



# **Land south of Junction of Old Market Street and Middleton Old Road, Manchester M9 8DS**

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September 2024 (updated November 2024)

## **Flood Risk Assessment & Drainage SUDS for Planning**

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EnviroSolution has expertise and experience in all aspects of environmental enforcement, regulation and assessment, working in conjunction with the HSE, Local Authorities and Environment Agency. With specific capability in environmental protection and planning policy and control, EnviroSolution has a core knowledge base to assist clients in dealing with Flood Risk issues.

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## 1.0 Scope

This report contains the details of an FRA and SUDS Drainage Strategy for planning carried out by Envirosolution Ltd for Land south of Junction of Old Market Street and Middleton Old Road, Manchester M9 8DS, henceforth referred to as “the site” in this report.

This report has been prepared for Saleem Architects Ltd and must not be relied upon by any other party without the explicit written permission of Envirosolution Ltd.

All parties to this report do not intend any of the terms of the Contracts (Right of Third Parties Act 1999) to apply to this report. Please note this report does not purport to provide definitive legal advice nor can it be used to demonstrate that the site will never flood in the future or provide exact specifications / warranties for the products used.

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## 2.0 Introduction

The information source used to undertake this FRA has been collected from the following sources:

- British Geological Survey Website and iGeology Website
- EA Website
- Manchester City Council: policies, mapping and guidance
- Manchester City Council as the Lead Local Flood Authority: SUDS guidance
- Internet mapping and searches

## 3.0 Existing Site Status and Setting

### 3.1 Site Location and Status

The site is defined by buildings / former building footprint and 100% hardstanding. The site location is indicated in red on the site location plan included within Appendix A.

### 3.2 Geology

#### Geology

Based on BGS mapping and boreholes (and known conditions of the majority of this part of Liverpool):

- Bedrock: Manchest Marls Mudstone
- Superficial deposits: potential for Glaciofluvial Sheet Deposits, Devensian - Sand and gravel

It is considered that given the site setting / constraints of a fully constrained site and requirements of the statutory consultees, there is no need to undertake BRE365 testing for planning because a soakaway is not an option. As a constrained inner urban site adjacent to a culverted watercourse, surrounded by infrastructure and other buildings, it is not feasible to incorporate a soakaway on this site.

### 3.3 Flood Risk Assessment: posed to and from the site & scheme

| Flood Sources      | Site Status                                                                                                                                                                                             | Comment on flood risk posed to / from the development                                                                                                                                                                                                                                                                            |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fluvial / Tidal    | Site is in 100% FZ1 and not within any climate change allowances extents based on available data<br><br>Watercourse is c. 12.0m distance to the south<br>Culverted tributary is to the west of the site | Scheme will reduce flood risk overall<br>No impacts on the culvert or the watercourse<br>Environmental Permit for the outfall can be secured post planning (EA will not allow application until planning is secured in any case)<br>Temporary phase: culvert can be surveyed and then monitored if necessary during construction |
| Surface Water      | Site is within EA NO - low hazard in EA high risk scenario<br>In part low to medium hazard in the medium and low risk scenarios                                                                         | Scheme will not increase the flood risk posed from this source: retroactive SUDS are appropriate<br>Scheme will not obstruct any surface water flow pathways or ponding areas<br>Scheme reduces site levels in the garden hence potential storage betterment                                                                     |
| Groundwater        | Site is not within an area of high potential for elevated groundwater flooding (less than 25% zone)                                                                                                     | Scheme will not increase the risk posed to or from groundwater<br>Suitable waterproofing of ground and pool structure below ground                                                                                                                                                                                               |
| Artificial Sources | Site is not within EA general Reservoir Flood Warning area<br>No other artificial sources with likely flood flowpaths that could reach the site                                                         | Low Risk                                                                                                                                                                                                                                                                                                                         |
| Climate Change     | Not within a fluvial or tidal climate change extent<br>40% can be used in the SUDS storage calculations                                                                                                 | Development will manage the peak flow and volume of discharge from the site<br>Low risk posed to and from the development                                                                                                                                                                                                        |

### 3.4 EA 2024 Surface Water Hazard Data

#### Explanation of the EA surface water data:

The EA's surface water modelling and mapping does need some explaining in order to understand how the conclusions on relevant site and scheme specific risk vs hazard are arrived at, because there is a combination of flooding probability scenario (magnitude and likelihood of occurring) and the resultant depths / speeds which means there is more than one variable to consider in the risk assessment:

The EA's official approach is thus:

- 'High Risk'; >3.3% AEP (more often than 1 in 30).
- 'Medium Risk'; 3.3% to 1.1% AEP (between 1 in 30 and 1 in 100).
- 'Low Risk'; 1% to 0.1% AEP (between 1 in 100 and 1 in 1000). (more blue colouring showing on the map as this is a large magnitude flood but not as likely to occur hence: extreme)
- 'Very Low Risk'; <0.1% AEP (less often than 1 in 1000).

**For clarity: The EA's Low Risk category includes the 1in500year and up to the most extreme event, the 1in1000year; we state this as many LLFA's are now requiring the 1in500year.**

#### For this site and scheme:

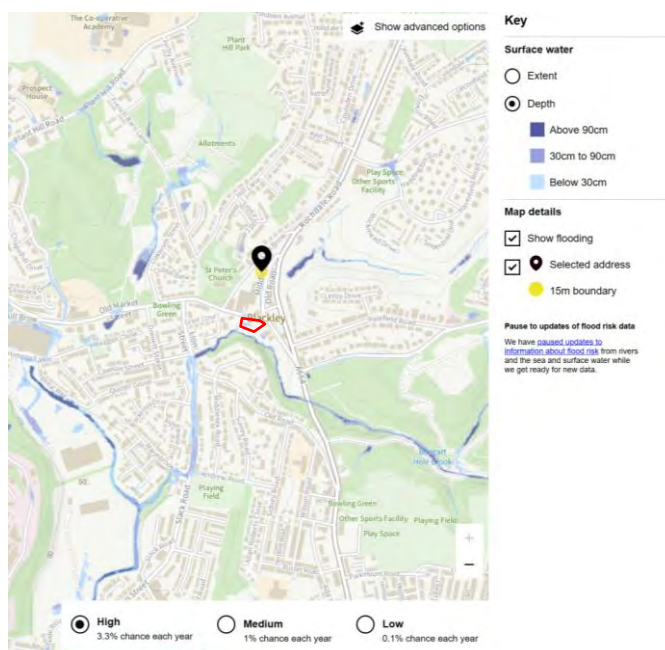
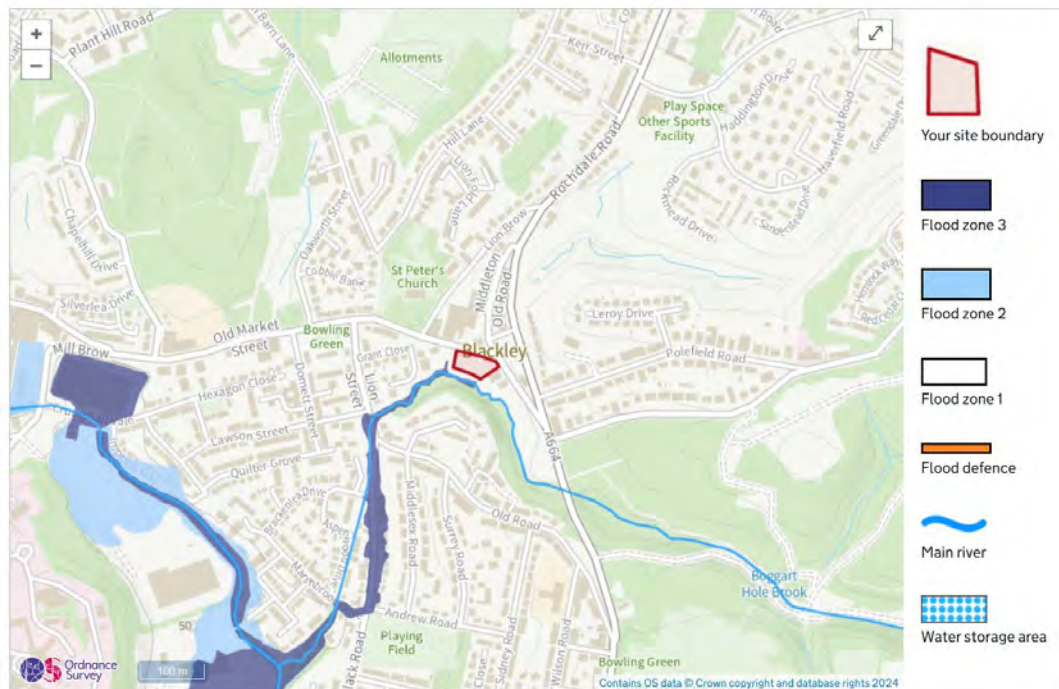
- High – No flooding at the site / patchy areas on adjacent highways
- Medium – Patchy low hazard flooding at the site; surface water pathway to watercourse to

