Keystone
Design Associates Ltd.

DRAINAGE STRATERGY

LAND ADJACENT VIRGINIA COTTAGE, BENNETT'S LANE, BLACKPOOL

September 2021

Development House
261 Church Street
Blackpool
FY1 3PB
Tel: 01253 649040
Fax: 01253 752901
Email: info@keystonedesign.co.uk

DOCUMENT ISSUE RECORD

Revision	Date	Details
Full	September 2021	Issued for action
A	May 2022	Issued for action

LAND ADJACENT VIRGINIA COTTAGE, BENNETT'S LANE, BLACKPOOL

Report Approved by D.W.Hadwin B.Eng(Hons) C.Eng MICE
For Keystone Design Associates

Signature.....

Date.....6th September 2021.....

CONTENTS

1.0 INTRODUCTION

1.01 It is proposed to develop the existing site to accommodate a residential development with associated landscaping at land adjacent to Virginia Cottage, Bennett's Lane, Blackpool.

1.02 The works for the development would comprise the erection of six two-storey dwelling houses and installation of the new infrastructure, including landscaping, of which the drainage would be material. This report discusses the proposed strategy for the disposal of both foul and surface water.

1.03 This report is intended to provide supporting information for the consent of planning permission.

2.0 DESCRIPTION OF DEVELOPMENT

2.01 The site is currently vacant land adjacent to Virginia Cottage, Bennett's Lane, Blackpool. The proposed dwellings are to be constructed across the site.

2.02 The proposed dwellings are to be two storeys, compromising of four bedrooms, two of which will have en-suites, a lounge, kitchen/family room, dining room, utility and garage.

2.03 The proposed will be constructed at, or close to, existing levels & it is not anticipated that major retaining structures or significant changes in levels will be required.

2.05 The necessary infrastructure to cater for the proposed development will need to be installed, this being services and drainage.

2.06 The drawing attached to appendix C as supplied by this office illustrates the proposed scheme.

3.0 LOCATION OF SITE

3.01 The site is located to the east side of Bennett's Lane, Blackpool. The site is identified on the location plan at as appendix A.

3.02 The site is situated approximately 2.9m south east of the town centre of Blackpool. The site is surrounded by residential properties to the north and west and situated approximately 2.9m from the M55. The site is also located in Marton; Marton is a settlement on the coastal plain of the Fylde, most of which is now part of Blackpool. Marton, which consisted of Great Marton, Little Marton, Marton Fold and The Peel, was originally part of the parish of Poulton-le-Fylde, before the development of Blackpool as a resort.

3.03 The site is located in a flood zone 1.

3.04 The ordnance survey grid reference is SD N432718, E332916.

3.05 The site is 0.58Ha area.

4.0 EXISTING DRAINAGE

4.01 No drainage was found on site. There is a dyke located to the east of the site. For the purpose of surface water drainage calculations the site will be treated as greenfield.

4.02 There is no mains drainage located on site. Foul water sewers are located in Bennett's Lane and there is a dyke located to the east of the site.

5.0 SURFACE WATER DRAINAGE STRATEGY

5.01 The primary flood risk to others generated by a development is the surface water runoff. The proposed development will have 61% permeability which will increase the amount of surface water discharge; to comply with the planning condition the surface water runoff which will be attenuated within the site boundary.

5.02 The surface water drainage for any development site should be designed so that that the volumes and peak flow rates of surface water leaving the site are limited to the original greenfield rates.

5.03 In order to comply with not increasing volume of discharge as a consequence of the development it will be necessary to provide surface water storage and/or infiltration to limit and reduce both the peak rate of discharge from the site.

5.04 The Environment Agency require that, for the range of annual flow rate probabilities, up to and including the 1% annual probability (1 in 100 year event) the developed rate of run-off into a watercourse should be no greater than the undeveloped rate of run-off for the same event. Water Authorities take a similar approach to that of the Environment Agency, however they ask that flows be restricted to include up to the 3.33% annual probability (1 in 30 year event), whilst demonstrating that the 1 in 100 year event does not pose a threat to the locality (known as designing for exceedance).

5.05 Climate change (CC) will be taken into account by increasing the rainfall intensity by 30% in compliance with DEFRA technical standards.

6.0 SUSTAINABLE DRAINAGE

6.01 The Technical Guidance for the National Planning Policy Framework requires that a develop exceeding 0.4Ha or more than 4 dwellings requires that the management of the surface water runoff utilises Sustainable Urban Drainage (SUDS) and considers the hierarchy of provision which are as follows

- Infiltration to ground - soakaways and permeable surfacing.
- Discharge to local watercourse.
- Discharge to surface water drain.
- Discharge to sewer.

6.02 The first option to be considered for surface water disposal for all proposed development must be infiltration into the ground. Even when there are alternative sewer connections or watercourses available infiltration must still be utilised unless it is proved unfeasible. The suitability for infiltration is determined by a percolation test. Where the underlying soil conditions are relatively impermeable, or the water table is high the site would not be suitable for ground infiltration and discharge to a water course or sewer may be considered.

6.03 The sub soil in this area is firm to stiff clay close to the surface. The water table is also close to the ground surface. These ground conditions are not suitable for ground infiltration.

6.04 As discharge to the ground is not appropriate, the next level of SuDs is to be considered. The dyke to the east of the site is a watercourse as defined in the SuDs Manual 2015. It is proposed to discharge surface water to the watercourse.

6.05 In order to prevent an increase in flood risk to adjacent land and downstream of the site it will be necessary to restrict the surface water discharge from the development to the equivalent QBAR Greenfield run-off rate from the site (mean annual greenfield peak flow). The SuDS Manual recommends the use of Report No.124 'Flood estimation for small catchments', Institute of Hydrology for catchments smaller than 50 hectares. The total site area of the development site 0.58 ha.

6.06 The Environment Agency standard advice is to calculate the existing Greenfield run-off from the entire developable site. HR Wallingford Greenfield runoff estimation tool has been used to calculate this figure. The results and output are included within Appendix D. The calculated QBAR rate is 4.0 l/s, which is the maximum final discharge rate that should not be exceeded.

6.07 When calculating the final allowable discharge rate only the impermeable areas are considered. The other areas of the site which include landscaping and porous pavement will not contribute to the surface water run-off. The total area of impermeable surfacing is calculated at 39% of the total site area. Existing Greenfield run-off rates are calculated at 4.0l/s per ha and the 1 in 30 year event at 6.8l/s and the 1 in 100 year event at 8.3l/s.

6.08 Surface water flows from the site are to be restricted to the equivalent QBAR rate of 5.0l/s. This is greater than the calculated 4.8l/s as a practicable minimum limit on the discharge rate from a flow attenuation device is often a compromise between attenuating to a satisfactorily low flow rate while keeping the risk of blockage to an acceptable level. This limit is therefore set at 5 litres per second.

6.09 The Draft National Standards for Sustainable drainage systems covers the whole range of sustainable approaches to surface water drainage management including:

- source control measures including rainwater recycling and drainage.
- infiltration devices to allow water to soak into ground, that can include individual soakaways and communal facilities.
- filter strips and swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns.
- filter drains and porous pavements to allow rainwater and run-off to infiltrate into permeable material below ground and provide storage if needed.
- basins and ponds to hold excess water after rain and allow controlled discharge that avoids flooding, and
- Underground storage to hold excess water after rain and allow controlled discharge that avoids flooding.

6.10 These SuDS solutions are considered below with reference to their suitability for the proposed development.

SuDS Group	Technique	Likely to be suitable?	Notes
Source Control	Rainwater Harvesting	Yes	Would not feasibly accommodate the full increase of volume of runoff created by the proposed development but would work alongside any attenuated system Rainwater butts can also be used to reduce run-off and water use.
Infiltration Devices	Permeable Paving	No	The ground sub striate is not suitable for limited infiltration.
	Infiltration trenches and basins	No	Could be used to slow the movement of water down, but not as an effective means of dealing with run-off and The ground sub striate is not suitable for infiltration
Filtration	Soakaways	No	Clay substrate and high water table not suitable for surface water disposal
	Open Swales	No	Use for attenuation, evaporation, water quality and slowing water movement down and will fit with nature of site. Insufficient space to accommodate pond Hazardous to site users
	Filter Strips	No	Could be used to slow the movement of water down, but not as an effective means of directly dealing with run-off
Retention/ Detention	Basin / Ponds	Yes	Suitable for controlling discharge to watercourse via a piped outfall, evaporation and treatment of run-off.
Underground Storage	Culverts / Tanks / Oversized Pipes	Yes	Suitable for controlling discharge to watercourse or sewer via a piped outfall No land take required to accommodate

7.0 PROPOSED DRAINAGE STRATEGY - SURFACE WATER

7.01 It is proposed that surface water drainage from the proposed development will be discharged into a pond via the proposed manholes. The surface water will go through a pump before being discharged into the dyke located to the east of the site via a new drainage system constructed on site.

7.02 It is important when designing drainage systems for new developments that a scheme be considered to deal with the first 5mm of rainfall to hit the site. Around 50% of rainfall events are less than 5mm and cause no measurable runoff from greenfield areas into receiving waters. In contrast, runoff from a development takes place for virtually every rainfall event. This difference means that watercourses receive frequent discharges with polluted wash off from urban surfaces (hydrocarbons, suspended solids, metals etc). Replication of the greenfield runoff from small events will result in many fewer polluted discharges so limiting the potentially damaging impact on the receiving environment. This concept is known as interception and the volume of rainfall required to replicate the event known as Interception Storage.

7.03 The concept of Interception storage to prevent any runoff from rainfall depths up to 5mm, should therefore be provided. Certain SuDS features such as Swales and Pervious Pavements provide runoff characteristics that reflect this behaviour depending on their design. These have been accommodated within the scheme with both porous paving and the detail of the storage crate system. An estimation of the Interception storage requirements for the outline proposal is included within the calculations below ($9.03m^3$).

