



**21 Huyton Church Road, Huyton with
Roby, Liverpool L36 5SH**

**SUDS strategy is based on United Utilities not allowing
SUDS storage with a connection to combined sewer
Combined sewer is the only option at this location**

October 2021

SUDS for Planning

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EnviroSolution offers a broad set of services that allow the land or property owner or manager to access a suite of services that are not normally available from a single, high quality and professional source.

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 a SUDS Drainage Strategy for planning carried out by Envirosolution Ltd for 21 Huyton Church Road, Huyton with Roby, Liverpool L36 5SH, henceforth referred to as “the site” in this report.

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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
- Knowsley Metropolitan Borough Council: policies, mapping and guidance
- Knowsley Metropolitan Borough Council Preliminary Flood Risk Assessment
- Knowsley Metropolitan Borough 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 0.24ha and comprises an existing commercial building with impermeable car parking area, hard and soft landscaping and access areas. The site location is indicated in red on the site location plan included within Appendix A.

The site is in a predominantly residential area.

3.2 Geology

Geology

Based on BGS mapping and boreholes (and known conditions of the majority of Hounslow area):

- Bedrock: Pennine Middle Coal Measures Formation - Mudstone, Siltstone And Sandstone
- Superficial deposits: Till, Devensian - Clay, Sandy, Gravelly, Cobbly.

The Coal Measures and Till are not in general suitable strata for use as shallow or deep soakaways due to their physical and chemical properties; pathways for contamination need to be avoided. Given the geology and proximity to other properties, the SUDS strategy necessarily needs to be storage on site with restricted discharge to sewer.

No infiltration testing is required at this stage and it is an appropriate risk management strategy to design the SUDS as if infiltration were not feasible in order to oversize the SUDS storage. It is considered that given the geology and site setting / constraints and requirements of the statutory consultees, there is no need to undertake BRE365 testing

because a soakaway is not an option.

3.3 Existing Drainage

Public sewer records have not been sourced however the site is an operating commercial building with connections to the sewers.

There are also manholes on the existing site

The invert levels for the manholes on site are understood to be c. 1.45m below ground level (bgl) and 1.1m bgl.

The lower ground structures proposed indicate that some form of pumping / sump will be required.

There is no evidence of any existing SUDS.

The site currently discharges 100% without attenuation to the sewer.

An assessment of the Greenfield equivalent discharge for the site has been carried out. This has confirmed an average discharge rate (QBAR) of a nominal less than 0.29 l/s. This low rate is due to the relatively small nature of the site. A copy of the calculation output is included in Appendix C.

4.0 Assessment of Proposed Development

4.1 Proposed Development

The proposed development is (Appendix B) comprises:

- Erect new residential scheme with lower ground floors
 - Maximisation of porous and permeable areas as amenity / parking
 - Maximisation of highest forms of SUDS
- **Reduces flood risk overall and meets LLFA SUDS requirements**
- **SUDS to be of the highest in the hierarchy**
- **Noting constraints of front RPZ's and the lower ground structures**
 - Restricting discharge on a previously unattenuated site
 - New SUDS to meet 2021 requirements
 - **SUDS also constrained due to United Utilities not allowing SUDS storage with a connection to a combined sewer**

4.2 Foul Drainage

Based on proposed residential development the maximum peak foul discharge generated represents a minimal increase which unlikely to give rise to any capacity concerns within the public sewer network.

Subject to the approval of United Utilities, it is proposed to connect the foul discharge to the public foul sewer via the existing connection, subject to condition and level.

Subject to exact confirmation of the public sewer invert level and the proposed finished development levels, it is expected that a gravity connection will be feasible.

4.3 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.

Intrusive ground investigation works have not been carried out on site at this stage, however, the likely strata as per the British Geological Survey (BGS) mapping suggests the strata would not be suitable for the use of infiltration SUDS techniques.

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. surface storage, with also permeable paving and underground storage.

It is proposed to provide an attenuation based surface water strategy to serve run-off from the proposed roof area; no restriction device is required given the extreme runoff rate is lower than the lowest suitable restriction rate.

The restriction is provided by the oversized storage.

4.4 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.

- The scheme significantly reduces impermeable areas (by c. 40%)
- Therefore it is considered appropriate to use:
 - 100% of impermeable areas (existing and proposed) in the calculations
 - 900m²
- This is still oversizing
- Design event for storage - 100 year (with climate change; see below)
- Climate change allowance - 40%
- Use 3 l/s purely for the sizing of the storage
 - No formal restriction device is required because the largest possible discharge from the site is a lower rate than the lowest rate of restriction device feasible
- The storage calculation output is included within Appendix C.
 - Storage required: 33.0m³

4.5 SUDS Specifications: SUDS Hierarchy Compliant

Formal SUDS Type	Source Control	Dimensions	Storage Volume
Porous amenity areas	Yes	n/a	n/a
Permeable Paving	YES	n/a	n/a
Rain Garden Planted Areas Splayed end to the rainwater downpipes with diverter Capture low order storms only: with overflow to continue via rainwater downpipe to manhole If direct connection to combined sewer, UU will not allow	YES	29.0 m length in total 0.4m width Use 0.35m height of void storage = 4.06m ³	4.06m ³
Permeable Parking / Turning area with lined granular underground storage Capture low order storms only: with overflow to continue via rainwater downpipe to manhole If direct connection to combined sewer, UU will not allow, hence change to capture low order storms only: with overflow to continue via rainwater downpipe to manhole	YES Permeable paving takes roof runoff	Total area of 355.25m ² Use 0.30m depth of lined granular storage in addition to any make-up for the permeable paving = 106.58m ³ of storage Assume a 30% void for the granular angular storage = 31.97m ³ Refer to Appendix D for location of these areas within the site	31.97m ³
		Total	36.03m ³ Greater than the already significantly oversized 33.0m ³ required
Green Roof Areas Bin and Cycle	YES	Area of minimum 23m ² Assume 0.4m depth void storage = 9.2m ³	Not included at this stage to attain the required oversized volume of storage

The indicative layout plan included within Appendix D shows locations for the SUDS structures. The scheme restricts the discharge to the sewer hence the approval of United Utilities is considered obtainable during detailed designs as this is betterment with future-proofing for the 100 year lifetime of the scheme and reduces flood risk to and from the infrastructure.