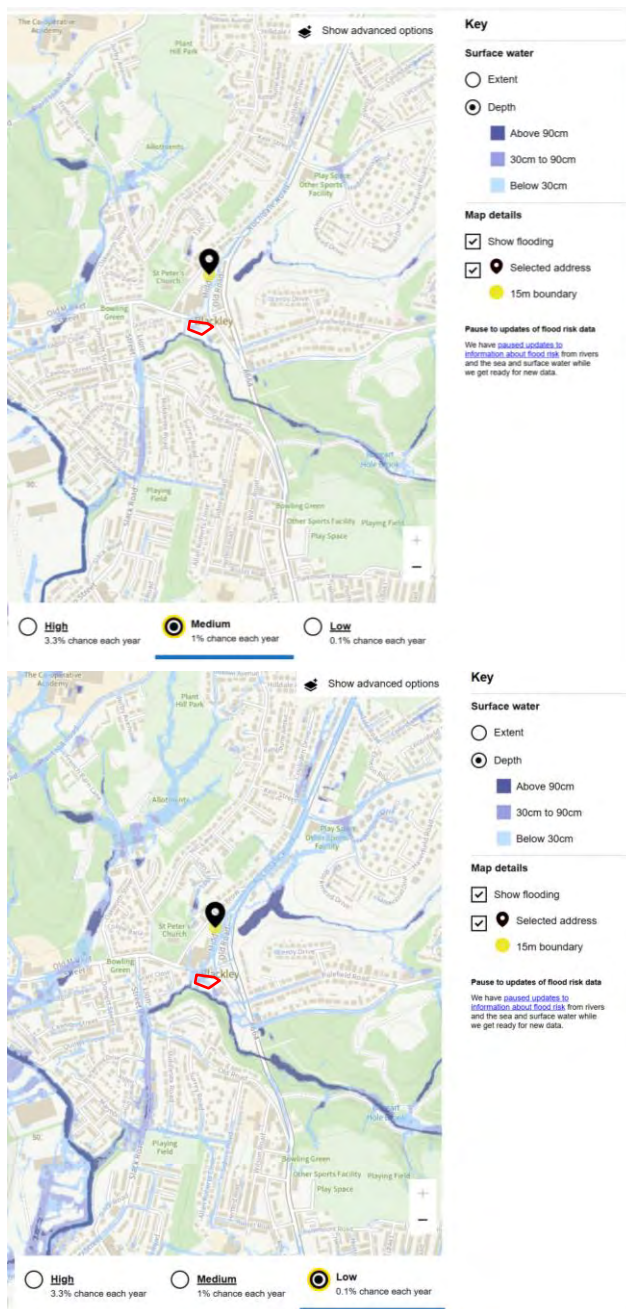
south

- Low - each year, the area has a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%)

- o Partial flooding at the site;

- **Appropriate approach: new waterproofing and flood resilience / resistance to create a better protected and flood future-proofed property than is existing**





### 3.5 Existing Drainage

Public sewer records have been sourced. The site is an existing site with former buildings with connections to the sewer.

United Utilities plans confirm that this provides suitable connection diameter for the 110mm / 150mm pipe that would also have a restriction to 2.0l/s.

There is no evidence of any existing SUDS. The site currently discharges 100% without attenuation or allowance for climate change to the sewer.

This scheme will stop this and will establish Source Control SUDS and restriction to the surface water sewer.

### **3.6 LLFA Common Responses From 22years of Project Experience**

*A full drainage design drawing and supporting hydraulic calculations are required to show that*

- *flows for up to the 1:30yr critical rainfall event are retained within the system and that*

The calculations show that the site provides storage for the full 1in100year+40%cc. This means the 1in30year critical rainfall event and even up to the 1in100year+40%cc are fully retained within the system on site.

We understand that some drainage departments prefer to ensure there is still a tank at the ground level.

This is why we suggest the option that there is always the back up, as with any site, for there to be a tank sized to accommodate all critical storms up to the 1in100year+40%cc i.e. therefore the 1in 30year critical rainfall event is also retained within the system.

All storm water falls on to an area that is formally drained and accommodated / retained within the site boundary.

The drainage layout in Appendix D shows the pipe connections and likely pipe sizes and appropriate connection sizes to reach the existing sewer in the street.

Network analysis of the internal pipes is not required at this stage to demonstrate that the SUDS drainage system will not cause flooding of the building and off site. This is simply a much more detailed stage design requirement. It is known that this type of building will require design to Building Regs which controls the appropriate communication of storm water to storage devices and must interface with all other utilities, the make up of the walls, ceilings, choice of materials, steel frames etc, all information which we simply do not have and do not need at this stage for the drainage design.

This arrangement of internal pipes to take storm water to a tank is universal, not complex and not novel in anyway.

We cannot provide exact specifications of a tank at this stage or the internal pipe layouts because we simply do not have the level of design at planning stage to make this meaningful and it is also not a concern that would raise a material consideration at planning.

We have oversized the flood storage volume and we have provided more volume of storage than is required by that already oversized flood storage.

- for the 1:100yr+40% climate change allowance, critical rainfall event there will be no flooding to any buildings and any excess volumes of water will be retained on site.

The site is defined by the footprint of the building.

We have designed the system such that there is no exceedance off site for the

appropriate critical design storm scenarios:

The volume of storage has been sized to accommodate 100% of the critical 1in100year+40% climate change storm with an additional buffer to further oversize the oversized storage. In fact, we show three times the amount of storage can be accommodated in the scheme.

There will be no flooding off site.

