landscaped depression has been proposed. The basin area will be used as a recreational or other amenity facility.
Filter Strips / Swales	Good removal of urban pollutants, reduces runoff rates and volumes.	Not enough open/green space for their workable inclusion or being able to tie in with depths of connecting buried pipes.
Infiltration Devices (e.g. soakaways)	Reduces total runoff volume from the development.	Soakaways are not suitable due to site ground conditions and limited space.
Permeable Surfaces and Filter Drains	Permeable surfaces together with their associated substructures are an efficient means of intercepting runoff, reducing the volume and frequency of runoff and providing a treatment medium.	While possible as there is no infiltration potential it would merely be a storage option with only 30% void. It is far more cost effective and maintainable to collect surface water and use attenuation tanks.



Tanked systems	Ideal for sites with insufficient space for basins etc., provide a volume of below ground storage with a high void ratio.	Potential to be installed under the main central area with clearance from the foundations.
Flow reduction	Manages and reduces the flood risk to the local surface water sewers and watercourses	A hydrobrake can be installed downstream of attenuation tanks and control flows to the natural greenfield run off rates
Rainwater Harvesting	The reuse of water from roofed areas to provide grey (non-potable) water for flushing WCs within buildings can reduce storm runoff without the need for treatment.	Rainwater harvesting could be utilised within the proposed development to provide water for non-potable uses such as toilet flushing or irrigation. However, the attenuation benefits of rainwater harvesting are limited and would only be realised when the tanks were not full.

6.7 Strategy – Discharge Rate

In accordance with the Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment the development should aim for 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. Therefore, in lieu of detailed existing drainage calculations, a brownfield run-off rate has been calculated below using the Modified Rational Method:

$$Q = C \times i \times A$$

Where Q = Flow Rate (l/s)

C = Dimensionless Coefficient

i = Rainfall Intensity (mm/hr)

A = Area (ha)

The existing site is 0.8ha and is estimated to have a 70% impermeable area, therefore has a total impermeable area of 0.56ha. On this basis the run-off rate has been calculated as the following:

$$2.78 \times 50 \times 0.56 = 69.5 \text{ l/s}$$

$$69.5 \times 0.5 \text{ (50\% betterment)} = 35 \text{ l/s}$$

However, upon review of the Hydrobrake flow control, a minimum outlet pipe diameter of 300mm is required exceeding the downstream pipe diameter, therefore this rate cannot be used. The maximum discharge rate requirement into the flow control for a 225mm diameter outlet pipe is 25 l/s. On this basis a betterment of 50% is proposed to give a discharge rate 12.5 l/s.



6.8 Strategy – Attenuation

The site will require attenuation due to the restricted discharge rate. Manchester City Council as the Lead Local Flood Authority, in their updated 2019 SuDS Requirements for New Developments, require maximisation of green infrastructure wherever practicable to control surface water runoff to as near to its source as possible, through the implementation of SuDS.

Hydraulic calculations have been produced within Appendix B which identifies a requirement for approximately 90m³ storage volume to cater for the 1 in 100 year storm event plus 40% climate change based on a total positively drained impermeable area of 3140m². The proposal is to use a detention basin within the courtyard area and a small geo-cellular tank to attenuate this volume.

The basin will be in the form of a landscaped depression which will only fill up in heavy storm events once flows reach the specified threshold through a flow control device, allowing the basin area to be used as a recreational or other amenity facility. Refer to Appendix B for full layout proposals and calculations.

6.9 Strategy – Treatment

Although the surface water will outfall to a combined sewer, the SuDS principles proposed will conform to the basic level of treatment control as a minimum. The water quality benefits of a vegetated basin are associated with the removal of sediment and buoyant materials, but levels of nutrients, heavy metals, toxic materials and oxygen-demanding materials may also be significantly reduced. As per the CIRIA SuDS Manual Table 4.3 the pollution hazard level for residential roofs is considered 'Very low' and the pollution hazard level for the rest of the site is considered 'Low'. The detention basin could also have areas of coarse aggregate stone where further treatment can be provided. The treatment provided on this site exceeds the pollution hazard indices for suspended solids, metals and hydrocarbons.

6.10 Designing for Local Drainage System Failure/Design Exceedance

When considering residual risk, it is necessary to make predictions as to the impacts of a storm event that exceeds the design event, or the impact of a failure of the local drainage system. The Surface Water Drainage Strategy applies a safe and sustainable approach to discharging rainfall runoff from the site and this reduces the risk of flooding however, it is not possible to completely remove the risk. This section of the FRA is therefore associated with the way the residual risk is managed.

As part of the FRA it must be demonstrated that the flooding of property will not occur in the event of local drainage system failure and/or design exceedance. It is not economically viable or sustainable to build a drainage system that can accommodate the most extreme events. Consequently, the capacity of the drainage system may be exceeded on rare occasions, with excess water flowing above ground⁶.

The attenuation requirements have been designed to accommodate the 1 in 100 year storm event plus climate change (+40%). The design of the site layout provides an opportunity to manage this local

⁶ CIRIA (2006) Designing for exceedance in urban drainage – good practice.



drainage system failure/exceedance flow and ensure that indiscriminate flooding of property does not occur.

The site will be designed to not flood in a 1 in 100 year event plus 40% Climate Change. The topography of the proposed site will ensure buildings are not at risk from an exceedance event by providing low points in the form of shallow depressions within landscaped areas. Gradients will be engineered towards the low points and make sure overland flow routes are not directed towards any buildings and ensure neighbouring sites are not at risk from flooding. The site is proposing a greater landscaped area than existing,

thereby further reducing the amount of surface water runoff. Surface water runoff will be directed to the drainage system through drainage gullies located around the perimeter of the buildings and through contouring of the hardstanding areas. It is not considered that there is an increased risk to the properties on the site or located adjacent to the site.



7. Risk Management

7.1 Introduction

In this flood zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout, form of the development and the use of flood mitigation measures including SuDS techniques. The flooding sources will have to be mitigated on the site by using a number of techniques, and mitigation strategies to manage and reduce the overall flood risk at the site. These will be used to ensure the development will be safe and there is:

- Minimal risk to life;
- Minimal disruption to people living and working in the area;
- Minimal potential damage to property;
- Minimal impact of the proposed development on flood risk generally; and;
- Minimal disruption to natural heritage.

7.2 Minimum Floor Level

There is no minimum finished floor level proposed as a result of flooding. However, it is recommended that generally all buildings are located above the back of footway of the car parking areas by 150mm to enable the full capacity of any secondary flood conveyance to be utilised.

7.3 Flood Resilience and Resistance

The development of the layout should always consider that the site is potentially at risk from an extreme event and as such the implementation of flood resilience and resistance methods should be assessed. Relatively simple measures such as raising utility entry points, using first floor or ceiling down electrical circuits and sloping landscaping away from properties can be easily and economically incorporated into the development of the site.

7.4 Access and Egress

The site and surrounding area is located within Flood Zone 1 therefore a permanently safe and dry access can be maintained.

7.5 Surface Water Drainage Strategy

A Drainage Strategy for the proposed development which proposes to reduce the surface water runoff rates by 50% compared to the existing situation has been developed (Ref: 892-TSY-ZZ-XX-RP-C-1001) and is contained within Appendix B.



7.6 Flooding Consequences

The mitigation measures detailed above show that the flood risk can be effectively managed and therefore the consequences of flooding are acceptable.



8. Summary and Conclusion

8.1 Introduction

This report presents an FRA in accordance with the NPPF for the proposed development on Wilmslow Road, Manchester. This FRA identifies and assesses the risks of all forms of flooding to and from the development and demonstrates how these flood risks will need to be managed so that the development remains safe throughout the lifetime, taking climate change into account.

8.2 Flood Risk

The site is not at risk of flooding from a major source (e.g. fluvial and/or tidal). The site has a 'low probability' of fluvial flooding as the site is located within Flood Zone 1 with less than a 1 in 1000 annual probability of river flooding in any year (<0.1%). A number of secondary flooding sources have been identified which may pose a low risk to the site. These are:

- Surface Water (pluvial) Flooding
- Sewer Flooding

The risk of flooding from all sources is considered to be low or not significant. The flooding sources will only inundate the site to a relatively low water depth and water velocity, will only last a short period of time, in very extreme cases and will not have an impact on the whole of the proposed development site.

The proposed development is classified as 'more vulnerable', 'more vulnerable' uses are appropriate within Flood Zone 1 after the completion of a satisfactory FRA. The flood risk at the site, will be further managed and mitigated by using a number of risk management techniques, and mitigation strategies to manage and reduce the overall flood risk at the site.

In conclusion, the flood risk to the site can be considered to be limited; the site is situated in Flood Zone 1, with a low annual probability of flooding and from all sources. The site is unlikely to flood except in very extreme conditions.

8.3 Sequential and Exception Tests

The development proposals should be considered by the LPA to satisfy the Sequential and Exception Tests as set out in the NPPF.

8.4 Surface Water Drainage Strategy

A Drainage Strategy for the proposed development which proposes to reduce the surface water runoff rates by 50% compared to the existing situation has been developed. In this instance the discharge of surface water via infiltration and to a watercourse is deemed unsuitable, therefore discharge to the public sewer is proposed. Surface water runoff from the new development will be collected by way of rainwater pipes into a dedicated below ground surface water drainage system which will discharge from the site and connect into the combined sewer at Manhole 5201 in Langley Road. The site is



classed as brownfield and is currently in use by the existing USDAW offices, but a positive drainage system is yet to be identified.

Hydraulic calculations have been produced which identifies a requirement for approximately 90m³ storage volume to cater for the 1 in 100 year storm event plus 40% climate change based on a total positively drained impermeable area of 3140m². The proposal is to use a detention basin within the courtyard area and a small geo-cellular tank to attenuate this volume.

The basin will be in the form of a landscaped depression which will only fill up in heavy storm events once flows reach the specified threshold through a flow control device, allowing the basin area to be used as a recreational or other amenity facility.

8.5 Risk Management

The flooding sources will be managed on the site by using a number of mitigation strategies to manage and reduce the overall flood risk at the site and will ensure the development will be safe. Measures used:

Minimum Floor Level - There is no minimum finished floor level proposed as a result of flooding. However, it is recommended that generally all buildings are located above the back of footway of the car parking areas by 150mm to enable the full capacity of any secondary flood conveyance to be utilised.

Flood Resilience and Resistance - The development of the layout should always consider that the site is potentially at risk from an extreme event and as such the implementation of flood resilience and resistance methods should be assessed.

Access and Egress - The site and surrounding area is located within Flood Zone 1 therefore a permanently safe and dry access can be maintained.

Surface Water Drainage Strategy - A Drainage Strategy for the proposed development which proposes to reduce the surface water runoff rates by 50% compared to the existing situation has been developed.

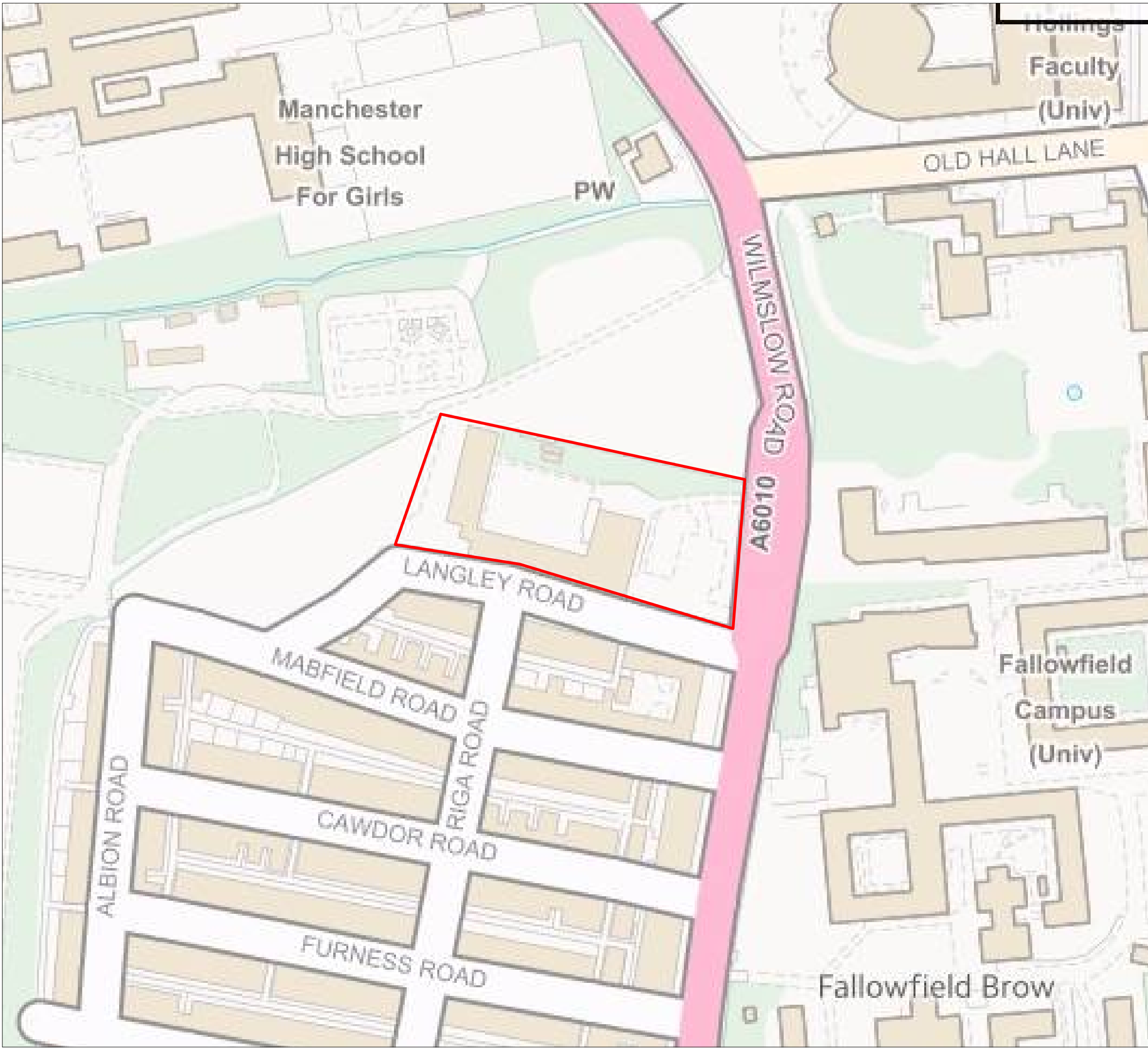
8.6 Conclusion

In conclusion, the site would be expected to remain dry in all but the most extreme conditions. Providing the recommendations made in this FRA are instigated, flood risk from all sources would be minimised, the consequences of flooding are acceptable, and the development would be in accordance with the requirements of the NPPF.

This FRA demonstrates that the proposed development would be operated with minimal risk from flooding, would not increase flood risk elsewhere and is compliant with the requirements of the NPPF. The development should not therefore be precluded on the grounds of flood risk.