7.04 Above and beyond the Interception Storage requirements there are the more intense storms to consider. Attenuation will be required within the system to accommodate the volume of surface water created by restricting the outfall rates to the existing 5.0l/s equivalent.

7.05 There are a number of options available for attenuating the proposed flows from the development; however it is considered that the storage would be to utilise a traditional piped system.

7.06 The attenuation will be provided in the form of oversized pipes and manholes, a system which is highlighted within the SuDS manual. This solution allows for large quantities of storage at relatively shallow depths.

7.07 In calculating the surface water run off the following assumptions have been made:-

- **No infiltration** – Due to the ground conditions no infiltration is assumed, however if any could be achieved the volume discharged would be reduced.
- **No Rainwater Harvesting / Water Butts** – Suitably designed rainwater harvesting tanks can significantly reduce the volume of run-off and form an integral part of the attenuated system. United Utilities usually accept that such techniques are suitable for collecting water up to and including the 1 in 1 year event.
- **No storage within swales** – Swales have a combined advantage of providing a volume of storage, slowing the rate at which water enters the downstream system and providing a certain amount of infiltration into the ground.
- Within the analysis it has also been assumed that 100% of the rainwater falling on the proposed impermeable areas enters the system. It is therefore considered that the analysis undertaken is robust.

7.08 In order to comply with Environment Agency peak rates of run-off will be restricted to the existing greenfield run-off rate and storage will be provided up to and including the 1 in 100yr storm event plus an allowance of 30% increase for climatic change. This is above and beyond the requirements of a United Utilities adopted drainage system which requires storage up to and including the 1 in 30yr storm event. Flows would be restricted by the pump chamber which will limit discharge to 5.0l/s.

7.09 Teckla Tedds program for attenuation design has been used to calculate the storage volume required for the development attached as appendix D. The interception volume is calculated at 9.03m^3 and the 1 in 100 year event storage requirement is calculated at 109.5m^3. Proposed Run-off Rates include an increase of 30% climatic change allowance.

7.10 It is generally accepted that surface water systems are designed to accommodate the 1 in 30yr plus climatic change event and anything above and beyond that could be allowed to flood the system. This is known as designing for exceedance. It is not achievable to accommodate exceedance due to the topography therefore the system has been designed to fully accommodate the full exceedance within the drainage network.

7.11 It is also important to note that this system takes no account of the peripheral storage that will be available within the remainder of the proposed drainage network and therefore, notwithstanding the techniques outlined in para 6.9, the storage attenuation requirements will be less.

MAINTENANCE OF PROPOSED SUDS SYSTEMS.

7.12 It is important during any development process to consider the long term maintenance of the proposed drainage system. The more traditional non-SuDS route would be to have the system offered up for adoption though United Utilities, where they would take on responsibility for the maintenance of the drainage network. However, this is not the case with SuDS.

7.13 With the emerging Flood and Water Management Act 2010 (although it is noted that Schedule 3 relating to SuDS has not yet come into force), the SuDS Approving Body (SAB), would be obliged to adopt sustainable drainage solutions which comply with National Standards. Consequently, the system would have to be reviewed and approved by the SAB to ensure it meets these relevant standards.

7.14 Until such a time as Schedule 3 of the Act comes into force, the SuDS system (although approved by both the LPA and the SAB) would remain private and be maintained and managed by a private management company. This maintenance would be secured through ownership of the property. The system has been designed to require minimum maintenance and, the inspection and upkeep of the drainage system can be maintained in perpetuity.

8.0 PROPOSED DRAINAGE STRATEGY – FOUL WATER

8.01 No foul sewers are recorded on site. It is proposed to connect and discharge to the existing foul drainage sewer located in Bennetts Lane.

8.02 The proposed the development is to accommodate up to 6 houses. This comprises of 6 4bed, 8 person house. The drainage has been designed to accommodate 48 persons. From British Water Code of Practice – Flow loads – 3 the predicted flow rate is 180 x 48 = 8640 l/day or 0.10 l/s. The calculated foul discharge from the site in compliance with Approved Document part H of the Building Regulations Table A1 would be 5.4l/s.

9.0 CONCLUSIONS

9.01 The site lies within Flood Zone 1 and in accordance with PPG is therefore suitable for residential development.

9.02 Run-off from the proposed development will be restricted to existing greenfield run-off rates with an outfall into the existing dyke. Storage up to and including the 1 in 100yr + climatic change event will be provided within the boundary of the site; the attenuation will be in the form of oversized pipes.

9.03 The developer is committed to delivering a sustainable development and the drainage proposals will be designed in accordance with the techniques set out within the SuDS Manual. Future maintenance of the system will be secured in perpetuity, through ownership of the site

9.04 Foul drainage will be discharged to the foul sewer.

9.05 The strategy outlined above shows a viable sustainable drainage solution is achievable within the constraints of the site. The delivery of a SuDS surface water system together with an appropriately designed foul network and connection has been secured through planning condition.

10.0 APPENCIES

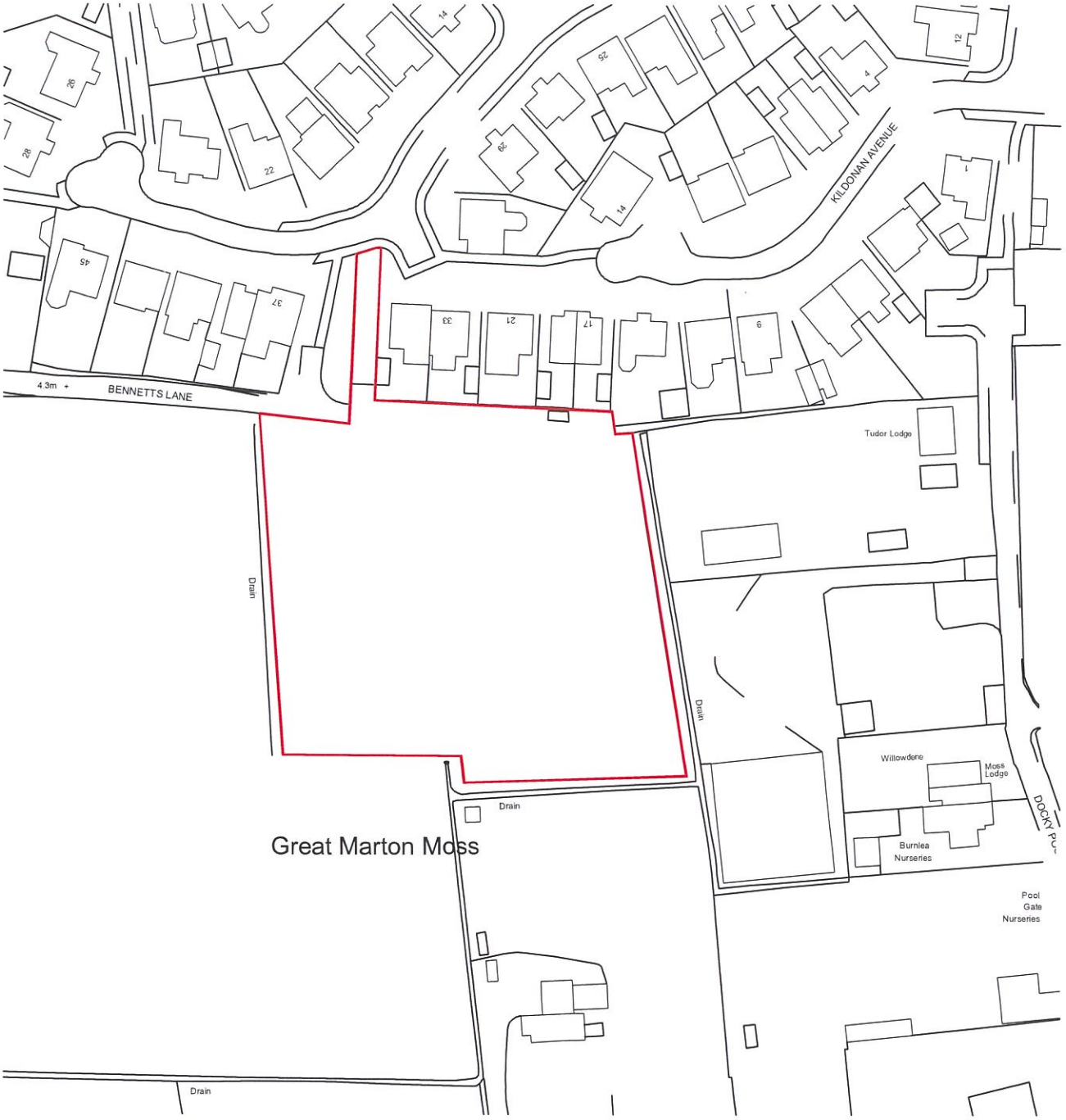
Appendix A Location plan

Appendix B Environment Agency Flood Map

Appendix C Proposed Scheme Drawings

Appendix D Drainage Calculations

Appendix A
Location plan



SITE KEY

DENOTES BOUNDARY

SITE AREA 5854sqm

Keystone Design

Associates Ltd

Registered Office
261 Church Street
Blackpool
FY1 3PB

Tel. No. 01253 649040
Fax. No. 08704 648222
Email : Info@keystonedesign.co.uk

PROJECT: LAND AT VIRGINIA COTTAGE, BENNETTS LANE, BLACKPOOL

DRAWING TITLE: SITE LOCATION PLAN

Drawn	Checked	Date	Scale
JG		28/06/21	1:1250@A4

DRAWING No. A021/061/P/03

Rev.

