Virgil Street, Trafford

Outline Drainage Strategy

Project No: 2202-01
February 2023
VST-REN-00-ZZ-RP-C-00002
Rev: 01

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author	**Henry Wilkinson**
date	**01.02.2023**
approved	**Helen Gribbon**
date	**01.02.2023**

Contact Details:-

Helen Gribbon | Director
BEng, MScArch ,CEng ,MIStructE

Carvers Warehouse, 77 Dale Street
Manchester, M1 2HG

e: helengribbon@renaissance-ltd.com

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CONTENTS

1.0 INTRODUCTION 1

1.1 PURPOSE OF THIS REPORT 1

2.0 THE SITE 2

2.1 SITE LOCATION 2
2.2 SITE DESCRIPTION 2
2.3 EXISTING SITE DRAINAGE 3
2.4 GEOLOGY 3
2.5 HYDROLOGY 3
2.6 PROPOSED DEVELOPMENT 3

3.0 EXISTING & PROPOSED SURFACE WATER DISCHARGE RATES 4

3.1 PRE-DEVELOPMENT SURFACE WATER RUN-OFF RATES 4

4.0 SURFACE WATER DISCHARGE & SUDS ASSESSMENT 6

4.1 SURFACE WATER DISCHARGE ASSESSMENT 6
4.2 SUSTAINABLE URBAN DRAINAGE 6
4.3 WATER QUALITY ASSESSMENT 7
4.4 SUDS MANAGEMENT PLAN 8

5.0 OUTLINE DRAINAGE STRATEGY 9

5.1 SURFACE WATER SYSTEM 9
5.2 FOUL WATER SYSTEM 9
5.3 PHASING & SURFACE WATER MANAGEMENT DURING CONSTRUCTION 10

APPENDICES	
APPENDIX A	**Existing Topographical Survey**
APPENDIX B	**Culvert Survey Summary**
APPENDIX C	**United Utilities Sewer Records**
APPENDIX D	**Proposed Development Layouts**
APPENDIX E	**Existing Impermeable Areas Plan**
APPENDIX F	**MicroDrainage Existing Runoff calculations**
APPENDIX G	**MicroDrainage Greenfield Runoff calculations**
APPENDIX H	**Proposed Drained Areas Plan**
APPENDIX I	**MicroDrainage Quick Storage Estimates**
APPENDIX J	**Proposed Below Ground Drainage Layout**

1.0 INTRODUCTION

1.1 Purpose of this report

This Outline Surface Water Drainage Strategy has been prepared to support the planning application for the proposed Virgil Street development.

The assessment includes: a summary of the site, an estimate of the existing and proposed surface water discharge rates, infiltration assessment, SUDs assessment, and outline drainage proposals and performance criteria.

This report should be read in conjunction with the renaissance Flood Risk Assessment, March 2023 and the completed North-West SuDS Pro-Forma.

The proposals within this report are intended to demonstrate the feasibility of the overarching drainage strategy to support the planning proposal.

2.0 THE SITE

2.1 Site Location

The proposed development site is located on Virgil Street, Old Trafford, Stretford.

When considered cumulatively, the site is bound to the west by Oldfield Road; the east by Islington Way; north partially by James Street; and south partially by a railway line.

The site location is described below:

- Post Code M15 4ED
- OS X (Easting) 382544
- OS Y (Northing) 396815
- Nat. Grid SJ 825968
- What3Words upper.traps.gloves

The site location is illustrated in Figure 2.1 below.

Figure 2.1: Site Location

2.2 Site Description

The development site is circa 0.178 hectares and comprises several areas of land as indicated in the site location plan above. The site comprises parking to the northern end, a warehouse towards the southern end with vegetation to the most southerly tip. The site can only be accessed off Virgil Street. Refer to topographical survey contained within Appendix A for details.

The structure of the two storey warehouse building appears to be masonry clad with the brick bond suggesting a cavity wall construction and accented piers suggesting a framed structure

A culverted watercourse, (the river Cornbrook), is known to pass along the northern side of the site and passes under the existing warehouse on site. The culvert has been surveyed and a summary of the survey information is contained in Appendix B.

Car parking areas are largely formed of asphalt/tarmacadam/ concrete hard standing. The access road is formed of asphalt/tarmacadam.

2.3 Existing Site Drainage

The majority of the existing site areas are impermeable with associated existing drainage. The adjacent culverted watercourse has been surveyed to establish its line and level and inform the proposals for the site. A summary of the survey is enclosed in Appendix B. Based on United Utilities' sewer records drawing (Appendix C) and Topographical, survey (Appendix A) the existing on site foul and surface water drainage from the site is thought to discharge to the United Utilities (UU) sewers within Virgil Street. The location, condition and connectivity of the existing site drainage is to be confirmed with a CCTV survey.

2.4 Geology

BGS mapping does not display any made ground deposits on site, however given the presence of made ground in the surrounding area and the site's historical mapping and development that has taken place, made ground deposits are likely to be present.

The site is indicated to be underlain by Glaciofluvial Sheet Deposits. This stratum typically comprises sand and gravel.

The deeper solid geology is indicated to be part of the Chester Formation which typically comprises sandstone.

One normal fault is shown to lie 188m to the south-west of the site. However, any movement anticipated from this fault will now have ceased. No risk to the site has been identified from Non-Coal Mining activities.

2.5 Hydrology

A summary of the pertinent hydrological aspects within the Geo-Environmental Data Report are provided below:

- Nearest Watercourse: Onsite - Cornbrook, underground inland river flowing south-east to north-west.
- Nearest Surface Water Abstraction: No active surface water abstractions within 1500m.
- Closest Active Licenced Discharge Consent: None within 500m.

Information obtained from the Environment Agency (EA) Risk of Flooding from Rivers and the Sea (RoFRaS) database indicates that a very low risk of flooding exists at the site from Rivers and the Sea.

The same source indicates there is a potential for surface water flooding at the subject site, with a low risk rating, (greater than 1 in 1000 but less than 1 in 100 chance of flooding in any given year).

The site is also indicated by the same source to be a risk of flooding from reservoirs.

The site is not indicated to lie within an EA designated Zone 2 or 3 flood plain.

Refer to renaissance flood risk assessment (ref VST-REN-00-ZZ-RP-C-00001) date February 2023 for details.

2.6 Proposed Development

Erection of four houses with ground floor parking and associated amenity space along with the change of use of Palmer House to Class E (g) with associated external alterations and the construction of a new car park and amenity space. The detail and extent of the wider site can be seen within the Nick Moss Architects Feasibility Report, provided to renaissance by the architect. Refer to Appendix D for further details.

3.0 EXISTING & PROPOSED SURFACE WATER DISCHARGE RATES

3.1 Pre-Development Surface Water Run-Off Rates

The total site area, including the existing building is considered 61% impermeable consisting of the existing building and concrete hardstanding. The remaining 39% is considered permeable.

The existing building and associated drainage network within the site are being maintained and as a result, the area of the building footprint has not been included in the discharge calculations. This results in two separate zones of land with a total impermeable area of 0.058 Ha.

Refer to topographical survey in Appendix A and Existing Impermeable Areas drawing VST-REN-XX-XX-DR-C-00050 in Appendix E.

3.2 Existing Brownfield Run-Off Rates

To estimate the pre-development surface water discharge into the public sewer a two-pipe model has been modelled in industry approved Micro Drainage Software (Appendix F). The model uses a variable rainfall intensity for the different storm events and is based on a 60-minute storm duration. A summary of the results are presented in the Tables 3.1.1:

Return Period	$Q_{BROWNFIELD}$ (l/s)		
	Zone A	Zone B	Total
1 in 1 year	1.0	0.2	1.2
1 in 2 year	1.3	0.2	1.5
1 in 30 year	2.3	0.4	2.7
1 in 100 year	3.0	0.6	3.6

Table 3.1 –Brownfield Run-off Rates

3.3 Existing Greenfield Run-Off Rates

The greenfield run-off for the total site area has been considered, this has been calculated using MicroDrainage ICP SUDS method (Appendix G). The rates presented below are what would be typical of a site with an equivalent surface area which remains undeveloped / covered in grass or vegetation. A partly urbanised catchment ratio of 0.75, Q_{BAR} has a return period of 2.3 years.

The equivalent greenfield run-off rate is tabled below: -

Return Period	$Q_{GREENFIELD}$ (l/s)		
	Zone A	Zone B	Total
1 in 1 year	0.6	0.1	0.7
1 in 2 year	0.7	0.1	0.8
1 in 30 year	1.0	0.1	1.1
1 in 100 year	1.1	0.2	1.3
Q_{BAR}	0.7	0.1	0.8

Table 3.2 – Greenfield Run-off Rates

3.4 Proposed Surface Water Discharge Rates

As set out within the Strategic Flood Risk Assessment (SFRA) developments which have been previously developed (brownfield) should aim for a minimum reduction in surface water runoff rates of 50%, with an aim of reducing runoff to Greenfield rates up to a 1 in 100 year storm event, considering climate change.

The North West SuDS Pro-Forma requires that discharge from the development is to be restricted to Q_{BAR} to control the flow and volume of runoff from the site.

Based on the small site area and existing building on the site, it is not practical to discharge via one outfall. Instead it is proposed to drain each of the zones mentioned above separately

Considering the above, the discharge rate for the development will be restricted to as close to Q_{BAR} as reasonably possible. It is therefore proposed that the maximum discharge will be limited to **2 l/s** for each of the outfalls (4 l/s total) to prevent the risk of blockage.

3.5 Attenuation Requirements

The proposed development results in circa 884.4m^2 of building footprint, external hard landscaping and car parking. Refer to Appendix H for the proposed impermeable areas.

Due to the nature of the development urban creep has not been considered as it is unlikely that the percentage of impermeable area will increase during the lifetime of the development.

The post development discharge rates will include for an increase in the rainfall intensity of 45% for the 1% annual exceedance probability (AEP), to allow for climate change as is consistence with a design life of the development of 100 years, as outlined by the National Planning Practice Framework (NPPF).

Quick storage estimates for the above return periods, using Micro Drainage, indicate that the approximate attenuation volumes shown in table 3.4 are required to limit the peak surface water discharge for each of the zones of land to 2 l/s. The micro drainage calculations can be seen in Appendix I.

Return Period	Storage Volume (m^3)		
	Zone A	Zone B	Total
1 in 100 year + 45% Climate Change	20	8	28

Table 3.4 – Surface Water Attenuation Estimates

4.0 SURFACE WATER DISCHARGE & SUDS ASSESSMENT

4.1 Surface Water Discharge Assessment

In accordance with NPPF, the following hierarchy of surface water drainage options has been considered:

- Discharge into the ground (infiltration);
- Discharge to a surface water body;
- Discharge to a surface water sewer, highway drain, or another drainage system;

BGS mapping indicates there to be a high chance of made ground deposits on site which could potentially pose risks to the mobilisation of contaminants should infiltration be utilised. Based on this, large scale infiltration is unlikely to be feasible, however, the possibility and extent of small scale infiltration will be reviewed upon receipt of the phase 2 site investigation report.

Opportunities for discharge to watercourse have been considered. The closest watercourse is the Cornbrook culverted watercourse which flows beneath the site from south-east to north-west.

It is therefore proposed that surface water will be collected by a dedicated gravity system designed in accordance with BS EN 752 before discharging to the Cornbrook Culvert.