Appendix A – Drawings



KEY

 Site Boundary



PROJECT	Wilmslow Road, Manchester
CLIENT	Watkin Jones & Son
TITLE	Site Location
PROJECT REF	TE/01279/FRA
DRAWING NO	TM/1279/FRA/1
SCALE	NTS@A3
DATE	February 2020



KEY

Site Boundary

Flood Zone 3

Flood Zone 2

Flood Zone 1



PROJECT	Wilmslow Road, Manchester
CLIENT	Watkin Jones & Son
TITLE	Environment Agency Flood Zones
PROJECT REF	TE/01279/FRA
DRAWING NO	TM/1279/FRA/2
SCALE	NTS@A3
DATE	February 2020



KEY

Site Boundary

Very Low

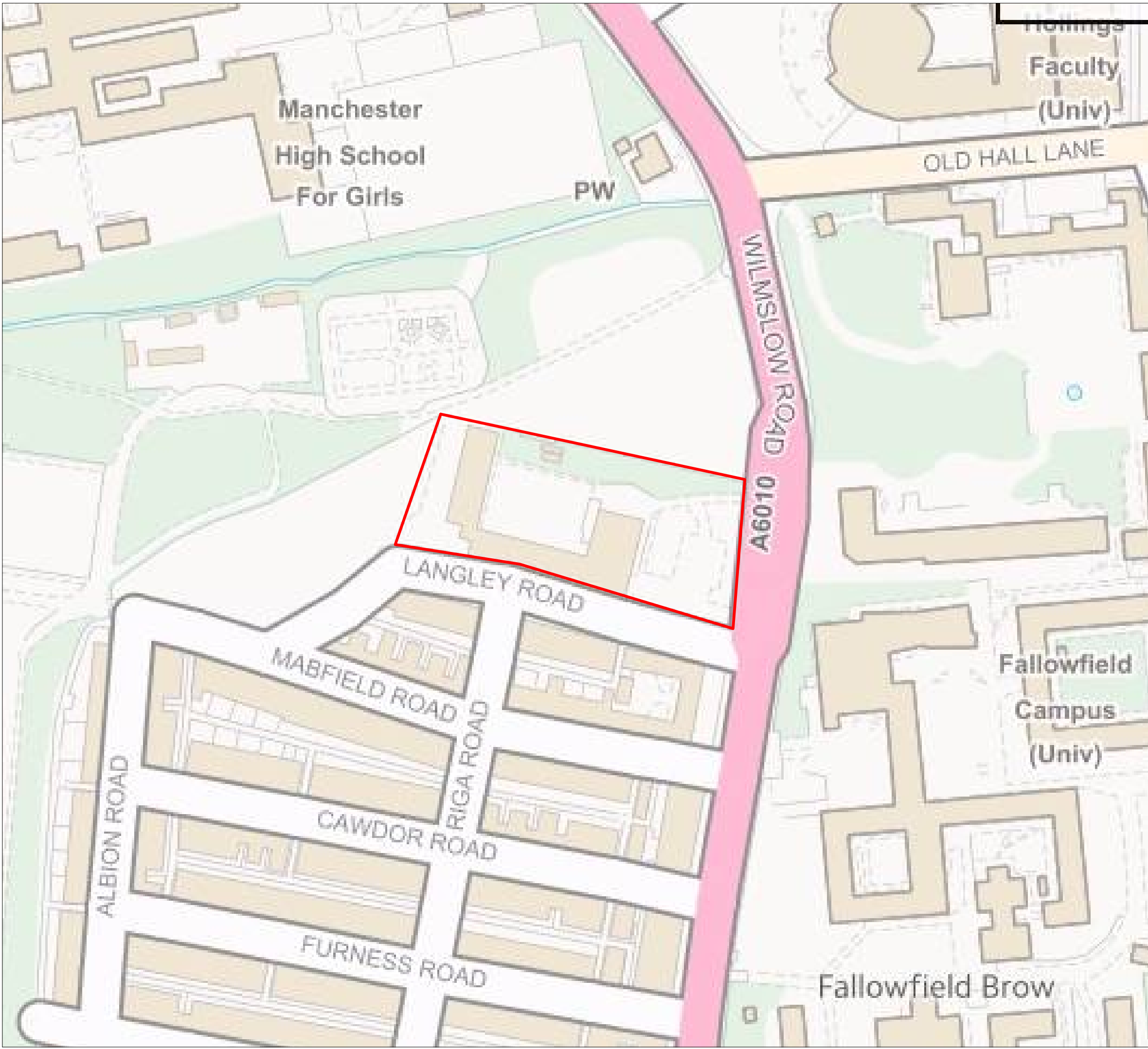
Low

Medium

High



PROJECT	
Wilmslow Road, Manchester	
CLIENT	
Watkin Jones & Son	
TITLE	
Environment Agency Surface Water Flood Map	
PROJECT REF	
TE/01279/FRA	
DRAWING NO	
TM/1279/FRA/3	
SCALE	
NTS@A3	
DATE	
February 2020	



KEY

-  Site Boundary
-  Reservoir Flood Outline



PROJECT	
Wilmslow Road, Manchester	
CLIENT	
Watkin Jones & Son	
TITLE	
Environment Agency Reservoir Flood Map	
PROJECT REF	
TE/01279/FRA	
DRAWING NO	
TM/1279/FRA/4	
SCALE	
NTS@A3	
DATE	
February 2020	



Appendix B – Drainage Strategy



Drainage Strategy Report

Wilmslow Road, Manchester

Client:	Watkin Jones
Document Type:	Report
Document No.:	892-TSY-ZZ-XX-RP-C-1001
Revision:	002
Date:	23/11/2020



Constructionline



Registered in England and Wales
company no. 07661675



Document Title:	Drainage Strategy Report
Document No.:	892-TSY-ZZ-XX-RP-C-1001
Revision:	002
Date:	23/11/2020

Version History

This report has been prepared by Tier Consult (SY) Ltd with all reasonable skill, care and diligence, within the best practice and guidance current at the time of issue, within the scope of works which have been agreed with the client.

This report is confidential to the client and Tier Consult (SY) Ltd accepts no responsibility whatsoever to third parties to whom this report, or any part thereof is presented, unless this is formally agreed in writing by a Director of Tier Consult (SY) Ltd before any reliance is made. Any such party relies upon the information at their own risk. Tier Consult (SY) Ltd disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Revision	Date	Notes	Prepared by	Checked by	Approved by
001	30/11/2020	First Issue	GB	DAB	WB
002	14/12/2020	Blue Roof Omitted	GB	DAB	WB



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1. Introduction

This report is prepared in accordance with instructions from Watkin Jones to support a planning application to Manchester City Council for a student accommodation development on the site of the existing Union of Shop, Distributive and Allied Workers (USDAW) central office, Fallowfield, Manchester, M14 6LJ.

2. Scope & Objectives

The purpose of the report is to determine the means of collection and discharge of the foul and surface water from the proposed development.

3. Limitations

This report is prepared for the sole use of Watkin Jones, for the purposes of developing the identified site. The report shall not be used by any third party, unless that party has been granted a contractual right to rely on the report for the purpose that it was prepared.

The report is prepared on the information derived from various sources including the appropriate design standards.

If the development proposal changes it will be necessary to update the report to reflect those changes.

4. Site Description

4.1 Location

The existing site area is approximately 0.8ha and comprises a rectangular shaped parcel of developed land located approximately 4km south of Manchester city centre adjacent Langley Road and Wilmslow Road. The existing USDAW central office buildings are formed in a 'U' shape with parking either side of the building and vehicular access gained from Langley Road. Immediately to the north and west of the site are undeveloped greenfield areas of fields and woodland. To the east is Wilmslow Road with Fallowfield Campus beyond. To the south is Langley Road and existing residential development.

4.2 Topography

The site falls approximately 2.8m from +43.96m AOD in the south eastern corner to +41.10m AOD in the north western corner. The site slopes gradually from east to west at a gradient of 1 in 60 and from north to south at a gradient of 1 in 50 with the lowest part of the site located in the north western corner. The topographical survey is included within Appendix C.

4.3 Watercourses

The nearest receiving watercourse is the Platt Brook located in Platt Fields Park adjacent a boating lake approximately 425m to the North West, which links with Gore Brook to the North. There is also



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an unidentified body of water approximately 100m to the North of the site which is thought to run in a Westerly direction towards the boating lake.

4.4 Sewerage

According to the United Utilities sewer records shown in Appendix D there are combined sewers in Langley Road where two sewer legs join into manhole ref. 5200, before draining down Riga Road in a southerly direction. There is also a short leg of 150mm diameter combined sewer which connects to existing manhole 5200 which is thought to serve the existing building. There is also a 1900mm brick and 500mm combined sewer located within Wilmslow Road which drain to the North. A CCTV survey of the existing sewers within and around the vicinity of the site is required to identify the exact location, depths, and condition of the sewers.

4.5 Geology

According to the BGS Geology of Britain Viewer, the site is located on Chester Formation Sandstone at the bedrock formation with Diamicton, Devensian Till recorded superficial deposits. The Ground Investigation Report TE1279GIR1.1 produced by Tier Environmental dated 18 May 2020 indicates made ground between depths of 0.3m and 2m, Glacial Till between depths of 0.4m and 2m, and Chester Formation between depths of 2.8m to 4.7m.

4.6 Proposed Development

The proposal comprises partial demolition of existing buildings, conversion and extension of a retained building, new development to accommodate student residential accommodation and amenity/management facilities, with hard and soft landscaping, parking and access arrangements. The new buildings will consist of 3 blocks of which one will have 12 storeys and the others 4 storey. Including the new conversion and extension of an existing villa, the total building area will be approximately 2487m² (30% of total site area). The rest of the site will be large soft landscaping with some areas of hard landscaping including a small car park and footpaths. The proposals are shown on the architects Proposed Site Plan within Appendix B.

5. Foul Sewerage Proposals

5.1 Design Codes

The foul drainage system will be designed in accordance with the following documents:

- BS EN 752:2008 Drain and sewer systems outside buildings
- BS EN 10256-2:2000 Gravity drainage systems inside buildings
- Building Regulations Part H: Drainage and waste disposal
- Sewers For Adoption 7th Edition



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5.2 Foul Strategy

The foul sewerage for the proposed development will replicate the existing system by collecting future foul water outside the building. This will then discharge by gravity into the existing public 225mm combined sewer with a connection point at manhole 5201 within Langley Road. Any existing foul drainage on site will be utilised where possible subject to a CCTV survey of the existing sewers.

5.3 Proposed Foul Drainage

The foul drainage system has been sized based on British Water Code of Practice consumption figures where accommodation assumes 150 litres discharge per person per day. Assuming a worst-case scenario of full occupancy in each room +1 guest per room to ensure sufficient capacity is within the system, then a peak foul discharge rate of 9 l/s would be generated with an average of 1.5 l/s.

For the refurbishment of the villa, discharge units have been estimated in accordance with BS EN 12056-2:2000. The wastewater flow rate for this building has been calculated to be 2.60 l/s. Refer to Appendix E for foul calculations.

5.4 Approvals

At the detailed design stage, a Section 106 application will be made to United Utilities under the Water Industry Act 1991 for consent to discharge foul drainage from the proposed development to the public sewerage system. A pre-development enquiry has been made to United Utilities to examine the availability of the public sewers.

All relevant authorities will be kept informed regarding the design of the proposed foul system. It is standard practice for detailed drainage design for foul systems to be subject to the approval of the local planning authority subsequent to the grant of planning permission and this will be sought from Manchester City Council at the appropriate time.

6. Surface Water Proposals

6.1 Design Codes

The surface water drainage system will be designed in accordance with the following documents:

- BS EN 752:2008 Drain and sewer systems outside buildings
- BS EN 10256-2:2000 Gravity drainage systems inside buildings
- Building Regulations Part H: Drainage and waste disposal
- Sewers For Adoption 7th Edition
- CIRIA SuDS Manual C753



6.2 Strategy – Discharge Options

The drainage system will be based on the following SuDS principles for the disposal of the surface water run-off, as shown on drawing 892-TSY-ZZ-XX-DR-C-8000 *Drainage Strategy* in Appendix E and as described below.

There are four possible options to discharge the surface water runoff in accordance with Requirement of part H3 of Building Regulations and the SuDS hierarchy defined within the National Planning Policy Framework (NPPF). Surface water shall discharge to one of the following, listed in order of priority:

- an adequate soakaway or some other adequate infiltration system
- a watercourse
- a surface water sewer
- a combined sewer

It is necessary to identify the most appropriate method of controlling and discharging surface water. The SuDS techniques suitable for the proposed development have been identified using the selection process defined in CIRIA C753 The SuDS Manual.

The table below shows a list of SuDS options and their relative benefits in terms of sustainability. The following section discusses the application of these features and their feasibility in the context of the proposed development.

Most Preferable	SUDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife
	Basins and ponds - Constructed wetlands - Balancing ponds - Detention basins - Retention ponds	✓	✓	✓
	Filter strips and swales (Infiltration)	✓	✓	✓
	Permeable Surfaces and Filter Drains (used as storage) - Gravelled areas - Solid paving blocks - Permeable paving	✓	✓	
	Tanked systems - over-sized pipes/tanks - cellular storage	✓		
Least Preferable				



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Discharge via Infiltration

The preferred method for the disposal of surface water in the hierarchy is infiltration to ground. In determining the future surface runoff from the site, the potential of using infiltration would need to be assessed for feasibility by undertaking soakaway tests to BRE Digest 365. However, upon review of the Tier Environmental Ground Investigation report ref. TE1279GIR1.1, the site is built on made ground and glacial till deposits up to 2m deep. This is deemed as very poor infiltration media, therefore soakaways can be considered an unlikely option for the disposal of surface water.

Discharge to Watercourse

The second consideration in the SuDS hierarchy is discharge to watercourse. The nearest receiving watercourse is the Platt Brook which is located over 400m away. This distance makes it an impracticable solution and therefore will not be considered an option.

Discharge to Sewer

In this instance the discharge of surface water via infiltration and to a watercourse is deemed unsuitable, therefore discharge to the public sewer is proposed. Surface water run-off from the new development will be collected by way of rainwater pipes into a dedicated below ground surface water drainage system which will discharge from the site and connect into the combined sewer at Manhole 5201 in Langley Road. The site is classed as brownfield and is currently in use by the existing USDAW offices, but a positive drainage system is yet to be identified. A full CCTV survey will be undertaken to confirm pipe depths and condition.

6.3 Strategy – Discharge Rate

In accordance with the *Manchester City, Salford City and Trafford Councils Level 2 Hybrid Strategic Flood Risk Assessment* the development should aim for 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. Therefore, in lieu of detailed existing drainage calculations, a brownfield run-off rate has been calculated below using the Modified Rational Method:

$$Q = C \times i \times A$$

Where Q = Flow Rate (l/s)
C = Dimensionless Coefficient
i = Rainfall Intensity (mm/hr)
A = Area (ha)

The existing site is 0.8ha and is estimated to have a 70% impermeable area, therefore has a total impermeable area of 0.56ha. On this basis the run-off rate has been calculated as the following:

$$\begin{aligned} 2.78 \times 50 \times 0.56 &= 69.5 \text{ l/s} \\ 69.5 \times 0.5 \text{ (50\% betterment)} &= 35 \text{ l/s} \end{aligned}$$



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However, upon review of the Hydrobrake flow control, a minimum outlet pipe diameter of 300mm is required exceeding the downstream pipe diameter, therefore this rate cannot be used. The maximum discharge rate requirement into the flow control for a 225mm diameter outlet pipe is 25 l/s. On this basis a betterment of 50% is proposed to give a discharge rate **12.5 l/s**.

6.4 Strategy – Attenuation

The site will require attenuation due to the restricted discharge rate. Manchester City Council as the Lead Local Flood Authority, in their updated 2019 *SuDS Requirements for New Developments*, require maximisation of green infrastructure wherever practicable to control surface water runoff to as near to its source as possible, through the implementation of SuDS.

Hydraulic calculations have been produced within Appendix E which identifies a requirement for approximately 115m³ storage volume to cater for the 1 in 100 year storm event plus 40% climate change based on a total positively drained impermeable area of 3140m². The proposal is to use a detention basin within the courtyard area and a geo-cellular tank to attenuate this volume. The basin will be in the form of a landscaped depression which will only fill up in heavy storm events once flows reach the specified threshold through a flow control device, allowing the basin area to be used as a recreational or other amenity facility.

Refer to Appendix E for full layout proposals and calculations.

6.5 Strategy – Treatment

Although the surface water will outfall to a combined sewer, the SuDS principles proposed will conform to the basic level of treatment control as a minimum. The water quality benefits of a vegetated basin are associated with the removal of sediment and buoyant materials, but levels of nutrients, heavy metals, toxic materials and oxygen-demanding materials may also be significantly reduced. As per the CIRIA SuDS Manual Table 4.3 the pollution hazard level for residential roofs is considered 'Very low' and the pollution hazard level for the rest of the site is considered 'Low'. The detention basin could also have areas of coarse aggregate stone where further treatment can be provided. The treatment provided on this site exceeds the pollution hazard indices for suspended solids, metals and hydrocarbons.