H:/Server/Drawings/2021/Bennetts Lane Land at Viginia Cott

Appendix B
Environment Agency Flood Map

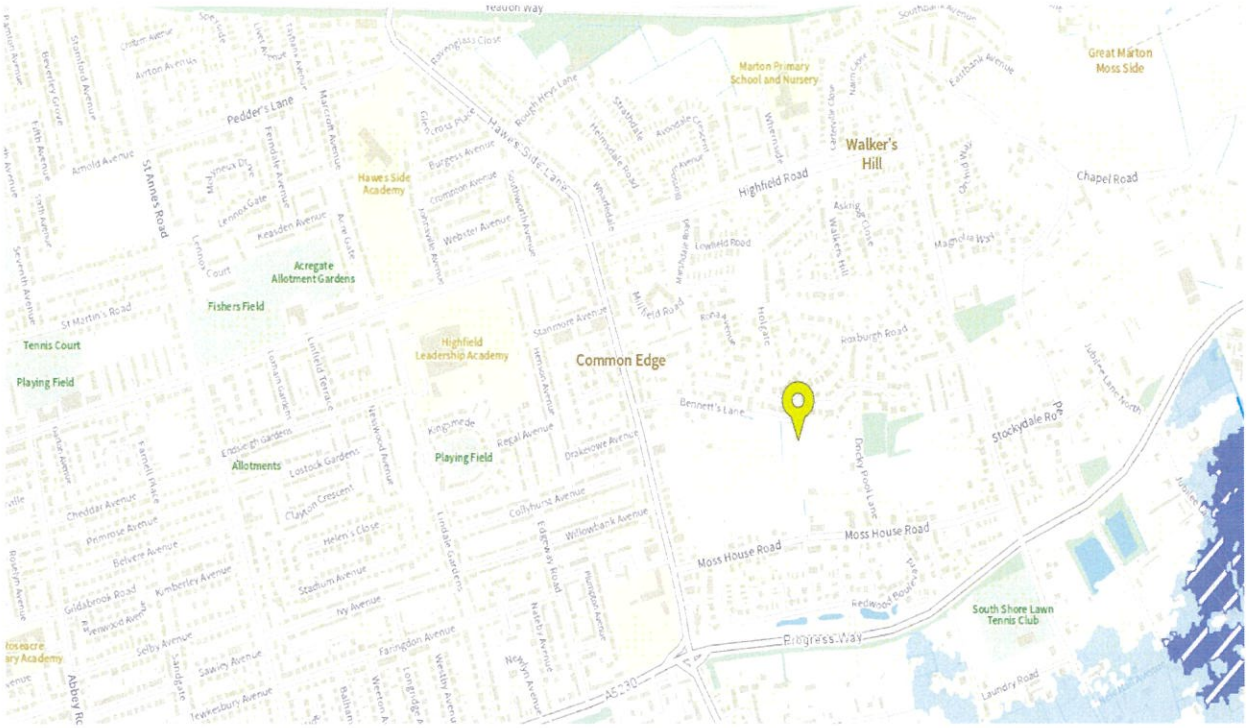
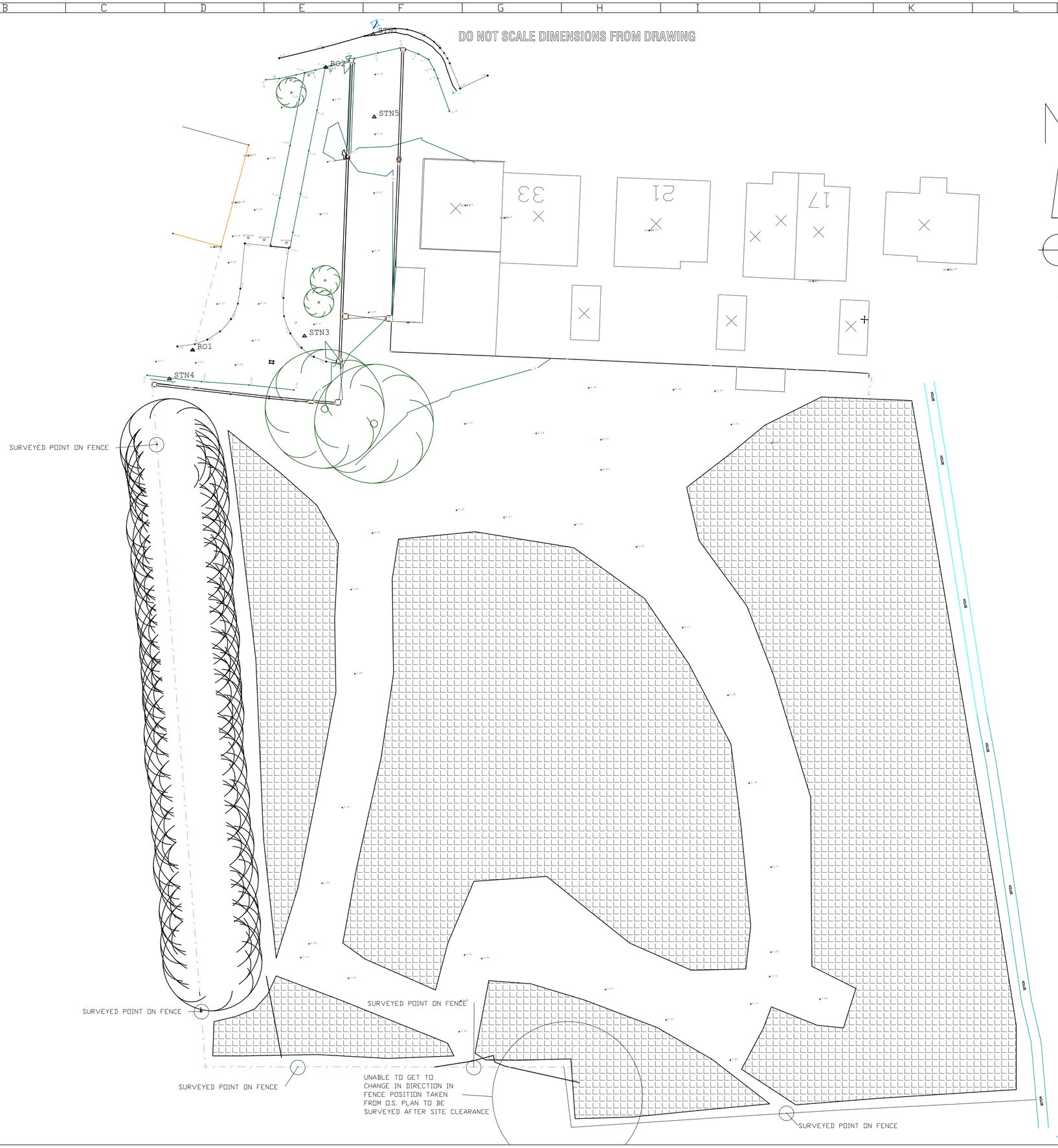


Fig 1 Extract from Environment Agency Flood Map

Appendix C
Proposed Scheme Drawing

DO NOT SCALE DIMENSIONS FROM DRAWING

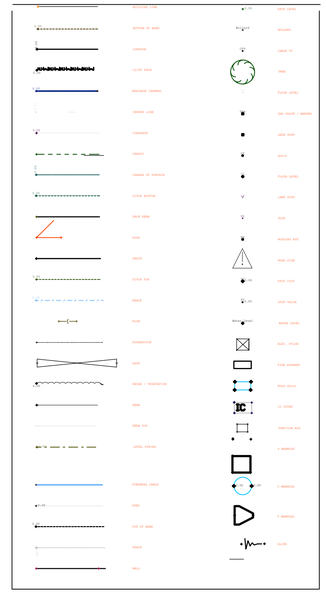


0m 2m 4m 6m 8m 10m

1:200 SCALE BAR

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.