If required by UU, all the SUDS storage features can be changed to “offline” and hence will have no direct connection to the combined manhole hence UU would not object on these grounds.

4.6 Green Roofs

The rooftop areas have not been included as part of the final total SUDS storage volumes at this stage because the exact make-up for a green roof would not be confirmed. It is not possible or necessary at this stage to design to exact specifications of green roof as the stratum depth is not known and it is not necessary to quantify for the planning stage because

the scheme can meet the storage volume requirements without the need for the roof storage areas.

The main building roof areas are heavily pitched and there is not a large area of flat roof as part of the designs, which further restricts the availability of areas for roof storage.

The SUDS strategy has been done in this way at this stage so there is no reliance on an unknown to demonstrate compliance.

4.7 Pipe Sizes / Manholes / Pipe Runs

The layout in Appendix D is necessarily indicative based on best practice given the stage of design.

The 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 planning and 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

The SUDS strategy does not rely on any green roof areas to meet the required storage volumes.

Whilst internal rainwater harvesting is not proposed, rainwater pipes are to be fitted with water butts wherever feasible (see Appendix D). Whilst the use of water butts won't reduce the design criteria of the receiving below ground drainage system, their use will reduce the time of entry and provide a supply of water for irrigation.

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 permeable paving and the granular storage will receive an adequate level of filtration through the associate substrate.

4.8 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 E.

5.0 Summary

It is proposed to connect the foul drainage from the new development to the public sewer in Huyton Church Road via the existing shared connections if feasible. The condition of the existing connection 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 United Utilities, 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 is proposed to construct the new external hard standing areas from permeable paving. 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.

APPENDICES

APPENDIX A



Notes:

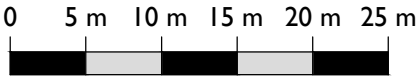
Drawings are based on survey data and may not accurately represent what is physically present.

Do not scale from this drawing. All dimensions are to be verified on site before proceeding with the work.

All dimensions are in millimeters unless noted otherwise.

Purcell shall be notified in writing of any discrepancies.

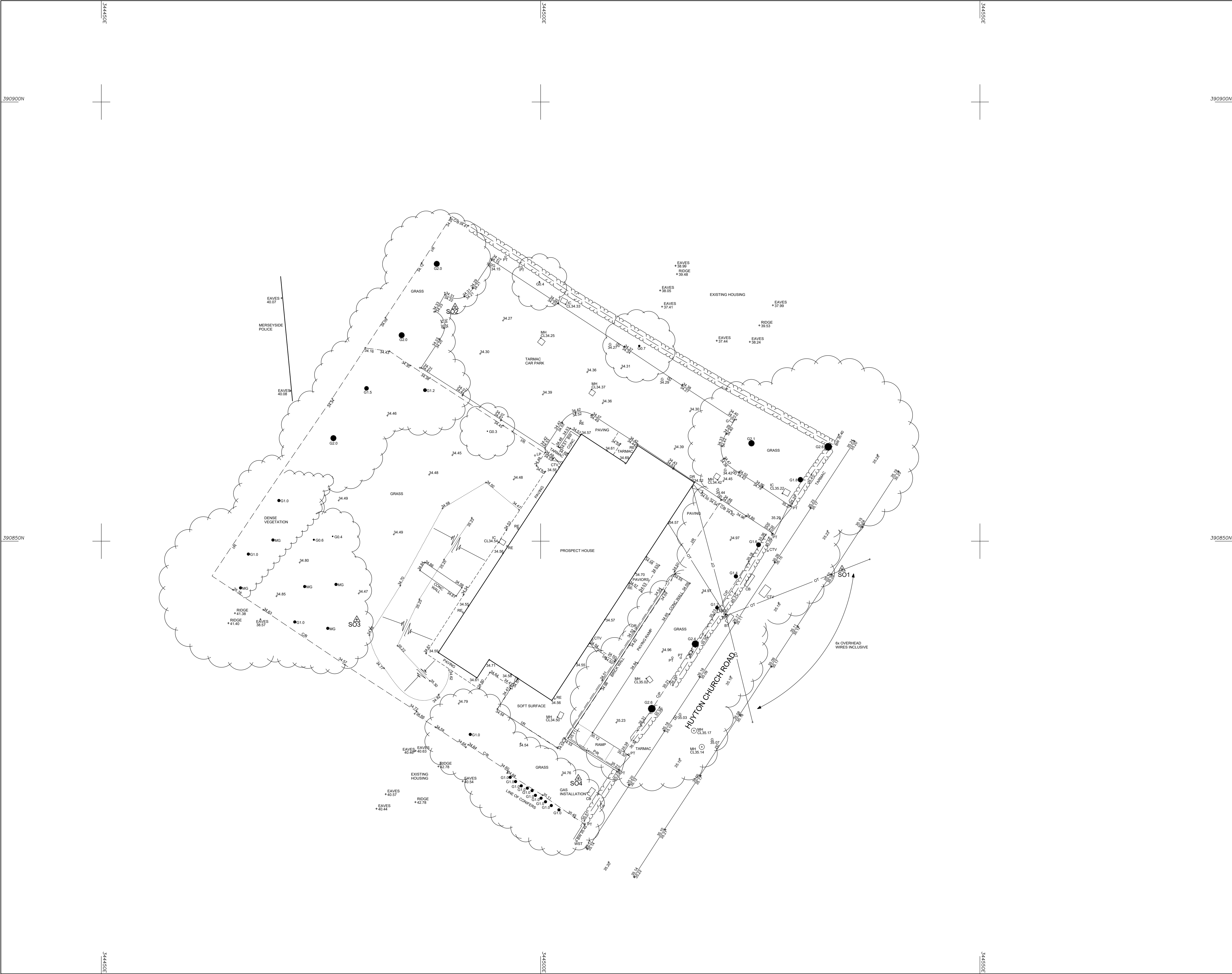
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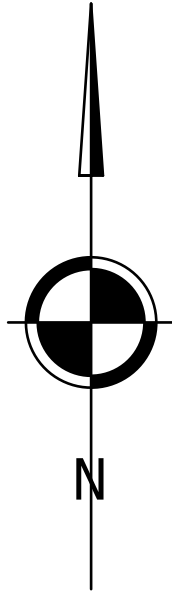
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PROJECT		21 Huyton Church Road, Huyton		
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SIZE & SCALE		1:500 @ A3	1:1000 @ A4	
DRAWING STATUS		ISSUED FOR COMMENT		