6.6 Proposed Surface Water Flooding/Exceedance

The site is not at risk from pluvial flooding and at the detailed design stage, the site will be designed to not flood in a 1 in 100 year event plus 40% Climate Change. The topography of the proposed site will ensure buildings are not at risk from an exceedance event by providing low points in the form of shallow depressions within landscaped areas. Gradients will be engineered towards the low points and make sure overland flow routes are not directed towards any buildings and ensure neighbouring sites are not at risk from flooding. The site is proposing a greater landscaped area than existing, thereby further reducing the amount of surface water run-off.



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6.7 Approvals

At the detailed design stage, A Section 106 application will be made to United Utilities under the Water Industry Act 1991 for consent to discharge foul sewage from the proposed development to the public sewerage system. A pre-development enquiry has been made to United Utilities to examine the availability of the public sewers.

All relevant authorities will be kept informed regarding the design of the proposed surface water system. It is standard practice for detailed drainage design for foul systems to be subject to the approval of the local planning authority subsequent to the grant of planning permission and this will be sought from Manchester City Council at the appropriate time.

7. Conclusions

The site is less than 1 hectare and considered at low risk of flooding where there is no significant risk from fluvial or pluvial flooding. Consequently, there is no requirement for a Flood Risk Assessment and the sequential test is deemed to be satisfied with no need to consider either the Exception Test or the application of flood resilience.

Surface water will discharge to the public combined sewer located within Langley Road at a restricted rate of 12.5 l/s providing at least 50% betterment to existing brownfield. Foul drainage will also discharge by gravity to the same public combined sewer through a combined lateral sewer.

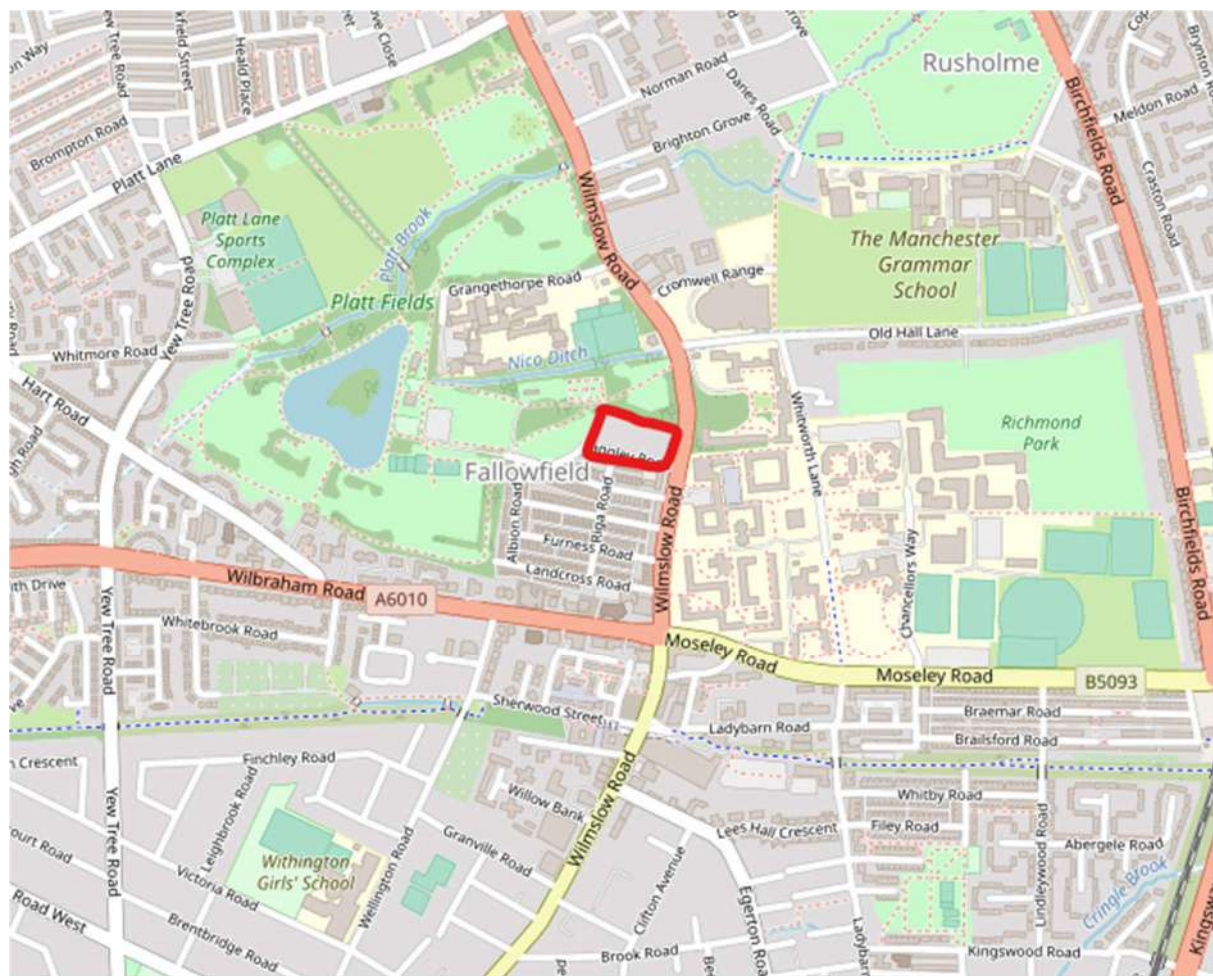
The surface water drainage system will use SuDS attenuation techniques where possible to adequately cater 90m³ for the 1 in 100 year plus 40% Climate Change, including a detention basin within the courtyard.

With regard to flood risk & drainage, the site is suitable for the proposed use. Subject to the implementation of this Drainage Strategy, the development may be occupied safely and adequately drained while reducing flood risk overall.



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Appendix A – Location Plan





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Appendix B – Proposed Site Plan

DRAFT
WORKS IN PROGRESS

NOTES:
1. DO NOT SCALE FROM THIS DRAWING. ALWAYS WORK TO NOTED DIMENSIONS.
2. ALL SETTING OUT, LEVELS AND DIMENSIONS TO BE CHECKED ON SITE PRIOR TO THE INSTALLATION OF MATERIALS AND ANY DISCREPANCIES ARE TO BE BROUGHT TO THE ATTENTION OF THE CONTRACT ADMINISTRATOR IMMEDIATELY.
3. THIS DRAWING MUST BE READ WITH THE RELEVANT SPECIFICATION DOCUMENTS AND DETAIL DRAWINGS. ANY DISCREPANCIES MUST BE BROUGHT TO THE ATTENTION OF THE CONTRACT ADMINISTRATOR IMMEDIATELY.
4. THIS DRAWING IS COPYRIGHT PROTECTED AND MAY NOT BE REPRODUCED IN WHOLE OR PART WITHOUT WRITTEN AUTHORITY.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

THIS DRAWING WAS PLOTTED ON:
25/11/20

REVISION HISTORY

DATE	REV	ZONE	DESCRIPTION	CHK
08/10/20	1		Architect GF Plan Updated	ST
13/10/20	2		Fire Tender (Draft)	ST
25/11/20	3		Change in Building Footprint	ST

KEY

GENERAL INFORMATION

APPLICATION SITE BOUNDARY

LEVELS

PROPOSED LEVELS

EXISTING LEVELS RETAINED

HARDWORKS

SURFACE TYPE A: RESIN BOUND GRAVEL
TO PRIMARY ROUTES
DETAILS TO BE CONFIRMED

SURFACE TYPE B: LOOSE GRAVEL
TO MAIN COURTYARD
DETAILS TO BE CONFIRMED

SURFACE TYPE C: GREEN GAP PAVING
TO CAR PARK & BIN HOLDING AREA
DETAILS TO BE CONFIRMED

SURFACE TYPE D: ASPHALT
TO VEHICULAR AREAS
DETAILS TO BE CONFIRMED

STEPS
SOLID STEP UNIT WITH CONTRASTING INLAY NOSING
DETAILS TO BE CONFIRMED

LOW BRICK WALL
DETAILS TO BE CONFIRMED

EXISTING WALL & GATE

SOFTWORKS

EXISTING TREE

PROPOSED CLEAR STEM TREE
REFER TO PLANTING SCHEDULE

PROPOSED MULTI-STEM TREE
REFER TO PLANTING SCHEDULE

ORNAMENTAL PLANTING
REFER TO PLANTING SCHEDULE

LAWN
REFER TO PLANTING SCHEDULE

INSTANT HEDGEROW
REFER TO PLANTING SCHEDULE

FURNITURE

TIMBER SEATING
SUBJECT TO FURTHER DETAIL

HANDRAIL
SUBJECT TO FURTHER DETAIL

PEDESTRIAN GATE
SUBJECT TO FURTHER DETAIL

RAILING
SUBJECT TO FURTHER DETAIL

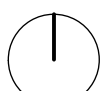
SECURE CYCLE STORE
SUBJECT TO FURTHER DETAIL

LIGHTING

ILLUMINATED BOLLARD
LOCATIONS AS SHOWN
DETAILS TO BE CONFIRMED

IN-GROUND UPLIGHTER
LOCATIONS AS SHOWN
DETAILS TO BE CONFIRMED

ALL WORKS SHOWN OUTSIDE OF THE
RED LINE BOUNDARY ARE FOR
ILLUSTRATION PURPOSES ONLY



ORIGINATOR

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LANDSCAPE ARCHITECTURE
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CLIENT

Watkin Jones

PROJECT

**188 Wilmslow Road
Fallowfield**

DRAWING TITLE

Landscape GA

DRAWING NUMBER

204-LYR-XX-ZZ-DWG-L-1001

REV | STATUS

3 | DRAFT

SCALE

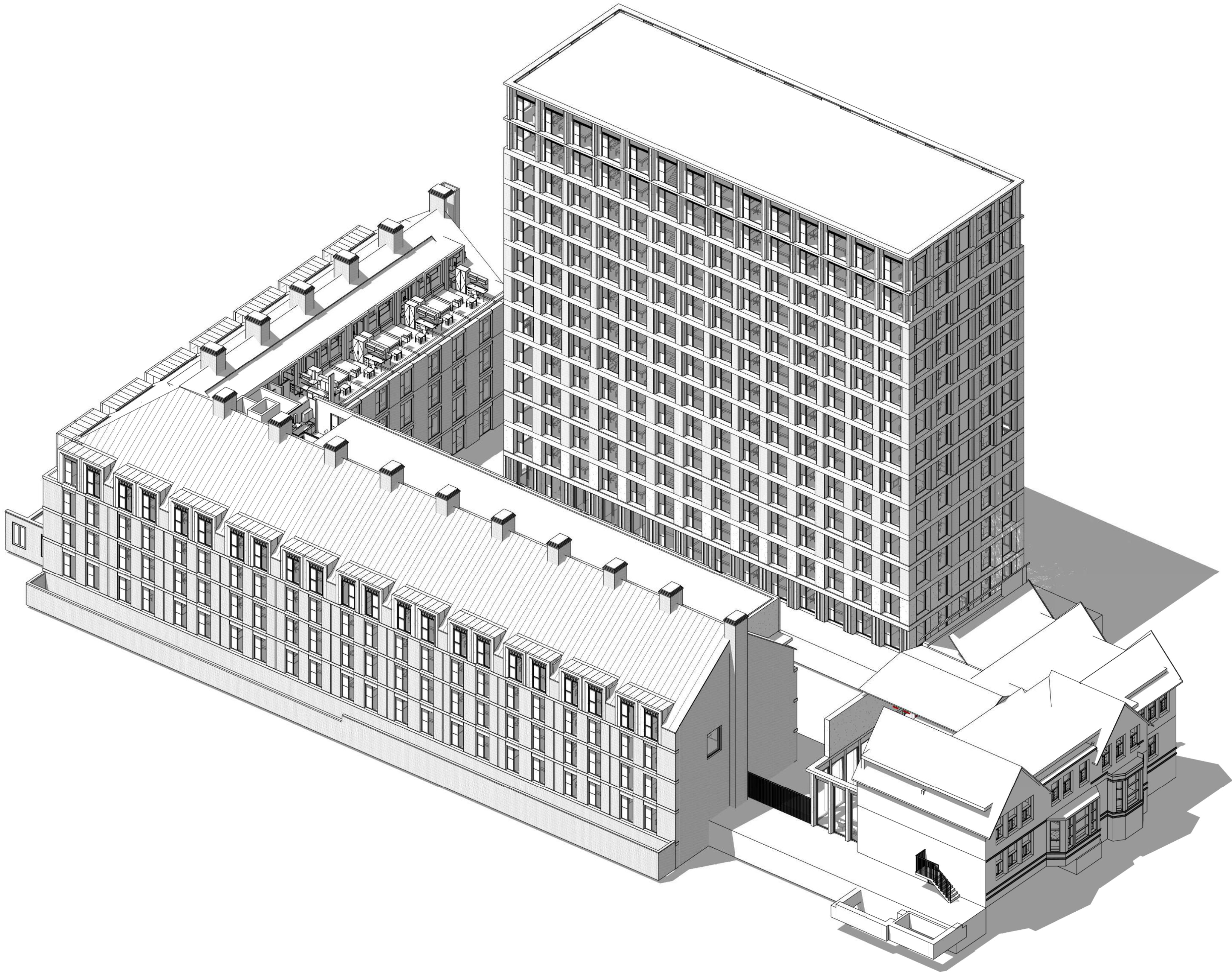
1:250 @ A1

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Rev	Description	Date	By
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WORKING PROGRESS

Client

TBC

Project

188 Wimslow
Road_Manchester

Title

Axonametric B

Status

Preliminary

Project number

1093

Date

11/20/20

Drawn by

MP

Checked by

MP

Scale

@A2

Revision

Drawing No.

1093-TGA-XX-ZZ-DR-A-10001

20/11/2020 13:48:00



Document Title:	Drainage Strategy Report
Document No.:	892-TSY-ZZ-XX-RP-C-1001
Revision:	002
Date:	23/11/2020

Appendix C – Topographical Survey



Document Title:	Drainage Strategy Report
Document No.:	892-TSY-ZZ-XX-RP-C-1001
Revision:	002
Date:	23/11/2020

Appendix D – Existing Sewer Records

Dean Burrows

**UNIT 3
ACRES HILL BUSINESS PARK, acres hill lane
SHEFFIELD,
S9 4LR**

FAO:

How to contact us:

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

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: 892-Wilmslow Road
Our Ref: UUPS-ORD-162211
Date: 23/04/2020**

Dear Sirs

Location: WILMSLOW ROAD

I acknowledge with thanks your request dated 23/04/2020 for information on the location of our services.