G J Brookes Limited
LAND SURVEYORS & SITE ENGINEERS

14 Joyce Avenue
Blackpool
Lancashire
FY4 4HL

TEL: 01253 766135
MOBILE: 07973 266034
E-MAIL: gjbrookesltd@hotmail.com

Rev.	Amendments	Date	By

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
TOPOGRAPHY SURVEY

Client	Scales
MR WITHERS	1:200@A1

Drawn	Checked	Date
JG		03/09/21

DRAWING No.	Revision
A021/061/S/01	-

H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

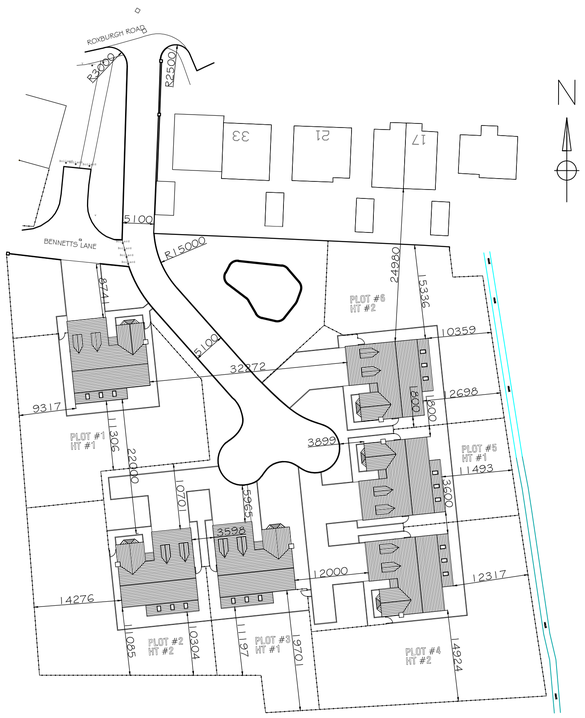
Revision -

DRAWING No. A021/061/S/01

DO NOT SCALE DIMENSIONS FROM DRAWING

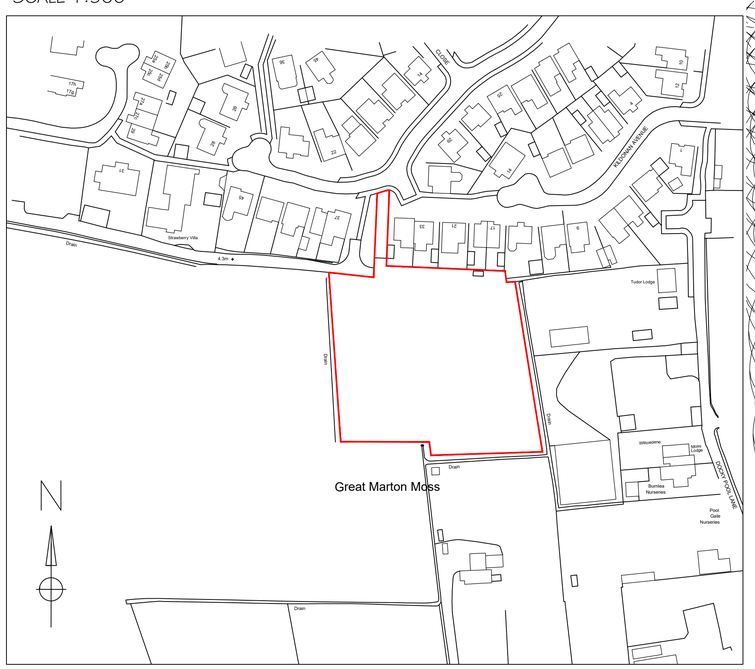
Revision A

DRAWING No. A021/061/P/01



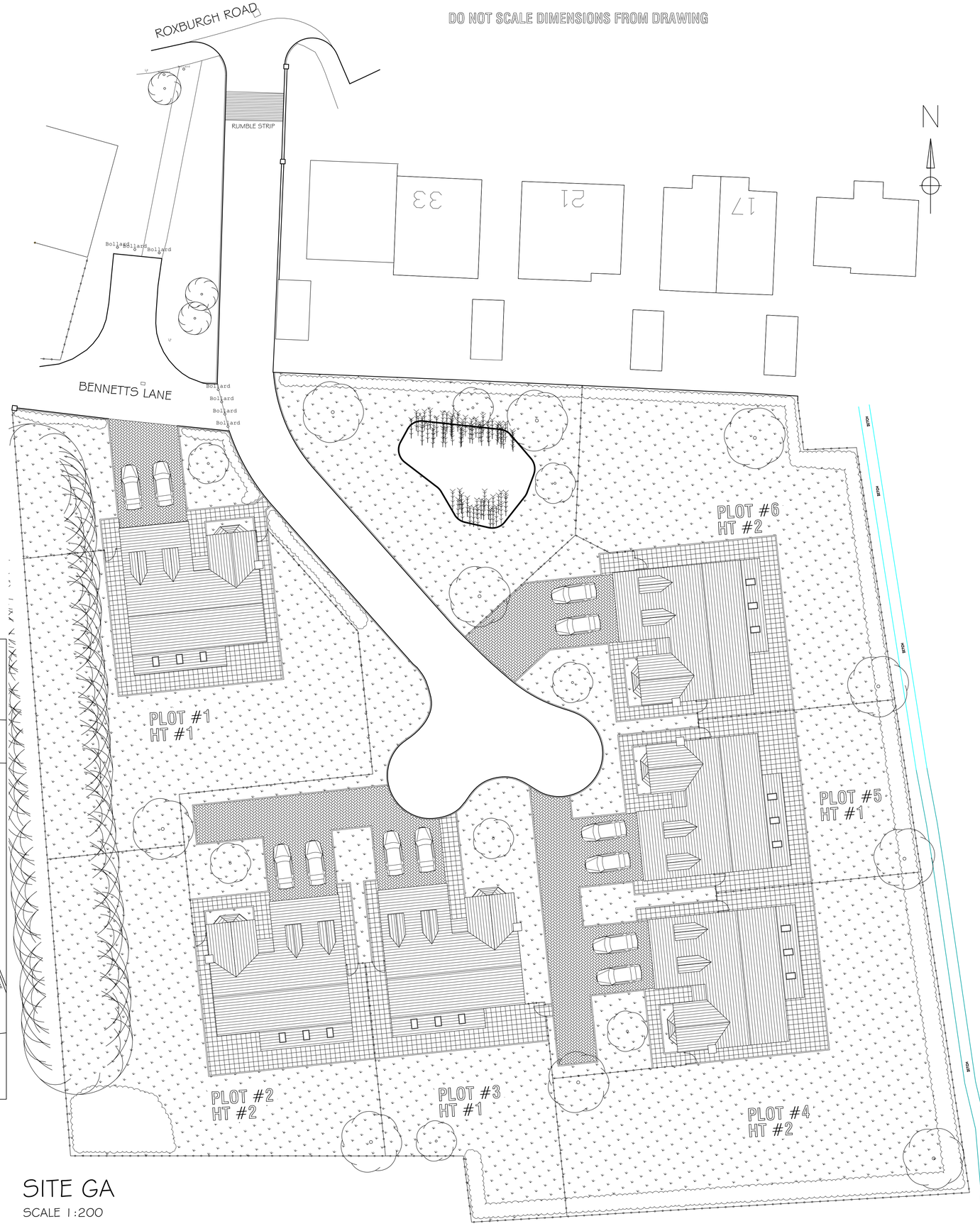
SITE SETTING OUT

SCALE 1:500



LOCATION PLAN

SCALE 1:1250



SITE GA

SCALE 1:200

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

CONFIGURATION

TOTAL SITE AREA 5854m²

PLOT 1 AREA 876m²
PLOT 2 AREA 872m²
PLOT 3 AREA 582m²
PLOT 4 AREA 1053m²
PLOT 5 AREA 529m²
PLOT 6 AREA 876m²

Rev.	Amendments	Date	By
A	House Type Changed	02/09/21	JG

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED SITE GA

Client	Scales	
MR WITHERS	AS SHOWN@A1	
Drawn: JG	Checked:	Date: 29/03/2021
DRAWING No. A021/061/P/01		Revision A

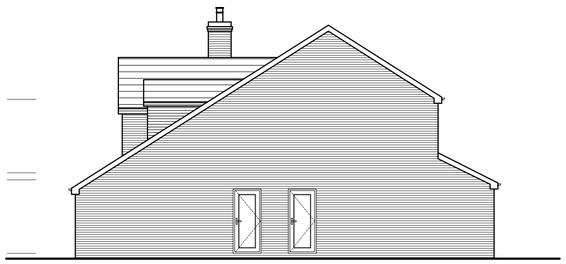
H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