By oversizing the storm water storage and furthermore using the additional storage at height of planters / vegetation with their additional void storage, this is a very appropriate approach for high rise buildings which have limited communal external space at ground level to ensure no exceedance.

As per Section 4.4 below, the SUDS store for 100% of the 1in100year+40%.

The scheme has the proven viable options of discharging surface water to a watercourse and a sewer at a heavily restricted discharge rate.

## **4.0 Assessment of Proposed Development**

### **4.1 Proposed Development**

The proposed development (Appendix B) comprises:

- Erect residential scheme with maximized SUDS
- **Ground floor external areas maximized for Source Control SUDS**
- **SUDS to be of the highest in the hierarchy feasible for a constrained urban site**
  - o Restricting discharge on a previously unattenuated site
  - o New SUDS to meet 2024 requirements
  - o Re-use existing connections for separate foul and surface water (or new connections as part of Sec 106 with United Utilities and/or EA consent for new formal outfall to watercourse)
  - o Re-use existing outfall to Boggart Hole Brook

### **4.2 Surface Water Drainage**

In accordance with the NPPF, PPG and LLFA policy requirements, sustainable drainage systems (SUDS) should be incorporated wherever possible to reduce positive surface water run-off and flood risk to other areas.

As a precaution for the discharge connection, so as not to rely on an unknown and to demonstrate a worse case of SUDS storage on site with restricted discharge, it is recommended that SUDS techniques are restricted to the use of the highest forms of SUDS feasible i.e. upper levels storage.

It is proposed to provide an attenuation based surface water strategy to serve run-off from the proposed roof area; a formal restriction device can be used but is not likely required given the extreme runoff rate is lower than the lowest suitable restriction rate.

Given the scheme meets the SUDS hierarchy for connections and SUDS measures, this complies with UU's connection requirements.

The culverted watercourse adjacent is a viable option and one that would be promoted by the EA and the LLFA; to have an overflow to the sewer is the appropriate response.

United Utilities do not allow ground level Source Control SUDS to connect directly to the combined sewer. This scheme does not do this in any case.

### 4.3 SUDS Storage Calculations

Calculations have been prepared based on the Micro Drainage software package to assess the size of structure require, based on the following design criteria.

- Site area is c. 0.19ha (1,900m<sup>2</sup>)
- Site incorporates new areas of soft and porous landscaping
- Scheme will be only 60% impermeable
- Use 75% of the site hence additional 15% oversizing

So for clarity:

- The scheme reduces the impermeable areas overall
- Design event for storage - 100 year (with climate change; see below)
- Climate change allowance - 40%
- Calculations use the 2.0 l/s to derive the oversized storage calculations
- The calculation output is included within Appendix C.
  - o Oversized storage required: 66.0m<sup>3</sup>
  - o **This scheme demonstrates it could incorporate easily ????? storage using Source Control rain garden planters and attenuation tank**
  - o **This is greater than 3 times the required storage**
  - o This is fully compliant

#### 4.4 SUDS Specifications: SUDS Hierarchy Compliant

| Formal SUDS Type                                                                                                                                                                                  | Source Control             | Dimensions                                                                                                                                                                                                                                                                                                                                    | Storage Volume                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rain Garden in communal ground areas adjacent to RWP's<br>Easily accessible for maintenance                                                                                                       | Yes & Natural Interception | Total area for planters with intergrated c. 65.0m <sup>2</sup> , on areas adjacent to walls with RainWater Pipe for direct connection via splayed ends<br>Incorporate integrated storage of 0.55m storage<br>= 35.75m <sup>3</sup><br>Assume 95% void ratio using cellular storage under the rain garden soil strata<br>= 33.96m <sup>3</sup> | 33.96m <sup>3</sup>                                                                                                                                         |
| <i>Cellular Storage</i><br><i>Below the ground floor parking.</i><br><i>(Still required by some LLFA's as back up if the water company will adopt / subject to UU's requirements at the time)</i> | No                         | Area of 137.5m<br>Use 0.6m depth<br>= 82.5m <sup>3</sup><br>Assume 95% void ratio<br>= 78.375m <sup>3</sup><br><b>This tank has greater capacity than the critical 1in30year AND the 1in100year+40%cc critical storm even with oversizing</b><br>Off the shelf specifications are widely available                                            | 78.375m <sup>3</sup>                                                                                                                                        |
|                                                                                                                                                                                                   |                            | Total                                                                                                                                                                                                                                                                                                                                         | <b>112.335m<sup>3</sup></b><br><b>Greater than the already oversized 66.0m<sup>3</sup> required to demonstrate the scheme has sufficient space for SUDS</b> |

The SUDS strategy provides more than the oversized calculated volume.

The indicative layout plan included within Appendix D shows locations for the SUDS structures.

## 4.5 SUDS Hierarchy: Roof Areas & Pipe Connections

**SUDS Hierarchy Connections:** There are no additional rivers / seas or drainage ditches available adjacent to the site and soakaways are not feasible for this constrained urban site given the geology; the culverted watercourse and the sewer as back up are the only options. The scheme meets the SUDS hierarchy for SUDS measures also:

**SUDS Hierarchy Measures:** The upper roof areas are not suitable for sedum roof as they are either pitched or a small area which would not be easy to maintain.

Maximising the SUDS as Source Control on the external ground floor areas is the most appropriate response as this is fully accessible for maintenance; this also minimizes the extra weight at the full height of the building, to reduce embodied carbon.

The exact pipe sizes, runs, inverts and manholes will be confirmed as part of detailed designs; specifications of landscaping and drainage products need to be confirmed through detailed design stage at a later date.

This is not required at this stage to demonstrate scheme can accommodate the surface water flows or meet LLFA requirements.

### Further Enhancements

Whilst internal rainwater harvesting is not proposed, rainwater pipes can be fitted with water butts AND can discharge directly to the rain garden planters. Regardless, the use of water butts won't reduce the design criteria of the receiving below ground drainage system.

It will be necessary for the surface water drainage system to comply with the Environment Agency's pollution prevention guidance. Roof run-off is classified as uncontaminated and, in accordance with EA pollution prevention guidance, will not require any treatment. Any surface water run-off draining through sedum roof and planters will receive an adequate level of filtration through the associate substrate.

## 4.6 Maintenance

With respect to maintenance, the proposed SUDS techniques should be maintained in accordance with the appropriate regimes set out within the SUDS manual and will be the responsibility of the owner / management company.

A SUDS maintenance schedule is included within Appendix D.