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

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

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

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

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

Yours Faithfully,



Karen McCormack
Property Searches Manager

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

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

TERMS AND CONDITIONS:

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



Reho	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
6300	42.93	CO	0	300	300	CO	60.40955	1 in 239	
6501	41.61	CO	38.4	300	300	VC	20.24458		
3000	38.73	CO	33.44	300	300	VC	22.84458		
5220	VC	CO	39.57	225	225	VC	8.80658		
7501	41.63	CO	39.57	225	225	VC	34.0147	1 in 94	
5217	VC	CO	39.57	225	225	VC	67.32286		
7300	43.79	SW	41.45	225	225	VC	74.04053	1 in 103	
6201	43.68	CO	0	1900	1900	BR	59.4108		
8300	44.29	SW	42.26	225	225	VC	75.18643	1 in 98	
4300	41.49	CO	39.12	225	225	VC	67.11559	1 in 43	
5400	41.32	CO	0	1900	1900	BR	134.2832		
5504	41.24	CO	35	300	300	VC	13.60147	1 in 151	
7403	41.74	CO	36.25	450	450	VC	2.346501		
2500	38.67	CO	34.16	300	300	VC	73.24616	1 in 198	
6403	41.74	CO	36.25	450	450	VC	84.48077	1 in 217	
6402	41.45	CO	0	475	475	VC	83.60024	1 in 248	
3501	39.66	CO	33.78	300	300	VC	74.43118		
4202	41.88	CO	38.73	225	225	VC	75.89466		
5102	41.65	CO	0	1900	1900	BR	92.76314		
7500	41.63	CO	38.65	300	300	VC	66.51548	1 in 235	
5200	42.37	CO	39.42	225	225	VC	28.63564	1 in 75	
6400	41.28	SW	39.35	150	150	VC	18.60108		
6500	41.41	CO	38.17	300	300	VC	50.21952	1 in 173	
5201	42.88	CO	38.85	225	225	VC	27.86265	1 in 75	
3208	VC	CO	38.85	150	150	VC	62.53844		
3002	36.79	CO	32.69	100	100	VC	81.88638		
8405	VC	CO	32.69	100	100	VC	6.528187		
3201	38.74	CO	35.79	375	375	VC	24.08319	1 in 65	
4300	41.48	CO	38.12	225	225	VC	42.35346		
4500	41.01	CO	28.08	300	300	BR	144.2468	1 in 759	
5202	43.91	CO	41.71	225	225	VC	53.65091	1 in 51	
3100	38.07	CO	35.04	300	300	VC	28.07681	1 in 261	
5101	41.85	CO	31.63	600	600	CO	93.84147	1 in 626	
3202	41.85	CO	31.63	100	100	VC	7.604055		
5503	41.41	CO	30.9	525	525	VC	76.83749	1 in 452	
5501	41.27	BR	30.71	825	825	BR	153.5741		
6402	41.45	CO	30.82	475	475	BR	13.92839		
6202	43.7	CO	31.47	500	500	CO	106.5662		
5002	39.74	CO	32.32	500	500	BR	35.12834		
3200	39.6	VC	36.76	300	300	VC	67.26912	1 in 72	
4200	40.48	CO	37.55	300	300	VC	55.68176	1 in 71	
6401	41.49	CO	35.85	450	450	VC	3	1 in 1	
4501	40.44	CO	33.46	350	350	VC	72.38712	1 in 154	
5231	VC	CO	35.85	150	150	VC	5.333312		
7401	42.6	SW	40.68	225	225	VC	17.75022	1 in 21	
4203	42	CO	38.65	300	300	VC	49.0006	1 in 52	
4101	40.84	CO	37.68	375	375	VC	49.91968	1 in 59	
4000	38.55	CO	35.49	225	225	VC	105.418	1 in 94	
3101	37.43	CO	34.34	450	450	VC	126.3022	1 in 152	
5111	VC	CO	34.34	225	225	VC	24.83661		
5203	43.29	CO	36.52	300	300	VC	81.58431	1 in 35	
4103	38.94	CO	36.79	375	375	VC	52.17279	1 in 23	
7400	41.74	CO	36.21	450	450	VC	63.1981		
7405	VC	CO	36.21	100	100	VC	2.786955		
5109	VC	CO	37.33	300	300	VC	57.36808		
5140	VC	CO	43.7243	300	300	VC	43.7243	1 in 84	
5005	VC	CO	33.48	225	225	VC	16.4179	1 in 15	
5017	VC	CO	33.48	150	150	VC	3.343338		
3221	VC	CO	33.48	225	225	VC	6.317622		
5225	VC	CO	33.48	225	225	VC	24.21125		
8407	VC	CO	33.48	100	100	VC	22.63418		

LEGEND

Abandoned

Foul

Surface Water

Combined

Public Sewer

Private Sewer

Section 104

Rising Main

Sludge Main

Overflow

Water Course

Highway Drain

All point assets follow the standard colour convention:
red - combined
brown - foul
blue - surface water
purple - overflow

Manhole

Head of System

Extent of Survey

Rodding Eye

Inlet

Discharge Point

Vortex

Penstock

Washout Chamber

Valve

Air Valve

Non Return Valve

Soakaway

Gully

Cascade

Flow Meter

Hatch Box

Oil Interceptor

Summit

Drop Shaft

Orifice Plate

Side Entry Manhole

Outfall

Screen Chamber

Inspection Chamber

Bifurcation Chamber

Lamp Hole

T Junction / Saddle

Catchpit

Valve Chamber

Vent Column

Vortex Chamber

Penstock Chamber

Network Storage Tank

Sewer Overflow

Ww Treatment Works

Ww Pumping Station

Septic Tank

Control Kiosk

Change of Characteristic

MANHOLE FUNCTION

FO Foul
SW Surface Water
CO Combined
OV Overflow

SEWER SHAPE

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

SEWER MATERIAL

AC Asbestos Cement
BR Brick
PE Polyethylene
RP Reinforced Plastic Matrix
CO Concrete
CSB Concrete Segment Bolted
CSU Concrete Segment Unbolted
CC Concrete Box Culverted
PSC Plastic / Steel Composite
GRC Glass Reinforced Plastic
DI Ductile Iron
PVC Polyvinyl Chloride
CI Cast Iron
SI Spun Iron
ST Steel
VC Vitrified Clay
PP Polypropylene
PF Pitch Fibre
MAC Masonry, Coursed
MAR Masonry, Random
U Unspecified

Address or Site Reference:

WILMSLOW ROAD,

Scale: 1:1250

Date: 23/04/2020

Sheet: 1 of 1

Printed by: Property Searches

SEWER RECORDS

United Utilities
helping life flow smoothly

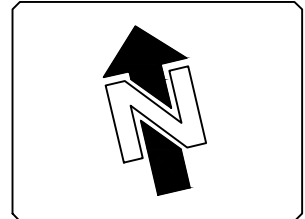
The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Document Title:	Drainage Strategy Report
Document No.:	892-TSY-ZZ-XX-RP-C-1001
Revision:	002
Date:	23/11/2020

Appendix E – Drainage Strategy Drawings & Calculations



DETENTION BASIN WITH STONE FILLED TRENCH
PERFORATED PIPE WRAPPED IN PERMEABLE MEMBRANE TO ACT AS AN OVERFLOW IN HEAVY STORM EVENTS. OPEN TRENCH FILLED WITH COARSE GRADED AGGREGATE WITH BASIN AND TRENCH LINED WITH IMPERMEABLE MEMBRANE. DETENTION BASIN TO HAVE A PERMEABLE SURFACE AND MAX 1 IN 3 SIDE SLOPES.
PERFORATED PIPE SIZE TO BE 225mm AT AN INVERT OF 41.404.
1.0 x 1.0m DEEP TRENCH
0.5m DEEP BASIN
ATTENUATION VOLUME 70m³
1 IN 30 YEAR WATER LEVEL = 42.413 (DRY BASIN)
1 IN 100 YEAR WATER LEVEL + 40% CLIMATE CHANGE = 42.641 + 300mm FREEBOARD

Notes

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS TOGETHER WITH THE APPROPRIATE SPECIFICATIONS.
- IT IS THE CONTRACTORS RESPONSIBILITY TO CHECK ALL DIMENSIONS ON SITE. DIMENSIONS MUST NOT BE SCALED FROM THIS DRAWING. ANY DISCREPANCIES TO BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE ARCHITECT IN WRITING.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ALL LEVELS ARE IN METRES, UNLESS NOTED OTHERWISE.

LEGEND

- SITE BOUNDARY
- PROPOSED FOUL DRAIN
- PROPOSED SURFACE WATER DRAIN
- PROPOSED COMBINED DRAIN
- PROPOSED CHANNEL DRAIN
- PROPOSED FOUL POLYPROPYLENE INSPECTION CHAMBER
- PROPOSED SW POLYPROPYLENE INSPECTION CHAMBER
- PROPOSED FOUL PRECAST CONCRETE MANHOLE
- PROPOSED SW PRECAST CONCRETE MANHOLE
- PROPOSED COMBINED PRECAST CONCRETE MANHOLE
- EXTENTS OF PROPOSED CELLULAR ATTENUATION
- EXISTING UU COMBINED WATER SEWER
- EXCEEDANCE FLOOD ROUTE

NOTES

- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE DRAINAGE STRATEGY REPORT 892-TSY-ZZ-XX-RP-C-1001.
- THIS DRAWING IS A PRELIMINARY STRATEGY ONLY. FURTHER DETAILS WILL BE CONFIRMED AT THE DETAILED DESIGN STAGE.
- EXISTING SEWERS TAKEN FROM UNITED UTILITIES ASSET RECORDS, DEPTHS AND LOCATION NEED TO BE CONFIRMED BY SEWER CCTV SURVEY.
- DRAINAGE LAYOUT BASED ON LATEST LANDSCAPE ARCHITECTS SITE LAYOUT DRAWING REF. 204-LYR-XX-ZZ-DWG-L-1001 REV 3.
- ALL ATTENUATION VOLUME REQUIREMENTS ARE MINIMUM REQUIREMENTS. ADDITIONAL STORAGE MAY BE REQUIRED WITHIN THE SYSTEM TO SUIT LANDSCAPE DESIGN/ SITE LEVELS.
- RAIN WATER PIPES AND INTERNAL DRAINAGE TO BE CONFIRMED BY ARCHITECT - DRAINAGE DESIGN MAY CHANGE TO SUIT THESE LOCATIONS.
- PROPOSED SITE LEVELS HAVE BEEN PROVIDED BY LAYER ARCHITECTS DRAWING REF. 204-LYR-XX-ZZ-DWG-L-1001 REV 3.



ALL DRAINAGE PROPOSALS ARE SUBJECT TO A CCTV SURVEY OF EXISTING DRAINAGE AND APPROVAL FROM UNITED UTILITIES AND MANCHESTER CITY COUNCIL

P2	14/12/20	GB	BLUE ROOF OMITTED	WB
P1	30/11/20	GB	FIRST ISSUE	WB
Rev	Date	By	Description	Appd

Revisions

Status

PRELIMINARY



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Acres Hill Business Park
Acres Hill Lane
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Client



Architect

TIM GROOM ARCHITECTS

Project

WILMSLOW ROAD, MANCHESTER

Title

DRAINAGE STRATEGY

Scale	Drawn	Revision
1:250@A1	GB	P2
Date	Checked	
NOV 2020	DAB	

Drawing Ref:

Project no/City/road/Volume/Level/Type/Sheet/Number

892-TSY-ZZ-XX-DR-C-8000

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	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	0.360	Preferred Cover Depth (m)	0.600
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)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.017	5.00	42.680	600	385497.476	394346.588	0.825
9	0.025	5.00	43.250	450	385491.546	394323.593	0.750
2			43.250	600	385495.243	394337.929	1.448
3			43.250	600	385518.668	394331.888	1.591
13	0.044	5.00	43.370	450	385562.169	394298.175	0.750
14			43.630	450	385567.636	394320.434	1.239
15	0.021	5.00	44.400	450	385561.778	394328.719	2.110
16			43.250	450	385550.333	394331.605	1.078
4	0.011	5.00	43.200	600	385542.094	394325.848	1.684
10	0.045	5.00	41.900	600	385479.080	394308.505	0.825
11	0.054	5.00	42.500	600	385505.939	394301.579	1.589
12	0.007	5.00	43.000	600	385533.464	394294.482	2.257
17			43.100	600	385534.314	394297.852	2.378
5	0.075	5.00	43.025	1500	385540.518	394319.736	1.546
6			43.025	600	385544.107	394316.983	1.573
6A	0.015	5.00	43.100	1800	385539.055	394296.673	2.520
7			43.000	1200	385538.365	394293.922	2.501
5201			43.000	1200	385536.742	394287.670	3.150

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	1	2	8.942	0.600	41.855	41.802	0.053	169.0	225	5.15	50.0
2.000	9	2	14.805	0.600	42.500	41.877	0.623	23.8	150	5.12	50.0
1.001	2	3	24.191	0.600	41.802	41.659	0.143	169.0	225	5.55	50.0
1.002	3	4	24.192	0.600	41.659	41.516	0.143	169.0	225	5.95	50.0
4.000	13	14	22.921	0.600	42.620	42.391	0.229	100.0	150	5.38	50.0
4.001	14	15	10.147	0.600	42.391	42.290	0.101	100.0	150	5.55	50.0
4.002	15	16	11.803	0.600	42.290	42.172	0.118	100.0	150	5.74	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	1.003	39.9	3.2	0.600	1.223	0.017	0.0	44	0.609
2.000	2.074	36.7	4.7	0.600	1.223	0.025	0.0	37	1.441
1.001	1.003	39.9	8.0	1.223	1.366	0.042	0.0	68	0.787
1.002	1.003	39.9	8.0	1.366	1.459	0.042	0.0	68	0.787
4.000	1.005	17.8	8.3	0.600	1.089	0.044	0.0	72	0.989
4.001	1.005	17.8	8.3	1.089	1.960	0.044	0.0	72	0.989
4.002	1.005	17.8	12.3	1.960	0.928	0.065	0.0	92	1.084

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)
4.003	16	4	10.051	0.600	42.172	41.591	0.581	17.3	150	5.81	50.0
1.003	4	5	6.312	0.600	41.516	41.479	0.037	169.0	225	6.06	50.0
3.000	10	11	27.738	0.600	41.075	40.911	0.164	169.0	225	5.46	50.0
3.001	11	12	28.425	0.600	40.911	40.743	0.168	169.0	225	5.93	50.0
3.002	12	17	3.476	0.600	40.743	40.722	0.021	169.0	225	5.99	50.0
3.003	17	6A	4.885	0.600	40.722	40.580	0.142	34.4	225	6.03	50.0
1.004	5	6	4.523	0.600	41.479	41.452	0.027	169.0	225	6.13	50.0
1.005	6	6A	20.929	0.600	41.452	40.580	0.872	24.0	225	6.26	50.0
1.006	6A	7	2.836	0.600	40.580	40.499	0.081	35.0	225	6.28	50.0
1.007	7	5201	6.459	0.600	40.499	39.850	0.649	10.0	225	6.31	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)
4.003	2.433	43.0	12.3	0.928	1.459	0.065	0.0	55	2.103
1.003	1.003	39.9	22.4	1.459	1.321	0.118	0.0	121	1.032
3.000	1.003	39.9	8.5	0.600	1.364	0.045	0.0	71	0.803
3.001	1.003	39.9	18.8	1.364	2.032	0.099	0.0	109	0.988
3.002	1.003	39.9	20.1	2.032	2.153	0.106	0.0	113	1.004
3.003	2.238	89.0	20.1	2.153	2.295	0.106	0.0	73	1.818
1.004	1.003	39.9	36.6	1.321	1.348	0.193	0.0	170	1.133
1.005	2.682	106.6	36.6	1.348	2.295	0.193	0.0	91	2.440
1.006	2.218	88.2	59.6	2.295	2.276	0.314	0.0	136	2.377
1.007	4.171	165.9	59.6	2.276	2.925	0.314	0.0	93	3.831

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	8.942	169.0	225	Circular_Default Sewer Type	42.680	41.855	0.600	43.250	41.802	1.223
2.000	14.805	23.8	150	Circular_Default Sewer Type	43.250	42.500	0.600	43.250	41.877	1.223
1.001	24.191	169.0	225	Circular_Default Sewer Type	43.250	41.802	1.223	43.250	41.659	1.366
1.002	24.192	169.0	225	Circular_Default Sewer Type	43.250	41.659	1.366	43.200	41.516	1.459
4.000	22.921	100.0	150	Circular_Default Sewer Type	43.370	42.620	0.600	43.630	42.391	1.089
4.001	10.147	100.0	150	Circular_Default Sewer Type	43.630	42.391	1.089	44.400	42.290	1.960
4.002	11.803	100.0	150	Circular_Default Sewer Type	44.400	42.290	1.960	43.250	42.172	0.928
4.003	10.051	17.3	150	Circular_Default Sewer Type	43.250	42.172	0.928	43.200	41.591	1.459
1.003	6.312	169.0	225	Circular_Default Sewer Type	43.200	41.516	1.459	43.025	41.479	1.321
3.000	27.738	169.0	225	Circular_Default Sewer Type	41.900	41.075	0.600	42.500	40.911	1.364

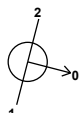
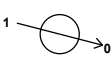
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	600	Manhole	Adoptable	2	600	Manhole	Adoptable
2.000	9	450	Manhole	Adoptable	2	600	Manhole	Adoptable
1.001	2	600	Manhole	Adoptable	3	600	Manhole	Adoptable
1.002	3	600	Manhole	Adoptable	4	600	Manhole	Adoptable
4.000	13	450	Manhole	Adoptable	14	450	Manhole	Adoptable
4.001	14	450	Manhole	Adoptable	15	450	Manhole	Adoptable
4.002	15	450	Manhole	Adoptable	16	450	Manhole	Adoptable
4.003	16	450	Manhole	Adoptable	4	600	Manhole	Adoptable
1.003	4	600	Manhole	Adoptable	5	1500	Manhole	Adoptable
3.000	10	600	Manhole	Adoptable	11	600	Manhole	Adoptable