DO NOT SCALE DIMENSIONS FROM DRAWING

Revision A

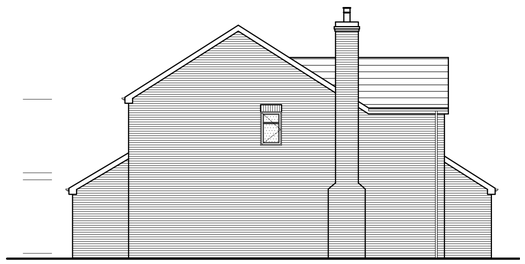
DRAWING No. A021/061/P/02

FRONT ELEVATION

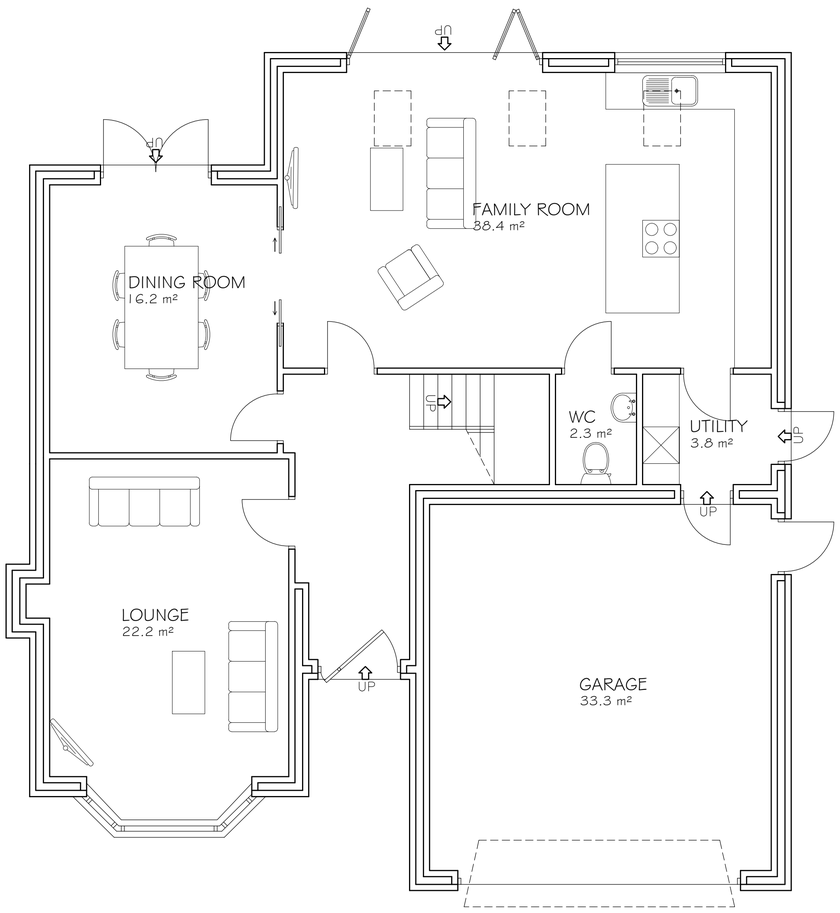


SIDE ELEVATION

REAR ELEVATION

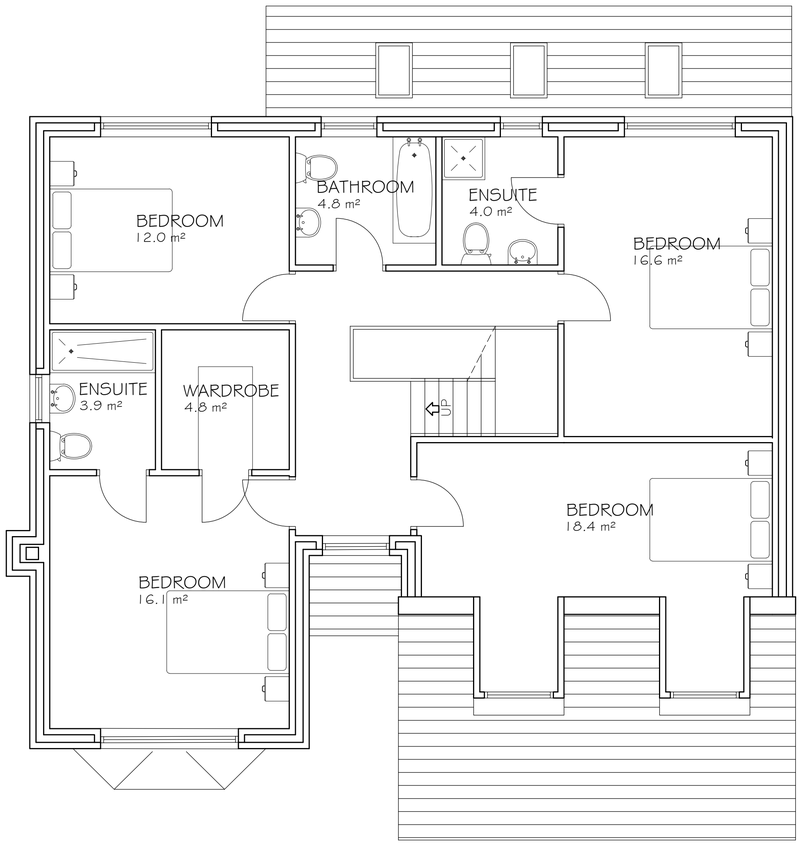


SIDE ELEVATION



GROUND FLOOR LAYOUT

TOTAL FLOOR AREA 133 m²



FIRST FLOOR LAYOUT

TOTAL FLOOR AREA 96 m²

0m 1m 2m 3m

1:50 SCALE BAR

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

Rev.	Amendments	Date	By
A	House Type Changed	02/09/21	JG

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED HOUSE TYPE 1

Client	Scales
MR WITHERS	1:50/1:100@A1

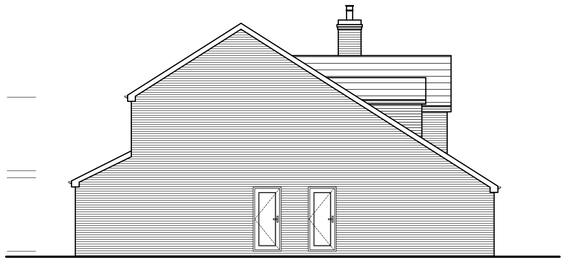
Drawn	Checked	Date
JG		29/03/2021

DRAWING No.	Revision
A021/061/P/02	A

H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

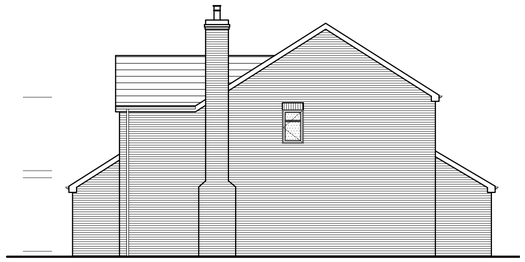
DO NOT SCALE DIMENSIONS FROM DRAWING

FRONT ELEVATION

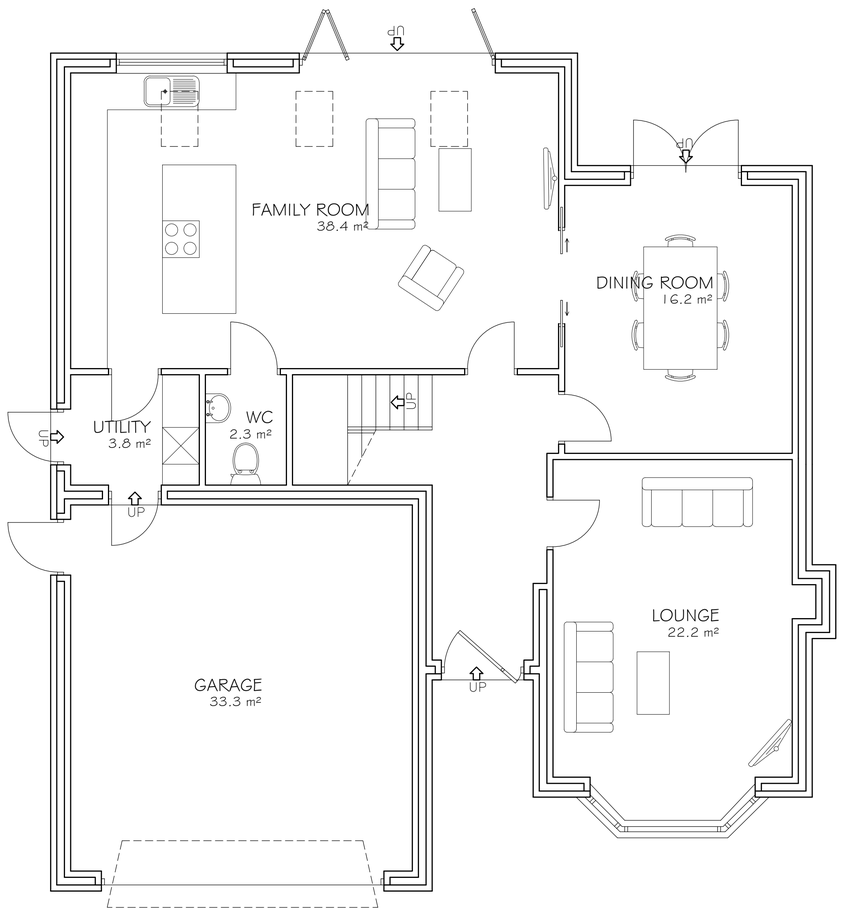


SIDE ELEVATION

REAR ELEVATION

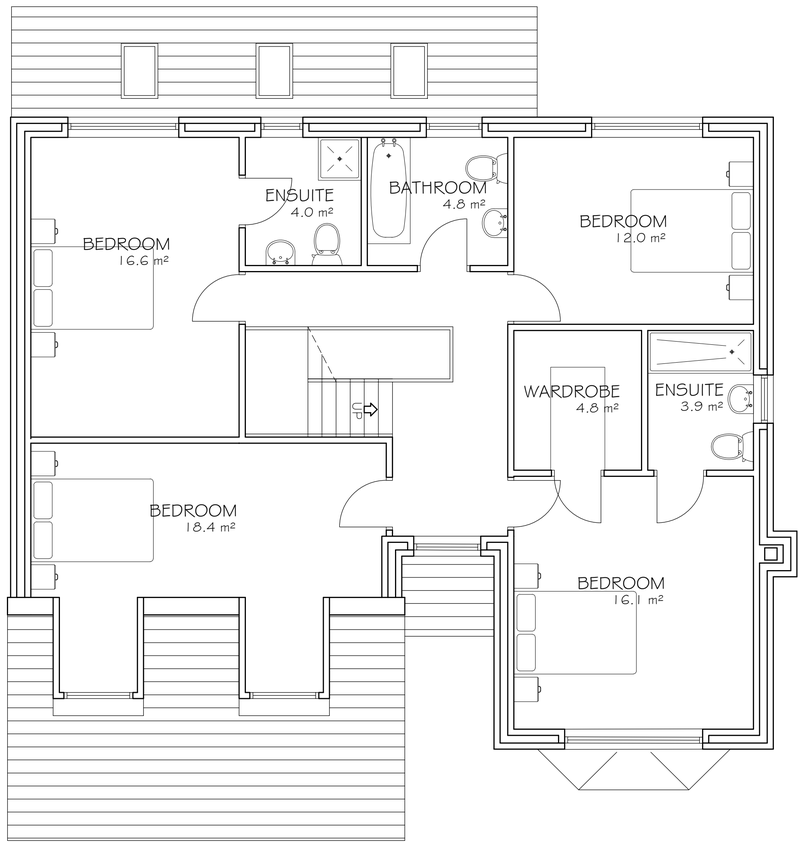


SIDE ELEVATION



GROUND FLOOR LAYOUT

TOTAL FLOOR AREA 133 m²



FIRST FLOOR LAYOUT

TOTAL FLOOR AREA 96 m²

0m 1m 2m 3m

1:50 SCALE BAR

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

Rev.	Amendments	Date	By

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED HOUSE TYPE 2

Client	Scales
MR WITHERS	1:50/1:100@A1

Drawn	Checked	Date
JG		29/03/2021

DRAWING No.	Revision
A021/061/P/03	-

H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

DO NOT SCALE DIMENSIONS FROM DRAWING

0m 2m 4m 6m 8m 10m
1:200 SCALE BAR

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

Rev.	Amendments	Date	By

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED DRAINAGE

Client	Scales
MR WITHERS	1:200@A1

Drawn	Checked	Date
JG		03/09/2021

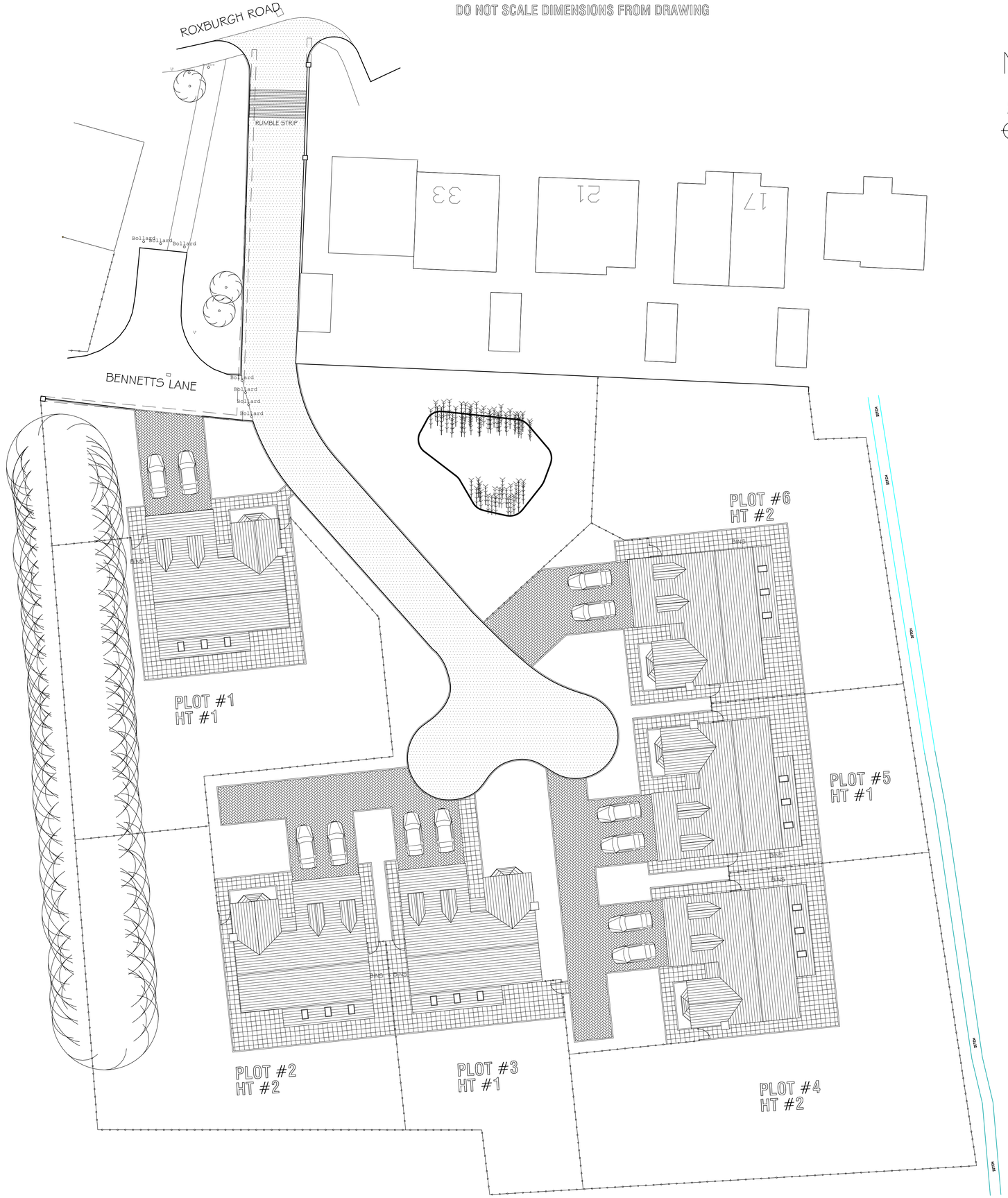
DRAWING No.	Revision
A021/061/P/04	-

H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

Revision -

DRAWING No. A021/061/P/04