JOB NUMBER	237498
DRAWING NO.	01
REVISION	-





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Note:
The survey is plotted on a plane local
Grid. Orientation to National Grid.
All levels relate to Ordnance Datum,
achieved using the
OS National GPS Network.
Survey Control Markers established for
Mapping purposes only and should not be
used for Construction without the written
approval of Survey Operations Ltd.

SURVEY STATIONS			
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SO2	344490.26	390876.67	34.24
SO3	344479.08	390841.07	34.63
SO4	344504.28	390823.02	35.15



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Tel: 01695 725662 Fax: 01695 51816
Email: mail@survops.co.uk - www.survops.co.uk

Client
Steven Abbott Associates

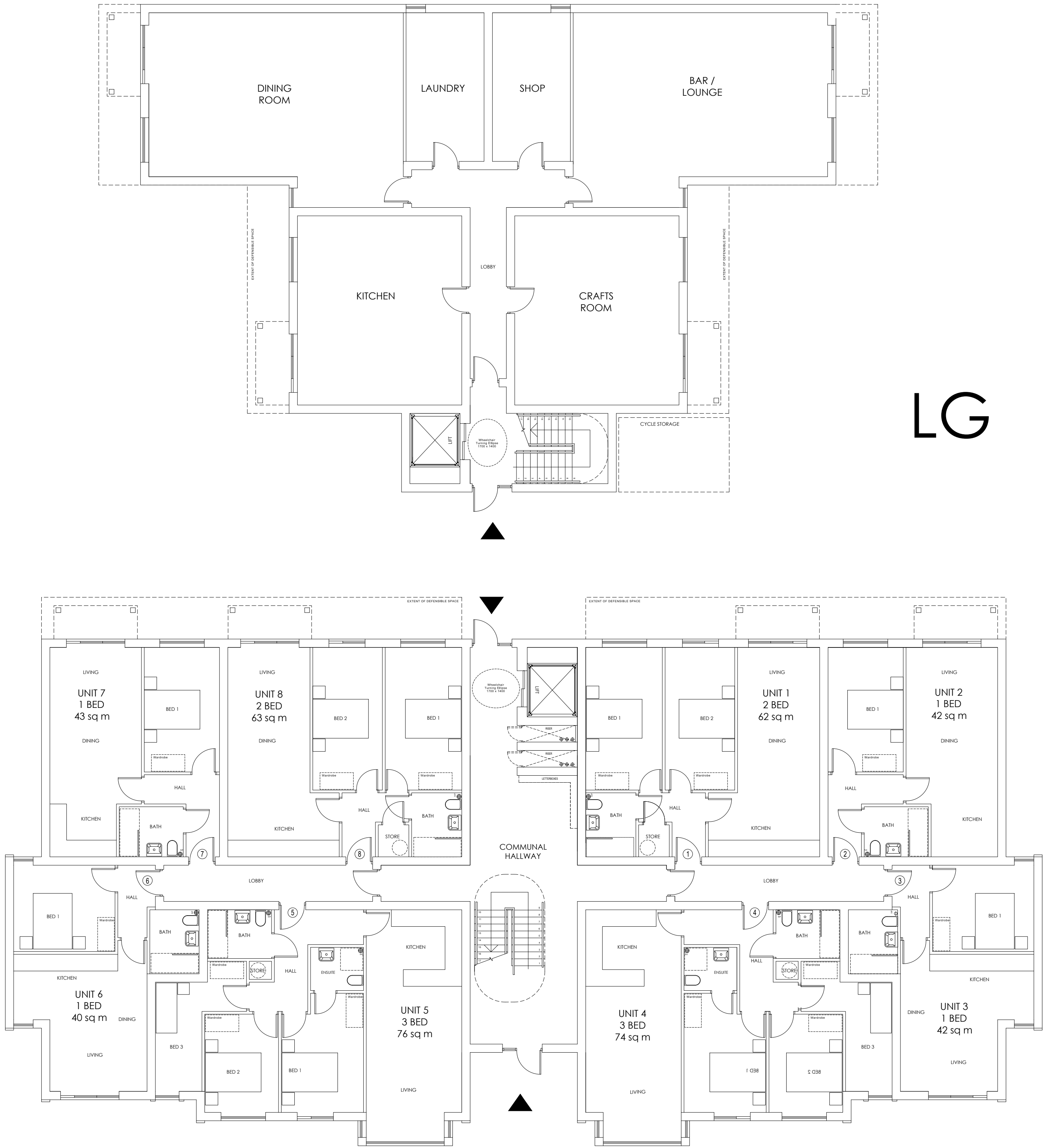
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Prospect House
Huyton

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Date	APR 20	Drawn	IT
Job Number	19L181	Checked	TP

Sheet Size & Drg Number & Revision
A1 19L181/001

APPENDIX B

FOR PLANNING



NB. LAYOUT IS INDICATIVE ONLY, SUBJECT TO SURVEYS AND SUBSEQUENT DETAILED DESIGN

NOTES

This drawing to be read in accordance with the specification/Bills of Quantities and related drawings.

No Dimensions to be scaled from this drawing. All stated dimensions to be verified on site and Smashbox Architecture to be notified of any discrepancies.