Pipeline Schedule

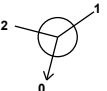
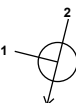
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
3.001	28.425	169.0	225	Circular_Default Sewer Type	42.500	40.911	1.364	43.000	40.743	2.032
3.002	3.476	169.0	225	Circular_Default Sewer Type	43.000	40.743	2.032	43.100	40.722	2.153
3.003	4.885	34.4	225	Circular_Default Sewer Type	43.100	40.722	2.153	43.100	40.580	2.295
1.004	4.523	169.0	225	Circular_Default Sewer Type	43.025	41.479	1.321	43.025	41.452	1.348
1.005	20.929	24.0	225	Circular_Default Sewer Type	43.025	41.452	1.348	43.100	40.580	2.295
1.006	2.836	35.0	225	Circular_Default Sewer Type	43.100	40.580	2.295	43.000	40.499	2.276
1.007	6.459	10.0	225	Circular_Default Sewer Type	43.000	40.499	2.276	43.000	39.850	2.925

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
3.001	11	600	Manhole	Adoptable	12	600	Manhole	Adoptable
3.002	12	600	Manhole	Adoptable	17	600	Manhole	Adoptable
3.003	17	600	Manhole	Adoptable	6A	1800	Manhole	Adoptable
1.004	5	1500	Manhole	Adoptable	6	600	Manhole	Adoptable
1.005	6	600	Manhole	Adoptable	6A	1800	Manhole	Adoptable
1.006	6A	1800	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.007	7	1200	Manhole	Adoptable	5201	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)	
1	385497.476	394346.588	42.680	0.825	600		0	1.000	41.855	225
9	385491.546	394323.593	43.250	0.750	450		0	2.000	42.500	150
2	385495.243	394337.929	43.250	1.448	600		1	2.000	41.877	150
							2	1.000	41.802	225
							0	1.001	41.802	225
3	385518.668	394331.888	43.250	1.591	600		1	1.001	41.659	225
							0	1.002	41.659	225
13	385562.169	394298.175	43.370	0.750	450		0	4.000	42.620	150
14	385567.636	394320.434	43.630	1.239	450		1	4.000	42.391	150
							0	4.001	42.391	150
15	385561.778	394328.719	44.400	2.110	450		1	4.001	42.290	150
							0	4.002	42.290	150

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
16	385550.333	394331.605	43.250	1.078	450	 1	4.002	42.172	150
						0	4.003	42.172	150
4	385542.094	394325.848	43.200	1.684	600	 1	4.003	41.591	150
						2	1.002	41.516	225
						0	1.003	41.516	225
10	385479.080	394308.505	41.900	0.825	600	 0	3.000	41.075	225
						0	3.000	40.911	225
11	385505.939	394301.579	42.500	1.589	600	 1	3.001	40.911	225
						0	3.001	40.743	225
12	385533.464	394294.482	43.000	2.257	600	 1	3.002	40.743	225
						0	3.002	40.722	225
17	385534.314	394297.852	43.100	2.378	600	 1	3.003	40.722	225
						0	1.003	41.479	225
5	385540.518	394319.736	43.025	1.546	1500	 1	1.004	41.479	225
						0	1.004	41.452	225
6	385544.107	394316.983	43.025	1.573	600	 1	1.005	41.452	225
						0	1.005	40.580	225
6A	385539.055	394296.673	43.100	2.520	1800	 1	1.006	40.580	225
						2	1.006	40.499	225
						0	1.007	40.499	225
7	385538.365	394293.922	43.000	2.501	1200	 1	1.007	39.850	225
						0	1.007	39.850	225
5201	385536.742	394287.670	43.000	3.150	1200	 1			

Simulation Settings

Rainfall Methodology FSR
FSR Region England and Wales
M5-60 (mm) 18.000
Ratio-R 0.360
Summer CV 0.750
Winter CV 0.840

Analysis Speed Normal
Skip Steady State ✓
Drain Down Time (mins) 240
Additional Storage (m³/ha) 0.0
Check Discharge Rate(s) ✓
Check Discharge Volume ✓

Simulation Settings

100 year 360 minute (m³)

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
2	0	0	0
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m ³)	

Node 6A Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	40.580	Product Number	CTL-SHE-0153-1250-1575-1250
Design Depth (m)	1.575	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	12.5	Min Node Diameter (mm)	1500

Node 5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	41.479	Product Number	CTL-SHE-0109-6000-1400-6000
Design Depth (m)	1.400	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node 5 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	41.479
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	76

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	11.0	0.0	0.700	50.0	0.0	1.000	167.0	0.0
0.699	11.0	0.0	0.999	50.0	0.0	1.500	237.0	0.0

Node 6A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	40.580
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	68

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	35.0	0.0	0.800	35.0	0.0	0.801	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 95.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	41.890	0.035	2.1	0.0098	0.0000	OK
15 minute winter	9	10	42.530	0.030	3.1	0.0048	0.0000	OK
30 minute winter	2	24	41.873	0.071	4.0	0.0201	0.0000	OK
30 minute winter	3	25	41.875	0.216	6.1	0.0611	0.0000	OK
15 minute winter	13	10	42.678	0.058	5.4	0.0092	0.0000	OK
15 minute winter	14	11	42.450	0.059	5.3	0.0093	0.0000	OK
15 minute winter	15	11	42.365	0.075	7.8	0.0120	0.0000	OK
15 minute winter	16	11	42.215	0.043	7.8	0.0069	0.0000	OK
30 minute winter	4	25	41.873	0.357	10.5	0.1009	0.0000	SURCHARGED
15 minute winter	10	10	41.131	0.056	5.5	0.0157	0.0000	OK
15 minute winter	11	10	40.996	0.085	12.0	0.0241	0.0000	OK
15 minute winter	12	11	40.832	0.089	12.6	0.0252	0.0000	OK
15 minute winter	17	11	40.785	0.063	12.6	0.0178	0.0000	OK
30 minute winter	5	25	41.872	0.393	14.9	5.0112	0.0000	SURCHARGED
30 minute winter	6	25	41.488	0.036	6.0	0.0102	0.0000	OK
60 minute winter	6A	42	40.755	0.175	13.6	6.2643	0.0000	OK
60 minute winter	7	42	40.540	0.041	10.8	0.0467	0.0000	OK
60 minute winter	5201	42	39.889	0.039	10.8	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 winter	1	1.000	2	2.1	0.369	0.052	0.0509	
15 minute winter	9	2.000	2	3.1	1.244	0.083	0.0364	
30 minute winter	2	1.001	3	4.0	0.641	0.102	0.5989	
30 minute winter	3	1.002	4	3.6	0.286	0.090	0.9550	
15 minute winter	13	4.000	14	5.3	0.850	0.300	0.1437	
15 minute winter	14	4.001	15	5.3	0.694	0.297	0.0772	
15 minute winter	15	4.002	16	7.8	1.199	0.437	0.0770	
15 minute winter	16	4.003	4	7.8	1.622	0.181	0.1095	
30 minute winter	4	1.003	5	8.2	0.460	0.205	0.2510	
15 minute winter	10	3.000	11	5.4	0.509	0.135	0.2967	
15 minute winter	11	3.001	12	11.8	0.828	0.295	0.4037	
15 minute winter	12	3.002	17	12.6	1.071	0.317	0.0412	
15 minute winter	17	3.003	6A	12.6	1.548	0.142	0.0812	
30 minute winter	5	Hydro-Brake®	6	6.0				
30 minute winter	6	1.005	6A	6.0	0.995	0.056	0.3874	
60 minute winter	6A	Hydro-Brake®	7	10.8				
60 minute winter	7	1.007	5201	10.8	2.263	0.065	0.0307	29.9

Results for 2 year Critical Storm Duration. Lowest mass balance: 95.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	26	42.025	0.170	3.1	0.0480	0.0000	OK
15 minute winter	9	10	42.534	0.034	3.9	0.0054	0.0000	OK
30 minute winter	2	27	42.020	0.218	5.2	0.0618	0.0000	OK
30 minute winter	3	27	42.027	0.368	7.1	0.1041	0.0000	SURCHARGED
15 minute winter	13	10	42.687	0.067	7.0	0.0106	0.0000	OK
15 minute winter	14	11	42.459	0.068	6.9	0.0108	0.0000	OK
15 minute winter	15	11	42.378	0.088	10.0	0.0139	0.0000	OK
15 minute winter	16	11	42.221	0.049	10.0	0.0078	0.0000	OK
30 minute winter	4	27	42.023	0.507	11.1	0.1434	0.0000	SURCHARGED
15 minute winter	10	10	41.138	0.063	7.1	0.0179	0.0000	OK
15 minute winter	11	10	41.010	0.099	15.5	0.0280	0.0000	OK
15 minute winter	12	11	40.846	0.103	16.2	0.0291	0.0000	OK
60 minute winter	17	43	40.808	0.086	8.8	0.0242	0.0000	OK
30 minute winter	5	26	42.020	0.541	18.4	6.9053	0.0000	SURCHARGED
15 minute summer	6	15	41.488	0.036	6.0	0.0102	0.0000	OK
60 minute winter	6A	44	40.794	0.214	15.9	7.6465	0.0000	OK
60 minute winter	7	44	40.541	0.042	11.3	0.0479	0.0000	OK
30 minute winter	5201	26	39.890	0.040	11.3	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)
30 minute winter	1	1.000	2	2.1	0.378	0.053	0.3191	
15 minute winter	9	2.000	2	3.9	1.329	0.105	0.0906	
30 minute winter	2	1.001	3	5.2	0.655	0.130	0.9579	
30 minute winter	3	1.002	4	3.5	0.297	0.088	0.9621	
15 minute winter	13	4.000	14	6.9	0.903	0.388	0.1747	
15 minute winter	14	4.001	15	6.8	0.738	0.382	0.0933	
15 minute winter	15	4.002	16	10.0	1.279	0.563	0.0927	
15 minute winter	16	4.003	4	10.0	1.677	0.233	0.1138	
30 minute winter	4	1.003	5	9.2	0.465	0.230	0.2510	
15 minute winter	10	3.000	11	7.0	0.542	0.175	0.3592	
15 minute winter	11	3.001	12	15.2	0.883	0.380	0.4885	
15 minute winter	12	3.002	17	16.2	1.146	0.407	0.0509	
60 minute winter	17	3.003	6A	8.8	1.202	0.099	0.1287	
30 minute winter	5	Hydro-Brake®	6	6.0				
15 minute summer	6	1.005	6A	6.0	1.129	0.056	0.3847	
60 minute winter	6A	Hydro-Brake®	7	11.3				
60 minute winter	7	1.007	5201	11.3	2.293	0.068	0.0319	38.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 95.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	1	59	42.429	0.574	2.7	0.1623	0.0000	FLOOD RISK
15 minute winter	9	10	42.546	0.046	7.5	0.0073	0.0000	OK
60 minute winter	2	59	42.429	0.627	6.4	0.1773	0.0000	SURCHARGED
60 minute winter	3	57	42.428	0.769	6.9	0.2177	0.0000	SURCHARGED
15 minute winter	13	10	42.719	0.099	13.1	0.0158	0.0000	OK
15 minute winter	14	11	42.496	0.105	12.9	0.0167	0.0000	OK
15 minute winter	15	12	42.448	0.158	18.9	0.0252	0.0000	SURCHARGED
60 minute winter	16	58	42.429	0.257	10.3	0.0409	0.0000	SURCHARGED
60 minute winter	4	58	42.428	0.912	18.2	0.2582	0.0000	SURCHARGED
15 minute winter	10	10	41.163	0.088	13.4	0.0250	0.0000	OK
15 minute winter	11	10	41.060	0.149	29.3	0.0420	0.0000	OK
60 minute winter	12	44	40.978	0.235	16.8	0.0665	0.0000	SURCHARGED
60 minute winter	17	44	40.977	0.255	16.0	0.0721	0.0000	SURCHARGED
60 minute winter	5	58	42.428	0.949	29.6	21.8443	0.0000	SURCHARGED
15 minute summer	6	51	41.488	0.036	6.0	0.0102	0.0000	OK
60 minute winter	6A	45	40.975	0.395	23.4	14.1477	0.0000	SURCHARGED
60 minute winter	7	45	40.544	0.045	12.4	0.0504	0.0000	OK
60 minute winter	5201	45	39.892	0.042	12.4	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)
60 minute winter	1	1.000	2	2.6	0.380	0.064	0.3556	
15 minute winter	9	2.000	2	7.4	1.551	0.203	0.1628	
60 minute winter	2	1.001	3	6.9	0.599	0.173	0.9621	
60 minute winter	3	1.002	4	7.0	0.295	0.175	0.9621	
15 minute winter	13	4.000	14	12.9	1.019	0.729	0.2909	
15 minute winter	14	4.001	15	12.8	0.825	0.719	0.1556	
15 minute winter	15	4.002	16	18.6	1.405	1.049	0.2078	
60 minute winter	16	4.003	4	9.8	1.285	0.228	0.1769	
60 minute winter	4	1.003	5	17.7	0.462	0.445	0.2510	
15 minute winter	10	3.000	11	13.2	0.623	0.331	0.5861	
15 minute winter	11	3.001	12	28.6	1.023	0.718	0.7957	
60 minute winter	12	3.002	17	16.0	1.181	0.401	0.1382	
60 minute winter	17	3.003	6A	15.3	1.346	0.172	0.1943	
60 minute winter	5	Hydro-Brake®	6	6.0				
15 minute summer	6	1.005	6A	6.0	1.202	0.056	0.4573	
60 minute winter	6A	Hydro-Brake®	7	12.4				
60 minute winter	7	1.007	5201	12.4	2.353	0.075	0.0342	72.7

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 95.99%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	1	114	42.660	0.805	3.1	0.2279	0.0000	FLOOD RISK
120 minute winter	9	112	42.661	0.161	4.6	0.0255	0.0000	SURCHARGED
120 minute winter	2	112	42.660	0.858	7.5	0.2429	0.0000	SURCHARGED
120 minute winter	3	114	42.660	1.001	7.2	0.2833	0.0000	SURCHARGED
15 minute winter	13	11	43.370	0.750	23.7	0.1193	0.3597	FLOOD
15 minute winter	14	12	43.140	0.749	19.3	0.1191	0.0000	SURCHARGED
15 minute winter	15	12	43.030	0.740	27.4	0.1177	0.0000	SURCHARGED
30 minute winter	16	21	42.784	0.612	22.5	0.0973	0.0000	SURCHARGED
120 minute winter	4	114	42.660	1.144	20.0	0.3238	0.0000	SURCHARGED
60 minute winter	10	58	41.635	0.560	13.1	0.1584	0.0000	FLOOD RISK
60 minute winter	11	58	41.635	0.724	28.1	0.2048	0.0000	SURCHARGED
60 minute winter	12	59	41.633	0.890	27.0	0.2518	0.0000	SURCHARGED
60 minute winter	17	59	41.632	0.910	26.4	0.2576	0.0000	SURCHARGED
120 minute winter	5	114	42.660	1.181	33.5	57.3107	0.0000	SURCHARGED
60 minute winter	6	59	41.634	0.182	6.0	0.0515	0.0000	OK
60 minute winter	6A	59	41.632	1.052	35.2	29.2934	0.0000	SURCHARGED
15 minute summer	7	13	40.544	0.045	12.5	0.0505	0.0000	OK
15 minute summer	5201	13	39.892	0.042	12.5	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)
120 minute winter	1	1.000	2	2.9	0.335	0.073	0.3556	
120 minute winter	9	2.000	2	4.6	1.142	0.126	0.2606	
120 minute winter	2	1.001	3	7.2	0.509	0.180	0.9621	
120 minute winter	3	1.002	4	7.0	0.294	0.176	0.9621	
15 minute winter	13	4.000	14	19.3	1.096	1.087	0.4035	
15 minute winter	14	4.001	15	16.7	0.947	0.939	0.1786	
15 minute winter	15	4.002	16	25.2	1.432	1.420	0.2078	
30 minute winter	16	4.003	4	22.0	1.588	0.511	0.1769	
120 minute winter	4	1.003	5	19.8	0.498	0.497	0.2510	
60 minute winter	10	3.000	11	12.7	0.635	0.319	1.1032	
60 minute winter	11	3.001	12	25.0	0.900	0.628	1.1305	
60 minute winter	12	3.002	17	26.4	1.226	0.661	0.1382	
60 minute winter	17	3.003	6A	25.8	1.490	0.289	0.1943	
120 minute winter	5	Hydro-Brake®	6	6.0				
60 minute winter	6	1.005	6A	7.0	1.139	0.065	0.7764	
60 minute winter	6A	Hydro-Brake®	7	12.5				
15 minute summer	7	1.007	5201	12.5	2.356	0.075	0.0343	69.7