DO NOT SCALE DIMENSIONS FROM DRAWING



0m 2m 4m 6m 8m 10m

1:200 SCALE BAR

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

EXTERNAL WORKS SPECIFICATION

KEY

DENOTES CARRIAGEWAY SPECIFICATION
40mm THK HRA SURFACE COURSE WITH BLACK CHIPPINGS, 70mm THK BINDER COURSE, 20mm Agg HEAVY DUTY AC20, 120mm THK DBM BASE COURSE, 32mm Agg AC32 DENSE BASE, 225mm SUB BASE TYPE 1 GRANULAR MATERIAL, 300mm GF2 IMPROVER LAYER SELECTED GRANULAR MATERIAL

PAVING TO BE 600X600x35mm thk CONCRETE FLAGS, TYPE SYMPHONY A5 SUPPLIED BY MARSHALLS, COLOUR NATURAL LAID ON 35mm thk ZONE 2 SHARP SAND BED, ON 150mm thk DTp TYPE 1 SUB BASE ALL MANHOLES TO BE FITTED WITH RECESSED COVERS

PAVING TO BE 80mm thk CONCRETE BLOCK PAVERS, TYPE KEYBLOCK A5 SUPPLIED BY PLASMOOR, COLOUR Grey CHAMFERED EDGES, LAID IN 45 DEGREE HERRINGBONE PATTERN ON 30mm thk ZONE 2 SHARP SAND BED, ON 200mm thk DTp TYPE 1 SUB BASE

WALLS TO BE DEMOLISHED

ALL EXTERNAL WORKS TO BE CONFIRMED & APPROVED BY L.A.

Rev.	Amendments	Date	By

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED HARD LANDSCAPING

Client	Scales
MR WITHERS	1:200@A1

Drawn	Checked	Date
JG		03/09/2021

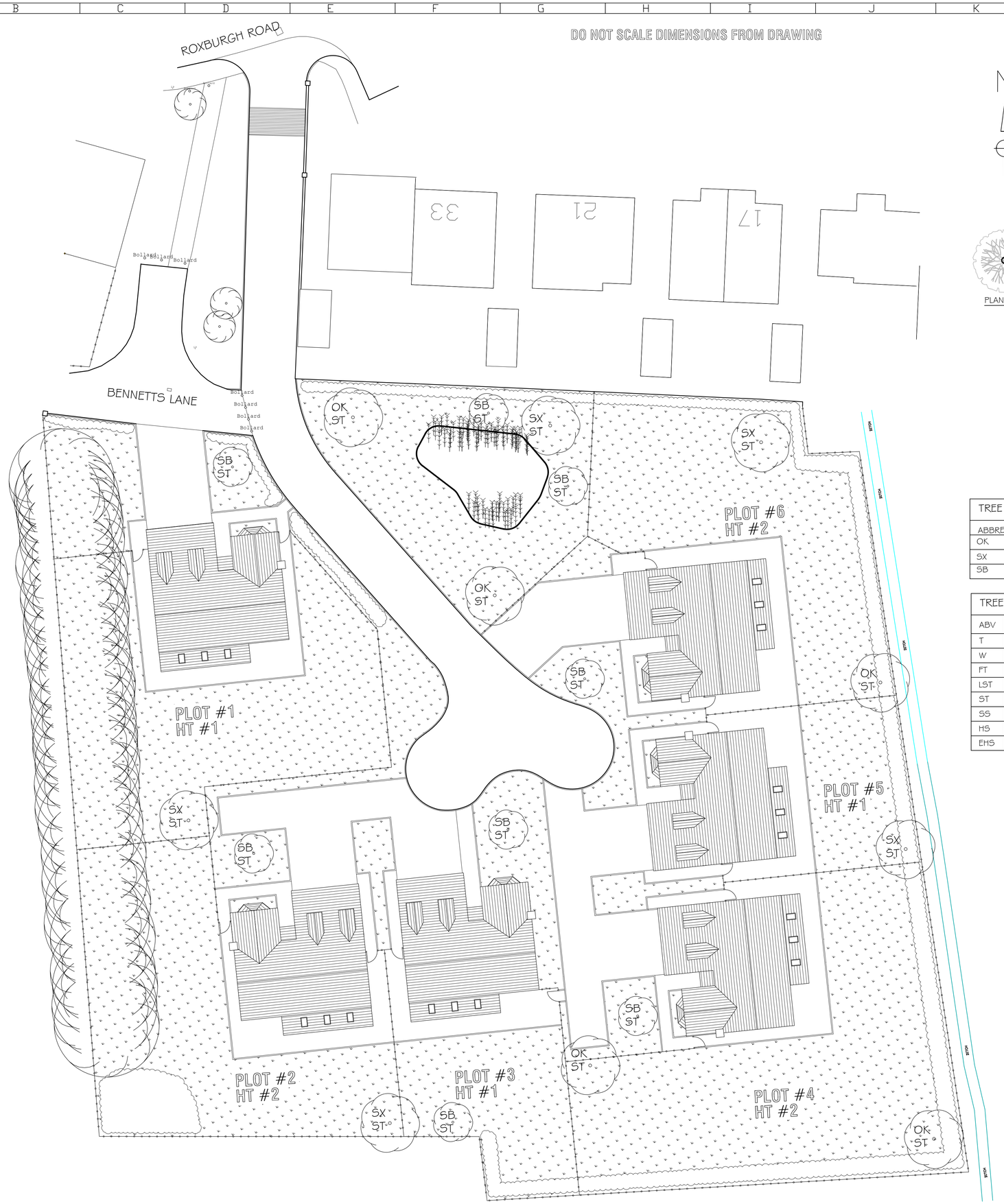
DRAWING No.	Revision
A021/061/P/05	-

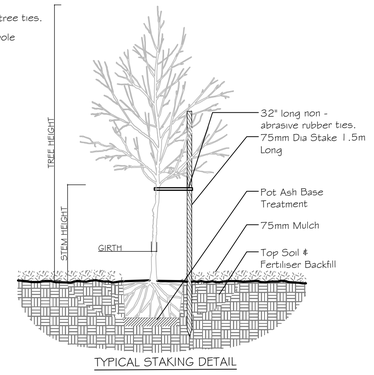
H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

Revision -

DRAWING No. A021/061/P/05

DO NOT SCALE DIMENSIONS FROM DRAWING





TYPICAL STAKING DETAIL

TREE SPECIES		
ABBREVIATION	TREE SPECIES	NO. OF TREES
OK	QUERCUS ROBUR	5
SX	SALIX	5
SB	SORBUS AUCUPARIA	8

TREE SIZE CATEGORY				
ABV	TYPE	TREE HEIGHT(cm)	GIRTH(cm)	STEM HEIGH(cm)
T	TRANSPLANT	30-120	N/A	N/A
W	WHIP	120-250	N/A	N/A
FT	FEATHERED TREE	180-240/240-300	N/A	N/A
LST	LIGHT STANDARD TREE	250-275	6-8	150-180
ST	STANDARD TREE	275-300	8-10	180-210
SS	SELECTED STANDARD	300-360	10-12	180-210
HS	HEAVY STANDARD	360-425	12-14	180-210
EHS	EXTRA HEAVY STANDARD	425-500	14-16	180-210

0m 2m 4m 6m 8m 10m

1:200 SCALE BAR.