4.2 Sustainable Urban Drainage

Table 4.1 below provides a summary of typical SUDs techniques outlined within CIRIA guide 753 SUDs manual. Based on a review of the suitability of the SUDs techniques it is proposed that the Virgil Street development may incorporate the following:

SUDS TECHNIQUE	DESCRIPTION	SUITABILITY FOR DEVELOPMENT SITE	
Rainwater Harvesting	Collection of rainwater run-off for use	Large impermeable area and limited usage deems this unsuitable	×
Soft Landscaping	Grassed areas that allow direct infiltration of rainwater	Soft landscaping will be utilised to limit the impermeable area	✓
Filter Drains	Granular filled Linear drains / soakaway with either granular fill and perforated pipe, or dense vegetation that treat runoff from adjacent impermeable areas	Not suitable due to known ground conditions	×
Swales	Shallow landscape channel that can infiltrate or convey runoff.	Existing trees and limited soft landscaping deem this unsuitable	×
Infiltration Basins	Depressions in the ground designed to store and infiltration runoff to the ground. Can be landscaped to provide amenity value.	Not suitable due to known ground conditions and limited space	×
Wet Ponds	Basins with permanent pool of water providing water quality treatment, wildlife, and amenity benefit. Designed to provide temporary storage for additional runoff.	Not suitable due to limited space and poses a health and safety risk to the end users.	×
Extended Detention Basins	Dry basins that are designed to temporarily store runoff providing water quality treatment.	Not suitable due to limited space and poses a health and safety risk to the end users.	×
Constructed Wetland	Ponds and shallow wetland areas with vegetation to improve pollution removal and enhance wildlife habitat.	Not suitable due to limited space and poses a health and safety risk to the end users.	×
Porous Paving	Granular build-up beneath permeable paving systems that can be used to either store runoff (lined system) and increase time of concentration or allow percolation into the ground.	Not suitable due to limited space on site	×
Trees Pits	Managed permeable paving systems around tree pits that can be used to either store runoff (lined system) and	Not suitable due to limited space on site	×

	increase time of concentration or allow percolation into the ground.		
Soakaways	Infiltration device to temporarily store runoff and allow it to percolate into the ground.	Not suitable due to proximity to existing buildings	×
Green Roof	Vegetated roof area that reduces runoff and increases time of concentration.	Not suitable due to sloped roofs	×
Blue Roof	Roof area designed to store and reduce peak runoff rates during intense storms.	Not suitable due to limited feasible roof area	×
Underground Storage	Attenuation structures installed below ground to provide runoff storage.	Suitable beneath the outdoor all-weather sports pitches and beneath external areas.	✓

× Not suitable ? Potentially suitable subject to further investigation ✓ Suitable

Table 4.1 – SUDs Techniques & Suitability for Development Site

4.3 Water Quality Assessment

The drainage from the site is from the roof to the main youth zone building and sports hall, external all-weather sports pitches, car park, access road and external hard landscaping. Water quality is generally affected by frequent rainfall events, 1 in 1 year events or less, which is circa 5mm/hr for the proposed development site. To assess the water quality consideration will be given to the guidance with the National Standard for Sustainable Urban Drainage (NSSUD) and CIRIA Guide C753. The pollution hazard levels for difference land uses are presented in table 4.2 and are based on the definitions in the NSSUD and C753.

POLLUTION HAZARD LEVEL	LAND USE
Very Low	**Residential roofs**
Low	Individual property driveways, non-residential roofs, residential car parks, low traffic roads, non-residential car parking with infrequent change (e.g. Schools, offices)
Medium	Commercial yards and delivery areas, non-residential car parking with frequent change (e.g. hospital, retail), minor roads
High	Site with heavy pollution (e.g. Haulage yards, lorry parks, waste sites, sites with chemical and fuels are delivered, handled, stored etc.)

Table 4.2 – Pollution Hazard Levels

The pollution hazard level is considered to be very low based on Table 4.2 with the primary consideration given to removal of gross solids and sediment.

The following tables indicate the minimum number of treatment stages required before surface runoff should reach the infiltration or receiving water body and are extracted from the NSSUD.

POLLUTION HAZARD LEVEL	LAND USE	LOW	MEDIDUM	HIGH
G1	Source Protection Zone 1, within 50m of a well, spring or borehole that supplies potable water.	1	3	Consult the EA
G2	Into or immediately adjacent to a sensitive receptor that could be influenced by infiltrated water. Includes designated nature conservation, heritage, and landscape sites – including Biodiversity Action Plan (BAP) habitats and Protected Species.	1	3	
G3	Source Protection Zone II and III or Principal Aquifer	1	3	
G4	Secondary Aquifer	1	2	
G5	Unproductive strata	1	2	

Table 4.3 – Groundwater Minimum Treatment Stages

POLLUTION HAZARD LEVEL	NORMAL SURFACE WATER	SENSITIVE SURFACE WATER
Low	0	1
Medium	2	3
High	Consult the EA	

Table 4.4 – Surface Water Body Minimum Treatment Stages

Infiltration is not viable due to the ground conditions however discharge into the principal and secondary aquifers would require 1 level of treatment for a low pollution level.

Discharge of surface water to the receiving public surface water sewer requires no treatment stages due to the low pollution hazard level. However, the adoption of SuDS, sumps and good practice will provide inherent treatment.

External areas will pass through silt traps/sumps prior to entering the attenuation tank and flow control device. The silt traps and sumps will allow most of the sediment and solids to settle out under low flows, prior to discharging to the public sewer. The run off from the car park will drain through a permeable paving system which will provide treatment at source by trapping pollutants within the sub-base allowing them to biodegrade over time.

4.4 SuDS Management Plan

The Sustainable Urban Drainage systems are to be maintained by the property owner and/or a maintenance company on their behalf. They will be required to maintain the SuDS features in line with the following recommendations and suppliers' requirements of the various features.

The following operation and maintenance requirements for the SUDs features incorporated into the development are to be adopted by the Building Management Company. These requirements are general and have been extracted from the CIRA Guide C753.

Table 21.3 - Operation and maintenance requirement for Attenuation storage tanks

The Contractor delivering the development is to update the general requirements to reflect the product specific requirements of the as installed proprietary SuDS and incorporate these into the Operation & Maintenance manual for the development.

TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

5.0 OUTLINE DRAINAGE STRATEGY

Refer to Appendix J for the Below Ground Drainage General Arrangement drawing.

5.1 Surface Water System

The development will have two dedicated surface water networks that will collect the rainwater from the proposed building roofs, and impermeable external areas on the site. The systems will then discharge under gravity to the Cornbrook Culvert located beneath the site, subject to approval by the lead local flood authority.

The surface water discharge from the site is to be limited to the rate detailed within Section 3.3 of this report using a flow control device within the final manholes on site prior to discharge at each of the proposed discharge points. Proposed discharge rates are to be confirmed with the Lead Local Flood Authority.

Attenuation will be provided by geocellular storage tanks in each of the networks.

The surface water discharging from the site will be from the proposed buildings and external hard landscaping and no water treatment is required to ensure water quality to the public sewer however the adoption of sumps within channels and catchpit manholes will provide inherent treatment.

The surface water drainage network is to be designed in accordance with Building Regulation Part H, BS EN 752 and Code for Adoption. In addition, the following requirements will also be adopted in accordance with the Non-Statutory Technical Standards for Sustainable Drainage: Practice Guidance and Salford City Council SuDS requirements for new developments:

- The below ground drainage system will be designed to ensure flooding does not occur on site for the 1 in 30 year and no internal flooding for the 1 in 100-year rainfall events
- The surface water system is to be designed to accommodate the 1, 2, 30 and 100 year return events and a 45% climate change allowances for the 100 year event. The system will be designed for a maximum storm duration of 6 hours.

Micro Drainage calculations for the proposed surface water system are available in Appendix J.

5.2 Foul Water System

The site will have a dedicated foul water network that will collect the foul water associated with the development that will discharge to the United Utilities 375-diameter combined sewer within Virgil Street. A drainage survey will be required to confirm whether any of the existing connections on the site can be reused.

A pre-development enquiry has been submitted to United Utilities to gain initial feedback.

The connection will be subject to a section 106 application with United Utilities.

The drainage system is to be designed in accordance with Building Regulations Part H, BS EN 752 and Codes for Adoption.

5.3 Phasing & Surface Water Management During Construction

It is assumed that, given the scale of the development, it will be delivered in a single phase.

The management of surface water management during construction will be addressed by the Main Contractor as part of their 'Construction Management Plan'.

A brief overview of the key consideration relating to surface water management and flood risk that will need to be incorporated into the Main Contractors construction methodology include:

- Subject to the level of contamination beneath the site, level of site remediation, and quality of working platform compaction to reduce infiltration, consideration should be given to the risk of residual contamination on site affecting groundwaters and the adjacent watercourse.
- The risk of spillage of diesel and other contamination risk during construction activities are to be assessed and measures implemented to ensure they do not cause a risk to groundwaters and the adjacent watercourse

APPENDIX A
Existing Topographical Survey

NOTES

KEY

Grid & Datum - NDO Survey Grid & Datum Best Mean Fit To Client Supplied Survey Drawing - "17831C-REV1"

STANDARD ABBREVIATIONS

STREET FURNITURE

A/C	-	AIR CONDITIONING
AE	-	AERIAL
AL	-	ALARM
AV	-	ACTIVE
BA	-	BUOYANCY AID
BB	-	BELISHA BEACON
BD	-	BUILDING DIVIDE
BH	-	BOREHOLE
BL	-	BASEMENT LIGHT
BO	-	BOLLARD
BP	-	BOUNDARY POST
BR	-	BOULDER
BS	-	BUS STOP
BU	-	BUSH
CA	-	CABLE
CB	-	CONTROL BOX
CC	-	CLOSE CIRCUIT TV
CIB	-	CIGARETTE BIN
Col	-	COLUMN
CT	-	CLOSE CIRCUIT TV POLE
DP	-	DOWN PIPE
DR	-	DRAIN
Dr Ch	-	DRAINAGE CHANNEL
DU	-	DUCT
EL	-	ELECTRIC
EP	-	ELECTRICITY POLE
ER	-	EARTH ROD
FA	-	FENDOR ANCHOR
F/B	-	FLOWER BED
FH	-	FIRE HYDRANT
FL	-	FLOODLIGHT
FS	-	FLAG STAFF
GA	-	GAS
GM	-	GAS METER
G	-	GIRTH
GP	-	GATE POST
GU	-	GULLY
GV	-	GAS VALVE
Hyd	-	HYDRANT
IC	-	INSPECTION COVER
IT	-	TRAFFIC COVER
JB	-	JUNCTION BOX
LA	-	LANDFILL PIPELET
LA	-	LADDER
LB	-	LITTER BIN
LC	-	LIGHTING COLUMN
LI	-	LIGHT
LP	-	LAMP POST
MBO	-	MOORING BOLLARD
MA	-	MAST
MH	-	MANHOLE
MO	-	MOBILEMENT
MP	-	MILE POST
MR	-	MOORING RING
MW	-	MONITORING WELL
NP	-	NAME PLATE
O/H	-	OVERHEAD
OSBM	-	ORDNANCE SURVEY BENCH MARK
PA	-	PLAY APPARATUS
PB	-	PILLAR BOX
PH	-	PUBLIC HOUSE
PI	-	PIPE
PL	-	PLANT
PM	-	PARKING METER
PN	-	PLANTER
PO	-	POST
PP	-	PETROL PUMP
RH	-	RIDGE HEIGHT
RS	-	ROAD SIGN
RTW	-	RETAINING WALL
RWP	-	RAINWATER PIPE
SA	-	STANCHION
SC	-	SPEED CAMERA
SD	-	SATELLITTE DISH
S/F	-	SAFETY FENCE
SG	-	SIGNAL
SI	-	SIGN
SMP	-	SERVICE MARKER POST
SS	-	SECURITY SENSOR
ST	-	STOP TAP
SU	-	STUMP
SV	-	STOP VALVE
SW	-	SWITCHGEAR
SY	-	STAY
TA	-	TAP
TBM	-	TEMPORARY BENCH MARK
TCB	-	TELEPHONE CALL BOX
TE	-	TELEPHONE
TM	-	TRAFFIC MACHINE
TS	-	TRAFFIC SIGNAL
TP	-	TELEGRAPH POLE
UTL	-	UNABLE TO LIFT
VDP	-	VEHICLE DETECTOR PAD
VP	-	VENT PIPE
WB	-	WHISTLE BLOW
WM	-	WATER METER
WO	-	WASH OUT
WP	-	WASTE PIPE

FENCE TYPES

B/W	-	BARBED WIRE
C/B	-	CLOSE BOARDED
C/I	-	CORRUGATED IRON
C/P	-	CONCRETE PANEL
H/R	-	HANDRAIL
I/R	-	IRON RAILING
PAL	-	PALISADE
P/C	-	POST & CHAIN
P/P	-	POST & PANEL
P/R	-	POST & RAIL
PSB	-	PEDESTRIAN SAFETY BARRIER
P/W	-	POST & WIRE
W/M	-	WIRE MESH

LEVELS

BL43.45	-	BED LEVEL
EV43.45	-	EAVE LEVEL
IL43.45	-	INVERT LEVEL
+43.45	-	SPOT LEVEL
RF43.45	-	ROOF LEVEL
RL43.45	-	RIDGE LEVEL
SB43.45	-	SOFT BED LEVEL
SL43.45	-	SOFFIT LEVEL
TH43.45	-	THRESHOLD LEVEL
WL43.45	-	WATER LEVEL