Foul water

Calculation of flowrate (using using British Water Code of Practice - Flows and Loads - 4

Proposed:	No.	Flow rate (l/day)	Total (l/day)
Rooms/ max occupany 2	884	150	132600
people per room	0	750	0
offices per 100m2	0	30	0
restaurant	0	90	0
Staff - full time	0	45	0
Staff - part ime	0		
Laundry	off-site		
Domestic washing			
machines	0	800	0
	Total		132600 l/day
		$Q_{\text{average}} =$	1.53 l/s
		$Q_{\text{peak}} =$	9.208333333 l/s

CALCULATIONS FOR:	USDAW Wilmslow Road, Manchester	JOB No. PAGE No.	892
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Foul Water Calculations

Proposed villa extension on Wilmslow Road development

Using BS EN 12056-2:2000

6.3 Calculation of Flow Rate

$$Q_{ww} = K \sqrt{(\sum DU)}$$

Where:

Q_{ww} = Waste Water Flow Rate (l/s)

K = Frequency Factor

($\sum DU$) = Sum of Discharge Units

Appliance	Total Number	DU	Total DU
Wash Basin	5	0.6	3
Bath	0	1.3	0
W.C	5	2.0	10
Floor Gully	0	1.3	0
Sink	0	1.3	0
Dishwasher	0	0.8	0
Shower without Plug	0	0.6	0
Urinal with Flushing Valve	1	0.8	0.8
Total =			13.8

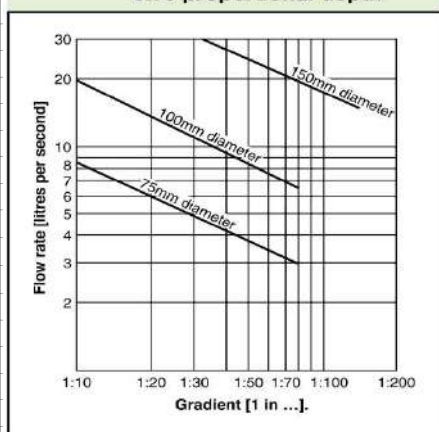
$$Q_{ww} = K \sqrt{(\sum DU)}$$

$$Q_{ww} = 0.7 \sqrt{13.8}$$

$$Q_{ww} = 2.60 \text{ l/s}$$

Using Diagram 9 from The Building Regulations 2010 Approved Document H - Drainage and Waste Disposal:

Diagram 9 Discharge capacities of foul drains running 0.75 proportional depth



The proposed $\varnothing 100\text{mm}$ foul water pipe at full capacity is required to be laid at a minimum gradient of approx 1 in 35

The proposed $\varnothing 150\text{mm}$ foul water pipe at full capacity is required to be laid at a minimum gradient of 1 in 150



Office: Sheffield

Designed:	GB	Checked:	DB
Date:	24/11/2020		
		Rev:	



Tier Consult (SY) Ltd

Unit 3 Acres Hill Business Park
Acres Hill Lane
Sheffield
S9 4LR
0114 241 9360



Appendix C – Proposed Site Layout

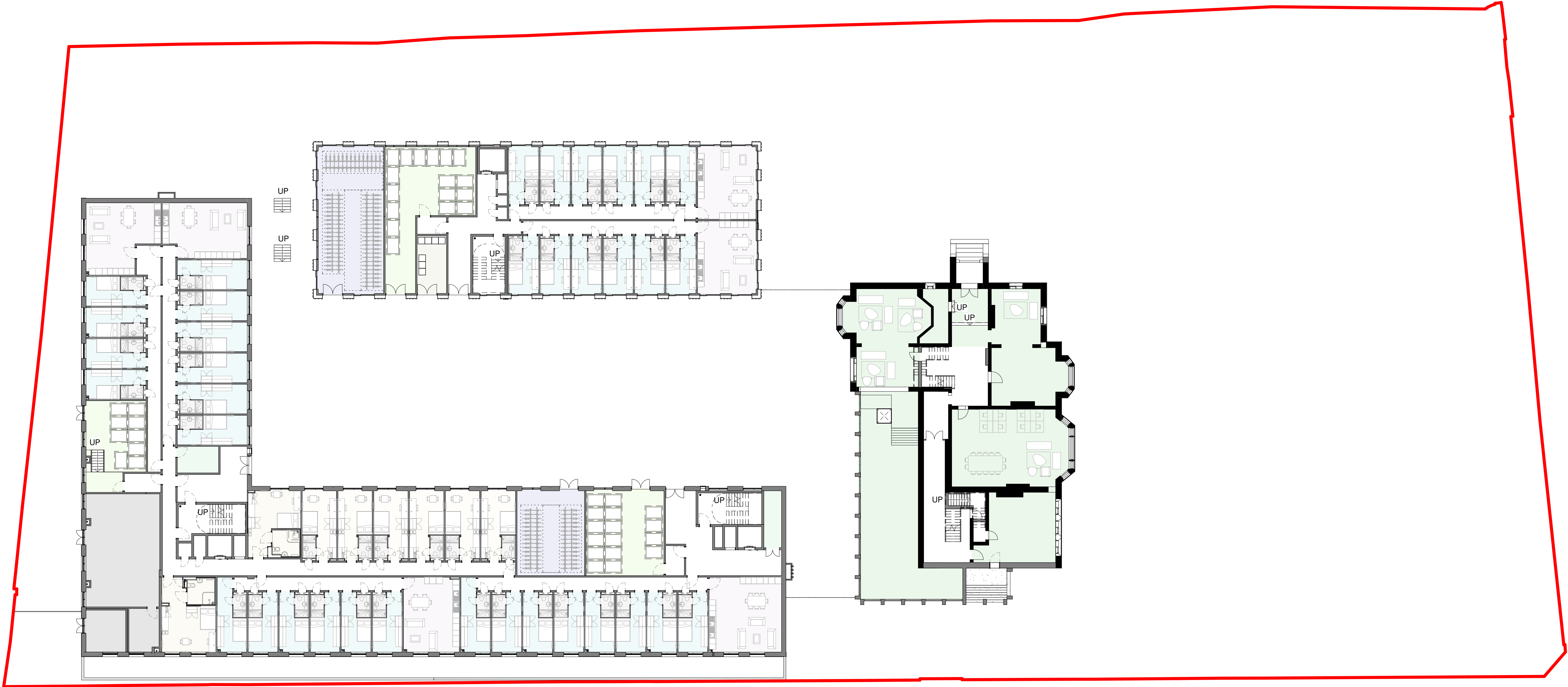


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Rev	Description	Date	By
A	Existing Building Room Areas Added	10.09.20	MP
B	Preliminary Issue	02.10.20	MP
C	Working Progress Update	16.10.20	MP
D	Scheme updated for Planning	18.11.20	MP



Client:
Watkin Jones Group Ltd

Project:
188 Wimslow Road_Manchester

Title:
GA Ground Floor

Status:
Planning

Project number: 1093
Date: 02/06/19

Drawn by: MP
Checked by: MP

Scale: 1 : 200@A1
Revision: D

Drawing No.:
1093-TGA-XX-00-DR-A-03000



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C	Scheme updated for Planning	18.11.20	MP



Client:
Watkin Jones Group Ltd

Project:
188 Wimslow Road_Manchester

Title:
GA 1st Floor

Status:
Planning

Project number: 1093
Date: 06/16/20

Drawn by: MP
Checked by: MP

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Revision: C

Drawing No.:
1093-TGA-XX-01-DR-A-03001

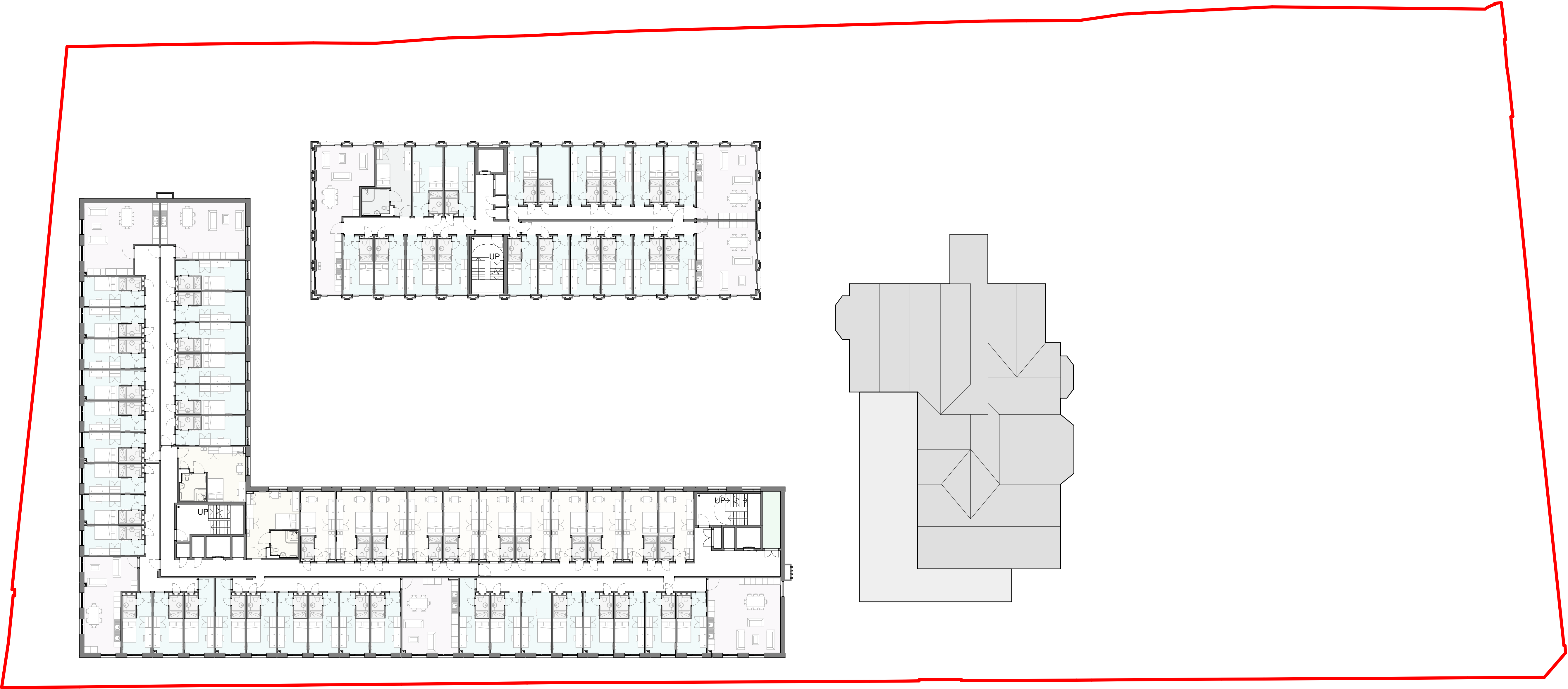


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C	Scheme updated for Planning	18.11.20	MP



Client
Watkin Jones Group Ltd

Project
188 Wimslow Road _ Manchester

Title
GA 2nd Floor

Status
Planning

Project number	Date
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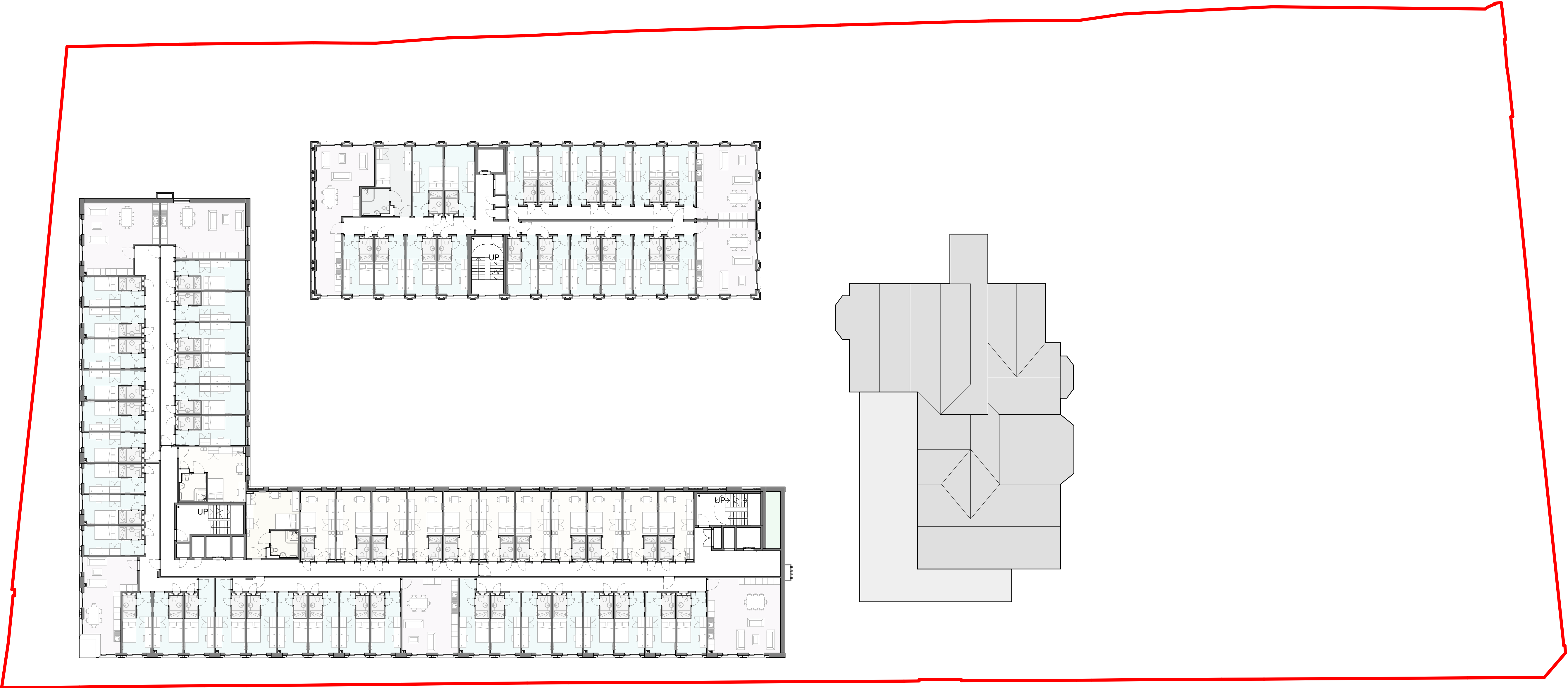


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Client
Watkin Jones Group Ltd