SCHEDULE OF ACCOMMODATION

Lower Ground Floor -

1 Bed	2nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	2nr	74-76 sqm
Total:	12 Apartments	

Ground Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

First Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

First Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

Third Floor -

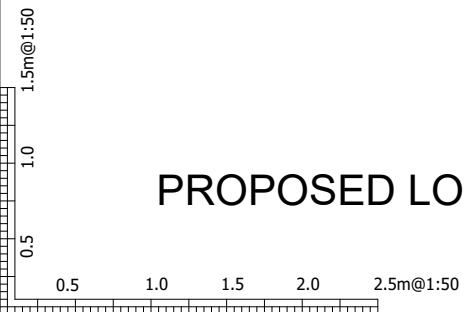
1 Bed	0nr	40 - 42 sqm
2 Bed	0nr	65 - 75 sqm
3 Bed	6nr	75-84 sqm
Total:	6 Apartments	
Total:	50nr Apartments	

Parking Provision -		
Car Parking	25nr	46%
Bicycles	54nr	100%

FOR PLANNING

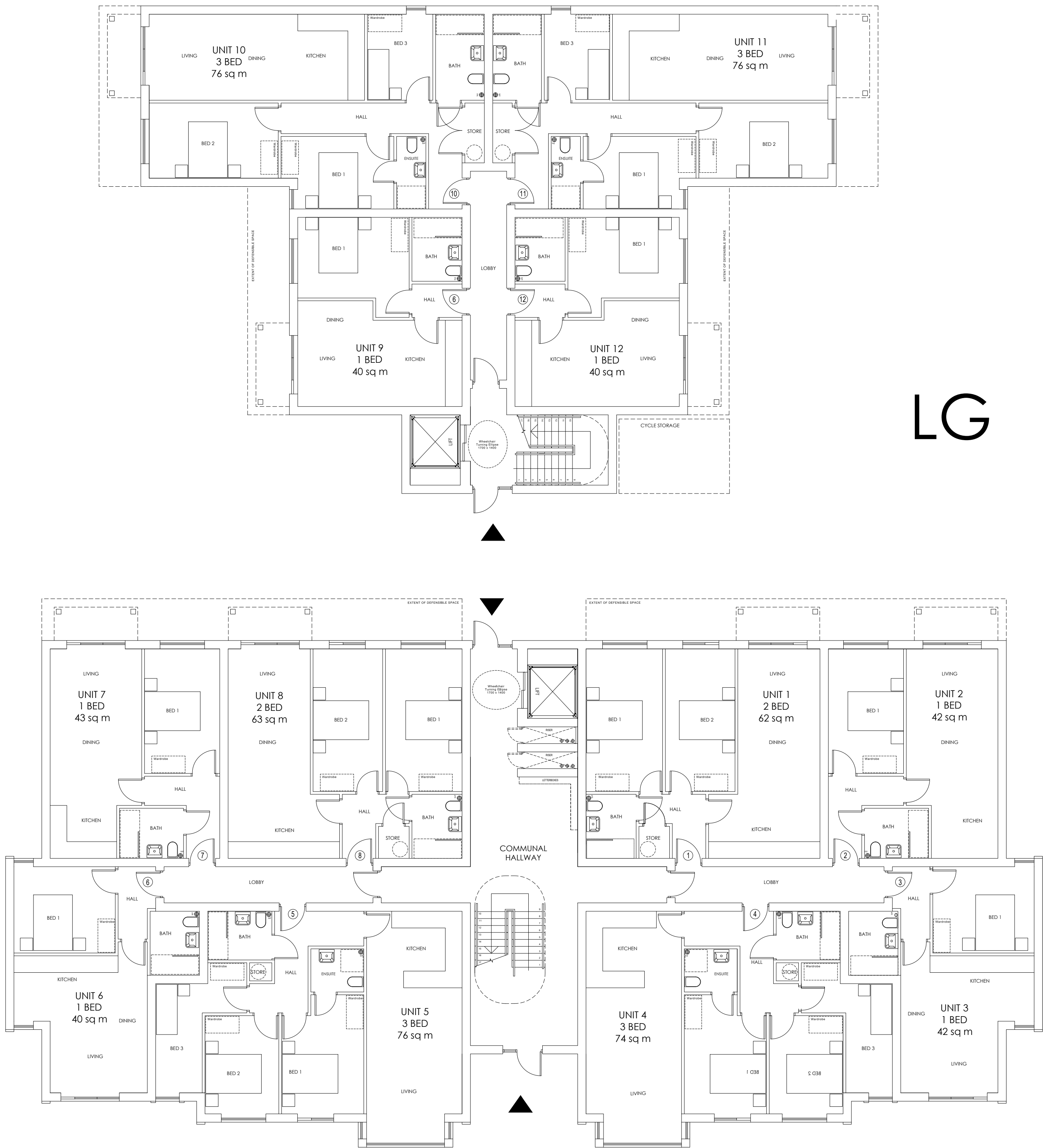
Project
21 HUYTON CHURCH ROAD
LIVERPOOL
MERSEYSIDE
L36 5SH

Title
PROPOSED LOWER GROUND
C2 USE ONLY
Up to 54nr APARTMENTS



PROPOSED LOWER GROUND FLOOR PLAN

FOR PLANNING



NB. LAYOUT IS INDICATIVE ONLY, SUBJECT TO SURVEYS AND SUBSEQUENT DETAILED DESIGN

NOTES

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SCHEDULE OF ACCOMMODATION

Lower Ground Floor -

1 Bed	6nr	40 - 42 sqm
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3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

Ground Floor -

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3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

First Floor -

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2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

First Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

Third Floor -

1 Bed	0nr	40 - 42 sqm
2 Bed	0nr	65 - 75 sqm
3 Bed	6nr	75-84 sqm
Total:	6 Apartments	
Total:	54nr Apartments	

Parking Provision -		
Car Parking	27nr	50%
Bicycles	54nr	100%

FOR PLANNING

Project
21 HUYTON CHURCH ROAD
LIVERPOOL
MERSEYSIDE
L36 5SH

Title
PROPOSED LOWER GROUND
C3 USE ONLY
Up to 54nr APARTMENTS

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Drawing Number 6489_PL03_C3	Revision -