SYMBOLS

HEDGE
GATE
BUILDING
TREE CANOPY
CONTROL STATION
TREE
BUSH

Rev	Date	Drawn	Description	Ch'k'd	App'd

N D OLIVER & CO
CHARTERED GEOMATIC SURVEYORS
Jupiter House, 21 Roebuck Lane, Sale, Manchester, M33 7SY
T: 0161 973 3495 F: 0161 962 6819
E: mail@ndoliver.com www.ndoliver.com

Client

NICK MOSS ARCHITECTS
29 BOW LANE
MANCHESTER
M2 4FW

Title

11 VIRGIL STREET
MANCHESTER
M15 4ED

TOPOGRAPHICAL SURVEY

SHEET 1 OF 1

Surveyed	PG	Drawn	JP	31/01/2022
Checked	AM	Approved	NDO	
Scale 1:200 @ A1	Project 11635			Status ORIG
	CAD File \\NDO-SBS\Projects\11635\DRAWING\011635_001.DWG			
Drawing No 11635 / 001				Rev 0

APPENDIX B
Culvert Survey Summary

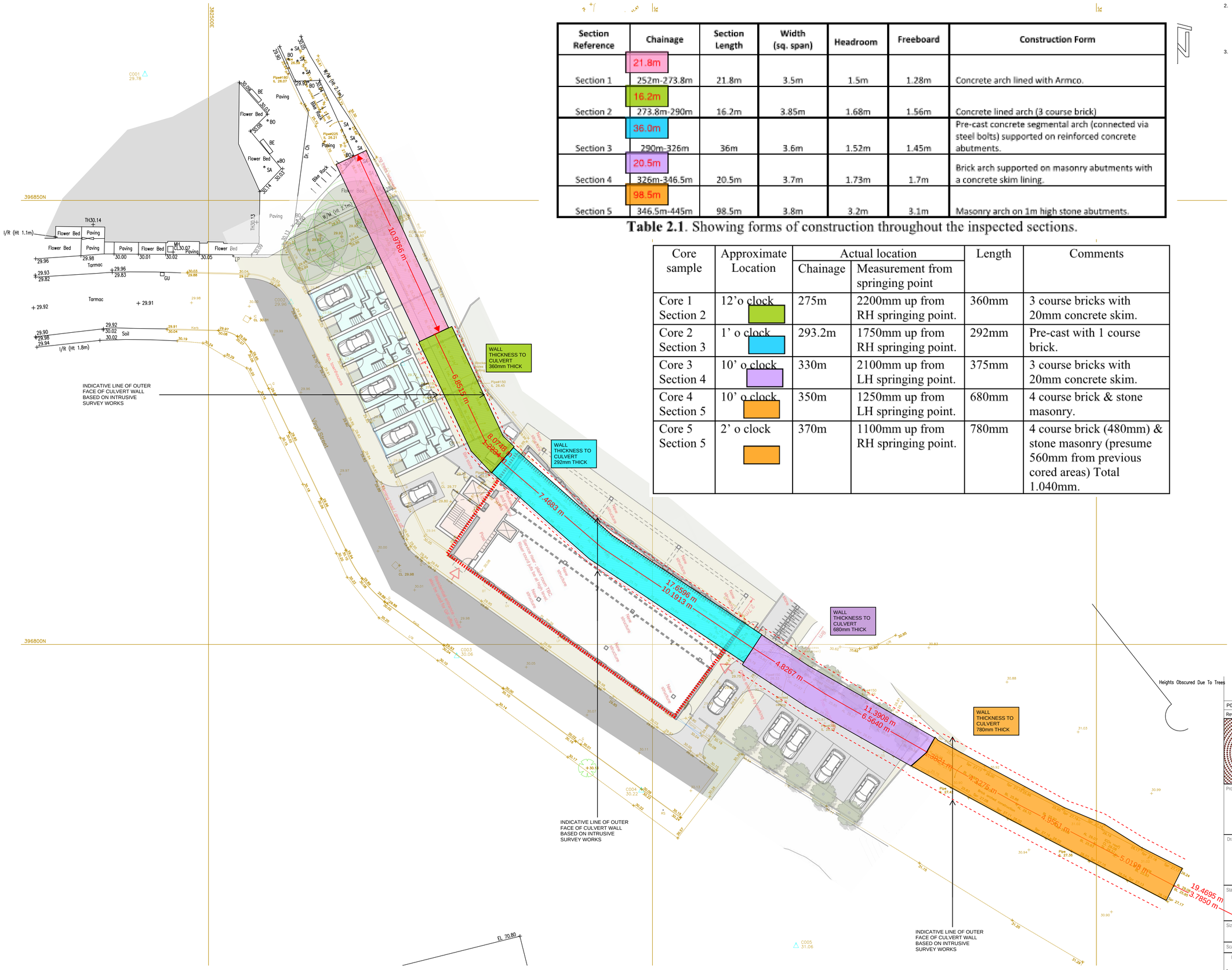
NOTES:

1. DO NOT SCALE OFF THIS DRAWING
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE CULVERT SURVEY REPORT UNDERTAKEN BY UP AND UNDER LIMITED, "*VISUAL CONDITION SURVEY & LINE AND LEVEL SURVEY MARCH 2018, PROJECT REF: UU6204/CBC/March 2018 - Issue 1*"
   AND
   THE SURVEY DRAWING UNDERTAKEN BY N D OLIVER & CO, DRG No 11635 / 001
3.

Section Reference	Chainage	Section Length	Width (sq. span)	Headroom	Freeboard	Construction Form
Section 1	21.8m 252m-273.8m	21.8m	3.5m	1.5m	1.28m	Concrete arch lined with Armco.
Section 2	16.2m 273.8m-290m	16.2m	3.85m	1.68m	1.56m	Concrete lined arch (3 course brick)
Section 3	36.0m 290m-326m	36m	3.6m	1.52m	1.45m	Pre-cast concrete segmental arch (connected via steel bolts) supported on reinforced concrete abutments.
Section 4	20.5m 326m-346.5m	20.5m	3.7m	1.73m	1.7m	Brick arch supported on masonry abutments with a concrete skim lining.
Section 5	98.5m 346.5m-445m	98.5m	3.8m	3.2m	3.1m	Masonry arch on 1m high stone abutments.

Table 2.1. Showing forms of construction throughout the inspected sections.

Core sample	Approximate Location	Actual location		Length	Comments
		Chainage	Measurement from springing point		
Core 1 Section 2	12'o clock	275m	2200mm up from RH springing point.	360mm	3 course bricks with 20mm concrete skim.
Core 2 Section 3	1' o clock	293.2m	1750mm up from RH springing point.	292mm	Pre-cast with 1 course brick.
Core 3 Section 4	10' o clock	330m	2100mm up from LH springing point.	375mm	3 course bricks with 20mm concrete skim.
Core 4 Section 5	10' o clock	350m	1250mm up from LH springing point.	680mm	4 course brick & stone masonry.
Core 5 Section 5	2' o clock	370m	1100mm up from RH springing point.	780mm	4 course brick (480mm) & stone masonry (presume 560mm from previous cored areas) Total 1.040mm.



Rev:	Description:	Date:	By:	Chkd:
P01	FOR INFORMATION	020422	HG	

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Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:

VIRGIL STREET TRAFFORD

Drawing Title:

SUMMARY OF CULVERT DETAILS

Status:

FOR INFORMATION

Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	APR 22	HG	HG	--

Scale:	Project No:
1:200	2202-01

Project: Originator: Volume: Level: Type: Role: Category/Number: Rev:

VST-REN-ZZ-XX-SK-S-01100 P01

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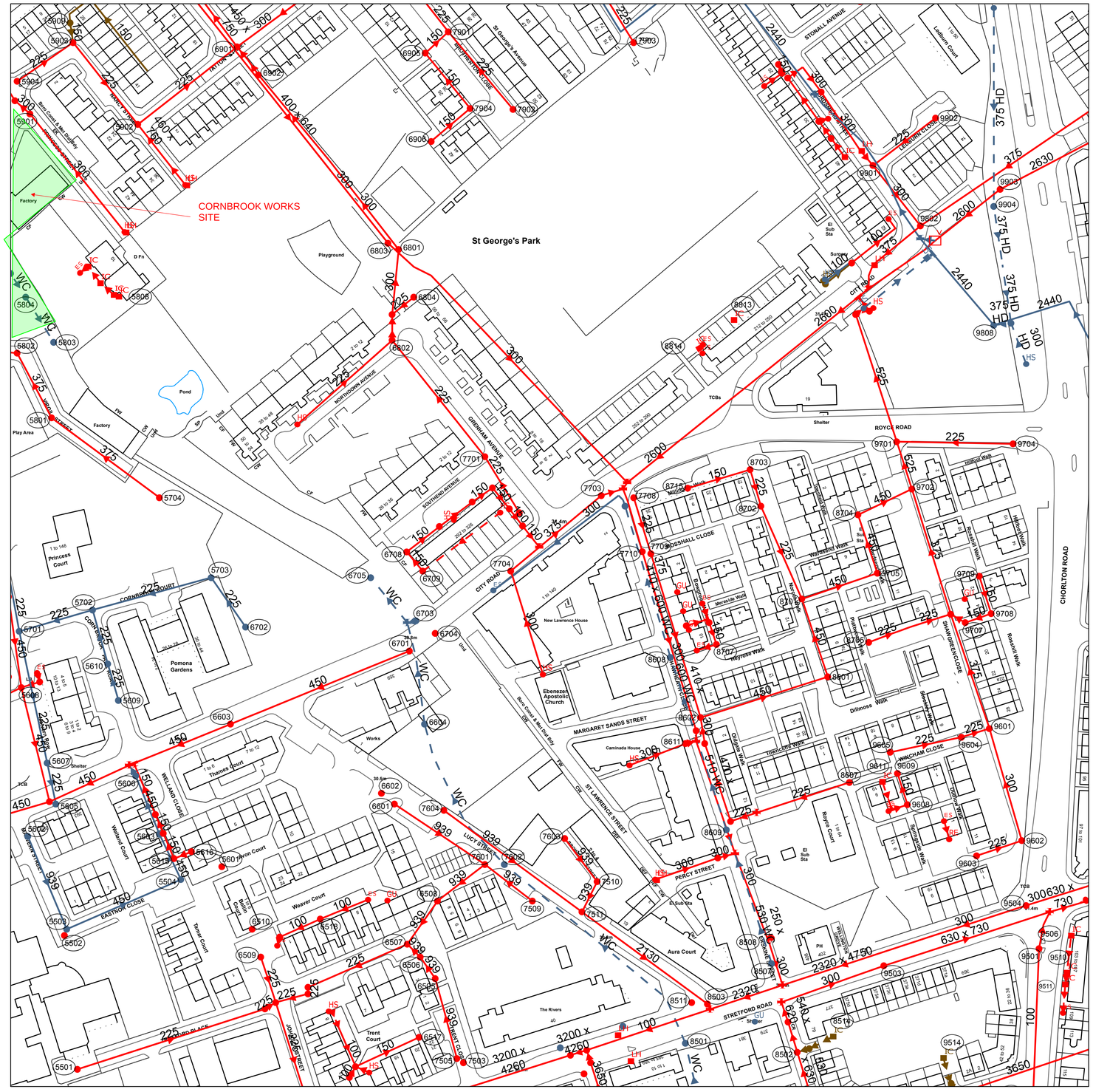
APPENDIX C
United Utilities Sewer Records


CORNBROOK WORKS SITE
St George's Park
Playground
Pond
Play Area
Princess Court
Pomona Gardens
New Lawrence House
Ebenezer Apostolic Church
Aura Court
The Rivers
Trent Court
Royal Court
Thames Court
Weaver Court
Mersey Court
Tyne Court
Welland Court
Iron Court
Bollin Court
Caminada House
Works
Factory
Shelter
TCBs
Sub Sta
Pump
Labburn Court
Ashton Court
Ashton Court Flats
Ashton Court Mews
Ashton Court Garages
Ashton Court Car Park
Ashton Court Bin Store
Ashton Court Cycle Store
Ashton Court Plant Room
Ashton Court Lobby
Ashton Court Lift
Ashton Court Stairs
Ashton Court Entrance
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Ashton Court Entrance Lobby Stairs Lift Lobby