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Title
GA 3rd Floor

Status
Planning

Project number	Date
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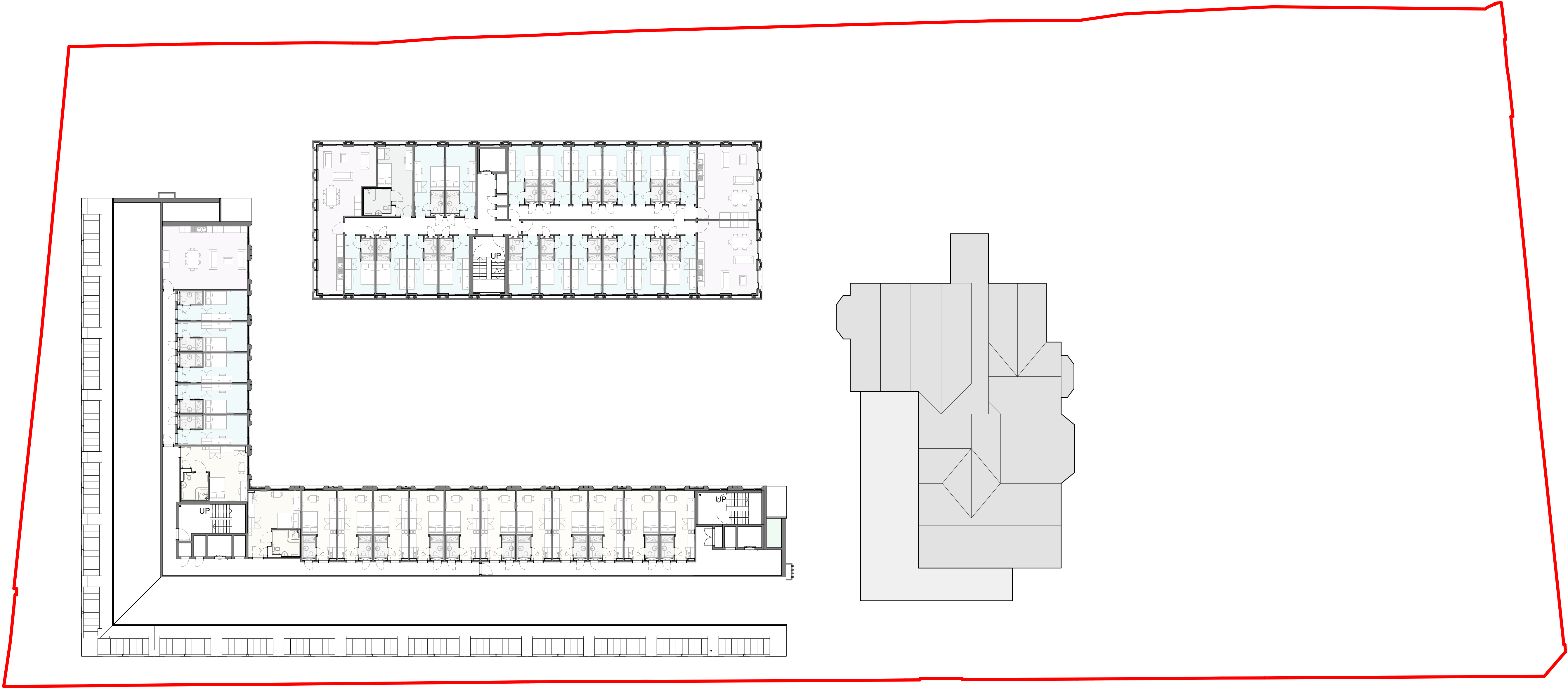


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C	Scheme updated for Planning	18.11.20	MP



Client
Watkin Jones Group Ltd

Project
188 Wimslow Road _ Manchester

Title
GA 4th Floor

Status
Planning

Project number	Date
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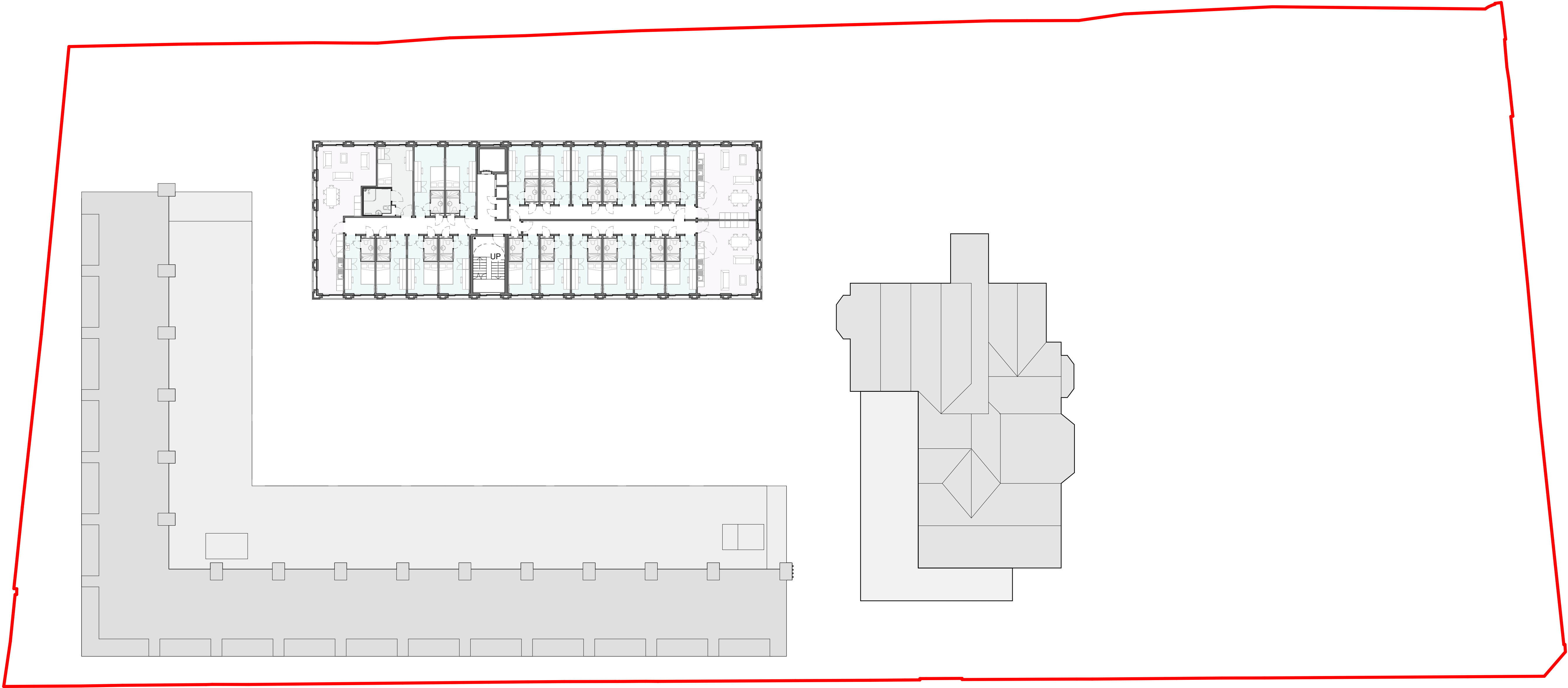


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Project
188 Wimslow Road_Manchester

Title
GA 5th Floor

Status
Planning

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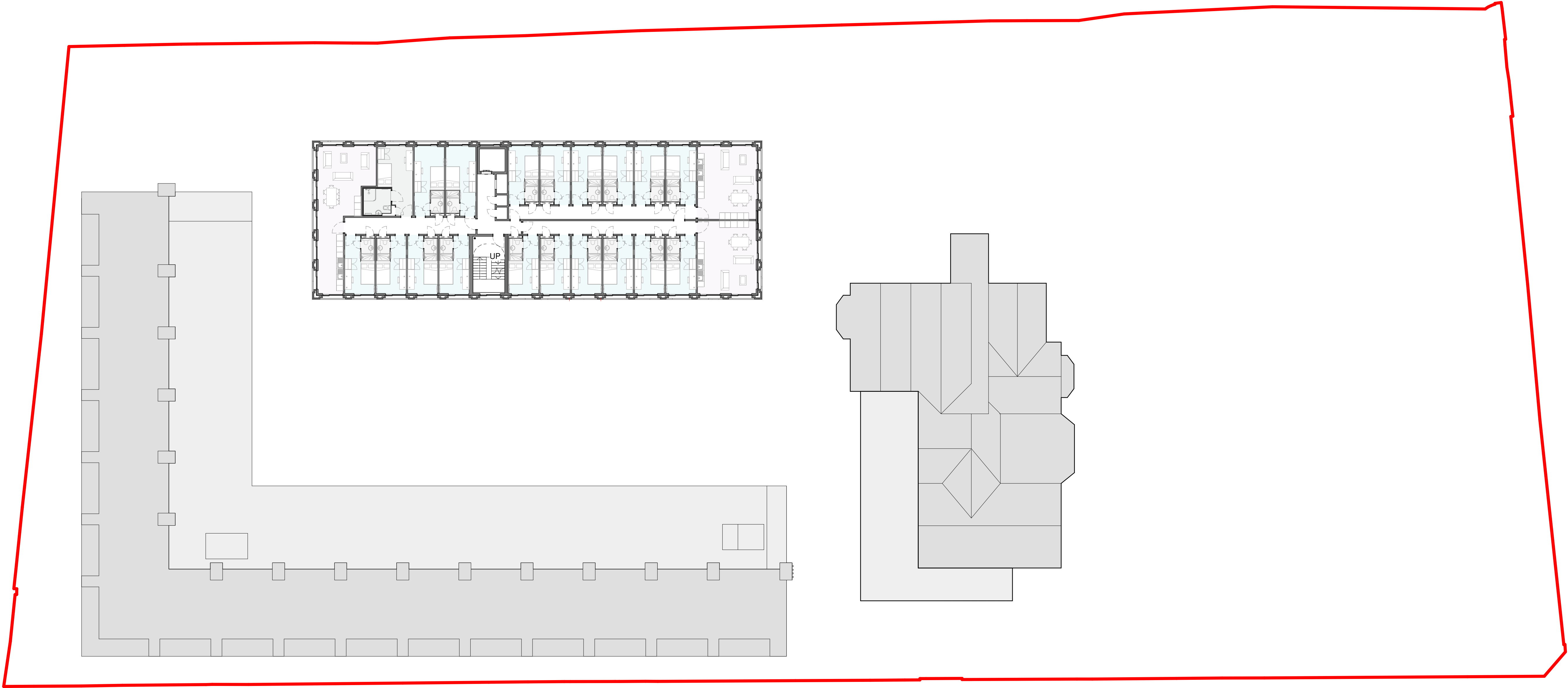


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Client
Watkin Jones Group Ltd

Project
188 Wimslow Road _ Manchester

Title
GA 6th Floor

Status
Planning

Project number	Date
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MP	MP

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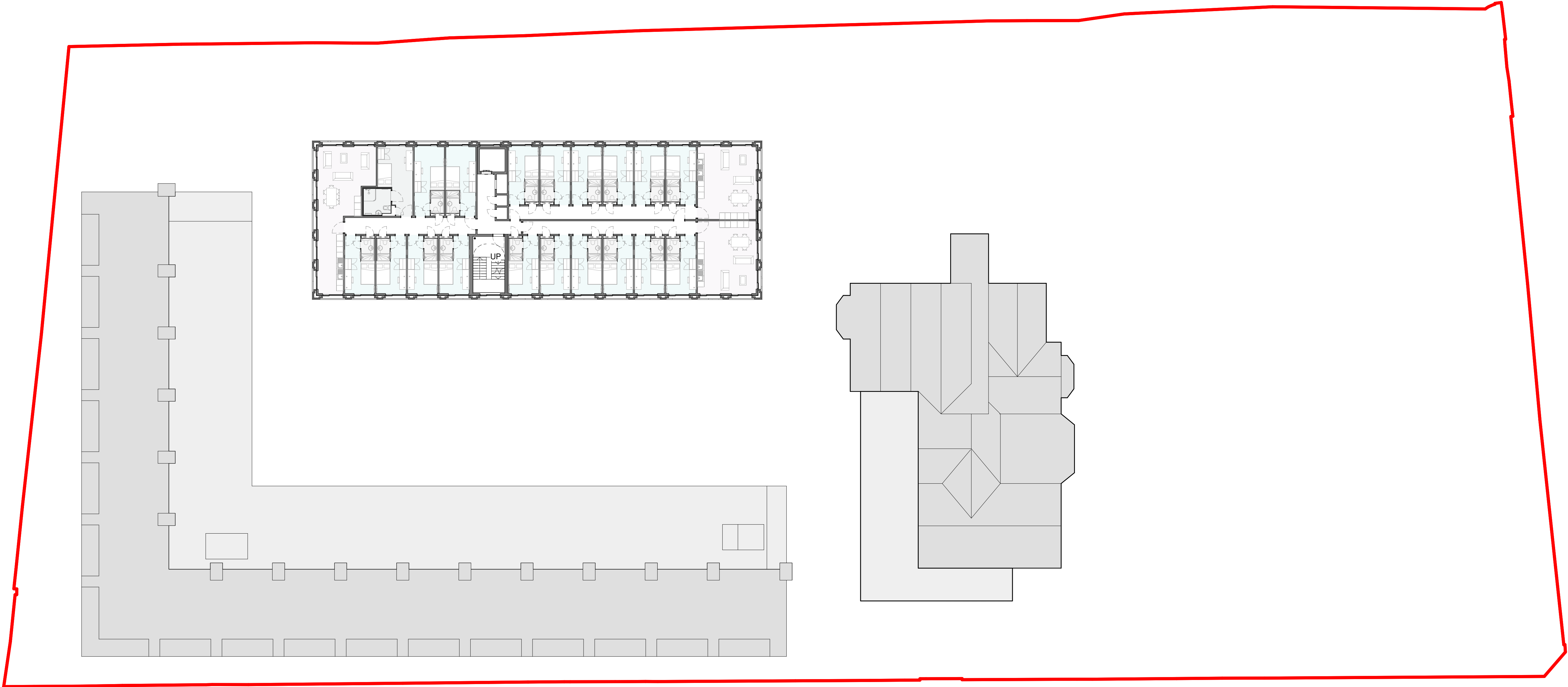


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B	Working Progress Update	16.10.20	MP
C	Scheme updated for Planning	18.11.20	MP



Client
Watkin Jones Group Ltd

Project
188 Wimslow Road_Manchester

Title
GA 7th Floor

Status
Planning

Project number	Date
1093	06/16/20

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MP	MP

Scale	Revision
1 : 200@A1	C

Drawing No.
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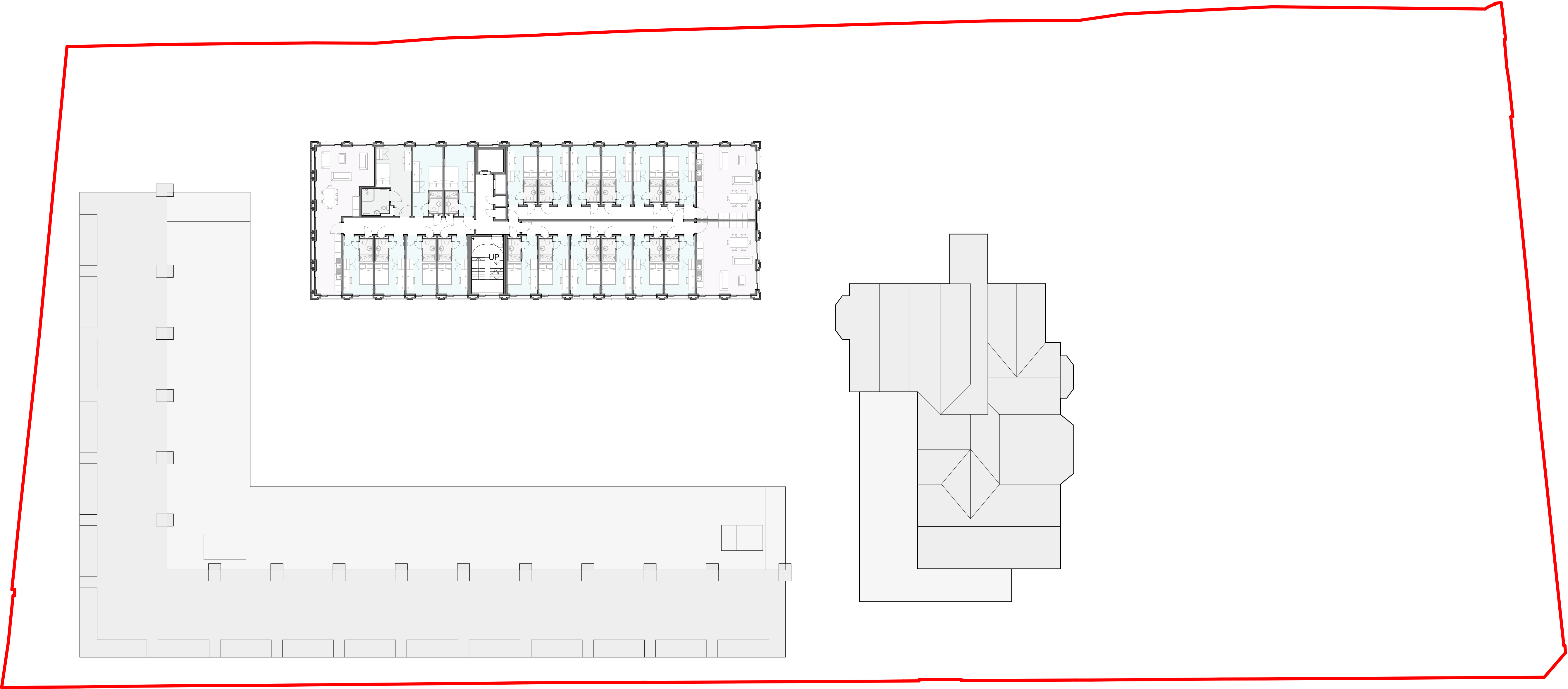