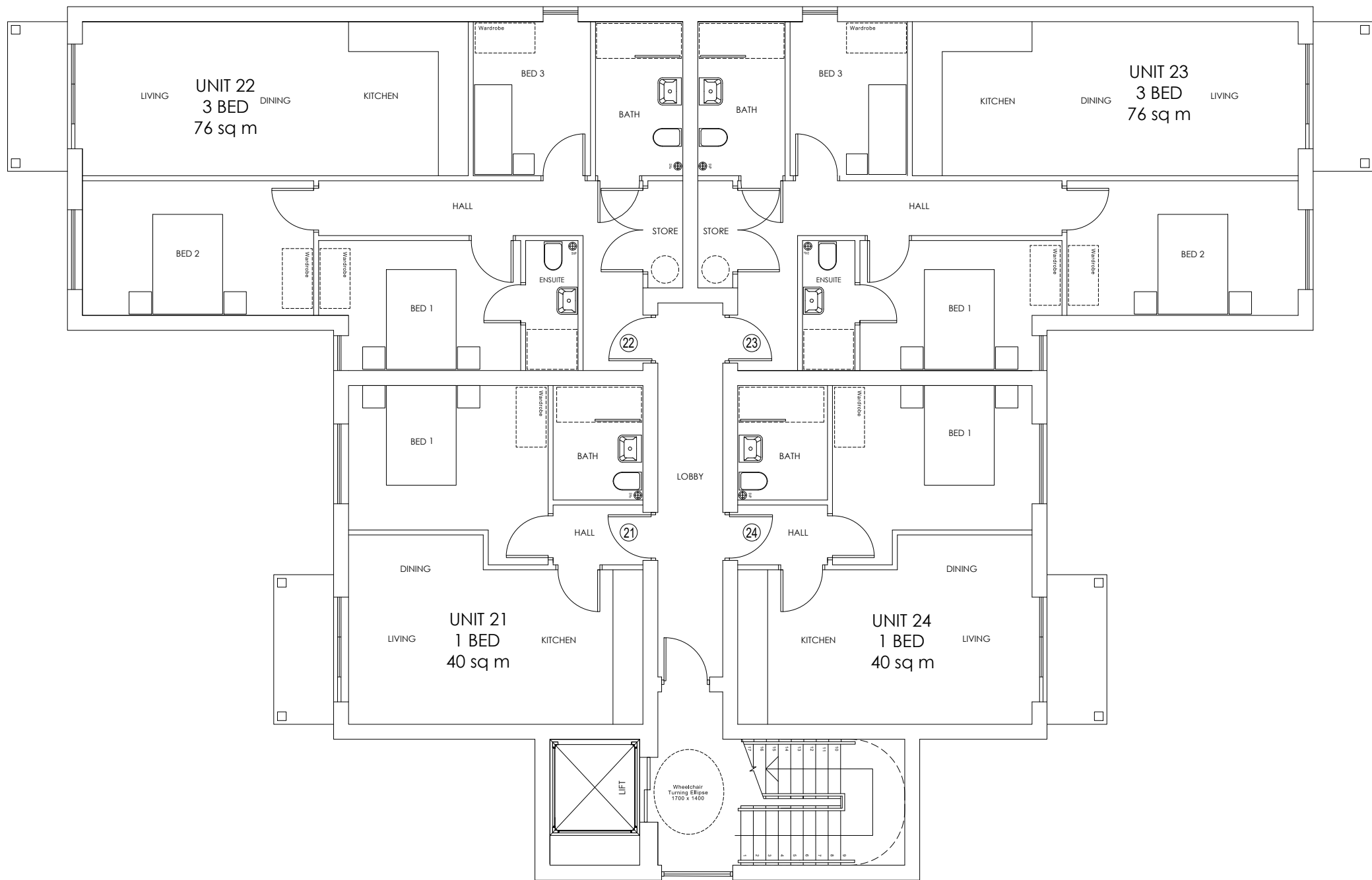
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PROPOSED LOWER GROUND FLOOR PLAN

FOR PLANNING



G



NB. LAYOUT IS INDICATIVE ONLY, SUBJECT TO SURVEYS AND SUBSEQUENT DETAILED DESIGN

NOTES

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2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	
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2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	
First Floor -		
1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	
Third Floor -		
1 Bed	0nr	40 - 42 sqm
2 Bed	0nr	65 - 75 sqm
3 Bed	6nr	75-84 sqm
Total:	6 Apartments	
Total:	54nr Apartments	