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

EXTERNAL WORKS SPECIFICATION

KEY

- DENOTES TURF AREA
- DENOTES NEW ELDER HAWTHORN (CRATAEGUS) HEDGE
- DENOTES NEW TREES
- DENOTES NEW REEDS
- DENOTES EXISTING TREES TO BE REMOVED

ALL EXTERNAL WORKS TO BE CONFIRMED & APPROVED BY L.A.

KEY

SOR HS — SPECIES ABBREVIATION / SIZE CATAGORY

1 Based on Keystone Design Associates drg. No. A021/061/P/06
2 Planting to be carried out during suitable conditions within normal planting season November - March; seeding during suitable conditions in spring or plants autumn; alternatively at other times but using only container grown and dependent on extra watering for all plant establishment.

Container-grown trees/specimen shrubs: *Pits 450x450x450mm backfilled with 3 parts topsoil (imported if necessary) mixed with 1 part peat-free planting compost & 4no. 15gm. controlled-release, 2-year effective15+9+9+3 fertiliser tablets; soak rootball before and water after planting; mulch pit area to a depth of 75mm using composted bark with size range 90% within 50-100mm, after planting and watering*

Ornamental shrub and ground cover planting: *min 450mm depth topsoil; pits 300x300x300mm unless specified larger; backfilled with 3 parts topsoil (imported if necessary) mixed with 1 part peat-free planting compost & 2no. 15gm controlled-release, 2-year effective 15+9+9+3 fertiliser tablets; mulch planting beds to a depth of 75mm using composted bark with size range 90% within 50-100mm, after planting and watering*

Topsoil: *Min depth 150mm for grassed areas & 450mm for planting areas; preparation including grading to marry in levels including finishing 25mm above adjacent hard surfaces, kerbs, inspection covers etc. and min 150mm below damp proof course level; cultivation, and stone-picking to 50mm dimension*

Grassed areas: *Turf with low-maintenance drought-tolerant high-stabilisation amenity mix turf; water well*

Maintenance:
YEAR 1: include watering during establishment; grass cutting; hand weeding and litter picking as necessary; replacemenplanting and top-up of mulch;
YEAR 2: Grass cutting; weeding and litter picking as necessary; prune planting only as necessary to avoid obstruction and overhang to paths, parking, lights, signs, CCTV etc.; replacement planting as necessary;top-up of mulch
YEARS 3 - 5: Grass cutting; weeding and litter picking as necessary; pruning and replacement planting as Year 2

Rev.	Amendments	Date	By

Keystone Design Associates Ltd.
Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED SOFT LANDSCAPING

Client	Scales	
MR WITHERS	1:200@A1	
Drawn: JG	Checked:	Date: 03/09/2021

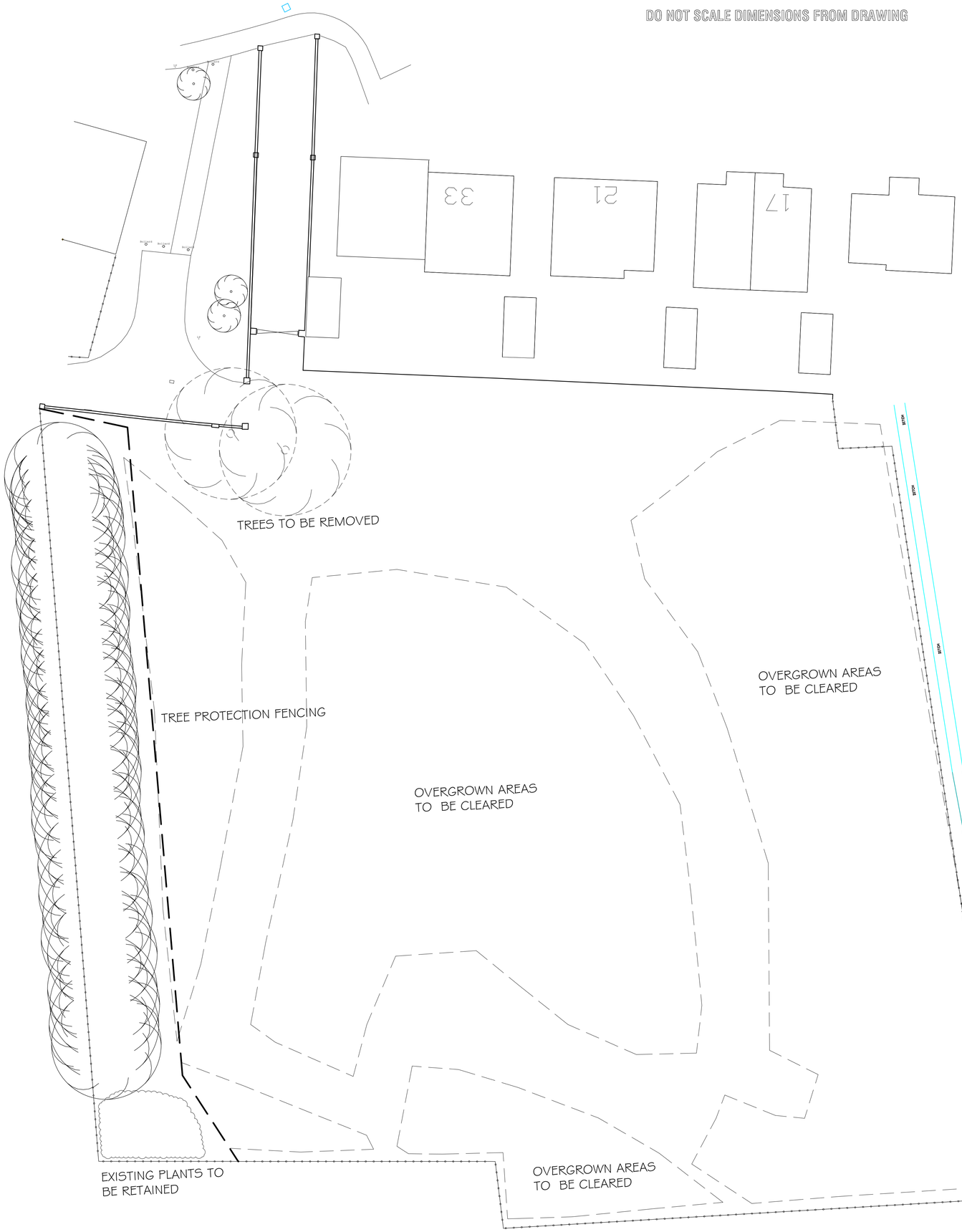
DRAWING No. A021/061/P/06 — Revision -

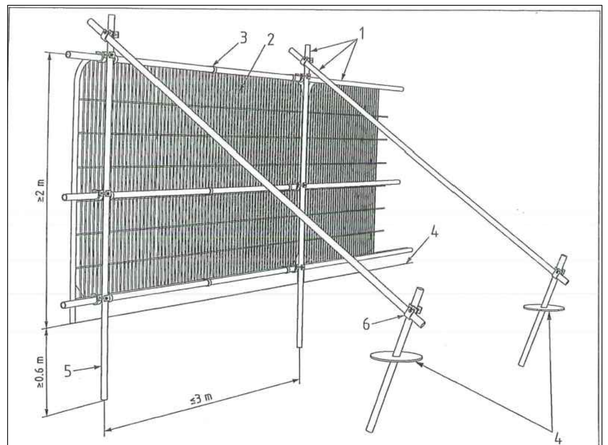
H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

Revision -

DRAWING No. A021/061/P/06

DO NOT SCALE DIMENSIONS FROM DRAWING





Key

1 Standard scaffold poles
2 Heavy gauge 2 m tall galvanized tube and welded mesh infill panels
3 Panels secured to uprights and cross-members with wire ties
4 Ground level
5 Uprights driven into the ground until secure (minimum depth 0.6 m)
6 Standard scaffold clamps

0m 2m 4m 6m 8m 10m
1:200 SCALE BAR

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

EXTERNAL WORKS SPECIFICATION

KEY

DENOTES EXISTING TREES TO BE REMOVED

DENOTES LINE OF TREE PROTECTION FENCING

FENCE LINE TO BE POSITIONED AT 1.5m FROM TRUNK IN ACCORDANCE WITH BS5837:2012 CLAUSE 4.6. BARRIERS TO BE HERAS FENCING 1.8M HIGH SUPPORTED ON SCAFFOLD POLES AT 3.0M C/C AND BRACED IN ACCORDANCE WITH BS5837:2012 CLAUSE 6.2.2 AND FIG 2.

ALL EXTERNAL WORKS TO BE CONFIRMED & APPROVED BY L.A.