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Watkin Jones Group Ltd

Project
188 Wimslow Road_Manchester

Title
GA 8th Floor

Status
Planning

Project number	Date
1093	06/16/20

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MP	MP

Scale	Revision
1 : 200@A1	C

Drawing No.
1093-TGA-XX-08-DR-A-03008

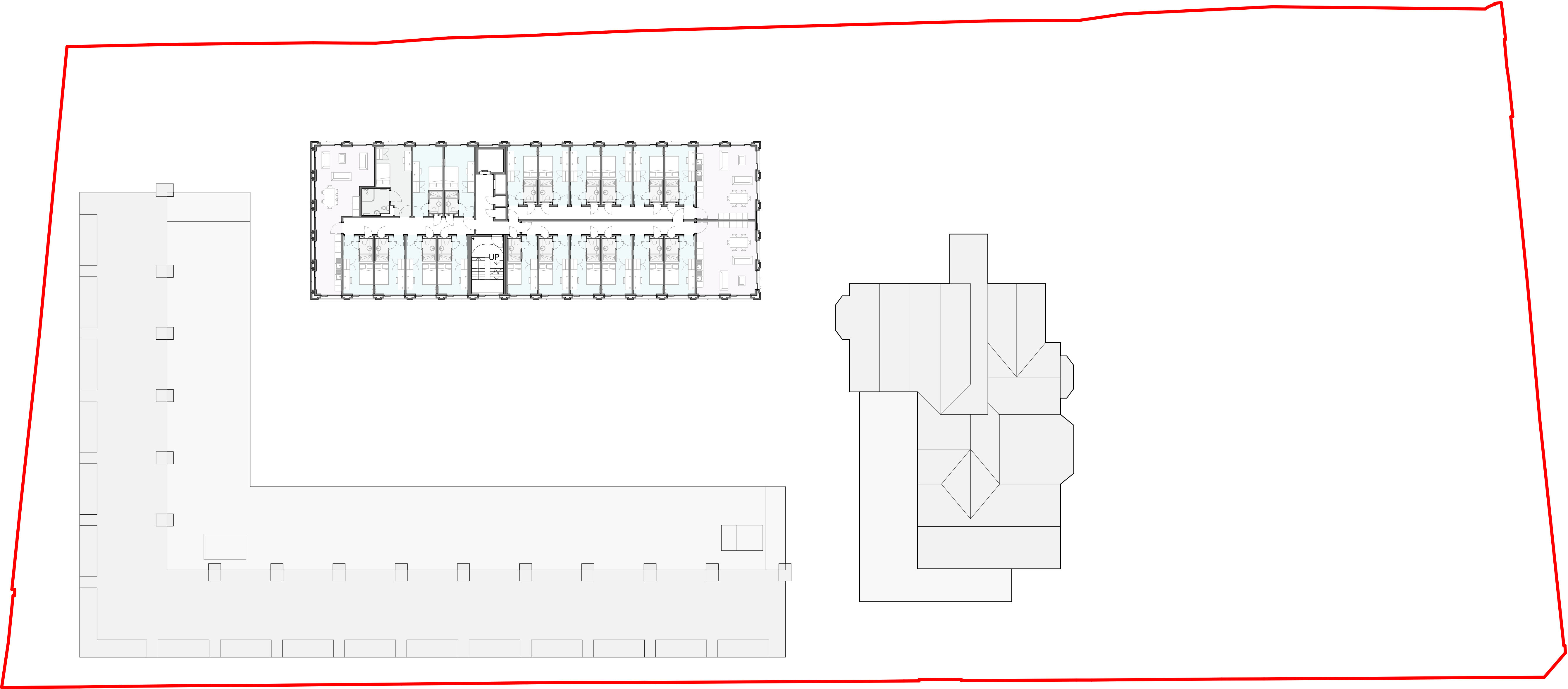


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Client
Watkin Jones Group Ltd

Project
188 Wimslow Road_Manchester

Title
GA 9th Floor

Status
Planning

Project number	Date
1093	11/20/20
Drawn by	Checked by
MP	MP
Scale	Revision
1 : 200@A1	

Drawing No.
1093-TGA-XX-09-DR-A-03009

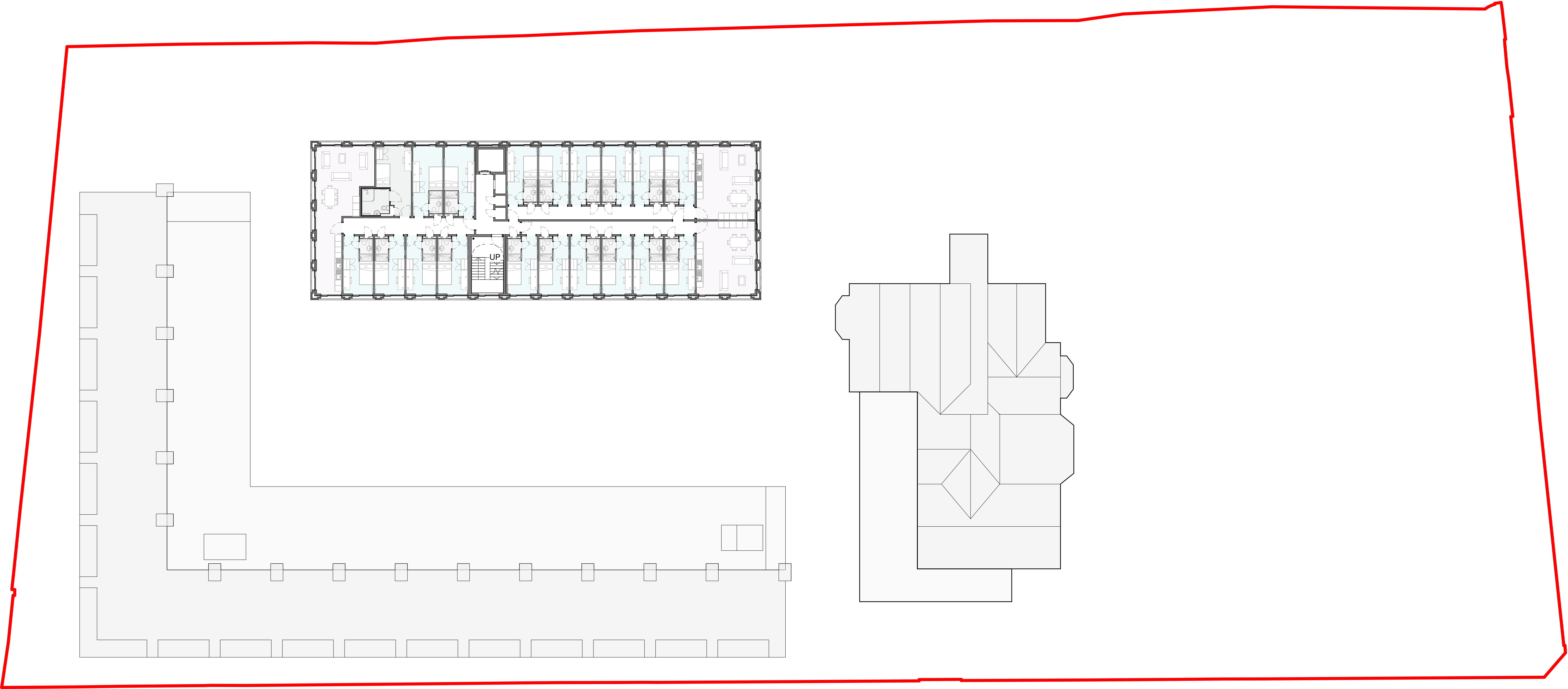


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Client
Watkin Jones Group Ltd

Project
188 Wimslow Road_Manchester

Title
GA 10th Floor

Status
Planning

Project number	Date
1093	11/20/20

Drawn by	Checked by
MP	MP

Scale	Revision
1 : 200@A1	

Drawing No.
1093-TGA-XX-DR-A-03010

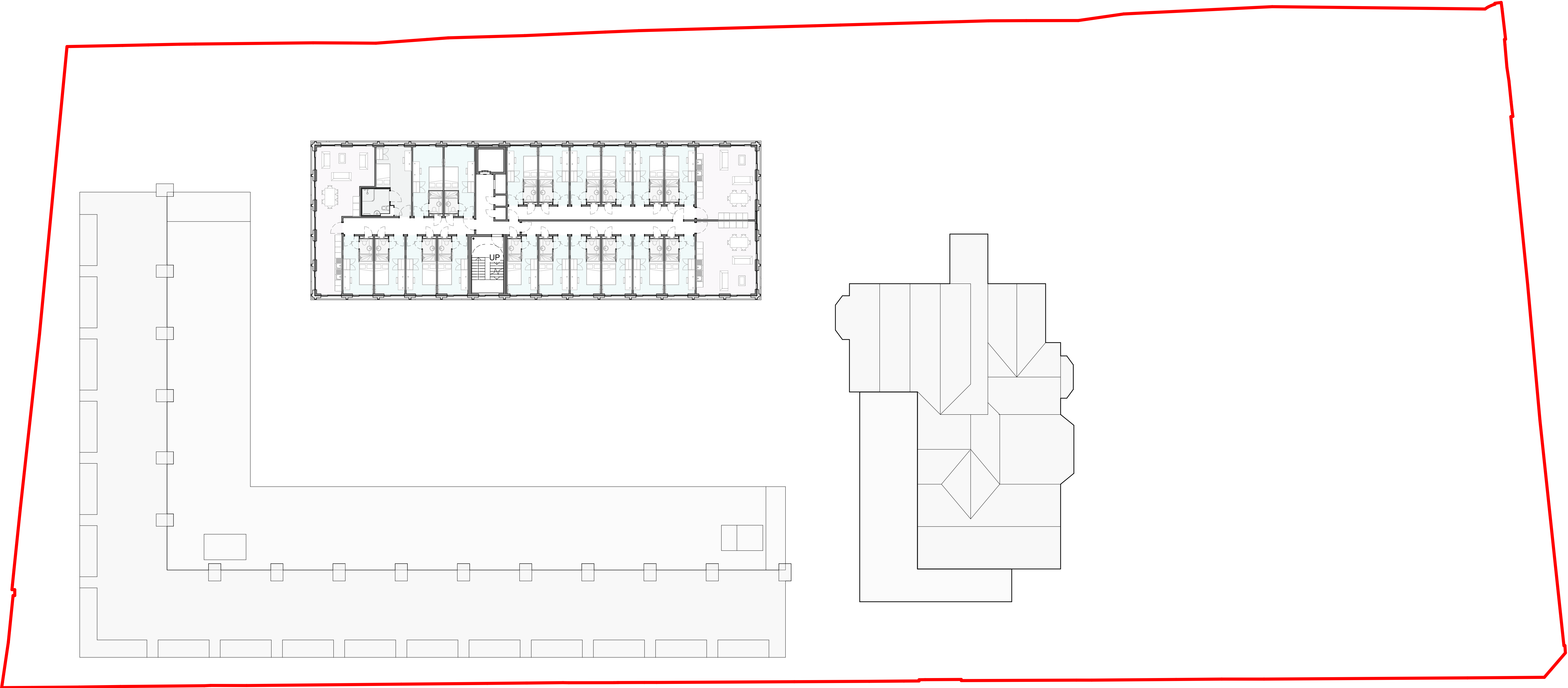


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Client
Watkin Jones Group Ltd

Project
188 Wimslow Road_Manchester

Title
GA 11th Floor

Status
Planning

Project number	Date
1093	11/20/20

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MP	MP

Scale	Revision
1 : 200@A1	

Drawing No.
1093-TGA-XX-DR-A-03011

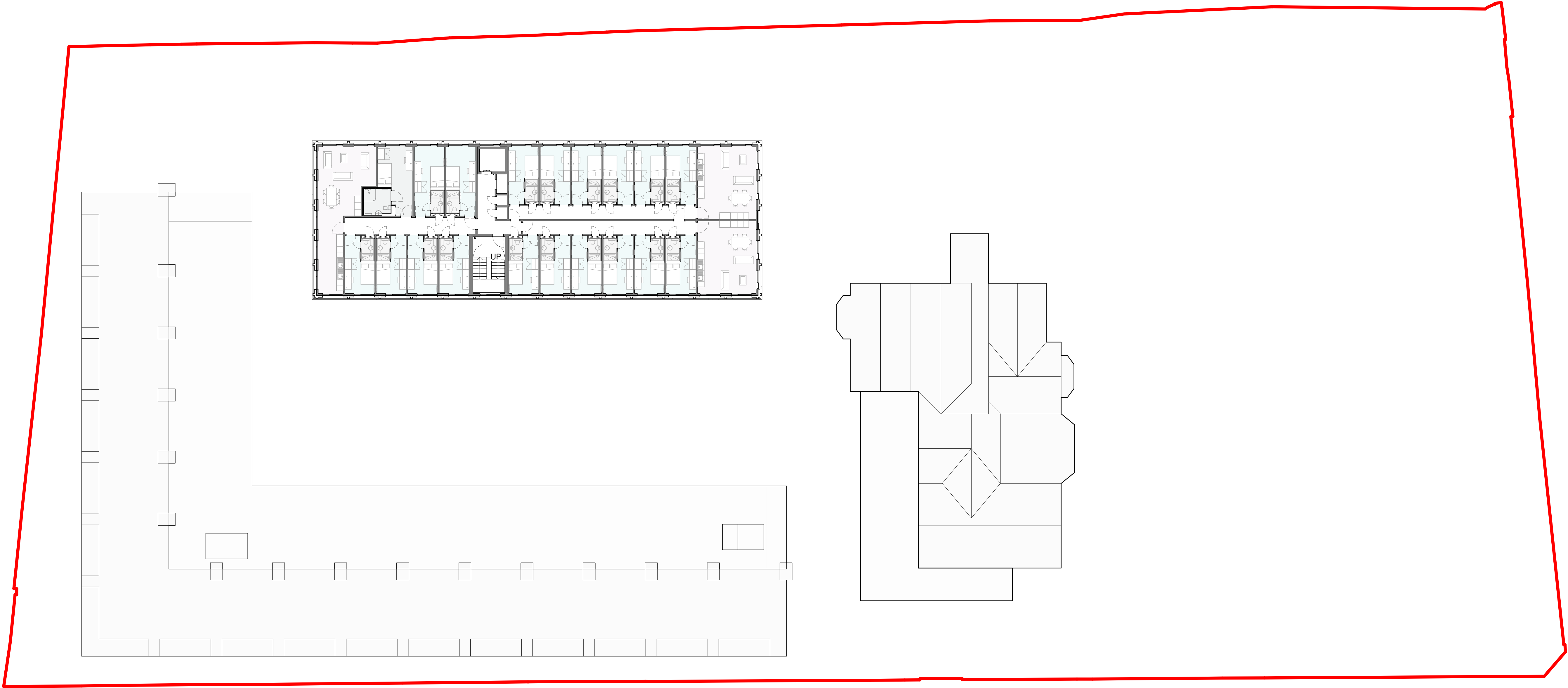


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Client
Watkin Jones Group Ltd

Project
188 Wimslow Road_Manchester

Title
GA 12th Floor

Status
Planning

Project number	Date
1093	11/20/20
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Scale	Revision
1 : 200@A1	

Drawing No.
1093-TGA-XX-DR-A-03012