FOR PLANNING

Project

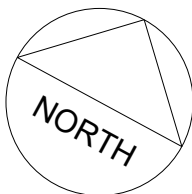
21 HUYTON CHURCH ROAD
LIVERPOOL
MERSEYSIDE
L36 5SH

Title

PROPOSED GROUND FLOOR

Up to 54nr APARTMENTS

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Drawn	Checked
SB	-
Drawing Number	Revision
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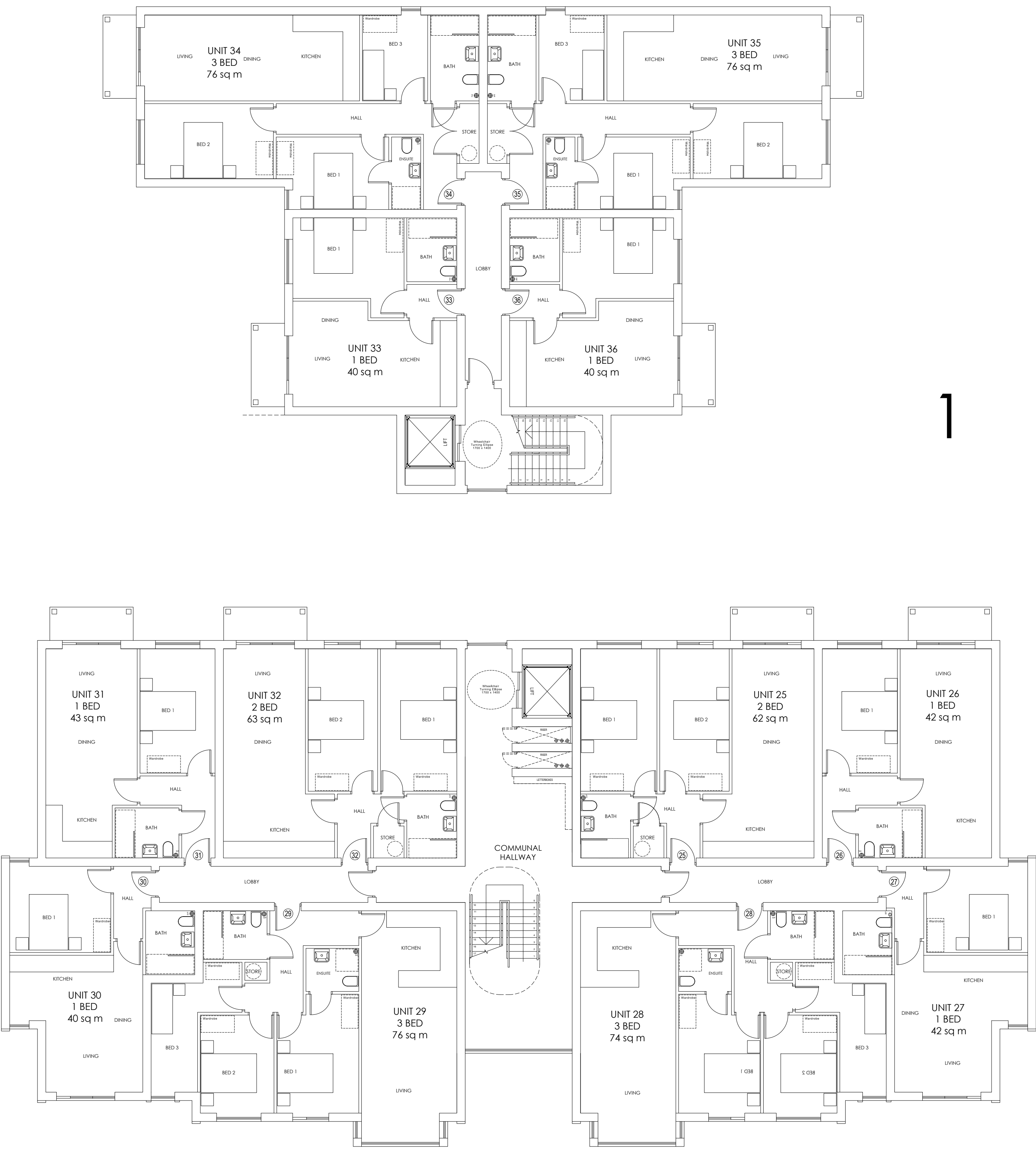
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0.5 1.0 1.5 2.0 2.5m@1:50

PROPOSED GROUND FLOOR PLAN

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Total:	12 Apartments	
Ground Floor -		
1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	
First Floor -		
1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	
First Floor -		
1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	
Third Floor -		
1 Bed	0nr	40 - 42 sqm
2 Bed	0nr	65 - 75 sqm
3 Bed	6nr	75-84 sqm
Total:	6 Apartments	
Total:	54nr Apartments	

FOR PLANNING

Project

21 HUYTON CHURCH ROAD
LIVERPOOL
MERSEYSIDE
L36 5SH

Title

PROPOSED FIRST FLOOR

Up to 54nr APARTMENTS

Scale

RTD @ A1

Drawn

SB

Drawing Number

6489_PL05

Date

SEPTEMBER 2021

Checked

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Revision

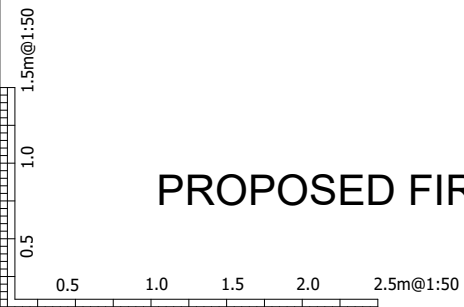
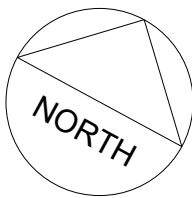
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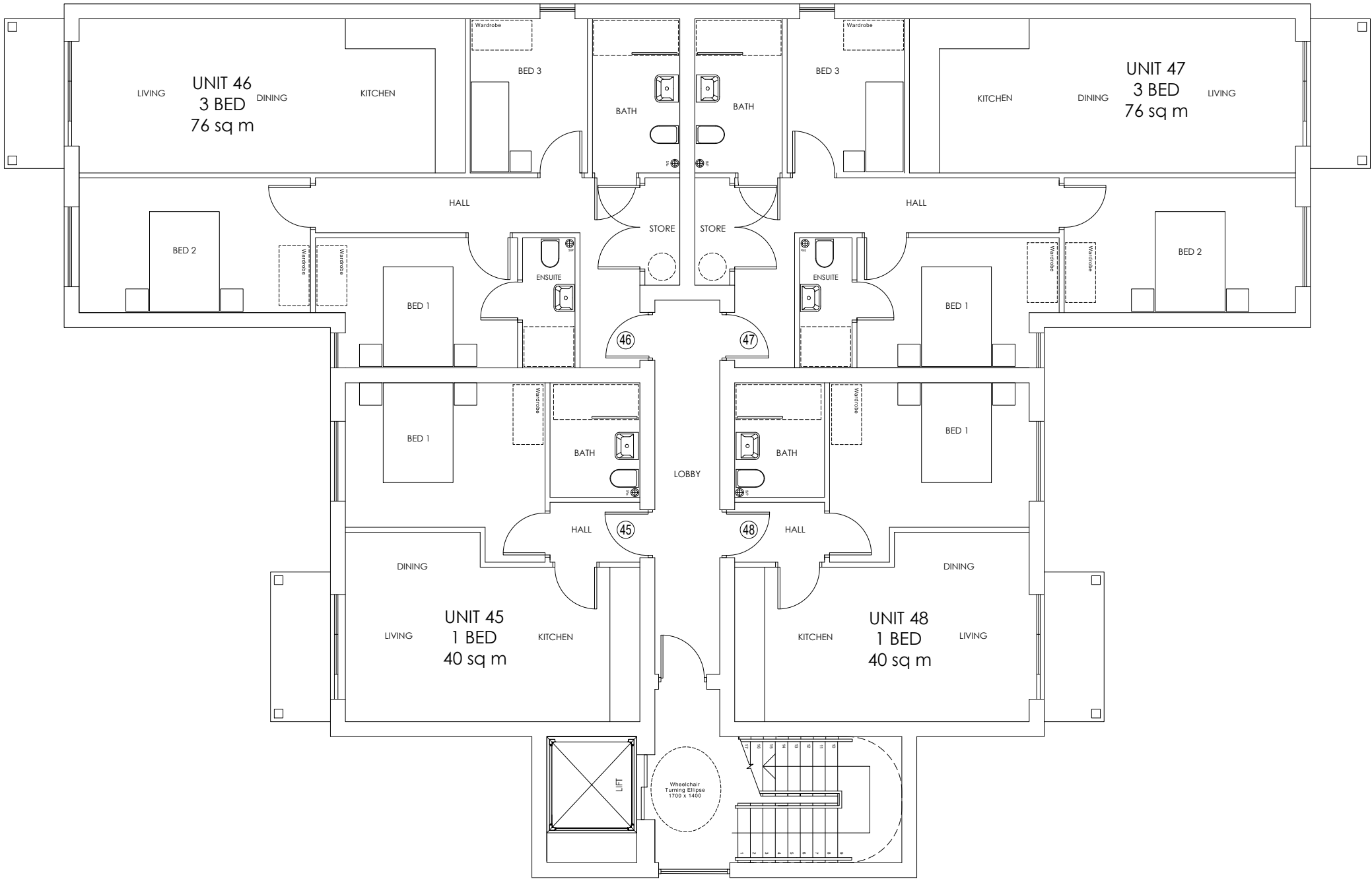
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PROPOSED FIRST FLOOR PLAN