## 5.0 Summary

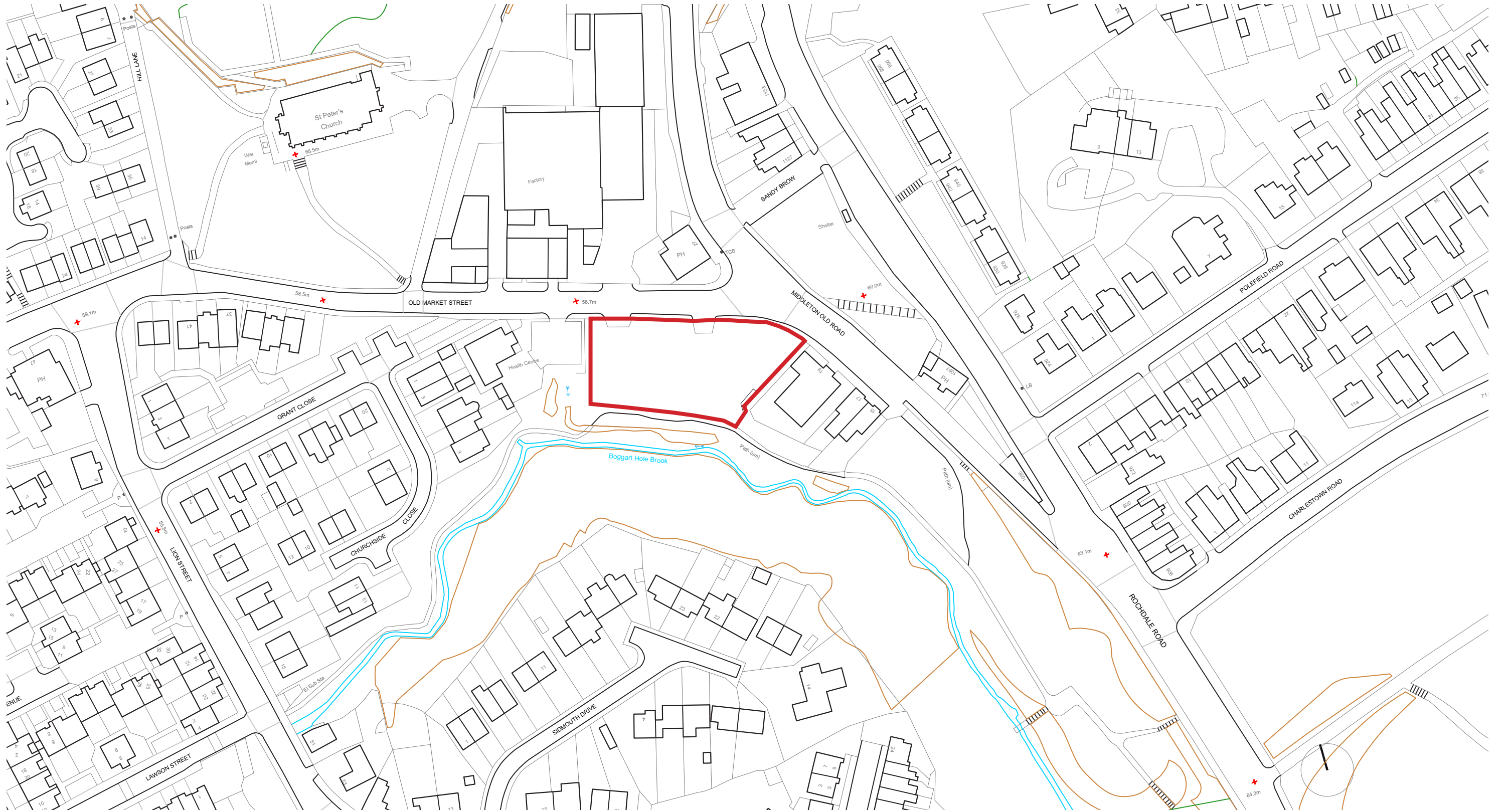
The condition of any existing connections should be verified by a CCTV survey prior to re-use. Should it not be feasible to re-use the existing connection then it will be necessary to provide a new one. Any amendments to the existing discharge arrangements or new connection will be subject to the approval of the water company, via a Section 106 Connection Application under the Water Industry Act 1991 at the design stage.

It is proposed to provide an attenuation based surface water drainage system to serve run-off from the new development roof area. It is proposed to use the highest forms of SUDS feasible. It should be noted that the proposed surface water strategy will reduce positive run-off from the site in the post development scenario and therefore reduce flood risk to other areas. The proposed drainage strategy is subject to the approval of the Local Planning Authority, Lead Local Flood Authority and United Utilities.

Given the scheme meets the SUDS hierarchy for connections and SUDS measures, this complies with UU's connection requirements.

## **APPENDICES**

## **APPENDIX A**



0m 20 40 60 100 250

**LOCATION PLAN**  
1:1250 @ A3

**Dimensioning**

Figured dimensions only to be taken from these designs and drawings. Work to annotated dimensions only. All dimensions to be checked on site. Architectural designers to be informed immediately of any discrepancies before work proceeds. Drawings are to be read in conjunction with relevant specifications, structural engineers and service engineers' drawings.

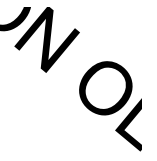
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STATUS:  
**PLANNING**



| Rev | Date     | Description                   |
|-----|----------|-------------------------------|
| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

|             |                                       |
|-------------|---------------------------------------|
| CLIENT:     | -                                     |
| PROJECT:    | Land @ Old Market Street<br>Crumpsall |
| TITLE:      | Location Plan                         |
| SCALE:      | 1:1250 @ A3                           |
| DRAWING NO. | A100                                  |
| REV:        | A                                     |
| DATE:       | April 2024                            |



## A3

DATE:  
2024

## **APPENDIX B**



Dimensioning

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STATUS:  
**PLANNING**

| Rev | Date     | Description                   |
|-----|----------|-------------------------------|
| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-  
PROJECT:  
Land @ Old Market Street  
Crumpsall

TITLE:  
Proposed Site Plan

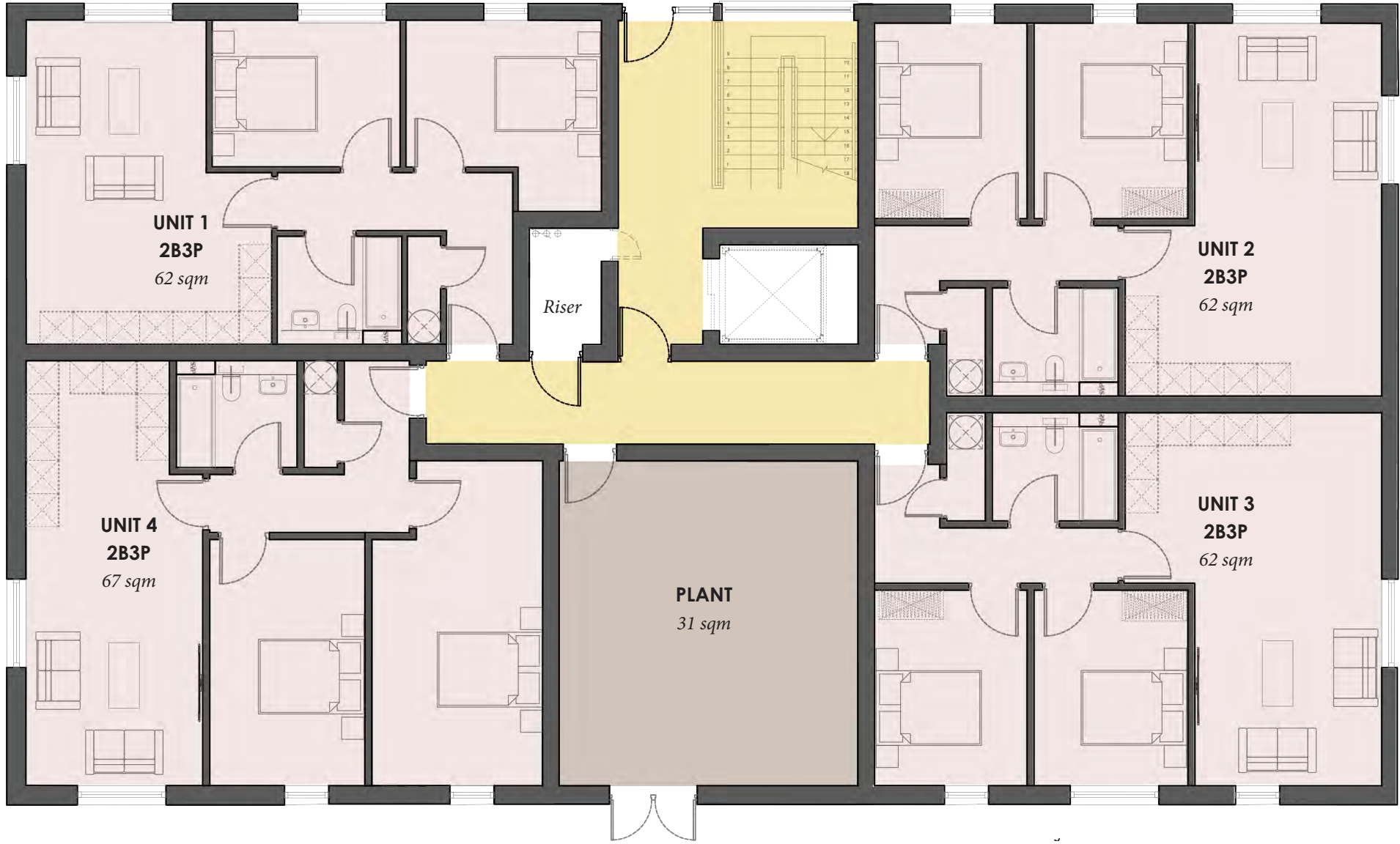
SCALE:  
1:200 @ A3  
DRAWING NO.  
A102