APPENDIX D
Proposed Development Layouts

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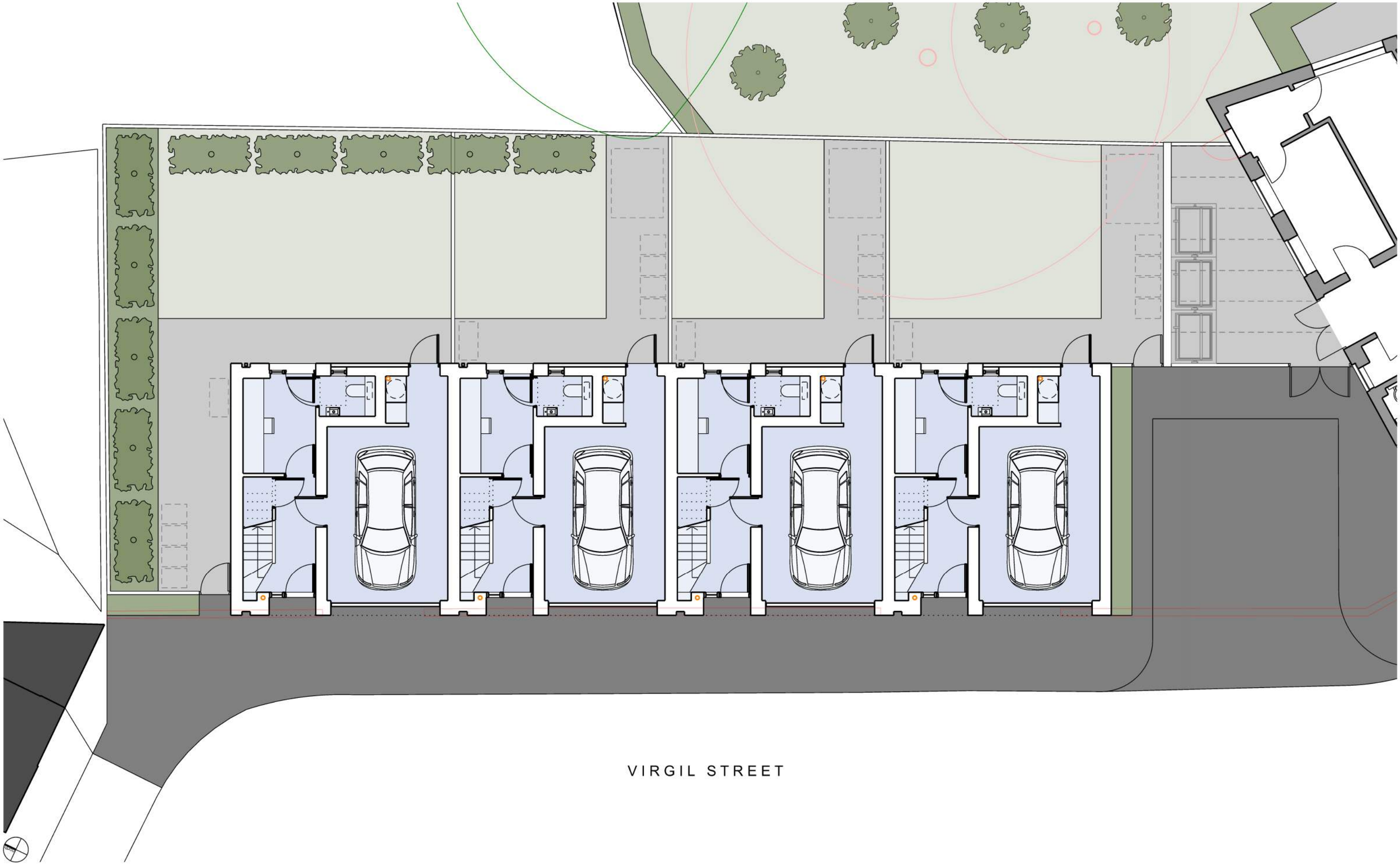
revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Planting bed introduced against fence to street in northwest corner.

0m 10m 20m 30m 40m

project
VIRGIL STREET
job number
0213
title
PROPOSED SITE PLAN
scale
1:400 @ A3
status
INFORMATION
drawing number
AL(05)105 P4



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revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Landscape adjustments

0m 5m 10m

project
VIRGIL STREET
job number
0213
title
PROPOSED GROUND FLOOR PLAN
scale
1:100 @ A3
issued for
INFORMATION
drawing number: issue:
AL(05)120 P4

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revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Landscape adjustments

0m 5m 10m

project
VIRGIL STREET
job number
0213
title
PROPOSED FIRST FLOOR PLAN
scale
1:100 @ A3
status
INFORMATION
drawing number: sheets
AL(05)121 P4

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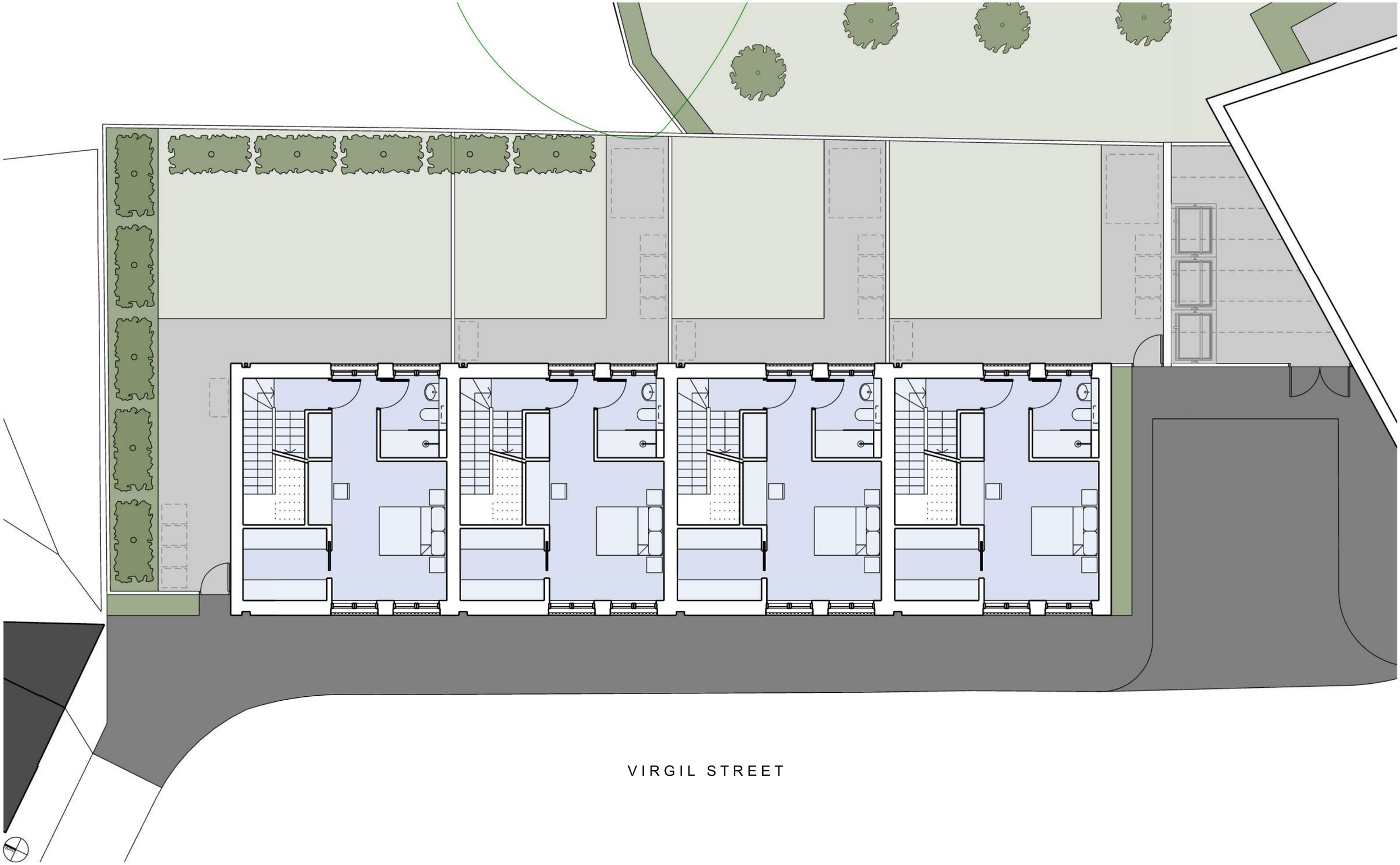
revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Landscape amendments

0m 5m 10m

project
VIRGIL STREET
job number
0213
title
PROPOSED SECOND FLOOR PLAN
scale
1:100 @ A3
issued for
INFORMATION
drawing number: issue:
AL(05)122 P4



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revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Landscape amendments

0m 5m 10m

project
VIRGIL STREET
job number
0213
title
PROPOSED THIRD FLOOR PLAN
scale
1:100 @ A3
issued for
INFORMATION
drawing number: issue:
AL(05)123 P4

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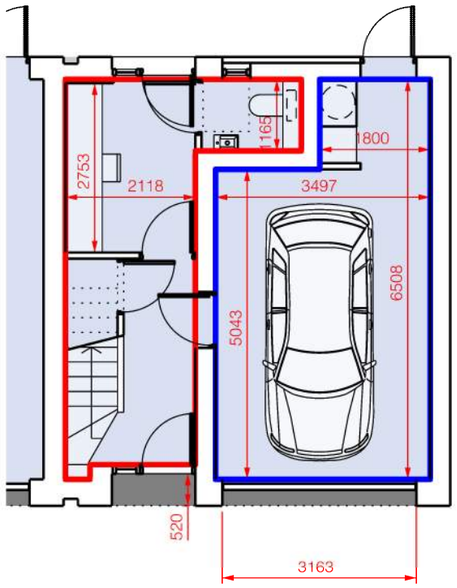
revisions + notes:

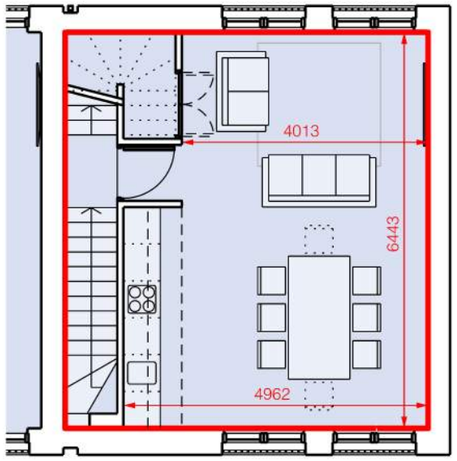
Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Ground level landscape adjustments

0m 5m 10m

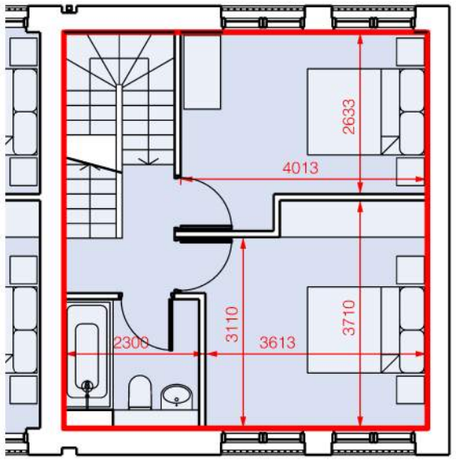
project
VIRGIL STREET
job number
0213
title
PROPOSED FOURTH FLOOR PLAN
scale
1:100 @ A3
issued for
INFORMATION
drawing number issue
AL(05)124 P4



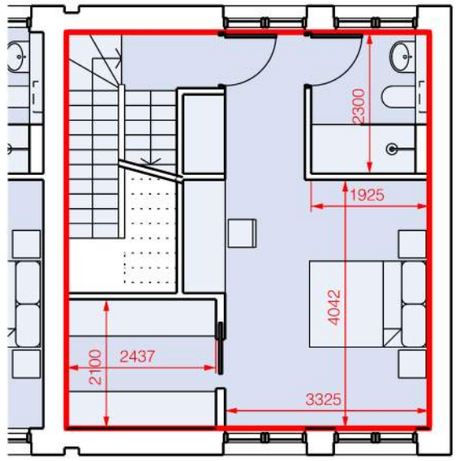
GROUND FLOOR PLAN



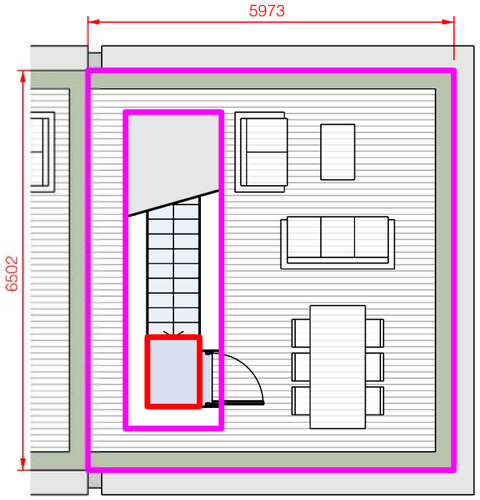
FIRST FLOOR PLAN



SECOND FLOOR PLAN



THIRD FLOOR PLAN



FOURTH FLOOR PLAN

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revisions + notes:

Rev P2 07.06.2023	Scale added
Rev P3 19.01.2024	Amended to terraced homes

0m 5m 10m

All 4no. townhouses are the same size.