Rev.	Amendments	Date	By

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED TREE PROTECTION SCHEME

Client	Scales
MR WITHERS	1:200@A1

Drawn	Checked	Date
JG		03/09/2021

DRAWING No.	Revision
A021/061/P/07	-

H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

Revision -

DRAWING No. A021/061/P/07

DO NOT SCALE DIMENSIONS FROM DRAWING

SECTION AA

SECTION BB

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. DO NOT SCALE FROM THIS DRAWING.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATED DRAWINGS AND DOCUMENTS. THE USER SHOULD CONSULT THE DRAWING ISSUE REGISTER FOR DETAILS.
4. THE CONTRACTOR IS TO CHECK AND VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF CONSTRUCTION WORKS.
5. THE ENGINEER/ARCHTIECT SHOULD BE CONTACTED IMMEDIATELEY IF THE ASSUMPTIONS USED IN THE DESIGN AND DRAWING PREPARARTION DIFFER TO THAT FOUND ON SITE.

Rev.	Amendments	Date	By

Keystone Design Associates Ltd.

Registered Office
Development House
261 Church Street
Blackpool
FY1 3PB
Tel. No. 01253 649040
Fax. No. 01253 752901
Email : info@keystonedesign.co.uk

PROJECT ADDRESS
LAND AT VIRGINIA COTTAGE, BENNETTS LANE
BLACKPOOL, LANCASHIRE

PROJECT TITLE
RESIDENTIAL DEVELOPMENT

DRAWING TITLE
PROPOSED SITE SECTIONS

Client	Scales
MR WITHERS	1:200@A1

Drawn	Checked	Date
JG		03/09/2021

DRAWING No.	Revision
A021/061/P/08	-

H:\Documents\Drawings\2021\Bennetts Lane Virginia Cottage

0m 2m 4m 6m 8m 10m
1:200 SCALE BAR

Revision -
DRAWING No. A021/061/P/08

Appendix D
Drainage Calculations

ATTENUATION DESIGN

In accordance with CIRIA publication C697 - The SUDS Manual

Tedds calculation version 1.0.02

Pre post runoff method

Site characteristics

Location	Preston
Hydrological region	10
Soil type (Wallingford Procedure W.R.A.P map)	4
Standard percentage runoff	SPR = **0.47**
Average annual rainfall	SAAR = **950** mm
5 year return period rainfall of 60 minute duration	M5_60min = **17.0** mm
Ratio 60-minute to 2 day rainfalls of 5 year return	r = **0.30**
Rainfall intensity increase due to global warming	$p_{climate}$ = **30**%
Routing coefficient	c_r = **1.30**
Volumetric runoff coefficient	c_v = **0.75**

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%)	Impermeable. area (ha)
1	house	0.58	39.0	0.23
	Total	0.58	39.0	0.23

Greenfield runoff rates

Catchment area	AREA = **50.00** hectare
Greenfield runoff rate (50 hectare site)	$\bar{Q}_{rural} = 0.00108 m^3/s \times (AREA/1km^2)^{0.89} \times (SAAR/1mm)^{1.17} \times SPR^{2.17}$ = **345.1** l / s
Greenfield runoff rate	$\bar{Q} = \bar{Q}_{rural} / AREA \times A$ = **4.0** l / s
Greenfield runoff rate per unit area	$\bar{Q}_A = \bar{Q} / A$ = **6.9** l / s / hectare

Estimated site discharges

FSR growth rate (1 year)	FSR_{1yr} = **0.87**
Discharge (1 year)	$Q_{1yr} = \bar{Q} \times FSR_{1yr}$ = **3.5** l/s
FSR growth rate (30 year)	FSR_{30yr} = **1.70**
Discharge (30 year)	$Q_{30yr} = \bar{Q} \times FSR_{30yr}$ = **6.8** l/s
FSR growth rate (100 year)	FSR_{100yr} = **2.08**
Discharge (100 year)	$Q_{100yr} = \bar{Q} \times FSR_{100yr}$ = **8.3** l/s

Table equations

Peak flow	$Q_{post\_imp} = c_r \times I_{max} \times A_{imp}$
Runoff volume	$V_{post\_imp} = Q_{post\_imp} \times D / c_r$
Post development runoff	$\bar{Q}_{post} = Q_{post\_imp} + Q_{post\_open}$
Permitted discharge	$O_{exist} = Q \times D$
Post development runoff volume	$I_{post} = Q_{post\_open} \times D + V_{post\_imp}$
Storage volume required	$S_{post} = I_{post} - O_{exist}$

Required storage for period of 1 year

Discharge per hectare	$Q_{1yr\_area} = Q_{1yr} / A$ = **6.0** l/s/hectare
Greenfield runoff rate post development	$Q_{1yr\_post\_open} = Q_{1yr\_area} \times A_{imp}$ = **1.4** l/s

Duration (min)	1 year rainfall (mm)	Rainfall intensity (mm/hr)	Peak flow (m^3/s)	Runoff volume (m^3)	Post dev. runoff (m^3/s)	Permit dischrge (m^3)	Post dev. runoff vol (m^3)	Storage vol. reqd (m^3)
5	4.6	55.5	0.05	10.4	0.05	1.04	10.84	9.80
10	6.6	39.7	0.03	15.0	0.03	2.09	15.77	13.68
15	8.0	32.1	0.03	18.1	0.03	3.13	19.36	16.23
30	10.7	21.4	0.02	24.1	0.02	6.26	26.57	20.32
60	14.3	14.3	0.01	32.4	0.01	12.51	37.24	24.72
120	18.5	9.3	0.01	41.8	0.01	25.03	51.59	26.56
240	23.9	6.0	0.00	54.0	0.01	50.06	73.54	23.48
360	27.5	4.6	0.00	62.1	0.01	75.09	91.35	16.26
600	33.4	3.3	0.00	75.5	0.00	125.15	124.32	-0.83
1440	46.5	1.9	0.00	104.9	0.00	300.36	222.08	-78.28

Attenuation storage required

Vol. increase due to head-discharge relationship p_{hydro} = **1.25**

Maximum attenuation storage required $V_{req\_max} = V_{max\_1yr} \times p_{hydro}$ = **33.2** m^3

Required storage for period of 30 year

Discharge per hectare $Q_{30yr\_area} = Q_{30yr} / A$ = **11.7** l/s/hectare

Greenfield runoff rate post development $Q_{30yr\_post\_open} = Q_{30yr\_area} \times A_{imp}$ = **2.6** l/s

Duration (min)	30 year rainfall (mm)	Rainfall intensity (mm/hr)	Peak flow (m^3/s)	Runoff volume (m^3)	Post dev. runoff (m^3/s)	Permit dischrge (m^3)	Post dev. runoff vol (m^3)	Storage vol. reqd (m^3)
5	11.0	131.5	0.11	24.7	0.11	2.04	25.54	23.50
10	16.2	97.2	0.08	36.6	0.08	4.08	38.17	34.10
15	19.7	78.9	0.06	44.5	0.07	6.11	46.91	40.80
30	26.1	52.2	0.04	58.9	0.05	12.23	63.69	51.46
60	34.0	34.0	0.03	76.8	0.03	24.45	86.35	61.89
120	42.1	21.0	0.02	95.0	0.02	48.91	114.07	65.16
240	51.7	12.9	0.01	116.9	0.01	97.82	155.00	57.18
360	57.8	9.6	0.01	130.6	0.01	146.73	187.78	41.05
600	67.2	6.7	0.01	151.8	0.01	244.54	247.16	2.61
1440	86.7	3.6	0.00	195.7	0.01	586.90	424.60	-162.31

Attenuation storage required

Vol. increase due to head-discharge relationship p_{hydro} = **1.25**

Maximum attenuation storage required $V_{req\_max} = V_{max\_30yr} \times p_{hydro}$ = **81.5** m^3

Required storage for period of 100 year

Discharge per hectare $Q_{100yr\_area} = Q_{100yr} / A$ = **14.4** l/s/hectare

Greenfield runoff rate post development $Q_{100yr\_post\_open} = Q_{100yr\_area} \times A_{imp}$ = **3.2** l/s

Duration (min)	100 year rainfall (mm)	Rainfall intensity (mm/hr)	Peak flow (m^3/s)	Runoff volume (m^3)	Post dev. runoff (m^3/s)	Permit dischrge (m^3)	Post dev. runoff vol (m^3)	Storage vol. reqd (m^3)

Duration (min)	100 year rainfall (mm)	Rainfall intensity (mm/hr)	Peak flow (m^3/s)	Runoff volume (m^3)	Post dev. runoff (m^3/s)	Permit dischrge (m^3)	Post dev. runoff vol (m^3)	Storage vol. reqd (m^3)
5	13.9	166.8	0.14	31.4	0.14	2.49	32.37	29.87
10	20.8	125.0	0.10	47.0	0.11	4.99	48.97	43.99
15	25.5	102.2	0.08	57.7	0.09	7.48	60.59	53.11
30	34.1	68.3	0.06	77.1	0.06	14.96	82.92	67.96
60	44.7	44.7	0.04	100.9	0.04	29.92	112.55	82.63
120	54.9	27.5	0.02	124.1	0.03	59.84	147.41	87.57
240	67.0	16.8	0.01	151.4	0.02	119.68	198.08	78.40
360	74.6	12.4	0.01	168.4	0.01	179.52	238.37	58.85
600	86.0	8.6	0.01	194.2	0.01	299.21	310.85	11.64
1440	108.2	4.5	0.00	244.2	0.01	718.09	524.28	-193.81

Attenuation storage required

Vol. increase due to head-discharge relationship p_{hydro} = **1.25**

Maximum attenuation storage required $V_{req\_max} = V_{max\_100yr} \times p_{hydro}$ = **109.5** m^3

Interception storage

Interception rainfall depth d_{int} = **5** mm

Volume of interception storage required $V_{int\_req} = 0.8 \times A_{imp} \times d_{int}$ = **9.03** m^3