REV:  
A

DATE:  
April 2024

INTERNAL PARKING SIDE

OLD MARKET STREET



BLOCK A  
GROUND FLOOR PLAN

1:100 @ A3



4 x TWO BEDROOMS FLAT

Dimensioning

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STATUS:  
PLANNING

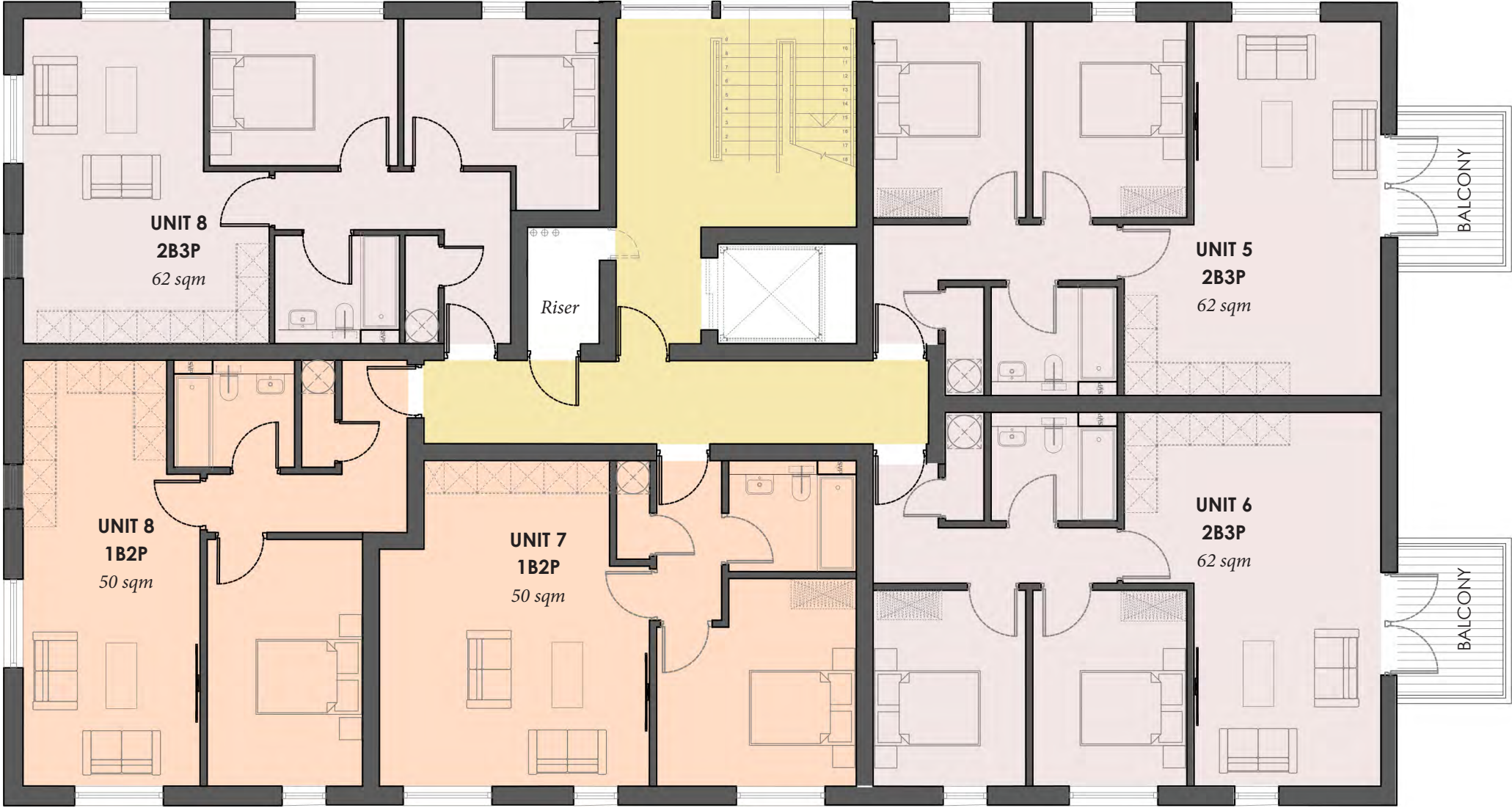


| Rev | Date     | Description                   |
|-----|----------|-------------------------------|
| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-  
PROJECT:  
Land @ Old Market Street  
Crumpsall  
TITLE:  
Block A - 00 GA  
SCALE:  
1:100 @ A3  
DRAWING NO.  
A200

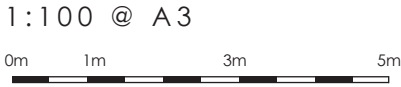
REV:  
A  
DATE:  
April 2024

INTERNAL PARKING SIDE



**BLOCK A**  
**PROPOSED FIRST - THIRD FLOOR PLAN**

3 x TWO BEDROOMS FLAT  
2 x ONE BEDROOM FLAT



**Dimensioning**  
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|-----|----------|-------------------------------|
| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-  
PROJECT:  
Land @ Old Market Street  
Crumpsall