FLOOR	AREA		
GROUND	15.4	20.3	(Garage + Utility)
FIRST	38.1		
SECOND	38.1		
THIRD	38.1		
FOURTH	1.0	30.8	(Terrace)
TOTAL	**130.6 m²** (NOT INCL GARAGE or TERRACE)		

The 4no. townhouses are LARGER than the relevant Nationally Described Space Standards.

NDSS for 3 bed / 3 storey dwellings;

4 person	90m²
5 person	99m²
6 person	108m²

project
VIRGIL STREET
job number
0213
title
PLAN SUMMARY
scale
1:100 @ A3
paper size
INFORMATION
drawing number
AL(05)126 P3
status

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revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Facade treatment amended. Soft landscape extended.

0m 5m 10m 15m 20m 25m

project
VIRGIL STREET
job number
0213
title
PROPOSED VIRGIL STREET CONTEXT ELEVATION
scale
1:250 @ A3
status
INFORMATION
drawing number revision
AL(05)130 P4

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Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Facade treatment amended. Soft landscape extended.

0m 5m 10m 15m 20m 25m

project
VIRGIL STREET
job number
0213
title
PROPOSED REAR ELEVATION
scale
1:250 @ A3
issued for
INFORMATION
drawing number issue
AL(05)131 P4

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revisions + notes:

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Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	15.02.2024	Materials and finishes amended

0m 5m 10m

1. Red textured brick
2. Powder coated aluminium window
3. Powder coated aluminium door
4. Powder coated aluminium garage door
5. Powder coated cladding
6. Powder coated planter
7. Timber lattice bin store roof
8. Timber fencing
9. Dog tooth brickwork spandrel
10. Louvers
11. Powder coated steel balustrade
12. Recessed brick courses
13. Air source heat pump

project
VIRGIL STREET
job number
0213
title
PROPOSED ELEVATIONS
scale
1:100 @ A3
status
INFORMATION
drawing number revision
AL(05)140 P4

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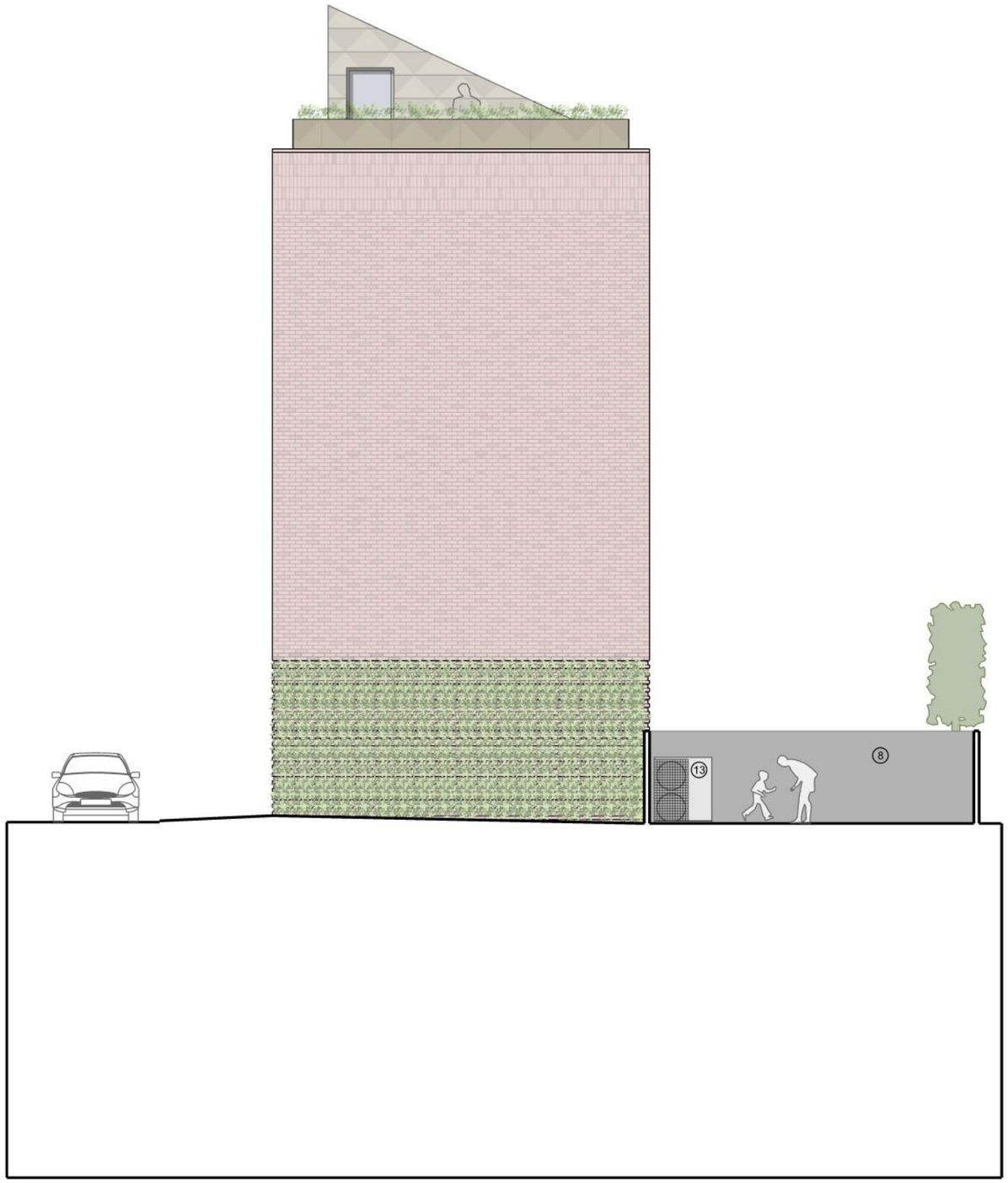
revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Materials and finishes amended

0m 5m 10m

1. Red textured brick
2. Powder coated aluminium window
3. Powder coated aluminium door
4. Powder coated aluminium garage door
5. Powder coated cladding
6. Powder coated planter
7. Timber lattice bin store roof
8. Timber fencing
9. Dog tooth brickwork spandrel
10. Louvers
11. Powder coated steel balustrade
12. Recessed brick courses
13. Air source heat pump

project
VIRGIL STREET
job number
0213
title
PROPOSED ELEVATIONS
scale
1:100 @ A3
status for
INFORMATION
drawing number status
AL(05)141 P4



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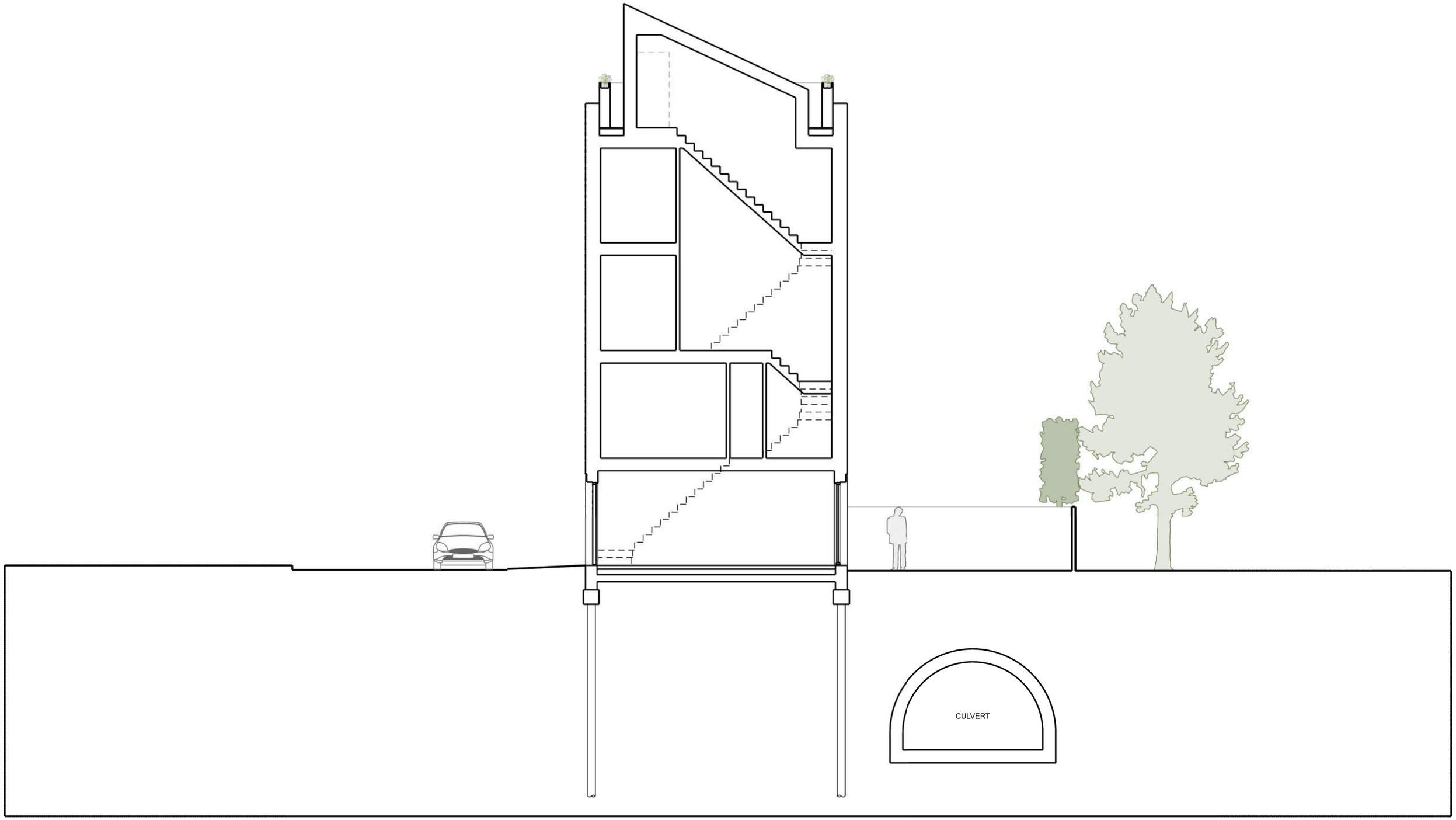
revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	19.01.2024	Amended to terraced homes
Rev P4	05.03.2024	Materials and finishes amended

0m 5m 10m

1. Red textured brick
2. Powder coated aluminium window
3. Powder coated aluminium door
4. Powder coated aluminium garage door
5. Powder coated cladding
6. Powder coated planter
7. Timber lattice bin store roof
8. Timber fencing
9. Dog tooth brickwork spandrel
10. Louvers
11. Powder coated steel balustrade
12. Recessed brick courses
13. Air source heat pump

project
VIRGIL STREET
job number
0213
title
PROPOSED SIDE ELEVATIONS
scale
1:100 @ A3
status
INFORMATION
drawing number issue
AL(05)142 P4



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revisions + notes:

Rev P1	28.03.2023	Planning application issue
Rev P2	07.06.2023	Scale added
Rev P3	05.03.2023	Section updated at roof level

0m 5m 10m

project
VIRGIL STREET
job number
0213
title
PROPOSED SECTION A-A
scale
1:100 @ A3
issued for
INFORMATION
drawing number: issue:
AL(05)150 P3

APPENDIX E
Existing Impermeable Areas Plan

NOTES:

1. THIS DRAWING IS INTENDED TO INDICATE THE EXISTING DRAINED AREAS FROM THE VIRGIL STREET SITE. IT IS BASED UPON A REVIEW OF THE TOPOGRAPHICAL SURVEY AND AERIAL IMAGES OF THE SITE.