FOR PLANNING



2



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2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

Ground Floor -

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3 Bed	4nr	74-76 sqm
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3 Bed	4nr	74-76 sqm
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First Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

Third Floor -

1 Bed	0nr	40 - 42 sqm
2 Bed	0nr	65 - 75 sqm
3 Bed	6nr	75-84 sqm
Total:	6 Apartments	
Total:	54nr Apartments	

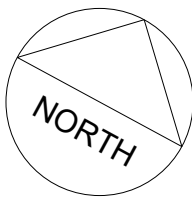
FOR PLANNING

Project
21 HUYTON CHURCH ROAD
LIVERPOOL
MERSEYSIDE
L36 5SH

Title
PROPOSED SECOND FLOOR

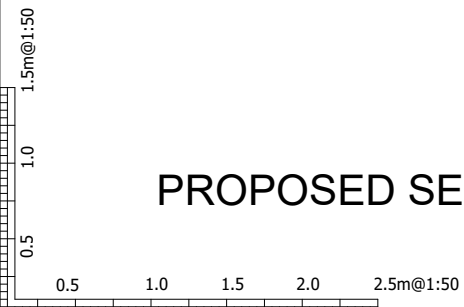
Up to 54nr APARTMENTS

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Drawn SB	Checked -
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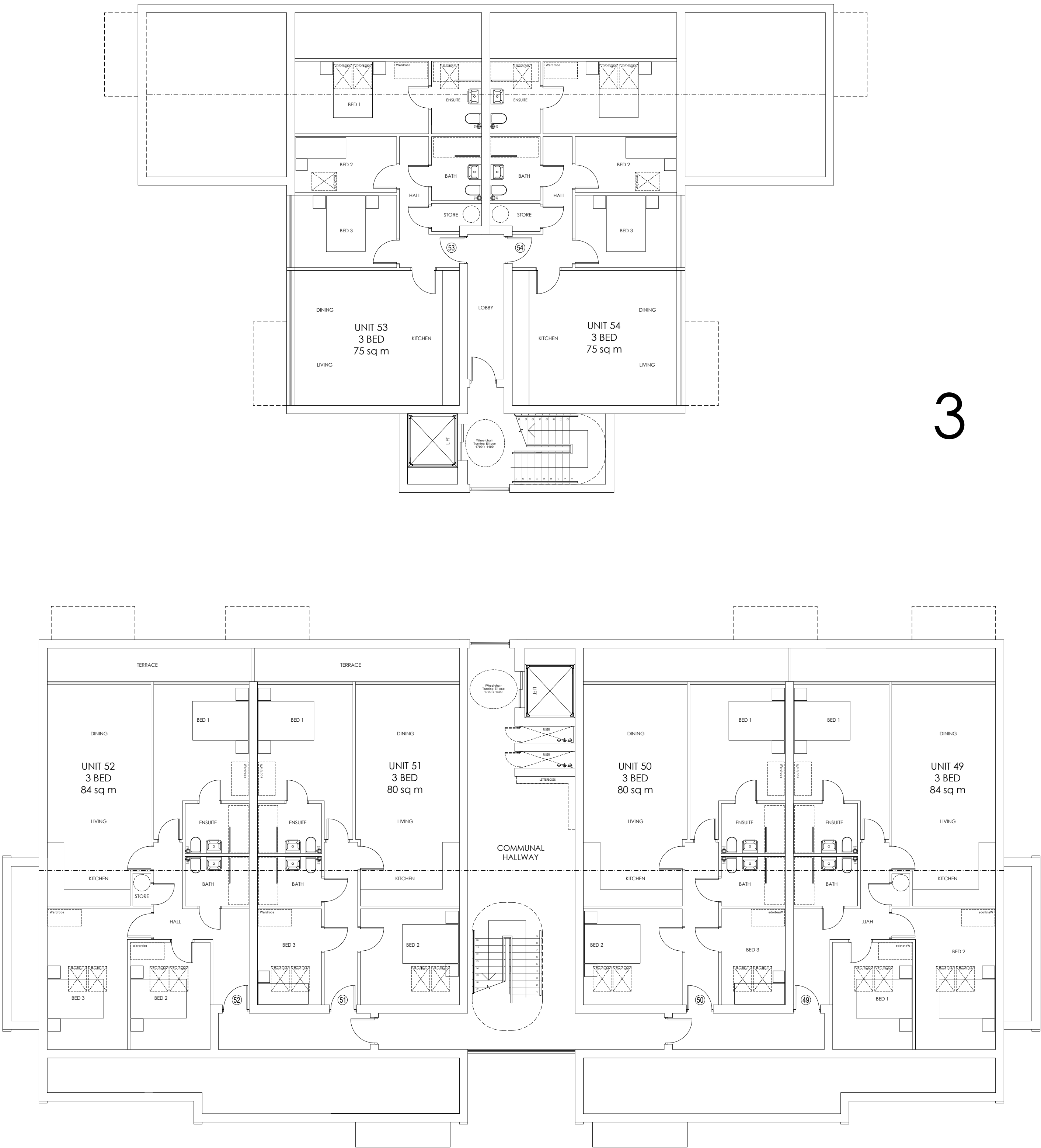
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PROPOSED SECOND FLOOR PLAN