TITLE:  
Block A - 01-03 GA

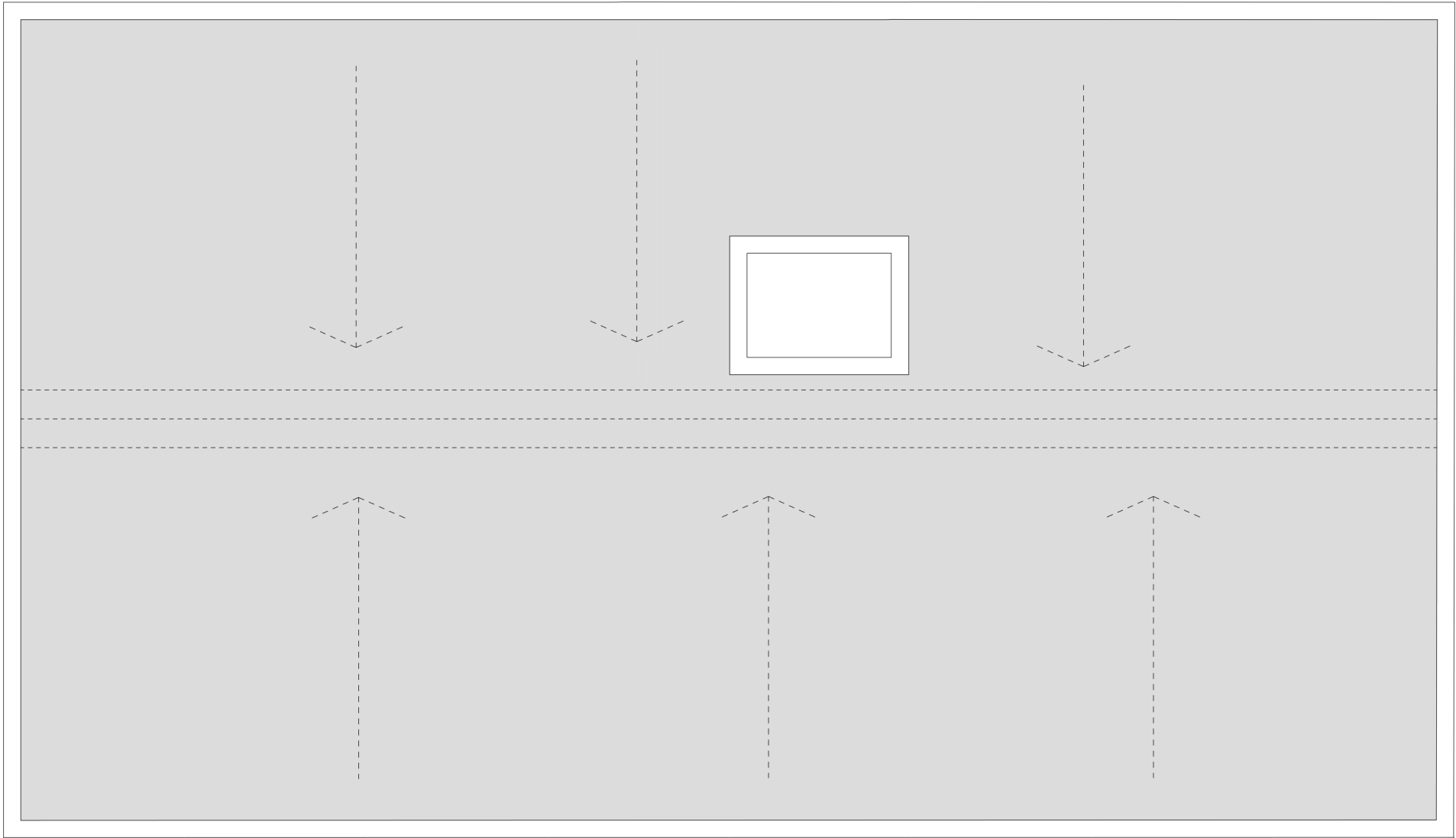
SCALE:  
1:100 @ A3  
DRAWING NO.  
A201

REV:  
A

DATE:  
April 2024

INTERNAL PARKING SIDE

OLD MARKET STREET



BLOCK A  
ROOF PLAN

1:100 @ A3



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STATUS:  
**PLANNING**



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|-----|----------|-------------------------------|
| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-  
PROJECT:  
Land @ Old Market Street  
Crumpsall

TITLE:  
Block A - Roof Plan

SCALE:  
1:100 @ A3  
DRAWING NO.  
A202

REV:  
A

DATE:  
April 2024

OLD MARKET STREET



**BLOCK B**  
**GROUND FLOOR PLAN**

1:100 @ A3



INTERNAL PARKING SIDE

3 x TWO BEDROOMS FLAT  
2 x ONE BEDROOM FLAT

**Dimensioning**

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| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-  
PROJECT:  
Land @ Old Market Street  
Crumpsall  
TITLE:  
Block b - 00 GA  
SCALE:  
1:100 @ A3  
DRAWING NO.  
A203

REV:  
A  
DATE:  
April 2024

OLD MARKET STREET



**BLOCK B**  
**PROPOSED FIRST - THIRD FLOOR PLAN**

1:100 @ A3



INTERNAL PARKING SIDE

3 x TWO BEDROOMS FLAT  
3 x ONE BEDROOM FLAT

**Dimensioning**

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| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:

PROJECT:  
Land @ Old Market Street  
Crumpsall

TITLE:  
Block A - 01-03 GA

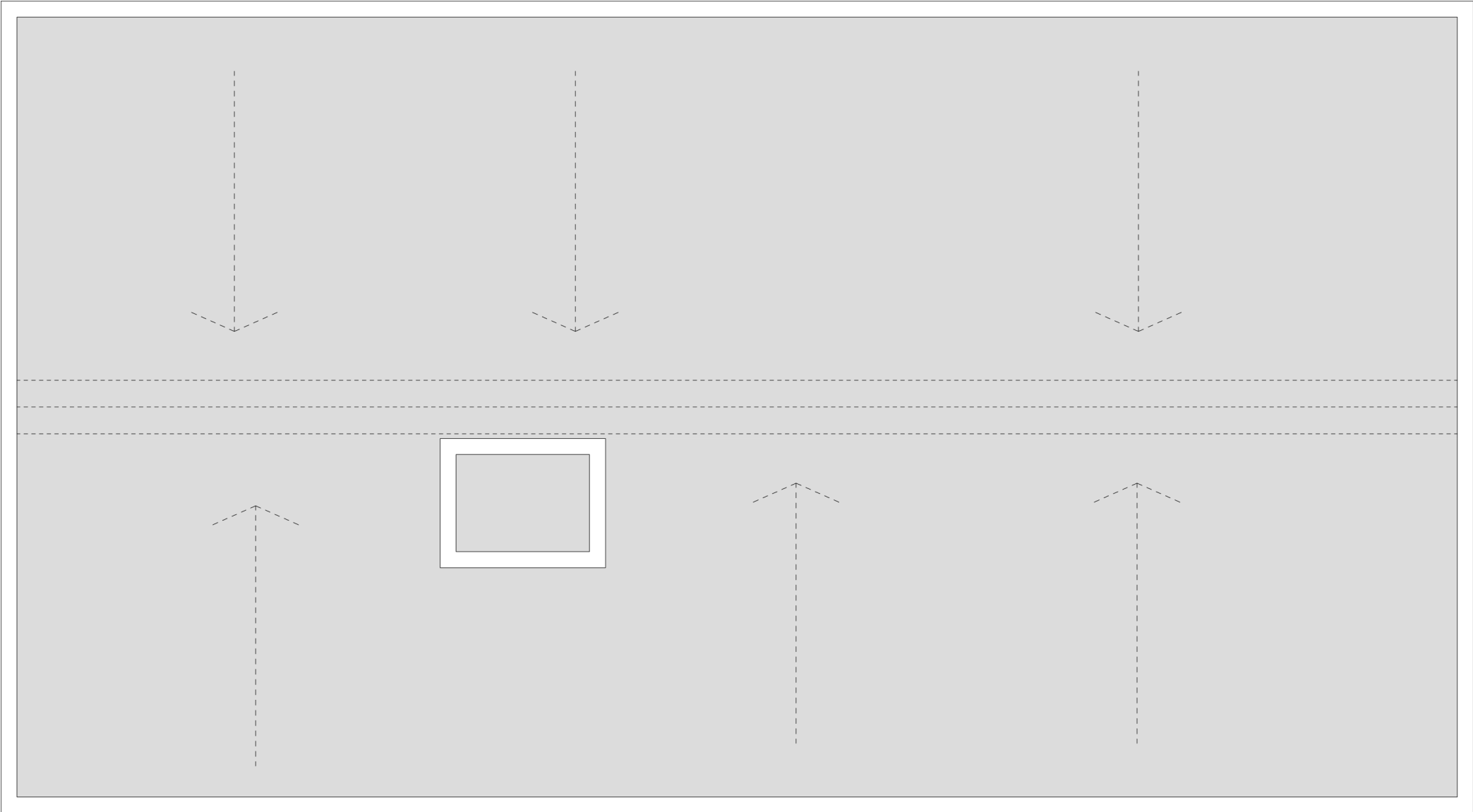
SCALE:  
1:100 @ A3

DRAWING NO.  
A204

REV:  
A

DATE:  
April 2024

OLD MARKET STREET



BLOCK B  
ROOF PLAN  
1:100 @ A3



INTERNAL PARKING SIDE

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| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-  
PROJECT:  
Land @ Old Market Street  
Crumpsall

TITLE:  
Block A - Roof Plan

SCALE:  
1:100 @ A3  
DRAWING NO.  
A205

REV:  
A

DATE:  
April 2024



OLD MARKET STREET ELEVATION

1:200 @ A3

Dimensioning

Figured dimensions only to be taken from these designs and drawings. Work to annotated dimensions only. All dimensions to be checked on site. Architectural designers to be informed immediately of any discrepancies before work proceeds. Drawings are to be read in conjunction with relevant specifications, structural engineers and service engineers' drawings.

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STATUS:  
**PLANNING**



| Rev | Date     | Description                   |
|-----|----------|-------------------------------|
| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-  
PROJECT:  
Land @ Old Market Street  
Crumpsall

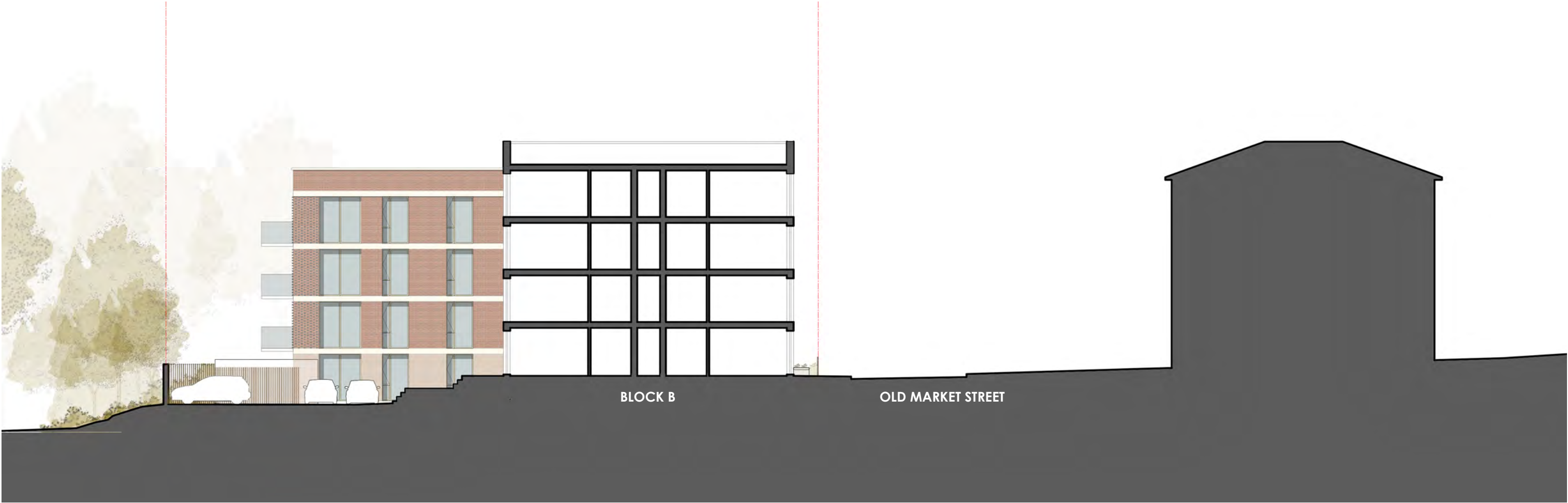
TITLE:  
Proposed Street Elevation

SCALE:  
1:100 @ A3

DRAWING NO.  
A206

REV:  
A

DATE:  
April 2024



SECTION THROUGH COURTYARD & BLOCK B

1:200 @ A3

**Dimensioning**  
Figured dimensions only to be taken from these designs and drawings. Work to annotated dimensions only. All dimensions to be checked on site. Architectural designers to be informed immediately of any discrepancies before work proceeds. Drawings are to be read in conjunction with relevant specifications, structural engineers and service engineers' drawings.

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STATUS:  
**PLANNING**



| Rev | Date     | Description                   |
|-----|----------|-------------------------------|
| -   | 01/07/24 | Issued to client for comments |
| A   | 08/07/24 | Issued for Planning           |

CLIENT:  
-

PROJECT:  
*Land @ Old Market Street  
Crumpsall*

TITLE:  
*Proposed Street Elevation ii*

SCALE:  
*1:100 @ A3*

DRAWING NO.  
*A207*

REV:  
A

DATE:  
*April 2024*

## **APPENDIX C**

|                |                                   |
|----------------|-----------------------------------|
| Calculated by: | George Locke                      |
| Site name:     | Jct Old Mkt & Middleton<br>M9 8DS |
| Site location: | Jct Old Mkt & Middleton<br>M9 8DS |

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

## Site Details

|            |                   |
|------------|-------------------|
| Latitude:  | 53.52248° N       |
| Longitude: | 2.21671° W        |
| Reference: | 725278914         |
| Date:      | Sep 19 2024 10:56 |

## Site characteristics

|                                                        |       |
|--------------------------------------------------------|-------|
| Total site area (ha):                                  | 0.19  |
| Significant public open space (ha):                    | 0     |
| Area positively drained (ha):                          | 0.19  |
| Impermeable area (ha):                                 | 0.142 |
| Percentage of drained area that is impermeable (%):    | 75    |
| Impervious area drained via infiltration (ha):         | 0     |
| Return period for infiltration system design (year):   | 10    |
| Impervious area drained to rainwater harvesting (ha):  | 0     |
| Return period for rainwater harvesting system (year):  | 10    |
| Compliance factor for rainwater harvesting system (%): | 66    |
| Net site area for storage volume design (ha):          | 0.19  |
| Net impermeable area for storage volume design (ha):   | 0.15  |
| Pervious area contribution to runoff (%):              | 30    |