   FOR TOPOGRAPHICAL SURVEY REFER TO13643-100_2DT

   EXISTING DISCHARGE RATES GIVEN HAVE BEEN CALCULATED USING MICRODRAINAGE. BROWNFIELD RUN-OFF RATES ARE BASED ON THE HARD PAVED AREAS.

KEY

- SITE BOUNDARY
  TOTAL AREA: 1780m² (0.178 ha)
- ZONE A BOUNDARY
- ZONE B BOUNDARY
- SOFT LANDSCAPING
  AREA = 770 m² (0.065 Ha)
- ZONE A POSITIVELY DRAINED HARD PAVING
  AREA = 510 m² (0.051 Ha)
- ZONE B POSITIVELY DRAINED HARD PAVING
  AREA = 65 m² (0.007 Ha)
- EXISTING BUILDING - DRAINAGE TO BE MAINTAINED. AREA NOT CONSIDERED IN CALCULATIONS

BROWNFIELD RUN-OFF RATES

	BROWNFIELD RUN-OFF		
EVENT	AREA A	AREA B	TOTAL
1:1	1.0 l/s	0.2 l/s	1.2 l/s
1:2	1.3 l/s	0.2 l/s	1.5 l/s
1:30	2.3 l/s	0.4 l/s	2.7 l/s
1:100	3.0 l/s	0.6 l/s	3.6 l/s

- BROWNFIELD RUN-OFF CALCULATED IN MICRODRAINAGE USING 2-PIPE MODEL
- POSITIVELY DRAINED AREA POST-DEVELOPMENT

GREENFIELD RUN-OFF RATES

	GREENFIELD RUN-OFF		
EVENT	AREA A	AREA B	TOTAL
1:1	0.6 l/s	0.1 l/s	0.7 l/s
1:2	0.7 l/s	0.1 l/s	0.8 l/s
1:30	1.0 l/s	0.1 l/s	1.1 l/s
1:100	1.1 l/s	0.2 l/s	1.3 l/s
Q_{bar}	0.7 l/s	0.1 l/s	0.8 l/s

- GREENFIELD RUN-OFF CALCULATED IN MICRODRAINAGE USING SOURCE CONTROL

Rev:	Description:	Date:	By:	Chkd:
P02	UPDATED PLANNING BOUNDARY	28.03.24	HW	HG
P01	DRAFT FOR COMMENT	01.02.23	HW	HG

renaissance

Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:

VIRGIL STREET, TRAFFORD

Drawing Title:

EXISTING DRAINED AREAS

Status:

STAGE 2

Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	FEB'23	HW	HW	HW

Scale:	1: 200	Project No:	2202-01

Project:	Originator:	Volume:	Level:	Type:	Role:	Category/Number:	Rev:
VST-REN-XX-XX-DR-C-00050-P02							

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APPENDIX F
Microdrainage Existing Runoff Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.361	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.036	4-8	0.015

Total Area Contributing (ha) = 0.051

Total Pipe Volume (m³) = 1.590

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	20.000	0.200	100.0	0.051	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	20.000	0.200	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.25	18.800	0.051	0.0	0.0	0.0	1.31	52.0	6.9
1.001	50.00	5.51	18.600	0.051	0.0	0.0	0.0	1.31	52.0	6.9

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.051	0.051	0.051
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.051	0.051	0.051

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.001		20.000	18.400	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.361		

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.359
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	400.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	360
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	1	+0%					18.826
1.001	2	360 Summer	1	+0%					18.626

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.199	0.000	0.03			1.4	OK	
1.001	2	-0.199	0.000	0.03			1.4	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.359
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	400.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	360
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	2	+0%					18.828
1.001	2	360 Summer	2	+0%					18.628

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.197	0.000	0.04			1.7	OK	
1.001	2	-0.197	0.000	0.04			1.7	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.359
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 360
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	30	+0%					18.838
1.001	2	360 Summer	30	+0%					18.638

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.187	0.000	0.07			3.2	OK	
1.001	2	-0.187	0.000	0.07			3.2	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.359
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 360
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	100	+0%					18.845
1.001	2	360 Summer	100	+0%					18.645

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.180	0.000	0.09			4.1	OK	
1.001	2	-0.180	0.000	0.09			4.1	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.361	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.005	4-8	0.002

Total Area Contributing (ha) = 0.007

Total Pipe Volume (m³) = 1.590

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	20.000	0.200	100.0	0.007	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	20.000	0.200	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.25	18.800	0.007	0.0	0.0	0.0	1.31	52.0	0.9
1.001	50.00	5.51	18.600	0.007	0.0	0.0	0.0	1.31	52.0	0.9

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.007	0.007	0.007
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.007	0.007	0.007

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.001		20.000	18.400	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Storm Duration (mins)	30
Ratio R	0.361		

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.359
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 360
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	1	+0%					18.804
1.001	2	360 Summer	1	+0%					18.604

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.221	0.000	0.00			0.2	OK	
1.001	2	-0.221	0.000	0.00			0.2	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.359
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 360
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	2	+0%					18.805
1.001	2	360 Summer	2	+0%					18.605

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.220	0.000	0.01			0.2	OK	
1.001	2	-0.220	0.000	0.01			0.2	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.359
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 360
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	30	+0%					18.810
1.001	2	360 Summer	30	+0%					18.610

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.215	0.000	0.01			0.4	OK	
1.001	2	-0.215	0.000	0.01			0.4	OK	

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 0
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.359
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 400.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 360
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	360 Summer	100	+0%					18.813
1.001	2	360 Summer	100	+0%					18.613

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.212	0.000	0.01			0.6	OK	
1.001	2	-0.212	0.000	0.01			0.6	OK	

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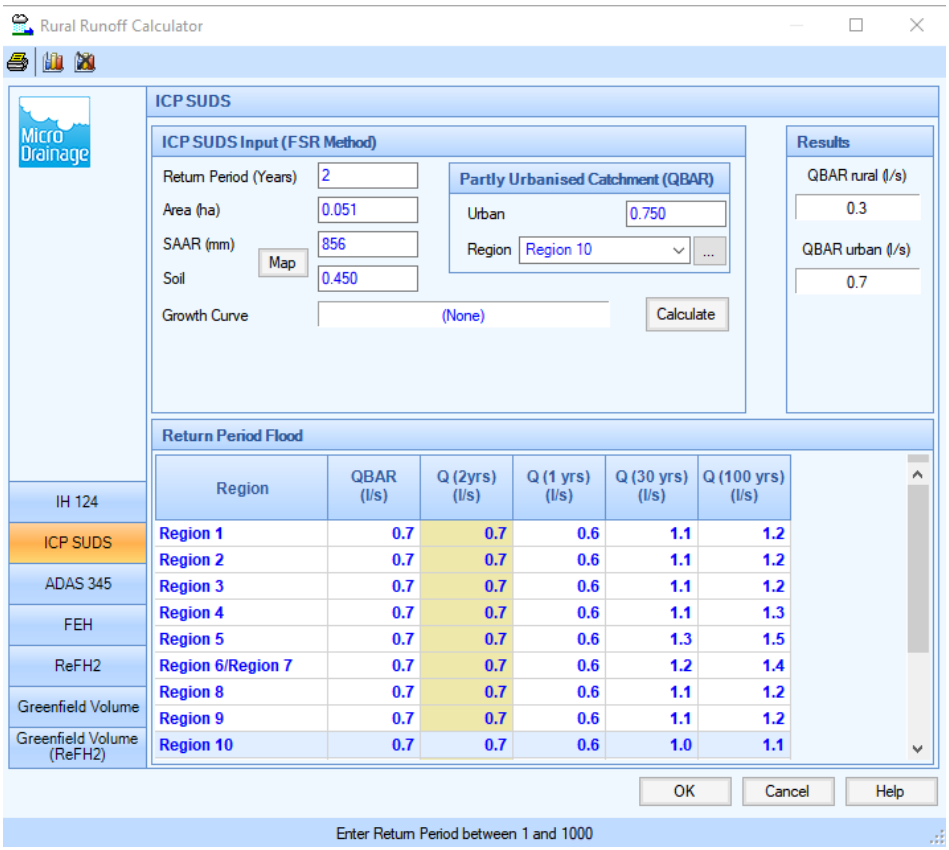
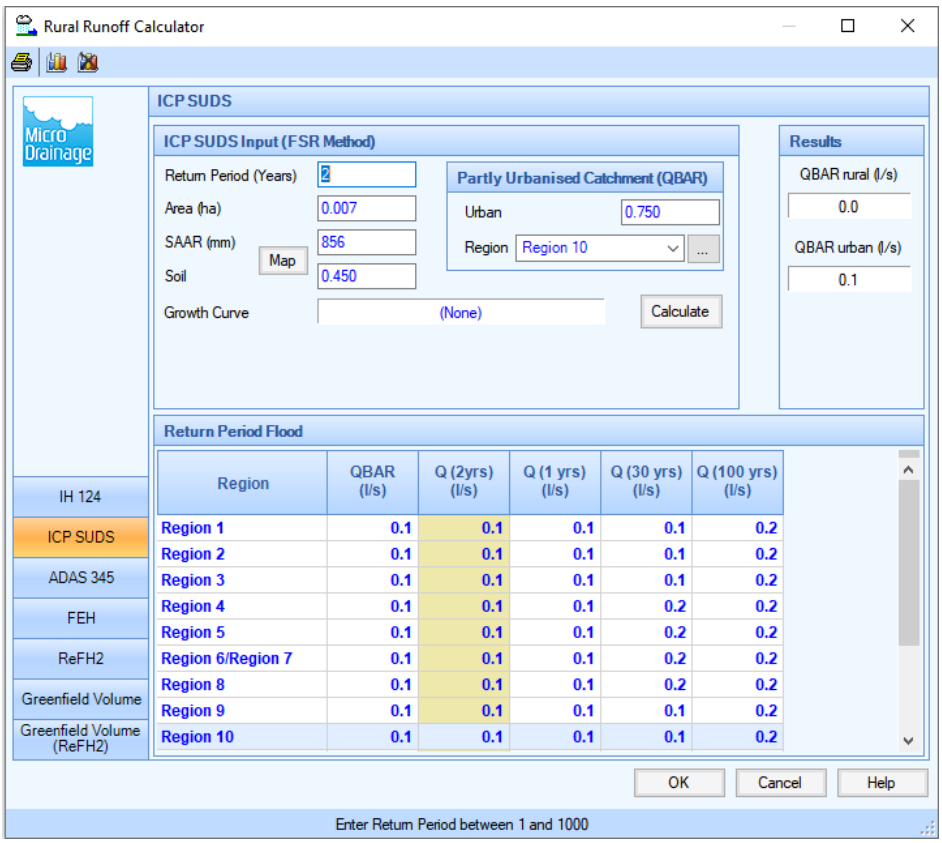
APPENDIX G
Microdrainage Greenfield Runoff Calculations

Zone A



Region	QBAR (l/s)	Q (2yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	0.7	0.7	0.6	1.1	1.2
Region 2	0.7	0.7	0.6	1.1	1.2
Region 3	0.7	0.7	0.6	1.1	1.2
Region 4	0.7	0.7	0.6	1.1	1.3
Region 5	0.7	0.7	0.6	1.3	1.5
Region 6/Region 7	0.7	0.7	0.6	1.2	1.4
Region 8	0.7	0.7	0.6	1.1	1.2
Region 9	0.7	0.7	0.6	1.1	1.2
Region 10	0.7	0.7	0.6	1.0	1.1