FOR PLANNING



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2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

Ground Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

First Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

First Floor -

1 Bed	6nr	40 - 42 sqm
2 Bed	2nr	62 sqm
3 Bed	4nr	74-76 sqm
Total:	12 Apartments	

Third Floor -

1 Bed	0nr	40 - 42 sqm
2 Bed	0nr	65 - 75 sqm
3 Bed	6nr	75-84 sqm
Total:	6 Apartments	
Total:	54nr Apartments	

FOR PLANNING

Project
21 HUYTON CHURCH ROAD
LIVERPOOL
MERSEYSIDE
L36 5SH

Title
PROPOSED THIRD FLOOR

Up to 54nr APARTMENTS

Scale
RTD @ A1

Date
SEPTEMBER 2021

Drawn
SB

Checked
-

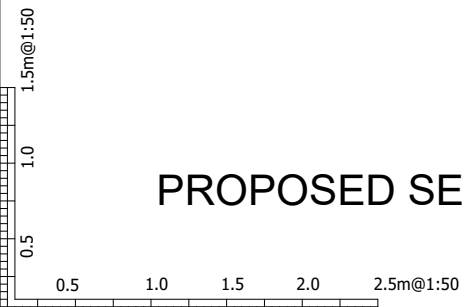
Drawing Number
6489_PL07

Revision
-

NORTH

SMASHBOX

97 ALDERLEY ROAD | WILMSLOW | CHESHIRE | SK9 1PT
T. 01625 466 557 E. hello@smashboxarchitecture.com
www.smashboxarchitecture.com



PROPOSED SECOND FLOOR PLAN

APPENDIX C

Calculated by:

Site name:

Site location:

This is an estimation of the greenfield runoff rates that are used 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). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:

Longitude:

Reference:

Date:

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method:

SPR estimation method:

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	860	860
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.54	1.54
1 in 1 year (l/s):	1.34	1.34
1 in 30 years (l/s):	2.61	2.61
1 in 100 year (l/s):	3.19	3.19
1 in 200 years (l/s):	3.64	3.64

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at 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 www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. 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 this data in the design or operational characteristics of any drainage scheme.

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:

Site name:

Site location:

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:

Longitude:

Reference:

Date:

Site characteristics

Total site area (ha):	0.09
Significant public open space (ha):	0
Area positively drained (ha):	0.09
Impermeable area (ha):	0.09
Percentage of drained area that is impermeable (%):	100
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):	0.09
Net impermeable area for storage volume design (ha):	0.09
Pervious area contribution to runoff (%):	30

* 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_{BAR} 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):	3

Methodology

esti	IH124	
Q_{BAR} 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:	--	63
Rainfall 100 yrs 12 hrs:	--	80.85
FEH / FSR conversion factor:	1.05	1.05
SAAR (mm):	860	860
M5-60 Rainfall Depth (mm):	20	20
'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
Growth curve factor 100 years:	2.08	2.08
Q_{BAR} for total site area (l/s):	0.55	0.55
Q_{BAR} for net site area (l/s):	0.55	0.55

Site discharge rates	Default	Edited	Estimated storage volumes	Default	Edited
1 in 1 year (l/s):	3	3	Attenuation storage 1/100 years (m³):	33	33
1 in 30 years (l/s):	3	3	Long term storage 1/100 years (m³):	0	0
1 in 100 year (l/s):	3	3	Total storage 1/100 years (m³):	33	33

This report was produced using the storage estimation tool developed by HRWallingford and available at 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

Blue filled circles

Rainwater Pipes with diverters to communicate water direct to rain garden and thence to subbase storage SUDS or porous garden



Exact connections to be confirmed as part of construction site set out.

There are existing connections adjacent given the existing fully functioning site adjacent with foul and surface water connections to the sewers adjacent to the site.

Red Dashed Box

Lined Granular storage under permeable car park area; store then discharge restricted rated to inspection chamber and then to sewer

See report for dimensions

Orange filled circle

Rainwater Butt: overflow to planter / connections

Green Box

Rain gardens planter voided surface storage

See report for dimensions

Green Dashed Box

Sedum / Green Roof Area; not included in SUDS calculations at this stage as not necessary to rely on this to meet the volume requirements

Tree Root Protection Areas at front

Restriction of SUDS measures in this area



Existing Manhole inverts at c. 1.10m – 1.4m below ground level

APPENDIX E

SUDS Maintenance Schedule

Installation	Maintenance Required	Frequency	Responsibility
Rain Garden Planter & Permeable Paving (Patio and Access / Parking) Sedum roof collection system if included in final scheme (incl. associated distribution pipework and sump chambers)	Inspection, debris removal and jetting	Typically, inspection is recommended annually or after a severe or significant storm event, with any jetting/cleaning being carried out as necessary.	Estate/Building Management Company