## Methodology

|                                     |                             |
|-------------------------------------|-----------------------------|
| esti                                | IH124                       |
| Q <sub>BAR</sub> estimation method: | Calculate from SPR and SAAR |
| SPR estimation method:              | Calculate from SOIL type    |

## Soil characteristics

|            | Default | Edited |
|------------|---------|--------|
| SOIL type: | 4       | 4      |
| SPR:       | 0.47    | 0.47   |

## Hydrological characteristics

|                              | Default | Edited |
|------------------------------|---------|--------|
| Rainfall 100 yrs 6 hrs:      | --      | 55     |
| Rainfall 100 yrs 12 hrs:     | --      | 71.82  |
| FEH / FSR conversion factor: | 1.14    | 1.14   |
| SAAR (mm):                   | 955     | 955    |
| M5-60 Rainfall Depth (mm):   | 17      | 17     |
| 'r' Ratio M5-60/M5-2 day:    | 0.4     | 0.4    |
| Hydrological region:         | 10      | 10     |
| Growth curve factor 1 year:  | 0.87    | 0.87   |
| Growth curve factor 10 year: | 1.38    | 1.38   |
| Growth curve factor 30 year: | 1.7     | 1.7    |

\* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q<sub>BAR</sub> and other flow rates will have been reduced accordingly.

## Design criteria

Climate change allowance factor

1.4

Urban creep allowance factor

1.1

Volume control approach

Use long term storage

Interception rainfall depth (mm):

5

Minimum flow rate (l/s):

2

Growth curve factor 100 years:

2.08

2.08

$Q_{BAR}$  for total site area (l/s):

1.32

1.32

$Q_{BAR}$  for net site area (l/s):

1.32

1.32

## Site discharge rates

1 in 1 year (l/s):

2

2

1 in 30 years (l/s):

2.2

2.2

1 in 100 year (l/s):

2.7

2.7

## Estimated storage volumes

Attenuation storage 1/100 years (m<sup>3</sup>):

60

60

Long term storage 1/100 years (m<sup>3</sup>):

7

7

Total storage 1/100 years (m<sup>3</sup>):

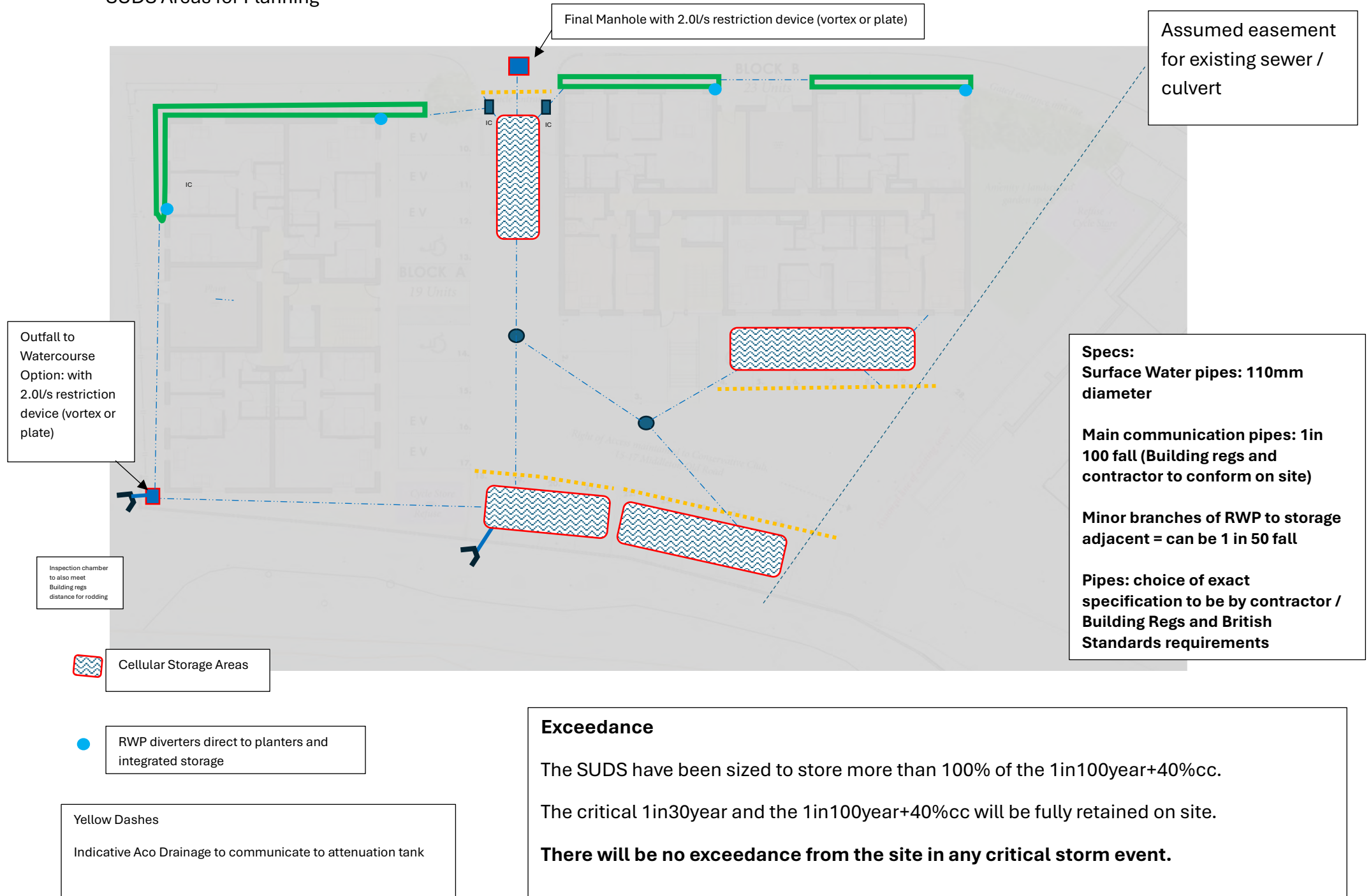
66

66

This report was produced using the storage estimation tool developed by HRWallingford and available at [www.uksuds.com](http://www.uksuds.com). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at <http://uksuds.com/terms-and-conditions.htm>. The outputs from this tool have been used to estimate storage volume requirements. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

## **APPENDIX D**

## SUDS Areas for Planning



## SUDS Areas for Planning



**Example  
Rainwater  
Pipe Diverter**

Ground Level Rain Garden Planter Areas  
With integrated SUDS cellular storage



**SUDS Maintenance Schedule**

| Installation                                                                               | Maintenance Required                                                                                                           | Frequency                                                                                                                                                                                 | Responsibility                                  |
|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| Rain Garden Planters / Planted Raind Beds<br>Sedum Roof areas (if they are to be included) | Inspection, debris removal and jetting: part of general garden maintenance<br><br>Weeding / Mowing: general garden maintenance | Follow manufacturer guidance<br><br>Typically, inspection is recommended annually or after a severe or significant storm event, with any jetting/cleaning being carried out as necessary. | Homeowner or Estate/Building Management Company |