Zone B

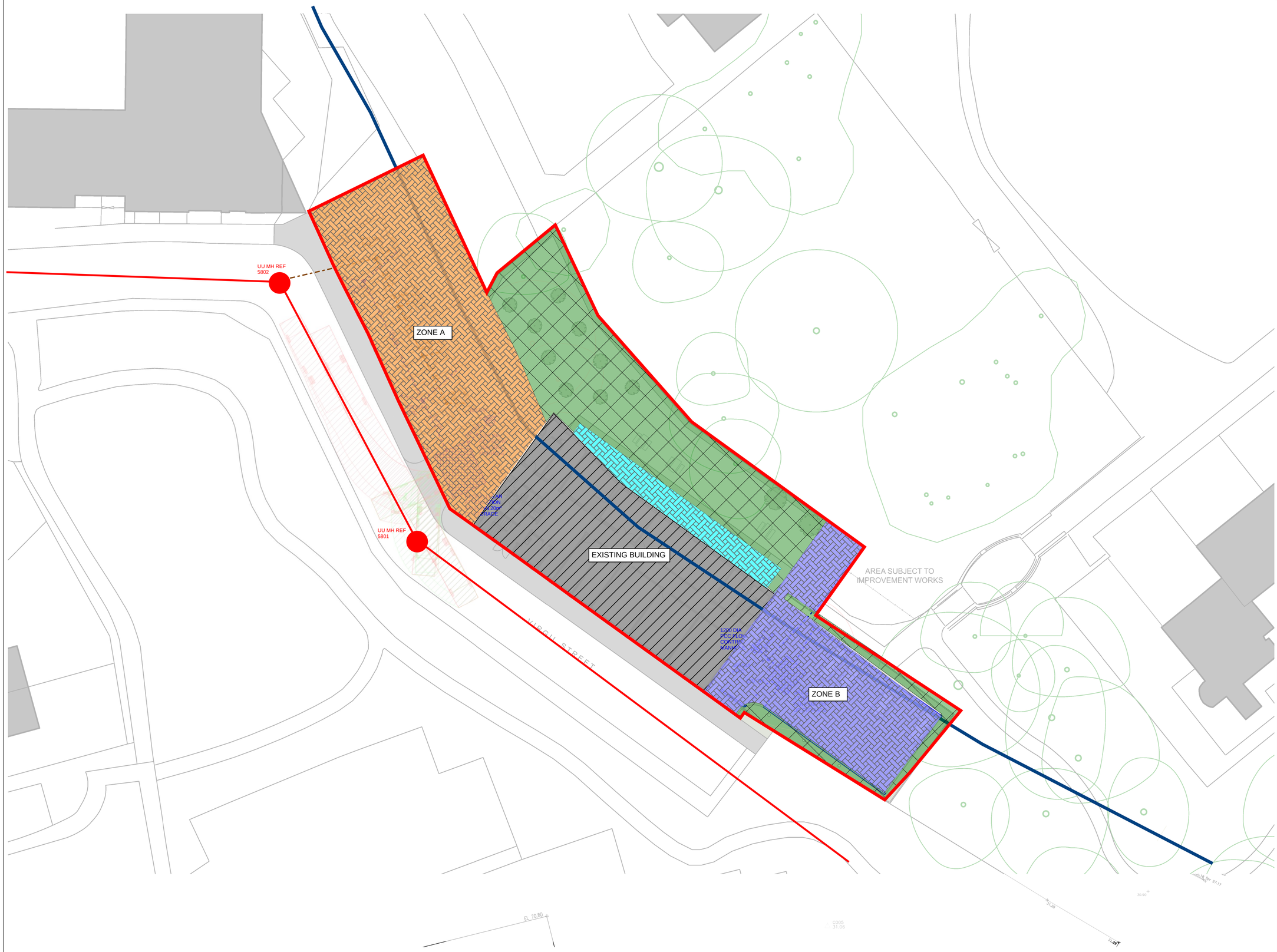


Region	QBAR (l/s)	Q (2yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	0.1	0.1	0.1	0.1	0.2
Region 2	0.1	0.1	0.1	0.1	0.2
Region 3	0.1	0.1	0.1	0.1	0.2
Region 4	0.1	0.1	0.1	0.2	0.2
Region 5	0.1	0.1	0.1	0.2	0.2
Region 6/Region 7	0.1	0.1	0.1	0.2	0.2
Region 8	0.1	0.1	0.1	0.2	0.2
Region 9	0.1	0.1	0.1	0.1	0.2
Region 10	0.1	0.1	0.1	0.1	0.2

APPENDIX H
Proposed Drained Areas Plan

NOTES:

1. THIS DRAWING IS INTENDED TO INDICATE THE PROPOSED DRAINED AREAS FROM THE VIRGIL STREET SITE AND BELOW GROUND DRAINAGE DRAWING. IT IS BASED UPON A REVIEW OF THE PROPOSED LANDSCAPING PLAN
2. FOR TOPOGRAPHICAL SURVEY REFER TO13643-100_2DT
3. EXISTING DISCHARGE RATES GIVEN HAVE BEEN CALCULATED USING MICRODRAINAGE. BROWNFIELD RUN-OFF RATES ARE BASED ON THE HARD PAVED AREAS.



KEY

- SITE BOUNDARY
  TOTAL AREA: 1780m² (0.178 ha)
- ZONE A PROPOSED IMPERMEABLE AREA
  AREA = 510 m² (0.051 Ha)
- ZONE B PROPOSED IMPERMEABLE AREA
  AREA = 300 m² (0.030 Ha)
- IMPERMEABLE AREA DRAINING TO SOFT LANDSCAPING
  AREA = 70 m² (0.007 Ha)
- SOFT LANDSCAPING
  AREA = 465 m² (0.047 Ha)
- EXISTING BUILDING - DRAINAGE TO BE MAINTAINED. AREA NOT CONSIDERED IN CALCULATIONS

Rev:	Description:	Date:	By:	Chkd:
P02	REVISED INLINE WITH LATEST PROPOSALS	28.03.24	HW	HG
P01	DRAFT FOR COMMENT	01.02.23	HW	HG

renaissance

Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:

VIRGIL STREET, TRAFFORD

Drawing Title:

PROPOSED DRAINED AREAS

Status:

STAGE 2

Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	FEB'23	HW	HW	HG

Scale:	Project No:
1: 200	2202-01

Project:	Originator:	Volume:	Level:	Type:	Role:	Category/Number:	Rev:

VST-REN-XX-XX-DR-C-00060-P02

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APPENDIX I
Microdrainage Quick Storage Estimates

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 76 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	28.743	0.543	0.0	2.0	2.0	10.3	O K
30 min Summer	28.888	0.688	0.0	2.0	2.0	13.1	O K
60 min Summer	28.977	0.777	0.0	2.0	2.0	14.8	O K
120 min Summer	28.988	0.788	0.0	2.0	2.0	15.0	O K
180 min Summer	28.961	0.761	0.0	2.0	2.0	14.5	O K
240 min Summer	28.923	0.723	0.0	2.0	2.0	13.7	O K
360 min Summer	28.832	0.632	0.0	2.0	2.0	12.0	O K
480 min Summer	28.724	0.524	0.0	2.0	2.0	10.0	O K
600 min Summer	28.627	0.427	0.0	2.0	2.0	8.1	O K
720 min Summer	28.548	0.348	0.0	2.0	2.0	6.6	O K
960 min Summer	28.435	0.235	0.0	2.0	2.0	4.5	O K
1440 min Summer	28.326	0.126	0.0	1.8	1.8	2.4	O K
2160 min Summer	28.281	0.081	0.0	1.5	1.5	1.5	O K
2880 min Summer	28.264	0.064	0.0	1.2	1.2	1.2	O K
4320 min Summer	28.249	0.049	0.0	0.9	0.9	0.9	O K
5760 min Summer	28.242	0.042	0.0	0.7	0.7	0.8	O K
7200 min Summer	28.238	0.038	0.0	0.6	0.6	0.7	O K
8640 min Summer	28.235	0.035	0.0	0.5	0.5	0.7	O K
10080 min Summer	28.233	0.033	0.0	0.5	0.5	0.6	O K
15 min Winter	28.818	0.618	0.0	2.0	2.0	11.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	122.849	0.0	11.7	18
30 min Summer	82.249	0.0	15.7	32
60 min Summer	52.627	0.0	20.1	60
120 min Summer	32.592	0.0	24.9	92
180 min Summer	24.304	0.0	27.9	126
240 min Summer	19.616	0.0	30.0	162
360 min Summer	14.378	0.0	33.0	232
480 min Summer	11.541	0.0	35.3	296
600 min Summer	9.724	0.0	37.2	354
720 min Summer	8.449	0.0	38.8	412
960 min Summer	6.764	0.0	41.4	522
1440 min Summer	4.934	0.0	45.3	750
2160 min Summer	3.592	0.0	49.5	1100
2880 min Summer	2.864	0.0	52.6	1468
4320 min Summer	2.078	0.0	57.2	2180
5760 min Summer	1.653	0.0	60.7	2936
7200 min Summer	1.383	0.0	63.5	3592
8640 min Summer	1.196	0.0	65.8	4272
10080 min Summer	1.056	0.0	67.9	5096
15 min Winter	122.849	0.0	13.1	18

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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	28.983	0.783	0.0	2.0	2.0	14.9	O K
60 min Winter	29.095	0.895	0.0	2.0	2.0	17.0	O K
120 min Winter	29.108	0.908	0.0	2.0	2.0	17.3	O K
180 min Winter	29.069	0.869	0.0	2.0	2.0	16.5	O K
240 min Winter	29.009	0.809	0.0	2.0	2.0	15.4	O K
360 min Winter	28.870	0.670	0.0	2.0	2.0	12.7	O K
480 min Winter	28.697	0.497	0.0	2.0	2.0	9.4	O K
600 min Winter	28.554	0.354	0.0	2.0	2.0	6.7	O K
720 min Winter	28.453	0.253	0.0	2.0	2.0	4.8	O K
960 min Winter	28.341	0.141	0.0	1.9	1.9	2.7	O K
1440 min Winter	28.281	0.081	0.0	1.5	1.5	1.5	O K
2160 min Winter	28.259	0.059	0.0	1.1	1.1	1.1	O K
2880 min Winter	28.249	0.049	0.0	0.9	0.9	0.9	O K
4320 min Winter	28.240	0.040	0.0	0.6	0.6	0.8	O K
5760 min Winter	28.235	0.035	0.0	0.5	0.5	0.7	O K
7200 min Winter	28.232	0.032	0.0	0.4	0.4	0.6	O K
8640 min Winter	28.229	0.029	0.0	0.4	0.4	0.6	O K
10080 min Winter	28.227	0.027	0.0	0.3	0.3	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	82.249	0.0	17.6	31
60 min Winter	52.627	0.0	22.5	60
120 min Winter	32.592	0.0	27.9	98
180 min Winter	24.304	0.0	31.2	136
240 min Winter	19.616	0.0	33.6	174
360 min Winter	14.378	0.0	36.9	252
480 min Winter	11.541	0.0	39.5	316
600 min Winter	9.724	0.0	41.7	370
720 min Winter	8.449	0.0	43.4	422
960 min Winter	6.764	0.0	46.4	522
1440 min Winter	4.934	0.0	50.7	738
2160 min Winter	3.592	0.0	55.4	1092
2880 min Winter	2.864	0.0	58.9	1460
4320 min Winter	2.078	0.0	64.1	2204
5760 min Winter	1.653	0.0	68.0	2856
7200 min Winter	1.383	0.0	71.1	3600
8640 min Winter	1.196	0.0	73.7	4320
10080 min Winter	1.056	0.0	76.0	4984

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.051

Time (mins) From:	To:	Area (ha)
0	4	0.051

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Model Details

Storage is Online Cover Level (m) 29.800

Cellular Storage Structure

Invert Level (m) 28.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	20.0	0.0	1.001	0.0	0.0
1.000	20.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCL-0064-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise blockage risk
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	28.200
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.259	2.0
Kick-Flo®	0.569	1.6
Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.7	1.200	2.2	3.000	3.3	7.000	4.9
0.200	2.0	1.400	2.3	3.500	3.5	7.500	5.0
0.300	2.0	1.600	2.5	4.000	3.8	8.000	5.2
0.400	1.9	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.8	2.000	2.7	5.000	4.2	9.000	5.5
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.6
0.800	1.8	2.400	3.0	6.000	4.5		
1.000	2.0	2.600	3.1	6.500	4.7		

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Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 36 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	28.895	0.695	0.0	2.0	2.0	5.3	O K
30 min Summer	29.018	0.818	0.0	2.0	2.0	6.2	O K
60 min Summer	29.055	0.855	0.0	2.0	2.0	6.5	O K
120 min Summer	29.003	0.803	0.0	2.0	2.0	6.1	O K
180 min Summer	28.916	0.716	0.0	2.0	2.0	5.4	O K
240 min Summer	28.815	0.615	0.0	2.0	2.0	4.7	O K
360 min Summer	28.580	0.380	0.0	2.0	2.0	2.9	O K
480 min Summer	28.445	0.245	0.0	2.0	2.0	1.9	O K
600 min Summer	28.368	0.168	0.0	1.9	1.9	1.3	O K
720 min Summer	28.324	0.124	0.0	1.8	1.8	0.9	O K
960 min Summer	28.288	0.088	0.0	1.6	1.6	0.7	O K
1440 min Summer	28.263	0.063	0.0	1.2	1.2	0.5	O K
2160 min Summer	28.249	0.049	0.0	0.9	0.9	0.4	O K
2880 min Summer	28.242	0.042	0.0	0.7	0.7	0.3	O K
4320 min Summer	28.235	0.035	0.0	0.5	0.5	0.3	O K
5760 min Summer	28.230	0.030	0.0	0.4	0.4	0.2	O K
7200 min Summer	28.228	0.028	0.0	0.3	0.3	0.2	O K
8640 min Summer	28.225	0.025	0.0	0.3	0.3	0.2	O K
10080 min Summer	28.224	0.024	0.0	0.3	0.3	0.2	O K
15 min Winter	28.994	0.794	0.0	2.0	2.0	6.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	122.849	0.0	6.7	17
30 min Summer	82.249	0.0	8.9	29
60 min Summer	52.627	0.0	11.4	46
120 min Summer	32.592	0.0	14.2	80
180 min Summer	24.304	0.0	15.9	116
240 min Summer	19.616	0.0	17.1	150
360 min Summer	14.378	0.0	18.8	206
480 min Summer	11.541	0.0	20.1	262
600 min Summer	9.724	0.0	21.1	316
720 min Summer	8.449	0.0	22.0	374
960 min Summer	6.764	0.0	23.5	490
1440 min Summer	4.934	0.0	25.8	734
2160 min Summer	3.592	0.0	28.1	1076
2880 min Summer	2.864	0.0	29.9	1436
4320 min Summer	2.078	0.0	32.5	2172
5760 min Summer	1.653	0.0	34.5	2840
7200 min Summer	1.383	0.0	36.1	3672
8640 min Summer	1.196	0.0	37.4	4400
10080 min Summer	1.056	0.0	38.6	5120
15 min Winter	122.849	0.0	7.5	17

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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	29.147	0.947	0.0	2.0	2.0	7.2	O K
60 min Winter	29.185	0.985	0.0	2.0	2.0	7.5	O K
120 min Winter	29.091	0.891	0.0	2.0	2.0	6.8	O K
180 min Winter	28.950	0.750	0.0	2.0	2.0	5.7	O K
240 min Winter	28.778	0.578	0.0	2.0	2.0	4.4	O K
360 min Winter	28.455	0.255	0.0	2.0	2.0	1.9	O K
480 min Winter	28.334	0.134	0.0	1.9	1.9	1.0	O K
600 min Winter	28.293	0.093	0.0	1.6	1.6	0.7	O K
720 min Winter	28.279	0.079	0.0	1.4	1.4	0.6	O K
960 min Winter	28.262	0.062	0.0	1.2	1.2	0.5	O K
1440 min Winter	28.249	0.049	0.0	0.9	0.9	0.4	O K
2160 min Winter	28.240	0.040	0.0	0.6	0.6	0.3	O K
2880 min Winter	28.235	0.035	0.0	0.5	0.5	0.3	O K
4320 min Winter	28.229	0.029	0.0	0.4	0.4	0.2	O K
5760 min Winter	28.225	0.025	0.0	0.3	0.3	0.2	O K
7200 min Winter	28.223	0.023	0.0	0.2	0.2	0.2	O K
8640 min Winter	28.221	0.021	0.0	0.2	0.2	0.2	O K
10080 min Winter	28.220	0.020	0.0	0.2	0.2	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	82.249	0.0	10.0	30
60 min Winter	52.627	0.0	12.8	48
120 min Winter	32.592	0.0	15.9	88
180 min Winter	24.304	0.0	17.8	124
240 min Winter	19.616	0.0	19.1	162
360 min Winter	14.378	0.0	21.0	210
480 min Winter	11.541	0.0	22.5	260
600 min Winter	9.724	0.0	23.7	308
720 min Winter	8.449	0.0	24.7	368
960 min Winter	6.764	0.0	26.4	490
1440 min Winter	4.934	0.0	28.8	728
2160 min Winter	3.592	0.0	31.5	1084
2880 min Winter	2.864	0.0	33.5	1432
4320 min Winter	2.078	0.0	36.4	2144
5760 min Winter	1.653	0.0	38.7	2832
7200 min Winter	1.383	0.0	40.4	3648
8640 min Winter	1.196	0.0	41.9	4376
10080 min Winter	1.056	0.0	43.2	5032

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.360	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.029

Time (mins) From:	To:	Area (ha)
0	4	0.029

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Model Details

Storage is Online Cover Level (m) 29.800

Cellular Storage Structure

Invert Level (m) 28.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	8.0	0.0	1.001	0.0	0.0
1.000	8.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SCL-0064-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise blockage risk
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	28.200
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0
Flush-Flo™	0.259	2.0
Kick-Flo®	0.569	1.6
Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.7	1.200	2.2	3.000	3.3	7.000	4.9
0.200	2.0	1.400	2.3	3.500	3.5	7.500	5.0
0.300	2.0	1.600	2.5	4.000	3.8	8.000	5.2
0.400	1.9	1.800	2.6	4.500	4.0	8.500	5.4
0.500	1.8	2.000	2.7	5.000	4.2	9.000	5.5
0.600	1.6	2.200	2.9	5.500	4.4	9.500	5.6
0.800	1.8	2.400	3.0	6.000	4.5		
1.000	2.0	2.600	3.1	6.500	4.7		

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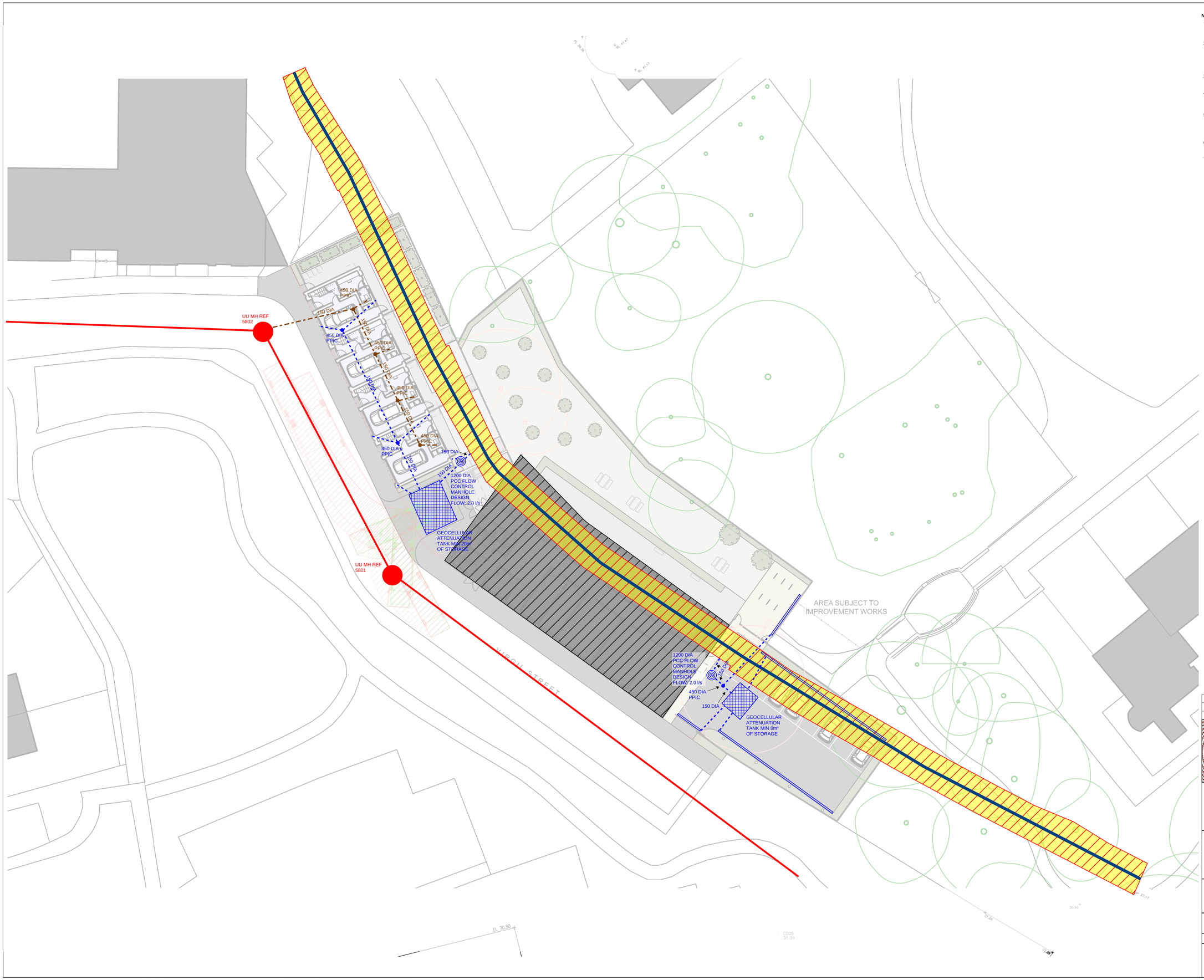
APPENDIX J
Proposed Below Ground Drainage Layout



NOTES:

1. THIS DRAWING INDICATES THE PROPOSED DESIGN APPROPRIATE FOR RIBA STAGE 2 AND IS SUBJECT TO DESIGN DEVELOPMENT AS THE SCHEME PROGRESSES AND FURTHER ANALYSIS IS UNDERTAKEN.
2. ALL BELOW GROUND DRAINAGE WORKS TO BE IN ACCORDANCE WITH RELEVANT BUILDING REGULATIONS AND SEWER SECTOR GUIDANCE APPENDIX C- DESIGN AND CONSTRUCTION GUIDANCE. IF DISCREPANCIES ARE NOTED BETWEEN SSG AND DRAWINGS THESE SHOULD BE BROUGHT TO THE ATTENTION OF RENAISSANCE FOR REVIEW.
3. RWPs, SVPs, SSs AND FLOOR GULLEYS TO BE TRAPPED AND HAVE RODDABLE ACCESS
4. THE CHAMBER SIZE OF MANHOLES WITH MORE THAN ONE CONNECTION IN THEM MAY NEED TO BE INCREASED AN INCREMENT TO ACCOMMODATE THE CONNECTIONS AND BENDS.
5. MINIMUM COVER TO DRAINAGE CROWN LEVEL:
   LANDSCAPED AREAS- 0.35m
   TRAFFICKED AREAS- 0.90m
   ADOPTED HIGHWAYS- 1.20m
6. ALLOW FOR HIGHWAYS GULLIES, CHANNEL DRAINS AND BRANCH DRAINS [OMITTED FOR CLARITY]
7. OUTLINE DRAINAGE STRATEGY AND PROPOSED DISCHARGE RATE IS TO BE DISCUSSED AND AGREED WITH THE LEAD LOCAL FLOOD AUTHORITY AND UNITED UTILITIES AS PART OF A PLANNING PRE-APPLICATION AND PRE-DEVELOPMENT ENQUIRY RESPECTIVELY.

DRAWING LEGEND

- SITE BOUNDARY
- PROPOSED SURFACE WATER DRAINAGE (150 DIA PIPES AND 450 DIA PPIC UNO)
- PROPOSED FOUL WATER DRAINAGE (150 DIA PIPES AND 450 DIA PPIC UNO)
- UNITED UTLITIES COMBINED SEWER
- 1200 DIA PCC MANHOLE W/ HYDROBRAKE FLOW CONTROL DEVICE
- CHANNEL DRAIN
- GEO-CELLULAR ATTENUATION TANK
- APPROXIMATE EXTENT OF CORNBROOK CULVERT BELOW. REFER TO CULVERT SURVEY SUMMARY (REF: VST-REN-ZZ-XX-SK-S-01100)

Rev:	Description:	Date:	By:	Chkd:
P02	REVISED INLINE WITH AMENDED PROPOSALS	28.03.24	HW	AI
P01	FOR INFORMATION	01.02.23	HW	HG

renaissance

Renaissance Associates Ltd
Carvers Warehouse
77 Dale Street
Manchester
M1 2HG

Project:

VIRGIL STREET, TRAFFORD

Drawing Title:

DRAINAGE STRATEGY

Status:

STAGE 2

Size:	Date:	Drawn by:	Designed by:	Checked by:
A1	FEB'23	HW	--	HG

Scale:	Project No:
1: 200	2202-01

Project:	Originator:	Volume:	Level:	Type:	Role:	Category/Number:	Rev:
VST-REN-XX-00-DR-C-01100-P02							

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